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Breast cancer care in the Canada and the United States: Ecological comparisons of extremely impoverished and affluent urban neighborhoods

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Abstract

This study examined the differential effect of extreme impoverishment on breast cancer care in urban Canada and the United States. Ontario and California registry-based samples diagnosed between 1998 and 2000 were followed until 2006. Extremely poor and affluent neighborhoods were compared. Poverty was associated with non-localized disease, surgical and radiation therapy (RT) waits, nonreceipt of breast conserving surgery, RT and hormonal therapy, and shorter survival in California, but not in Ontario. Extremely poor Ontario women were consistently advantaged on care indices over their California counterparts. More inclusive health insurance coverage in Canada seems the most plausible explanation for such Canadian breast cancer care advantages.

Keywords

Breast cancer care; Poverty; Affluence; Survival; United States; Canada

1. Introduction

Social, political and economic forces converged in twentieth century America to produce extreme socioeconomic segregation in and around many urban places. Extremely poor neighborhoods tended to concentrate in inner-cities at the same time that extremely affluent neighborhoods were developing in suburban to exurban areas that tended to sprawl away from cities. Extremes of impoverishment and affluence and so relative socioeconomic inequities have fluctuated over recent generations, but distinct very low-income ghettos and well-to-do enclaves clearly persist in twenty-first century urban America. Such socioeconomic extremes are not unknown in Canada (Duncan et al., 1993; Gorey, 1998), but

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perhaps because of their greater prevalence and apparent virulence as well as their stronger association with race in America, they have been studied much more there. In particular, substantially increased risks of diverse population health problems in extremely poor neighborhoods have been well described in America, but not in Canada. One exemplary sentinel indicator of population health—breast cancer care—has been consistently observed to be of much lower quality in low-income neighborhoods and communities in the United States and of relatively higher quality in similar Canadian places. Though probably similar on many risks and vulnerabilities, low-income Canadian women with breast cancer, indeed all low-income Canadians are relatively less deprived than their American counterparts on at least one potentially critical characteristic. Their access to medically necessary health care is guaranteed. Such is clearly not the case for Americans. This between-country health insurance difference, therefore, is at the heart of this study's theoretical context. The health insurance theory predicts that breast cancer care will be much more equitable in Canada and that Canadian patients who reside in extremely poor neighborhoods will receive much higher quality health care than do their counterparts in America.

William Julius Wilson's (1987) germinal work in the high poverty neighborhoods of 1960s Chicago began the description and analysis of so-called underclass neighborhoods where 30% or more of the households had annual incomes below the US Census Bureau's poverty criterion. Modestly advancing the predictive validity of such high poverty areas while greatly extending this field's external validity, Paul Jargowsky (1997);Jargowsky and Mary Jo Bane (1991) studied census tract-based areas of extreme impoverishment where 40% or more of the households were poor in 239 US metropolitan areas during the generational time frame of the 1970s through the 1990s. Together they described high to extreme poverty areas as places of prevalent demographic vulnerability, where all of the following people tended to be more concentrated: racial/ethnic minority group members, young adults without a high school diploma, single mothers, the unemployed and those who had withdrawn from the labor market altogether, and welfare recipients. Perhaps not surprisingly, analysts have since observed consistent and generally strong associations between extreme impoverishment and diverse indicators of familial, social and personal illness in America: child neglect and abuse, teen pregnancy, violent crime, low birth weight, obesity, hypertension, diabetes, heart disease, cancer, AIDS, depression and suicide (Drake and Pandey, 1996; Geronimus et al., 2006; Harding, 2003; Krieger et al., 2003; Krivo and Peterson, 1996; Pearl et al., 2001; Rehkopf and Buka, 2006; Robbins and Webb, 2004; Zierler et al., 2000). Similar poverty–illness associations have been observed in Canada, though Canadian analysts have tended to use less extreme poverty criteria (e.g., 20% or more poor) or to study the linear health affects of relatively low-income areas that are characterized by their median incomes (Dupere et al., 2009; Gorey et al., 1998; Hou and Chen, 2003; Lemstra et al., 2006; Mustard et al., 1999).

