Nursing Care of the Elderly

A Literature Review of Nurses' Challenge in Pharmacotherapy of the Elderly

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ABSTRACT

The aim of this final project was to identify and explore issues a nurse has to consider in safe pharmacotherapy of the elderly as described in the literature with the purpose of heightening nurses' awareness to improve patient safety in and outcomes of pharmacotherapy. A list of good nursing practices was elaborated.

A literature review was conducted on the basis of 29 research articles from health care settings of six different countries with a western health care model. The systematic search from CINAHL and MEDLINE databases was completed by a manual search for recently published research studies in nursing journals. The data were processed by content analysis.

Findings revealed unanimous understanding that safe pharmacotherapy in this vulnerable group of elderly means first of all prevention of medication errors and adverse drug events. Because medication errors emerge throughout the medication process, emphasis to prevent such errors is put on those phases of the medication process not yet physically involving the patient such as prescribing phase, receiving a prescribed order, dispensing, preparing and administering medication phase. Apart from having sufficient professional and geriatric knowledge, nurses have to give special attention to appropriateness of drugs, drug compatibility and adverse effects of drugs. Prescribed orders have to be adjusted to a patient's age and/or creatinine clearance and the geriatric principle of "starting low and going slow" to be applied. Incomplete knowledge of a patient's total drug regimen presents a potential risk factor as well as alteration of drugs. Frequency of adverse drug events is far too high in this age group; reasons for this are manifold. Monitoring of drug administration is scarce, recognition of adverse drug events in elderly is not easy. An important mean to improve patient safety is patient education.

To increase safety of the elderly in the medication process, sensitivity and cautiousness with strict rules, guidelines and protocols should be implemented in pharmacotherapy, as it is done with children and adolescents. Apart from a sensitization of the whole society for the vulnerability of a growing number of elderly, this is especially applicable in the field of nurse education. Especially nursing homes, where drug alteration is a common practice, have a need for improvement and new procedures and techniques.

Keywords

Aged, drug therapy, drug monitoring, drug administration, medication error, ...

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TIIVISTELMÄ

Tämän opinnäytetyön tarkoituksena oli tunnistaa ja tutkia asioita, joita sairaanhoitajan pitää ottaa huomioon vanhusten turvallisessa lääkehoidossa. Pyrkimyksenä oli tehostaa sairaanhoitajan tietoisuutta, millä tavoilla voisi parantaa potilaan turvallisuutta lääkehoidossa ja lääkehoidon tuloksia. Luettelo hyvän hoidon käytännöistä oli laadittu.

Kirjallisuuskatsaukseen valittiin 29 tieteellistä julkaisua, joiden tutkimukset olivat peräisin kuuden maiden terveyden hoidon ympäristöltä. Niiden maiden terveyshoito toimi länsimaisen mallin mukaan. Aineisto kerättiin systemaattisesti CINAHL ja MEDLINE tietokannoista sekä manuaalisesti. Aineisto analysoitiin ja tulokset koottiin käyttäen sisällön analyysia.

Tuloksista kävi ilmi julkaisuiden tekijöiden yksimielisyys. Vanhusten lääkehoidon turvallisuus tarkoittaa ensinäkin lääkevirheen ja lääkkeen haittavaikutusten ennaltaehkäisy. Lääkevirheet ilmestyvät koko lääkehoidon prosessissa. Niiden ennaltaehkäisyssä painotetaan lääkehoidon prosessivaiheeseen kuin lääkemääräykseen, lääkemääräyksen vastaanottamiseen, jakamiseen, annosteluun ja valmistamiseen sekä antamiseen. Sairaanhoitajan pitää hallita riittävää ammattilista tietoa ja geriatria tietoa. Huomio on eritysti kiinnitettävä lääkkeen tarkoituksenmukaisuuteen (tarpeellisuuteen?), soveltuvuuteen ja lääkkeen vasta-aiheiseen. Lääkemääräykset sopeutetaan potilaan ikään ja/tai munuaistoimintaan (Kreatiniinin poistamiseen) ja käytetään geriatrien periaatteen ”aloitta lääkkeen pienellä annoksella ja hitaasti”. Keskeneräinen tieto potilaan kokonaislääkemääräyksestä ja poikkeama lääkkeen käyttökuntoon saattamisesta (kuin lääkkeen jauhaminen ja/tai osittaminen) ovat vaaralliset tekijät/vaarantaa potilaan turvallisuutta. Lääkkeen haittavaikutusten määrä vanhusten lääkehoidossa on erittäin korkea ja siihen liittyvät syyt ovat monenlaiset. Lääkkeen antamisen seuranta on harvinainen ja haittavaikutusten tunnustaminen ei ole helppoa tässä ikäryhmässä. Tärkeä keino parantaa lääkehoidon turvallisuutta on potilaan ohjaus ja neuvonta lääkehoitoon liittyvissä kysymyksissä.

Sääntöjen, ohjeiden ja protokollan mukainen lääkehoidon toteuttaminen kuten lasten lääkehoidossa oleva rutiini voisi lisääntyä vanhusten turvallisuutta lääkehoidon prosessissa. Erityisesti vanhainkodeissa tarvitaan parannuksia lääkkeen käyttökuntoon saattamisessa. Lääkkeen osittamisen, jauhamisen tai muut poikkeamat lääkkeen annoksen valmistuksessa pitää estää ja ottaa käyttöön uusia teknikkoja ja menetelmiä.

Avainsanat

vanhus, lääkehoito, lääkevirhe, lääkehoidon prosessi, lääkkeen haittavaikutukset, vanhaink

CONTENTS

APPENDIX 2: HARVEST as a tool for health professionals to improve prescribing practices and prevent adverse drug effects in the elderly (Helton et al. 2005)

1 INTRODUCTION

Elderly care has until recently played a minor role within health sectors of many countries. This is changing with ever increasing numbers of older adults. In Finland the group of people between 75 and 84 years of age has roughly doubled during the last twenty years, while the group of over 84 years of age has almost tripled during the same period, and both groups are expected to grow further (Kivelä 2004). The percentage of over 65 years old was 16.5% in 2006 (Statistics 2007) and expected to grow to one fourth of the whole population during the next 20 years.

A longer life means for most of the elderly to live with a chronic disease or comorbid conditions. Chronic diseases such as hypertension, cardiovascular disease, arthritis, stroke, cancer and diabetes mellitus are more prevalent with increasing age (Beyth 1999). Recent developments in drug therapy improve outcomes in elderly patients with dementia, osteoporosis, Parkinson's disease and other conditions (Simonson and Feinberg 2005). Though there is no doubt that appropriate drug use may be the single most important intervention in elderly care, it is at the same time obvious that an increasing number of medications to be taken concurrently can endanger the patient's safety. The natural process of aging is accompanied by physiological changes that manifest individually in reduced organ function, in slowed metabolism and slowed elimination amongst other changes. Amella (2006) states that as a result of such changes disease can present differently in a person over 65 years old than it would in a younger adult or child.

Pharmacokinetic refers to all processes in the body that influence the concentration of a medication in the serum such as absorption, distribution, metabolism and excretion; it is altered compared to younger adults (Burkhardt et al. 2007). Pharmocodynamic, which describes the biological activity of a medication, is also influenced by age-associated physiological changes. One example of great relevance for elderly care is the increased sensitivity of the elderly to central nervous system (CNS) affecting substances. Application of antipsychotic, anxiolytic, antidepressant, and sedative drugs often lead to falls, confusion and decline in the functional status of the elderly (Burkhardt et al. 2007).

Polymedicine or polypharmacy, which is in Finland defined as taking more than five different drugs at the same time (Hartikainen 2002), is a well known and dangerous problem in the elderly. Already in 1997, Rochon and Gurwitz described the connection between multimorbidity and polypharmacy. According to a 5-year study of the elderly's drug use in Finland, 67% of 75 years old used at least 6 different drugs and 28% of that age group at least ten different drugs at the same time (Jyrkka et al. 2006) . The highest drug consumption was reported by women of 85 years and older; 50% of this age group used at least ten different drugs at the same time.

The elderly in institutionalized care use more drugs than those in home care. Almost all patients in institutionalized care and two third of home care patients take at least one CNS affecting drug (Jyrkka et al. 2006). Every tenth either uses inappropriate drugs for the elderly as defined by Beer (Molony 2004) or uses two or more drugs from the same drug group, often without reasons, or takes a drug combination with a serious risk for interactions. Thus drugs do no longer provide therapeutic benefit but may cause drug-related problems. Polypharmacy can lead for example to changes in mental state, a symptom which may mistakenly be attributed to old age (Amella 2006).

Few studies have been conducted to assess the safety and efficacy of medications in older adults. This is problematic for clinicians who prescribe for a growing older population (Edlund 2007). Inappropriate prescribing, adverse drug events and drug interactions are common and often preventable drug-related problems. Research results of studies undertaken in US nursing facilities report that from an overall rate of adverse drug events up to 50% were preventable (Simonson and Feinberg 2005).

Further complications with drug therapy implementation arise from the fact that many of the elderly have difficulties with swallowing (dysphagia). About 53-74% of American nursing home residents, 14% of hospital patients and 33% of rehabilitation centre patients have some form of dysphagia. People who are likely to develop dysphagia include those who for example have had a stroke, or have diseases such as Parkinson's, multiple sclerosis, cancer, and dementia, or who are on medications that cause sedation, impair cognition, or decrease production of saliva (Dorner 2002). For these patients the

drug regimen should be in an easy-to-swallow-form, but only a minor part of the drugs is prescribed as mixture or solution. Nevertheless, in order to get these drugs administered to patients, it seems to be a common routine to crush them.

