Persistence and Compliance With Cardiovascular Drug Therapy Among Seniors
Our Vision

Our Mandate
To lead the development and maintenance of comprehensive and integrated health information that enables sound policy and effective health system management that improve health and health care.

Our Values
Respect, Integrity, Collaboration, Excellence, Innovation
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- Drug Plan and Extended Benefits Branch, Saskatchewan Ministry of Health
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- First Nations and Inuit Health Branch, Non-Insured Health Benefits Directorate, Health Canada

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- Cynthia Jackevicius, BScPhm, PharmD, MSc, FCSHP, BCPS; Professor of Pharmacy Practice and Administration, Western University of Health Sciences; Adjunct Scientist, Institute for Clinical Evaluative Sciences

Please note that the analyses and conclusions in this document do not necessarily reflect those of the individuals or organizations mentioned above.
Key Findings

- Cardiovascular drugs are prescribed to treat a variety of cardiac conditions—including hypertension and heart failure—and to help prevent heart attacks. Not taking medication as prescribed can lead to negative health outcomes for patients and additional costs to the health care system, as well as the wasted cost of the medication, whose full benefit is not being realized.

- This study uses drug claims data from the National Prescription Drug Utilization Information System (NPDUIS) Database to examine persistence and compliance with the most commonly used cardiovascular drug classes among seniors to assess the degree to which these drugs are being used as prescribed.

- Nearly three-quarters (72.9%) of seniors taking selected cardiovascular drugs in 2011 were persistent with their drug therapy, going through the entire year without a gap in treatment greater than 30 days.

- 4 in 5 (80.6%) seniors had medication on hand for at least 80% of the year and were considered compliant with their cardiovascular drugs.

- Persistence and compliance rates were lower among seniors beginning a new drug therapy. Half of new users were persistent (51.8%) and compliant (59.0%) for the first year of drug therapy; in comparison, roughly three-quarters of established drug users were persistent (74.9%) and compliant (82.7%).

Introduction

Cardiovascular disease is the second most common cause of death—behind only cancer—in Canada. Among seniors, cardiovascular drugs are used more widely and account for a higher proportion of drug spending than any other category of drugs. Cardiovascular drugs are prescribed to treat a variety of cardiac conditions—including hypertension and heart failure—and to help prevent heart attacks. Not taking medication as prescribed can lead to negative health outcomes for patients and additional costs to the health care system, as well as the wasted cost of the medication, whose full benefit is not being realized.

Persistence refers to continuously using a drug for the prescribed duration, while medication compliance (also called adherence) refers to conforming to the prescribed dose, timing and frequency of medication. Persistence is typically measured by evaluating refill patterns to identify gaps in therapy, while compliance is commonly examined using the proportion of days covered and medication possession ratio.

Previous studies have found that the proportion of Canadian seniors remaining persistent and compliant with cardiovascular drugs over the course of a year varies depending on the definitions used and whether the studies focused on new users. The proportion of seniors defined as persistent ranged from 43% to 78% among new cardiovascular drug users, and from 77% to 97% among established users. Previous studies have also found that compliance rates ranged from 68% to 85% for Canadian seniors on cardiovascular drugs.
This study uses drug claims data from the National Prescription Drug Utilization Information System (NPDUIS) Database to examine persistence and compliance with the most commonly used cardiovascular drug classes among seniors to assess the degree to which these drugs are being used as prescribed. It also looks at potential risk factors that lead to non-persistence and non-compliance. The study uses data from 8 Canadian provinces (Prince Edward Island, Nova Scotia, New Brunswick, Ontario, Manitoba, Saskatchewan, Alberta and British Columbia) and 1 federal drug program, managed by the First Nations and Inuit Health Branch (FNIHB). This analysis focuses on seniors (those age 65 and older), the population for which the most complete data is available.

Methods

National Prescription Drug Utilization Information System Database

The drug claims data used in this analysis comes from the NPDUIS Database, as submitted by the public drug programs in P.E.I., Nova Scotia, New Brunswick, Ontario, Manitoba, Saskatchewan, Alberta and B.C., as well as the FNIHB federal drug program. The NPDUIS Database houses pan-Canadian information related to public drug 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.

