


# Regional variation in immediate breast reconstruction in Australia

K. L. Flitcroft<sup>1,2</sup> , M. E. Brennan<sup>1,2</sup>, D. S. J. Costa<sup>4</sup> and A. J. Spillane<sup>1,2,3,5</sup>

<sup>1</sup>Breast and Surgical Oncology at the Poche Centre, <sup>2</sup>Northern Clinical School, University of Sydney, and <sup>3</sup>Surgical Oncology, Breast and Endocrine Surgery Department, Mater Hospital, Sydney, and <sup>4</sup>Pain Management Research Unit, University of Sydney at Royal North Shore Hospital, and <sup>5</sup>Surgical Oncology, Breast and Endocrine Surgery Department, Royal North Shore Hospital, St Leonards, New South Wales, Australia  
Correspondence to: Dr K. L. Flitcroft, Breast and Surgical Oncology at the Poche Centre, 40 Rocklands Road, North Sydney, New South Wales 2060, Australia (e-mail: kathy.flitcroft@melanoma.org.au)

**Background:** Breast reconstruction following mastectomy has proven benefits and is the standard of care in many high-income countries. This audit documented regional variation in immediate breast reconstruction rates across Australia.

**Methods:** The Breast Surgeons of Australia and New Zealand (BreastSurgANZ) Quality Audit database and geospatial software were used to model the distribution of breast reconstructions performed on women having mastectomy in Australia in 2013. Geospatial mapping identified the distribution of these procedures in relation to the Greater Capital City Statistical Areas (GCCSAs) of the five largest states. Data were analysed using  $\chi^2$  tests of independence and an independent-samples *t* test.

**Results:** Of 3786 patients having a mastectomy, 692 underwent breast reconstruction of which 679 (98.1 per cent) were immediate reconstructions. Rates of reconstruction differed significantly between jurisdictions ( $\chi^2 = 164.90$ ), and were significantly higher in GCCSAs ( $\chi^2 = 144.60$ ) and private hospitals ( $\chi^2 = 50.72$ ) (all  $P < 0.001$ ). Immediate breast reconstruction was not reported for 43.8 per cent of hospitals where mastectomy was conducted by members of BreastSurgANZ, including 29.8 per cent of hospitals within GCCSAs. A wider age range of women appeared to have had immediate reconstructions at hospitals within GCCSAs, although the difference in mean age between regions was not significant. Immediate breast reconstruction was considerably less likely to be performed in women who lived in areas of lower to mid socioeconomic status.

**Conclusion:** Variations in the rate of immediate breast reconstruction may not be purely resource-driven.

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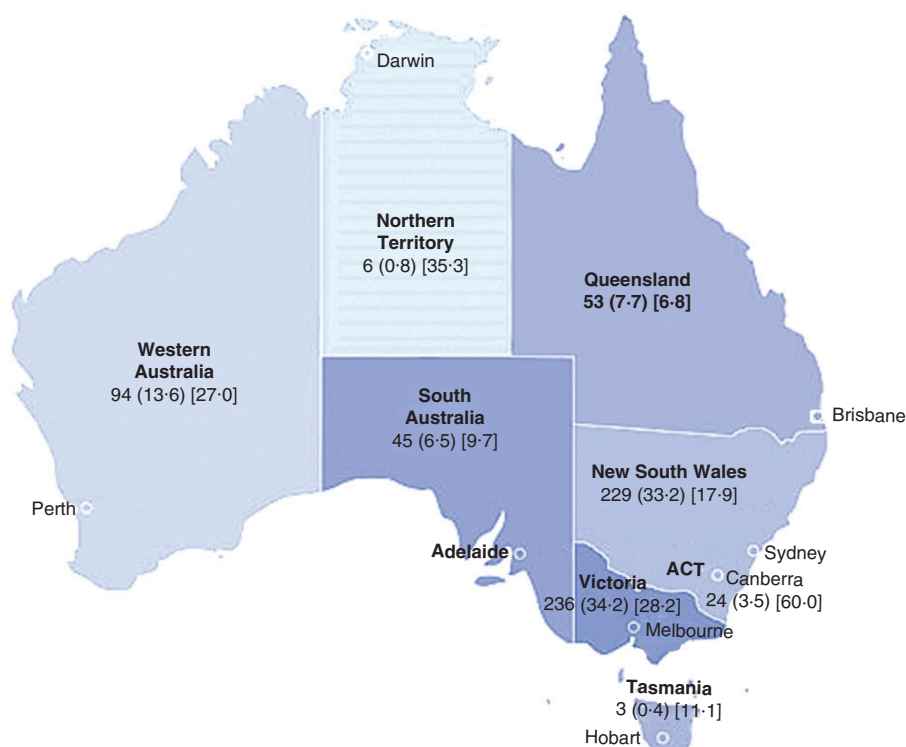
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## Introduction

