ABSTRACT Word Count: 247

Background: The first year after cancer diagnosis is a period of intensive treatment and high cost. We estimate costs for the 21 most common cancers in Ontario in the year before and the first year after diagnosis.

Methods: We selected patients diagnosed between 1997 and 2007 at ≥19 years of age, with valid ICD-O and histology codes, who survived >30 days after diagnosis, and had no second cancer within 90 days of the initial cancer, from the Ontario Cancer Registry (N= 402,399). We used linked administrative data to calculate mean costs for each cancer during the pre- and post-diagnosis periods for short-term and long-term survivors (lived <1 year and >=1 year after diagnosis, respectively).

Results: Pre-diagnosis costs were approximately $6,604 for all cancer patients ranging from $2,000 for testicular cancer to $10,000 for liver cancer for long-term survivors and from approximately $6,000 for brain cancer to $11,000 for female breast cancer for short-term survivors. Average post-diagnosis costs for our cohort were about $33,294; costs were lowest for thyroid cancer (under $15,000) and highest for esophageal cancer (over $50,000) for long-term survivors and ranged from $28,000 for liver cancer to $80,000 for testicular cancer for short-term survivors.

Interpretation: Our research provides cancer-related cost estimates for the pre- and post-diagnosis phases and offers insight into the economic burden incurred by the Ontario health care system. These estimates can help inform policy makers' decisions regarding resource allocation for cancer prevention and control and serve as important input for economic evaluations.

BACKGROUND

Cancer is the leading cause of premature mortality, the second leading cause of death overall and the fourth leading cause of hospitalization[1] in Canada. The number of new cancer cases diagnosed annually in Ontario doubled from 30,337 in 1982 to 61,178 in 2006 (1), undoubtedly accompanied by an increase in the costs of cancer care. The most recent estimate of the total cost of cancer care in Canada is $14.2 billion in 1998. Cancer care constitutes a large percentage of illness costs in Canada; it is the third most costly disease category, after cardiovascular and musculoskeletal diseases (2).

The first year after cancer diagnosis is a period of particularly high costs and intensive treatment (3, 4). Studies in the United States (US) have found that first year costs are highest for brain, pancreatic, esophageal, and gastric cancers, and lowest for melanoma of the skin, breast and prostate cancer (3). No comprehensive studies of pre- and post- diagnosis costs in Canada have been published. Also, few studies in any country have examined the costs of cancer treatment for patients under the age of 65 (5, 6).

Our objective was to estimate the pre- and post-diagnosis costs for patients diagnosed with the 21 most common cancers in Ontario between 1997 and 2007, and to understand the pattern of resource utilization. We used a large population-based sample of adult patients and rich administrative health care data. Our cost estimates will be of use for future economic evaluations, and for planning future health care budgets and setting priorities for resource allocation in cancer prevention and control.

[1] http://www.phac-aspc.gc.ca/publicat/lcd-pcd97/index-eng.php

METHODS

We conducted a descriptive costing study evaluating all direct medical costs from the perspective of the payer, the Ontario Ministry of Health and Long-term Care. All costs were adjusted to 2009 Canadian dollars (10). Study approval was obtained from the Research Ethics Board at the University of Toronto.

Patients were identified from the Ontario Cancer Registry (OCR), the population-based cancer registry for Canada's largest province (7). We included patients who were 19 years of age or older at time of diagnosis and whose first diagnosis for a primary cancer occurred between January 1st 1997 and December 31st 2007. In addition, we selected patients who were assigned a single, valid International Classification of Diseases-Oncology topography code corresponding to a primary cancer diagnosis with no second cancer diagnosed within 90 days after the initial cancer diagnosis, and who survived more than 30 days after the initial diagnosis. We excluded all patients who had a cancer diagnosis recorded in the Ontario Health Insurance Plan (OHIP) database 180 days or more before the OCR diagnosis date.

We classified patients into one of the 21 most common cancer sites: brain, female breast, cervix, colorectal, corpus uteri, esophagus, gastric, head and neck, leukemia, liver, lung, lymphoma, melanoma, multiple myeloma, ovary, pancreas, prostate, renal, testis, thyroid and urinary bladder. A 22nd category consisted of all other tumour sites combined (see Appendix 1 for further details). When selecting our cohort, we identified some usual and/or incorrect histology codes

for some cancer sites. As a result, we selected the 20 most frequent histology codes for each cancer type. These codes were then reviewed by two practicing oncologists (K.C. and W.C.) to ensure that our cohort was representative of current clinical practice (see Appendix 1 for included histology codes by cancer site).

We used a phase-based approach (3, 8, 9) to examine the costs of care incurred before and after diagnosis. We divided each patient's observation time into two time periods based on date of diagnosis. The pre-diagnosis phase was defined as the 12 months before diagnosis. This phase is typically characterized by diagnostic testing to establish the cancer diagnosis. The second phase, the initial phase of care, was defined as the date of diagnosis and the subsequent 12 months. This is when patients receive primary treatment, and adjuvant/neoadjuvant therapy, if required. Unfortunately, we do not have information on stage distribution at diagnosis for our cohort. Studies in the US have found that, within phase of care, net costs of care vary with stage at diagnosis, with costs generally higher for patients diagnosed with distant disease than for patients diagnosed with localized disease (3). Furthermore, most patients diagnosed at advanced stages generally live for a short period of time after diagnosis (3) We therefore stratified patients according to survival into short-term survivors (lived < 1 year after diagnosis) and long-term survivors (lived >=1 year after diagnosis).

All administrative databases were accessed through the Institute for Clinical Evaluative Sciences in Toronto, Ontario. Individual patient data were linked using Ontario Health Insurance Plan number and de-identified. We determined the utilization and costs of all resources used by patients (See Appendix 2 for details.)

We also calculated mean costs of care for the four major cancers (prostate, female breast, lung and colorectal) by local health integration network (LHIN). Finally, we applied our overall (unstratified) post-diagnosis cost estimates to the number of patients diagnosed with cancer in 2009 in Ontario to provide an estimate of the total economic burden incurred by the Ontario health care system during the first year of treatment.

RESULTS

The final cohort consisted of 402,399 patients, with a mean age of 64 years at diagnosis. Approximately 17.6% (N=70,809) were short-term survivors and 82.4% (N=331,590) were long-term survivors. Table 1 provides the characteristics of our cohort. The most common sites were prostate, female breast, colorectal and lung.

The mean overall pre-diagnosis cost for our cohort was approximately $6,604 while the mean overall post-diagnosis cost in the year after treatment was $33,294. Pre-diagnosis costs for long-term survivors ranged from $1,922 for testicular cancer to $10,218 for liver cancer (Figure 1, Appendix 3 Table 1A) ; for short term survivors, costs ranged from $5,995 for brain cancer to $11,337 for breast cancer (Figure 2, Appendix 3 Table 2B). Among both groups of patients, the pre-diagnosis costs were mainly due to hospitalization and diagnostic tests, which accounted for approximately 50% of total costs (Appendix 3). Pre-diagnosis costs were approximately 20% of first-year post-diagnosis costs. In general, pre-diagnosis costs were higher for short-term survivors.

First-year post-diagnosis costs for long-term survivors were highest for esophageal cancer ($54,445) (Figure 1, Appendix 3 Table 2A). Other cancers with high first-year mean costs included multiple myeloma ($50,908), brain ($46,428), and pancreatic ($43,518) cancers (Figure 1). Overall, the resource categories that contributed the most to these cancers were inpatient hospitalization (35%), chemotherapy (12%) and same-day surgery (9%). Thyroid, testis, melanoma, and prostate cancers exhibited the lowest mean first-year direct costs (from $11,727 for thyroid to $15,646 for prostate). Among short-term survivors, the most expensive cancers in the post-diagnosis phase were testicular cancer ($81,506) and leukemia ($62,482), while liver cancer ($28,209) was the least expensive (Figure 2, Appendix 3 Table 2B). The costliest resource during the post-diagnosis period for both groups of survivors was inpatient hospitalization (35% of total costs for long-term survivors and 62% for short-term survivors). The variation in costs was much greater for long-term survivors (factor of 5) than for short-term survivors (factor of about 3); lower variation among short-term survivors may be explained by the fact that most costs were associated with supportive care in hospitalized patients rather than curative surgical, radio- or chemotherapy.

When comparing geographic variation in costs across local health integration networks, the variation in the mean first-year costs of care for prostate cancer was smaller than that observed in other cancer sites (Figure 3) (from < $15,000 to $15,000-$19,999). We found greater cost variations between LHINs for breast, lung and colorectal cancers (Figure 3). In general, the larger and more northern LHINs (LHIN 14 - North West, LHIN 11 – Champlain, and, to a lesser extent, LHIN 13 - North East) had, on average, the highest first year costs, while the smaller

LHINs (LHIN 3 - Waterloo Wellington, except lung cancer, and LHIN 6 - Mississauga Halton) had the lowest ones.

We also applied our overall post-diagnosis cost estimates to individuals diagnosed with cancer in 2009 to obtain an estimate of the total economic burden incurred by the Ontario health care system during the first year of treatment (Table 2). We found that colorectal, prostate, lung and breast cancers presented the largest financial burden for this period.

DISCUSSION

In our study, costs varied considerably between cancers. In the pre-diagnosis period, cancers such as liver and pancreatic cancer, and multiple myeloma, which can present late, and are often diagnosed during a hospitalization (12, 13, 14), are associated with higher costs. In the post-diagnosis period, cancers with low 5-year relative survival (15), such as esophageal and pancreatic cancers, and multiple myeloma, reported the highest costs of care for long-term survivors. High costs were mainly due to hospitalizations (particularly cancer-related surgery and stem-cell transplantation for multiple myeloma (14, 16)), chemotherapy and outpatient prescription drugs. On the other hand, cancers with 5-year relative survival rates over 90% (11), such as melanoma, thyroid and testicular cancers, presented the lowest costs of care. This was not the case for short-term survivors where cancers affecting mostly younger patients, such as testicular cancer and leukemia, and commonly treated more aggressively than other cancers (17), presented high first-year costs.

