Evaluation of the pharmacist role in discharge from hospital

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Abstract

When patients are discharged from hospital it is vital that the information regarding their medication is provided to the General Practitioner (GP) as accurately and efficiently as possible. However errors frequently occur and the NHS is currently investigating how to improve discharge systems, one approach is to use pharmacists to write discharge prescriptions or To Take Out (TTOs). The aim of the audit was to compare discrepancies on TTOs (To take out) between different transcribers: doctors, pharmacists and nurses and identify factors which are predictors of discharge discrepancies.

Discharge summaries written by different transcriber groups from three study wards at one hospital were selected. Discrepancies were identified by comparing the unauthorised TTO (TTO prior to final pharmacy check) to authorised TTOs, medical notes and prescription chart. Discrepancies were classified according to the CHUMS classification procedure. Logistic regression was used to identify predictors of discrepancies.

Two hundred and fifteen TTOs were included in the audit written by pharmacists, doctors and nurses (n= 85, 81 and 49, respectively). Nearly 50% of TTOs contained at least one discrepancy, the most common of which was omission of a medicine. The significant predictors of discrepancies were if a TTO was written by a nurse or a doctor or if there was more than three hours between an unauthorised TTO being authorised (Odds ratios were 3.45, 2.26 and 3.88, respectively).

Overall this study demonstrates the using pharmacist transcribers is at least as safe as previous systems and is unlikely to introduce additional discrepancies. Alternative approaches which support the healthcare team to work closer together at the time of discharge should reduce delays authorising the TTO and reduce discrepancies.

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Chapter 1

Hospital discharge in the UK

The number of people admitted to hospital over the past 10 years has increased from 11 million in 1998 to 13.5 million in 2008 (1). With increasing numbers of people being admitted to hospital, and most significant increase in the number of hospital beds both the length of stay and the discharge process need to be as efficient as possible in order to mange this workload. Moves towards economic rationalisation within the health care sector have put pressure on acute health care facilities to decrease hospital length of stay.

The average length of stay in hospital has reduced from 8.4 days in 1998 to 5.7 days in 2008 and this continue to reduce; although there is wide variation in length of stay between hospitals (2). However, approximately 5% of patients discharged from NHS hospitals are readmitted as emergency admissions within 28 days, indicating that they were discharged too soon (3). However there are many reasons that may cause readmission not related to premature discharge s~~i~~uch as poor patient adherence to medication and adverse social circumstances. Therefore, if reducing hospital stays is to be effective, discharge procedures must meet patient needs in order to avoid the potential adverse effects of a premature discharge. Pharmacists are usually the last healthcare professional to review discharge information, and therefore have an important role to play in preventing hospital readmission and medication errors.

1.1 The importance of hospital discharge

The discharge summary is the main communication between a hospital and the General Practitioner (GP) regarding a patient's discharge. However a number of problems have been identified with discharge summaries including lack of timeliness and a lack of information (4),. In addition, a 2009 report by the Care Quality Commission (CQC) identified that prescription errors and a failure to review a patients medication after discharge was the fourth most common complaint to the National Patient Safety Agency (NPSA) (5). Therefore there have been a number of attempts to improve discharge procedures from hospital.

1.2 Discharge planning

Discharge planning is not a new phenomenon, but was first suggested in the late 1800s by Lillian Wald (6). The term was officially introduced to the NHS in the 1960s as hospitals started to focus on reducing the length of hospital stays and minimising costs. Discharge planning then became a standard procedure.

Discharge planning is a routine process for healthcare systems in many countries (7), and it is an interdisciplinary process that helps patients and their families to manage at home following a hospital admission (8). The Cochrane Collaboration defined the discharge planning process as, *"the development of an individualised discharge plan for a patient prior to them leaving hospital for home"* (7).

