Title: Temporal Trends In The Association Between Socioeconomic Status And Cancer Survival: A Population-Based Study

Running title: Temporal trends in SES-related disparities in cancer survival

Authors: Andrew Dabbikeh[1], MSc, Yingwei Peng[1,2], PhD, William J Mackillop[1,2,3], MB, ChB, Christopher M Booth[2,3], MD, Jina Zhang-Salomons[1,2,3], MSc

[1] Department of Public Health Sciences, Queen's University.
[2] Division of Cancer Care and Epidemiology, Queen's Cancer Research Institute.
[3] Department of Oncology, Queen's University.

Address for corresponding author:

Jina Zhang-Salomons
10 Stuart Street, Level 2, Kingston, ON K7L3N6
Telephone: 613-533-6895
Fax: 613-533-6794
E-mail: Jina.Zhang-Salomons@krcc.on.ca

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Abstract: (word count: 244)

Purpose: Cancer survival is known to be associated with socioeconomic status (SES). The income gap in between the richer and poorer has widened over the last 20 years in Canada. The purpose of this study was to investigate temporal trends in SES-related disparities in cancer specific survival.

Methods: Ontario Cancer Registry identified 920,334 cancer cases between 1993 and 2009. Median household-income from the Canadian census was linked to the registry. Cancer-specific survival was calculated by SES quintiles and year of diagnosis and was modeled by Cox regression.

Results: For all cancers combined, the hazard of death decreased by 3.1% (HR:0.969, 95% CI:0.967–0.971) per year in the richest quintile (Q5), and by 1.2% (HR:0.988, 95%CI:0.987–0.990) per year in the poorest quintile (Q1). In breast cancer, the hazard decreased by 4.3% (HR:0.957, 95%CI:0.951–0.964) per year in Q5 and 2.0% (HR:0.980, 95%CI:0.975–0.986) in Q1. In lung cancer, the hazard decreased by 1.4% (HR:0.986, 95%CI:0.982–0.990) per year in Q5 and 0.3% (HR:0.997, 95%CI:0.995–1.000) in Q1. In colorectal cancer, the hazard decreased by 3.7% (HR:0.963, 95%CI:0.958–0.968) per year in Q5 and 1.8% (HR:0.982, 95%CI:0.978–0.985) in Q1. In head and neck cancer, the hazard decreased by 3.1% (HR 0.969, 95%CI:0.958–0.979) per year in Q5 and 1.0% (HR:0.990, 95%CI:0.983-0.996) in Q1.

Conclusions: Cancer specific survival in Ontario has improved more among the patients from affluent communities than those from poorer communities, and this phenomenon cannot be explained by increased disparity in income.

Key words: cancer, survival, socioeconomic status (SES), disparity, temporal trend

INTRODUCTION (word count: 2462)

Since the first report of an association between socioeconomic status (SES) and cancer survival by Cohart in 1955,[1] it has become well established that SES is a predictor of cancer survival.[2,3] This association has been observed consistently in studies from different health care systems in North America, Australia and Europe.[2,3] In the late 1990s, several studies compared the effect of SES on cancer survival in the Canadian province of Ontario with that observed in the SEER population of the United States;[4,5,6] It was shown that, despite Canada's system of universal health insurance, there was a significant association between SES and survival in several major types of cancer.[4] The magnitude of that association was, however, smaller in Ontario than in the US.[5]

Over the last two decades, public health agencies in Canada and around the world have emphasised the importance of reducing social disparities in health.[7,8] At the same time, income inequality has been increasing in many countries, including Canada.[9] It is not known whether these changes in income distribution have translated into an increase in income-related disparities in cancer survival.

Few studies have assessed the temporal trend in the association between SES and cancer survival. One Canadian study investigated this trend in head and neck (H&N) cancer from 1992 to 2005.[10] The authors found a significant increase in the difference in cancer survival between the richest and poorest for oropharynx cancer, a disease for which the etiology has shifted from predominantly smoking to papillomavirus infection.[11] No significant changes were found in cancers at other sites in the H&N. A prospective cohort study in the UK investigated the same time trend by social classes defined by occupation among 7,489 men.[12] The authors observed no change in the association between cancer survival and occupation during the 35-year follow-up period. An

American study examined whether the disparity in cancer survival by insurance status changed between 1999 and 2004, and found that survival improved for privately-insured patients, but not for patients insured by Medicaid.[13]

The objective of this study was to determine whether the magnitude of the association between SES and cancer survival changed between 1993 and 2009 in Ontario, Canada.

