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Research

Characteristics of high–drug-cost beneficiaries of public drug plans in 9 Canadian provinces: a cross-sectional analysis

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Abstract

Background: Drugs are the fastest growing cost in the Canadian health care system, owing to the increasing number of high-cost drugs. The objective of this study was to examine the characteristics of high–drug-cost beneficiaries of public drug plans across Canada relative to other beneficiaries.

Methods: We conducted a cross-sectional study among public drug plan beneficiaries residing in all provinces except Quebec. We used the Canadian Institute for Health Information's National Prescription Drug Utilization Information System to identify all drugs dispensed to beneficiaries of public drug programs in 2016/17. 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 (> $1000), median number of drugs, proportion of beneficiaries aged 65 or more, the 10 most costly reimbursed medications and the 10 medications most commonly reimbursed. We reported estimates overall and by province.

Results: High–drug-cost beneficiaries accounted for nearly half (46.5%) of annual spending, with an average annual spend of $14 610 per beneficiary, compared to $1570 among other beneficiaries. The median number of drugs dispensed was higher among high–drug-cost beneficiaries than among other beneficiaries (13 [interquartile range (IQR) 7–19] v. 8 [IQR 4–13]), and a much larger proportion of high–drug-cost beneficiaries than other beneficiaries received at least 1 high-cost claim (40.9% v. 0.6%). Long-term medications were the most commonly used medications for both groups, whereas biologics and antivirals were the most costly medications for high–drug-cost beneficiaries.

Interpretation: High–drug-cost beneficiaries were characterized by the use of expensive medications and polypharmacy relative to other beneficiaries. Interventions and policies to help reduce spending need to consider both of these factors.

Drug costs are the fastest growing major expenditure in the Canadian health care system.[1,2] They account for 15.7% of all public health care spending, grow by 4.2% annually and outpace 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 the return to growth in drug spending between 2013 to 2018[1] 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 use as well as approval of a growing number of high-cost new therapies.[4] These 2 factors can lead to a high level of clustering among beneficiaries of public drug programs, in which a small number of beneficiaries account for a high proportion of total spending. Although previous work has shown a high rate of clustering in total health care and drug expenditures across Canada, characteristics of these beneficiaries for drug spending nationally are unknown.[1] In addition, how the characteristics vary by the differing provincial public drug program structures is unknown.[5] A 2018 Canadian Institute for Health Information report indicated that beneficiaries across Canada with more than $10 000 spent annually on drugs represented only 2% of all beneficiaries yet accounted for one-third of overall spending, with the latter 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.

Competing interests: Muhammad Mamdani has received honoraria from Boehringer Ingelheim, Pfizer, Bristol-Myers Squibb and Bayer. No other competing interests were declared.

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The objective of this study was to examine the characteristics of high–drug-cost beneficiaries across Canada relative to other beneficiaries.

Methods

Design, data source and population

We conducted a cross-sectional study among active beneficiaries of public drug plans residing in 9 provinces across Canada (all except Quebec), defined as people who had at least 1 prescription reimbursed by a provincial public drug program between Apr. 1, 2016, and Mar. 31, 2017. We used the Canadian Institute for Health Information's National Prescription Drug Utilization Information System to identify all drugs dispensed to beneficiaries of public drug plans over the study period.[6] In general, all public drug programs have coverage for all people receiving social assistance and those aged 65 years or more. Programs differ in their coverage for catastrophic drug programs, ranging from 3% to 12% of annual income.[7] Catastrophic drug programs are defined as reimbursement plans that support people whose out-of-pocket spending on medications places potential financial stress on them. In addition, 2 provinces (Alberta and New Brunswick) offer the option for purchase of public coverage.

The National Prescription Drug Utilization Information System 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 differently between provinces.

Statistical analysis

We identified the total number of active beneficiaries of public drug programs and their associated annual cost to the program in each of the 9 included provinces. We created an overall estimate by combining data from all 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%). In a secondary analysis, we explored a third group, beneficiaries with very high drug costs (defined as the top 1% of beneficiaries based on annual costs). These cut-offs are commonly used to report cost distribution for high-cost health care users.[2,8,9] We defined cost as the total amount paid by the public payer; it does not include deductibles and out-of-pocket payments.

For each cost group and province, we reported the following: total drug costs, minimum cost threshold (defined as the beneficiary with the lowest total drug spend in each group), prevalence of high-cost drug claims (defined as a claim reimbursed for a cost > $1000), median number of unique drugs dispensed per person, number of beneficiaries aged 65 years or more, 10 most commonly reimbursed medications and 10 most costly reimbursed medications. Medications were captured on the drug name level. All provinces studied require that people provide a form of identification (generally a provincial health insurance card) when their prescription is dispensed, which can be used to link individual-level prescription history. We also created Lorenz curves overall and by jurisdiction to visually depict the level of clustering in payments.

