Continuity of care during hospital stay:

A review and evaluation of medicines reconciliation on admission

A research project

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Abstract

Background:

Errors in the stage of prescribing make approximately 16 % of all medication errors. There is a need to identify the frequency of this, and also to assess the impact of contributions by pharmacists to the patient's care.

Aim and objectives:

To characterise the nature and frequency of medicines errors in patients during the process of admission to hospital, and also to evaluate the new medicines reconciliation service at Ayr Hospital.

Methods:

A prospective audit survey was carried out at an acute medical receiving ward at Ayr Hospital. Patients' records at admission were used to compare the drugs first prescribed by the doctor, with the list made by pharmacist. Patients seen by a pharmacist in the study period were asked to take part in the study. Information about the new MR service was obtained by looking into the MR-forms for each patient, and this was used as a basis for evaluating the service.

Results:

In the study period of 5 weeks there were recorded 255 contributions by pharmacist, distributed on 105 patients in total. The median number of discrepancies found per patient was 2.4 and no discrepancies were found in 25/105 (23.8 %) of the cases. Some 67.5 per cent of all the interventions were assessed to be significant and result in an improvement in the standard of care, while 6.7 per cent were assessed to be very significant and prevent a major organ failure or adverse reaction of similar importance.

Conclusion:

Pharmacists have an important role in improving the quality of patient care and contributions made by pharmacists are both important and necessary.
There is a need for improvement in current practice of how the MR service is delivered.

Abbreviations

BNF	British National Formulary
CI	Confidence interval
COPD	Chronic obstructive pulmonary disease
CP	Chest pain
CPOE	Computerized Physician Order Entry
CVA	Cerebro vascular accident
GP	General Practitioner
HEPMA	Hospital Electronic Prescribing Medicines and Administration
IQR	Inter Quartile Range
MR	Medicines Reconciliation
NHS	National Health Services
NPC	National Prescribing Centre
NPSA	National Patient Safety Agency
NRLS	National Reporting and Learning System
SD	Standard deviation
SOB	Shortness of breath
UK	United Kingdom

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1. Introduction

1.1 Medicines management

Medicines management is defined as “a system of processes and behaviours that determines how medicines are used by patients and by the NHS. Effective medicines management services will have the patient as the primary focus, thus delivering better targeted care and better informed individuals”. [1]

Medicines management in hospitals encompasses the entire way that medicines are selected, procured, delivered, prescribed, administered and reviewed to optimise the contribution that medicines make to producing informed and desired outcomes of patient care. [2]

Examples of medicines management services already being provided by primary care organisations were identified in a survey carried out by the NPC (National Prescribing Centre) in 2001. The results of the survey, together with other work done in the area of medicines management, led to the classification of such services into five main types [3]:

1. Systems and processes – Inefficient or ineffective medicines management systems and processes can result in poor delivery of the service. Improving repeat prescribing, ensuring that guidance and policies are implemented are examples of services that are all part of medicines management.

2. Health of the public – Services that are included in this section may be developed for specific groups or for a disease area that is high on the local public health agenda. Risk management and disease prevention strategies are also ways in which medicines management services can help improve the health of the population.

3. Medicines management at the interface – Systems and communication often break down at the interface between health care settings, leading to poor

patient care. Medicines management and better communication can help prevent this. Examples of services include use of guidelines, discharge planning, and use of patients' own drugs in hospital.

4. Patients and their medicines – Integration of health and social care is an important part of current NHS reforms. Medicines managament services could help bring together these aspects of treatment, allowing patients to remain safe and independent in their normal social environment for as long as possible. Examples of such services include patient education, provision of support for carers, delivery of medication and repeat dispensing.

5. Clinical medicines management – involves assessment and review of prescribing for individuals. This type of service includes clinical pharmacy interventions, and then also pharmaceutical care.

All members of the clinical team need to work together to manage medicines effectively. Important members of this clinical team are the clinical pharmacists and their work in delivering pharmaceutical care.

1.1.1 Pharmaceutical care

An important part of health services in the UK is clinical pharmacists working with pharmaceutical care, for example in hospitals. Over the past few years pharmaceutical care has emerged as a major topic in pharmacy. The concept of this was developed in the United States by Douglas Hepler and Linda Strand. Pharmaceutical care is defined as "the responsible provision of drug therapy for the purpose of achieving definite outcomes that improve a patient's quality of life."[4]

Pharmaceutical care involves the process through which a pharmacist cooperates with a patient and other professionals in designing, implementing, and monitoring a therapeutic plan that will produce specific outcomes for the patient. This involves three major functions[5]:

1. Identifying potential and actual drug-related problems
2. Resolving actual drug-related problems
3. Preventing potential drug-related problems

Many lifesaving medicines work in small quantities; too much or too little can be the difference between successful treatment, unsuccessful treatment, or toxicity. It is because of the recognised need to help patients get the most benefit from their medicines and to minimise the associated risks that the practice of pharmaceutical care became increasingly meaningful. [6]

Pharmaceutical care reflects a systematic approach that makes sure that the patient gets the right medicines, in the right dose, at the right time and for the right reasons. Pharmacists can and do make a unique contribution to improving patient care. Of all the healthcare professions, pharmacists have the widest knowledge in the science and use of medicines. [6]

Scotland has examples of some of the best practice in pharmaceutical care. The strategy for pharmaceutical care in Scotland was written as a response to our national health: a plan for action, a plan for change. The main aim of this strategy is to work in partnership both with other healthcare professionals and with patients, to ensure they make the best and safest use of medicines. [6] Pharmacists have always worked to promote, maintain and improve health, but now this has been specifically identified as part of specialist public health practice. Scotland is leading the way in the development of this discipline and pharmacists are working in a more structured manner to integrate and develop systems to improve health.

1.2 Medication errors

Every day, about two and a half million medicines are prescribed in the community and in hospitals across the UK. Most of these medicines are used safely and they help people to get better or stay well. But sometimes errors occur and these can lead to harm. Some of the errors can have the potential to cause discomfort or deterioration in the patient's condition. There are data reports from the NRLS (National Reporting and Learning System) of permanent harm and death where vital

medicines, such as medicines to treat epilepsy and to prevent strokes, had been omitted.[7] Medication errors can cause unnecessary pain and harm to patients and can even lead to death. In addition, medication errors account for a substantial amount of NHS resources.

A study of more than 18.000 patients admitted to two large hospitals over six months found that 6, 5 per cent of admissions related to harm from medicines.

Medication errors are a part of what NPSA (National Patient Safety Agency) defines as a medication safety incident, and these kind of errors are incidents in which there has been an error in the process of prescribing, dispensing, preparing, administering, monitoring, or providing medicine advice, regardless of whether any harm occured. [7]
A medication error is defined as “any preventable event that may cause or lead to inappropriate medication use or patient harm while the medication is in the control of health professional, patient or consumer.” [8]

Errors can occur in all stages of the medication process. This process consists of these stages:

1. prescribing (ordering a given medicine and dose)
2. dispensing (supplying medicines to individuals or to hospital wards)
3. preparation (preparing a dose of medicine for administration)
4. administration (administering the dose of medicine by the appropriate route and method)
5. monitoring (checking the administration and effect of a medicine)[7]

The three most frequently occurring types of medication errors (omissions and inaccuracies) are [7]:

- Wrong dose, strength or frequency of medicine
- Omitted medicine
- Wrong medicine

1.2.1 Medication errors in hospital

Although most prescribing and dispensing happens in the community, over 80% of the medication incidents reported to the NRLS for a period, occurred in a hospital. The following section presents types of medication errors that can occur in hospital. [7]

Wrong dose or strength, or wrong frequency:

This is the most common type of medication error and accounts for 28, 2 per cent of all the reported medication incidents in hospitals. This error may be overdoses resulting in toxicity, or underdoses, where the patient does not benefit from taking the medicine.

Wrong route:

Wrong route errors occur when a medicine is prescribed or administered by a route other than that intented by the manufacturer of the product. These errors can also occur when a medicine is prescribed or administered by an inappropriate route for the patient, or by the correct route but to the wrong site.

Omitted medicine:

This is the second most commonly reported type of medication incident in hospitals. Short term medication omissions are unlikely to cause harm to patients. For patients who rely on taking medicines regularly to stay well such as people with diabetes, epilepsy or transplants, missed doses may result in severe harm. For patients who are acutely unwell and require immediate treatment, the omission of a medicine, for example, intravenous antibiotics over a weekend, may cause harm.

Wrong medicine:

These errors include medicines prescribed, dispensed or administered, that the patient should not have had. This can occur as a result of confusion between two medicines that look-alike or sound-alike, e.g similar medicines names or similar packages for different medicines.

Another reason can be that it sometimes can be difficult for the doctors to find the patient's drug history when admitted to hospital. Wrong sources used to find the correct drug history, can lead to a wrong medicine prescribed.

Mismatching between patient and medicine:

Incidents which are reported in this section occur in all stages of the medicine process, and this type of error involves that a medicine is given to the 'wrong patient'. It is an important issue that all hospital inpatients should wear identification wristbands to help ensure that the right patient receives the right care.

Wrong formulation:

Medicines are available in a variety of forms:

- Injections and infusions for intravenous administration
- Modified release tablets or liquid medicines for oral administration

Some 2.4 per cent of medication incidents from hospitals are reported with the right medicine given in the wrong form. An example of this could be that modified release is given instead of immediate release.

1.2.2 Prescribing errors

Prescription is the first stage of the medication process and errors here can lead to problems further in the process. Errors in the stage of prescribing make approximately 16% of all medication errors, according to data from the NRLS.
The absolute frequency of prescribing errors leading to patient harm is not known. A reason for this is that almost all studies have involved detection of errors by pharmacists which further will lead to avoidance of harm to patients.

