Estimating the national wage loss from cancer in Canada

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ABSTRACT

Objectives

Using primary and secondary data sources, we set out to estimate the Canadian wage loss from cancer for patients, caregivers, and parents from a patient and a societal perspective.

Methods

First, a multiple-database literature search was conducted to find Canadian-specific direct surveys of wage loss from cancer. Second, estimates for wage loss were generated from the nationally representative Canadian Community Health Survey (CCHS) Cycle 3.1. In addition, both estimates were standardized to derive a friction-period estimate and were extrapolated to produce national annual estimates.

Results

The literature search identified six direct surveys that included a total of 1632 patients with cancer. The CCHS Cycle 3.1 included 2287 patients with cancer. Overall, based on the direct surveys, newly diagnosed cancer patients reduced their labour participation in the friction period by 36% ($4,518), and caregivers lost 23% of their workable hours ($2,887). The CCHS estimated that annual household income was 26.5% lower ($4,978) for respondents with cancer as compared with the general population. For the year 2009, results from direct surveys indicated that new cancers in Canada generated a wage loss of $3.18 billion; the CCHS Cycle 3.1 estimate was $2.95 billion.

Conclusions

Wage loss from cancer is a significant economic burden on patients, their families, and society in Canada, with direct surveys and the CCHS providing similar estimates.

KEY WORDS

Productivity, societal cost of cancer, burden, indirect cost, wage loss

1. INTRODUCTION

The risk of developing cancer is significant in Canada. Based on current incidence rates, 39% of Canadian women and 44% of Canadian men will develop cancer during their lifetime. During 2009, an estimated 166,400 new cases of cancer occurred in Canada. On average, that number translates into 3200 Canadians diagnosed with cancer every week [1]. In addition, cancer accounted for almost one third of premature death costs (32%), reflecting the fact that cancer is the leading cause of premature death in Canada. Of the costs related to premature death from all diseases, lung cancer alone accounted for 6% (26% of the total attributable to cancer) [1].

The high incidence of costly disease makes the economic burden, which includes costs to the patient and to the public health care system for the morbidity of cancer, high. Although recent numbers are not available, the total cost (direct and indirect costs combined) of cancer for Canada in 1998 was CA$14.2 billion—9% of the total cost of all illness, and 1.6% of gross domestic product. Those numbers include the indirect cost of CA$11.8 billion in present value of wage loss from morbidity and mortality (16%), which ranks second only to that for musculoskeletal diseases [2]. That total is equivalent to CA$388 per capita, an estimate that did not include the impact of wage loss for caregivers. In the United States in 2002, the present value of wage loss from morbidity and mortality was estimated at US$115 billion (US$410 per capita) [3]. When that national study included the impact on caregivers, wage loss more than doubled to US$232 billion (US$810 per capita).

Although direct medical costs associated with cancer such as hospitalizations [1] or drugs [4] have been reported, little has been published regarding the

indirect costs associated with cancer. These costs are often a considerable financial burden on the patient and the family, with an estimated 91% of households suffering a loss of income or a rise in costs as a direct result of cancer [5]. Thus, one of the main concerns with cancer is loss of wages for the patient and the patient's caregivers. The extent of wage loss to patients and caregivers is an important effect that is not always captured in economic evaluations of treatments that reduce the risk for cancer, the incident rates of cancer, the outcomes of cancer, or the side effects of cancer. Yet loss of work has a profound effect on the patient and should be included when reporting the economic burden associated with cancer.

Two different methods for estimating wage loss are the friction-period method and the human-capital approach, each having a different purpose [6]:

- The friction-period method identifies the wage loss that can occur in the short term until the patient is replaced by another worker. Some governing bodies (those in Quebec, for instance) require that economic evaluations—that is, cost effectiveness analyses—limit the wage loss to the friction period for a *societal perspective* in which a sensitivity analysis captures the effect on the total society [7]. The friction-period method assumes that the loss to society is the short-term productivity interruption only. It disregards the personal aspect of wage loss, but it does allow for the capture of benefits from therapies that prevent side effects of treatment that would have a significant impact on quality of life for the patient and the family. Any reduction in the need for care directly affects the wage loss that the patient experiences. Ontario and Canada's national agencies do not allow drug submissions to include wage loss in the primary analysis.
- The second method for estimating wage loss is the human-capital approach, which captures the full period of wage loss. This method assumes that the pool of workers is limited and that replacing a worker who leaves because of illness draws the new worker from other productive work. In reality, the friction-period estimate is a subset of the human-capital estimate.

