



# The Prevalence of Potentially Inappropriate Drug Prescription among Elderly Patients Registered in Balder Clinic in Åmål, Sweden

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## Abstract

**Background:** Medication is necessary for the treatments of illness, to maintain current health problems and to prevent further decline of health. However, it can be challenging to select the best treatment for a patient as several treatment options and several drug alternatives are available, particularly when prescribing to elderly patients. The Swedish National Board of Health and Welfare has developed some indicators to screen the quality of drug therapy among the elderly. These quality indicators show medications that have a high tendency for adverse drug effects when used by the elderly; it also recommends alternatives with low or no risk.

**Aim:** The aim of this study was to investigate the prevalence in prescribing potentially inappropriate drug to patients that are 75 years old or older registered at the Balder clinic in Åmål, Sweden.

**Methods:** Data was analyzed based on age, sex and number of prescribed drugs for patients 75 years or older who were registered in Balder clinic in Åmål, Sweden. The prescription pattern was followed from August 2015 – August 2016. All inappropriate drugs were identified and noted using the quality control guidelines from the Swedish National Board of Health and Welfare<sup>6</sup>. These include: benzodiazepines, anticholinergic drugs, three or more psychotropic drugs, NSAIDs and drug combinations that have the potential to be involved in drug-drug interactions, in particularly severe (D) interactions.

**Results:** The prevalence of inappropriate drug prescription (a drug is said to be inappropriate for treating older population when the risk for harmful effect outweighs the benefit for the person and there is a safer alternative with a better outcome) was in total 39.2% of which; the prescription of 3 or more psychotropic drugs was 18.5%, the prescription of drugs with anticholinergic properties 13.1%, NSAIDs 8.6%, long acting benzodiazepines 6.6% and potential drug-drug interaction 2.8%.

**Conclusion:** This study indicates that potentially inappropriate prescription is common among elderly patients at the Balder clinic in Åmål, Sweden. The adherence to the different prescribing quality indicators was not generally high. The use of more than 3 psychotropic drugs was high while drug with potential drug-drug interaction was low compared to the other quality indicators. Younger elderly patients (75-79 years) had a better quality of drug prescription compared with older elderly patients (80 years or more). Health care providers should be aware of the risk involved when a patient is exposed to such combinations. For elderly patients, medications should be evaluated at each patient visit to prevent unnecessary exposure to potentially harmful treatments.

**Keywords:** Inappropriate drug prescription, elderly, quality indicators

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# Introduction

Medication is necessary for treatments of sickness, to maintain current health problems and to prevent further decline of health. However, it can be challenging to select the best treatment for a patient as several treatment options and several drugs alternative are available, particularly when prescribing to elderly patients. Several characteristics of ageing affect prescribing and influences inappropriate drug use<sup>1,2</sup>. A drug is said to be inappropriate for treating older population when the risk for harmful effect outweighs the benefit for the person and there is a safer alternative with a better outcome<sup>1-3</sup>.

Potentially inappropriate prescription (PIP) is an important and preventable safety measure in the taking care of the elderly patients<sup>3</sup>. In order to identify PIPs several screening tools have been developed. The first is the Beer's list, published in the United States in 1991, it includes medications that should be avoided when treating elderly patients. Its limitations were its focus only on the drugs in the American market and restriction to potential inappropriate medications. Other screening tools were subsequently developed in several countries with the aim of improving medical quality and of minimizing the use of inappropriate drugs which result in adverse effects<sup>4</sup>. Quality indicators are used worldwide and believed to be effective in promoting quality healthcare. They differ slightly in terms of target population and structure but they all aim at improving the care routine of the elderly.

In 2004, the Swedish National Board of Health and Welfare introduced some indicators to evaluate the quality of drug therapy among the older population<sup>5</sup>. In 2010 the quality indicators were updated. The updated indicator was meant to apply for patients that are 75 years or older regardless of their level of frailty or where they lived in Sweden. The quality indicators are in two groups: Drug-specific and diagnosis-specific indicators. In this study my focus is on drug-specific indicators, which cover areas like polypharmacy, drug-drug interactions, dosage of drugs, choice of drugs for indications and drugs that need dose adjustment in renal impairment. These indicators act as guidelines for physicians when prescribing medications for the elderly. Table 1 shows examples of drugs that should be avoided, except when specific reasons exist.

Table. 1 Examples of drug in ATC code that should be avoided, except when specific reasons exist<sup>6</sup>.