Our findings are generally concordant with research from the US (3, 18), which found that first-year net costs for patients aged 65 years and older were highest for brain and other nervous system cancers ($65,409 for men and $69,908 for women, 2004 USD), followed by pancreatic and esophageal cancers, and lowest for melanoma of the skin.

We also examined costs for the top four cancers by LHIN and found that patients living in northern and larger LHINs had the highest costs. The explanation for variation in unadjusted costs is, at present, unclear. One potential explanation may be that patients in geographically remote regions may be diagnosed with cancer at later stages, thus requiring more aggressive and expensive treatment. In this first study, our aim was to simply describe health costs, and facilitate hypothesis generation for future studies; exploring causal relationships requires additional analysis.

Our results provide some insight into the economic burden incurred by the Ontario health care system before diagnosis and during the first year of care. Applying the post-diagnosis cost estimates for long-term survivors to individuals diagnosed with cancer in 2009 provides a rough approximation of total economic burden incurred by the health care system during the first year of treatment. Our calculations suggest that the cancers with the largest financial burden during the first year post-diagnosis are colorectal, prostate, lung and breast cancers; this is due to underlying incidence, survival, and the magnitude of first-year cost estimates. If we extend these results to the Canadian population (assuming first-year costs are the same across all provinces/territories), we find that costs for the first year after diagnosis alone rise to $538 million, $479 million, $410 million and $390 million for colorectal, lung, prostate and breast

cancers, respectively. In 2009, Canada's gross domestic product (GDP) was about $1.5 trillion[2]; if our estimates are correct, first-year costs for these four cancers combined would have represented about 0.12% of Canada's GDP in that year.

These estimates can also help inform future research funding priorities. In 2008, breast cancer, leukemia and prostate cancer received the greatest share of site-specific research investment in Canada in 2008 ($62.4 million, $24.3 million and $21.2 million, respectively) while lung and colorectal cancers were only allocated $14.7 million and $14.2 million, respectively (19). Our analysis suggests that the latter present the highest economic burden (for the first year post-diagnosis in Ontario), yet they are provided with relatively lower levels of research investment (19). Thus, current research investment for these cancer sites is not commensurate with the burden of disease.

Fundamentally, our analysis is descriptive. As with the epidemiology of disease, description is required to obtain a better understanding of a given disease and for hypothesis generation. Little high quality descriptive work has been published regarding cancer costs in Canada. This type of analysis is the first step toward understanding a major aspect of the burden of cancer and will be useful for cost-effectiveness analysis and burden of illness studies. These data will also be highly useful for administrators and health services researchers who fund, plan, provide, and evaluate cancer services provided to Canadians.

[2] Statistics Canada. Table 384-0002 - Gross domestic product (GDP), expenditure-based, provincial economic accounts, annual (dollars), CANSIM (database). http://www5.statcan.gc.ca/cansim/a26?lang=eng&retrLang=eng&id=3840002&paSer=&pattern=&stByVal=2&p1=-1&p2=37&tabMode=dataTable&csid=

Strengths

Our study made use of rich administrative data and included a large population-based sample of all adults in the province of Ontario. Previous work has shown that cancer costs vary substantially by age (20) as younger patients may receive more aggressive therapy (17). Most studies that examine cancer costs are limited to patients 65 years and older; however, a significant number of cancer patients are between the ages of 50 and 64 (about 30% in Ontario) (1), and about 35% of our cohort. We provide cost estimates for cancers that have not been reported previously (3), such as multiple myeloma, and for cancers that are typically more common among younger adults, such as thyroid and testicular cancers.

Our costing methods were very detailed as we considered all resources paid for by the Ontario Ministry of Health under a comprehensive universal health care insurance plan; this has been done in the past for only a few, individual cancers (5). Furthermore, our study is the one of the few to use Ontario administrative data to cost cancer care and the only one, to our knowledge, to estimate pre-diagnosis and first-year post-diagnosis costs for all major cancers.

Limitations

One potential limitation to our work is that we did not examine costs among children and adolescents; there is currently a lack of costs estimates for this group. Also, we were not able to present cost estimates by cancer stage as this information was not available from the OCR for the period of our study. Our analysis provides cost estimates for the 12 month pre-diagnosis and post-diagnosis periods only; future work includes the estimation of costs across all phases of care (initial, continuing and terminal phases of care). In our current estimates we did not consider date

of death, and thus we are likely including some costs associated with terminal/palliative care, even for the long-term survivors. Finally, we provide cost estimates that included all health care costs used to treat cancer patients, not net costs of care (i.e., the difference in costs between cancer patients and control subjects); the latter are to be estimated in future work using a matched case-control costing methodology (9; 17; 21).

Conclusions

In order to improve the quality and efficiency of care delivered to cancer patients, it is important for health care providers to have a good understanding of the resources and costs associated with diagnosis and treatment. Our research provides cancer-specific cost estimates for the pre- and post-diagnosis phases; these can help inform policy makers' decisions regarding resource allocation for cancer prevention and control and serve as an important input for economic evaluations. In particular, our findings have been useful in flagging additional areas of interest, such as potential geographic disparities in the cost of cancer care.

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Table 1 – Characteristics of cancer patients

Characteristic	N (%)
Overall sample	402,399 (100)
Type of Cancer	
Prostate	68,940 (17.1)
Female breast	68,709 (17.1)
Colorectal	58,659 (14.6)
Lung	42,046 (10.4)
Melanoma	17,059 (4.2)
Bladder	12,580 (3.1)
Head and neck	12,462 (3.1)
Corpus uteri	12,352 (3.1)
Thyroid	11,448 (2.8)
Lymphoma	10,467 (2.6)
Renal	10,204 (2.5)
Gastric	8,107 (2.0)
Leukemia	8,052 (2.0)
Ovary	7,167 (1.8)
Pancreas	6,358 (1.6)
Brain	5,462 (1.4)
Cervix	4,819 (1.2)
Esophagus	4,349 (1.1)
Myeloma	4,315 (1.1)
Testis	3,054 (0.8)
Liver	2,640 (0.7)
Other tumours	23,150 (5.8)
Age in years at diagnosis	
Mean (SD)	63.5 (13.95)
Median (IQR)	65 (54-74)
Sex	
Female	196,017 (48.7)
Male	206,382 (51.3)
Neighbourhood income quintile	
Missing	1,683 (0.4)
1 – Low	75,662 (18.8)
2 – Medium-low	81,882 (20.3)
3 – Medium	79,363 (19.7)
4 – Medium-High	79,577 (19.8)
5 - High	84,232 (20.9)
Rural residence	59,648 (14.8)
Residence in long-term care facility	3,871 (1)

SD – standard deviation
IQR – interquartile range

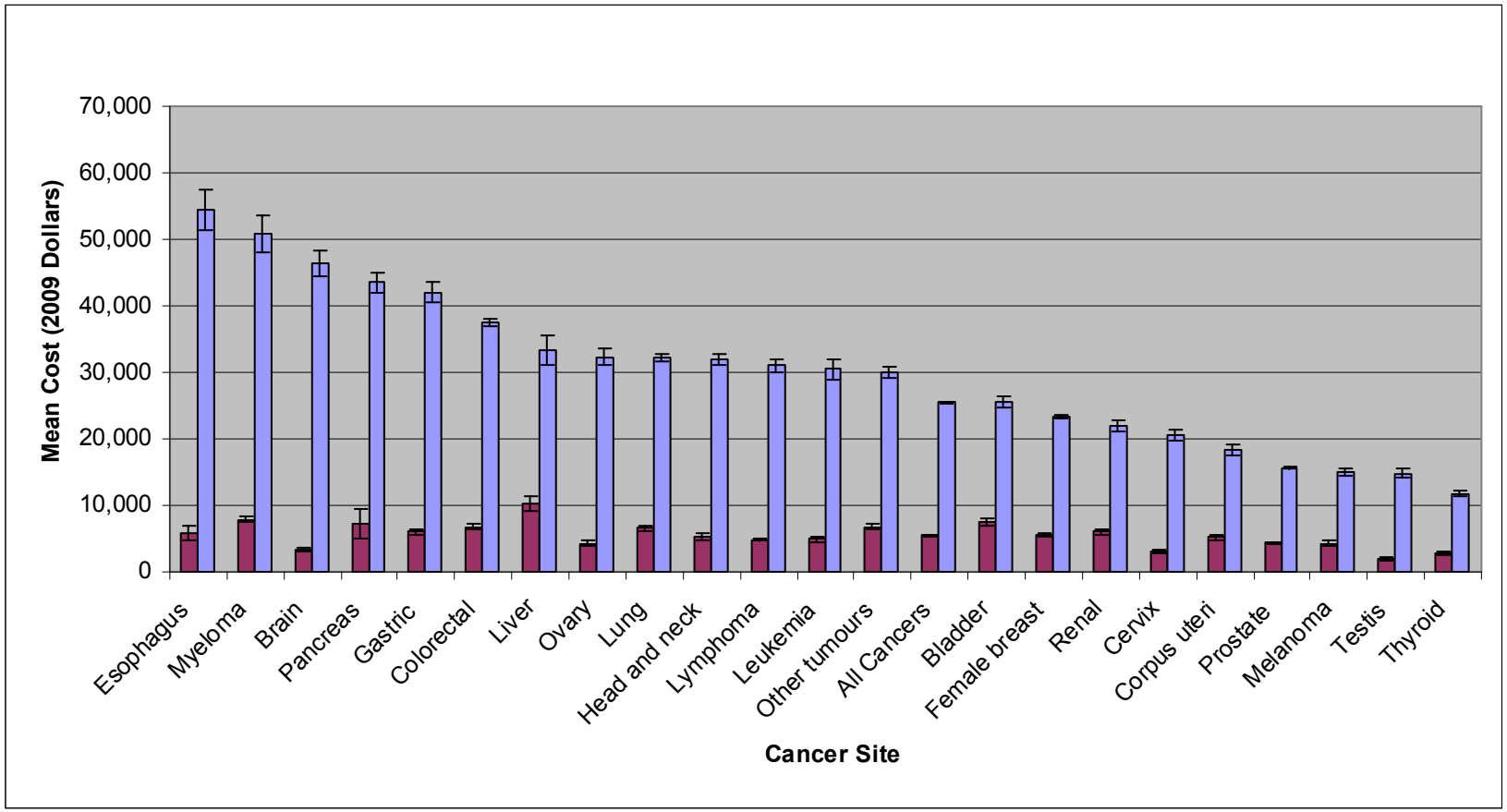
Table 2 – Total first-year cost estimates for selected cancers by sex for Ontario (in 2009 Canadian dollars)