The nurse plays a central role in drug therapy that involves physicians and pharmacists, but the nurse is responsible for the patient's safety in receiving the correct drug regimen (O'Shea 1999). Even though plenty of research has been conducted in clinical settings in respect to safe medication and medication errors, attention to this special age group of the elderly has only been given recently.

The overall question is how nurses can contribute to increase patient safety in drug therapy of the elderly to achieve an optimal outcome. This final project aims to identify and explore issues a nurse has to consider in safe drug therapy of the elderly as described in the literature with the purpose of heightening nurses' awareness to improve patient safety and drug therapy outcomes.

2 PHARMACOTHERAPY IN ELDERLY CARE

2.1 The goal in pharmacotherapy in Finland

Tilvis (2001) described the goal of drug therapy in elderly care as to improve diseases and symptoms with the help of drugs in order to increase older adults' well-being and support their independence. For Riggs (2004) the goal is to prolong the elderly's quality of life, not to prevent disease which means to carefully balance safe and effective therapy with the potential for complications. Drugs are used to obtain an optimal clinical outcome for the patient in short or long-term. There is a high risk for drug-related problems especially in the elderly due to age-related changes in connection with chronic diseases and conditions, multiple medications, and an increased sensitivity to drugs. If for instance a drug will only have a minimal effect on improving the quality of life, it should not be used. Kivelä and Räihä (2007) as well as Burkhardt et al. (2007) see the heterogeneity of the elderly as problematic in defining expected outcomes of drug ther-

apy. They also mention the fact that far less research has been undertaken in this age group in regard to drug effects than in younger adults. Recommendations for outcomes of older and frail adults are thus derived from research of younger and physically better shaped younger adults. The central goals of drug therapy of the elderly, however, do not differ from the goals of younger adults; prevention of death by treating threatening illnesses with antibiotics is one example. Emphasis is not only put on the extension of life but on maintaining physical, cognitive, psychological and social capabilities as well as on improving the elder's quality of life by alleviation of disease symptoms. Kivelä and Räihä (2007) also mention a good nutritional status and fluid balance as preconditions for best outcomes of drug therapy. And last but not least, should the geriatric principle of drug therapy in elderly be followed "start low and go slow" with constant monitoring as suggested by Kivelä and Räihä (2007), Burkhardt et al. (2007) and Foreman and Zane (1996). Bergman-Evans (2006) and Amella (2006) formulate this geriatric principle as medication doses should reflect age and renal status of the older adult. Simonson and Feinberg (2005) add that an elderly, presenting with signs or symptoms such as confusion, forgetfulness, gait instability, parkinsonian signs, incontinence or fatigue, should be thoroughly assessed for adverse drug reactions before attributing these symptoms to a new illness. Adverse drug events are the most important unwanted outcomes of drug therapy (Burkhardt et al. 2007).

2.2 Guidelines for pharmacotherapy in Finland

A national guide for safe pharmacotherapy in social and health care was published by the Finnish Ministry of Social Affairs and Health in 2006. It states explicitly in which manner and by whom drug therapy should be implemented:

> "Pharmacotherapy is a health care activity that is carried out, as a rule, by health care professionals with training in pharmacotherapy and under their responsibility. Licensed health care professionals with appropriate training bear the overall responsibility for the provision of pharmacotherapy, and every employee giving pharmacotherapy or taking

> part in it is responsible for his/her actions. Foremen guide and supervise the carrying out of pharmacotherapy in accordance with a pharmacotherapy plan, as well as decide on the division of labor and cooperation between the different personnel groups so that the skills and knowledge of all groups are made use of optimally".

Technically drug therapy is a multidisciplinary process in which every part of the health care team - physician, pharmacist, nurse and patient – carries out its duties. This process is compiled of different phases as prescribing, receiving the prescription, dispensing, preparing, checking and administering the drug, monitoring the outcomes, reporting adverse drug events, teaching patients about their drugs, and documenting the whole process. Nurses play a crucial role in this process as they participate in every step apart from prescribing and dispensing the drug. Hall (2002) describes them as the eyes and ears of patient safety.

Regarding the necessary skills for pharmacotherapy implementing health personnel, the Ministry of Social Affairs and Health (2006) states that the meaning of pharmacotherapy as part of the entire care and the process of pharmacotherapy itself has to be understood. It is not enough to have technical skills only, but the implementation of pharmacotherapy requires command of basic judicial-ethical, pharmacologic, physiologic, pathophysiologic and drug calculation knowledge as well as knowledge in handling medication storage and disposal. It is inevitable for safe drug administration to be aware and understand the various forms of medications as well as their properties and to prepare the different forms of medications in the correct way. Safe implementation of pharmacotherapy requires for instance that sterile products are not contaminated or the long-term effect of orally given medications is not destroyed by crushing them.

The guide emphasizes under medication distribution and administration that the nurse shall have a quiet environment to concentrate on his/her task as well as recommends the double checking of medications before administration in order to avoid medication errors. Drug therapy also includes the responsibility of the nurse to inform and teach the patient in regard to his/her medication regimen. The health care plan for drug therapy

determines the goal and, thus, the evaluation of drug effects, adverse effects, side-effects, possible interactions and documentation of the whole treatment process. It is the physician's task to ascertain that the medication administering personnel has the respective knowledge of possible medication effects.

A registered nurse in Finland has the skills and rights to order medications to the unit, prepare them for administration, and administer them orally, rectally, subcutaneously, intradermally and intramuscularly. With additional training, a registered nurse can obtain a license to administer intravenous fluids and medications, implement blood transfusions, participate in medication therapy given to the epidural space, and administer vaccinations. The Ministry of Social Affairs and Health emphasizes each nurse's responsibility over the actions they take when providing or participating in medication management (Safe Pharmacotherapy 2006).

2.3 Legislation in Finland

Under the act on the status and the rights of patients (No.785/1992) the Finnish Legislation ensures that every patient has a right to good quality health care and related treatments under the given resources. It regulates the patient's right for information about his/her health status, treatment options and their effects as well as the right for self-determination.

The act on health care professionals (No.559/1994) regulates who and on what basis can practise as a nurse among other health care professionals. Health care professionals must promote and maintain health, prevent illness, cure those who are ill and alleviate their suffering. They must employ generally accepted, empirically justified methods, in accordance with their training, which should be continually supplemented. Each health care professional must weigh the benefits and possible hazards of their professional activity to the patient.

Any health professional, who neglects the described obligations or performs tasks outside of his/her training, professional skills, and knowledge, or behaves otherwise incorrectly in carrying out professional tasks, can be sanctioned by the National Authority for Medicolegal Affairs.

These acts can be envisaged as the basis for the patient's safety in drug therapy. Medication complications such as adverse drug effects are a possible risk in drug therapy and can, thus, threaten patient's safety. Since adverse drug effects are considered as medication errors or a consequence of medication errors they comprise professional misconduct. Nurses' behaviours and professional actions shall be directed by the Finnish Legislation, guidelines and directives by the Ministry of Social Affairs and Health as well as by the Ethical Guidelines of Nursing by Finnish Nurses Association.

2.4 Elderly care and the nurse's role in drug therapy

A nurse as a part of the professional health team takes a central role in drug therapy as s/he is responsible for preparing and checking the drug, administering it to the patient, teaching the patient, monitoring outcomes and documenting the whole process. In fact, s/he is the last check-point to a possible medication error between the prescription of a drug and the administration of the same to the patient. The administration of medication is much more than just giving a pill (CARNA 2006), it means to have knowledge, skills and judgement to assess the appropriateness of a particular medication. The nurse has to understand the indications for administration of a particular drug as well as the actions, interactions, usual dose, route, side-effects and adverse effects of the drug in order to monitor the client during and following the administration. S/he has to be able to cope with side-effects or adverse effects of the drug. For calculating the dosage and preparing the medication correctly s/he needs mathematical skills. And finally s/he has to have evaluative skills in order to document the effect of the drug on the patient's health status.

Literature shows that medication errors happen at every step of drug therapy, but most frequently during drug administration. It also shows that the definition of medication error varies widely. An independent body composed of 20 national organizations in the United States (NCC-MERP) formulated the following definition (Brown 2001:79): ”A medication error is a preventable event that may cause or lead to inappropriate medication use or patient harm while the medication is in the control of the health care professional, patient, or consumer. Such events may be related to professional practice, health care products, procedures, and systems, including prescribing, order communication, product labelling, packaging, and nomenclature, compounding, dispensing, distribution, administration, education, monitoring, and use.”

Other medication error categories still appear; adverse drug events (ADEs), which result in patient’s harm or injury, are one of those categories. ADEs include a rash that develops following proper antibiotic administration as well as injury resulting from medications given erroneously (Brown 2001).

Especially in elderly care, inappropriate drug use as defined by Beer’s criteria (Molony 2004), prescription of incorrect dosages, dosages administered at wrong times, omitting dosages and stopping medication too soon (Lefkovitz and Zarowitz 2007, Simonson and Feinberg 2005) are sources of adverse drug events. It is often difficult to recognize adverse drug events (ADEs) in the elderly due to atypical or hyposymptomatic signs (Lee 1996); fatigue and missing or decreased appetite can, for instance, present as the only symptoms of overdosing with Digoxin (Burkhardt et al. 2007). Frey and Rahman (2003) argue that just any change in the status of an elderly should be considered as a drug side effect until proven otherwise. Bergman-Evans (2006) names different groups of the elderly which are particularly at risk for medication mismanagement. They include those who treat themselves, those who lack coordinated care, those who have recently been discharged from hospital, the group of elderly with impaired cognitive status, and those with complicated medication regimens due to several chronic diseases. Overall, medication safety is a major concern with the elderly.

