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Associations of Physician Supplies with Colon Cancer Care in Ontario and California, 1996 to 2006

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Abstract

Background—This study examined the differential effects of physician supplies on colon cancer care in Ontario and California. The associations of physician supplies with colon cancer stage at diagnosis, receipt of surgery and adjuvant chemotherapy, and 5-year survival were observed within each country and compared between-country.

Methods—Random samples of Ontario and California cancer registries provided 2,461 and 2,200 colon cancer cases that were diagnosed between 1996 and 2000, and followed until 2006. Both registries included data on the stage of disease at the time of diagnosis, receipt of cancer-directed surgery, receipt of adjuvant chemotherapy, and survival. Census tract-level data on low-income prevalence were, respectively, taken from 2001 and 2000 Canadian and United States

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population censuses. County-level primary care physician and gastroenterologist densities were computed for the same years.

Results—Significant income-adjusted, gastroenterologist density threshold effects (2.0 or more vs. less than 2.0 per 100,000 inhabitants) were observed for early diagnosis (OR = 1.57) and 5-year survival (OR = 1.63) in Ontario, but not in California. Significant incremental threshold effects of primary care physician densities on chemotherapy receipt (8.0 and 9.0 or more per 10,000 inhabitants, respective ORs of 1.79 and 2.37) were also only observed in Ontario.

Conclusions—These colon cancer care findings support the theory that while personal economic resources are more predictive in America, community-level resources such as physician supplies are more predictive of health care access and effectiveness in Canada.

Keywords

Physician supply; Primary care; Gastroenterology; Colon cancer; Canada; USA

The two developed nations of North America—Canada and the United States—present a natural health care laboratory. Though culturally and environmentally similar, they provide health care to their residents in very different ways. The most obvious distinction is that Canadian health care, paid for by a single, public payer, guarantees medically necessary care for all, while care in America that is paid for by multiple, private and public payers, makes no such guarantee. Studies that have observed significant health outcome differences between Canadian and American patients have typically implicated this payer difference that leaves many more Americans among the ranks of the under- or uninsured without access to effective care. We are not aware of any previous Canada–US study that has accounted for another, probably very important factor, overall health care financing or regional health care resource differences. This one will. In addition to knowing the sources of health care funds, it is probably also very important to understand the adequacy of that funding. This study compares Canada and America on one such key health care resource, a proxy for community health care service endowments [1, 2], physician supply.

Social policy analysts in both Canada and the US have identified contemporary physician supply problems [3–6]. Canadian advocates have focused on the need for more physicians overall while their American counterparts have focused on the need for more primary care physicians. Though based on limited evidence, these views seem to have taken positions of near axiomatic truth, but what are the actual population health effects of such physician supply shortages if indeed they do exist? How strong are the relationships between various physician supplies and key health care processes and outcomes in Canada and the US? Valid answers to questions such as these could inform the rational development of evidence-based physician supply policies on both sides of the border. This study makes opportunistic use of existing physician supply and cancer surveillance systems in Canada and the US to demonstrate this principle.

A number of within-country analyses of physician supplies and health care have focused on a sentinel indicator of great public health significance—breast cancer care. They found that community, typically county-level, primary care physician supplies were significantly

associated with more localized disease at diagnosis and with longer breast cancer survival in both Canada and the US, the associations seeming to be somewhat stronger in Canada [7–11]. Moreover, neither overall physician supplies nor aggregate specialist physician supplies seemed significantly associated with breast cancer care in either country after primary care physicians were accounted for. Prevalently affecting women and men, colon cancer care may be an even more sentinel health care performance indicator. The second most frequent cause of cancer death in North America, its prognosis is excellent with early diagnosis and timely access to the best available treatments [12, 13]. Colon cancer care may also be particularly instructive in Canada versus US physician supply-health care outcome analyses. Colon cancer screening technologies exist and matter, but have only recently begun to be implemented in both countries [14, 15]. Also, increasingly effective adjuvant chemotherapies have proliferated in both countries, first during the 1990s for lymph node metastasized (stage III) colon cancer, and more recently for lymph node-negative (stage II) disease [16–18]. It seems plausible that adequate supplies, not only of primary care physicians [19–21] but also of key specialists such as gastroenterologists [22–24], would positively affect the availability, accessibility, and coordination of colon cancer screening, treatment, follow-up, and survival in both Canada and the US.

