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Frequency and cost of potentially inappropriate prescriptions for older Canadian women and men: an analysis of provincial drug plan claims

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Abstract

Background: We sought to quantify the frequency and cost of potentially inappropriate prescribing for older women and men in Canada.

Methods: This is a retrospective analysis of 2013 calendar year prescription drug claims from publicly financed drug plans in all provinces except for Quebec. We identified the frequency and cost of potentially inappropriate prescription dispensed to provincial drug plan enrollees aged 65 years using the 2012 Beers criteria for drug type, dose, and duration.

Results: Averaged across six provinces with relatively complete data coverage (BC, AB, SK, MB, ON, and PEI), we found that approximately 37% of older persons filled one or more prescription meeting the Beers criteria in 2013. A greater proportion of women (42%) than men (31%) filled potentially inappropriate prescriptions. Highest rates of potentially inappropriate prescription drug use were among women aged 85 and older (46%). Benzodiazepines and other hypnotics were the leading contributors to overall frequency and sex differences in potentially inappropriate prescription use among older Canadians. We estimated that \$75 per Canadian aged 65 and older, or \$419-million in total, was spent on potentially inappropriate prescriptions outside of hospital settings in 2013.

Interpretation: Potentially inappropriate prescribing for older adults remains common and costly in Canada, especially for women. A national strategy to reduce the use and cost of potentially inappropriate prescriptions among the elderly would likely generate significant health system savings while simultaneously generating major benefits to patient health.

Frequency and cost of potentially inappropriate prescriptions for older Canadian women and men: an analysis of provincial drug plan claims

Introduction

Caring for older patients requires particular attention to prescribing appropriateness because many medications pose greater health risks when prescribed for older adults, compared to available pharmacological and non-pharmacological alternatives.(1-4) Research has shown that use of such potentially inappropriate medications among older patients is relatively common and can lead to unnecessary hospitalisations as well as increase the risk of death.(5-7)

Leaders in Canada's medical profession are taking increased action to help physicians and patients choose prescription drug treatments wisely.(8) Such clinical leadership has been cited as a critical step toward a national strategy on appropriate use of medicines.(9) However, although medication safety has been identified as a strategic priority of the National Patient Safety Consortium,(10) Canadian governments have yet to invest in a large-scale, pan-Canadian strategy on prescribing quality.

Cost may be one of the barriers to a national strategy that improves the quality of prescribing. Professional education and academic detailing; public awareness and patient education campaigns; and the development of electronic systems for prescription decision-making, monitoring, and feedback all have the potential to contribute to better medicine use in Canada, but all come at considerable cost.(11) To help inform policy discussions regarding the costs and benefits of quality improvement initiatives, we sought to quantify the frequency and cost of potentially inappropriate prescribing for older women and men in Canada.

Methods

This study draws on 2013 calendar year data from National Prescription Drug Utilization Information System (NPDUIS) Database, housed at the Canadian Institute for Health Information. NPDUIS contains prescription claims from publicly financed drug plans in all provinces except for Quebec. These data cover the use and cost of prescriptions filled by plan enrollees outside of acute care hospitals, which accounts for approximately 90% of the total pharmaceutical market inclusive of hospital purchases.(12)

NPDUIS contains records of prescriptions for which at least part of the drug cost was accepted as an eligible cost by the public plan, either for payment by the program or as credit toward the program's deductible (if applicable). The NPDUIS data therefore exclude drugs not covered by provincial drug plans and patients not entitled to or registered for public drug benefits. To account for provincial differences in the share of older populations that are eligible for public drug coverage, we report results for each province and for high-coverage provinces (those with data on greater than 85% of adults aged 65 years and older).

We identified the frequency and cost of potentially inappropriate prescriptions for beneficiaries aged 65 years and older covered by provincial drug benefit programs, using the Beers criteria, 2012 edition.(1) As certain drugs on the American-developed Beers criteria are not available in other countries, we applied list modifications developed by the Canadian Institute for Health Information.(13)

All prescriptions meeting Beers criteria based on drug, dose, and duration were identified as potentially inappropriate. One exception was insulin, which was not included in this analysis

