Drug-related problems in the elderly - Interventions to improve the quality of pharmacotherapy

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- Interventions to improve the quality of pharmacotherapy

by

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To my family

“Cuiusvis hominis est errare, nullius nisi insipientis in errore perseverare.”

Marcus Tullius Cicero

CONTENTS

ORIGINAL ARTICLES

The thesis is based on the following studies, which are referred to by their Roman numerals:

I. **Midlöv P**, Bondesson Å, Eriksson T, Petersson J, Minthon L, Höglund P. Descriptive study and pharmacotherapeutic intervention in patients with epilepsy or Parkinson's disease at nursing homes in southern Sweden. *European Journal of Clinical Pharmacology* 2002; 57:903-910.

II. **Midlöv P**, Bergkvist A, Bondesson Å, Eriksson T, Höglund P. Medication errors when transferring elderly patients between primary health care and hospital care. *Pharmacy World and Science* 2005; 27:116-120.

III. **Midlöv P**, Bondesson Å, Eriksson, T, Nerbrand C, Höglund P. Effects of educational outreach visits on prescribing of benzodiazepines and antipsychotic drugs to elderly patients in primary health care in southern Sweden. *Family Practice* 2006; 23: 60-64.

IV. **Midlöv P**, Holmdahl L, Eriksson T, Bergkvist A, Ljungberg B, Widner H, Nerbrand C, Höglund P. Medication Report reduces the number of medication errors when elderly patients are transferred from hospital to primary care. *(Submitted).*

ABBREVIATIONS

ADL	Activity of daily living
ADR	Adverse drug reactions
ADWE	Adverse drug withdrawal event
ATC	Anatomical therapeutic chemical classification system. In the Anatomical Therapeutic Chemical (ATC) classification system, the drugs are divided into different groups according to the organ or system on which they act and their chemical, pharmacological and therapeutic properties.
CI	Confidence interval
DDD	Defined daily dose. The assumed average maintenance dose per day for a drug used for its main indication in adults.
DRP	Drug-related problems
GP	General Practitioner
NSAID	Non-steroidal anti-inflammatory drugs
OTC	Over the counter. Drugs sold without a prescription.
SAA	Serum anticholinergic activity
SSRI	Selective serotonin re-uptake inhibitor

INTRODUCTION

The number of elderly in the Swedish population has increased during the last forty years. In 2005 17% were 65 years or older and 9% were 75 years or older (www.scb.se). Elderly people often use many drugs (Straand and Rokstad 1999), in particular those residing in nursing homes (The National Board of Health and Welfare 1999). Pharmacotherapy can effectively cure, prevent or palliate many conditions in late life. Drug-related problems (DRP) are however common in elderly patients (Hanlon et al. 2003). Drug-related problems has been defined as "an event or circumstance involving drug treatment that actually or potentially interferes with a patient's experiencing an optimum outcome of medical care" (Hepler and Strand 1990). With this definition DRP include e.g. drug use without an indication, drug interactions, subtherapeutic dosage, overdosage, noncompliance, drug interactions and adverse drug reactions (ADRs). All medications have adverse effects with varying clinical consequences and severity. These adverse effects can result from medications taken individually or can result from pharmacokinetic and pharmacodynamic interactions of medications being taken in combination (Kostoff and Delafuente 2006). Elderly patients are more susceptible to ADR than younger patients. This is due to the fact that elderly use many drugs but also due to physiological changes with increasing age that affects the pharmacokinetics and pharmacodynamics. However, in the absence of disease, the decline in physiological functions most often causes no symptoms.

The potential risk of drug-drug interactions is increased with the number of drugs used and age (Seymour and Routledge 1998; Veehof et al. 2000). Since the interactions are more common in frail patients, the consequences are likely to be worse than in younger individuals. If the physician is aware of potential interactions these can many times be avoided by choosing other drugs. If this is not possible, drug dosages have to be adjusted and pharmacotherapy more cautiously evaluated.

Adverse drug events are common preventable causes of emergency medical admissions in the elderly (Chan et al. 2001). Studies have shown that 15-22% of the hospitalised elderly patients are admitted because of DRP (Bero et al. 1991; Roughead et al. 1998; Cooper 1999). Drug-related problems thus cause much suffering for the elderly patients and great costs for the society.

Appropriate pharmacotherapy should however not be withheld because of the risks of DRP in treating elderly. The pharmacotherapy should instead be adjusted to the individual patient.

Pharmacotherapy in primary care

In the county of Skåne, in southern Sweden, general practitioners (GPs) prescribe 69% of all drugs that are prescribed to elderly patients (Apoteket 2006). The responsibility for medication management in Swedish nursing homes as well as for elderly patients in ambulatory care in general relies on GPs. Before admission to nursing homes elderly may be prescribed numerous drugs from different physicians. It is known that patients who receive prescriptions from more than one physician are more likely to receive inappropriate medications (Piecoro et al. 2000; Dhalla et al. 2002). Thus it is important that one physician has the overall responsibility for the patient's pharmacological treatment. For the frailest patients, elderly in nursing homes, this is especially important. When a patient is living in a nursing home the GP should, if not before, have complete information on the patient's medications. Admission to a nursing home could provide a good opportunity to review and improve the elderly patient's pharmacotherapy. In a

Canadian study the prevalence of inappropriate prescriptions decreased after nursing home admission (Dhalla et al. 2002) whereas in an American study there was no significant change (Zuckerman et al. 2005).
In Sweden general practitioners are allowed to prescribe all approved drugs and prescriptions are valid for one year. Patients with medications for chronic use are often prescribed their medications once a year, at a yearly check-up. Pharmacotherapy should thus be evaluated at least once a year. If the GP does not have time to do this, there may be a risk of drugs being used for longer periods than there is need for.
Even if the physician is responsible for the prescribing of drugs, the patient's role in prescribing is increasing. According to Swedish legislation in the late 1990ies patients have an increasing role in all treatment decisions. Patients have of course influence on medication adherence (the patient's use of the right drug in the correct dose at the right interval). Patients' knowledge of the drugs is positively associated with their adherence (Barat et al. 2001). Several other factors influence medication adherence: (1) patient variables such as age, gender, personality, beliefs, etc, (2) health status and disease, (3) characteristics of the medicines, (4) economic factors, and (5) physician factors (Balkrishnan 1998). It has been shown that patients are more motivated to use their medications as instructed if their belief in its necessity outweighs their concerns about taking it (Horne and Weinman 1999). Lack of adherence i.e. underuse of medications may lead to therapeutic failure. In a review on the pharmacological treatment of congestive heart failure it was stated that angiotensin-converting enzyme inhibitors were underused, were often prescribed at clinically insufficient doses, and were used more often in "young" elderly nursing home residents (Litaker and Chou 2003). There might however be rational reasons for this underuse of drugs. Doses may be lower than recommended because of previous drug-related problems.
It is not only the elderly patient that does not know what drugs are used. In a Canadian study the family physicians were often unaware of all the medications their patients were actually taking (Frank et al. 2001). If the GP is not aware of concomitant medications, it is not easy to adjust doses because of possible interactions, thus there may be an increased risk of interactions and ADR.
In many parts of Sweden it is difficult for the GP to be aware of all their patients' medications. Patients may receive prescriptions from several physicians. There are different systems of medical records in different clinics. The medical records that do not belong to the own clinic are not accessible to any other physician. In many cases the GPs not even have access to their own medical records when they are seeing patients in nursing homes. One reason for this is that in many parts of Sweden the GP-practices and the nursing homes are run by different caregivers.

