

# Patterns of physician follow-up among young cancer survivors

*Report of the Childhood, Adolescent, and Young Adult Cancer Survivors (CAYACS) research program*

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## Abstract

**Objective** To describe the frequency and pattern of physician visits in 1998 to 2000 among childhood and adolescent cancer survivors in British Columbia (BC), to compare their use of physician services with use in the general population, and to examine the effects of clinical and sociodemographic factors on care.

**Design** Retrospective, observational, population-based cohort study, with a comparison group. Cohort records from population registries were linked to physician claim data and oncology visit records for 1998 to 2000.

**Setting** Outpatient physician care in BC.

**Participants** All (N=1157) survivors of cancer diagnosed before age 20 years in BC between 1970 and 1992 who survived at least 5 years after diagnosis, and an age-sex frequency-matched population sample of 11 570 individuals.

**Main outcome measures** Probability of a physician visit and frequency of physician visits.

**Results** Approximately 97% of survivors saw at least 1 physician in the 3-year period, compared with 50% of the general population sample. The probability of a GP visit was 96% higher (adjusted 95% confidence interval [CI] 1.8 to 2.1), and the likelihood of a specialist visit was 157% higher (adjusted 95% CI 2.4 to 2.8) than for the general population. Survivors were more than twice as likely to see GPs at least 10 times (adjusted relative risk 2.23, 95% CI 2.0 to 2.4) and had 49% more visits than the general population. Cancer diagnosis and treatment affected visit patterns, but socioeconomic status and rural residency did not significantly affect the probability of a visit.

**Conclusion** Demand for physician care among childhood and adolescent cancer survivors is considerably greater than for the general population, and this need persists many years after diagnosis. Physicians need information on the unique health care requirements of this patient group in order to provide appropriate care.

## EDITOR'S KEY POINTS

- Because of continuing health risks among childhood and adolescent cancer survivors, their use of health services is likely to exceed that of the general population. This study sought to examine the frequency and pattern of physician visits and compared this to use by the general population.
- This study, using health administrative data sets, is the first to demonstrate increased demand for both family physician care and specialist care among childhood cancer survivors in Canada. Almost all survivors visit physicians in a 3-year period. This increased demand persists up to 20 years after diagnosis. Very high users included those with previous central nervous system tumours or those who received therapy other than surgery alone.

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# Le suivi médical des jeunes survivants du cancer

## Rapport du programme de recherche Childhood Adolescent and Young Adult Cancer Survivors (CAYACS)

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### Résumé

**Objectif** Décrire le type et la fréquence des visites médicales effectuées par des enfants et des adolescents survivants du cancer entre 1998 et 2000 en Colombie-Britannique (CB), comparer l'usage qu'ils font des services médicaux à celui de la population générale et déterminer comment les facteurs cliniques et sociodémographiques influencent les soins.

**Type d'étude** Étude de cohorte stratifiée rétrospective et d'observation, incluant un groupe de comparaison. Les dossiers de la cohorte tirés de registres de la population ont été mis en lien avec les données des réclamations des médecins et avec les visites oncologiques enregistrées entre 1998 et 2000.

**Contexte** Soins donnés à des patients externes par des médecins en CB.

**Participants** Tous ceux (N=1157) qui ont eu un diagnostic de cancer avant l'âge de 20 ans en CB entre 1970 et 1992 et qui ont survécu au moins 5 ans après ce diagnostic, et un échantillon de 11 570 sujets de la population générale appariés en fréquence pour l'âge et le sexe.

**Principaux paramètres à l'étude** Probabilité de consulter un médecin et fréquence des visites à des médecins.

**Résultats** Environ 97% des survivants ont consulté au moins 1 médecin durant la période de 3 ans, contre 50% pour ceux de la population générale. La probabilité pour les survivants de consulter un MF était 96% plus grande (intervalle de confiance à 95% [IC] ajusté 1,8 à 2,1) et celle de consulter un spécialiste était 157% plus grande (IC ajusté 2,4 à 2,8) que pour la population générale. Les survivants étaient plus de deux fois plus susceptibles de consulter un MF au moins 10 fois (risque relatif ajusté 2,23, IC à 95% 2,0 à 2,4) et avaient fait 49% plus de visites que ceux de la population générale. Le modèle des visites était influencé par le diagnostic de cancer, mais le statut socioéconomique et la résidence rurale n'avaient pas d'influence significative sur la probabilité d'une visite.

**Conclusion** La demande de soins de la part des médecins est beaucoup plus grande chez les enfants et les adolescents survivants du cancer que chez ceux de la population générale, et ce besoin persiste plusieurs années après le diagnostic. Les médecins doivent prendre conscience des soins particuliers que requièrent ces patients afin de leur prodiguer des soins appropriés.

#### POINTS DE REPÈRE DU RÉDACTEUR

- Parce que les enfants et les adolescents survivants du cancer continuent d'être à risque de problèmes de santé, ils sont susceptibles de faire un plus grand usage des services de santé que ceux de la population générale.
- Cette étude, qui utilisait diverses données administratives de la santé, est la première à démontrer qu'au Canada, les enfants survivants du cancer exigent davantage de soins de la part des médecins de famille et des spécialistes. Presque tous ces survivants consultent des médecins sur une période de 3 ans. Cette plus grande demande de soins persiste jusqu'à 20 ans après le diagnostic. Les plus fortes demandes proviennent de ceux qui ont eu des tumeurs du système nerveux central ou qui ont dû avoir des traitements autres que chirurgicaux.

Owing to considerable advances in treatment, approximately 80% of Canadian children and adolescents diagnosed with cancer now survive 5 or more years after diagnosis.<sup>1</sup> Between 63% and 75% of survivors face chronic or late-occurring health problems, which are often related to treatment.<sup>1-10</sup> High-quality follow-up care of these survivors involves ongoing surveillance and care related to cancer recurrence and late effects of the cancer or its treatment, as well as addressing general care needs such as promotion of healthy behaviour, screening, and care of unrelated conditions.<sup>2,11-14</sup> In addition to health status and health risk or need, use of health services is affected by predisposition to using services and the ability to obtain services.<sup>15</sup>

Two questionnaire-based studies have reported on physician consultation by childhood cancer survivors.<sup>16,17</sup> Self-selection of participants, self-reported use of physician services, and either the lack of a comparison group or low participation from controls might affect the validity of these results. This study seeks to address these methodologic concerns and to provide more detailed assessment of physician consultation in Canada in a geographically defined cohort of survivors with a longer follow-up period.