1.1. North American health care policy laboratory

Sharing a 5000km border and having many social, cultural, lifestyle and physical environmental similarities, it seems that the myriad risks associated with extremely poor neighborhoods probably operate similarly to cause diverse diseases in the United States and Canada. The factors that are ultimately causally related to disease occurrences, however, are not necessarily the same as the factors that are related to their effective care and outcomes. For instance, though common coronary heart disease and cancer morbidities are well known to be strongly associated with poverty in both the US and Canada, their mortalities and survival rates remain strongly associated with poverty in the US, while such associations seem null to nil in Canada (Gorey et al, 1998; Pilote et al., 2007). This pattern may be most parsimoniously explained by between-country health insurance differences. Their social–cultural–lifestyle–environmental similarities notwithstanding, all Canadians, be they extremely poor or affluent, employed, unemployed or having withdrawn from the labor market are distinctly advantaged as compared with their American counterparts. They universally enjoy access to a single payer system of health care. Low-income Americans are essentially much more prevalently exposed to various under- or uninsured statuses that greatly increase their risk of experiencing substandard health care or no health care at all (DeNavas-Walt et al., 2006; Gorey, 1999).

1.1.1. Breast cancer care in Canada and the US—Breast cancer care is one sentinel indicator of a health care system's performance. The most common type of cancer among North American women, its prognosis is typically excellent with early diagnosis and timely access to the best available treatments (Canadian Cancer Society, 2006; Ries et al., 2008). Moreover, for a number of reasons breast cancer seems particularly instructive for Canada–US cancer care comparisons. First, though the US and Canada, respectively, rank number one and two at the top of the world's breast cancer survival distribution, the overall difference between them is miniscule (RR=1.02; Coleman et al., 2008). Second, Canada–US comparative studies of breast cancer survival that accounted for socioeconomic factors consistently observed income by country interactions (Gorey, in press; Gorey et al., 1997, 2000a, 2000b, 2003b, 2009c; Zhang-Salomons et al., 2006). Moderate to strong inverse income–survival associations were consistently observed among US cohorts, but not among Canadian cohorts. Within-country social forces then seemed to operate so that low-income Canadian women experienced moderate to large survival advantages compared with their counterparts in the US, but between-country differences among, respective, middle- and high-income groups were consistently null. All of these studies used census tract-based US poverty measures and analogous low-income measures in Canada, but these did not measure the construct of extreme poverty areas as defined by either Wilson (1987) or Jargowsky and Bane (1991). Most of the low-income area comparisons, for example, were of lowest income third to fifths that typically only approached prevalence estimates of 20% poor. Third and finally, breast cancer diagnosis and treatments (screening, stage at diagnosis, waits for care, access to surgery, chemotherapy and radiation therapy) seem very sensitive to poverty in the US and have demonstrated similar poverty by country interactions in Canada–US comparisons that have been observed for breast cancer survival (Gold et al., 2008; Gorey et al., in press, 2009d; Polednak, 2002, 2004; Schootman et al., 2009). But again, their lowest income areas typically only ranged from 10% to 20% poor.

1.1.2. Hypotheses—We are unaware of any previous study that compared cancer care in high poverty urban areas of the United States and Canada. Focusing on breast cancer, this one will do so. Placing a greater emphasis on the "haves and have nots" than previous of this field's studies have, its findings could perhaps be of incrementally greater practical-policy significance. Consistent with health insurance theoretical explanations we hypothesized the following. Within-country comparisons: (1) extremely poor urban neighborhoods will be significantly disadvantaged as compared with extremely affluent urban neighborhoods on breast cancer stage at diagnosis, waits for surgical and adjuvant treatments, receipt of surgical and adjuvant treatments and survival in the US, but not in Canada. Between-country comparisons: (2) women with breast cancer in extremely poor urban Canadian neighborhoods will be significantly advantaged on all of the cancer care and outcome measures as compared with their American counterparts. A hypothetical addendum predicts such Canadian advantages among the extremely poor to be qualitatively larger than those previously observed among the poor. (3) In contrast, extremely affluent Canadian and American urban neighborhoods are not expected to differ significantly on any measure of cancer care or outcome.

