Polypharmacy and inappropriate medicines among participants in the MedBridge study

Hanna Holst

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Uppsala University Hospital

Supervisor: Ulrika Gillespie
Examiner: Margareta Hammarlund-Udenaes

Division of Pharmacokinetics and Drug Therapy
Department of Pharmaceutical Biosciences
Faculty of Pharmacy
Uppsala University
Abstract

Introduction: Polypharmacy and inappropriate medication are common issues in elderly patients. Older people are more likely to suffer from adverse drug reactions and other drug-related problems due to the increased presence of multimorbidity, inappropriate polypharmacy, age related impairments in the hepatic metabolism and renal clearance of medication and enhanced pharmacodynamic sensitivity to specific drugs.

Aim: The aim of this study was to analyze, compare and describe medication use in the MedBridge study population, in total and for different patient groups.

Materials and Methods: Medication data from approximately 700 patients from Uppsala University Hospital and the hospital of Enköping was extracted from the medical record system and stored in an electronic data capture system. This data was joined together with the collected data from the other 1939 study participants and exported to Microsoft excel for analyses.

Results: The mean value of prescribed medicines was 9.2. Women had significantly higher (p<0.05) number of prescribed medicines. Participants aged 85 or older had the highest number of prescribed medicines and participant between 65-74 had the least prescribed medicines. The mean value was significantly higher (p<0.05) for women aged 85 years or older and women between 75-85 years compared with women aged 65-74. In this population 461 patients (17.4%) used at least one inappropriate medicine. Of all the women 18.8% used at least one inappropriate medicine and 15.7% of all the men. Women aged 85 years or older used the most inappropriate medicines and men between 65-74 used the least. Women aged 85 or older used significantly (p<0.05) higher amount of inappropriate medicines than women aged 65-74 years did.

Conclusion: In conclusion, this report shows that many of our elderly have’s polypharmacy and that women are using more medicines than men and more inappropriate medicines than men. It also indicates that the older you get, the more medicines you use.
Populärvetenskaplig sammanfattning

Användandet av många läkemedel, polyfarmaci, och användningen av läkemedel som är olämpliga är vanliga problem hos äldre patienter. Äldre personer har lättare att drabbas av problem relaterade till läkemedelsanvändningen på grund av att de ofta är multisjuka, har många läkemedel som kan kroka med varandra (interaktioner), får åldersrelaterade förändringar i levern och njurarna som påverkar nedbrytningen av läkemedlen samt förändringar i kroppen som gör att äldre blir känsligare för vissa typer av läkemedel.

Den här studien syftade till att analysera, beskriva och jämföra läkemedelsanvändningen i MedBridge studiens patientpopulation. För att göra det samlades läkemedelslistor in från journalsystemet Cosmic och sparades därefter i en databas. När all data var insamlad exporterades de till Microsoft Excel för att analyseras. Resultaten visade bland annat att medelvärdet för förskrivna läkemedel var 9,2 per person och att kvinnor använde signifikant mer läkemedel än män. Patienter som var 85 år eller äldre hade flest läkemedel och patienter mellan 65 och 74 år det lägsta antalet förskrivna läkemedel. Kvinnor som var 85 år eller äldre var den grupp som använde flest läkemedel och män mellan 65 och 74 år använde minst läkemedel. Medelvärdet för antalet läkemedel var signifikant högre för kvinnor som var 85 år eller äldre samt för kvinnor mellan 75 och 84 år jämfört med kvinnor i åldersgruppen 65–74 år. Av alla patienter i studien använde 17,4% åtminstone ett olämpligt läkemedel. Av alla kvinnor hade 18,8% minst ett olämpligt läkemedel och 15,7% av alla män. Kvinnor som var 85 år eller äldre hade flest olämpliga läkemedel förskrivna och män mellan 65 och 74 år hade det lägsta antalet. Kvinnor över 85 år använde signifikant fler olämpliga läkemedel jämfört med kvinnor mellan 65–74 år. Den här studien visar på att polyfarmaci är mycket vanligt hos äldre samt att kvinnor använder fler läkemedel än vad män gör och att de använder flera olämpliga läkemedel jämfört med män. Studien visar också på att läkemedelsanvändningen ökar med stigande ålder.
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1 Introduction
The prescribing of medicines is a fundamental component of care for the elderly (1–4). However, there is an increasing concern with polypharmacy. Polypharmacy and inappropriate medications are common issues in elderly patients (1). Polypharmacy has many definitions, in this study, polypharmacy is defined as 5 or more prescribed medicines (4) and an inappropriate medication is by definition a medicine whose adverse risks exceed its health benefits (1). Older people are more likely to suffer from adverse drug reactions and other drug-related problems due to the increased presence of multimorbidity, inappropriate polypharmacy, age-related impairments in the hepatic metabolism and renal clearance of medications and enhanced pharmacodynamic sensitivity to specific drugs (1,3,5). Inappropriate-polypharmacy is associated with a negative impact on morbidity, mortality and costs (6). Optimizing medicine prescribing for this group of patients has become an important public health issue worldwide. Prescribing for elderly can be a challenge for clinicians as the health status of elderly people ranges widely from those who are fit to those who are frail. This makes generalization of prescribing decisions difficult (3).

