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Polypharmacy and
Inappropriate Drug Use among Elderly Patients
admitted to a Short-Term Nursing Home in
Örebro

Version 2

Author: Martina Aaro, Bachelor of medicine

Supervisor: Åsa Andersson, RPT, PhD

Department of Geriatric Medicine

Örebro University Hospital

Örebro, Sweden

ABSTRACT

Introduction

Aging affects multiple organs, pharmacokinetic processes and pharmacodynamic processes. Older people, taking prescribed drugs are exposed to an increased risk for adverse events. Especially for a certain group of drugs, sometimes referred to as inappropriate drug use (IDU).

Aim

To investigate the number of drugs and IDU among patients entering a short-term nursing home called Tullhuset, and to evaluate how often a valid indication for each patient with IDU can be found. Finally the study will investigate potential differences between patients with IDU and patients without.

Methods

The study was designed as a retrospective study evaluating clinical practice using medical records, and was carried out at the department of Geriatric medicine at Örebro University Hospital. Patients entering Tullhuset from the 15th of August to the 14th of October in 2016 were included, after discharge from hospitals in the region Örebro län.

Results

A total of 57 patients were included in the study. The mean age was 83 years and the mean number of secondary diagnoses was four. The prevalence of polypharmacy was 96%, and 56% for excessive polypharmacy. There were 49% with IDU, and a valid indication was found in 57% of these cases. Institutional housing was found to be significantly higher among those with IDU.

Conclusion

A majority of the patients entering Tullhuset fulfilled the criterion for polypharmacy, and even for excessive polypharmacy. The IDU was also high and a valid indication was frequently absent, suggesting that several patients had not suitable drug therapies. However, as long as a valid indication for IDU is documented, then its use in elderly patients is acceptable. Nevertheless, our results indicate that there are areas to improve when optimising geriatric care in region Örebro län, and to keep the number of drug therapies to a minimum.

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INTRODUCTION

The population in the world is aging. Numerous countries are facing new challenges due to the growing proportion of the elderly [1]. Sweden has one of the highest life expectancies in the world [2]. In 2014 almost 20 % of the Swedish population were 65 years or older and this proportion is expected to increase to 25 % in year 2060, according to Statistics Sweden [3].

The aging process increases the risk of developing various chronic disorders [4]. The coexistence of a certain number of chronic disorders (usually two or three) is commonly termed multimorbidity [4-6]. Drug treatments are essential to maintain health and improve quality of life. However, there are many drug-related problems among older people causing unnecessary suffering, which also influences costs of care. Short-termed solutions are common when treating different symptoms among the elderly and there is often a lack of a holistic view. It is essential to constantly re-evaluate the indication for each drug treatment [2].

The elderly (65 years or older) consume 40% of the prescribed drugs and the number of prescriptions has doubled during the last 20 years among people 75 years or older. The average drug regimen in this age group is more than five drugs per person [2], commonly defined as polypharmacy. Excessive polypharmacy is often defined as the simultaneous use of ten or more drugs [7-9]. A significant proportion of an elderly patient's life is affected by polypharmacy [10]. The number of drugs is a definitive risk factor for adverse events and drug-related interactions, which increases the risk for inappropriate drug use and decreases compliance [8]. Excessive polypharmacy should therefore be considered a warning sign of an inappropriate drug treatment [8,11].

Aging affects multiple organs, pharmacodynamic- and pharmacokinetic processes. A decline in cognitive function is associated with aging, potentially impairing the ability to complete everyday tasks independently and accurately [12-14]. The number of glomeruli in the kidney decreases, causing a decline in the glomerular filtration rate, which affects the ability to eliminate water-soluble drugs [14,15]. Increasing age may also cause significant changes in the body composition. Skeletal muscle mass and

total body water decreases, with a contrasting increase in body fat. This results in increased half-life of lipid-soluble drugs [14].