METHODS

Source of Data

This is a population-based retrospective study using data from the Ontario Cancer Registry (OCR) and Statistics Canada. 920,334 cases of cancer diagnosed between 1993 and 2009 were identified through OCR. The OCR provides date of diagnosis, disease site, date of death, cause of death, age, sex, and postal code at diagnosis. Disease sites are coded as the ICD-O-3 (International Classification of Diseases for Oncology, 3rd edition) codes. Cause of death, provided as ICD9 and ICD10 codes, is available up to December 31, 2011, while the date of death is complete up to December 31, 2013. Median household-income (MHI) was collected from the 1996, 2001, and 2006 censuses at the level of dissemination area (DA) for 2006 census and enumeration area (EA) for 1996 and 2001 census, from Statistics Canada. The DA/EAs were grouped into quintiles based on their MHI, with the 5th quintile (Q5) representing the communities where the wealthiest 20% in Ontario resided and the 1st quintile (Q1) representing the communities where the poorest 20% resided.

The MHI quintiles at DA/EA level were linked to each cancer case through patient's postal code by utilizing the Postal Code Conversion File (PCCF+),[14] which provided the correspondence between postal codes and census DA/EAs. Although postal code and DA/EA are similar in size, their boundaries do not respect each other. When a postal code straddles the boundary of more than one DA/EA, the DA/EA with its majority of dwellings in this postal code was chosen. The MHI from the 1996 census (1995 income), 2001 census (2000 income), and 2006 census (2005 income) was assigned to the cases diagnosed from 1993 to 1997, 1998 to 2002, and 2003 to 2009, respectively.

Statistical Analysis

Cancer-specific survival (CSS) was estimated by SES and year of diagnosis. The five-year CSS was calculated as one minus the cumulative incidence function for death from any cancer at five years from diagnosis. Survival time (in month) was calculated from the date of diagnosis to the date of death from cancer, date of death from other causes (competing events), or until December 31, 2011 if alive at the time (censored).

The Fine-Gray sub-distribution proportional hazards regression was used to investigate the interaction effect between SES and year of diagnosis on time to cancer death controlling for age and sex, and to calculate the hazard ratios.[15,16] The results were considered significant at the 0.05 level, and all tests of statistical significance were two-sided. The statistical analysis was performed using SAS 9.4 (SAS Institute Inc., Cary, NC, USA). The analysis obtained ethical approval from Queen's University.

RESULTS

Study Population

Table 1 presents summary statistics of the study population. Median age was 67 years; Males represented a slightly larger proportion (51.9%) than females. The annual incident cases grew from 44,165 in 1993 to 65,522 in 2009. Fifteen percent of patients resided in Q5 and 22.9% in Q1. Breast cancer represented the highest percentage of all cancer cases, followed by lung, colorectal, and H&N cancers. There was no difference in the case mix between cancer sites across the years (appendix Table 1).

Temporal trend in survival by SES quintiles

Improvement in cancer survival in Ontario between 1993 and 2006 differed by neighborhood income (Figure 1). When all cancers were combined, the 5-year CSS for patients in Q1 improved by 3.5% from 55.3% (95%CI: 54.4%–56.2%) in 1993 to 58.8% (95%CI: 58.0%–59.6%) in 2006. For patients in Q5, the 5-year CSS improved by 8.6% from 63.4% (95%CI: 62.1-64.6%) in 1993 to 72.0% (95%CI: 71.1%–72.9%) in 2006. In other words, comparing the 5-year CSS rates in Q5 and Q1, the difference had widened from 8.1% in 1993 to 13.2% in 2006.

Similar temporal trend were also found for specific cancer sites, but at different magnitudes (Figure 2). In breast cancer (Figure 2a), 5-year CSS for Q1 improved by 2.2% from 80.4% (95%CI: 78.3%–82.4%) in 1993 to 82.6% (95%CI: 80.8 –84.3%) in 2006. In contrast, the CSS in Q5 improved by 5.4% from 83.1% (95%CI: 80.7%–85.4%) in 1993 to 88.5% (95%CI: 86.8%–90.0%) in 2006. Comparing the CSS in Q5 and Q1, the difference had widened from 2.8% in 1993 to 5.9% in 2006. For lung cancer (Figure 2b), the CSS in Q1 changed by only 0.3% from 21.7% (95%CI: 20.0%–23.6%) in 1993 to 21.4% (95%CI: 19.7%–23.1%) in 2006. In contrast, the CSS in Q5 changed by 3.3% from 22.0% (95%CI: 19.0%–25.4%) in 1993 to 25.3% (95%CI: 22.6%–28.3%) in 2006.The patients in Q2–Q4 showed no substantial change in survival. When the CSS in Q1 and Q5 were compared, the difference had widened from 0.3% in 1993 to 3.9% in 2006. For colorectal cancer (Figure 2c), the CSS among those in Q1 increased by 3.4% from 56.2% (95%CI: 53.8%–58.6%) in 1993 to 59.6% (95%CI: 57.3%–61.8%) in 2006. In contrast, the CSS in Q5 increased by 12.3% from 56.5% (95%CI: 52.9 –60.2%) in 1993 to 68.8% (95%CI: 66.2%–71.4%) in 2006. Comparing the CSS in Q5 and Q1, the difference had widened from 0.3% in 1993 to

9.2% in 2006. For H&N cancer (Figure 2d), the CSS in Q1 increased by 5.0% from 57.6% (95%CI: 53.1%–62.1%) in 1993 to 62.6% (95%CI: 58.2%–67.0%) in 2006. For those in Q5, the 5-year CSS increased by 4.9% from 69.5% (95%CI: 62.4%–76.4%) in 1993 to 74.4% (95%CI: 69.1%–79.4%) in 2006.