## **Indicators**

Proportion (percent) of individual using

1. Long acting benzodiazepines (N05BA01, N05CD02, N05CD03)
2. Drug with significant anticholinergic properties (N04A, N06AA, N05BB01 etc)
3. Tramadol (N02AX02)
4. Propiomazine

**Standard:** Proportion (percent individuals) should be as low as possible

Reports has shown significate decreases in the use of inappropriate medication since the introduction of quality indicators in 2004 but lots more attention is still needed in this area<sup>6,7</sup>

Table 2. The Swedish indicators for quality of drug therapy for elderly, version 2010<sup>6</sup>.

Indicators	No. of items	Examples
<b>1. Drug-specific indicators</b>		
1.1 Drug that should be avoided unless specific reasons exist	4	Long-acting benzodiazepines, drugs with anticholinergic effect and tramadol
1.2 Drug for which the use requires a correct and current indication	8	NSAIDS, opioids, SSRIs, antipsychotics and proton pump inhibitors
1.3 Inappropriate dosage regimen	6	Hypnotics, > 1 month of regular use. Antiepileptics, > 1 year without review, antipsychotics, > 3 months without review
1.4 Inappropriate daily dose	6	Low dose ASA, daily dose > 75 mg, Risperidone, daily dose > 1.5 mg and Oxazepam, daily dose > 30mg
1.5 Polypharmacy	2	
Use of ten or more drugs		
Use of three or more psychotropic drugs		
Drug duplication		Two or more opioids or hypnotics
1.6 Drug combination that may lead to clinically relevant drug-drug interaction	1	Potassium plus potassium-sparing agents. Warfarin plus NSAID
1.7 Drug use and renal function	1	Metformin, digoxin, potassium-sparing diuretics, atenolol
1.8 Drug use and certain symptom. Symptomatic orthostatic hypotension. Falls and cognitive impairment	3	Calcium channel blockers antipsychotics, diuretics, hypnotics, antidepressant. Anticholinergic drug, opioids, antiepileptics
1.9 Psychotropic drugs and inappropriate anxiolytics and hypnotics	2	Diazepam, propiomazine
<b>2. Diagnosis-specific indicators</b>		
2.1 Hypertension	4	Hazardous cardioselective calcium blockers
2.5 Diabetes, type 2	4	Hazardous metformin with estimated GFR<60 ml/min
2.6 Gastroesophageal reflux disease and peptic ulcer disease	5	Hazardous NSAID with history of GERD
2.7 Urinary tract infection	8	Hazardous quinolone antibacterials
2.8 Pain	6	Hazardous NSAIDs – continuous treatment of tramadol
2.9 Dementia	5	Hazardous drug with anticholinergic properties.
2.10 Depression	2	Irrational prescription of anxiolytics and hypnotics without antidepressant treatment
2.11 Sleep disturbance	6	Hazardous propiomazine, alimemazine, hydroxyzine and promethazine

## Challenges in prescribing medications for elderly

Prescribing of drug for elderly population is a fundamental component of their care. This can be challenging, as lots of factors has to be considered. The aging process itself can be linked to decrease in pharmacokinetics and pharmacodynamics. These changes can alter drug handling in respect to hepatic elimination and renal excretion, thus affecting the choice of drug, dosage and administration<sup>8</sup>. This is why elderly are referred to as a 'special population'<sup>4</sup>.

Aging decreases the hepatic volume and hepatic blood flow of an individual. The clearance of drugs and other substrates by the liver depends on the hepatic blood flow, activity of metabolizing enzymes and protein binding. Decrease in drug metabolism can be directly related to decrease in blood flow to the liver. This in turn affects the rate of drug elimination and exposes the individual to high level of drug and can cause adverse drug reactions. Renal excretion of drugs by glomerular filtration and kidney secretion decreases with age. Individual follow-up is recommended to guide dosage of medication to prevent adverse negative effect due to great inter-individual differences in response to drug use, as ageing itself is associated with individual decreased in renal function<sup>9,10</sup>.

## Polypharmacy

High age is often associated with multiple diseases. Multiple disease increases the risk for polypharmacy. According to the drug-specific quality indicators published in 2010 by the Swedish National Board of Health and Welfare, polypharmacy is defined as the use of 10 or more medications and the use of more than 3 psychotropic drugs<sup>6</sup>. Polypharmacy and inappropriate drug prescription is a significant issue among the elderly population. It can be appropriate in some older individuals. However, polypharmacy often result to increase morbidity, mortality and increased cost of health care when used wrongly<sup>16</sup>. This can be challenging for health care givers to follow up and poses a major patient safety concern for the older population.