For either method, two sources of information can capture the extent to which cancer patients will experience wage loss. Direct surveys of patients who are being treated or who have been treated for an episode of cancer are primary sources that collect data on experience of wage loss. Such surveys can be conducted as part of a pragmatic trial on cancer therapy or as a separate effort to collect specific information outside of a trial context. Large national surveys such as those conducted by Statistics Canada [8] are secondary data sources for estimating wage loss for cancer patients.

One particular survey that is important to health policy is the Canadian Community Health Survey (CCHS) [9]. The CCHS began in 2001 after being transformed from a discontinued cross-sectional National Population Health Survey. The explicit purpose of the biennial CCHS is to gather health-related data at the sub-provincial levels of geography (health region or combined health regions). This large national survey, which is representative by strata of the Canadian population, surveys 120,000 people having 27 health conditions. The survey captures several important characteristics such as basic demographics, quality of life, and current employment experience. The survey is freely available at participating universities in Canada and can be used to estimate wage loss from cancer.

Given the lack of published literature on wage loss from cancer and given the availability of primary and secondary data, we set out, in the present paper, to provide an update to the 1998 estimate of wage loss from cancer in Canada. We first conducted a literature search for all direct patient surveys leading to Canadian estimates of wage loss from cancer. We then used the CCHS to estimate wage loss for the morbidity of cancer. Based on these two data sources, we provide friction-period estimates to capture short-term wage loss (useful as input for economic evaluations) and human-capital estimates for the national burden of cancer in 2009 (useful for quantifying the national impact of cancer). Finally, we compared and reconciled differences between the two data sources.

2. METHODS

2.2 Primary Data: Literature Review of Direct Patient Surveys

We searched the literature for articles dealing with the wage loss for a patient with cancer, or the wage loss for the caregiver associated with a cancer patient, or both. Separate searches were conducted on multiple databases, seeking articles from a Canadian perspective. The initial searches of Ovid MEDLINE, Ovid EMBASE, Cochrane Reviews, Health Economic Evaluations Database, and National Health Service Economic Evaluation Database (both Economic Evaluations and Technology Assessments) took place on October 15, November 7, October 29, October 29, and October 29, 2007, respectively; all searches were updated on July 28, 2008. The language was limited to English, and no limit was placed on the study type (for example, "clinical trial").

The search strategies were developed and tested to identify wage loss for patients with cancer (Table I). The search was not restricted by cancer type; nor by the technology, drug, or program being evaluated; nor by the method used to calculate the wage loss. Specific major MeSH headings used for MEDLINE and EMBASE included "Costs and Cost Analysis" and the

