Drug Use Among Seniors in Canada, 2016

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Acknowledgements

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The Canadian Institute for Health Information (CIHI) is an independent, not-for-profit organization that provides essential information on Canada's health systems and the health of Canadians.

We provide comparable and actionable data and information that are used to accelerate improvements in health care, health system performance and population health across Canada. Our stakeholders use our broad range of health system databases, measurements and standards, together with our evidence-based reports and analyses, in their decision-making processes. We protect the privacy of Canadians by ensuring the confidentiality and integrity of the health care information we provide.

Production of this analysis is made possible by financial contributions from Health Canada and provincial and territorial governments. The views expressed herein do not necessarily represent the views of Health Canada or any provincial or territorial government.

Highlights

Drug Use Among Seniors in Canada, 2016 provides an in-depth look at the number and types of drugs prescribed to seniors (those age 65 and older) in all Canadian provinces and Yukon, as well as to seniors with drug coverage through the First Nations and Inuit Health Branch (FNIHB). More focused analyses examine potentially inappropriate drug use and drug use among seniors living in long-term care facilities. Where possible, results are disaggregated by sex, age, neighbourhood income and geographic location (urban or rural/remote).

Key findings from the report include the following:

- **The number and types of drugs prescribed to seniors changed very little between 2011 and 2016.** In 2016, seniors were prescribed an average of 6.9 different drug classes over the year, compared with 7.1 in 2011. Approximately one-quarter of seniors were prescribed 10 or more drug classes in each year. Cardiovascular-related drugs made up 5 of the top 10 most commonly prescribed drug classes in each year.

- **Seniors living in low-income neighbourhoods and rural/remote neighbourhoods used more drugs.** In the 6 provinces where the neighbourhood could be identified, 21.4% of seniors living in the lowest-income neighbourhoods were prescribed 10 or more drug classes, compared with 14.3% of seniors living in the highest-income neighbourhoods. 20.4% of seniors living in rural/remote neighbourhoods were prescribed 10 or more drug classes, compared with 16.8% of seniors living in urban neighbourhoods.

- **The number of drugs being prescribed to seniors was the factor most responsible for hospitalizations related to adverse drug reactions (ADRs).** Seniors prescribed 10 to 14 drug classes were over 5 times more likely to be hospitalized for an ADR than seniors prescribed between 1 and 4 drug classes, after controlling for other factors; seniors prescribed 15 or more different drug classes were 8 times more likely.

- **Seniors living in long-term care (LTC) facilities were prescribed more drugs than seniors living in the community — 9.9 different drug classes, on average, compared with 6.7 drug classes.** The use of opioids and antidepressants was higher among seniors living in LTC facilities. LTC residents were prescribed opioids twice as often (39.9% compared with 20.4%) and antidepressants more than 3 times as often as seniors living in the community (60.3% compared with 19.1%).

- **There has been a decrease in potentially inappropriate drug use.** Chronic use of potentially inappropriate drugs (as defined by the 2015 Beers criteria) decreased from 33.9% of seniors in 2011 to 31.1% in 2016. The use of both antipsychotics and benzodiazepines decreased, likely due in part to ongoing initiatives to reduce their use. However, the use of proton pump inhibitors (PPIs), which have also been the focus of such initiatives, increased over the same period.

More information

The following companion product to this report is available on CIHI's website at cihi.ca:

Drug Use Among Seniors in Canada, 2016: Data Tables (.xlsx)

Introduction

Although seniors (those age 65 and older) make up only 17% of the Canadian population, they are estimated to account for roughly 40% of all spending on prescribed drugs and 55% of public drug program spending.[1–3] The seniors population is growing faster than any other population in Canada — increasing by an average of 3.9% per year from 2011 to 2016 (compared with 0.6% for non-seniors).[1] On average, seniors use more drugs than any other age group, in large part due to their predisposition to a higher number of chronic conditions.[4–8] The use of multiple drugs is associated with a higher rate of potentially inappropriate drug use and a higher risk of adverse drug events.[9–11] Seniors are at a higher risk of adverse drug events due to age-related changes in the body and the higher number of drugs they often are taking, compared with younger populations. The use of multiple drugs also increases the rate of emergency department visits and hospitalizations.[12–14]

The report has 4 main sections:

- Number of drugs prescribed to seniors
- Drug classes most commonly prescribed to seniors
- Potentially inappropriate prescribing to seniors
- Prescribing to seniors in long-term care facilities

Where appropriate, the analysis is broken down by sex, age, neighbourhood income and geographic location.

The data for this report covers all Canadian provinces and Yukon, plus 1 federal drug program, managed by Health Canada's First Nations and Inuit Health Branch (FNIHB). It uses drug claims data from the National Prescription Drug Utilization Information System (NPDUIS) and builds on 2 previous CIHI reports examining drug use among seniors (released in 2010 and 2014). For the first time, the report includes data from Newfoundland and Labrador, Quebec and Yukon.

As prescription claims data indicates only that a drug was dispensed, and not that it was used, it may not always reflect utilization. A patient may take all, some or none of a dispensed prescription. Seniors with no claims from a public drug program are not included in these calculations — although this percentage is relatively small in the seniors population. Drug claims not accepted by public drug programs are not included in this analysis, unless otherwise noted. For information on the terms used in this report, see Appendix A; for more detailed methodological notes, see Appendix B.

Number of drugs prescribed to seniors

This section examines the number of drug classes prescribed to seniors in Canada. It breaks down the number of drugs prescribed to seniors by sex, age, neighbourhood income and geographic location (urban or rural/remote) to identify differences in usage patterns. Additional analysis examines the association between the number of drugs prescribed and the likelihood of being hospitalized for an adverse drug reaction. These results refer to the total number of drugs prescribed to seniors over the course of the year, not necessarily the number being taken at one point in time. This section addresses the following questions:

- How many different drugs are seniors prescribed?
- How does the number of drugs prescribed for seniors vary across the jurisdictions?
- How does the number of drugs prescribed for seniors vary by socio-demographic factors?
- Are seniors who are prescribed a higher number of drugs at a greater risk of a hospitalization due to an adverse drug reaction?

Number of different drugs

In 2016, nearly two-thirds (65.7%) of seniors were prescribed 5 or more different drug classes, with more than one-quarter (26.5%) being prescribed 10 or more different drug classes and 8.4% prescribed 15 or more drug classes. There was little change in the average number of drugs prescribed to seniors[i] between 2011 (7.1) and 2016 (6.9) (Figure 1).

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i. The total number of drugs prescribed to seniors is underestimated when looking only at public drug program data. In Manitoba and British Columbia, which submitted both public and private drug data to CIHI, the average number of drug classes increased from 5.4 (public drug claims only) to 6.5 (public and private drug claims).

Figure 1   Percentage of seniors, by number of drug classes, Canada,* 2011 and 2016
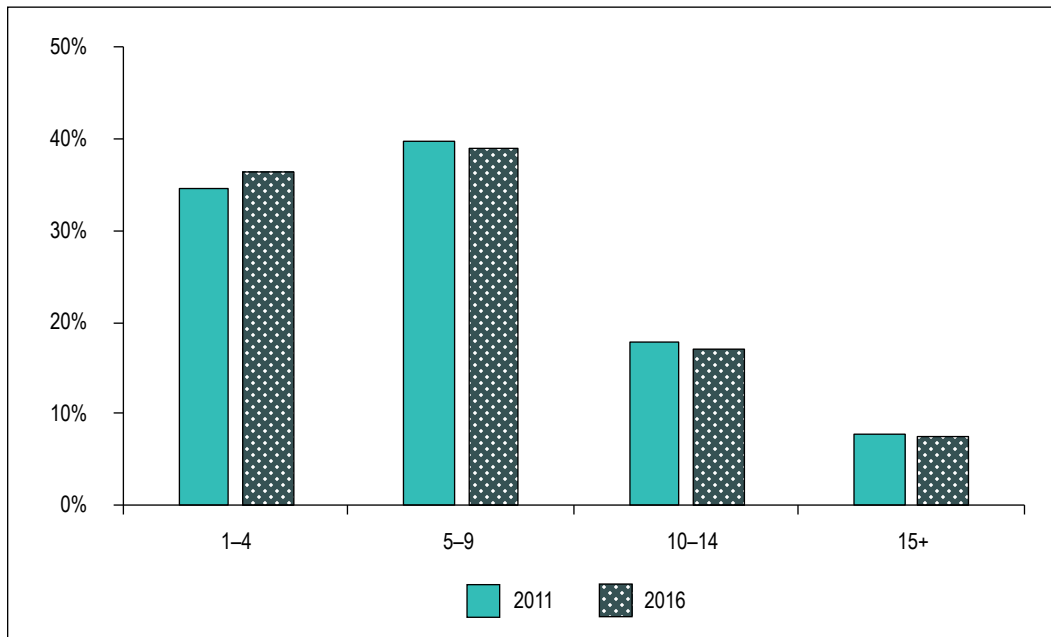
Note
*   The Northwest Territories and Nunavut do not currently submit data to NPDUIS. Quebec has been excluded because data was not available prior to 2014.
Source
National Prescription Drug Utilization Information System, Canadian Institute for Health Information.

Some drugs are taken chronically (i.e., taken consistently over a period of months or longer), while other drugs, such as opioids and anti-infectives, are typically taken for a defined short course of treatment. Chronic use is defined in this analysis as having at least 2 claims and 180 cumulative supply days for a drug class over the year. In 2016, approximately one-third (35.3%) of seniors had chronic use of 5 or more different drug classes, while 1 in 18 seniors (5.5%) had chronic use of 10 or more different drug classes (Figure 2). Even when controlling for the overall number of drugs used, chronic use of a higher number of drugs is associated with a higher risk of hospitalization, admission to a long-term care facility and death.[15] Age is an important predictor of chronic drug use; older seniors often have a higher prevalence of chronic conditions that require drug therapy.[16]

Figure 2   Percentage of seniors, by number of drug classes and number of chronic drug classes, Canada,* 2016
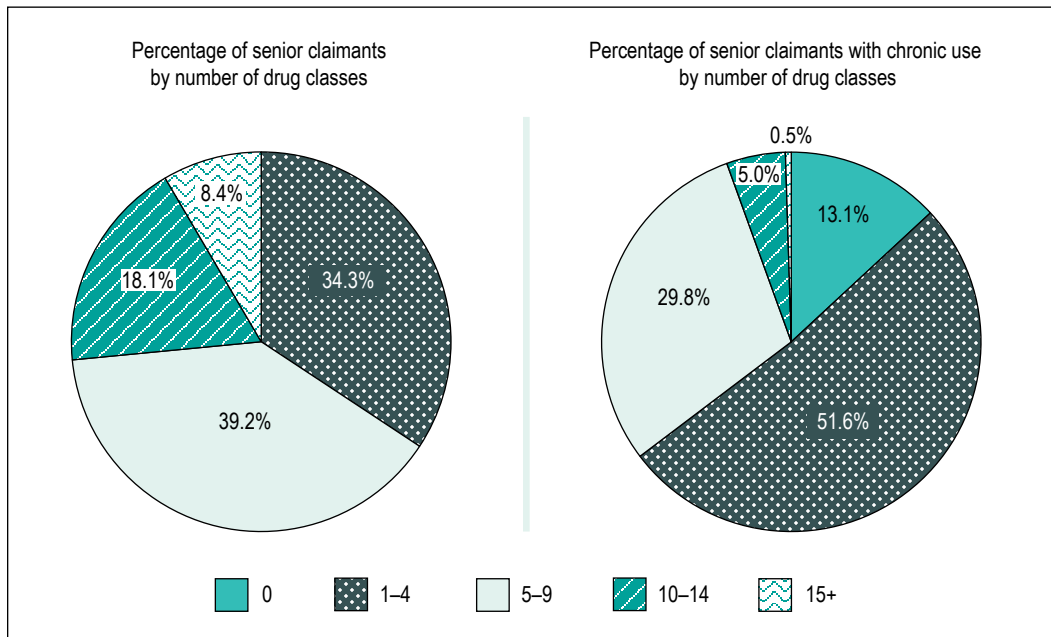
Note
* The Northwest Territories and Nunavut do not currently submit data to NPDUIS.
Sources
National Prescription Drug Utilization Information System, Canadian Institute for Health Information;
Banque médicaments, Régie de l'assurance maladie du Québec.

Prescribing cascades, which are more likely to occur with the chronic use of multiple drugs, can contribute to the use of a higher number of drugs among seniors.[17] A prescribing cascade occurs when an adverse drug event is misinterpreted as a new condition, and a new drug or change in dose is prescribed to treat the adverse event. An adverse event may occur with a drug that had previously worked without any issues due to age-related changes in the body, which is more common in seniors. A common adverse event from a prescribing cascade is hypertension from the use of non-steroidal anti-inflammatory drugs (NSAIDs) that results in the subsequent prescription of an antihypertensive or an increase in the dose of the antihypertensive.[17] In 2016, 71.4% of seniors who were chronic users of an NSAID were also using an antihypertensive, compared with 67.6% of seniors who were not chronic users of an NSAID. This difference is statistically significant; however, we are not able to measure whether the difference is due to a prescribing cascade or other factors.

Variation by jurisdiction

Drug use varies across jurisdictions due to several factors, including differences in population (i.e., differences in sex and age), general health of the population and public drug program design (Figure 3). The proportion of seniors who were prescribed 10 or more different drug classes ranged from 51.5% among seniors covered by the FNIHB plan and 37.6% in Newfoundland and Labrador to 16.6% in Prince Edward Island and 12.9% in British Columbia. (For more information on the number of drug classes prescribed by jurisdiction, see *Drug Use Among Seniors in Canada, 2016: Data Tables*.)

Figure 3   Percentage of seniors, by number of drug classes and jurisdiction, Canada,* 2016

Notes
*   The Northwest Territories and Nunavut do not currently submit data to NPDUIS.
Public drug programs in Newfoundland and Labrador, Nova Scotia and New Brunswick provide coverage to smaller proportions of seniors than those in other jurisdictions. Rates for these provinces may not be representative of the full seniors population. Comparing rates between jurisdictions should be done with caution. (For more information on public drug coverage available to seniors, see CIHI's National Prescription Drug Utilization Information System Plan Information Document.)
Sources
National Prescription Drug Utilization Information System, Canadian Institute for Health Information;
Banque médicaments, Régie de l'assurance maladie du Québec.

It is important to take public drug program design into consideration when comparing the number of drugs claimed by seniors. For example, the FNIHB program covers a higher number of drug classes than most other programs. Additionally, public drug coverage for seniors living in Newfoundland and Labrador, Nova Scotia and New Brunswick is mainly offered to low-income seniors and covers a population with higher needs, which results in a higher average number of drug classes. (For more information about the population reported on in this report, see appendices C and D.)

Variation by socio-demographic factors

Sex

On average, female seniors were prescribed slightly more drugs than male seniors. In 2016, 66.7% of female seniors had claims for 5 or more drug classes, including 27.7% who had claims for 10 or more (Figure 4). Among males, 64.5% had claims for 5 or more drug classes, including 25.1% who had claims for 10 or more. Previous reports have found that women tend to use more drugs than men because women tend to have more chronic conditions and seek more preventive care than men.[18–20] Women also live longer than men, on average;[1] however, the higher drug use among female seniors is evident in all age groups. (For more information on the number of drug classes used by sex and age group, see *Drug Use Among Seniors in Canada, 2016: Data Tables*.)