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3 because it is only considered potentially inappropriate if prescribed to be taken on a sliding scale,
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5 which is impossible to determine from drug claims data alone.
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9 We measured total costs of prescriptions using relevant fields in the NPDUIS dataset,
10 including ingredient cost and dispensing fees. Because most provincial drug plans for older
11 persons involve deductibles, co-insurance, or co-payments paid by enrolled beneficiaries, our
12 cost estimates included public payment for the medicines in addition to payments made by
13 patients. We extrapolated the per enrollee cost of potentially inappropriate prescriptions among
14 provinces with high NPDUIS data coverage to the national population of persons age 65 and
15 older.
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28 This study was approved by the University of British Columbia's Behavioural Research
29 Ethics Board.
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32 33 **Results**

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35 Table 1 lists the province-specific shares of provincial drug plan enrollees aged 65 and
36 older that filled one or more Beers list prescriptions in 2013. Overall rates of use of potentially
37 inappropriate prescriptions were highest in provinces that did not meet the high-coverage criteria
38 of having NPDUIS data on greater than 85% of residents over age 65 (New Brunswick, Nova
39 Scotia, and Newfoundland and Labrador). Rates of exposure in those provinces may reflect a
40 selection bias associated with public coverage targeted at more vulnerable members of the older
41 population.
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54 Among high-coverage provinces, approximately 37% of older persons filled one or more
55 prescription meeting the Beers criteria for drug type, dose, and duration. Prevalence of use of
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3 potentially inappropriate prescriptions in these high-coverage provinces ranged from 29% of
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5 older adults in Prince Edward Island to 41% in Alberta.
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9 A greater proportion of women (42%) than men (31%) filled potentially inappropriate
10 prescriptions in the high-coverage provinces. Prevalence of use of potentially inappropriate
11 prescriptions increased with age for women and men in all provinces. Among high-coverage
12 provinces, prevalence was highest among women aged 85 and older, with nearly half (46%) of
13 this cohort filling one or more prescriptions for a drug on the Beers list.
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23 Table 2 lists the province-specific estimates of the cost of Beers list prescriptions filled
24 by enrollees in public drug plans who were aged 65 and older in 2013. As with estimates of
25 exposure, the estimates of the cost of potentially inappropriate prescriptions per public drug plan
26 enrollee were highest in provinces with limited NPDUIS data coverage (New Brunswick, Nova
27 Scotia, and Newfoundland and Labrador).
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36 In high-coverage provinces, total costs of prescriptions meeting the Beers criteria
37 averaged \$75 per public drug plan enrollee per year. These average costs ranged from \$49 in
38 Prince Edward Island to \$88 in Manitoba. Following the patterns of prevalence of use, costs of
39 potentially inappropriate prescriptions filled by public drug plan beneficiaries were higher
40 among women than men, and increased with age. Average cost of these prescriptions was highest
41 among women aged 85 and older.
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52 Table 3 shows the frequency and cost of the top 20 types of potentially inappropriate
53 prescriptions filled by older patients in the NPDUIS participating provinces. Though there were
54 differences in the top potentially inappropriate medications across provinces (data not shown –
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3 available as an appendix), the overall total reflects the pattern in most provinces with high
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5 NPDUIS data coverage. Benzodiazepines and other hypnotics were the leading contributors to
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7 both the frequency and cost of potentially inappropriate prescriptions among older Canadians.
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9 These medicines, as well as some with patterns of use that are more prevalent in women (such as
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11 nitrofurantoin and estrogens), were also the primary source of sex differences in potentially
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13 inappropriate medication use and cost among older Canadians.
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19 Table 4 provides estimates of overall cost of Beers List drugs purchased by older
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21 Canadians. Canada-wide, the estimated cost of potentially inappropriate prescriptions is \$259-
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23 million for women aged 65 and older, and \$160-million for men aged 65 and older. The
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25 estimated total cost of Beers List drugs purchased by older Canadians is approximately \$419-
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27 million.
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32 Interpretation

