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ORIGINAL ARTICLE

Population-based home care services in breast cancer: utilization and costs

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ABSTRACT

Objective

To determine utilization and costs of home care services (HCS) for individuals with a diagnosis of breast cancer (BC).

Methods

Incident cases of invasive BC in women were extracted from the Ontario Cancer Registry (2005–2009) and linked with other Ontario health care administrative databases. Control patients were selected from the population of women never diagnosed with any type of cancer. The types and proportions of HCS used were determined and stratified by disease stage. Attributable home care utilization and costs for BC patients were determined. Factors associated with HCS costs were assessed using regression analysis.

Results

Among the 39,656 BC and 198,280 control patients identified (median age: 61.6 years for both), 75.4% of BC patients used HCS (62.1% stage I; 85.7% stage II; 94.6% stage III; 79.1% stage IV) compared with 14.6% of control patients. The number of HCS used per patient–year were significantly higher for the BC patients than for the control patients (14.97 vs. 6.13, $p < 0.01$), resulting in higher costs per patient–year ($1,210 vs. $325; $885 attributable cost to BC, $p < 0.01$). The number of HCS utilized and the associated costs increased as the BC stage increased. In contrast, HCS costs decreased as income increased and as previous health care exposure decreased.

Interpretation

Patients with BC used twice as many HCS, resulting in costs that were almost 4 times those observed in a matched control group. Less than an additional $1000 per BC patient per year were spent on HCS utilization in the study population.

KEY WORDS

Breast cancer, home care, costs, population-based, disease stage

1. INTRODUCTION

As the pressure to reduce the length of hospital stays increases, use of home care services is increasing[1]. As a result of health care reforms in the province of Ontario beginning in the mid-1990s, the setting for some health care services has shifted from the hospital to the home. Benefits of a home care system include reduced pressure on acute care facilities through expeditious discharge of patients to a setting that would allow for patients to be managed at their residence; convenience for patients; and bridging care between acute care facilities, rehabilitation programs, and long-term care facilities. Despite attempts in various health care systems to replace hospitals with services delivered to patients in the home[2], only a handful of population-based studies have examined home care utilization and its associated costs[3–6].

In Ontario, a province with a population of 13.2 million[7], home care services for permanent residents are provided through the publicly funded health care system. The provincial government (Ontario Ministry of Health and Long-Term Care through Community Care Access Centres) reimburses some home care services such as nursing care, personal support, and respite care. For each service delivered, a record of the type and cost of the service is captured in a provincial database linkable to other administrative data including the Ontario Cancer Registry. This population-level data provides researchers with a unique opportunity to explore utilization patterns and costs of home care services delivered to various populations—for example, women diagnosed with breast cancer (BC).

Breast cancer is a leading cause of morbidity and mortality in Canadian women[8]. Based on 10-year prevalence, an estimated 59,236 women in Ontario are living with BC[9]. The range of care and the treatment intent for BC patients can vary depending on factors such as prognosis or disease stage. It was hypothesized that home care services would be highly utilized in a BC population and increase with the severity of disease, because postsurgical drain or wound care, medication administration, and palliative or end-of-life needs are some of the services BC patients may receive through home care.

The objective of the present analysis was to determine

- the overall utilization and costs associated with home care services for individuals with a diagnosis of BC;
- the attributable utilization and costs for BC patients compared with a non-cancer control group; and
- the utilization and costs for BC patients by stage of disease at diagnosis and by the phase-of-care continuum.

2. METHODS

Incident cases of invasive BC in women (International Classification of Diseases, 9th Revision, code 174.x) diagnosed between January 1, 2005, and December 31, 2009, were extracted from the Ontario Cancer Registry. The Ontario Cancer Registry is a database of all Ontario residents who have been newly diagnosed with cancer, or who have died of cancer in Ontario. Breast cancer patients in the Ontario Cancer Registry were linked, by their encrypted health card number, to a spectrum of linkable administrative datasets for cancer diagnosis, disease severity, demographics, and home care utilization. Patients with an invalid health card number were excluded.

