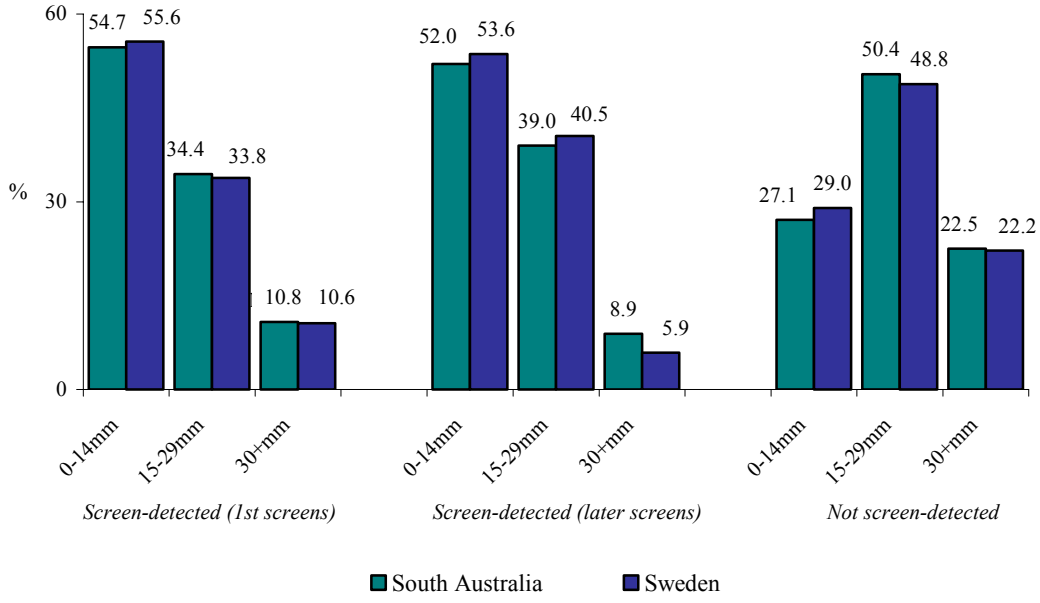
A B S T R A C T

Time trends in sizes of female-breast cancers in South Australia

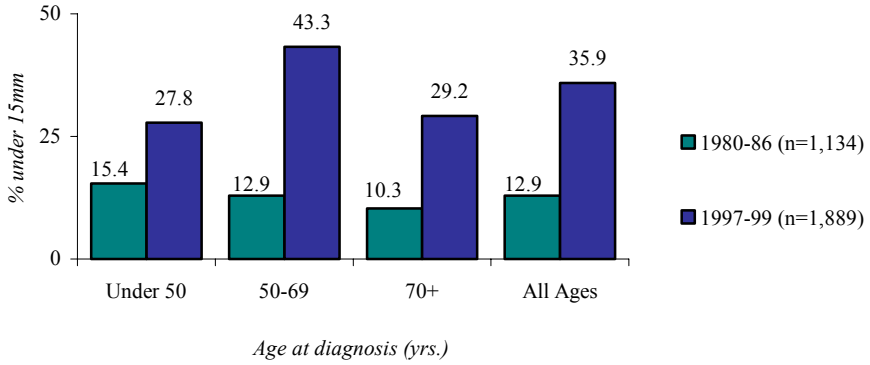
Priority has been given to the early detection of breast cancer in Australia for many years, with population-based mammographic screening commencing around 1990. A subsequent study in South Australia indicated that cancers detected in women participating in the screening programme were of a similar size distribution to the distribution observed in the Swedish two-county study (Figure 1).

Figure 1: Diameters of invasive breast cancers detected in women screened through mammography in South Australia and in the Swedish two county study



In this Chapter, time trends in sizes were examined at a population level in South Australia. The proportion of infiltrating ductal carcinomas detected when small (diameter <15mm) increased from 13% to 36% between 1980-86 and 1997-99. The largest increase applied to the principal target age range for screening of 50-69 years, namely, from 13% to 43% (Figure 2).