TABLE I Literature search

Step	Search strategy: EMBASE (1988 to 2007 Week 44)	Citations located	Search strategy: Ovid MEDLINE In-process and other non-indexed citations and Ovid MEDLINE (1950 to present)	Citations located
1	"Costs and Cost Analysis"/	15247	costs.mp. and cost analysis/ [mp=ti, ot, ab, nm, hw]	36179
2	Cost-Benefit Analysis/	25971	cost-benefit analysis/	41359
3	"Cost of Illness"/	4188	cost of illness/	9691
4	exp Health Care Costs/	91660	exp health care costs/	29574
5	exp Health Expenditures/	91660	exp health expenditures/	11458
6	exp Economic Evaluation/	88793	(cost$ or economic or price?).ti.	73478
7	"Cost Benefit Analysis"/ or "Cost Effectiveness Analysis"/ or "Cost of Illness"/ or "Cost Utility Analysis"/	75823	(burden$ adj2 (disease$ or illness$)).ti,ab.	3780
8	exp Health Care Cost/	91660	(econom$ adj5 (analys#s or impact$)).ti,ab.	7578
9	(cost$ or economic or price?).ti.	41483	((economic or emotional or financial or social) adj burden$).ti,ab.	2943
10	(burden$ adj2 (disease$ or illness$)).ti,ab.	3364	(foregone income$ or productivity loss$).ti,ab.	357
11	(econom$ adj5 (analys#s or impact$)).ti,ab.	6358	((attributable or healthcare or health care) adj2 expenditure$).ti,ab.	1717
12	((economic or emotional or financial or social) adj burden$).ti,ab.	2639	human capital.ti,ab.	515
13	(foregone income$ or productivity loss$).ti,ab.	344	(demographic adj (approach$ or method$)).ti,ab.	103
14	((attributable or healthcare or health care) adj2 expenditure$).ti,ab.	1337	(friction adj2 (approach$ or method$)).ti,ab.	55
15	human capital.ti,ab.	301	or/1–14	156570
16	(demographic adj (approach$ or method$)).ti,ab.	41	(Canad$ or British Columbia$ or Alberta$ or Saskatchewan$ or Manitob$ or Quebe$ or Ontari$ or Nova Scotia$ or Newfoundland or Labrador or Prince Edward Island or PEI or New Brunswick or Northwest Territor$ or Yukon Nunavut).af.	519786
17	(friction adj2 (approach$ or method$)).ti,ab.	53	15 and 16	8454
18	or/1–17	182730	cancer/	192627
19	exp neoplasms/	1152021	cancer$.af.	920573
20	exp Neoplasm/	1152021	tumor.af.	750942
21	(cancer$ or tumo#r$ or neoplasm$).ti.	283666	tumour.af.	114810
22	or/19–21	1173012	neoplasm$.mp.	1536408
23	(Canad$ or British Columbia$ or Alberta$ or Saskatchewan$ or Manitob$ or Quebe$ or Ontari$ or Nova Scotia$ or Newfoundland or Labrador or Prince Edward Island or New Brunswick or Northwest Territor$ or Yukon or Nunavut).af.	406585	neoplasm$.af.	1538076
24	18 and 22 and 23	1172	18 or 19 or 20 or 21 or 22 or 23	2025109
25			17 and 24	651

keywords "cost," "expenditures," and "economic(s)." The searches in MEDLINE and EMBASE also targeted specific methods of calculating wage losses: "human capital" (that is, human potential loss), "demographic approach" (that is, regression methods), and "friction method" (that is, short-term wage loss).

The search allowed for the identification of any one of the MESH headings, the keyword, or methods keywords. To identify costs specific to a Canadian context, a search filter identified "Canadian" or any province in any field (title, abstract, author, publication). No limits were imposed on reviews or comments. For any review or comment that cited a secondary article with the potential to include wage loss, that secondary article was retrieved and reviewed.

After running each search individually, the bibliographic records were imported into a reference database (Reference Manager Network, version 11: Thomson Reuters, Carlsbad, CA, U.S.A.). References were screened by title and abstract for duplication, and duplicates were removed to a secondary database (RH). After removal of duplication, articles were title- and abstract-screened for relevance (RH). For title and abstract screening, the inclusion criteria were Canadian or provincial patient populations with any type of cancer, neoplasms, or tumours, and any of loss of work, wage losses, indirect costs, or societal costs. If the abstract or critical details were missing, the article was included for a full-text review based on the same criteria. The same criteria were applied during the full-text review.

Following the literature screening process, detailed information on the methodology to derive the estimates was abstracted (RH). Specific abstracted information included year; patient population; type of cancer; primary data source; and cost estimates, resource units (number of days of work lost to cancer for the patient or the caregiver or both), and dollar value of the wage loss. For articles that provided estimates, the results were pooled using simple averages. Next, the friction-period estimate and the human-capital national annual estimates were generated.

2.1.1 Friction-Period Method

The surveys provided varying lengths of follow-up, such as 1 month or 6 weeks. To adjust for this variation, we first estimated the average weekly loss in hours by dividing the total hours over the follow-up period by the length of follow-up. Next, to estimate the friction-period loss, we multiplied the average weekly loss in hours by the length of the friction period in weeks. The length of the friction period was based on data from Statistics Canada's Labour Force Survey [10], which estimates the duration of unemployment as 14.6 weeks. In using that estimate, we assumed that the date at which a respondent becomes unemployed because of illness is the same date that another respondent of similar skill becomes unemployed. Based on our direct survey estimates, we estimated the weekly wage loss based on the survey period and multiplied that wage loss by 14.6 weeks. Finally, we estimated the value of the wage loss by multiplying the number of hours lost in the friction period by average hourly paid wage for Canada [10].