Due to the many physiological changes associated with aging, certain groups of drugs become inappropriate for the elderly to use, sometimes referred to as inappropriate drug use (IDU) [16,17]. Falls and hip fractures are commonly caused by benzodiazepines due to their sedative effect [2]. Long-acting benzodiazepines also induce a risk for “hangover effect” and daily drowsiness [18]. Cognition disorders and confusion are common side effects of anticholinergic drugs, including drugs preventing incontinence and some psychopharmacological drugs, among the elderly [2]. Codeine and tramadol induce risk for vertigo and nausea [19]. Nonsteroidal anti-inflammatory drugs (NSAID) consumption results in increased risk for gastric haemorrhage, and impaired heart function and renal failure [2,18,20]. Propiomazine is also important to avoid among the elderly as it may cause day sleepiness and extrapyramidal adverse effects, for example restless legs [18]. Zolpidem induces increased risk of nightly confusion [19]. The use of Neuroleptics results in a significant risk for extrapyramidal symptoms [21], cognitive disorders, sedation and orthostatism [19]. Selective Serotonin Reuptake Inhibitors (SSRI) drugs induce risk of falls [20].

Previous studies have shown that an increased number of drugs may result in a greater likelihood for IDU [11,16,22,23]. According to Bergman et al, increasing number of prescribers per resident tend to result in a higher number of drugs prescribed, and is associated with a lower quality of drug therapy [24]. Previous studies have also suggested that IDU is more common among women than men [16,25]. All factors discussed above are important to consider when prescribing new drugs to the elderly, as well as for medical reconciliations. This topic is of great importance, it is no less relevant in the region Örebro län, where 21,2% were 65 years or older in year 2015 [26].

Aim of the study

Patients in Örebro are sometimes discharged from the hospitals in region Örebro län to a short-term nursing home called Tullhuset, which opened the 14th of November in 2014, where geriatricians are available. The aim of this study is to investigate the

number of drugs and the IDU among these patients, and to evaluate how often a valid indication for each patient with IDU can be found. Finally, this study will investigate if there are any potential differences between patients with inappropriate drugs and patients without.

MATERIAL AND METHOD

This study was designed as a retrospective study evaluating clinical practice using medical records, and was carried out at the department of Geriatric medicine at Örebro University Hospital. The study was part of a two-year follow-up protocol to investigate how geriatric care is conducted at a nursing home called Tullhuset.

Participants: Patients included were those entering Tullhuset from the 15th of August to the 14th of October in 2016, after discharge from hospitals in region Örebro län. Exclusion criteria were patients younger than 65 years old and those admitted directly from their households, due to the lack of medical records.

Study procedure: A structured protocol of all included patients was completed through information from the database “Kliniska Portalen”, the software containing medical records. The same person collected and evaluated all data.

Information regarding number of drugs and current medications was primarily collected from the discharge summary from the hospitals. If current medications were missing, the information was collected from the electronic drug administration system. Parameters of interest were also sex, age, main diagnosis and number of secondary diagnoses.

The patient was considered exposed to IDU if any inappropriate drugs were found on the list of current medications. If the indication for the IDU was documented in the medical records and seemed reasonable, it was considered a valid indication. The search for a valid indication for each patient with IDU was mainly accomplished in current documentation of the hospital stay, however, if no indication was found, medical records from previous hospital admissions and primary care consultations were also used.

In this study elderly patients were defined as 65 years or older. Multimorbidity was described as the number of secondary diagnoses, and partly as the occurrence of diagnoses in three or more organ systems. Polypharmacy was defined as five or more drugs per patient at the same time, and excessive polypharmacy as ten or more drugs [8]. IDU was defined as drugs that should be prescribed restrictively to the elderly, according to the regional Drug Therapeutic Committee (DTC) in Örebro (Long acting benzodiazepines, anticholinergics, Codeine, Tramadol, NSAID, Propiomazin and Zolpidem) [19]. This list of drugs represents current guidelines used at the hospitals in region Örebro län, regarding IDU among the elderly. A few other drugs were also considered as IDU, according to the National board of Health and Welfare, and Swedish Agency for Health Technology Assessment and Assessment of Social Services (other benzodiazepines [2], SSRI [18,20] and neuroleptics [18,21]).

