2009

Breast cancer survival in ontario and california, 1998-2006: socioeconomic inequity remains much greater in the United States

Kevin M. Gorey
University of Windsor

Published in final edited form as:

Ann Epidemiol. 2009 February ; 19(2): 121–124. doi:10.1016/j.annepidem.2008.10.010.

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

KEVIN M. GOREY, Phd, Msw, **ISAAC N. LUGINAAH, Phd**, **ERIC J. HOLOWATY, MD**, **KAREN Y. FUNG, Phd**, and **CAROLINE HAMM, MD**

School of Social Work, University of Windsor, Ontario (K.M.G.), Department of Geography, University of Western Ontario, London (I.N.L.); Division of Preventive Oncology, Cancer Care Ontario, Toronto (E.J.H.); Department of Mathematics and Statistics, University of Windsor, Ontario (K.Y.F.); and Windsor Regional Cancer Center, Ontario (C.H.)

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,

Address correspondence to: Kevin M. Gorey, Professor and Assumption University Research Chair in Canadian and American Population Health, School of Social Work, University of Windsor, 401 Sunset Avenue, Windsor, Ontario, N9B 3P4, Canada. Tel.: 519-253-3000, ext. 3085; fax: 519 973-7036., gorey@uwindsor.ca.

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.

This research was supported in part with funds from the Canadian Breast Cancer Research Alliance (Canadian Institutes of Health Research [CIHR] grant MOP-67161), the Canadian Cancer Society (National Cancer Institute of Canada grant 016160), the Social Sciences and Humanities Research Council of Canada (grant 410-2002-0173) as well as a CIHR investigator award and partnership appointment to its first and second investigators. The authors gratefully acknowledge the administrative and logistical assistance of William E. Wright, Chief, Cancer Surveillance Section of the California Department of Health Services at the time this study was initiated. We also gratefully acknowledge the research and technical assistance of Carole Herbert (Cancer Care Ontario), Madhan Balagurusamy, Leah Archambault, Natalie Herbert, Dylan Herbert (University of Windsor), and Mark Allen (California Cancer Registry). This study was reviewed and cleared by the University of Windsor’s research ethics committee as well as the Ontario Cancer Research Network’s research ethics board.

References

1. Gorey KM, Holowary EJ, Fehringer G, Laukkanen E, Moskowitz A, Webster DJ, et al. An international comparison of cancer survival: Toronto, Ontario, and Detroit, Michigan, metropolitan areas. Am J Public Health 1997;87:1156–1163. [PubMed: 9240106]
2. Gorey KM, Kliewer E, Holowaty EJ, Laukkanen E, Ng EY. An international comparison of breast cancer survival: Winnipeg, Manitoba and Des Moines, Iowa, metropolitan areas. Ann Epidemiol 2003;13:32–41. [PubMed: 12547483]

