

Characteristics of high drug cost beneficiaries across Canada: A pan-Canadian Analysis

Mina Tadrous, PharmD, PhD^{1,2}; Diana Martins, MSc³; Muhammad M. Mamdani, PharmD, MA, MPH^{2,4-6};
Tara Gomes, MHSc, PhD^{2,3,4}

1. Women's College Hospital Research Institute, Toronto
2. Leslie Dan Faculty of Pharmacy, University of Toronto, Toronto
3. Li Ka Shing Knowledge Institute, St. Michael's Hospital, Toronto
4. Institute of Health Policy, Management and Evaluation, University of Toronto, Toronto
5. Li Ka Shing Centre for Healthcare Analytics Research and Training, St. Michael's Hospital, Toronto
6. Department of Medicine, Faculty of Medicine, University of Toronto, Toronto

Short Title: High drug-cost beneficiaries across Canada

Corresponding Author:

Mina Tadrous
76 Grenville St.
Toronto, Ontario
mina.tadrous@wchospital.ca
Phone: 416-323-6400

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Abstract:***BACKGROUND:***

Drugs are the fastest growing cost in the Canadian healthcare system, due to the increased number of high-cost drugs. The objective of this study was to examine the characteristics of high drug-cost beneficiaries across Canada relative to non-high drug-cost beneficiaries.

METHODS:

We conducted a cross-sectional study among public drug-plan beneficiaries residing in 9 provinces. We stratified the cohort into 2 groups: high drug-cost beneficiaries (top 5% of beneficiaries based on annual-costs) and other beneficiaries (remaining 95%). For each group we reported total drug-costs, prevalence of high-cost claims, median number of drugs, proportion of beneficiaries aged 65 and over, and the top 10 most costly and reimbursed medications. We reported estimates overall for all provinces (excluding Quebec and Territories) and by province.

RESULTS:

In FY 2016 high drug-cost beneficiaries accounted for nearly half of annual spending (46.5%), with an average annual spend of \$14,610 per beneficiary as compared to \$1,570 among non-high drug-cost beneficiaries. The median number of drugs dispensed was higher among high drug-cost beneficiaries (13 (IQR 7-19) vs. 5 (IQR 3-9)) and a larger proportion of high drug-cost beneficiaries received at least 1 drug-claim costing above \$1,000 (40.9% vs. 0.6%). Chronic medications were the most utilized medications for both groups, while biologics and antivirals were the most costly medications for high drug-cost beneficiaries.

INTERPRETATION:

High drug-cost beneficiaries are characterized by the use of expensive medications and polypharmacy relative to non-high drug cost beneficiaries. Interventions and policies to help reduce spending need to consider both of these factors.

BACKGROUND

Drug costs are the fastest growing major expenditure in the Canadian Healthcare system.^{1,2} They account for 15.7% of all public healthcare spending, growing 4.2% annually, and outpacing both hospital and physician expenditures.² Initially the high rates of increasing drug costs were thought to have subsided with the genericization of previous blockbuster drugs,³ however this recent return to growth in drug spending is concerning for public drug programs across the country.

The recent increased spending on drugs is likely associated with both an increase in overall drug utilization as well as a growing number of new therapies being approved with high prices.⁴ These two factors can lead to a high level of clustering among public drug program beneficiaries, in which a small number of beneficiaries account for a high proportion of total spending. Although previous work has cited a high rate of clustering in total healthcare and drug expenditure across Canada, characteristics of these beneficiaries for drug spending nationally is unknown.¹ In 2018, a CIHI drug spending report found that beneficiaries across Canada with over \$10,000 spent annually on drugs represented only 2% of all beneficiaries, yet accounted for one-third of overall spending, with this proportion expected to grow.¹ In light of the ongoing discourse for a national pharmacare strategy, a better understanding of high drug-cost beneficiaries across Canada is important to inform current planning. The objective of this study was to examine the characteristics of high drug-cost beneficiaries across Canada relative to non-high drug-cost beneficiaries.

METHODS

We conducted a cross-sectional study among active public drug plan beneficiaries residing in 9 provinces across Canada (all except Quebec), defined as individuals who had at least 1 prescription reimbursed by a provincial public drug program between April 1, 2016 and March 31, 2017 (Fiscal Year (FY) 2016). We used the Canadian Institute for Health Information's National Prescription Drug Utilization Information System (CIHI NPDUIS) to identify all drugs dispensed to public drug beneficiaries over the study period. CIHI NPDUIS captures all publicly funded drugs dispensed in the community, except for medications dispensed in an inpatient hospital setting. We excluded all claims for services that are reimbursed by the government for all Canadians (regardless of eligibility for public drug programs), which include vaccinations and professional pharmacy services. We also excluded all cancer treatments in our primary analysis to allow for comparability across Canada, since cancer treatments may be reimbursed

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3 differently between provinces. In a sensitivity analysis, we replicated the findings to include these
4 cancer agents.
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8 We identified the total number of active drug program beneficiaries and their associated annual cost to
9 the public drug program in each of the 9 included provinces. We created an overall estimate by
10 combining data from all 9 included provinces; importantly these 'overall' estimates do not include data
11 from Quebec or the territories. We stratified the cohort into 2 groups: "high drug-cost beneficiaries (top
12 5% of beneficiaries based on annual costs) and other beneficiaries (remaining 95%). In a secondary
13 analysis, we explored a third group, defined as the top 1% of beneficiaries, to characterize "very high
14 drug-cost beneficiaries". Cost was defined as the total amount paid by the public-payer, this does not
15 include deductibles and out-of-pocket payments. For each cost group and province we reported the
16 following: 1) total drug costs; 2) minimum cost threshold defined as the individual with the lowest total
17 drug spend in each group; 3) prevalence of high-cost drug claims (defined as a claim reimbursed for a
18 cost greater than \$1,000); 4) median number of unique drugs dispensed per person; 5) number of
19 beneficiaries aged 65 and over; 6) top 10 most commonly reimbursed medications; and 7) top 10 most
20 costly reimbursed medications. All provinces studied require that individuals provide a form of
21 identification (generally a provincial health insurance card) at the time of their prescription being
22 dispensed, which can be used to link individual-level prescription history. This protocol was approved by
23 the Research Ethics Board of St. Michael's Hospital, Toronto.
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36 RESULTS