*Figure 2: % of infiltrating ductal carcinomas of the female breast with diameters under 15mm by age at diagnosis; South Australia 1980-86 and 1997-99**



** Source: SA Cancer Registry.*

Reductions in size were evident across a broad cross-section of ages, residential areas, and socioeconomic groups. While reductions occurred irrespective of whether the principal language spoken in the woman's country of birth was English, women from English-speaking countries tended to have the largest reductions. Despite small numbers of non-Caucasian cases available for analysis, it was evident that their tumours tended to be larger than those of non-Caucasians.

It is concluded that secular trends towards smaller breast tumours in South Australia: are occurring; are consistent with a screening effect; and likely will continue in response to increased screening coverage of the population. There is the indication that non-Caucasian women, and women born in countries where English is not the principal language, have comparatively large tumours at diagnosis and may warrant special emphasis when promoting early detection.

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CHAPTER 4

Time trends in sizes of female-breast cancers in South Australia

INTRODUCTION

Priority has been given to the early detection of breast cancer in Australia, with a primary emphasis on breast self-examination occurring in the early 1980s, followed by the introduction of mammographic screening from the late 1980s.[1,2] Population-based mammographic screening was commenced in South Australia in 1988 as a pilot programme.[3] This was followed by the introduction of the National Program for the Early Detection of Breast Cancer in mid-1991 by the Commonwealth Government, States and Territories.[4] The National Program was based on recommendations of the Australian Health Ministers' Advisory Council that two-yearly screening be made available to women aged 40 years and over, with a targeting of 50-69 year olds.[2]

Invasive breast-cancer data from the South Australian Cancer Registry have shown an increase in proportions of lesions that were under 20mm in diameter from 28% in 1980-86 to 51% in 1997 and 56% in 1998.[4] While the Registry did not collect diameter data in the intervening years, it seemed likely that increasing numbers of small lesions would have accompanied progressive increases in mammographic screening coverage.

A study in 1995 of tumour diameters for women participating in the screening programme indicated that 68% were under 20mm in diameter.[5] The corresponding proportion for age-matched controls drawn at random from the Registry was 46%. It was evident from household survey data that about 27% of control women likely would have had mammographic screening through another service outlet during the preceding three-year period.[6] Accordingly, the effect of mammographic screening likely would have been larger than reflected in these diameter differences.

In this chapter, time trends in breast-cancer diameters, as indicated by South Australian Registry data for 1980-86 and 1997-99, are investigated by age at diagnosis, Adelaide or country place of residence, socioeconomic status of residential postcode, race, and principal language of country of birth. Trends in tumour diameter and TNM stage also are investigated, using data from clinical registries at South Australian teaching hospitals.

METHODS

SA Cancer Registry

Diameters were recorded for infiltrating ductal carcinomas of the breast, which comprised approximately 85% of all invasive lesions.[1] They included a sample of 1,134 cases selected to be representative of cases diagnosed in 1980-86,[1] plus 1,889 cases where this information had been recorded for 1997-99 (i.e., 92% of cases).

Diameters were classified such that comparisons could be made with data from the Swedish two-county trial,[7,8] namely: <10, 10-14, 15-19, 20-29, 30-39, and >=40 mm. The Mann-Whitney U Test (MW) was used for univariate comparisons of diameter distributions.[9] Because distributions were not found to vary between 1980-83 and 1984-86 (MWp=0.564), data for those periods were combined.

Comparisons of diameters were made between 1980-86 and 1997-99 for all cases collectively and by: age at diagnosis (i.e., under 50, 50-69, or 70 years and over); place of residence (i.e., Adelaide or country SA); socioeconomic status of Adelaide residential postcode (according to the ABS SEIFA index);[10] race (i.e., Caucasian or non-Caucasian); and principal language of country of birth (i.e., English or other). The data for a small number of Aboriginal, Asian and other non-Caucasian women were combined because a heterogeneity in tumour diameters was not indicated (Kruskal Wallis ANOVA; p=0.726).[9]

Multivariate analyses of the relative probability of tumour diameters being small (i.e., <15mm) were undertaken, using indicator variables for age, place of residence, socioeconomic status of Adelaide residential postcode, race, and principal language of country of birth. This was performed for the 1980-86 and 1997-99 diagnostic periods separately, using Cox proportional hazards regression models in which survival was treated as a constant and the censoring variable as the outcome.[11]

Hospital-based registries

Both diameters and TNM stage distributions were compared for all female breast cancers between the 1987-92 and 1993-98 diagnostic periods, using the Mann-Whitney U Test.[9,12] The registries had recorded these characteristics for 93% and 99% of invasive breast cancers respectively (all histological types combined).

