

Rational drug treatment in the elderly

*Good friends are like stars...
You don't always see them, but you know they are always there.*

(Bertrand Russel 1872–1970)

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INGER NORDIN OLSSON

Rational drug treatment in the elderly
"To treat or not to treat"

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"To treat or not to treat"

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Abstract

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The general aim of this thesis was to examine the effect of interventions on the usage of inappropriate and hazardous multi-medication in the elderly ≥ 75 years with ≥ 5 drugs.

Methods: Paper I describes a cluster randomization of nursing homes, the outcomes were; number of drugs, health status and evaluations. A randomized controlled trial concerning elderly in ordinary homes was performed in paper II and the outcomes were; EQ-5D index, EQ VAS and prescription quality. In paper III a cohort study was carried out and the outcomes were; medication appropriateness index, EQ-5D index and EQ VAS. In paper IV, registered nurses from the nursing homes study were interviewed in a descriptive study with a qualitative approach.

Results: There was a significant reduction of number of drugs used per patient at the intervention nursing homes ($p < 0.05$). Monitoring and evaluation of medications were significantly more frequent at the intervention homes ($p < 0.01$). The registered nurses at the nursing homes described a self-made role in their profession and the leadership was not at sight. Drug treatment seems to be a passive process without own reflection. Extreme polypharmacy was persistent in all three groups of elderly living in ordinary homes and there was an unchanged frequency of drug-risk indicators. In the cohort study a lower medication quality was shown to be associated with a lower quality of life. EQ-5D index was statistically significantly different among the groups as was EQ VAS.

Conclusion: The nursing home study showed an extreme shortage of monitoring of health status and surveillance of the effects of drugs in the elderly. More attention must be focused on the complexity of the nursing process; medication management must be promoted in teamwork with the physician. The resistance to change prescriptions in accordance with the intervention underlines the need of new strategies for improving prescription quality. Since medication quality is related to the patients' quality of life, there is immense reason to continuously evaluate every prescription and treatment in shared decision with the patient.

Keywords: elderly, polypharmacy, drug evaluation, nursing process, monitoring, inappropriate prescribing, quality of life, patient participation.

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LIST OF PUBLICATIONS

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

- I. **Nordin Olsson I**, Curman B, Engfeldt P. Patient focused drug surveillance of elderly patients in nursing homes. *Pharmaco-epidemiology and Drug Safety* 2010; 19: 150-157.
- II. **Nordin Olsson I**, Runnamo R, Engfeldt P. Drug treatment in the elderly: An intervention in primary care to enhance prescription quality and quality of life. *Scandinavian Journal of Primary Health Care* 2011. *In press*.
- III. **Nordin Olsson I**, Runnamo R, Engfeldt P. Medication quality and quality of life in the elderly, a cohort study. *Health and Quality of Life Outcomes* 2011, 9:95.
- IV. **Nordin Olsson I**, Wätterbjörk I, Blomberg K. Registered Nurses' perceptions of their professional role in medication in elderly care. *Manuscript submitted*.

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LIST OF ABBREVIATIONS

ADR	Adverse drug reaction
ApoDos	Medication dispensing system
CDT	Clock drawing test
DRP	Drug related problem
EQ-5D	EuroQol group; quality of life questionnaire
EQ VAS	EuroQol group; visual analogue scale
MAI	Medication appropriateness index
MMSE	Mini-mental state examination
NSAID	Non-steroidal anti-inflammatory drug
QoL	Quality of life
PPI	Proton-pump inhibitor
RN	Registered nurse
SALAR	Swedish Association of Local Authorities and Regions
SoS	The National Board of Health and Welfare
SSRI	Selective serotonin reuptake inhibitor
WHO	World Health Organization

CONTENTS

BIOGRAPHICAL ACCOUNT.....	11
BACKGROUND.....	13
Care of elderly.....	15
The challenge of multi-medication	17
AIM OF THE THESIS	20
METHODS.....	21
Paper I.....	21
Study participants	21
Study procedure	22
Paper II	23
Study participants	23
Study procedure	23
Paper III	25
Study participants and procedure.....	25
Paper IV	28
Study participants	28
Study procedure and setting	28
DATA ANALYSIS	30
Quantitative analysis (I, II and III)	30
Paper I.....	30
Paper II	30
Paper III.....	30
Qualitative analysis (IV).....	31
Paper IV	31
ETHICAL CONSIDERATIONS	32
RESULTS	33
Paper I.....	33
Paper II	36
Paper III	40
Paper IV	44
DISCUSSION AND IMPLICATIONS	47
Paper I.....	50
Paper II	52
Paper III	53
Paper IV	54

METHODOLOGICAL CONSIDERATIONS.....	57
CONCLUSIONS.....	60
FUTURE RESEARCH.....	61
SUMMARY IN SWEDISH.....	63
Delarbete 1.....	63
Resultat.....	63
Delarbete 2.....	64
Resultat.....	64
Delarbete 3.....	65
Resultat.....	65
Delarbete 4.....	65
Resultat.....	66
Slutsatser.....	67
ACKNOWLEDGEMENTS.....	69
REFERENCES.....	73
APPENDIX.....	83
I. EQ-5D instrument.....	83
II. Medication appropriateness index (MAI).....	84

BIOGRAPHICAL ACCOUNT

I believe that it can be of importance to include a short biographical account to illustrate the researcher's pre-understanding of the field. This might give a human touch and broader perspective to the research results, the context and the complexity of the area.

I am a 56-year-old female physician, specialized in family medicine. I have worked for more than twenty years and have a substantial clinical experience as a physician in primary care. I have also been in charge of a health care centre and I have been a senior consultant in the county council's primary care. My interest and preferences have been development of primary care; the medical knowledge and the competence in the primary care team as well as the citizens' need of high quality and safety in the healthcare given. The patients' needs are different at different times and for care professionals there must always be a focus on the individual.

The primary health care centers' work depend on good collaboration and cooperation with hospitals and municipalities to establish continuity in the caregiving process. The workload and the obligations as well as expectations of the primary care have increased dramatically during my three decades as a physician, accompanied by political statements of the cost effectiveness and benefits of an extended primary care. An evident challenge is the permanent shortage of family physicians, affecting primary care nationwide.

There have been a lot of changes affecting working procedures in healthcare followed by increasing demands of health and welfare parallel to inevitable signs of limitations in society resources meaning that prioritizing is a necessity. I have followed the technical and pharmaceutical development giving enormous new possibilities for longer life and better quality of life, but also demanding carefulness and humbleness to maintain respect for human values.

I have worked before and after the "Elderly Reform", where the main intention was to demedicalize the care of elderly and promote social interventions by the municipality. But with an ageing population the morbidity increases due to the burden of chronic diseases and so does the need of medical support. Drug treatment is one of the most common interventions in healthcare today especially regarding the elderly. With support from my supervisor I started my scientific journey and my PhD education. Starting

with the theoretical principles of drug treatment in the elderly and adding results from empirical studies I gained new insights into the challenge of multi-medication and completed this thesis.

In October 2010 I changed employer to the Department of Supervision at the National Board of Health and Welfare. This was an important step not only in my own *modus operandi* from being a clinician working with guidelines and recommendations to becoming a medical supervisor in a governmental agency. Even more important and challenging is the opportunity to use acquired knowledge in surveillance of the national commission for care of the elderly. Moreover, the experience of participation in revision and development of governmental regulations for drug treatment of the elderly has strengthened my insights from my research in this demanding area.

The feeling of knowledge and ability to handle challenges in a research field, emerging out of clinical experience and science, with empiric cornerstones and scientific theory has given a sense of self-confidence accompanied with humbleness from trial and error emphasizing the importance of re-thinking and the courage to question.

RATIONAL DRUG TREATMENT IN THE ELDERLY "TO TREAT OR NOT TO TREAT"

BACKGROUND

The title of this thesis applies to the World Health Organization (WHO) definition of rational use of medicines¹: *"Patients receive medications appropriate to their clinical needs, in doses that meet their own individual requirements, for an adequate period of time, and at the lowest cost to them and their community"* (WHO 1985).

Drug treatment is probably the most common intervention in health and medical care worldwide, meaning it affects an enormous amount of patients and gives enormous benefits but also demands enormous resources including both healthcare staff and money as well as creates enormous risks when not correctly managed. The WHO also states: *"More than 50% of all medicines are prescribed, dispensed or sold inappropriately and half of all patients fail to take medicines correctly. The overuse, underuse or misuse of medicines harms people and wastes resources"*². The Swedish National Board of Health and Welfare (SoS) applies to the WHO recommendations for drug use in the elderly, where the indication is the basic principle, followed by benefits of treatment in relation to harmfulness and inappropriateness³.

In the developed world the real challenge for the healthcare system is the ageing population, accompanied by an increasing burden of chronic diseases and chronic medication⁴. For many groups of patients treatment with modern drugs has made a great contribution to better quality of life (QoL), fewer disabling symptoms, and decreased need for health care and sometimes, better prognoses. However, an increasing proportion of negative side effects due to extensive pharmacological treatment have been noted especially among the multi-diseased elderly⁵⁻⁶. More attention is now paid to risks with multi-medication meaning over-, under- and misuses⁷⁻¹⁰ of drugs, particularly since it is followed by marked increases in expenditure for healthcare and pharmaceuticals. The reasons for ongoing multi-medication are many; an overload of treatment possibilities, doubtful indications and unclear diagnostics, but most of all a remarkable lack of systematic evaluations of drug effects^{9, 11-12}.

The burden of chronic diseases rises as we live longer and so does the burden of chronic ongoing multi-medication. Older people use more drugs than younger, but the mean age of the users differs between different drug groups¹³. Multi-medication or polypharmacy, defined as ≥ 5 drugs¹⁴⁻¹⁵, is present in 73% of the elderly population¹⁶. Both age and comorbidity of the patient are risk factors for polypharmacy¹⁷. Inappropriate drug use¹⁸ and drug related problems (DRPs) like interactions and negative side effects¹⁷ as well as risk of falls and confusion are risks associated to polypharmacy accompanied by rising costs for healthcare¹².

The total cost of prescribed pharmaceuticals in Sweden year 2010 was 25 billion SEK and the most prescribed drugs were paracetamol, penicillin V and low dose aspirin¹³. During the last twenty years the costs for drugs have changed due to an ageing population, more intense drug treatment, new guidelines, new pharmaceuticals and most of all due to the new reimbursement system¹⁹. The factor forcing the costs to rise year by year is predominantly the increasing population of elderly¹⁶. The elderly ≥ 75 years consume more than 25% of the pharmaceuticals sold though they only constitute 9% of the population³. The use of pharmaceuticals for people ≥ 75 years is at average 5-6 drugs which is twice as much as two decades ago²⁰. About 12% of people ≥ 80 years in Sweden use 10 or more drugs, with a range of 10%-16% for women and 7%-11% for men²¹. The usage of 10 or more drugs is often labeled excessive polypharmacy or extreme polypharmacy and is an alerting sign of risks or inappropriateness in drug treatment²². The proportion of patients enrolled in the medication dispensing system (ApoDos) with excessive polypharmacy is 26%, a marked difference to the 7% of patients with excessive polypharmacy and ordinary prescriptions²¹.

The drugs predominantly involved in causing adverse drug reactions (ADRs) are from four groups, namely low dose aspirin, diuretics, warfarin and non-steroidal anti-inflammatory drugs (NSAID)²³⁻²⁴. According to different studies DRPs cause or contribute to a range of 3-15% of all hospital admissions^{23, 25-26}. Drug-related admissions are associated with prescribing problems (31%), with adherence problems (33%) and with monitoring problems (22%)²³. Approximately 90% of the ADRs are of type A, meaning they are predictable and preventable²⁵. Though many drugs have improved longevity and QoL, in the face of limited resources there is a need to reduce the burden and extra costs associated with inappropriate drug use, lessen DRPs affecting morbidity as well as mortality and assess the benefit vs. harm with treatment^{7, 10, 24}.

Care of elderly

In many countries the care of elderly is dependent on an integration of care given by different caregivers, the county council and the municipalities. In Sweden the paradigm shift took place via the “Elderly Reform” in 1992, where the main responsibility for care of the elderly was transferred from the county council to the municipality through changes in legislation and taxation²⁷.

One of the central ideas behind the “Elderly Reform” was to “demedicalize care of elderly persons”²⁷ and instead enhance social environmental factors. Serious challenges and difficulties of this paradigm shift have become obvious since the multi-diseased elderly often are discharged rapidly resulting in more advanced and rising care-load in the municipality demanding medical care, not preferably social efforts²⁷⁻²⁸. The “chain-of-care”²⁷ is an established phenomena meaning transferring the multi-diseased patients back and forth along the care giving system between the municipality, the primary care and the hospital. This implicates that it is common to have many different caregivers, where no one takes the overall responsibility²⁹ and no one has the opportunity to survey all current prescriptions.

There are many narratives about the Bermuda triangle where ships were wrecked or lost. Figure 1 (page 16) illustrates the advanced collaboration and challenge in the ”chain-of-care” after the “Elderly Reform”, also sometimes called “the Bermuda triangle or where the patient was lost”³⁰.