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35 For the nine provinces participating in the NPDUIS, we documented that filling
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37 medicines that are potentially inappropriate for older men and women is relatively common
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39 among public drug plan enrollees who are 65 or older. Averaged across the six provinces with
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41 relatively complete NPDUIS data coverage (BC, AB, SK, MB, ON, and PEI), approximately
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43 37% of older persons filled one or more prescriptions meeting the Beers criteria for drug type,
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45 dose, and duration in 2013. These estimates are similar to estimates for other time periods in
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47 Canada.(13)
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53 Consistent with studies from other jurisdictions,(5, 6) we also found that a greater
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55 proportion of women filled potentially inappropriate prescriptions at greater total cost than men,
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3 and that the use and cost of potentially inappropriate medications increased with age. Given
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5 Canadian population projections indicating that the proportion of adults aged 65 years and older
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7 is expected to double over the next 25 years, with women outnumbering men, the safety and cost
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9 implications of these findings are significant.
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14 We estimated that \$75 per Canadian aged 65 and older, or \$419-million in total, was
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16 spent on potentially inappropriate prescriptions outside of hospital settings in 2013. These are the
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18 first cost estimates for Canada. They are lower than a comparable estimate from Ireland that,
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20 using the STOPP criteria, found potentially inappropriate medications cost approximately \$160
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22 (Canadian) per older person.(14)
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28 Our estimates only account for the direct costs associated with potentially inappropriate
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30 use of medications in Canada. Fu and colleagues estimated the incremental healthcare
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32 expenditure attributable to potentially inappropriate medication use by older Americans was
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34 USD\$749 in 2001.(15) Adjusting for exchange rates, inflation, and the relative cost of US health
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36 care, this would be equivalent to an attributable cost of CAD\$675 per older Canadian patient
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38 exposed to potentially inappropriate prescriptions in 2013. Combining this estimate with
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40 exposure rates found in our study, the estimated indirect health care costs attributable to
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42 potentially inappropriate medication use among older Canadians would be approximately \$1.4-
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44 billion in 2013. Many of these indirect costs are associated with the adverse effects of
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46 inappropriate medications, such as the increased risk of falls, fractures and hospitalizations
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48 attributable to older adults use of benzodiazepines, which we found to be among the most
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50 frequently used Beers list drugs in Canada.(16)
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Limitations

Our study is limited by the availability and quality of data on prescription drug use in Canada. The NPDUIS dataset used is a pan-Canadian repository of available public claims data; however, it only includes data for enrollees in public plans and only captures drugs approved for reimbursement under public plans. We therefore estimated national averages using observations from provinces with reasonably complete coverage of older populations (85% or above in 6 provinces).

Our results underestimate use and cost of potentially inappropriate medications not on provincial formularies. The most notable impact of this limitation concerns zopiclone, which is not on the formulary in Saskatchewan or Ontario and thus not included in the NPDUIS data for those provinces. Market research data indicate that older patients in Saskatchewan or Ontario filled approximately \$16-million worth of prescriptions for zopiclone in 2012/13 – paid for either out of pocket or through private insurance.⁽¹²⁾ Assuming the rate of potentially inappropriate zopiclone use among older patients in Saskatchewan or Ontario was comparable to the rate in British Columbia – a low zopiclone use comparator because British Columbia restricts zopiclone coverage – 2.2% of older persons in Saskatchewan or Ontario would be exposed to such potentially inappropriate prescriptions at a total cost of approximately \$8-million.

The NPDUIS data are not linked to medical and hospital records. As such, we were unable to adjust for diagnoses that could render the use of a Beers list drug appropriate. To limit the extent of over-estimating exposure to potentially inappropriate prescriptions, we only included drugs that the 2012 Beers criteria suggest should always be avoided (Table 2 of the 2012 criteria). We did not account for drugs that are only inappropriate for patients with specific

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3 medical conditions. Nevertheless, the exposure rates measured in this study likely overstate total
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5 inappropriate drug use.
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10 Finally, our measure of potentially inappropriate prescribing is based on prescription
11 dispensations. While dispensation of prescribed drugs is not equivalent to consumption of the
12 medicines, it is likely that most patients who invest the time and out-of-pocket costs necessary to
13 have prescriptions filled do so with intent to consume them. Moreover, as some prescriptions
14 will be written but not filled by patients, this measure is arguably an understatement of the extent
15 of potentially inappropriate prescribing for older Canadians.
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23 24 25 *Conclusion*