The potential benefits for women who choose breast reconstruction following mastectomy for breast cancer are well documented<sup>1–4</sup>. Offering reconstruction is promoted as the standard of care in Australia<sup>5</sup>, the USA<sup>6</sup>, the UK<sup>7</sup> and much of Europe<sup>8</sup>. Despite the introduction of legislation in 2008 to guarantee insurance coverage for reconstruction after mastectomy in the USA<sup>9</sup>, racial and socioeconomic disparities in its delivery have persisted or widened<sup>10</sup>. Regional variations in the supply of plastic surgeons and distance to travel have been identified as potential explanations<sup>11,12</sup>.

In the UK, offering immediate breast reconstruction (unless medically contraindicated) has been the standard of care since 2002<sup>13</sup>. The National Mastectomy and Breast Reconstruction Audit<sup>14</sup> found that 21 per cent of women who had mastectomy underwent immediate reconstruction, although there was geographical variation of 9–43 per cent. Proposed explanations for these disparities included a lack of integration between surgical specialties<sup>13</sup>.

Obtaining accurate information on breast reconstruction rates and distribution within Australia is difficult<sup>15</sup>. Breast Surgeons of Australia and New Zealand Incorporated (BreastSurgANZ), the main binational representative body of breast surgeons, oversees the BreastSurgANZ Quality



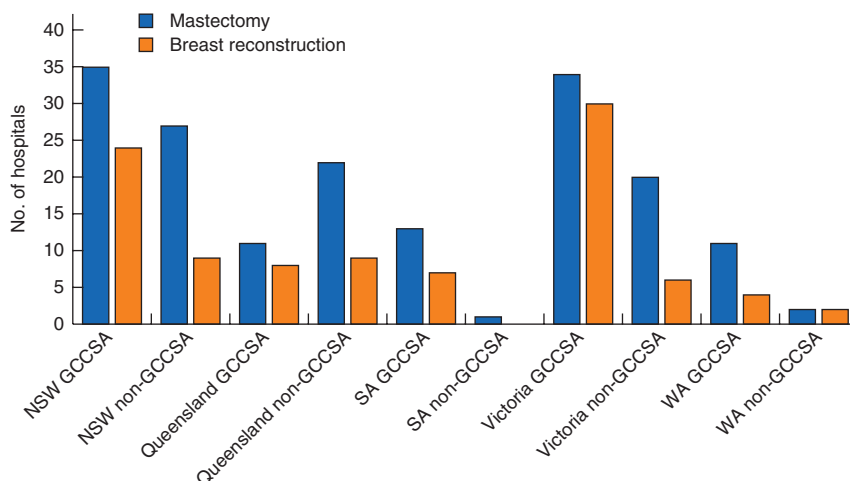
**Fig. 1** Number of women undergoing breast reconstruction with proportion of all Australian women undergoing this procedure in parentheses, and breast reconstruction rate in square brackets, by state and territory, 2013. ACT, Australian Capital Territory. Data source: reference 16

Audit (BQA). This audit examines breast surgery performed by full members, who are required to submit de-identified data on all patients with breast cancer managed by surgery<sup>16</sup>. The BQA has recorded more than 12 000 new entries each year in recent years, and is estimated to include around 70–80 per cent of the incident cases of early breast cancer in Australia<sup>16</sup>. It is the only accessible national source of hospital-level data covering both the public and private sectors. This level of data is essential in order to map where breast reconstruction is performed, and thereby identify gaps in the provision of this service. There are, however, limitations to this data source, including the lack of available information about breast reconstructions performed by plastic and reconstructive surgeons.

Variation in Australian rates of breast reconstruction has been associated with a range of factors, including socioeconomic status (SES) and health insurance coverage<sup>17</sup>, geographical location<sup>18</sup>, age, indigenous status and co-morbidity<sup>19</sup>, level of education, having children and requiring radiotherapy<sup>20</sup>. Another possible explanation for divergence in uptake is variation in access to this service, so that not all eligible women are being offered the choice. A

2012 survey of more than 700 members of Breast Cancer Network Australia found that 10 per cent of women who had a mastectomy did not recall discussing reconstruction with their surgeons and were not offered it<sup>21</sup>. Others may have discussed breast reconstruction but were advised to delay this until after their cancer treatment.