Fitting a Fine-Gray model confirmed a significant interaction between SES quintiles and year of diagnosis after controlling for age and sex (see Appendix Table 2 for p-values). During the study period, the hazard of death decreased by 3.1% per year in Q5 and 1.2% per year in Q1 for all cancers combined, decreased by 4.3% in Q5 and 2.0% in Q1 per year in breast cancers, decreased by 1.4% in Q5 and 0.3% in Q1 per year in lung cancer, decreased by 3.7% in Q5 and 1.8% in Q1 per year in colorectal cancer, and decreased by 3.1% in Q5 and 1.0% in Q1 per year in H&N cancer (the actual HRs and their 95% confidence intervals are shown in Table 2a).

Temporal trend in survival by constant dollars

During the study period, the gap of the actual income between Q5 and Q1 has widened from \$56,706 in 1996 census to \$70,693 (in constant dollar) in 2006 census, representing a 24.7% increase (Figure 3). Because the above analysis treated the quintiles as categorical variables, the effect observed could be in part mediated by the increase in the income gap alone. To obviate this potential mediation effect, we converted the MHI at DA/EA level from each census into 2010 constant dollars and used this income value to fit a second Fine-Gray model (see Appendix Table 3). The model confirmed significant interactions between year of diagnosis and MHI for the 5 major disease sites and for all cancers combined. The hazards of death per year of diagnosis were lower in the communities with higher MHI, and higher in the communities with lower MHI (Table 2b). For example, when all cancers were combined, the hazard of death decreased by 0.9% per year (HR: 0.991, 95%CI: 0.989, 0.993) among the communities with a MHI of \$20,000, and decreased by 3.1% per year (HR: 0.969, 95%CI: 0.966, 0.973) among the communities with a MHI of $100,000.

DISCUSSION

This study found that, over the last two decades, CSS in the general population of Ontario has improved; but the improvement in survival was greater in patients from affluent communities than in those from poorer communities, and income-associated disparities in survival have therefore widened. This phenomenon was observed in cancers of the lung, breast, colon-rectum, H&N region, as well as in all cancers combined. Furthermore, the analysis found that the income associated disparities in the survival trend could not be simply explained by the widened disparity in income.

The overall improvements in CSS observed here probably reflect earlier diagnosis due to improved screening, or improvements in treatment, or both. The fact that survival has improved more in richer communities suggests that, in general, improvements in screening and treatment may have had more impact on this group than on poorer communities. The specific explanations for the widening gap in survival between richer and poorer probably differ among the different types of cancer. For example, in the context of breast cancer, where screening is known to improve outcomes at the population level[17,18], SES-related differences in the utilization of screening might contribute to the SES-related differences in CSS. Consistent with this hypothesis, an Ontario study of breast cancer screening between 1999 and 2010 showed that mammographic screening was used less frequently in lower income neighborhoods[19]. However, this study did not find an increase in the income-associated disparities in screening rates over time.[19] Further studies will be required to determine whether SES-related disparities in the use of screening have increased in recent years in other diseases in which screening is effective. However, differential use of screening does not offer any explanation for the widening gap in survival between richer and poorer in lung or H&N cancer because no screening was routinely offered in Ontario for either of these diseases.

Multiple incremental improvements in the effectiveness of cancer treatment are probably responsible for much of the overall improvement in CSS observed in this study. Over the last two decades, new and increasingly effective types of adjuvant treatment have become available for many types of cancer. Furthermore, there is evidence from Ontario that new forms of adjuvant treatment are used more frequently in richer communities.[20,21] Thus, it seems probable that the more rapid adoption of new and effective treatments in richer communities might be responsible for the observed increase in SES-associated disparities in CSS.

Comorbidity has been shown to vary by SES among cancer patients,[22,23] and been associated with poorer CSS in some diseases, although to a lesser degree than with all-cause survival.[24] Comorbid condition of cancer patients by SES in Ontario has not been reported, therefore it is difficult to ascertain whether the observed time trend in SES associated disparities in survival was related to comorbidity. Lifestyle factors as a mediator between SES and survival were also proposed.[3] It was believed that poor lifestyle such as smoking or poor diet could lead to an overall poorer health of cancer patients and therefore reduce their chance of survival. An Ontario study on SES disparities in tobacco use in the general population found no interaction between time and education between 1999 and 2006, although both smoking rates and education level have increased over time.[25] Further research is needed on the relationship between SES, smoking status, and cancer survival to better understand the temporal trend observed in this study.