## Drug Quality indicators

One ways to easily identify potentially inappropriate prescription (PIP) in elderly population is to use quality indications. These quality indicators show medications that have a high tendency for adverse drug effects when used by elderly, and also recommend alternatives with low or no risk<sup>5-11</sup>.

Using a selection of the quality indicators published in 2010 by the Swedish National Board of Health and Welfare, inappropriate drug use was defined as the use of any of the medication in Table 3<sup>6</sup>.

Table 3. Inappropriate drugs for the elderly<sup>5-12,21</sup>.

Quality indicators	Examples	Reasons
1. Long acting benzodiazepines	Diazepam, Flunitrazepam and Nitrazepam	Increase age have effect on liver function and thus increases negative side effects associated with these drugs like daytime sleepiness, cognitive disorders, muscle weakness and balance disorders among elderly patients. It increases fall risk and should be avoided.
2. Drug with anticholinergic properties	Atarax, Saroten, Vesicare, Theralen etc.	Drug with anticholinergic properties which includes antihistamines, cyclic antidepressants, urinary and gastrointestinal antispasmodics, anticholinergic and anti-parkinsonian drugs and low potency

		antipsychotics. These group of medication is associated with anticholinergic effects and increases risk for confusion, urinary retention, dry mouth and constipation.
3. The use of 3 or more psychotropic drugs	Imovane, Mirtazapine, Propavan, Oxascand, Sertraline etc.	The use of 3 or more psychotropic drugs from any of the groups that includes, antidepressant, hypnotic-sedatives, antipsychotics and anxiolytic.
4. NSAIDs	Naproxen, Diclofenak, Brufen, Pronaxen, Celebra, etc.	These drug increase risk for gastrointestinal bleeding and acute kidney problem in old people.
5. Drug-drug interactions	D-interactions between Warfarin and NSAIDs.	Drug-drug interactions are divided to type A, type B, type C and type D depending on their clinical relevance. Type A has probably no clinical relevance, type B clinical relevance not yet established, type C has clinical relevant but may be controlled by individual dosage and type D has clinica relevance and should be avoided. The potential drug-drug interactions that will be considered in this study is D interaction <sup>21</sup> . Drug combinations that result to D interaction should be avoided.

Prescription quality have to be of ultimate attention when prescribing to patients with multiple disorder or elderly population to avoid PIP and drug-drug interactions<sup>5-11</sup>. The role of a pharmacist worldwide is to ensure safe, effective and rational use of medication<sup>17</sup>. Studies have shown that medical interventions chosen by physicians and nurses together with clinical pharmacist have been effective in reducing the use of inappropriate drugs and have resulted in a decrease in drug-drug interactions among older patients<sup>17,18</sup>. Despite the efforts to improve the prescription quality of drug to the older population, the health sector has to select an effective strategy to minimize the use of inappropriate drugs<sup>19</sup>. There is a need of control of the prescription pattern in health care system that provide health care for elderly patients as this can lead to effective treatment alternative for them<sup>20</sup>. Our study at Balder clinic in Åmål was initiated in this context.

## Aim of the study

The aim of this study was to investigate the prevalence in prescribing potentially inappropriate drug to elderly patients registered in Balder clinic in Åmål, Sweden. Balder clinic provides health care for about eight thousand residence in Åmål municipality in Sweden. It is a private clinic with about 20 doctors.

The questions this study aim to address are:



- What is prevalence of the prescription of potentially inappropriate drug among elderly patients registered in Balder clinic in Åmål.
- Is there a correlation between age and the prescription of inappropriate drugs?
- Does gender play a role in the risk of elderly getting an inappropriate prescription?
- What is the most common PIP often prescribed by physician`s among the five quality indicator?

## Methods

### Ethics committee approval

Approval by the ethical review board in Stockholm was not necessary for this project.