Prescribing errors occur for many reasons including inadequate knowledge of the patient and their clinical condition, inadequate knowledge of the drug, calculation errors, illegible handwriting, drug name confusion and poor history taking.[8]

Here are some examples of situations on how lack of knowledge and information about the patient can lead to prescribing errors:

- Doctor/pharmacist is called to a ward to prescribe for a female patient without being aware that she is pregnant
- Prescribing a NSAID to a patient without knowing that the patient has a history of peptic ulcer disease.
- Prescribing a drug that is excreted via kidneys without knowing that the patient has renal failure
- Prescribing a low-molecular-weight heparin for a patient without knowing the patient's weight, this is needed to calculate the dose.
- Prescribing a substance without knowing that the patient is allergic to this substance.

Another reason for prescribing errors can be inadequate knowledge of the drug. The problem here can be drugs prescribed that are contraindicated of different reasons or combinations that may cause harmful drug interactions. An example can be if a beta-blocker is prescribed for an asthmatic patient without realising that the drug is contraindicated in asthma. Another example can be if the cholesterol-lowering drug simvastatin is prescribed to a patient taking regular warfarin without knowing that in this case there is a risk of overanticoagulation.

Calculation errors could also contribute to prescribing errors. For some potent medicines prescribed for adults and many medicines for children, the dose, volume or rate of administration needs to be calculated. These calculations can be complex and are therefore major sources of prescribing error. [8]

Illegible prescriptions (handwritten) are also a major source of prescribing errors. In these cases the person who is reading the prescription has to make an own interpretation, and if this interpretation is wrong this could lead to errors further in the medication process; in transcribing, dispensing or administration.

Drug-name confusion (medicines with similar sounding names and drug names that look alike) may result in prescribing errors. This will be most common in the cases with handwritten prescriptions

Another important reason for prescribing errors can be errors in the stage of taking drug history; an essential part of safe prescribing is an accurate medication history.

1.2.3 Prescribing errors at hospital admission

In 2002, a study was done in the UK on prescribing errors in hospital inpatients, and incidence and clinical significance were assessed. Pharmacists at this hospital prospectively recorded details of all prescribing errors identified in non-obstetric inpatients during a 4 week period. Potential clinical significance was assessed by a pharmacist and a clinical pharmacologist.
A prescribing error was identified in 1, 5 % of the 36 200 medication orders that were written during the study period. The majority of all errors (61 %) originated in medication order writing, and most serious errors (58 %) originated in the prescribing decision. [9]

The process of prescribing medicines occurs during the whole stay in hospital, and an important part of this process is when medicines are prescribed at the time of admission.

Up to 27 % of all prescribing errors in hospitals can be attributed to incomplete histories at the time of admission.[10] Accurate medication histories at the time of hospital admission is an important element of medication safety and it is shown that accurate medication histories reduce errors and potential for harm [11]. First, they may uncover reasons for a patient's illness, such as adverse drug events or nonadherence to drug therapy. Second, medication history errors may result in interrupted or inappropriate drug therapy during and following the hospital stay. Third, computerized physician order entry systems could fail to detect these errors. For example the CPOE systems would not be capable of detecting unintentional omissions of medications taken before admission without a link to community pharmacy databases. [10]

1.3 Interventions

Interventions made by pharmacist are an important part of improving the health care system worldwide.
Classification of prescription interventions has generally been according to reasons for the intervention for example prescribing omission, prescribing error, drug interaction and drug therapy monitoring problem.

An intervention is classified as [12]:

- Review of medication
- Change of medication
- Change of formulation
- Modification of dose
- Continuation of medication
- Archive, monitor
- Add new drug
- Discontinue medication

1.3.1 Clinical significance of interventions

In 1992 a study was published, on assessing the quality of ward pharmacists' interventions. In this study the interventions was measured using a six-point scoring system that have been employed for the assessment of interventions by ward pharmacists [13]. The different scores in the scoring system are listed below.

1. Intervention detrimental to patient's well-being
2. Intervention of no significance to patient care
3. Intervention significant, but does not lead to improvement in patient care
4. Intervention significant and results in an improvement in the standard of care
5. Intervention very significant and prevents a major organ failure or adverse reaction of similar importance
6. Intervention potenially life-saving

The study was over a 12-month period, and the total number of interventions recorded was 1315. The median of all the scores was 4, no potientially life-saving interventions or any which were detrimental to patients' care were recorded.
Some 53 per cent of all the interventions were scored as 4 or above, and therefore lead to an improvement in patient care. With these results, the study concluded that pharmacists do have a role in improving the quality of patient care.

Another study has been done on pharmacists contributions made on acute medical wards at a hospital in London. The objectives in this study were to document the number, types and clinical significance of interventions made by the admission pharmacists. In the study a total of 122 patients were seen and 194 interventions made, this make an average of 1.6 interventions per patient in total. All of the interventions made by the pharmacists were considered to be of either moderate or major significance. The most common intervention made after a pharmacist had taken a drug history was recommending starting medicines which had been unintentionally omitted. [14]

In both studies mentioned above, the conclusion says that pharmacists contributions at hospitals are important. Pharmacists can reduce potential harm to patients and reduce errors, through their work e.g. on admission wards.

1.4 The 'Safer Patients Initiative'

Around 16 million people are admitted to hospital each year in the UK. The majority are treated safely and successfully. However, a disturbingly high number will find that something goes wrong with their treatment or care, resulting in unnecessary harm, pain and suffering, sometimes leading to death. [15]
It is estimated that over 850 000 incidents harm or nearly harm NHS' hospital in the UK each year. Incidents include medication errors, infections during treatment on intensive care units, and infections associated with surgery. [16]

To reduce medication errors and events, there is a project called “The Safer Patients Initiative”, that is a joint venture between The Health Foundation and the Institute for Healthcare Improvement. The vision of the Safer Patient Initiative is that no patient should suffer unnecessary harm, pain or suffering as a result of error or planned medical intervention (UK- safer patient initiative overview). The over-all goal of the Safer Patients Initiative is a 50 per cent reduction in adverse events across each of the hospitals taking part. [17]

In 2006 there were 20 hospitals in UK that joined the Scheme. In Scotland it is Dumfries and Galloway Royal Infirmary (NHS Dumfries and Galloway) working with The Ayr Hospital (NHS Ayrshire & Arran.)

1.5 Medicines reconciliation

As a part of the safer patient initiative, Ayr Hospital has just started a form developed to capture medicines reconciliation. Medication reconciliation is a technique for identifying discrepancies in drug regimen and the aim of medicines reconciliation on hospital admissions is to ensure that medicines prescribed on admission correspond to those that the patient was taking before admission .[18, 19] When medicines have not been reconciled, problems can occur, for example patients might receive the wrong dose of their medicine, may not receive their medicine at all or the stay in hospital might be extended.[20]

The National Prescribing Centre defines medicines reconciliation as [18]:

- Collecting information on medication history using the most recent and accurate sources of information to create a full and current list of medicines.
- Checking or verifying this list against the current prescription chart in the hospital ensuring any discrepancies are accounted for and actioned appropriatly.
- Communicating through appropriate documentation, any changes, omissions and discrepancies.

Medicines reconciliation can occur when patients are admitted to hospital, transferred to other units within the hospital or to another hospital, or discharged from hospital.

Medicines reconciliation should take place as soon as possible after admission, usually within 24 hours. [18]

Factors that may contribute to medicines reconciliation errors include the following:

- No access to the patients prescription list from primary care
- Discrepancies between the primary care presription list and the medications the patient is taking. This mat happen because the patient is no longer taking prescribed medications, because they are taking medications they have obtained themselves (for example, over-the-counter medicines, herbal medicines or vitamins), or because they are taking the incorrect dose.
- Difficulties in obtaining an accurate account of a patient's medication, which may be caused by an acute condition, sensory or cognitive impairment, lack of access to family or carer support, or language barriers.[18]

Among complicated patients, complete agreement between the medication list and what the patient is actually taking occurs in only 5 % of patients [21]. A reason could be that many prescribed drugs are a part of treatment that has originally been initiated by general practitioners (GPs), and it can therefore be a challenge to find the correct medication history when the patient is admitted to hospital. There are many different sources that a doctor and a pharmacist can use to get as much information as possible about the drug history to the patient, and some examples are:

- Patient (with interview at admission)
- Relative / Carer
- Patient's Own Drugs
- GP Referral Letter
- GP Practice
- Emergency Summary Care
- Nursing Home Chart
- Previous Discharge Letter
- Community Pharmacy

Consulting the patient is one of the most important ways to find out what medicines the patient is currently taking, when admitted to hospital.

Important (core) components of a complete medication history [22]:

1. Pharmacists should introduce themselves to the patient and explain the purpose of the visit / consultation.

2. Identify any drug allergies or serious adverse drug reactions, ensuring that the nature of the reaction is obtained.

3. Ascertain any information the patient or carer is able to provide about their drug therapy from (in order of priority):
    a. Their own knowledge
    b. Their own medication
    c. A GP referral letter
    d. A copy of recent prescription list
    e. Community pharmacist
    f. A recent discharge notification
    g. Telephoning or faxing information from the GP
    h. Medical notes

4. Ensure that following are recorded:
    a. Generic name of the medicine
    b. Dose
    c. Route
    d. Frequency
    e. Lenght of therapy if appropriate
    f. Any recently discontinued medicines and the reason for stopping

5. Ensure that items such as inhalers, eye drops, topical preparations, injections and courses of medication held in readiness are included as patients may not consider these as medicines.

6. Ascertain their adherence to the prescribed medication regimen.

7. Identify an self-treatment e.g OTC, herbal, homeopathic remedies.

8. Include any important drug related information such as
    a. Dialysis fluids
    b. Maintenance doses for steroids
    c. Home nebulisers
    d. Dosettes filled community pharmacies (blisterpacks)
    e. Source of supply, if unusual

9. Where practical, drug histories should be obtained from a minimum of two sources.

1.5.1 Medication reconciliation; current practice at Ayr Hospital

The medicines reconciliation form used in Ayr Hospital is for the doctor to use when a patient is seen for the first time at hospital, and the form has now been embedded in the acute medicines admissions clerk in proforma. In this form the doctor can document the source of information, admission medicines and also information about adverse reactions and allergies. After this, the pharmacist has the opportunity to make changes, to try to make a complete drug history and also add other important information. The form should be completed within 24 hours after admission, by doctor first, and then by the pharmacist. This process has so far been very much pharmacist driven and a challenge is to engage the medical staff. As a part of evaluating this service an audit is carried out every month detailing out of 20 patients how many have medicines reconciliation completed.