In a sensitivity analysis, we replicated the findings to include cancer agents.

All analyses were conducted with SAS Version 9.2 (SAS Institute) and Microsoft Excel.

Ethics approval

This protocol was approved by the Research Ethics Board of St. Michael's Hospital, Toronto.

Results

The overall analysis of publicly funded beneficiaries in 2016/17 exhibited a high level of clustering in spending (Table 1), with high–drug-cost beneficiaries accounting for nearly half (46.5%) of total annual spending. The minimum cost threshold for these beneficiaries was $5291, and the average cost was $14 610 per beneficiary (Table 1). These findings remained consistent in the sensitivity analysis when cancer treatments were included (Appendix 1, Supplemental Tables S1–S5, available at www.cmajopen.ca/content/8/2/E297/suppl/DC1).

Overall, we found that the median number of drugs dispensed was higher among high–drug-cost beneficiaries than among other beneficiaries (13 [interquartile range (IQR) 7–19] v. 8 [IQR 4–13]), and a much larger proportion of high–drug-cost beneficiaries than other beneficiaries received at least 1 high-cost drug claim (40.9% v. 0.6%) (Table 2). Overall, high–drug-cost beneficiaries were less likely than other beneficiaries to be aged 65 or more (48.2% v. 65.1%).

Provincial comparisons

High–drug-cost beneficiaries accounted for close to half of total annual spending in each province (range 40.8% [Nova Scotia] to 55.4% [Saskatchewan]) (Table 1). However, the minimum cost threshold varied considerably, from $2282 in Prince Edward Island to $8567 in Manitoba. The average drug cost per person also exhibited geographic variability, ranging from $6650 in Prince Edward Island to $25 560 in Manitoba. These findings remained consistent in the sensitivity analysis when cancer treatments were included (Appendix 1, Supplemental Tables S1–S5). All provinces showed signs of clustering among high–drug-cost beneficiaries (Appendix 1, Supplemental Figure S2).

Across all provinces, the median number of drugs dispensed was higher among high–drug-cost beneficiaries (range 8 [IQR 5–14] in British Columbia to 16 [IQR 12–21] in Nova Scotia) than among other beneficiaries (range 3 [IQR 1–6] in Saskatchewan to 6 [IQR 4–10] in Nova Scotia) (Table 2). The number of high–drug-cost beneficiaries who received a high-cost claim ranged widely across provinces, from 4.8% in Prince Edward Island to 63.4% in Manitoba. Consistent with the overall analysis, high–drug-cost beneficiaries were typically

Table 1: Total public drug program spending overall and for high–drug-cost beneficiaries* in Canada (excluding Quebec and territories), 2016/17

Province	Overall		High–drug-cost beneficiaries			
	Total program spending, $ millions	Mean cost per beneficiary, $	Total program spending, $ millions	% of program spending	Minimum cost threshold, $	Mean cost per beneficiary, $
Overall	8185.0	1570	3809.0	46.5	5291	14 610
British Columbia	1087.2	1473	586.6	54.0	5319	15 896
Alberta	773.3	1330	363.5	47.0	3791	12 502
Saskatchewan	316.7	1106	175.5	55.4	3940	12 253
Manitoba	320.8	2347	174.7	54.5	8567	25 560
Ontario	5126.3	1673	2242.6	43.7	5656	14 640
New Brunswick	210.9	1662	93.5	44.3	5408	14 744
Nova Scotia	187.0	1369	76.3	40.8	4065	11 175
Prince Edward Island	26.0	632	13.7	52.6	2282	6650
Newfoundland and Labrador	136.8	1326	56.0	41.0	4397	10 863

*Defined as the top 5% of beneficiaries based on annual costs.

Table 2: Drug use by high–drug-cost beneficiaries and other beneficiaries

Province	High–drug-cost beneficiaries			Other beneficiaries		
	No. of drugs, median (IQR)	% with claim > $1000	% aged ≥ 65 yr	No. of drugs, median (IQR)	% with claim > $1000	% aged ≥ 65 yr
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
Nova Scotia	16 (12–21)	16.5	81.5	6 (4–10)	0.2	88.0
Prince Edward Island	12 (8–16)	4.8	41.7	4 (2–6)	0.0	62.3
Newfoundland and Labrador	16 (9–22)	15.3	38.3	6 (3–10)	0.2	50.3

Note: IQR = interquartile range.

less likely than other beneficiaries to be aged 65 or more. Less than 50% were in this age group in 6 of the 9 provinces, with the exceptions being Ontario (54.9%), Alberta (66.0%) and Nova Scotia (81.5%).