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2. Methods

2.1. Samples

This historical cohort study is one of a series of analyses of cancer care in diverse urban and rural places in Ontario and California. For the present urban analysis, the Ontario Cancer Registry (OCR) and the California Cancer Registry (CCR), respectively, provided 624 and 660 primary, invasive, adult (25 or older) female breast cancer cases diagnosed between January 1, 1998 and December 31, 2000 in comparable urban areas. The OCR and CCR comprehensively surveille the most populace Canadian province and state in America with demonstrated validity. They have both been estimated to ascertain nearly all breast cancer cases (greater than 98%) with nearly perfect rates of microscopic confirmation and nearly nil rates of autopsy or death certificate only identification (Hall et al., 2006; North American Association of Central Cancer Registries, 2009; Walter et al., 1994; Zippin et al., 1995). The CCR incorporated additional hospital and physician follow back procedures to more completely capture breast cancer stage and treatment data than is typical of most other US cancer registries (Wright, 1996). The OCR abstracted the same stage and treatment variables from health records as it did not routinely collect them. Agreements were extremely high across study variables among three chart abstractors who were trained by an experienced cancer registrar. An inter-rater reliability assessment of 150 randomly sampled health records found that kappa (κ) coefficients ranged from 0.88 to 0.96 across the additional abstracted study variables.

Provincial and state samples (660 each), stratified by place, were randomly selected from megalopolises with more than 5 million residents (greater metropolitan Toronto [GMT] and the San Francisco bay area [SFBA]) and small cities with populations between 300,000 and 400,000 (Windsor-Essex county and Modesto-Stanislaus county) (Statistics Canada, 2002; US Bureau of the Census, 2002). Only 36 of the Ontario patient health records were unavailable for retrospective review. In a statistical sense this represented a significant between-country difference as all of the California records were available; χ^2 (1, N=1320)=37.01, p<.05. However, such losses to retrospective chart abstraction and database enhancement did not differ significantly on key study independent, dependent or co-variables that were routinely collected by the OCR (age, place, neighborhood income and 5-year survival). Therefore, it seems very unlikely that this meager sample loss confounds any of this study's hypothesized income–breast cancer care relationships.

2.1.1. Extremely poor and extremely affluent neighborhoods—Statistics Canada and the US Bureau of the Census use conceptually similar indices of economic deprivation —respectively, "low-income" and "poverty" thresholds. Both are based on annual household income from all sources adjusted for household size. The Canadian low-income cutoff is a more liberal criterion though, approximately equal to 140% of the US poverty threshold (Osberg, 2000). Though not a poverty measure, per se, the Canadian low-income measure seems a close conceptual match for "near poverty" status that is sometimes used in US contexts (Gorey and Vena, 1995). Our previous analytic experience also suggested that though these two measures were not compositionally identical, they would allow for the valid contextual definition of relatively low- to high-income neighborhoods in both countries. In constructing extremely poor and extremely affluent urban neighborhoods, the following procedural goals were balanced. First, it was deemed most important that such neighborhood definitions be face validly aligned with this field's germinal measures. Such was balanced against a second important goal that planned comparisons have adequate statistical power to detect modest to large rate differences of 15% or more. Samples of 50 each, in extremely poor and extremely affluent, Canadian and American neighborhoods were thus required (α=0.05 [2-tailed] and power [1−β]=0.80; Fleiss, 1981). Finally, because previous research observed similar income–breast cancer care gradients in large and small urban areas, they were represented equally (Gorey et al., 2009c, 2009d, in press).

Breast cancer cases in Ontario and California were first, respectively, joined to the 2001 Canadian and 2000 US censuses based on each patient's residential census tract (CT) at the time of diagnosis (Statistics Canada, 2002; US Bureau of the Census, 2002). Then to maximize the predictive validity of extremely poor to affluent groups, low- to high-income deciles were defined by their prevalence of, respective, low-income or poor households (Krieger et al., 2002). Finally, to maximize between-country construct validity as well as to satisfy this study's power demands, the 50 most extremely low or high CT residences on median annual household income within the lowest and highest deciles ultimately defined each country's extremely poor and extremely affluent neighborhoods. For comparison, less extremely poor and affluent areas were defined similarly, but they were based on low- to high-income quintiles. These merely poor and affluent areas each included 100 breast cancer patients. Poverty/low-income and median-income distributions of this study's CT or neighborhood-based, aggregated extremely poor to extremely affluent areas are displayed in Table 1. This study's procedures seem to have selected extremely poor urban neighborhoods in California that most closely converge with Wilson's (1987) high poverty neighborhood definition (median=29% poor [65% of them were between 30% and 39% poor]). Moreover, household incomes typically differed by less than $3000 in such, respective, extremely poor urban neighborhoods of America and Canada. Perhaps not surprisingly, very extreme affluence was a bit more prevalent in the California sample, but on both sides of the border, this study's definition seemed to converge quite closely with contemporary definitions of extreme affluence (e.g., less than 5% poor or typical incomes of $75,000 to $100,000 or more; Barrett et al., 2008; Brookfield et al., 2009; Henry et al., 2009; Lee and Marlay, 2007).