The study has its limitations. The accuracy of cause of death classification is a known concern for calculating CSS. A previous study compared the cause of death classification in the OCR with those recorded in a clinical database for a group of H&N patients.[26] Among the 276 patients died of H&N cancer, 23 (8%) were misclassified as non-cancer death. Misclassification from the death of other causes to the death of H&N cancer also occurred. Furthermore, the author found no difference in the CSS calculated using OCR and that calculated using their clinical database, which could be explained if the pattern of misclassification is random. Although misclassification of cause of death does occur, there is no evidence to suggest that the misclassification could be responsible for the increase in SES-related disparities in CSS observed in this study.

The temporal trend in the SES-associated disparity in cancer survival observed in this study has important implications in the management of cancer care. The overall improvement in cancer survival is consistent with the improved access to diagnosis and treatments.[27] However, the slower improvement in outcomes observed in poorer communities suggests that new approaches to cancer diagnosis and treatment may be adopted more slowly among lower SES groups. Further studies focussing on particular disease groups will be required to identify the specific factors which mediate the association between SES and survival. A better understanding of the causal pathway from SES and cancer survival is required to inform strategies aimed at narrowing the gap in survival between richer and poorer. Similar studies in different countries that possess different social and health care systems may also help to further our understanding of this important determinant of health.

CONCLUSION

Despite increased awareness of the relationship between SES and cancer survival, cancer specific survival in Ontario has improved more among the patients from affluent communities than those from poorer communities, and this phenomenon cannot be explained by increased disparity in income.

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FIGURE LEGEND

Figure 1. Temporal trend in 5-year cancer-specific survival by SES quintile for all cancers in Ontario from 1993 to 2006.

Figure 2. Temporal trend in 5-year cancer-specific survival of breast cancer (a), lung cancer (b), colorectal cancer (c), and head & neck cancer (d) in Ontario from 1993 to 2006, by SES quintile.

Figure 3. Median household income for each income quintile from 1996, 2001 and 2006 census.

Table 1. Distribution of cancer cases by study variables in Ontario from 1993 to 2009.

Variables	Groups	# of Cases	Percentage
Age	<50	136515	14.8%
	50-59	154531	16.8%
	60-69	234047	25.4%
	70-79	249900	27.2%
	80+	145341	15.8%
Sex	Males	477336	51.9%
	Females	442998	48.1%
Year of Diagnosis	1993	44165	4.8%
	1994	44847	4.9%
	1995	44738	4.9%
	1996	46082	5.0%
	1997	47804	5.2%
	1998	49403	5.4%
	1999	51164	5.6%
	2000	52811	5.7%
	2001	54559	5.9%
	2002	55452	6.0%
	2003	56098	6.1%
	2004	58477	6.4%
	2005	59971	6.5%
	2006	61439	6.7%
	2007	63909	6.9%
	2008	63893	6.9%
	2009	65522	7.1%
SES	1 (Poorest)	210539	22.9%
	2	197432	21.5%
	3	180032	19.6%
	4	157701	17.1%
	5 (Richest)	137659	15.0%
	Missing	36971	4.0%
Site	Breast	124221	13.5%
	Lung	122889	13.4%
	Head & Neck	30695	3.3%
	Colorectal	122183	13.3%
	Others	520346	56.5%
	All sites	920334	

Table 2a. Time trend in cancer survival in different SES quintiles, expressed as the hazard of death per year of diagnosis (HR) from the Fine-Gray model, for cancer cases diagnosed between 1993 and 2009 in Ontario, Canada.

Disease site	SES quintiles*	HR (95% confidence interval)
All cancers		
	1 (poorest)	0.988 (0.987,0.990)
	2	0.983 (0.982,0.985)
	3	0.980 (0.978,0.981)
	4	0.977 (0.975,0.979)
	5 (richest)	0.969 (0.967,0.971)
Breast		
	1 (poorest)	0.980 (0.975,0.986)
	2	0.974 (0.968,0.976)
	3	0.968 (0.962,0.973)
	4	0.966 (0.960,0.972)
	5 (richest)	0.957 (0.951,0.964)
Lung		
	1 (poorest)	0.997 (0.995,1.000)
	2	0.997 (0.995,1.000)
	3	0.995 (0.992,0.997)
	4	0.996 (0.992,0.997)
	5 (richest)	0.986 (0.982,0.990)
Colorectal		
	1 (poorest)	0.982 (0.978,0.985)
	2	0.978 (0.975,0.982)
	3	0.975 (0.971,0.979)
	4	0.971 (0.966,0.975)
	5 (richest)	0.963 (0.958,0.968)
Head & Neck		
	1 (poorest)	0.990 (0.983,0.996)
	2	0.988 (0.981,0.995)
	3	0.985 (0.978,0.993)
	4	0.979 (0.970,0.988)
	5 (richest)	0.969 (0.958,0.979)