Beneficiaries with very high drug costs

In the secondary analysis, beneficiaries with very high drug costs also accounted for a large proportion of spending in all provinces (Table 3); they accounted for nearly one-quarter (23.3%) of total spending overall. The minimum cost threshold was $18 831, and the average drug cost per person was $36 553. Clustering of costs was similar across provinces (range for total annual spending 21.0% in New Brunswick to 29.2% in Prince Edward Island) (Table 3). However, there was a wide range in the minimum cost threshold, from $7932 in Prince Edward Island to $30 978 in Manitoba, and in the average drug cost per person, from $18 465 in Prince Edward Island to $62 519 in Manitoba.

Table 3: Total public drug program spending overall and for beneficiaries with very high drug costs*

Province	Overall total program spending, $ millions	Beneficiaries with very high drug costs			
		Total program spending, $ millions	% of total program spending	Minimum cost threshold, $	Average cost, $
Overall	8185.0	1906.0	23.3	18 831	36 553
British Columbia	1087.2	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	5126.3	1107.5	21.6	18 073	36 144
New Brunswick	210.9	44.2	21.0	20 442	34 822
Nova Scotia	187.0	42.2	22.6	15 606	30 882
Prince Edward Island	26.0	7.6	29.2	7932	18 465
Newfoundland and Labrador	136.8	29.1	21.3	13 386	28 161

*Defined as the top 1% of beneficiaries based on annual costs.

The median number of drugs dispensed was slightly lower for beneficiaries with very high drug costs than for high–drug-cost beneficiaries in most provinces (range 6 [IQR 2–12] in Prince Edward Island to 10 [IQR 6–15] in Newfoundland and Labrador), whereas the majority of beneficiaries with very high drug costs received at least 1 high-cost drug claim (range 73.5% in Prince Edward Island to 99.5% in Alberta). Beneficiaries with very high drug costs were also younger than high–drug-cost beneficiaries, with a lower proportion aged 65 or more (range 18.9% in BC to 52.7% in Nova Scotia).

Top 10 drugs according to use and cost

There were differences in the patterns of drug use and spending between the 2 high-cost groups overall (Table 4). The most commonly reimbursed drugs were relatively similar across all groups of beneficiaries, with agents for common chronic conditions (e.g., inhalers, statins and antibiotics) being the most commonly used treatments. The sole exception was the high use of biologics among beneficiaries with very high drug costs: 2 biologics (infliximab [n = 9645] and adalimumab [n = 6549]) were among the 10 most used medications in this group. In contrast, the medications with the highest total spending varied between the 3 beneficiary groups. Antivirals (e.g., those indicated to treat hepatitis C and HIV infection) and biologics were the highest-cost treatments among those with very high drug costs. Among high–drug-cost beneficiaries, there was high spending on biologics, insulin, antipsychotics and hydromorphone. These trends were similar across provinces (Appendix 1, Supplemental Tables S1 and S2). Importantly, 7 of the 9 provinces had a biologic as the highest cost medication among high–drug-cost beneficiaries.

Interpretation

We found that a minority of beneficiaries accounted for a substantial proportion of public drug spending in 9 Canadian provinces, with the costs incurred by high–drug-cost beneficiaries representing close to half of the annual spending of public drug programs. Yet, the characteristics and patterns of medication use of these beneficiaries were variable. There appears to be evidence of 2 factors contributing to the clustering of high–drug-cost beneficiaries: patients receiving expensive medications, such as biologics and hepatitis C treatments, and patients with complex needs who have a high comorbidity burden and are receiving a greater number of medications. Addressing both of these issues will be important in the effort to develop robust and sustainable public drug programs.

Our findings highlight the importance of developing strategies that address the impact of rising costs of new and expensive medications.[10,11] They are in keeping with recent evidence showing the growing impact of high-cost agents on public spending.[9] The increase in spending is attributable, in part, to both high use of costly treatments available under public drug programs and frequent use of multiple medications for common chronic conditions. These results align with observations from public and private payers, in Canada and other jurisdictions.[12–15]

There is also strong evidence that the price of new drugs has been outpacing the consumer price index over the past 2 decades, and the number of high-cost drugs has increased substantially over time.[9] For example, the annual number of approved drugs in Canada with a cost greater than $10 000 increased from 20 in 2005 to 124 in 2015.[4] These high

Table 4: Ten most costly and 10 most commonly reimbursed medications, by cost category of beneficiaries

	Beneficiaries with very high drug-costs		High–drug-cost beneficiaries		Other beneficiaries	
Rank	Drug name	No. of users	Drug name	No. of users	Drug name	No. of users
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	56 988	Rosuvastatin	894 699
2	Infliximab*	9645	Salbutamol	55 470	Atorvastatin	785 322
3	Salbutamol	9104	Rosuvastatin	44,517	Pantoprazole	733 233
4	Codeine/ acetaminophen	7524	Atorvastatin	43 747	Amoxicillin	723 256
5	Prednisone	7308	Metformin	43 583	Levothyroxine	705 881
6	Amoxicillin	7274	Furosemide	41 962	Salbutamol	646 392
7	Rosuvastatin	7072	Amlodipine	36 877	Amlodipine	632 970
8	Adalimumab*	6549	Levothyroxine	36 700	Metformin	599 120
9	Methotrexate	6277	Amoxicillin	34 237	Codeine/ acetaminophen	531 586
10	Levothyroxine	6228	Codeine/ acetaminophen	34 045	Ramipril	473 130

*Denotes a biologic (not including insulin or low-molecular-weight heparin).
†Denotes an antiviral.

prices likely contributed to the degree of clustering of public drug spending among beneficiaries observed in our study.