The NPDUIS Database includes claims accepted by public drug programs, either for reimbursement or toward a deductible.

The NPDUIS Database does not include information regarding:
- Drugs dispensed in hospitals;
- 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.

Although public drug coverage is available to seniors in each of the 9 jurisdictions included in the analysis, each of the drug plans is designed differently. These differences may affect drug utilization within the plans and, in turn, the claims submitted to the NPDUIS Database. Further information about public drug programs in Canada can be found in the NPDUIS Plan Information Document, available at www.cihi.ca/drugs.

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i. 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.
Definitions

1. **Claimants**: Seniors who had at least 1 claim accepted by a public drug program, either for reimbursement or toward a deductible.

2. **Compliance**: Conforming to the prescribed dose, timing and frequency of medication—see the section Measuring Persistence and Compliance.

3. **Days’ supply**: The duration (in days) of the dispensed prescription, as indicated by the dispensing pharmacy.

4. **Drug class**: Subgroup of chemicals classified by the World Health Organization (WHO) at the fourth level of the Anatomical Therapeutic Chemical (ATC) classification system, 2013 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.

5. **Established user**: A claimant who had a claim for a drug class during the reference period and had a claim for the same drug class in the previous 365 days.

6. **New user**: A claimant who had a claim for a drug class during the reference period but did not have a claim for the same drug class, but did have a claim for another drug class, in the previous 365 days.

7. **Persistence**: Continuous use of a drug for a prescribed duration—see the section Measuring Persistence and Compliance.

Drug Classification Systems

This analysis focuses on the 6 most commonly used cardiovascular drug classes. These drug classes were identified by the drug identification numbers assigned by Health Canada and by the following WHO ATC codes:

- C10AA—HMG-CoA reductase inhibitors (statins)
- C09AA—angiotensin-converting enzyme (ACE) inhibitors
- C07AB—beta-blocking agents
- C08CA—dihydropyridine calcium channel blockers
- C03AA—thiazide diuretics
- C09CA—angiotensin II antagonists (ARBs)

ACE inhibitors and ARBs were grouped together when determining persistence and compliance because they have similar patterns of clinical use and patients may switch between the 2 classes over time.
Measuring Persistence and Compliance

Persistence and compliance were determined by following a patient with claims for any cardiovascular drug class over a 365-day period using 2 different methods.

Persistence

Persistent drug use was measured by the amount of time a drug class was used before the presence of a gap in drug therapy that exceeded a predetermined number of days (i.e., the allowable gap). Drug therapy was examined for the 365-day period that started on the date of the senior’s first claim for a cardiovascular drug class in 2011 by looking at subsequent claims to determine whether the prescription was refilled before the previous prescription ran out. If a senior did not refill in a number of days less than or equal to the days’ supply of the previous claim, plus the allowable gap, then he or she was considered to have had a gap in drug therapy and to have been non-persistent. If a senior refilled before the previous prescription ran out, any remaining supply from the previous claim was added to the days’ supply dispensed in the refill. To ensure seniors were present in the database for the entire 365-day period, they were required to have a drug claim in the following year.ii

Compliance

The proportion of days covered (PDC) was used to measure medication compliance. The PDC was calculated by summing the days’ supply for a senior taking a single drug class over a 365-day period following the date of the senior’s first claim for a cardiovascular drug class in 2011. Days’ supply that extended beyond the end of the period were excluded from the PDC calculation. For example, if 30 days’ supply was dispensed 20 days before the end of the period, then only 20 days’ supply was included in the calculation. In cases where the total days’ supply dispensed over the course of the year was greater than 365, this value was capped at 365 days’ supply. This value was then divided by 365 to express the PDC value as a percentage of the year in which the senior was in possession of the drug class. To account for seniors who stopped drug therapy or left the database, seniors were required to have a drug claim in the following year.