Disease stage (stage I–IV) at diagnosis for this BC cohort was obtained from Cancer Care Ontario, an agency that oversees the administration of cancer services in Ontario. The staging algorithm used the following hierarchy: collaborative > pathologic > clinical staging[10]. Home care data and demographic data (for example, age, income, region) were obtained from the Institute for Clinical Evaluative Sciences[a] using the Ontario Home Care Administrative System (before April 1, 2005) or the Home Care Database, formerly known as Central Home Care Client Database (from April 1, 2005), and using the Registered Persons Database.

Cases and controls were required to match exactly on sex, birth year, region, income group, and resource utilization band (RUB). The RUB is designed to measure the intensity of health care resources utilized (for example, extent of physician services and hospitalization) over a 2-year look-back period from the index date. Income group assignment was based on neighbourhood income per person equivalent from Statistics Canada's Postal Code Conversion File (version 5E). Each case was matched to 5 controls selected from the population of women never diagnosed with any type of cancer—that is, women without a record in the Ontario Cancer Registry. Control patients with an invalid health card number or those who had died before the diagnosis date of the matched BC patient were excluded. For each BC patient, the date of diagnosis was assigned as the index date. The index date for a control patient was the date on which they matched optimally with a case.

Home care activities included visits from a multidisciplinary team including nursing, physiotherapy, occupational therapy, respiratory services, nutrition consultant or dietician, speech language pathology, social work, psychology, case management, homemaking or personal support, placement services, and respite care. Unit costs (in 2009 Canadian dollars)[b] for home care services were based on sums reimbursed by Ontario Ministry of Health and Long-Term Care[12]. Each home care service was defined as a visit, and a visit was 1 hour. The services are mutually exclusive because they are recorded individually. All patients were followed from index date to death or to March 31, 2010, whichever came first.

The follow-up period was divided into three discrete care phases: initial, continuing, and terminal[13]. The initial care phase was defined as the first 6 months (180 days) after diagnosis. The terminal care phase was defined as the 6 months before death and was included only for BC patients who died during the study follow-up period. The continuing care phase was defined as the interval between the initial and terminal phases. The hierarchy terminal care > initial care > continuing care was used such that all phases were mutually exclusive. To illustrate, if a woman with BC died 6 months after the index diagnosis date, her 6-month data would be included only in the terminal phase, with no time allocated to the initial or continuing care phases. A patient who died 9 months after the index diagnosis date would have 6 months in the terminal phase, 3 months in initial care, and no time in continuing care. Finally, a patient who died 20 months after the index diagnosis date would have 6 months in the terminal phase, 6 months in initial care, and 8 months in continuing care. If a patient did not die within the study time horizon, the

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[a] The Institute for Clinical Evaluative Sciences is an independent, not-for-profit organization whose core function is to conduct research that contributes to the effectiveness, quality, equity, and efficiency of health care and health services in Ontario.

[b] On December 19, 2011, 1.00 Canadian dollar equalled 0.96 U.S. dollar[11].

patient would have at most 6 months of initial care, with any remaining time allocated to continuing care.

Summary statistics of the demographic characteristics for the BC and control patients were calculated. All home care utilization and cost data are presented as means weighted by the length of follow-up for each patient. Attributable home care activity utilization and costs for BC were determined by examining the differences between BC and control patients. The Pearson chi-square was used to compare the proportion of individuals with at least 1 home care visit between BC and control patients. The Cochran–Armitage trend test was used to compare the proportion of patients who used home care services between the BC patients at different stages. We calculated weighted costs per person–year for each subgroup by dividing the costs for patients in the subgroup during the whole study period by the corresponding years of follow-up. The cost per person–year was also calculated for patients in the various BC stages.

Home care services utilized and their costs were analyzed by phase of care and by stage of disease at diagnosis. Utilization and costs were estimated as a mean number of visits and costs over a 30-day time period.

Factors associated with costs per 30 days in each phase were assessed using multivariate linear regression analysis. The BC patients were included in the regression analysis only if the patient used home care in the phase of care being analyzed. The purpose of the regression model was to investigate factors associated with home care costs by phase of care among BC cases who had used home care in the phase of care of interest. The variables examined were age, income group, RUB, and stage at diagnosis.

All analyses were performed using the SAS software application (version 9.2: SAS Institute, Cary, NC, U.S.A.).