Approval was obtained from the head physician in Balder clinic, Åmål. All personal information of the patients involved in the study was handled with care. If needed the clinic will contact each individual

### Study design and study population

This is a cohort study based on a population of elderly patients that are aged 75 years or more. There were 1499 patients 75 years or older registered in Balder clinic on September 30, 2016. Patients included in the study if they were 75 years or older and have been prescribed at least ten medications by any physician working in Balder clinic within the period August 2015 to August 2016. A total of 395 (26%) patients met the inclusion criteria and were included in the analysis. A total of 1104 (74%) patients were excluded from the study because they had less than 10 medications or were deceased at the time of data collection. Thus, our study population represents 26% of the elderly registered in Balder clinic Åmål. Balder clinic has a drug register that contain individual-base data for all prescription to all the individuals registered in the clinic. I conducted analysis based on sex, age and the number of prescribed medications for patients 75 years or more that are registered and receive treatments from Balder clinic Åmål, Sweden. The population prescription records were controlled for a period of one year.

### Measurements

Data were obtained from the patient`s personal medical journals. No additional information about indication or diagnoses were obtained from the patient`s medical journals because of lack of time. All inappropriate drugs where identified and noted using the quality control from the Swedish National Board of Health and Welfare (Table 3)<sup>6</sup>. D interactions were determined using the Swedish and Finish drug-drug interaction database (SFINX)<sup>21</sup>. Inappropriate drug prescription was defined as the prescription of one or more of the five quality indicators. Low proportion of patients with these indicators indicates good prescribing quality. For easy analysis data, the patient`s age was grouped into four age categories: 75-79, 80-84, 85-89 and 90 and older.

### Statistical analysis

Statistical analysis was performed using Excel 2013 to describe the study population, with categorical data shown as frequencies. The prevalence of PIPs using the Swedish quality indicators was calculated, and the most common PIP was reported. Chi squared and Fisher`s exact tests were calculated online using the calculators available at <http://www.socscistatistics.com/test/Default.aspx> to determine if gender is associated with inappropriate prescription.

## Results

Data were collected from 395 elderly patients that met the inclusion criteria. The main characteristics of the study population are presented in Table 4. Of these patients 264 (67%) were women and 131 (33%) were men. The mean age of the patients was 85 and ranges between 75 and 105 years. The total number of prescription for these patients was 4823, with a range varying from 10 to 20 prescriptions per person. The mean number of prescription per person was 12. The overall prevalence of PIP (a drug is said to be inappropriate for treating older population when the risk for harmful effect outweighs the benefit for the person and there is a safer alternative with a better outcome) in the study period, using the five quality indicators on the data collected, was 39.2%. A total of 196 PIPs were detected in 395 participants. A total of 155 patients were prescribed one potentially inappropriate prescription, 29 patients were prescribed two potentially inappropriate prescriptions and 6 patients were prescribed three potentially inappropriate prescriptions. Elderly patients 90 years or more were more likely to be exposed to at least one potentially inappropriate prescription than the other age groups (75-79, 80-84 and 85-89)  $p=0.009$  (Chi-square test). Overall, 40.1% of the women and 37.4% of the men were exposed to inappropriate prescription. The Fisher exact test did not give a significant value to show that women had more risk to being prescribe potentially inappropriate prescription than men,  $p=0.66$ .

Table 4. The characteristics of the study population

<i>Characteristic</i>	<i>Total no. of participants</i>	<i>No. of participants with PIPs</i>	<i>Prevalence of PIPs (%)</i>
<i>Age (years)</i>			
75 -79	72	25	34.7
80 – 84	123	48	39.0
85 – 89	115	36	31.3
≥ 90	85	46	54.1
<i>Gender</i>			
Men	131	49	37.4
Women	264	106	40.1
<i>No. of prescribed drug</i>			
≥ 10	395	155	39.2

Table 5, shows how the prescription were distributed among men and women in the different age groups. Gender did not influence inappropriate prescription in the different age groups ( $P=1, 0.85, 0.67$ , and  $0.82$  for 75-79, 80-84, 85-89 and  $\geq 90$  years age groups, respectively, Fisher's exact test).

Table 5. Number of inappropriate drug prescription stratified by age and gender

<b>Age</b>	<b>Women with PIP, n (%)</b>	<b>Men with PIP, n (%)</b>
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75 -79	17 (34.0)	08 (36.4)
80 – 84	30 (40.0)	18 (37.5)
85 – 89	25 (33.3)	11 (27.5)
≥ 90	34 (53.1)	12 (57.1)

N= 395

The distribution of each quality indicator in the different genders is as shown in Table 6. It indicates that gender has no influence on any of the quality indicator. Both genders are exposed to equal probability of being prescribed potentially inappropriate prescription. P=0.5, 0.6 and 0.6 (Fisher's exact test) for benzodiazepines, the prescription of 3 or more psychotropic drugs and drugs with anticholinergic properties respectively.