37 Overall Estimates

38 The overall analysis of publicly funded beneficiaries in FY 2016 exhibited a high-level of clustering in
39 spending (Table 1), with high drug-cost beneficiaries accounting for nearly half of total annual spending
40 (46.5 %). The minimum spend (cost threshold) for high drug-cost beneficiaries was \$5,291, with an
41 average annual spend of \$14,610 per beneficiary (Table 1). These findings remained consistent in the
42 sensitivity analysis when cancer treatments were included (See Supplemental Tables). Overall, we found
43 that the median number of drugs dispensed was higher among high drug-cost beneficiaries (13
44 (interquartile range (IQR) 7-19)), compared to all other beneficiaries (5 (IQR 3-9)), and a much larger
45 proportion of high drug-cost beneficiaries received at least 1 high-cost drug claim compared with other
46 beneficiaries (40.9% vs. 0.6%; Table 2). Overall, high drug-cost beneficiaries were less likely to be over
47 the age of 65 (48.2%) compared to all other beneficiaries (65.1%).
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Provincial Comparisons

In FY 2016 high drug-cost beneficiaries accounted for a large proportion of spending in all provinces (**Table 1**), with high drug-cost beneficiaries accounting for close to half of total annual spending in each province (range: 40.8% (Nova Scotia) to 55.4% (Saskatchewan)). However, the minimum spend (cost threshold) varied considerably, ranging from \$2,282 in PEI to \$8,567 in Manitoba. Among these beneficiaries, the average annual drug cost per person also exhibited geographic variability, ranging from \$6,650 (PEI) to \$25,560 (Manitoba). These findings remained consistent in the sensitivity analysis when cancer treatments were included (**See Supplemental Tables**).

Across all provinces we found that the median number of drugs dispensed was higher among high drug-cost beneficiaries (range: 8 in British Columbia to 16 in Nova Scotia), compared to all other beneficiaries (range: 3 in Saskatchewan to 6 in Nova Scotia; **Table 2**). Importantly, the number of high drug-cost beneficiaries that received an expensive claim ranged widely across provinces, from a low of 4.8% in PEI to a high of 63.4% in Manitoba. Consistent with the overall analysis, high drug-cost beneficiaries were typically less likely to be elderly compared with other beneficiaries. Specifically, less than 50% of high drug-cost beneficiaries were over the age of 65 in 6 of the 9 provinces, with the exceptions being Ontario (54.9%), Alberta (66.0%) and Nova Scotia (81.5%).

Secondary Analysis: Very high drug-cost beneficiaries (Top 1%)

The secondary analysis of very high drug-cost beneficiaries also accounted for a large proportion of spending in all provinces (**Table 3**), with these beneficiaries accounting for nearly one-quarter of total annual spending (23.3%) overall. The minimum spend (cost threshold) for the top 1% of beneficiaries was \$18,831 and had an average annual spend of \$36,553 per person. Clustering of costs among very high drug-cost beneficiaries was similar across all provinces (range: 21.0% (New Brunswick) to 29.2% (PEI) of total annual spending; **Table 3**). However, there was a wide range in the minimum spend (cost threshold) (range: from \$7,932 (PEI) to \$30,978 (Manitoba)) and average cost per person (range: from \$18,465 (PEI) to \$62,519 (Manitoba)) for these beneficiaries.

Among the very high drug-cost beneficiaries we found that the median number of drugs dispensed was slightly lower compared to high drug-cost beneficiaries in most provinces (range: from 6 (IQR 2-12) (PEI)

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3 to 10 (IQR 6-15), whereas the majority of these beneficiaries received at least 1 high cost drug claim
4 (range: from 73.5% (PEI) to 99.5% (Alberta)). Very high drug-cost beneficiaries were also younger than
5 high drug-cost beneficiaries, with a lower proportion over the age of 65 (range: from 18.9% (British
6 Columbia) to 52.7% (Nova Scotia)).
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10 11 Top 10 drugs by cost and utilization

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13 There were some differences in the patterns of drug spending between high cost groups overall (**Table**
14 **4**). In terms of utilization, the most commonly reimbursed drugs were relatively similar across all groups
15 of beneficiaries, with agents for common chronic conditions (e.g. inhalers, statins and antibiotics) being
16 the most commonly used treatments. The one exception was the high use of biologics among very high
17 drug-cost beneficiaries, with 2 biologics (infliximab (n=9,645) and adalimumab (n=6,549)) in the top 10
18 most utilized medications in this beneficiary group. In contrast, the medications with the highest total
19 spending varied between all three groups. Antivirals (e.g. those indicated to treat Hepatitis C and HIV)
20 and biologics were the highest cost treatments among the very high drug-cost beneficiaries. Among high
21 drug-cost beneficiaries, there was still high spending on biologics in addition to insulin, antipsychotics
22 and hydromorphone. These trends were similar across provinces (**See Supplemental material**).
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30 Importantly, 7 of the 9 provinces had a biologic as the highest cost among high drug-cost beneficiaries.
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33 **INTERPRETATION**