Analysis of data on the national distribution of breast reconstruction in Australia has been published recently<sup>22</sup>. These national figures tend to mask regional differences in availability and uptake of reconstruction, and may hide inequalities in access to services. To identify gaps in services and explore the equity implications of these gaps, it is necessary to examine the situation at a regional level. Each of the eight Australian jurisdictions is divided into two areas by the Australian Bureau of Statistics: the Greater Capital City Statistical Area (GCCSA) and the Rest of State/Territory regions<sup>23</sup>. GCCSAs are designed to represent a socioeconomic definition of each state and territory capital city. They do not define the geographical edge of the city, but rather have a functional boundary that includes people who regularly socialize, shop or work within the city, but live in the small towns and rural areas surrounding the city<sup>23</sup>.



**Fig. 2** Number of hospitals in which mastectomy and breast reconstruction were performed in women under the care of BreastSurgANZ members in the five most populous Australian states, 2013. GCCSA, Greater Capital City Statistical Area; NSW, New South Wales; SA, South Australia; WA, Western Australia. Data source: references 16 and 24

This study aimed to identify the extent of any variation between and within regions in terms of breast reconstruction rates and the relationship with patient age, public/private hospital status and SES of patients' place of residence. The potential implications are that if such intra-area discrepancies are significant, then reported national rates of breast reconstruction hide an underlying variation within otherwise similarly resourced areas.

## Methods

Breast reconstruction procedures were identified nationally using 2013 hospital-level BQA data and geospatial software. Data were obtained for each hospital in Australia where full members of BreastSurgANZ were involved in the management of women undergoing mastectomy for early breast cancer<sup>16</sup>.

Deidentified patient data for women who had undergone mastectomy, with or without breast reconstruction, were then mapped, focusing on the following variables: location (jurisdictional as well as inside or outside GCCSAs), age, public *versus* private hospital status and SES of patients' postcode of residence. This mapping of variables to hospital location and GCCSA/non-GCCSA region was contracted to a specialist group, the Australian Population and Migration Research Centre (incorporating GISCA, the National Centre for Social Applications of GIS (Geographic Information Systems)), at the University of Adelaide. Individual hospitals were not named to prevent the identification of patients and surgeons.

## Statistical analysis

$\chi^2$  tests of independence were used to determine the association between breast reconstruction uptake and each discrete variable. An independent-samples *t* test was used to analyse the continuous variable of age. Analysis was conducted using SPSS<sup>®</sup> version 24 (IBM, Armonk, New York, USA);  $P < 0.050$  was considered statistically significant.

## Results

### Variation in breast reconstruction rates

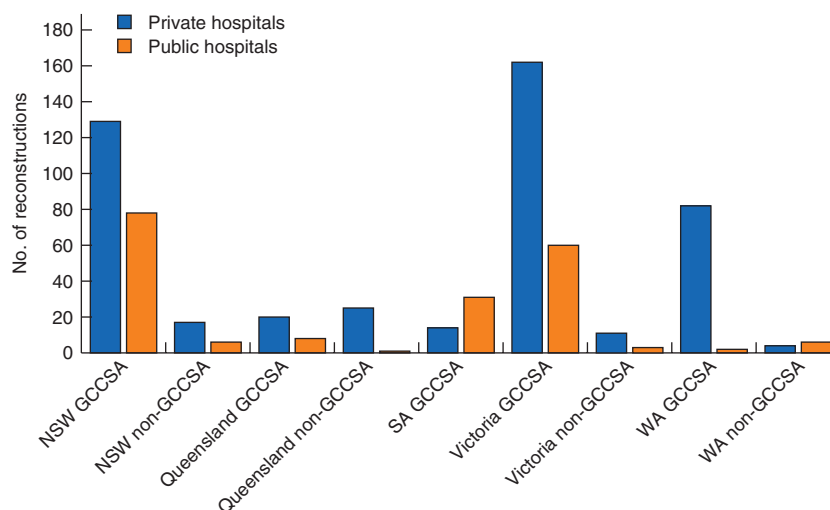
For all eight jurisdictions combined, there were 3786 records of women who had undergone mastectomy in 181 hospitals during 2013. Some 692 of these women (18.3 per cent) had breast reconstruction<sup>16</sup>, which was immediate reconstruction in the vast majority (679, 98.1 per cent). The time between mastectomy and reconstruction in the 13 women with delayed reconstruction ranged from 3 to 13 months<sup>16</sup>.