Table 6. The prevalence of the 5 quality indicators in the different genders

Prescription	Women, n (%)	Men, n (%)
Anticholinergic drugs	36 (13.6)	15 (11.5)
Long-acting benzodiazepines	16 (06.1)	10 (07.6)
≥3 Psychotropic drugs	51 (19.3)	22 (16.7)
NSAIDs	16 (06.1)	08 (06.1)
Potential drug-drug interaction	07 (02.7)	04 (03.1)

The total number of women and men, 264 respectively 131

NSAIDs= nonsteroidal anti-inflammatory drugs.

Table 7 describes the prevalence for each of the five quality indicators. The most common potentially inappropriate prescription is the use of 3 or more psychotropic (73 patients, 18.5%), followed by the prescription of drugs with anticholinergic properties (52 patients, 13.1%), NSAIDs (34 patients, 8.6%), long acting benzodiazepines (26 patients, 6.6%) and potential drug-drug interaction (11 patients 2.8%).

Table 7. The most common PIPs prescribed by the physicians in Balder clinic

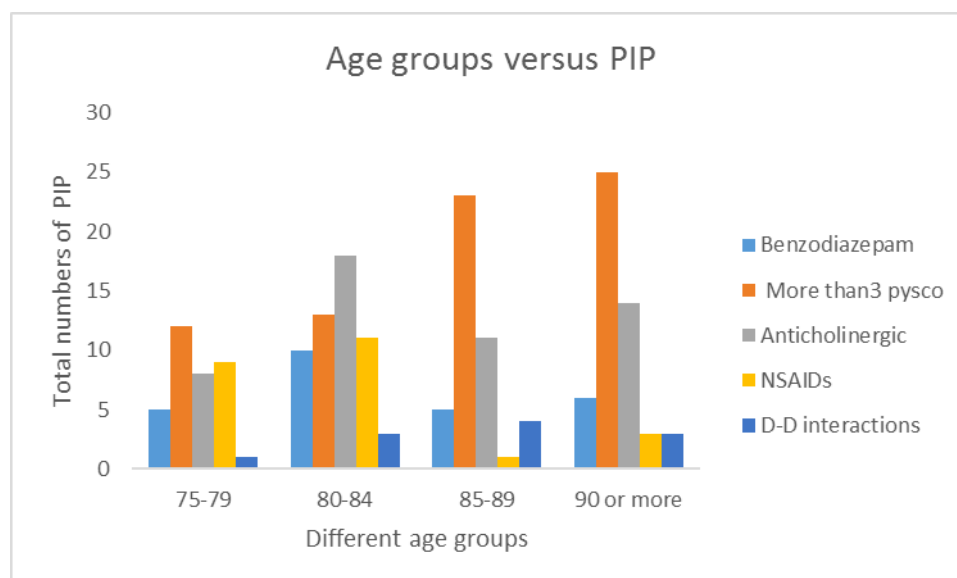
Most common potentially inappropriate prescription (PIPs) based on the Swedish National Board of Health and Welfare		
Inappropriate drug	No. of Patients	Percentage
Anticholinergic drugs	52	13,1
Long-acting benzodiazepines	26	6,6
≥3 Psychotropic drugs	73	18,5
NSAIDs	34	8,6
Drug-drug interactions	11	2,8

The total number of women and men, 264 respectively 131

NSAIDs= nonsteroidal anti-inflammatory drugs.

Figure.1 shows the distribution of the number of PIP detected per patient in the different age groups, using the Swedish quality indicator of health and welfare. The prescription of 3 or more psychotropic drugs was high among the older elderly (age groups 85-89 and 90 years or more),  $P=0.007$ , Chi square test. NSAIDs prescriptions was low among the older elderly patients (age groups 85-89 and 90 years or more) and high in younger elderly age groups 75-79 and 80-84,  $P=0.008$ , Chi square test.

Figure.1 The distribution of potentially inappropriate prescription in the different age groups



PIP = potentially inappropriate prescription

NSAIDs = nonsteroidal anti-inflammatory drugs.

Light blue bar, orange bar, grey bar, yellow bar and dark blue bar represent the prescriptions of Benzodiazepines, 3 or more psychotropic drugs, drugs with anticholinergic properties, nonsteroidal anti-inflammatory drugs and D-type drug – drug interaction respectively.