The PDC—used to measure compliance—is related to the persistence measure in that a gap in therapy affects the PDC score. For example, a 90-day supply of medication followed by a 30-day gap in therapy would result in a PDC score of 90 ÷ (90 + 30) = 0.75, or 75%. The 2 measures are also complementary.6, 9, 18 Examining gaps in treatment provides information on the timeliness and consistency of refills that PDC does not.18 On the other hand, PDC examines medication use throughout the period of analysis, while the measure of persistence stops once a person is considered non-persistent.18 Examining both persistence and compliance provides a more complete picture of how patients are taking their medications.6, 9, 18

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ii. This excluded 6.8% of seniors who had claims in 2011 from the analysis.
Identifying Risk Factors for Non-Persistence and Non-Compliance

Relative risk of non-persistence and non-compliance associated with various factors was measured by performing a logistic regression using public drug claims data. Risk factors examined included sex, age group, type of therapy, urban/rural residence, number of drug classes, number of pharmacies and number of prescribers. The number of distinct drug classes seniors took, the number of pharmacies they visited and the number of prescribers they had were calculated for the 365-day period following their first drug claim in 2011. Socio-economic factors—urban/rural residence and income quintiles—were identified using the Postal Code Conversion File (PCCF) from Statistics Canada and assigned to seniors by linking to their postal code as it appeared on their first claim in 2011.19

A claimant was identified as being non-persistent if he or she did not maintain drug therapy for a full 365 days (with a 30-day allowable gap in treatment) and non-compliant if he or she had a PDC value less than 80% for a specific cardiovascular-related drug class. A 30-day gap is commonly used as the allowable gap to determine persistence.9, 12

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.

Public program policies on maximum and minimum prescription lengths differ, which leads to differences in average prescription lengths among jurisdictions. The average prescription length varied from 27.7 days for seniors covered through FNIHB to 63.5 days for seniors living in Alberta. Differences in prescription length may affect measures of persistence and compliance, with longer prescription lengths increasing the likelihood of persistence or compliance. For example, a person dispensed a 360-day supply of medication in his or her first prescription of the year would be considered both persistent and compliant using these methods regardless of when or whether he or she refilled the prescription, whereas a person dispensed a 90-day supply at a time would need to refill multiple times during the year to be considered both persistent and compliant. However, the fact that rates of persistence and compliance among seniors covered by FNIHB are slightly higher than those among seniors in Alberta suggests that the policy differences, and the resulting differences in average days’ supply between jurisdictions, do not appear to have a significant impact on the results.

Although identifying drug therapy compliance using claims data provides useful information, we cannot confirm that the drugs are being used as prescribed. Because the PDC is calculated at the drug class level, a patient who switches between chemicals within a drug class before the first chemical is completed can result in an overestimated numerator. Although this can result in overestimation, it is unlikely to have a significant effect on results in this analysis. In 2012, seniors had a claim for a single chemical within the cardiovascular-related drug class they were taking 98.6% of the time.
Analysis

How Many Seniors on Public Drug Programs Are Prescribed Cardiovascular Drugs?

In 2012, cardiovascular drugs were the most widely used category of drugs and accounted for a higher proportion of public drug spending than any other category of drugs among seniors. More than three-quarters (78.7%) of seniors on public drug programs had a claim for at least 1 cardiovascular drug. The use of these drugs accounted for more than one-quarter (26.2%) of total public drug program spending for seniors.

This analysis focuses on the 6 most commonly used cardiovascular drug classes among seniors on public drug programs in 2012. These 6 drug classes accounted for nearly one-fifth (19.6%) of total public drug program spending. The most commonly used drug class was statins, which are used to lower cholesterol. Nearly half (46.6%) of seniors had at least 1 claim for a statin in 2012, and spending on statins accounted for 7.9% of total public drug program spending. The remaining drug classes are commonly used to treat high blood pressure and heart failure.

How Persistent Are Seniors Who Take Cardiovascular Drugs?