2.1.2 Human-Capital Method

To derive the national annual estimate of wage loss for cancer in 2009, we relied on incident rates and our friction-period estimates. The cancer incidence was stratified by age group: <20 years, 20–59 years, and 60 years and older [1], where 60 is the median age of retirement in Canada. We assumed that a child incurs a parent's loss of wage, an individual 20–59 years incurs a patient and caregiver cost, and an individual 60 year or older incurs only a caregiver cost. For simplicity, we assumed that each patient had only one caregiver. Then, we multiplied our friction-period estimate by incident rates and extrapolated the time from 14.6 weeks to 52 weeks. We also determined the wage loss for assisting patients with terminal cancer by multiplying the former result by 89% (the increase in the wage loss for caregivers when the cancer is terminal [11]) times the incidence of terminal cancer in Canada [1]. We then added that estimate to the former result to derive the total costs of wage loss from cancer in 2009.

Data was extracted to Excel 2002 (Microsoft Corporation, Redmond, WA, U.S.A.), and estimations were conducted in Excel. No corrections were required for missing data, and the analysis focused on newly diagnosed cancers, although studies may have retrospectively reviewed a cancer episode or prospectively follow newly diagnosed patients. Wherever possible, variations in loss of work for different cancer types (subgroups) or data collection methods were investigated and described post hoc.

2.2 Secondary Data: Canadian Community Health Survey

The secondary source of data was the CCHS Cycle 3.1 (from data collected in 2005). Subject were asked the question "Do you have cancer?" For each subject that responded yes, the characteristics of the individual and household were captured. If the subject was a woman, and if she answered yes to having had a recent mammogram that required follow-up and yes to having cancer, then the cancer was classified as breast cancer. Similarly, if a woman responded yes to having cancer and also yes to having recently had a hysterectomy, then the cancer was assumed to be ovarian or cervical. For men who identified themselves as having cancer, answering yes to recently having had a prostate procedure led to an assumption of prostate cancer. Similarly, if the man answered yes to cancer and recently having had a problematic fecal occult blood test, then colorectal cancer was assumed.

After the cases of cancer and the subgroups of particular cancer types were identified, a regression—using

binary variables for cancer, sex, and marital status, and a continuous variable for household size—estimated household wage loss. The size of the regression coefficient for each cancer type identified the impact that the particular cancer type had on annual household wage. These results were presented for all cancer patients and for subgroups by cancer type. The cancer coefficient in the regression model reflects the extent of household wage loss for subjects with cancer relative to other individuals in the CCHS. To capture the extent of wage loss from cancer relative to the general population, the estimates was adjusted upward by the difference between the average household wage in the CCHS and the average household wage for the general population. This adjustment relies on the fact that the CCHS is a stratified sample that reflects national population characteristics. The friction-period estimate was generated by dividing the friction-period wage loss by the average annual household wage loss (14.6/52 weeks). Finally, the values were inflated to 2009 dollars using the Consumer Price Index [12]. To derive the national annual household wage loss from cancer, the average household wage loss from the regression coefficient was multiplied by the same incidence rates used in the direct-survey method.

3. RESULTS

3.1 Literature Review

The searches conducted on individual databases identified 2397 relevant articles (Figure 1). Of those 2397 articles, 636 (26%) were identified as duplicates and were removed. The remaining 1761 unique articles were reviewed by title and abstract as being possible relevant. Abstracts were available for 66% of the articles. Of the 127 articles that underwent full-text review, only six articles contained a Canadian or provincial perspective on wage loss from cancer.

