

# USING REAL WORLD DATA TO DETERMINE HEALTH SYSTEM COSTS OF CANADIANS DIAGNOSED WITH CHRONIC LYMPHOCYTIC LEUKEMIA

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## Introduction

- Chronic lymphocytic leukemia (CLL) is the most common type of adult leukemia in Canada, accounting for about 44% of all leukemias.(1)
- In 2016/17, approximately 1,745 Canadians were diagnosed with CLL, and 611 Canadians died from the disease.(2) CLL affects mainly older patients, with a median age at diagnosis of 71 years (1) and the five-year net survival rate is 83%.(3)
- Current recommendations for first line (1L) treatment for fit, younger CLL patients without high-risk cytogenetics, is a combination of fludarabine, cyclophosphamide and rituximab (FCR). (4) For older, unfit patients, 1L chlorambucil in combination with obinutuzumab (C+O) is often used.
- Newer targeted therapies (e.g., ibrutinib, acalabrutinib) have proven effective in those considered FCR-ineligible, and has shown improved efficacy compared to C or C+O.(4,5)
- In Canada, ibrutinib was approved in Nov 2014, and funded in untreated patients or patients with at least one prior therapy, including 17p deletion. Acalabrutinib is the second Bruton's tyrosine kinase (BTK) inhibitor recently approved, in Nov 2019.

## Objective

- There is a need to better characterize CLL treatments and associated costs in Canada in support of appraisals by HTA bodies is important, especially with the recent approvals of newer therapies. We report on costs associated with CLL from a population-level using administrative datasets available in Ontario.

## Methods

- DESIGN:** Longitudinal, population-level study of CLL patients diagnosed between 1-Jan-2010 and 31-Dec-2017 from the Ontario Cancer Registry (OCR), with follow-up until 31-Dec-2018.
- ETHICS:** This study was approved by the Research Ethics Board at Sunnybrook Health Sciences.
- DATA SOURCES:** Administrative data from the OCR and 11 other health databases.
- COSTING:** Costs from provincial administrative databases included:
  - Cancer clinic visits, chemotherapies funded by the New Drug Funding Program (NDFP), emergency department visits, home care services, inpatient hospitalizations, oral medications funded by the Ontario Drug Benefit (ODB) Program and physician services funded by the Ontario Health Insurance Plan (OHIP) were resources that were costed.
  - Activity level reporting of costs for chemotherapies administered in-hospital was not reported.
  - Total cohort, annual and mean per patient costs (CAD 2018) were determined using a costing methodology from ICES called GETCOST. The costs of short-term care episodes (e.g., hospitalization) were determined by multiplying the encounter's resource intensity weight by an annual cost per weighted case; long-term care episodes (e.g., complex continuing care) were determined by weighted days, and costs of visit-based encounters were determined at utilization.
  - To estimate costs attributable with CLL ("cases"), a matched cohort arm ("controls") was included to account for non-CLL costs. Controls were non-CLL patients who met the following criteria: no CLL index date within 1 year (randomly generated for the controls to match the date at diagnosis of cases), age at diagnosis  $\pm$  1 year, sex, location of residence, Charlson score, comorbidities, prior cancer diagnosis and minimum 6-months follow-up. Cases and controls were matched 3:1.

## Results

- 2,572 CLL cases were identified and matched with 7,611 controls (median age 68 years; 66% male).
- In Table 1, the overall mean attributable cost per CLL patient was found to be \$54,315. Negative costs indicate higher costs for the control group and costs by year were examined.
- The majority of costs were incurred in Year 1, with a steady decrease over subsequent years.
- The main cost drivers were oral medication, cost of intravenous medications such as obinutuzumab and other chemotherapy and cancer clinic visits.