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28 We found evidence of considerable use and cost of potentially inappropriate medications
29 among older men and women across Canada. With more than one in three older persons filling
30 one or more prescriptions meeting the Beers criteria for drug type, dose, and duration, we
31 estimate that the total cost of these medications is over \$400-million per year. Attributable health
32 care costs resulting from inappropriate medicine use could be several times greater.
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41 As the causes of inappropriate medicine use are many and complex, the solution to the
42 problem requires a national strategy that is multi-pronged and well-coordinated. Such a strategy
43 will not come cheaply. MedicineWise, the agency that coordinates Australia's national strategy
44 on quality use of medicines, has an annual budget of approximately CAD\$47-million but reports
45 to generate direct savings to the public drug plan of CAD\$67-million.(17) Our study findings
46 suggest that if a similar investment in Canada were to generate even a 10% reduction in the use
47 and cost of potentially inappropriate prescriptions among the older adults only, the investment
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3 would likely be more than offset by health system savings while simultaneously generating
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5 major benefits to patient health.
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Confidential

Table 1: Share of provincial drug plan enrollees filling one or more potentially inappropriate prescription, by province, sex, and age, using Beers criteria for drug type, dose, and duration.

| | Share of population aged 65+ covered by the NPDUIS Database | Female | | | | Male | | | | Female + Male Grand Total |
|------------------------------------|-------------------------------------------------------------|--------|-------|-----|----------|-------|-------|-----|----------|------------------------------|
| | | 65-74 | 75-84 | 85+ | All ages | 65-74 | 75-84 | 85+ | All ages | |
| BC | 89% | 42% | 45% | 50% | 44% | 29% | 35% | 41% | 32% | 37% |
| AB | 92% | 46% | 48% | 47% | 47% | 31% | 35% | 37% | 33% | 41% |
| SK | 93% | 39% | 43% | 47% | 42% | 27% | 33% | 36% | 30% | 37% |
| MB | 94% | 43% | 45% | 46% | 44% | 31% | 35% | 38% | 33% | 39% |
| ON | 96% | 37% | 43% | 46% | 40% | 26% | 34% | 39% | 30% | 36% |
| NB | 55% | 55% | 57% | 61% | 57% | 41% | 45% | 51% | 43% | 51% |
| NS | 68% | 47% | 49% | 50% | 48% | 37% | 43% | 45% | 40% | 45% |
| PE | 92% | 34% | 35% | 37% | 34% | 21% | 25% | 22% | 23% | 29% |
| NL | 55% | 56% | 58% | 60% | 57% | 49% | 52% | 54% | 50% | 54% |
| All high-coverage provinces | 93% | 39% | 44% | 46% | 42% | 27% | 34% | 38% | 31% | 37% |

Note: High-enrolment provinces are provinces in which at least 85% of the population aged 65 and older is covered by the NPDUIS Database.

Table 2: Total cost of potentially inappropriate prescriptions filled by provincial drug plan enrollees, by province, sex, and age, using Beers criteria for drug type, dose, and duration.

| | Share of population aged 65+ covered by the NPDUIS Database | Female | | | | Male | | | | Female + Male All ages |
|------------------------------------|-------------------------------------------------------------|--------|-------|-------|----------|-------|-------|-------|----------|---------------------------|
| | | 65-74 | 75-84 | 85+ | All ages | 65-74 | 75-84 | 85+ | All ages | |
| BC | 89% | \$84 | \$83 | \$92 | \$85 | \$64 | \$64 | \$69 | \$65 | \$76 |
| AB | 92% | \$101 | \$98 | \$101 | \$100 | \$62 | \$66 | \$71 | \$64 | \$84 |
| SK | 93% | \$91 | \$90 | \$92 | \$91 | \$67 | \$68 | \$71 | \$68 | \$81 |
| MB | 94% | \$103 | \$98 | \$91 | \$99 | \$73 | \$76 | \$74 | \$74 | \$88 |
| ON | 96% | \$67 | \$82 | \$111 | \$80 | \$55 | \$66 | \$84 | \$62 | \$72 |
| NB | 55% | \$148 | \$142 | \$162 | \$149 | \$110 | \$109 | \$132 | \$112 | \$134 |
| NS | 68% | \$102 | \$100 | \$101 | \$101 | \$88 | \$96 | \$97 | \$91 | \$97 |
| PE | 92% | \$60 | \$58 | \$60 | \$60 | \$37 | \$40 | \$28 | \$37 | \$49 |
| NL | 55% | \$134 | \$129 | \$138 | \$133 | \$122 | \$117 | \$126 | \$121 | \$128 |
| All high-coverage provinces | 93% | \$78 | \$85 | \$104 | \$85 | \$59 | \$66 | \$78 | \$63 | \$75 |

Note: High-enrolment provinces are provinces in which at least 85% of the population aged 65 and older is covered by the NPDUIS Database. Drug costs include public and private shares of total ingredient costs and dispensing fees for eligible prescriptions under provincial drug benefit programs.