The county-level density of primary care physicians was observed to be very modestly associated with more localized colon cancer at diagnosis and with longer colon cancer survival during the mid-1990s in Florida [25, 26]. However, total physician and gastroenterologist densities were not significantly associated with such colon cancer care indices. These US studies appropriately, but only very grossly, adjusted for personal economic resources (e.g., median household income of patients' county of residence at the time of diagnosis), and we are unaware of any such previous study of physician supply-colon cancer care in Canada. This study aims to observe more contemporaneous physician supply–colon cancer care relationships in both Canada and the US that more precisely account for within- and between-country income differences. Accounting for personal economic resources is probably critical because they have been consistently observed to explain very little of the variability in Canadian cancer care while they are well known to be highly predictive of such cancer care processes and outcomes in America [27–31]. Based on these and related research findings [32, 33], we theorize that income-adjusted community-level resources such as physician supplies are more predictive of health care access and effectiveness in Canada than in the US. The theory essentially posits that with guaranteed access, income and its correlates, including health insurance, matter less, while the availability of health care resources, including physician supplies, matter more. We therefore hypothesized the following. Primary care physician and gastroenterologist supplies are significantly associated with effective colon cancer care—earlier diagnosis, better treatment access and survival—in Canada, but not in the United States. We also explored income by physician supply interactions on colon cancer care.

Methods

Respectively, 2,461 and 2,200 invasive staged colon cancer cases were randomly selected from Ontario and California Cancer Registry (OCR, CCR) databases between 1996 and 2000, and followed until 2006. Samples were stratified by place, including very large

metropolitan areas (Toronto and San Francisco), small metropolitan areas (Windsor and Modesto) and rural places in each province and state. Such samples were selected to allow for efficient enhancements of the OCR (stage and treatment variables added) and then for staged colon cancer care comparisons of similar, unique and interesting places in Ontario and California. The OCR and the CCR comprehensively survey the most populace Canadian province and American state with demonstrated validity. They have both been estimated to ascertain nearly all colon cancer cases with near-perfect rates of microscopic confirmation and nearly nil rates of death certificate only identification [34–37]. Colon cancer stage and treatment variables that had been routinely coded by the CCR were reliably abstracted from hospital and physician office-based patient charts for the OCR sample [38–40]. Inter-rater reliability assessments of 150 randomly selected health records among three trained abstractors found κ coefficients that ranged from 0.88 to 0.96. When the American Joint Committee on Cancer (AJCC, stage I to stage IV) stage of disease at the time of diagnosis was not reported it was derived from Surveillance, Epidemiology and End Results (SEER)-based extent of disease variables. The following treatment variables were also included: receipt of initial cancer-directed surgery and receipt of adjuvant chemotherapy.

Colon cancer cases in Ontario and California were, respectively, joined to the 2001 Canadian and 2000 US censuses based on each patient's residential census tract (CT) at the time of diagnosis [41, 42]. Rural cases in Ontario were joined to census subdivisions as these areas are not geocoded to the level of CTs. Relatively low- to high annual household income quintile neighborhoods were constructed using Statistics Canada's low-income criterion and the US Census Bureau's poverty threshold. Purchasing power-adjusted median incomes were very similar in Ontario and California's lowest three income neighborhood quintiles, a key study group: respectively, $45,075 and $42,000 USD [43, 44]. Relative affluence was more prevalent in California. Residents of its two highest income neighborhood quintiles typically earned nearly $18,000 more annually than their counterparts in Ontario ($80,635 vs. $62,725 USD).