Nearly three-quarters (72.9%) of seniors taking selected cardiovascular drugs in 2011 were persistent with their drug therapy, going through the entire year without a gap in treatment greater than 30 days (Table 1). Persistence rates among seniors varied across jurisdictions, from 67.4% in B.C. to 77.2% in New Brunswick. These results are similar to those in previous studies focusing on seniors using statins and antihypertensive drugs, which found between 65% and 79% of seniors were persistent (i.e., had 1 full year of continuous therapy with a 30-day allowable gap) with their cardiovascular drugs.14, 17

iii. Statins, ACE inhibitors, beta-blocking agents, dihydropyridine calcium channel blockers, thiazide diuretics and ARBs.
Persistence and Compliance With Cardiovascular Drug Therapy Among Seniors

Table 1: Proportion of Seniors With Persistent Use of Selected Cardiovascular Drugs, by Gap Length and Jurisdiction, Selected Jurisdictions*

<table>
<thead>
<tr>
<th>Jurisdiction</th>
<th>60-Day Gap</th>
<th>30-Day Gap</th>
<th>15-Day Gap</th>
<th>5-Day Gap</th>
</tr>
</thead>
<tbody>
<tr>
<td>P.E.I.</td>
<td>83.8%</td>
<td>76.1%</td>
<td>65.0%</td>
<td>41.0%</td>
</tr>
<tr>
<td>N.S.</td>
<td>83.6%</td>
<td>75.7%</td>
<td>64.7%</td>
<td>42.7%</td>
</tr>
<tr>
<td>N.B.</td>
<td>84.5%</td>
<td>77.2%</td>
<td>67.1%</td>
<td>46.1%</td>
</tr>
<tr>
<td>Ont.</td>
<td>83.4%</td>
<td>74.6%</td>
<td>63.5%</td>
<td>43.2%</td>
</tr>
<tr>
<td>Man.</td>
<td>80.2%</td>
<td>71.2%</td>
<td>59.8%</td>
<td>39.6%</td>
</tr>
<tr>
<td>Sask.</td>
<td>81.4%</td>
<td>72.2%</td>
<td>60.0%</td>
<td>36.7%</td>
</tr>
<tr>
<td>Alta.</td>
<td>80.2%</td>
<td>70.6%</td>
<td>58.2%</td>
<td>37.4%</td>
</tr>
<tr>
<td>B.C.</td>
<td>76.8%</td>
<td>67.4%</td>
<td>57.1%</td>
<td>37.8%</td>
</tr>
<tr>
<td>FNIHB</td>
<td>82.4%</td>
<td>73.7%</td>
<td>60.7%</td>
<td>39.5%</td>
</tr>
<tr>
<td>Total</td>
<td>81.8%</td>
<td>72.9%</td>
<td>61.7%</td>
<td>41.3%</td>
</tr>
</tbody>
</table>

Note

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

A 30-day gap is commonly used as the allowable gap to determine persistence, although it is unknown at what length of gap the benefits of drug therapy begin to decrease. As expected, the proportion of seniors determined to be persistent with their cardiovascular drugs differs based on the allowable gap length used. Using a longer allowable gap of 60 days results in a higher proportion (81.8%) of seniors being defined as persistent, while using a shorter allowable gap of 5 days results in a lower proportion (41.3%) being defined as persistent.

Non-persistence can signify a temporary lapse in treatment or that treatment has been discontinued entirely. Of seniors who were non-persistent with their cardiovascular drugs, nearly three-quarters (72.4%) restarted the same drug therapy within 365 days, while the remainder (27.6%) discontinued therapy (defined as not having any claims for that drug class in the 365 days following the allowable gap).

Persistence rates were lower among seniors beginning a new drug therapy. Half of new users (51.8%) were defined as persistent for the first year of drug therapy (Table 2). By comparison, roughly three-quarters (74.9%) of established drug users were persistent. On average, new users remained persistent for 260 days before a gap in therapy was observed.
Table 2: Proportion of Seniors With Persistent* Use of Selected Cardiovascular Drugs, by Cardiovascular Drug Class, Selected Jurisdictions†