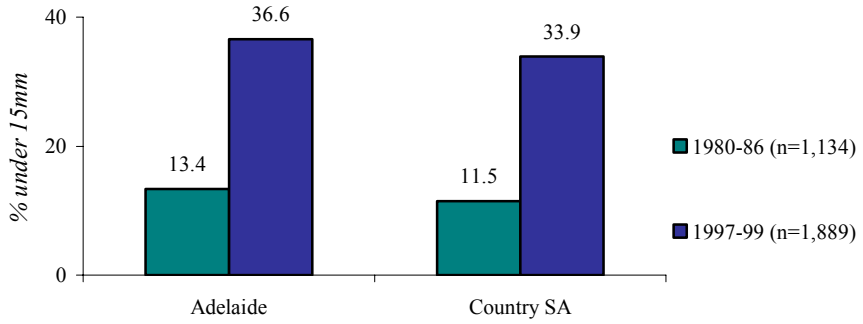
RESULTS

SA Cancer Registry

A marked reduction in diameter was evident between 1980-86 and 1997-99 (MWp<0.001), with the proportion of lesions that were small (<15mm) increasing from 13% to 36% (Table 1) (Figure 2). The corresponding increase was from: 15% to 28% for women under 50 years of age; 13% to 43% for 50-69 year olds (the mammographic screening target); and 10% to 29% for women aged 70 years or more (Table 1). While the proportion of cancers that were small decreased by age in 1980-86, a peak was evident among the 50-69 year screening target in 1997-99.

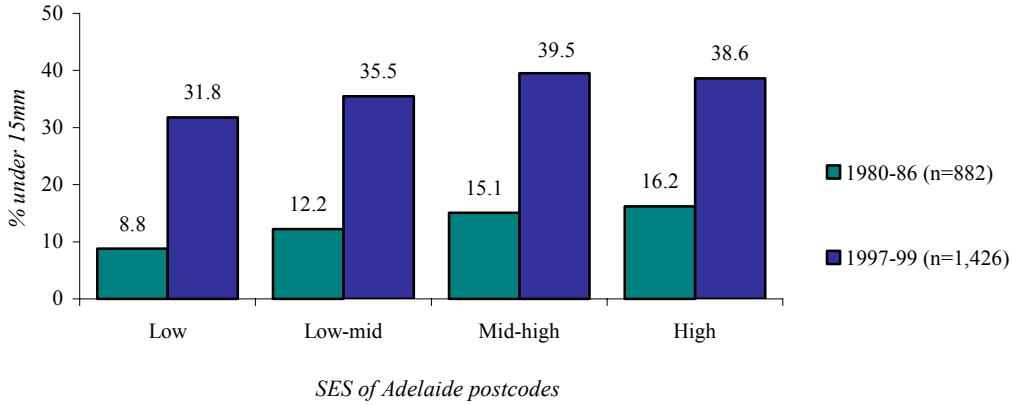
Both Adelaide and country residents showed an increased proportion of lesions that were small between 1980-86 and 1997-99 (MWp<0.001) (Table 2) (Figure 3), as did women from postcodes of varying socioeconomic status in Adelaide (MWp≤0.017) (Table 3) (Figure 4).