Ontario (2001) and California (2000) active physician supply counts were, respectively, based on the Scott's Medical Database and the AMA Physician Masterfile [45, 46]. Primary care physicians in both countries were defined as those who reported their primary specialty area as general practice or family practice. Consistent with previously validated primary care definitions and prevalent practice patterns, general internists in California and emergency family medicine physicians in Ontario were also included [7, 8, 47–49]. Physicians in either country who reported that the majority of their clinical time was spent in the practice of gastroenterology or who were board-certified gastroenterologists were defined as such. Physician supply densities per 10,000 populations for primary care physicians and per 100,000 for gastroenterologists were calculated for Ontario's 49 census divisions and California's 58 counties [41, 42]. Twenty-four of Ontario's census divisions correspond to counties, the remainder to districts or regional municipalities.

Maximum likelihood logistic regression models were used to estimate the respective associations of physician supply densities with colon cancer stage at diagnosis, receipt of surgery and adjuvant chemotherapy, and 5-year survival. Age- and income-adjusted odds ratios (OR) and their 95% confidence intervals (CI) were estimated from regression statistics

[50]. Preliminary analyses suggested probable threshold effects so each incrementally higher physician supply category was compared to the average effect of the previous categories. In addition to maximizing statistical power, such reverse Helmert contrasts allowed for the identification of any such thresholds [50, 51]. Consequently, key study comparisons had the statistical power to detect rate differences of less than 10% ($\alpha = 0.05$ [two-tailed] and power [$1 - \beta$] = 0.80) [52]. All rates were directly age-adjusted; using this study's combined Ontario-California population of colon cancer cases as the standard. Within- and between-country comparisons used standardized rate ratios (RR) with 95% CIs that were based on the Mantel–Haenszel Chi-square test [53, 54]. Further methodological details have been reported [7, 8, 29–31]. This study protocol was cleared by the University of Windsor's research ethics committee.

Results

Physician supply density parameters are displayed in Table 1. First, the supply of all active physicians, primary care as well as all specialists was much greater in California than in Ontario. Moreover, this difference seemed directly related to urbanity. The very large metropolitan area of San Francisco, for example, had nearly 15 more physicians for every 10,000 people in its population than its counterpart, Toronto, did. The small metropolitan area of Modesto differed less, but still notably as compared with Windsor, having nearly four more physicians for every 10,000 of its residents. While the rural areas of California and Ontario differed by less than one physician per 10,000 population. Second, the greater physician supplies in California seemed, in fact, to be principally of specialist physicians. Respective urban areas, be they large or small, had nearly identical supplies of primary care physicians, and primary care physician densities in rural places were, in fact, somewhat greater in Ontario. Third, nearly half (47.0%) of this study's Ontario physician work-force was engaged in primary care whereas only slightly more than a quarter (27.2%) of the California workforce was so engaged. Fourth and finally, gastroenterologists reflected the above-noted pattern of greater supplies in California, particularly in California's urban areas.

Physician Supplies and Colon Cancer Care

As hypothesized, the supply of gastroenterologists was significantly associated with 5-year colon cancer survival in Ontario, but not in California (Table 2). An age-, income-, and stage-adjusted threshold effect was observed at 2.0 or more gastroenterologists per 100,000 Ontario residents (OR = 1.63, 95% CI: 1.03, 2.57). The odds of surviving for 5 years among colon cancer patients residing in census divisions or regions with 2.0 or more gastroenterologists per 100,000 inhabitants were 63% greater than such odds among their counterparts in regions with fewer than 2.0 gastroenterologists per 100,000 inhabitants. It is also clear that few (5.8%) of the Ontario study sample lived in such well-supplied areas. Factors that did not add significantly to the explanation of survival were also notable: patient sex, place (large or small urban or rural, and the population's age distribution) and other physician supplies (total, primary care and other specialists such as general surgeons and oncologists).