Figure 4   Percentage of seniors, by number of drug classes and sex, Canada,* 2016
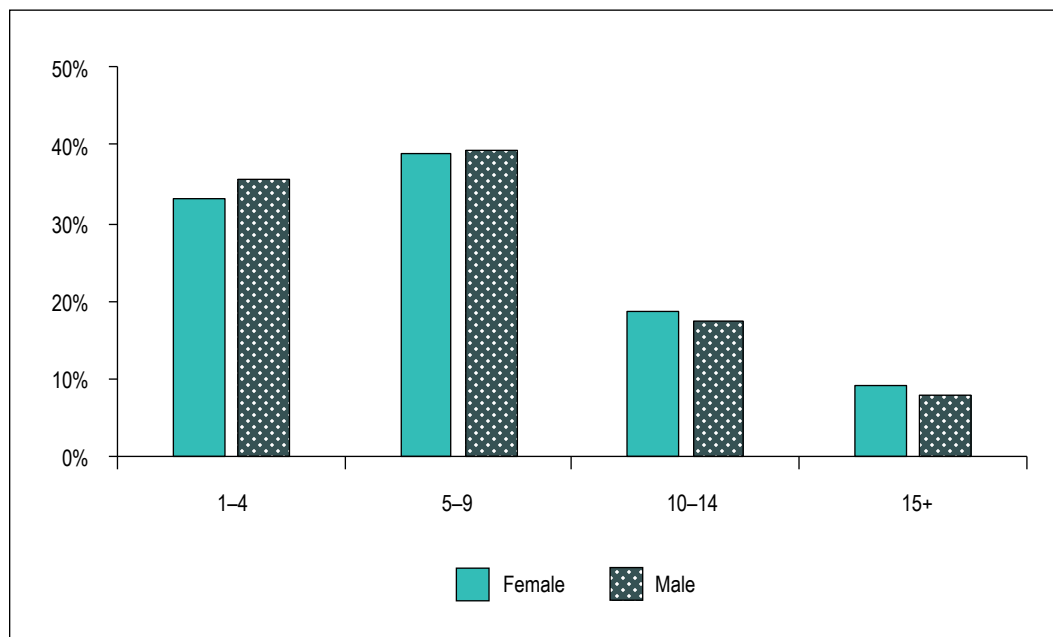
Note
*   The Northwest Territories and Nunavut do not currently submit data to NPDUIS.
Sources
National Prescription Drug Utilization Information System, Canadian Institute for Health Information;
Banque médicaments, Régie de l'assurance maladie du Québec.

Age

The number of drug classes prescribed to seniors increased with age (Figure 5). In 2016, 58.2% of seniors age 65 to 74 had claims for 5 or more drug classes and 20.6% had claims for 10 or more, including 6.3% with claims for 15 or more classes. Among seniors age 85 and older, 79.6% had claims for 5 or more drug classes, while 38.4% had claims for 10 or more, including 12.7% with claims for 15 or more classes. This trend was similar among both males and females.

Figure 5   Percentage of seniors, by number of drug classes and age group, Canada,* 2016

Note
*   The Northwest Territories and Nunavut do not currently submit data to NPDUIS.
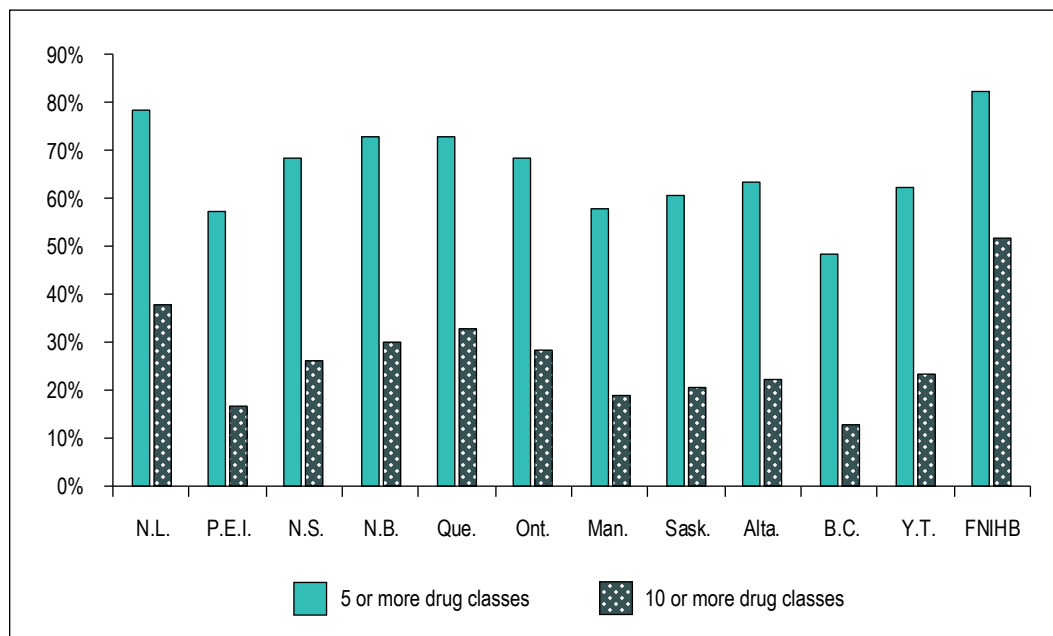**Sources**
National Prescription Drug Utilization Information System, Canadian Institute for Health Information;
Banque médicaments, Régie de l'assurance maladie du Québec.

Neighbourhood income

Seniors living in neighbourhoods with the lowest income were prescribed a higher number of drugs than seniors living in neighbourhoods with the highest income (Figure 6). In 2016, 21.4% of seniors in the lowest-income neighbourhoods were using 10 or more drug classes, compared with 14.3% of seniors living in the highest-income neighbourhoods.

Figure 6   Percentage of seniors, by number of drug classes and neighbourhood income quintile, selected jurisdictions,* 2016
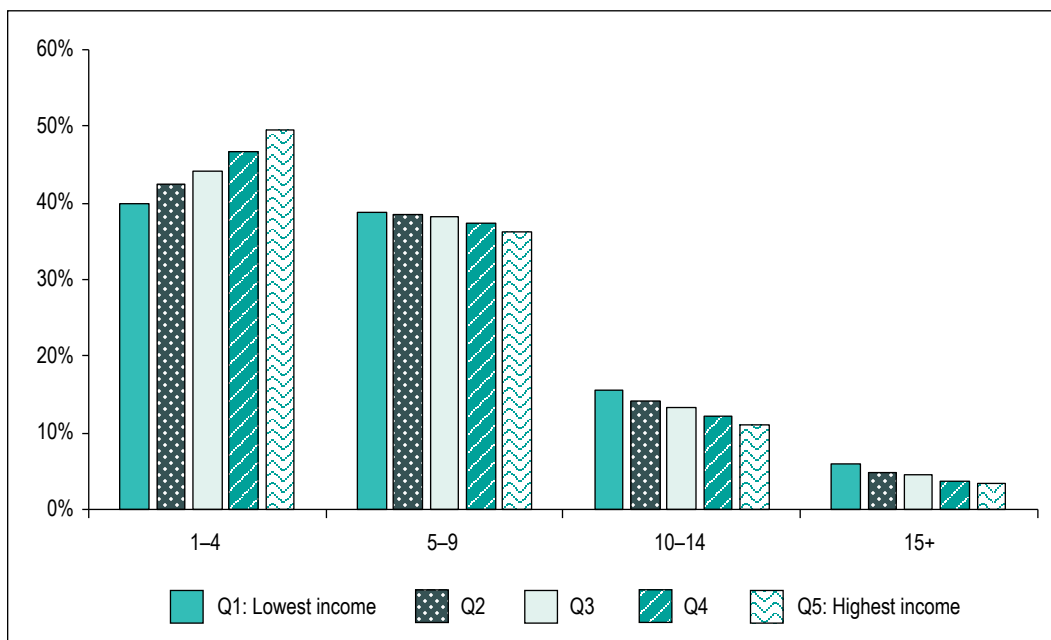
Note

*   There were 6 jurisdictions submitting claims data to NPDUIS where patient postal code can be identified, as of November 2017: Newfoundland and Labrador, Prince Edward Island, Manitoba, Alberta, British Columbia and Yukon.

Sources

National Prescription Drug Utilization Information System, Canadian Institute for Health Information; Postal Code Conversion File Plus (PCCF+), Statistics Canada.

The elevated drug use among those in the lowest-income neighbourhoods may be related in part to differences in health status by income: Canadians with the lowest income were twice as likely to report living with cardiovascular disease as those with the highest income.[21] A study from Ontario also found that seniors with lower income used significantly more drugs than seniors with higher income, an association that persisted even after statistically adjusting for measures of health status and health care utilization.[22]

Geographic location

Drug use was higher among seniors living in rural/remote neighbourhoods (Figure 7). A total of 20.4% of seniors living in rural/remote neighbourhoods used 10 or more different drug classes, compared with 16.8% of seniors living in urban neighbourhoods. Similar patterns are seen for each sex and age group. However, patterns varied among the jurisdictions: the use of 10 or more different drug classes was higher in rural neighbourhoods in P.E.I., Manitoba and Alberta; use was lower in rural neighbourhoods in B.C.; and there were no differences in neighbourhoods in Newfoundland and Labrador and Yukon. (For more information, see *Drug Use Among Seniors in Canada, 2016: Data Tables*.)

Figure 7   Percentage of seniors, by number of drug classes and geographic location, selected jurisdictions,* 2016
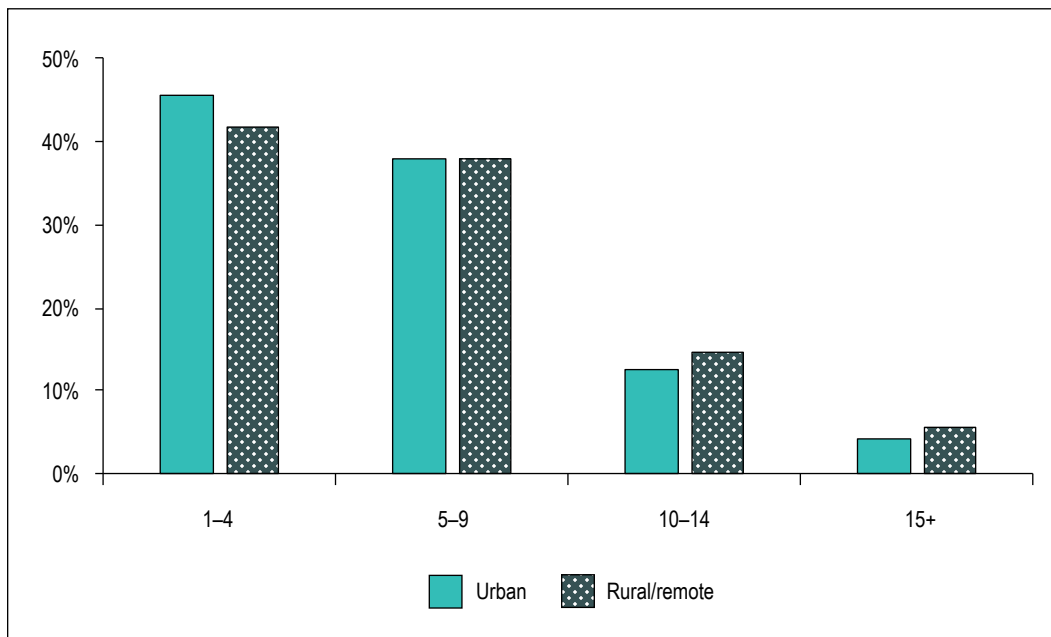
Note

*   There were 6 jurisdictions submitting claims data to NPDUIS where patient postal code can be identified, as of November 2017: Newfoundland and Labrador, Prince Edward Island, Manitoba, Alberta, British Columbia and Yukon.

Sources

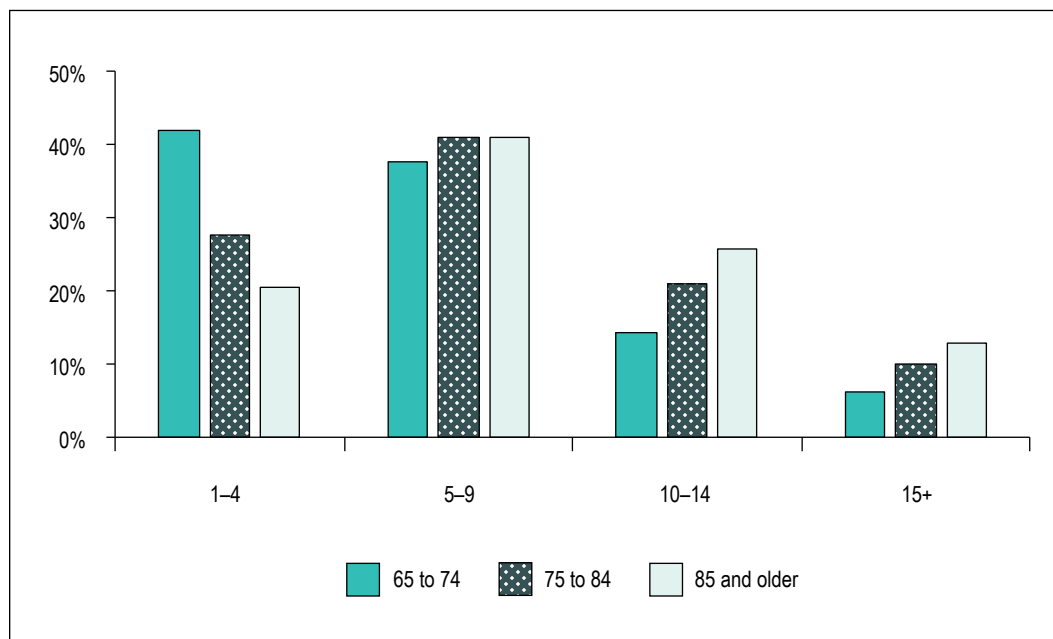National Prescription Drug Utilization Information System, Canadian Institute for Health Information; Postal Code Conversion File Plus (PCCF+), Statistics Canada.

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Hospitalization due to adverse drug reaction

Data from the Discharge Abstract Database (DAD) and Hospital Morbidity Database (HMDB) — which contain demographic, administrative and clinical data on acute care institution separations (discharges, deaths, sign-outs and transfers) — is used to identify hospitalizations for adverse drug reactions (ADRs) among seniors in Canada. This data was linked to NPDUIS data to examine drug use before an ADR-related hospitalization. Linkable NPDUIS data is available for Newfoundland and Labrador, P.E.I., Manitoba, Alberta, B.C. and Yukon.

The number of drugs being prescribed to seniors is the factor most responsible for ADR-related hospitalizations (other factors examined include sex, age, number of prescribers, number of pharmacies, and other hospitalization in previous year).[9] In 2016, 0.7% of seniors were hospitalized for an ADR. This rate increased dramatically among seniors using more drugs (Figure 8). Seniors using 10 or more different drug classes made up 21.1% of the seniors population and accounted for 58.6% of ADR-related hospitalizations. (For more information on how ADR-related hospitalizations were defined, see Appendix B.)

Figure 8   Percentage of seniors hospitalized for an ADR, by
number of drug classes, selected jurisdictions,* 2016
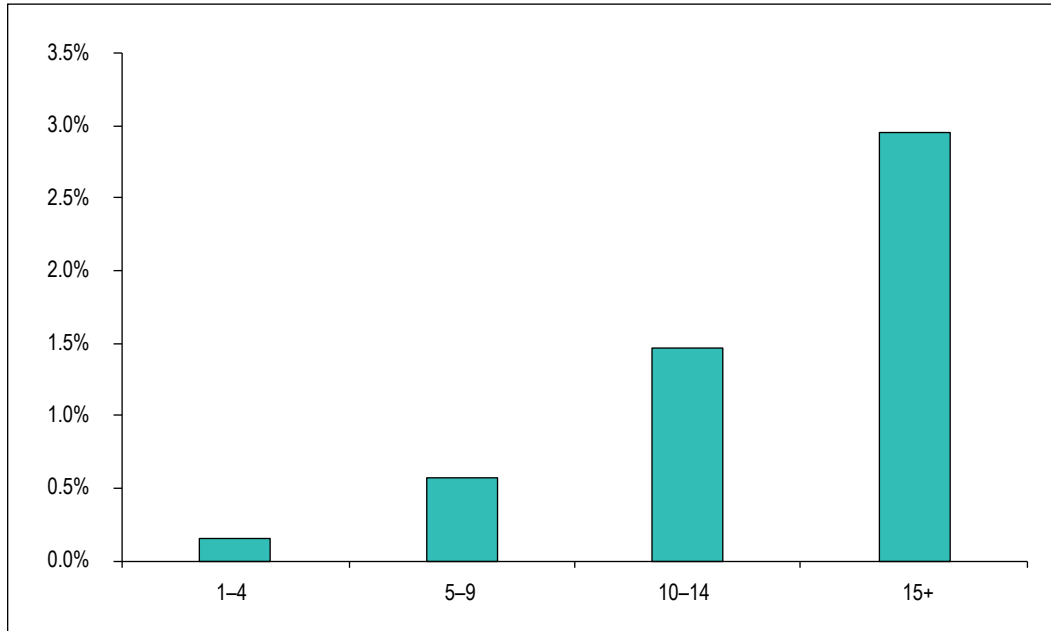
Note

*   There were 6 jurisdictions submitting linkable claims data to NPDUIS as of November 2017: Newfoundland
and Labrador, Prince Edward Island, Manitoba, Alberta, British Columbia and Yukon.