3. RESULTS

The mean age was 61.6 years for the BC and control patients alike. Of home care services provided, 93.6% were provided in private homes, 1.1% occurred in other residential units, and 3.3% had no location specified. Most members of the cohort resided in an urban setting; 20% were in the highest income group (Table I). Compared with 3% of the control patients, almost 11% of the BC patients died during the follow-up period. Among BC patients, 89.3% underwent breast-related surgery (total, radical, partial)[c]. Nearly 18% of the BC patients were not staged. Of the BC patients, 75% used at least 1 home care service; only 15% of control patients used such services. The attributable cost for home care service visits to BC patients compared with control patients was $885 per person–year (Table I). Overall, the average cost per service for the various demographic subgroups was generally more than 50% higher for BC than for control patients. When stratified by type of home care activity, nursing (56.5%), homemaking or support (38.3%), and physiotherapy (1.4%) were the most commonly reported home care activities provided to BC patients. For the control patients, homemaking or personal support (78.9%), nursing (15.2%), and physiotherapy (2.0%) were the most frequently reported home care activities used. The proportion of nursing and homemaking or personal support activities were significantly different between BC and control patients.

Most BC patients had early-stage disease. For BC patients only, the number of home care services used per year increased with the disease stage (Table II). The costs for home care services used by BC patients also increased per patient–year. Nursing care generally increased by stage (stage I: 52.0%; stage II: 59.7%; stage III: 68.1%; stage IV: 58.1%), and homemaking or support generally decreased by stage (stage I: 42.1%; stage II: 35.3%; stage III: 27.1%; stage IV: 36.1%).

Table III shows results by stage and phase. When stratified by stage, the number of home care services—and the 30-day costs—generally increased as the severity of the disease increased.

We used regression models to assess, by phase of care, factors associated with the 30-day costs (dependent variable) for BC patients who had used home care services (Table IV). The regression coefficients estimated the dollar value for the variable associated with home care. The regression analysis of home care costs for BC patients can be interpreted in two ways:

- Relative cost of a variable
- Estimation of the overall home care cost

With respect to relative cost, modelling the cost of home care in the initial phase of care showed that a BC patient less than 45 years of age had home care costs that were lower by $14.62. There was no change in costs for a BC patient 55–64 years of age, and for a BC patient between the ages of 75 and 84 years, costs were increased by $13.55 for 30-day home care. The estimate for overall home care cost during initial care for a woman 55–64 years of age, urban middle-income group, moderate RUB, and stage II at diagnosis is 330.89 + 0 + 42.90 + (–92.04) + 97.99, which totals to $379.74 for 30 days.

In the initial and continuation phases, aging was associated with increased 30-day home care costs; lower incomes were associated with increased 30-day home care costs; increased cancer severity was associated with increased 30-day home care costs. Also, as RUB intensity (patients with a prior history of higher health care utilization) increased, the 30-day

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[c] The Canadian Classification of Intervention codes used to identify surgery were 1YM87, 1YM88, 1YM89, 1YM90, 1YM91, and 1YM92.

TABLE I Baseline demographics and associated costs for the breast cancer and control cohorts investigated

Variable	*Cases*				*Controls*			
	(n)	*(%)*	*Mean home care services used per person–year (n)*	*Home care costs per person–year*	*(n)*	*(%)*	*Mean home care services used per person–year (n)*	*Home care costs per person–year*
Individuals (*n*)	39,656	—			198,280	—		
Using home care services	29,882	75.4	14.97	$1210	28,941	14.6	6.13	$325
Age (years)								
Mean	61.56±14.01				61.56±14.02			
Median (interquartile range)	61 (51–72)				61 (51–72)			
Rural								
Yes	5,010	12.6	17.02	$1407	25,050	12.6	0.81	$322
No	34,613	87.3	14.68	$1182	173,065	87.3	6.05	$350
Missing	33	0.1	7.37	$578	165	0.1	6.65	$60
Income groups								
Urban lowest	6,043	15.2	19.62	$1479	30,125	15.2	8.61	$453
Urban second-lowest	6,630	16.7	15.24	$1225	33,195	16.7	6.56	$336
Urban middle	6,868	17.3	15.07	$1221	34,340	17.3	5.67	$305
Urban second-highest	7,334	18.5	12.84	$1078	36,670	18.5	5.36	$287
Urban highest	7,717	19.5	11.77	$982	38,585	19.5	4.6	$256
Rural	4,996	12.6	17.05	$1409	24,980	12.6	6.66	$350
Missing	59	0.1	12.36	$815	295	0.1	2.56	$134
Resource utilization band								
None	453	1.1	14.29	$1353	2,265	1.1	0.8	$58
Healthy user	209	0.5	10.93	$1143	1,045	0.5	0.1	$12
Low	2,109	5.3	10.59	$1043	10,545	5.3	1.04	$59
Moderate	22,034	55.6	11.49	$1027	110,170	55.6	2.76	$151
High	9,851	24.8	16.74	$1304	49,255	24.8	7.61	$409
Highest	5,000	12.6	30.53	$1979	25,000	12.6	21.62	$1114