As for colon cancer care processes, Table 2 also shows incremental threshold effects of gastroenterologist supplies on localized diagnoses and of primary care physician supplies on the receipt of adjuvant chemotherapy. Again as hypothesized, these income-adjusted effects were observed in Ontario, but not in California. In Ontario, the odds of being diagnosed very early with localized or AJCC stage I colon cancer increased substantially, that is by approximately 50% (OR = 1.51, 95% CI: 1.12, 2.02) in areas that had, on average, a half to nearly one gastroenterologist per 100,000 inhabitants. Such odds were further substantially increased by 57% (OR = 1.57, 95% CI: 1.09, 2.27) in areas with population densities of 2.0 or more gastroenterologists for every 100,000 inhabitants. The bottom of the table shows the same pattern of incremental benefits, this time of increased primary care physician supplies on receipt of indicated adjuvant chemotherapy. Incremental and categorically large beneficial effects were observed for 8.0 or more (OR = 1.79, 95% CI: 1.00, 3.22) and then again for 9.0 or more (OR = 2.37, 95% CI: 1.17, 4.79) primary care physicians per 10,000 regional residents. Patients with stage II or stage III colon cancer who lived in Ontario regions that enjoyed such primary care physician supplies were much more likely to receive adjuvant chemotherapy than were their counterparts in lesser supplied regions. Though many of the Ontario study sample lived in such well-supplied areas (40.8%), the majority did not. Physician supplies were not associated with the receipt of colon cancer surgery as nearly all received such care in both countries. Finally, consistent with this study's theoretical perspective, California analyses that were not income-adjusted (not shown in table) found significant gastroenterologist and primary care physician supply thresholds for localized stage at diagnosis and adjuvant chemotherapy.

Exploration of Income by Gastroenterologist Supply by Country Interactions

Consistent with well-known income–cancer care relationships, income was significantly associated with 5-year colon cancer survival in this study's California sample, but not in its Ontario sample. For example, such age-adjusted survival in California's three lowest aggregated income areas was significantly lower than in its two highest income areas (RR = 0.85, 95% CI: 0.78, 0.93). Adjusting for the main effect of income, we explored its interactions with physician supplies and observed significant income by gastroenterologist supply by country interactions on colon cancer care. The interaction depicted in the top half of Table 3 suggests that specifically among relatively low-income patients, having greater access to gastroenterologists seems to impart a significant survival advantage (RR = 1.32, 95% CI: 1.06, 1.64) in Ontario, but not in California. Such low-income patients in Ontario seem to have a distinct survival advantage as compared with their counterparts in California (RR = 1.29, 95% CI: 1.04, 1.61). The interaction depicted in the bottom half of Table 3 suggests a similar early diagnostic advantage among low-income Ontarians (RR = 1.29, 90% CI: 1.00, 1.66). Alternatively, relatively high-income patients who lived in areas of California with lower gastroenterologist supplies seemed to be diagnosed earlier than their counterparts in Ontario were (RR = 0.56, 95% CI: 0.36, 0.87).

No such three-way interactions involving primary care physician supplies were observed. However, a two-way primary care physician supply by country interaction was suggested. Among samples restricted to stage II or stage III colon cancer, more Ontario patients who lived in areas with 8.0 or more primary care physicians per 10,000 inhabitants received

chemotherapy than did those in lesser supplied areas of Ontario. Their respective age- and income-adjusted chemotherapy rates were 44.5 and 37.6% (RR = 1.18, 95% CI: 1.04, 1.34). No such primary care physician supply-chemotherapy association was observed in California. Consequently, specific to primary care physician supply areas below the 8.0 criterion, it seemed that there may be a modest chemotherapy access advantage in California (RR = 0.90, 90% CI: 0.82, 0.99). Ontario and California chemotherapy treatment rates were identical in areas at or above the 8.0 primary care physician criterion.