1.1 Number of prescribed medicines
Several studies show that the number of medications prescribed to patients older than 65 year is increasing (7–9). A study made in 2002 points out that in patients older than 65 years of age 12% of the study population used at least 10 prescription medicines and 23% at least 5 (8). Another study from 2018 made in Sweden including patients aged 75 or older, states that 68% of the population used five or more prescribed medicines and that 19% used over 10 prescribed medicines (9). A study from 2000 made in Sweden, including the general population aged 75 or older living at home, states that 87% of the study population received at least one prescribed drug (10). Of those who received prescribed medicines, 60% used three or more medicines and 34% used five or more medicines. The study did also point out that 32% of the study populations received prescribed drugs from two or more physicians. In 15% the investigators found potential drug-drug interactions (10).
1.2 Consequences of inappropriate polypharmacy

Polypharmacy is often clinically indicated and beneficial in specific condition’s like diabetes mellitus and different heart diseases. However, the use of multiple medicines poses medication safety risks to patients (11,12). It has been reported that patients taking 5 or more medications had an 88% increased risk of experiencing an adverse drug event (13). Studies on the subjects have been done and they all say the same; patients with polypharmacy are more likely to be hospitalized from adverse drug events (13,14). Adverse drug events can cause suffering and inconvenience for the patient and their families and can also cause hospitalizations, which represent a high cost for society (12,15). One concern with inappropriate polypharmacy is that it increases healthcare costs, both for the patient and the healthcare system (16). The higher the number of prescribed medicines the higher the risk of potentially serious drug-drug interactions (11). A study analyzing data from data bases stated that 81% of patients receiving over 15 medicines were exposed to potentially serious interactions compared to 11% of those dispensed two to four medicines (11). The prevalence of drug-drug interactions from a study made in 2005 was 15-40% in frail elderly patients (17). The risk of drug-disease interactions (contra-indications) also increases with an increased number of prescribed medicines (18).

1.3 Inappropriate medicines

Inappropriate medicines are common among elderly patients. In this patient group inappropriate drugs increase the risk of adverse outcomes (1). A study made in 2016 points out that 44% of the study population had been prescribed an inappropriate medicine (19). Studies have shown that there is a positive correlation between inappropriate prescribing and negative quality of life (3). Some of the adverse outcomes from inappropriate medicines are cognitive impairment and functional decline (6). The use of inappropriate medicines is increased in patients taking multiple medications (1). A study from Sweden studying the Swedish prescribed drug register over the period 2006-2013 showed, however, that the prescribing of inappropriate medicines to patients aged 65 or older has decreased. The positive trend was more pronounced for those aged 75 or older. The investigators of the study point out the improvements were likely to be
due to increased knowledge and attention by prescribers regarding inappropriate medicines, increased discussion around inappropriate medicines and the publication of the national guidelines *Indicators of good drug use in elderly*, in 2009 (20). The inappropriate medicines, dosage regimes and medicine combination prescribed below were chosen from *Indicators of good drug use in elderly*, national indicators from The Swedish National Board of Health and Welfare (21).