When the care of the elderly became a major concern for the municipality, with the overall responsibility it had organizational consequences concerning specialized elderly homes, leadership issues, and issues such as prioritized needs of the elderly. Registered nurses (RNs) have a central role in the responsibility for the care of the elderly and their families as well as leaders of the nursing staff. In nursing homes it is either RNs from the municipality or a contractor who are responsible for the care given to the residents, but for patients living in ordinary homes it can be the county council, the municipality or a contractor involved as care provider²⁷. The RNs often work by themselves with a distance to colleagues and physicians implicating that they have to rely on their own professional confidence and sometimes experience working conditions involving intense work load and discontinuity³¹.

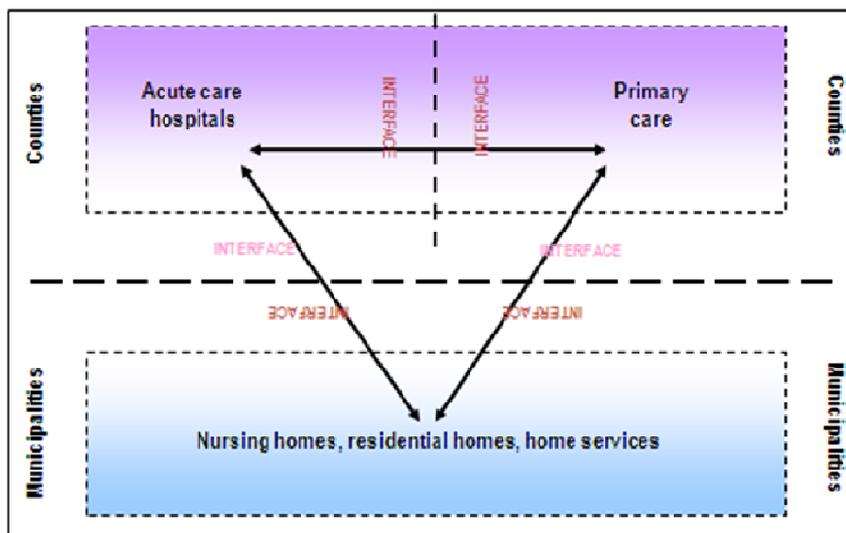


Figure 1. Bermuda Triangle. Published with kind permission of Ingvar Karlberg.

The physicians are employed by the county council or work on contractor basis. They are predominantly specialized in family medicine and work in primary health care centers^{27, 32}. The family physicians are the main prescribers in every part though responsible for the medical care given the physician is an outsider in the care giving process. The shortage of family physicians nationwide affects their professional role and work performance possibilities resulting in high pressure and discontinuity³². The overall monitoring of the patients' health status, their wellbeing and care planning are done by the RNs at the nursing home. They have regular rounds with the physicians and also contact them when needed. There are written agreements between the municipality and the county council about the time and obligations for the family physicians to fulfill for care of the elderly and especially at the nursing homes.

This means that different contracts of employment, legislations and agreements surround the collaborative work which not always support and optimize the care given³². This causes challenges in the complex system of medical care and care planning for the multi-diseased elderly in many aspects, where drug treatment is a very important part³³.

The challenge of multi-medication

There are studies of different strategies for handling drug treatment including polypharmacy: the pharmacists' drug review at admission to or discharge from hospital³⁴, home based medication review³⁵⁻³⁷, pharmacists' advice³⁸⁻³⁹, telephone calls⁴⁰, consultant team advice⁴¹⁻⁴³, and educational programs about drugs⁴⁴⁻⁴⁵. However, the results of these studies vary and it is not possible to draw any clear conclusions regarding the effects of these strategies.

The multi-diseased elderly are among those most dependent on good healthcare, since they have reduced autonomy, and less ability and possibility to communicate about their conditions or symptoms. The challenge for caregivers, that is in this context healthcare professionals, is to find an adequate level of follow-up, taking into consideration normal ageing and concomitant diseases⁴⁶.

Due to ageing there are often changes in pharmacokinetics and pharmacodynamics to different extent in each individual which always demand closer monitoring and individual adjustment of dosages. Among other things, renal function decrease⁴⁷, and there are greater interindividual differences in response to drugs^{33, 48-49}. These changes may cause negative side effects such as ADRs and drug interactions, and in combination with polypharmacy the consequence is a considerable increase in the costs of drug treatment and healthcare utilization^{7, 10}.

The last decade drug treatment has increased dramatically⁵⁰ and especially for the elderly in nursing homes⁵¹. The role of the physician has been questioned in many studies, but it has not been evaluated. Therefore our intention and objective in the first study was to focus on the important role of the prescribing physicians in achieving higher quality of drug treatment, by carrying out a physician-led study.

It is worth reminding that the SoS and the Swedish Association of Local Authorities and Regions (SALAR)⁵²⁻⁵³ concur with the WHO recommendations for drug use in the elderly, where the indication is the basic principle, followed by benefits of treatment in relation to harmfulness and inappropriateness^{3, 52}. The SoS has identified some drug-risk indicators in treatment, that is drugs not appropriate for use in the elderly. Occurrence of these drugs in the patient's medication list signals increased risks of ADRs and drug interactions which could affect the quality of drug treatment and the patient's well being³. If the goal for healthcare is to help people live

longer and feel better⁵⁴, there is a need for focusing on “well being”, that is QoL, as a main outcome measure⁴, not only treatment goals per se.

Polypharmacy and/or poor quality of drug treatment are consequently challenges that should be addressed. Drug treatment can be either the facilitator, which gives the opportunities or the opposite, an intensifier of problems by occurrence of unacceptable side effects possibly leading to decreased QoL.

There are currently no studies that have definitively determined whether various methods designed to reduce drug-related problems in the elderly affect QoL. Most studies in the area focus on prescription reviews done by drug specialists, for example pharmacists¹². The evidence that this kind of intervention can prevent medication related adverse events is weak⁵⁵⁻⁵⁶. In the second paper the purpose was to investigate if a more basic kind of intervention and prescription review could be effective. We wanted to conduct a study that focused on the easiest possible intervention to increase prescription quality and thereby increase QoL. The intervention should be cost efficient, focus on colleague to colleague advice and possible to perform in the primary health care centre without additional resources such as pharmacist.

The ageing process and becoming old is a complex phase encompassing many perspectives, for example loss of functions and decreasing autonomy, higher morbidity and need of care. Prescribing for older people demands specific knowledge^{17, 57}. Multi-medication or polypharmacy is among the most obvious signs of risks in drug treatment, resulting in increased risks for inappropriate drug use and ADRs, followed by higher morbidity and hospitalization⁵⁸⁻⁶¹. Polypharmacy also include risks of underutilization of each drug and underprescription of appropriate drugs^{9, 62-63} all possibly affecting QoL. Compared to other age groups there is a greater impact of health and functional ability on QoL in older ages⁶⁴⁻⁶⁵. In the area of medicine this demands a paradigm shift towards shared decision and incorporating the patient’s preferences when the crucial factor is QoL⁵⁴. The standardized and non-disease specific EQ-5D instrument⁶⁶ is used to assess the patient’s health related QoL. Together with their self-rated QoL via the EQ VAS form⁶⁶, a reliable and valid depiction of their QoL is obtained.

Today there is no comprehensive documentation system for sharing medical records between caregivers making surveillance of all the patients’ prescribed drugs possible. This means that no one has the possibility to survey

all current prescriptions^{12, 67}. A risk factor in this context is the prescribing physician¹⁷, since prescribing demonstrates initiative and action, but good and appropriate prescribing demands many considerations. There is an evident shortage of systematic follow-up including discussions and decisions of treatment goals for and with the patient⁹.

Assessment of prescription quality and medication appropriateness demands reliable tools. The medication appropriateness index (MAI) developed by Hanlon et al⁶⁸ has been shown to fulfill the criteria⁶⁸⁻⁷⁰. The MAI score is a reliable instrument to evaluate the elderly patient's drug therapy⁷¹, to continuously question the treatment and the lack of follow-up, to achieve better and more appropriate prescribing and most of all to minimize adverse drug events^{57, 72-73}.

The intention in the third paper was to see if there is an association between medication quality and quality of life. We also wanted to examine if there is an association between medication quality and cognitive impairment.

The prescribing process is complex especially concerning the multi-diseased elderly as it involves the patient, the prescribers and the caregivers i.e. it embraces the total healthcare system⁷⁴. In addition to rising expenses for healthcare the issue of multi-medication is a giant challenge in a health economic aspect for the society now and in the future^{72, 74-75}.

Community health nursing is a growing area of practice where guidelines are often lacking⁷⁶⁻⁷⁷. Services in these settings include both health services and issues of daily living, such as meals, functionality and social activities. The RNs in elderly care both in Sweden and internationally have been described as working under pressure^{31, 78-79}, and lacking specialist competence in elderly care⁷⁹⁻⁸¹. The professional role of the RNs include different domains; assessment, planning, treating and evaluation³¹ and also involving medication management⁷⁸ meaning that medication monitoring is an important nurse function⁸².

In the fourth study we focus on the role of the municipal RN as main caregiver working in collaboration with the consultant physician. The aim of the study was to describe RNs' perception of their professional role especially regarding medication management in elderly care.

AIM OF THE THESIS

The general aim of this thesis was to examine the effect of different interventions to implicate on the usage of inappropriate and hazardous multi-medication in elderly. The studies were performed with different perspectives; surveillance in nursing homes and the nursing process, prescription quality and physician feedback, medication appropriateness and quality of life.

The specific aims were:

- To focus on the patient's health status and the actions taken by the prescribing physicians to achieve a higher quality of drug treatment, by carrying out a physician-led study (Paper I).
- To examine if prescription reviews sent from a primary care physician to other primary care physicians could affect prescription quality and the patient's quality of life, and also if there were any additive effects by encouraging the patients to question their drug treatment by giving them their medication record (Paper II).
- To investigate if there is an association between medication quality and quality of life (Paper III).
- To describe registered nurses' perceptions of their professional role especially regarding medication management in elderly care (Paper IV).

METHODS

Different methods have been used in the underlying research studies. Complete and detailed descriptions are provided in each publication or manuscript.

Paper I

The study was an open intervention study of elderly people in nursing homes in the city of Örebro in Sweden.

Study participants

Three hundred and two residents of eight nursing homes were involved in the study. The care of elderly at nursing homes is a major concern for the municipality, which has the overall responsibility and the nursing homes are their properties. Two municipal administrators gave permission for the study and their written agreement was needed to conduct the study. They selected the nursing homes without knowing anything about the intervention and also chose four other nursing homes to act as control group. There are strict criteria for becoming a nursing home resident; functional disablement, with or without cognitive impairment and the need of twenty-four hour care.

All patients living in the intervention nursing homes were eligible to be included in the study. The only exclusion criterion, except not willing to participate, was moving to another facility. All the patients or their relatives in the intervention nursing homes gave written informed consent to participate and the patients were then consecutively included in the study.

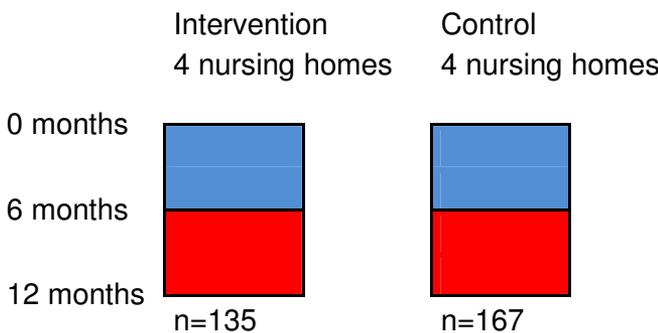


Figure 2. Study design, paper I.

Study procedure

The intervention period was 6 months, with follow-up via the medical records after a further 6 months. Before the study start, introductory meetings were held for the physicians and nurses at the intervention nursing homes about the aims of the study and to stress the structure of the intervention: systematic medical activity and follow-up of health status. To handle the challenge of extensive polypharmacy in this group of elderly we wanted to focus on the patient's health condition and from that tailor the drug treatment.

The standard routines for medical consultations and care giving at the nursing homes were followed in every other respect. The overall monitoring of the patients' health status, their wellbeing and care planning are done by the nurses at the nursing home. They have regular rounds with the physicians and also contact them when needed. The functional status are assessed and monitored by the occupational therapist.

Two nurses without connections to any of the participating nursing homes were employed for the study. They filled in the patients' case record forms regarding the number of drugs, evaluations and care utilization.

An overall form was completed for each participant describing type of municipal facility and type of drug dispensing/administration route.

The physician's responsibility in the intervention nursing homes included:

1. Completing a medication record for each patient by making a drug revision together with the nurse at the time of inclusion. Checking all the drugs, their indications and dosages, and then deciding whether or not to continue the medication.
2. Evaluating every change in medication and signing the evaluation with the date of follow-up throughout the study.
3. Registering health care utilization, i.e. every medical consultation about or home visit to the patient. A home visit was by rule defined as "eye-to-eye contact" between doctor and patient regardless of reason; everything else was defined as medical consultations (discussion between nurse and physician). Admissions to hospital were counted from the inpatient register.

The patients' physical health status was examined at both study start and study end through determining baseline nutritional status and blood pressure in supine and upright position as well as renal function.

For annual prescription renewals, the tests above ought to be checked once a year/patient. The frequency of these examinations was compared between the intervention and the control group.