Even though nurses and physicians are involved in the care of nursing home residents, their roles and perspectives are different. The nursing staff spends much more time with residents, attends to their functional and self-maintenance needs and concerns, while physicians come on routine scheduled visits, in general for several hours per week and at intervals only. Though the physician has medical decision authority, it is the nurse's close relationship with the resident that allows him/her to interpret the resident's signs and needs (Cohen-Mansfield et al. 2006). This illustrates and emphasizes the nurse's important role in elderly care and the necessity for comprehensive geriatric, gerontological and pharmacological knowledge.

Many elderly patients are admitted to hospitals through emergency departments where nurses are specialized to deliver fast-paced care in critical situations of life and death, but have either no time or too little knowledge for basic care of the elderly. Also nurses in emergency departments have need for more training in geriatrics and gerontology according to Robinson and Mercer (2007).

3 THE AIM OF THE FINAL PROJECT AND RESEARCH QUESTIONS

The aim of this final project is to identify and explore issues a nurse has to consider in safe drug therapy of the elderly as described in the literature with the purpose of heightening a nurse's awareness to improve patient safety and drug therapy outcomes. Two research questions are to be answered by the literature review:

1. What issues a nurse has to consider in safe drug therapy of the elderly?

2. Which good nursing practices can contribute to increased patient safety and a positive outcome in drug therapy of the elderly?

4 METHODS

4.1 Data collection and selection

A literature review was the chosen method for this final project. The aim of a literature review is to present current evidence-based knowledge for a particular topic. It comprises a scientific research method in which the critical review of existing literature contributes to the formulation of research questions, quality assessment of collected information, discussion and presentation of findings and results. It is a method to gather and process data according to a strict scientific design in order to minimize systematic bias and allow reproducibility of a review (LoBiondo-Wood and Haber 2006, Polit and Hungler 2004). In a literature review, database reports of primary or original scholarship are utilized.

The literature search for this final project was conducted in several steps. Articles were searched from the internet database OVID containing CINAHL (the Cumulative Index to Nursing and Allied Health Literature) and MEDLINE, a large database in medical and health sciences based on the National Library of Medicine. The selection criteria for acceptance of articles to be included in this literature review were set as follows:

1. The article is based on empirical research
2. The article has relevance for nursing
3. The article is of relevance to the study's topic and/or relates tothe nurse's role
4. The article is published between 1996 and 2007
5. The article is available in full text
6. The article is published in English, Finnish or German

The literature search of the databases was conducted with the keywords aged, institutionalized care, elderly care, gerontological care, nursing homes, drug therapy, drug administration, drug monitoring, adverse drug events or medication errors, and patient safety. Even though the time frame of eleven years for the search of the databases seems to be long and seems to score vast amounts of articles, as for instance

in case of drug administration, the final number of articles chosen was relatively small: Many articles did not refer to nursing (MEDLINE), nurses' roles or to the special age group (>= 65 years of age) of this final project or were not of original research.

Search of CINAHL database produced results as follows:
1. The keyword 'aged', combined by and with drug therapy / and medication errors / and polypharmacy /and prescription drugs gave no hits. The same search with drug therapy / or medication error / or polypharmacy / or prescription drugs resulted in 1773 articles. Limitation to 'research' yielded 733 articles and 664, respectively, by limitation to 'publication year 1996-2007'. After reading through the abstracts, 33 articles remained, out of which three were selected (Table 1).

2. Search with the keyword drug administration mapped to subheadings dosage forms / or drug compounding / or drug incompatibility / or drug labeling / or drug packaging / or drug stability / or drug storage supplied 5077 articles. The same search with and lead again to 0 hits. After limitation to 'research' 1373 articles remained, and after limitation to 'full text' 229, out of which 5 articles were chosen (Table 1).

3. Database search with the keyword 'drug monitoring' to all subheadings combined with aged by and yielded 313 articles, with limitation to 'full text' 59 articles, out of which 3 were selected (Table 1).

4. The keyword adverse drug events/ or medication errors/ yielded, combined with aged by and, 556 articles; limited to 'research' and 'full text' 23 articles remained, out of which two were chosen, one being a duplicate from drug therapy search (Table 1).

5. Search with medication error/ pc [prevention and control] revealed 2014 articles. 131 articles remained from combination with aged by and. As a result, one article was chosen (Table 1).

6. Search with the keywords 'patient safety', 'institutionalized care', 'elderly care', 'gerontological care' and 'nursing homes' was not fruitful.

TABLE 1: Data search from CINAHL

Database: CINAHL	Hits		SELECTION
keyword(s)	total	with limits	Author/year
aged and drug therapy/or medication errors/ or polypharmacy/or prescritpion drugs	1773	664	Helton et al. 2005 Mannesse et al. 2000 Ruths et al. 2003
dosage forms/or drug compounding/or drug incompatibility/or drug labeling/or drug packaging/or drug stability/or drug storage	5077	229	Barnes et al. 2006 Ellenbecker et al. 2004 Lilley and Guanci 1996 Warn 2007 Wright 2002
aged and drug monitoring	313	59	Karch and Karch 2003b Lilley and Guanci 1998d Shirrel et al. 1999
aged and adverse drug events/or medication errors	556	23	Ruths et al. 2003 Thomas and Brennan 2000
aged and medication error/prevention and control	2014	131	Karch and Karch 2003a

Search of the database MEDLINE produced the following results (Table 2):

1. Using the same keywords as for the search in CINAHL database under point 1 and with limitation to full text, 475 articles were found. Hereunder were several reviews which have been utilized for describing the background of this final project as well, but for this literature review four (4) articles were selected, whereby one was a duplicate (*) of the CINAHL database search.

2. Search with the keyword drug administration, limited to ‘aged 65 and over’ and to full text, produced 800 articles, but few related to nursing and/or the role of the nurse in drug therapy in general. No articles were chosen.

3. Search of MEDLINE with the keyword drug monitoring yielded 504 articles and limited to full text 93. But apart from a reply by Hancock (1999) to a case study found by CINAHL database search (Shirrel et al.1999), no articles were chosen.

4. Search of MEDLINE with ‘medication errors / or safety management’ produced 590 articles and, limited to full text, 86 articles. Ten articles were chosen after which one duplicate was eliminated already (Table 2).

5. Search of MEDLINE database with keywords ‘gerontological care’ (= geriatric nursing / and nursing staff), and ‘institutionalized care’ did not lead to useful results. Search with the keyword ‘nursing homes’ yielded one article (Table 2).

TABLE 2: Data search from MEDLINE

Database: MEDLINE	**Hits**	**SELECTION**
keyword(s)	**with limits**	**Author/year**
aged and drug therapy/or medication errors/ or polypharmacy/or prescritpion drugs	475	Edwards 1997 Karch and Karch 2003c Karch and Karch 2000 Ruths et al. 2003*
drug administration/ aged 65 and over	800	none
drug monitoring	93	Reply by Hancock 1999 to Shirrel et al. 1999
medication errors/ or safety management	86	Ahmed and Hamrah 1999ab Ahmed and Fecik 2000 Jordan 2002 Karch and Karch 2003a Karch and Karch 2000 Lilley and Guanci 1998abc Lilley and Guancy 1997
nursing homes	347	Field et al. 2001

Manual literature search in the Journal of Advanced Nursing, the Journal of Gerontological Nursing and the Journal of Geriatric Nursing as well as search according to given references of identified articles, respectively, resulted in three findings:

- McBride-Henry and Foureur 2007
- Ruths et al. 2001
- Vogelsmeier et al. 2007.

4.2 Data analysis

In order to answer the research questions, meaning has to be given to the collected data. The chosen literature was first tentatively analysed and summarized, as can be seen in Appendix 1. The method of choice was content analysis.

Content analysis is used to describe the characteristics of a document in a systematic and objective way (Polit and Hungler 2004). It aims to produce concepts or categories which provide a condensed and general description of the phenomena in question. Through content analysis data are simplified, categorized and conceptualized (Lo-Biondo-Wood and Haber 2006).

The chosen literature was divided into three groups according to the sample of the conducted research. The largest group of articles was composed of case studies with nurse – patient and nurse - physician interaction. Another group of articles had nurses chosen as its sample of conducted research, while a third group of articles was based on patient records as the sample of conducted research. Thirdly all relevant information regarding the phenomena of the pharmacotherapy process of the elderly were collected and categorized according to their similarities and differences. This categorized information was then combined according to themes, as indicated by the chosen literature which are the different phases of the pharmacotherapy process. Finally, the data were restricted to the pharmacotherapy phases with nurses' involvement.

4.3 Reliability and validity

The database searches were conducted only from reliable internet databases such as CINAHL and MEDLINE in the field of health care, which ensures some degree of surveillance. The correctness of the search process was ensured with expertise assistance. Only original research with apparent and trustworthy research methods was included in the review. One article with valuable qualitative information was included in the review despite an imprecisely given sample size in the description of its research methods.

The chosen literature was read and tentatively analysed; results are shown in Appendix 1. With 29 articles the literature review looks extensive, but it has to be taken into account that 17 case studies, partly very brief, are included in this number.

The reviewed articles presented research in health care settings from six different countries with the majority of 21 articles from the USA, two articles from Canada, UK, and Norway, respectively, and one article from New Zealand and one from Australia. Unfortunately, no Finnish articles were chosen. All reviewed research was carried out in hospitals, emergency departments or nursing homes that operate according to a Western health care model. Validity of this review is, consequently, secured.