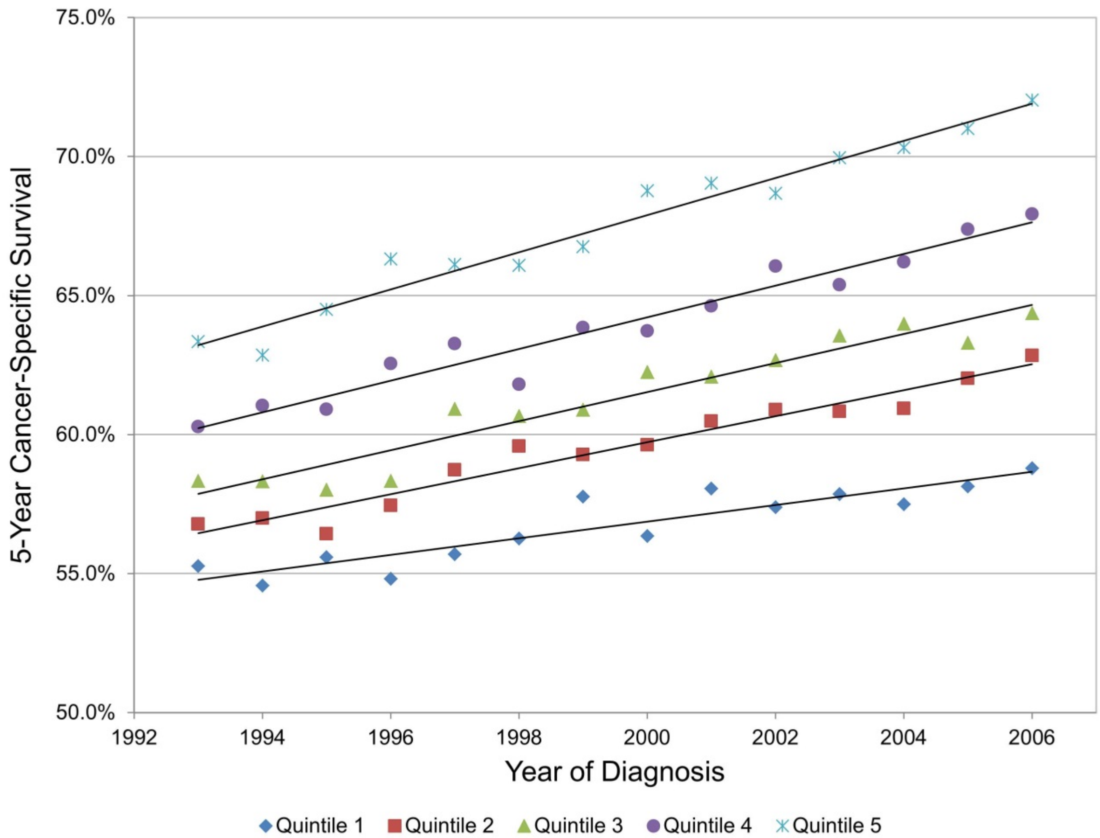
***Quintile 1 was defined as the communities in which Ontario's richest 25% of population resides according to a specific census year.**

Table 2b. Time trend in cancer survival in selected median-household-income (MHI) categories, expressed as the hazard of death per year of diagnosis (HR) from the Fine-Gray model, for cancer cases diagnosed between 1993 and 2009 in Ontario, Canada.