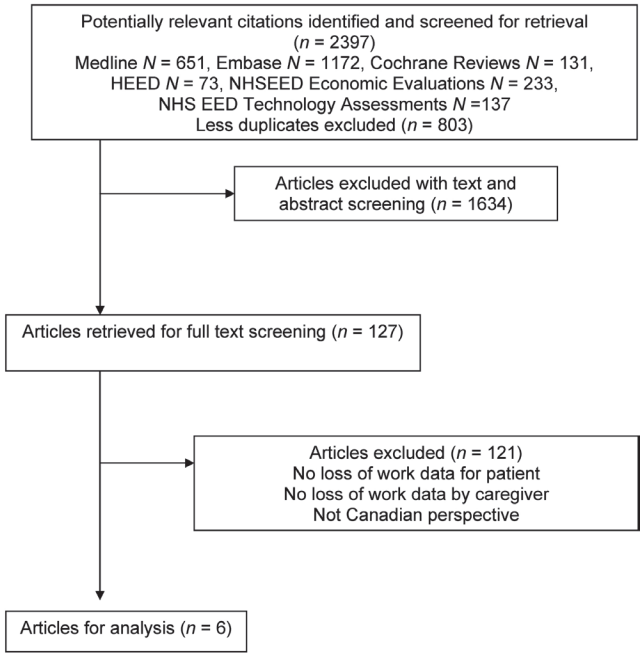

FIGURE 1 *Quorum diagram.*

Table II describes the included studies [13–18]. Generally, the articles provide prospective estimates from surveys that were gathered in clinic, by mail, or by retrospective telephone interview, and they include loss of paid work, loss of unpaid work, or loss of work for caregivers. The cancer types were breast cancer [15,16,18], mixed cancers (breast, colorectal, lung, prostate) [17], or emesis related to mixed cancers (breast, lung, lymphoma) [13], and childhood cancers [14].

Table III shows the estimates of wage loss from cancer for each of the included studies. For patients, the impact on earnings was a loss of 210 hours in the friction period (14.4 hours per week), which represents a reduction of 36% in available hours. This loss of hours corresponds to an average wage loss of $4,518. For caregivers, 134 hours were lost on average (9.2 hours per week), for a 23% loss of available hours or $2,887. Together, the patient and caregiver wage losses for the friction period totalled to $7,405 in 2009 dollars per cancer episode.

The annual national estimates were generated based on estimates of new cancers by age group: 1300 new cases for the <20 group; 50,500, for the 20–59 group; and 114,700, for the 60 and older group [1]. Using these incidence rates and the wage losses for patients, caregivers, and parents, the total wage loss for the friction period for new cases is $708 million dollars. Extending those wage losses to an annual cost leads to a wage loss of $2.521 billion in 2009 dollars. This estimate excludes the wage loss from assisting patients with terminal cancer (the approximately 73,800 people who die from cancer every year), which adds a further $659 million if the terminal period continues for 1 year. Overall, we estimate the wage loss in Canada from cancer to be $3.18 billion in 2009 dollars.

3.2 Secondary Data: Canadian Community Health Survey

The CCHS Cycle 3.1 included 2287 people with cancer (Table IV). Approximately 1000 people with cancer over the age of 65 years were excluded from the analysis because it was assumed that they were not in the labour market, and the CCHS did not capture family members not residing at the same address. Further exclusions based on young age limited the number of people between 19 and 65 years of age with cancer to 929 individuals.

The baseline characteristics of the 86,603 people between the ages 19 and 65 years without cancer that were available for analysis were similar to the characteristics of the people with cancer (Table IV). The people with cancer were slightly older (52.5 years

TABLE II Primary data results: cancer type, demographics, and costing methodology for estimated wage loss of cancer morbidity in the included studies

References	*Cancer type*	*Pts (n)*	*Patient demographics*	*Methods*	*Source of data for wage loss*
O'Brien *et al.* 1993 [13]	Emesis after single-day chemotherapy	92	Mean age: 57 years (range: 23–75 years) 65% Women	In-clinic prospective survey 5 days after episode	Patient or caregiver loss of work
	Breast	27			
	Lung	15			
	Lymphoma	21			
	Ovarian	20			
	Other	9			
Barr 1996 [14]	Childhood cancer	64	Age < 18 Sex ratio not reported	In-clinic prospective weekly diary	Parent's loss of work
	Wilms tumour	6			
	Leukemia	52			
	Neuroblastoma	6			
Grunfeld *et al.* 2004 [15]	Breast cancer	89	Mean age: 56.2 years (range: 26–83 years) 48% Women	Prospective questionnaire every 3 months at 1 or 2 regional cancer centres	Caregiver's loss of work
Drolet *et al.* 2005 [16]	Breast cancer survivors	646	Median age range: 40–49 years Overall age range: 18–59 years 100% Women	Retrospective telephone interview 3 years after initial diagnosis of breast cancer	Patient's loss of work
Longo *et al.* 2006 [17]	Total	282	Mean age: 61.2 years (range: 26–87 years) 47% Women	In-clinic prospective monthly questionnaire	Loss of work
	Breast	74			
	Colorectal	70			
	Lung	68			
	Prostate	70			
Lauzier *et al.* 2008 [18]	Breast cancer	459	Mean age: 50.3 years (standard deviation: 7.2 years) 100% Women	Telephone interview at 1, 6, and 12 months of all diagnosed cases of breast cancer in 1 of 8 hospitals	Patient's loss of work