*Figure 3: % infiltrating ductal carcinomas of the female breast with diameters under 15mm by place of residence; South Australia 1980-86 and 1997-99**



** Source: SA Cancer Registry.*

*Figure 4: % infiltrating ductal carcinomas of the female breast with diameters under 15mm by socioeconomic status of Adelaide residential postcode**

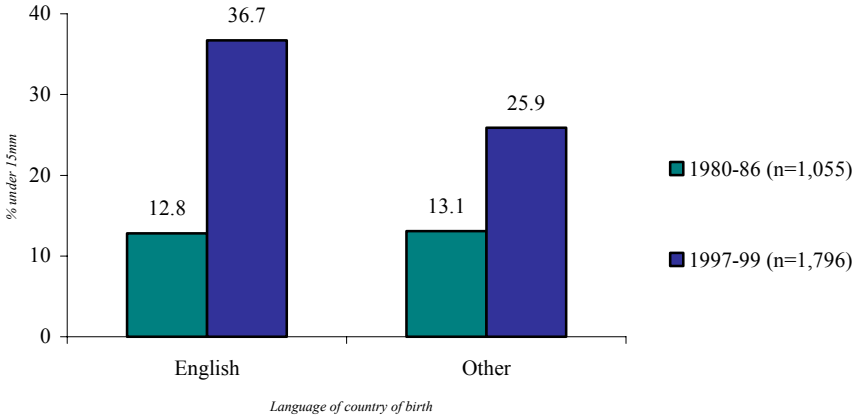


** Source: SA Cancer Registry.*

Only data for 27 non-Caucasian cases were available for analysis. Still, there was evidence that they had larger diameters than applying for Caucasian cases (MWp=0.002) (Table 4). Caucasian women showed a statistically significant reduction in diameter between 1980-86 and 1997-99 (MWp<0.001), whereas non-Caucasian women did not (MWp=0.202), although the latter comparison lacked statistical power due to small numbers (Table 4).

Women experienced significant reductions in tumour diameters between 1980-86 and 1997-99, irrespective of whether they were born in a country where the principal language was English (p<0.001) (Table 5) (Figure 5).

*Figure 5: % female breast cancers with diameters under 15mm by language of country of birth; South Australia 1980-86 and 1997-99**



** Source: SA Cancer Registry.*

Multivariate analyses of data for cases diagnosed in 1997-99 confirmed that the probability of a lesion being small was elevated for 50-69 year olds (Table 6). This did not apply in 1980-86 prior to the introduction of population-based mammographic screening. In both periods, the probability of small lesions tended to higher in the higher socioeconomic areas, although there were overlapping 95% confidence ranges. In both periods, Caucasians tended more than non-Caucasians to have small lesions. While the probability of lesions being small was similar in 1980-86, irrespective of whether English was the principal language of the country of birth, small lesions

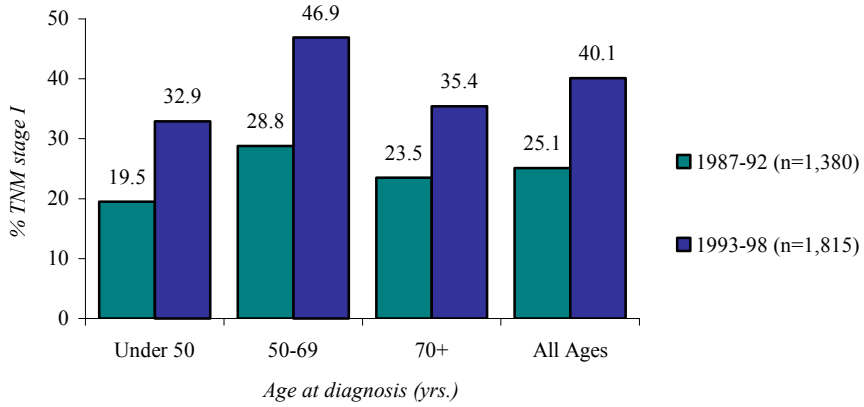
tended to be more common in women from English than non-English speaking countries in 1997-99.

Hospital-based registries

Tumour diameters reduced between 1987-92 and 1993-98, irrespective of age MWp<=0.005) (Table 7). The proportion of lesions that were small (<15mm) increased from: 16% to 28% for all ages combined; 15% to 22% for women under 50 years of age; 18% to 35% for 50-69 year olds; and 12% to 21% for women aged 70 years or more.

TNM stage distributions also varied between 1987-92 and 1993-98, irrespective of age (MWp<0.001) (Table 8). The proportion that were Stage I increased from: 25% to 40% for all ages combined; 20% to 33% for women under 50 years of age; 29% to 47% for 50-69 year olds; and 24% to 35% for women aged 70 years or more (Figure 6).