### 1.3.1 Anticholinergic medicines

Anticholinergic medicines is a class of medicines that blocks the neurotransmitter acetylcholine in the brain and peripheral tissues (22). Pharmacokinetic changes in the body that are age-related make the elderly population more sensitive to this type of medicines (23). The most significant change is the increased permeability of the blood brain barrier as a result of dilation of blood vessels and opening of tight junctions (24). These changes make the elderly more sensitive to the central adverse effects (25) and can cause adverse reactions such as falls, malnutrition, confusion, acute urinary retention and memory loss (26,27). A study of 750 people aged >65 years shows that individuals using anticholinergic medicines were more likely to have cognitive impairment than those using non-anticholinergic medications (28).

### 1.3.2 Long-acting benzodiazepines

When ageing, the volume of water in the body decreases and the proportion of fat increases. These changes lead to an increased accumulation of fat-soluble medicines such as benzodiazepines (29,30). The increased accumulation can lead to adverse effects such as falls, fractures, cognitive impairment and dependency (30,31). A study made in 2013 looking at the association between falls rates and the use of benzodiazepines discovered that 59% had experienced one or more fall while using benzodiazepines during a one year period (32). A study which compared the accumulation between short-acting and long-acting benzodiazepines states that long-acting benzodiazepines accumulate more than short-acting benzodiazepines (30). The same study also states that the elimination of long-acting benzodiazepines was much longer than for short-acting benzodiazepines (30).
1.3.3 Tramadol and codeine
Tramadol and codeine are weak opioids used to treat pain (33). The risk of getting side effects from the central nervous system of tramadol increases with increased aged. Such adverse reactions can be tiredness, dizziness and confusion (34). Tramadol is therefore not recommended to treat pain in elderly. Codeine does not give specific adverse drug reactions to elderly (35). The reason for the recommendation to not use codeine in elderly is the individual variability in its effectiveness which depends on drug metabolism into its active metabolites (35). The variability is even bigger in the elderly population and it may lead to lack of effect (35).

1.3.4 Antidiabetic pharmaceuticals
Glibenclamide and pioglitazone are two medicines used to treat diabetes (36–38). Glibenclamide is a sulfonylurea compound and pioglitazone is a thiazolidinedione (38). Glibenclamide has active metabolites and long half-life which leads to a higher risk of hypoglycemia (36). Glibenclamide is to a high extent excreted by the kidneys. The kidney function deteriorates with age, which puts the elderly population at higher risk for hypoglycemia (36,37). The unbeneficial side effect profile of pioglitazone makes the medicine inappropriate to use. Studies confirms that pioglitazone gives an increased risk for fluid retention, heart failure and osteoporosis (38–40).

1.3.5 Inappropriate dosage and drug regimes
Acetylsalicylic acid is a platelet aggregation inhibitor with several different indication (41). Studies haves shown that higher doses than 75 mg do not give a better effect, in fact studies show that higher doses gives an increased risk for gastrointestinal ulcers, bleeding and negative impact on the kidney function. Therefor higher doses than 75 mg should not be used (41). Zopiclone is used for treating insomnia and oxazepam is used for treating insomnia and anxiety (42). When given in higher doses than zopiclone 7,5 mg/day and oxazepam 30 mg/day the risk of adverse drug reactions such as daytime sleepiness, dizziness and negative cognitive impact increases (42,43). Higher doses of zopiclone and oxazepam should therefore not be used. The use of psychotropic medicines is often justified and necessary, but the use of too many psychotropics, to one individual, does not only increase the risk of adverse drug reactions and drug-drug interactions, it can also be a sign that there are shortcomings in the treatment of the
patient’s psychiatric conditions (44–46). There-fore the number of psychotropic medicines should not be higher than 3 and if it is – this should lead to investigations and reconsiderations of the treatment (45). Changes in pharmacokinetics and pharmacodynamics associated with aging lead to increased risk of adverse effects such as sedation, confusion and increased risk of falls (47). The increased risk of adverse effects in combination with studies showing that elderly on a regular basis were prescribed 3 or more psychotropics medicines lead to the limit of 3 or more psychotropics (47).