Pharmacological alterations with age

Elderly are because of pharmacological alterations more susceptible to DRP. Decline of physiological functions is a gradual ongoing process. An abrupt decline in any function is always due to disease or external causes, such as drugs, and not to normal aging. The inter-individual variability is greater in elderly than in younger adults. Individuals become more dissimilar as they age. Some healthy elderly may not be very affected by pharmacological alterations whereas others have become very susceptible to adverse effects of drugs. It is important to be aware that side effects can occur with drugs and drug doses unlikely to produce side effects in young adults.

Absorption of drugs

Drugs can be administered in different ways. The most common and important way is orally. The absorption of orally taken drugs depends on the function of ventricle, intestines and the blood flow to the intestines. Although the functions of these organs may decrease with age, absorption of most drugs is not diminished with age (Turnheim 2003). The absorption of drugs administered as intramuscular or subcutaneous injections may be diminished in elderly because of reduced tissue blood perfusion. This is also true for transdermal administration of drugs (Turnheim 2003).

Distribution of drugs

The increase in percentage of body fat and the reduction in total body water result in changes in the distribution of drugs depending on lipid solubility. Since the volume of distribution is increased, the elimination half-life of lipid-soluble drugs is increased. This affects for example medium- and long-acting benzodiazepines that can accumulate in the body.

Some drugs are bound to plasma proteins in blood. Even if plasma albumin level may decrease in the elderly, this is rarely of clinical importance as drug elimination increases when the unbound drug concentration is increased.

Metabolism and elimination of drugs

Metabolism of drugs depends on hepatic blood flow, the function and capacity of drug-metabolising enzymes in the liver. These parameters are reduced in the elderly. Concomitant medications and diseases are factors that further affect drug metabolism in the liver.

The nutritional status of a patient has effect on the rate of drug metabolism. In frail elderly, drug metabolism is diminished to a greater extent than in elderly with normal body weight (Walter-Sack and Klotz 1996; Vestal 1997). Very old individuals often loose weight. There is thus a risk that these patients receive higher doses per unit bodyweight than younger heavier patients.

Renal function in elderly is about 50% of that in young adults. This is a progressive decline that starts as early as age 30 and continues throughout life. Serum creatinine is not a good measure of renal function in elderly because muscle mass is reduced. Creatinine clearance should be used instead.

The decrease in renal function is the most important change in pharmacokinetics in the elderly as a group and the physician should always adjust drug dosages according to renal function. Many drugs are affected by decreased renal function e.g. digoxin, metformin.

Pharmacodynamic alterations with increasing age

Most organ systems are more vulnerable in the elderly. In general this means an increased sensitivity to unwanted effects of drugs. Age-related changes in pharmacodynamics may occur at the receptor or signal-transduction level. A third possibility is that homeostatic mechanisms may be attenuated (Turnheim 2003).

Elderly patients are more susceptible to anticholinergic effects. Serum anticholinergic activity (SAA) can be detected in most older persons and even low SAA is associated with cognitive impairment (Mulsant et al. 2003). Elderly patients taking anticholinergic drugs are more likely to be mildly cognitively impaired and have an increased risk of delirium (Han et al. 2001; Lechevallier-Michel et al. 2005; Ancelin et al. 2006). Anticholinergic effects include tachycardia, urinary retention, constipation, dry mouth, and delirium. These are common symptoms in elderly patients and it is important to have anticholinergic effects of drugs in mind in these cases. Drugs with anticholinergic

properties are e.g. many anti-psychotic drugs, tricyclic antidepressants and drugs against urinary incontinence.
The frequency of ADR caused by non-steroidal anti-inflammatory drugs (NSAID) increases with age (Wolfe et al. 1999). Use of NSAID is quite common in all age groups. The symptoms of these ADR may initially be vague as e.g. tiredness. This could then be the only symptom of anaemia due to gastrointestinal bleeding.
There is a loss of blood vessel distensibility with age. This can partly explain the increase of systolic blood pressure. Aging is also associated with a reduction in baroreflex-mediated heart rate response to hypotensive stimuli (Verhaeverbeke and Mets 1997; Lakatta and Levy 2003). Drugs that lower the arterial blood pressure cause postural hypotension more often in the elderly. Postural hypotension contributes to the risk of syncope and falls especially in the elderly (Verhaeverbeke and Mets 1997). In case of postural hypotension, drug treatment should always be reviewed. It is not only cardiovascular drugs that may cause postural hypotension; many anti-psychotic drugs may also have this adverse effect.
Elevated blood pressure play however an important role in the development of brain complications of hypertension and reduction of abnormally elevated blood pressure safely and effectively decreases morbidity and mortality rates in the elderly (Amenta et al. 2002).

Inappropriate medications in the elderly

Inappropriate prescribing can be defined as prescribing that does not agree with accepted medical standards (Hanlon et al. 2001). In Sweden the National Board of Health and Welfare has recommended physicians to avoid or minimise the prescribing of drugs considered to be inappropriate to elderly patients (The National Board of Health and Welfare 2003). Similar recommendations have been made in different countries. In many scientific studies medications are deemed as inappropriate to the elderly according to Beers criteria. According to Beers criteria and different national recommendations, the use of long-acting benzodiazepines and anti-psychotic drugs should be avoided in the elderly. Inappropriate drug use is common among nursing home residents (Dhalla et al. 2002; Hagen et al. 2005) as well as in prescribing to elderly ambulatory care patients (Goulding 2004).