*Figure 6: % female breast cancers diagnosed at TNM stage I, by age at diagnosis: South Australian hospital-based registries; 1987-98**



** Registries in SA teaching hospitals.*

DISCUSSION

Results indicate that early-detection interventions in South Australia have been accompanied by reductions in breast-tumour diameter. Prior to population-based mammographic screening, 13% of infiltrating ductal carcinomas were small (i.e., <15mm in diameter), whereas this proportion had increased to 36% by 1997-99.

A 1995 study had indicated that effects of mammographic screening in South Australia were similar to those observed in the Swedish two-county study.[5,7,8] For example, the proportion of small cancers among screen-detected lesions was 54% in both instances. The respective proportions also were similar for interval cancers, namely, 27% and 29%. It seemed likely therefore, that mammographic screening would be having the expected effect in South Australia and would be contributing to the reductions in tumour size at a population level, that have been described in this Chapter.

It also is notable that the age range with the highest proportion of small lesions in 1997-99 was the principal target range for mammographic screening (i.e., 50-69 year olds). A peak was not seen in this age range prior to screening. Increases in the proportions of tumours that were small applied to all age groups and to a broad cross-section of residential areas.

Of the 27 infiltrating ductal cancers recorded among non-Caucasian women, none had diameters smaller than 15mm. This compared with the 7.2 expected from non-Caucasian small-cancer detection rates. Comparisons between sub-groups of non-Caucasian women were not feasible, due

to small numbers. In broad terms, however, the results indicate that non-Caucasian women were at an elevated risk of delayed diagnosis and may warrant special attention in early-detection promotion.

While the proportions of infiltrating ductal carcinomas that were small were similar in 1980-86, irrespective of whether women were born in an English speaking or non-English speaking country, the increase over time was larger among the former. As a result, the proportion that were small was lower among women from non-English speaking countries than for other women in 1997-99.

While the study group was too small for comparisons by country of birth within the non-English speaking category, the results suggest that early-detection initiatives have been less effective in general terms in this broad category of women. It may be appropriate, therefore, to place a special emphasis on women from non-English countries, when promoting early detection.

Data from hospital-based registries showed similar reductions in tumour diameter to those indicated by the population-based data, together with reductions in stage. The proportions of lesions that were small were consistent with the proportions indicated by the population-based data, after allowing for displacement in time.

Based on the decreases in tumour diameters observed between 1980-86 and 1997-99 from the population-based data, and 15-year case-fatality rates from breast cancer by diameter,[13] a 27% reduction in mortality might be expected, although this figure may be distorted by lead-time and related effects. Notably, a 14% reduction already has been observed when 1997-99 data were compared the preceding 10-year data.[13] This has been attributed both to earlier detection and treatment advances.

It is concluded that trends towards smaller breast tumours in South Australia are consistent with a screening effect and likely will continue as a result of a greater screening coverage of the population. As a consequence, mortality effects from screening are expected to increase progressively and complement gains from treatment advances.

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*TABLE 1: Diameters of infiltrating ductal carcinomas of the female breast by woman's age at diagnosis and diagnostic period; South Australia, 1980-86 and 1997-99**

	Age (yrs.)						*Total*	
	Under 50		*50-69*		*70+*			
Diameter (mm)	1980-86 (n=293)	1997-99 (n=510)	1980-86 (n=580)	1997-99 (n=944)	1980-86 (n=261)	1997-99 (n=435)	1980-86 (n=1,134)	1997-99 (n=1,889)
Under 10	3.4%	9.4%	2.6%	17.7%	1.9%	9.2%	2.6%	13.5%
10-14	11.9%	18.4%	10.3%	25.6%	8.4%	20.0%	10.3%	22.4%
15-19	14.3%	21.8%	14.8%	19.3%	16.9%	18.4%	15.2%	19.7%
20-29	28.0%	27.6%	30.5%	21.2%	26.1%	29.7%	28.8%	24.9%
30-39	17.1%	11.8%	15.2%	7.9%	17.2%	12.4%	16.1%	10.0%
40+	25.3%	11.0%	26.6%	8.3%	29.5%	10.3%	26.9%	9.5%
Total	100%	100%	100%	100%	100%	100%	100%	100%
	(MW p<0.001)		*(MW p<0.001)*		*(MW p<0.001)*		*(MW p<0.001)*	