*Fig. 1* provides an overview of the relative proportions of reported reconstructions in women under the care of BreastSurgANZ surgeons in each jurisdiction. Small numbers of reconstructions were performed in the Northern Territory (6), the Australian Capital Territory (24) and Tasmania (3). These three jurisdictions had data only from the private sector, with just a single procedure performed outside their GCCSAs (in Tasmania). This combination of factors made them unsuitable for further detailed analysis, leaving 659 women under the care of BreastSurgANZ members who had performed breast reconstruction in 176

**Table 1** Mastectomy rate, breast reconstruction rate and age of women who had reconstruction, at hospitals within and outside Greater Capital City Statistical Areas, for the five most populous states in Australia, 2013

	No. of mastectomies	Mastectomy rate per location (%)	No. of breast reconstructions	Reconstruction rate per location (%)	Patient age (years)*
New South Wales					
GCCSA	771	60.4	206	26.7	50.8(9.7) (28–82)
Non-GCCSA	505	39.6	23	4.6	51.5(8.5) (39–70)
Queensland					
GCCSA	399	51.4	28	7.0	52.6(9.7) (36–75)
Non-GCCSA	378	48.6	25	6.6	50.2(6.7) (40–65)
South Australia					
GCCSA	458	98.9	45	9.8	50.7(9.3) (32–69)
Non-GCCSA	5	1	0	0	–
Victoria					
GCCSA	632	75.4	221	35.0	50.8(9.9) (26–77)
Non-GCCSA	206	24.6	15	7.3	52.5(11.0) (38–70)
Western Australia					
GCCSA	307	88.2	84	27.4	51.8(9.9) (31–73)
Non-GCCSA	41	12	10	24	53.1(10.2) (43–69)

\*Values are mean(s.d.) (range). GCCSA, Greater Capital City Statistical Area. Data sources: references 16 and 24.

**Fig. 3** Number of women who had breast reconstruction under the care of BreastSurgANZ members in public and private hospitals in Greater Capital City Statistical Areas (GCCSAs) and non-GCCSAs of the five most populous Australian states, 2013. NSW, New South Wales; SA, South Australia; WA, Western Australia. Data source: references 16, 24 and 25

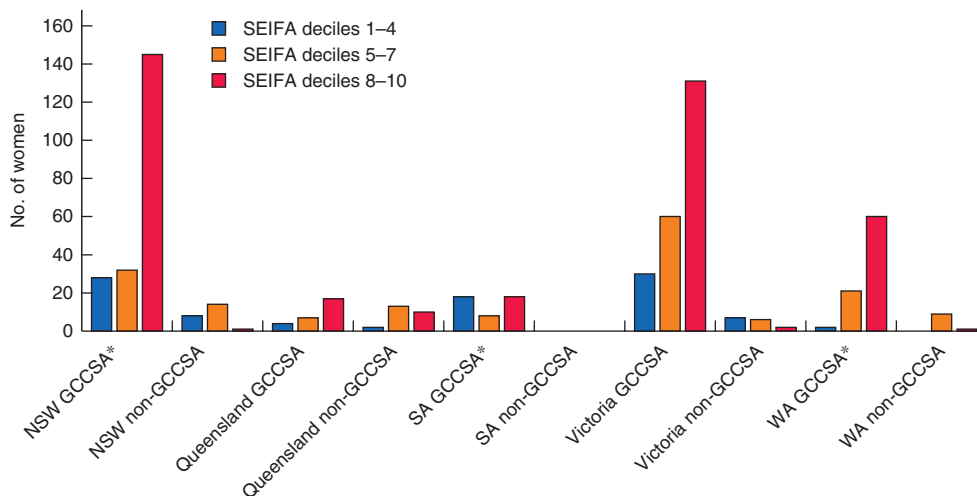
hospitals within the five largest states available for analysis. There was a significant difference in rates of breast reconstruction between the five states ( $\chi^2 = 164.90$ ,  $P < 0.001$ ).

### Breast reconstruction rates by hospital and GCCSA

The BQA data revealed no records of reconstructive surgery at 77 of the 176 hospitals (43.8 per cent) where BreastSurgANZ members performed mastectomy in 2013, representing 31 of the 104 hospitals (29.8 per cent) within the GCCSAs and 46 of 72 (64 per cent) in the non-GCCSA

regions. In Greater Melbourne, 11.8 per cent of hospitals performing mastectomy did not perform breast reconstruction; this compared with 27.3 per cent of hospitals in Greater Brisbane, 31.4 per cent in Greater Sydney, 46.2 per cent in Greater Adelaide, and 63.6 per cent in Greater Perth.

Overall, reconstruction rates were significantly higher in GCCSA than non-GCCSA regions ( $\chi^2 = 144.60$ ,  $P < 0.001$ ). Fig. 2 highlights the inter-regional variation. Notably, all breast reconstructions in South Australia were performed in Greater Adelaide. In contrast, there was little difference in the reconstruction rates between GCCSA



**Fig. 4** Number of women who had breast reconstruction under the care of BreastSurgANZ members in Greater Capital City Statistical Areas (GCCSAs) and non-GCCSAs of the five most populous states, by Socio-Economic Indexes for Areas (SEIFA) place of residence, 2013. Lower decile numbers reflect higher relative socioeconomic disadvantage. \*Postcode not available for one patient. NSW, New South Wales; SA, South Australia; WA, Western Australia. Data source: references 16, 24 and 25

and non-GCCSA areas in Queensland and Western Australia.