	Number of Newly Diagnosed Cases (2009)	Mean Cost per Case (2009)	Total Cost (2009)
Prostate	7,235	$25,054	$181,265,690
Breast	5,217	$30,180	$157,449,060
Colorectal	5,010	$41,170	$206,261,700
Lung	4,867	$33,435	$162,728,145
Non-Hodgkin Lymphoma	1,838	$43,646*	$80,221,348
Melanoma	1,490	$25,937	$38,646,130
Pancreas	746	$39,671	$29,594,566
Brain	695	$50,737	$35,262,215

* Mean cost estimate is for lymphoma (Hodgkin and non-Hodgkin)

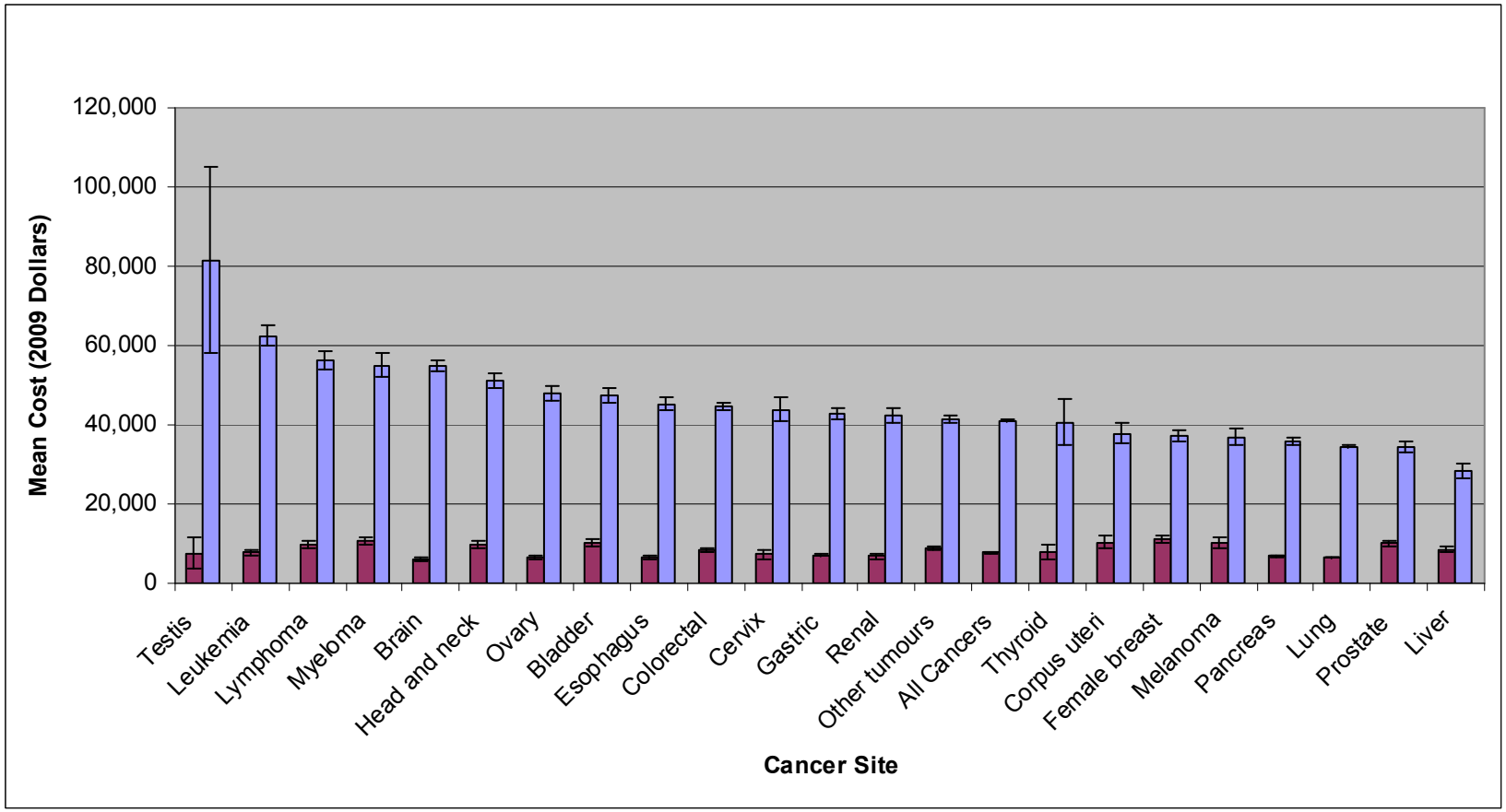
Data Sources: Age-standardized incidence rates are from the Canadian Cancer Society (Canadian Cancer Statistics 2009); number of cases is based on population estimates from Statistics Canada (Catalogue no. 91-520-X).

Figure 1 – Mean direct cost of cancer care for the first year before and after diagnosis by cancer site (long-term survivors)*



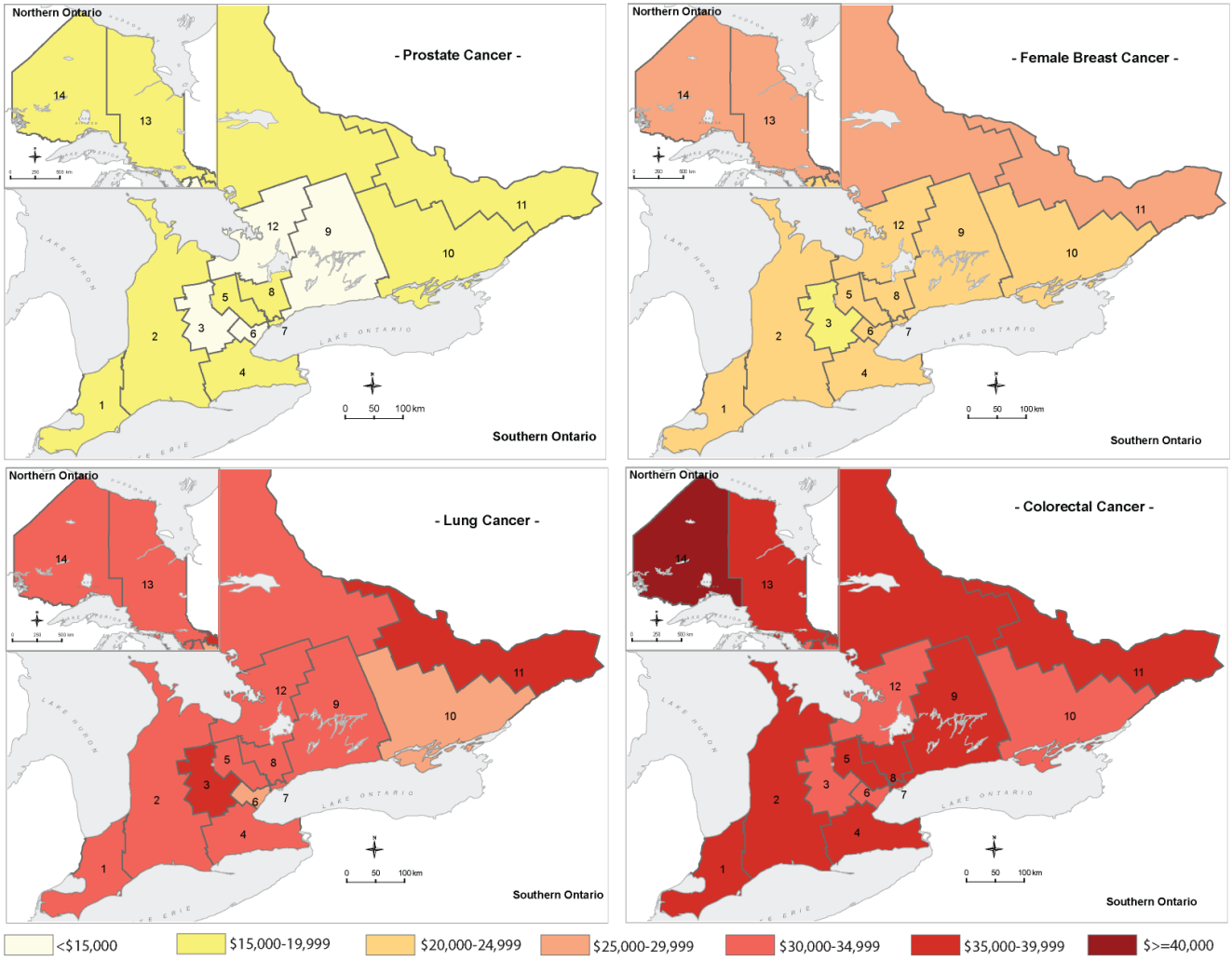
*The pre-diagnosis phase of care is the last 12 months before diagnosis (in maroon). The initial phase of care is the first 12 months following diagnosis (in purple). Error bars are 95% confidence intervals. All estimates are in 2009 Canadian dollars. See Tables in Appendix 3 for more details.