Statistics

T-test was used when analysing differences in age, number of secondary diagnoses and number of drugs, and was calculated using SPSS statistics 22. *P*-values ≤ 0.05 were considered statistically significant. The programme Confidence Interval Analysis (CIA) was used for calculating differences in proportions, a method described by Newcombe & Altman [27]. 95% confidence intervals (95%CI) were used to report these results, and were considered statistically significant if the 95%CI did not include zero.

Ethics

The head of the department of Geriatric medicine approved the quality study. No ethical approval was required from the Ethics Committee. However, cautious managing of personal data was required and the data was de-identified after it had been collected.

RESULTS

During the two-month period, 64 patients were admitted to Tullhuset, however, four patients were excluded due to not fulfilling the age criterion and three patients were excluded due to arriving from their households. A total of 57 patients were therefore enrolled in the study. A significantly

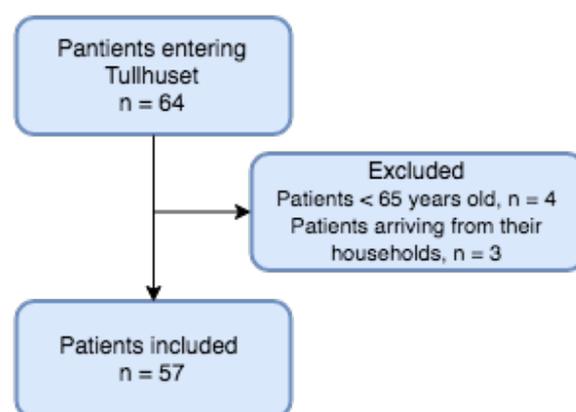


Figure 1: Flowchart of the included and excluded patients.

larger proportion of the included patients had diagnoses in three or more organ systems, compared to the excluded patients (32% difference, 95% CI: 3; 65). A larger proportion of the included patients were women, but the difference was not significant (63% compared to 43%, 20% difference, 95%CI: -14; 50). Before the included 57 patients were admitted to the hospitals, a majority were living in their ordinary houses, however, when admitted many patients were in need of assistance in daily life activities. Further details are given in table 1.

Table 1. Characteristics of the included patients, n = 57	
Women, n (%)	36 (63)
Mean age, (SD*)	83 (8)
Min-max	66-97
Living alone, n (%)	39 (68)
Ordinary housing, n (%)	50 (88)
Disabilities	
Cognitive impairment, n (%)	17 (30)
Mobility aids, n (%)	50 (88)
Assistance in walking procedures, n (%)	45 (79)
Assistance in hygiene routines, n (%)	46 (81)
Multi morbidity	
Mean number of secondary diagnoses, (SD*)	4 (2)
Min-max	0-10

*SD = standard deviation.

Polypharmacy: Out of the 57 patients, 55 (96%) had polypharmacy (five or more drugs), see figure 2. A total of 32 patients (56%) had ten or more drugs per person and therefore were considered to be exposed to excessive polypharmacy.

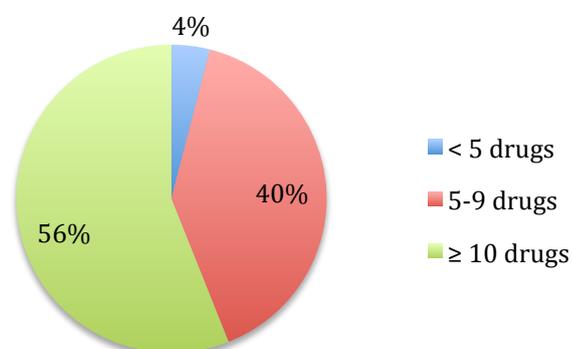


Figure 2: The proportion of patients with a certain number of drugs.

IDU and indications: The number of patients with some type of IDU was 28 (49%), 15 of these (54%) only had one type prescribed, and 13 patients (46%) had two to three types. Of the patients exposed to IDU, eight of them (24%) received drugs listed as inappropriate by the regional DTC in region Örebro län. A valid indication for each patient with IDU was found in 16 (57%) of all 28 cases. The most common type prescribed was other benzodiazepines (oxazepam), followed by SSRI drugs, as seen in figure 3.