### Breast reconstruction rates by age and GCCSA

Mean age did not differ significantly between GCCSAs (51.2 years) and non-GCCSAs (50.2 years) ( $t(65) = 0.82$ ,  $P = 0.412$ ). However, the age range of women having a reconstruction in GCCSAs was considerably wider, and it was only in GCCSAs that women aged over 70 years underwent a reconstruction (Table 1). The minimum age was also younger in the GCCSAs of the four states for which comparable data were available (excluding South Australia).

### Breast reconstruction rates by hospital status and GCCSA location

Fig. 3 shows the number of reconstructions in public and private sectors for the GCCSAs and non-GCCSAs of the five most populous Australian states. Overall, the reconstruction rate for private hospitals was significantly higher than that for public hospitals ( $\chi^2 = 50.72$ ,  $P < 0.001$ ), with 70.4 per cent of procedures performed in private hospitals. The numbers of reconstructions by state and hospital sector also differed significantly ( $\chi^2 = 29.68$ ,  $P < 0.001$ ).

### Breast reconstruction rates by socioeconomic category and GCCSA

Fig. 4 illustrates the range in SES of the patient's place of residence, as defined by the Australian Bureau of Statistics' Socio-Economic Indexes for Areas (SEIFA)

scores. Statistical analysis incorporating both SEIFA and GCCSA categories was unlikely to be robust owing to sample size imbalance and so was not undertaken. However, descriptive analysis demonstrated a substantial national difference in reconstruction rates between women living in different SES deciles. Of all women having immediate reconstruction performed by BreastSurgANZ members in 2013, 15.1 per cent lived in the lowest four SES decile areas, 26.0 per cent lived in the middle three SES decile areas, and 58.9 per cent lived in the top three SES decile areas.

Of the 73 women living in non-GCCSA regions who underwent immediate breast reconstruction, 14 (19 per cent) lived in the top four SES decile areas, 42 (58 per cent) in the middle three SES decile areas, and 17 (23 per cent) in the lowest four SES decile areas. Overall, reconstruction was much less likely to be performed in women who lived in lower to mid SES areas, but more likely in women from lower to mid SES areas in non-GCCSA regions. The exception was South Australia, where all reconstructions were performed within the GCCSA.

### Discussion

This large cohort of patients managed by BreastSurgANZ members has provided evidence of statistically significant variation in breast reconstruction rates between states, along with regional differences within states. These variations have implications regarding equity.

Data from this study demonstrate that 29.8 per cent of the 104 hospitals within GCCSAs where BreastSurg-



ANZ members performed mastectomy in 2013 did not record any breast reconstructions. Although these hospitals were all staffed by specialist surgeons who were BreastSurgANZ members, not all of them performed reconstructive surgery. It seems likely that among general surgeons who were not full members of BreastSurgANZ and who did not contribute to the BQA, the rate of reconstruction was even lower.

There are several potential reasons why particular hospitals may not offer reconstructive surgery. Lack of specialized equipment or shortage of operating time may be factors, but any hospital capable of conducting mastectomy could at least undertake implant-based reconstruction requiring neither specialized equipment nor the extended time necessary for autologous breast reconstruction. In Australia, there are no established intersurgeon or interhospital referral pathways for women seeking breast reconstruction. Surgeons may freely refer their patients on to other surgeons, but they are not obliged to do so, and it is surgeons who determine where surgery takes place. Further information about breast reconstruction practice in Australia is contained in *Appendix S1* (supporting information).

While acknowledging that not all women will choose to have immediate reconstruction and that some may be clinically unsuitable owing to co-morbidities, it seems implausible that all women undergoing mastectomy for breast cancer at 31 hospitals within GCCSAs would decline immediate reconstructive surgery or were considered clinically ineligible. It is also possible that some hospitals did not allow breast reconstruction, or that the surgeons performing the mastectomy chose not to perform immediate reconstruction, were not trained or experienced in reconstructive surgery, or had no working arrangements with plastic surgeons capable of performing implant-based or autologous immediate reconstruction. Hospitals or surgeons may be acting as gatekeepers to access breast reconstruction. If this is the case, women with breast cancer face an apparent 'postcode lottery' where, depending on where they live and to which surgeon they are referred, they may or may not be offered immediate reconstruction.

This phenomenon does not seem to be limited to Australia. A recent Swedish study<sup>26</sup> reported significant regional variation in immediate breast reconstruction rates that were explained by disparities in patient information, availability of plastic surgery services and involvement in decision-making. The authors noted that the decision to offer this service 'lies in the hands of the breast surgeon scheduling surgery', even when working in consultation with a plastic surgeon. They went on to hypothesize that surgeons trained in breast reconstruction were more likely

to inform their patients about this option than those who were not<sup>26</sup>.

