The Breast 24 (2015) 524–527

Contents lists available at ScienceDirect

The Breast

journal homepage: www.elsevier.com/brst

Temporal trends show improved breast cancer survival in Australia but widening urban–rural differences

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ARTICLE INFO

Article history:
Received 10 January 2015
Received in revised form
9 March 2015
Accepted 18 March 2015
Available online 3 April 2015

Keywords:
Breast cancer
Geography
Inequality
Temporal trends
Survival
Population health

ABSTRACT

We examined geographic patterns in breast cancer survival over time using population-based data for breast cancer diagnosed between 1987 and 2007 in New South Wales, Australia. We found that five-year relative survival increased during the entire study period. Multivariable analysis indicated that there was little geographic variation in 1992–1996, but in 1997–2001 and 2002–2007 geographic variation was statistically significant ($P < 0.01$), with women living in rural areas having higher risk of death from breast cancer. The underlying reasons for this widening survival disparity must be identified so that appropriately targeted interventions can be implemented and the disparity reduced.

Introduction

Breast cancer is the most commonly diagnosed cancer in Australian women [1]. As in most developed countries [2], prognosis for breast cancer patients has improved over the past 20 years in Australia [3,4]. These survival benefits were not however uniformly experienced by all population subgroups, with patients living in socioeconomic disadvantaged or geographically remote areas having poorer survival [5–8]. Factors that may mediate these disparities include differences in the stage at diagnosis, access to and quality of care received, and other correlates of geographic or socioeconomic disadvantage. While disparities in cancer survival according to place of residence are well established in Australia [5–8], few studies have looked at the temporal trends in these disparities.

The aim of this study was to describe recent geographic patterns in breast cancer survival in the Australian state of New South Wales (NSW), and investigate temporal trends in these geographic variations adjusted for confounders.

Methods

Data were obtained from the NSW Central Cancer Registry for all first primary breast cancers (ICD-O3: C50) [9] diagnosed in women aged 18–84 years from January 1987 to December 2007 that were prevalent cases between 1992 and 2007. Cases were excluded if they were reported through death certificate only or first identified post-mortem. Ethics approval was obtained from the NSW Population and Health Service Research Ethics Committee (ref: 2009/03/139).

The outcome variable was all-cause survival after a diagnosis of breast cancer. Survival status was obtained through record linkage of the cancer cases in the cancer registry with the death records from the NSW Register of Births, Deaths and Marriages and the National Death Index. All eligible patients were followed up until 31 December 2007, the most recent data available.

Two area-based measures were used: geographic remoteness and socioeconomic status (SES) of local government areas of

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http://dx.doi.org/10.1016/j.breast.2015.03.006
0960-9776/

residence at diagnosis. Geographic remoteness of residence was categorised into major cities, inner regional, rural (including outer regional, remote and very remote areas) using the Australian Standard Geographic Classification Remoteness Structure [10]. The socioeconomic disadvantage tertiles were defined using the Index of Relative Socio-economic Disadvantage derived from the 2001 Census [11].

Additional variables included were age at diagnosis (18–49, 50–59, 60–69 and 70–84 years), and disease stage at diagnosis (localised, regional, distant and unknown).

Statistical analysis

The methods used have been described in detail previously [12]. Five-year relative survival was calculated for each geographic region using the period approach [13], with cancer cases under observation in each of three "at-risk" periods: 1992–1996, 1997–2001 and 2002–2007. The period approach was used because it provides reliable predictions of 5-year cohort survival when sufficient follow-up is not available for recent diagnosed patients, such as for those diagnosed in the most recent period (2002–2007) [14]. We then used a Poisson regression model [15] to calculate the relative excess risk (major cities as reference category) of death (RER) within 5 years of diagnosis, adjusting for age group, disease stage at diagnosis, and SES tertiles stratified by at risk period. We fitted two models: one including SES and another without. To support interpretation of results, we repeated the above analysis stratified by disease stage (localised vs non-localised). Finally, we added an interaction term to the model between the geographic location and at-risk period to allow the effect of geographic remoteness to change over time and then assessed if this interaction was statistically significant. A two-sided, log-likelihood ratio test with a P value <0.05 indicated statistical significance. Further analysis was undertaken to investigate the possible impact of lead-time bias on survival due to potential urban–rural differences in the intensity of mammographic screening. We investigated this possibility by estimating the age-standardised mortality ratio during the first five years after breast cancer diagnosis by geographic location over the three at risk periods. Analyses were performed using Stata statistical software, version 13.1 (StataCorp).