**Table 1: Mean per patient costs attributable to CLL from time of diagnosis and during the study period**

Resource Type	Total period	Year 1	Year 2	Year 3	Year 4	Years 5	Year 6	Year 7	Year 8	Year 9
<b>Cancer clinic</b>	\$14,864	\$6,642	\$2,134	\$1,988	\$1,581	\$1,226	\$741	\$414	\$134	\$3
<b>IV treatments</b>	\$14,971	\$6,972	\$2,630	\$2,055	\$1,386	\$924	\$578	\$306	\$118	\$1
<b>Complex continuing care</b>	-\$1,287	-\$430	-\$311	-\$293	-\$69	-\$137	-\$88	\$65	-\$24	\$0
<b>Dialysis</b>	-\$2,342	-\$619	-\$634	-\$392	-\$228	-\$236	-\$149	-\$53	-\$31	\$0
<b>ER Visits</b>	\$402	\$140	-\$16	\$75	\$82	\$52	\$33	\$23	\$12	\$2
<b>Hospitalizations</b>	\$2,663	\$840	-\$1,459	\$585	\$993	\$694	\$427	\$396	\$172	\$16
<b>Laboratory</b>	\$234	\$104	\$34	\$31	\$26	\$20	\$11	\$6	\$2	\$1
<b>Non-physician (OHIP)</b>	-\$12	-\$7	-\$1	-\$4	\$0	\$0	\$1	\$0	\$0	\$0
<b>Oral medications</b>	\$15,161	\$1,645	\$1,736	\$2,220	\$2,293	\$2,091	\$2,222	\$1,969	\$951	\$34
<b>Outpatient total costs</b>	\$2,762	\$1,256	\$411	\$382	\$324	\$196	\$104	\$62	\$25	\$2
<b>All physician visits</b>	\$3,082	\$1,222	\$0	\$613	\$465	\$336	\$236	\$149	\$57	\$6
<b>Rehabilitation (inpatient)</b>	-\$415	-\$110	-\$311	-\$40	-\$2	-\$8	\$21	\$15	\$21	\$0
<b>Same day surgery</b>	\$175	\$206	-\$49	\$7	-\$3	\$10	\$10	-\$4	-\$1	\$0
<b>Total costs</b>	\$50,259	\$17,860	\$4,164	\$7,226	\$6,848	\$5,168	\$4,147	\$3,346	\$1,436	\$64
<b>Total costs (excluding negative costs)</b>	\$54,315	\$19,026	\$5,421	\$7,956	\$7,146	\$5,550	\$4,362	\$3,320	\$1,470	\$64

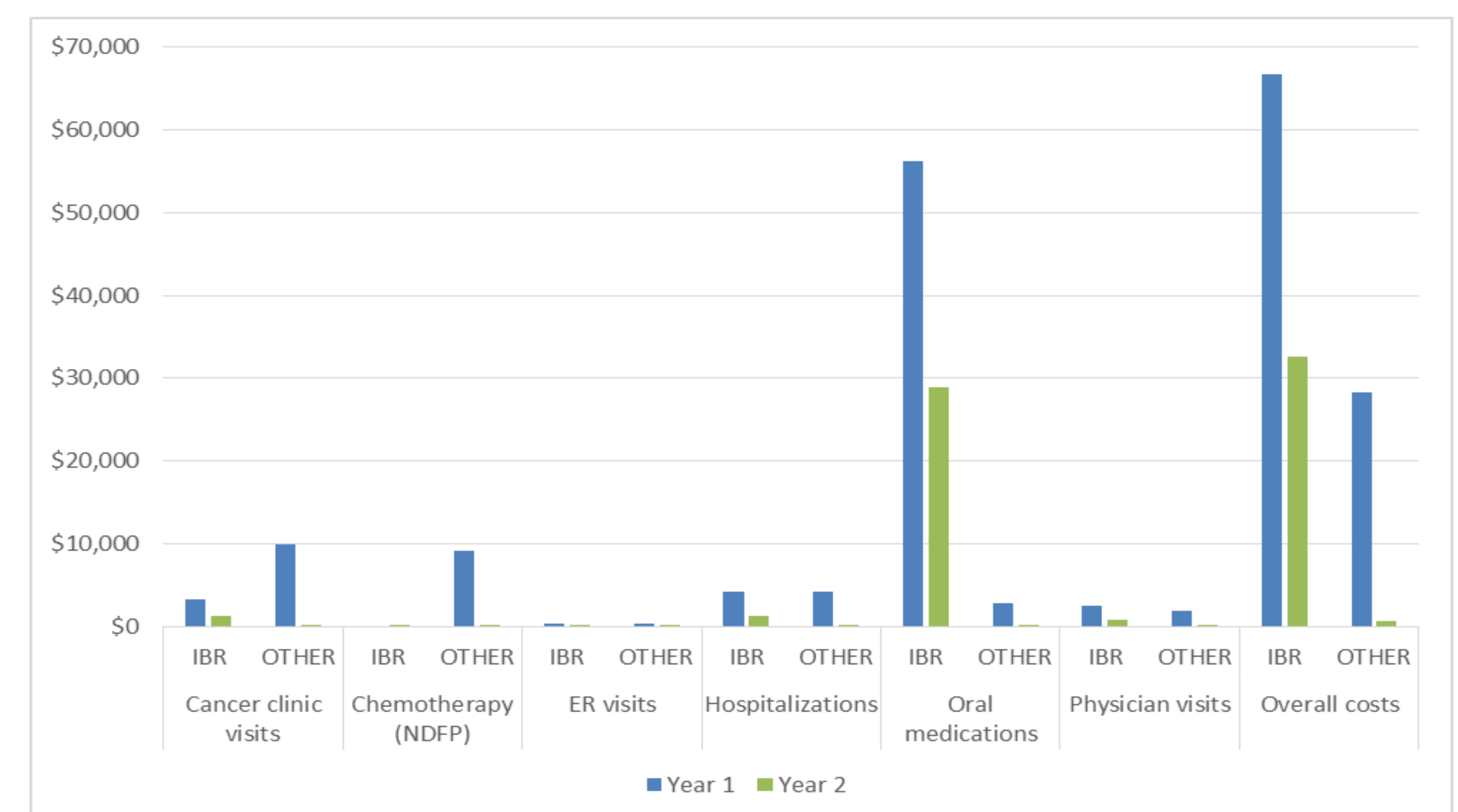
## Costs stratified by line of treatment initiation