Paper II

The study was a randomised controlled study of elderly patients living in ordinary homes in Örebro County Council.

Study participants

All patients ready for discharge from the University Hospital in Örebro and fulfilling the criteria were eligible for the study. Inclusion criteria were: ≥ 75 years, ≥ 5 drugs and living in ordinary homes. Exclusion criteria were dementia, abuse or malignant disease diagnosed before the study start. The electronic care planning system (Meddix), used throughout the county council and municipalities, made the surveillance of all discharges complete and all patients had the same opportunity to be included. The study was performed in primary care, since the family physicians are responsible for the medical care of the elderly after discharge from hospital.

If the patient was eligible at discharge, a letter concerning the study including informed consent was sent to the patient. A research assistant without any connection to the study consecutively randomised the patients to one of the three study groups, see Figure 3.

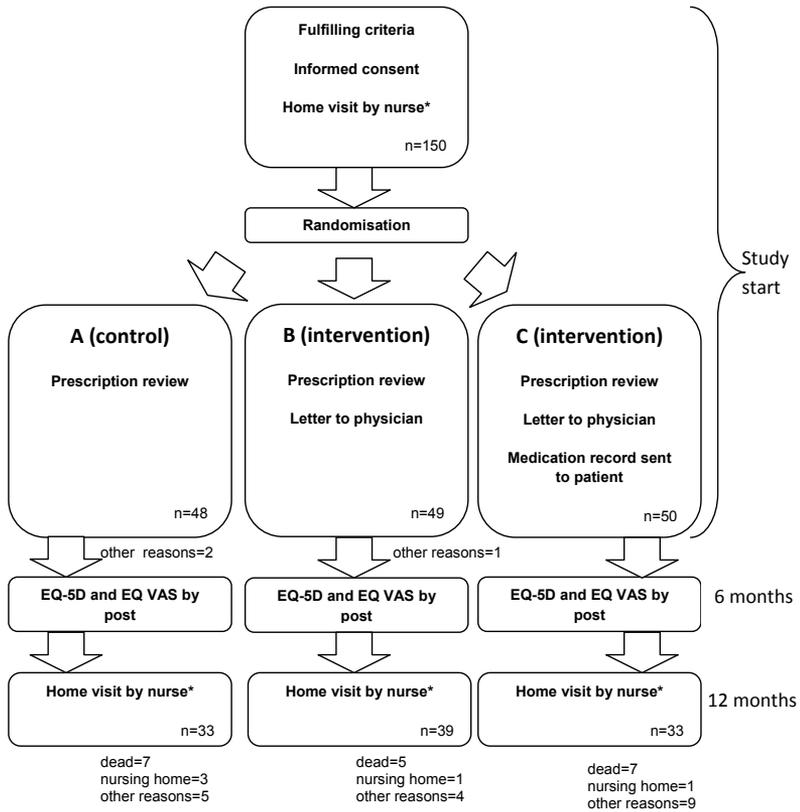
Study procedure

Group A (control): home visit by study nurse within one month after discharge, QoL survey by post at 6 months and second home visit by study nurse at 12 months.

Group B (intervention): as group A and a letter with a prescription review (according to points 1-4 below) sent to the physician/primary healthcare centre.

Group C (intervention): as group B combined with a current and comprehensive medication record consisting of the patient's written drug regimen and indications sent to the patient to enable participation in their drug treatment. This was accompanied by an instruction to utilize the record throughout the healthcare system, make notes and discuss their drug treatment with their physicians⁵².

Figure 3. Study flow chart, paper II.



Flow chart of the study and randomisation process. Dropouts for other reasons include no answer after three telephone calls, not opening the door at agreed visiting time and no longer willing to participate.

During the home visit patients in all three groups were asked about their drug regimen and compliance to capture their “true” medication record. To measure QoL the validated questionnaire EQ-5D was used after approval of the EuroQol group^{66, 83}. EQ-5D is a generic instrument evaluating function in five dimensions (mobility, self-care, usual activities, pain/discomfort and anxiety/depression). The EQ-5D index was used for an overall estimation of QoL⁸⁴. EQ VAS was used for self-rating of current health-related QoL⁶⁶.

The study physician completed a prescription review assessing the following as indicators of prescription quality^{3, 12, 72, 85-86}.

1. Number of drugs; total, on regular basis and on demand
2. Number of drug-risk indicators
3. Drug interactions by using a computer program that warns for interactions of C-type and D-type⁸⁷
4. Number of medication errors and/or discrepancies between medication list (prescriptions) and the patient’s own regime (drugs noted but not taken, drugs taken but not noted and wrong dosages)

The prescription reviews were then sent to the primary healthcare centres to alert the family physicians together with a letter explaining the errors and suggested proceedings.

At study end the comprehensive medication records for the patients in group C were collected by the nurse. All home visits throughout the study were done by the same study nurse who was blinded to the groups. Before study start all primary healthcare centres and family physicians in the area were informed about the study.

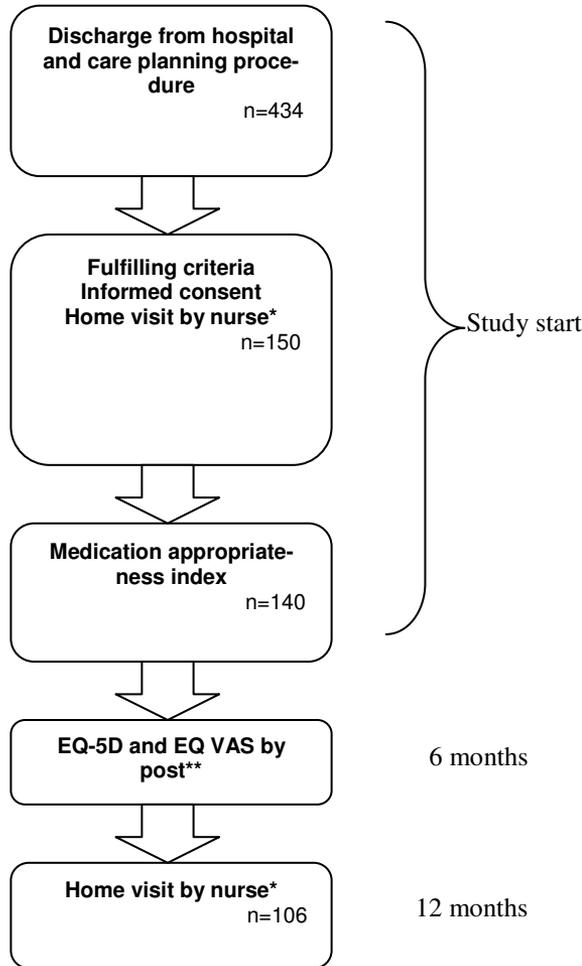
Paper III

A cohort study with the same underlying study population as in paper II, but additional data were studied.

Study participants and procedure

150 patients were identified for inclusion in the study, see Figure 4. When the initial home visits were done questions were asked about satisfaction and capability of managing the medication and the dosage regimen/dispensing. Screening for cognitive impairment was also done since this is often omitted and is a main issue for the patients’ capability to

Figure 4. Study flow chart, paper III.



dead=18
nursing home=5
other reasons=11

*see methods

**79% response rate

Dropouts for other reasons include no answer after three telephone calls, not opening the door at agreed visiting time, medical record not attainable and no longer willing to participate.

handle their medication. Both the Mini Mental State Examination (MMSE)⁸⁸ and clock drawing test (CDT) were used, as the latter is more sensitive to decline in activities and orientation in daily life⁸⁹⁻⁹⁰. The patients also completed an EQ-5D and EQ VAS survey. The study nurse asked all patients about their drug regimen and compliance, to compare with their prescriptions. The “true” drug lists (the combinations of prescriptions from all physicians involved or previously involved in the patient’s care) were then forwarded to the research centre. After six months all the patients received a letter with a new EQ-5D and EQ VAS survey. The study ended after 12 months with a follow-up home visit including EQ-5D, EQ VAS and questions of drug utilization. All the home visits throughout the study were done by the same study nurse.

To evaluate medication quality the MAI was used. The MAI is considered to be the most reliable and valid comprehensive instrument of today⁷¹. It consists of explicit criteria and implicit judgment meaning it permits standardisation and takes advantage from clinical knowledge and judgment in the evaluation process⁷⁰⁻⁷¹. The MAI review is based on thorough examinations of the patients’ medication lists, prescriptions and medical records. Every drug was checked in accordance with the MAI routine on ten items regarding medication indication, effectiveness, dosage, directions, drug-drug interactions, drug-disease interactions, practicality, expense, duplication and duration⁶⁸⁻⁶⁹. This renders a weighted MAI score per drug ranging between 0 (good quality) and 18 (poor quality). In adherence with the principles of appropriate prescribing for elderly^{57, 72, 86, 91} the item of indication was deemed fundamental in our analysis and scoring of MAI. The total MAI score for each patient is calculated as the sum of the individual drug MAIs for that patient. The assessment of indications was based on the patients’ medical records.

To measure QoL and functional status the validated EQ-5D questionnaire was used after approval of the EuroQol group. The EQ-5D index was used for an overall estimation of QoL. The preference weights and the calculation algorithm we used in this study were determined in the UK using data from the Measurement and Valuation of Health Survey⁸⁴. EQ VAS was used for self-rating of current health-related QoL.

The study participants were divided into three equal size groups, A*, B* and C*. The third of the patients with the lowest MAI score (measured at study start) and therefore the “best” medication quality was allocated to group A*. Group B* and C* represented the thirds with the “middle/centre” re-

spectively the “worst” medication quality. The groups were then compared with respect to EQ-5D index and EQ VAS at the three measuring points (study start, 6 months and 12 months) and MMSE/CDT at baseline.

Paper IV

The study has a descriptive study design with a qualitative approach.

Study participants

The study was carried out in Örebro, in the central part of Sweden. The same eight nursing homes from different parts of the town that were selected by the municipal administrators in paper I were asked to participate in the study. To obtain different perspectives, as well as a range of working manner, competence and experience, the head of each nursing home was requested to invite two RNs to participate. All invited RNs agreed to take part in the interviews. All interviews were conducted at the RNs' workplaces at a time determined by the participants. The RNs represented dementia care and general elder care, the two categories of care for the elderly that have developed with the municipality as care provider since the introduction of the Elderly Reform. Sixteen RNs were interviewed, 15 women and one man. Their years of working as an RN ranged between 1 and 39 years while duration of working in the same workplace ranged from a few months to 18 years (Table 1).

Study procedure and setting

All the interviews were performed by the same interviewer, a home service administrator. This meant that the interviewer was familiar with the organization and municipal legislation and was experienced in the interview technique. The interview guide for the interviews was based on expertise in the area of care giving and social work for the elderly in the municipality. It provided background information on the education and experience of RNs and employment in the municipality. This was followed by questions about the RNs' perspective of their own profession including conditions and possibilities. There was a section containing questions about care of the elderly, followed by questions on drug treatment. The interview ended with questions on possibilities and needs for new strategies to develop progression of the nursing profession in elderly care in the future.

The interviews lasted 20–40 minutes with a mean time of 32 minutes. All responses and data were recorded and then written down word for word by a research assistant for further qualitative analysis.

Table 1. Study participants, paper IV.

Participant	Years as RN	Experience of community elderly care (years)	Years in the same workplace	Education in drug prescribing (No/Yes)	Education in advanced level
RN 1	36	18	18	No	Courses in diabetes, incontinence
RN 2	18	6,5	6,5	No	Courses in pain, neurology, surgery
RN 3	37	13	13	No	Courses in documentation,
RN 4	21	7	1,5	No	
RN 5	39	6	5	No	Course in pharmacology
RN 6	1	5	1	No	
RN 7	8	18	8	No	
				Only in incontinence	
RN 8	5	18	5	No	
RN 9	34	18	months	No	District nurse
RN 10	15	2	2	No	
				Only in incontinence	
RN 11	10	7	7	No	Course in geriatric
RN 12	36	5	5	No	
				Only in incontinence, stoma	
RN 13	27	18	8	No	Course in supervision
RN 14	29	18	2	No	Courses in palliative care, documentation
				Only in incontinence	
RN 15	20	6	1	No	Courses in psychiatric care, pedagogy, philosophy
RN 16	10	7	7	No	Courses in nutrition

DATA ANALYSIS

Quantitative analysis (I, II and III)

The data were analyzed using the SPSS program, version 15 in all the three studies.

Paper I

When we designed the study, neither the mortality rate nor the health care consumption for the residents in nursing homes was known. From observations concerning residents in short term facilities we calculated that about 50% of the residents would have died or been referred to the hospital during the study period. The number of residents needed in order to detect a reduction of 50% during the study period was then calculated to be 60 in each group, with a power of 80% and a significance level of 5%. Since we predicted a high rate of dropouts, we aimed to include 120 residents in each group. For normally distributed data unpaired or paired Student's t-test was used for the statistical analyses. For non-parametric data Chi-square test or Mann-Whitney's test were used.

Paper II

There are no data concerning the effect of prescription reviews on QoL therefore we had to approximate the effect of such an intervention. We estimated that QoL could increase with 20% in the intervention groups. With a power of 80% and a significance level of 5% it was then calculated that a total study population of 150 individuals, with 50 individuals in each arm, should be an appropriate sample size taking into account a dropout rate of 10%. For statistical analyses Wilcoxon, Chi-square, Kruskal-Wallis or Friedman test were used.