## Discussion

A total of 395 patients from the initial population of elderly (1499) were included in the study because they met the inclusion criteria. After following the prescription of the patients from August 2015 to August 2016, the main findings was a high prevalence of inappropriate drug prescribing. The prevalence of potentially inappropriate prescription in the study population using the Swedish quality indicator was 39.2%. As many as one in three patients were exposed to inappropriate drug prescription. This indicates that elderly patients registered in Balder clinic in Åmål, Sweden are exposed to potentially inappropriate drug prescribing. Even though the study population represent 29% of the elderly patients receiving health care from Balder clinic in Åmål, the result reveals a modest picture of the prescription pattern in the Balder clinic and it also indicate that 29% of elderly registered in the clinic is exposed to excessive polypharmacy. The continuity of a prescriber on a patient was rare.

At least two different prescribers were involved in prescribing medication for majority of the patients in the study population. Poor continuity of contact with just one health care provider can easily expose patients to polypharmacy or potentially inappropriate prescription.

### **Extent of potentially inappropriate prescription**

In Sweden, reports have shown that polypharmacy, excessive polypharmacy and the use of inappropriate medications among elderly persons is common<sup>21,22</sup>. There are many consequences that can be related to polypharmacy. Elderly patients are at a higher risk of being prescribed potentially inappropriate medications that can cause adverse drug reactions and can also affect their compliance. Polypharmacy when unnecessary is not cost effective and as such health care providers should fully evaluate patient medications to ensure that polypharmacy does not lead to unnecessary cost or other health issues. Approximately one out of three patients in this study population were exposed to polypharmacy.

The study shows an age-related difference in the prevalence of inappropriate prescription among elderly. Among the different age groups, the younger elderly (75-79 years) patients generally had lower prevalence of inappropriate prescription when compared to persons that were 90 years or more. This result confirms a similar study carried out in the northeastern part of Skåne in Sweden.<sup>26</sup> The high prevalence of inappropriate prescription among elderly can be as a result of lack of awareness of the potential risk on the patients by the physicians, lack of comprehensive medical reviews for the patients, lack of counseling by the pharmacist when medications were dispensed and lack of awareness of from the elderly patients. In some cases the physician may be stuck in old prescribing pattern of inappropriate medication and finds it almost impossible to make new and effective changes<sup>27-29,33</sup>

Previous studies have showed that women had a greater likelihood to be prescribe inappropriate medications<sup>30,31</sup>. In this study, gender had no influence on the prescription of inappropriate prescription. The possible explanation to the difference in this study is not conclusive. But in studies where women were more exposed to inappropriate prescription, possible reasons given was that women are quick to complain about health conditions more often than men, the load of family responsibility as a woman and that the ways in which women communicate health situations to their health care providers<sup>30-32</sup>.

A safe prescription system for elderly patients should include the decision to indicate a drug, deciding on the best drug option, determining a dose and monitoring the patient for effective outcome. It is also necessary to educate elderly patients about possible side effects and indication for seeking consultation necessary. Polypharmacy and inappropriate prescription cause many adverse drug reactions that are sometimes life threatening. Side effects are often a result of inappropriate prescriptions. The possibility of an adverse drug reaction should always be considered when treating an elderly patient, and all new symptoms should be seen as drug related until proven otherwise<sup>39-41</sup>.

### **Prescribing Quality Indicators**

#### ***Three or more psychotropic drugs***

The quality indicator of prescription of three or more psychotropic drugs was extensively prescribed among elderly patients. Previous studies of elderly patients in Sweden have reported even higher prevalence in the prescription of 3 or more psychotropic drugs<sup>34-36</sup>. The prevalence in the prescription

of 3 or more psychotropic drug was consistent with age. It was low among the younger patients and very high among patients 90 years or more. However, it should be noted that some of the psychotropic drug in the study were prescribed with dosage to use as-when needed. The full extent to which patients had used their medications is not known. Among the psychotropic drugs, the prescription of antidepressant drugs was common, followed by insomnia and medications for anxiety. It is not clear if the increase in psychotropic drugs prescription is as a result of the health care giver efforts to find which drug combination that has best effects.