The medicines reconciliation form used in Ayr hospital consists of the following sections (see appendix I for a view of the form):

- Source of information
- Admission medicines
- Action → changes made by pharmacist
    1. Suspending
    2. Amending
    3. Stopping a medicine
    4. Changes in dose, strength, frequency
- Information about OTC / Herbal / Homeopathic / Illicit substances

- Further information (other information that could be important and relevant for the patient's stay in hospital.)
- Adverse reactions / Allergies
- Questions to be answered by the doctor
    1. Are you satisfied this medication history is complete and accurate?
    2. If NO, what further action is necessary?

1.5.2 Pharmacist-led interventions in medicines reconciliation

Pharmacists can make interventions in different stages; at admission is one of them, and this is often connected to medicines reconciliation.

In a systematic review there was searched (in 11 databases) for studies published in english in or after 1950 until june 2007 that addressed any intervention designed to improve medicines reconciliation and prevent medication error at the point of admission into hospital. Twelve studies were included in the review, and 8 of these included involvement of a clinical pharmacist. [23]

Involvement of pharmacists in medicines reconciliation were examined in one randomised controlled trial (RCT), two before and after trials and five observational studies presented in the systematic review. The RCT was carried out in the USA, and the other studies took place in the UK. [24, 25, 26, 27, 28, 29, 30, 31]

The RCT reported that the number of discrepancies between hospital and home medication fell after pharmacist involvement compared with standard care. The numbers of discrepancies fell from 44 per 100 patients to 19 per 100 patients. [24]

In both before and after studies, the intervention of the pharmacist allowed a greater number of medication errors to be identified and corrected than in the control arm of the study.

The five last of the eight studies, were prospective studies based in the UK. They compared a pharmacist's obtained medication history with that obtained by the

admitting physician. In three of these studies the numbers of error per patient was 202 per 100 patients and 136.4 per 100 patients. [27, 28, 29]
The two last studies showed some interesting results. In one of them pharmacists appeared to omit more medicines than physicians, but in the other study findings were equal to the other studies; there was found a higher error rate in physicians than pharmacists. [30, 31]

1.6 Clinical setting

The study was carried out on an acute medical receiving ward at the Ayr Hospital. Patients that are admitted to this ward either have a referral from GP, or they come via the A & E. This ward has 18 beds, divided in four single rooms, two four-bedded rooms and one six-bedded room. In this ward there usually is a ward round twice daily, and the ward round team consists of a pharmacist, a staff nurse and two doctors. The clinical pharmacy service at station 7 is provided by two pharmacists at the morning and one pharmacist at the afternoon.

An important part of this pharmacists' job is medicines reconciliation at the time when the patients are admitted to the ward. The pharmacists use approximately 15-20 minutes on each patient. They try to see as many patients as possible, to find their correct drug history and check that every patient have all their medicines prescribed with the right dose and frequency. To have all this information as correct as possible different information sources are used, and at least two sources should be used. As a part of the ward round team, they give advice and recommendations to the doctors about what should be prescribed, but they are also allowed to transcribe medicines and do corrections by themselves.

Most of the patients that are admitted to station 7, are moved to other wards or discharged quite fast after they have been seen by the doctors. This involves that some of the patients will not receive pharmaceutical care in this ward.

2. Aims, objectives, subjects and settings

2.1 Aims

(1) To characterise the nature and quantify the incidence of medicines omissions and inaccuracies in patients during the process of admission to hospital; and (2) To evaluate the medicines reconciliation service (MR service)

2.2 Objectives

- Review the literature on MR services and on clinical evaluation of pharmacists' contributions.
- Define the new MR service at Ayr Hospital
- Design and apply a template to summarise anonymously each patient's clinical condition and medical history on admission. Collect data on the changes made by the pharmacist to the physician's drug history.
- Evaluate the clinical significance of the changes made at individual patient level using an expert group of three clinical pharmacists
- Report the findings in terms of frequency and type of drug history corrections and the assessed impact of the contribution of the service to patient care. Receive feedback from pharmacists and clinicians at Ayr hospital by group interview

2.3 Subjects and settings

Data on the changes made by the pharmacist, at station 7, Ayr Hospital will be collected. The MR service will be audited using prospective follow up of patients recruited into the service (during weekdays, n=200) and retrospective audit of those excluded by being admitted at weekends (n=50) over a study period of 2-4 weeks.

3. Methods

The project was designed as a prospective audit survey of patients' records at admission to compare the drugs first prescribed by the doctor, with the list that the pharmacist makes. In addition, the researcher also evaluated the use of the medicines reconciliation service for the included patients. The study period was set to be 2-4 weeks depending on number of patients included during the period.

3.1 Ethical approval

An application for ethical approval of the survey was sent to the Ayrshire and Arran Health Board Ethics Committee. Together with the application, there was sent a short project protocol, a consent form and a patient information sheet.
The project was approved the 14th of January 2009. (Consent form and patient information sheet; see appendix II and III)

3.2 Literature review

The literature was obtained from research in electronic library databases including Medline (PubMed). The databases were searched to find literature on both clinical significance of interventions, and literature on medicines reconciliation.
Some literature was also obtained from accessing relevant NHS documents locally and via the internet.
In PubMed there were searched in MeSH, and also in free text. Both were necessary to ensure that all relevant information were included.

3.3 Observation of current practice at Ayr Hospital

The researcher was introduced to the current practice at Ayr Hospital by following a pharmacist in different wards, included the acute medical receiving ward, and the aim of this was mainly to observe how pharmaceutical care is delivered by pharmacists.

In addition, there was also observed how the medicines reconciliation service is delivered in station 7.

3.4 The study

3.4.1 Pilot phase

The researcher designed a template for data collection, and tested the template during a pilot phase of approximately two weeks. The testing was done on a number of 20 cases in total, that amount to 10 % of 200. Necessary changes and corrections were done during the pilot phase, and the final template was also tested to ensure that all the important information could be recorded in the template.
The final template (see a view in appendix IV) contained anonymised patient information (age and gender), a summary of the patient's clinical condition, including past medical history and present complaint, a list of drugs prescribed at admission and types of medication errors.

The types of medication errors were divided in the following categories:

1. Wrong dose, strength or frequency of medicine
2. Omitted medicine
3. Wrong medicine
4. Wrong formulation
5. Others

The recording template also contained a page to evaluate the MR-service, and this part consisted of the following sections:

- Information sources used by pharmacist (if the section was answered or not, and types of sources used)
- Information sources used by physician/doctor (if the section was answered or not, and types of sources used)
- Did the doctor complete the allergy-section? (Options: 'Yes' or 'No')
- Was the doctor satisfied with the medication history? (Options: 'Yes', 'No' or 'Not answered')

- Numbers of changes/corrections made by the pharmacist to the list of admission medicines. The following changes were recorded:
    - Drugs added to the list
    - Drugs removed from the list
    - Doses changed
    - Frequencies changed
    - Other changes/corrections

3.4.2 Inclusion of patients

The initial aim was to include 200 patients admitted in weekdays and 50 patients admitted in weekends.
Since the researcher was not a part of the health care team for these patients, there was necessary to ask every patient for consent. Before any information about the patient records could be used, each patient had to agree to take part in the study by signing a patient consent form.

The inclusion criteria was that the patient had to be admitted to station 7 during the study period, and the patient had to be suitable for the study and also be able to give consent.
The pharmacists and the researcher handed out information sheets to every patient who was assessed to be suitable and able to give consent. The information sheet contained information about the purpose of the study, and what it would involve for them to take part. Then they had time to read the information, and time to decide if they wanted to be included in the study or not. The patients, who wanted to be a part of the study, could then ask questions to the researcher, if they had any, and then they signed the consent form. The patient received a copy of this consent form, the researcher had one copy, and the original was filed in the patient's medical notes. A list of patient numbers, names and birth dates for all the included patients was made during the inclusion period, and this list was kept separate from the data template to keep this information anonymous.

3.4.2.1 Inclusion of patients in weekends

Information about how many patients admitted to the ward in the weekends was obtained from a ward notebook. In this book the nursing staff record all patients admitted to station 7, presenting complaints and time for when they are transferred to other wards, or discharged. This made it possible for the researcher to follow up the patients that were admitted to the ward during the weekend.
An inclusion criteria for these patients was that they had to be seen by a pharmacist after the weekend.

3.4.3 Data collection

After a patient was included to the study and the consent form was signed, the patient's clinical file was read and necessary information was collated into the anonymised template. All the changes and corrections for each patient were observed and recorded, by using the MR service form. During the pilot phase, the researcher discovered that admission medicines written on this form were not always equal to what was actually prescribed. Access to the electronic prescribing system was therefore needed.
At the morning of each day of data collection, there were printed out a list of everything that was prescribed for all the patients that at that time where admitted at station 7, before the patients were seen by the pharmacist. This was written in the template as 'current drugs prescribed at admission'. It was then possible for the researcher to record types of medication errors that the doctors had done, in terms of interventions. (The frequency and type of drug history corrections made by pharmacist)

3.5 Expert group

The expert group consisted of 4 clinical pharmacists from Ayr Hospital. The expert assigned a category of clinical impact to each intervention according to an established set of definitions for clinical significance (see introduction).

3.5.1 Scoring system

The pharmacists in the expert group found the wording in the scoring system unclear, and it was therefore a need to make an interpretation of the criteria. To set a standard for the assessment, the expert group decided to assume that the interventions made by pharmacist would not have been done by any other professionals during the hospital stay.

Interpretation of the criteria for assessment of interventions

1. Intervention detrimental to patient's well-being

    - An intervention which appears to be inappropriate based on the available information (presenting complaint, past medical history) e.g. getting a medicine prescribed which would be contraindicated based on the available information. This also include if the patient came in on a drug that needs to be reviewed.