1.3.6 inappropriate drug combinations
Double blockade of the renin-angiotensin system increases the risk for hypotension, hyperkalemia and renal impairment, including renal failure. Therefore the combination of two medicines, both blocking the renin-angiotensin system is not recommended (48). Cardio selective calcium antagonist in combination with beta blockers have a negative inotropic effect. The combination leads to an additive effect in the heart’s AV conduction with the risk of conduction disorders and should therefore not be used (49). Donepezil in combination with citalopram increases the risk of QT prolongation which increases the risk for severe heart rhythm disorders. Both citalopram and donepezil individually increase the risk of QT prolongation by inducing inhibition of calcium channel and should therefore not be used together (50). Anticoagulants, like warfarin and acetylsalicylic acid, in combination with non-steroidal anti-inflammatory drugs increase the risk of bleeding more than just the use of one of them in monotherapy (14,51,52). Proton-pump inhibitors is proven to reduce the risk of gastrointestinal bleeding (53,54). The combination of anticoagulants and non-steroidal anti-inflammatory medicines should not be used without a proton-pump inhibitor (55,56).

1.4 Preventing problems with inappropriate polypharmacy and inappropriate medications
Evidence based prescribing is one of the key challenges to achieving appropriate medication use among the population (57). Another challenge is to optimize patients medications after needs, preferences and values (58). Optimizing patients’ medications involves encouraging the use of appropriate medicines, in a way that the patient is
willing and able to comply with, to treating the diseases according to established guidelines, as well as targeting both over- and under prescribing (58). One strategy to optimize patients medication treatments is to preform medication reviews (59–62). A study from Sweden studied how pharmacists preforming the medication reviews could reduce the number of prescribed medicines and the number of inappropriate medications (59). The pharmacists found 3868 drug related problems and 2860 of these received an intervention recommendation to withdraw a medicine, decrease the dose and change of medicine therapy. These interventions led to a decrease in the mean of prescribed medicines from 11.3 to 10.5 (59). A study from 2014 states that up to 30% of all hospitalizations in older patients are medication-related and that half of these are preventable (63).

1.5 The MedBridge study
Medication Reviews Bridging Healthcare (MedBridge) is an on-going cluster randomized controlled trial involving Uppsala University Hospital and the hospitals of Västerås, Gävle and Enköping (64). The study is designed to further evaluate the effects of involving clinical pharmacists in hospital health-care teams. The main aim is to study the effects of hospital-initiated comprehensive medication reviews, including active follow up, on elderly patients’ rehospitalizations (64).

2 Aim
The aim of this study was to analyze, compare and describe medication use, in total and for different patient groups, to illustrate the use in the MedBridge study population.

2.1 Objectives
- To describe the medication use for the whole population regarding the number of prescribed medications.
- To describe the use of inappropriate medicines for the whole population regarding the number of prescribed medications.
- To describe the medication use in different patient groups, divided into age- and gender groups.
- To describe the use of inappropriate medicines in different patient groups, divided into age- and gender groups.
• To test for statistically significant differences in medication use between groups.
• To test for statistically significant differences in the use of inappropriate medication between groups.

3 Materials and Methods

3.1 Setting and study population

This descriptive study included all 2639 patient included in the MedBridge study.

3.1.1 Inclusion criteria

Patients aged 65 years or older who have signed an informed consent to participate and have been admitted to one of the study wards in the MedBridge study.

3.1.2 Inappropriate medicines

The inappropriate medicines, dosage regimes and medicine combination were chosen from Indicators of good drug use in elderly, national indicators from The Swedish National Board of Health and Welfare (21).

