Cross-national comparison of medication use in Australian and Dutch nursing homes

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Abstract

Background: cross-national comparisons can be used to explore therapeutic areas and identify potential medication issues.

Methods: we used cross-sectional pharmacy supply data to explore medication use for nursing home residents in Australia (AU n = 26 homes, 1,560 residents) and the Netherlands (NL n = 6 homes, 2,037 residents). Binary logistic regression analysis was used to calculate the sex and aged adjusted odds ratios (OR) and associated 95% confidence intervals with a flexible Bonferoni–Holm procedure used to adjust for multiple hypothesis testing.

Results: total use of antipsychotics (AU: 37.7%, NL: 40.3%; OR 0.91 (0.79–1.04, P = 0.16) and antibacterials (66.8% AU, 62.4% NL, OR 1.08 (0.93–1.24, P = 0.31) was similar, but choice of individual agents differed between the two countries. Differences were observed in the use of antithrombotics (46.7% AU, 64.7% NL, OR 0.48 (0.42–0.56, P > 0.01), ophthalmologicals (44.3% AU, 22.1% NL, OR 2.80 (2.42–3.24, P < 0.001), laxatives (77.1% AU, 65.8% NL, OR 1.65 (1.41–1.92, P < 0.001).

Conclusion: while the general prevalence of medication use in nursing home residents was similar across the two countries, distinct differences existed in the choice of agent among therapeutic groups. Comparing use between countries identified a number of potential medication related problem areas that need further exploration.

Keywords: aged, nursing homes, drug utilisation, cross-national comparison, medication, older people

Introduction

Medication use increases with age, medical complexity and frailty [1]. Nursing home residents are frailter than their community-dwelling counterparts and use more medications. Use of multiple medications, especially among frail older adults in residential care, has been associated with an increased risk of harm [1, 2].

Cross-national comparisons facilitate increased understanding of forces driving health policy and health systems [3] and can be used to explore therapeutic areas and identify potential medication issues. Cross-national drug utilisation studies have identified issues across a number of therapeutic areas, including antibiotics [4, 5], benzodiazepines [6] and antipsychotics [7]. However, such work has tended to focus on specific therapeutic areas.

Despite increased medication use and increased risk of potential harm among nursing home residents little is known about cross-national differences in overall drug utilisation among nursing home residents. The aim of this study was to
explore medication use among nursing home residents in Australia (AU) and the Netherlands (NL) with a focus on identifying potential issues for high-risk medications.

**Methods**

**Data source and study population**

We conducted a cross-sectional analysis using pharmacy dispensing data, of all medications (prescription and non-prescription medications) used in 2009 by residents in 26 Australian and 6 Dutch nursing homes. Drugs were classified according to the Anatomical Therapeutical Chemical (ATC) classification system as defined by the WHO Collaborating Centre for Drug Statistics Methodology [8].

**High risk medications**

The following therapeutic areas, known to be problematic in older people, were explored: psychotropic medication (anti-psychotics (ATC: N05A), anxiolytics (N05B), hypnotics and sedatives (N05C) and antidepressants (N06A)), pain medication (anti-inflammatory and antirheumatic products (M01), topical products for joint and muscular pain (M02) and analgesics (N02)), osteoporosis medication (vitamin A and D in combination (A11CB), vitamin D and vitamin D analogues (A11CC), calcium (A12A), selective oestrogen receptor modulators (G03XC), teriparatide (H05AA02), parathyroid hormone (H05AA03), calcitonin preparations (H05BA), bisphosphonates (M05BA), bisphosphonate combinations (M05BB) and other drugs affecting bone structure and mineralisation (M05BX)) and systemic antibiotics (J01).

**Statistical analysis**

Prevalence of medication use was defined as the number of individuals who received at least one supply of the medication during 2009. Binary logistic regression was used to calculate odds ratios (OR), adjusted for age and sex, and associated 95% confidence intervals (CI). A flexible Bonferroni–Holm procedure was adopted to control for multiple testing. The statistical analysis was performed using SPSS 20.0 (IBM Corp., Armonk, NY, USA).

**Ethics**

Ethical approval was granted in Australia by the Concord Repatriation General Hospital Human Research Ethics Committee (CH62/6/2010-049). In the Netherlands, no formal ethical approval was needed according to Dutch law (M12.114962).