2. Intervention of no significance to patient care

    - Clarification of any ambiguity in prescribing documentation which is unlikely to cause harm to the patient e.g. specifying route for eye drops (unlikely to be many instances of this with HEPMA system). This criteria also include time changes which are not significant.

3. Intervention significant, but does not lead to improvement of patient care

    - A change to the prescription which has no impact on the therapeutic benefit for the patient e.g. switches to formulary preparation (Gaviscon D3 forte to Adcal D3, Gaviscon to Peptac). Intervention is deemed as if it had not been made the patient may not have received this medicine while in hospital. This also includes interventions with drugs that were assessed by the expert group to be less significant for the patient because of less clinical effectiveness.

4. Intervention significant and results in an improvement in the standard of care

    - If the intervention had not been made there may have been a detrimental effect on the long-term standard of care or elements of the existing treatment plan may have been lost or compromised e.g. continuation of medicines the patient was taking prior to admission which remain appropriate in view of available information.

5. Intervention very significant and prevents a major organ failure or adverse reaction of similar importance

    - An intervention with the potential to prevent clinical harm of a non-life-threatening nature. It is not possible to assess if the intervention would have prevented a major organ failure but its potential to do so can be assessed. E.g. suspending aspirin in suspected CVA, getting a medicine discontinued if the patient has a suspected allergy (excluding anaphylaxis)

6. Intervention potentially life-saving

    - Intervention which prevents administration of a toxic dose or a medicine for which there is a clear and life-threatening contraindication e.g. warfarin prescribed in presence of GI bleed, lithium prescribed for patient with lithium toxicity, medication which has been taken in overdose prescribed for the patient. This will be based on clinical assessment of the risk based on the medicine involved, presenting complaint and past medical history.

3.5.2 Assessment of clinical significance

After the interpretation of the criteria was done, the expert group got a information sheet for each patient. The sheet contained information about the patient's age and gender, presenting complaint, drugs prescribed at admission, past medical history and types of errors made by doctor/changes made by pharmacist; all the information

that were assessed by the researcher to be relevant. Then all the interventions/contributions were assessed with clinical significance together with information about the patient. In some cases more information was needed as basis, and then the expert group used the electronic prescribing system to get this information. They discussed every case together and agreed one clinical significance for each case. The expert pharmacists managed to assess all the interventions within three meetings on one hour each.

3.6 Group interview and feedback

According to the objectives the results should have been presented to clinicians and pharmacists at Ayr Hospital. After the expert group meetings were finished there were not enough time to gather clinicians and pharmacists to have a group interview as planned. Researcher had some feedback from some of the clinical pharmacists that attended the expert group, and this was included in the results.

4. Results

4.1 Inclusion of patients

The initial aim of the study was to include 200 patients admitted in weekdays and 50 patients admitted in weekends, during the study period of 2-4 weeks. The researcher experienced that it was difficult to achieve this number, and after 5 weeks the researcher had managed to include 106 patients to the study. Because of lack of more time the data collection had to stop after these 5 weeks.

The reason it was so difficult to include patients was the need to have consent from every patient. Many of the patients were not suitable to be included in the study, and during the study period the researcher only managed to include less than 50 per cent of all the patients that were admitted during the period. Examples of reasons for a patient to be assessed as not suitable/not able to give consent:

- Clinical condition (patient in with confusion, overdose etc, or very unwell at the time of admission
- Disease (e.g. dementia)

Some patients were assessed as not suitable for the study, because they did not have the new medicines reconciliation form in their notes. There were also a few patients that did not want to be a part of the study after they had read the information sheet. Most of these patients did not give a reason why they didn't want to be included.

The following table shows distribution of age and gender in all consenting patients.

Table 1: Distribution of age and gender in all consenting patients (n=106)

	Male	**Female**
Number (%)	49 (46.2)	57 (53.8)
Mean (SD) age	63.8 (15.7)	64.1 (16.7)
Median (IQR) age	66 (49,75)	68 (54,76)

Table 2 shows the most common presenting complaints for the patients included. Some of the patients were admitted with more than one presenting complaint, so these patients may count for more than one of the presenting complaints in the table.

Table 2: Most common presenting complaints (n=106)

	Patients (%)
SOB	33 (31.1)
CP	32 (30.2)
Pain	14 (13.2)
Cough	9 (8.5)
Diarrhoea	9 (8.5)
Vomiting	9 (8.5)
Arm/facial weakness	6 (5.7)
Anaemia	5 (4.7)
Collapse	4 (3.8)
Swollen leg w/pain	4 (3.8)

It was also difficult to include patients that had been admitted in the weekends. Most of these patients had left the hospital during the weekend and the rest of the patients had been moved to other wards. The researcher followed up these patients by visiting other wards, but this turned out to be very time demanding. In addition some of the patients had not been seen by a pharmacist yet and were often discharged before a pharmacist managed to see the patients. Of the total 106 included patients only 12 were patients admitted in the weekends.

4.2 Pharmacist contributions

All the changes and corrections made by pharmacist to the physician's drug history, were recorded. In the study period there were recorded 255 contributions, and this was recorded for 105 patients. Researcher did not get access to the medical notes to one consenting patient, this was because of discharge. The MR-form for this patient was evaluated, so the researcher has chosen to keep the patient as included in the study.

The median number of discrepancies found per patient was 2,4 and no discrepancies were found in 25/105 (23.8 %) of the cases. The highest number of discrepancies found for one patient was 10. The following table shows a classification of type of errors made by physician/doctor.

Table 3: Frequency Distribution of Pharmacist Contributions

Type of Medication Error	Count (%)
Wrong dose/strength	23 (9.0 %)
Wrong frequency	17 (6.7 %)
Omitted medicine	147 (57.6 %)
Wrong medicine	23 (9, 0 %)
Wrong formulation	12 (4.7 %)
Other changes	33 (13.0 %)
Total	**255 (100 %)**

Other changes included the following:

- Administration times changed. Following drugs were involved: Lisinopril, allopurinol, amlodipine, doxazosin, loratadine, alendronic acid, gabapentin, insulin (three cases) and quinine sulphate
- One drug switched to another drug
    - Calcichew changed to adcal D3 (two cases)
    - Omeprazole changed to esomeprazole
    - Bumetanide changed to furosemide
    - Co-dydramol changed to co-codamol
    - Tramadol changed to co-codamol
    - Naproxen changed to etodolac
    - Gaviscon changed to peptac (two cases)
    - Diltiazem changed to adizem XL preparation
- Stat doses prescribed (eight cases)
- Latanoprost eyedrops changed from drops in one eye to both eyes

- Dose changes without changes in daily dose
    - Dexamethasone 4 mg once daily changed to 2 mg twice daily (daily dose still 4 mg)

    - Furosemide 120 mg od changed to 80 mg am and 40 mg noon (daily dose still 120 mg)
- Creon capsules; 'as required' dose added to regular dose because dose varies depending on intake

Table 4: Frequency of types of contributions and distribution per patient. (See appendix V for a detailed table)

	Count (%)	Mean per patient (95 % CI)	Median (IQR)
Wrong dose/strength	23 (9.0)	0.22 (0.12, 0.32)	0 (0,0)
Wrong frequency	17 (6.7)	0.16 (0.08, 0.25)	0 (0,0)
Omitted medicine	147 (57.6)	1.40 (1.02, 1.78)	1 (0,2)
Wrong medicine	23 (9.0)	0.22 (0.13, 0.30)	0 (0,0)
Wrong formulation	12 (4.7)	0.11 (0.04, 0.19)	0 (0,0)
Other changes	33 (13.0)	0.31 (0.14, 0.49)	0 (0,0)
Total contributions	255 (100.0)	2.43 (1.96, 2.90)	2 (1,3)

There were many different drugs involved in the pharmacist's contributions and the 255 changes and corrections were distributed on a total of 119 drugs. Table 5 shows the most common medicines involved. (See appendix VI for a table with all the involved drugs distributed in the different categories of errors.)

Table 5: Most common drugs involved in the recorded contributions

	Count (%)
Salbutamol	18 (7.1%)
Seretide	12 (4.7%)
Glyceryl trinitrate	10 (3.9%)
Omeprazole	9 (3.5%)
Aspirin	8 (3.0%)
Paracetamol	6 (2.4%)
Furosemide	6 (2.4%)

4.3 Expert group – assessment of clinical significance of contributions

The expert group made an assessment of clinical significance of all the interventions made by pharmacist, to see how important these contributions are. Some 67.5 per cent of all the interventions were assessed to be a clinical significance of 4 – interventions significant and results in an improvement in the standard of care. No potentially lifesaving interventions were recorded, and only one intervention was assessed to be detrimental to patient's well-being.