<table>
<thead>
<tr>
<th>Drug Class</th>
<th>New Drug Therapy</th>
<th>Established Drug Therapy</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Statins</td>
<td>56.9%</td>
<td>74.1%</td>
<td>72.9%</td>
</tr>
<tr>
<td>ACE Inhibitors and ARBs</td>
<td>53.0%</td>
<td>77.9%</td>
<td>75.7%</td>
</tr>
<tr>
<td>Beta-Blocking Agents</td>
<td>59.0%</td>
<td>76.2%</td>
<td>74.8%</td>
</tr>
<tr>
<td>Dihydropyridine Calcium Channel Blockers</td>
<td>56.6%</td>
<td>75.5%</td>
<td>73.9%</td>
</tr>
<tr>
<td>Thiazide Diuretics</td>
<td>34.3%</td>
<td>66.0%</td>
<td>61.4%</td>
</tr>
<tr>
<td>Total</td>
<td>51.8%</td>
<td>74.9%</td>
<td>72.9%</td>
</tr>
</tbody>
</table>

Notes
* Persistent use is defined using a 30-day allowable gap in drug treatment.
† 9 jurisdictions submitting claims data to the NPDUIS Database as of December 2013: Prince Edward Island, Nova Scotia, New Brunswick, Ontario, Manitoba, Saskatchewan, Alberta, British Columbia and First Nations and Inuit Health Branch.

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

Of new users who were non-persistent, one-half (50.0%) discontinued therapy, compared with 23.5% of established users. Overall, one-quarter (24.9%) of new users discontinued therapy, compared with 6.7% of established users.

Previous studies have shown that established users are more likely to be persistent with cardiovascular therapy.6, 13, 14, 16, 17 Additional studies have also found that a lack of knowledge of medications, which may be more likely among new users of a drug, increases the likelihood of non-persistence and non-compliance.21, 22

The proportion of seniors who were persistent did not vary significantly by cardiovascular drug class, with the exception of thiazide diuretics, which showed lower persistence rates (Table 2). The proportion of persistent seniors ranged from 61.4% for thiazide diuretics, to 72.9% for statins, to 75.7% for ACE inhibitors and ARBs. Thiazide diuretics also had a higher rate of discontinuation.19 This may in part be because the use of thiazide diuretics is associated with an increased number of side effects compared with other antihypertensive drugs.23–26 However, it has also been noted that cases where diuretics are being used to treat acute conditions, like edema, can be incorrectly classified as non-persistent chronic use.26, 27

Previous studies have found that programs that help patients manage chronic conditions and drug use through monitoring and education—particularly those involving multiple health professionals, including physicians, pharmacists and nurses—can improve persistence and compliance and help reduce negative health outcomes and hospitalizations.22, 28–30

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iv. Proportion of seniors who discontinued drug therapy—statins: 4.7%; ACE inhibitors and ARBs: 8.6%; beta-blocking agents: 6.5%; dihydropyridine calcium channel blockers: 8.8%; and thiazide diuretics: 19.7%. 
How Compliant Are Seniors Who Take Cardiovascular Drugs?

In addition to taking cardiovascular drug therapy continuously, patients must take their drugs at the prescribed dose, duration and timing to realize the full benefit (i.e., be compliant). Similar to non-persistence, non-compliant use of cardiovascular drugs among seniors has been found to lead to negative health outcomes and additional costs to the health care system.

The PDC was used to measure compliance. On average, seniors taking selected cardiovascular drugs had medication on hand for 87.8% of days over a year. 4 in 5 (80.6%) seniors had a PDC score greater than or equal to 80% and were considered compliant with their cardiovascular drugs. This is similar to rates found in previous studies focusing on seniors in Ontario using statins, beta blockers and calcium channel blockers, which found that between 68% and 85% of seniors were compliant with their cardiovascular drugs. Compliance across jurisdictions ranged from 75.8% in B.C. to 83.1% in New Brunswick.