home care costs increased. The terminal care phase did not show clear relationships. A consistent pattern across all phases of care was observed only with stage, where costs increased with disease severity.

4. DISCUSSION

Our results show that 75% of BC patients and 15% of control patients received at least 1 home care service. Within the first 180 days after diagnosis (initial care), home care costs for BC patients were approximately 4 times those for control patients. The higher costs in the initial care phase may be a result of postoperative nursing care—for example, wound management (in our cohort, 89% of BC patients underwent a BC-related surgical intervention). Post-surgery care commonly involves drainage tube management, which could well be handled by community-based nurses. Because not all patients receiving surgical interventions also received home care services, we hypothesize that the difference would be either different referral patterns, continued hospitalization, or no additional care being required.

Costs for the BC patients were also high in both the continuation and terminal care phases, which could represent additional nursing care for management of treatment-related side effects during treatment of metastatic disease or for end-of-life care. These differential service intensities are in line with findings reported for other cohorts[14].

Utilization and associated costs increased with disease severity through stages I–III, but actually declined in patients with stage IV disease at diagnosis. Interestingly, the rates of home care utilization differ between stages I and II, when similar utilization rates might be anticipated, given similar surgical procedures. Further investigation showed more extensive surgery in stage II (23%) than in stage I (8%) for mastectomy. However, it is possible that patients with stage II disease may have had more extensive surgery

TABLE II Breast cancer cases with at least one home care service, overall and by stage of disease at diagnosis

Group	*Cohort size* (n)	*Patients with home care services* (n)	(%)	*Services per patient–year* (n)	*Cost per patient–year*
Cases	39,656	29,882	75.4[a]	14.97[a]	$1210[a]
Controls	198,280	28,941	14.6	6.13	$325
					Attributable: $885
Cases					
Stage I		8,464	62.1	8.35	$679
Stage II		10,797	85.7	15.94	$1318
Stage III		4,507	94.6	25.17	$2170
Stage IV		1,228	79.1	55.75	$4546
Not staged		4,886	68.7	15.00	$1101

[a] $p < 0.01$.

TABLE III Home care services and costs by phase of care and stage of disease at diagnosis