Paper III

The study groups were analysed with respects to EQ-5D index and EQ VAS measured at study start, 6 months and 12 months. Jonckheere-Terpstra trend test across groups was performed. It tests the alternative hypothesis that the population medians are ordered in a particular direction (that is, if there is a dose-response relationship).

To be able to correct for number of drugs, sex and age as possible confounding factors, we created a linear multiple regression model with the EQ-5D index utility as response variable. The explanatory variables of primary interest were total MAI score, sex, age and number of medica-

tions. We also performed similar calculations with EQ VAS as the response variable.

To adjust for comorbidities we used the Charlson Comorbidity Index⁹². In addition we analysed the different MAI groups with respects to MMSE and CDT using the Jonckheere-Terpstra test.

Qualitative analysis (IV)

Paper IV

The text was analysed by the qualitative content analysis method developed by Graneheim and Lundman⁹³. This analysis includes several steps. In the first step the interviews were read through several times to gain a sense of the whole. Meaning units were identified corresponding to the aim of the study. In the second step the meaning units were shortened to condense meaning, yet still preserving their core. In step three the condensed meaning units were coded. The codes were compared for differences and similarities, and sorted into subcategories and, thereafter, abstracted categories. Finally a latent theme was formulated (Table 2).

Meaning units	Subcategories	Categories	Theme
My area of responsibility is to see that there are drugs, to talk to the doctor, to change medication according to the doctor's prescription – that's my part...	Conducts their responsibility in the administration of prescription drug	Executor	Occupying different roles in an undefined profession lacking leadership
It is the staff who signals since they are the ones who give the drugs and see the first reaction...	RN delegates drug administration and the monitoring of effects and side effects to nursing staff	Supervisor	

Table 2. Two examples showing the analysis process, from identification of meaning units, to formulation of subcategories, categories and, finally, a theme, in describing the registered nurses (RNs)' perceptions of their professional roles, especially regarding medication management in elderly care.

The analysis was primarily carried out by the second author (I.W.). All authors read through the interviews and discussed results throughout the whole process. Quotations were chosen in order to illustrate the findings and were translated from Swedish to English by an authorized translator.

ETHICAL CONSIDERATIONS

The Regional Ethics Committee of Uppsala University approved the studies.

After oral information written informed consent was obtained from all participants. If the patients at the nursing homes were not able to give informed consent by themselves due to dementia or stroke, their relatives were asked.

When serious DRPs indicating adverse events were discovered by the study nurse at the home visits the responsible physician was contacted by telephone or letter and everything was documented.

RESULTS

Paper I

Baseline data are shown in Table 3. As shown, nearly all participants in the study fell into the category of permanent nursing home residents and were enrolled in ApoDos.

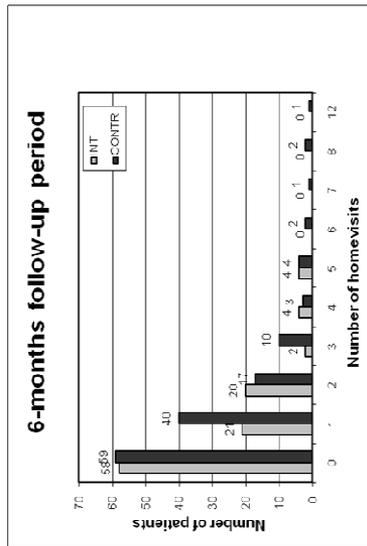
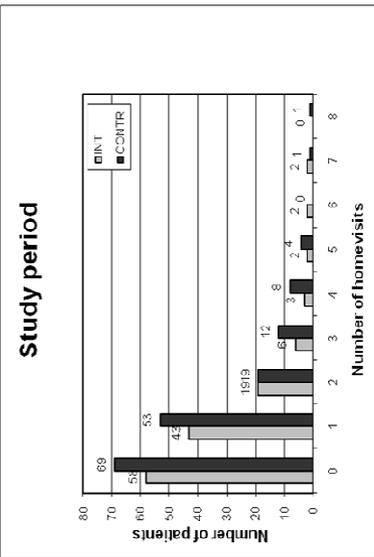
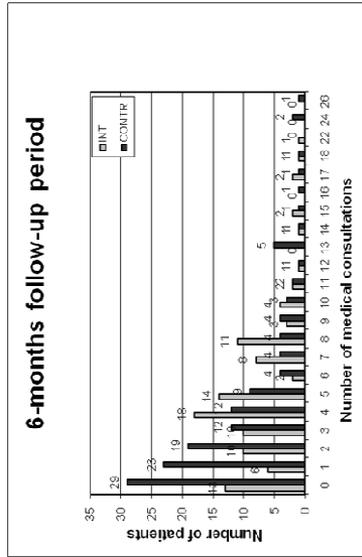
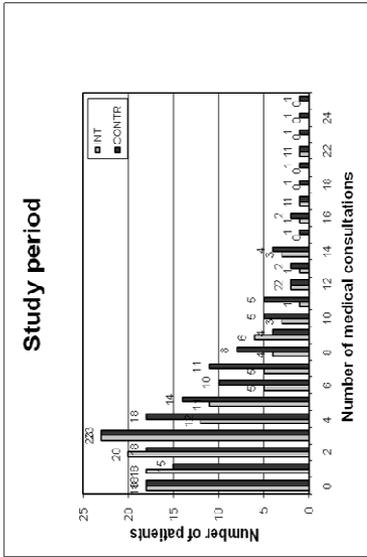
		Intervention n=135		Control n=167	
Sex	male	36	27%	51	31%
	female	99	73%	116	69%
Age (years)	mean (range)	86	(55-102)	85	(61-102)
	median	86		86	
Nursing home	short time	4	3%	0	0%
	permanent	131	97%	167	100%
Medication dispensing system	yes	125	93%	163	98%
	no	10	7%	4	2%
Residents with polypharmacy (≥ 5)		119	88%	156	93%

Table 3. Baseline data for the intervention and control patients, paper I.

Assessment of health care utilization implied visualization of different working manors. For working procedures, such as medical consultations and home visits there were significant differences (as described below) between the groups, even if the distributions of care given were extremely skewed (Figure 5).

When health care utilization was compared between the groups it was found that the mean number of medical consultations was significantly higher in the control group during the study period ($p < 0.05$) but significantly lower during the follow-up period ($p < 0.05$) for the same group compared to the intervention group. When changes per patient were calculated, there was a significant increase in medical consultations in the intervention group at follow-up ($p < 0.05$) as compared with the control group. On the same premise, there was a significant decrease in home visits in the intervention group at follow-up ($p < 0.05$). Concerning health care utilization at hospital there were very low frequencies for these multi-diseased

Figure 5. Health care utilization, paper I.



elderly, and because of these small numbers statistical calculations were considered to be of no interest.

The results concerning drug treatment must be seen from several perspectives, between and within the groups, as well as at study start vs. study end. During the study period there was a statistically significant reduction of drugs used on a regular basis ($p < 0.05$) in the intervention group. There was a statistically significant increase in total number of drugs as well as drugs used on a regular basis in the control group ($p < 0.01$) (Table 4).

Number (means) of drugs per patient

	Intervention		Control	
	Study start	Study end	Study start	Study end
Total	9.00	8.70	10.54 ^c	11.02 ^{b,d}
On regular basis	6.94	6.48 ^a	7.46 ^c	7.75 ^{b,d}
As needed	2.14	2.11	2.70	2.70

Statistical evaluations were performed with Students t-test

Number of drugs were compared;

a. between study start and end in the intervention group, $p < 0.05$

b. between study start and end in the control group, $p < 0.01$

c. between intervention and control groups at study start, $p < 0.01$

d. between intervention and control groups at study end, $p < 0.01$

Table 4. Drug treatment during study period, paper I.

The differences in number of drugs per patient within the group were also analyzed statistically. There was a statistically significant reduction in the total number of drugs and in drugs used on a regular basis in the intervention group ($p < 0.01$) as compared to the control group. For drugs prescribed “as needed”, there was no significant difference between the groups.

We saw statistically significant differences in activity of evaluation and follow-up of drug treatment between the groups (Table 5). Systematic routines in the intervention group contributed to improvement. The most apparent finding although, was the lack of assessment of drug effect whenever a change was done.

We achieved improvements by the systematic work and saw statistically significant differences in examinations (i.e., weight, blood pressure) and

drug surveillance (i.e. laboratory tests) between the groups (Table 6). Although the monitoring frequencies varied, they were generally extremely low.

	Intervention		Control	
	n		n	
Start of new medications or changes of dosage	356		518	
Evaluations of effects	219	61.5%	199	38.4% **
Cessation of medications	65		43	
Evaluations of effects	40	61.5%	1	2.3% **

The numbers refer to medication changes and evaluations during the study period

Statistical evaluations were performed with Chi-square test.

** = $p < 0.01$

Table 5. Evaluation of drug therapy, paper I.

	Intervention				Control			
	Study start		Study end		Study start		Study end	
	n=135	(percent)	n=109	(percent)	n=167	(percent)	n=139	(percent)
Weight	133	(99)	101	(93)	2 ^a	(1)	3 ^b	(2)
Blood-hemoglobin	131	(97)	102	(94)	49 ^a	(29)	25 ^b	(18)
Plasma-albumin	127	(94)	101	(93)	7 ^a	(4)	2 ^b	(1)
Bloodpressure supine	131	(97)	99	(91)	9 ^a	(5)	3 ^b	(2)
Bloodpressure upright	65	(48)	45	(41)	0 ^a	(0)	3 ^b	(2)
Plasma-creatinine	130	(96)	101	(93)	24 ^a	(14)	17 ^b	(12)
Cystatin C-GFR	125	(93)	99	(91)	0 ^a	(0)	0 ^b	(0)

a. between intervention and control group at study start

b. between intervention and control group at study end

The numbers reflect the number of measurements during indicated periods, statistically analyzed with the Chi-square test

** = $p < 0.01$

Table 6. Monitoring frequencies of health status, paper I.

Paper II

150 patients were identified for inclusion in the study. The mean ages in group A, B and C were 82.5 ± 4.9 (mean \pm SD), 83.4 ± 5.1 and 83.9 ± 5.1 . The sex distributions were 56%/44% (female/male), 63%/37% and 64%/36% respectively. No statistically significant differences between the groups were observed with respect to mortality or dropouts (for numbers and reasons see Figure 3).

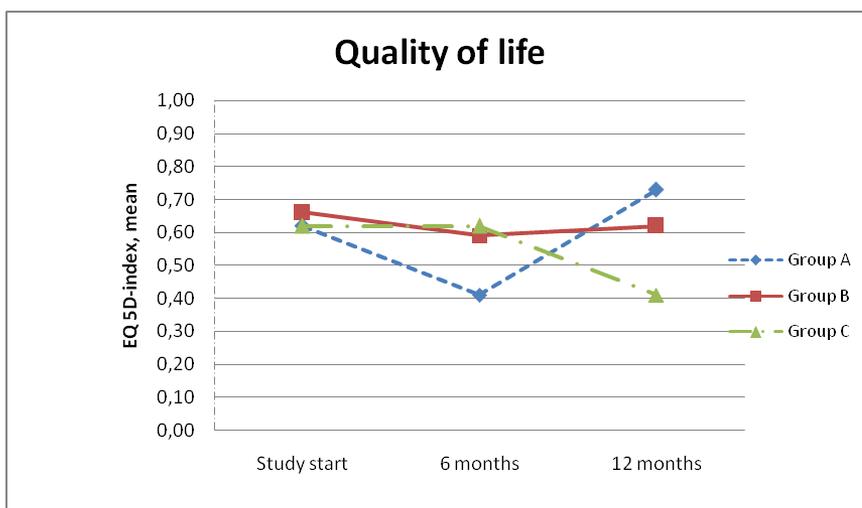
Table 7. Prescription quality, paper II.

	Group A			Group B			Group C			p-value overall
	Baseline	12 months	p-value	Baseline	12 months	p-value	Baseline	12 months	p-value	
Number of drugs per patient (median)	8.0	9.0	0.029	10.0	11.0	0.655	10.0	10.0	0.454	0.382
Number of drug-risk indicators per patient (median)	2.0	2.0	0.181	2.0	2.0	0.813	2.0	2.0	0.401	0.444
Number of medication errors per patient (median)	5.0	2.0	0.099	3.0	2.0	0.031	3.0	3.0	0.862	0.331
Proportion of correct medication lists (%)	10.0	18.0	0.130	4.0	13.0	0.029	8.0	12.0	0.371	0.614
Proportion of patients with interactions of C-type (%)	60.6	57.8	0.135	43.9	48.7	0.327	42.4	48.5	0.705	0.788
Proportion of patients with interactions of D-type (%)	3.0	3.0	0.655	2.6	7.7	0.317	21.2	6.1	0.096	0.088

For statistical analyses Wilcoxon, Chi-square or Kruskal-Wallis test were used.