The Childhood, Adolescent, and Young Adult Cancer Survivors (CAYACS) research program has assembled a cohort of all 5-year survivors of cancer or tumours diagnosed before 25 years of age in British Columbia (BC) between 1970 and 1995, as well as population comparison groups from provincial registries, and linked these records to provincial administrative data sets, including health care data sets, with follow-up data to the end of 2000.<sup>18</sup> Our objective in this particular study was to assess physician visits among childhood and adolescent survivors in a 3-year period by comparing their visit patterns to those of the general population and identifying factors associated with physician visits.

## METHODS

### Identification of survivor cohort

There were 1816 individuals identified from the BC Cancer Registry who were diagnosed before 20 years of age between January 1, 1970, and December 31, 1992, with a primary cancer or tumour as defined by the International Classification of Childhood Cancers,<sup>19,20</sup> who resided in BC at the time of diagnosis, who survived 5 or more years after diagnosis, and who were still alive on December 31, 2000. The survivor study group consisted of 1157 (64% of 1816) survivors whose records linked to the client registry and claims file of the provincial health insurance plan during the study period, indicating provincial residence, using a unique person-specific health identifier number. The linked files of the survivor group were de-identified for analysis.

### Identification of comparison group

An anonymized, randomly selected population sample of 11 570 individuals (who lived to at least 5 years of age, who were still alive and registered with the provincial health insurance plan from January 1, 1998, to December 31, 2000, and who were frequency-matched by birth year and sex to the survivor group) was obtained from the client registry of the BC health insurance plan, and linked to the claims file using the health identifier number.

### Data collection

For survivors, demographic and diagnostic information was obtained from the provincial cancer registry. For both study groups, annual residence (postal code) and alive BC residence follow-up information (recorded as active insurance status) was obtained from the provincial health insurance plan client registry. The health insurance claims file provided information about dates of physician visits, scrambled physician numbers, and practitioner types for all fee-for-service outpatient visits. Information on pediatric oncology visits was manually abstracted from scheduling records at the BC Children's Hospital (BCCH), the only provincial pediatric oncology referral centre. Information on other (medical and radiation) oncology visits was obtained from electronic scheduling records at the BC Cancer Agency (BCCA), the provincial cancer agency where all radiation therapy and adult-age pediatric oncology follow-up care is delivered. Information on primary treatment, relapse or recurrence, and subsequent primary cancers was manually abstracted from medical charts at BCCH and BCCA.

### Outcome measures

All visits by a patient to a particular oncologist on a single day were counted as 1 visit. Similarly, a visit to any other health practitioner was defined as at least 1 fee claim for a specific client by an individual practitioner on a single calendar day. Practitioner type was captured by certification in a particular specialty, including GPs, which might differ from type of care provided. An initial visit to a specialist can only occur through referral from a GP; return visits within a specified time period do not require additional referral. For each subject, the total number of health practitioner visits (overall and by practitioner type) from 1998 to 2000 was determined.

### Potential modifying variables

These included sex, attained age (as of December 31, 2000), socioeconomic status, region (defined according to regional health administrative area), and rural or urban residence at the beginning of the observation period (January 1, 1998). Socioeconomic status was determined by linking postal codes of residence to neighbourhood-level census data for 1996, the closest census year to the start of the observation period.<sup>21</sup>

Urban or rural residence was classified by geographic area based on population size and socioeconomic homogeneity.<sup>22</sup> Potential clinical modifiers of visits among survivors included initial cancer diagnosis, age at diagnosis, time since diagnosis, calendar period of diagnosis, primary treatment, and relapse and second-cancer status at the start of the follow-up period.

## Statistical analysis

Two-part regression was used to model the probability of a physician visit and the number of visits (for those with 1 or more visits). Multiple Poisson regression was performed to calculate the relative risk (RR) of visiting a physician at least once.<sup>23</sup> Trend tests for the ordered categorical variables were performed by assigning a numeric value to each factor level and treating the resulting variable as continuous in the Poisson model; the *P* value of this covariate indicates the strength of the linear trend. For total visits, GP visits, and total specialist visits, linear regression on the logarithm of non-zero visit counts was performed to calculate the ratio of the number of visits between cases and controls with at least 1 visit. All analyses were performed using R software from R Foundation for Statistical Sciences, version 1.8.1,<sup>24</sup> using 2-sided tests with  $\alpha=.05$ .

## Study and data approvals

Ethics approvals were obtained from the University of British Columbia-affiliated BCCA and BCCH clinical research ethics boards. Approvals for data use were obtained from the BC Cancer Registry, the BCCH and BCCA health records departments, the BC Ministry of Health, and BC Vital Statistics. The Ministry of Health required suppression of cells with fewer than 5 patients in the text and tables to protect confidentiality.

## RESULTS

### Description of study populations

Sociodemographic characteristics of the subjects and survivors and the clinical attributes of the survivors are shown in **Tables 1** and **2**. Among survivors, the mean time from diagnosis to the end of the follow-up period was 13.2 years (range 8 to 20 years), and the mean attained age was 25.5 years. By the end of 2000, 61% of survivors were 20 years of age or older.

### Comparison of physician visits

From 1998 to 2000, 97% of survivors visited at least 1 physician, compared with 50% of the population sample (**Table 3**). After controlling for sociodemographic factors, survivors were significantly more likely than those in the general population group to consult any physician (oncologists were not included) (adjusted

RR=1.97, 95% confidence interval [CI] 1.9 to 2.1), have at least 1 GP visit (adjusted RR=1.96, 95% CI 1.8 to 2.1), and have at least 10 GP visits (adjusted RR=2.23, 95% CI 2.0 to 2.4). Survivors were also significantly more likely to visit any of the identified specialists expected to be visited as a result of known late effects (adjusted RR=2.57, 95% CI 2.4 to 2.8) and twice as likely to use claims-related (ie, physician-referred) services of nonphysician health practitioners (adjusted RR=1.86, 95% CI 1.7 to 2.0). The increase in probability of a visit to a GP or a specialist (not including oncologists)