**Results**

A total of 1,560 of Australian (AU) and 2,037 Dutch (NL) nursing home residents received one or more medications in 2009. Despite differences in facility size, the distribution of age, gender and number of medications per resident was similar between the two countries. Dutch residents were slightly older than those in Australia with the mean age of Australian residents 85.8 (SD 7.5) and Dutch residents 82.8 (SD 7.5) (P < 0.001). The majority were female (70.3% AU, 68.2% NL, P = 0.19). The mean number of medications per resident was 11.1 (SD 5.3) in Australia and 10.1 (SD 6.7) in the Netherlands (P < 0.001).

**Medication use**

Similar patterns of medication use were observed between the two countries at the ATC main group level (level 1) (Table 1). Use of medications targeting the alimentary tract and metabolism (ATC A), skin (ATC D), hormones (ATC H), Nervous system (ATC N), sensory organs (ATC S) and antiparasitic products (ATC P) was higher in Australia, while use of medications targeting the blood (ATC B) was higher in the Netherlands.

Table 1. Prevalence and Adjusted ORs of medication use per ATC main group (1st level) in Australian and Dutch nursing homes

<table>
<thead>
<tr>
<th>ATC main group</th>
<th>ATC code</th>
<th>Prevalence (%)</th>
<th>Adjusted OR* (95% CI)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alimentary tract and metabolism</td>
<td>A</td>
<td>95.7</td>
<td>2.26 (1.69–3.03)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Blood and blood forming organs</td>
<td>B</td>
<td>61.8</td>
<td>0.57 (0.49–0.66)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Cardiovascular system</td>
<td>C</td>
<td>73.8</td>
<td>1.05 (0.90–1.23)</td>
<td>0.53</td>
</tr>
<tr>
<td>Dermatologicals</td>
<td>D</td>
<td>53.5</td>
<td>1.51 (1.32–1.73)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Genito urinary system and sex hormones</td>
<td>G</td>
<td>17.0</td>
<td>1.01 (0.85–1.22)</td>
<td>0.88</td>
</tr>
<tr>
<td>Systemic hormonal preparations</td>
<td>H</td>
<td>23.9</td>
<td>1.23 (1.04–1.44)b</td>
<td>0.01</td>
</tr>
<tr>
<td>Antineoplastics and immunomodulating agents</td>
<td>J</td>
<td>67.1</td>
<td>1.07 (0.93–1.24)</td>
<td>0.36</td>
</tr>
<tr>
<td>Musculo-skeletal system</td>
<td>M</td>
<td>28.3</td>
<td>0.85 (0.61–1.19)</td>
<td>0.35</td>
</tr>
<tr>
<td>Nervous system</td>
<td>N</td>
<td>95.7</td>
<td>2.12 (1.57–2.85)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Antiparasitic products, insecticides and repellents</td>
<td>P</td>
<td>5.6</td>
<td>6.20 (3.76–10.23)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Respiratory system</td>
<td>R</td>
<td>32.4</td>
<td>0.92 (0.80–1.06)</td>
<td>0.26</td>
</tr>
<tr>
<td>Sensory organs</td>
<td>S</td>
<td>49.2</td>
<td>2.82 (2.43–3.26)</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

*Adjusted for age and sex.

bNo longer significant after correction for multiple testing with Bonferroni–Holm procedure.
K. Taxis et al.

Use of high-risk medications

Across many of the high-risk therapeutic areas there were similarities in total use but significant differences in the choice of drug class or agents within the therapeutic area (Supplementary data, Table S1, available in Age and Aging online). Approximately 40% of residents used an antipsychotic (N05AD, \( P < 0.001 \)) while Australian residents were more likely to receive a traditional antipsychotic (N05AX, \( P < 0.001 \)). Use of hypnotics and sedatives was similar across both countries (\( P = 0.21 \)) but the use of anxiolytics was higher in the Netherlands (\( P < 0.001 \)).

Use of pain medication was high in both countries (Supplementary data, Table S1, available in Age and Aging online). Use of anti-inflammatory and antirheumatic agents, including non-steroidal anti-inflammatories was almost double in the Netherlands (\( P < 0.001 \)) while use of opioids was significantly higher in Australia (\( P < 0.001 \)). Proton pump inhibitor (PPI) use was higher in the Netherlands (\( P < 0.001 \)) while contact laxative use much higher in Australia (\( P < 0.001 \)). With systemic antibacterials, overall use between the countries was similar (\( P = 0.31 \)) but there were differences in the use of cephalosporins (\( P < 0.001 \)), quinolones (\( P < 0.001 \)) and macrolides (\( P < 0.001 \)). Differences in the use of other antibacterials (J01X) were mainly driven by differences in the use of nitrofurantoin (2.4% AU, 21.3% NL, \( P < 0.001 \)). Use of vitamin K antagonist anticoagulants and heparins was higher in the Netherlands (\( P < 0.001 \)) while use of aspirin at an antplatelet dose was similar between countries (\( P = 0.9 \)). Higher use of antimicrobial eye drops and artificial tear preparations resulted in almost double the prevalence of use in Australia compared to the Netherlands (\( P < 0.001 \)).