<table>
<thead>
<tr>
<th>Jurisdiction</th>
<th>At Least 70% PDC</th>
<th>At Least 80% PDC</th>
<th>At Least 90% PDC</th>
</tr>
</thead>
<tbody>
<tr>
<td>P.E.I.</td>
<td>86.2%</td>
<td>80.4%</td>
<td>72.3%</td>
</tr>
<tr>
<td>N.S.</td>
<td>86.7%</td>
<td>81.9%</td>
<td>74.3%</td>
</tr>
<tr>
<td>N.B.</td>
<td>88.1%</td>
<td>83.1%</td>
<td>75.8%</td>
</tr>
<tr>
<td>Ont.</td>
<td>87.3%</td>
<td>82.5%</td>
<td>73.8%</td>
</tr>
<tr>
<td>Man.</td>
<td>83.1%</td>
<td>78.3%</td>
<td>69.8%</td>
</tr>
<tr>
<td>Sask.</td>
<td>81.6%</td>
<td>77.0%</td>
<td>67.7%</td>
</tr>
<tr>
<td>Alta.</td>
<td>84.7%</td>
<td>79.7%</td>
<td>70.0%</td>
</tr>
<tr>
<td>B.C.</td>
<td>83.7%</td>
<td>75.8%</td>
<td>66.1%</td>
</tr>
<tr>
<td>FNIHB</td>
<td>83.1%</td>
<td>77.8%</td>
<td>68.2%</td>
</tr>
<tr>
<td>Total</td>
<td>86.0%</td>
<td>80.6%</td>
<td>71.7%</td>
</tr>
</tbody>
</table>

*Note* | *9 jurisdictions submitting claims data to the NPDUIS Database as of December 2013: Prince Edward Island, Nova Scotia, New Brunswick, Ontario, Manitoba, Saskatchewan, Alberta, British Columbia and First Nations and Inuit Health Branch.

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

A threshold of 80% of PDC is commonly used to determine compliance, although it is unknown at what rate of compliance the benefits of drug therapy begin to decrease. The proportion of seniors determined to be compliant differs depending on the PDC threshold used. Using a lower threshold of 70% of PDC, 86.0% of seniors were defined as compliant, while 71.7% were defined as compliant using a threshold of 90%.

Similar to persistence rates, compliance rates were much lower among new users of cardiovascular therapy. When looking at seniors who started new drug therapy, more than half (59.0%) of seniors were compliant for their first year of cardiovascular drug therapy, compared with 82.7% of established drug users.
### Table 4: Proportion of Compliant* Seniors Among Seniors Taking Cardiovascular Drugs, by Selected Cardiovascular Drug Classes, Selected Jurisdictions†

<table>
<thead>
<tr>
<th>Drug Class</th>
<th>New Drug Therapy</th>
<th>Established Drug Therapy</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Statins</td>
<td>65.6%</td>
<td>82.9%</td>
<td>81.7%</td>
</tr>
<tr>
<td>ACE Inhibitors and ARBs</td>
<td>59.6%</td>
<td>85.0%</td>
<td>82.7%</td>
</tr>
<tr>
<td>Beta-Blocking Agents</td>
<td>66.3%</td>
<td>83.5%</td>
<td>82.2%</td>
</tr>
<tr>
<td>Dihydropyridine Calcium Channel Blockers</td>
<td>63.8%</td>
<td>82.8%</td>
<td>81.2%</td>
</tr>
<tr>
<td>Thiazide Diuretics</td>
<td>40.3%</td>
<td>74.3%</td>
<td>69.3%</td>
</tr>
<tr>
<td>Total</td>
<td>59.0%</td>
<td>82.7%</td>
<td>80.6%</td>
</tr>
</tbody>
</table>

**Notes**
* Compliance is defined as a PDC score ≥80%.
† 9 jurisdictions submitting claims data to the NPDUIS Database as of December 2013: Prince Edward Island, Nova Scotia, New Brunswick, Ontario, Manitoba, Saskatchewan, Alberta, British Columbia and First Nations and Inuit Health Branch.

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

Also similar to persistence rates, the proportion of seniors who were compliant did not vary significantly by cardiovascular drug class, with the exception of thiazide diuretics. The proportion of compliant seniors ranged from 69.3% for thiazide diuretics, to 81.2% for dihydropyridine calcium channel blockers, to 82.7% for ACE inhibitors and ARBs.

As previously mentioned, seniors were more likely to discontinue thiazide diuretic therapy than other cardiovascular drug classes. After excluding patients who discontinued therapy, compliance rates were much more consistent across drug classes, ranging from 83.3% for thiazide diuretics, to 85.0% for statins, to 88.9% for ACE inhibitors and ARBs. Overall, 86.6% of seniors were defined as compliant after excluding patients who discontinued therapy.