There are, however, factors to be mentioned that influence the validity and reliability of this literature review. First of all, not all of the studies could be obtained in full text which means that some important research articles might have been left out. Even though the applied techniques of this literature review should enable its repetition, selection and analysis of data is always influenced by personal judgement. The precision of the data analysis was partly hampered by varying terminology of different authors.

5 FINDINGS

5.1 Issues nurses should consider in safe drug therapy of the elderly

The reviewed literature presents a manifold picture of what should be considered by nurses and other health personnel in safe drug therapy. All authors of the chosen articles understand safe drug therapy as the prevention of medication errors and adverse drug events (ADEs), which are defined by a number of authors (Lilley and Guanci 1998c, Ahmed and Hamrah 1999b, Thomas and Brennan 2000, Field et al. 2001, Ellenbecker et al. 2004) as medication errors. Ellenbecker (2004) emphasize that nurses must be constantly aware of the risks associated with medication errors and be constantly vigilant to avoid them, especially with this vulnerable group of the elderly. McBride-Henry and Foureur (2007) mention an estimation according to which one in five medication doses

reaching the patient contain a medication error and, thus, put the patient at risk of injury. Karch and Karch (2003a) report of the errors being categorized as wrong patient (8% of errors), wrong timing of drug dose (8% of errors), wrong drug administered (16% of errors), wrong route of administration (17% of errors), and wrong dose (48% of errors), and a small category of miscellaneous errors.

The elderly are especially vulnerable to adverse drug effects and adverse drug reactions as a result of drug accumulation in the body which is influenced by concomitant use of drugs, diseases, patient's age (Lilley and Guanci 1996, Lilley and Guanci 1998bd, Thomas and Brennan 2000), and weight and nutritional status (Edwards 1997).

Medication orders pass through several steps before the actual administration to the patient (Lilley and Guancy 1998a), which increases the possibilities for errors (Edwards 1997, Ahmed and Hamrah 1999b, McBride-Henry and Foureur 2007, Warn 2007). Significant responsibility in keeping the patient safe during medication administration lies on nurses' shoulders. Different health care settings employ different protocols for safe medication administration. Nurses' responsibilities, however, reach beyond this and must include ongoing assessment, recognition and reporting of adverse drug effects (Lilley and Guanci 1996, Jordan 2002, Warn 2007). According to Gurwitz et al. (2005) cited by Vogelsmeier et al. (2007), many of the ADEs found in the elderly relate to the ordering stage of medications. It is also suggested that most drug problems are probably created during drug prescription and/or monitoring (Field et al. 2001, Ruths et al. 2003). McBride-Henry and Foureur (2007) see medication errors happening during prescribing, preparing or administering drugs, not including the monitoring phase. However, only Vogelsmeier et al. (2007) name all the phases of the medication process as sensitive to errors (prescribing, documenting, dispensing, administering and monitoring).

In this literature review, the research questions are to be answered from the nurse's point of view, and prescribing is actually excluded, because it is the domain of physicians and/or advanced practice nurses. The prescribing process stands, however, at the beginning of the medication therapy process and inevitably influences all further phases of the drug therapy.

Thomas and Brennan (2000) remind that the elderly do not always present typical signs and symptoms of diseases, making timely and accurate diagnoses more difficult. Vogelsmeier et al. (2007) discuss introduction of new technology into the process of medication administration such as computer based prescription in order to overcome communication problems which were identified as compromising patient safety in all phases of the medication process of the elderly. Quite a number of authors of the reviewed literature identify a need for better and safer prescribing practices and protocols and/or guidelines for prescribing for the elderly patients (Ruths et al. 2001, Kelly et al. 2003, Helton et al. 2005), or need for regular reviews and up-dates of indications for medications in drug therapy of the elderly (Field et al. 2001, Ruths et al. 2003).

To answer both research questions in detail, categories were chosen according to the different phases of the medication therapy process with nurses' involvement as derived by themes from the chosen literature, i.e. receiving a prescribed medication order, dispensing, preparing and administering medication, monitoring medication administration, and educating patients.

5.1.1 Receiving a prescribed medication order

The nurse has to be sure of the reason and/or the diagnosis of the patient for the prescribed medication; the order has to be legible and the used abbreviations unmistakably clear and understandable (Karch and Karch 2003ac, Vogelsmeier et al. 2007).

Karch and Karch (2003a) recommend a nurse who starts to work in a new institution or in a new unit to ask for a list of common abbreviations. In case of unfamiliarity with a drug (drug class, preparation, administration), s/he has to clarify the situation immediately and effectively (Lilley and Guanci 1998c) by appropriate means such as a handbook/manual, communication with colleagues, a pharmacist or a physician.

Of great importance is the knowledge that in elderly patients with age-related decreased renal and liver function drug dosages have to be adjusted to either creatinine clearance or the age of the patient. If, as it is routine in acute care, antibiotics are to be administered before laboratory tests are ready, dosages for those medications have to fulfill the geriatric principle "start low and go slow" (Lilley and Guanci 1996). Furthermore, Karch and Karch (2003c) expect the nurse to know about medications like methotrexate for rheumatoid arthritis, fosamax and prosac which are relatively unusual and only administered once or twice a week.

Nurses are also expected to recognize medications by drug class in order to know and be aware of prescribed medications' potential for side-effects, serious adverse effects and drug-food and drug-drug interactions (Ahmed and Fecik 2000, Helton et al. 2005, Lilley and Guanci 1996); in emergency situations, especially when a physician, who does not know the patient, is involved, correct and complete drug information by the nurse can be life-saving (Ahmed and Fecik 2000).

Large volumes of prescribed medications compromise safe medication practice (Vogelsmeier et al. 2007), because almost all drugs interact adversely at least with one other drug and physicians can hardly avoid this by prescribing numerous drugs (Edwards 1997); large volumes of prescribed medications represent a marker for severe adverse drug effects in patients (Mannesse et al. 2000) and/or inappropriate medication regimens (Ruths et al. 2003).

Inappropriate regimens mean simultaneous treatment with two or more psychotropic drugs, receiving drugs from two or three different therapeutic subgroups concurrently, using simultaneously neuroleptics and anti-depressants, and using anxiolytic and hypnotic benzodiazepines concurrently (Ruths et al. 2001). Also psychoactive drugs, opioids and anti-infective drugs, account for most adverse drug effects in the elderly (Field et al. 2001, Ruths et al. 2003). Concomitant use of narcotic pain agents, anticonvulsants and anti-depressants increase the risk for adverse drug effects in the elderly by the factor three compared to taking a drug from one of the medication categories only (Kelly et al. 2003).

Lilley and Guanci (1996) are of the opinion that the nurse should have knowledge of a drug's potential for adverse interaction with other medications, foods, or diagnostic agents, while Edwards (1997) formulates it as having understanding of drug's pharmacokinetic and pharmacodynamic processes in order to be able to check medication lists for the compatibility of drugs.
Even though physicians and pharmacists should have done their work to check patient medication lists for inappropriate orders, the final check should lie with the nurse. Consequently, nurses need continuous education regarding inappropriately prescribed medications, adverse drug effects of medications, and better prescribing practices for the elderly in order to recognize side-effects and inappropriate drugs in this clientel (Helton et al. 2005).

5.1.2 Dispensing, preparing and administering medications

Even though the dispensing process of drugs differs in various countries, problems with selection, identification, preparation and administration of drugs are similar.

Nurses have to be aware of sound-alike and look-alike drugs with distinctly different actions. While generic names of drugs that sound similar are almost always in the same category, trade names are not as demonstrated by the example of Lamictal (anti-epileptic drug) and Lamisil (anti-fungal drug), but even though being in the same category like Humalog (insulin lispro) and Humulin (regular human insulin), medications have different actions (Lilley and Guanci 1998a, 1997). Vogelsmeier et al. (2007) warn that utilization of both, generic and brand names, lead often to confusion and should be avoided. In addition different pharmacies supplying medications are barriers to a safe medication process.
In drug preparation, emphasis is given on the need for clear labeling, being aware of similar containers with different drug content, checking and double checking drugs before dispensing, keeping treatment solutions elsewhere than oral medications (Ahmed

and Hamrah 1999a), and storing sound-alike medications apart from each other (Lilley and Guanci 1998a).

A critical point in the preparation of medications is the alteration of a drug form. Crushing of drugs and opening of capsules is carried out by nurses due to physical and behavioral characteristics of patients as swallowing difficulties, non-compliance with the regimen, impaired cognitive function, or due to the fact that a patient is receiving many drugs at the same time or due to economical reasons that the tablet form is cheaper than a liquid form (Barnes et al. 2006). Crushing of drugs or opening of capsules means unlicensed administration of the medication/s with the nurse alone being responsible, if the action was unauthorized, and partly responsible, when it was authorized by the prescriber (Wright 2002). This practice destroys the properties of medications as for example with sustained-release or extended-release tablets among others and can lead to severe adverse drug effects and even death of the patient (Karch and Karch 2000). Crushing of drugs and opening of capsules is unnecessary, because there are either oral liquids or dispersible tablets available when the medication cannot be administered by alternative routes; only when all alternatives have been considered with no other possibility left, and appropriate advice from a pharmacist has been sought, should this unlicensed way of administering medication or delivery via feeding tube be used (Wright 2002). With clinical guidelines and pharmaceutical information or written protocols on how to deal with dysphagy patients safe practice could improve (Wright 2002, Barnes et al. 2006).