Sources

National Prescription Drug Utilization Information System, Discharge Abstract Database and Hospital Morbidity Database, Canadian Institute for Health Information.

In 2016, seniors who were prescribed 10 to 14 different drug classes were 5 times more likely to be hospitalized for an ADR than seniors prescribed between 1 and 4 drug classes, after controlling for other factors; seniors prescribed 15 or more different drug classes were 8 times more likely to be hospitalized for an ADR. (For more information, see Appendix E.)

Anticoagulants — used for heart attack and stroke prevention — accounted for nearly one-quarter (23.9%) of all ADR-related hospitalizations among seniors. This was followed by antineoplastics (12.5%) — used to treat cancer — and opioids (8.1%) — used to manage pain. (For more information on the drugs most commonly associated with ADR-related hospitalizations, see Appendix F.)

Seniors, particularly those with multiple chronic conditions, may need to take multiple drugs to manage their conditions. The use of a higher number of drugs is associated with a higher risk of ADRs and other adverse events such as drug interactions.[23–25] Regular reviews of patients' medications by their physicians and pharmacists can help reduce these risks.[26] Medication reconciliation, a process where medications are systematically reviewed at care transition points (e.g., when a patient is admitted to hospital), can also help reduce the risk of ADRs by ensuring that any changes in medication that occur at these points are assessed and documented.[27]

Drug classes most commonly prescribed to seniors

This section examines the drugs most commonly prescribed to seniors in Canada. It breaks down the most commonly prescribed drugs by sex, age, average neighbourhood income and geographic location. This section addresses the following questions:

- Which drugs are most commonly prescribed to seniors?
- How do the drugs most commonly prescribed to seniors vary by socio-demographic factors?

Top drug classes

In 2016, statins — used to treat high cholesterol — were the most commonly prescribed drug class, used by nearly half of seniors (48.4%) (Table 1). Statins were the most commonly prescribed drug class in every jurisdiction, sex and age group. They were also the most commonly prescribed drug class in every neighbourhood income quintile and in both urban and rural/remote neighbourhoods.

Table 1 Top 10 drug classes prescribed to seniors, by rate of use and chronic use, Canada,* 2016

Drug class	Common uses	Rate of use	Rate of chronic use
HMG-CoA reductase inhibitors (statins)	High cholesterol	48.4%	43.5%
Proton pump inhibitors (PPIs)	Gastroesophageal reflux disease, peptic ulcer disease	32.1%	23.5%
Angiotensin-converting enzyme (ACE) inhibitors, excluding combinations	High blood pressure, heart failure	24.5%	21.1%
Beta-blocking agents, selective	High blood pressure, heart failure, angina (chest pain)	23.5%	20.6%
Dihydropyridine calcium channel blockers	High blood pressure	21.9%	18.8%
Thyroid hormones	Hypothyroidism	19.1%	17.9%
Angiotensin II antagonists, excluding combinations	High blood pressure, heart failure	15.7%	13.8%
Natural opium alkaloids	Management of moderate to severe pain	15.1%	2.5%
Biguanides	Diabetes	14.9%	12.9%
Benzodiazepine derivatives	Agitation, anxiety, insomnia, seizures	12.9%	6.1%

Note
* The Northwest Territories and Nunavut do not currently submit data to NPDUIS.
Sources
National Prescription Drug Utilization Information System, Canadian Institute for Health Information; Banque médicaments, Régie de l'assurance maladie du Québec.

Statins are more prominently used among males and seniors age 75 to 84. Men have a higher prevalence of cardiovascular disease, which contributes to their higher use of statins.[21] In 2016, the use of statins decreased with age, with 53.1% of seniors age 75 to 84 using them compared with 41.8% among seniors age 85 and older; this pattern is seen in both females and males. The decrease may be partly due to the statin therapy being stopped among older seniors. Studies have shown that potential risks may outweigh the benefits in patients with advanced illness.[28]

The next most commonly prescribed drug class in 2016 was proton pump inhibitors (PPIs) — used to treat gastroesophageal reflux disease and peptic ulcer disease — which were used by about one-third of seniors (32.1%). 4 of the top 10 drug classes were used to treat high blood pressure.

9 of the 10 most commonly prescribed drug classes were the same in 2016 as they were in 2011, with the exception of single-ingredient thiazide diuretics, which are used to treat high blood pressure. The usage rate of single-ingredient thiazides decreased from 16.8% in 2011 (the 7th most commonly used drug class) to 11.6% in 2016 (the 12th most commonly used drug class). This decrease does not appear to be due to an increased use of thiazide combination products; the use of both single-ingredient and combination thiazides decreased from 26.9% in 2011 to 20.5% in 2016.

The top 5 most commonly prescribed drug classes for all Canadian seniors were included in the 10 most commonly prescribed drug classes in each of the 12 jurisdictions. Statins were the most commonly prescribed drug class in every jurisdiction. PPIs were the second most commonly prescribed drug class in every jurisdiction except Yukon and B.C., where it ranked fourth and ninth, respectively. The lower rate of PPI use in B.C. may be due to a special authorization request being required for public coverage of PPIs. (For the top drug classes by rate of use for each jurisdiction, see *Drug Use Among Seniors in Canada, 2016: Data Tables*.)

Opioids

Opioids (including natural opium alkaloids — the eighth most commonly prescribed drug class among seniors) were used by 19.3% of seniors in 2016. Use was similar among females and males, and increased as seniors aged — from 18.3% among younger seniors (age 65 to 74) to 22.2% among older seniors (age 85 and older). The use of opioids was more common among seniors living in long-term care (LTC) facilities (based on LTC data available in NPDUIS for 5 provinces: P.E.I., New Brunswick, Ontario, Manitoba and B.C.). In 2016, opioids were used by 39.9% of LTC residents, compared with 20.4% of seniors living in the community. Use was more common among older seniors both in LTC facilities and in the community.

Despite the high use of opioids among seniors, chronic use is relatively low — only 3.5% among seniors in 2016. It was higher among females (3.9%) than males (2.9%). Chronic opioid use also increased with age, rising from 3.1% among younger seniors to 5.0% among older seniors.

Opioids were the third most common cause of ADR-related hospitalizations, accounting for 8.1% of these hospitalizations among seniors in 2016. Potential side effects from opioids are greater among those with more comorbidities and those taking a higher number of drugs; consequently, seniors are at a particularly high risk of hospitalization due to opioid-related ADRs.[29, 30] On average, 19.2 out of every 100,000 seniors were hospitalized for an opioid-related poisoning — the second-highest rate among all age groups, behind only those age 45 to 64 (20.2 per 100,000).[31] However, seniors had the largest proportion of opioid-related poisonings related to therapeutic use, highlighting the importance of safer opioid prescribing among seniors.[32]

The use of opioids among seniors has decreased in recent years. However, the use of strong opioids (oxycodone, hydromorphone, morphine and fentanyl) has slightly increased over the same time period (Figure 9). CIHI's recent report *Pan-Canadian Trends in the Prescribing of Opioids, 2012 to 2016* found similar trends in opioid use among all age groups. Previous research has found that prolonged use of strong opioids is associated with increased risk of adverse drug events — including inadvertent overdose and death.[33]

Figure 9   Seniors' usage rate of opioids, by type of use, Canada,* 2011 to 2016
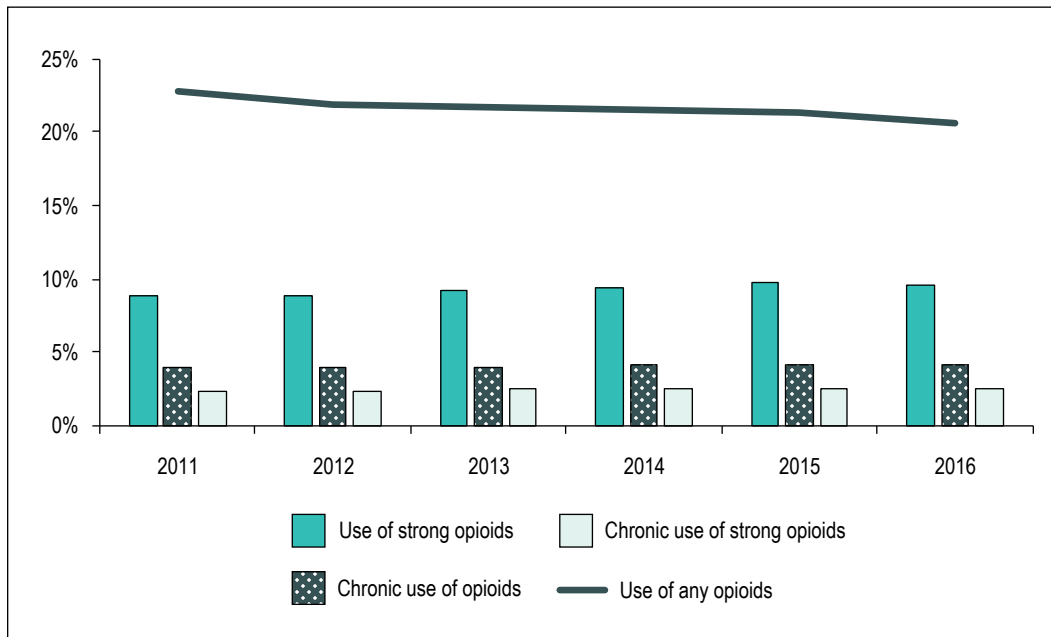
Note
*   The Northwest Territories and Nunavut do not currently submit data to NPDUIS. Quebec has been excluded because data was not available prior to 2014.
Source
National Prescription Drug Utilization Information System, Canadian Institute for Health Information.

Variation by socio-demographic factors

Sex

The most commonly prescribed drug classes were slightly different for male and female seniors (Table 2). Males were prescribed more cardiovascular-related drugs, due to a higher prevalence of cardiovascular disease. Females were prescribed more thyroid hormones — used to treat hypothyroidism, which is more common among females. The use of PPIs was more common among females (34.3%) than males (29.3%). (For usage rates of the top drug classes by sex, see *Drug Use Among Seniors in Canada, 2016: Data Tables*.)

Table 2 Top 10 drug classes prescribed to seniors, usage rate by sex, Canada,* 2016

Drug class	Common uses	Rate of use	
		Female	Male
HMG-CoA reductase inhibitors (statins)	High cholesterol	42.1%	56.2%
Proton pump inhibitors (PPIs)	Gastroesophageal reflux disease, peptic ulcer disease	34.3%	29.3%
Angiotensin-converting enzyme (ACE) inhibitors, excluding combinations	High blood pressure, heart failure	20.6%	29.2%
Beta-blocking agents, selective	High blood pressure, heart failure, angina (chest pain)	21.5%	26.0%
Dihydropyridine calcium channel blockers	High blood pressure	22.0%	21.8%
Thyroid hormones	Hypothyroidism	25.7%	10.9%
Angiotensin II antagonists, excluding combinations	High blood pressure, heart failure	16.8%	14.5%
Natural opium alkaloids	Management of moderate to severe pain	15.3%	14.9%
Biguanides	Diabetes	12.5%	17.8%
Benzodiazepine derivatives	Agitation, anxiety, insomnia, seizures	15.9%	9.3%

Note
* The Northwest Territories and Nunavut do not currently submit data to NPDUIS.
Sources
National Prescription Drug Utilization Information System, Canadian Institute for Health Information; Banque médicaments, Régie de l'assurance maladie du Québec.

Age

While the usage of most of the top 10 most commonly prescribed drug classes increased with age, the use of statins and biguanides — used to treat diabetes — decreased with age (Table 3). This is due in part to diabetes being more common among men, and men making up a smaller portion of the group age 85 and older.[1, 34] (For the usage rate of top drug classes by age group, see *Drug Use Among Seniors in Canada, 2016: Data Tables*.)

Table 3   Top 10 drug classes prescribed to seniors, usage rate by age group, Canada,* 2016

Drug class	Common uses	Rate of use		
		Age 65 to 74	Age 75 to 84	Age 85+
HMG-CoA reductase inhibitors (statins)	High cholesterol	47.5%	53.1%	41.8%
Proton pump inhibitors (PPIs)	Gastroesophageal reflux disease, peptic ulcer disease	28.3%	35.5%	39.0%
Angiotensin-converting enzyme (ACE) inhibitors, excluding combinations	High blood pressure, heart failure	22.5%	26.7%	27.2%
Beta-blocking agents, selective	High blood pressure, heart failure, angina (chest pain)	18.7%	27.9%	32.5%
Dihydropyridine calcium channel blockers	High blood pressure	17.8%	25.5%	29.8%
Thyroid hormones	Hypothyroidism	16.0%	20.8%	26.6%
Angiotensin II antagonists, excluding combinations	High blood pressure, heart failure	13.8%	18.1%	17.8%
Natural opium alkaloids	Management of moderate to severe pain	14.2%	15.4%	17.9%
Biguanides	Diabetes	15.3%	16.0%	10.9%
Benzodiazepine derivatives	Agitation, anxiety, insomnia, seizures	11.1%	14.4%	16.9%

Note
* The Northwest Territories and Nunavut do not currently submit data to NPDUIS.
Sources
National Prescription Drug Utilization Information System, Canadian Institute for Health Information; Banque médicaments, Régie de l'assurance maladie du Québec.

8 of the 10 most commonly prescribed drug classes for all Canadian seniors were included in the top 10 for each of the 3 age groups. The use of sulfonamide diuretics — used to treat high blood pressure and heart failure — is notably higher among seniors age 85 and older. This may be due in part to a higher prevalence of cardiovascular disease, particularly heart failure, in this age group.[34, 35]

Neighbourhood income

As previously mentioned, seniors in low-income neighbourhoods were prescribed more drugs on average than seniors in high-income neighbourhoods. They also were prescribed slightly more of the most commonly prescribed drug classes than seniors in highest-income neighbourhoods (Table 4). However, differences in the usage rates of these drugs did not differ greatly by neighbourhood income — with the exception of PPIs and biguanides. PPI use was higher among seniors living in low-income neighbourhoods (24.4%) than among those living in high-income neighbourhoods (19.5%). Low income, as well as low education, has been associated with chronic use of PPIs due to differences in health and health care use.[36] Biguanide use was also higher among seniors living in low-income neighbourhoods (16.6%) than among those in high-income neighbourhoods (11.8%). This is likely due to the higher prevalence of diabetes among low-income adult Canadians than among their high-income counterparts.[34]

Table 4   Top 10 drug classes prescribed to seniors, usage rate by neighbourhood income quintile, selected jurisdictions,* 2016

Drug class	1: Lowest income	2	3	4	5: Highest income
HMG-CoA reductase inhibitors (statins)	41.7%	41.8%	41.3%	40.7%	39.2%
Angiotensin-converting enzyme (ACE) inhibitors, excluding combinations	27.7%	26.7%	26.0%	25.3%	23.9%
Proton pump inhibitors (PPIs)	24.4%	23.1%	22.4%	20.9%	19.5%
Beta-blocking agents, selective	23.5%	22.7%	22.0%	21.1%	19.5%
Thyroid hormones	20.1%	20.0%	19.7%	19.4%	19.0%
Dihydropyridine calcium channel blockers	21.1%	20.5%	19.5%	18.4%	16.8%
Natural opium alkaloids	17.5%	16.4%	15.6%	15.2%	14.7%
Biguanides	16.6%	15.7%	14.8%	13.6%	11.8%
Thiazides, excluding combinations	12.9%	12.9%	12.9%	12.7%	12.2%
Angiotensin II antagonists, excluding combinations	13.0%	12.8%	12.4%	11.7%	11.1%

Note
*   There were 6 jurisdictions submitting claims data to NPDUIS where patient postal code can be identified, as of November 2017: Newfoundland and Labrador, Prince Edward Island, Manitoba, Alberta, British Columbia and Yukon.
Sources
National Prescription Drug Utilization Information System, Canadian Institute for Health Information;
Postal Code Conversion File Plus (PCCF+), Statistics Canada.