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35 Our study found that a minority of beneficiaries accounted for a substantial proportion of public drug
36 spending in nine provinces across Canada, with the costs incurred by high drug-cost beneficiaries
37 representing close to half of public drug programs' annual spending. Yet, the characteristics and
38 medication use patterns of high drug-cost beneficiaries are variable. In fact, there appears to be
39 evidence of two factors contributing to the clustering of high drug-cost beneficiaries: 1) patients
40 receiving expensive medications, such as biologics and hepatitis C treatments, and 2) complex patients
41 with a high comorbidity burden who are receiving a greater number of medications. Addressing both of
42 these issues will be important in the effort to develop robust and sustainable public drug programs.
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50 Our study highlights the importance of developing strategies that address the impact of rising costs of
51 new and expensive medications^{5,6} and aligns with recent evidence demonstrating the growing impact of
52 high-cost agents on public spending.⁷ The increase in spending is attributable, in part, to both high use
53 of costly treatments available under public drug programs as well as frequent utilization of multiple
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3 medications for common chronic conditions. These results align with observations from other public and
4 private payers, in Canada and other jurisdictions.⁸⁻¹¹ Our study is the first to explore this issue across 9
5 provinces giving a more national scope to problem. There is also strong evidence that the price of new
6 market entry drugs has been outpacing the consumer price index over the past two decades, and the
7 number of drugs with high cost has dramatically increased over time.⁷ For example, the annual number
8 of approved drugs with costs over \$10,000 increased from 20 drugs in 2005 to 124 drugs in 2015.⁴ These
9 high prices have likely contributed to the degree of clustering of public drug spending among
10 beneficiaries observed in our study. The patterns we observed are also anticipated to grow due to the
11 increasing availability of expensive medications, which raises concerns of the expansion and
12 sustainability of provincial public drug programs. Moreover, there is evidence to suggest that public payers
13 are inheriting privately-insured patients receiving high-cost agents due to a process that allows private
14 payers to leverage publicly funded catastrophic drug programs.^{12,13} As private payers are faced with a
15 larger number of claims for high-cost agents, they may be looking to shift the risk to public payers and
16 reduce the impact of these agents on their premiums.¹² This dynamic should be monitored closely as it
17 may have a growing impact on public drug spending.
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30 This study comes at a critical time as the federal government in Canada explores the potential for a
31 broader universal pharmacare strategy and the potential development of a national formulary and drug
32 agency.¹⁴ Considering drivers of high drug-cost beneficiaries in a pharmacare strategy would allow for
33 broader negotiations on a pan-Canadian level, which in turn could result in price listing agreements that
34 are proven to incur cost-savings.^{15,16} Additionally, policymakers should consider this opportunity to
35 develop pan-Canadian strategies that explore other mechanisms to address high drug costs. This may
36 include preferential listing of biosimilars (in place of biologics) and ongoing formulary modernization to
37 ensure appropriate use of costly medications.¹⁷⁻¹⁹
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45 Our results also highlight that high drug-cost beneficiaries used more medications on average compared
46 to other beneficiaries, highlighting the complexity of conditions among these patients. Approaches to
47 address the high costs among complex patients who are receiving a large number of chronic
48 medications requires interventional approaches beyond pricing policies.¹⁸ One potential approach that
49 this population could benefit from is the implementation of drug-specific case management strategies.
50 Case-management strategies have been used by a number of payers, mostly in the United States, to
51 address spending for high drug-cost beneficiaries.²⁰⁻²³ An important characteristic of successful
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3 strategies has been the adoption of segmented and targeted approaches.¹⁰ For example, among
4 patients using a large number of chronic medications, there are previously noted differences between
5 younger and older patients.^{10,24} Specifically, medications indicated for mental health diagnoses have
6 been found to be a major cost-driver among younger high drug-cost beneficiaries, while among older
7 high drug-cost beneficiaries, management of chronic diseases such as COPD and diabetes are more likely
8 to influence costs.^{10,23,24} These approaches may also help to assess potential overprescribing that has
9 been cited in complex populations.²⁵ Development of disease case-management strategies should help
10 account for these differences when developing policies.
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18 Our study is not without limitations. First, only beneficiaries who had at least one drug claim paid by a
19 public drug program in a given year were included in this study since we do not have data in all
20 provinces on public drug program eligibility. Therefore, this study did not include beneficiaries who are
21 eligible for public drug benefits but who did not receive a medication over the study period, nor did it
22 include people whose claims were accepted (e.g. to be applied toward a deductible), but not paid for by
23 public drug programs. It is likely that if these individuals were included, the differences in minimum cost
24 thresholds between high drug-cost beneficiaries and all other beneficiaries would be even more
25 pronounced. Second, we do not have information on private insurance status and it is possible that
26 individuals may have received other medications that were not captured in our study, particularly
27 among those who utilized the catastrophic drug programs. Lastly, much of the information on drug
28 pricing is based on the total amount paid to pharmacies. This information does not account for actual
29 prices paid by public payers based on confidential listing agreements with manufacturers, and thus the
30 costs reported in some drug classes may overestimate the true public program costs.
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41 The results of this study elucidate clustering of public-drug spending among a small proportion of high
42 drug-cost beneficiaries. This work can be used to inform policies specific to this population that can help
43 curb rising costs and optimize medication use. Future work should explore interventions to address
44 growing drug costs in this population, accounting for the two separate concerns depicted in our study.
45 This includes targeted approaches addressing the use a costly medications as well as the use of a large
46 number of medications. Future analysis should further refine these populations and explore their
47 characteristics separately as potential interventions and policies to help reduce spending among these
48 populations would differ.
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All authors were involved in the design, interpretation of results, writing, conceptualization of recommendations, and revision of the manuscript (MT, DM, MMM, TG). MT and TG, were involved in the implementation of the study. MT is the guarantor of the content of the manuscript.

DISCLOSURES

Dr Muhammad Mamdani has received honoraria from Boehringer Ingelheim, Pfizer, Bristol-Myers Squibb, and Bayer. No other authors have any conflicts of interest to declare.

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TABLES AND FIGURES

Table 1: Proportion of total program spending (TPS) and total program spending by high drug-cost beneficiaries (top 5%), fiscal year 2016

Province	Overall		High drug-cost beneficiaries			
	Total Program Spending	Average Cost per beneficiary	Total Program Spending	Proportion of Program Spending	High Drug-cost Beneficiary Cost Threshold	Average Cost per beneficiary
Overall	\$ 8,185.0	\$ 1,570	\$ 3,809.0	46.5%	\$ 5,291	\$ 14,610
British Columbia	\$ 1,087.2	\$ 1,473	\$ 586.6	54.0	\$ 5,319	\$ 15,896
Alberta	\$ 773.3	\$ 1,330	\$ 363.5	47.0	\$ 3,791	\$ 12,502
Saskatchewan	\$ 316.7	\$ 1,106	\$ 175.5	55.4	\$ 3,940	\$ 12,253
Manitoba	\$ 320.8	\$ 2,347	\$ 174.7	54.5	\$ 8,567	\$ 25,560
Ontario	\$ 5,126.3	\$ 1,673	\$ 2,242.6	43.7	\$ 5,656	\$ 14,640
New Brunswick	\$ 210.9	\$ 1,662	\$ 93.5	44.3	\$ 5,408	\$ 14,744
Prince Edward Island	\$ 26.0	\$ 632	\$ 13.7	52.6	\$ 2,282	\$ 6,650
Nova Scotia	\$ 187.0	\$ 1,369	\$ 76.3	40.8	\$ 4,065	\$ 11,175
Newfoundland and Labrador	\$ 136.8	\$ 1,326	\$ 56.0	41.0	\$ 4,397	\$ 10,863