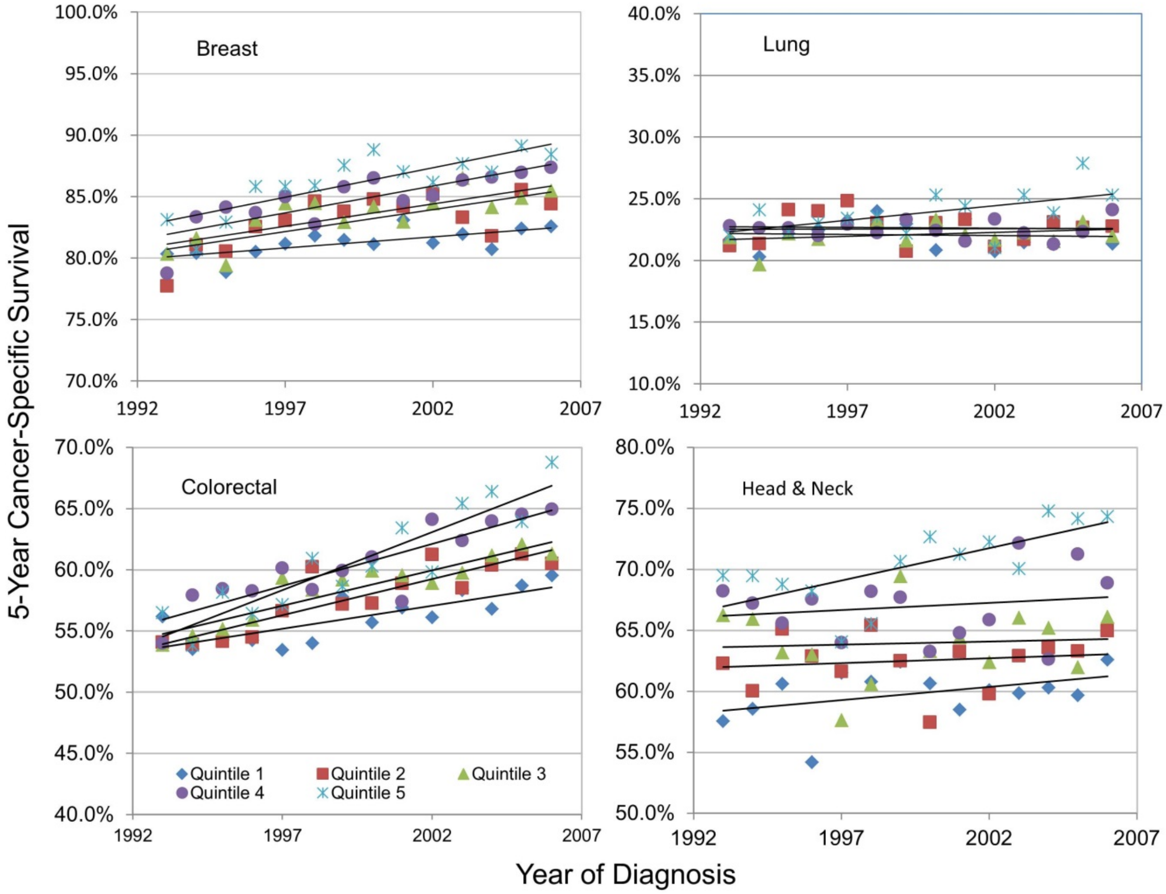
Disease site	MHI*	HR (95% confidence interval)
All cancers		
	$20,000	0.991 (0.989, 0.993)
	$40,000	0.985 (0.983, 0.988)
	$60,000	0.980 (0.977, 0.983)
	$80,000	0.975 (0.971, 0.978)
	$100,000	0.969 (0.966, 0.973)
Breast		
	$20,000	0.985 (0.981, 0.988)
	$40,000	0.979 (0.975, 0.983)
	$60,000	0.974 (0.970, 0.978)
	$80,000	0.968 (0.964, 0.973)
	$100,000	0.963 (0.958, 0.968)
Lung		
	$20,000	0.997 (0.995, 0.999)
	$40,000	0.992 (0.989, 0.994)
	$60,000	0.986 (0.983, 0.989)
	$80,000	0.981 (0.977, 0.984)
	$100,000	0.975 (0.971, 0.979)
Colorectal		
	$20,000	0.987 (0.984, 0.989)
	$40,000	0.981 (0.978, 0.984)
	$60,000	0.976 (0.972, 0.979)
	$80,000	0.970 (0.967, 0.974)
	$100,000	0.965 (0.961, 0.969)
Head & Neck		
	$20,000	0.996 (0.991, 1.000)
	$40,000	0.990 (0.985, 0.995)
	$60,000	0.985 (0.979, 0.990)
	$80,000	0.979 (0.974, 0.984)
	$100,000	0.974 (0.968, 0.979)

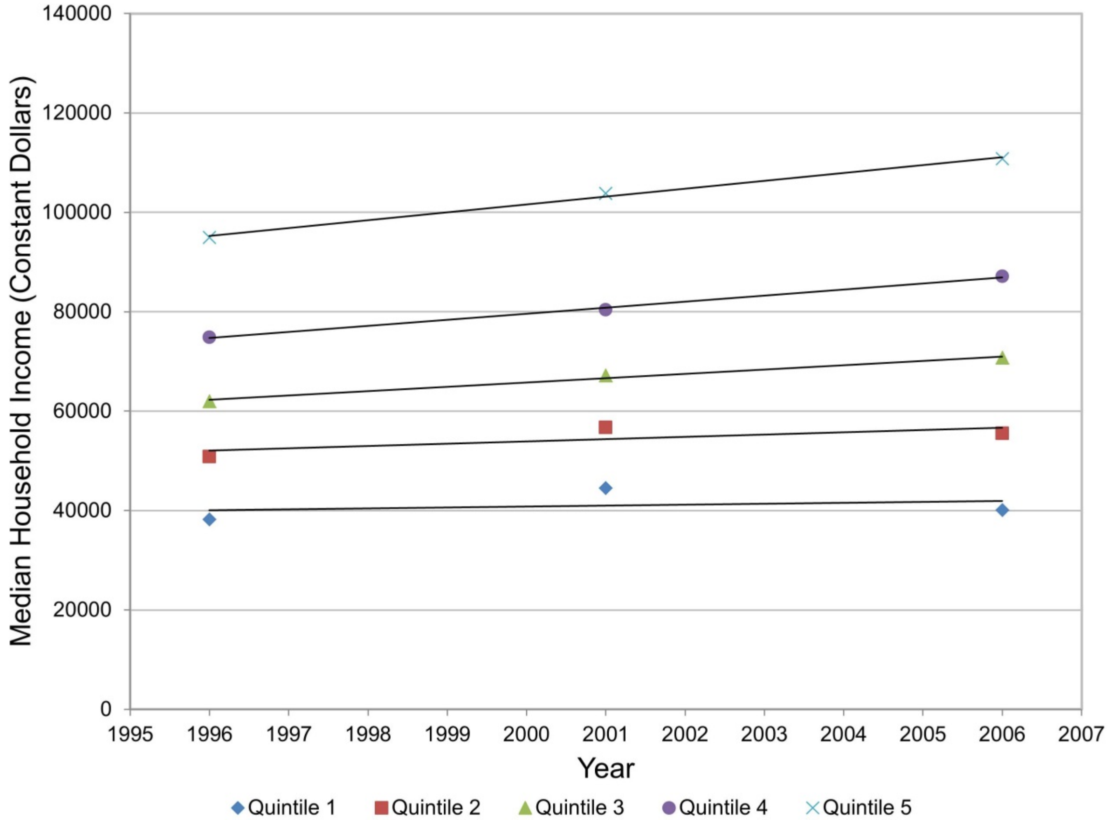
*** Median household income was represented by 2010 constant dollar.**