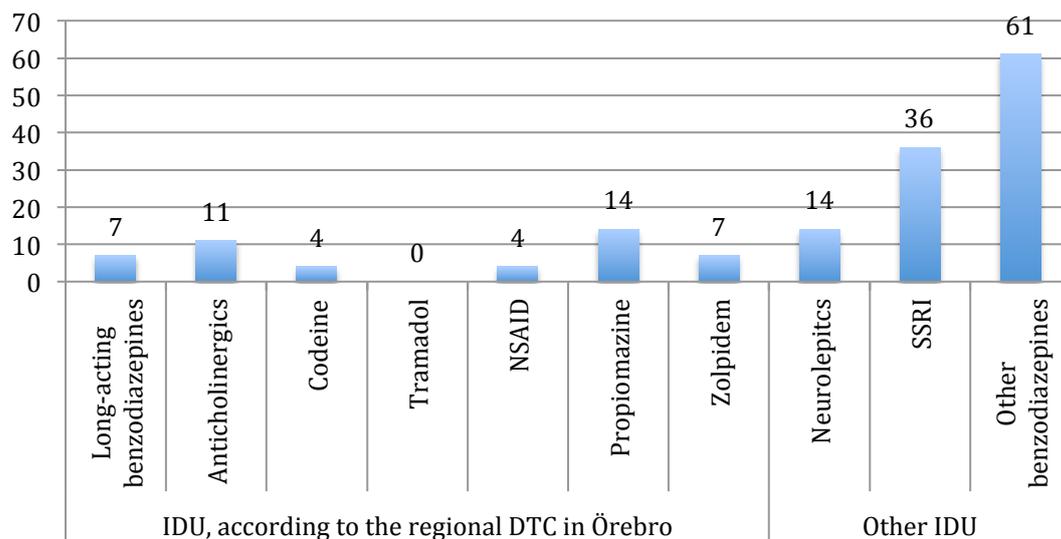


Figure 3: The proportion of all inappropriate drugs among the 28 patients with IDU.
DTC = Drug Therapeutic Committee. IDU = Inappropriate Drug Use.

Comparison: The majority of the patients, with or without IDU, were living alone and in their own accommodations. However, institutional housing was significantly higher among those with IDU, see table 2. Most commonly patients in both groups were hospitalised due to falls, (36% in the IDU-group compared to 28% among those with no IDU). Polypharmacy was common in both groups, however, the number of drugs was higher in the IDU-group, and an even greater difference in number of patients exposed to excessive polypharmacy (23% difference, 95%CI -3;45), although the difference was not found significant.

	IDU n = 28	No IDU n = 29	Difference [p]/ (95% CI**)	Significance
Women, n (%)	18 (64)	18 (62)	2 (-22; 26)	N.S
Mean age, (SD*)	84 (8)	82 (7)	2 [0,30]	N.S
Min-max	68-97	66-96		
Living alone, n (%)	19 (68)	20 (69)	-1 (-24; 22)	N.S
Ordinary housing, n (%)	22 (79)	28 (97)	-18 (-36; -0,3)	Yes
Cognitive impairment, n (%)	9 (32)	8 (28)	4 (-19; 27)	N.S
Morbidity and medication status				
Mean number of secondary diagnoses, (SD*)	5 (2)	4 (2)	1 [0,17]	N.S
Min-max	1-10	0-8		
Mean number of drugs, (SD*)	11 (4)	9 (4)	2 [0,09]	N.S
Min-max	5-22	1-20		
Polypharmacy \geq 5 drugs, n (%)	28 (100)	27 (93)	7 (-6; 22)	N.S
\geq 10 drugs, n (%)	19 (68)	13 (45)	23 (-3; 45)	N.S

*SD = standard deviation, **CI = Confidence interval

DISCUSSION

The aim of this study was to investigate the number of drugs and the IDU among patients admitted to Tullhuset, and to evaluate the occurrence of a valid indication for each patient with IDU. Furthermore, the study intended to investigate potential differences between patients with inappropriate drugs and patients without.