vs. 42.4 years), and they included more women. The household wage from all sources was higher in the non-cancer group; people with cancer were more likely to be employed full-time.

The model-based decline in household wage for people with cancer relative to those without the disease was $4,978 for the friction period (Table IV). For men only, the regression-adjusted effect of cancer on household wage for the friction period was a loss of $5,119; the result for women was $4,851. The effect of prostate cancer on household wage was highest ($8,255); other results were similar to the mean and sex-specific estimates.

We also estimated the annual national loss of household wages by applying the incidence rates used in the direct-survey methods. Given an annual household wage loss from cancer of $17,729 per person, the national estimate of household wage loss comes to $2.95 billion.

3.3 Comparison Between Literature Values and CCHS Values

There are similarities between direct patient and caregiver survey and national survey estimates for wage loss in the friction period (Figure 2). The average losses for patients and caregivers in direct surveys were $4,518 and $2,887 respectively, for a total of $7,405. The national survey estimate was lower at $4,978. One key difference was that the national survey does not capture the friction period and may include patients who have had cancer for more than 1 year, who have learned to cope, and who have readjusted to maintain labour market participation or who have moved beyond any short-term leave allowances. In addition, the national survey includes household wage, which includes the respondent, but which may not capture wage loss for caregivers outside the immediate family. The different estimates may have different applications.

TABLE III Primary data results: standardization of direct patient survey estimates to friction-period wage loss

Reference	*Period studied*	*Loss type*	*Work loss*		*Wage loss*[b]
			Weekly (hours)	*Per friction period*[a] *[hours (% MAH)]*	
O'Brien *et al.* 1993 [13]	Current episode	Total	Patient: 15.4	225 (39)	$4832
			Caregiver: 14.5	212 (36)	$4549
Barr 1996 [14]	Current episode	Total	Parent: 7.1	104 (18)	$2228
Grunfeld *et al.* 2004 [15]	Preceding 4 weeks	Weekly total	Caregiver: 6.1	89 (15)	$1914
Drolet *et al.* 2005 [16]	First year after diagnosis	Total	Patient: 18.8	274 (47)	$5899
Longo *et al.* 2006 [17]	Preceding 30 days	Total	Patient: 12.6	184 (32)	$3953
			Caregiver: 7.0	102 (18)	$2196
Lauzier *et al.* 2008 [18]	First year of diagnosis	Median	Patient: 10.8	158 (27)	$3389
		Average	Patient (n=4)	210 (36)	$4518
			Caregiver (n=3)	134 (23)	$2887
			Parent [n=1 (Barr 1996 [14])]	104 (18)	$2228

[a] Example: 12.6 hours weekly for 14.6 weeks = 183.96 hours. Maximum available hours (MAH) = 40 hours × 14.6 weeks = 584 hours. Percentage of MAH = 183.96/584 = 32%. Working hours assumed to be 8 hours daily, 40 hours weekly.
[b] Based on average hourly wage: $21.49 in 2009 [10]. Example: 183.96 hours × 21.49 = $3953.

TABLE IV Characteristics of individuals with or without cancer, from the Canadian Community Health Survey Cycle 3.1, 2006 [9]

Demographic	*Cancer diagnosis*		*Difference*[a]
	Without	*With*	
Subjects (n)	86,603	926	—
Mean age (years)	42.4±12.5	52.5±9.8	–10.1
Men (%)	46.7	41.2	5.5
Household wage ($)[b]	53,768	47,207	6,561
Usual hours worked	41.9	41.2	0.7
Full-time employed (%)	83.6	87.2	–3.6

[a] Without cancer – with cancer.
[b] Actual average household wage for the non-elderly population in 2005 was $66,800 [19].