**Table 1. Characteristics of survivors and controls**

| CHARACTERISTICS      | CONTROLS<br>(N = 11570),<br>N (%) | SURVIVORS<br>(N = 1157),<br>N (%) | P<br>VALUE* |
|----------------------|-----------------------------------|-----------------------------------|-------------|
| Sex                  |                                   |                                   | NA          |
| • Male               | 6110 (52.8)                       | 611 (52.8)                        |             |
| • Female             | 5460 (47.2)                       | 546 (47.2)                        |             |
| Age in 2000, y       |                                   |                                   | .608        |
| • 5-19               | 3448 (29.8)                       | 358 (30.9)                        |             |
| • 20-34              | 6238 (53.9)                       | 621 (53.7)                        |             |
| • ≥ 35               | 1884 (16.3)                       | 178 (15.4)                        |             |
| Socioeconomic status |                                   |                                   | .149        |
| • 5 (highest)        | 2138 (18.5)                       | 244 (21.1)                        |             |
| • 4                  | 2066 (17.9)                       | 216 (18.7)                        |             |
| • 3                  | 2133 (18.4)                       | 190 (16.4)                        |             |
| • 2                  | 2248 (19.4)                       | 221 (19.1)                        |             |
| • 1 (lowest)         | 2404 (20.8)                       | 223 (19.3)                        |             |
| • Unknown            | 581 (5.0)                         | 63 (5.4)                          |             |
| Residence            |                                   |                                   | .078        |
| • Metropolitan area  | 6443 (55.7)                       | 624 (53.9)                        |             |
| • Large community    | 1660 (14.3)                       | 191 (16.5)                        |             |
| • Small community    | 1599 (13.8)                       | 174 (15.0)                        |             |
| • Rural area         | 1868 (16.1)                       | 168 (14.5)                        |             |
| Region of residence  |                                   |                                   | .320        |
| • Vancouver Coastal  | 2690 (23.2)                       | 245 (21.2)                        |             |
| • Interior           | 1956 (16.9)                       | 208 (18.0)                        |             |
| • Fraser             | 3852 (33.3)                       | 402 (34.7)                        |             |
| • Island             | 2015 (17.4)                       | 202 (17.5)                        |             |
| • Northern           | 1014 (8.8)                        | 99 (8.6)                          |             |
| • Unknown            | 43 (0.4)                          | <5* (<0.4)                        |             |

\*Calculated using  $\chi^2$  tests.

\*Exact number suppressed to protect confidentiality.



**Table 2. Clinical characteristics of survivors**

| CHARACTERISTICS                        | SURVIVORS (N = 1157*), N (%) |
|--|------------------------------|
| Age at diagnosis, y                    |                              |
| • 0–4                                  | 404 (35.0)                   |
| • 5–9                                  | 217 (18.8)                   |
| • 10–14                                | 218 (18.9)                   |
| • 15–19                                | 315 (27.3)                   |
| Time since diagnosis, y                |                              |
| • 5–9                                  | 194 (16.9)                   |
| • 10–14                                | 377 (32.9)                   |
| • 15–19                                | 283 (24.7)                   |
| • 20–24                                | 188 (16.4)                   |
| • ≥ 25                                 | 103 (9.0)                    |
| Diagnosis                              |                              |
| • ALL                                  | 242 (20.9)                   |
| • Other leukemia                       | 30 (2.6)                     |
| • Hodgkins lymphoma                    | 135 (11.7)                   |
| • Non-Hodgkins lymphoma                | 65 (5.6)                     |
| • CNS tumour                           | 229 (19.8)                   |
| • Renal tumour                         | 73 (6.3)                     |
| • Bone tumour                          | 52 (4.5)                     |
| • Carcinomas                           | 102 (8.8)                    |
| • Other                                | 229 (19.8)                   |
| Period of diagnosis                    |                              |
| • 1970–1980 (11 y)                     | 259 (22.4)                   |
| • 1981–1990 (10 y)                     | 618 (53.4)                   |
| • 1991–1995 (6 y)                      | 280 (24.2)                   |
| Treatment                              |                              |
| • Surgery only                         | 243 (21.0)                   |
| • Radiation only                       | 46 (4.0)                     |
| • Chemotherapy only                    | 194 (16.8)                   |
| • Chemotherapy and surgery             | 150 (13.0)                   |
| • Chemotherapy and radiation           | 208 (18.0)                   |
| • Radiation and surgery                | 138 (11.9)                   |
| • Chemotherapy, radiation, and surgery | 105 (9.1)                    |
| • Unknown                              | 73 (6.3)                     |

ALL—acute lymphoblastic leukemia, CNS—central nervous system.

\*Data were not available for all survivors for all characteristics.

## Factors affecting physician visits among survivors

Female survivors were significantly more likely to have 10 or more GP visits (RR=1.78, 95% CI 1.5 to 2.1) and were more likely to visit specialists (RR=1.15, 95% CI 1.0 to 1.3) than male survivors were (Table 4), consistent with sex-specific health services use patterns in the general population. Socioeconomic status and rural residence did not affect the likelihood of any type of physician visit. Older survivors were more likely to have 10 or more GP visits than younger survivors were, with a significant trend with increasing age ( $P=.003$ ). No disease- or treatment-related factors were shown to affect the risk of having a GP or specialist visit, and the time since diagnosis also showed no effect. Survivors of bone tumours had an increased likelihood of oncologist visits compared with survivors of acute lymphoblastic leukemia (RR=3.89, 95% CI 1.9 to 7.8), while survivors having received any chemotherapy treatment for their primary cancer were significantly more likely to have oncologist visits compared with survivors who received only surgery.

As shown in Table 5, (for those with at least 1 visit) female survivors had almost twice the number of GP visits of male survivors and 34% more specialist visits, again as expected based on sex-specific health services use patterns in the general population. A trend toward more visits with increasing age was seen for both GP and oncologist visits ( $P<.001$ ). Visits to all physicians, and GPs specifically, increased with lower socioeconomic status ( $P<.001$ ), but socioeconomic status did not affect specialist or oncologist visits. Regions other than the Vancouver Coastal Health Authority had slightly higher numbers of visits to GPs compared with other regions; living in a rural area did not appear to affect the number of physician visits (data not shown).

Survivors of tumours of the central nervous system had significantly more overall visits (RR=1.25, 95% CI 1.1 to 1.5) and specialist visits (RR=1.33, 95% CI 1.1 to 1.7) compared with survivors of acute lymphoblastic leukemia. Survivors who had experienced relapses had significantly more visits to all types of physicians (RR=1.44, 95% CI 1.2 to 1.7). When compared with survivors who had had surgery only, survivors who had had other treatment combinations had increased overall visit frequency and specialist visit frequency.

## DISCUSSION

Almost all survivors saw at least 1 physician in the 3-year period studied, approximately twice as often as their peers without previous cancer diagnoses. They also used specialist services more often than the general population did. Those with initial diagnoses of central nervous

for survivors compared with the population sample was higher for male participants than for female participants. Similar results were seen for adult-age survivors consulting any physician, consulting GPs or specialists (except for pediatricians), and visiting a GP at least 10 times.

Among those who had at least 1 visit (of any kind), survivors had 49% more visits overall than the population group, 28% more visits to GPs, 65% more visits to specialists, and 18% more visits to nonphysician health practitioners (Table 3).