### ***Drugs with anticholinergic properties***

About 13 percent of the study population were prescribed drugs with strong anticholinergic properties. Among the drugs prescribed antipruritic (medication that inhibits itching or allergy) like Atarax, Theralen and Lergigan were the most frequent anticholinergic drug prescribed, followed by urinary antispasmodics and nonselective monoamine reuptake inhibitors (tricyclic antidepressants). These findings are also similar to a study that showed that this type of medication was largely among women and that there was a high prevalence of incontinence among patients exposed to anticholinergic medication<sup>37</sup>. Explanation for high prescribing of anticholinergic drugs is primarily due to the use of antipruritic medication and the introduction of new urinary antispasmodic drugs.

### ***Long-acting benzodiazepines***

A total of 6,6 percent of the study population were prescribed long acting benzodiazepines. The prescription of long acting benzodiazepines was relatively high in all age groups but more frequent in age groups 80 – 84 years. The frequency is low when compared to previous studies but the result also indicates a significant increase in the prevalence in the prescriptions of long acting benzodiazepines among elderly<sup>12,25</sup>. This decrease in the frequency of patients been prescribed long acting benzodiazepines may be due to awareness by the physicians about the implications of such prescriptions such as increase risk to fall and dizziness<sup>25</sup>.

### ***NSAIDs***

The frequency in prescription of NSAIDs was extremely high among age groups 75-79 and 80-84 years and very low in age groups 85-89 and 90 years or older. Old people are often vulnerable to pain and this increases with age. The increase in prescription among the young elderly may be due to old prescription pattern. The major concerns in the prescription of NSAIDs among older population is nephrotoxicity, cardiovascular risk, drug-drug interactions and gastrointestinal toxicity. NSAIDs gastrointestinal toxicity increases in frequency and severity with increase in age<sup>37</sup>. A recent study showed limited evidence indicating that any of the NSAIDs are safer for older adults than the other. Adverse effects are found in all the groups of NSAIDs<sup>38</sup>.

### ***Potential Drug-Drug interactions***

This study considered only class D-interactions that are clinically important according to the Pharmaceutical Specialities in Sweden (FASS) drug formulary. The frequency of study population with class D interaction (2.8%) is low when compare to previous studies in Sweden<sup>12,36</sup>. The most common D interaction was between Warfarin and Tramadol followed by the prescription of a potassium sparing diuretic like Spironolactone with potassium supplements or Enalapril.

### ***Causes of potentially inappropriate prescription***

Minimizing the prevalence of potential inappropriate prescription is important as it may have positive health outcomes. Several factors are associated with potential inappropriate prescription among elderly patients. These can be divided into categories of condition of the patient factor, the prescriber factor and work-environment factor<sup>39,40</sup>.

Some patients have the tendency to influence their prescriptions decisions based on their expectations. Most times inappropriate prescription originate from the inability of the elderly patients to explain their health issues to their health care giver particularly those patients with complex health issues or daily medication.

Prescription decisions are mainly done by the physicians and their own clinical experience. In a situation where the physicians have very little knowledge or training in geriatric pharmacotherapy this can be lead to inappropriate prescription. Everyone who prescribes for elderly patients needs to be aware of the physiological changes that occurs with aging which can affect drug pharmacokinetics and pharmacodynamics.

The environment in which the prescriber operates can also affect his or her decision when prescribing medication. Health care givers often work in busy and stressful environments, with distractions that may affect their decisions while prescribing. Sufficient staffing, sufficient time for prescribing and comfortable work load can have positive effect on patient's health care<sup>39</sup>.

## **Methods to reduce inappropriate prescription**

### ***Education***

Education is an important tool that can be used to reduce inappropriate medication among elderly patients. The fact that older patients are easily exposed to inappropriate prescription, makes it is important that medical students and doctors receive adequate training in geriatric medicine and geriatric pharmacotherapy, regardless of the career path they choose. It is of important that information of the risks and benefits of medication in elderly patients are made available to both elderly patients and to physicians<sup>42</sup>.

### ***Pharmacist involvement***

Involvement of other health staff like pharmacists can help in identifying inappropriate prescription. In Sweden, the pharmacy has a computer-based system that can easily identify inappropriate prescriptions when used by a pharmacist. After identification of the inappropriate prescription, the next step is to advice the physician involved on how to correct the prescription. When pharmacist's recommendations are taken into consideration, there will be improvements in patient outcomes. Prescribing will no longer be a solitary activity undertaken by only physicians<sup>39,40</sup>. The quality of prescription will improve positively when prescribers and other health care professionals work together to improve care of patients.