4. DISCUSSION

The indirect costs associated with cancer treatment have not been well described in a Canadian setting. A literature review identified wage loss for patients with a treatment episode of cancer. A search strategy limited to the Canadian context was developed and executed for multiple databases. Only six articles were identified that included appropriate information. These articles included three estimates that used the human-capital approach and three that captured wage loss at the friction period.

The estimates have some validity, in that the higher costs estimated for patients with emesis related to chemotherapy indicate that these patients may be undergoing therapy as compared with recovering from therapy. Interestingly, for patients who are experiencing emesis, only 36% of the total hours available for work in the friction period are lost, which suggests that many people continue to work during an episode of cancer. In addition, estimates from prospective surveys during cancer treatment episodes are similar to estimates from retrospective random surveys.

Variations occur between the estimates for patient and caregiver wage loss in the direct patient surveys because of the sampling methods used and the target populations studied. For example, Longo *et al.* [17] captured a sample that was, on average, 61 years of age and that may therefore contain some older retired or semiretired individuals, being that Canada's median retirement age is less than 61 years. Correspondingly, the wage-loss estimates from that study are lower than the overall average. Conversely, other estimates [15,16,18] included only patients with breast cancer, who are younger, and they thus resulted in higher wage-loss estimates. However, Drolet *et al.* [16] provided a lower estimate of the impact of breast cancer, because those authors averaged wage loss over a 3-year period, in which the early stages may have a incurred a higher wage loss. In addition, their sample included women an average of 56 years of age—a group that may not have included only full-time workers. For patients with emesis during chemotherapy [13], only the friction period was reported, and that article came to a slightly higher estimate of wage loss.