Geographic location

Use of the most common drug classes among seniors was consistent between seniors living in urban and rural/remote neighbourhoods, with the exception of PPIs (Table 5). 27.5% of seniors living in rural and remote neighbourhoods were using PPIs, compared with 20.6% of seniors living in urban neighbourhoods. There appears to be no relationship that explains the differences between seniors' usage of these drugs and living in urban and rural/remote neighbourhoods.

Table 5   Top 10 drug classes prescribed to seniors, usage rate by geographic location, selected jurisdictions,* 2016

Drug class	Urban	Rural/ remote
HMG-CoA reductase inhibitors (statins)	41.1%	40.0%
Angiotensin-converting enzyme (ACE) inhibitors, excluding combinations	25.4%	27.7%
Proton pump inhibitors (PPIs)	20.6%	27.5%
Beta-blocking agents, selective	21.1%	23.9%
Thyroid hormones	19.6%	19.7%
Dihydropyridine calcium channel blockers	19.3%	18.7%
Natural opium alkaloids	16.1%	14.9%
Biguanides	14.4%	14.8%
Thiazides, excluding combinations	12.4%	14.1%
Angiotensin II antagonists, excluding combinations	12.1%	12.4%

Note

* There were 6 jurisdictions submitting claims data to NPDUIS where patient postal code can be identified, as of November 2017: Newfoundland and Labrador, Prince Edward Island, Manitoba, Alberta, British Columbia and Yukon.

Sources

National Prescription Drug Utilization Information System, Canadian Institute for Health Information; Postal Code Conversion File Plus (PCCF+), Statistics Canada.

Potentially inappropriate prescribing to seniors

Potentially inappropriate drug use is of concern among seniors because the use of these drugs is associated with increased risk of negative health outcomes, falls, adverse drug events, increased hospital usage and higher health costs.[4, 37, 38] Also, it was estimated that drugs defined as potentially inappropriate for use by seniors cost $419 million (or $75 per Canadian senior) in 2013.[39]

This section examines potentially inappropriate drug use among seniors by using the 2015 Beers list — a widely used tool, initially developed by Dr. Mark H. Beers in 1991. (For additional information on the Beers criteria, please see Appendix B.) This section will address the following questions:

- How many seniors were prescribed potentially inappropriate drugs?
- How does potentially inappropriate drug use among seniors vary by jurisdiction?
- How does potentially inappropriate drug use among seniors vary by socio-demographic factors?

Number and types of drugs prescribed

In 2016, nearly half of seniors (49.4%) had at least one claim for a drug on the Beers list. Some 18.0% of seniors had claims for multiple drugs on the Beers list, including 8.1% who were chronic users of 2 or more different drugs. Concurrent use of drugs on the Beers list increases the chance of side effects.[4, 40]

Overall, PPIs were used, potentially inappropriately, by 23.6% of seniors in 2016. Potentially inappropriate use of PPIs is considered any use longer than 8 weeks — excluding high-risk patients (those who are using oral corticosteroids or chronic NSAIDs). The PPI pantoprazole was the most commonly used drug on the Beers list — chronically used by 10.3% of seniors (Table 6). 2 other PPIs (rabeprazole and omeprazole) were also among the most commonly used drugs from the Beers list. (For more information on the top chemicals from the Beers list by sex and age group, see Appendix G.)

Table 6   Top 10 chemicals from Beers list* prescribed to seniors, by rate of use and chronic use, Canada,[†] 2016

Chemical	Indicated uses	Beers criteria rationale (potential harm)	Rate of use	Rate of chronic use
Pantoprazole (PPI) (>8 weeks)	Gastroesophageal reflux disease, peptic ulcer disease	*Clostridium difficile* infection, bone loss, fractures	13.2%	10.3%
Lorazepam	Anxiety, insomnia	Cognitive impairment, delirium, falls, fractures	8.8%	3.6%
Nitrofurantoin	Antibiotic to treat urinary tract infection	Pulmonary toxicity, hepatoxicity, peripheral neuropathy	5.0%	0.1%
Rabeprazole (PPI) (>8 weeks)	Gastroesophageal reflux disease, peptic ulcer disease	*Clostridium difficile* infection, bone loss, fractures	4.3%	3.5%
Amitriptyline	Depression	Sedation, orthostatic hypotension	2.9%	1.8%
Quetiapine	Schizophrenia, bipolar disorder	Cognitive decline, stroke, mortality	2.8%	1.7%
Omeprazole (PPI) (>8 weeks)	Gastroesophageal reflux disease, peptic ulcer disease	*Clostridium difficile* infection, bone loss, fractures	2.7%	2.2%
Zopiclone	Insomnia	Cognitive impairment, delirium, falls, fractures	2.4%	1.5%
Oxazepam	Anxiety, insomnia	Cognitive impairment, delirium, falls, fractures	2.4%	1.4%
Estradiol (oral/ topical patch)	Menopause	Potential carcinogen (breast and endometrium)	2.1%	1.2%

Notes
* AGS Beers Criteria 2015 Updated Version, with modifications to make the measure of potentially inappropriate use more applicable to the Canadian market (see Appendix B).
† The Northwest Territories and Nunavut do not currently submit data to NPDUIS.
Sources
National Prescription Drug Utilization Information System, Canadian Institute for Health Information; Banque médicaments, Régie de l'assurance maladie du Québec.

4 of the 10 most commonly prescribed chemicals from the Beers list are recommended to always be avoided in seniors.[37] Psychotropic drugs such as benzodiazepines, certain antidepressants and antipsychotics should be avoided as first-line treatment options for seniors in most situations because of their potential to increase the risk of falls, fractures and cognitive impairment. Despite this recommendation, lorazepam and oxazepam (benzodiazepines), zopiclone (a benzodiazepine-related drug) and quetiapine (an antipsychotic) are some of the chemicals from the Beers list most commonly used among seniors.

Between 2011 and 2016 (with the 2015 Beers criteria applied to both years), the use of drugs on the Beers list decreased from 50.2% to 47.2%, while the chronic use of these drugs decreased from 33.9% to 31.1% (Figure 10). Similar trends were seen for both females and males and in each age group.

Figure 10 Seniors' usage rate of drugs from Beers list,* Canada,[†] 2011 to 2016

Notes

* AGS Beers Criteria 2015 Updated Version, with modifications to make the measure of potentially inappropriate use more applicable to the Canadian market (see Appendix B).

† The Northwest Territories and Nunavut do not currently submit data to NPDUIS. Quebec has been excluded because data was not available prior to 2014.

Source

National Prescription Drug Utilization Information System, Canadian Institute for Health Information.

Several interventions have been implemented to reduce inappropriate prescribing to seniors, such as education (for both prescribers and patients) and medication reviews. Interventions such as pharmacist-led medication reviews have increased drug knowledge, increased drug adherence and decreased drug-related problems.[41, 42] However, most interventions have had little effect on clinical outcomes such as mortality, hospitalizations, emergency department visits or health status.[41–43] Health outcomes resulting from deprescribing vary depending on the drug being targeted by an intervention.[44]

Variation by jurisdiction

Use of drugs on the Beers list ranged from 38.7% in B.C.[ii] to 66.0% in Newfoundland and Labrador and New Brunswick (Figure 11). As previously stated, comparisons between jurisdictions need to be done with caution, as differences between jurisdictions are due in part to differences in the public drug program plan design. Trends varied among the jurisdictions, with the rates of use decreasing in some jurisdictions and increasing in others. The jurisdictions with the most notable increases between 2011 and 2016 were P.E.I. (from 42.5% to 45.4%), Newfoundland and Labrador (from 62.7% to 66.0%) and New Brunswick (from 63.2% to 66.0%); and the jurisdictions with the most notable decreases were Ontario (from 51.1% to 46.9%) and B.C. (from 43.0% to 38.7%). (For more information, see *Drug Use Among Seniors in Canada, 2016: Data Tables*.)

Figure 11 Seniors' usage rate of drugs from Beers list,* by jurisdiction, Canada,[†] 2016

Notes
* AGS Beers Criteria 2015 Updated Version, with modifications to make the measure of potentially inappropriate use more applicable to the Canadian market (see Appendix B).
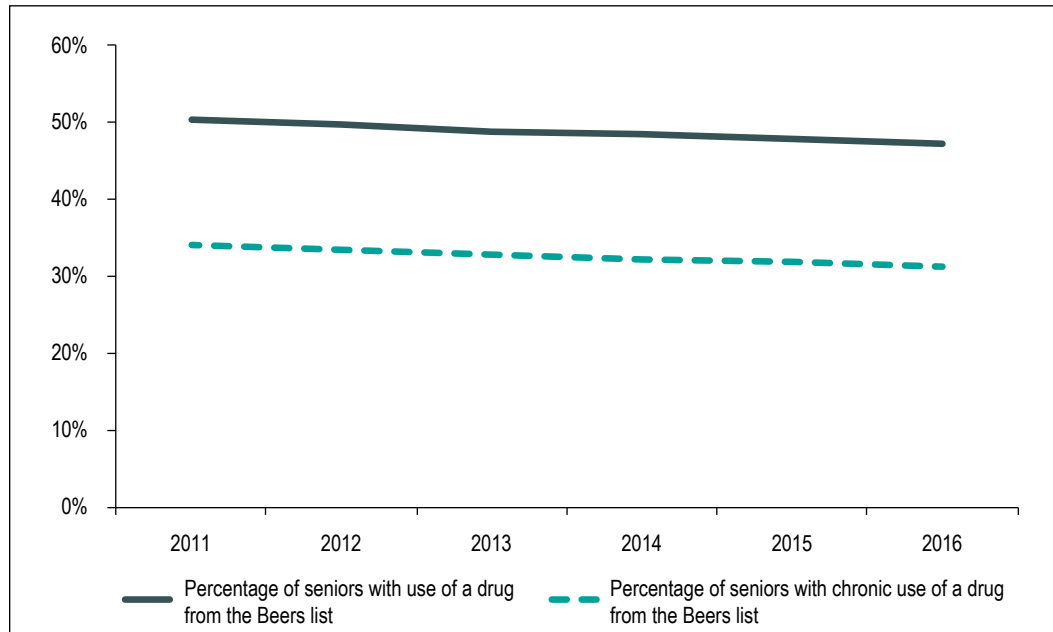† The Northwest Territories and Nunavut do not currently submit data to NPDUIS.
Public drug programs in Newfoundland and Labrador, Nova Scotia and New Brunswick provide coverage to smaller proportions of seniors than those in other jurisdictions. Rates for these provinces may not be representative of the full seniors population. Comparing rates between jurisdictions should be done with caution. (For more information on public drug coverage available to seniors, see CIHI's National Prescription Drug Utilization Information System Plan Information Document.)
Sources
National Prescription Drug Utilization Information System, Canadian Institute for Health Information;
Banque médicaments, Régie de l'assurance maladie du Québec.

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ii.   The usage rate of at least one drug from the Beers list increases to 44.2% in B.C. when adding private drug use.

Variation by socio-demographic factors

Sex and age

The use of potentially inappropriate drugs on the Beers list was more common among females (Figure 12). In 2016, 54.1% of females had at least one claim for a drug on the Beers list, compared with 43.6% of males. This trend is similar for chronic use of drugs on the Beers list: 36.8% of females and 29.8% of males. The difference is partially due to female seniors having a higher use of PPIs — one of the most commonly used drug classes from the Beers list. Previous research has shown that women have a greater chance of receiving an inappropriate medication, even after statistically adjusting for differences in clinical, socio-economic and personal characteristics.[38, 45]

Figure 12 Seniors' usage rate of drugs from Beers list,* by sex and age group, Canada,† 2016
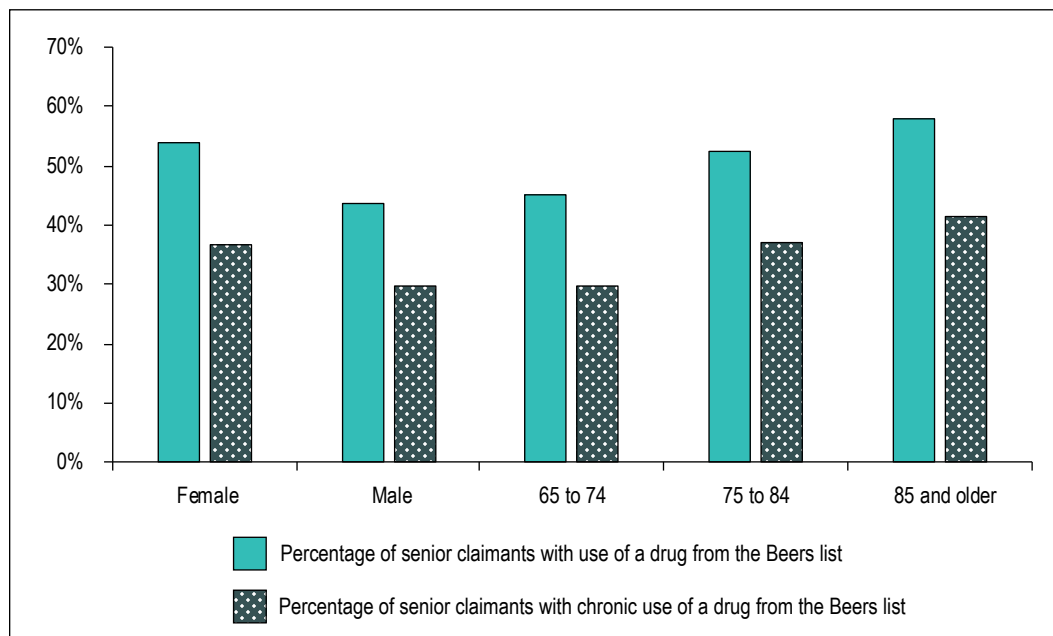
Notes
* AGS Beers Criteria 2015 Updated Version, with modifications to make the measure of potentially inappropriate use more applicable to the Canadian market (see Appendix B).
† The Northwest Territories and Nunavut do not currently submit data to NPDUIS.
Sources
National Prescription Drug Utilization Information System, Canadian Institute for Health Information; Banque médicaments, Régie de l'assurance maladie du Québec.

The use of drugs on the Beers list increased among the seniors age groups. 45.3% of seniors age 65 to 74 had a claim for at least one drug on the Beers list, compared with 57.8% of those age 85 and older. Similarly, for chronic users of at least one drug on the Beers list, the proportion was higher among the older age group: 29.7% of those age 65 to 74, compared with 41.3% of seniors age 85 and older.

Neighbourhood income

Seniors living in low-income neighbourhoods were prescribed more potentially inappropriate drugs than seniors living in high-income neighbourhoods (Figure 13). Both overall use and chronic use of drugs on the Beers list were higher in low-income neighbourhoods. Overall use and chronic use of drugs on the Beers list ranged from 43.2% to 48.3% and from 25.4% to 30.5%, respectively.