The discharge process varies from hospital to hospital, and it is not entirely evidence-based (9). Its aims are: to reduce the length of stay; avoid unplanned readmissions; and to improve the co-ordination of services after discharge. It can be divided into the following steps (7):

1. Pre-admission assessment
2. Case finding on admission
3. In-patient assessment and preparation of a discharge plan based on individual patient needs
4. Implementation of the discharge plan
5. Monitoring

To achieve high quality discharge planning, the process should start before the patient is admitted to the hospital (10), and it should include the physical, psychological and social aspects of individual patient care (11).

Physical aspects consider the medical condition of the patient and include consciousness, pain, wound management and mobility. Psychological aspects include information about patient recovery at home in relation to their illness or procedure undertaken. They will consider the needs of carers or relatives, information about follow-up appointments and appropriate transfer of care arrangements. Social criteria comprise of suitable home transportation for the patient, and arrangement of suitable assessments in the home.

The Cochrane Collaboration conducted a systematic review of discharge planning including trials up to 2009 (7). They included 21 randomised controlled trials (RCTs) that compared individualised patient discharge plans with routine discharge plans. They identified that

discharge planning reduced length of stay and readmission rates, but its affect on mortality, costs and health outcomes remains uncertain. A meta-analysis conducted by Philips *et al.* which investigated the effect of comprehensive discharge planning compared to usual care in older heart failure patients additionally reported an improvement in survival and reduction in costs (12).

While comprehensive discharge planning is the aspiration for most hospitals, resource limitations have currently restricted its implementation. In most instances the discharge summary remains the single most important document to provide information to next clinician following a hospital discharge.

1.3 Development of hospital discharge summary

In the early 1970s, a discharge summary was divided into two documents: an initial report that was sent to the GP by post within approximately four days of patient discharge, and a final report that was posted to the GP to arrive within 19 days of discharge (13). Through the 1980s and 1990s, discharge summaries were mainly handwritten by junior doctors at the end of the patient's stay. The hospital sent a copy of the discharge summary by post to the GP, in addition to the patient being given a copy to hand deliver to the GP (14).

In the 1980s the discharge summary was generally composed of four sections: personal details; general practitioner information; information given to patient; and details of discharge medication (15). However, GPs felt that they needed more information to be included in the discharge report, such as consultant identification, diagnostic assessment,

information on drug reaction, and treatment on discharge. Accordingly, the information within the discharge summary was improved to satisfy the needs of GPs.

The increase in the amount of information contained within the discharge summary made it longer than the two pages it had previously been, which decreased its ease of use (14). Van Walraven, Rokosh conducted a study to examine the quality of discharge summaries and concluded that when a discharge summary concentrates only on discharge information and is written on a maximum of two pages, it is easier to use and delivered to the GP more quickly (16). Therefore to provide GPs with the information they require in a succinct format, details about a patient's medication formed the discharge prescription, sometimes called a To Take Out prescription or TTO. For the remainder of this report it will be referred to as a TTO.

Historically, the TTO was sent to the pharmacy where it was clinically checked to ensure all prescribed medication was appropriate for the patient. As part of this process medication that was no longer needed would be removed (17, 18). To help clarify any uncertainty with GPs it was recommended that a list of stopped medication also be included on a TTO (17).

Over time, the contents of the discharge summaries have changed as studies have examined their contents and quality. In 1999, Van Walraven and Rokosh (16) recommended that, in order to increase the quality of a discharge summary, it should contain: the admission diagnosis, which would clearly explain the reasons for admission and the patient's complaints; pertinent physical examination findings, procedures, and complications

encountered in the hospital; discharge diagnosis; discharge medication; active medical problems at discharge; follow-up appointments; and any relevant advice (19).