Table 2: Drug utilization by province and high drug-cost beneficiary group, fiscal year 2016

Jurisdiction	High drug-cost beneficiaries			Other beneficiaries		
	Number of drugs	Beneficiaries with claim over \$1,000	Beneficiaries aged 65+	Number of drugs	Beneficiaries with claim over \$1,000	Beneficiaries aged 65+
	Median (IQR)	N (%)	(%)	Median (IQR)	N (%)	(%)
Overall	13 (7-19)	40.9%	48.2%	8 (4-13)	0.6%	65.1%
British Columbia	8 (5-14)	38.0%	26.1%	4 (2-7)	0.6%	45.6%
Alberta	13 (8-18)	38.4%	66.0%	6 (3-9)	0.3%	81.2%
Saskatchewan	12 (7-18)	22.1%	39.3%	3 (1-6)	0.1%	45.4%
Manitoba	9 (5-15)	63.4%	23.4%	6 (3-10)	1.0%	40.5%
Ontario	14 (8-19)	44.4%	54.9%	6 (3-10)	0.7%	71.5%
New Brunswick	11 (6-17)	37.2%	34.6%	6 (3-10)	0.6%	63.4%
Prince Edward Island	12 (8-16)	4.8%	41.7%	4 (2-6)	0.0%	62.3%
Nova Scotia	16 (12-21)	16.5%	81.5%	6 (4-10)	0.2%	88.0%
Newfoundland and Labrador	16 (9-22)	15.3%	38.3%	6 (3-10)	0.2%	50.3%

IQR: Interquartile range

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Table 3: Secondary analysis of proportion of total program spending (TPS) and total program spending by very high drug-cost beneficiaries (top 1%), fiscal year 2016

Province	Overall		Very High Drug-cost Users (Top 1%)		
	Total Program Spending	Total Program Spending	Proportion of TPS	Cost Threshold	Average Cost
Overall	\$ 8,185.0	\$ 1,906.0	23.3%	\$ 18,831	\$ 36,553
British Columbia	\$ 1,087.2	\$ 297.8	27.4	\$ 19,890	\$ 40,345
Alberta	\$ 773.3	\$ 189.3	24.5	\$ 19,590	\$ 32,545
Saskatchewan	\$ 316.7	\$ 89.7	28.3	\$ 17,888	\$ 31,319
Manitoba	\$ 320.8	\$ 85.5	26.6	\$ 30,978	\$ 62,520
Ontario	\$ 5,126.3	\$ 1,107.5	21.6	\$ 18,073	\$ 36,144
New Brunswick	\$ 210.9	\$ 44.2	21.0	\$ 20,442	\$ 34,822
Prince Edward island	\$ 26.0	\$ 7.6	29.2	\$ 7,932	\$ 18,465
Nova Scotia	\$ 187.0	\$ 42.2	22.6	\$ 15,606	\$ 30,882
Newfoundland and Labrador	\$ 136.8	\$ 29.1	21.3	\$ 13,386	\$ 28,161

Table 4: Top 10 chemicals by total drug program spending and Use by high cost category and by jurisdiction, fiscal year 2016

Very high drug-cost Beneficiaries (Top 1%)		High drug-cost Beneficiaries (Top 5%)		Other beneficiaries		
Total Spending						
1	Infliximab*	\$ 331,002,170	Ranibizumab*	\$ 149,319,608	Salmeterol/Fluticasone	\$110,037,629
2	Sofosbuvir/ledipasvir [#]	\$ 270,669,622	Aflibercept	\$ 122,412,063	Atorvastatin	\$108,457,147
3	Adalimumab*	\$ 145,652,072	Adalimumab*	\$ 82,784,426	Perindopril	\$91,622,949
4	Lenalidomide	\$ 118,550,630	Paliperidone	\$ 62,288,410	Rosuvastatin	\$86,933,263
5	Etanercept*	\$ 86,154,466	Etanercept	\$ 50,613,266	Metformin/Sitagliptin	\$83,201,111
6	Sofosbuvir [#]	\$ 74,950,373	Insulin glargine	\$ 38,740,800	Sitagliptin	\$76,710,532
7	Ranibizumab*	\$ 65,440,527	Infliximab*	\$ 37,537,419	Methadone	\$76,477,878
8	Aflibercept	\$ 52,468,572	Hydromorphone	\$ 36,425,150	Rivaroxaban	\$75,651,662
9	Eculizumab*	\$ 37,516,433	Aripiprazole	\$ 34,064,003	Insulin glargine	\$74,519,810
10	Dasabuvir/Ombitasvir/ Paritaprevir/Ritonavir [#]	\$ 36,048,600	Methadone	\$ 28,115,644	Pantoprazole	\$72,636,566
Total use						
1	Pantoprazole	10,090	Pantoprazole	10,090	Rosuvastatin	10,090
2	Infliximab*	9,645	Salbutamol	9,645	Atorvastatin	9,645
3	Salbutamol	9,104	Rosuvastatin	9,104	Pantoprazole	9,104
4	Codeine/APAP	7,524	Atorvastatin	7,524	Amoxicillin	7,524
5	Prednisone	7,308	Metformin	7,308	Levothyroxine	7,308
6	Amoxicillin	7,274	Furosemide	7,274	Salbutamol	7,274
7	Rosuvastatin	7,072	Amlodipine	7,072	Amlodipine	7,072

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8	Adalimumab*	6,549	Levothyroxine	6,549	Metformin	6,549
9	Methotrexate	6,277	Amoxicillin	6,277	Codeine/APAP	6,277
10	Levothyroxine	6,228	Codeine/APAP	6,228	Ramipril	6,228
1	Pantoprazole	10,090	Pantoprazole	10,090	Rosuvastatin	10,090

Note: *Denotes a biologics (not including insulin or LMWH) and #denotes an antiviral.