Figure 13 Seniors' usage rate of drugs from Beers list,* by neighbourhood income quintile, selected jurisdictions,† 2016
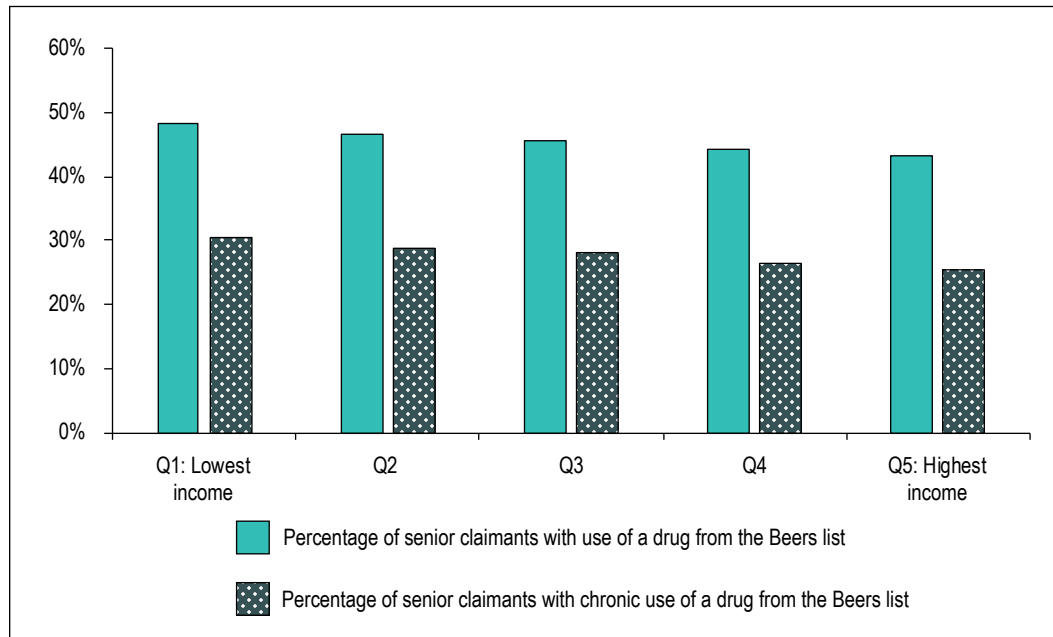
Notes

* AGS Beers Criteria 2015 Updated Version, with modifications to make the measure of potentially inappropriate use more applicable to the Canadian market (see Appendix B).

† There were 6 jurisdictions submitting claims data to NPDUIS where patient postal code can be identified, as of November 2017: Newfoundland and Labrador, Prince Edward Island, Manitoba, Alberta, British Columbia and Yukon.

Sources

National Prescription Drug Utilization Information System, Canadian Institute for Health Information; Postal Code Conversion File Plus (PCCF+), Statistics Canada.

Geographic location

Among seniors living in rural/remote neighbourhoods, 49.7% were prescribed at least one drug on the Beers list and 32.5% had chronic use of drugs on the Beers list; comparative proportions for seniors living in urban neighbourhoods were 44.4% and 26.6%, respectively (Figure 14).

Figure 14 Seniors' usage rate of drugs from Beers list,* by geographic location, selected jurisdictions,[†] 2016
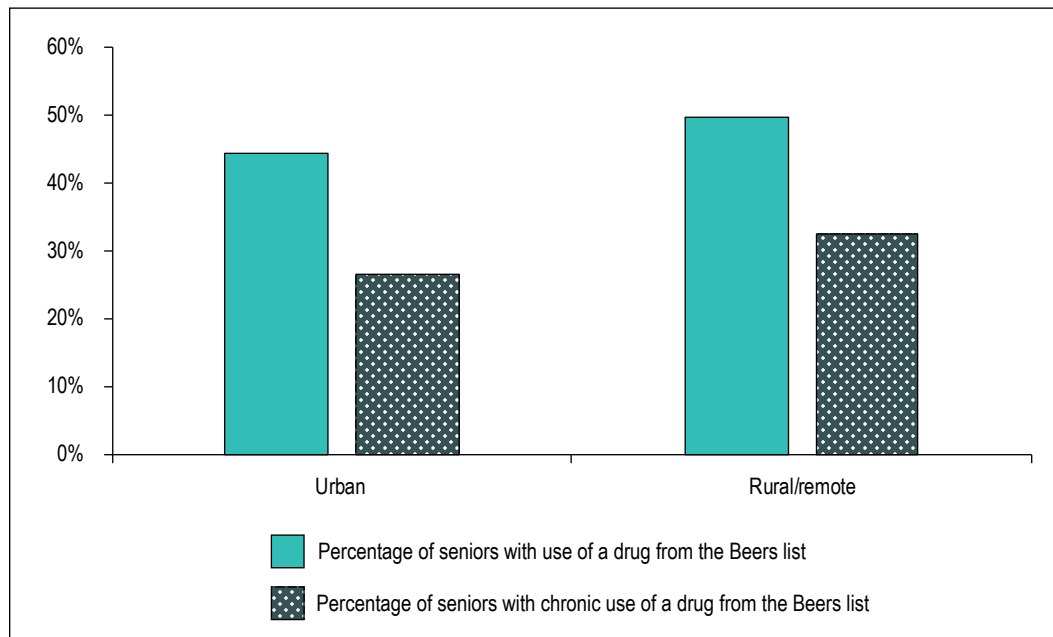
Notes
* AGS Beers Criteria 2015 Updated Version, with modifications to make the measure of potentially inappropriate use more applicable to the Canadian market (see Appendix B).
† There were 6 jurisdictions submitting claims data to NPDUIS where patient postal code can be identified, as of November 2017: Newfoundland and Labrador, Prince Edward Island, Manitoba, Alberta, British Columbia and Yukon.
Sources
National Prescription Drug Utilization Information System, Canadian Institute for Health Information; Postal Code Conversion File Plus (PCCF+), Statistics Canada.

Previous Canadian and international studies have found differences in prescribing patterns by patients' income and socio-economic status.[46, 47] More deprived populations were more likely to be prescribed 5 or more drugs and to be prescribed potentially harmful drugs (e.g., long-acting sulfonylureas used to treat diabetes).[46, 47] The results suggested that socio-economic status may affect the appropriateness of prescribing.[46] Place of residence may also affect the appropriateness of prescribing. A U.S. study found that older people who lived in less urban areas (metro areas with population less than 250,000) may be at a higher risk for being prescribed potentially inappropriate psychotropic medicines due to differences in levels of health based on access to geriatric specialists and mental health care.[48]

Proton pump inhibitors

PPIs are the second most commonly prescribed drug class among seniors, and their use increased from 26.7% in 2011 to 29.1% in 2016. The use of PPIs is more common among women and increases with age (for both men and women). Prolonged use of PPIs has been linked with increased chances of *Clostridium difficile* infection, bone loss and fractures.[37]

Prolonged use (more than 8 weeks) is considered potentially inappropriate for seniors, except for high-risk patients (those who are using oral corticosteroids or chronic NSAIDs), erosive esophagitis, Barrett's esophagitis, pathological hypersecretory condition or demonstrated need for maintenance treatment (due to failure of drug discontinuation or H2 blockers). In 2016, 73.5% of PPI users (excluding those who were using oral corticosteroids or chronic NSAIDs) were on PPIs for at least 8 weeks (Figure 15). Rates were similar between females and males and increased with age: PPI use exceeding 8 weeks was 71.8% among younger seniors and 77.7% among older seniors.

Figure 15 Proportion of senior PPI users* with prolonged use (>8 weeks), by sex and age group, Canada,[†] 2011 and 2016
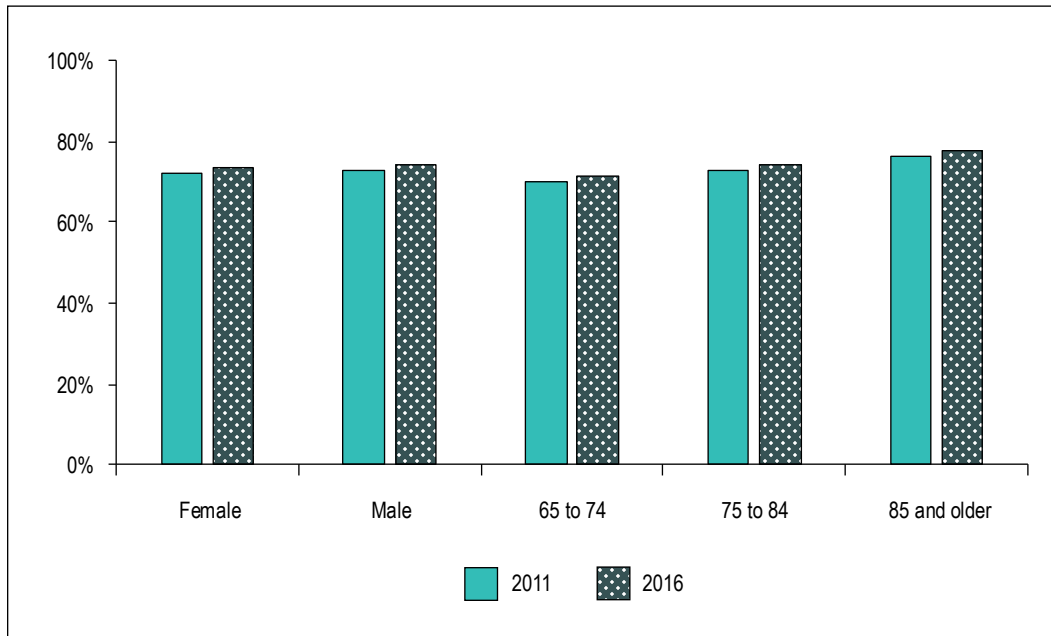
Notes
* Excluding those who were using oral corticosteroids or chronic NSAIDs.
† The Northwest Territories and Nunavut do not currently submit data to NPDUIS. Quebec has been excluded because data was not available prior to 2014.
Source
National Prescription Drug Utilization Information System, Canadian Institute for Health Information.

Deprescribing is one of the key initiatives focused on decreasing the inappropriate use of PPIs. It is the process of tapering, stopping, discontinuing or withdrawing drugs, with the goal of managing polypharmacy and improving outcomes.[19, 20] The Canadian Deprescibing Network (CaDeN) is a group committed to improving the health of Canadians by reducing the use of potentially inappropriate medicines and enhancing access to non-drug alternatives.[19] Members of CaDeN have developed evidence-based guidelines to help clinicians make decisions about when and how to safely stop PPI use.[49] These guidelines recommend deprescribing PPIs after 4 weeks of treatment in adults whose symptoms have resolved. Exceptions to this recommendation are outlined for patients being treated for certain chronic conditions.[49] Despite these recommendations, there has been no decrease in the proportion of seniors with prolonged use of PPIs.

Benzodiazepines

The use of benzodiazepines in seniors is of concern due to the increased risk of cognitive impairment, delirium, falls and fractures. The proportion of seniors using benzodiazepines decreased from 17.5% in 2011 to 14.0% in 2016 (Figure 16). This trend was observed in both females and males and in all age groups.

Figure 16 Seniors' usage rate of benzodiazepines (and related products), by type, Canada,* 2011 to 2016

Note

*   The Northwest Territories and Nunavut do not currently submit data to NPDUIS. Quebec has been excluded because data was not available prior to 2014.

Source

National Prescription Drug Utilization Information System, Canadian Institute for Health Information.

Short-acting benzodiazepines (e.g., lorazepam, oxazepam) were used by 77.4% of benzodiazepine users in 2016. Use has decreased for both sexes and every age group. The use of long-acting agents (e.g., diazepam) and z-drugs (benzodiazepine-related drugs, such as zopiclone) has stayed similar. The use of short-acting benzodiazepines is often preferred because there is less risk that their sedative effects will persist during the day.[50] Studies have not found significant differences in adverse events between benzodiazepines and z-drugs.[50, 51]

When deprescribing benzodiazepines, the medication needs to be tapered off gradually, as an abrupt discontinuation can result in withdrawal symptoms. Members of CaDeN have developed a deprescribing algorithm and are in the process of drafting deprescribing guidelines for benzodiazepine drugs.[52]

Prescribing to seniors in long-term care facilities

This section examines drugs prescribed to seniors living in LTC facilities. It addresses the following questions:

- How many drugs are prescribed to seniors living in LTC facilities?
- How many seniors living in LTC facilities are prescribed potentially inappropriate medications?

In 2016, LTC data was available for 5 provinces in NPDUIS — P.E.I., New Brunswick, Ontario, Manitoba and B.C. (For more information on the LTC population, see Appendix H.) Seniors living in LTC facilities in these provinces made up 4.5% of all public drug program senior claimants (0.9% of seniors age 65 to 74, 4.1% of seniors age 75 to 84 and 18.3% of seniors age 85 and older).

Number of drugs prescribed

On average, seniors living in LTC facilities were prescribed 9.9 drug classes in 2016, compared with 6.7 among seniors living in the community. Male seniors living in LTC facilities were prescribed more drugs than females, with 51.0% of males taking 10 or more drugs compared with 47.1% of females (Figure 17). Younger seniors were prescribed more drugs than older seniors, with 52.3% of seniors age 65 to 74 prescribed 10 or more drugs compared with 46.5% of seniors 85 and older. These trends are the opposite of what we see among seniors living in the community, where females and older seniors were prescribed more drugs on average.

Figure 17 Percentage of seniors living in LTC facilities, by number of drug classes, sex and age group, selected jurisdictions,* 2016
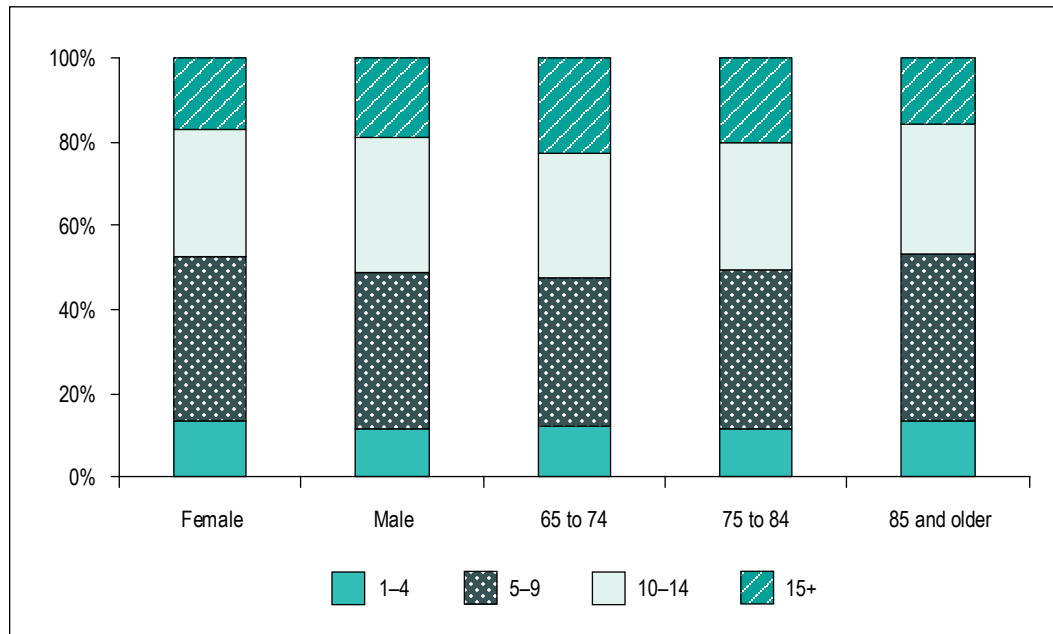
Note

* There were 5 provinces submitting identifiable LTC data to NPDUIS as of November 2017: Prince Edward Island, New Brunswick, Ontario, Manitoba and British Columbia.
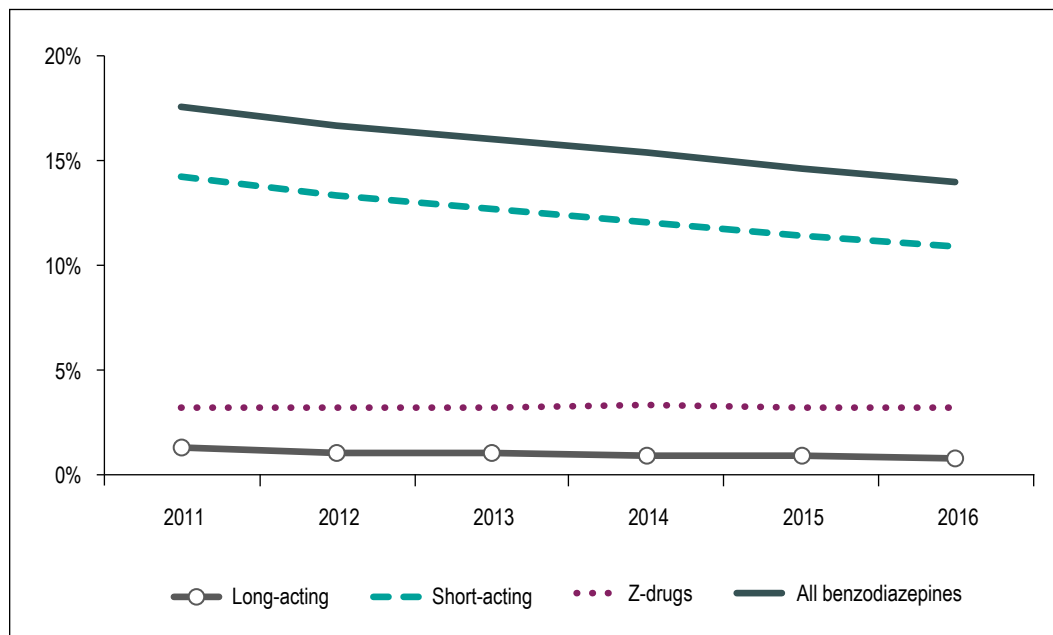
Source

National Prescription Drug Utilization Information System, Canadian Institute for Health Information.