Nurses provide medications to patients following specialized protocols such as the seven rights of safe medication administration (Warn 2007). The original protocol of five rights consisting of right patient, right medication, right dosage, right route, and right time (Lilley and Guanci 1997, McBride-Henry and Foureur 2007) was extended by right reason (Ruths et al. 2003) and right documentation (Warn 2007). Right reason means that the medication is administered for the correct indication or diagnosis and excludes inappropriate drug choices for the elderly, and right documentation refers to monitoring patients' reaction to the administered medication. Also checking and dou-

ble-checking of medications before administration belongs to the protocol (Lilley and Guanci 1997, 1998a; Ahmed and Hamrah 1999a).

Special protocols have to be followed in respect to IV medications; specific guidelines for administration concentration and infusion time have to be followed for a number of drugs as epinephrine, lidocaine, potassium chloride, furosemide, digoxin immune fab, labetalol, morphine, peperidine, phenobarbital, and diazepam (Karch and Karch 2003b).

5.1.3 Monitoring medication administration

The nurse has to know the patient's total drug intake (including OTC-drugs) and the effects of each drug, wanted and unwanted; s/he has to monitor the patient for therapeutic and adverse effects and confer with a clinician or a pharmacist in problematic or unclear situations (Edwards 1997). Lilley and Guanci (1998d) warn that it can be very difficult to obtain complete information of a patient's total drug intake, even lead to life-endangering situations. A typical example of such a problematic situation is a patient with an acute infection in need for antibiotic treatment with clarithromycin that reports to the doctor taking furosemide for her/his heart condition but forgets to tell about her/his digoxin medication. When used concomitantly clarithromycin increases the serum level of digoxin.

Therapeutic monitoring

There is need for therapeutic drug monitoring when drugs with narrow therapeutic ranges are handled with the elderly such as aminoglycosides (gentamycin, tobramycin and amikacin), digoxin, theophylline, cyclosporin, and in rare cases also vancomycin (Shirrel et al. 1999). Measurements of blood serum levels of a given drug are essential in determining the drug's appropriateness and efficacy and in checking for possible drug toxicity.

Monitoring of adverse drug events

The percentage of appearing adverse drug events in the elderly vary from author to author and setting to setting but, as a result, nurses are daily confronted with adverse drug events in the older adult patient population with especially the group taking five or more drugs concomitantly (polypharmacy) being at risk for adverse drug events.

It is sometimes difficult to distinguish an adverse drug effect from pathophysiologic factors of the disease affecting the response of medication administration (Edwards 1997). The nurse can also be mistaken with the reasons for the adverse drug effect, for instance, thinking of an allergic reaction of the patient to a medication when in fact the reason was wrong infusion practice (Karch and Karch 2003b).

The most common symptoms for adverse drug reactions in the elderly are drowsiness, stupor, weakness, depression, and sleepiness, others are diarrhea, rash, nausea, changes in blood sugar levels, low heart rate, hypertension, dizziness, increased edema, constipation, dry mouth, hypotension, irritability, pain, confusion, vomiting, incontinence, and tachycardia (Ellenbecker et al. 2004).

Gastrointestinal bleeding and haematuria may indicate the presence of severe adverse drug reactions (Mannesse et al. 2000) as well as falls (Mannesse et al. 2000, Thomas and Brennan 2000, Kelly et al. 2003, Ruths et al. 2003) and confusion (Ahmed and Hamrah 1999b) in the elderly. Mannesse et al. (2000) show that falls were not recognized as predictors of ADRs in earlier research because the British National Formulary does not list a fall as a drug side effect.

The list of possible symptoms of adverse drug reactions is almost endless, other authors (Lilley and Guanci 1998d) report of headaches, nausea, diarrhea, blurred vision, lightheadedness and short breath as adverse drug effects of a patient that received furosemide and clarithromycin but had forgotten about his/her second heart drug digoxin.

Serious ADRs as tremor, seizures, cyanosis, severe respiratory depression, and coma among others, can for example be seen when Monoamine oxidase inhibitors (MAOIs) are administered concomitantly with incompatible substances. ADRs can also manifest as arrhythmia, myocardial infarction and heart block subsequently to for example tri-cyclic antidepressant (TCA) medication (Ahmed and Fecik 2000).

Whatever symptoms there might be, if the nurse believes that a patient has a medication regimen problem, it is his/her responsibility to take this matter up with a physician (Edward 1997). The nurse should also remember that adverse drug effects may appear a week or an even longer period after medication administration.

5.1.4 Patient education

Patient education serves as an important means. Many patients continue their drug regimen which they have received during a hospital stay at home and, in order to prevent medication errors and increase medication safety as well as medication adherence they need to learn more about it (Lilley and Guanci 1996, Karch and Karch 2003a).

Inadequate preparation of patients being discharged from hospitals often leads to confusion and/or malpractices (Ellenbecker et al. 2004). Cutting tablets in half due to financial constraints (Karch and Karch 2000) happens when, for instance, the daily dose is halved and the patient keeps old supplies at home, as well as cutting and/or crushing tablets, opening capsules or chewing tablets in order to facilitate the swallowing of the drugs, not knowing that these processes destroy the medication's properties and endanger patients' lives (Wright 2002, Barnes et al. 2006).

When receiving new medications patients should be asked to destroy all old medications in order to avoid errors and misuse (Ruths et al. 2003).

5.2 Good nursing practices contributing to increased patient safety and a positive outcome of drug therapy in the elderly

All authors of the chosen literature name directly and indirectly subjects and/or activities of health care personnel that increase safety in pharmacotherapy of the elderly. The extraction of subjects and/or activities valid for nurses' actions in pharmacotherapy is formulated as good nursing practices.

Good nursing practices for increased patient safety as indicated by the reviewed literature derive from the fields of nurses' professional knowledge (Lilley and Guanci 1997 and 1998a-d, Ahmed and Hamrah 1999ab, Ahmed and Fecik 2000, Wright 2002, Warn 2007), nurses' knowledge in geriatric nursing (Edwards 1997, Lilley and Guanci 1998bd, Ahmed and Hamrah 1999b, Shirrel et al. 1999, Mannesse et al. 2000, Field et al. 2001, Jordan 2002, Helton et al. 2005), intra-, inter-, and multi-disciplinary communication (Lilley and Guanci 1996 and 1998c, Edwards 1997, McBride-Henry and Foureur 2007, Vogelsmeier et al. 2007, Warn 2007), and patient education (Lilley and Guanci 1996, Karch and Karch 2000 and 2003a).

In the following table good nursing practices are listed according to the different phases of the medication process.

Medication process phase	**Good nursing practice means**
Receiving a prescribed order	To check the patient's diagnosis (Karch and Karch 2003c) To carefully assess the patient's history and use critical thinking in order to detect and/or prevent adverse drug effects (Lilley and Guanci 1998d) To use caution when abbreviations are used /clarify meaning and dosages unmistakably and immediately (Karch and Karch 2003a) To recognize and inquire a possibly too high medication dose in respect to the patient's age (Ahmed and Hamrah 1999b) To identify drugs by drug class and be aware of possible risks, ADRs and interactions with other medications or agents, and learn about patient's medications which are not familiar (Ahmed and Fecik 2000)

Receiving a prescribed order (cont'd)	To use a drug handbook and/or other appropriate sources for information on unfamiliar drugs (Lilley and Guanci 1998c) To check the patient's medication regimen carefully for incompatible drugs (Edwards 1997) and indications for drugs from same drug classes (Kelly et al. 2003) in order to prevent ADRs and possible unnecessary doubling of medications To contact the patient's physician to clarify the patient's total drug regimen (Ellenbecker et al. 2004) To communicate effectively with multi-disciplinary groups such as physicians, pharmacists, registered nurses, certified medical technicians and licensed practical nurses on medication regimen (McBride-Henry and Foureur 2007, Vogelsmeier et al. 2007)) To remind a physician to review the patient's total medication regimen (Field et al. 2001, Ruths et al. 2003) To check indications for psychotropic drugs (Ruths et al. 2001) To improve and/or update pharmacologic and (patho-) physiologic knowledge by participating in further education/training courses (Edwards 1997, Helton et al. 2005)
Dispensing medication	To be aware of sound-alike and look-alike medications in the unit and to inform supervisor and colleagues about them (Lilley and Guanci 1998a) To double-check labels of medications prior to use (Ahmed and Hamrah 1999) To take extra time to read labels on drug packaging and lettering on pills (Lilley and Guanci 1998c)
Preparing medication	To make sure that drug dosages are adjusted to the patient's age and/or creatinine clearence (Lilley and Guanci 1998b) To increase awareness of "sound-alike" and "look-alike" medications in the unit and to store them apart from each other to avoid confusion (Lilley and Guanci 1997) To communicate with a pharmacist to identify potential risks of antibiotic medication administration (Lilley and Guanci 1996) Not to crush drugs or open capsules but look for alternatives to administer drugs such as a different route or the liquid form; in the case of no alternative to consult a pharmacist for possible risks, even though the procedure may be authorized by a physician, and to get written approval by a physician (Wright 2002)
Administering medication	To be sure that possible changes to the medication regimen were implemented correctly (Vogelsmeier et al. 2007) To stick to protocols and carry out medication administration according to the "seven rights" (Warn 2007)