2.1.2. Breast cancer care—Key study variables that had been routinely coded by the CCR were retrospectively abstracted in the same manner from hospital and physician office-based patient health records for the OCR sample: summary stage (localized, regional or metastasized), receipt of initial cancer directed surgery, type of surgery (breast conserving lumpectomy or mastectomy), receipt of adjuvant radiation therapy, chemotherapy or hormonal therapy, wait-times from diagnosis to surgery and radiation therapy (California Cancer Registry, 2003; Young et al., 2001). All of these cancer care variables had less than 5% missing data. Because such missing statuses were not significantly associated with either poverty-affluence or 5-year survival, they probably were not potent confounds. Chemotherapy and hormonal therapy initiation dates were prevalently missing from both the Ontario and California samples (12–20%), so their wait-times were not validly calculable. Long wait criteria of 2 months for surgery and 3 months post-lumpectomy for radiation therapy were used. Previous research suggested that such waits may be associated with disease recurrences, metastases and shorter survival (Chen et al., 2008b; Hershman et al., 2006; Lund et al., 2008). All breast cancer cases were followed until January 1, 2006 allowing, minimally, for the analysis of 5-year survival.

2.2. Analyses

All of the rates were directly age-adjusted, using this study's combined California–Ontario population of cases as the standard. So all of the rates (e.g., of lumpectomy or radiation therapy) within any table can be directly compared. Within- and between-country comparisons used rate ratios (RR) with 95% confidence intervals (CI) that were based on the χ^2-test (Mantel and Haenszel, 1959; Miettinen, 1976). Ninety percent CIs were reported for findings that approached statistical significance at $p<.10$. Both the Ontario and California wait distributions were distinctly skewed. That is, many more patients experienced relatively short waits than long ones. Therefore, median wait-times in days were compared within- and between-country with the non-parametric Mann–Whitney *U*-test (Hollander and Wolfe, 1999). Maximum likelihood logistic regression models were used to estimate the associations of breast cancer care (stage, waits, receipt of surgery and adjuvant treatments) with 5-year all-cause survival (Hosmer and Lemeshow, 2000). Odds ratios (OR) and CIs were estimated from regression statistics.

3. Results

3.1. Extreme poverty and breast cancer care and survival

All except one of the breast cancer care and outcome indices were significantly associated with extreme impoverishment among the urban California sample (Table 2). Extremely poor urban Californian women with breast cancer were much less likely than their extremely affluent counterparts to be diagnosed with localized disease (RR=0.71), to receive breast conserving surgery (RR=0.74), to receive adjuvant radiation (RR=0.46) or hormonal therapy (RR=0.60) or to survive for 5 years after their diagnosis (RR=0.82). No such associations were observed among the urban Ontario sample. Consequently, extremely poor patients in Ontario were extremely advantaged as compared with similarly poor American patients: receipt of lumpectomy (RR=1.51), radiation therapy (RR=2.21) or hormonal therapy (RR=1.77) and survival (RR=1.21). A similar pattern was observed for within-country treatment waits (Table 3). Relatively long initial surgical waits (RR=12.08) and long post-surgical waits for radiation therapy (RR=2.09) were very strongly associated with extreme poverty in California, but not in Ontario. The between-country pattern was notably different. For such waits it seems that affluent to extremely affluent Americans were advantaged, while among the poor to extremely poor, Canadians may have been.

3.2. Breast cancer care mediation by poverty-affluence

Age-, but not income-adjusted regression models observed that disease stage, long waits for care (radiation therapy in California and surgery in Ontario) and receipt of radiation therapy similarly predicted 5-year survival in the Canadian and American samples (Table 4, left column). After adjustment for income extremes, localized disease and radiation therapy waits were no longer predictive, and the radiation therapy receipt–survival association diminished significantly in California. Whereas, the income-adjusted model in Ontario was essentially identical to the unadjusted model (Table 4, right column). It seems that income extremes significantly mediate breast cancer care–survival relationships in the US, but not in Canada.