Figure 2 – Mean direct cost of cancer care for the first year before and after diagnosis by cancer site (short-term survivors)*



*The pre-diagnosis phase of care is the last 12 months before diagnosis (in maroon). The initial phase of care is the first 12 months following diagnosis (in purple). Error bars are 95% confidence intervals. All estimates are in 2009 Canadian dollars. See Tables in Appendix 3 for more detail.

Figure 3 – Mean cost estimates for prostate, female breast, lung and colorectal cancers by LHIN



Appendix 1 – Codes for cancer and histology

Cancer	ICD-O Code(s)	Included Histologies
Head and neck	C00.* – C06.*, C09.* – C14.* C30.* – C32.*	8004, 8010, 8011, 8020, 8041, 8042, 8051, 8070–8073, 8082, 8083, 8090, 8200, 8211, 8246, 8260, 8263, 8430
Esophagus	C15.*	8000, 8010, 8012, 8020, 8041, 8046, 8070–8072, 8076, 8083, 8123, 8140, 8144, 8145, 8260, 8480, 8481, 8490, 8560
Gastric	C16.*	8000, 8010, 8020, 8070, 8071, 8140, 8142, 8144, 8145, 8210, 8211, 8240, 8246, 8255, 8260, 8263, 8480, 8481, 8490, 8560
Colorectal	C18.0, C18.2 – C18.9 C19.9 C20.9 C21.8	8000, 8010, 8020, 8070, 8140, 8144, 8210, 8211, 8221, 8240, 8246, 8260, 8261, 8262, 8263, 8310, 8480, 8481, 8490, 8510
Liver	C22.0	8000, 8001, 8010, 8012, 8020, 8033, 8170–8172, 8174, 8175, 8180, 8440
Pancreas	C25.*	8000, 8001, 8010, 8012, 8020, 8041, 8046, 8140, 8150, 8240, 8246, 8260, 8440, 8470, 8480, 8481, 8490, 8500, 8550, 8560
Lung	C33.9 C34.*	8000, 8010, 8012, 8020, 8040, 8042, 8046, 8070–8072, 8140, 8240, 8246, 8250, 8255, 8260, 8480, 8481, 8550, 8560
Melanoma	C44.*	8720 – 8790 (with or without ICD-10 code C44.*)
Female breast	C50.* (female)	8000, 8010, 8050, 8140, 8211, 8480, 8500, 8501, 8503, 8504, 8510, 8520–8524, 8530, 8541, 8543, 8575
Corpus uteri	C54.*	8000, 8010, 8020, 8050, 8070, 8072, 8140, 8210, 8260, 8263, 8310, 8323, 8380, 8441, 8460, 8461, 8480, 8481, 8560, 8570
Cervix	C53.*	8010, 8041, 8052, 8070–8072, 8076, 8100, 8140, 8246, 8260, 8263, 8310, 8380, 8384, 8460, 8480, 8481, 8560, 8570
Ovary	C56.9	8000, 8010, 8020, 8070, 8140, 8260, 8310, 8323, 8380, 8441, 8442, 8460–8462, 8470, 8472, 8480, 8620, 9060, 9080
Prostate	C61.9	8000, 8010, 8041, 8046, 8070, 8130, 8140, 8145, 8201, 8255, 8260, 8310, 8340, 8341, 8380, 8480, 8481, 8490, 8500, 8550
Bladder	C67.*	8000, 8001, 8010, 8020, 8033, 8041, 8050, 8070, 8071, 8120, 8122, 8130, 8191, 8140, 8246, 8260, 8310, 8480, 8481, 8490

Appendix 1 – Codes for cancer and histology *(continued)*

Cancer	ICD-O Code(s)	Included Histologies
Renal	C64.9 C65.9	8000, 8010, 8012, 8050, 8070, 8120, 8130, 8140, 8255, 8260, 8270, 8290, 8310, 8312, 8316–8320, 8323
Brain	C71.*	8000, 8140, 9380, 9382, 9391, 9392, 9400, 9401, 9411, 9420, 9421, 9424, 9430, 9440–9442, 9450, 9451, 9470, 9573
Lymphoma	C77.*	9650–9667, 9590–9596, 9670, 9671, 9673, 9675, 9678–9680, 9684, 9687, 9689–9691, 9695, 9698–9702, 9705, 9708, 9709, 9714–9719, 9727–9729, 9823, 9827–9829
Multiple myeloma	-	9731, 9732, 9734
Leukemia	C42.*	9733, 9742, 9800, 9801, 9805, 9820, 9823, 9826, 9827, 9831–9834, 9835–9837, 9840, 9860, 9861, 9863, 9866, 9867, 9870–9876, 9891, 9895, 9897, 9910, 9920, 9930, 9931, 9940, 9945, 9946, 9948, 9963, 9964
Thyroid	C73.9	8000, 8010, 8021, 8050, 8070, 8071, 8140, 8260, 8290, 8330, 8331, 8335, 8337, 8340–8344, 8350, 8510
Testis	C62.*	8000, 8001, 8010, 8140, 8650, 8940, 9061, 9062–9065, 9070, 9071, 9080, 9081, 9083, 9085, 9100, 9101, 9364
Other tumour sites	C07.* – C08.* C17.* C18.1 C22.1 C24.* C26.0, C26.8 – C26.9 C37.9 C38.* - C41.* C42.2, C42.3 C47.* - C49.* C50.* (male) C51.* C52.9 C57.* C58.9 C60.* C63.* C68.* – C70.* C72.* C74.* – C75.* C80.9	EXCLUDED: 9590 – 9989 Leukemia, lymphoma and multiple myeloma

Legend: ICD-O – International Classification of Disease-Oncology

Appendix 2– Costing Methodology

The number of chemotherapy visits was obtained from the National Ambulatory Care Reporting System (NACRS) from 2003 onwards and from physicians' billings for chemotherapy injections in the Claims History Database of the Ontario Health Insurance Plan (OHIP) before 2003. The cost of chemotherapy visits (including the cost of the drugs administered) was estimated from the NACRS using the Resource Intensity Weight (RIW) method (1-3). The RIWs are index number values calculated by the Canadian Institute for Health Information (CIHI) (http://www.cihi.ca); they are estimated annually and represent the relative cost of patient types. We multiplied the RIW associated with each chemotherapy visit by the average provincial cost per weighted case to obtain the total cost. The average cost per visit in 2003 was then used to estimate the costs of all visits identified in the OHIP data for the pre-2003 period. In addition, we obtained the dosage and cost of chemotherapy drugs paid under the New Drug Funding Program (NDFP) from data obtained from Cancer Care Ontario. This program funds new and approved intravenous cancer drugs administered in hospitals and cancer centres.

We obtained data on radiation therapy from the Activity Level Reporting data[3] from Cancer Care Ontario (http://cancercare.on.ca). We used the National Hospital Productivity Improvement Project (NHPIP) code assigned to each fraction of radiation therapy to cost radiation therapy. We obtained the cost per NHPIP unit ($8.03 in 1995/96) from published Ontario data (4). This value includes salaries and benefits for secretaries, nurses, physicists, therapists; the cost of equipment (machines and cobalt source); the cost of supplies (medical/surgical, administration, physics, radiotherapy, planning CTs) and services (linens, lab, transcription, health information services, nutrition, clinics, department costs, offset revenues).

We obtained the number of diagnostic tests and their respective cost from the OHIP data. We divided the cost into technical and professional components. The technical component was included in the cost of diagnostic tests while the professional component was included in the cost incurred with physician services.

Individuals aged 65 years and older, long-term care residents, individuals receiving home care and other selected groups are eligible for prescription drug coverage under the Ontario Drug Benefit (ODB) Plan (http://www.health.gov.on.ca/english/public/program/drugs/drugs_mn.html). We estimated the quantity and cost of outpatient prescription drugs for patients 65 years of age and older from the ODB Plan records.

We used the Discharge Abstract Database (DAD), which contains demographic, administrative and clinical data on acute care institution separations (discharges, deaths,

[3] This includes all activity occurring at the former Regional Cancer Centres in Ontario. Princess Margaret Hospital data to be introduced during fiscal year 2005/06 (Ontario Health Planning Data Guide – Release 3.0, 2006).

sign-outs, transfers) across Canada, to determine the frequency and type of inpatient hospitalizations. Costs were estimated using the RIW method (1-3).

The NACRS contains administrative, clinical, financial, and demographic data for hospital-based ambulatory care, including same day surgery (SDS), emergency department (ED) visits, medical day/night care, and high-cost ambulatory clinics, and is available from 2002/03 onwards. For the pre-NACRS period, the number of SDS was determined from the DAD while the number of ED visits was estimated from the OHIP claims history database. The RIW methodology was employed to determine the costs for SDS visits identified before 2002 (1-3). For ED visits prior to 2002 we applied the average 2002 cost.

Various funded services are available to individuals requiring care at home in Ontario (http://www.health.gov.on.ca/english/public/program/ltc/8_home_comm_mn.html), including professionals (e.g. nurses, physiotherapists), and personal, homemaking and community support. We estimated the frequency, length of stay and type of home care service from the Ontario Home Care Administrative System (pre-April 2005) and the Home Care Database (post-April 2005). Unit costs were obtained from the Community Care Access Centres, Toronto (5).

Complex continuing care (CCC) includes medical long-term care, geriatric assessment and rehabilitation, psychogeriatric care, palliative care, and respite care. The frequency and length of stay in a CCC facility were obtained from the Continuing Care Reporting System data. We estimated the cost of each stay by multiplying the length of stay in days by the average case mix index (a diagnosis-related group weight) per patient-stay and the cost per weighted day for chronic care (5).