In the last ten years the concept of medicines reconciliation (MR) has been introduced. The Institute for Health Improvement (IHI) defined medicines reconciliation as "being the process of identifying the most accurate list of a patient's current medicines – including the name, dosage, frequency and route – and comparing them to the current list in use, recognizing and discrepancies, and documenting any changes, thus resulting in a complete list of medications, accurately communicated"(20). Consequently in 2008 The National Prescribing Centre (21) suggested that in order to complete the reconciliation process effectively, a minimum dataset needs to be given in a discharge summary when moving a patient from one health provider to another, and that this information must include:

1 Complete and accurate patient details i.e. full name, date of birth, weight if under 16 years, NHS/unit number, consultant, ward, date of admission, date of discharge

2 The diagnosis of the presenting condition plus co-morbidities

3 Procedures carried out

4 A list of all the medicines prescribed for the patient on discharge from hospital (and not just those dispensed at the time of discharge)

5 Dose, frequency, formulation and route of all the medicines listed

6 Medicines stopped and started, with reasons

7 Length of courses where appropriate (e.g. antibiotics)

8 Details of variable dosage regimens (e.g. oral corticosteroids, warfarin, etc.)

9 Known allergies, hypersensitivities and previous drug interactions

10 Any additional patient information provided such as corticosteroid record cards, anticoagulant books, etc.

Despite all the recommendations for the contents of a discharge summary, large variation still exists between hospitals and within hospitals (22). There is still no adopted consensus on what must be included (23, 24). If the right information is not included in a discharge summary it may have negative consequences for the patient.

1.4 Problems with discharge summaries

Inaccurate information in a TTO can mislead the GP, and may cause incorrect prescribing or even prescribing unwanted medicines. In 2008 it was reported that most discharge summaries details about medication were incomplete or inaccurate (25).

Traditionally, discharge summaries were handwritten documents transcribed from medical notes, which may explain the large number of problems identified and errors occurring within them (19, 26-28). When a patient is admitted to hospital, some or all of the items mentioned previously in Section 1.3 Should be documented and written in the discharge summary. Consequently, the GP should receive correct and clear information about their patient (14).

However, handwritten discharge summaries have been reported to be difficult to read or illegible, increasing the likelihood of errors (29). When writing is difficult to read it means it may not be used by healthcare staff in the future care of the patient (30).

The legibility of doctors' handwriting was examined by Lyons *et.al.* (31); comparing their writing with other healthcare professionals and administrative staff. The researcher contacted staff at three separate locations: the health authority headquarters, an accident and emergency department, and various departments in another hospital. They were asked to complete a form that contained boxes for the respondent's name, 29 alphabetical letters and digits from zero to nine. All 92 participants were requested to write as they normally would, as this was to be used as an example to examine their handwriting. The completed forms were scanned using the Teleform software package system, which translates handwriting to text for computer analysis, and highlights any poor, unreadable handwriting as an error. The study showed that the doctors' handwriting was generally poorer than other staff. Previously it has been suggested that doctors take less time reading and writing documents compared to other staff (32).

Handwritten discharges summaries often contain a number of errors, and several studies have mentioned that the most common error is missing information. Paterson *et al.* (33) conducted an audit by sending a questionnaire to family physicians to investigate the completeness of handwritten discharge summaries. They developed a standardised discharge summary form that was easy to complete; it included the minimum data needed by physicians, and was faxable. However, before completing the new form, physicians needed to be trained on the new design. The researchers were then able to judge whether or not the new standardised discharge summary was beneficial. They found it was easier to complete, took less time (as it was shorter than previous summaries), and was preferred by family

physicians. Paterson *et al.* also sent questionnaires to physicians to assess 166 discharge summaries (138 were received by family doctors); among them, 92% were legible and 88% were complete. The most common missing information was the doctor's signature, patient diagnoses, test results, medications in hospital and follow-up plans. In general, doctors preferred to receive standardised, well-structured discharge summary forms (19), and using such a form could increase the accuracy of the discharge summary because it would provide the hospital physician with specific spaces for information. This reminds the physicians to fill in all the potentially missing information on the form.