Residents in LTC facilities use more drugs than those in the community because they tend to be older, more frail and sicker than seniors living in the community.[6, 53, 54] This increased drug use continues even after adjusting for clinical characteristics.[55]

An Ontario study found that, on average, younger LTC residents used more drugs than older LTC residents and that there was high variation in the number of drugs used by LTC residents across facilities.[55] The study found that LTC residents were more likely to use more drugs in the first 90 days living in an LTC facility.[55] Previous research has focused on decreasing the number of drugs used by residents of LTC facilities, with particular focus on lowering the use of PPIs, benzodiazepines and antipsychotics.[56–59] The Canadian Foundation for Healthcare Improvement (CFHI) has several initiatives to promote the health of Canadians, including many with a focus on improving drug use among seniors — aging and senior care, antipsychotic medication, dementia and long-term care/continuing care. The Institute for Safe Medication Practices (ISMP) Canada has raised awareness of deprescribing drugs from the Beers list among seniors living in LTC facilities and in the community. Decreasing the use of these commonly used drugs could be contributing to the decline in the average number of drugs seniors in LTC facilities are using.

The average number of drug classes prescribed for seniors living in LTC facilities decreased from 10.5 in 2011 to 9.9 in 2016 (Figure 18). The proportion of seniors prescribed 10 or more different drug classes decreased from 53.4% in 2011 to 48.4% in 2016.

Figure 18 Percentage of seniors living in LTC facilities, by number of drug classes, selected jurisdictions,* 2011 to 2016

Note
* There were 5 provinces submitting identifiable LTC data to NPDUIS as of November 2017:
   Prince Edward Island, New Brunswick, Ontario, Manitoba and British Columbia.
Source
National Prescription Drug Utilization Information System, Canadian Institute for Health Information.

The top drug classes prescribed to seniors differ between those living in LTC facilities and those in the community (Table 7). "Other antidepressants," the most commonly used drug class among seniors living in LTC facilities, was prescribed more than 4 times as often for seniors living in LTC (39.2%) compared with those in the community (8.8%). The most common chemical in the "Other antidepressants" drug class is trazodone — used by 25.8% of seniors living in LTC facilities. Usage rates of all classes of antidepressants were 60.3% among seniors living in LTC facilities and 19.1% among seniors living in the community. The use of natural opium alkaloids (select opioids) was also more prevalent among seniors living in LTC facilities (35.0%) than among seniors living in the community (14.7%). Statins, the most commonly used drug class among seniors in the community, was the sixth most commonly used drug class among seniors living in LTC facilities.

Table 7   Top 10 drug classes prescribed to seniors living in LTC facilities,
by rate of use and chronic use, selected jurisdictions,* 2016

Drug class	Common uses	Rate of use	Rate of chronic use
Other antidepressants	Depression	39.2%	25.3%
Proton pump inhibitors (PPIs)	Gastroesophageal reflux disease, peptic ulcer disease	38.3%	23.6%
Natural opium alkaloids	Management of moderate to severe pain	35.0%	10.7%
Selective serotonin reuptake inhibitors (SSRIs)	Depression	34.1%	23.2%
Sulfonamide diuretics	High blood pressure, heart failure	28.5%	16.4%
HMG-CoA reductase inhibitors (statins)	High cholesterol	28.0%	16.9%
Beta-blocking agents, selective	High blood pressure, heart failure, angina (chest pain)	26.2%	16.5%
Thyroid hormones	Hypothyroidism	25.3%	18.4%
Angiotensin-converting enzyme (ACE) inhibitors, excluding combinations	High blood pressure, heart failure	24.0%	15.2%
Fluoroquinolones	Antibiotics	23.6%	0.1%

Note

*   There were 5 provinces submitting identifiable LTC data to NPDUIS as of November 2017: Prince Edward Island, New Brunswick, Ontario, Manitoba and British Columbia.
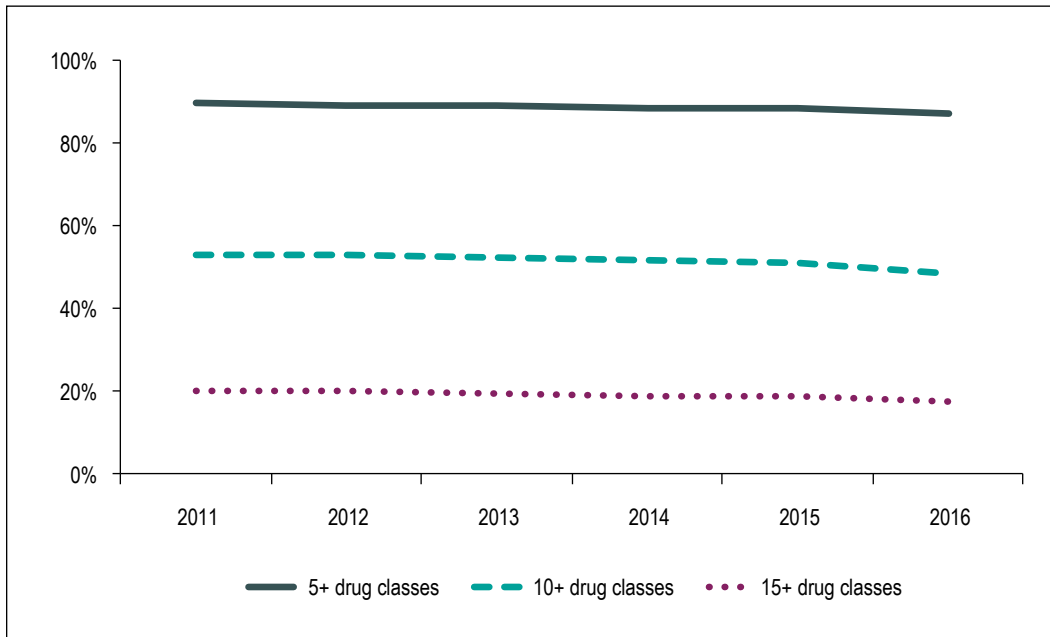
Source

National Prescription Drug Utilization Information System, Canadian Institute for Health Information.

Potentially inappropriate prescribing

Fewer seniors living in LTC facilities were using potentially inappropriate drugs in 2016 (69.8%) than in 2011 (76.5%) (Table 8). Chronic use of at least one drug on the Beers list also decreased from 48.1% to 40.7% of seniors. Male and female seniors have similar rates of use of drugs on the Beers list for both years.

Table 8 Percentage of seniors living in LTC facilities prescribed drugs from Beers list,* by rate of use and chronic use, by sex, age group, selected jurisdictions,† 2011 and 2016

Sex and age group	2011		2016	
	Percentage of LTC residents with any use of drugs on Beers list	Percentage of LTC residents with chronic use of drugs on Beers list	Percentage of LTC residents with any use of drugs on Beers list	Percentage of LTC residents with chronic use of drugs on Beers list
Female	76.3%	48.8%	69.4%	40.9%
Male	76.8%	46.4%	70.5%	40.2%
Age 65 to 74	81.5%	55.8%	76.0%	50.7%
Age 75 to 84	78.5%	50.4%	72.2%	43.4%
Age 85 and older	74.4%	45.4%	67.4%	37.5%
Overall	76.5%	48.1%	69.8%	40.7%

Notes
* AGS Beers Criteria 2015 Updated Version, with modifications to make the measure of potentially inappropriate use more applicable to the Canadian market (see Appendix B).
† There were 5 provinces submitting identifiable LTC data to NPDUIS as of November 2017: Prince Edward Island, New Brunswick, Ontario, Manitoba and British Columbia.
Source
National Prescription Drug Utilization Information System, Canadian Institute for Health Information.

Work done by CaDeN members initially targeted 3 drug classes that could be considered for deprescribing among seniors: benzodiazepines, PPIs and sulfonylureas.[56] These 3 drug classes are included on the Beers list and their use by seniors is associated with additional risks.[37, 56]

On average, the use of antipsychotics and benzodiazepines in LTC facilities has decreased since 2011, while the use of antidepressants has increased (Figure 19). The increase in antidepressants is mostly due to an increase in the use of trazodone. This may be due to trazodone increasingly being prescribed off-label as a sedative in place of prescribing benzodiazepines.[60, 61] Regular public reporting of the indicator Potentially Inappropriate Use of Antipsychotics in Long-Term Care (prescribing of antipsychotics without the diagnosis of psychosis) may contribute to the continuing decline in inappropriate prescribing of antipsychotics in LTC facilities. (For additional information, see CIHI's Your Health System web tool.)[62]

Figure 19 Percentage of seniors living in LTC facilities prescribed psychotropic drugs, by type of drug, selected jurisdictions,* 2011 to 2016
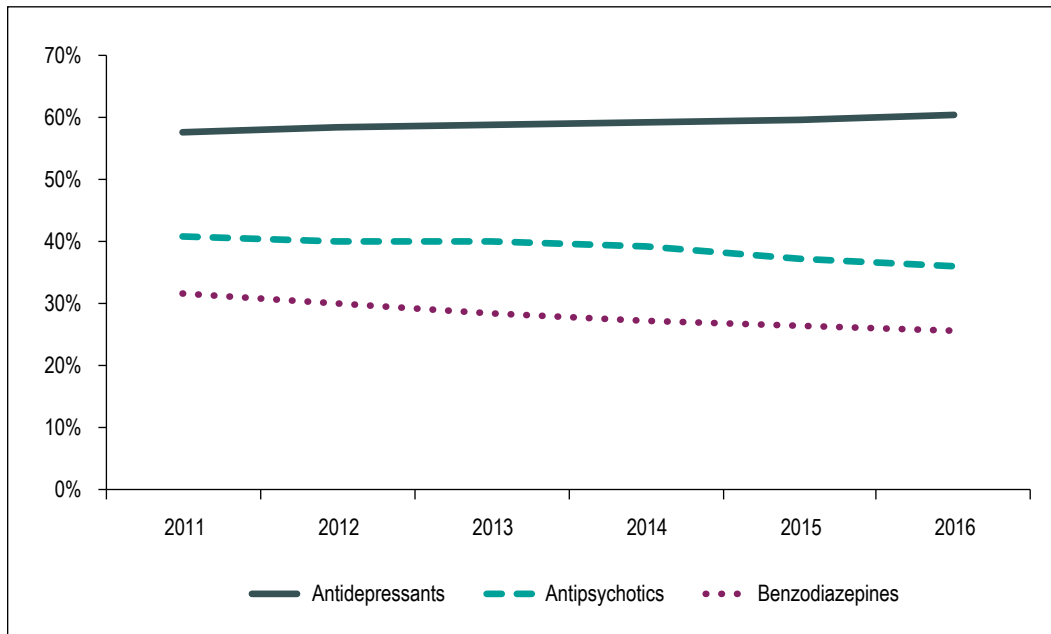
Note

* There were 5 provinces submitting identifiable LTC data to NPDUIS as of November 2017:
   Prince Edward Island, New Brunswick, Ontario, Manitoba and British Columbia.

Source

National Prescription Drug Utilization Information System, Canadian Institute for Health Information.

The decrease in use of antipsychotics and benzodiazepines was seen in both females and males as well as in every age group. The increase in use of antidepressants was also seen across both sexes and all age groups.

These changes show the effectiveness of programs designed to decrease the use of potentially inappropriate drugs in certain populations. Benzodiazepines was 1 of the 3 drug classes initially targeted by CaDeN members for deprescribing among seniors.

Conclusion

On average, the number of drugs being prescribed to seniors did not change significantly between 2011 and 2016. Approximately one-quarter of seniors were prescribed 10 or more drug classes in each year. Statins were the most commonly prescribed drug class and cardiovascular-related drugs made up 5 of the top 10 most commonly prescribed drugs in each year.

Seniors living in neighbourhoods with the lowest income were prescribed more drugs (21.4% were prescribed 10 or more drug classes) than those in the highest-income neighbourhoods (14.3% were prescribed 10 or more drug classes). Seniors living in rural/remote neighbourhoods were prescribed more drugs (20.4% were prescribed 10 or more drug classes) than those living in urban neighbourhoods (16.8% were prescribed 10 or more drug classes). Seniors living in low-income and rural/remote neighbourhoods also were prescribed more potentially inappropriate drugs.

In 2016, 0.7% of seniors were hospitalized for an ADR. The number of drugs was the factor most highly associated with ADR-related hospitalizations. Seniors prescribed 10 to 14 different drug classes were 5 times more likely to be hospitalized for an ADR than seniors prescribed between 1 and 4 drug classes, after controlling for other factors. Seniors prescribed 15 or more different drug classes were 8 times more likely to be hospitalized for an ADR.

The need to reduce the number of drugs and potentially inappropriate drugs being prescribed for seniors is a topic of increasing concern among practitioners, researchers and organizations throughout Canada — including the Canadian Deprescribing Network, the Canadian Foundation for Healthcare Improvement, the Institute for Safe Medication Practices and the Canadian Patient Safety Institute. Initiatives and campaigns, such as Choosing Wisely Canada, are taking place across the country with the goal of improving prescribing practices with the support of data analyses.[63] Several studies speak to the importance of deprescribing among elderly patients, particularly at end of life.[28, 64]

These initiatives may be having an impact, as chronic use of potentially inappropriate drugs decreased from 33.9% in 2011 to 31.1% in 2016. The use of antipsychotics and benzodiazepines — 2 classes that have been the focus of targeted initiatives — decreased from 40.7% to 35.9% and from 31.6% to 25.7%, respectively, among seniors living in LTC facilities. However, the chronic use of PPIs, which have also been the focus of such initiatives, increased from 19.4% in 2011 to 21.3% in 2016.

Future work could examine the effect of changes in drug use on clinical outcomes and evaluate the impact of interventions aimed at improving the appropriateness of prescribing in seniors. Particular attention could be paid to the effects of those interventions on subpopulations that use a higher number of drugs and have more potentially inappropriate drug use — including women, older seniors and those living in low-income and rural/remote neighbourhoods.

Appendix A: Glossary

Please note that some of the terms in this glossary may have alternate definitions. The stated definitions are meant to reflect how these terms were used in the context of this report only and are not necessarily the sole definitions of these terms.

Accepted claim: A claim for which the drug program accepts at least a portion of the cost, either toward a deductible or for reimbursement.

Adverse drug reaction (ADR): Harmful and unintended response to a drug that occurs at doses normally used or tested to diagnose, treat or prevent a condition or to modify an organic function. (See Appendix B for more detail.)

Anatomical Therapeutic Chemical (ATC) system: A classification system that divides drugs into different groups according to the organ or system on which they act and their chemical, pharmacological and therapeutic properties. This report uses the 2017 version of the ATC classification system.

Beers list: A list of drugs identified as potentially inappropriate for use in seniors. The American Geriatrics Society Beers Criteria 2015 Updated Version is used in this report, with slight modifications to make the measure of potentially inappropriate use more applicable to the Canadian market. (See Appendix B for more detail.)