We estimated the time spent in long-term care (LTC) facilities using the LTC flag in the Ontario Drug Benefit Plan database. We dated the onset of LTC from the first of three consecutive LTC-flagged drug claims and dated the cessation of LTC from the first of three consecutive non-LTC flagged drug claims to obtain the length of stay. The costs associated with nursing, food and programming for LTC residents are covered by the Ministry of Health and Long-term Care (http://www.health.gov.on.ca/) (5).

Finally, the number of all physician services and respective payments were estimated from the claims history database of the OHIP.

We used the health care component of the Statistics Canada Consumer Price Index for Ontario to adjust for inflation and reported all costs in 2009 Canadian dollars.

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Appendix 3 – Supplementary Tables

Table 1. A – Mean (95% confidence interval) direct healthcare costs by tumour site and resource for pre-diagnosis phase for cancer patients that live beyond the first year post-diagnosis (long-term survivors) in 2009 Canadian dollars

		Hospital-based Care			Tertiary Care			Other		
Type of Cancer	**Total Cost**	**Inpatient Hospitalization**	**Same-day Surgery**	**ED Visits**	**Home Care**	**Continuing Care**	**Long-term Care**	**Diagnostic Tests**	**Physician Services**	**Outpatient Drugs**
Liver	10,218 (9,157; 11,279)	3,190 (2,528; 3,852)	1,039 (752; 1,327)	251 (205; 297)	372 (251; 494)	205 (-178; 587)	268 (21; 515)	3,811 (3,591; 4,032)	149 (104; 194)	933 (808; 1,058)
Myeloma	7,916 (7,447; 8,384)	1,687 (1,485; 1,890)	466 (349; 584)	187 (172; 202)	302 (243; 361)	109 (30; 188)	576 (259; 892)	3,720 (3,583; 3,856)	103 (83; 123)	766 (716; 817)
Bladder	7,438 (6,870; 8,007)	1,257 (1,170; 1,345)	893 (777; 1,010)	106 (100; 113)	317 (278; 355)	493 (130; 856)	1,444 (1,149; 1,739)	1,948 (1,904; 1,991)	108 (100; 116)	873 (847; 899)
Pancreas	7,140 (4,885; 9,394)	1,557 (1,338; 1,776)	1,847 (-368; 4,062)	197 (176; 219)	100 (67; 133)	52 (-14; 119)	132 (-34; 297)	2,545 (2,431; 2,659)	79 (62; 96)	631 (569; 694)
Colorectal	6,804 (6,479; 7,130)	1,186 (1,140; 1,231)	585 (543; 628)	115 (112; 118)	281 (266; 297)	674 (449; 899)	1,343 (1,192; 1,494)	1,825 (1,805; 1,845)	82 (78; 87)	713 (701; 725)
Other tumours	6,741 (6,327; 7,156)	1,497 (1,412; 1,581)	829 (736; 921)	136 (127; 145)	298 (268; 327)	320 (59; 581)	994 (779; 1,210)	1,919 (1,880; 1,958)	96 (89; 103)	653 (633; 674)
Lung	6,585 (6,236; 6,935)	1,401 (1,310; 1,492)	763 (689; 836)	127 (122; 133)	279 (254; 305)	289 (34; 544)	408 (299; 518)	2,331 (2,295; 2,368)	99 (93; 106)	887 (865; 909)
Gastric	5,988 (5,531; 6,446)	1,327 (1,161; 1,493)	596 (474; 717)	122 (111; 132)	274 (219; 329)	159 (-78; 397)	486 (254; 718)	2,134 (2,060; 2,209)	91 (77; 106)	798 (755; 841)
Renal	5,986 (5,609; 6,362)	1,210 (1,111; 1,308)	650 (549; 752)	149 (141; 158)	197 (168; 226)	115 (-52; 282)	382 (129; 635)	2,498 (2,435; 2,561)	103 (94; 113)	681 (652; 711)
Esophagus	5,925 (4,833; 7,018)	1,288 (1,058; 1,517)	755 (513; 996)	95 (81; 109)	209 (136; 281)	656 (-234; 1,546)	387 (70; 704)	1,639 (1,542; 1,735)	115 (85; 145)	782 (720; 844)
Female breast	5,461 (5,184; 5,739)	499 (474; 524)	388 (358; 418)	43 (42; 45)	234 (221; 246)	515 (327; 704)	1,642 (1,494; 1,790)	1,611 (1,595; 1,627)	46 (44; 48)	482 (473; 490)
Head and neck	5,295 (4,772; 5,818)	844 (734; 954)	671 (549; 794)	73 (68; 79)	220 (188; 251)	487 (147; 828)	981 (726; 1,237)	1,342 (1,301; 1,383)	71 (64; 78)	606 (580; 633)
Corpus uteri	5,145 (4,729; 5,561)	534 (472; 595)	450 (392; 507)	59 (55; 63)	254 (221; 288)	250 (36; 463)	1,106 (810; 1,402)	1,913 (1,873; 1,954)	61 (54; 67)	519 (499; 540)
Leukemia	4,963 (4,540; 5,386)	752 (664; 839)	447 (321; 573)	98 (89; 108)	184 (145; 222)	190 (4; 376)	632 (360; 904)	2,029 (1,970; 2,088)	53 (46; 61)	578 (539; 617)
Lymphoma	4,838 (4,602; 5,075)	975 (881; 1,070)	594 (492; 696)	127 (119; 135)	167 (140; 194)	26 (1; 51)	275 (139; 412)	2,116 (2,054; 2,177)	72 (62; 83)	485 (454; 517)
Prostate	4,352 (4,185; 4,519)	665 (638; 692)	502 (461; 542)	57 (55; 59)	123 (115; 132)	200 (92; 308)	528 (445; 611)	1,580 (1,565; 1,596)	63 (60; 65)	634 (625; 643)
Ovary	4,279 (3,926; 4,633)	648 (579; 718)	496 (281; 710)	109 (101; 117)	154 (120; 188)	26 (-6; 58)	293 (56; 530)	2,097 (2,033; 2,161)	49 (43; 55)	408 (383; 432)

Melanoma	4,239 (3,827; 4,652)	566 (518; 614)	507 (421; 593)	51 (47; 54)	177 (152; 202)	376 (101; 651)	929 (726; 1,133)	1,121 (1,091; 1,150)	54 (49; 58)	459 (441; 478)
Thyroid	3,866 (3,578; 4,154)	478 (431; 524)	296 (239; 353)	52 (48; 56)	59 (43; 74)	154 (-87; 395)	98 (-5; 200)	2,463 (2,411; 2,515)	64 (58; 70)	203 (187; 218)
Brain	3,420 (3,175; 3,666)	1,311 (1,165; 1,456)	249 (129; 370)	235 (216; 253)	60 (25; 94)	11 (-3; 25)	34 (-33; 101)	1,284 (1,211; 1,357)	55 (43; 68)	182 (155; 209)
Cervix	3,019 (2,695; 3,343)	446 (377; 515)	265 (215; 315)	67 (59; 75)	126 (90; 162)	43 (-20; 105)	362 (99; 625)	1,419 (1,360; 1,479)	49 (41; 56)	242 (214; 271)
Testis	1,922 (1,580; 2,263)	240 (175; 305)	211 (113; 310)	69 (61; 77)	29 (4; 55)	-	156 (-150; 462)	1,117 (1,061; 1,173)	17 (12; 22)	82 (57; 107)
All Cancers	5,451 (5,354; 5,547)	864 (849; 879)	542 (521; 563)	84 (83; 85)	210 (204; 215)	357 (293; 420)	930 (882; 979)	1,800 (1,792; 1,808)	69 (68; 71)	594 (590; 599)

Data sources: Ontario Cancer Registry, Cancer Care Ontario and administrative health data housed at the Institute for Clinical Evaluative Sciences (mean direct costs by phase of care).

Legend: ED – emergency department

Table 1. B – Mean (95% confidence interval) direct healthcare costs by tumour site and resource for pre-diagnosis phase for cancer patients that do **not** live beyond the first year post-diagnosis (short-term survivors) in 2009 Canadian dollars