Many other problems arise with handwritten discharge summaries, mainly to do with the communication processes involved. Sometimes it takes more than three weeks after a patient is discharged for the summary document to be received by the patient's GP (34) and one study reported that 25% of discharge summaries sent by mail never reach the family practitioner(23). Potentially more serious than this initial delay is information that might be missing from the summary, which typically includes patient demographics, dosage details, and extra medication sheets missed during transcription (26). Many of these errors are not limited to handwritten discharge summaries and are not a consequence of poor handwriting, they are usually because of transcription errors (mistakes in copying information from in-patient notes/prescription charts to the TTO) (14, 26).

Normally, pharmacists and nurses are the practitioners who deal with discharge summaries, and so both are responsible for identifying any related medication errors in them. As hospital doctors usually have a heavy workload, they normally rely on either pharmacists or ward

nurses to complete and correct the discharge summary (35-37). However, if the writing is hard to read, then identifying the correct information will be difficult and time-consuming for those pharmacists and nurses. Nurses and pharmacists may misunderstand the information and write incorrectly on the TTO, which can cause errors in subsequent care. GPs still complain of low levels of accuracy in TTOs, and so some studies have recommended using a standardised paper form for typing the discharge summary but with a bar code for medication (17, 38). Others suggest a standardised electronic system that allows hospital staff to type discharge summaries. Both of these obviate the problems associated with handwriting (39).

1.5 Electronic discharge summaries

With the increased need for more accurate discharge summaries and improved communication with GPs, hospitals have started to utilise computer-based (typed) electronic discharge summaries (40-43). Schabetsberger *et.al.*(40) stated that communication between healthcare providers through paper-based (typed) discharge letters is too slow and inferior in quality and suggested that by using electronic communication the quality of the discharge letter will improve.

The national report "A Spoonful of Sugar" stated that the hospital discharge process should not be delayed now that a patient's medication details are available on request and at their bedside, improve the accuracy and the quality of discharge information, also to support dispensing for discharge schemes (44). As electronic communication is much quicker than by post, the discharge summary can be checked by the GP almost immediately. On the other hand, any fault in the electronic system/maintenance will delay the ability to view the

information. In addition the creation of an electronic discharge summary is still based on handwritten notes, so the information needs to be transcribed by medical or non-medical staff into a computer (19); this process still carries risks and medical errors may appear due to transcription process.

O'Leary conducted a study showing that using an electronic discharge summary improved the quality and timeliness of the discharge summary (45). A retrospective study comparing 966 handwritten discharge summaries with 842 electronically typed ones was carried out in an Australian metropolitan hospital (26). The medication sections on both types of discharge summary (hand written or typed) were transcribed from in-patient records. The study found that in the handwritten and typed medication sections, the transcription errors were equivalent; about 12% of the handwritten ones contained medication errors, against 13% for the electronic ones. Omission of information was found to be the most common error. Unfortunately, this study was only conducted on one single hospital, which means that the staff dealing with the discharge summaries mostly repeated the same errors each time. Also, there may be bias in comparing the handwritten system, which had been in use for a long time at this hospital, with a new electronic system, as the staff were unfamiliar with the new system and were therefore more likely to make some mistakes.

Another study (19) comparing handwritten discharge summaries with electronic ones was conducted, where 245 in-patient discharge summaries were examined for documentation; 151 (62%) were electronic and the remaining 94 (38%) were handwritten. They identified a 17% deficiency rate in electronic discharge summaries compared to 11% in handwritten

summaries. Thus, the study showed that the electronic discharge summaries were not necessarily of better quality than the handwritten ones (19).

As technology has improved more hospitals have adapted an electronic discharge process in an attempt to minimise errors and reduce delays. By 1 April 2010 hospitals should must deliver patient discharge documentation to the GPs within 24h after patient discharge (46).

1.6 Fully electronic discharge summaries

A fully electronic discharge summary is one that can be typed on a computer and sent electronically to doctors or other staff to be signed and then released. The processes involved in fully electronic discharge summaries vary between systems, but generally, an authorised sender (doctor, nurse, pharmacist) collates a patient's data, creates a virtual discharge summary, and after approval, then sends it electronically to an identified receiver via a secure web portal system (40). The receiver (doctor, nurse, pharmacist) then follows certain procedures to identify errors; s/he then sends an 'error status' response back to the sender or accepts and proceeds with the discharge summary (47).