Discussion

Physician densities, particularly specialist physician densities, were observed to be substantially greater in urban California than in urban Ontario. Based on the evidence, though, of one sentinel health care indicator, colon cancer care, it seems that Californians may not practically benefit from such relatively affluent regional health care service endowments more than Ontarians do from their more modest, and perhaps better organized, health care system that emphasizes primary care. This historical cohort study was based on our theory that personal economic resources trump community health care resources in the United States. Its consistent, income-adjusted, findings that primary care physician supplies, gastroenterologists, and even total physician supplies were not significantly associated with any aspect of colon cancer care across diverse places in California supported the theory. Given Canada's access guarantee, our theory alternatively predicted that personal resources matter less and community health care resources, including physician supplies, matter more there. This study's consistent findings of independent protective associations of gastroenterologist densities with early diagnosis and 5-year survival, and of primary care physician densities with the receipt of indicated chemotherapy across diverse urban and rural places in Ontario served to cross-validate the theory. Finally, the significant income by gastroenterologist supply by country interactions seemed of potential policy significance on both sides of the border. In low-income areas with adequate supplies of gastroenterologists, rates of early colon cancer diagnosis and of 5-year survival were both 29% greater among Canadians. It seems that abundant health care resources alone will probably never be able to fix America's central health care problem, that is, that so many do not have effective access to the abundance. The provision of health care for all ought to be America's principal policy mission. In Canada, where health care resources seem to matter more, there seems a policy call to fill evidence-based undersupplies, not necessarily with opulent abundance, but with resources rationalized to maximize the health of all who live in Canada.

Historical, Theoretical, and Methodological Contexts

This study's US findings converged with those of other US studies that have found little to no association between primary care physician supplies and health care, including cancer care and access after individual-level factors such as income and health insurance have been accounted for [32, 33, 55]. However, its null findings diverged somewhat from previously observed modest primary care physician-colon cancer care associations [25, 26]. Similar to ours in their ecological measurement of income, others preferred to adjust for county-level median income, while we adjusted for census tract prevalence of poverty. We think that our analysis probably more precisely accounted for key correlates of low income in America

such as the tendency to be under- or uninsured [56–60]. As for this study's Canadian findings, they seemed to closely replicate recent estimates that the efficacy of the primary care physician-breast cancer care relationship in Canada may be maximized at seven or so such physicians for every 10,000 people to be served in a region [7, 8]. This study estimated a slightly higher primary care physician threshold effect on colon cancer care, specifically adjuvant chemotherapy, of eight to nine such physicians. It seems that the active referral and liaison with oncologists and other specialists, as well as the active treatment surveillance necessary for high quality primary colon cancer care may be more labor-intensive. Together though, these studies provide policy-makers with a basement primary care physician supply estimate that probably assures high-quality cancer care for most people, as well as with a ceiling estimate above which further physician supply investments are not likely to be cost-effective. Finally, the large colon cancer protective effects estimated for only two gastroenterologists per 100,000 people seem to clearly sentinel Canadian policy-makers. Recall that nearly all of this study's American participants lived in such minimally supplied regions (90%), while nearly all of its Canadian participants did not (94%). As colon cancer-screening programs proliferate, Canadian policy-makers probably ought to consider incentives to so bolster the supply of gastroenterologists as they may be a key to their ultimate success.