- In Table 2, mean costs (overall and by the top eight resource types) were compared from 1L treatment initiation to end of treatment or death/date of last follow-up and stratified by drug.
- The overall mean cost per patient was highest with ibrutinib (\$57,739) and lowest in the "other" group (\$31,658).
- Cost drivers were drug costs (ODB in the ibrutinib group, chemotherapy in the C+O, FCR and other groups), followed by cancer clinic visits.

**Table 2: Mean per patient cost of 1L-treated CLL patients (overall and by resource type), stratified by treatment**

Cost type	Ibrutinib	C+O	FCR	Other
<b>First line treatment- N (patients)</b>	<b>159</b>	<b>285</b>	<b>882</b>	<b>882</b>
Overall total costs	\$57,739	\$56,872	\$48,934	\$31,658
Cancer clinic visit total costs	\$5,342	\$16,461	\$21,204	\$9,800
Chemotherapy (NDFP) total costs	\$197	\$35,180	\$19,931	\$10,840
Emergency department visit total costs	\$491	\$217	\$305	\$425
Inpatient hospitalization admission total costs	\$5,010	\$1,440	\$2,126	\$3,476
Oral medications (ODB) total costs	\$41,115	\$1,138	\$2,233	\$2,636
Outpatient clinic visit total costs	\$1,292	\$529	\$845	\$1,383
Physician services (OHIP) total costs	\$2,817	\$1,626	\$2,101	\$2,244
Same day surgery admission total costs	\$661	\$76	\$40	\$129

- 526 patients received second line (2L) treatment, with the majority receiving ibrutinib (N=288) or other treatments (N=238).
- In Figure 1, costs for the top six resources utilized during 2L were reported over a 2-year period due to heavy censoring. The overall mean cost per patient for ibrutinib was \$99,309 compared to \$29,005 in the "other" group.
- Majority of costs were due to oral medication cost in year 1 and year 2. In the "other" group, costs were mainly driven by cancer clinic visits and IV medication costs, and cost associated with cancer clinic visits with ibrutinib remain lower compared to the "other" group



**Figure 1: Mean cost per patient from initiation to end of 2L treatment over a 2-year period**

- From initiation end of third line (3L) treatment, the overall mean cost per patient over the 2-year period was \$72,042.
- Costs were not stratified by type of treatment received due to small patient numbers. However, based on the treatment patterns, ibrutinib was also the most frequently administered 3L agent.
- As ibrutinib was the most frequently administered 3L therapy, the main cost driver was the cost of oral medication.

## Conclusions

- The mean cost per patient attributable to CLL was \$54,315, with increasing costs in relapsed/refractory setting. Costs are likely underestimated due to the short follow-up.
- Further analysis is required to estimate the predicted costs of treating CLL over a patient's lifetime.

## References

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