Many previous studies have shown that polypharmacy remains a significant problem [11,16,22,28,29], and this study was no exception. A total of 96% fulfilled the criterion for polypharmacy and 56% for excessive polypharmacy. The prevalence of polypharmacy has in a previous Swedish systematic literature study been found to range from 46-84% in hospital care patients [29], and in another study the prevalence was 51.7% for polypharmacy and 14.2% for excessive polypharmacy [16]. The frequency of polypharmacy in our study is more pronounced compared to previous studies. This is in keeping with another study showing that the prevalence of polypharmacy appears to increase over time [28]. However, it is important to keep in mind that the ageing process itself is a major factor affecting the frequency of polypharmacy as well. Moreover, the population in our study consists of quite old multimorbid elderly patients, admitted to a special institution, and therefore are not representative of the whole Swedish elderly population.

There may be several reasons for increasing prevalence of polypharmacy in society. One explanation is the occurrence of inadequate documentation, especially since many health care providers have different systems for recording medical information. Furthermore, the number of new available drug therapies is constantly increasing and it is also common that adverse events give rise to new symptoms, which further on give rise to a prescribing cascade [15]. Moreover, it is often a greater challenge to stop a medication than continuing an established drug regimen, for example due to the risk that the original condition could flare or the possibility of withdrawal symptoms [30]. Furthermore it is possible that the recommended prescriptions for different types of drugs are modified over time, changing the original indication [28]. An additional aspect is that the number of prescribers available in each care giving process has been shown to increase the number of prescribed drugs [15,24], due to lack of continuity. These factors combined may affect the frequency of polypharmacy. Nevertheless, it is

of great relevance that polypharmacy affects quality of drug therapy, which further on affects quality of life [31].

Previous studies have suggested that polypharmacy increases the risk inappropriate drug treatments [11,16]. In our study the number of drugs seemed to be higher in the group with IDU compared to the patients with no IDU, especially when comparing those exposed to excessive polypharmacy, however this was not statistically significant.

Almost half of the patients included in the study were exposed to IDU. In a previous Swedish systematic literature study the prevalence of IDU was found to range from 27% to 56% [29], and in other previous studies with similar age criterions it ranged from 17% to 74% [16,22,24,25,32]. Our prevalence of 49% seems to be in line with this. However, it is difficult comparing the prevalence of IDU between various studies, due to different definitions of IDU, which further on might cause the discrepancy of IDU frequency. Conversely, it is possible to compare the frequency of some specific inappropriate drugs. A total of 7% were using long-acting benzodiazepines in this study and 11% anticholinergics, this is in accordance with previous Swedish studies, in which it ranged from 4.4% to 13.5% and 6.1% to 20.2%, respectively [16,22,25,32]. The results indicate that there is room for improvements to optimise drug therapies of the elderly in Örebro.

There may be many factors affecting the prevalence of IDU and why it appears to be a common problem among elderly patients in today's society. For example there seems to be an association between the number of drugs and the risk for IDU [11,16], and the high prevalence of polypharmacy has already been discussed. Furthermore, institutionalization has been indicated to affect the risk for IDU [32]. Moreover, it has been shown that education and information to the physician and other medical staff affect the quality of drug therapies [2]. In our study there is a possibility that discharging doctors unknowingly were influenced by the fact that the patient was being transferred to a geriatric clinic, and therefore did not seek to optimising each patient's list of medications as thoroughly as the general population. In general, it is often easier assigning someone else the responsibility for the patient's drug therapy, than dealing with the problem yourself.

A valid indication was found in 16 of the 28 cases with IDU (57%), consequently, 43% did not have suitable drug treatments. These results are in keeping with the Olsson study [31], which indicates that there are many drug therapies prescribed without a valid indication. Possible causes for the absence of a valid indication are a lack of follow-up after commencing new drug therapies, and the absence or deficiency of regular medical reconciliations [30,31]. When a current indication is not found, it more or less should be an obligation to stop the medication [30].

It is noteworthy that institutional housing was significantly higher among the patients with IDU. Preferably, institutional housing would mean that there is someone to ensure appropriate drug treatments, and thus reducing the risk for each patient to be exposed to IDU. However, there are more available prescribers per resident in institutional housing than in ordinary housing, causing a lack of continuity of care [24]. This increases the risk for polypharmacy, which further on, as shown above, increases the risk for IDU. Another possible explanation is that patients with IDU are frailer, have more comorbidities and are in need of more help in everyday life, therefore ending up in institutional housing, which induces a greater risk for exposure to IDU.