Chemical: Subgroups classified by the World Health Organization at the fifth level of the ATC classification system, 2017 version. Each unique code represents a distinct chemical or biologic entity within the respective drug class.

Chronic drug use: A person having at least 2 claims and 180 days' supply for a given drug class.

Claim: 1 or more transactions, with the final result indicating that a prescription had been filled and dispensed in exchange for payment.

Claimant: A senior with at least one claim accepted by a public drug program, either for reimbursement or applied toward a deductible. In Manitoba and Saskatchewan, claimants are also seniors with accepted claims who are eligible for coverage under a provincial drug program but who have not submitted an application and, therefore, do not have a defined deductible.

Drug class: Subgroups of chemicals classified by the World Health Organization at the fourth level of the ATC classification system, 2017 version. At this level, subgroups are, in theory, regarded as groups of different chemicals that work in the same way to treat similar medical conditions (e.g., the chemical subgroup statins includes chemicals such as atorvastatin, rosuvastatin and simvastatin).

Drug program: A program that provides coverage for drugs for a set population; has defined rules for eligibility, payment, etc.

Drug program formulary: A formal listing of the benefits eligible for reimbursement under a specific drug benefit plan/program and the conditions under which coverage is provided. For the purpose of NPDUIS, a "benefit" means a drug, product, medical supply, equipment item or service covered under a drug benefit plan or program.

Geographic location: Summary of Statistical Area Classification (SAC) type as defined in the PCCF+ reference manual. Defined as urban (SACtypes 1, 2 and 3) and rural/remote (SACtypes 4, 5, 6, 7 and 8). The patient's postal code is used for this measure.

Indication: A reason for using a specific drug (e.g., gastroesophageal reflux disease is an indication for PPI use).

Jurisdiction: The federal/provincial/territorial jurisdiction responsible for the drug program formulary and for financing the paid amount of accepted claims.

Neighbourhood income quintile: As defined in the PCCF+ reference manual, neighbourhood income per person equivalent is a household size–adjusted measure of household income. The patient's postal code is used for this measure.

Out of pocket: Prescription drugs purchased without the use of public or private drug coverage.

Private drug coverage: Drug coverage offered to seniors by a private insurer.

Public drug coverage: Drug coverage offered to seniors by the federal/provincial/territorial jurisdictions.

Seniors: People age 65 and older.

Appendix B: Methodological notes

Data sources

National Prescription Drug Utilization Information System

The drug claims and formulary data used in this analysis comes from the National Prescription Drug Utilization Information System (NPDUIS), as submitted by provincial/territorial public drug programs in Newfoundland and Labrador, P.E.I., Nova Scotia, New Brunswick, Quebec, Ontario, Manitoba, Saskatchewan, Alberta, B.C. and Yukon, as well as the FNIHB federal public drug program. NPDUIS houses pan-Canadian information related to public program formularies, drug claims, policies and population statistics. It was designed to provide information that supports accurate, timely and comparative analytical and reporting requirements for the establishment of sound pharmaceutical policies and the effective management of Canada's public drug benefit programs.

NPDUIS includes claims accepted by public drug programs, either for reimbursement or to be applied toward a deductible.[iii] Claims are included regardless of whether the patient actually used the drugs.

NPDUIS does not include information regarding

- Prescriptions that were written but never dispensed;
- Prescriptions that were dispensed but for which the associated drug costs were not submitted to or not accepted by the public drug programs; or
- Diagnoses or conditions for which prescriptions were written.

For more information on public drug coverage available to seniors, please see CIHI's National Prescription Drug Utilization Information System Plan Information Document.

Provincial notes

Prince Edward Island

Claims dispensed through the following programs are included in NPDUIS: Children in Care, Financial Assistance, Seniors' Drug Cost Assistance, Diabetes, Family Health Benefit, High Cost Drug, Nursing Home, Quit Smoking and Sexually Transmitted Disease. Claims for all other plans are not submitted.

[iii]. In Manitoba and Saskatchewan, this includes accepted claims for people who are eligible for coverage under a provincial drug program but have not submitted an application and, therefore, do not have a defined deductible.

Nova Scotia

Claims dispensed through the Department of Community Services Pharmacare Benefits Program are not submitted.

Saskatchewan

Claims for non-published drug identification numbers (i.e., DINs not listed on the Saskatchewan Health Drug Plan Formulary) and claims dispensed through special programs (e.g., Saskatchewan Cancer Agency) are not submitted to NPDUIS. Claims dispensed through Saskatchewan Aids to Independent Living (SAIL) and Supplementary Health are included in NPDUIS only if they are for DINs published on the Saskatchewan Health Drug Plan Formulary.

Alberta

Claims dispensed through the following programs are not submitted: Income Support, Alberta Adult Health Benefit, Assured Income for the Severely Handicapped and Alberta Child Health Benefit. Claims dispensed to residents of LTC facilities are not submitted to NPDUIS.

Discharge Abstract Database and Hospital Morbidity Database

The DAD and HMDB contain demographic, administrative and clinical data on acute care institution separations (discharges, deaths, sign-outs and transfers). Facilities in all provinces and territories except Quebec are required to report data to the DAD. Quebec acute inpatient records are submitted to CIHI through a different process and are included in the HMDB. The HMDB is populated by a subset of DAD data for other jurisdictions. For this analysis, data for discharges from non-acute facilities was excluded. DAD data was used to identify seniors hospitalized for adverse drug reactions.

Limitations

As claims data indicates only that a drug was dispensed and not that it was used, it may not always reflect utilization. A patient may take all, some or none of a dispensed prescription.

NPDUIS contains limited information on claims that were not accepted by the public drug program (i.e., claims paid by private insurers or out of pocket by individuals). Therefore, the number of drugs or rate of use may be underestimated. However, for seniors, this underestimation applies mainly to drugs not covered by public drug programs and to those with restrictive coverage policies.

NPDUIS does not contain information regarding diagnoses or the conditions for which prescriptions were written. Therefore, the conditions that contribute to drug program spending cannot be identified with certainty. However, identifying the most common indications for the drug classes that account for the majority of spending gives an idea of which conditions are the main contributors.

Formulary comparison

Variation in the number and types of drugs covered by formularies across jurisdictions can lead to differences in drug utilization and expenditure.

This section assesses the commonality of the public drug formularies of the 12 jurisdictions as of December 31, 2016 (i.e., the degree to which the formularies of the 11 provincial/territorial and 1 federal drug plan are the same).

In 2016, drugs common in all 12 jurisdictions made up 93.8% of drug claims and 75.9% of drug program spending on seniors. For drug classes covered in at least 10 jurisdictions, the rates increase to 98.0% of drug claims and 96.6% of total program payments. Because such a large portion of drug use is for drug classes that are listed in all 12 jurisdictions, differences in formulary coverage are not expected to play a large role in any differences between jurisdictions in overall utilization and expenditure. However, differences in formulary coverage may have a significant impact on the utilization of specific drugs or drug classes across provinces. For example, the lower rate of PPI use in B.C. is due in part to the fact that PPI coverage is restricted to patients who have a documented failure with or intolerance to adequate doses of H2 receptor antagonists (e.g., ranitidine). Given this potential impact, it is important to consider differences in formulary listings when comparing provincial drug utilization or expenditure for specific drugs or drug classes.

Drug classification systems

Drugs can be analyzed using many different classification systems. For the purposes of this analysis, the following systems were used:

- The DIN, as assigned by Health Canada. A DIN is specific to manufacturer, trade name, active ingredient(s), strength(s) of active ingredient(s) and pharmaceutical form. In this analysis, references to drug products are implied to be specific to DIN level.
- The pseudo-drug identification number (PDIN), as assigned by a drug program, in cases where a benefit has not been assigned a DIN by Health Canada. This may occur when a benefit is not a drug product (e.g., a glucose test strip); when it is a compound consisting of multiple drug products, each with its own DIN; or when it is a pharmacy service (e.g., medication review).

- The 2017 version of the World Health Organization ATC classification system, as reported in the Health Canada Drug Product Database.[iv]

  – In the ATC classification system, drugs are divided into different groups according to the organ or system on which they act and their chemical, pharmacological and therapeutic properties.

  – The ATC does not distinguish between strength, dosage, route or form of drug, except as implied by the ATC (e.g., inhaled corticosteroid).

  – Drugs are classified in groups at 5 different levels:

    ○ The drugs are divided into 14 main groups (first level), with 1 pharmacological/ therapeutic subgroup (second level).

    ○ The third and fourth levels are chemical/pharmacological/therapeutic subgroups.

    ○ The second, third and fourth levels are often used to identify pharmacological subgroups when that is considered more appropriate than therapeutic or chemical subgroups.

    ○ The fifth level is the chemical substance.

  – Drug products assigned a DIN but not assigned to an ATC classification by Health Canada are automatically classified under the ATC classification "unassigned."

  – Benefits assigned a PDIN are automatically classified under the ATC classification "not applicable."

  – Where appropriate, CIHI may assign DINs or PDINs to other ATC classifications.

Calculation methods

Adverse drug reaction (ADR)

The World Health Organization defines ADRs as adverse effects of a drug that was properly administered in the correct dose, for therapeutic or prophylactic (i.e., preventive) use.[65] This definition excludes both intentional and unintentional poisonings, which are characterized by either an overdose of a prescribed substance or the wrong substance being given or taken in error.

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iv.   Although Health Canada typically assigns drug products to a fifth-level ATC, in some cases it may assign an ATC at the fourth or even third level.

ADRs were identified as abstracts that contained the following:

1. A most responsible diagnosis code that was either drug-related or due to a drug — provided that the most responsible diagnosis was not indicated to have occurred post-admission. These cases were identified when the same diagnosis was coded as both the most responsible diagnosis and a post-admission comorbidity (this removed 2.0% of ADRs among seniors identified by the most responsible diagnosis code); or
2. A pre-admission comorbidity that was either drug-related or due to a drug; or
3. An external cause code that was drug-related (ICD-10 codes Y40 to Y59), provided that the external cause code was not paired with a post-admission diagnosis.

Post-admission ADRs were excluded, as it was not known whether they would have required hospital treatment had they occurred outside of the hospital.

Drugs on Beers list

Drugs on the Beers list are drugs that have been identified as potentially inappropriate to prescribe to seniors due to an elevated risk of adverse effects, a lack of efficacy in seniors or the availability of safer alternatives.[37] A widely used list of these drugs, known as the Beers list, was originally developed in 1991 by Dr. Mark H. Beers and applied specifically to seniors living in LTC facilities; it was then expanded to include all seniors.[37] The 2015 version of the Beers list, updated by The American Geriatrics Society (AGS 2015 Updated Beers Criteria), is used in this report.

There were several new medications and changes in the 2015 update of the Beers criteria; most notable was the inclusion of long-term use of PPIs. Due to this addition, 3 of the 10 most commonly used chemicals from the Beers criteria are now PPIs (pantoprazole, rabeprazole and omeprazole). Another notable change includes the removal of the 90-day-use limitation on non-benzodiazepine and benzodiazepine receptor agonist hypnotics. In previous versions of the Beers criteria, the use of non-benzodiazepine hypnotics (zopiclone) was considered potentially inappropriate if taken chronically beyond 90 days; now any use is considered potentially inappropriate.

The Beers list separates potentially inappropriate drugs for seniors into 3 groups: drugs that are regarded as potentially inappropriate, drugs that are inappropriate for use in seniors due to drug–disease or drug–syndrome interactions and drugs that should be taken with caution. This analysis included only drugs that are regarded as potentially inappropriate according to the Beers list.

It should be noted that some drugs regarded as potentially inappropriate on the updated Beers list used in this report are considered potentially inappropriate for only a specific use or if they are prescribed in a certain way. Because information related to the reason for the prescription or details on how the drugs are prescribed are not available in NPDUIS, all drug claims in these cases were identified as potentially inappropriate.

Groups of drugs included on the Beers list can focus either on a therapeutic drug class (e.g., benzodiazepines) or on a specific drug (e.g., meperidine). Drugs may be considered potentially inappropriate only if taken in a certain formulation (e.g., dipyridamole should not be taken in oral short-acting form) or if taken in excess of a specific dose (e.g., doxepin doses greater than 6 mg/day).

The Beers list was developed, and focuses on drugs available, in the United States. In an effort to customize this analysis to the Canadian market, all benzodiazepines and benzodiazepine-related products were identified as potentially inappropriate, not only those explicitly listed in the Beers list. The only exception was clobazam, which was excluded because, unlike other benzodiazepines, it is used primarily for epileptic seizures. This modification is based on work by the Saskatchewan Health Quality Council.[66]

The Beers list also contains a designation for the quality of evidence regarding the inappropriateness of the drug and the strength of the recommendation. The quality of the evidence can be

- High — Evidence includes consistent results from well-designed, well-conducted studies in representative populations that directly assess effects on health outcomes;
- Moderate — Evidence is sufficient to determine effects on health outcomes, but the number, quality, size or consistency of included studies limits the strength of the evidence; or
- Low — Evidence is insufficient to assess effects on health outcomes.

The strength of the recommendation can be

- Strong — Benefits clearly outweigh risks and burden or risks and burden clearly outweigh benefits;
- Weak — benefits finely balanced with risks and burden; or
- Insufficient — Insufficient evidence to determine net benefits or risks.

No drugs were excluded from this analysis based on strength of evidence or recommendation. However, it should be noted that very few drugs on the list had a low quality of evidence, and those that did all had a strong strength of recommendation.

Number of drug classes

The number of drug classes a senior was using in a given year is calculated by counting the number of unique drug classes (ATC level 4) the person used during that year. This number does not necessarily reflect the number of drug classes he or she is using at one time.

Also, this measure does not consider whether a patient was using a drug from each class from the beginning of the year or whether a drug was started partway through the year. In addition, although looking at the number of drug classes (rather than at the number of unique chemicals) controls for switching between drugs within a drug class, it can understate the number of drugs a senior is using if he or she is using multiple drugs within a single drug class at the same time. Overall, it does not appear that these factors significantly impacted the analysis, as the average numbers of claimed drug classes and claimed chemicals were similar for all age groups. In 2016, seniors on public drug programs had claims for an average of 7.2 drug classes and 7.4 chemicals.

Long-term care residents

LTC facility residents were identified in 1 of 2 ways, depending on the jurisdiction. In P.E.I., New Brunswick, Manitoba and B.C., LTC facility residents were identified as those having claims accepted by drug programs designed to provide coverage to LTC facility residents. In Ontario, residents are flagged in NPDUIS as living in an LTC facility.

It should be noted that in P.E.I., only seniors whose LTC is subsidized by the government can be identified as LTC facility residents. LTC facility residents whose care is paid for either out of pocket or through private insurance are classified as non-LTC facility–residing seniors in NPDUIS. It is expected that this will increase the rate of use among non-LTC facility residents in P.E.I., though it is unclear what effect this will have on the rate of use among LTC facility residents. Because of P.E.I.'s relatively small population, it is not expected that this will have a great effect on the overall rates of use in the 5 provinces.

Percentage of seniors with accepted and paid claims

Percentage of seniors with accepted claims is calculated by dividing the number of senior claimants in a given year by the senior population reported for that province as of July 1 of that year.

Percentage of seniors with paid claims is calculated by dividing the number of seniors with paid claims in a given year by the senior population reported for that province as of July 1 of that year.

It should be noted that the denominators in the above 2 calculations include seniors who are not eligible for provincial drug coverage, either because they receive drug coverage from another source (e.g., federal drug programs, private drug insurance) or because they were eligible for public drug coverage but did not apply to have their deductible calculated. The proportions of patients with accepted and paid claims would be larger if only the eligible and enrolled population was considered. It should also be noted that, as the numerator is a cumulative count of claimants throughout the year and the denominator is measured at a given point in time, it is possible for the percentage to be greater than 100%.