<table>
<thead>
<tr>
<th>Inappropriate medicines/dosage regimes/combinations</th>
<th>ATC-code</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tramadol</td>
<td>N02AX02</td>
<td></td>
</tr>
<tr>
<td>Long-acting benzodiazepines</td>
<td>N05BA01</td>
<td></td>
</tr>
<tr>
<td></td>
<td>N05CD02</td>
<td></td>
</tr>
<tr>
<td></td>
<td>N05CD03</td>
<td></td>
</tr>
<tr>
<td>Antidiabetics</td>
<td>A10BB01</td>
<td></td>
</tr>
<tr>
<td></td>
<td>A10BG03</td>
<td></td>
</tr>
<tr>
<td>Drugs with anticholinergic effect</td>
<td>N06AA</td>
<td>Excluding low-dose Amitriptyline for pain treatment</td>
</tr>
<tr>
<td></td>
<td>R06AD01</td>
<td></td>
</tr>
<tr>
<td></td>
<td>R06AD02</td>
<td></td>
</tr>
<tr>
<td></td>
<td>R06AA04</td>
<td></td>
</tr>
<tr>
<td></td>
<td>N05AA02</td>
<td></td>
</tr>
<tr>
<td>Medicine/Condition</td>
<td>ATC Codes</td>
<td>Notes</td>
</tr>
<tr>
<td>--------------------------------------------------------</td>
<td>----------------------------------</td>
<td>----------------------------------------------------------------------</td>
</tr>
<tr>
<td>Codeine</td>
<td>N02AJ06, R05DA04</td>
<td></td>
</tr>
<tr>
<td>Acetylsalicylic acid &gt;75 mg/day</td>
<td>B01AC06</td>
<td></td>
</tr>
<tr>
<td>Oxazepam &gt;30 mg/day</td>
<td>N05BA04</td>
<td></td>
</tr>
<tr>
<td>Zopiclone &gt;7.5 mg/day</td>
<td>N05CF01</td>
<td></td>
</tr>
<tr>
<td>3 or more psychotropics</td>
<td>N05A, N05B, N05C, N06A</td>
<td></td>
</tr>
<tr>
<td>Double RAAS blockade</td>
<td>C09AA, C09CA</td>
<td>Patients who have 2 medicines of the same ATC-code are not included</td>
</tr>
<tr>
<td>Cardio selective calcium antagonist + β-blockade</td>
<td>C08DA, C08DB, C07AB</td>
<td></td>
</tr>
<tr>
<td>Citalopram + donepezil (interaction)</td>
<td>N06AB04, N06DA02</td>
<td></td>
</tr>
<tr>
<td>Warfarin or acetylsalicylic acid + NSAID without PPI</td>
<td>B01AA03, B01AC06, M01A</td>
<td>Excluding M01AX05, Glucosamine does not have impact on the bleeding risk</td>
</tr>
</tbody>
</table>
3.2 Data collection

Medication data from approximately 700 patients from Uppsala University Hospital and the hospital of Enköping was extracted from the electronic medical record system Cosmic (Cambio Healthcare Systems AB) and stored in the electronic data capturing system Castor EDC. The data that was collected from Cosmic and transferred to Castor EDC was the patients’ medications lists. This data, from the other 1939 study participants, had already been put into Castor by the study investigators. When data from all the 2639 patients was stored in Castor EDC the file was exported to Microsoft Excel. The exported data from all 2639 patient was checked to see if the information was complete. The information that was missing was extracted from Cosmic and put into Castor EDC. In the case of double lists, the incorrect list was removed. The information from Castor EDC was again extracted to a Microsoft Excel file, for analyses.

3.3 Outcome measure and statistics

The medication use and the use of inappropriate medicines were presented in the form of quantity, percentage, men and standard deviation. The outcome measures for this study was the prevalence and mean of numbers of medicine in different age groups and the prevalence of inappropriate medicines in the same groups. Microsoft Excel was used to calculate descriptive statistics.

Statistical tests were used to determine if there were any differences between the groups. Two-way t-tests with a 5% significance level were performed. Bonferroni Correction was used to correct the significance level. The two-way t-tests and Bonferroni Correction were preformed using Microsoft excel.

3.4 Ethical approval

No additional ethical approval was needed for this study since it’s a part of the MedBridge study which has received ethical approval from the Central Ethical Review Board in Sweden.
4  Results
The total number of patients included in the study was 2634. Five patients had to be excluded because it was not possible to determine which medicines they had at the time of enrollment in the MedBridge study. Fifty-three percent of the participants were women. The largest group of participants were 85 years of age or older (40.9%). Among men, the largest group of participants were aged between 75-84 years. Among women the largest group of participants were 85 years of age or older. In Table 1 the distribution between women and men and age groups is described. The mean value of prescribed medicines for the whole population was 9.2 medicines (ranging from 0 to 32). Women had more prescribed medicines, 9.5, than men, 8.9. The age group that had the highest number of prescribed medicines were those 85 years or older and the group with the lowest number of prescribed medicines were those between 65-74 years. The group which had most prescribed medicines were women aged 85 years or older, they had a mean of almost 10 prescribed medicines per person. The group that had the least prescribed medicines were women aged 65-74 years. The following differences were statistically significant (p<0.05); number of prescribed medicines for women compared with men. Mean value for women aged 85 and 75-85 years compared with women aged 65-74 years, mean value for patients aged 85 compared with patients aged 65-74 years.