Benzodiazepines

Benzodiazepines are widely used and their use is highest among the elderly (Flaherty 1998). In the county of Skåne GPs prescribe 74% of all benzodiazepines that are prescribed to patients older than 65 years and 81% of all benzodiazepines that are prescribed to patients 75 years or older (Apoteket 2006).
Approved indications for the use of benzodiazepines are the same for elderly patients as for younger adults. Anxiety and insomnia are the most common indications. Selective serotonin re-uptake inhibitors (SSRI) are however the first-line treatment for generalised anxiety disorder (Baldwin and Polkinghorn 2005). Benzodiazepines are also prescribed for multiple concomitant physical and psychological problems (Bogunovic and Greenfield 2004).
Elderly patients in nursing homes often receive benzodiazepines inappropriately (Oborne et al. 2003). Sometimes elderly patients in nursing homes are treated with benzodiazepines without actually talking to their nurse or physician (Holmquist et al. 2005). Benzodiazepines are more likely to accumulate in the elderly due to alterations in pharmacokinetics. Alterations in pharmacodynamics can be even more important in

explaining the altered response to benzodiazepines (Bogunovic and Greenfield 2004). Reducing benzodiazepine use by elderly patients is important for several reasons. Long-term use of benzodiazepines can accelerate cognitive decline in elderly patients (Paterniti et al. 2002). The elderly experience excessive sedation from benzodiazepines compared with younger individuals (Lechin et al. 1996). Benzodiazepine use by elderly patients are not only associated with cognitive side effects (Lechin et al. 1996; Gray et al. 1999), but also increases the risk of falls and hip fractures (Ray et al. 2000; Wang et al. 2001). These fractures lead to hospitalisation costs. In a European study it was estimated that costs of accidental injuries related to benzodiazepine use in the EU varied between Euro 1500 and 2200 millions each year. More than 90% of these costs were in the elderly with fractures as the major contributor (Panneman et al. 2003). Benzodiazepine withdrawal may play a role in the occurrence of delirium in the elderly. Thus, abrupt discontinuation of benzodiazepines might be difficult. Withdrawal symptoms include tremor, agitation, insomnia and seizures (Turnheim 2003). If benzodiazepines are used in the elderly, short-acting benzodiazepines such as oxazepam are preferred, because they do not accumulate in the blood. Long-acting benzodiazepines are associated with a higher risk of ADR, such as falls (Ray et al. 2000). If short-acting benzodiazepines are used they should be prescribed with caution, at low doses, and for short periods. As with all pharmacotherapy the effects should be evaluated.

Anti-psychotic drugs

In the county of Skåne GPs prescribe 57% of all anti-psychotic drugs that are prescribed to patients older than 65 years and 72% of all anti-psychotic drugs that are prescribed to patients 75 years or older (Apoteket 2006). Anti-psychotic drugs are associated with high risk of unwanted effects in the elderly. There is an increased risk of well-known adverse effects as tardive dyskinesia and parkinsonism (Avorn et al. 1995; Woerner et al. 1998). Other adverse effects e.g. worsening cognitive decline (McShane et al. 1997) are also more frequent in the elderly. Most of these drugs are not well-studied for other diagnoses than psychotic diseases. In treatment of dementia, the efficacy of anti-psychotic drugs is low, and the efficacy rate is equivalent to the side effect rate (Lanctot et al. 1998). Despite these facts anti-psychotic drugs are often used in elderly without a psychotic disorder. In a British audit-study in primary care, it was found that the use of anti-psychotic drugs was infrequent, but most was unsatisfactory (Mortimer et al. 2005). The lack of psychotic disorder diagnosis among the users of these drugs was common. In Sweden there is often a lack of documentation of indications and evaluations when elderly are treated with anti-psychotic drugs (Holmquist et al. 2003). In a Norwegian study on nursing home residents clinically relevant medication problems were identified in 76% of the patients and anti-psychotics were the class most often involved (Ruths et al. 2003). Several studies have confirmed that elderly patients in nursing homes or in their own homes are prescribed anti-psychotic drugs without a correct indication (Golden et al. 1999; The National Board of Health and Welfare 1999; Ruths et al. 2001; Fahey et al. 2003; Hagen et al. 2005). In an Australian study on nursing home residents the proportion of patients taking anti-psychotics was 24% in 2003 and this was roughly the same as in 1993 (27%) and in 1998 (23%) (Snowdon et al. 2005). To reduce the use of anti-psychotic drugs in the elderly is still an important issue.

Delirium in the elderly

Delirium or confusion is more frequent in advanced age. It is a common ADR among elderly in Sweden (SWEDIS 2004). Delirium is a very painful condition both to the patients and to family members or personnel involved in the care of the elderly. It is also a very harmful condition. Patients with delirium have an increased risk of dementia, higher mortality and worse physical and cognitive status (Francis et al. 1990; Rockwood et al. 1999; McCusker et al. 2001).

Delirium can sometimes be misdiagnosed. Dementia has some symptoms in common with delirium but dementia is characterised by a more slow on-set and slow progression of symptoms. Delirium on the other hand has a more rapid on-set and greater fluctuation in symptoms. There is mostly an external cause to delirium. The most common causes are drugs and diseases. In other words whereas dementia cannot be cured, delirium can by removing the external cause.

Some of the symptoms in delirium are also common in depression in the elderly. Depression is common among elderly (Samuelsson et al. 2005). It is often under-diagnosed and inadequately treated (Bergdahl et al. 2005). Selective serotonin re-uptake inhibitors (SSRI) are often effective in treating elderly patients with depression.

Many drugs can predispose or actually cause delirium in elderly. Postoperative confusion is for example more frequent in long-term benzodiazepine users (Kudoh et al. 2004). Other drugs that may cause delirium are e.g. anti-psychotics, drugs against urinary incontinence, corticosteroids, anti-epileptics and drugs that lower blood pressure. Usually the main suspects for causing drug-induced cognitive impairment are the anticholinergic and anti-psychotic drugs, and these should be the first drugs to be discontinued (Moore and O'Keeffe 1999; Alagiakrishnan and Wiens 2004).

In an American study on hospitalised elderly persons five independent precipitating factors for delirium were identified: use of physical restraints, malnutrition, more than three medications added, use of bladder catheter, and any iatrogenic event (Inouye and Charpentier 1996).