** Source: SA Cancer Registry.*

*TABLE 2: Diameters of infiltrating ductal carcinomas of the female breast by woman's place of residence and diagnostic period; South Australia, 1980-86 and 1997-99**

	Place of residence			
	Adelaide		*Country SA*	
Diameter (mm)	1980-86 (n=882)	1997-99 (n=1,426)	1980-86 (n=252)	1997-99 (n=463)
Under 10	2.7%	13.9%	2.4%	12.3%
10-14	10.7%	22.7%	9.1%	21.6%
15-19	14.9%	20.0%	16.3%	19.0%
20-29	29.4%	25.0%	27.0%	24.4%
30-39	15.6%	9.8%	17.9%	10.6%
40+	26.8%	8.6%	27.4%	12.1%
Total	100%	100%	100%	100%
	(MW p<0.001)		*(MW p<0.001)*	

** Source: SA Cancer Registry.*

*TABLE 3: Diameters of infiltrating ductal carcinomas of the female breast by socioeconomic status of woman's residential postcode and diagnostic period; Adelaide, 1980-86 and 1997-99**

	Socioeconomic status							
	Low		*Low-mid*		*Mid-high*		*High*	
Diameter (mm)	1980-86 (n=215)	1997-99 (n=352)	1980-86 (n=180)	1997-99 (n=251)	1980-86 (n=172)	1997-99 (n=256)	1980-86 (n=315)	1997-99 (n=567)
Under 10	0.0%	10.2%	2.2%	13.9%	3.5%	16.8%	4.4%	14.8%
10-14	8.8%	21.6%	10.0%	21.5%	11.6%	22.7%	11.7%	23.8%
15-19	13.0%	19.6%	16.1%	19.5%	12.2%	18.8%	16.8%	21.0%
20-29	28.4%	25.6%	35.6%	25.5%	28.5%	26.2%	27.0%	24.0%
30-39	16.3%	12.2%	11.7%	10.4%	14.5%	7.0%	18.1%	9.3%
40+	33.5%	10.8%	24.4%	9.2%	29.7%	8.6%	21.9%	7.1%
Total	100%	100%	100%	100%	100%	100%	100%	100%
	(MW p<0.001)		*(MW p=0.017)*		*(MW p<0.001)*		*(MW p<0.001)*	

** Source: SA Cancer Registry.*

*TABLE 4: Diameters of infiltrating ductal carcinomas of the female breast by woman's race and diagnostic period; South Australia, 1980-86 and 1997-99**

	Caucasian		*Other races*	
Diameter (mm)	1980-86 (n=1,090)	1997-99 (n=1,767)	1980-86 (n=8)	1997-99 (n=19)
Under 10	2.6%	13.0%	0.0%	0.0%
10-14	10.4%	22.2%	0.0%	0.0%
15-19	14.8%	20.0%	12.5%	21.1%
20-29	28.5%	25.2%	25.0%	42.1%
30-39	16.2%	10.0%	12.5%	15.8%
40+	27.4%	9.6%	50.0%	21.1%
Total	100%	100%	100%	100%
	(MW p<0.001)		*(MW p=0.202)*	

** Source: SA Cancer Registry.*
NB: Race not known for 4.6% of cases.

*TABLE 5: Diameters of infiltrating ductal carcinomas of the female breast by principal language of woman's country of birth and diagnostic period; South Australia, 1980-86 and 1997-99**

	Language of country of birth			
	English		*Other language*	
Diameter (mm)	1980-86 (n=933)	1997-99 (n=1,568)	1980-86 (n=122)	1997-99 (n=228)
Under 10	2.5%	13.3%	3.3%	9.6%
10-14	10.3%	23.4%	9.8%	16.2%
15-19	14.7%	20.5%	12.3%	16.7%
20-29	28.9%	24.4%	26.2%	29.8%
30-39	16.2%	9.3%	14.8%	14.0%
40+	27.4%	9.0%	33.6%	13.6%
Total	100%	100%	100%	100%
	(MW p<0.001)		*(MW p<0.001)*	

* *Source: SA Cancer Registry.*
NB: Country of birth not known for 5.7% of cases.