Administering medication (cont'd)	Not to assume that the drugs in the medication drawer are the right ones but to check them before administration against the records/orders (Ahmed and Hamrah 1999b) To double-check (Lilley and Guanci 1998a) and triple-check (Lilley and Guanci 1997) medications before administration To correctly follow guidelines of IV medication administration and/or dilute IV medication and use infusion pump for administration (Karch and Karch 2003b) To obtain written authorization from a prescriber /physician where unlicensed drug administration is requested in order to reduce liability of the administering nurse (Wright 2002) To consult a pharmacist in multiple drug administration for ADE prevention (Edwards 1997)
Monitoring medication administration	To assess the patient's response to a medication after each and every dose provided by the nurse (Warn 2007) To carefully assess the patient's history and use critical thinking in order to detect and/or prevent adverse drug effects (Lilley and Guanci 1998d) To have knowledge of drugs' potential for ADRs, drug-drug and drug-food and drug-diagnostic agents' interactions (Lilley and Guanci 1996, Ahmed and Fecik 2000) To understand most common types of preventable ADEs with single-drug administration such as cumulative effects, tolerance and dependency (Edwards 1997) To remember that ADEs may take a week or longer to appear (Edwards 1997) To use additionally to Beer's criteria the tool 'HARVEST' (Appendix 2) in order to prevent and minimize adverse drug effects as of amitriptyline in the elderly (Helton et al. 2005) To understand the importance of therapeutic drug monitoring for elderly (Edwards 1997, Shirrel et al. 1999) To especially and carefully monitor patients with multiple medical conditions, taking psychoactive drugs, antibiotics, opioids, or anti-seizure drugs, for adverse drug reactions (Field et al. 2001) To identify symptoms of dry mouth, flushing, dilated pupils, hyperpyrexia, and increasing confusion as signs of TCA overdose (Ahmed and Hamrah 1999b) To identify dry mouth, constipation, increased appetite, weight gain, dental caries and gastrointestinal obstruction as adverse effects of antipsychotic medications (Jordan 2002) To identify gastrointestinal bleeding, haematuria and an injurious fall with e.g. hip fracture as indicators for the presence of severe ADRs (Mannesse et al. 2000)

Monitoring medication administration (cont'd)	To be aware of Monoamine oxidase inhibitors' (MAOIs) serious and multiple drug-drug and drug-food interactions (Ahmed and Fecik 2000) To inform the physician when there is reason to believe that a patient has a medication regimen problem (Edwards 1997, Warn 2007)
Documentation	To report on medication errors (Lilley and Guanci 1998ac) To follow up on medication treatment from shift to shift (Lilley and Guanci 1998c) To document ADRs in the patient chart (Warn 2007)
Patient education	To make the medication regimen absolutely clear for the patient: drug name and purpose, dose, time, route, possible ADRs, when to see a physician, what possibly to avoid (foods, other medications, sun, driving or operating a machine etc.), what possibly to add to food/daily routine, e.g. increase fluid intake with medication (Lilley and Guanci 1996) To give written, personalized information to the patient about the use of a once-weekly drug as well as a prepared, marked calendar as to when the drug should be taken (Karch and Karch 2003c) To make sure the patient understands the reasons well why s/he should discard her/his old or left-over drugs when receiving new prescriptions (Karch and Karch 2000)

TABLE 3: Good nursing practices according to the medication process phase

6 DISCUSSION

6.1 Major findings

The aim of the literature review was to identify and explore the issues a nurse has to consider in safe drug therapy of the elderly and to heighten nurses' awareness of good practices to improve safety in drug therapy.

The findings were in general as anticipated. Literature showed that there is plenty of material available regarding pharmacotherapy from a medical or pharmacologic point of view as well as plenty of material regarding the elderly, but a combination of both with a focus on nursing was pretty scarce. Despite the fact that the group of the elderly,

utilizing the majority of medications, is growing rapidly, the interest for this group still remains limited. This reflects the low status of the elderly in western culture where, compared to eastern cultures, the elderly are not valued, respected nor considered as a pool of experience and wisdom. They are looked at as old fashioned, slow, and inflexible, having lived their lives not worth much of attention and even as a burden, when they become sick. From the medical point of view there is hardly a cure to be expected from drug therapy regarding various diseases and symptoms, but from the patient's perspective a reasonable drug therapy can improve the quality of life tremendously.

6.1.1 More awareness and interest for the vulnerable elderly

The lack of interest in this age group is mentioned by several authors and is also visible in missing protocols for appropriate prescribing for the elderly. Furthermore, there seems to be little awareness in health personnel dealing with the elderly in respect to quality, quantity and the duration of drug therapy as the following example demonstrates. A fall and a potentially fatal fracture could have been prevented "if the physician had considered the patient as an older adult and not just as another patient with depression and constipation" (Helton et al. 2005).

Many authors discuss prescribing since it is inevitably influencing patient safety as well as nurses' responsibility in the pharmacotherapy process. Nurses, however, do not prescribe in general but are responsible for implementing prescribed orders. They are without doubt the last to prevent the patient from a medication error before drug administration.

6.1.2 Geriatric drug management for nurses

There is consent among the authors that it belongs to the nurse's tasks to judge the appropriateness of a particular drug, dosage, possible interactions and adverse effects or

compatibility with other drugs, especially in those patients with numerous medications, psychoactive drugs, opioids, and anti-infective drugs. Nurses' judgment should be generally based on Beer's Criteria and supplements to its criteria, respectively. Several authors even suggest that nurses should back-up and control physicians prescribing work. It is, therefore, not surprising that many authors emphasize a solid foundation of pharmacologic and (patho-) physiologic knowledge and constant refreshing of the same in nurses to comply with this task. Implementation of geriatric principles such as dosage adjustments to either age or creatinine clearance of the patient as well as starting medications at low dosages is considered as a must in elderly care to improve patient safety.

Incompleteness of a patient's total drug regimen is a potential risk factor for safe drug therapy. Yet to obtain complete information on a patient's total drug regimen can be very difficult and time consuming, and time is a limiting factor in nursing care. Medication records may be unreadable, may not be updated, a patient may be too sick or cannot remember, and a patient's primary care provider (PCP) or the treating physician at community level, which in Finland is usually a physician of the health care center in the vicinity of the patient's living place, may be unreachable.

6.1.3 The risk of medication alteration

There are certainly differences in regard to drug therapy problems with the elderly, for instance due to personal interest, workload and/or due to settings such as the hospital setting with pretty fast turn-over rates of patients and consequently short nurse-patient contacts and the nursing home setting where nurses get to know their patients well. While in the latter nurses may be more aware and knowledgeable in respect to their patients' drug regimens, medication preparation problems compromise patient safety. The common practice of altering drugs to facilitate administering (e.g. swallowing) presents an illegal and unnecessary act with possible serious consequences for the patient and the nurse. The reviewed literature indicates surprisingly little awareness in nurses on the aspect that in the event of adverse drug reactions the nurse is fully

responsible when drug alteration is unauthorized and 50% responsible when authorized in written form by a physician. Here is definitely information and education on the subject in demand.

6.1.4 The hazard of adverse drug events

It was surprising to see that many articles of the reviewed literature dealt with the problem of adverse drug events caused by drug therapy. Non-standardized utilization of terminology was partly confusing. While some authors utilized adverse drug events (ADE), adverse drug effects (ADE) and adverse drug reactions (ADR) as synonyms, others differentiated (Field et al. 2001) between preventable adverse drug events, caused by medication error, and non-preventable drug events, not caused by an error and, thus, called adverse drug reaction.

Despite these discrepancies there is common understanding that the frequency of adverse drug reactions in the elderly is far too high and that prevention of adverse drug events has first of all to improve through interference in the drug therapy processes before drug administration to the patient which are the phases of prescribing, dispensing, and drug preparation. Secondly, the monitoring of drug administration and the documentation of the same as well as the evaluation of drug therapy outcomes should be improved.

Reasons for the fact that monitoring of medication administration does not occur at all or occurs only scarcely, are limited assessment skills and lack of experience in nurses. This can be true taking into account the little awareness of and little attention towards drug therapy problems in the elderly by health professionals. On the other hand the recognition of adverse drug events in the elderly is not an easy task since they present in manifold ways. Adverse drug events can be an undesirable response to a particular drug or interacting drugs (Mannesse et al. 2000), depending on individual (patho-)physiologic changes and respective drug regimens, and they can occur at doses normally used in human drug therapy and cannot be avoided or prevented currently

unless abstaining from medication treatment (Warn 2007), or, as Lilley and Guanci (1998) define, they are mild adverse reactions better known as side-effect of a medication. Also constantly new medications on the market impact the monitoring of adverse drug reactions and events.

Some authors suggest an improvement in acute and surgical units where the elderly are treated for falls. Health personnel should be more aware of patients' drug regimens, as most falls are considered to be caused by adverse drug reactions.

Improved communication between health personnel and pharmacists in order to increase patient safety in drug therapy is plausible for various countries where dispensing drugs is carried out by pharmacists. This is not applicable for the Finnish situation because in Finland pharmacists are seldom seen at ward level.

6.1.5 The benefits of patient education

Thorough patient education is stated as a very important means of increasing drug therapy safety in the elderly. Due to time constraints it is in practice often neglected. The patient should be empowered to understand as much as possible about her/his drug regimen, become an expert of her/his own disease(s) as some of the authors formulate it. Knowledge especially in regard to possible adverse reactions could prove very valuable. Self-monitoring of drug therapy outcomes could lead to more self-reliance in patients and, thus, improve communication with the treating physician. Many older adult patients do not dare to question physicians' decisions for diagnosis and/or prescriptions nor to ask if some drugs of their drug regimen could be spared.

6.2. Implications for clinical practice

The vulnerability of older adults in drug therapy can be compared to infants, children and young adults, even though reasons for the vulnerability are opposite. While

physiologic systems in infants, children and young adults are not yet (fully) developed, older adults face a decrease in the same with growing age. Strict rules, guidelines and protocols are available and implemented in the drug therapy of children. The same sensitivity and cautiousness should be applied to the elderly with respective rules, guidelines and protocol applications by physicians, nurses and practical nurses in the drug therapy process.