Table 6: The clinical significance of the pharmacist contributions

	Assessed clinical significance	Count	%
1	Intervention detrimental to patient's wellbeing	1	0.4
2	Intervention of no significance to patient care	26	10.2
3	Intervention significant, but does not lead to improvement of patient care	39	15.3
4	Intervention significant and results in an improvement in the standard of care	172	67.5
5	Intervention very significant and prevents a major organ failure or reaction of similar importance	17	6.7
6	Intervention potentially life-saving	0	0
TOTAL		**255**	**100**

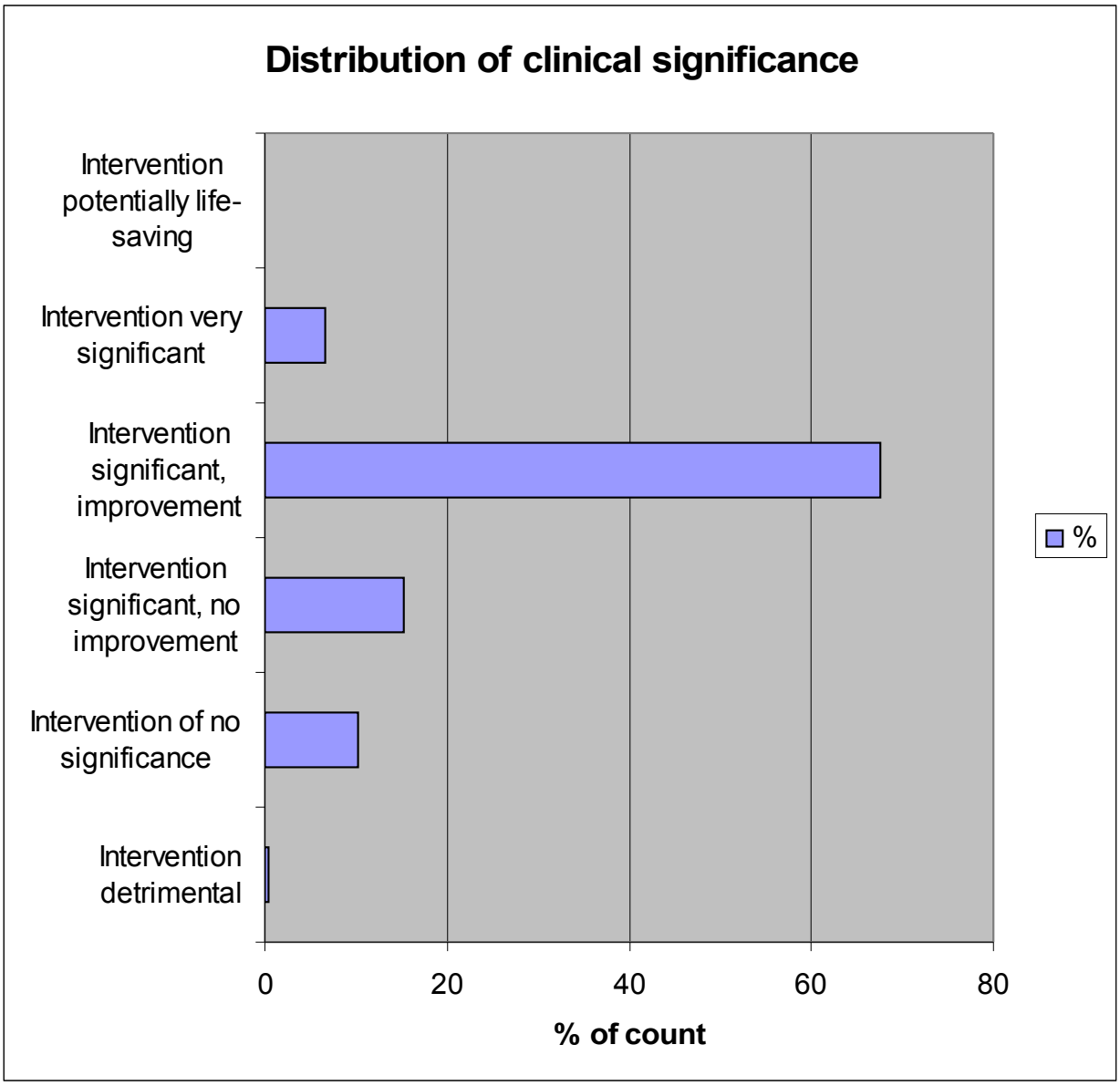

Figure 1: Distribution of scores in all the interventions made by pharmacist.

The intervention assessed as detrimental to the patient's wellbeing

In this case the patient was taking oxycodone 5 mg daily at home, and when admitted to hospital 10 mg daily was prescribed. The pharmacist changed this to the dose that the patient was taking at home, but the patient was admitted with pain and should have stayed on the prescribed dose for review.

The interventions assessed as very significant

As listed in the table above, there were 17 cases assessed with a clinical significance of 5 – interventions that are very significant and prevent a major organ failure or adverse reaction of similar importance. The following section is a description of these cases.

In three cases a PPI was omitted, and in all three cases this was important medicines due to presenting complaint.

- Omeprazole was omitted and the patient was admitted with anaemia
- Lansoprazole was omitted and the patient was admitted with epigastric pain
- Esomeprazole was omitted and the patient was admitted with anaemia

In six cases important cardiovascular medicines were omitted. These cases were distributed on two patients, both of them admitted with chest pain. Medicines involved were bisoprolol, aspirin, isosorbide mononitrate (two cases), ramipril and clopidogrel.

Four of the cases involved a medicine prescribed, that the patient should not be taking.

- Alendronic acid was prescribed but the patient was not using this medicine at home. The patient was admitted with oesophagitis.
- Simvastatin was prescribed although the patient already was on atorvastatin.
- Aspirin was prescribed when the patient was admitted with a suspected cerebrovascular accident
- Paracetamol was prescribed although the patient was allergic to this substance.

In three cases wrong frequency or/and dose were prescribed.

- Folic acid was prescribed daily, but patient was usually on a weekly dose. In addition the patient was on a weekly dose of methotrexate.
- Capecitabine was prescribed with both wrong dose and wrong frequency. These errors made a big difference from the dose the patient should have

had. The doctor prescribed 500 mg once daily, but the patient was usually taking 2000 mg twice daily.

In one case naproxen was prescribed when patient was admitted with symptoms that could indicate stroke. Naproxen was in this case changed to etodolac (which the patient was usually on) and then suspended by pharmacist.

Examples of cases assessed as not significant for the patient were when administration times were changed or stat-doses prescribed.

The type of error with the highest frequency was omitted medicines. The table below shows the distribution of clinical significance of the interventions made by pharmacist in the errors that were classified as omitted medicines. The interventions/errors are divided in terapeutic cathegories according to the BNF-system.

Table 7: Clinical significance of interventions made in the category omitted medicines.

	1	**2**	**3**	**4**	**5**	**6**	**Number (%) of contributions**
Gastro-intestinal system	-	-	7	8	2	-	17 (11.6%)
Cardiovascular system	-	-	-	36	6	-	42 (28.5%)
Respiratory system	-	-	1	29	-	-	30 (20.4%)
Central nervous system	-	-	3	25	-	-	28 (19.1%)
Infections	-	-	-	2	-	-	2 (1.4%)
Endocrine system	-	1	-	8	-	-	9 (6.1%)
Obstetric, gynaecology and urinary tract disorders	-	-	-	3	-	-	3 (2.0%)
Malignant disease and Immunosuppression	-	-	-	-	-	-	0 (0.0%)
Nutrition and blood	-	-	-	3	-	-	3 (2.0%)
Musculoskeletal and joint diseases	-	-	-	3	-	-	3 (2.0%)
Eye	-	-	1	-	-	-	1 (0.7%)
Ear, nose and oropharynx	-	-	1	1	-	-	2 (1.4%)
Skin	-	-	1	3	-	-	4 (2.7%)
Immunological products and vaccines	-	-	-	-	-	-	0 (0.0%)
Anaesthesia	-	-	-	-	-	-	0 (0.0%)
Others	-	-	-	3	-	-	3 (2.0%)
Total (%)	**0 (0.0)**	**1 (0.7)**	**14 (9.5)**	**124 (84.4)**	**8 (5.4)**	**0 (0.0)**	**147 (100%)**

4.4 Evaluation of the MR-service

Researcher managed to evaluate this service in 105 patients. The last patient was discharged before researcher had access to the patient's medical notes. During the data collection the researcher recorded how the MR-service was delivered by doctors and pharmacists. This included if the doctor completed all the sections, which changes and corrections the pharmacist had to make and what information that was added by pharmacist.

It was recorded how many drugs that should have been on the admission medicines list and changes/corrections done by pharmacist on this list. The changes and corrections was classified in the following sections:

- Drugs added to the list (not written by doctor)
- Drugs removed from the list (wrong medicines written by doctor)
- Doses changed (included doses both changed from what was written and doses added to a drug already on the list)
- Frequencies changed (included frequencies both changed from what was written and frequencies added to a drug already on the list)
- Other changes/corrections

The two most common contributions in other changes were addition of administration times and writing of brand-names.

The list of admission medicines should contain all medicines that the patient were taking at home, before admitted to hospital. Of the 774 drugs that should have been written on the MR-form, 297 (38.4%) drugs had to be added by pharmacist.

In the remaining 477 drugs written by doctor there was a high frequency of errors. In 128 cases there was a need for corrections in dose; 28 (%) doses were changed by pharmacist and 100 (%) doses were added. In 147 cases there was a need for corrections in frequencies; 9 (%) frequencies were changed and 138 (%) frequencies were added. There were also 20 cases of other changes and corrections.

The following table shows how all these changes and corrections were distributed on all the patients with evaluated forms.

Table 8: Distribution per patient on changes and corrections (n=105)

	count (%)	Mean per patient (95 % CI)	Median (IQR)
Drugs added to the list	297 (47.8)	2.8 (2.0, 3.6)	1 (0,3)
Drugs removed from the list	29 (4.7)	0.3 (0.2, 0.4)	0 (0,0)
Doses changed	128 (20.6)	1.2 (0.9, 1.5)	1 (0,2)
Frequencies changed	147 (23.4)	1.4 (1.0, 1.8)	0 (0,2)
Other changes	20 (3.2)	0.2 (0.1, 0.3)	0 (0,0)
Total number of changes and corrections	621 (100.0)	5,9 (5.0, 6.8)	4 (2,9)
Total number of drugs that should be on the list	774 (100.0)	7.4 (6.5, 8.3)	7 (4,10)

In addition the doctors had written 29 medicines wrong, and these drugs were removed from the list during the MR-process. (See appendix VII to see distribution all types of changes/corrections per patient)

In the MR-form, the doctors and pharmacist are supposed to document what sources they have used to find the correct drug history for the patient. Only in 20 (19 %) of the cases the doctor had documented this information, and in the other 85 (81 %) cases the section was not answered. The pharmacists had documented information sources in 104 (99%) of all the cases.

The most common information sources used were patient, patient's own drugs, GP referral letter, contact with GP practice and use of previous discharge letter.

The next section to be evaluated was the 'adverse reaction and allergies'-section. In 76 (72.4%) of the cases the section was answered, in 16 (15.2 %) cases the pharmacist had to answer the section and in 13 (12.4 %) cases the doctor had just partly answered and then the section was completed by pharmacist.