### ***Medical reviews***

Similarly, a positive approach towards improving prescription for elderly patients include periodic reviews of current drug therapy, discontinuation of unnecessary prescriptions, prescription of medication with the lowest possible effective dose and the sole use of safe and beneficial medications<sup>41</sup>. It is also important for the patient to inform health care providers of any other medications that they are using, both prescribed and nonprescribed medications. If possible, such medication can be brought with patient to all health care provider visits. Such information is useful for the prescriber to make decisions that minimize risk and benefit the patient.

The involvement of patients or their carers in making these decisions, especially in frail elderly patients, can help in both patient's decisions to use medication and to communicate better with the physician<sup>42,43</sup>.

### **Work environment**

The situation of the working environment of a physician has effects on how well he/she prescribes. Insufficient staffing, poor communication, large workloads and reduced supervision can be negative contributing factors<sup>41,42</sup>. Another way to improve good prescription practice is to encourage all prescribers, irrespective of how long they have been in practice, to check all prescriptions for correct dose, drug -drug interactions, correct formulation, treatment duration and correct mode of delivery. When inappropriate prescriptions occur, particularly those with significant clinical consequences, they should be reported and discussed among themselves as a group. This encourages learning opportunities and minimizes similar error in future<sup>42</sup>.

### **Prescribing tools**

There are several prescribing quality assessment tools. The quality indicators published in 2010 by the Swedish National Board of Health and Welfare are designed to detect preventable potentially inappropriate prescriptions. Routine application of the quality indicators can significantly reduce the average number of unnecessary prescriptions been prescribed to elderly patients, reduce drug cost and minimize adverse drug related problems<sup>42</sup>.

## **Limitations and strengths of this study**

This is the first study done to investigate the prevalence of inappropriate drug prescription among elderly patients registered in Balder clinic Åmål in Sweden. The results from this study should be interpreted with care because information on medical records or diagnosis were not considered. One important limitation of this study is that not all the elderly patients registered in Balder clinic were involved in the study population and the study does not cover all the Swedish quality indicators of inappropriate drug therapies among the elderly. Secondly, even though the Swedish quality indicators are widely used in Sweden, there are cases where medications classified as potentially inappropriate medications can be considered because of the patient's condition. Moreover, there were no follow ups on relationship of patient, health care provider, visit characteristics to the prescription of these medication and to check if the patients used the prescribed potentially inappropriate medications. The effect of the patients excluded from the study population on the result is unknown and there might have been explainable reasons for some of the potentially inappropriate drug prescribed. Finally, only detailed information on prescription from Balder clinic were considered, I had no access to prescription information from other clinic where some patients may be receiving treatments like dental care, or from specialist hospitals.

The strength of this study includes its large population size and the use of a computerized prescription data base system to evaluate the prevalence of potentially inappropriate medications. The accuracy of the result is higher than just relying on patient information on their medications. The one-year follow up was another important strength in this study to monitor prescription pattern.

A lot of elderly patients are suffering because of avoidable complications resulting from inappropriate prescription. There is need for change, the doctor-pharmacist working relationship is of importance to achieve the best treatment options for elderly patients even though most of the time doctors don't like to listen to pharmacist. I hope this project helps to encourage doctor-pharmacist relationship



between doctors at Balder clinic and the need for interventions like yearly medical reviews on elderly patient.

It was interesting to see how Chi test or Fisher test showed no association between gender and inappropriate prescription in the study population. I would have drawn wrong conclusion if I had relied only on just my calculation from excel.

## **Conclusions**

This study shows that potentially inappropriate prescription is common among elderly patients registered in Balder clinic in Åmål, Sweden, which corresponds to previous findings of previous studies in Sweden. The prevalence of the different prescribing quality indicators was not generally high. The use of more than 3 psychotropic was high while the prescription of drug with potential drug-drug interaction was low compared to the other quality indicators. Younger elderly (75-79 years) had a better quality of drug prescription compared with older elderly patients (80 years and more). Inappropriate prescription was found to be common among women than men. In general, interventions are needed to decrease the prescription of potentially inappropriate prescription among elderly patients in Balder clinic. Several factors are associated with prescribing a potential inappropriate medication among elderly patients. These factors can be divided into categories of condition of the patient factor, the prescriber factor and work-environment factor. When these factors are improved, together with the involvement of other health care staff like pharmacist a better health care system can be achieved for elderly patients.

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