Temporal trends in SES-related disparities in cancer survival



Temporal trends in SES-related disparities in cancer survival

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APPENDIX:

Appendix Table 1. Annual cases of cancer diagnosed in Ontario between 1993 and 2009.

	Cancer Site								
	All Cancers	Breast		Lung		Head & Neck		Colorectal	
Year		Cases	%	Cases	%	Cases	%	Cases	%
1993	44165	5990	13.56%	6423	14.54%	1605	3.63%	5930	13.43%
1994	44847	6076	13.55%	6380	14.23%	1696	3.78%	6183	13.79%
1995	44738	6281	14.04%	6458	14.44%	1640	3.67%	6096	13.63%
1996	46082	6374	13.83%	6699	14.54%	1712	3.72%	6220	13.50%
1997	47804	6842	14.31%	6653	13.92%	1628	3.41%	6222	13.02%
1998	49403	7005	14.18%	6972	14.11%	1636	3.31%	6761	13.69%
1999	51164	7303	14.27%	6985	13.65%	1644	3.21%	6958	13.60%
2000	52811	7155	13.55%	7191	13.62%	1743	3.30%	7238	13.71%
2001	54559	7334	13.44%	7326	13.43%	1773	3.25%	7361	13.49%
2002	55452	7689	13.87%	7219	13.02%	1765	3.18%	7394	13.33%
2003	56098	7455	13.29%	7222	12.87%	1770	3.16%	7350	13.10%
2004	58477	7751	13.25%	7487	12.80%	1913	3.27%	7702	13.17%
2005	59971	7914	13.20%	7915	13.20%	1994	3.32%	7823	13.04%
2006	61439	8014	13.04%	7896	12.85%	1907	3.10%	7947	12.93%
2007	63909	8297	12.98%	7926	12.40%	2103	3.29%	8203	12.84%
2008	63893	8187	12.81%	7990	12.51%	2055	3.22%	8455	13.23%
2009	65522	8554	13.06%	8147	12.43%	2111	3.22%	8340	12.73%

Appendix Table 2. The results of Fine-Gray model for breast, lung. head and neck, and colorectal cancers, as well as for all cancers combined (SES was represented by income quintiles with the richest quintile as reference group).

Site	Parameter	Group	Estimate	Hazard Ratio	p-value
All					
	SES	1	0.10975	1.116	<.0001
		2	0.07675	1.080	<.0001
		3	0.06418	1.066	<.0001
		4	0.03002	1.030	0.0085
	Year of Diagnosis		-0.03145	0.969	<.0001
	Year of Diagnosis x SES	1	0.01968	1.020	<.0001
	Year of Diagnosis x SES	2	0.01457	1.015	<.0001
	Year of Diagnosis x SES	3	0.01098	1.011	<.0001
	Year of Diagnosis x SES	4	0.0082	1.008	<.0001
	SEX	Female	-0.04869	0.952	<.0001
	AGE	<50	-1.09359	0.335	<.0001
		50-59	-0.65857	0.518	<.0001
		60-69	-0.46141	0.630	<.0001
		70-79	-0.23688	0.789	<.0001
Breast					
	SES	1	0.0529	1.054	0.1303
		2	0.03253	1.033	0.3682
		3	0.04568	1.047	0.2118
		4	-0.00303	0.997	0.9363
	Year of Diagnosis		-0.04368	0.957	<.0001
	Year of Diagnosis x SES	1	0.0241	1.024	<.0001
	Year of Diagnosis x SES	2	0.01703	1.017	0.0002
	Year of Diagnosis x SES	3	0.01103	1.011	0.0158
	Year of Diagnosis x SES	4	0.00929	1.009	0.0508
	AGE	<50	-0.64488	0.525	<.0001
		50-59	-0.69791	0.498	<.0001
		60-69	-0.58719	0.556	<.0001
		70-79	-0.33706	0.714	<.0001
Lung					
	SES	1	-0.00547	0.995	0.8002
		2	-0.02957	0.971	0.1852
		3	-0.00886	0.991	0.6979
		4	-0.02888	0.972	0.2326
	Year of Diagnosis		-0.0141	0.986	<.0001
	Year of Diagnosis x SES	1	0.01128	1.011	<.0001