**Table 3. Physician visits of survivors and controls from 1998 to 2000: Results in boldface are statistically significant.**

| PHYSICIAN VISITS                   | SURVIVORS<br>N (%) | CONTROLS<br>N (%) | VISIT PROBABILITY |                 | VISIT PROBABILITY (ADJUSTED) |                 | RELATIVE VISIT FREQUENCY* |                |
|------------------------------------|--------------------|-------------------|-------------------|-----------------|------------------------------|-----------------|---------------------------|----------------|
|                                    |                    |                   | RR                | 95% CI          | ADJUSTED RR <sup>†</sup>     | 95% CI          | ADJUSTED<br>VISIT RATIO   | 95% CI         |
| Physician (excluding oncologists)  | 1125 (97.2)        | 5758 (49.8)       | <b>1.95</b>       | <b>1.8–2.1</b>  | <b>1.97</b>                  | <b>1.9–2.1</b>  | <b>1.49</b>               | <b>1.5–1.6</b> |
| General practitioner               | 1112 (96.1)        | 5730 (49.5)       | <b>1.94</b>       | <b>1.8–2.1</b>  | <b>1.96</b>                  | <b>1.8–2.1</b>  | <b>1.28</b>               | <b>1.2–1.4</b> |
| • At least 10 visits               | 607 (52.5)         | 2758 (23.8)       | <b>2.20</b>       | <b>2.0–2.4</b>  | <b>2.23</b>                  | <b>2.0–2.4</b>  | NA                        |                |
| Specialist (excluding oncologists) | 863 (74.6)         | 3394 (29.3)       | <b>2.54</b>       | <b>2.4–2.7</b>  | <b>2.57</b>                  | <b>2.4–2.8</b>  | <b>1.65</b>               | <b>1.5–1.8</b> |
| • Dermatology                      | 159 (13.7)         | 593 (5.1)         | <b>2.68</b>       | <b>2.3–3.2</b>  | <b>2.72</b>                  | <b>2.3–3.2</b>  | 0.92                      | 0.8–1.1        |
| • Neurology                        | 126 (10.9)         | 230 (2.0)         | <b>5.48</b>       | <b>4.4–6.8</b>  | <b>5.61</b>                  | <b>4.5–7.0</b>  | <b>1.45</b>               | <b>1.3–1.7</b> |
| • Psychiatry                       | 73 (6.3)           | 262 (2.3)         | <b>2.79</b>       | <b>2.2–3.6</b>  | <b>2.85</b>                  | <b>2.2–3.7</b>  | 0.90                      | 0.6–1.3        |
| • Obstetrics and gynecology        | 144 (26.4)         | 824 (15.1)        | <b>1.75</b>       | <b>1.5–2.1</b>  | <b>1.77</b>                  | <b>1.5–2.1</b>  | 0.90                      | 0.8–1.1        |
| • Ophthalmology                    | 208 (18.0)         | 439 (3.8)         | <b>4.74</b>       | <b>4.0–5.6</b>  | <b>4.78</b>                  | <b>4.1–5.6</b>  | <b>1.21</b>               | <b>1.1–1.4</b> |
| • Otolaryngology                   | 127 (11.0)         | 324 (2.8)         | <b>3.92</b>       | <b>3.2–4.8</b>  | <b>3.94</b>                  | <b>3.2–4.8</b>  | <b>1.21</b>               | <b>1.0–1.4</b> |
| • Surgery                          | 362 (31.3)         | 1062 (9.2)        | <b>3.41</b>       | <b>3.0–3.8</b>  | <b>3.43</b>                  | <b>3.0–3.9</b>  | <b>1.21</b>               | <b>1.1–1.3</b> |
| • Pediatrics                       | 234 (20.2)         | 234 (2.0)         | <b>10.0</b>       | <b>8.3–12.0</b> | <b>9.95</b>                  | <b>8.3–11.9</b> | <b>1.58</b>               | <b>1.3–1.9</b> |
| • Internal medicine                | 296 (25.6)         | 850 (7.3)         | <b>3.48</b>       | <b>3.1–4.0</b>  | <b>3.59</b>                  | <b>3.2–4.1</b>  | <b>1.30</b>               | <b>1.2–1.5</b> |
| • Urology                          | 61 (5.3)           | 194 (1.7)         | <b>3.14</b>       | <b>2.4–4.2</b>  | <b>3.19</b>                  | <b>2.4–4.3</b>  | 0.90                      | 0.7–1.1        |
| • Other physician                  | 194 (16.8)         | 868 (7.5)         | <b>2.24</b>       | <b>1.9–2.6</b>  | <b>2.26</b>                  | <b>1.9–2.6</b>  | <b>1.12</b>               | <b>1.0–1.2</b> |
| Nonphysician practitioner          | 702 (60.7)         | 3801 (32.9)       | <b>1.85</b>       | <b>1.7–2.0</b>  | <b>1.86</b>                  | <b>1.7–2.0</b>  | <b>1.18</b>               | <b>1.1–1.3</b> |
| • Chiropractic                     | 226 (19.5)         | 1172 (10.1)       | <b>1.93</b>       | <b>1.7–2.2</b>  | <b>1.95</b>                  | <b>1.7–2.3</b>  | <b>1.25</b>               | <b>1.1–1.5</b> |
| • Physical therapy                 | 224 (19.4)         | 1121 (9.7)        | <b>2.00</b>       | <b>1.7–2.3</b>  | <b>2.02</b>                  | <b>1.8–2.3</b>  | <b>1.03</b>               | <b>0.9–1.2</b> |
| • Optometry                        | 475 (41.1)         | 2721 (23.5)       | <b>1.75</b>       | <b>1.6–1.9</b>  | <b>1.75</b>                  | <b>1.6–1.9</b>  | <b>1.02</b>               | <b>1.0–1.7</b> |
| • Naturopathy                      | 47 (4.1)           | 123 (1.1)         | <b>3.85</b>       | <b>2.7–5.4</b>  | <b>3.94</b>                  | <b>2.8–5.5</b>  | <b>1.18</b>               | <b>0.9–1.6</b> |
| • Other                            | 104 (9.0)          | 562 (4.9)         | <b>1.85</b>       | <b>1.5–2.3</b>  | <b>1.90</b>                  | <b>1.5–2.4</b>  | <b>1.21</b>               | <b>1.0–1.5</b> |

CI—confidence interval, NA—not applicable, RR—relative risk.

\*Among those with at least 1 visit.

†Adjusted for age, sex, socioeconomic status, urban or rural location, and region of residence.

system tumours, or initial treatment other than surgery alone, had greater demand. As in the general population, age and sex affected the likelihood of a physician visit. It appears that demand for overall physician care is not affected by urban or rural residence or region of residence, although use of GPs increases with lower socioeconomic status.