Confidential

Supplemental Material

Table 1: Top 10 chemicals by total drug program spending by high cost category and by jurisdiction, fiscal year 2016

Note: Biologics (not including insulin or LMWH) highlighted in Blue. Antivirals are highlighted in Yellow.

Jurisdiction	Rank	Very high drug-cost Beneficiaries (Top 1%)		High drug-cost Beneficiaries (Top 5%)		Other beneficiaries	
		Drug Name	Total program spending	Drug Name	Total program spending	Drug Name	Total program spending
Alberta	1	Infliximab	\$ 64,867,932	Adalimumab	\$ 15,203,734	Salmeterol/Fluticasone	\$ 14,831,765
	2	Adalimumab	\$ 22,541,668	Glatiramer	\$ 8,771,051	Atorvastatin	\$ 12,238,077
	3	Sofosbuvir/Ledipasvir	\$ 18,438,149	Ranibizumab	\$ 8,172,466	Perindopril	\$ 10,760,204
	4	Etanercept	\$ 13,613,780	Infliximab	\$ 7,673,371	Pantoprazole	\$ 10,565,809
	5	Fingolimod	\$ 7,766,826	Etanercept	\$ 7,322,786	Formoterol/Budesonide	\$ 10,260,184
	6	Dimethyl fumarate	\$ 5,239,637	Insulin glargine	\$ 5,471,808	Rivaroxaban	\$ 9,512,546
	7	Eculizumab	\$ 4,867,085	Ustekinumab	\$ 5,318,795	Rosuvastatin	\$ 9,416,492
	8	Octreotide	\$ 4,366,391	Darbepoetin alfa	\$ 4,902,197	Tiotropium	\$ 8,710,675
	9	Interferon beta-1a	\$ 4,179,173	Oxycodone	\$ 4,591,761	Insulin glargine	\$ 7,982,133
	10	Ustekinumab	\$ 3,942,333	Tinzaparin	\$ 3,725,097	Amlodipine	\$ 7,829,082
BC	1	Infliximab	\$ 78,004,144	Adalimumab	\$ 34,992,444	Methadone	\$ 18,223,015
	2	Sofosbuvir and ledipasvir	\$ 77,711,332	Etanercept	\$ 21,280,993	Nicotine	\$ 14,368,720
	3	Adalimumab	\$ 28,897,862	Paliperidone	\$ 16,557,128	Atorvastatin	\$ 11,565,450
	4	Sofosbuvir	\$ 19,268,081	Infliximab	\$ 10,651,648	Quetiapine	\$ 10,465,102
	5	Dasabuvir/Ombitasvir/Paritaprevir/Ritonavir	\$ 16,854,455	Clozapine	\$ 9,562,226	Salmeterol/Fluticasone	\$ 10,347,632
	6	Alfa1 antitrypsin	\$ 7,253,536	Methadone	\$ 8,171,709	Ramipril	\$ 8,085,614
	7	Fingolimod	\$ 6,399,483	Aripiprazole	\$ 8,065,912	Gabapentin	\$ 8,068,948
	8	Etanercept	\$ 5,576,629	Abatacept	\$ 6,409,482	Insulin glargine	\$ 8,062,263
	9	Dimethyl fumarate	\$ 4,405,563	Quetiapine	\$ 5,525,898	Aripiprazole	\$ 7,965,701

	10	Ustekinumab	\$ 3,355,662	Golimumab	\$ 5,238,164	Amlodipine	\$ 6,980,233
1	1	Infliximab	\$ 29,708,571	Adalimumab	\$ 12,666,070	Salmeterol/Fluticasone	\$ 4,723,815
2	2	Sofosbuvir/Ledipasvir	\$ 8,773,436	Etanercept	\$ 9,221,641	Atorvastatin	\$ 2,666,029
3	3	Lenalidomide	\$ 7,827,696	Infliximab	\$ 6,328,948	Aripiprazole	\$ 2,323,571
4	4	Adalimumab	\$ 7,001,596	Interferon beta-1a	\$ 3,978,582	Hydromorphone	\$ 2,081,694
5	5	Etanercept	\$ 3,833,907	Glatiramer acetate	\$ 2,602,596	Omeprazole	\$ 2,041,208
6	6	Sofosbuvir	\$ 3,599,508	Ustekinumab	\$ 1,855,149	Gabapentin	\$ 1,991,915
7	7	Alfa1 antitrypsin	\$ 2,590,337	Tenofovir/Emtricitabine	\$ 1,820,047	Methylphenidate	\$ 1,832,170
8	8	Octreotide	\$ 1,662,581	Dimethyl fumarate	\$ 1,773,657	Clozapine	\$ 1,801,696
9	9	Alglucosidase alfa	**	Golimumab	\$ 1,608,363	Quetiapine	\$ 1,767,142
10	10	Dasabuvir/Ombitasvir/Paritaprevir/Ritonavir	\$ 1,168,231	Darunavir	\$ 1,602,081	Risperidone	\$ 1,696,644
11	1	Infliximab	\$ 7,614,736	Ranibizumab	\$ 2,881,004	Salmeterol/Fluticasone	\$ 3,804,852
12	2	Lenalidomide	\$ 4,805,559	Methadone	\$ 2,436,610	Perindopril	\$ 3,690,595
13	3	Adalimumab	\$ 3,539,920	Aflibercept	\$ 2,149,400	Methadone	\$ 3,597,739
14	4	Etanercept	\$ 2,086,924	Adalimumab	\$ 2,104,495	Pantoprazole	\$ 2,993,426
15	5	Sofosbuvir/Ledipasvir	\$ 1,744,353	Paliperidone	\$ 2,103,991	Atorvastatin	\$ 2,416,560
16	6	Ustekinumab	\$ 1,180,724	Hydromorphone	\$ 1,336,460	Nifedipine	\$ 2,396,405
17	7	Teriflunomide	\$ 1,123,646	Risperidone	\$ 1,264,379	Rosuvastatin	\$ 2,371,423
18	8	Dimethyl fumarate	\$ 1,122,056	Infliximab	\$ 1,247,366	Fluticasone	\$ 2,134,415
19	9	Interferon beta-1a	\$ 1,009,154	Etanercept	\$ 1,239,067	Rivaroxaban	\$ 1,893,174
20	10	Ranibizumab	\$ 843,777	Clozapine	\$ 975,819	Perindopril/Diuretics	\$ 1,808,922
21	1	Infliximab	\$ 4,245,402	Methadone	\$ 2,929,381	Nifedipine	\$ 2,640,961
22	2	Lenalidomide	\$ 3,417,974	Ranibizumab	\$ 1,641,543	Rosuvastatin	\$ 2,294,220
23	3	Adalimumab	\$ 3,320,198	Insulin (human)	\$ 846,398	Rabeprazole	\$ 2,019,865
24	4	Sofosbuvir/Ledipasvir	\$ 2,488,984	Adalimumab	\$ 833,129	Fluticasone	\$ 1,939,230
25	5	Ustekinumab	\$ 1,290,300	Insulin (human)	\$ 783,089	Atorvastatin	\$ 1,670,545
26	6	Golimumab	\$ 1,068,247	Darbepoetin alfa	\$ 599,397	Methadone	\$ 1,551,484
27	7	Imiglucerase	**	Salmeterol/Fluticasone	\$ 451,759	Perindopril	\$ 1,486,857