4. Discussion

This study, the first we are aware of that compared sentinel health processes and outcomes —breast cancer care and survival—in extremely poor urban neighborhoods in Canada and the United States, found near unequivocal support for its hypotheses. Extreme impoverishment was strongly associated with nonlocalized disease at diagnosis, long waits for initial surgery and adjuvant RT, non-receipt of breast conserving surgery, RT and hormonal therapy, and shorter survival in California. All such associations were null in Ontario. Consequently, extremely poor Ontario women were largely advantaged on most breast cancer care indices and 5-year survival over their counterparts in California. Moreover, such Canadian advantages were larger among extremely poor women than they were among less extremely poor women. The qualitative hypothesis that such Canadian advantages among the extremely poor would be larger than those previously observed among the poor was also supported. For example, among otherwise similar, but less impoverished samples of women with node negative breast cancer in Ontario and California,

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Canadian women were significantly advantaged on their receipt of post-surgical adjuvant RT (RRs of 1.39 and 1.23 with and without chemotherapy; Gorey et al., 2009d), but not nearly as advantaged as this study's sample of extremely poor Canadian women were (RR=2.21). Relatedly, a synthesis of 10 previous Canada–US comparisons of 5-year breast cancer survival observed a smaller aggregate Canadian advantage in near poor to poor areas (RR=1.14; Gorey, in press) than this one did in extremely poor areas (RR=1.21). These findings, along with the regression-based suggestion that breast cancer care–survival relationships are largely mediated by income extremes in the United States, but not in Canada seem to most parsimoniously indict inadequate health insurance coverage among America's extremely poor. In fact, this study's findings seem extraordinarily convergent with US studies that have consistently observed strong relationships between low-income, various under- and uninsured statuses, and relatively later stage at breast cancer diagnosis, lack of treatment access and early death (Anderson and Eamon, 2005; Chen et al., 2008a; Coburn et al., 2008; Griggs et al., 2007; Hahn et al., 2007; Purc-Stephenson and Gorey, 2008; Studts et al., 2006; Ward et al., 2008). It is likely that the differential outcomes this study observed will persist until medical coverage and the best available care is made available to all Americans with cancer (Freedman, 2004).

It was also hypothesized that extremely affluent Canadian and American urban neighborhoods were not expected to differ significantly on any measure of cancer care or outcome. Indeed, such was the case for breast cancer stage at diagnosis, receipt of lumpectomy and all adjuvant treatments as well as 5-year survival. However, non-significant trends to significant differences indicative of American advantages in affluent to extremely affluent neighborhoods were observed on waits for initial surgery and on waits for post-lumpectomy RT. Affluent to extremely affluent Americans enjoyed shorter waits, but typically their waits were only one (surgery) to four (RT) weeks shorter than those of their Canadian counterparts. This difference is probably clinically insignificant for most patients as waits of that magnitude were not significantly related to survival in this study nor in previous ones (Chen et al., 2008a, 2008b; Hershman et al., 2006). Moreover, the implementation of federal and provincial government wait time guarantees for many services including cancer treatments suggests that cancer survival in Canada is likely to become even more equitable in the future (Cancer Care Ontario, 2009).

4.1. Potential study limitations

A number of potential alternative explanations related to this study's use of ecological measures, particularly of extremely impoverished neighborhoods, could be advanced by alternative theorists. One might legitimately wonder, for instance, if the racial/ethnic composition of such neighborhoods, rather than their prevalent representation of extremely low incomes, could account for this study's observed United States–Canada breast cancer care and survival differences. First, it should be noted that this study's sample of 50 women with breast cancer who resided in extremely poor urban Californian neighborhoods were predominantly non-Hispanic white women (n=42). Three each were African and Asian American, and two were Hispanic. We were not able to adjust for this factor directly as the OCR does not code race/ethnicity. We were able, however, to replicate key findings with the following conservative comparison: non-Hispanic white women in California versus the entire racial/ethnically diverse sample of women in Ontario. Among them, extremely poor Ontario women remained advantaged on early stage at diagnosis (RR=2.09, 95% CI 1.22, 3.58), shorter waits for surgery (RR=0.31, 90% CI 0.11, 0.84), receipt of lumpectomy (RR=1.99, 95% CI 1.25, 3.16), RT (RR=1.52, 95% CI 1.00, 2.30) and hormonal therapy (RR=1.96, 95% CI 1.06, 3.62), and on 5-year survival (RR=1.30, 90% CI 1.01, 1.67). One might also wonder if the, respective, neighborhood-level measures of extreme impoverishment were actually measuring the same contextual construct in California and