Polypharmacy

There is no universal definition of polypharmacy. One common definition is the use of five or more drugs. Another definition is the use of more drugs than clinically necessary. On average elderly people in Swedish nursing homes have been reported to use ten drugs and elderly people living in their own homes five drugs (The National Board of Health and Welfare 2002). In a Danish study on 75-year-old persons living in their own homes only 3% did not take any drugs. The average number of drugs in use was 5.4 and 34% used five or more drugs (Barat et al. 2000). Polypharmacy is in other words widespread in the population, especially among the elderly (Bjerrum et al. 1998). Polypharmacy increases the risks of ADR, interactions and incorrect drug use (LeSage 1991), thus increases the risk of DRP and drug-related costs. There is also a clear relation between falling and the use of higher number of medications (Tinetti 2003). Reducing polypharmacy is not always easy. In a Finnish study they achieved some drug reductions but when the intervention ceased the number of drugs used soon returned to its earlier level (Pitkala et al. 2001).

Clinicians who try to reduce polypharmacy need to exercise caution in stopping medications in the elderly. In that case medications can often be successfully stopped without causing an adverse drug withdrawal event (ADWE) (Graves et al. 1997). It is recommended to stop one medication at a time. In an American study the number of

medications discontinued was significantly associated with ADWE occurrence (Graves et al. 1997).

Medication errors

There is a wide variety of definitions and methods used to identify the frequency and nature of medical errors (Sandars and Esmail 2003). In a review of studies on medical errors the authors found that prescription errors were identified to occur in up to 11% of all prescriptions in primary care (Sandars and Esmail 2003). Errors occur in all steps in the medication process, ordering, transcription, dispensing, administration and discharge summaries (Lisby et al. 2005). Medication errors are common at all levels in the care of elderly patients. Medication errors are common in hospitals (Lesar et al. 1990; Dean et al. 2002; Richards et al. 2003; Runciman et al. 2003; Bobb et al. 2004) as well as in the transfer between care levels (Wilson et al. 2001; Gleason et al. 2004; Paulino et al. 2004). In other words medication errors occur whenever there are activities that concern the pharmacological treatment. The errors are not always reported. This may be because staff feels that disciplinary action can be taken against the person who commits an error. In Britain, the government has taken steps away from this "blame-culture" (Wise 2001). In a declaration it is stated that honest failure should not be responded to primarily by blame and retribution, but by learning and by a drive to reduce risk for future patients.

Transfer of information between care levels

In these studies we have mainly focused on what happens when elderly patients are transferred between hospital and primary care. There are many other transfers that could be associated with risks of prescribing error, e.g. when patients are transferred from one clinic to another, between hospitals or between different GPs. It is important to minimise the number of medication errors due to errors in transfer of information. When a patient is admitted to hospital accurate information on drug use prior to hospital care is important also because it may uncover reasons for a patient's illness, such as adverse drug events or non-adherence to pharmacotherapy. Adherence is of great importance to the patient's outcome. In a large study on patients with heart failure, good adherence to medication was associated with a lower risk of death than poor adherence. This was true both in the group that was treated with angiotensin receptor blocker and for the group treated with placebo (Granger et al. 2005).

In a systematic review of medication history errors at admission to hospital, errors in prescription medication histories occurred in up to 67% of cases (Tam et al. 2005). In six of the studies the investigators estimated that 11-59% of the medication history errors were clinically important. In a recently published US study a medication discrepancy was identified in the medical records of 65% of patients at admission to hospital (Lessard et al. 2006).

The situation when patients are admitted to hospital is mostly not optimal for the transfer of information on medications. At least in Sweden most patients are admitted to hospital as emergency patients. No referral is necessary, so the GPs may not know that their patients are in the hospital. The transfer of information may therefore be incomplete. The patients may not know, or be able to tell, their medications. The physician has in most Swedish hospitals no access to the medical records or lists of medications in primary care.

When patients are discharged from hospital there is a need for correct transfer of information on medications in order to fulfil the intentions of the hospital physicians.

Use of educational programmes on pharmacotherapy

Educational programmes on pharmacotherapy have by tradition been dominated by the pharmaceutical companies. In Sweden physicians get most of their pharmacotherapeutical training from the pharmaceutical industry (Ekedahl et al. 1995). This has been one important way of marketing pharmaceutical products. Other popular marketing strategies are through web-sites, conferences, evening meetings, advertisements in papers and on the Internet. As drug-costs have increased there has been a demand for more education on pharmacology that is not sponsored by pharmaceutical companies. In 2005 there was a new agreement between The Swedish Association of the Pharmaceutical Industry (LIF) and Swedish Federation of County Councils (Landstingsförbundet). The aim of this agreement is to ensure that the cooperation between the pharmaceutical industry and the health-care sector is conducted in a responsible and relevant manner. One result of this is that education to a greater extent is financed by the counties and less by the industries.

In a Dutch study there was a negative correlation between quality of prescribing by solo GPs and frequency of visits by pharmaceutical industry representatives (Muijrers et al. 2005). It has been shown that GPs with high prescribing costs are significantly more likely to see drug company representatives more frequently (Watkins et al. 2003). In a Spanish study the authors concluded that the quality of prescribed drugs increases as the physician places more confidence in independent sources of information and decreases as the physician relies more on sources of information from the pharmaceutical industry (Figueiras et al. 2000).

In Sweden as in many other countries it has become more common with different kinds of educational outreach visits to GPs. When the effects of such education have been studied many have had positive effects (Avorn and Soumerai 1983; Braybrook and Walker 1996; Wahlstrom et al. 1997; Reeve et al. 1999; Lowe et al. 2000; van Eijk et al. 2001; Richards et al. 2003). Not all educational programmes have however had an impact on GPs' prescribing habits (Borgiel et al. 1999; Pimlott et al. 2003; Crotty et al. 2004; Witt et al. 2004). Educational programmes have been shown to be effective not only on prescribing habits but also on health outcomes of GPs' elderly patients (Kerse et al. 1999).

In a review of eighteen studies on educational outreach visits the authors concluded that outreach visits appear to be a promising approach to modifying health professional behaviour, especially prescribing (Thomson O'Brien et al. 2000). Educational outreach visits are not always conducted without difficulties. The GPs might be reluctant to participate. In one study the GPs expressed these opinions and referred to previous experience of top-down managerial initiatives about prescribing quality (Watkins et al. 2004). To be successful the kind of education and how it is conducted naturally are important.

Rationale for the studies

In this thesis the emphasis has been on the pharmacotherapy in elderly with special focus on primary health care. In Sweden elderly patients are mainly treated by their GP unless they are in a hospital. This means that GPs are in general responsible for the prescribed drugs even if the original prescription was initiated by a hospital physician.