	8	Dimethyl fumarate	\$ 929,877	Clozapine	\$ 402,894	Metoprolol	\$ 1,317,710
1	9	Etanercept	\$ 905,340	Paliperidone	\$ 382,815	Salmeterol/Fluticasone	\$ 1,315,805
2	10	Interferon beta-1a	\$ 769,915	Morphine	\$ 369,167	Omeprazole	\$ 1,202,767
3	1	Infliximab	\$ 8,510,238	Adalimumab	\$ 1,508,474	Rosuvastatin	\$ 3,274,532
4	2	Adalimumab	\$ 6,151,155	Insulin glargine	\$ 1,044,312	Atorvastatin	\$ 2,941,950
5	3	Lenalidomide	\$ 4,728,894	Hydromorphone	\$ 1,004,208	Perindopril	\$ 2,782,994
6	4	Etanercept	\$ 3,856,445	Insulin (human)	\$ 979,550	Rabeprazole	\$ 2,433,663
7	5	Ivacaftor	\$ 1,718,320	Salmeterol/Fluticasone	\$ 919,444	Levothyroxine sodium	\$ 2,140,084
8	6	Golimumab	\$ 1,241,652	Dalteparin	\$ 753,367	Nifedipine	\$ 2,110,545
9	7	Ustekinumab	\$ 1,074,379	Etanercept	\$ 724,671	Salmeterol/Fluticasone	\$ 2,105,252
10	8	Sofosbuvir/Ledipasvir	\$ 986,105	Insulin detemir	\$ 635,095	Insulin (human)	\$ 1,974,249
11	9	Octreotide	\$ 976,124	Insulin aspart	\$ 633,899	Amlodipine	\$ 1,876,032
12	10	Abatacept	\$ 833,096	Infliximab	\$ 615,735	Omeprazole	\$ 1,806,201
13	1	Sofosbuvir/Ledipasvir	\$ 148,382,350	Ranibizumab	\$ 127,278,505	Metformin and sitagliptin	\$ 79,071,410
14	2	Infliximab	\$ 102,676,705	Aflibercept	\$ 112,664,676	Atorvastatin	\$ 72,434,758
15	3	Lenalidomide	\$ 96,914,294	Paliperidone	\$ 37,426,387	Sitagliptin	\$ 70,017,206
16	4	Ranibizumab	\$ 66,839,510	Insulin glargine	\$ 25,713,848	Salmeterol/Fluticasone	\$ 69,070,354
17	5	Aflibercept	\$ 56,911,069	Hydromorphone	\$ 22,882,175	Perindopril	\$ 65,554,954
18	6	Adalimumab	\$ 50,579,837	Aripiprazole	\$ 20,789,393	Apixaban	\$ 59,605,420
19	7	Etanercept	\$ 43,524,508	Adalimumab	\$ 19,488,982	Rosuvastatin	\$ 59,534,671
20	8	Sofosbuvir	\$ 43,520,384	Lamivudine/Abacavir/Dolutegravir	\$ 18,886,292	Rivaroxaban	\$ 53,077,762
21	9	Eculizumab	\$ 31,107,836	Tenofovir	\$ 17,137,188	Insulin glargine	\$ 50,378,061
22	10	Octreotide	\$ 23,355,851	Risperidone	\$ 15,792,857	Methadone	\$ 49,284,275
23	1	Infliximab	\$ 1,471,212	Methadone	\$ 642,682	Pantoprazole	\$ 552,717
24	2	Adalimumab	\$ 1,440,688	Insulin (human)	\$ 159,751	Methadone	\$ 464,136
25	3	Lenalidomide	\$ 814,157	Pantoprazole	\$ 141,566	Atorvastatin	\$ 364,888
26	4	Etanercept	\$ 449,238	Salmeterol/Fluticasone	\$ 124,469	Rosuvastatin	\$ 335,442
27	5	Pirfenidone	\$ 287,202	Clozapine	\$ 123,870	Perindopril	\$ 301,234
28	6	Aflibercept	\$ 262,070	Adalimumab	\$ 122,548	Amlodipine	\$ 264,573
29	7	Risperidone	\$ 237,664	Insulin lispro	\$ 111,587	Insulin (human)	\$ 230,631