Strengths and limitations

Our study was designed to investigate the number of drugs per patient, the exposure to IDU and the occurrence of a valid indication of treatment for patients admitted to Tullhuset after discharge from hospitals. The study population is well defined and the risk for any patient to falsely being excluded was minimised, as all patients admitted to Tullhuset were always registered in an administrative system. Since the study only included a small number of patients, the opportunity to contextualise these results relative to the whole Swedish population is limited. However, there are other Swedish studies [16,22,24] supporting our findings. Another limitation is that only one person read the medical records, making it easier to miss essential information. However, this is also a major strength, as the data was collected in a structured manner by one person, avoiding diverging opinions. In addition, the use of a project manual further minimised the risk of discontinuity.

Furthermore, it is important to be aware of the possibility that our results (concerning number of drugs and the IDU) may have been compromised by inaccurate lists of medications. Additionally, there is also a risk that patients do not take all drugs prescribed (adherence) and the possibility that patients take herbal products or non-prescription drugs, which may cause interactions. Moreover, it is essential to keep in mind that all information regarding the drug therapies only reflects a moment at a specific time, and that some drug therapies were to be finished (for example thrombosis prophylaxis) in the near future after discharge. It is also essential to be aware of that scrutinizing medical record for a valid indication for each patient with IDU is a question of interpretation.

Additionally, one limitation in this study is the lack of data describing the patients' different types of diagnoses, to be able to investigate if there might be any association between this variable and the prevalence of IDU. Another limitation is that our results concerning IDU are difficult to compare with other studies, due to different definitions of IDU. In our study the definition of IDU was mainly based on a list from the regional DTC in Örebro, with the list being comprised by local guidelines. However, some other Swedish studies [16,25,32] used quality indicators concerning drug use among elderly from the Swedish National Board of Health and Welfare. Nevertheless, the guidelines in Örebro were interesting to analyse since the included patients in our study were hospitalised in the region Örebro län.

This study investigated the medication status among elderly patients at the moment of discharge from the hospitals, before admittance to Tullhuset. In the future it would be interesting to design a study investigating possible changes to drug therapies when the elderly patients are discharged from Tullhuset.

Future improvements

It would be preferable for one main doctor to be in charge of each patients' drug treatments, to accomplish continuity for all individuals. It would hopefully reduce the risk for elderly patients to experience adverse events and unnecessary prescribing cascades. Information about earlier drug therapies and indications for each prescribed drug would be accessible, assuring a higher quality of drug therapy and a better

quality of life. Further on, this would probably reduce avoidable hospitalisations and unnecessary costs of care.

Conclusion

Polypharmacy and IDU remains a significant problem among the elderly, and it is not less important in Örebro. However, it is important to keep in mind that the population in our study is not representative of the whole Swedish elderly population. A majority of the patients entering Tullhuset fulfilled the criterion for polypharmacy, and even for excessive polypharmacy. The IDU was also high and a valid indication was frequently absent, suggesting that several patients had not suitable drug therapies. However, as long as a valid indication for IDU is documented, then its use in elderly patients is acceptable.

The results in this study indicate that there are areas to improve when optimising geriatric care, and the importance of keeping the number of drug therapies to a minimum. In the future it would be preferable for one main doctor to be in charge of each patients' drug treatment. This would mean that one individual would be responsible for follow-up of new drug treatments and review of indication for each drug. Furthermore, it is essential to highlight the importance that all doctors have a responsibility to critically scrutinise each patient's list of medication to see if a valid indication exists.

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Ethical consideration

Medical research is about balancing maximum benefit for the patients and maximum benefit for the health care system. However, patients sometimes suffer from negative experiences and loss of integrity when included in medical studies.