Two studies<sup>27,28</sup> from the USA support the 'gatekeeper' theory. One<sup>27</sup> concluded a breast surgeon's decision to refer a patient for breast reconstruction significantly increased the likelihood of her receiving reconstruction. The authors of the second study<sup>28</sup> quantified this outcome, reporting that a 'surgeon's propensity' to refer patients with breast cancer to a plastic surgeon before their cancer surgery explained 15 per cent of intersurgeon variation. They concluded that 'similar patients may get different treatment depending on their surgeon'<sup>28</sup>. A recent study<sup>29</sup> examining breast reconstruction in all 92 hospitals that perform breast surgery in the Netherlands, found large interhospital variation in rates of reconstruction even after adjustment for patient and tumour factors. These authors concluded that other 'unidentified factors, such as patient preferences, surgeons' beliefs or hospital organisational factors' may contribute to variation<sup>29</sup>.

Surgeons' attitudes also appear to play a significant role in England. A 2014 audit revealed substantial variation in immediate reconstruction rates across the English Cancer Networks, with clinicians reporting that resource issues rarely prevented timely access<sup>14</sup>. This audit also captured data on reasons for clinicians not offering breast reconstruction, and identified patient age, co-morbidity and the need for adjuvant treatments as key factors. Variation in reconstruction rates, however, was not explained by differences in patient age, co-morbidities or tumour characteristics across networks, so the clinician-cited reasons were not supported by the data. The authors concluded that 30-day national waiting time targets for patients with cancer may have discouraged surgeons from referring patients to plastic surgeons and that 'clinicians should improve local referral pathways to minimise treatment delays, improve choice and ensure access to a full range of treatment options'<sup>14</sup>.

Although rates of immediate breast reconstruction seem to be increasing in the UK, substantial regional variation still exists, suggesting unequal access to reconstructive services<sup>30</sup>. Women from more deprived areas were less likely to have immediate reconstruction, although it was unclear whether this difference was due to patient preference or service provision<sup>30</sup>. Older women were also less likely to be offered an immediate reconstruction, even when their clinical characteristics were not contraindications, indicating that clinicians were not following national guidelines<sup>31</sup>.

The recently released Cancer Australia Statement<sup>32</sup> noted that it is 'not appropriate to perform a mastectomy without first discussing with the patient the options of immediate or delayed breast reconstruction'. If

all surgeons performing mastectomy were currently discussing all breast reconstruction options with their patients and making appropriate referrals, such a statement would be unnecessary.

The major limitation of the present study is reliance on incomplete data available from the BQA. The existing data cover approximately 70–80 per cent of all new breast cancer presentations in Australia in 2013. The majority of surgeons not captured by this audit are most likely those who do smaller volumes of breast surgery and fewer reconstructions, as surgeons with higher caseloads are likely to be BreastSurgANZ members and have their data included in the BQA. Less overall coverage may reduce the estimate of breast reconstruction rates, but the disproportionate coverage of surgeons with higher caseloads may have the opposite effect.

Episodes of immediate breast reconstruction are recorded in the BQA, even where the BreastSurgANZ member performed the mastectomy but not the reconstruction (when it was performed by a plastic surgeon colleague). Although data for immediate reconstructions are therefore likely to be accurate, the converse may be the case for delayed reconstructions. BreastSurgANZ members may be less likely to update patient data for these procedures performed by plastic surgeons after the oncological surgery. As there is no national audit of breast reconstructions undertaken by plastic surgeons, no accurate estimate can be made of the numbers of delayed reconstructions being performed. Even in rural and remote areas of Australia that have some access to plastic surgeons, acute plastic surgical procedures take priority over breast reconstruction. Such data, if available, would be likely to demonstrate more inequity rather than less.

Privacy restrictions on the reporting of data dictated that individual clinical data could not be presented. Although this restriction prevented any analysis of the relative contribution of disease pathology and co-morbidities to the lack of reconstructions performed, it seems highly unlikely that clinical factors would exclude a particular hospital from performing *any* reconstruction after mastectomy on *all* patients undergoing mastectomy.

These data have demonstrated significant variation in immediate breast reconstruction rates in Australia, even between hospitals in similar resource-rich locations, indicating that the variation is not solely resource-driven. If surgeons are acting as gatekeepers and restricting access to breast reconstruction, then changes to education and training of surgeons must be undertaken to eliminate this discriminatory and inequitable practice.

Thorough analysis of breast reconstruction after mastectomy is needed at national level to obtain definitive

answers. Access to deidentified individual patient data that allows for follow-up of women who have undergone mastectomy will shed more light on the issues that determine access to breast reconstruction, including the role of the surgeon.