Nova Scotia

Ontario

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Insulin lispro

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	8	Golimumab	\$ 226,509	Olanzapine	\$ 111,147	Fluticasone	\$ 213,218
	9	Interferon beta-1a	\$ 222,685	Fluticasone	\$ 107,413	Omeprazole	\$ 209,668
	10	Fingolimod	\$ 219,460	Hydromorphone	\$ 101,677	Nifedipine	\$ 194,951
Saskatchewan	1	Infliximab	\$ 29,224,199	Adalimumab	\$ 4,341,960	Methylphenidate	\$ 4,134,652
	2	Adalimumab	\$ 13,904,222	Etanercept	\$ 3,251,959	Insulin glargine	\$ 3,565,614
	3	Sofosbuvir/Ledipasvir	\$ 8,070,050	Hydromorphone	\$ 3,076,061	Salmeterol/Fluticasone	\$ 2,986,275
	4	Etanercept	\$ 5,352,192	Insulin glargine	\$ 2,716,952	Perindopril	\$ 2,953,658
	5	Dimethyl fumarate	\$ 3,687,514	Infliximab	\$ 2,669,912	Hydromorphone	\$ 2,707,466
	6	Sofosbuvir	\$ 2,467,151	Glatiramer	\$ 2,542,614	Rivaroxaban	\$ 2,616,595
	7	Interferon beta-1a	\$ 1,955,792	Paliperidone	\$ 2,215,723	Nifedipine	\$ 2,484,144
	8	Ustekinumab	\$ 1,840,246	Clozapine	\$ 1,966,654	Atorvastatin	\$ 2,428,239
	9	Golimumab	\$ 1,839,197	Golimumab	\$ 1,900,253	Rosuvastatin	\$ 2,036,727
	10	Dasabuvir/Ombitasvir/Paritaprevir/Ritonavir	\$ 1,012,192	Erythropoietin	\$ 1,662,673	Tiotropium	\$ 2,032,495

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Table 2: Top 10 chemicals by rate of use, by high cost category and by jurisdiction, fiscal year 2016

Note: Biologics (not including insulin or LMWH) highlighted in Blue. Antivirals are highlighted in Yellow.

Jurisdiction	Rank	Very high drug-cost Beneficiaries (Top 1%)		High drug-cost Beneficiaries (Top 5%)		Other beneficiaries	
		Drug Name	Number of Users (n)	Drug Name	Number of Users (n)	Drug Name	Number of Users (n)
Alberta	1	Infliximab	1,785	Rosuvastatin	101,728	Levothyroxine	115,386
	2	Pantoprazole	1,206	Atorvastatin	96,282	Pantoprazole	114,298
	3	Methotrexate	1,137	Metformin	78,404	Rosuvastatin	101,728
	4	Adalimumab	1,118	Amlodipine	76,953	Atorvastatin	96,282
	5	Folic acid	948	Amoxicillin	70,730	Metformin	78,404
	6	Codeine/APAP	858	Zopiclone	70,544	Amlodipine	76,953
	7	Zopiclone	820	Diclofenac	68,515	Amoxicillin	70,730
	8	Prednisone	782	Codeine /APAP	67,620	Zopiclone	70,544
	9	Levothyroxine	733	Rosuvastatin	101,728	Diclofenac	68,515
	10	Amoxicillin	729	Atorvastatin	96,282	Codeine /APAP	67,620
BC	1	Infliximab	2,323	Salbutamol	6,186	Levothyroxine	87,178
	2	Codeine /APAP	1,287	Codeine /APAP	5,561	Ramipril	86,533
	3	Sofosbuvir /ledipasvir	1,278	Gabapentin	5,465	Atorvastatin	86,055
	4	Adalimumab	1,157	Quetiapine	5,159	Codeine /APAP	83,408
	5	Salbutamol	1,126	Lorazepam	4,744	Amoxicillin	79,299

1	6	Prednisone	1,065	Atorvastatin	4,215	Salbutamol	78,086
2	7	Methotrexate	876	Metformin	4,073	Metformin	74,771
3	8	Amoxicillin	868	Pantoprazole	4,023	Nicotine	70,813
4	9	Lorazepam	759	Levothyroxine	4,013	Rosuvastatin	66,972
5	10	Gabapentin	751	Ramipril	4,008	Amlodipine	64,547
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7	1	Infliximab	506	Codeine /APAP	1,218	Salbutamol	21,055
8	2	Codeine /APAP	309	Salbutamol	1,170	Amoxicillin	19,180
9	3	Hydrocortisone	258	Levothyroxine sodium	888	Codeine /APAP	18,777
10	4	Zopiclone	213	Gabapentin	881	Levothyroxine	18,628
11	5	Salbutamol	207	Zopiclone	852	Atorvastatin	17,679
12	6	Prednisone	203	Prednisone	811	Metformin	17,020
13	7	Adalimumab	188	Metformin	810	Metoprolol	15,737
14	8	Amoxicillin	185	Atorvastatin	779	Furosemide	14,472
15	9	Omeprazole	176	Omeprazole	768	APAP	13,787
16	10	Azithromycin	168	Adalimumab	748	Omeprazole	13,199
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18	1	Pantoprazole	433	Pantoprazole	1,968	Pantoprazole	33,131
19	2	Salbutamol	290	Salbutamol	1,637	Rosuvastatin	23,935
20	3	Zopiclone	284	Zopiclone	1,309	Salbutamol	23,158
21	4	Infliximab	239	Lorazepam	986	Levothyroxine	21,228
22	5	Gabapentin	206	Rosuvastatin	973	Atorvastatin	17,287
23	6	Prednisone	206	Furosemide	936	Metformin	16,745