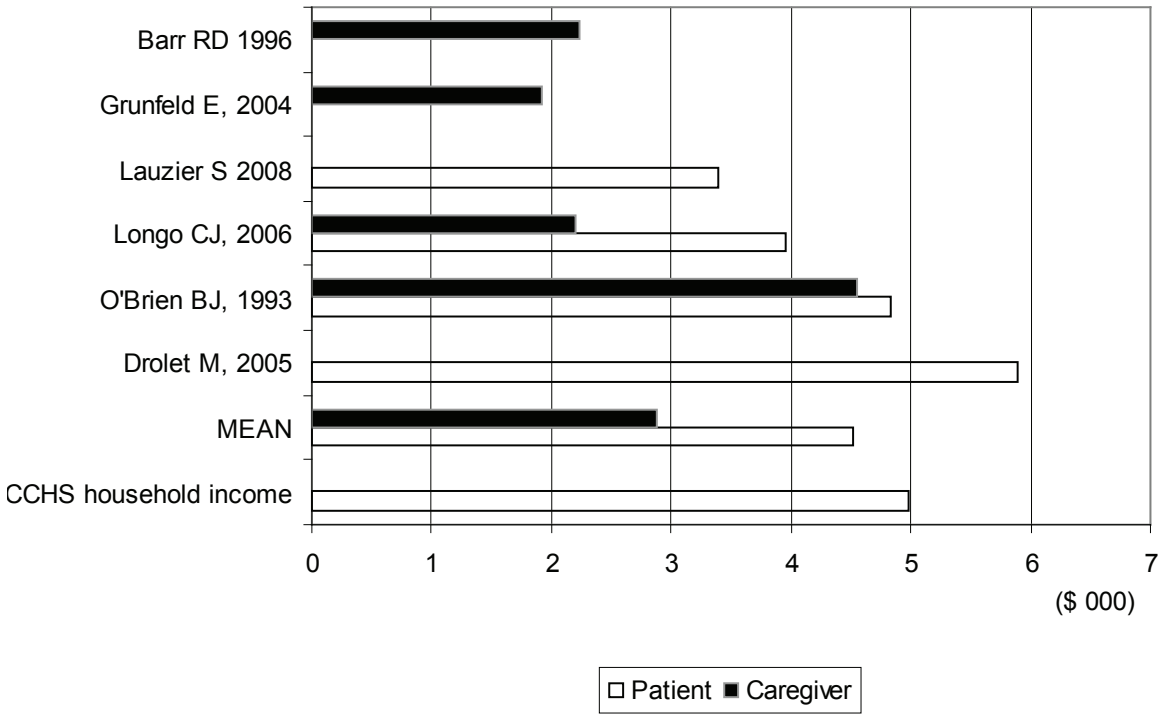

FIGURE 2 Comparison of wage loss attributable to morbidity for cancer between direct surveys and the population-based Canadian community health survey (2009 Canadian dollars) for the friction period of 14.6 weeks.

TABLE V Secondary data results: wage losses attributable to morbidity for cancer, from the Canadian Community Health Survey (CCHS) Cycle 3.1, 2006 [9,a]

Analysis	*Patients (n)*	*Wage loss ($)*[b]		
		Mean (±standard error)	*95% confidence interval*	*Per friction period*
Model-based	929	17,729 (798)	16,166 to 19,293	4,978
Men	383	18,231 (1,221)	15,838 to 20,624	5,119
Prostate cancer	212	29,402 (13,742)	2,468 to 56,336	8,255
Colorectal cancer	72	18,396 (5,148)	8,307 to 28,485	5,165
Women	546	17,277 (1,047)	15,225 to 19,329	4,851
Breast cancer	26	19,531 (5,274)	9,194 to 29,868	5,484
Ovarian/cervical cancer	193	16,698 (2,579)	11,642 to 21,753	4,688

[a] Differences from with cancer to without cancer in the CCHS were inflated by the difference between the CCHS patient population and the general non-elderly population.
[b] 2009 Canadian dollars.

The present analysis has limitations. First, the small number of studies providing estimates of wage loss for cancer patients prevents subgroup and sensitivity analyses. This paucity of published literature is surprising, considering the large number of cancer types. Further research by cancer type may be useful, by providing a range of estimates, from simple skin cancers extracted in the dermatologist's office to leukemia requiring bone marrow transplant.

Another limitation occurs in capturing the wage loss for people who do not have a caregiver. For individuals lacking a caregiver in the immediate household, a community-based survey that captures household income will not capture caregivers outside the immediate family. Similarly, a larger household may have more than one caregiver, and a survey that looks at the patient and one primary caregiver will exclude other caregiver's wage loss.

Our secondary data source, the CCHS, allowed us to estimate the effect on household wages of having cancer. The limitations of the analyses using the national survey include the fact that neither the start date for the cancer treatment episode, nor the stage of the cancer, is identified. This omission may produce a bias in the cost for a treatment episode of cancer. Another limitation is that caregiver burden beyond the immediate household is not captured, which also likely produces an underestimate of the true burden of wage loss. Despite those limitations, the CCHS is a large, nationally representative survey that provides valuable information for estimating household wage loss from cancer and 26 other chronic conditions. Its estimates, which are based on a large sample, are beneficial to researchers involved in cost-of-illness studies or economic evaluations; they could be more convenient and robust than a process of generating and analyzing questionnaires to obtain loss-of-work estimates for chronic illness.

5. CONCLUSIONS

The literature review identified five small-to-medium studies and one large study that provided estimates of work loss attributable to cancer for a total of 1632 patients. The resulting estimates are consistent for breast and mixed cancers, suggesting that cancer patients experience a 36% decline in their labour participation by number of hours worked. In addition, caregivers lose approximately 23% of their workable hours to support a patient with cancer (parental loss is 18%). Based on 2287 patients with cancer, the CCHS Cycle 3.1 estimated that cancer reduces household wages by 26.5% on an annual basis. These estimates are useful for economic models that incorporate societal costs (including wage loss) or for estimates of overall economic burden.

The economic burden of wage loss attributable to cancer is significant in Canada. The 1998 estimate for wage loss from morbidity for Canada was $1.15 billion, excluding caregiver burden. For new cancer episodes in 2009, the estimated wage loss for patients, caregivers, and parents from analysis of direct surveys was $3.18 billion, and from analysis of the CCHS, it was $2.95 billion for immediate members of a household.

6. CONFLICT OF INTEREST DISCLOSURE

No funding was received for this project.

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