Table 3: Frequency and cost of potentially inappropriate prescriptions filled by older patients in all provinces except Quebec, 20 most frequent drug types, using Beers criteria for drug type, dose, and duration

| | Share of population filling one or more potentially inappropriate prescription | | | Average per capita cost of potentially inappropriate prescriptions filled | | |
|---------------------------------|--------------------------------------------------------------------------------|------|---------------|---------------------------------------------------------------------------|--------|---------------|
| | Female | Male | Female + Male | Female | Male | Female + Male |
| Lorazepam | 11.0% | 6.1% | 8.8% | \$6.95 | \$3.46 | \$5.40 |
| Nitrofurantoin | 8.3% | 1.9% | 5.5% | \$3.23 | \$0.75 | \$2.13 |
| Amitriptyline | 3.9% | 2.0% | 3.1% | \$4.12 | \$1.85 | \$3.11 |
| Quetiapine | 2.8% | 2.2% | 2.5% | \$8.24 | \$5.95 | \$7.22 |
| Clonazepam | 3.0% | 1.9% | 2.5% | \$3.02 | \$1.82 | \$2.49 |
| Zopiclone | 2.9% | 1.9% | 2.4% | \$5.25 | \$3.50 | \$4.47 |
| Conjugated estrogens | 4.2% | 0.0% | 2.4% | \$3.71 | -- | \$2.06 |
| Glibenclamide | 1.7% | 2.7% | 2.2% | \$1.80 | \$2.52 | \$2.12 |
| Indomethacin | 0.7% | 2.6% | 1.6% | \$0.30 | \$1.09 | \$0.65 |
| Terazosin | 0.4% | 2.9% | 1.5% | \$0.82 | \$5.04 | \$2.70 |
| Oxazepam | 1.8% | 1.1% | 1.5% | \$1.61 | \$0.84 | \$1.27 |
| Risperidone | 1.6% | 1.1% | 1.4% | \$5.48 | \$3.64 | \$4.66 |
| Estradiol | 2.6% | 0.0% | 1.4% | \$5.95 | -- | \$3.31 |
| Temazepam | 1.6% | 1.2% | 1.4% | \$1.41 | \$0.96 | \$1.21 |
| Metoclopramide | 1.3% | 1.0% | 1.2% | \$0.65 | \$0.45 | \$0.56 |
| Amiodarone | 0.7% | 1.1% | 0.9% | \$1.41 | \$2.26 | \$1.79 |
| Meloxicam | 1.1% | 0.6% | 0.9% | \$1.65 | \$0.93 | \$1.33 |
| Cyclobenzaprine | 1.0% | 0.9% | 0.9% | \$0.54 | \$0.40 | \$0.48 |
| Diclofenac, combinations | 0.8% | 0.8% | 0.8% | \$3.98 | \$3.59 | \$3.80 |
| Alprazolam | 1.1% | 0.6% | 0.8% | \$0.96 | \$0.49 | \$0.75 |

Note: Drug costs include public and private shares of total ingredient costs and dispensing fees for eligible prescriptions under provincial drug benefit programs.

Table 4: Estimates of total cost of potentially inappropriate prescriptions for older Canadians

| | Females age 65 and older | Males age 65 and older | Females and males age 65 and older |
|-------------------------------------------------------------------------------------------------------------------------|--------------------------|------------------------|------------------------------------|
| Average per drug plan enrollee cost of prescriptions meeting Beers criteria in provinces with high NPDUIS data coverage | \$85 | \$63 | \$75 |
| National population of age/sex group (thousands) | 3,064 | 2,521 | 5,585 |
| Estimate of total cost of potentially inappropriate prescriptions for all Canadians age 65 and older (\$-millions) | \$259 | \$160 | \$419 |

Note: High-enrolment provinces are provinces in which at least 85% of the population aged 65 and older is covered by the NPDUIS Database. Drug costs include public and private shares of total ingredient costs and dispensing fees for eligible prescriptions under provincial drug benefit programs.

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