The last section to be completed by the doctors was the following questions ‘Is the doctor satisfied the medication history is complete and accurate?’ and ‘If NO, what action is necessary?’ In 99 (94, 2 %) cases the questions were not answered.

In total there was only one case where the doctor had completed the form correctly and no changes or corrections were needed. In this particular case all sections was completed and all questions answered. In total there were six cases where the doctor had not documented anything on the form, and in 13 cases only the allergy-section was completed.

The result was also compared to the actual errors made in the prescribing process, by comparing changes in the form with changes made to the doctors list of prescribed medicines. The comparison was just done visually (with comparing tables in appendix 5 and 7), and the aim of this was to see if there was any possible connection between these results.

In the cases where the doctor had completed the MR form almost correctly, few prescribing errors were made and also few changes or corrections by pharmacist were necessary. In the cases were the forms were only partly completed or not completed at all, a higher number of errors were recorded.

4.5 Feedback from clinical pharmacists at Ayr Hospital

Some of the key comments that the researcher received from the clinical pharmacists at Ayr Hospital are listed below:

- The results give detailed information as to exactly what has had to be added by the pharmacist to ensure the form is completed.
- The results are useful evidence and can be used as basis to future discussions with senior medical staff. This can help to engage all medical staff in the process.

5. Discussion

5.1 Limitations in the study

5.1.1 Inclusion of patients and data collection

In the inclusion of patients the researcher experienced that it was difficult to include patients, because many of them were unwell, not able to give consent or not suitable for other reasons. Since these patients were missed because they could not be included in the study, the numbers in the study may not be accurate to describe the current situation at the acute medical ward at Ayr Hospital. If it had been possible to include all the patients that were admitted to the ward in the study period, the numbers of medication errors and interventions would have been more accurate, and this number would have described the actual conditions in a more accurate way.

The researcher had to do this study prospectively, and all the patients included had to be seen by a pharmacist before data collection was possible. This involved the constraint that the researcher only could include patients when the pharmacist was working (usually between 8.30 am and 4.30 pm), and therefore a lot of patients could be admitted and then discharged without having the chance to be included. Patients missed by the pharmacist because of discharge, for example, were also missed by the researcher and could not be included.

Although the initial aim of the study was to include 250 patients in total, a number of 106 patients was included and could be representative to describe the current situation. The included patients showed an equal distribution of gender and this is another statement to indicate that the numbers are representative.

5.1.2 The expert group

The method used by the expert group could have been done in another way. The pharmacists discussed the interventions together and a result of this can be that they may have affected each other. The results could have been different if all the

pharmacists had assessed the interventions independently and then met to have the discussion.

5.2 Contributions made by pharmacist and assessment of clinical significance

In the study period of 5 weeks there were identified 255 contributions made by pharmacist, distributed on 105 patients. This made a rate of 2.4 per patient. The frequency of interventions made per patient needs to be compared to other studies found in the literature review (see introduction). In one study there were recorded 1315 interventions over a 12-month period, which gives an average of 110 in one month. There is no information on how many patients that the interventions were identified. In another study 122 patients were included in the study and 194 interventions were made. This makes an average of 1.6 interventions per patient in total. That study was over a 7-days period.

The numbers found in this study seem to be higher than the other studies, when looking at the results. This indicates that the frequency of contributions made according to prescribing errors, is quite high at this ward. Still it is limitations with comparing this study with the two earlier studies, because there is some information missing (number of patients), and also because there are some differences on length of study period and on study design.

A lot of patients could not be included in the study because of the need for consent. Many of these patients that could not give consent had a lot of medicines prescribed. Interventions made in medication errors, could probably have higher clinical significance for patients that are taking more medications and have more complex diseases. If the researcher had managed to include these types of patients in addition to the other patients, the results of the assessment on clinical significance could have been different.

In the assessment of clinical significance there was assumed that the interventions would not have been done if the pharmacist hadn’t been there. This was necessary

as a standard before the expert group could assess all the interventions equally. In some cases it would not be accurate to assess the intervention with this standard, because the medication errors could be discovered during the hospital stay. Many patients know very well what kind of medicines they are taking, and in these cases the patients might have asked for medicines not given, corrected the dose or even refused to take medicines that were wrong medicines prescribed. Then it would have been possible to discover the prescribing errors and avoid or reduce harm.

In addition the patient would have been followed up during the hospital stay, and for example omissions of important medicines could have been discovered through monitoring. One example of this could be; if medicines for high blood pressure were missed at admission, the patient could have experienced symptoms of increased blood pressure. Due to this, medicines needed would probably have been prescribed by the doctors. If antidiabetics are omitted it could be possible to discover this via monitoring of blood glucose, both in hospital and when the patient is at home.
Even though the errors are discovered, the examples mentioned above show that the errors often are discovered as a result of an adverse effect, and the errors have already caused harm for the patient.

An example of a potentially serious case can be that the prescribing errors are not discovered during the hospital stay. These errors may lead to errors on the discharge letter, and this could further cause the patient to not have a necessary supply of important medicines. In some cases the medicines that are omitted at the hospital, may not be prescribed by the GP because the medicines are missed of the discharge letter. An example of this could be if a medicine to prevent stroke is omitted; this could in long term lead to serious harm for the patient
Though, there is a possibility that the GP may contact the hospital, if there are questions concerning medicines that suddenly have been discontinued.

Since this study has involved detection of errors by pharmacists, it is difficult to say how harmful these errors would have been for each individual patient. Detection of errors with following changes and corrections, may result in avoidance of harm to patients, and it is only possible to say if the error was *potentially* harmful.

The assessment of clinical significance shows that the impact of the contribution of the service has high importance. The high frequency of medication errors at the time of admission reflects that there is a need for pharmacists working with medicines reconciliation. Approximately 74 % of all contributions were assessed to have a clinical importance of 4 or above, and these results show that pharmacists make an important contribution to the patients with reducing errors and potential harm for patients.

One reason for the high frequency of prescribing errors could be that the doctors are very busy and the errors are a result of lack of time. There can often be difficult and time demanding to use many different sources to find a correct drug history for the patient, and the acute ward at Ayr hospital is very busy most of the time.

Another important issue to consider is that in this project the doctors/physicians where unaware that they were participating a study while the pharmacists were aware. This could have affected the results, because there is a possibility that the pharmacists have made a even better job when they were aware of being a part of a study.

In addition, the doctors know that the pharmacist is there to check their medication list, and this might be a reason that they do not do things more correctly. If the researcher had managed to include more patients from the weekend, it would have been possible to see if there were any significant differences between when doctors work in weekends without a pharmacist, and when they work along with pharmacists in the weekdays.

The high frequency of interventions in some of the terapeutic classes could be explained by the presenting complaints and past medical history to the included patients. As shown in the results there were cardiovascular medicines and asthma/COPD medicines that were most involved in the interventions, which may have a connection with the most commonly presenting complaints; CP and SOB.

5.3 Patients admitted in the weekends

As mentioned in both methods and results there was difficult to include patients that had been admitted in the weekends. Only 10 patients were included and this were not enough cases to tell if there is any difference between patients admitted in the weekends and patients admitted in the weekdays. The difference in those patients will be that those admitted in weekends will not always be recruited in this service, and the aim was to see if this made a difference for patients admitted in weekends.

Although, it may be possible to say something about patients in the weekends, based on the results from the study. As listed in table 4 in results there are two means with their confidence intervals that are interesting; omitted medicine (mean 1.40 with CI: 1.02, 1.78) and total contributions (imean 2.43 with CI: 1.96, 2.90). This means that the possibility is that 19 out of 20 patients will at least have one omission when admitted to hospital and two contributions in total. Since patients admitted in weekends will not receive the medicine reconciliation service from pharmacist before Monday, there is a possibility that important medicines are omitted for several days. This could lead to harm for the patients, and may potentially be more harmful than omissions discovered by pharmacist short time after admission. Although there is possible to indicate that there are differences, more numbers will be needed before it is possible to conclude with differences.

5.4 Evaluation of medicines reconciliation service

The results of the evaluation were mainly that the doctors completed the form in very few of the observed cases. The medicines reconciliation service with using the admission medicines form is quite new at Ayr Hospital and this might be a reason for the observed results. Another explanation of this can be that the process of determining the patient's drug history can be quite time demanding and also difficult. The acute ward is often very busy and it is possible that in many cases the doctor don't have time to complete the forms. Still, the results indicate that there is a need for improvement on how this service is delivered by doctors.

When results of this evaluation was compared with results from the changes made to the prescribed medicines, there was possible to see that often errors made on the MR form also were made in the prescription process.

5.5 Feedback from clinical pharmacists on the evaluation of the MR-service

Some of the key comments were that the results give detailed information as to exactly what had to be added by the pharmacist to ensure the form is completed fully. The results were assessed to be useful evidence of this and could be used as basis for future discussions the pharmacists have with senior medical staff to help to engage all medical staff in the process.

6. Conclusion

The project has shown that it is possible to characterise the nature and quantify the incidence of omissions and inaccuracies in patients during the process of admission to hospital, by doing a prospective study. To find a more correct frequency of prescribing errors made at hospital admission, it is necessary to include all types of patients. This was not possible in this study because of the need for consent from the patients before they could be included in the study.

To identify the importance of patients that are excluded from the MR service because of admission in the weekends, there is necessary to include more patients. Then it can be possible to compare these patients with patients admitted in weekdays.

The clinical significance of all the pharmacist's contributions could be assessed with the use of a scoring system. A major part of the contributions were assessed to be either significant or very significant and could potentially result in an improvement in the standard of care.

The project has shown that pharmacists have an important role in the process of medicines reconciliation. Their work with finding a correct drug history when patients are admitted at hospital can reduce and even avoid potential harm for the patients. The project has also shown that it is a need for improvement in how the medicines reconciliation service is delivered by doctors at this acute medical ward.