A sequence of several short info/education units at ward level and/or a lecture at setting level could be concrete measures for the implementation of this recommendation.

6.3 Implications for nurses' education

The growing number of the elderly requires a sensitization of the whole society but especially in the field of nurse education. According to the writer's experience this does not require changes of curricula as the present existing ones contain potential for better preparation of nurses for safe drug therapy of the elderly in the field of pharmacology as well as of geriatrics.

General pharmacology courses such as 'drug and pain management 1-3' could for instance integrate attention for drug-drug and drug-food interactions for important drug classes and explain the phenomenon polypharmacy in general.
Theory courses preceding clinical studies such as 'Nursing of the elderly' and/or 'Geriatrics', held by nurses and physicians, could refer to the special vulnerability of the elderly and include subjects such as polypharmacy in the elderly, resulting adverse drug reactions, and inappropriate drugs for the elderly (e.g. according to the Beer's criteria).

6.4 Suggestions for further research

As the findings indicate, there is no research available regarding the alteration of drugs and the influences on drug therapy outcomes. Due to the fact that countries have

different health sector legislation in regard to the utilization and funding of medications, it is difficult to specify research recommendations here.

If the common practice of altering medications will be improved by exchange with liquids, nurses will have to envisage new technical problems such as (pre-) dispensing possibly more than one liquid medication to medicine trays and/or dosettes, the latter being totally useless for this purpose. Especially in nursing homes, there will be need for some new techniques and possible procedures.

7 CONCLUSIONS

Nurses carry tremendous responsibility in regard to patients' safety in pharmacotherapy. Medication safety in relation to nursing focuses often on wrong medication practices of nurses. It is positive to see that the reviewed literature either refers to this problem or is one step ahead to utilize nurses' know-how in order to develop more effective and safe practices. During elaboration of this literature review the writer has come to the conclusion that there are not so many new issues to be considered for nurses in safe drug therapy of the elderly. The first step to increase patient safety in the drug therapy of the elderly is to emphasize awareness for the vulnerability of this special age group in all health personnel. This aspect needs consideration especially in Finland where an effort has been made to improve safety in pharmacotherapy by establishing new guidelines by the Ministry of Health and Social Affairs (Safe Pharmacotherapy 2005).
When awareness of vulnerability of the elderly in drug therapy has been established, the most important issues to be considered are:

1. Regular reviews of older patient's drug regimens with exclusion of inappropriate medications
2. Adjustment of drug dosages to either creatinine clearance or to the age of the patient
3. Application of the geriatric principle "start low and go slow" especially with new drugs in the regimen and/or in acute care

4. Prevention of drug alteration before drug administration to the patient
5. Monitoring of medication and drug therapy outcomes with documentation.

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Articles used for literature review

Author, title, journal	Purpose of the study	Sample size	Data collection and analysis	Main findings
Ahmed, D. and Fecik, S. (2000) MAOIs: Still here, still dangerous. American Journal of Nursing, 100(2), 29-30	To demonstrate the need to identify MAOIs (Monoamine oxide inhibitors) by brand names.	Case study	Retrospective description of a clinical case	Despite newer SSRIs MAOIs are in use. Nurses have to know their serious multiple drug/food interactions and recognize them by brand names. They ought to instruct their patients to mention to clinicians drug name and that they are on a tyramine-free diet.
Ahmed, D. and Hamrah, P. (1999a) Right drug, wrong dose. American Journal of Nursing, 99(1), 12	To demonstrate that the nurse is the last check point between a medication order and its administration to the patient	Case study	Retrospective description of a clinical case	Unclear medication orders have to be clarified. A dose of amitriptyline 100mg/d is almost never prescribed for the elderly due to reduced kidney and liver functions. Checking the patient's medical history may be life-saving.
Ahmed, D. and Hamrah, P. (1999b) Labeling lapse. American Journal of Nursing, 99(3), 12	To demonstrate application of topical medication as oral medication because of similar package/bottle.	Case study	Retrospective description of a clinical case	Need for clear labeling of prepared medications and keeping treatment solutions elsewhere than oral medications. Listing topical medications on the MAR.
Barnes L., Cheek J., Nation R.L., Gilbert A., Paradiso L. and Ballantyne A. (2006) Making sure the residents get their tablets: medication administration in care homes for older people. Advanced Nursing, 56(2), 190-199	To explore issues concerning the practice of altering medication dose forms prior to administration of medicines to residents in homes for older people.	11 registered nurses from 10 residential homes for older people from six regions of South Australia.	1.observation of medication administration practices 2.document collection and analysis 3. in-depth interviews with registered nurses; qualitative thematic analysis of data	Making sure they get their medication; facing dilemma and uncertainty; inconsistency and contradiction; competing demands; time management; individualized needs/wants; cost/availability of alternative formulations
Edwards, J. (1997) Guarding against adverse drug events. American Journal of Nursing, 97(5), 26-27	To demonstrate that the patient's safety in pharmacologic therapy lies with the nurse.	Case study	Retrospective description of a clinical case	Nurse has to know the patient's total drug intake (including OTC-drugs) and the effects of each drug, wanted and unwanted, in order to minimize incidence and severity of ADEs. She has to monitor patient for therapeutic and adverse effects and confer with clinician or pharmacist in problematic or unclear situations.

Ellenbecker CH., Frazier SC. and Verney S. (2004) Nurse's observations and experiences of problems and adverse effects of medication management in home care. Geriatric Nursing, 25(3), 164-170	To explore and describe the current state of medication management for patients receiving services from certified home health care agencies.	101 home health care nurses from 12 agencies in six states, Connecticut, Massachusetts, Michigan, Montana, and Wisconsin (US)	Non-experimental descriptive study: data collection by self-report from home health care nurses. SPSS for quantitative analysis; qualitative data were analyzed according to themes	78% at risk for ADR taking five or more drugs; 5% showed ADR the previous week. Symptoms of ADRs most frequent were drowsiness, stupor, weakness, depression, sleepiness and others. Medication mismanagement occurred due to lack of knowledge, cognitive ability, problems with medical orders/nature of the system, nature of the patient.
Field T., Gurwitz J., Avorn J., McCormick D. Jain S., Eckler M. , Benser M. and Bates D. (2001) Risk factors of adverse drug events among nursing home residents. Archives of Internal Medicine, 161(13), 1629-1634	To better define resident level factors associated with high risk of ADEs to support interventions for preventing ADEs and lessen their impact.	410 cases plus 410 randomly selected controls from 18 nursing homes in central and eastern Massachusetts with mean bed size of 149	Case control study within a prospective study of ADEs . For each ADE a control from the same home was randomly selected. Data were abstracted from medical records on functional status, medical conditions, and medication use.	ADEs identified in 410 residents; risk factors were being a new resident, taking anti-infective medications, antipsychotics or antidepressants. Risk of ADEs increased with number of regularly taken medications.
Helton T., McGrain A.R. and Muliira J.K., (2005) A case study: Inappropriate use of amitryptyline in the elderly. Geriatric Nursing, 26(5), 317-320	To demonstrate inappropriate use of amitriptyline in elderly and identify interventions to improve inappropriate use.	Case study	Retrospective description of a clinical case	The elderly are at higher risk for ADEs and interactions; higher risk for inappropriate prescribing practices. Intervention: use of 'HARVEST' (a tool) additionally to Beer's criteria.
Jordan, S. (2002) Managing adverse drug reactions: An orphan task. Journal of Advanced Nursing, 38(5), 437-448	To explore the introduction of nurse-administered evaluation-checklists in relation to nurse prescribing initiatives and division of professional responsibilities for medication management.	20 nurse-client interactions per group (sample and control group)	Observational study with comparator group design.	Implementation of evaluation checklists increased the numbers of ADRs detected and actioned by nurses. They also served to apportion aspects of medication management between nurses and prescribers.
Karch A. and Karch F. (2003a) Looks can be deceiving: Use caution when using abbreviations. American Journal of Nursing, 103(10), 73	To demonstrate that use of abbreviations can be misread, misinterpreted, or misunderstood and omitting a "0" in decimal figures can be dangerous	Case study	Retrospective description of a clinical case	The physician has to adapt to local behaviors of utilizing abbreviations. The nurse has to be familiar or to check the patient's diagnosis before administering a drug.