Ecological Measurement—A potential alternative theoretical explanation could be advanced related to this study's use of ecological measures. This study's physician supply measures were county-level aggregates and so did not directly examine individual physician–patient relationships. Instead, they were conceived as proxies of community-level phenomena, that is, of regional health care service endowments. So we think that tentative population-level policy-relevant inferences may be most appropriately drawn from this study. One might also wonder if the racial/ethnic composition of ecologically defined low-income neighborhoods or lesser physician supplied regions could alternatively account for this study's observed Canada–US colon cancer care differences. We think not for the following reasons. First, recent studies of colon cancer care in America have consistently found that socioeconomic differences explained most of the observed racial group differences [60–62]. Secondly, though we were not able to adjust for this factor directly as the OCR does not code race/ethnicity, we were able to replicate key findings with the following conservative comparison: the subsample of non-Hispanic white patients in California versus the entire racial/ethnically diverse Ontario sample. Take perhaps the most provocative between-country comparison displayed in Table 3 for example, the 5-year survival comparison of patients living in relatively low-income areas that were, however, adequately supplied with gastroenterologists. The original analysis demonstrated an Ontario survival advantage (RR = 1.29, 95% CI: 1.04, 1.61). Ontario's advantage was maintained even when all members of any racial/ethnic minority group who represented a third of the California sample (Hispanic people [12.2%], Asian/Pacific Islanders [12.0%], non-Hispanic black people [9.7%], and others [0.8%]) were excluded (RR = 1.27, 95% CI: 1.02, 1.57).

Study Generalizability—This study's most policy-relevant inferences seem Ontarian. Its Ontario sample, however, was not necessarily representative of Ontario as a whole, so its findings may not be generalizable to all of Ontario's diverse places. Our original Ontario

sampling frame was randomly selected from purposively diverse and potentially policy-important places. We oversampled large (Toronto) and small (Windsor) urban and rural places. Admittedly, this study's findings are most generalizable to such places. Relatedly, key within-Ontario strata of the observed income by gastroenterologist supply by country interactions were based on less than 3% of our sample of colon cancer cases in Ontario. These suggested earlier diagnoses and better survival in Ontario's relatively low-income areas that seemed adequately supplied with gastroenterologists. Such were admittedly explorations and are probably best treated as screened hypotheses for future research testing. It should be noted, however, that this key sample arose almost exclusively from the exurban to rural fringes of Ontario's large urban centers, places where one out of every five Ontarians live that are generally under-supplied with specialist physicians, including gastroenterologists [41, 63]. It seems plausible that colon cancer care in Ontario would be positively affected by bolstering the health care service endowments of such areas, including their supplies of gastroenterologists.

Conclusions

This study's colon cancer care findings support the theory that while personal economic resources are more predictive in America, community-level resources such as physician supplies are more predictive of health care access and effectiveness in Canada.

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Table 1

Physician supplies by places in Ontario (2001) and California (2000)

Physicians	Rate per 10,000 population		Ontario-California rate difference
	Ontario	California	
All physicians	18.1	26.1	−8.0
Toronto and San Francisco	19.6	34.3	−14.7
Windsor and Modesto	11.9	15.8	−3.9
Rural places	10.4	11.2	−0.8
Primary care physicians	8.5	7.1	1.4
Toronto and San Francisco	8.8	8.9	−0.1
Windsor and Modesto	5.8	5.7	0.1
Rural places	7.8	6.2	1.6
	Rate per 100,000 population		
	Ontario	California	
Gastroenterologists	1.2	3.3	−1.1
Toronto and San Francisco	1.5	4.2	−2.7
Windsor and Modesto	0.5	2.9	−2.4
Rural places	0.2	0.4	−0.2

Table 2

Associations of physician supplies with colon cancer care in Ontario and California: patients diagnosed between 1996 and 2000 were followed until 2006