Variable	*Cases*	*Stage I*	*Stage II*	*Stage III*	*Stage IV*	*Not staged*
Individuals (*n*)	39,656	13,628	12,602	4,765	1,553	7,108
Initial care (*n*)[a]	26,561					
Contributors to person-days in this phase (*n*)	38,542	13,587	12,500	4,688	1,194	6,573
Patients utilizing home care service [*n* (%)]	26,589 (69.0)	7,759 (57.1)	10,117 (80.9)	4,096 (87.4)	789 (66.1)	3,828 (58.2)
Services/30 days (*n*)						
Mean	2.57	1.53	3.01	4.09	4.53	2.47
95% CL	2.53, 2.62	1.47, 1.58	2.93, 3.09	3.94, 4.25	4.09, 4.98	2.34, 2.59
Cost per 30 days						
Mean	$262	$165	$312	$412	$416	$234
95% CL	258, 266	160, 169	305, 318	400, 424	382, 450	224, 244
Continuation care[a]	14,025					
Contributors to person-days in this phase (*n*)	35,863	12,742	11,640	4,271	979	6,231
Patients utilizing home care service [*n* (%)]	14,041 (39.2)	3,058 (24.0)	5,269 (45.3)	2,718 (63.6)	615 (62.8)	2,381 (38.2)
Services/30 days (*n*)						
Mean	1.04	0.52	1.06	1.71	4.12	1.11
95% CL	0.99, 1.08	0.47, 0.57	0.98, 1.14	1.57, 1.85	3.56, 4.67	1.00, 1.21
Cost per 30 days						
Mean	$71	$33	$71	$130	$313	$71
95% CL	68, 73	30, 35	66, 75	121, 138	276, 350	64, 78
Terminal care[a]	2,968					
Contributors to person-days in this phase (*n*)	4,295	387	789	742	822	1,555
Patients utilizing home care service [*n* (%)]	2,970 (69.2)	358 (66.7)	580 (73.5)	599 (80.7)	620 (75.2)	913 (58.7)
Services/30 days (*n*)						
Mean	7.37	6.11	6.68	8.93	8.76	6.55
95% CL	7.00, 7.73	4.88, 7.35	5.92, 7.44	8.02, 9.84	7.87, 9.66	5.95, 7.15
Cost per 30 days						
Mean	$604	$477	$488	$713	$770	$554
95% CL	574, 634	359, 595	438, 538	646, 779	700, 841	500, 608

[a] Comparison between stage I, II, III, IV patients, $p < 0.001$. Chi-square test for categorical variables, one-way analysis of variance for continuous variables.
CL = confidence limits.

TABLE IV Regression coefficients estimate 30-day home care costs for breast cancer cases that utilized home care

Variable	*Initial care*		*Continuation care*		*Terminal care*	
	Parameter estimate	*Standard error*	*Parameter estimate*	*Standard error*	*Parameter estimate*	*Standard error*
Intercept	330.89	9.72[a]	168.25	13.68[a]	811.60	103.52[a]
Age group (reference: 55–64 years)						
<45 Years	–14.62	7.62	–38.84	10.35[a]	–135.26	84.27
45–54 Years	–13.44	6.43[b]	–29.68	8.97[a]	–111.84	70.82
65–74 Years	–12.42	6.82	33.85	10.01[a]	–122.83	67.45
75–84 Years	13.55	7.73	83.02	10.77[a]	–106.43	64.58
≥85 Years	37.10	12.17[b]	161.91	15.29[a]	25.14	74.05
Income group (reference: Urban highest)						
Urban lowest	72.22	7.73[a]	77.00	10.74[a]	57.84	69.84
Urban second-lowest	46.06	7.56[a]	36.04	10.69[a]	–25.88	70.41
Urban middle	42.90	7.45[a]	28.29	10.53[b]	86.56	70.67
Urban second-highest	22.69	7.32[b]	7.83	10.37	62.55	71.53
Rural	69.83	8.04[a]	22.84	10.87[b]	50.13	73.83
Resource utilization band (reference: Highest)						
None	25.53	28.45	23.30	33.12	17.09	164.87
Healthy user	–107.03	32.34[a]	–109.12	45.48[b]	72.30	257.69
Low	–113.53	11.83[a]	–94.60	16.15[a]	–115.52	113.97
Moderate	–92.04	7.42[a]	–102.90	9.84[a]	–62.27	54.38
High	–70.63	8.01[a]	–68.15	10.53[a]	–120.79	57.96
Stage (reference: Stage I)						
Stage II	97.99	5.56[a]	34.16	8.44[a]	–44.39	82.57
Stage III	184.17	7.13[a]	85.52	9.79[a]	181.99	82.93[b]
Stage IV	334.14	13.74[a]	369.67	16.37[a]	318.63	82.55[a]
Not staged	103.22	7.31[a]	29.37	10.17[b]	220.82	77.73[b]

[a] $p < 0.001$.

[b] $p < 0.05$.

requiring more postoperative outpatient care, or may have received more aggressive adjuvant therapy and radiation therapy, requiring additional home care support. Further analysis of surgical interventions and home care utilization is ongoing.