This study provides a comprehensive assessment of follow-up physician care in Canada for this patient group over many years. The patterns of physician use seen in this study are consistent with survivors' risks of late effects (in particular for survivors of central nervous system and bone tumours and those receiving multiple types of treatments) and demonstrate a much greater use of resources than among the general population.

The proportion of survivors consulting GPs in this study, covering a 3-year period, was higher than previous studies by Oeffinger et al,<sup>16</sup> who reported that 87% of survivors had general medical contact in a 2-year period, and Shaw et al,<sup>17</sup> who reported that 71% of survivors visited GPs in a 1-year period. Both earlier studies showed similar increased rates of specialist visits (61% cancer-related encounters in Oeffinger and colleagues' study, and 68% in Shaw and colleagues' study); however, Shaw et al reported similar proportions of survivors and controls having had GP visits (71% vs 73%). In our study

the probability of a GP visit was much higher among survivors than among the population comparison group. In contrast to these previous studies, in which visits were self-reported by consenting participants, our study using administrative records indicated that the probability of seeing a GP increased with increasing age and time since diagnosis; age was the stronger predictor of a visit. The likelihood of seeing an oncologist was also elevated with increasing age, in contrast to the studies by Oeffinger et al and Shaw et al, whereas the chance of seeing a specialist decreased, similar to Shaw and colleagues' study. Real differences in use of physician services might exist between participants in this study and the (mainly) US participants in Oeffinger and colleagues' study, owing to differences in the health care systems (in particular more complete insurance coverage in our study), but such differences would be less likely with Shaw and colleagues' study of Canadian survivors, who were served by the same health system as our study participants were. Reported differences between this and previous studies might also be the result of participant and recall bias in the self-report studies.

The advantage of using Canadian health administrative data sets is that they are intended to capture all medically necessary care and, therefore, can be considered an unbiased surrogate measure of the level of

**Table 4. Factors affecting relative risk of a physician visit among survivors from 1998 to 2000: Results in boldface are statistically significant.**