Table 1. Demographic characteristics of patients. Men, women and age groups are presented as a part of total participants. Age groups for the gender are presented as a part of total women/men.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Patients (n)</th>
<th>Part of (%)</th>
<th>Mean number of medicines (standard deviation)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>2634</td>
<td>100</td>
<td>9.2</td>
</tr>
<tr>
<td>Men</td>
<td>1282</td>
<td>48.7</td>
<td>8.9</td>
</tr>
<tr>
<td>Women</td>
<td>1352</td>
<td>51.3</td>
<td>9.5</td>
</tr>
<tr>
<td>65-74 years</td>
<td>540</td>
<td>20.4</td>
<td>8.2</td>
</tr>
<tr>
<td>75-84 years</td>
<td>1014</td>
<td>38.5</td>
<td>9.0</td>
</tr>
<tr>
<td>≥85 years</td>
<td>1080</td>
<td>40.9</td>
<td>9.7</td>
</tr>
<tr>
<td>Men 65-74 years</td>
<td>270</td>
<td>20.9</td>
<td>8.8</td>
</tr>
<tr>
<td>Men 75-84 years</td>
<td>552</td>
<td>42.9</td>
<td>8.8</td>
</tr>
<tr>
<td>Men ≥85 years</td>
<td>460</td>
<td>35.7</td>
<td>9.2</td>
</tr>
<tr>
<td>Women 65-74 years</td>
<td>271</td>
<td>20.2</td>
<td>7.6</td>
</tr>
</tbody>
</table>
4.1 Overall medication use

As shown in Figure 1. 2132 (80.8%) patients used 5 or more prescribed medicines, 1129 (42.8%) patients used 10 or more prescribed medicines and 115 (4.4%) patients used 20 or more medicines. The highest overall prevalence was among women aged 85 years or older, of whom 541 used at least 5 prescribed medicines and 307 took 10 or more medicines. The lowest prevalence was among women in the age group 65-74 years, of whom 197 patients used 5 or more prescribed medicines and 95 patients used 10 or more prescribed medicines. Men between 75-84 years had the highest number of prescribed medicines, were 29 patients used 20 or more prescribed medicines. The patient with the highest number of prescribed medicines in this group were 31 medicines.

Table 2 presents how many medicines that were prescribed for the whole population and if the medicine was prescribed as medication taken regularly or only as a when needed regimen. There were 20881 medicines prescribed and 81.2 % of them were prescribed as regular medications.
Table 2. Description of medicine status.

<table>
<thead>
<tr>
<th>Medicine Status</th>
<th>Quantity</th>
<th>Part of total (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prescribed medicines</td>
<td>20.881</td>
<td>100</td>
</tr>
<tr>
<td>Regular medicines</td>
<td>16.954</td>
<td>81.2</td>
</tr>
<tr>
<td>when needed medicines</td>
<td>3928</td>
<td>18.8</td>
</tr>
</tbody>
</table>

4.2 The use of inappropriate medicines

In this population 461 patients, which represents 17.4% of the whole population, used at least one inappropriate medicine or combination. There were only 23 patients (5%) that used 3 or more inappropriate medicines. Of all men 15.7% used at least one inappropriate and 18.8% of all women. In Table 3 and 4 all the inappropriate substances, substance groups, dose regimes and medicine combinations are presented. The most prescribed inappropriate substance/substance group were agents for incontinence, 2.9% of the whole population, followed by propiomazine, 2.4% of the whole population. The most prescribed medicines combination was 3 or more psychotropics. The least prescribed inappropriate medicine was codeine without paracetamol and the least prescribed inappropriate combination were cardio selective calcium antagonists in combination with a β-blocking agent.

Table 3. Description of the use of inappropriate medicines substance or substance group. Presenting number of patients using the medicine and the part of the whole population.