Ontario. They were, after all, not compositionally identical; one being based in the US Census Bureau's "poverty" threshold, the other on Statistics Canada's "low-income" criterion. We cannot know for sure because no previous study has directly compared the construct or predictive validities of such ecological measures in Canada and the US. Some analytic comfort was provided though by the fact that both national censuses provide estimates of median CT or neighborhood-level income in urban areas. Using this fact, we observed that household incomes typically differed by less than $3000 in the, respective, extremely poor urban neighborhoods of California ($27,400) and Ontario ($30,275) that we studied. This suggests their similar aggregate lack of purchasing power, which is probably also the best contextual definition of this study's central ecological measure. Though probably similarly challenged to purchase life's necessities, residents of such neighborhoods clearly differ contextually in one important way. Canadians, even in such extremely poor neighborhoods, seem to be able to "purchase" much higher quality health care than can similarly poor Americans.

One might also wonder if other systemic health care factors, beyond payer and health insurance differences, potently confound this study's key between-country findings. Though this study seemed to most parsimoniously indict inadequate health insurance coverage as well as its corollaries of inaccessible primary care and cancer care among America's poor (Gorey, in press; Starfield, in press), one might plausibly argue that between-country primary care differences themselves could independently explain our findings. We think probably not for the following reasons. Analyses of the same Ontario–California database observed significant primary care physician-cancer care effects that were not moderated by income in Ontario, but no such independent effects of primary care in California (Gorey et al., 2009a, 2009b). Moreover, consistent with other analysts (McGrail et al., 2009), we found that after income or insurance status are accounted for, primary care itself seems to explain very little of the health inequalities in Canada or the United States. Between-country screening differences could be advanced as another plausible alternative explanation. Again, we think it improbable because overall screening mammography rates as well as income–mammography associations seemed roughly similar in Ontario and California between 1995 and 2005, and apparently effective publicly funded screening programs had been instituted in both Ontario and California during the 1990s (Meersman et al., in press; Minore et al., 2001; Purc-Stephenson and Gorey, 2008; Schueler et al., 2008; Shields and Wilkins, 2009). But even if screening differences did influence this study's findings, they would probably have only affected its findings related to breast cancer stage at the time of diagnosis. This and other studies' between-country comparisons of treatments and survival are unlikely to have been influenced at all by any screening differences.

This study's samples of women with breast cancer may not be generalizable to all such women in Ontario and California or to other provinces and states. Samples were drawn from purposively diverse and potentially policy-important places in Ontario and California: very large and small cities. Admittedly, our findings are most generalizable to such places. It should be noted, however, that after accounting for demographic, socioeconomic and clinical factors, place, per se, did not seem to matter in any of this study's analytic models nor in those of other of this field's studies (e.g., Gorey, in press; Gorey et al., 2009c, 2009d). Furthermore, though not as well controlled, this study's general pattern of findings had previously been observed in Manitoba and in a number of other states: Michigan, Washington, Connecticut, Iowa and Hawaii (Gorey et al., 1997, 2000a, 2000b, 2003). Its inferences, therefore, can probably be confidently generalized to urban areas, small cities to megalopolises, across Canada and the United States.

5. Conclusions

Extremely poor Ontario women were advantaged on breast cancer care and survival over their counterparts in California. Breast cancer care–survival relationships seem to be largely mediated by income extremes in the United States, but not in Canada. More inclusive health care insurance coverage in Canada versus America, particularly among each country's extremely poor people, seems the most plausible explanation for such observed Canadian breast cancer care and survival advantages.

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Table 1

Descriptive profiles of census-tract based income areas in urban California (San Francisco and Modesto, 2000) and Ontario (Toronto and Windsor, 2001).

Income areas	California			Ontario		
	Poverty prevalence			Low-income prevalence		
	Range	Median	Income[a]	Range	Median	Income[b]
Extremely affluent	0.79–3.99	2.14	101,600	1.30–4.50	2.90	88,400
Affluent	0.79–4.99	2.62	71,000	1.30–5.99	3.65	82,900
Poor	11.00–59.32	21.95	32,000	24.50–52.80	30.45	35,125
Extremely poor	21.30–59.32	29.35	27,400	30.00–52.80	37.10	30,275

[a] Census tract median annual household income in US dollars.