| FACTORS                                | ≥ 10 GP VISITS |             |                |             | SPECIALIST |             |                |             | ONCOLOGIST |             |                |             |
|--|----------------|-------------|----------------|-------------|------------|-------------|----------------|-------------|------------|-------------|----------------|-------------|
|  | N (%)          | RR          | 95% CI         | P FOR TREND | N (%)      | RR          | 95% CI         | P FOR TREND | N (%)      | RR          | 95% CI         | P FOR TREND |
| Sex                                    |                |             |                | NA          |            |             |                | NA          |            |             |                | NA          |
| • Male                                 | 235 (38.5)     | 1.00        |                |             | 424 (69.4) | 1.00        |                |             | 114 (18.7) | 1.00        |                |             |
| • Female                               | 372 (68.1)     | <b>1.78</b> | <b>1.5–2.1</b> |             | 439 (80.4) | <b>1.15</b> | <b>1.0–1.3</b> |             | 140 (25.6) | <b>1.40</b> | <b>1.1–1.7</b> |             |
| Socioeconomic status                   |                |             |                | .062        |            |             |                | .614        |            |             |                | .266        |
| • 5 (highest)                          | 111 (45.5)     | 1.00        |                |             | 172 (70.5) | 1.00        |                |             | 57 (23.4)  | 1.00        |                |             |
| • 4                                    | 99 (45.8)      | 1.00        | 0.8–1.3        |             | 159 (73.6) | 1.00        | 0.8–1.3        |             | 49 (22.7)  | 1.01        | 0.7–1.4        |             |
| • 3                                    | 101 (53.2)     | 1.11        | 0.9–1.5        |             | 148 (77.9) | 1.07        | 0.9–1.3        |             | 41 (21.6)  | 0.88        | 0.6–1.3        |             |
| • 2                                    | 126 (57.0)     | 1.20        | 0.9–1.6        |             | 169 (76.5) | 1.05        | 0.9–1.3        |             | 46 (20.8)  | 0.85        | 0.6–1.2        |             |
| • 1 (lowest)                           | 140 (62.8)     | 1.29        | 1.0–1.7        |             | 173 (77.6) | 1.09        | 0.9–1.4        |             | 47 (21.1)  | 0.84        | 0.6–1.2        |             |
| • Unknown                              | 30 (47.6)      | 1.00        | 0.7–1.5        |             | 42 (66.7)  | 0.93        | 0.7–1.3        |             | 14 (22.2)  | 0.92        | 0.5–1.6        |             |
| Residence                              |                |             |                | .632        |            |             |                | .746        |            |             |                | .22         |
| • Metropolitan                         | 609 (97.6)     | 1.00        |                |             | 609 (97.6) | 1.00        |                |             | 158 (25.3) | 1.00        |                |             |
| • Large community                      | 186 (97.4)     | 1.12        | 0.9–1.5        |             | 186 (97.4) | 1.03        | 0.8–1.3        |             | 30 (15.7)  | 0.99        | 0.7–1.4        |             |
| • Small community                      | 169 (97.1)     | 1.01        | 0.8–1.3        |             | 169 (97.1) | 0.94        | 0.7–1.2        |             | 38 (21.8)  | <b>1.45</b> | <b>1.0–2.0</b> |             |
| • Rural                                | 161 (95.8)     | 0.95        | 0.7–1.3        |             | 161 (95.8) | 0.99        | 0.8–1.3        |             | 28 (16.7)  | 1.12        | 0.7–1.7        |             |
| Age in 2000, y                         |                |             |                | .003        |            |             |                | .144        |            |             |                | <.001       |
| • 5–19                                 | 149 (41.6)     | 1.00        |                |             | 287 (80.2) | 1.00        |                |             | 25 (7.0)   | 1.00        |                |             |
| • 20–34                                | 357 (57.5)     | <b>1.40</b> | <b>1.2–1.7</b> |             | 450 (72.5) | 0.89        | 0.8–1.0        |             | 194 (31.2) | <b>4.57</b> | <b>3.3–6.1</b> |             |
| • ≥ 35                                 | 101 (56.7)     | <b>1.40</b> | <b>1.1–1.8</b> |             | 126 (70.8) | 0.87        | 0.7–1.1        |             | 35 (19.7)  | <b>3.01</b> | <b>1.9–4.6</b> |             |
| Time since diagnosis, y                |                |             |                | .583        |            |             |                | .567        |            |             |                | .073        |
| • 5–9                                  | 96 (49.5)      | 1.00        |                |             | 161 (83.0) | 1.00        |                |             | 44 (22.7)  | 1.00        |                |             |
| • 10–14                                | 180 (47.7)     | 0.98        | 0.8–1.3        |             | 276 (73.2) | 0.90        | 0.7–1.1        |             | 63 (16.7)  | <b>0.53</b> | <b>0.3–0.9</b> |             |
| • 15–19                                | 152 (53.7)     | 1.04        | 0.8–1.4        |             | 209 (73.9) | 0.92        | 0.7–1.2        |             | 71 (25.1)  | 0.64        | 0.4–1.0        |             |
| • 20–24                                | 111 (59.0)     | 1.10        | 0.8–1.5        |             | 136 (72.3) | 0.92        | 0.7–1.2        |             | 59 (31.4)  | 0.76        | 0.4–1.3        |             |
| • ≥ 25                                 | 60 (58.3)      | 1.03        | 0.7–1.5        |             | 73 (70.9)  | 0.89        | 0.6–1.2        |             | 16 (15.5)  | <b>0.31</b> | <b>0.2–0.6</b> |             |
| Diagnosis                              |                |             |                | NA          |            |             |                | NA          |            |             |                | NA          |
| • ALL                                  | 119 (49.2)     | 1.00        |                |             | 176 (72.7) | 1.00        |                |             | 43 (17.8)  | 1.00        |                |             |
| • Other leukemia                       | 17 (56.7)      | 1.02        | 0.6–1.7        |             | 23 (76.7)  | 1.07        | 0.7–1.7        |             | 7 (23.3)   | 0.98        | 0.4–2.6        |             |
| • Hodgkins lymphoma                    | 73 (54.1)      | 0.95        | 0.7–1.3        |             | 96 (71.1)  | 1.02        | 0.8–1.3        |             | 48 (35.6)  | 1.59        | 0.9–2.7        |             |
| • Non-Hodgkins lymphoma                | 30 (46.2)      | 0.91        | 0.6–1.4        |             | 46 (70.8)  | 1.02        | 0.7–1.4        |             | 16 (24.6)  | 1.21        | 0.6–2.5        |             |
| • CNS tumour                           | 131 (57.2)     | 1.07        | 0.8–1.4        |             | 189 (82.5) | 1.14        | 1.0–1.4        |             | 50 (21.8)  | 1.03        | 0.6–1.7        |             |
| • Renal tumour                         | 34 (46.6)      | 0.93        | 0.6–1.4        |             | 57 (78.1)  | 1.07        | 0.8–1.5        |             | 16 (21.9)  | 1.14        | 0.6–2.3        |             |
| • Bone tumour                          | 30 (57.7)      | 1.03        | 0.7–1.6        |             | 44 (84.6)  | 1.20        | 0.9–1.7        |             | 27 (51.9)  | <b>3.89</b> | <b>1.9–7.8</b> |             |
| • Carcinomas                           | 64 (62.7)      | 0.99        | 0.7–1.4        |             | 61 (59.8)  | 0.85        | 0.6–1.2        |             | 16 (15.7)  | 0.48        | 0.3–0.9        |             |
| • Other                                | 109 (47.6)     | 0.95        | 0.7–1.2        |             | 171 (74.7) | 1.04        | 0.8–1.3        |             | 31 (13.5)  | 0.65        | 0.4–1.1        |             |
| Age at diagnosis, y                    |                |             |                | NA          |            |             |                | NA          |            |             |                | NA          |
| • 0–4                                  | 175 (43.3)     | 1.00        |                |             | 308 (76.2) | 1.00        |                |             | 52 (12.9)  | 1.00        |                |             |
| • 5–9                                  | 128 (59.0)     | 1.23        | 1.0–1.6        |             | 167 (77.0) | 1.06        | 0.9–1.3        |             | 60 (27.6)  | 1.54        | 1.0–2.5        |             |
| • 10–14                                | 118 (54.1)     | 1.07        | 0.8–1.4        |             | 169 (77.5) | 1.13        | 0.9–1.4        |             | 63 (28.9)  | 1.27        | 0.8–2.1        |             |
| • 15–19                                | 185 (58.7)     | 1.12        | 0.9–1.5        |             | 217 (68.9) | 0.99        | 0.8–1.3        |             | 78 (24.8)  | 1.03        | 0.6–1.7        |             |
| Relapse status                         |                |             |                | NA          |            |             |                | NA          |            |             |                | NA          |
| • No relapse                           | 525 (51.1)     | 1.00        |                |             | 756 (73.6) | 1.00        |                |             | 215 (20.9) | 1.00        |                |             |
| • Relapse                              | 82 (63.1)      | 1.20        | 1.0–1.5        |             | 107 (82.3) | 1.12        | 0.9–1.4        |             | 39 (30.0)  | <b>2.11</b> | <b>1.4–3.3</b> |             |
| Second-cancer status                   |                |             |                | NA          |            |             |                | NA          |            |             |                | NA          |
| • No second cancer                     | 573 (51.5)     | 1.00        |                |             | 823 (73.9) | 1.00        |                |             | 243 (21.8) | 1.00        |                |             |
| • Second cancer                        | 34 (77.3)      | 1.31        | 0.9–1.9        |             | 40 (90.9)  | 1.18        | 0.9–1.6        |             | 11 (25.0)  | 1.10        | 0.5–2.4        |             |
| Treatment                              |                |             |                | NA          |            |             |                | NA          |            |             |                | NA          |
| • Surgery only                         | 126 (51.9)     | 1.00        |                |             | 175 (72.0) | 1.00        |                |             | 32 (13.2)  | 1.00        |                |             |
| • Chemotherapy only                    | 89 (45.9)      | 0.97        | 0.7–1.3        |             | 151 (77.8) | 1.05        | 0.8–1.3        |             | 29 (14.9)  | <b>1.85</b> | <b>1.0–3.3</b> |             |
| • Radiation only                       | 28 (60.9)      | 1.08        | 0.7–1.6        |             | 34 (73.9)  | 1.07        | 0.7–1.6        |             | 8 (17.4)   | 1.23        | 0.5–3.0        |             |
| • Chemotherapy and surgery             | 77 (51.3)      | 1.06        | 0.8–1.4        |             | 112 (74.7) | 1.05        | 0.8–1.3        |             | 35 (23.3)  | <b>2.30</b> | <b>1.3–4.1</b> |             |
| • Chemotherapy and radiation           | 108 (51.9)     | 1.02        | 0.8–1.3        |             | 147 (70.7) | 1.02        | 0.8–1.3        |             | 60 (28.8)  | <b>2.43</b> | <b>1.3–4.0</b> |             |
| • Radiation and surgery                | 84 (60.9)      | 1.13        | 0.9–1.5        |             | 117 (84.8) | 1.21        | 1.0–1.5        |             | 51 (37.0)  | <b>3.50</b> | <b>2.0–6.0</b> |             |
| • Chemotherapy, radiation, and surgery | 59 (56.2)      | 1.09        | 0.8–1.5        |             | 84 (80.0)  | 1.11        | 0.9–1.4        |             | 35 (33.3)  | <b>3.95</b> | <b>2.2–7.1</b> |             |

ALL—acute lymphoblastic leukemia, CI—confidence interval, CNS—central nervous system, NA—not applicable, RR—relative risk.