Discussion

We found that while the general prevalence of medication use in nursing home residents was similar across the two countries, distinct differences existed in the choice of agent among therapeutic groups. Comparing use between countries identified a number of potential medication related problem areas.

High-risk medication use

Striking differences in the use of pain medications was noted that might indicate potential medicated related issues were observed. A higher use of opioids in Australia raises the question of potential over-use in Australia or under-use in the Netherlands. A second potential issue may be the relatively frequent use of NSAIDs in the Netherlands despite the widespread concern about the risks of adverse effects of NSAIDs in older people [9]. Such issues require further exploration, incorporating assessment of clinical need, to fully understand the patterns of use observed.

We found a high prevalence of prescribing psychotropic medication in both countries indicating that despite ongoing international concerns about safety risks, including increased mortality and falls, of psychotropic medication, these medications continue to be frequently prescribed in nursing homes [10–13]. There were interesting differences in the choice of individual psychotropic agents. Australian [14] and Dutch [15] national guidelines both recommend risperidone as drug of first choice for the treatment of neuropsychiatric symptoms in patients with dementia, but a local Dutch guideline recommended the use of haloperidol which may account for the high a typical antipsychotic use observed in the Dutch population [16, 17]. Guideline recommendations may also explain some of the observed differences in co-prescribing with analgesics. Concomitant use of a PPI with an NSAID is recommended in both countries [15, 17] thus the higher NSAID use in the Netherlands may explain the higher PPI use. Similarly, national guidelines in both countries recommend co-prescription of laxatives with opioids [15, 18] and the higher opioid use in Australia may account for the higher laxative use [18].

Differences in clinical guidelines as well as differences in access to specific agents may also have contributed to the differences observed for the systemic antibiotics. While the prevalence of systemic antibiotics in Australia and the Netherlands was similar, the use of specific antibiotic groups varied considerably. Use in both countries appeared to follow national treatment guidelines with differences between the countries reflecting difference in the guidelines. With the exception of the high quinolone use observed in the Dutch cohort, similar use patterns have also been observed in other Northern European countries [15]. In Australia, access to quinolones use outside of the hospital setting is strictly restricted [5]. To fully understand differences in antibacterial use and the implications for development of resistance, data on indication, dose and duration of use are needed to assess the quality of prescribing antibiotics in the nursing homes.

Differences in health system utilisation may explain some of the variation observed for antithrombotic medications despite a similar incidence of thromboembolic events in both countries [19, 20]. One possible explanation for higher Dutch use may be that Dutch nursing homes often accept patients for post surgical, for example following hip surgery. Differences in the management of anticoagulation may also contribute to the higher use of anticoagulation in the Netherlands where specialised community-based anticogulation services are available.

Strengths and limitations

Use of medication dispensing data which includes all prescribed and non-prescribed medications used in the included facilities provided a complete medication record for each resident. Limitations of this work include calculating the prevalence of use over the whole year period without differentiating between periodic or ongoing use. Also it is not known to what degree the data presented is representative of national prescribing patterns for each country or can be extrapolated to other countries and contexts. Furthermore, there may be differences between the facilities included in this study in terms of mortality and length of stay, which could not be included in this work.
Conclusion

This study examined medication in two countries use across a range of therapeutic areas. It provides insight into medications most commonly used by nursing home residents and highlights a number of potential medication related safety issues. When exploring the cross-national similarities and differences observed in this study other factors such as health system differences, the influence of local policies and guidelines that may impact medication use should be considered.

Key points

• Similar prescribing patterns in Australian and Dutch nursing homes for many drug classes were found.
• In both countries, a high prevalence of psychotropic medication, pain medication, laxatives and antibacterial medications was observed.
• Despite similar use of pharmacological classes, differences in the choice of individual medications were observed.
• When exploring cross-national similarities and differences other factors such as health system differences, the influence of local policies and guidelines should be considered.

Supplementary data

Supplementary data mentioned in the text are available to subscribers in Age and Ageing online.

Conflicts of interest

G.S. is Managing Director of Webstercare.

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