Appropriate medications in the elderly

There have been several international studies on the use of appropriate and inappropriate medications in the elderly. Recommendations of drug treatment to elderly

have in Sweden been made both nationally and locally in the different counties of Sweden. We wanted to investigate how frequent the use of inappropriate drugs was in nursing home residents in Sweden and if this frequency could be affected by our intervention.

Transfer of information between care levels

The transfer of information between care levels is crucial to the care of the elderly and especially to the frail elderly patients living in nursing homes or in their own homes with help from community nurses. Prior to our study there was a Norwegian study that had shown a high frequency of medication errors due to errors in transfer of information (Myhr and Kimsas 1999). The last fifteen years computer-based medical records have become common in all levels of the Swedish health care. In many parts there are different systems in primary care, hospitals and the nursing homes. The GP often have no access to other caregivers' medical records. Thus correct and rapid transfer of information is necessary to avoid medication errors.

Educational programmes

One important reason for evaluating educational programmes seems to be financial. When the financial and human resources are limited it is important to use methods that have been proven effective. Methods that are not proven to be effective should either be abandoned or altered. Another reason to scientifically evaluate educational programmes is to be able to convince colleagues who may be sceptical to participate unless it has been proven effective.

Deciding which medications should be targeted

Elderly patients are more susceptible to adverse drug events than younger patients. Anti-psychotic drugs and benzodiazepines are drugs with a high risk of unwanted effects in the elderly. The National Board of Health and Welfare has stated that there is an overuse of these drugs in the elderly and there are both national and international recommendations that the use of these drugs should be reduced in the elderly.

AIMS OF THE THESIS

The general aim of this thesis was to identify problems concerning pharmacotherapy and to develop models to improve pharmacotherapy in the elderly aiming at reducing the number of drug-related problems.

The specific objectives were:

- To describe the frequency of use of drugs that has been classified as inappropriate to geriatric nursing home patients (Paper I).

- To describe the frequency of medication errors when elderly patients are transferred between hospital and primary care (Papers II and IV).

- To evaluate the effects on quality of life in nursing home patients when their GPs receive advice on pharmacotherapy from a multi-speciality team (Paper I).

- To evaluate the effects of educational outreach visits to GPs on the prescribing of benzodiazepines and anti-psychotic drugs to elderly (Paper III).

- To evaluate the use of a Medication Report to decrease the number of medication errors when elderly patients are transferred from hospital to primary care (Paper IV).

MATERIAL AND METHODS

Different methods have been used in the present work and detailed descriptions are provided in each publication or manuscript.

Paper I

This study was cooperation between Primary Care, the Department of Clinical Pharmacology and Apoteket AB (National Corporation of Swedish Pharmacies). It was planned in 1998. In the year 1999 Apoteket AB planned to highlight information on neurological diseases and they therefore especially contributed to the financing of projects on these clinical conditions.

- A letter was sent to the heads of all nursing homes in the county of Skåne in Sweden. They were asked to participate in the study if there were any patients in their nursing home with anti-epileptic or anti-parkinsonsian medications.
- The patient's drug use and drug-related problems were documented.
- The use of drugs deemed inappropriate for geriatric nursing home residents according to Beers criteria was specifically documented. Health-related quality of life was evaluated using SF-36 (Sullivan et al. 1995). Confusion state was measured using the Behaviour Pathology in Alzheimer's Disease Rating Scale (Behave-AD) (Reisberg et al. 1987) and ability to perform activities of daily living (ADL) was assessed using the Schwab and England capacity for daily living scale (Fahn et al. 1987).
    - We selected a generic health-related quality of life instrument, SF-36. In the elderly the use of this instrument has been documented, it has however not been used frequently in nursing homes.
    - Confusion state was measured using the Behavior Pathology in Alzheimer's Disease Rating Scale (Behave-AD). This is a 25-item scale that measures behavioural symptoms in seven clusters, paranoid and delusional ideation, hallucinations, activity disturbances, aggressiveness, diurnal rhythm disturbances, affective disturbances, and anxiety and phobias, scored on a four-point (0-3) scale of increasing.
    - The patient's ability to perform activities of daily living (ADL) was assessed by the contact person at the nursing home using the Schwab and England capacity for daily living scale.
    - A multi-speciality team consisting of pharmacists, a primary care physician, a neurologist, a neuro-psychiatrist and a clinical pharmacologist evaluated the patients' medication and, when appropriate, suggested changes.
    - For the group randomised to active intervention, the physicians, involved in the care of the patients, then received the recommendations for changes in drug treatment from the multi-speciality team.
- All measurements were repeated after approximately 6 months.

Paper II

- Nurses in the community nursing system or at nursing homes in the town of Landskrona identified elderly patients that had been admitted to hospital care.

- All written information on medications was collected. This included referral forms, admission records, discharge summaries, and medication lists from the hospitals and from the community nursing system or nursing homes.
- Two different persons separately evaluated all information on the patients' drugs and medication errors. Thereafter their evaluations were compared and agreed on.

Paper III

- All GP practices in two districts of the county of Skåne were offered group-education programme on "drug treatment that may cause confusion in the elderly" by a physician and a pharmacist.
- Among the 15 GP practices that accepted, 8 were randomised to educational outreach visits.
- Prescribing statistics on benzodiazepines, medium- and long-acting benzodiazepines and anti-psychotic drugs were collected for the periods before and after the educational outreach visits from Apoteket AB (National Corporation of Swedish Pharmacies) measured as DDD. All statistics in the active group were compared with the statistics in the control group.
- After these measures the 7 GP practices in the control group participated in the educational outreach visits.
- To evaluate the opinions of the participating GPs, they answered a questionnaire. This was constructed based on a questionnaire used in a similar study (Reeve et al. 1999).

Paper IV

Based on the results of Paper II we introduced a Medication Report to improve transfer of information on pharmacological treatment between care levels.

- Elderly patients that were discharged from hospital care were included if they would receive their medication from a nurse either in a nursing home or within the community nursing system.
- The control group consisted of patients treated in the same departments one year earlier and who did not receive a medication report.
- All written information on medications was collected. This included referral forms, admission records, discharge summaries, and medication lists from the hospitals and from the community.
- Clinical risks, as a theoretical consequence of the errors, were evaluated for each patient with an error, separately by two physicians.

