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Breast Cancer Survival in Ontario and California, 1998–2006: Socioeconomic Inequity Remains Much Greater in the United States

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Abstract

This study re-examined the differential effect of socioeconomic status on the survival of women with breast cancer in Canada and the United States. Ontario and California cancer registries provided 1,913 cases from urban and rural places. Stage-adjusted cohorts (1998–2000) were followed until 2006. Socioeconomic data were taken from population censuses. SES-survival associations were observed in California, but not in Ontario, and Canadian survival advantages in low-income areas were replicated. A better controlled and updated comparison reaffirmed the equity advantage of Canadian health care.

INTRODUCTION

A study of cancer survival in Toronto, Ontario and Detroit, Michigan, compared their ecologically-defined poor during the late 1980s and found significantly advantaged survival among Canadians for most common types of cancer (1). This consistent pattern of Canadian survival advantage was then systematically replicated for a sentinel cancer of great public health significance—breast cancer—across diverse Canadian and United States metropolitan areas through the mid-1990s (2–4). No such between-country differences were observed among middle- or high-income groups. None of the previous international comparative studies of breast cancer survival accounted for between-country case-mix differences on the stage of disease at the time of diagnosis. This study did, and it also extended analyses beyond metropolitan areas to the year 2006. Consistent with a health insurance theory to explain frequently observed socioeconomic status (SES) breast cancer care gradients in the United States, but not in Canada (5–13), We hypothesized that the Canadian breast cancer survival advantage among the relatively poor observed previously would be replicated systematically.

METHODS

The Ontario Cancer Registry (OCR) and the California Cancer Registry (CCR), both demonstrably comprehensive and valid, respectively, provided 929 and 984 primary,

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invasive, non-metastasized, adult (25 or older) female breast cancer cases diagnosed between January 1, 1998 and December 31, 2000 (ICD-9 code = 174) (14–17). Cases were selected randomly from very large metropolitan areas (greater metropolitan Toronto and the San Francisco bay area), small cities (Windsor and Modesto), and small rural places (18–25). Census tract-based SES measures (meeting a “low-income” criterion in Canada and “poverty” threshold in the United States) of shown predictive validity defined relative income tertiles (18–20,26,27). These tertiles seemed to achieve their analytic goal of aggregating relatively similar low- to high-income areas within countries. Ontario SES tertiles were defined as high-income areas (low-income prevalence 0.0%–7.4% [median household income = \$73,200 CAD]), middle-income (7.5%–14.1% [\$51,300 CAD]), and low-income (14.2%–52.8% [\$38,400 CAD]). California tertiles were defined as high-income (0.8%–6.0% poor [\$75,900 USD]), middle-income (6.1%–11.6% [\$51,500 USD]) and low-income (11.7%–62.0% [\$34,000 USD]). Although inadequately powerful to detect modest, stage-adjusted effects, SES quintile effects were explored because their lowest quantiles corresponded well to areas that have been validated as relatively vulnerable working-class or lower middle-class to high poverty under-class areas (28): Ontario (low-income prevalence 21.0%–52.8% [median household income = \$30,930 CDN]) and California (17.0%–62.0% poor [\$28,800 USD]).

Stage of disease at diagnosis (node negative [localized or regional] or regional node-positive), routinely coded by the CCR, was very reliably abstracted from patient charts for the OCR sample (average κ coefficient among three chart abstractors was 0.95) (29–31). Cohorts were followed for 5-year all-cause survival until December 31, 2005, with ample power to detect 15% survival rate differences between three socioeconomic strata within three types of places ($\alpha = 0.05$ [two-tailed] and power $(1 - \beta) = 0.80$) (32). Key comparisons used survival rate ratios (SRR). All rates were directly age-adjusted, using this study’s combined Ontario–California population of cases as the standard, so all of the rates are directly comparable. Confidence intervals (95% CI) around SRR were based on the Mantel-Haenszel χ^2 test (33,34). Further methodological details have been presented previously (5).

RESULTS

Breast cancer survival was not associated with income in Ontario, but it was in California. As compared with California’s highest income areas, the 5-year survival rate was significantly lower in the state’s lowest income areas (SRR = 0.89), and this association was restricted to node-positive disease (SRR = 0.83). As hypothesized for low-income groups, significantly advantaged Canadian survival was observed (SRR = 1.11), again restricted to node-positive breast cancer (SRR = 1.22). Also consistent with a health insurance hypothesis, these respective associations were larger when the analysis was restricted to patients diagnosed before the age of 65 not yet eligible for Medicare coverage in the United States (SRR = 1.24 [95% CI: 1.07, 1.43] and 1.37 [95% CI: 1.10, 1.71], not shown in Table 1). This pattern of within- and between-country findings did not differ significantly by large or small urban or rural places.