Table 7 shows the prescription quality for the patients who completed the study. There were no significant differences when similar comparisons were done with all patients included. Extreme polypharmacy was common and persistent in all three groups and this was accompanied by an unchanged frequency of drug-risk indicators (Table 7). The frequency of correct medication lists was very low in all three groups (Table 7). The frequencies of interactions of type C and D are shown as proportions of patients having them (Table 7). The 99 prescription review letters (49 in group B and 50 in group C) sent to physicians/primary care centers, resulted in only 8 (3 respectively 5) actions.

Regarding QoL the EQ-5D results show higher percentages with symptoms in the dimensions of mobility, pain/discomfort and anxiety/depression. The response frequency for the EQ-5D questionnaires that were sent to the patients at 6 months was high; 84% - 79% - 80% respectively for each group. The EQ-5D index varied over time, but there were no significant differences in or between the groups (Figure 6).



Statistical analyses were done within and between the groups using Friedman Test and Kruskal-Wallis test. No significant difference anywhere.

Figure 6. EQ-5D index, paper II.

The EQ VAS shows notably low scores for the patients' own assessment of health-related QoL (Table 8). In group C (patient participation), the usage

Table 8. Patients' assessments of their health related QoL, EQ VAS, paper II.

	Group A			Group B			Group C		
	Baseline	6 months	12 months	Baseline	6 months	12 months	Baseline	6 months	12 months
Mean EQ VAS score	50	55	56	51	52	54	51	52	56
(±SD)	(19)	(19)	(17)	(17)	(19)	(14)	(16)	(20)	(17)
Median EQ VAS score	50	50	50	50	50	50	50	50	50
(IQR)	(40-60)	(50-72)	(50-68)	(45-60)	(42-60)	(50-60)	(40-60)	(40-70)	(50-64)

Statistical analyses were done within and between the groups using Friedman Test and Kruskal-Wallis Test. No significant difference anywhere.

of the medication records was registered when returned to the research centre. From the 33 patients fulfilling the study at 12 months, 21 medication records were returned, but only 8 of them had been used. This was accompanied by different messages of forgetfulness, feeling unaccustomed to participating and also referring to fear of causing trouble.

Paper III

Table 9 shows the characteristics of our study population. The proportion of patients satisfied with their drug therapy and patients' self-rated ability to handle their drug therapy is also presented in Table 9. 84% of the patients in the study claimed to be satisfied with their drug therapy but only 56% felt able to handle their drug regimen. 79% of our patients preferred life quality over long life. Notable is the fact that 32% of the participants had MMSE <25 as well as reductions in CDT score indicating possible cognitive impairment. The number of deaths during the 12 month study period in group A*, B* and C* were 5 (11%), 7 (15%) respectively 6 (13%). 1, 4 respectively 2 of these patients died within the first 6 months.

The results from calculating MAI are presented in Table 10 as are the number of drugs per patient. In addition to wrong dosages, interaction/duration problems etc, the fact that a relatively large part of drug regimens lack indication causes surprisingly high total MAI scores. Extreme polypharmacy, defined as taking ≥ 10 drugs was common and persistent in all three groups (Table 10). Some drugs are considered to pose special risks for the elderly. These are presented in Table 11 together with percent of patients taking the drug and percent of prescriptions lacking indication.

The differences in EQ-5D index and EQ VAS between the MAI groups are presented in Figures 7 and 8. The Jonckheere-Terpstra trend test shows that a lower medication quality is associated with a lower quality of life. EQ-5D index was statistically significantly different (declining for each group) among the groups ($p=0.001$ at study start, $p=0.001$ at 6 months and $p=0.013$ at 12 months) as was EQ VAS ($p=0.026$ at study start, $p=0.003$ at 6 months and $p=0.007$ at 12 months).

The same analysis was performed after dividing the study group into two age groups (above and below median; ≤ 83 , ≥ 84 years) and male/female groups to adjust for age and sex. Even with these small groups the results remain statistically significant for EQ-5D for 9 out of 12 comparisons (4 groups, 3 different points in time) and the trend towards lower EQ-5D

	<i>Total</i> <i>n=140</i>	<i>Group A*</i> <i>n = 47</i>	<i>Group B*</i> <i>n = 47</i>	<i>Group C*</i> <i>n = 46</i>
Age; mean	83.4 (5.0)	83.3 (4.5)	84.3 (5.4)	82.7 (5.0)
Sex; women (%)	62.1	66.0	53.2	67.4
men (%)	37.9	34.0	46.8	32.6
Mini Mental State Examination (MMSE); median,	27 (23-28)	26 (23-28)	27 (23-29)	27 (24-29)
Clock Drawing Test (CDT); median	2.0 (1.0-3.0)	2.0 (1.0-3.0)	2.0 (1.0-2.0)	2.0 (1.8-3.0)
Are satisfied with drug therapy (%)	84.3	85.1	87.2	80.4
Feel able to handle drug therapy (%)	55.7	63.8	44.7	58.7
Prefer life quality before long life (%)	79.3	78.7	78.7	80.4

The values are presented as mean (\pm SD), median (IQR) or percentage.

Table 9. Characteristics of the study population, paper III.

	<i>Study start</i>			
	<i>Total</i>	<i>Group A*</i>	<i>Group B*</i>	<i>Group C*</i>
Number of drugs per patient; median	10.0	8.0	10.0	12.0
Number of drugs lacking indication per patient; median	3.0	1.0	3.0	6.0
Number of drugs lacking indication per patient; min - max	0 - 15	0 - 2	2 - 4	4 - 15
MAI score median	54.0	18.0	54.0	108.0
MAI score mean	61.3	16.0	51.3	117.7
MAI score min - max	0 - 270	0 - 36	36 - 72	72 - 270

Table 10. Drug treatment and Medication Appropriateness Index, paper III.

	<i>Percent taking the drug</i>	<i>Percent lacking indication</i>
Analgesics (light), ongoing	40.1	36.3
Analgesics (midrange), ongoing	7.5	50.0
Analgesics (strong), ongoing	9.5	47.1
Bulk/laxatives, ongoing	22.4	67.9
Benzodiazepines (short acting), total	10.2	82.4
Benzodiazepines (long acting), total	4.8	66.7
Sleeping tablets, total	44.2	88.1
NSAID, total	5.4	50.0
Neuroleptics, total	3.4	100.0
PPI, total	27.9	57.9
Digoxin, total	13.6	35.0
Loop diuretics, total	59.9	18.6
SSRI, total	19	70.4
Other anticholinergics*, total	21.8	70.4

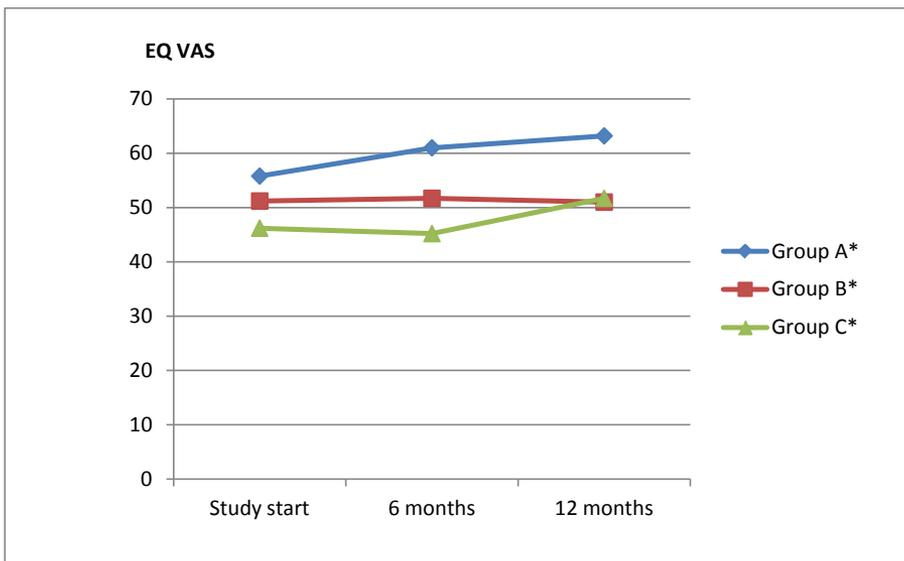
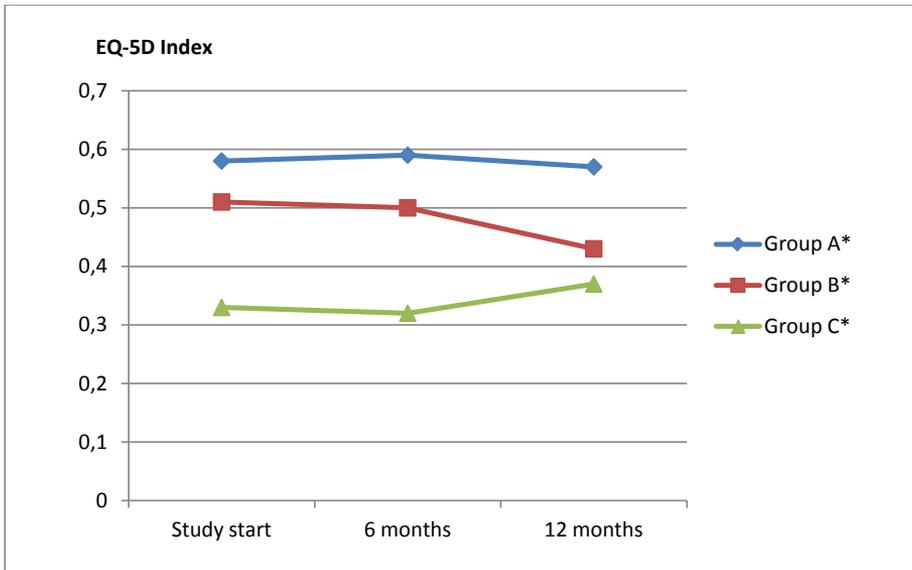
*Amitriptyline, Clomipramine, Clemastine, Desloratadine, Hydroxyzine, Loratadine, Montelukast and Tolterodine

Table 11. Special risk drugs, paper III.

with lower medication quality still remains between the groups. For EQ VAS the results were statistically significant for 7 out of 12 comparisons. The same trend with declining EQ VAS with lower medication quality remains.

When we performed the linear regression with EQ-5D index as the response variable and MAI groups, age, sex and number of drugs as explanatory variables we basically found similar results. The difference in EQ-5D index between group A* and group C* was statistically significant at the first two points in time but not at the 12 month measuring point (p=0.019 at study start, p=0.011 at 6 months and p=0.233 at 12 months). There was no statistically significant difference between the middle group and the group with the highest MAI score.

Figures 7 and 8. EQ-5D index and EQ VAS, paper III.



When performing the linear regression with EQ-5D index as the response variable and MAI groups, age, sex and Charlson Comorbidity Index as explanatory variables we found that comorbidity did not affect EQ-5D index. The difference in EQ-5D between MAI group A* and group C* remained statistically significant at all three points in time ($p=0.001$ at study start, $p=0.002$ at 6 months and $p=0.033$ at 12 months). There was no statistically significant difference between the middle group and the group with the highest MAI score. For EQ VAS, there was a statistically significant difference between group A* and C* at the six and 12 month measuring points but not at baseline ($p=0.052$ at study start, $p=0.009$ at 6 months and $p=0.042$ at 12 months). As with EQ-5D index, there was no statistically significant difference between the middle group and the group with the highest MAI score.

Number of drugs had a statistically significant impact on both EQ-5D index and EQ VAS at all points in time. Sex or age did not affect either EQ-5D index or EQ VAS. We also analysed the different MAI groups with respects to MMSE and CDT using the Jonckheere-Terpstra test. In our study group we could not find any indication that cognitive impairment is associated with low medication quality.

Paper IV

Undefined profession lacking leadership

The results contain one theme: Occupying different roles in an undefined profession lacking leadership, meaning that the RNs described a self-made role in their profession and that there was no proper organizational leadership. The findings can be categorized into seven roles showing different aspects of the RNs' work: *controller*, *executer*, *messenger*, *supervisor*, *initiator*, *visionary* and *solitary worker*.

Controller

The RNs described the role of controlling subordinate nursing staff in their work of administering drugs to elderly people. In order to avoid mistakes, RNs compile the list of medications and furnish clear and unambiguous instructions regarding their administration. Procedures are in place for managing mistakes in drug administration and these are followed to trace the source of any mistakes. The RN checks whether the subordinate nursing staff have kept a record of all distributed drugs. Where a signature is missing, the RN needs to follow up whether this is a real mistake, or

whether the patient has received the drug, and the signature is merely missing.

Executer

In working with drug prescriptions from the physicians, the RN's role was described as an executer. The responsibility for this task is clearly defined and the RNs were confident in this task.

Almost all RNs mentioned advantages in using a specific procedure of dispensing medication, called ApoDos, and the main advantage of this system was the clear responsibility. The responsibility for correct dosage in the dispensers belonged to the ApoDos system and not the RN. The RNs recognized disadvantages of the system including large waste of drugs and the time it takes to manage changes in dosage. None of the RNs stated that they had taken any action to change the system.

Messenger

The RNs described their role of messenger when they had to pass on information from the nursing staff or patients' relatives to the physician. Some RNs took the decision to pass information on to the physician on their rounds of the wards in consultation with the nursing staff or other RNs, while others took the decision by themselves.