Karch A. and Karch F.(2003b) Not so fast: IV push drugs can be dangerous when given too rapidly. American Journal of Nursing, 103(8), 71	To demonstrate the need for absolute correct application of IV drugs.	Case study	Retrospective description of a clinical case	Observing an ADE the nurse can be mislead regarding the cause. Education on guidelines to administer IV drugs is crucial.
Karch A. and Karch F. (2003c) A weekly dosage taken daily: Drugs available in new once-weekly formulations require extra vigilance. American Journal of Nursing, 103(4), 64	To demonstrate the danger of prescribing new once-weekly formulations	Case study	Retrospective description of a clinical case	Patients should be given education as well as written information about once-weekly drug use. They should know the drug name, why it is taken and when and how.
Karch A. and Karch F. (2000) Cutting it close. American Journal of Nursing, 100(1), 23	To demonstrate a medications property loss by cutting it in half.	Case study	Retrospective description of a clinical case	Patients have to be informed/ taught by a clinician, a pharmacist and a nurse how to take medication and why not to alter the form.
Kelly, K.D., Pickett, W., Yiannakoulias, N., Rowe, B.H., Schopflocher, D.P., Svenson, L. and Voaklander, D.C. (2003) Medication use and falls in community-dwelling older persons. *Age and Ageing*, 32(5), 503-509	To examine the association between injurious falls that require emergency care and various classes of medications as important modifiable risk factor in fall prevention.	11390 individuals (2278 cases and 9112 controls >=66 years of age) from Capital Health Region of Edmonton in Alberta Province/Canada	Data selection from computerized administrative data sets linked by unique personal health number; Case control section derived from individuals presenting to emergency department with injurious falls. SPSS for statistical analysis.	The use of narcotics, anti-convulsants, anti-depressant agents were significant medication predictors of an injurious fall in the elderly residing in the community in addition to the risk associated with their medical condition.
Lilley, L.L. and Guanci, R. (1998a) What's in a drug name. American Journal of Nursing, 98(10), 14	To demonstrate the danger of medications with similar names but distinctly different actions.	Case study	Retrospective description of a clinical case	Be aware of sound-alike medications. Inform supervisor and colleagues if there are look-alike and sound-alike drugs on the unit. Take extra time to read labels, double-check those in question by using drug handbook
Lilley L.L. and Guanci R. (1998b) It pays to wait. American Journal of Nursing, 98(11), 12	To demonstrate necessity to wait for lab results before administering new medication.	Case study	Retrospective description of a clinical case	For administering special drug class medications such as cephalosporin a patient's renal functions have to be checked first or the geriatric principle of "start low and go slow" has to be considered

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Lilley, L.L. and Guanci, R. (1998c) Distraction delays a dose. American Journal of Nursing, 98(2), 12	To demonstrate ineffective problem solving and lack of follow-up.	Case study	Retrospective description of a clinical case	A nurse has to apply other problem solving means if she's not receiving answer from physician. She has responsibility for follow-up and info transfer to next shift.
Lilley, L.L. and Guanci, R. (1998d) A dangerous combination. American Journal of Nursing, 98(5), 10	To demonstrate how missing information on drug regimen can lead to life-endangering crisis.	Case study	Retrospective description of a clinical case	Patient teaching is important: Critical thinking is a life-saving intervention and patient teaching a life-sustaining.
Lilley, L.L. and Guanci, R. (1997) When 'Look-alikes' and 'Sound-alikes' don't act alike. American Journal of Nursing, 97(9), 12-14	To demonstrate a threefold error: wrong insulin drug, wrong time, wrong dose.	Case study	Retrospective description of a clinical case	Be cautious. Use double-check system. Collaborate with a pharmacy to increase awareness of sound-alike/look-alike medications with different ways of administration. Medication storage apart from each other.
Lilley L.L. and Guanci R. (1996) Avoiding adverse reactions. American Journal of Nursing, 96(6), 18-19	To demonstrate the possibility of drug-drug or drug-food interactions and the need for functioning system and communication in the health care team.	Case study	Retrospective description of a clinical case	A pharmacist corrects a physician's prescription. A physician orders to take drug level controls. A nurse discovers further source of ADE causing medications and informs the physician who changes drug order.
Mannesse CK., Derkx FHM., De Ridder MAJ., In't Veld AJM. and Van der Cammen TJM. (2000) Contribution of adverse drug reactions to hospital admission of older patients. Age and Ageing, 29, 35-39	To describe the severity of adverse drug reactions as a factor in hospital admission of older patients, and to identify risk indicators for severe adverse drug reactions in these patients.	158 individuals in 5 wards in a university hospital in the Netherlands.	Interview plus complete patient assessment, laboratory tests, mobility score, ADL index. Statistical analysis to build a multiple logistic regression model.	44% of patients showed one or more ADR, 25% severe. A fall before hospital admission, gastrointestinal bleeding or haematuria and the use of three or more drugs were significant factors in identifying patients with severe ADRs.
McBride-Henry K. and Foureur M. (2007) A secondary care nursing perspective on medication administration safety. Journal of Advanced Nursing, 60(1), 58-66	To explore how nurses in a secondary care environment understand medication administration safety and the factors that contribute to or undermine safe practice during this process.	3 focus groups of 6-10 participants of clinically based nurses at a teaching hospital in New Zealand	Data collection by semi-structured interview and, after transcription analysis with QSR NVivo software according to narrative themes.	Themes: understanding medication culture, teams mean safety, communication within the multidisciplinary team, knowledge of medication procedures, working with dysfunctional organizational systems, and strategies for improving them.

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Ruths S., Straand J. and Nygaard H.A. (2003) Multidisciplinary medication review in nursing home residents: what are the most significant drug-related problems? The Bergen District Nursing Home Study. Quality Safety Health Care, 12, 176-180	To identify the most frequent clinically relevant medication problems and to analyze them according to the drugs involved and types of problems.	1354 residents in 23 nursing homes in Bergen, Norway.	By comprehensive medication review with regard to indications for drug use and active medical conditions. Classification of drug related problems according to drugs involved and types of problems.	2445 potential medication problems in 1036 (76%) residents. Psychoactive drugs accounted for 38% of all problems; antipsychotics were the most involved class. Multiple psychoactive drug use was particularly problematic. Potential medication problems classified as risk of ADRs, inappropriate drug choice and under use of beneficial treatment.
Ruths S., Straand J. and Nygaard H.A. (2001) Psychotropic drug use in nursing homes - diagnostic indications and variations between institutions. Eur J Clin Pharmacol, 57, 523-528	To analyze psychotropic drug use among nursing home residents with regard to diagnostic indications and patient and institution characteristics.	1552 residents from 23 nursing homes in Bergen, Norway.	Patient's age, gender, all drugs used day before data recording were collected. Analysis as descriptive cross-sectional investigation with specified drug classes.	918 residents used 1421 psychotropic drugs daily. Two/more psychotropic drugs were used by 56%; 41% from two different subgroups and 8% from 3. Indications for psychotropic drug use should regularly be evaluated with dose reduction and cessation. Neuroleptics and benzodiazepines are inappropriately used still. Increased risk for falls, fractures, and drug-drug interactions.
Shirrel D., Gibbar-Clements, T., Dooley R. and Free C. (1999) Understanding therapeutic drug-monitoring. American Journal of Nursing, 99(1), 42-44	To demonstrate the vital role of therapeutic drug-monitoring in competent patient care.	Case study	Retrospective description of a clinical case	Antibiotics with narrow therapeutical ranges need peak/trough level monitoring for positive outcome and prevention of toxic ranges.
Thomas E.J. and Brennan TA. (2000) Incidence and types of preventable adverse events in elderly patients: population based review of medical records. British Medical Journal, 320, 741-744	To determine the incidence and types of preventable adverse events in elderly patients.	15000 hospitalized patients discharged in 1992 (excluding psychiatric and Veterans Administration hospitals)	Initial record review by 31 nurses, positive records proceeded to physicians (adverse event AE analysis form); definition of variables as AE, patient characteristics, disability ratings); statistical analysis	AEs were twice as much in the elderly than in none elderly (<65). Preventable adverse drug events, falls, and events related to medical procedure were more common in the elderly patients. Age was not the independent variable associated with these outcomes.

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Vogelsmeier A., Scott-Cawiezell J. and Zellmer D. (2007) Barriers to safe medication administration in the nursing home. Journal of Gerontological Nursing, 33(4), 5-12	To obtain information about existing medication administration process, barriers in the medication use process, and initial thoughts on issues related to medication safety and error.	76 staff members from 5 nursing homes in 3 Midwestern states with 60 to 200 beds participated in key informant interviews.	Guided interview process: Key informant interviews with nurse leaders and 2 project coordinators from 5 nursing homes; 2 focus groups in each nursing home with 4 to 9 participants (registered nurses, nurse managers, pharmacy consultants) in each nursing home. Individual and in-depth reviews according to themes.	Prescription: complexity and large number of medications ordered per resident; ineffective communication system among nurses, physicians and pharmacies. Documenting: current method insufficient. Dispensing: depending on pharmacy services different expectations to what is timely delivery of medications. Administration: delayed without double checking among others. Monitoring: inadequate follow-up on pain management medications.
Warn, D. (2007) The nurse's role in adverse drug reaction monitoring. Nursing BC, 39(4), 25-27	To demonstrate safe medication administration	Case study	Retrospective description of a clinical case	Medication provision with adherence to seven rights. Need for complete and ongoing assessment of medication efficacy at every medication provision. In case of ADR identification or even suspicion of ADR immediate action.
Wright D. (2002) Medication administration in nursing homes. Nursing Standard, 16(42), 33-38	To describe the difficulties faced when administering oral medications to patients with swallowing difficulties in nursing homes, the methods that are used to overcome these difficulties and their appropriateness.	Out of 763 nurses attending an educational event 540 answered the questionnaires.	Supervised administration of a questionnaire: All nurses attending the study days were targeted at practice and asked to complete the questionnaire. Data were analyzed for extent of dysphagia and methods to overcome dysphagia, experience of overcoming dysphagia, and ease of changing medication.	Almost ¼ of nursing home residents exhibits problems with swallowing medication. Methods to overcome administration problems were mixing with food, omitting the dose, crushing medication or opening capsule, and obtaining liquid alternatives. Experiences with a General Practitioner in changing therapy from solid to liquid are also studied.

APPENDIX 2: H A R V E S T as a tool for health professionals to improve prescribing practices and prevent adverse drug effects in elderly (Helton et al. 2005)

H	Have a list of commonly prescribed medications
A	Assess patient health status that may predispose to medication adverse effects
R	Review Beer's criteria before initiating medications
V	Verify new and existing medications
E	Ensure patient understanding of medication adverse effects
S	Safety through preventative and proactive monitoring of medications
T	Therapeutic goals established to minimize adverse effects