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### References

- 1 National Clinical Audit Support Programme (NCASP). *National Mastectomy and Breast Reconstruction Audit (Report 2)*. The Information Centre (NHS), Leeds, 2009.
- 2 Musgrave KJ, Bochner M, Kollias J. Surgical decision-making in immediate breast reconstruction. *World J Surg* 2010; **4**: 3029–3035.
- 3 Corderio PG. Breast reconstruction after surgery for breast cancer. *N Engl J Med* 2008; **359**: 1590–1601.
- 4 Howes BHL, Watson DI, Xu C, Fosh B, Canepa M, Dean MR. Quality of life following total mastectomy with and without reconstruction *versus* breast-conserving surgery for breast cancer: a case-controlled cohort study. *J Plast Reconstr Aesthet Surg* 2016; **69**: 1184–1191.
- 5 Cancer Australia. *Clinical Practice Guidelines for the Management of Early Breast Cancer* (2nd edn); 2001. <http://canceraustralia.gov.au/publications-resources/cancer-australia-publications/clinical-practice-guidelines-management-early> [accessed 5 July 2016].
- 6 National Comprehensive Cancer Network. *NCCN Guidelines Version 3. 2013*. Breast Cancer. [http://www.nccn.org/professionals/physician\\_gls/pdf/breast.pdf](http://www.nccn.org/professionals/physician_gls/pdf/breast.pdf) [accessed 5 July 2016].
- 7 National Institute for Health and Care Excellence (NICE). *Breast Cancer (Early and Locally Advanced)*; February 2009. <http://www.nice.org.uk/guidance/CG80> [accessed 5 July 2016].
- 8 European Society of Breast Cancer Specialists (EUSOMA). *Breast Unit Guidelines. Breast Surgeons*. [http://www.eusoma.org/Engx/Guidelines/Guideline.aspx?cont=sub5\\_2](http://www.eusoma.org/Engx/Guidelines/Guideline.aspx?cont=sub5_2) [accessed 9 March 2017].