Manitoba

New Brunswick

1		7	Lorazepam	198	Metformin	934	Zopiclone	16,123
2		8	Rosuvastatin	192	Prednisone	909	Lorazepam	15,156
3		9	Adalimumab	175	Levothyroxine	897	Amoxicillin	13,746
4		10	Levothyroxine	154	Gabapentin	880	Metoprolol	12,101
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7		1	Rabeprazole	306	Salbutamol	1,583	Amoxicillin	21,174
8		2	Salbutamol	236	Rabeprazole	1,562	Rosuvastatin	20,799
9		3	Prednisone	229	Rosuvastatin	1,155	Rabeprazole	20,394
10		4	Zopiclone	195	Zopiclone	1,146	Salbutamol	19,368
11		5	Adalimumab	184	Insulin (human)	1,117	Metoprolol	14,493
12		6	Rosuvastatin	180	Furosemide	1,034	Metformin	13,366
13		7	Amoxicillin	178	Amoxicillin	973	Lorazepam	12,418
14		8	Lorazepam	164	Metformin	967	Atorvastatin	11,368
15		9	Ciprofloxacin	161	Lorazepam	956	Hydrochlorothiazide	11,139
16		10	Infliximab	157	Insulin (human)	929	Levothyroxine sodium	11,026
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18		1	Adalimumab	326	Salbutamol	2,132	Rosuvastatin	30,964
19		2	Infliximab	309	Furosemide	1,946	Levothyroxine	28,840
20		3	Rabeprazole	284	Rabeprazole	1,680	Rabeprazole	23,155
21		4	Methotrexate	262	Metformin	1,669	Atorvastatin	21,004
22		5	Levothyroxine	229	Rosuvastatin	1,629	Metoprolol	20,097
23		6	Salbutamol	222	Levothyroxine	1,625	Salbutamol	19,520
24		7	Prednisone	219	Metoprolol	1,390	Metformin	19,248
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1	8	Rosuvastatin	217	Insulin (human)	1,345	Hydrochlorothiazide	17,138
2	9	Etanercept	197	Prednisone	1,321	Amlodipine	16,569
3	10	Folic acid	179	Atorvastatin	1,287	Amoxicillin	14,762
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5	1	Pantoprazole	7,083	Pantoprazole	37,252	Rosuvastatin	604,402
6	2	Salbutamol	5,977	Salbutamol	33,686	Atorvastatin	506,390
7	3	Rosuvastatin	5,464	Rosuvastatin	30,160	Pantoprazole	486,193
8	4	Amoxicillin	4,608	Atorvastatin	28,181	Amoxicillin	457,544
9	5	Amlodipine	4,575	Metformin	27,005	Amlodipine	422,938
10	6	Atorvastatin	4,458	Furosemide	25,900	Salbutamol	402,057
11	7	Codeine /APAP	4,107	Amlodipine	25,040	Levothyroxine	391,981
12	8	Prednisone	4,057	Levothyroxine	21,504	Metformin	348,436
13	9	Levothyroxine	3,843	Amoxicillin	21,316	Codeine /APAP	323,008
14	10	Metformin	3,756	Hydromorphone	20,883	Ramipril	273,744
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16	1	Pantoprazole	96	Pantoprazole	585	Rosuvastatin	6,369
17	2	Adalimumab	90	Salbutamol	573	Levothyroxine	6,008
18	3	Salbutamol	89	Levothyroxine	382	Metformin	6,001
19	4	Prednisone	56	Metformin	353	Pantoprazole	5,791
20	5	Infliximab	55	Furosemide	346	Amoxicillin	5,498
21	6	Levothyroxine	52	Rosuvastatin	326	Amlodipine	4,487
22	7	Amoxicillin	50	Amoxicillin	322	Atorvastatin	4,442
23	8	Metformin	49	Ipratropium	309	Ramipril	4,010
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1	9	Cefalexin	49	Insulin (human)	305	Salbutamol	3,869
2	10	Rosuvastatin	47	Prednisone	287	Metoprolol	3,783
3	1	Infliximab	866	Furosemide	2,942	Amoxicillin	41,488
4	2	Folic acid	550	Salbutamol	2,838	Rosuvastatin	28,126
5	3	Adalimumab	537	Metformin	2,742	Cefalexin	26,300
6	4	Prednisone	506	Pantoprazole	2,639	Atorvastatin	24,905
7	5	Methotrexate	476	Insulin glargine	2,508	Levothyroxine	24,380
8	6	Pantoprazole	443	Hydromorphone	2,308	Metformin	24,343
9	7	Salbutamol	409	Prednisone	2,233	Salbutamol	23,633
10	8	Amoxicillin	401	Levothyroxine	2,089	Pantoprazole	22,440
11	9	Hydromorphone	378	Rosuvastatin	2,036	Azithromycin	20,390
12	10	Cefalexin	365	Atorvastatin	1,991	Amlodipine	19,481
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Table 3: Proportion of total program spending (TPS) and total program spending by high drug-cost beneficiaries group including Cancer, fiscal year 2016

Jurisdiction	Top 1%		Top 5%		Top 10%		Overall
	Total Program Spending	Proportion of TPS	Total Program Spending	Proportion of TPS	Total Program Spending	Proportion of TPS	Total Program Spending
	(\$ Million)	(%)	(\$ Million)	(%)	(\$ Million)	(%)	(\$ Million)
BC	\$ 297.8	27.4	\$ 586.6	54.0	\$ 731.9	67.3	\$ 1,087.2
AB	\$ 189.3	24.5	\$ 363.5	47.0	\$ 450.7	58.3	\$ 773.3
SK	\$ 89.7	28.3	\$ 175.5	55.4	\$ 218.0	68.8	\$ 316.7
MB	\$ 85.5	26.6	\$ 174.7	54.5	\$ 215.3	67.1	\$ 320.8
ON	\$ 1,107.5	21.6	\$ 2,242.6	43.7	\$ 2,915.8	56.9	\$ 5,126.3
NB	\$ 44.2	21.0	\$ 93.5	44.3	\$ 119.7	56.8	\$ 210.9
PE	\$ 7.6	29.2	\$ 13.7	52.6	\$ 17.2	65.9	\$ 26.0
NS	\$ 42.2	22.6	\$ 76.3	40.8	\$ 99.1	53.0	\$ 187.0
NL	\$ 29.1	21.3	\$ 56.0	41.0	\$ 74.1	54.2	\$ 136.8

Table 4: Drug utilization among the top 1% of beneficiaries group, fiscal year 2016

Jurisdiction	Top 1%		
	Number of drugs Median (IQR)	Beneficiaries with claim over \$1,000 N (%)	Beneficiaries aged 65+ (%)
Overall	8 (4-13)	94.7%	36.9%
British Columbia	6 (3-10)	97.6%	18.9%
Alberta	7 (3-11)	99.5%	32.5%
Saskatchewan	7 (4-11)	94.9%	20.8%
Manitoba	7 (4-12)	95.9%	21.6%
Ontario	10 (5-15)	93.0%	46.6%
New Brunswick	9 (5-13)	91.6%	33.4%
Prince Edward island	6 (2-12)	73.5%	31.6%
Nova Scotia	8 (4-13)	97.6%	52.7%
Newfoundland and Labrador	10 (6-15)	92.3%	25.8%

IQR: Interquartile range