RESULTS

Inappropriate medications in nursing homes (Paper I)

According to Beers criteria 32 (43%) patients with epilepsy and 31 (37%) patients with Parkinson's disease used at least one drug that is classified as inappropriate to geriatric nursing home patients. Of these patients five with epilepsy used two or more inappropriate drugs whereas six patients with Parkinson's disease used two or more inappropriate drugs. The indication for the use of a patient's total drug treatment was not documented for 37 (50%) of patients with epilepsy and 34 (40%) of patients with Parkinson's disease, i.e. the indication for use of at least one drug was missing. This means that there were no information in any medical records, medication lists etc on why a drug has been prescribed. The most common drug-related problems for patients with epilepsy were adverse effects and improper choice of drug whereas for patients with Parkinson's disease drug treatment without disease or symptom and adverse effects were most frequent.

Changes in prescribing after information or educational outreach visits (Papers I and III)

The advice from the multi-speciality team did not have any positive effects on quality of life, behavioural symptoms or activity of daily lives (ADL) in the nursing home residents. For patients with epilepsy in the active group we proposed 99 changes in medication and 44 of these were carried out. The most common advice was withdrawal/decreased dose of antiepileptic drug or of drugs that can decrease the seizure threshold. For patients with Parkinson's disease in the active group we proposed 109 changes and 33 of these were carried out.
For patients with epilepsy there were no significant differences between the active and control group in changes in SF-36, Behave-AD or ADL.
For patients with Parkinson's disease there were no significant differences between the active and control group in changes in SF-36 or Behave-AD but a significant decrease in ADL in the active group. The mean decrease for patients with Parkinson's disease in ADL was 4.4 (CI 1.3 – 7.5) in the active group and 0.63 (CI -2.9 – 4.1) in the control group which was significant (p=0.02). There were no significant differences between the active and control group in the magnitude of disease specific symptoms or in the need for care compared with 6 months earlier neither for patients with epilepsy nor for patients with Parkinson's disease.

The educational outreach visits had significant effects on the prescribing of benzodiazepines and medium- and long-acting benzodiazepines to elderly patients in primary health care but no significant effect on the prescribing of anti-psychotic drugs. One year after the educational outreach visits there was a decrease in prescribing of medium- and long-acting benzodiazepines (26%) and total benzodiazepines (27%) in the active group compared with the control group. These decreases were significant, $p<0.05$. There were significant decreases after nine months but not after three or six months. For anti-psychotic drugs there were no significant differences between active and control groups.

The opinions of GPs towards the educational program in this study were overall positive. The participating physicians in general agreed with the statements that this education was relevant to their clinical work and that it improved their knowledge.

Errors in transfer of medications between hospital and primary care (Paper II)

When patients were transferred from primary health care to hospital 21% of all data on medications were transferred erroneously compared with 17% in the opposite transfer of patients, in the Landskrona study (Paper II).
The patients in this study used on average 11 drugs before, during and after hospital stay. On average there were two medication errors each time a patient was transferred between primary and hospital care.
When patients were transferred from primary health care to hospital 29 of 34 patients (85%) had at least one medication error compared with 19 of 35 patients (54%) for the opposite transfer of patients.
Errors in medications for on-demand use were more than twice as common as errors in drugs for continuous use. The most common drugs were drugs belonging to group N (Central Nervous System), C (Cardiovascular System) and A (alimentary tract and metabolism) according to ATC codes. The number of errors was largest for the most common drugs according to ATC codes. The most common error when patients were transferred to hospital was withdrawal of drug. When patients were discharged from hospital the most common error was that a drug was erroneously added.
When patients were discharged from hospital there was a significant positive influence on the number of patients that had at least one medication error from use of Medication Dispensing System, Odds Ratio 18 (CI 1.9 – 169). Of 26 patients with Medication Dispensing System 18 patients had at least one medication error whereas of 9 patients without Medication Dispensing System one patient had at least one medication error.

Effects of Medication Report on errors in transfer of information (Paper IV)

In the study on the use of Medication Report (Paper IV) when elderly patients were discharged from hospital care 79 of 248 patients (32%) in the intervention group had at least one medication error as compared to 118 of 179 patients (66%) in the control group. In the intervention group 15% of the patients had errors that were considered to have moderate or high risk of clinical consequences compared to 32% in the control group. The differences were statistically significant ($p<0.001$).
At discharge, the patients had on average 8.7 and 8.4 drugs for regular use and 1.4 and 1.8 for on demand use in the intervention and control group, respectively. The total number of medication errors was 0.97 per patient in the intervention and 2.22 in the control group. The most common medication error was that drugs were erroneously added (commission error), with 0.64 per patient in the intervention and 1.29 in the control group. Corresponding values for erroneous change in dosage was 0.21 and 0.45 and for omission errors 0.12 and 0.45, respectively.
The distribution of degree of clinical risk was similar in the intervention and control group. Among patients with at least one medication error in the intervention group 54% were without, 41% with moderate and 5% with high clinical risk. Among patients with

at least one medication error in the control group 52% were without, 41% with moderate and 8% with high clinical risk.
Before hospital care 155 patients in the active and 108 patients in the control group received their medications from a nurse, either at a nursing home or in the patients' own home. For this group of patients we had complete information on medications also prior to hospital care. On average in the intervention group the patients had 9.2 and in the control group 9.1 drugs for regular use. Patients in the intervention group had 2.2 and patients in the control group 2.7 drugs for on demand use. On average there were 2.4 medication errors in the intervention group and 2.5 in the control group when patients were admitted to the hospital.

DISCUSSION

To improve the pharmacological treatment of elderly is of concern not only to the elderly who are the ones that would gain most from such improvements, but also to the society. The elderly use a large amount of health care resources since they experience a higher incidence of disease-related morbidities, consume more drugs, and account for more adverse drug events.

Our knowledge about the effects of medications on the elderly is insufficient. The elderly are often excluded from clinical trials on drugs primarily destined for their consumption (Schmucker and Vesell 1999). Elderly are excluded both directly by being too old and indirectly by having concomitant medications or illness. New drugs are tested in relatively few patients prior to regulatory approval and marketing. Many potential adverse drug reactions (ADR) may be unknown when the new drug is prescribed. This is especially important when prescribing to patients belonging to groups that were excluded from clinical trials. Physicians should therefore be cautious in the prescription of new drugs to elderly patients.

For society there is an economic interest in optimising pharmacotherapy. As stated previously, hospital care due to ADR is common in the elderly and is expensive to the health care system. Drug costs are of course also a burden to society. Many physicians feel that drug cost is an important factor in their therapeutic decision making, but they are not always well informed about the cost of commonly prescribed drugs (Walzak et al. 1994; Korn et al. 2003).