The patterns we observed will likely grow owing to the increasing availability of expensive medications, which raises concerns over the expansion and sustainability of provincial public drug programs. In addition, there is evidence to suggest that public payers are inheriting privately insured patients receiving high-cost agents owing to a process that allows private payers to leverage publicly funded catastrophic drug programs.[16,17] As private payers are faced with a larger number of claims for high-cost agents, they may be looking to shift the risk to public payers and reduce the impact of these agents on their premiums.[16] This phenomenon should be monitored closely, as it may have a growing impact on public drug spending.

Currently, the federal government in Canada is exploring the potential for a broader universal pharmacare strategy and the potential development of a national formulary and drug agency.[18] Our results highlight the impact of differences between public drug program structures that should inform the development of any pharmacare strategy.[5] Considering drivers of high–drug-cost beneficiaries in a pharmacare strategy would allow for broader negotiations on a pan-Canadian level, which, in turn, could result in price-listing agreements that are proven to result in cost savings.[19,20] In addition, policy-makers should consider this opportunity to develop pan-Canadian strategies that explore other mechanisms to address high drug costs. This may include preferential listing of biosimilars (in place of biologics) and ongoing formulary modernization to ensure appropriate use of costly medications.[21–23]

Lessons can also be learned from the differing ways provinces cover specific medications, which would help optimize the development of a national formulary. For example, differing

listings for ranibizumab, a treatment for age-related macular degeneration, between BC and Ontario led to this agent's being one of the top spends in both high-cost groups in Ontario, whereas it did not make the top 10 in BC.

In the present study, high–drug-cost beneficiaries used more medications on average than other beneficiaries, which highlights the complexity of conditions among the former. Interventional approaches beyond pricing policies are required to address the high costs among patients with complex needs who are receiving a large number of long-term medications.[22] One such approach is the implementation of drug-specific case-management strategies, which have been used by several payers, mostly in the United States, to address spending for high–drug-cost beneficiaries.[24–27]

An important characteristic of successful strategies has been the adoption of segmented and targeted approaches.[14] For example, among patients using a large number of long-term medications, differences have been noted between younger and older patients.[8,14] Specifically, among high–drug-cost beneficiaries, medications indicated for mental health diagnoses were found to be a major cost driver for younger patients, whereas management of chronic diseases such as chronic obstructive pulmonary disease and diabetes was more likely to influence costs for older patients.[8,14,27] These approaches may also help to assess the potential overprescribing that has been noted in populations with complex needs.[28] Development of case-management strategies should help account for these differences when developing policies.

Limitations

Only beneficiaries who had at least 1 drug claim paid by a public drug program in 1 year were included in this study since we did not have data from all provinces on eligibility for public drug programs. Therefore, this study did not include beneficiaries who were eligible for public drug benefits but did not receive a medication over the study period, nor did it include people whose claims were accepted (e.g., to be applied toward a deductible) but not paid for by public drug programs. It is likely that, if these people were included, the differences in minimum cost thresholds between high–drug-cost beneficiaries and all other beneficiaries would be even more pronounced.

We do not have information on private insurance status, and it is possible that people may have received other medications that were not captured in our study, particularly among those who used the catastrophic drug programs.

This analysis was informed only by drug claims data, and we do not have information on comorbidities. We inferred the extent of comorbidities using types and number of drugs, which is a validated method of assessing comorbidity when only drug claims data are available.[29]

Last, much of the information on drug pricing is based on the total amount paid to pharmacies. This information does not account for actual prices paid by public payers based on confidential listing agreements with manufacturers, and, thus, the costs reported in some drug classes may overestimate the true public program costs.

Conclusion

We found clustering of public drug program spending among a small proportion of high–drug-cost beneficiaries. This finding can be used to inform policies specific to this population that can help curb rising costs and optimize medication use. Future work should explore targeted interventions to address growing drug costs in this population, accounting for the 2 separate concerns depicted in our study: the use of costly medications and the use of a large number of medications. Future analysis should further refine these 2 populations and explore their characteristics separately, as potential interventions and policies to help reduce spending among these groups would differ.

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