[b] Census tract median annual household income in Canadian dollars.

Table 2

Associations of country and place with breast cancer care and survival: relatively poor compared with affluent neighborhoods, and extremely poor compared with extremely affluent neighborhoods.

Cancer care indicator	California				Ontario				Ontario/California	
Neighborhood	*n*	Rate[a]	RR[b]	95% CI[c]	*n*	Rate[a]	RR[b]	95% CI[c]	RR	95% CI[c]
Localized disease at diagnosis										
Extremely affluent	50	0.720	1.00	…	50	0.680	1.00	…	0.94	0.71, 1.24
Affluent	99	0.677	1.00	…	100	0.641	1.00	…	0.95	0.80, 1.13
Poor	100	0.600	0.89	0.73, 1.09	100	0.648	1.01	0.89, 1.15	1.08	0.88, 1.33
Extremely poor	50	0.512	**0.71**	**0.52, 0.97**	50	0.640	0.94	0.71, 1.25	1.25	0.90, 1.74
Received lumpectomy										
Extremely affluent	50	0.644	1.00	…	50	0.646	1.00	…	1.00	0.94, 1.06
Affluent	99	0.596	1.00	…	100	0.630	1.00	…	1.06	0.84, 1.34
Poor	99	0.545	0.91	0.70, 1.18	99	0.708	1.12	0.92, 1.36	**1.30**	**1.05, 1.62**
Extremely poor	50	0.477	**0.74**	**0.55, 0.99**[d]	49	0.718	1.11	0.85, 1.45	**1.51**	**1.09, 2.09**
Received radiation therapy										
Extremely affluent	50	0.620	1.00	…	50	0.564	1.00	…	0.91	0.67, 1.23
Affluent	99	0.566	1.00	…	100	0.520	1.00	…	0.92	0.72, 1.18
Poor	100	0.480	0.85	0.65, 1.10	100	0.572	1.10	0.85, 1.43	1.19	0.91, 1.56
Extremely poor	50	0.286	**0.46**	**0.29, 0.73**	50	0.631	1.12	0.85, 1.47	**2.21**	**1.42, 3.45**
Received chemotherapy										
Extremely affluent	49	0.426	1.00	…	50	0.406	1.00	…	0.95	0.67, 1.34
Affluent	98	0.425	1.00	…	100	0.371	1.00	…	0.87	0.64, 1.19
Poor	99	0.414	0.97	0.72, 1.30	100	0.386	1.04	0.80, 1.35	0.93	0.70, 1.24
Extremely poor	50	0.411	0.96	0.60, 1.52	49	0.423	1.04	0.56, 1.95	1.03	0.74, 1.44
Received hormonal therapy										
Extremely affluent	48	0.520	1.00	…	50	0.498	1.00	…	0.96	0.64, 1.43
Affluent	98	0.455	1.00	…	100	0.541	1.00	…	1.19	0.91, 1.55
Poor	98	0.287	**0.63**	**0.43, 0.92**	100	0.547	1.01	0.88, 1.16	**1.91**	**1.36, 2.67**
Extremely poor	49	0.312	**0.60**	**0.36, 0.99**	49	0.551	1.11	0.75, 1.65	**1.77**	**1.12, 2.79**
Five-year survival										

Cancer care indicator	California				Ontario				Ontario/California	
Neighborhood	***n***	**Rate[a]**	**RR[b]**	**95% CI[c]**	***n***	**Rate[a]**	**RR[b]**	**95% CI[c]**	**RR**	**95% CI[c]**
Extremely affluent	50	0.812	1.00	…	50	0.883	1.00	…	1.09	0.89, 1.33
Affluent	99	0.806	1.00	…	100	0.887	1.00	…	1.10	0.98, 1.23
Poor	100	0.690	**0.86**	**0.74, 1.00**	100	0.828	0.94	0.85, 1.04	**1.20**	**1.03, 1.40**
Extremely poor	50	0.663	**0.82**	**0.68, 0.99**[d]	50	0.803	0.91	0.77, 1.08	**1.21**	**1.01, 1.45**[d]

Notes: Within-country comparisons were of the poor versus the affluent and of the extremely poor versus the extremely affluent. *n*=number of incident breast cancer cases, RR=standardized rate ratio, CI=confidence interval. Bolded RRs and CIs are statistically significant.