Physicians in general and GPs in particular will probably face more demands on data on the quality and not just quantity of their delivery of health care. In Britain a system like this has recently been implemented (Roland 2004). This system includes several quality indicators, and some of them concern the quality of pharmacotherapy. It is in the interest of the GP both out of concern about their patients and their finances to improve the quality in the pharmacotherapy of the elderly.

The impact of interventions on drug use

Interventions of teams on drug use

Interventions of teams have to be evaluated like all other interventions in the care of elderly. It might be that such interventions do not have any effect if the team members do not have actual contact with the patient. In an Australian study on multi-disciplinary case conferences in nursing homes this method however resulted in improved care with fewer inappropriate medications prescribed to the elderly (Crotty et al. 2004). This was performed in a similar way as our intervention with multi-speciality team. One possible disadvantage in our study may be that GPs in Sweden are not used to advice from teams or that they prefer a dialogue with the multi-speciality team.

Educational outreach visits

Educational outreach visits have been shown effective in several studies. It is, however, not only what we do but also how these educational sessions are conducted that matters. In a Spanish study “conventional educational sessions” were effective in affecting prescribing patterns, but evidence based educational outreach visits were more effective (Bernal-Delgado et al. 2002). Educational outreach visits cannot be forced on anyone. An open dialogue is preferred instead of a monologue that is not requested by the GPs. The prescribing habits of those who do not accept educational outreach visits may be harder to affect. On the other hand one reason for declining participation in educational programmes may be that the GP is not convinced of the effectiveness. If the

effectiveness of different educational programmes is shown the previous reluctant colleagues may change their mind. There is an assumption that more rational prescribing would also be more cost-effective prescribing, we have however not studied cost-effectiveness.

Inappropriate drug use in the elderly

The use of inappropriate drugs in the elderly may affect the patients' quality of life and even cause hospital care. Many of these drugs are harmful and even lethal when used inappropriately. Benzodiazepines are the dominant drug type used by elderly persons who committed suicide by drug poisoning in Sweden (Carlsten et al. 1999). Flunitrazepam or nitrazepam were implicated in 90% of the single benzodiazepine suicides (Carlsten et al. 2003).
Drug reviews of patients' drug treatment by multidisciplinary teams have shown to decrease the number of drug-related problems (Lipton et al. 1992; Bellingan and Wiseman 1996), improve the out-come of drug treatment (Jaber et al. 1996; Bogden et al. 1998; Gattis et al. 1999), decrease the number of re-admissions to the hospital (Gattis et al. 1999; Brookes et al. 2000) and increase the patients compliance to and knowledge about their drug treatment (Lowe et al. 2000). Our intervention did not affect the use of inappropriate drugs in the elderly. Reducing the use of inappropriate drugs in the elderly is of great importance for the elderly patients. To achieve this reduction the list of medications should be reviewed periodically. The effects and needs for the medications should be evaluated.

Methodological consideration

In the papers on appropriateness of drugs and transfer of information on drugs (Papers I, II and IV) we have studied elderly patients in nursing homes or community nursing system. The reasons are as stated previously that these patients are most vulnerable to DRP and that for these patients we knew exactly what medications they actually used. We cannot say for sure that other healthier elderly patients use inappropriate medications or have medication errors in the same frequency. If we invent procedures that reduce the number of inappropriate drugs and medication errors for the frailest elderly we believe that these healthier elderly patients would also benefit from this. Paper III on the other hand dealt with prescribing of anti-psychotic drugs and benzodiazepines to all elderly patients. In that study we received prescribing statistics on all drugs prescribed. These statistics were presented in different age groups on a group-level and we could not specify whether the elderly patients lived in a nursing home or not. One limitation in educational outreach visits is that this type of education may attract only those that already have a high quality in prescribing. It is harder to affect the prescribing of physicians that refuse to participate in this type of education. We offered educational outreach visits to 41 GP-practices but only 15 accepted. In our study the educational outreach visits were very well appreciated. For obvious reasons we do only know that it was well appreciated among the 15 practices that participated. Some of the instruments that we used are not designed exactly to the kind of patients that were included in the first study (Paper I). After our study was started a study on SF-36 use in nursing homes was published (Andresen et al. 1999). They concluded that the utility of the SF-36 may be limited to assessments of subjects with higher cognitive and physical functioning rather than typical nursing home residents. The SF-36 might benefit from modification for this setting, or by tests of proxy ratings.

We used the Behavior Pathology in Alzheimer's Disease Rating Scale (Behave-AD) to measure changes in behavioural symptoms. Behave-AD was designed primarily for use in patients with Alzheimer's disease.
We wanted to use validated internationally well-known instruments. The reason for using two instruments that were not optimal for our group of patients was that we did not find any better instrument and that we wanted to be able to compare our results with those of other studies.
Paper IV evaluated the effects of the Medication Report by comparing the intervention group with a retrospective control group. To conduct randomised controlled studies on medication errors when elderly patients are transferred between hospital and primary care is not easy. We would then have had to randomise patients in the participating clinics to a discharge with a Medication Report or without this information. The same physician should in that case sometimes make structured information on medications and sometimes not. It would have been very hard to maintain a distinction between intervention and control group and to keep the physicians motivated to participate.

Reduce the number of medication errors

We have shown that it is possible to reduce the number of medication errors by the use of Medication Report at discharge from hospital. There are many different possible interventions that could reduce the number of medication errors at all levels where they occur. There is a great need for more research in this area. Computerised prescribing systems already have great potentials. In one US hospital they reduced serious medication errors by 86% (Bates et al. 1999). In another US study an online system integrating computers, pharmacists and physicians improved prescribing patterns and quality of care (Monane et al. 1998). In that study they used a database with explicit criteria to identify potentially inappropriate drug use in the elderly. Computer alerts then triggered telephone calls to physicians by pharmacists with training in geriatrics.

Electronic and computerised systems can help. The methods have to be evaluated like all other procedures in medicine. The number of medication errors could be reduced by simple changes of existing procedures. We have shown this by the use of the Medication Report and we welcome other types of interventions/procedures.
We should generally have a more open approach to errors and encourage reporting of errors. The important thing is not to find "a guilty person". Instead we should learn from errors and avoid repeating them.
Cicero's statement more than 2000 years ago still is true: "It is the nature of man to err, but it is the nature of only the foolish to persist in error."