Psychotropic drugs

The psychotropic drug classes included in this analysis were identified by the DINs assigned by Health Canada and by the World Health Organization ATC codes N05BA — benzodiazepines (under the broader class of anxiolytics), N05CD — benzodiazepines (under the broader class of sedatives and hypnotics), N05CF — benzodiazepine-related drugs, N06A — antidepressants, and N05A — antipsychotics. All dosage forms and strengths of these chemicals that were available in Canada during the study period, with the exception of lithium (ATC code N05AN) and clobazam (ATC code N05BA09), were included. Lithium was excluded because, unlike other drugs in its ATC class, it is not used to treat behavioural and psychological symptoms of dementia in elderly persons; clobazam was excluded because, unlike other benzodiazepines, it is used primarily for epileptic seizures.

Rate of use

Calculated as the total number of seniors with claims for the group (e.g., drug class or chemical) in question, divided by the total number of seniors with claims.

Appendix C: Seniors population and public drug program claimants

Table C1 Seniors population and public drug program claimants, by jurisdiction, sex and age group, 2016

Jurisdiction	Number	Sex		Age group		
		Female	Male	65 to 74	75 to 84	85 and older
Newfoundland and Labrador						
Seniors population	101,212	53.4%	46.6%	62.4%	28.1%	9.5%
Seniors claimants	51,080	58.2%	41.8%	50.7%	34.6%	14.7%
Prince Edward Island						
Seniors population	28,026	54.7%	45.3%	60.6%	28.4%	11.0%
Seniors claimants	26,161	54.4%	45.6%	57.1%	30.3%	12.5%
Nova Scotia						
Seniors population	183,415	54.7%	45.3%	59.2%	28.8%	12.0%
Seniors claimants	121,154	57.5%	42.5%	53.3%	31.8%	15.0%
New Brunswick						
Seniors population	147,862	54.1%	45.9%	58.6%	29.1%	12.3%
Seniors claimants	78,116	58.0%	42.0%	48.6%	33.8%	17.7%
Quebec						
Seniors population	1,502,903	54.9%	45.1%	57.3%	29.8%	12.9%
Seniors claimants	1,296,015	56.1%	43.9%	54.6%	31.4%	13.9%
Ontario						
Seniors population	2,291,002	55.0%	45.0%	56.2%	30.4%	13.4%
Seniors claimants	2,154,273	55.1%	44.9%	54.2%	31.1%	14.7%
Manitoba						
Seniors population	198,410	54.9%	45.1%	56.1%	29.4%	14.5%
Seniors claimants	185,154	55.5%	44.5%	53.5%	30.2%	16.3%
Saskatchewan						
Seniors population	170,343	54.5%	45.5%	53.6%	30.9%	15.5%
Seniors claimants	160,203	54.8%	45.2%	50.8%	31.2%	18.1%
Alberta						
Seniors population	507,723	54.0%	46.0%	58.6%	28.9%	12.5%
Seniors claimants	465,722	54.0%	46.0%	56.1%	30.6%	13.3%

Jurisdiction	Number	Sex		Age group		
		Female	Male	65 to 74	75 to 84	85 and older
British Columbia						
Seniors population	849,890	53.0%	47.0%	57.0%	29.8%	13.1%
Seniors claimants	752,387	53.7%	46.3%	54.7%	30.8%	14.5%
Yukon						
Seniors population	4,468	49.8%	50.2%	69.4%	24.1%	6.5%
Seniors claimants	3,566	45.5%	54.5%	69.1%	23.6%	7.3%
First Nations and Inuit Health Branch						
Seniors population*	59,366	58.9%	41.1%	n/a	n/a	n/a
Seniors claimants	53,273	58.8%	41.2%	66.7%	26.9%	6.4%
Canada						
Seniors population	5,989,898	54.5%	45.5%	57.0%	29.9%	13.1%
Seniors claimants[†]	5,347,104	55.2%	44.8%	54.4%	31.1%	14.5%

Notes

* The FNIHB population is for 2014–2015.

† The Northwest Territories and Nunavut do not currently submit data to NPDUIS.

n/a: Not available.

Sources

Statistics Canada; National Prescription Drug Utilization Information System, Canadian Institute for Health Information; Banque médicaments, Régie de l'assurance maladie du Québec.

Appendix D: Percentage of total seniors population with accepted and paid claims through public drug programs

Table D1 Seniors population with accepted and paid claims through public drug programs, by selected jurisdiction, Canada,* 2011 and 2016

Jurisdiction	Percentage of total seniors population with accepted claims		Percentage of total seniors population with paid claims	
	2011	2016	2011	2016
Newfoundland and Labrador	57.6%	50.5%	57.6%	50.4%
Prince Edward Island	91.1%	93.3%	89.7%	92.6%
Nova Scotia	69.0%	66.1%	68.5%	65.4%
New Brunswick	56.8%	52.8%	56.8%	52.8%
Quebec†	n/a	86.2%	n/a	84.5%
Ontario	93.3%	94.0%	93.2%	93.8%
Manitoba	93.9%	93.3%	43.6%	30.1%
Saskatchewan	93.4%	94.0%	87.0%	83.8%
Alberta	92.1%	91.7%	92.1%	91.7%
British Columbia	89.8%	88.5%	54.1%	38.8%
Yukon	81.4%	79.8%	81.4%	79.8%
First Nations and Inuit Health Branch‡	73.0%	89.7%	73.0%	89.7%

Notes

* The Northwest Territories and Nunavut do not currently submit data to NPDUIS.

† Quebec data was not available before 2014.

‡ The FNIHB population is from 2010–2011 (for 2011) and 2014–2015 (for 2016) Non-Insured Health Benefits Program annual reports. 2014–2015 is the most recent published Non-Insured Health Benefits Program annual report.

n/a: Not available.

Sources

National Prescription Drug Utilization Information System, Canadian Institute for Health Information; Banque médicaments, Régie de l'assurance maladie du Québec.

Appendix E: Risk factors associated with ADR-related hospitalizations

Table E1 Risk factors associated with ADR-related hospitalizations, selected jurisdictions,* Canada, 2016

Variable	Value	Odds ratio (confidence interval)	P-value	Percentage of seniors
Sex	Female†	1.000	—	54.3%
	Male	1.058 (1.015–1.102)	0.0072	45.7%
Age group	65 to 74†	1.000	—	52.1%
	75 to 84	1.381 (1.317–1.449)	0.0048	32.7%
	85 and older	1.693 (1.605–1.785)	<0.0001	15.2%
Number of drug classes	1 to 4†	1.000	—	40.3%
	5 to 9	2.683 (2.479–2.904)	<0.0001	38.7%
	10 to 14	5.124 (4.712–5.571)	<0.0001	14.9%
	15 and more	7.951 (7.274–8.691)	<0.0001	6.2%
Number of prescribers	1†	1.000	—	23.4%
	2 or more	1.390 (1.279–1.512)	<0.0001	76.6%
Number of pharmacies	1†	1.000	—	66.4%
	2 or more	1.066 (1.022–1.111)	0.0028	33.6%
Previous non-ADR-related hospitalization	No†	1.000	—	85.3%
	Yes	3.420 (3.272–3.576)	<0.0001	14.7%
Use of drugs on Beers list‡	No†	1.000	—	56.3%
	Yes	1.107 (1.058–1.157)	<0.0001	43.7%

Notes

* There were 6 jurisdictions submitting linkable claims data to NPDUIS as of November 2017: Newfoundland and Labrador, Prince Edward Island, Manitoba, Alberta, British Columbia and Yukon.

† Reference group.

‡ AGS Beers Criteria 2015 Updated Version, with modifications to make the measure of potentially inappropriate use more applicable to the Canadian market (see Appendix B).

— Not applicable.

Sources

National Prescription Drug Utilization Information System, Discharge Abstract Database and Hospital Morbidity Database, Canadian Institute for Health Information.

Appendix F: Top 10 drug classes most commonly associated with seniors' ADR-related hospitalizations

Table F1 Top 10 drug classes most commonly associated with seniors' ADR-related hospitalizations, Canada, 2016

Drug class	Common uses	Most common diagnosis related to hospitalization	Percentage of ADRs
Anticoagulants	Heart attack and stroke prevention	Coagulation defect, unspecified	23.9%
Other antineoplastic drugs	Cancer	Neutropenia	12.5%
Opioids and related analgesics	Pain management	Constipation	8.1%
Glucocorticoids and synthetic analogues	Asthma	Type 2 diabetes mellitus with poor control, so described	4.9%
Beta-adrenoreceptor antagonists, not elsewhere classified	Heart failure, high blood pressure, angina (chest pain)	Bradycardia, unspecified	3.5%
NSAIDs (excluding salicylates)	Arthritis, pain management	Acute renal failure, unspecified	3.3%
Loop (high-ceiling) diuretics	Heart failure, high blood pressure	Acute renal failure, unspecified	3.3%
Benzothiadiazine derivatives	High blood pressure	Hypo-osmolality and hyponatraemia	3.1%
Other diuretics	Heart failure, high blood pressure	Acute renal failure, unspecified	2.5%
Angiotensin-converting enzyme (ACE) inhibitors	High blood pressure, heart failure	Acute renal failure, unspecified	2.2%

Sources
Discharge Abstract Database and Hospital Morbidity Database, Canadian Institute for Health Information.

Appendix G: Top 10 chemicals from Beers list prescribed to seniors, by rate of use and chronic use, by sex and age group, Canada, 2016

Table G1 Top 10 chemicals from Beers list* prescribed to seniors, by rate of use and chronic use, by sex and age group, Canada,[†] 2016

Chemical	Common uses	Sex		Age group		
		Female	Male	65 to 74	75 to 84	85 and older
Pantoprazole (PPI) (>8 weeks)	Gastroesophageal reflux disease, peptic ulcer disease	13.8%	12.5%	11.2%	14.7%	17.7%
Lorazepam	Anxiety, insomnia	10.9%	6.2%	7.6%	9.6%	11.4%
Nitrofurantoin	Antibiotic to treat urinary tract infection	7.6%	1.7%	4.1%	5.5%	7.0%
Rabeprazole (PPI) (>8 weeks)	Gastroesophageal reflux disease, peptic ulcer disease	4.7%	3.8%	3.6%	5.1%	5.5%
Amitriptyline	Depression	3.7%	1.8%	3.1%	2.9%	2.0%
Quetiapine	Schizophrenia, bipolar disorder	3.0%	2.4%	2.1%	2.8%	5.2%
Omeprazole (PPI) (>8 weeks)	Gastroesophageal reflux disease, peptic ulcer disease	2.9%	2.3%	2.3%	2.9%	3.3%
Zopiclone	Insomnia	2.8%	2.0%	2.2%	2.6%	3.1%
Oxazepam	Anxiety, insomnia	3.0%	1.7%	1.7%	2.9%	4.2%
Estradiol (oral/topical patch)	Menopause	3.7%	0.0%	2.7%	1.5%	0.7%

Notes

* AGS Beers Criteria 2015 Updated Version, with modifications to make the measure of potentially inappropriate use more applicable to the Canadian market (see Appendix B).

† The Northwest Territories and Nunavut do not currently submit data to NPDUIS.

Sources

National Prescription Drug Utilization Information System, Canadian Institute for Health Information; Banque médicaments, Régie de l'assurance maladie du Québec.

Appendix H: Population of long-term care residents

Table H1 Population of long-term care residents, by selected jurisdiction,* sex and age group, 2016

Jurisdiction	Seniors claimant population	Sex		Age group		
		Female	Male	65 to 74	75 to 84	85 and older
Prince Edward Island	545	71.4%	28.6%	12.5%	27.0%	60.6%
New Brunswick	5,398	68.8%	31.2%	12.3%	29.4%	58.3%
Ontario	99,197	68.8%	31.2%	11.8%	29.0%	59.2%
Manitoba	10,091	69.3%	30.7%	9.5%	25.7%	64.8%
British Columbia	28,121	66.3%	33.7%	10.6%	27.5%	61.9%
Overall	143,352	68.4%	31.6%	11.4%	28.5%	60.1%

Note

* There were 5 provinces submitting identifiable LTC data to NPDUIS as of November 2017: Prince Edward Island, New Brunswick, Ontario, Manitoba and British Columbia.

Source

National Prescription Drug Utilization Information System, Canadian Institute for Health Information.

Appendix I: Text alternative for figures

Text alternative data table for Figure 1: Percentage of seniors, by number of drug classes, Canada,* 2011 and 2016

Number of drug classes	2011	2016
1−4	34.7%	36.5%
5−9	39.8%	39.0%
10−14	17.8%	17.0%
15+	7.7%	7.4%

Note

* The Northwest Territories and Nunavut do not currently submit data to NPDUIS. Quebec has been excluded because data was not available prior to 2014.

Sources

National Prescription Drug Utilization Information System, Canadian Institute for Health Information.

Text alternative data table for Figure 8: Percentage of seniors hospitalized for an ADR, by number of drug classes, selected jurisdictions,* 2016

Number of drug classes	Percentage of all seniors claimants with an ADR-related hospitalization
1−4	0.2%
5−9	0.6%
10−14	1.5%
15+	2.9%

Note

* There were 6 jurisdictions submitting linkable claims data to NPDUIS as of November 2017: Newfoundland and Labrador, Prince Edward Island, Manitoba, Alberta, British Columbia and Yukon.

Sources

National Prescription Drug Utilization Information System, Discharge Abstract Database and Hospital Morbidity Database, Canadian Institute for Health Information.

Text alternative data table for Figure 9: Seniors' usage rate of opioids, by type of use, Canada,* 2011 to 2016

Year	Use of any opioids	Use of strong opioids	Chronic use of opioids	Chronic use of strong opioids
2011	22.8%	8.9%	4.0%	2.3%
2012	21.9%	8.9%	4.0%	2.4%
2013	21.7%	9.2%	4.0%	2.4%
2014	21.5%	9.4%	4.0%	2.5%
2015	21.3%	9.7%	4.1%	2.5%
2016	20.7%	9.6%	4.1%	2.5%

Note

* The Northwest Territories and Nunavut do not currently submit data to NPDUIS. Quebec has been excluded because data was not available prior to 2014.

Source

National Prescription Drug Utilization Information System, Canadian Institute for Health Information.

Text alternative data table for Figure 15: Proportion of senior PPI users* with prolonged use (>8 weeks), by sex and age group, Canada,[†] 2011 and 2016

Sex/age group	2011	2016
Female	71.8%	73.4%
Male	72.8%	74.1%
Age 65 to 74	70.3%	71.8%
Age 75 to 84	72.6%	74.3%
Age 85 and older	76.1%	77.7%

Notes

* Excluding those who were using oral corticosteroids and chronic NSAIDs.

† The Northwest Territories and Nunavut do not currently submit data to NPDUIS. Quebec has been excluded because data was not available prior to 2014.

Source

National Prescription Drug Utilization Information System, Canadian Institute for Health Information.

Text alternative data table for Figure 16: Seniors' usage rate of benzodiazepines (and related products), by type, Canada,* 2011 to 2016

Rate of benzodiazepine use	2011	2012	2013	2014	2015	2016
Long-acting	1.2%	1.1%	1.0%	0.9%	0.9%	0.8%
Short-acting	14.2%	13.4%	12.7%	12.1%	11.4%	10.9%
Z-drugs	3.2%	3.2%	3.3%	3.3%	3.3%	3.2%
All benzodiazepines	17.5%	16.7%	16.0%	15.4%	14.7%	14.0%

Note

* The Northwest Territories and Nunavut do not currently submit data to NPDUIS. Quebec has been excluded because data was not available prior to 2014.

Source

National Prescription Drug Utilization Information System, Canadian Institute for Health Information.

Text alternative data table for Figure 19: Percentage of seniors living in LTC facilities prescribed psychotropic drugs, by type of drug, selected jurisdictions,* 2011 to 2016

Psychotropic drugs	2011	2012	2013	2014	2015	2016
Antidepressants	57.5%	58.5%	58.8%	59.4%	59.7%	60.3%
Antipsychotics	40.7%	39.9%	39.8%	39.3%	37.2%	35.9%
Benzodiazepines	31.6%	29.9%	28.5%	27.3%	26.4%	25.7%

Note

* There were 5 provinces submitting identifiable LTC data to NPDUIS as of November 2017: Prince Edward Island, New Brunswick, Ontario, Manitoba and British Columbia.

Source

National Prescription Drug Utilization Information System, Canadian Institute for Health Information.

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