*TABLE 6: Relative probability (RP) of infiltrating ductal carcinomas of the female breast being detected when small (diameter < 15mm) according to woman's age at diagnosis, place of residence, race, and principal language of country of birth; South Australia, 1980-86 and 1997-99**

	~ Multivariate analyses ~			
	1980-86 (n=1,051)		*1997-99 (n=1,767)*	
Predictors	*RP (95% confidence limits)*		*RP (95% confidence limits)*	
Age (yrs.):				
Under 50 (reference)	1.00		1.00	
50-69	0.80	(0.54, 1.18)	1.48	(1.22, 1.81)
70+	0.63	(0.39, 1.04)	0.99	(0.77, 1.27)
Residence:				
Country SA (reference)	1.00		1.00	
Adelaide:				
Low SES	0.67	(0.36, 1.23)	0.96	(0.75, 1.24)
Low/mid SES	1.00	(0.56, 1.78)	1.03	(0.78, 1.35)
Mid/high SES	1.27	(0.73, 2.20)	1.19	(0.92, 1.54)
High SES	1.35	(0.83, 2.19)	1.15	(0.93, 1.42)
Race:				
Caucasian (reference)	1.00		1.00	
Other	0.00	(0.00, -)	0.00	(0.00, -)
Language:				
English (reference)	1.00		1.00	
Other	1.08	(0.63, 1.83)	0.77	(0.58, 1.00)

* *Source: SA Cancer Registry.*
Derived from Cox proportional hazards regression models in which survival was treated as a constant and the censoring variable was used to indicate the outcome.

*TABLE 7: Diameters of female-breast cancers by woman's age at diagnosis and diagnostic period; SA hospital-based registries, 1987-98**

	Age (yrs.)						*Total*	
	Under 50		*50-69*		*70+*			
Diameter (mm)	1987-92 (n=290)	1993-98 (n=475)	1987-92 (n=604)	1993-98 (n=818)	1987-92 (n=344)	1993-98 (n=457)	1987-92 (n=1,238)	1993-98 (n=1,750)
Under 10	3.4%	7.8%	4.8%	14.9%	2.6%	6.6%	3.9%	10.8%
10-14	11.4%	13.9%	13.2%	19.8%	9.3%	14.9%	11.7%	16.9%
15-19	16.2%	18.9%	16.4%	17.2%	12.2%	14.9%	15.2%	17.1%
20-29	26.9%	25.1%	28.8%	23.3%	28.8%	28.2%	28.4%	25.1%
30-39	17.6%	13.9%	16.4%	12.2%	22.4%	15.3%	18.3%	13.5%
40+	24.5%	20.4%	20.4%	12.5%	24.7%	20.1%	22.5%	16.6%
Total	100%	100%	100%	100%	100%	100%	100%	100%
	(MW p=0.005)		*(MW p<0.001)*		*(MW p<0.001)*		*(MW p<0.001)*	

* *Clinical registries at teaching hospitals.*

*TABLE 8: TNM stages of female-breast cancers by woman's age at diagnosis and diagnostic period; SA hospital-based registries, 1987-98**

	Age (yrs.)						*Total*	
	Under 50		*50-69*		*70+*			
Stage	1987-92 (n=323)	1993-98 (n=487)	1987-92 (n=653)	1993-98 (n=853)	1987-92 (n=404)	1993-98 (n=475)	1987-92 (n=1,380)	1993-98 (n=1,815)
I	19.5%	32.9%	28.8%	46.9%	23.5%	35.4%	25.1%	40.1%
II	61.3%	52.8%	51.5%	42.7%	52.0%	46.3%	53.9%	46.3%
III	12.4%	10.5%	9.8%	4.8%	12.1%	9.3%	11.1%	7.5%
IV	6.8%	3.9%	10.0%	5.6%	12.4%	9.1%	9.9%	6.1%
Total	100%	100%	100%	100%	100%	100%	100%	100%
	(MW p<0.001)		*(MW p<0.001)*		*(MW p<0.001)*		*(MW p<0.001)*	

* *Clinical registries at teaching hospitals.*

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