Supervisor

Nursing interventions were described as being initiated mostly by nursing staff or else by relatives of the elderly, in which case the RNs made their own assessment and follow-up. Some RNs stated that they took the initiative for nursing interventions, and later tutored and delegated the task to the nursing staff. Monitoring effects and side effects of drugs was sometimes delegated to subordinate nursing staff or done in conjunction with the staff as a mutual responsibility, although some RNs perceived this as an RN task and responsibility.

Initiator

In working with the ward's drug supplies, RNs described the role of active initiator. Registered nurses actively manage the supplies and the RNs were concerned about which drugs are available for the RN to give without prescription from the physician.

Visionary

The RNs described visions of changing the living conditions for the elderly in municipal nursing homes. They expressed the vision of nursing homes being better staffed to ensure that the elderly could lead a more active life and also, that the nursing staff would have some time to, e.g., engage in conversation with the elderly. Some RNs suggested that RNs be educated in different specializations such as diabetic care or pain treatment. One RN expressed the wish that drug use would be decreased by giving better care.

Solitary worker

The RNs described themselves as not been recognized by the management, and as working in isolation. They felt that management often did not understand the RN's position and situation, possibly because management were usually not medical professionals. Positive feedback the RNs received about their work came from the patients and not the management.

The RNs did experience that competence development was not a high priority for management. Financial contributions from management were poor and, in terms of time schedules, the RNs had no opportunity to attend courses to further their education. However, the RNs themselves showed a passive attitude and did not take much action in this matter.

DISCUSSION AND IMPLICATIONS

When applying to the Hippocratic Oath, physicians are taught to do well and not to harm. The hierarchic structure of healthcare has undergone tremendous changes but the patient is still in a weak position despite the ongoing discussion of patient participation and empowerment. In a world of pharmacological possibilities the debate regarding prescribing ought to be as prominent as ever. Concerning the elderly patient there must be a crusade finding the breaking point where the intention to do “well” and not to harm means to deprescribe or refrain from prescribing based on shared decision with the patient to prioritize their QoL, i.e. “to treat or not to treat”.

From evidence based medicine we know that multi-medication or poly-pharmacy is a hazardous state per se, especially for the elderly, as it is accompanied by higher rates of adverse reactions, higher care utilization and higher risk of falls. There is also a risk of under-utilization of each drug and under-prescription of appropriate drugs when there is no caregiver who has an overview of the complete medication list^{62-63, 94-95}.

To prescribe drugs is important in medical treatment and demonstrates initiative and action, but good and appropriate prescribing demands many considerations. It involves evaluation of symptoms, follow-up of effect, adjustment of dose and monitoring over time as well as deprescribing when indicated^{72, 91, 96}. Prescribing for elderly demands special knowledge and close monitoring¹². This includes courage to deprescribe and the necessity of avoiding the prescribing cascade⁹⁷. For the elderly patients who have multiple health problems, the risks increase as there are often many prescribers with different specializations involved, focusing on their area of specialization and with no one taking an overall responsibility regarding the patient¹².

In this context, the ApoDos medication dispensing system is an important factor to analyze. This is a technical system to enhance delivery and dispensing of drugs. It is used predominantly in nursing homes in Sweden and for multi-diseased patients taking many drugs on a regular basis. The use of this system has increased during recent years, but there has been criticism of this system, especially from physicians⁹⁸ as the system is complex. There is no encouragement to reduce or remove drugs; it is always easier to continue with the status quo. In contrast, many RNs appreciate the system, as it reduces time-consuming manual dispensing, guarantees that the pa-

tients receive their prescribed drugs and minimizes drug allocation mistakes. The problem is that many RNs consider these matters more important than the risks associated to persistent polypharmacy. The ApoDos does not support flexible medication management and an adjustment of dosages since one of the prerequisite to be enrolled is stable medication. One obvious contradiction is that the health status of multi-diseased elderly alter, implicating that the more rigid ApoDos system may conserve inappropriate medication²¹.

During the nursing homes study we encouraged the physicians in the intervention group to evaluate every change in medication, which is a challenge and a time-consuming effort to fit into the schedule of the physicians at the nursing homes. It also raised the demands on the nurses to check and follow up on the residents' well-being, to communicate with them and to document the results. In all other age groups, when more drugs are added to treatment we increase monitoring, but there is a strange and unsatisfactory phenomena regarding the elderly patients. Among the elderly, nearly all monitoring and surveillance disappears and polypharmacy becomes a permanent state⁹⁹. This highlights the need for a reinforced base for systematic teamwork between daily care and medical treatment in care of the elderly.

The aim of the interview study emerged from the above mentioned findings in our previous study of drug treatment of elderly in nursing homes. Despite involving the physicians, i.e. the prescribers, we did not succeed in achieving the expected improvements regarding drug treatment. Instead gaps in the care giving process appeared where lacks in systematic work and differences in work performances were obvious¹⁰⁰. The question awoke if a missing link to enhance drug treatment at nursing homes is to be found in the RNs perspective of their work.

There are risks in health care and there are risks for patient safety in municipal elderly care¹⁰¹ and if the physicians are not aware of the RNs' perceptions of their professional role, drug treatment and evaluation may be hazardous. Whether an RN defines her or himself as more of a "controller" or as more of an "executer" or alternatively a "messenger" or "supervisor" will have consequences on the work delivered. For the "controller" and the "supervisor", the focus is on the subordinate nursing staff either because of a shortage of resources²⁸ or because of a personal preference. In both cases, the RN needs to rely on the knowledge of the nursing staff³¹.

In cases where RNs see themselves chiefly as an “executer” or a “messenger” the drug administration seems to be a passive process for them, involving little own reflection

When discussing the risks of multi-medication for the elderly the shortage of family physicians is mentioned first of all encompassing the known issue that no physician takes the overall responsibility^{32, 102-103}. It has been shown that family physicians’ opinions about overall responsibility regarding the patients’ complete medication diverge into different categories characterized as: imposed responsibility, mainly responsible for own prescriptions, responsible for all prescriptions, different but shared responsibility with the patient and the patient is responsible for transferring information⁶⁷. The consequences of these opinions together with our results mean numerous of possibilities and risks all affecting the care given and the teamwork in such a complex field as drug treatment. Patient safety and good health care depends on cooperation and collaboration on the organizational level as well as personal skills.

The risks associated to multi-medication or polypharmacy in the elderly i.e. ADRs, hospitalization and mortality^{73, 104-105} are known risk factors to affect QoL. We initiated two studies to see if medication quality i.e. prescription quality as well as medication appropriateness could also be associated to QoL. The reason for this is that we wanted to study quality of drug treatment from a patient perspective. With increasing number of elderly who faces the problems that come with old age, chronic medication and chronic diseases, the real challenge for the healthcare of tomorrow is both “to help people live longer and feel better”⁵⁴. To achieve this, the healthcare professions need to adopt new outcomes, including QoL. By choosing QoL as an outcome instead of solely treatment goals per se we wanted to accomplish more of a patient focus and a movement towards shared decisions by empowerment of patient participation.

Part of the intervention was enablement of patient participation. We saw many errors; wrong dosages were taken as well as wrong regimen but the patients did not want to cause problems in their relation with the doctor. They avoided time demanding questions, although they felt insecure with their medication. The comments here were that they “wanted information and a good relation”, accompanied by an overall trust in the “good” doctors and their judgement on “giving the right treatment” which is similar to findings in other studies that address patient participation¹⁰⁶. This reduces discussions about benefits and risks of polypharmacy, since continu-

ity, access and having a “good doctor” is more important. Empowerment of the patient’s involvement in their drug treatment is a main issue for the future, and further studies will be needed to evaluate the effects on treatment quality as well as QoL.

Regarding cost benefit there are different perspectives for the individual and for the healthcare organization. We did not introduce any new expensive methods, but to gain positive results the work is demanding in terms of time resource. To achieve the goal of fewer and more adequate drugs there needs to be more systematic evaluations, more reports, and more medical consultations. If the primary aim is better QoL for the patients with fewer ADRs and reduced health care utilization there are benefits for everyone. These factors can easily be translated into indicators of high quality drug treatment and good health economy.

At the time of the studies the risk of polypharmacy in the elderly was a hotly debated subject in Sweden and in the county councils, with special educational efforts and information meetings in hospitals, primary care and community care. Every physician and nurse was informed at this time about the negative effects of extensive drug treatment of the elderly. However, the health care organization seems to have resisted adapting to this information and made no real attempts to make appropriate adjustments. The message from the organizations sometimes seems to be that it is better to do nothing and maintain the status quo concerning medication, as every change demands new evaluations and time-consuming work, if active efforts are to be made to combat polypharmacy.

Paper I

In the nursing homes study we have shown that physician-led patient focused drug surveillance in the elderly is associated with a statistically significant reduction in number of drugs per patient and a statistically significant increase in the frequency of evaluations of drug treatment. The result is in accordance with the intention of the intervention and the aim of achieving a higher quality of drug treatment. However, we were not able to show any difference in mortality rate. We did find significant differences in care given between the groups, and specifically in care utilization per patient.

Regarding the care utilization in the nursing homes, the elderly have relatively poor autonomy and restricted possibilities for demanding care. As they are almost all receiving drug treatment, there should be a basic syste-

matic schedule of follow-up which is supplemented on the basis of individual needs.

Statistically significant differences in the total amounts of care given were found. Consequently, the amount, content and quality of the care given need to be further evaluated. Statistically significant changes in number of medical consultations and home visits can be explained by the intervention, i.e. the regular physical examinations and systematic evaluations, and the changes are notable.

We have shown extreme interindividual variations in care utilization between patients which is indicative of a lack of a systematic way of working. The frequencies of hospitalization were lower than expected in both groups, which is a positive finding, as one challenge in this context is to consider adjusted level of care for this group of multi-diseased elderly patients.

We show a significant decrease in drug treatment in the intervention group during the study period, as compared with a significant increase in both the total number of drugs and the drugs taken on a regular basis in the control group during the same time period. Again favoring the intervention group, we show a significant difference in evaluation and follow-up of drug treatment. It is noteworthy how often treatment is added and/or changed without evaluation, and how few efforts are made to discontinue medications, especially in light of the broad occurrence of polypharmacy.

The intervention demanded clinical monitoring of the patient. To focus on the surveillance of drug use, the medical records were scrutinized in the search for parameters concerning nutritional status, blood pressure and renal function, as these are considered as general parameters for health status in the elderly¹⁰⁷. In all other age groups, when more drugs are added to treatment we increase monitoring, but there is a strange and unsatisfactory change in relation to elderly patients. Among the elderly, nearly all monitoring and surveillance disappears and polypharmacy becomes a permanent state⁹⁹.

Our conclusion is that the intervention efforts were worthwhile, since significant results were achieved and there were no extensive expenditures. However, to make further progress additional steps need to be taken. We need a paradigm shift in cultural behaviour where it is every caregiver's and physician's mission to challenge and prevent the occurrence of poly-

pharmacy in elderly patients. It cannot be regarded as someone else's problem, there must be the courage to end a drug treatment and, as written by Sloan "it should never be assumed that once a drug is started, the drug should never be discontinued"³³.

Paper II

In paper II we wanted to assess the effect in prescription quality and QoL after intervention with prescription reviews and promotion of patient participation via a randomised controlled study. The main results of the study are the persistent low values of QoL, demonstrated by low EQ-5D index and EQ VAS in all three study groups throughout the study. The intervention had no statistically significant effect on QoL or prescription quality. The findings show low interest from the physicians in actions for improving prescription quality to achieve better QoL by reducing risks for this group of vulnerable elderly. The findings also visualize the remaining hierarchic structure in healthcare where most of the patients still do not dare to discuss their drug treatment.

One reason for the physicians' unwillingness to change prescriptions according to the prescription review may be the fact that changes require additional work, such as increased monitoring and follow-up and time to consider the suggestions¹⁰⁸. Another reason is the fact that many prescribers with different specializations are involved in the care of the patient, focusing on their area of specialization and with no one taking the overall responsibility regarding the patient. All prescribers independently of specialization have the same obligation in the prescribing process⁹⁶ but the phenomenon of many caregivers/physicians involved causes risks and problems when there is no individual caregiver who has an overview of the medication list and as the responsibility is not apparent^{67, 98}.

Today there are no systematic evidence based models or smart tools for optimizing drug treatment available^{12, 59}. This study was planned and carried out so that the family physicians involved in the intervention had to perform a minimum of extra work. The physicians' work was facilitated by the prescription reviews which showed number of drugs and drug-risk indicators as well as warnings of interactions. Interactions of C- and D-type are real risk measurements for the patient as well as the healthcare system, as they signal preventable risks in drug treatment⁸⁷. The results presented here show low responsiveness to the alarm signals. This underlines the major challenge of finding new strategies for improving prescrip-

tion quality to improve patient outcome measures such as QoL and reduce the known risks of polypharmacy for the elderly.

Paper III

The main result of our study demonstrates an association between medication quality and QoL. Through the study and by using reliable instruments, MAI together with EQ-5D and EQ VAS, we have been able to visualize the association between inappropriate medication and low QoL. We found a remarkable high number of patients with inappropriate medication. The findings are of importance for the individual as well as the healthcare system since the vulnerable group of elderly with chronic health problems and chronic drug treatment is growing.