Results

Of the 63,757 eligible women diagnosed with breast cancer, 72.8% were resident in major cities and 20.6% were resident in inner regional areas. Characteristics of the study population can be found in online Appendix 1.

The 5-year relative survival for women diagnosed with breast cancer increased during the entire study period, from 81.5% in 1992–1996 and 86.7% in 1997–2001 to 89.6% in 2002–2007. The improvement in survival over time was also observed across categories of geographic remoteness (Fig. 1), but survival was consistently lower for women living in rural areas across the whole study period 1992–2007.

The results of our multivariable analysis (Table 1) show that after adjustment for all prognostic factors there was little geographic variation in 1992–1996. During 1997–2001, the adjusted RER was significantly higher for patients living in inner regional and rural areas than for those in major cities, although the RER for inner regional became non-significant after further adjustment for SES. In the most recent period (2002–2007), the RER for rural areas was larger and statistically significant, while the RER for inner regional areas was not statistically significant. The interaction between geographic remoteness and at-risk period was significant ($P = 0.037$), indicating that the urban–rural differential had widened over time. Stratified analyses (online Appendix 2) found that the urban–rural disparities were only observed for non-localised cancer ($p = 0.001$).

Further analysis suggested that similar geographic patterns were observed in mortality over time (online Appendix 3). The risk of dying in the first 5 years after diagnosis was more than 10% higher for women living in rural areas in the most recent period, although this did not reach statistical significance due to the small

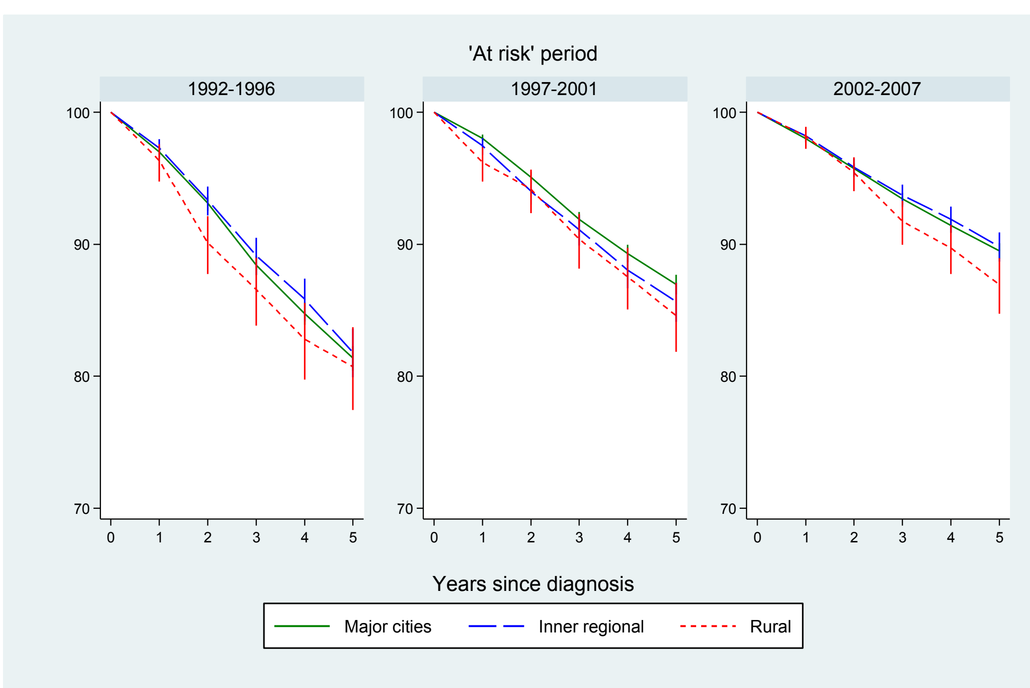

Fig. 1. Relative survival (95% confidence interval: CI) for breast cancer in NSW, Australia, by geographic remoteness for each of the three at-risk periods, 1992–2007.