### What Factors Contribute to Non-Persistence and Non-Compliance?

Relative risk factors for non-persistence and non-compliance with cardiovascular drug therapies were measured using a logistic regression with drug claims data for seniors on public drug programs in 3 provinces (P.E.I., Manitoba and B.C.).v, vi

The largest contributor to non-persistence and non-compliance among seniors was starting a new cardiovascular therapy. Controlling for other factors, seniors starting a new drug therapy were 2.5 times more likely to be non-persistent and 2.8 times more likely to be non-compliant than seniors with established drug therapy (Table 5).

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v. The 3 provinces where patient postal code is available and seniors living in long-term care facilities can be identified in the NPDUIS Database.
vi. Findings were similar when compared with a regression model using all jurisdictions.
Table 5: Risk Factors Associated With Non-Persistence and Non-Compliance* of Cardiovascular Drug Use Among Seniors on Public Drug Programs, Selected Jurisdictions†

<table>
<thead>
<tr>
<th>Variable</th>
<th>Value</th>
<th>Non-Persistence</th>
<th>Non-Compliance</th>
<th>Percentage of Seniors</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Odds Ratio</td>
<td>p-Value</td>
<td>Odds Ratio</td>
<td>p-Value</td>
</tr>
<tr>
<td>Sex</td>
<td>Male</td>
<td>1.06 (1.05–1.07)</td>
<td>&lt;0.0001</td>
<td>1.04 (1.03–1.05)</td>
</tr>
<tr>
<td></td>
<td>Female</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Age Group</td>
<td>65–74</td>
<td>1.21 (1.19–1.22)</td>
<td>&lt;0.0001</td>
<td>1.18 (1.16–1.19)</td>
</tr>
<tr>
<td></td>
<td>75–84</td>
<td>1.05 (1.03–1.06)</td>
<td>&lt;0.0001</td>
<td>1.03 (1.01–1.04)</td>
</tr>
<tr>
<td></td>
<td>85+</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Type of Therapy</td>
<td>Established Therapy</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td>New Start</td>
<td>2.49 (2.46–2.53)</td>
<td>&lt;0.0001</td>
<td>2.78 (2.74–2.82)</td>
</tr>
<tr>
<td>Residence</td>
<td>Community</td>
<td>1.30 (1.26–1.33)</td>
<td>&lt;0.0001</td>
<td>1.25 (1.21–1.29)</td>
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<tr>
<td></td>
<td>Long-Term Care Facility</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Number of Drug Classes</td>
<td>&lt;5 Drugs</td>
<td>1.24 (1.21–1.26)</td>
<td>&lt;0.0001</td>
<td>1.25 (1.23–1.28)</td>
</tr>
<tr>
<td></td>
<td>5–9 Drugs</td>
<td>0.97 (0.95–0.98)</td>
<td>&lt;0.0001</td>
<td>0.97 (0.95–0.99)</td>
</tr>
<tr>
<td></td>
<td>10–14 Drugs</td>
<td>0.90 (0.88–0.91)</td>
<td>&lt;0.0001</td>
<td>0.89 (0.87–0.91)</td>
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<tr>
<td></td>
<td>15+ Drugs</td>
<td>—</td>
<td>—</td>
<td>—</td>
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<tr>
<td>Number of Pharmacies</td>
<td>Single Pharmacy</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
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<td>Multiple Pharmacies</td>
<td>1.40 (1.39–1.41)</td>
<td>&lt;0.0001</td>
<td>1.36 (1.34–1.37)</td>
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<tr>
<td>Number of Prescribers</td>
<td>Single Prescriber</td>
<td>—</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td>Multiple Prescribers</td>
<td>1.08 (1.06–1.09)</td>
<td>&lt;0.0001</td>
<td>1.06 (1.05–1.08)</td>
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<tr>
<td>Geographic Area</td>
<td>Urban</td>
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<td>—</td>
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<tr>
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<td>Rural</td>
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<td>0.4048</td>
<td>1.03 (1.01–1.04)</td>
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<td>Income Quintile</td>
<td>Q1 (Lowest Income)</td>
<td>—</td>
<td>—</td>
<td>—</td>
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<tr>
<td></td>
<td>Q2</td>
<td>1.00 (0.99–1.02)</td>
<td>0.6512</td>
<td>0.99 (0.98–1.00)</td>
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<td>Q3</td>
<td>1.01 (0.99–1.02)</td>
<td>0.4798</td>
<td>0.99 (0.98–1.01)</td>
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<tr>
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<td>Q4</td>
<td>1.03 (1.02–1.05)</td>
<td>&lt;0.0001</td>
<td>1.02 (1.00–1.03)</td>
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<tr>
<td></td>
<td>Q5 (Highest Income)</td>
<td>1.11 (1.10–1.13)</td>
<td>&lt;0.0001</td>
<td>1.07 (1.06–1.09)</td>
</tr>
</tbody>
</table>