[a]All rates were directly age-adjusted using this study's combined Ontario-California population of cases as the standard (age strata: 25–44, 45–54, 55–64, 65–74 and 75 years or older), so all of the rates for each cancer care indicator are directly comparable.

[b]A survival rate ratio of 1.00 is the within-country baseline.

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

[d]90% confidence interval.

Table 3

Associations of country and place with breast cancer care delays: relatively poor compared with affluent neighborhoods, and extremely poor compared with extremely affluent neighborhoods.

Cancer care indicator	California				Ontario				Ontario/California		
Neighborhood	*n*	Rate[a] (Mdn)	RR[b]	95% CI[c]	*n*	Rate[a] (Mdn)	RR[b]	95% CI[c]	MDD	RR	95% CI[c]
Waited 60 days or longer for initial surgery											
Extremely affluent	47	0.013 (3)	1.00	…	50	0.072 (8)	1.00	…	5	**5.53**	**1.00, 30.58**[d]
Affluent	90	0.045 (5)	1.00	…	100	0.101 (13)	1.00	…	8*	2.24	0.75, 6.71
Poor	94	0.100 (10)	2.22	0.77, 6.41	99	0.081 (13)	0.80	0.33, 1.95	3	0.81	0.40, 1.63
Extremely poor	47	0.157 (11)*	**12.08**	**1.65, 88.66**	49	0.065 (9)	0.90	0.53, 1.52	32	**0.41**	**0.17, 0.99**[d]
Received lumpectomy and waited 90 days or longer for radiation therapy											
Extremely affluent	24	0.375 (68)	1.00	…	20	0.700 (97)	1.00	…	29	**1.87**	**1.05, 3.33**
Affluent	42	0.405 (89)	1.00	…	41	0.699 (110)	1.00	…	21*	**1.73**	**1.15, 2.60**
Poor	35	0.584 (105)	1.44	**1.01, 2.05**[d]	56	0.573 (110)	0.82	0.62, 1.09	5	0.98	0.41, 2.34
Extremely poor	17	0.785 (111)*	**2.09**	**1.17, 3.74**	27	0.556 (95)	0.79	0.50, 1.24	316	**0.71**	**0.51, 0.99**[d]

Notes: Within-country comparisons were of the poor versus the affluent and of the extremely poor versus the extremely affluent. *n*=number of incident breast cancer cases, Mdn=median days waited, RR=standardized rate ratio, CI=confidence interval, MDD=median days difference. Bolded RRs and CIs are statistically significant.

[a] All rates were directly age-adjusted using this study's combined Ontario-California population of cases as the standard (age strata: 25–44, 45–54, 55–64, 65–74 and 75 years or older), so all of the rates for each cancer care indicator are directly comparable.

[b] A survival rate ratio of 1.00 is the within-country baseline.

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

[d] 90% confidence interval.

* Median wait differed significantly from baseline (within-country) or between-countries: Mann–Whitney *U*-test, $P<0.05$.

Table 4

Associations of stage of disease at diagnosis and treatments with 5-year breast cancer survival: entire urban sample analyses within countries.

Cancer care indicator	Logistic regression models			
	Age-adjusted[a]		Age & income-adjusted[b]	
	OR	95% CI	OR	95% CI
California (N=656)				
Localized disease at diagnosis	**2.17**	**1.39, 3.39**	1.53	0.54, 4.33
Waited 90 days or longer for RT	**0.35**	**0.16, 0.74**	0.83	0.50, 1.38
Receipt of radiation therapy (RT)	**3.95**	**2.07, 7.53**	**2.33**	**1.55, 3.51**
Ontario (N=624)				
Localized disease at diagnosis	**2.19**	**1.38, 3.47**	**2.14**	**1.35, 3.42**
Waited 60 days or longer for surgery	**0.43**	**0.22, 0.85**	**0.42**	**0.21, 0.83**
Receipt of radiation therapy (RT)	**1.56**	**1.05, 2.31**[c]	**1.61**	**1.01, 2.56**

Notes: All breast cancer care indices were entered into regression models in temporal order.

OR=odds ratio, CI=confidence interval. Bolded ORs and CIs are statistically significant.

[a]Adjusted across the following age strata: 25–44, 45–54, 55–64, 65–74 and 75 years or older.

[b]Adjusted across the following categorical income areas: extremely poor, poor, middle-income areas, affluent and extremely affluent.

[c]90% confidence interval.