DISCUSSION

This study updated and replicated the Canadian breast cancer survival advantage in relatively poor areas observed previously, particularly among younger patients not yet eligible for Medicare in the United States. This stage-adjusted analysis also found that the Canadian survival advantage probably pertains exclusively to those with more advanced, node-positive disease. The stage-specific finding seems to implicate health care systemic differences, specifically, Canada’s universally accessible care versus the United States’ prevalent inaccessibility among the under- and uninsured. Relatively more surgical and

adjuvant (chemo-, radiation, and hormone therapies) innovations of varying costs and evidentiary supports were contemporaneously advanced for the treatment of node-positive breast cancer. It seems plausible that low-income patients in the United States may be more deprived at the hands of such greater clinical and managerial discretion.

This study could conceivably be limited by its focus on all-cause, rather than cancer-specific survival. However, we do not believe that for the following reasons. Cancer is the underlying cause of death among the vast majority of women with cancer (2,3). The underlying cause of many “non-cancer” deaths can often be associated directly with nontreatment or even with some cancer treatment complications (35). Although length of survival is highly accurate in these cancer registries, the underlying cause of death is not (14). A sub-analysis limited to women under the age of 50 seemed to rule out related methodological confounding. Their expected survival without cancer was virtually 100% and their underlying cause of death among this study’s nonsurviving sample was nearly exclusively cancer. Key within- and between-country findings were replicated among them. For node-positive breast cancer, the SES tertile-5-year survival association remained null in Ontario ($n = 96$, $SRR = 0.95$ [95% CI: 0.79, 1.14]) and significant in California ($n = 90$, $SRR = 0.81$ [90% CI: 0.67, 0.98]), and among low-income groups, the finding of significantly advantaged Canadian survival was also replicated ($n = 67$, $SRR = 1.43$ [95% CI: 1.09, 1.88]).

CONCLUSION

An updated stage-adjusted comparison of breast cancer survival replicated the equity advantage of Canadian cancer care. More inclusive health care insurance coverage in Canada versus the United States particularly among each country’s relatively poor people, remains the most plausible explanation for such a Canadian advantage. Canada’s single payer health care system seems to have offered similar advantages across a number of diverse urban and rural contexts.

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Associations of country and socioeconomic status with 5-year breast cancer survival within stage of disease at diagnosis

TABLE 1

Income group	Ontario				California				Ontario vs. California			
	Breast cancer cases (n)	SR	SRR [†]	95% CI [‡]	Breast cancer cases (n)	SR	SRR [†]	95% CI [‡]	SRR [†]	95% CI [‡]	SRR [†]	95% CI [‡]
Highest	186	0.876	1.00	—	196	0.840	1.00	—	1.04	0.96, 1.13	1.04	0.96, 1.13
Middle	184	0.852	0.97	0.88, 1.06	193	0.822	0.98	0.90, 1.06	1.04	0.94, 1.15	1.04	0.94, 1.15
Lowest	187	0.835	0.95	0.87, 1.04	201	0.806	0.96	0.88, 1.04	1.04	0.93, 1.16	1.04	0.93, 1.16
Node negative breast cancer	186	0.830	0.95	0.88, 1.03	196	0.834	0.99	0.92, 1.06	1.00	0.91, 1.09	1.00	0.91, 1.09
High	196	0.829	0.95	0.88, 1.03	198	0.746	0.89 [*]	0.81, 0.98 [*]	1.11 [*]	1.00, 1.23 [*]	1.11 [*]	1.00, 1.23 [*]
Middle	209	0.885	1.00	—	234	0.851	1.00	—	1.04	0.97, 1.12	1.04	0.97, 1.12
Low	202	0.871	0.98	0.89, 1.08	237	0.849	1.00	0.94, 1.06	1.03	0.95, 1.12	1.03	0.95, 1.12
Node positive breast cancer	214	0.840	0.95	0.88, 1.02	231	0.818	0.96	0.88, 1.05	1.03	0.94, 1.13	1.03	0.94, 1.13
High	105	0.788	1.00	—	92	0.774	1.00	—	1.02	0.90, 1.16	1.02	0.90, 1.16
Middle	103	0.732	0.93	0.81, 1.07	93	0.711	0.92	0.78, 1.09	1.03	0.84, 1.26	1.03	0.84, 1.26
Low	96	0.781	0.99	0.88, 1.11	97	0.642	0.83 [*]	0.69, 0.99 [*]	1.22 [*]	1.02, 1.46 [*]	1.22 [*]	1.02, 1.46 [*]

CI = confidence interval; SR = 5-year survival rate; SRR = survival rate ratio.

^{*} Statistically significant.

[†] Survival rate ratio of 1.00 is the baseline.

[‡] Confidence intervals are based on the Mantel-Haenszel χ^2 test.