Notes
* Non-persistence is defined as having 365 consecutive days of drug therapy with more than a 30-day allowable gap in treatment.
Non-compliance is defined as having less than 80% of PDC over a 1-year period.
† 3 provinces submitting claims data with patient postal code and that can be identified as a long-term care facility in the NPDUIS Database as of December 2013: Prince Edward Island, Manitoba and British Columbia.

Sources
National Prescription Drug Utilization Information System Database, Canadian Institute for Health Information; Postal Code Conversion File, Statistics Canada.
Seniors living in the community were more likely to be non-persistent and non-compliant with their cardiovascular medications than seniors living in long-term care (LTC) facilities. It has been suggested that persistence and compliance is higher in LTC facilities due to increased monitoring of drug use. However, it may also be due to differences in health status between those living in LTC facilities and the community, which were not controlled for in this analysis and which are known to affect persistence and compliance.

Seniors taking fewer than 5 drugs were more likely to be non-persistent and non-compliant than those taking more than 5 drugs. Previous studies have found a lower rate of persistence among seniors using a higher number of different drugs.

Other factors that contributed to a higher likelihood of non-persistence and non-compliance with cardiovascular drugs were having multiple prescribers or visiting multiple pharmacies during the year. Senior males, younger seniors and seniors living in higher-income areas were also more likely to be non-persistent and non-compliant. Previous studies have found varying results for these factors.

Some factors noted in the literature could not be examined due to the nature of the data. Previous studies found that individuals with hospital visits in the previous year and those with more severe, or a higher number of, comorbidities were more likely to be persistent. A study found that individuals with a higher number of comorbidities were more likely to be persistent but less likely to be compliant.
Summary

This study used drug claims data to examine persistence and compliance with the most commonly used cardiovascular drug classes among seniors. It also looked at the degree to which these drugs are being used as prescribed, as well as the potential risk factors that lead to non-persistence and non-compliance. Not taking medication as prescribed can lead to negative health outcomes for patients and additional costs to the health care system, as well as the wasted cost of the medication, whose full benefit is not being realized.5–8

While the majority of seniors appear to be taking their cardiovascular drugs as prescribed, with nearly three-quarters (72.9%) being defined as persistent and roughly four-fifths (80.6%) being defined as compliant, results suggest that some seniors may not be deriving full benefit from their prescribed medications.

The largest contributor to non-persistence and non-compliance for seniors was starting a new cardiovascular-related drug therapy. Among seniors starting a new drug therapy, 51.8% were defined as persistent and 59.0% as compliant, compared with 74.9% and 82.7%, respectively, among established users. Other factors that contributed to a higher likelihood of non-persistence and non-compliance with cardiovascular drugs were having multiple prescribers or visiting multiple pharmacies during the year. Senior males, younger seniors and seniors living in higher-income areas were also more likely to be non-persistent and non-compliant.

Previous studies have found that programs that help patients manage chronic conditions and drug use through monitoring and education—particularly those involving multiple health professionals, including physicians, pharmacists and nurses—can improve persistence and compliance and help reduce negative health outcomes and hospitalizations.22, 28–30 Improved medication management and education may be particularly valuable for patients starting a new cardiovascular therapy.
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