		Hospital-based Care			Tertiary Care			Other		
Type of Cancer	**Total Cost**	**Inpatient Hospitalization**	**Same-day Surgery**	**ED Visits**	**Home Care**	**Continuing Care**	**Long-term Care**	**Diagnostic Tests**	**Physician Services**	**Outpatient Drugs**
Female breast	11,337 (10,405; 12,268)	1,672 (1,404; 1,941)	558 (308; 808)	138 (120; 156)	1,425 (1,237; 1,613)	901 (407; 1,394)	3,634 (3,115; 4,153)	1,7730 (1,670; 1,876)	71 (56; 87)	1,165 (1,091; 1,238)
Myeloma	10,683 (9,674; 11,691)	3,176 (2,659; 3,694)	756 (316; 1,197)	330 (287; 374)	807 (606; 1,008)	349 (63; 634)	609 (301; 916)	3,395 (3,145; 3,646)	142 (98; 185)	1,118 (1,021; 1,216)
Corpus uteri	10,447 (8,872; 12,022)	1,957 (1,375; 2,538)	505 (68; 942)	199 (157; 241)	1,509 (1,128; 1,890)	543 (-109; 1,195)	2,405 (1,611; 3,200)	2,100 (1,913; 2,287)	94 (62; 126)	1,135 (1,023; 1,247)
Melanoma	10,267 (8,875; 11,659)	2,437 (1,803; 3,071)	573 (265; 881)	152 (119; 185)	1,284 (967; 1,602)	353 (-213; 920)	2,515 (1,768; 3,262)	1,746 (1,574; 1,917)	108 (75; 140)	1,099 (973; 1,224)
Bladder	10,223 (9,462; 10,983)	2,612 (2,180; 3,045)	754 (522; 985)	205 (183; 226)	1,145 (985; 1,305)	373 (135; 611)	1,777 (1,420; 2,134)	1,982 (1,889; 2,074)	131 (108; 155)	1,244 (1,178; 1,309)
Prostate	10,084 (9,279; 10,888)	2,823 (2,476; 3,169)	768 (347; 1,189)	187 (164; 209)	1,074 (901; 1,246)	357 (121; 594)	1,411 (1,099; 1,724)	2,038 (1,930; 2,146)	141 (113; 169)	1,285 (1,220; 1,350)
Lymphoma	9,834 (8,885; 10,782)	3,034 (2,556; 3,513)	1,046 (507; 1,585)	277 (246; 308)	677 (549; 805)	162 (23; 301)	638 (397; 880)	2,712 (2,524; 2,900)	132 (95; 169)	1,155 (1,052; 1,257)
Head and neck	9,650 (8,788; 10,511)	2,459 (2,053; 2,866)	702 (475; 930)	178 (153; 202)	981 (815; 1,147)	614 (232; 997)	1,967 (1,594; 2,340)	1,577 (1,471; 1,683)	126 (99; 153)	1,045 (976; 1,115)
Other tumours	8,741 (8,348; 9,134)	2,336 (2,149; 2,523)	828 (689; 968)	238 (223; 253)	682 (606; 757)	277 (123; 432)	979 (821; 1,138)	2,324 (2,252; 2,395)	106 (95; 118)	970 (929; 1,011)
Liver	8,489 (7,809; 9,169)	2,315 (1,896; 2,735)	593 (460; 726)	270 (231; 309)	521 (366; 676)	47 (-20; 114)	79 (-11; 169)	3,549 (3,290; 3,808)	101 (73; 129)	1,014 (875; 1,153)
Colorectal	8,374 (8,036; 8,711)	2,111 (1,932; 2,289)	656 (541; 771)	176 (167; 186)	746 (683; 808)	301 (192; 410)	1,170 (1,027; 1,313)	2,098 (2,040; 2,155)	99 (90; 108)	1,017 (981; 1,053)
Thyroid	7,850 (6,030; 9,671)	2,027 (999; 3,056)	191 (110; 273)	187 (125; 249)	469 (141; 796)	35 (-34; 105)	1,367 (304; 2,430)	2,323 (1,942; 2,704)	173 (50; 295)	1,077 (857; 1,297)
Leukemia	7,679 (7,080; 8,279)	2,110 (1,816; 2,404)	665 (433; 896)	194 (171; 217)	588 (444; 733)	115 (5; 225)	520 (285; 754)	2,308 (2,169; 2,447)	106 (81; 131)	1,075 (941; 1,209)
Testis	7,634 (3,577; 11,691)	3,484 (260; 6,707)	106 (-16; 228)	282 (76; 489)	318 (-12; 648)	-	-	2,629 (941; 4,316)	31 (-11; 73)	784 (120; 1,449)
Cervix	7,232 (5,865; 8,599)	1,432 (915; 1,949)	405 (-2; 813)	163 (124; 203)	807 (504; 1,110)	307 (-119; 732)	1,425 (696; 2,154)	1,739 (1,538; 1,940)	43 (22; 64)	910 (694; 1,127)
Gastric	7,196 (6,811; 7,582)	1,681 (1,510; 1,852)	607 (456; 757)	183 (169; 198)	565 (482; 648)	185 (56; 315)	624 (471; 777)	2,256 (2,173; 2,339)	101 (87; 116)	993 (944; 1,041)
Pancreas	6,916 (6,630; 7,203)	1,592 (1,444; 1,739)	827 (681; 974)	232 (215; 249)	341 (285; 396)	27 (-14; 68)	225 (136; 314)	2,703 (2,617; 2,789)	81 (70; 91)	890 (847; 933)
Renal	6,843 (6,077; 7,609)	1,743 (1,352; 2,134)	624 (376; 872)	186 (166; 206)	381 (274; 488)	237 (-147; 622)	250 (94; 406)	2,432 (2,296; 2,567)	138 (68; 208)	852 (776; 928)

Lung	6,533 (6,360; 6,705)	1,630 (1,529; 1,730)	647 (559; 734)	182 (176; 188)	412 (384; 440)	119 (83; 155)	287 (241; 332)	2,173 (2,137; 2,209)	87 (81; 93)	997 (975; 1,019)
Ovary	6,442 (5,878; 7,007)	1,397 (1,141; 1,652)	640 (378; 903)	202 (176; 228)	575 (419; 731)	114 (-10; 237)	361 (155; 567)	2,197 (2,070; 2,325)	63 (46; 81)	892 (807; 977)
Esophagus	6,394 (5,883; 6,904)	1,541 (1,320; 1,762)	621 (416; 826)	145 (129; 161)	535 (425; 644)	141 (19; 264)	570 (386; 753)	1,816 (1,698; 1,934)	85 (70; 99)	941 (880; 1,002)
Brain	5,995 (5,547; 6,444)	2,333 (1,999; 2,668)	506 (332; 679)	233 (214; 251)	313 (242; 384)	108 (9; 208)	48 (7; 88)	1,715 (1,634; 1,797)	93 (74; 111)	647 (605; 689)
All Cancers	7,756 (7,645; 7,867)	1,957 (1,901; 2,014)	676 (631; 721)	195 (191; 199)	619 (598; 640)	224 (187; 260)	791 (748; 834)	2,194 (2,173; 2,215)	98 (94; 102)	1,001 (989; 1,014)

Data sources: Ontario Cancer Registry, Cancer Care Ontario and administrative health data housed at the Institute for Clinical Evaluative Sciences (mean direct costs by phase of care).

Legend: ED – emergency department

Table 2. A – Mean (95% confidence interval) direct healthcare costs by tumour site for initial phase cancer patients that live beyond the first year post-diagnosis (long-term survivors) in 2009 Canadian dollars

		Hospital-based Care			Tertiary Care			Other		
Type of Cancer	**Total Cost**	**Inpatient Hospitalization**	**Same-day Surgery**	**ED Visits**	**Home Care**	**Continuing Care**	**Long-term Care**	**Diagnostic Tests**	**Physician Services**	**Outpatient Drugs**
Esophagus	54,445 (51,459; 57,432)	27,506 (25,314; 29,698)	3,986 (3,508; 4,464)	410 (373; 447)	4,058 (3,806; 4,310)	2,099 (687; 3,511)	694 (338; 1,050)	2,542 (2,408; 2,676)	4,757 (4,567; 4,948)	2,268 (2,137; 2,399)
Myeloma	50,908 (48,094; 53,722)	19,844 (18,877; 20,810)	6,804 (5,304; 8,304)	476 (445; 506)	3,650 (3,448; 3,851)	4,125 (2,364; 5,887)	1,690 (1,209; 2,171)	4,295 (4,100; 4,490)	1,974 (1,881; 2,067)	4,204 (3,998; 4,410)
Brain	46,428 (44,549; 48,308)	19,282 (18,396; 20,168)	592 (136; 1,048)	490 (456; 525)	3,250 (2,981; 3,519)	4,615 (3,553; 5,678)	433 (234; 632)	2,076 (1,961; 2,190)	4,945 (4,784; 5,106)	5,046 (4,654; 5,439)
Pancreas	43,518 (41,915; 45,122)	19,820 (18,813; 20,827)	1,830 (1,472; 2,187)	471 (423; 518)	3,350 (3,088; 3,612)	1,011 (364; 1,659)	383 (161; 605)	2,690 (2,538; 2,841)	3,812 (3,671; 3,954)	2,147 (1,960; 2,335)
Gastric	42,033 (40,518; 43,548)	20,457 (19,589; 21,325)	2,433 (2,145; 2,721)	368 (339; 397)	2,986 (2,828; 3,144)	2,384 (1,536; 3,232)	948 (645; 1,252)	2,391 (2,304; 2,478)	3,620 (3,521; 3,719)	1,663 (1,581; 1,745)
Colorectal	37,601 (37,027; 38,175)	15,738 (15,566; 15,911)	2,470 (2,367; 2,572)	286 (279; 292)	2,679 (2,637; 2,720)	2,902 (2,497; 3,307)	1,798 (1,638; 1,957)	1,985 (1,961; 2,008)	3,040 (3,014; 3,066)	1,296 (1,275; 1,317)
Liver	33,350 (31,221; 35,480)	15,658 (14,218; 17,097)	1,082 (875; 1,288)	412 (353; 472)	1,642 (1,429; 1,856)	1,076 (522; 1,631)	492 (170; 815)	6,564 (6,015; 7,114)	3,754 (3,534; 3,975)	2,289 (2,050; 2,528)
Ovary	32,287 (31,083; 33,491)	12,665 (12,259; 13,070)	3,020 (2,529; 3,510)	267 (250; 285)	2,566 (2,432; 2,699)	1,458 (747; 2,169)	744 (460; 1,028)	2,210 (2,136; 2,283)	2,290 (2,234; 2,346)	1,265 (1,199; 1,331)
Lung	32,250 (31,744; 32,756)	12,833 (12,571; 13,095)	2,199 (2,090; 2,308)	331 (321; 342)	2,205 (2,133; 2,278)	1,470 (1,187; 1,753)	677 (552; 803)	2,792 (2,746; 2,839)	3,158 (3,114; 3,201)	1,896 (1,855; 1,938)
Head and neck	31,964 (31,060; 32,869)	11,055 (10,673; 11,437)	2,675 (2,465; 2,884)	210 (199; 221)	2,271 (2,182; 2,360)	1,361 (814; 1,907)	568 (388; 748)	1,352 (1,311; 1,393)	2,521 (2,459; 2,583)	1,517 (1,467; 1,568)
Lymphoma	31,092 (30,135; 32,049)	7,591 (7,201; 7,982)	4,882 (4,567; 5,198)	281 (267; 295)	1,677 (1,602; 1,751)	1,202 (638; 1,766)	651 (434; 868)	2,687 (2,618; 2,755)	3,456 (3,401; 3,511)	2,587 (2,469; 2,705)
Leukemia	30,480 (29,002; 31,958)	17,185 (16,343; 18,026)	2,477 (1,936; 3,018)	263 (246; 281)	1,038 (964; 1,113)	1,550 (798; 2,303)	816 (545; 1,086)	2,159 (2,089; 2,230)	999 (957; 1,041)	3,195 (2,984; 3,406)
Other tumours	29,928 (29,112; 30,743)	13,033 (12,687; 13,379)	2,213 (2,063; 2,363)	255 (244; 265)	2,097 (2,028; 2,165)	1,881 (1,361; 2,401)	1,045 (826; 1,265)	2,097 (2,050; 2,144)	2,774 (2,724; 2,823)	1,454 (1,373; 1,534)
Bladder	25,481 (24,625; 26,338)	9,233 (8,934; 9,532)	6,161 (5,863; 6,459)	220 (209; 232)	1,278 (1,211; 1,344)	1,469 (901; 2,036)	1,190 (917; 1,464)	1,883 (1,833; 1,932)	1,865 (1,822; 1,908)	1,184 (1,150; 1,217)
Female breast	23,274 (22,980; 23,568)	3,977 (3,909; 4,046)	2,435 (2,340; 2,530)	148 (145; 152)	1,810 (1,783; 1,836)	982 (786; 1,177)	741 (654; 828)	2,393 (2,373; 2,412)	2,000 (1,985; 2,015)	1,209 (1,191; 1,227)
Renal	21,856 (21,021; 22,691)	11,523 (11,195; 11,851)	799 (698; 900)	196 (186; 207)	882 (820; 944)	1,217 (696; 1,739)	810 (571; 1,049)	2,634 (2,562; 2,705)	2,464 (2,386; 2,543)	1,025 (973; 1,076)
Cervix	20,653 (19,855; 21,450)	6,761 (6,400; 7,121)	1,473 (1,326; 1,619)	165 (150; 180)	772 (692; 852)	480 (75; 884)	258 (79; 438)	1,365 (1,299; 1,431)	2,955 (2,827; 3,084)	488 (440; 536)
Corpus uteri	18,337 (17,612; 19,063)	7,577 (7,347; 7,806)	1,116 (1,034; 1,198)	121 (113; 129)	962 (903; 1,021)	1,106 (600; 1,612)	913 (657; 1,169)	1,561 (1,520; 1,602)	1,479 (1,447; 1,511)	700 (674; 726)