7. Appendices

7.1 Appendix I: Medicines reconciliation form used at Ayr Hospital

Multidisciplinary Medicines Reconciliation Form

Must be started by admitting Clinician within 24 hours

NHS Ayrshire & Arran

Source of Information (Use at least two sources) (Tick)

Patient	☐	Emergency Care Summary	☐
Relative/Carer	☐	Nursing Home Chart	☐
Patient's Own Drugs	☐	Previous Discharge Letter	☐
GP Referral Letter	☐	Repeat Prescription slip	☐
GP Practice	☐	Other (Please state)	☐

Admission Medicines			**Action** Note: Unless otherwise indicated below, medicine should be continued on prescription sheet				
Name, Form, Route (specify if not oral)	Dose	Frequency eg 3X	Suspend	Amend	Stop	Comments (if medicine suspended, amended stopped or inaccurate)	Pharm initials if change

OTC/ Herbal/ homeopathic/ illicit substances	Further information eg compliance aid, recent discontinued medicines

Adverse Reactions/Allergies None Known ☐ or

Medicine/Substance	Reaction

Are you satisfied this medication history is complete and accurate? Yes ☐ No ☐

If **No** what further action is necessary (Contact GP etc) …… Tick when resolved ☐

Pharmacist review signature……Date/Time ……..Beep No ……

7.2 Appendix II: The consent form

NHS Ayrshire & Arran

CONSENT FORM

The study of Recording of Medicines on Admission to Hospital

Name of Researcher: Anita Reinaas Lysheim

Please initial box

1. I confirm that I have read and understand the information sheet dated 12/12/2008 for the above study. I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily. ☐
2. I understand that my participation is voluntary and that I am free to withdraw at any time, without giving any reason, without any medical care or legal rights being affected. ☐
3. I understand that relevant sections of any of my medical notes and data collected during the study, may be looked at by responsible individuals from Ayr Hospital pharmacy department. I give permission for these individuals to have access to my records. ☐
4. I agree to take part in the above study. ☐

_____	_____	_____
Name of Patient	Date	Signature
_____	_____	_____
Name of Person taking consent (if different from researcher)	Date	Signature
_____	_____	_____
Researcher	Date	Signature

When completed, 1 for patient; 1 for researcher site file; 1 (original) to be kept in medical notes.

7.3 Appendix III: The information sheet

PATIENT INFORMATION SHEET

The study of Recording of Medicines on Admission to Hospital

You are being invited to take part in a research study. Before you decide it is important for you to understand why the research is being done and what it will involve. Please take time to read the following information carefully. Talk to others about the study if you wish.

Ask us if there is anything that is not clear or if you would like more information. Take time to decide whether or not you wish to take part.

What is the purpose of the study?

On admission to hospital a list of the medicines you are taking at home are recorded by the doctor and this is checked by the pharmacist. We have started to use a new form to do this.

The aim of this study is to find out if this form helps us do this by comparing the list the doctor has taken to the list the pharmacist takes.

One final year pharmacy university student from Norway who is currently working with the pharmacists in Ayr Hospital and Strathclyde University will carry out the study. The student's name is Anita Reinaas Lysheim.

Why have I been chosen?

You have been chosen because you have been admitted to our medical receiving ward in Ayr Hospital (station 7) during the study time period.

It is hoped we will study a total of about 200 patients during the time period.

Do I have to take part?

No. It is up to you to decide whether or not to take part. If you do, you will be given this information sheet to keep and be asked to sign a consent form. You are still free to withdraw at any time and without giving a reason.
A decision to withdraw at any time, or a decision not to take part, will not affect the standard of care you receive.

What will happen to me if I take part?

If you decide to take part in this study, your notes will be accessed when you in hospital.

The information contained in your notes about the list of medicines you were taking before you came into hospital will be used by the student in the research.

Any information taken from your notes will be kept anonymous.

What do I have to do?

You are only required to give permission for the information in your notes to be used as part of the study.

You will not have to do anything, complete any forms or visit any clinics or hospitals during the study.

If you decide to take part in the study, you will be asked to sign a consent form. This will allow us to access your notes when you are in hospital and use the information in your notes.

After this you will not be asked to do anything else.

What are the possible benefits of taking part?

There are no direct benefits to your treatment by taking part in the study.

However, if the study produces good results it will give us information on how to change the recording form to help us collect information in the future.

This may benefit patients in Ayrshire and Arran in the future.

What if there is a problem?

Any complaint about the way you have been dealt with during the study will be addressed.

If you have any complaints or would like further information about the study please contact:

Gillian A Jardine
Principal Pharmacist
Ayr Hospital
Dalmellington Road
Ayr
KA6 6DX
Telephone: 01292 614504

If you remain unhappy and wish to complain formally, you can do this through the NHS Complaints Procedure. Details can be obtained from Ayr Hospital.

Will my taking part in the study be kept confidential?

Yes. All the information about your participation in this study will be kept confidential.

You will be given a copy of the information sheet and a signed consent form to keep.

Thank you for taking time to read the information sheet and for considering taking part in this study.

7.4 Appendix 4 – Final data collection template

STATION 7 – the study of Recording of Medicines on Admission to Hospital

Patient nr:	.
Sex:	
Age:	
Date:	

Present complaint:

Past medical history:

Types of omissions/inaccuracies:

- Wrong dose, strength or frequency of medicine
- Omitted medicine
- Wrong medicine
- Wrong formulation
- Others

Current drugs prescribed (at admission):

Name of medicine, form, route	Dose	Frequency	Other relevant notes

Audit of the MR – service:

Information sources used by:

The Doctor

Patient	.
Relative / Carer	
Patient's Own Drugs	
GP Referral Letter	
GP Practice	
Emergency Care Summary	
Nursing Home Chart	
Previous Discharge Letter	
Repeat Prescription	
Other	
Not answered	

The Pharmacist

Patient	.
Relative / Carer	
Patient's Own Drugs	
GP Referral Letter	
GP Practice	
Emergency Care Summary	
Nursing Home Chart	
Previous Discharge Letter	
Repeat Prescription	
Other	
Not answered	

Did the doctor complete the "adverse reactions/allergies" – section?

Yes	No

Is the doctor satisfied this medication history is complete and accurate?

Yes	No	Not answ.

Number of:

- Drugs added to the list: ____
- Drugs removed from the list: ____
- Doses changed: ____
- Frequencies changed: ____
- Other changes/corrections: __

7.5 Appendix V. Detailed table of distribution of errors per patient

Patient nr	Total number of interventions	Wrong dose/strength	Wrong frequency	Omitted medicine	Wrong medicine	Wrong formulation	Other changes
1	1	1	0	0	0	0	0
2	1	1	0	0	0	0	0
3	1	1	0	0	0	0	0
4	3	0	0	2	0	1	0
5	4	0	0	1	1	2	0
6	2	1	1	0	0	0	0
7	7	0	0	7	0	0	0
8	2	1	0	0	0	0	1
9	5	0	0	1	0	0	4
10	2	0	0	1	0	0	1
11	2	0	1	1	0	0	0
12	1	1	0	0	0	0	0
13	3	1	0	2	0	0	0
14	1	0	0	0	1	0	0
15	5	0	0	4	0	0	1
16	0	0	0	0	0	0	0
17	1	0	0	1	0	0	0
18	0	0	0	0	0	0	0
19	9	0	0	9	0	0	0
20	2	0	0	2	0	0	0
21	6	0	1	4	1	0	0
22	4	1	1	1	0	1	0
23	2	1	0	0	0	0	1
24	2	0	0	2	0	0	0
25	3	1	1	0	0	0	1
26	3	0	0	3	0	0	0
27	1	0	1	0	0	0	0
28	0	0	0	0	0	0	0
29	2	0	0	0	2	0	0
30	1	1	0	0	0	0	0

Patient nr	Total number of interventions	Wrong dose/strength	Wrong frequency	Omitted medicine	Wrong medicine	Wrong formulation	Other changes
31	2	0	0	1	1	0	0
32	0	0	0	0	0	0	0
33	6	1	1	0	1	1	2
34	3	0	0	2	0	0	1
36	0	0	0	0	0	0	0
37	1	0	0	1	0	0	0
38	2	0	0	1	1	0	0
39	0	0	0	0	0	0	0
40	1	0	0	1	0	0	0
41	0	0	0	0	0	0	0
42	1	0	0	1	0	0	0
43	1	0	0	1	0	0	0
44	4	1	1	0	1	0	1
45	6	1	0	5	0	0	0
46	3	0	0	2	0	1	0
47	2	0	0	1	0	0	1
48	2	0	0	2	0	0	0
49	0	0	0	0	0	0	0
50	3	0	1	0	0	0	2
51	3	0	0	1	0	2	0
52	2	0	0	1	1	0	0
53	0	0	0	0	0	0	0
54	2	0	0	1	1	0	0
55	3	0	0	3	0	0	0
56	6	0	0	4	1	0	1
57	9	0	1	7	1	0	0
58	3	0	0	1	1	0	1
59	0	0	0	0	0	0	0
60	4	0	0	2	1	1	0
61	7	0	0	6	1	0	0

Patient nr	Number of interventions	Wrong dose/strength	Wrong frequency	Omitted medicine	Wrong medicine	Wrong formulation	Other changes
62	0	0	0	0	0	0	0
63	1	0	0	0	0	1	0
64	1	0	0	1	0	0	0
65	2	0	0	2	0	0	0
66	10	1	0	4	1	1	3
67	4	0	0	4	0	0	0
68	2	0	0	2	0	0	0
69	0	0	0	0	0	0	0
70	2	0	0	0	1	0	1
71	3	0	0	3	0	0	0
72	4	0	0	3	1	0	0
73	5	2	0	2	0	0	1
74	1	0	0	1	0	0	0
75	0	0	0	0	0	0	0
76	0	0	0	0	0	0	0
77	4	0	0	4	0	0	0
78	1	0	0	0	1	0	0
79	3	0	1	2	0	0	0
80	0	0	0	0	0	0	0
81	9	3	3	2	0	0	1
82	3	0	1	1	1	0	0
83	2	0	0	2	0	0	0
84	0	0	0	0	0	0	0
85	8	0	0	8	0	0	0
86	8	0	0	8	0	0	0
87	0	0	0	0	0	0	0
88	0	0	0	0	0	0	0
89	2	0	0	1	1	0	0
90	8	0	0	1	0	0	7
91	0	0	0	0	0	0	0