\*Exact number suppressed to protect confidentiality.

**Table 5. Factors affecting visit frequency among survivors from 1998 to 2000: Results in boldface are statistically significant.**

| FACTORS                                | PHYSICIAN (EXCLUDING ONCOLOGISTS) |                |             | GENERAL PRACTITIONER |                |             | SPECIALIST  |                |             | ONCOLOGIST  |                |             |
|--|-----------------------------------|----------------|-------------|----------------------|----------------|-------------|-------------|----------------|-------------|-------------|----------------|-------------|
|  | VR                                | 95% CI         | P FOR TREND | VR                   | 95% CI         | P FOR TREND | VR          | 95% CI         | P FOR TREND | VR          | 95% CI         | P FOR TREND |
| Sex                                    |                                   |                | NA          |                      |                | NA          |             |                | NA          |             |                | NA          |
| • Male                                 | 1.00                              |                |             | 1.00                 |                |             | 1.00        |                |             | 1.00        |                |             |
| • Female                               | <b>1.90</b>                       | <b>1.7–2.1</b> |             | <b>1.90</b>          | <b>1.7–2.1</b> |             | <b>1.34</b> | <b>1.2–1.5</b> |             | <b>0.94</b> | <b>0.8–1.2</b> |             |
| Socioeconomic status                   |                                   |                | <.001       |                      |                | <.001       |             |                | .082        |             |                | .128        |
| • 5 (highest)                          | 0.97                              | 0.8–1.2        |             | 1.02                 | 0.9–1.2        |             | 0.95        | 0.8–1.2        |             | 1.35        | 1.0–1.9        |             |
| • 4                                    | 1.16                              | 1.0–1.4        |             | 1.19                 | 1.0–1.4        |             | 1.02        | 0.8–1.3        |             | 1.14        | 0.8–1.6        |             |
| • 3                                    | <b>1.20</b>                       | <b>1.0–1.4</b> |             | <b>1.19</b>          | <b>1.0–1.4</b> |             | 1.13        | 0.9–1.4        |             | 1.18        | 0.8–1.7        |             |
| • 2                                    | <b>1.43</b>                       | <b>1.2–1.7</b> |             | <b>1.49</b>          | <b>1.3–1.8</b> |             | 1.13        | 0.9–1.4        |             | <b>1.47</b> | <b>1.1–2.1</b> |             |
| • 1 (lowest)                           | 0.95                              | 0.7–1.3        |             | 0.95                 | 0.7–1.2        |             | 1.16        | 0.8–1.7        |             | 1.21        | 0.7–2.1        |             |
| Region of residence                    |                                   |                | NA          |                      |                | NA          |             |                | NA          |             |                | NA          |
| • Vancouver Coastal                    | 1.00                              |                |             | 1.00                 |                |             | 1.00        |                |             | 1.00        |                |             |
| • Interior                             | 1.24                              | 1.0–1.6        |             | <b>1.34</b>          | <b>1.1–1.7</b> |             | 1.02        | 0.8–1.4        |             | 0.92        | 0.6–1.5        |             |
| • Fraser                               | 1.12                              | 1.0–1.3        |             | <b>1.19</b>          | <b>1.0–1.4</b> |             | 0.86        | 0.7–1.1        |             | 1.26        | 1.0–1.7        |             |
| • Island                               | 1.19                              | 1.0–1.4        |             | <b>1.29</b>          | <b>1.1–1.6</b> |             | 0.85        | 0.7–1.1        |             | 1.01        | 0.7–1.5        |             |
| • Northern                             | 1.07                              | 0.8–1.4        |             | 1.25                 | 1.0–1.6        |             | 0.75        | 0.5–1.1        |             | <b>0.52</b> | <b>0.3–0.9</b> |             |
| Age in 2000, y                         |                                   |                | .059        |                      |                | <.001       |             |                | .101        |             |                | <.001       |
| • 5–19                                 | 1.00                              |                |             | 1.00                 |                |             | 1.00        |                |             | 1.00        |                |             |
| • 20–34                                | <b>1.15</b>                       | <b>1.0–1.3</b> |             | <b>1.41</b>          | <b>1.3–1.6</b> |             | <b>0.83</b> | <b>0.7–1.0</b> |             | 1.45        | 1.0–2.1        |             |
| • ≥35                                  | 1.14                              | 1.0–1.4        |             | <b>1.42</b>          | <b>1.2–1.7</b> |             | 0.89        | 0.7–1.1        |             | <b>2.68</b> | <b>1.7–4.3</b> |             |
| Time since diagnosis, y                |                                   |                | .076        |                      |                | <.001       |             |                | .045        |             |                | .179        |
| • 5–9                                  | 1.00                              |                |             | 1.00                 |                |             | 1.00        |                |             | 1.00        |                |             |
| • 10–14                                | 0.94                              | 0.8–1.1        |             | 1.02                 | 0.9–1.2        |             | 0.97        | 0.8–1.2        |             | 0.83        | 0.6–1.2        |             |
| • 15–19                                | 0.94                              | 0.8–1.1        |             | 1.07                 | 0.9–1.3        |             | 0.83        | 0.7–1.0        |             | 0.84        | 0.6–1.2        |             |
| • 20–24                                | 1.11                              | 0.9–1.4        |             | 1.22                 | 1.0–1.5        |             | 1.01        | 0.8–1.3        |             | 0.78        | 0.5–1.1        |             |
| • ≥25                                  | 1.04                              | 0.8–1.4        |             | 1.15                 | 0.9–1.5        |             | 1.02        | 0.7–1.4        |             | 0.70        | 0.4–1.2        |             |
| Diagnosis                              |                                   |                | NA          |                      |                | NA          |             |                | NA          |             |                | NA          |
| • ALL                                  | 1.00                              |                |             | 1.00                 |                |             | 1.00        |                |             | 1.00        |                |             |
| • Other leukemia                       | 1.27                              | 0.9–1.8        |             | 1.08                 | 0.8–1.5        |             | 1.25        | 0.8–2.0        |             | 1.58        | 0.8–3.2        |             |
| • Hodgkins lymphoma                    | 0.95                              | 0.8–1.2        |             | 0.94                 | 0.8–1.2        |             | 1.14        | 0.9–1.5        |             | 1.33        | 0.9–1.9        |             |
| • Non-Hodgkins lymphoma                | 0.91                              | 0.7–1.2        |             | 0.91                 | 0.7–1.2        |             | 1.04        | 0.7–1.5        |             | 1.23        | 0.7–2.0        |             |
| • CNS tumour                           | <b>1.25</b>                       | <b>1.1–1.5</b> |             | 1.13                 | 1.0–1.3        |             | <b>1.33</b> | <b>1.1–1.7</b> |             | 1.43        | 1.0–2.1        |             |
| • Renal tumour                         | 0.86                              | 0.7–1.1        |             | 0.95                 | 0.8–1.2        |             | 0.89        | 0.7–1.2        |             | <b>1.78</b> | <b>1.1–2.9</b> |             |
| • Bone tumour                          | 1.22                              | 0.9–1.6        |             | 0.99                 | 0.8–1.3        |             | <b>1.43</b> | <b>1.0–2.0</b> |             | 1.19        | 0.8–1.8        |             |
| • Carcinomas                           | 0.95                              | 0.8–1.2        |             | 0.99                 | 0.8–1.2        |             | 1.23        | 0.9–1.7        |             | 1.07        | 0.7–1.8        |             |
| • Other                                | 1.06                              | 0.9–1.3        |             | 1.00                 | 0.8–1.2        |             | 1.13        | 0.9–1.4        |             | 1.03        | 0.7–1.6        |             |
| Age at diagnosis, y                    |                                   |                | NA          |                      |                | NA          |             |                | NA          |             |                | NA          |
| • 0–4                                  | 1.00                              |                |             | 1.00                 |                |             | 1.00        |                |             | 1.00        |                |             |
| • 5–9                                  | <b>1.23</b>                       | <b>1.0–1.5</b> |             | 1.15                 | 1.0–1.4        |             | <b>1.27</b> | <b>1.0–1.6</b> |             | 1.39        | 1.0–1.9        |             |
| • 10–14                                | 1.07                              | 0.9–1.3        |             | 0.97                 | 0.8–1.2        |             | 1.09        | 0.9–1.4        |             | <b>1.50</b> | <b>1.1–2.1</b> |             |
| • 15–19                                | 1.11                              | 0.9–1.3        |             | 1.07                 | 0.9–1.3        |             | 1.11        | 0.9–1.4        |             | 1.27        | 0.9–1.8        |             |
| Relapse status                         |                                   |                | NA          |                      |                | NA          |             |                | NA          |             |                | NA          |
| • No relapse                           | 1.00                              |                |             | 1.00                 |                |             | 1.00        |                |             | 1.00        |                |             |
| • Relapse                              | <b>1.44</b>                       | <b>1.2–1.7</b> |             | <b>1.26</b>          | <b>1.1–1.5</b> |             | <b>1.58</b> | <b>1.3–2.0</b> |             | 0.89        | 0.6–1.3        |             |
| Second-cancer status                   |                                   |                | NA          |                      |                | NA          |             |                | NA          |             |                | NA          |
| • No second cancer                     | 1.00                              |                |             | 1.00                 |                |             | 1.00        |                |             | 1.00        |                |             |
| • Second cancer                        | 1.36                              | 1.0–1.9        |             | <b>1.52</b>          | <b>1.1–2.1</b> |             | 1.06        | 0.7–1.6        |             | <b>1.89</b> | <b>1.1–3.4</b> |             |
| Treatment                              |                                   |                | NA          |                      |                | NA          |             |                | NA          |             |                | NA          |
| • Surgery only                         | 1.00                              |                |             | 1.00                 |                |             | 1.00        |                |             | 1.00        |                |             |
| • Chemotherapy only                    | 1.35                              | 1.0–1.8        |             | 1.16                 | 0.9–1.5        |             | <b>1.44</b> | <b>1.0–2.0</b> |             | 0.94        | 0.5–1.7        |             |
| • Radiation only                       | 1.69                              | 1.2–2.3        |             | <b>1.58</b>          | <b>1.2–2.2</b> |             | <b>1.69</b> | <b>1.1–2.5</b> |             | 0.79        | 0.4–1.6        |             |
| • Chemotherapy and surgery             | <b>1.28</b>                       | <b>1.0–1.6</b> |             | <b>1.26</b>          | <b>1.0–1.6</b> |             | <b>1.35</b> | <b>1.0–1.8</b> |             | 0.86        | 0.5–1.5        |             |
| • Chemotherapy and radiation           | <b>1.34</b>                       | <b>1.0–1.7</b> |             | 1.11                 | 0.8–1.4        |             | <b>1.58</b> | <b>1.2–2.2</b> |             | 1.11        | 0.7–1.9        |             |
| • Radiation and surgery                | <b>1.47</b>                       | <b>1.2–1.8</b> |             | <b>1.32</b>          | <b>1.1–1.6</b> |             | <b>1.44</b> | <b>1.1–1.9</b> |             | 1.01        | 0.7–1.6        |             |
| • Chemotherapy, radiation, and surgery | <b>1.50</b>                       | <b>1.2–1.9</b> |             | <b>1.28</b>          | <b>1.0–1.6</b> |             | <b>1.88</b> | <b>1.4–2.5</b> |             | 1.38        | 0.8–2.3        |             |