	Year of Diagnosis x SES	2	0.01135	1.011	<.0001
	Year of Diagnosis x SES	3	0.00871	1.009	0.0001
	Year of Diagnosis x SES	4	0.00976	1.010	0.0001
	SEX	Female	-0.11239	0.894	<.0001
	AGE	<50	-0.37455	0.688	<.0001
		50-59	-0.24243	0.785	<.0001
		60-69	-0.21057	0.810	<.0001
		70-79	-0.12318	0.884	<.0001
Head & Neck					
	SES	1	0.15557	1.168	0.0088
		2	0.10262	1.108	0.0922
		3	0.05735	1.059	0.3593
		4	0.02029	1.020	0.7575
	Year of Diagnosis		-0.03196	0.969	<.0001
	Year of Diagnosis x SES	1	0.02158	1.022	0.001
	Year of Diagnosis x SES	2	0.01965	1.020	0.004
	Year of Diagnosis x SES	3	0.01725	1.017	0.013
	Year of Diagnosis x SES	4	0.0108	1.011	0.138
	SEX	Female	-0.11748	0.889	<.0001
	AGE	<50	-0.90383	0.405	<.0001
		50-59	-0.45215	0.636	<.0001
		60-69	-0.28218	0.754	<.0001
		70-79	-0.14003	0.869	<.0001
Colorectal					
	SES	1	-0.02266	0.978	0.416
		2	-0.04186	0.959	0.1427
		3	-0.03974	0.961	0.1743
		4	-0.05874	0.943	0.0557
	Year of Diagnosis		-0.03779	0.963	<.0001
	Year of Diagnosis x SES	1	0.01916	1.019	<.0001
	Year of Diagnosis x SES	2	0.016	1.016	<.0001
	Year of Diagnosis x SES	3	0.01267	1.013	<.0001
	Year of Diagnosis x SES	4	0.00812	1.008	0.016
	SEX	Female	-0.06673	0.935	<.0001
	AGE	<50	-0.55141	0.576	<.0001
		50-59	-0.50594	0.603	<.0001
		60-69	-0.41254	0.662	<.0001
		70-79	-0.29245	0.746	<.0001

Appendix Table 3. The results of Fine-Gray model for breast, lung, head and neck, and colorectal cancers, as well as for all cancers combined (SES was represented by constant dollar).

Site	Parameter	Group	Estimate	Hazard Ratio	p-value
All					
	Constant Dollar (per $10,000)		-0.02233	0.978	<.0001
	Year of Diagnosis		-0.00341	0.997	0.0006
	Year of Diagnosis x Constant Dollar		-0.00218	0.998	<.0001
	Sex	Female	-0.04924	0.952	<.0001
	Age	<50	-1.09053	0.336	<.0001
		50-59	-0.65625	0.519	<.0001
		60-69	-0.46009	0.631	<.0001
		70-79	-0.23674	0.789	<.0001
Breast					
	Constant Dollar (per $10,000)		-0.01531	0.985	0.0016
	Year of Diagnosis		-0.00983	0.990	0.0127
	Year of Diagnosis x Constant Dollar		-0.0028	0.997	<.0001
	Age	<50	-0.63852	0.528	<.0001
		50-59	-0.69319	0.500	<.0001
		60-69	-0.58474	0.557	<.0001
		70-79	-0.3371	0.714	<.0001
Lung					
	Constant Dollar (per $10,000)		-0.00154	0.998	0.6007
	Year of Diagnosis		0.00274	1.003	0.1537
	Year of Diagnosis x Constant Dollar		-0.00114	0.999	0.0001
	Sex	Female	-0.1136	0.893	<.0001
	Age	<50	-0.37286	0.689	<.0001
		50-59	-0.24259	0.785	<.0001
		60-69	-0.20965	0.811	<.0001
		70-79	-0.12356	0.884	<.0001
Head & Neck					
	Constant Dollar (per $10,000)		-0.03208	0.968	<.0001
	Year of Diagnosis		0.00126	1.001	0.8159
	Year of Diagnosis x Constant Dollar		-0.00235	0.998	0.0046

	Sex	Female	-0.11957	0.887	<.0001
	Age	<50	-0.89787	0.407	<.0001
		50-59	-0.45096	0.637	<.0001
		60-69	-0.28376	0.753	<.0001
		70-79	-0.14151	0.868	<.0001
Colorectal					
	Constant Dollar (per $10,000)		-0.00057	0.999	0.8832
	Year of Diagnosis		-0.00772	0.992	0.0041
	Year of Diagnosis x Constant Dollar		-0.00257	0.997	<.0001
	Sex	Female	-0.06657	0.936	<.0001
	Age	<50	-0.55036	0.577	<.0001
		50-59	-0.50543	0.603	<.0001
		60-69	-0.41296	0.662	<.0001
		70-79	-0.29352	0.746	<.0001