Patient nr	Number of interventions	Wrong dose/strength	Wrong frequency	Omitted medicine	Wrong medicine	Wrong formulation	Other changes
92	1	0	0	1	0	0	0
93	0	0	0	0	0	0	0
94	3	0	0	2	0	0	1
95	0	0	0	0	0	0	0
96	0	0	0	0	0	0	0
97	1	0	0	0	0	1	0
98	2	0	0	2	0	0	0
99	0	0	0	0	0	0	0
100	1	0	0	0	1	0	0
101	0	0	0	0	0	0	0
102	2	1	1	0	0	0	0
103	5	2	1	2	0	0	0
104	0	0	0	0	0	0	0
105	3	0	0	3	0	0	0
106	2	0	0	1	0	0	1
TOTAL	**255**	**23**	**17**	**147**	**23**	**12**	**33**

Patient nr 35 is exluded from the table (see results for explanation)

7.6 Appendix VI. Drugs that were involved in the contributions

	Wrong dose/ strength	Wrong frequency	Omitted medicine	Wrong medicine	Wrong formulation	Other changes	Total number
Adcal D3			1	3			**4**
Alendronate			2	1		1	**4**
Allopurinol			1			1	**2**
Amiodarone			1				**1**
Amitriptyline			1				**1**
Amlodipine			2			1	**3**
Aspirin	1		5	1	1		**8**
Atenolol			2				**2**
Beclomethasone	1			1			**2**
Bendroflumethiazide			1				**1**
Betahistine			1				**1**
Bezofibrate			1				**1**
Bisacodyl			2				**2**
Bisoprolol			3				**3**
Brinzolamide	1						**1**
Bumetanide				1		1	**2**
Calcichew D3						2	**2**
Capacitabine	1	1					**2**
Carbocisteine			1				**1**
Chlorphenamin			1				**1**
Cinnarizine	1						**1**
Citalopram			3				**3**
Clopidogrel			1				**1**
Clotrimazole			1				**1**
Co-amilofruse			1				**1**
Co-codamol	1		2				**3**
Co-dydramol			1			1	**2**
Creon						1	**1**
Dexamethasone						1	**1**
Diclofenac			1				**1**
Digoxin			1				**1**
Dihydrocodeine			1				**1**
Diltiazem						1	**1**
Diprobase			1				**1**
Dipyridamol			1				**1**
Domperidone			1				**1**
Doxazosin						1	**1**
Doxycycline			1				**1**
Enalapril			1				**1**
Esomeprazole			2				**2**
Estradiol			1				**1**
Etodolac						1	**1**
Ezetimibe			1				**1**
Finasteride			1				**1**
Fluoxetine			2				**2**

	Wrong dose/ strength	Wrong frequency	Omitted medicine	Wrong medicine	Wrong formulation	Other changes	Total number
Fluticasone			2				**2**
Folic acid		1					**1**
Furosemide	2	1	2			1	**6**
Fybogel			1				**1**
Gabapentin				1		1	**2**
Gaviscon						2	**2**
Glicliazide		1					**1**
Glyceryl trinitrate			10				**10**
Half securon			1				**1**
Hyoscine butylbrom			2				**2**
Hypromellose			1				**1**
Insulin		1	1			3	**5**
Isosorbide mononitr.		1	2				**3**
Lactulose	1			5			**6**
Lansoprazole			1				**1**
Latanoprost						1	**1**
Levomepromazine			1				**1**
Levothyroxine	1	1	1				**3**
Lisinopril						1	**1**
Loperamide			1				**1**
Loprazolam			1				**1**
Loratadine						1	**1**
Losartan			1				**1**
Mebeverine				2			**2**
Meptazinol			1				**1**
Metformin	3						**3**
Methotrexate	1						**1**
Mirtazipine			1				**1**
Mometasone furoate	1						**1**
Montelukast			1				**1**
Movicol		1					**1**
Naproxen			1				**1**
Nasonex			1				**1**
Nefopam			1				**1**
Nicorandil				1			**1**
Omeprazole	1	2	5			1	**9**
Orlistat			2				**2**
Oxybutinin			2				**2**
Oxycodone	1						**1**
Oxycontin	1						**1**
Paracetamol		2	3	1			**6**
Paroxetine			2				**2**
Peptac			2				**2**
Persantin Retard			1				**1**
Pizotifen	1						**1**
Prednisolone			1		1		**2**

	Wrong dose/ strength	Wrong frequency	Omitted medicine	Wrong medicine	Wrong formulation	Other changes	Total number
Premarin			1				**1**
Premique			1				**1**
Propranolol		1			1		**2**
Promethazine	1						**1**
Pulmicort			1				**1**
Quinine sulphate	1		3			1	**5**
Ramipril			2				**2**
Ranitidine				1			**1**
Risendronate			1				**1**
Salbutamol			14		4		**18**
Salmeterol			1				**1**
Senna		1	1	2			**4**
Seretide	2	1	4	1	4		**12**
Simvastatin			2	1			**3**
Slow K			1				**1**
Sodium chloride			1				**1**
STAT doses						8	**8**
Symbicort			1				**1**
Synalar ointment			1				**1**
Tamsulosin			1				**1**
Temazepam		1					**1**
Terbinafine			1				**1**
Terbutaline			1				**1**
Tiotropium			2	1			**3**
Tramadol		1	1			1	**3**
Trazadone			2				**2**
Uniphyllin			1				**1**
Venlafaxine			1		1		**2**
Xalatan			1				**1**
TOTAL	23	17	147	23	12	33	255

7.7 Appendix VII. Recording of changes in the MR form

Patient nr	Drugs added to the list	Drugs removed from list	Doses changed	Frequencies changed	Other changes/ corrections	Total number of drugs on the list
1	0	0	1	0	0	4
2	0	1	0	0	0	2
3	0	0	1	0	1	3
4	2	0	4	0	0	6
5	0	2	3	1	1	7
6	1	0	1	9	0	9
7	8	0	1	1	0	9
8	2	1	0	1	0	9
9	0	0	0	0	1	14
10	1	0	1	1	1	10
11	1	0	1	1	0	6
12	0	0	2	4	0	10
13	2	0	1	0	1	5
14	11	0	0	0	0	11
15	6	1	1	3	0	9
17	0	0	4	5	0	5
18	0	0	0	0	0	0
19	1	0	2	7	1	8
20	7	0	1	3	0	10
21	4	4	3	2	0	18
22	7	0	0	0	0	7
23	2	1	1	0	0	12
24	1	0	2	1	0	3
25	15	0	0	0	0	15
26	0	2	1	0	0	8
27	0	0	0	0	1	6
28	0	0	0	0	0	8

Patient nr	Drugs added to the list	Drugs removed from list	Doses changed	Frequencies changed	Other changes/ corrections	Total number of drugs on the list
29	0	2	1	1	0	8
30	10	0	0	0	0	10
31	4	0	0	0	0	4
32	6	0	0	0	0	6
33	2	1	3	0	0	18
34	1	0	1	1	0	10
35	0	0	3	2	0	5
36	1	0	0	2	0	3
37	0	0	1	0	0	7
38	0	1	2	2	0	21
39	9	0	0	0	0	9
40	2	0	0	0	0	2
41	3	0	0	0	0	4
42	1	0	1	0	0	8
43	0	0	1	1	0	1
44	12	0	0	0	0	12
45	5	0	0	0	0	10
46	2	0	1	0	0	4
47	2	0	0	0	0	10
48	3	0	6	6	0	9
49	1	0	0	0	0	1
50	1	1	0	1	0	14
51	1	0	0	0	3	4
52	3	0	6	8	0	11
53	11	0	0	0	0	11
54	12	0	0	0	0	12
55	3	1	5	7	0	11
56	18	0	0	0	0	18

Patient nr	Drugs added to the list	Drugs removed from list	Doses changed	Frequencies changed	Other changes/ corrections	Total number of drugs on the list
57	7	0	4	3	0	11
58	17	0	0	0	0	17
59	0	0	2	3	0	3
60	1	1	3	7	0	10
61	1	3	6	6	0	10
62	0	1	0	0	0	1
63	0	0	2	4	0	4
64	0	0	1	2	0	4
65	1	0	0	0	0	2
66	15	0	0	0	0	16
67	2	0	2	2	0	4
68	5	0	0	0	0	5
69	0	0	0	0	1	1
70	0	2	3	2	0	8
71	1	0	2	2	0	3
72	12	0	0	0	0	12
73	1	0	5	3	0	6
74	0	0	1	1	0	1
75	0	0	0	0	1	4
76	2	0	0	0	0	2
77	9	0	0	0	0	9
78	3	0	0	0	0	3
79	5	1	2	4	0	15
80	1	0	1	2	0	3
81	5	0	5	5	0	10
82	0	1	0	0	0	11
83	7	0	0	0	0	7
84	0	0	1	1	0	2

Patient nr	Drugs added to the list	Drugs removed from list	Doses changed	Frequencies changed	Other changes/ corrections	Total number of drugs on the list
85	6	0	3	3	0	9
86	3	0	2	3	0	9
87	0	0	1	0	0	3
88	0	0	0	0	3	3
89	1	0	2	6	0	7
90	0	0	0	5	0	11
91	0	0	0	0	0	0
92	1	0	2	1	0	9
93	1	0	0	0	0	2
94	1	0	1	0	1	12
95	0	0	0	0	1	10
96	0	0	3	2	2	5
97	0	0	1	1	0	5
98	2	0	1	0	0	11
99	0	0	0	0	0	0
100	0	1	0	0	0	7
101	0	1	2	2	0	4
102	0	0	2	1	0	5
103	2	0	4	2	0	12
104	0	0	0	0	0	0
105	0	0	1	3	1	7
106	1	0	1	1	0	2
Total	**297**	**29**	**128**	**147**	**20**	**774**

Patient nr 16 is excluded from the table (see results)

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