Prostate	15,646 (15,426; 15,867)	4,455 (4,393; 4,518)	925 (887; 963)	116 (114; 119)	504 (489; 519)	700 (550; 849)	551 (479; 624)	1,716 (1,699; 1,732)	1,292 (1,280; 1,305)	2,108 (2,085; 2,131)
Melanoma	15,065 (14,521; 15,609)	1,911 (1,804; 2,019)	7,001 (6,612; 7,391)	100 (95; 105)	686 (649; 724)	589 (319; 860)	450 (327; 573)	1,558 (1,525; 1,590)	847 (822; 871)	881 (838; 925)
Testis	14,728 (14,035; 15,421)	4,219 (3,819; 4,620)	1,272 (1,084; 1,460)	136 (121; 150)	445 (381; 509)	60 (-22; 142)	76 (-14; 165)	1,634 (1,531; 1,736)	2,959 (2,871; 3,048)	576 (503; 649)
Thyroid	11,727 (11,362; 12,093)	6,273 (6,154; 6,393)	450 (374; 525)	85 (79; 90)	188 (164; 212)	308 (69; 548)	145 (58; 232)	2,690 (2,634; 2,746)	1,081 (1,060; 1,103)	308 (286; 329)
All Cancers	25,513 (25,359; 25,667)	8,804 (8,746; 8,861)	2,387 (2,344; 2,429)	200 (198; 202)	1,582 (1,569; 1,595)	1,377 (1,279; 1,475)	847 (806; 888)	2,120 (2,110; 2,130)	2,162 (2,153; 2,171)	1,541 (1,530; 1,553)

Data sources: Ontario Cancer Registry, Cancer Care Ontario and administrative health data housed at the Institute for Clinical Evaluative Sciences (mean direct costs by phase of care).

Legend: ED – emergency department

Table 2. A – Mean (95% confidence interval) direct healthcare costs by tumour site for initial phase cancer patients that live beyond the first year post-diagnosis (long-term survivors) in 2009 Canadian dollars (cont.)

		Cancer-specific Care	
Type of Cancer	**Total Cost**	**Chemotherapy**	**Radiation Therapy**
Esophagus	54,445 (51,459; 57,432)	4,031 (3,762; 4,300)	2,093 (1,918; 2,268)
Myeloma	50,908 (48,094; 53,722)	3,502 (3,338; 3,667)	344 (311; 377)
Brain	46,428 (44,549; 48,308)	2,647 (2,497; 2,797)	3,051 (2,918; 3,184)
Pancreas	43,518 (41,915; 45,122)	7,320 (6,898; 7,741)	685 (604; 767)
Gastric	42,033 (40,518; 43,548)	3,794 (3,605; 3,983)	989 (919; 1,059)
Colorectal	37,601 (37,027; 38,175)	4,776 (4,706; 4,845)	633 (618; 648)
Liver	33,350 (31,221; 35,480)	320 (247; 393)	60 (30; 90)
Ovary	32,287 (31,083; 33,491)	5,709 (5,559; 5,858)	94 (75; 112)
Lung	32,250 (31,744; 32,756)	3,600 (3,520; 3,680)	1,087 (1,057; 1,117)
Head and neck	31,964 (31,060; 32,869)	3,323 (3,210; 3,436)	5,112 (4,918; 5,305)
Lymphoma	31,092 (30,135; 32,049)	5,355 (5,161; 5,548)	723 (687; 758)
Leukemia	30,480 (29,002; 31,958)	751 (690; 811)	47 (37; 57)
Other tumours	29,928 (29,112; 30,743)	1,952 (1,885; 2,018)	1,129 (1,075; 1,183)
Bladder	25,481 (24,625; 26,338)	712 (662; 763)	286 (261; 310)
Female breast	23,274 (22,980; 23,568)	5,012 (4,948; 5,076)	2,568 (2,541; 2,596)
Renal	21,856 (21,021; 22,691)	242 (212; 272)	63 (54; 73)
Cervix	20,653 (19,855; 21,450)	2,468 (2,343; 2,592)	3,468 (3,316; 3,620)
Corpus uteri	18,337 (17,612; 19,063)	1,086 (1,038; 1,134)	1,717 (1,654; 1,779)

Prostate	15,646 (15,426; 15,867)	1,222 (1,199; 1,246)	2,055 (2,025; 2,086)
Melanoma	15,065 (14,521; 15,609)	939 (885; 994)	101 (83; 120)
Testis	14,728 (14,035; 15,421)	2,624 (2,478; 2,770)	727 (675; 779)
Thyroid	11,727 (11,362; 12,093)	115 (98; 132)	84 (65; 103)
All Cancers	25,513 (25,359; 25,667)	2,982 (2,960; 3,003)	1,512 (1,500; 1,524)

Data sources: Ontario Cancer Registry, Cancer Care Ontario and administrative health data housed at the Institute for Clinical Evaluative Sciences (mean direct costs by phase of care).

Legend: ED – emergency department

Table 2. B – Mean (95% confidence interval) direct healthcare costs by tumour site for initial phase cancer patients that do **not** live beyond the first year post-diagnosis (short-term survivors) in 2009 Canadian dollars