Medical ethics is essential to regulate research and to assure safety and integrity for each patient involved. There are four basic principles of ethics forming the foundation for medical ethics; the principle of autonomy, -beneficence, -non-maleficence and -justice. These moral principles often constitute the basis of further regulations and laws. There are many international systems of rules and guidelines regulating research, for example the declaration of Helsinki, and in Sweden there are ethical committees inspecting the medical research.

This study was designed as a retrospective study evaluating clinical practise using medical records, and the head of the department of Geriatric medicine approved the study. However, there was one basic principle of ethics that was not completely fulfilled, the principle of autonomy, since no patient consent was gathered from the included patients. The principle of autonomy is a fundamental ethic principle guaranteeing each patient to have the right to decide over his or her body. However, cautious managing of personal data was required in our study and all data was de-identified after it had been collected. The included patients did neither have to go through with any medical examination, nor pay a visit to the hospital. Altogether, these actions will hopefully guarantee that no patient suffered from negative experiences or loss of integrity. Hopefully future patients and the health care for elderly will benefit from the results in this study.

Cover letter

Corresponding author: Martina Aaro, Bachelor of medicine, Örebro University.

Dear Editor,

I here present to you “Polypharmacy and the Inappropriate Drug Use among Elderly Patients admitted to a Short-Term Nursing Home in Örebro”

This study was designed as a retrospective study evaluating clinical practise using medical records, and the head of the department of Geriatric medicine approved the study. The main findings in our study are that polypharmacy remains a significant problem in society and it needs to be highlighted. Of the 57 included patients, 96% were exposed to polypharmacy (five or more drugs), and 56% were even exposed to excessive polypharmacy (ten or more drugs). Since the elderly population is growing and are major consumers of prescribed drugs, it is a topic of great importance. Especially since the elderly often suffer from adverse events, which further on influences cost of care. Current study also showed that a total of 28 patients (49%) were exposed to inappropriate drug use (IDU), and in 12 cases (43%) a valid indication was not found. This suggests that a total of 43% did not have suitable drug therapies. Furthermore, these results indicate that there are areas to improve when optimising the geriatric care.

Best regards,

Martina Aaro

Populärvetenskaplig sammanfattning

Den äldre befolkningen ökar världen över och många länder ställs inför nya utmaningar i samhället. I Sverige utgjorde personer 65 år och äldre 20% av befolkningen under år 2014, och proportionen ökar i snabb takt. Den äldre populationen utgör de största konsumenterna av förskrivna läkemedel.

Åldrandeprocessen leder dock till ett flertal fysiologiska förändringar i kroppen, vilka medför att äldre har en ökad risk för biverkningar. Framförallt gäller detta en viss typ av läkemedel, vilka ofta benämns olämpliga läkemedel. En riskfaktor för olämpliga läkemedel är polyfarmaci, vilket innebär att en patient har fem eller fler läkemedel förskrivna. Ett flertal tidigare studier har illustrerat att just polyfarmaci hos de äldre är ett stort problemområde för sjukvården och samhället.

Nyligen genomfördes en journalstudie på Geriatriska kliniken, Universitetssjukhuset Örebro, där man undersökte förekomsten av polyfarmaci och olämpliga läkemedel. Totalt inkluderades 57 patienter som var 65 år och äldre. Majoriteten av dessa, 96%, var exponerade för polyfarmaci, och 56% var till och med exponerade för extrem polyfarmaci (tio eller fler läkemedel). Det framkom även att 28 patienter (49%) hade någon typ av olämpligt läkemedel förskrivet. I 12 av dessa 28 fall kunde inte heller någon tydlig indikation hittas för läkemedlet. Detta kan tolkas som att 43% av patienterna med olämpliga läkemedel hade läkemedelsbehandlingar vars indikationer skulle kunna granskas ytterligare.

Med dessa resultat betonas polyfarmaci och olämpliga läkemedel bland äldre som ett fortsatt stort problem. Studien belyser vikten av att försöka hålla antalet läkemedel per patient till ett minimum, samt vikten av att noggrant granska på vilka grunder ett läkemedel ordinerats. Det finns flera områden avseende omhändertagandet av äldre patienter som behöver förbättras för att kunna optimera vården, vilket är av stor vikt med tanke på den växande äldre populationen.