The 30-day home care costs increased with more severe disease, indicating that home care services increased when BC patients presented at a more advanced stage or as the disease advanced. Home care costs increased as income decreased, but increased as the level of previous health care utilization increased. In those instances, patients with higher incomes might use fewer publicly or government-funded home care services, hypothetically because of access to private home care services or informal care. That hypothesis cannot be proved using administrative databases.

In terms of phases of care in the present study, we relied on earlier work using a phase framework for costing[13]. Although a patient who dies within 6 months of diagnosis may receive a mix of both initial and terminal care, that patient is analyzed under terminal care. The complexity of the disease and the care provided may not be fully captured by the three simple phases used, but there is evidence for the three phases when the outcome is cost of care.

Based on the regression analysis, the variables in the terminal phase are generally not associated with home care costs, possibly indicating that costs are associated with need. In the continuing care phase, age and RUB might indicate an unmet need concerning care for other comorbid disease, because home care related to surgery was less likely a factor. Lower income was associated with higher costs in the initial and continuing care phases, possibly indicating that patients with the means are opting for private services, potentially because of the relative availability of publicly funded home care services. Stage was the only variable that was consistently associated with home care costs across all phases—a finding that appears to indicate that costs are associated with clinical needs.

A number of studies have shown that care in the community is less expensive than institutional or residential care[5,15–18]. Some of the home care costing work has been nested under the palliative or end-of-life care umbrella[14,19,20]. Walker and colleagues reported that the average home expenditure per patient for end-of-life care for a number of disease sites was $15,866 over an average of 141 days of care; however, it is unclear how much home care activity contributed to that figure[21].

The overall attributable cost calculated in the present study would translate to a provincial cost of approximately $7.0 million annually attributed to BC patients among all patients receiving home care services ($885 × 39,656 BC patients over a 5-year time horizon). To put that number into perspective, the Ontario Ministry of Health budget for 2009–2010 was $42.7 billion. Thus, home care services for BC patients represented 0.02% of the total health care budget per annum[18].

The administrative data do not reveal the purpose of the home care service, its efficiency of delivery, the effectiveness or sufficiency of the care given, the quality of the care, or even the appropriateness of home care. An examination of treatment management guidelines for home care service utilization would be required to determine the appropriateness of the care.

The results of the present analysis are representative only of the BC cohort from this provincial dataset. Population-based studies for other disease site cohorts are required to examine similarities and differences in utilization and associated costs[14,16,20,22–27]. The data source was administrative data from Ontario, which may not contain all variables of interest regarding home care utilization. A prospective study of primary care and home care records would be necessary to provide service-level details[14]. However, the database is representative of the entire BC population in Ontario during the years analyzed and presents attributable costs. A lack of staging information may influence service and cost allocation. More complete staging information for BC patients is available from Cancer Care Ontario starting in 2007.

Moving patient care from the hospital acute-care setting to the community and home care setting may raise concerns that costs are being shifted from the health sector to unpaid caregivers. However, the present study captured data only from the health system perspective and does not include any services provided by informal caregivers (for example, family and friends) who would be paying for such costs out of pocket—or for that matter, privately paid caregivers. A number of studies have examined informal care and have considered it costly[28–31]. We recognize that our work here represents only a portion of the home care received by individuals.

5. CONCLUSIONS

To date, the type and costs of home care services specific to the management of a single cancer type by the extent of disease present at diagnosis has not been examined in Ontario. A better understanding of the home care experience of women with BC may help to refine future resource allocation decisions.

At a population level, BC patients used twice as many home care services as did a matched control group, at approximately 4 times the cost. Home care services used by women with a diagnosis of BC were more than double those incurred for control patients. Greater disease stage was associated with increased home care utilization and correspondingly increased costs. Less than $1000 was spent on home care services per BC patient per year in Ontario. Compared with institutional costs, in which hospital days are typically costed at more than $1000 daily, shifting health services to the community through the use of home care services may represent potential savings to the health care system if quality services are available, effective, and appropriate.

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All authors contributed to the conception and design of the study. All authors contributed to the analysis and interpretation of the data. All authors critically revised this report for content and approved the final version of the manuscript that was submitted for publication.

7. CONFLICT OF INTEREST DISCLOSURES

The authors have no financial conflicts of interest to declare.

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