ALL—acute lymphoblastic leukemia, CI—confidence interval, CNS—central nervous system, NA—not applicable, VR—visit ratio.



need-based care in a defined population.<sup>25,26</sup> Nonlinkage of data is most likely the result of survivors moving out of the province by the start of follow-up; in contrast to questionnaire-based studies, this rate is not likely to be influenced by self-selection. The 64% linkage rate of survivors to health insurance records from 1998 to 2000 is consistent with the out-migration rate expected from diagnosis to the observation period, based on out-migration rates in BC.<sup>27</sup> This study did not include information on costs of care, the presence of specific late effects, reasons for visits, or comorbidity, all of which affect primary and specialist care and will be examined in future studies.

## Conclusion

This study demonstrates that survivors have an increased ongoing demand for GP and specialist physician care compared with the general population. Family physicians and specialists should be aware of both cancer-related and general care needs of this special population, and policy makers need to address these increased resource requirements in appropriate models of care delivery.

This study also shows that socioeconomic status or remote residence do not appear to be barriers to care for this population, consistent with Canadian health care goals of equitable access to care.

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## Contributors

**Ms McBride** initiated the concept of the study; determined the general design; supervised the acquisition, analysis, and interpretation of data; revised the article to include expanded analyses, background, and discussion; and approved the final version. All other authors made substantial contributions to the concept and design of the study or the acquisition, analysis, or interpretation of data and to drafting the article or revising it critically for important intellectual content; all authors approved of the final version to be published.

## Competing interests

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