- 9 Morrow M, Li Y, Alderman AK, Jagsi R, Hamilton AS, Graff JJ *et al.* Access to breast reconstruction after mastectomy and patient perspectives on reconstruction decision making. *JAMA Surg* 2014; **149**: 1015–1021.
- 10 Sisco M, Du H, Warner JP, Howard MA, Winchester DP, Yao K. Have we expanded the equitable delivery of postmastectomy breast reconstruction in the New Millennium? Evidence from the National Cancer Data Base. *J Am Coll Surg* 2012; **215**: 658–667.
- 11 Tseng WH, Stevenson TR, Canter RJ, Chen SL, Khatri VP, Bold RJ *et al.* Sacramento area breast cancer epidemiology study: use of postmastectomy breast reconstruction along the rural-to-urban continuum. *Plast Reconstr Surg* 2010; **126**: 1815–1824.
- 12 Albornoz CR, Cohen WA, Razdan SN, Mehrara BJ, McCarthy CM, Disa JJ *et al.* The impact of travel distance on breast reconstruction in the United States. *Plast Reconstr Surg* 2016; **137**: 12–18.
- 13 Potter S, Mills N, Cawthorn S, Wilson S, Blazeby J. Exploring inequalities in access to care and the provision of choice to women seeking breast reconstruction surgery: a qualitative study. *Br J Cancer* 2013; **109**: 1181–1191.
- 14 Jeevan R, Cromwell DA, Browne JP, Caddy CM, Pereira J, Sheppard C *et al.* Findings of a national comparative audit of mastectomy and breast reconstruction surgery in England. *J Plast Reconstr Aesthet Surg* 2014; **67**: 1333–1344.
- 15 Flitcroft K, Brennan M, Spillane A. The difficulties of sourcing Australian health data: the case of breast reconstruction. *ANZ J Surg* 2016; **86**: 537–539.
- 16 Breast Surgeons of Australia and New Zealand Incorporated. *BreastSurgANZ Quality Audit*. <http://www.surgeons.org/for-health-professionals/audits-and-surgical-research/morbidity-audits/bqa/> [accessed 9 August 2016].
- 17 Azzopardi J, Walsh D, Chong C, Taylor C. Surgical treatment for women with breast cancer in relation to socioeconomic and insurance status. *Breast J* 2014; **20**: 3–8.
- 18 Azzopardi J, Walsh D, Chong C, Taylor C. Impact of geographic location on surgical outcomes of women with breast cancer. *ANZ J Surg* 2014; **84**: 735–739.
- 19 Hall SE, Holman CDJ. Inequalities in breast cancer reconstructive surgery according to social and locational status in Western Australia. *Eur J Surg Oncol* 2003; **29**: S19–S25.
- 20 Bell RJ, Robinson PJ, Fradkin P, Schwarz M, Davis SR. Breast reconstruction following mastectomy for invasive breast cancer is strongly influenced by demographic factors in women in Victoria, Australia. *Breast* 2012; **21**: 394–400.
- 21 Breast Cancer Network Australia (BCNA). Issue of concern: breast reconstruction. *The Beacon*, Winter 2013; 3. [https://www.bcna.org.au/media/2243/63-the\\_beacon\\_63\\_0.pdf](https://www.bcna.org.au/media/2243/63-the_beacon_63_0.pdf) [accessed 10 November 2016].
- 22 Flitcroft K, Brennan M, Costa D, Spillane A. Documenting patterns of breast reconstruction in Australia: the national picture. *Breast* 2016; **30**: 47–53.
- 23 Australian Bureau of Statistics. *1270.0.55.001 – Australian Statistical Geography Standard (ASGS): Volume 1 – Main Structure and Greater Capital City Statistical Areas, July 2011*. <http://www.abs.gov.au/ausstats/abs@.nsf/0/89DE0953464EE050CA257801000C651B?opendocument> [accessed 9 August 2016].
- 24 Australian Government Department of Health, Canberra, Australian Capital Territory. *Digital Point Dataset: Hospital Locations*; 2014 [Access obtained by the Australian Population and Migration Research Centre, University of Adelaide].
- 25 Australian Bureau of Statistics. *2033.0.55.001 – Census of Population and Housing: Socio-Economic Indexes for Areas (SEIFA), Australia, 2011*. <http://www.abs.gov.au/ausstats/abs@.nsf/mf/2033.0.55.001> [accessed 26 May 2017].
- 26 Frisell A, Lagergren J, de Boniface J. National study of the impact of patient information and involvement in decision-making on immediate breast reconstruction rates. *Br J Surg* 2016; **103**: 1640–1648.
- 27 Preminger BA, Trencheva K, Change CS, Chiang A, El-Tamer M, Ascherman J *et al.* Improving access to care: breast surgeons, the gatekeepers to breast reconstruction. *J Am Coll Surg* 2012; **214**: 270–279.
- 28 Hawley ST, Hofer TP, Janz NK, Fagerlin A, Schwartz K, Deapen D *et al.* Correlates of between-surgeon variation in breast cancer treatments. *Med Care* 2006; **44**: 609–616.
- 29 van Bommel ACM, Mureau MAM, Schreuder K, van Dalen T, Vrancken Peeters MTFD, Schrieks M *et al.* Large variation between hospitals in immediate breast reconstruction rates after mastectomy for breast cancer in the Netherlands. *J Plast Reconstr Aesthet Surg* 2017; **70**: 215–221.
- 30 Jeevan R, Mennie JC, Mohanna PN, O'Donoghue JM, Rainsbury RM, Cromwell DA. National trends and regional variation in immediate breast reconstruction rates. *Br J Surg* 2016; **10**: 1147–1156.
- 31 Jeevan R, Browne JP, Gulliver-Clarke C, Pereira J, Caddy CM, van der Meulen JHP *et al.* Association between age and access to immediate breast reconstruction in women undergoing mastectomy for breast cancer. *Br J Surg* 2017; **10**: 555–561.
- 32 Cancer Australia. *Influencing Best Practice in Breast Cancer*. <https://thestatement.canceraustralia.gov.au/> [accessed 18 October 2016].

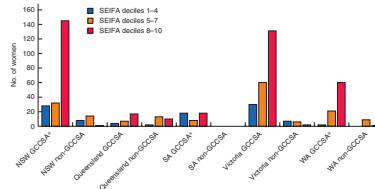
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## Graphical Abstract

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The figure shows the number of women who had breast reconstruction under the care of BreastSurgANZ members in Greater Capital City Statistical Areas (GCCSAs) and non-GCCSAs of the five most populous states, by Socio-Economic Indexes for Areas (SEIFA) place of residence, 2013. Lower decile numbers reflect higher relative socioeconomic disadvantage. \*Postcode not available for one patient. NSW, New South Wales; SA, South Australia; WA, Western Australia. Data source: references 16, 24 and 25.

The documented benefits of breast reconstruction (BR) for improved quality of life in the survivorship phase of breast cancer make increasing equitable access to BR services a mandatory component of a clinician's duty of care to these women.

Our data have demonstrated significant variation in immediate breast reconstruction (IBR) rates in similar resource-rich locations and inequitable distribution of BR uptake favouring women from higher socioeconomic areas.

If, as our data suggest surgeons may be acting as gatekeepers and restricting access to IBR by not referring women on for BR procedures, then changes to education and training of surgeons must be undertaken as a priority to eliminate this discriminatory and inequitable practice.