We find it remarkable that more than four out of five patients in the study are satisfied with their drug therapy while only slightly more than half the patients feel able to handle their drug regimen and the calculation of MAI shows us that medication quality is overall poor. A possible reason for the low self-rated capability to handle drug regimens is the fact that almost one third of the participants had MMSE <25 as well as reductions in CDT score, indicating cognitive impairment. A reason for patients claiming to be satisfied with their drug therapy while not being able to handle it could be trust in the “good doctor” and fear of damaging the doctor-patient relationship by voicing concerns about their drug therapy¹⁰⁹.

Polypharmacy is a giant challenge in many ways, but the objective of our study is appropriateness of the prescriptions in a wide perspective, meaning the burden of drug treatment for each patient. Appropriateness of medication is therefore the key word in every part of the discussion, because if appropriate and needed then the benefits of the medications are obvious for optimizing QoL. But as shown here, in many cases there is no indication for the treatment which is devastating throughout the system and especially for the patient. All these are important factors for the patients undergoing treatment as it affects their QoL. For some types of drugs this can seem as an issue of low significance (for example laxatives and vitamin pills) but the list of inappropriate drugs in our patient group also includes pain killers, sleeping pills and diuretics and in the worst cases anticoagulants and insulin. In every respect these results show lack of systematic work in the prescription process. The use of MAI with its explicit and implicit criteria gives an extensive and to some extent depressive perspective and shows the omission to fulfill the obligations connected to drug treatment.

The patient's QoL has historically been neglected since other outcomes are judged more important. Today there are guidelines for treatment of individual diseases, but there is a lack of guidelines and goals for treatment of the elderly with many diseases¹¹⁰. In the healthcare system there are now established incitements and rewards for following the guidelines for drug treatment (number of patients with recommended prescriptions) while considering the patient's quality of life is subordinate.

Paper IV

This study highlights varying perceptions of the RNs working in the municipality. When exploring RNs' views of their role in medication in care of the elderly, we identified seven differing categories. Our results show different approaches and perspectives of the RNs' work which often was characterized by absence of own judgment and action taken, especially regarding drug treatment, as well as a lacking organizational leadership. The question arose whether a missing link to enhanced drug treatment at nursing homes is to be found in RNs' perspectives on their work. Care taking of multi-diseased elderly individuals requires professional medical knowledge and organizational development. When medical or pharmacological education is conceived to be of low priority in the organization this is reason for concern.

Registered nurses often work in isolation, and at a great distance from the physician who needs to be contacted when a new care situation arises. Unlike RNs employed by the municipality, physicians are consultants employed by the county council. The RNs have the medical responsibility and leadership for the nursing staff including possibilities to prescribe different types of care and non-pharmacological treatment to the elderly. There is a wide range of possibilities for such types of care, though they demand time and strategies for assessment, planning, treatment and evaluation³¹. This requires leadership with understanding of the integration process in care of the elderly, of the medical processes and nursing skills involved, and of the social environment of the municipality in which the RNs are active.

With regard to the known risks of multi-medication for the elderly, the shortage of family physicians is often mentioned firstly encompassing the issue that no physician takes the overall responsibility^{32, 102}. Family physicians' opinions about responsibility regarding patients' complete medications have been categorized into: imposed responsibility, mainly responsible for own prescriptions, responsible for all prescriptions, shared respon-

sibility with the patient and the patient is responsible for transferring information⁶⁷, see Figure 9.

(D) Different but shared responsibility	
(E) Patient transferring drug information	(C) Responsible for all drugs
	(B) Responsible for own prescriptions
	(A) Imposed responsibility

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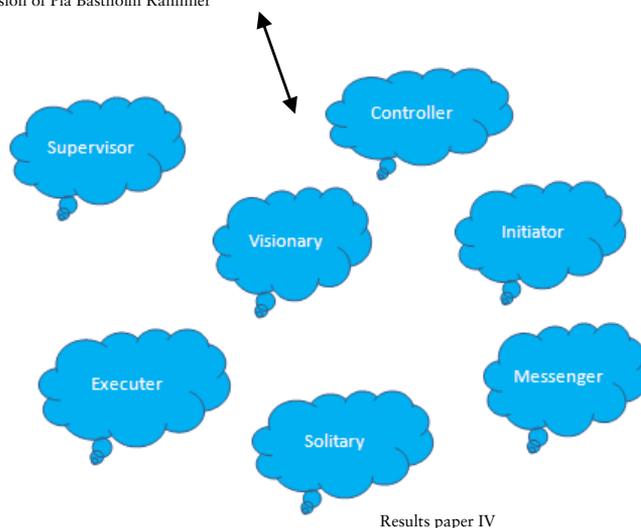


Figure 9. The figure illustrates the physicians' collective approach to managing responsibility for medications (top) and the RNs perceptions of their professional role in medication management (bottom).

The consequences of these opinions together with our results imply several possibilities and risks, all affecting the care given and the care team. Patient safety and good health care depends on co-operation and collaboration at an organizational level, as well as personal skills.

At nursing homes the use of the medication dispensing system (ApoDos) is very common. There are known risks with the ApoDos system, such as more inappropriate drugs^{21, 111} and errors when transferring⁹⁸. The dispensing system has been criticized by physicians for being rigid and not encouraging reduction or removal of drugs³². Still, the RNs in our study population said they appreciate the system, as mentioned above. The main advantage for the RNs is that ApoDos reduces the RN's responsibility in drug handling and makes delegation to the nursing staff possible. Our results suggest that the RNs considered these advantages more important than the risks of persistent polypharmacy and inappropriate medication. To provide appropriate drug treatment, the physicians are dependent on the RNs' judgment and actions³². There is an evident need to understand symptoms and effects as well as negative side effects in order to avoid the prescribing cascade⁹⁷. When RNs rely on the nursing staff an important part of the RNs' nursing skills in doing a check-up and alerting the physician is lost.

The main findings of this study indicate that there is a need for organizational re-thinking. In statements on the nursing process³¹ medical assessment, treatment and evaluation are emphasized as fundamental to care giving. One documentation model for nursing¹¹²⁻¹¹⁴ expresses this as wellbeing, integrity, prevention and safety (WIPS): by wellbeing is meant health and care giving; by integrity, respect for individual needs; by prevention, avoidance of further illness and disease; and by safety, a minimizing of risks in health care and drug treatment of the patients. Re-thinking sometimes means returning to basic principles of professional performance and thoughts, not necessarily developing a new model.

METHODOLOGICAL CONSIDERATIONS

The studies were performed in primary health care also implicating that “care as usual” was the prerequisite for all the controls. We have considered the design of “usual care control groups” and taken actions to prevent behavioural changes of control caregivers¹¹⁵. To be noticed in this perspective is that the control participants were not aware of their allocation or the content of the intervention¹¹⁵. In accordance with the ethical approval the control nursing homes and the control group in the randomized study were kept unaware of the interventions.

A limitation to be mentioned is that we were not allowed to do the randomisation of the nursing homes in the first study as intended. But as all patients living in the nursing homes are fulfilling equal criteria and they are randomly placed in a nursing home after assessment in the care planning process, the intervention and control groups were equivalent. To avoid influence on either control caregivers or intervention caregivers a cluster randomisation was done into equal size groups.

In the nursing home study we had expected a higher proportion of the patients to be from the short-term facilities were the mortality rate is higher and there are more hospital referrals than observed in our study. This resulted in an error in our power calculation leading to a study with low power. Therefore it is difficult to generalize about our results concerning mortality and hospital referrals and their relationships to the intervention.

The second study is a randomised controlled trial regarding elderly in ordinary homes’ prescription quality and QoL. There was no external investigators bias since there was only one nurse involved who completed all the home visits throughout the study. A weakness is that our estimation of the effect of the intervention on QoL was too high and therefore the power of the study is low. This means that there could be a small effect on QoL through an intervention like ours but such an eventual small effect is probably of no clinical significance.

The EuroQol measure of QoL have been used; the EQ-5D, the EQ-5D index and the EQ VAS^{66, 83-84}. This is probably the most recognized instrument for measuring QoL and it is extensively used in international studies. It is a standardized non-disease specific instrument for estimation of health-related QoL, with the advantage of also giving a single index for

comparison between groups. We chose it since we found it suitable for our study population of elderly and it was easy to use both in the interview situation and as a postal survey⁶⁶. It is short, minimizing the risk of exhaustion for the population in focus. According to previous research the EQ-5D is well suited for evaluating QoL in a population with cognitive impairment¹¹⁶, an important aspect in this context. It is nevertheless possible that a different result would be obtained with a different measure of QoL.

The same pertain to our chosen measure of medication quality. There are different systems for medication assessment and the main issue is to differentiate between explicit and implicit methods, where explicit criteria are more rigid and the implicit criteria are more based on clinical judgement⁷¹. The combination of both provides a structured method with possibilities of patient specific clinical judgements when necessary. The most known explicit method is Beers' criteria⁷¹. Though Beers' criteria is widely used and updated there is a need for new criteria⁶¹. The method used in our study, the MAI developed by Hanlon et al⁶⁸⁻⁷⁰, is a combined method. It has been extensively evaluated regarding reliability and validity and allows patient focused medication assessment⁷¹, though it is time consuming to use. The MAI, like other scoring systems, does not take into account that a patient might lack certain drugs that could be beneficiary to them, i.e. underprescription. The possible reduction in QoL and associated costs resulting from this underprescription is therefore not taken into account in this study.

The fact that we are using the patients' self stated medication lists in paper II and III as a basis for evaluating their prescriptions is both a strength and a weakness. By doing this, we are more likely to capture what medications the patient is actually taking but we are also subject to the patients' forgetfulness or possible unwillingness to share information.

The substantiality here is the fact that we are describing a group of people that will keep growing as the base of the population pyramid in the western world is contracting while the top is expanding. This means that measures to improve medication quality in the elderly in order to improve QoL will be a way to change a lot for lots of patients.

One strength of paper IV is that it was a follow-up of a previous study with new perspectives added. The study population included RNs from different workplaces with broad and different experiences who were given the opportunity to describe their perceptions of their profession with their

own words. Another strength is the research team and the levels of pre-understanding due to different backgrounds, which strengthened the validation. A limitation may be the use of an external interviewer, meaning possible loss of follow-up questions. An advantage of this, however, was a neutral interview position in respect of professional obligation and contradictions. A further limitation may be that the RNs were chosen by the heads of the nursing homes, implying a risk of a “gatekeeper” influencing the results, though in the light of our results we cannot see any signs of this. The content analysis of the interviews made it possible to see patterns in the RNs’ working performance.

CONCLUSIONS

- Polypharmacy is a frequent and a hazardous condition especially for vulnerable multi-diseased elderly patients in nursing homes. There should always be discussions about the benefits and risks of drug treatment, as well as close monitoring and evaluation. The indication should often be reconsidered; the drug can be discontinued by ongoing patient focused drug surveillance in perspective of actual health status.
- Today there are no evidence based models or smart tools for optimizing drug treatment available. Prescribing for elderly is a time demanding responsibility for physicians in primary care. A basic colleague to colleague intervention with prescription reviews had no effect on quality of prescriptions or quality of life. New strategies are needed for improving prescription quality to improve patient outcome measures such as quality of life.
- Drug treatment in the elderly is a huge challenge for healthcare. Since medication quality is related to the patient's quality of life, there is immense reason to continuously evaluate every prescription and treatment. The evaluation and if possible deprescribing should be done as a process where both the patient and physician are involved.
- The challenges in the care of multi-diseased elderly with multi-medication are enormous. More attention must be focused on the importance and the complexity of the nursing processes at the nursing homes and how it is interpreted by the RNs respectively the organization. If only the "technical" parts are promoted, there will be a backlash for the clinical parts such as health assessment and medication management. The main focus must be the patients and their well-being. There must be sufficient and adequate reporting based on the RNs nursing and medical skills to monitor and evaluate as well as to question the drug treatment in teamwork with the physician.

FUTURE RESEARCH

Our studies concentrate on the population of elderly with multiple medications and chronic diseases. Conclusions from these studies can therefore not be used to generalize about other parts of the population/community. The studies are also rather small. More and bigger studies are needed to investigate the impact of poor medication quality in the general population and to confirm the results from our studies.

As there is no single existing model or system that has been shown to improve prescribing or medication¹² for elderly further studies are needed starting from new and different perspectives. When the physicians' professional performance regarding prescribing diverge from the core curriculum that has been taught^{72, 117}, follow-up studies of basic principles is a necessity.

The SoS will now sharpen the governmental regulations¹¹⁸ for drug treatment of the elderly implicating that medication reconciliation and systematic monitoring are needed in order for the caregivers to fulfil their commission and this means possibilities of controlled before and after studies in this field. There is also a new law since 2010, the Patient Safety Act, emphasizing the responsibility of each professional in health and medical care to fulfil their obligations in adherence with science and proven knowledge¹¹⁹, this implies possibilities regarding further studies of collaborative teamwork between RNs and physicians regarding the challenge of multi-medication.

It was not possible to separate disease groups from one another since all patients were multi-diseased and had medical conditions from several different disease groups. If we would have been able to separate the different disease groups, and adjust for these in the analysis, we believe that we might have found a stronger relationship between medication quality and QoL. We believe that it is a possibility that poor medication quality in certain disease groups has a bigger impact on QoL than others. Further studies are needed to evaluate if and how poor medication quality in different disease groups affect QoL.