Ontario cohort				**California cohort**			
Gastroenterologists per 100,000 population	***n***	**OR**	**95% CI**	**Gastroenterologists per 100,000 population**	***n***	**OR**	**95% CI**
Associations with 5-year colon cancer survival							
None	726	1.00	…	Less than 2.0	233	1.00	…
0.1 to 0.4	620	1.16	0.89, 1.52	2.0 to 2.9	533	0.90	0.63, 1.27
0.5 to 0.9	263	0.99	0.71, 1.37	3.0 to 3.4	456	0.72	0.54, 0.96
1.0 to 1.9	710	1.13	0.89, 1.44	3.5 to 3.9	499	1.15	0.88, 1.49
2.0 or more	142	**1.63**	**1.03, 2.57**	4.0 or more	479	1.10	0.86, 1.42
Associations with localized colon cancer at diagnosis							
None	726	1.00	…	Less than 2.0	233	1.00	…
0.1 to 0.4	620	0.67	0.51, 0.87	2.0 to 2.9	533	1.21	0.90, 1.63
0.5 to 0.9	263	**1.51**	**1.12, 2.02**	3.0 to 3.4	456	0.84	0.66, 1.07
1.0 to 1.9	710	0.81	0.64, 1.03	3.5 to 3.9	499	0.84	0.67, 1.08
2.0 or more	142	**1.57**	**1.09, 2.27**	4.0 or more	479	0.83	0.67, 1.04
Primary care physicians per 10,000 population	*n*	OR	95% CI	Primary care physicians per 10,000 population	*n*	OR	95% CI
Associations with receipt of chemotherapy (stage II and III colon cancer)							
Less than 6.0	406	1.00	…	Less than 6.0	221	1.00	…
6.0 to 6.9	227	1.10	0.74, 1.64	6.0 to 6.9	171	0.84, 0.50	1.28
7.0 to 7.9	126	1.03	0.61, 1.72	7.0 to 7.9	314	1.08, 0.77	1.50
8.0 to 8.9	137	**1.79**	**1.00, 3.22**	8.0 to 8.9	86	1.29, 0.79	2.11
9.0 or more	386	**2.37**	**1.17, 4.79**	9.0 or more	149	1.14, 0.77	1.69

All effects were adjusted for age and income. Survival effects were also stage-adjusted. Each physician supply category was compared to the average effect of all previous categories. Bolded ORs and CIs are statistically significant ($p < .05$)

n number of incident colon cancer cases, *OR* odds ratio, *CI* confidence interval

Table 3

Depiction of income by gastroenterologist supply by country interactions on colon cancer care

Income group gastroenterologists per 100,000 population	Ontario, Canada				California, USA				Ontario/California	
	n	Rate	RR*	95% CI[a]	*n*	Rate	RR*	95% CI[a]	RR	95% CI[a]
Income by gastroenterologist supply by country on 5-year survival										
Two highest income quintiles										
Less than 2.0	909	.478	1.00	…	43	.599	1.00	…	0.80	0.61, 1.05
2.0 or more	75	.522	1.09	0.86, 1.39	838	.568	0.95	0.77, 1.18	0.92	0.75, 1.13
Three lowest income quintiles										
Less than 2.0	1,410	.485	1.00	…	190	.541	1.00	…	0.90	0.78, 1.04
2.0 or more	67	.642	**1.32**	**1.06, 1.64**	1,129	.499	0.92	0.79, 1.07	**1.29**	**1.04, 1.61**
Income by gastroenterologist supply by country on localized disease at diagnosis										
Two highest income quintiles										
Less than 2.0	909	.224	1.00	…	43	.399	1.00	…	**0.56**	**0.36, 0.87**
2.0 or more	75	.299	**1.33**	**0.95, 1.86**[b]	838	.344	0.86	0.56, 1.32	0.87	0.64, 1.18
Three lowest income quintiles										
Less than 2.0	1,410	.251	1.00	…	190	.379	1.00	…	0.66	0.53, 0.82
2.0 or more	67	.418	**1.67**	**1.20, 2.32**	1,129	.323	0.85	0.69, 1.05	**1.29**	**0.95, 1.75**[c]

n number of incident colon cancer cases, *RR* standardized rate ratio, *CI* confidence interval. All rates were directly age-adjusted using this study's combined Ontario-California population of cases as the standard (age strata: 25–59, 60–69, 70–79, 80 or older). RR and CI values in *bold* are statistically significant ($p < 0.05$) or approached statistical significance ($p < 0.10$)

*A survival rate ratio of 1.00 is the within-country baseline

[a]Confidence intervals are based on the Mantel–Haenszel χ^2 test

[b]90% confidence interval (1.00, 1.76)

[c]90% confidence interval (1.00, 1.66)