		Hospital-based Care			Tertiary Care			Other		
Type of Cancer	**Total Cost**	**Inpatient Hospitalization**	**Same-day Surgery**	**ED Visits**	**Home Care**	**Continuing Care**	**Long-term Care**	**Diagnostic Tests**	**Physician Services**	**Outpatient Drugs**
Testis	81,506 (58,086; 104,925)	55,771 (36,692; 74,851)	836 (191; 1,481)	845 (487; 1,202)	2,687 (1,602; 3,773)	1,712 (-1,599; 5,023)	-	2,262 (1,185; 3,340)	7,855 (5,880; 9,830)	3,424 (1,936; 4,913)
Leukemia	62,482 (59,800; 65,164)	50,915 (48,633; 53,197)	2,778 (1,729; 3,827)	663 (607; 718)	1,922 (1,767; 2,077)	1,081 (753; 1,410)	167 (95; 239)	1,066 (982; 1,150)	1,350 (1,255; 1,444)	1,563 (1,358; 1,768)
Lymphoma	56,199 (53,865; 58,533)	37,693 (35,718; 39,668)	2,554 (1,992; 3,116)	742 (684; 801)	2,710 (2,476; 2,944)	1,789 (1,324; 2,254)	195 (123; 267)	1,649 (1,516; 1,781)	3,138 (2,963; 3,313)	2,124 (1,902; 2,346)
Myeloma	55,092 (51,973; 58,212)	35,978 (33,835; 38,121)	3,221 (1,457; 4,984)	727 (656; 798)	2,816 (2,503; 3,128)	3,763 (2,731; 4,796)	593 (400; 786)	2,053 (1,769; 2,338)	2,049 (1,787; 2,311)	2,169 (1,893; 2,446)
Brain	55,045 (53,662; 56,427)	33,085 (32,003; 34,168)	230 (161; 298)	509 (476; 543)	3,964 (3,740; 4,188)	7,045 (6,389; 7,702)	269 (205; 333)	866 (796; 935)	3,571 (3,429; 3,712)	2,192 (2,005; 2,380)
Head and neck	51,016 (49,158; 52,874)	29,701 (28,243; 31,158)	1,218 (965; 1,471)	495 (458; 533)	3,668 (3,456; 3,881)	3,413 (2,839; 3,986)	218 (146; 290)	852 (796; 909)	2,933 (2,806; 3,060)	1,791 (1,683; 1,899)
Ovary	47,921 (46,008; 49,834)	29,854 (28,350; 31,359)	1,957 (1,378; 2,536)	547 (498; 595)	3,750 (3,448; 4,051)	3,186 (2,526; 3,846)	143 (71; 214)	1,438 (1,313; 1,563)	2,211 (2,078; 2,344)	1,296 (1,176; 1,416)
Bladder	47,542 (45,780; 49,303)	31,844 (30,290; 33,399)	1,522 (1,292; 1,751)	590 (550; 630)	2,891 (2,710; 3,071)	2,490 (2,037; 2,944)	461 (353; 568)	1,575 (1,482; 1,669)	3,168 (3,021; 3,314)	1,189 (1,079; 1,299)
Esophagus	45,333 (43,714; 46,952)	26,701 (25,313; 28,088)	2,179 (1,965; 2,393)	520 (487; 552)	3,563 (3,360; 3,767)	2,385 (1,994; 2,776)	133 (84; 182)	1,331 (1,239; 1,422)	3,075 (2,930; 3,219)	1,692 (1,585; 1,798)
Colorectal	44,738 (43,950; 45,527)	29,261 (28,586; 29,937)	1,201 (1,072; 1,331)	488 (470; 505)	3,159 (3,062; 3,257)	2,750 (2,522; 2,979)	344 (299; 388)	1,186 (1,143; 1,229)	2,852 (2,787; 2,917)	1,171 (1,107; 1,234)
Cervix	43,924 (40,889; 46,959)	23,652 (21,553; 25,750)	1,021 (582; 1,459)	561 (480; 643)	3,253 (2,806; 3,700)	2,698 (1,747; 3,649)	130 (25; 236)	1,450 (1,284; 1,616)	3,515 (3,096; 3,935)	1,784 (1,459; 2,109)
Gastric	42,870 (41,531; 44,209)	28,346 (27,144; 29,547)	1,394 (1,210; 1,577)	526 (495; 557)	3,052 (2,914; 3,190)	2,246 (1,940; 2,552)	151 (108; 193)	1,188 (1,128; 1,249)	2,642 (2,547; 2,736)	1,352 (1,274; 1,430)
Renal	42,420 (40,528; 44,313)	26,847 (25,352; 28,343)	905 (353; 1,458)	591 (545; 636)	3,271 (3,004; 3,539)	2,486 (1,999; 2,973)	131 (69; 194)	1,830 (1,693; 1,967)	3,476 (3,250; 3,702)	1,612 (1,381; 1,842)
Other tumours	41,345 (40,431; 42,259)	26,877 (26,096; 27,658)	1,386 (1,214; 1,558)	529 (507; 551)	3,174 (3,058; 3,291)	2,142 (1,921; 2,362)	189 (150; 229)	1,356 (1,299; 1,413)	2,544 (2,466; 2,622)	1,360 (1,288; 1,432)
Thyroid	40,574 (34,710; 46,439)	27,226 (22,094; 32,359)	715 (159; 1,272)	505 (383; 628)	2,272 (1,695; 2,849)	2,457 (1,119; 3,796)	26 (-11; 63)	1,385 (1,043; 1,727)	2,514 (2,148; 2,880)	1,200 (747; 1,653)
Corpus uteri	37,806 (35,286; 40,326)	23,642 (21,482; 25,802)	785 (531; 1,038)	539 (471; 607)	2,801 (2,438; 3,164)	2,679 (1,854; 3,504)	343 (165; 520)	1,378 (1,233; 1,522)	2,313 (2,099; 2,527)	1,162 (1,009; 1,315)
Female breast	37,086 (35,793; 38,380)	19,440 (18,521; 20,359)	1,531 (1,237; 1,825)	490 (458; 522)	3,661 (3,424; 3,898)	3,167 (2,604; 3,731)	488 (377; 599)	1,648 (1,564; 1,732)	1,960 (1,849; 2,071)	1,490 (1,389; 1,591)
Pancreas	35,823 (35,033; 36,613)	21,222 (20,591; 21,852)	1,439 (1,257; 1,621)	551 (525; 577)	3,371 (3,236; 3,506)	1,543 (1,343; 1,744)	47 (26; 69)	1,261 (1,199; 1,322)	1,814 (1,747; 1,882)	1,622 (1,532; 1,712)

Melanoma	36,809 (34,706; 38,912)	18,215 (16,825; 19,605)	4,720 (3,460; 5,980)	528 (473; 583)	3,177 (2,849; 3,505)	2,206 (1,550; 2,861)	230 (110; 351)	1,545 (1,378; 1,712)	2,759 (2,544; 2,973)	1,470 (1,285; 1,656)
Lung	34,620 (34,252; 34,987)	19,689 (19,392; 19,987)	1,351 (1,278; 1,424)	553 (541; 565)	2,771 (2,716; 2,827)	2,180 (2,067; 2,293)	133 (116; 150)	1,318 (1,290; 1,346)	2,224 (2,188; 2,260)	1,425 (1,387; 1,463)
Prostate	34,462 (33,176; 35,749)	19,968 (18,991; 20,944)	740 (561; 919)	527 (489; 566)	2,205 (2,026; 2,384)	3,273 (2,700; 3,846)	580 (460; 700)	1,553 (1,463; 1,643)	1,527 (1,427; 1,627)	3,008 (2,873; 3,143)
Liver	28,209 (26,379; 30,038)	18,287 (16,676; 19,899)	887 (630; 1,144)	614 (552; 677)	2,125 (1,918; 2,332)	1,396 (1,030; 1,763)	93 (35; 150)	1,821 (1,638; 2,003)	1,657 (1,480; 1,835)	896 (793; 1,000)
All Cancers	41,075 (40,808; 41,343)	25,354 (25,131; 25,576)	1,421 (1,363; 1,479)	544 (537; 551)	3,034 (3,000; 3,069)	2,530 (2,454; 2,607)	214 (202; 227)	1,323 (1,307; 1,340)	2,471 (2,448; 2,494)	1,507 (1,484; 1,530)

Data sources: Ontario Cancer Registry, Cancer Care Ontario and administrative health data housed at the Institute for Clinical Evaluative Sciences (mean direct costs by phase of care).

Legend: ED – emergency department

Table 2. B – Mean (95% confidence interval) direct healthcare costs by tumour site for initial phase cancer patients that do **not** live beyond the first year post-diagnosis (short-term survivors) in 2009 Canadian dollars (cont.)

		Cancer-specific Care	
Type of Cancer	**Total Cost**	**Chemotherapy**	**Radiation Therapy**
Testis	81,506 (58,086; 104,925)	5,909 (4,454; 7,364)	203 (16; 391)
Leukemia	62,482 (59,800; 65,164)	908 (821; 996)	69 (49; 89)
Lymphoma	56,199 (53,865; 58,533)	3,256 (2,912; 3,601)	348 (262; 435)
Myeloma	55,092 (51,973; 58,212)	1,394 (1,200; 1,587)	330 (283; 376)
Brain	55,045 (53,662; 56,427)	1,420 (1,317; 1,522)	1,894 (1,797; 1,991)
Head and neck	51,016 (49,158; 52,874)	2,688 (2,481; 2,896)	4,038 (3,720; 4,356)
Ovary	47,921 (46,008; 49,834)	3,505 (3,225; 3,786)	35 (22; 47)
Bladder	47,542 (45,780; 49,303)	1,302 (1,162; 1,442)	510 (452; 569)
Esophagus	45,333 (43,714; 46,952)	2,236 (2,084; 2,388)	1,520 (1,414; 1,625)
Colorectal	44,738 (43,950; 45,527)	2,077 (1,983; 2,171)	249 (229; 269)
Cervix	43,924 (40,889; 46,959)	2,811 (2,402; 3,221)	3,048 (2,630; 3,466)
Gastric	42,870 (41,531; 44,209)	1,597 (1,486; 1,708)	376 (334; 419)
Renal	42,420 (40,528; 44,313)	882 (782; 981)	389 (346; 431)
Other tumours	41,345 (40,431; 42,259)	1,263 (1,192; 1,333)	525 (478; 573)
Thyroid	40,574 (34,710; 46,439)	1,185 (776; 1,594)	1,088 (756; 1,420)
Corpus uteri	37,806 (35,286; 40,326)	1,240 (1,042; 1,439)	925 (748; 1,102)
Female breast	37,086 (35,793; 38,380)	2,416 (2,216; 2,616)	796 (705; 886)
Pancreas	35,823 (35,033; 36,613)	2,755 (2,613; 2,897)	198 (174; 222)

Melanoma	36,809 (34,706; 38,912)	1,381 (1,153; 1,609)	578 (484; 672)
Lung	34,620 (34,252; 34,987)	2,169 (2,118; 2,219)	807 (787; 826)
Prostate	34,462 (33,176; 35,749)	583 (502; 664)	498 (425; 570)
Liver	28,209 (26,379; 30,038)	359 (295; 423)	72 (45; 99)
All Cancers	41,075 (40,808; 41,343)	1,936 (1,907; 1,965)	740 (724; 756)

Data sources: Ontario Cancer Registry, Cancer Care Ontario and administrative health data housed at the Institute for Clinical Evaluative Sciences (mean direct costs by phase of care).

Legend: ED – emergency department