One of the most important fields for future research is health economy. The resources worldwide for healthcare are limited; there are several studies with estimation of pharmaceutical costs per se; ADRs, falls and hospitalisations, but there is also a need for studies focusing on the effects

and/or costs on the patient level i.e. patient related values. What are the health economic consequences of inappropriate medication and reduced well-being? A forthcoming task in health care is to evaluate the effect of empowerment of patient participation and the patients' opinions about drug treatment. What will they prefer? What will they avoid? How can healthcare professionals handle the patients' opinions with respect and responsibility? Regarding multi-medication among the multi-diseased the question is "to treat or not to treat" to achieve more appropriate medication and better QoL.

SUMMARY IN SWEDISH

SAMMANFATTNING PÅ SVENSKA

För många patientgrupper har behandlingsmöjligheterna med moderna läkemedel inneburit förbättrad livskvalitet, minskade invalidiserande symptom, minskat sjukvårdsbehov och förbättrad prognos. Detta är givetvis stora och tungt vägande fördelar. I takt med tiden och ökad överlevnad tack vare behandling ses dock en annan bild, avigsidan av alltför omfattande behandling hos en åldrande befolkning. Nu uppmärksammas och fokuseras också på de risker och negativa effekter som följer av en alltför extensiv medicinering hos äldre och framför allt de multisjuka äldre. Det handlar om läkemedelsrelaterade problem i form av biverkningar, interaktioner, överbehandling och olämplig behandling, åtföljt av en markant kostnadsökning av läkemedels- och sjukvårdsnotan. Orsaker till fortgående multimedicinering är flera, t ex oklara indikationer, brister i diagnostik och dålig uppföljning med utvärdering av insatta läkemedels effekter. Beräkningar visar att 3-15% av alla patienter som behöver sjukhusvård gör det på grund av läkemedelsrelaterade problem.

Komplexiteten i förskrivningsprocessen i vården, speciellt gällande de multisjuka äldre, involverar patienten, förskrivaren och vårdgivarna i stort, d.v.s. hela hälso- och sjukvårdssystemet. Adderat med ökade sjukvårdskostnader innebär det att problemet är en hälsoekonomisk utmaning för samhället nu och inför framtiden.

Delarbete 1

Patientcentrerad läkemedelsuppföljning på särskilda äldreboenden.

Studien baseras på patienter från åtta SÄBO, varav fyra i en interventionsgrupp och fyra i en kontrollgrupp, totalt 302 patienter. I interventionen ingick att varje förändring av ordinationerna skulle dokumenteras, motiveras samt följas upp av läkaren baserat på en helhetsbild av patientens hälsotillstånd. Vid uppföljningen registrerades alla vårdkontakter, hembesök, läkemedelsändringar, provsvar samt användning av de s.k. riskläkemedel för äldre som Socialstyrelsen identifierat.

Resultat

Ingen skillnad i mortalitet mellan grupperna noterades. Avseende vårdkonsumtion sågs en mycket ojämn fördelning som tecken på avsaknad av systematiskt arbetssätt. Interventionen medförde ett mer kostnadseffektivt arbetssätt inom interventionsgruppen. Inom interventionsgruppen åstad-

koms en sänkning ($p < 0,05$) jämfört med en ökning i kontrollgruppen ($p < 0,01$) av såväl totala antalet som antalet stående läkemedel. I jämförelse mellan grupperna visade kontrollgruppen en klart negativ utveckling med signifikant ökning av såväl totalt antal som stående läkemedel vid studiens slut, speciellt som antalet läkemedel ses som bärare av risker med polyfarmaci. Beträffande uppföljningar och utvärderingar av förändringar i läkemedelsbehandlingen sågs statistiskt signifikanta förändringar ($p < 0,01$) med fördel för interventionsgruppen. Genom interventionen åstadkoms signifikanta förbättringar i monitoreringen av patienternas hälsotillstånd ($p < 0,01$) som underlag för en bättre läkemedelsbehandling av de äldre.

Delarbete 2

Läkemedelsbehandling av äldre: En intervention i primärvård för att förbättra förskrivningskvalitet och livskvalitet.

I samband med utskrivning från sjukhus när vårdplanering aviserades i det elektroniska systemet Meddix fångades patienterna upp. När underskrivet samtycke inkom randomiserades patienterna till en av tre grupper. Grupp A; kontroll. Grupp B; läkemedelsöversyn med brev till vederbörande primärvårdsenhet/läkare. Grupp C; läkemedelsöversyn med brev till vederbörande primärvårdsenhet/läkare samt egen läkemedelslista till patienten. Vid studiens båda hembesök ingick i övrigt samma moment för alla patienter oavsett grupp och livskvaliteten mättes med EQ-5D och EQ VAS.

Till alla delar sköttes i övrigt patienterna enligt de gällande rutiner som fanns inom primärvården och landstinget vad gäller vårdplanering, utremittering och fortlöpande patientansvar.

Resultat

Inga skillnader kunde ses avseende mortalitet eller bortfall mellan de tre olika grupperna. Avseende antal läkemedel åstadkoms inga signifikanta förändringar i interventionsgrupperna. Medianantalet för s.k. riskindikatorer var 2,0 i alla grupper och helt opåverkat av interventionen. Fel i läkemedelslistan var mer regel än undantag. Förekomsten av C- och de mer allvarliga D-interaktionerna var lika och oförändrad rakt igenom studien.

Resultaten från de fem dimensionerna i EQ-5D omräknades till ett EQ-5D index, inga skillnader mellan grupperna konstaterades. Mätningen av självskattad livskvalitet med EQ VAS visade även den generellt låga värden, median 50 i alla grupper vid alla mätpunkter. Patientens möjlighet till egen påverkan av läkemedelsbehandlingen tycks inte ha inneburit någon effekt.

Delarbete 3

Kvalitet i läkemedelsbehandling och livskvalitet hos äldre, en kohortstudie.

Analys av kvaliteten i läkemedelsbehandlingen har skett enligt Medication Appropriateness Index (MAI). MAI består av ett frågebatteri rörande läkemedelsbehandlingen: indikation, effektivitet, dos, praktiska direktiv, korrekta direktiv, läkemedelsinteraktioner, läkemedel/sjukdomsinteraktion, duplicering, duration och kostnad. Inalles tio frågor med viktad svarspoäng beroende på frågans tyngd i relation till behandlingen. Utifrån erhållna MAI-summor delades sedan deltagarna in i tre lika stora grupper A*, B* och C*, från "bäst" till "sämst" medicinering och dessa grupper följdes sedan med hänsyn till livskvalitet (EQ-5D index och EQ VAS).

Resultat

Ett par inledande frågor användes för att fånga patientperspektivet. Här visade det sig att 86 % var nöjda med sin medicinering medan endast 56 % kände sig kapabla att hantera den. Anmärkningsvärt var att 32 % uppvisade tecken på kognitiv svikt via såväl MMT som klocktest utan att någon diagnos eller dokumentation runt detta fanns i journalen.

Avseende MAI med dess tio parametrar var det mest slående avsaknaden av indikation för fortgående behandling, vilket i den viktade summeringen värderades högt och därmed tillsammans med brister i övrigt gav en hög summa som tecken på olämplig och opassande medicinering.

Den statistiska analysen där EQ-5D index och EQ VAS ställdes mot MAI gjordes genom Jonckheere-Terpstra trend test samt linjär regression. Resultatet anger med statistisk signifikans att dålig kvalitet i läkemedelsbehandlingen följs av sämre livskvalitet och att detta består över tid. Resultatet kvarstod även när man justerade för ålder, kön, antal läkemedel och komorbiditet (samsjuklighet).

Delarbete 4

Sjuksköterskors uppfattning om sin yrkesroll i läkemedelsbehandling av äldre inom kommunal vård och omsorg.

En deskriptiv studie med kvalitativt anslag genomfördes med sjuksköterskor representerande de åtta äldreboenden som ingick i den första studien. Enhetscheferna vid respektive boende ombads tillfråga två sjuksköterskor med olika bakgrund och erfarenhet om att delta i intervjuer. Samtliga till-

frågade sjuksköterskor tackade ja till att delta, inalles 15 kvinnor och en man. En och samma person genomförde samtliga intervjuer. Intervjuerna följde en fastställd intervjuguide och tog i genomsnitt 32 minuter. Intervjuerna spelades in och skrevs sedan ut med exakt ordalydelse. Materialet analyserades med kvalitativ innehållsanalys beskriven av Graneheim och Lundman.

Resultat

I resultatet framkom ett tema: ”utövande av olika yrkesroller inom en odefinierad profession i avsaknad av ledarskap”. Sjuksköterskorna beskrev en egenhändigt utarbetad yrkesroll i en organisation utan ledarskap. Temat framkom och byggdes upp utifrån de sju olika yrkesroller som kategoriserades som: ”*controller, executer, messenger, supervisor, initiator, visionary and solitary*”.

I rollerna som ”*controller, executer, och messenger*” ingick att övervaka och följa upp omvårdnadspersonalen, utföra ordinationer eller vara budbärare framförallt mellan patient och anhöriga samt till läkare. För ”*supervisor*” handlade det om att initiera omvårdnadsinsatser och vara handledare. ”*Initiator*” beskrevs ta initiativ avseende läkemedelsförråd och att läkemedel finns tillgängliga. För ”*visionary*” fanns en önskan om en bättre äldre-vård med mer resurser. I uppfattningen som ”*solitary*” fanns en övergivenhets känsla både i person och i organisationen där sköterskorna beskrev sig inte vara sedda.

Studiens resultat belyser varierande uppfattningar i yrkesutövningen hos sjuksköterskor anställda inom kommunal vård och omsorg. Studien talar för ett passivt förhållningssätt avseende läkemedelsbehandling utan egen reflektion och ansvarstagande i yrkesutövningen.

Efter Ädelreformen har sjuksköterskorna den högsta medicinska kompetensen inom kommunal vård och omsorg. I yrkesrollen ingår omvårdnad och läkemedelshantering samt uppföljning och bedömning av hälsotillstånd oavsett läkemedelsbehandling eller inte.

Multimedicing är en riskfaktor för alla äldre och sjuksköterskans roll att utvärdera, omvärdera och ifrågasätta kan inte nog betonas. Det behövs inga nya metoder eller riktlinjer utan grundläggande omvårdnadsprinciper baserat på den s.k. VIPS-modellen; Välmående (hälsa och vård), Integritet (respekt för individen), Prevention (i sjukdomsförloppet) och Säkerhet (minimera risker vid vård och behandling) ses här vara centrala för att

kvalitetssäkra läkemedelsbehandling av äldre personer inom kommunal vård och omsorg. Ingen enskild åtgärd löser utmaningen i läkemedelsbehandlingen utan det bygger på ett aktivt professionellt och kompetent agerande av sjuksköterskor i samarbete med förskrivande läkare.

Slutsatser

- Multimedicinering är vanligt förekommande hos äldre, brister i monitorering och uppföljning samt omprövning av indikationen utifrån patientens hälsotillstånd föreligger.
- Återkoppling till läkare av funna risker och fel i läkemedelsanvändningen i avsikt att förbättra läkemedelsbehandlingen gav inget resultat.
- Det finns ett samband mellan patientens livskvalitet och kvaliteten i läkemedelsbehandlingen, d.v.s. anpassning och omprövning av medicineringen är avgörande.
- Vid intervjuer av sjuksköterskor framkom skilda uppfattningar om yrkesrollens ansvar att utvärdera och följa upp såväl hälsotillstånd som läkemedelsbehandling.

För varje multisjuk patient måste varje läkemedel värderas och omprövas för att minska riskerna med multimedicinering. Detta måste ske i samarbete och med respekt för patienten. “ Att behandla eller inte behandla ” är den ständiga frågan.

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APPENDIX

I. EQ-5D instrument

Rörlighet

- Jag går utan svårigheter
- Jag kan gå med viss svårighet
- Jag är sängliggande

Hygien

- Jag behöver ingen hjälp med min dagliga hygien, mat eller påklädning
- Jag har vissa problem att tvätta eller klä mig själv
- Jag kan inte tvätta eller klä mig själv

Huvudsakliga aktiviteter (*t ex arbete, studier, hushållssysslor, familje- och fritidsaktiviteter*)

- Jag klarar av mina huvudsakliga aktiviteter
- Jag har vissa problem med att klara av mina huvudsakliga aktiviteter
- Jag klarar inte av mina huvudsakliga aktiviteter

Smärtor/besvär

- Jag har varken smärtor eller besvär
- Jag har måttliga smärtor eller besvär
- Jag har svåra smärtor eller besvär

Oro/nedstämdhet

- Jag är inte orolig eller nedstämd
- Jag är orolig eller nedstämd i viss utsträckning
- Jag är i högsta grad orolig eller nedstämd

II. Medication appropriateness index (MAI)

1. Is there an indication for the drug?	
2. Is the medication effective for the condition?	
3. Is the dosage correct?	
4. Are the directions correct?	
5. Are there clinically significant drug-drug interactions?	
6. Are there clinically significant drug disease interactions?	
7. Are the directions practical?	
8. Is the drug the least expensive alternative compared with others of equal utility?	
9. Is there unnecessary duplication with other drugs?	
10. Is the duration of therapy acceptable?	

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