<table>
<thead>
<tr>
<th>Substance/Group</th>
<th>ATC-code</th>
<th>Patients (n)</th>
<th>Part of population (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tramadol</td>
<td>N02AX02</td>
<td>28</td>
<td>1.1</td>
</tr>
<tr>
<td>Diazepam</td>
<td>N05BA02</td>
<td>41</td>
<td>1.6</td>
</tr>
<tr>
<td>Nitrazepam</td>
<td>N05CD02</td>
<td>4</td>
<td>0.2</td>
</tr>
<tr>
<td>Flunitrazepam</td>
<td>N05CD03</td>
<td>12</td>
<td>0.5</td>
</tr>
<tr>
<td>Alimemazine</td>
<td>R06AD01</td>
<td>5</td>
<td>0.2</td>
</tr>
<tr>
<td>Non-selective monoamine reuptake inhibitors</td>
<td>N06AA</td>
<td>15</td>
<td>0.6</td>
</tr>
<tr>
<td>Levomepromazine</td>
<td>N05AA02</td>
<td>3</td>
<td>0.1</td>
</tr>
</tbody>
</table>
Propiomazine  N05CM06  64  2.4
Agents for incontinence and for controlling for the frequency of micturition  G04BD  78  2.9
Hydroxyzine  N05BB01  43  1.6
Propiomazine  R06AD02  12  0.5
Clementine  R06AA04  18  0.7
Codeine and paracetamol  N02AJ06  49  1.9
Codeine  R05DA04  1  0.04
Glibenclamide  A10BB01  8  0.3
Pioglitazone  A10BG03  3  0.1

Table 4. Description of the use of inappropriate dose regimes and medicine combinations. Presenting number of patients using the medicine and the part of the whole population.

As shown in Figure 2 women were those who used the most inappropriate medicines. Women 85 years or older used the most inappropriate medicines. The group that used the least of inappropriate medicines were men aged 65 to 74. The Figure also shows that patients between 75 to 84 years used the most inappropriate medicines. Women aged 85
years or older used a significantly (p<0.05) higher amount of inappropriate medicines than women aged 65-74 did.

![Figure 2: Use of inappropriate medicines, by gender and age.](image)

5 Discussion

This study showed that the use of polypharmacy among elderly is very common, which is consistent with previous research (9,65). In this study women were prescribed the highest number of medicines and the highest number of inappropriate medicines, especially the oldest women. These results agree with results of other studies that have been done within the field (66,67).

In our study there were 33% of men aged 75 or older who used at least 10 prescribed medicines and 47% among women in the same age group. Compared with the Swedish National Board of Health and Welfares’ open comparison between country councils in Sweden, patients in our study used more medicines than both the population in Uppsala and the whole population in Sweden (68). Their data showed that in Uppsala 12% of all men aged 75 years or older used at least 10 prescribed medicines and 13% of all women. Their comparison also showed that in the whole country 9.5% of men and 10.5% or women aged 75 years or older used 10 or more prescribed medicines (68). One reason for this is that our population is highly selected; including just hospitalized patients and not patients plus population of healthy elderly. Therefore, our results are, as
expected higher than in the comparison from The Swedish National Board of Health and Welfare.

The Swedish National Board of Health and Welfare also compared the use of inappropriate medicines. In our study 11% of all men aged 75 years or older and 14.3% of women used at least one inappropriate medicines compared with theirs results of 7.5% of men and 10.5% of women in Uppsala and 8% of men and 12% or women in Sweden (68). In this study when counting inappropriate medicines, no account has been taken for whether they have had several medicines of the same ATC-code or not. For instance, one depot tablet and one fast acting tablet or different strengths of the same medicine. Therefore, our result may be a bit higher than The Swedish National Board of Health and Welfares.

The limitations with this study were that we didn’t get to talk to the patients, so we couldn’t assure that the medicine lists were correct, and that the patient used everything or even more medicines. For the same reason we did not have information on the use of over the counter medicines. A strength of the study was that the study population was large and that the distribution between the groups was equal. It gives credibility to the significant values in this study.

The results in this study correspond with results from previous research. Despite that it’s important that we continue to do research on the use of medicines and inappropriate medicines in order to monitor the development of drug use. Further on more research should be done on how we can avoid adverse outcomes when using many medicines and how pharmacist can be useful in this question.

6 Conclusion
In conclusion, this report shows that many of our elderly have polypharmacy and that women are using more medicines than men and more inappropriate medicines than men. It also indicates that the older you get, the more medicines you use.
7 References


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