3. Gorey KM, Holowaty EJ, Fehringer G, Laukkanen E, Richter NL, Meyer CM. An international comparison of cancer survival: metropolitan Toronto, Ontario and Honolulu, Hawaii. Am J Public Health 2000;90:1866–1872. [PubMed: 11111258]
4. Gorey KM, Holowaty EJ, Fehringer G, Laukkanen E, Richter NL, Meyer CM. An international comparison of cancer survival: relatively poor areas of Toronto, Ontario and three US metropolitan areas. J Public Health Med 2000;22:343–348. [PubMed: 11077908]
5. Gorey KM, Luginaah IN, Holowaty EJ, Fung KY, Hamm C. Wait times for initial surgical and adjuvant treatment of breast cancer in Canada and the United States: evidence of greater socioeconomic inequity in America. J Clin Epidemiol. 2008 In press.
6. Gorey KM, Luginaah IN, Schwartz KL, Fung KY, Balagurusamy M, Bartfay E, et al. Increased racial differences on breast cancer and survival in America: historical evidence consistent with a health insurance hypothesis, 1975–2001. Breast Cancer Res Treat. 2008 In press.
7. Gorey KM, Fung KY, Luginaah IN, Bartfay E, Hamm C, Wright FC, et al. Cancer survival in Ontario, 1986–2003: evidence of equitable advances across most diverse urban and rural places. Can J Public Health 2008;99:12–16. [PubMed: 18435383]
8. Coburn N, Fulton J, Pearlman DN, Law C, DiPaolo B, Cady B. Treatment variation by insurance status for breast cancer patients. Breast J 2008;14:128–134. [PubMed: 18315690]
9. Bickell NA, LePar F, Wang JJ, Leventhal H. Lost opportunities: physicians' reasons and disparities in breast cancer treatment. J Clin Oncol 2007;25:2516–2521. [PubMed: 17577028]
10. Foley KL, Kimmick G, Camacho F, Levine EA, Balkrishnan R, Anderson R. Survival disadvantage among Medicaid-insured breast cancer patients treated with breast conserving surgery without radiation therapy. Breast Cancer Res Treat 2007;101:207–214. [PubMed: 16838114]
11. Griggs JJ, Culakova E, Sorbero ME, Poniewierski MS, Wolff DA, Crawford J, et al. Social and racial differences in selection of breast cancer adjuvant chemotherapy regimens. J Clin Oncol 2007;25:2522–2527. [PubMed: 17577029]
12. Richardson LC, Tian L, Voti L, Hartzema AG, Reis I, Fleming LE, et al. The roles of teaching hospitals, insurance status, and race/ethnicity in receipt of adjuvant therapy for regional-stage breast cancer in Florida. Am J Public Health 2006;96:160–166. [PubMed: 16317209]
13. McDavid K, Tucker TC, Sloggett A, Coleman MP. Cancer survival in Kentucky and health insurance coverage. Arch Intern Med 2003;163:2135–2144. [PubMed: 14557210]
14. Hall S, Schulze K, Groome P, Mackillop W, Holowaty E. Using cancer registry data for survival studies: the example of the Ontario Cancer Registry. J Clin Epidemiol 2006;59:67–76. [PubMed: 16360563]
15. Walter SD, Birnie SE, Marrett LD, Taylor SM, Reynolds D, Davies J, et al. The geographic variation of cancer incidence in Ontario. Am J Public Health 1994;84:367–376. [PubMed: 8129051]
16. North American Association of Central Cancer Registries. Data quality assessments. [Accessed on July 12, 2008]. Available at: http://ww.naaccr.org
17. Wright, WE. California Cancer Registry enhancement for breast cancer research. Berkeley (CA): California Public Health Foundation; 1996.
18. Statistics Canada. Profiles of census tracts, 2001 (Ontario). Ottawa: 2002.
19. Statistics Canada. Profiles of census subdivisions, 2001 (Ontario). Ottawa: 2002.
20. United States Bureau of the Census. 2000 census of population and housing in California: summary tape file 3 on CD-ROM. Washington, DC: US Department of Commerce; 2002.
21. Shugarman LR, Sorbero MES, Tian H, Jain AK, Ashwood JS. An exploration of urban and rural differences in lung cancer survival among Medicare beneficiaries. Am J Public Health 2008;98:1280–1287. [PubMed: 17971555]
22. WWAMI Rural Health Research Center. Rural-urban commuting area codes: Version 1.11. [Accessed on July 15, 2008]. Available at: http://www.depts.washington.edu/uwruca/ruca1/rucas/html
23. Ministry of Health and Long-Term Care. Residence coding manual. Toronto: 2003.
24. Statistics Canada. Definitions of "rural". Ottawa: 2002.

25. Health Canada. Definitions of “rural” summary. Ottawa: 2002.

26. Krieger N, Chen JT, Waterman PD, Rehkopf DH, Subramanian SV. Race/ethnicity, gender, and monitoring socioeconomic gradients in health: a comparison of area-based socioeconomic measures—The Public Health Disparities Geocoding Project. Am J Public Health 2003;93:1655–1671. [PubMed: 14534218]

27. Krieger N, Chen JT, Waterman PD, Soobader M, Subramanian SV, Carson R. Geocoding and monitoring of US socioeconomic inequalities in mortality and cancer incidence: does the choice of area-based measure and geographic level matter? The Public Health Disparities Geocoding Project. Am J Epidemiol 2002;156:471–482. [PubMed: 12196317]

28. Jargowsky, PA. Poverty and place: ghettos, barrios, and the American city. New York: Russell Sage Foundation; 1997.

29. California Cancer Registry. California Cancer Reporting System Standards. 7. Vol. I. Sacramento (CA): Department of Health Services, Cancer Surveillance Section; 2003. Cancer reporting in California: abstracting and coding procedures for hospitals.

30. Young, JL., Jr; Roffers, SD.; Ries, LAG.; Fritz, AG.; Hurlbut, AA., editors. NIH pub. no. 01–4969. Bethesda (MD): National Cancer Institute; 2001. SEER summary staging manual–2000: codes and coding instructions.

31. National Cancer Institute. NIH pub. no. 98–1999. 3. Bethesda (MD): National Institutes of Health; 1998. SEER Extent of Disease—1988 Codes and Coding Instructions.

32. Fleiss, JL. Statistical Methods for Rates and Proportions. 2. New York: John Wiley & Sons; 1981.

33. Miettinen OS. Estimability and estimation in case-referent studies. Am J Epidemiol 1976;103:226–235. [PubMed: 1251836]

34. Mantel N, Haenszel W. Statistical aspects of the analysis of data from retrospective studies of disease. J Natl Cancer Inst 1959;22:719–748. [PubMed: 13655060]

35. Brown BW, Brauner C, Minnotte MC. Noncancer deaths in white adult cancer patients. J Natl Cancer Inst 1993;85:979–987. [PubMed: 8496983]

TABLE 1

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

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

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.