SUMMARY AND CONCLUSIONS

Drug-related problems are common in elderly patients. Pharmacotherapy has to be adjusted to the elderly. Since elderly often have many medications different prescribers may be involved in the treatment. It is important to be aware of all the facts about the elderly patient before initiating pharmacotherapy; concomitant medications, illnesses, renal function etc. This study highlight difficulties in the transfer of information between different levels of care, difficulties in optimising pharmacotherapy in the elderly but also some possibilities to make improvements in these areas.
In conclusion:

- Drug-related problems are common in the elderly.
  - Inappropriate medications are frequently used in nursing homes (Paper I).
  - Medication errors are common when elderly patients are transferred between hospital and primary care (Papers II and IV).
- It is possible to reduce the number of drug-related problems.
  - We failed to demonstrate any positive effects on the quality of life in nursing home patients using advice from a multi-speciality team on pharmacotherapy (Paper I).
  - Educational outreach visits are well appreciated by GPs and can affect their prescribing habits leading to a decrease in prescribing of inappropriate medications to elderly patients (Paper III).
  - Medication Report is effective in reducing the number of medication errors when elderly patients are transferred from hospital to primary care (Paper IV).

SVENSK SAMMANFATTNING (SWEDISH SUMMARY)

Läkemedelsrelaterade problem hos äldre

- Interventioner för att förbättra läkemedelsbehandlingen

Läkare inom primärvården står för en stor del av den totala läkemedelsförskrivningen i Sverige och är en viktig målgrupp för läkemedelsindustrins information.
Det har i flera uppmärksammade studier från Socialstyrelsen uppmärksammats att läkemedelsbehandlingen för patienter boende i äldreboenden inte är optimal. Äldre personer, i synnerhet de som bor i äldreboende, har ofta en komplicerad sjukdomsbild och använder många läkemedel. Flera olika läkare kan vara inblandade i den aktuella behandlingen, tidigare sjukdomar och behandlingar är ofta dåligt dokumenterade och läkemedel finns ibland kvar utan kvarstående indikation. Läkemedel kan ge biverkningar och interaktioner som gör behandlingen komplicerad och omfattande. Det finns också rapporter om att 15-22 % av inläggningar på medicinkliniker beror på läkemedelsbiverkningar och att läkemedelsbiverkningar är den fjärde till sjätte vanligaste dödsorsaken. Antalet behandlingsmetoder med läkemedel ökar liksom andelen äldre varför denna typ av problem förväntas tillta i framtiden.
För patienter i särskilda boenden finns organisatoriska brister i bakgrundsdokumentation om sjukdomar, diagnoser, samt orsaker och mål för läkemedelsbehandling. Dessutom förs läkarens dagantecknigar och annan vårdpersonals omvårdnadsdokumentation ofta separat. Detta gör att grunderna för läkemedelsbehandlingen ej enkelt kan sättas in i ett helhetsperspektiv.
Det finns också studier som visat att i samband med skifte i behandlingsnivå t.ex. när patienten skrivs ut från sjukhus till sjukhem eller vice versa så orsakar felaktig rapportering att patienten får fel mediciner.
Syftet med denna studie har varit att beskriva de brister som finns vid läkemedelsbehandling hos äldre samt att pröva effekten av olika interventioner. Min utgångspunkt som allmänläkare har varit att göra interventioner som ska kunna påverka läkemedelsbehandlingen inom primärvården.

Resultaten av de olika delarbetena belyser några av de brister som alltjämt finns inom läkemedelsbehandling av äldre.

I den första delstudien som berörde sjukhemspatienter med Parkinsons sjukdom eller epilepsi så fann vi att 71 patienter (45 %) hade minst ett läkemedel utan angiven indikation i journal, kardex eller läkemedelslistor.
Olämpliga läkemedel för sjukhemspatienter enligt internationella kriterier (Beers) hade 32 (43 %) av epilepsi- och 31 (37 %) av parkinsonpatienterna. Vi prövade här en intervention i form av rekommendation från ett multi-disciplinärt team om läkemedelsbehandling. Detta team bestod av neurolog, klinisk farmakolog, apotekare och primärvårdsläkare. Teamet gick igenom patienternas medicinering och om man fann det lämpligt så lämnades förslag till möjliga förändringar i läkemedelsbehandlingen. Denna intervention hade emellertid inga positiva effekter när vi mätte utfall som patienternas livskvalitet, Aktivitet i Dagligt Liv (ADL) eller beteendesymtom.

I den andra delstudien så kartlade vi omfattningen av felaktig läkemedelsanvändning orsakat av brister i överföringen av information. Vi undersökte vad som hände när

patienter som var 65 år eller äldre flyttades mellan sjukhus och kommunal hemsjukvård eller sjukhem. I genomsnitt hade patienterna mer än 10 läkemedel vardera och det blev 2 läkemedelsfel varje gång patienten bytte vårdform, dvs ca 20 % av ordinationerna varje gång den äldre patienten skrevs in på eller ut från sjukhus.

I delstudie III utvärderades om läkemedelsfortbildning till primärvårdsläkare kan förändra förskrivningsmönstret vad gäller läkemedel till äldre. Utvärderingen innefattade bensodiazepiner och neuroleptika, läkemedel som är särskilt förknippade med mycket biverkningar hos äldre. Förskrivning av bensodiazepiner totalt och av långverkande bensodiazepiner sjönk signifikant i den aktiva gruppen men inte i kontrollgruppen. För neuroleptika sågs inga signifikanta förändringar i någondera grupp. Utvärderingsenkäten visade att fortbildningen överallt var mycket uppskattad.

I delstudie IV undersöktes huruvida införandet av läkemedelsberättelse kan minska antalet fel i läkemedelsjournaler då patienten överförs från slutenvård till kommunal vård. Läkemedelsberättelse är en del av utskrivningsinformationen som ska ges till patienten, sjuksköterska inom hemsjukvården samt till patientens familjeläkare. Läkemedelsberättelsen är ett strukturerat sätt att beskriva vilka läkemedel som har ändrats under sjukhusvistelsen samt varför ändringar har gjorts.
Det blev en signifikant minskad andel patienter med läkemedelsfel i gruppen med läkemedelsberättelse (32 %) jämfört med kontrollgrupp (66 %). Antalet fel i genomsnitt var 2,2 i kontrollgrupp och 1,0 i gruppen med läkemedelsberättelse.
Vi tror att minskningen i överföringsfel leder till minskat vårdbehov med färre sjukhusinläggningar och minskat lidande för äldre patienter. För sjukvården skulle det innebära minskad belastning och minskade kostnader.

Sammanfattningsvis så har vi påvisat en del problem vid läkemedelsbehandlingen av äldre patienter. Genom systematiska aktiviteter har vi minskat omfattningen av dessa problem.

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APPENDIX (I–IV)