With advances in computerised system technologies and in network services, the use of electronic discharge summaries should contribute to better services for patients and improved communication between healthcare providers (48). However fully electronic discharge summaries still have a number of potential limitations, such as the need for back-up systems in case of system failure (like power cuts, for example). Also, the use of an electronic system requires staff training, and electronic systems themselves will need updating and maintenance. There is also the problem of compatibility. Some systems may not be

compatible with others, whether in-house or external (34), and problems are still being reported with some of the programs used to create and write discharge summaries (49).

A review of the progress of electronic discharge summaries in 2007 by Craig *et.al.*(48) reported that fully electronic systems facilitate the exchange of information and the discharge process, saving time and resulting in discharge summaries being legible, and thereby reducing the chance of duplication and errors. However, building such a comprehensive system for displaying and communicating patient information between healthcare providers is expensive. To date, most hospitals in the UK have not been able to adopt a fully electronic system.

While there have been a number of developments in discharge summaries, it is clear that a number of errors or discrepancies still occur throughout the discharge process therefore it is important to explore these errors if systems are to be improved.

Chapter 2

Medication errors

The National Patient Safety Agency (NPSA) Report 2004 (UK) and the Institute of Medicine Report (IOM) Report 2000 (USA) both highlighted that medical errors cause a large number of deaths each year (50). These reports recognised that the majority of errors were not the result of reckless behaviour on the part of health care providers, but occurred as a result of the speed and complexity of the medication–use cycle.

Medication errors are the single most preventable cause of patient harm. Medication errors are broadly defined as any error in the prescribing, dispensing, or administration of a drug, irrespective of whether such errors lead to adverse consequences or not. The landmark IOM report estimated that errors in medical management lead to between 44,000–98,000 deaths in the US each year, though these figures have been questioned (51, 52).

The number of deaths from medication errors is increasing year on year, and many of these may be preventable (44). Medication errors can occur at any stage of the medication process, including prescribing, transcribing, dispensing, administering and monitoring (53). Alongside the heavy cost of life, the estimated financial cost for 450,000 preventable medication-related adverse events in American hospitals is $3.5 billion (51).

In the UK, the NPSA (body of the Department of Health) was established in 2001 with a mandate to identify patient safety issues and find appropriate solutions, by collecting

information on medication errors. The NPSA estimates that approximately 9% of in-patients are exposed to medication-related harm, and that most of these cases could be prevented. Between January 2005 and June 2006, there were around 60,000 incidents reported, estimated to cost the NHS more than £750 million (54, 55). The NSPA has also stated the number of reported medication errors is likely to be an underestimate of the total number, as many people may be unaware that an error has occurred, or they may be reluctant to report it (56).

One of the difficulties in this field is the variety of terms used in the definition and classification of medication errors. A more recent definition of medication error as: A failure in the treatment process that leads to, or has the potential to lead to, harm to the patient' has been proposed, along with a psychological approach to the classification of medication errors according to whether they are mistakes, slips, or lapses (52). The NPSA defines a medication error as: *"an error in the process of prescribing, dispensing, preparing, administrating, monitoring or providing medicine advice, regardless of whether any harm has occurred"*. Moreover, they classify medication errors under two groups: adverse events and near misses (i.e. where no harm has occurred or the incident has been averted).

2.1 Identification and classification

Medication errors can also be classified as psychological, modal, or contextual (57). The psychological classification explains events in terms of human factors, such as knowledge, instead of types of errors, which makes this inappropriate for this study. The contextual classification is concerned with the time and place of the error, and the medicines and people

involved in the incident, which does not cover all the aspects pertaining to medication errors in the discharge summary. However, the modal classification is concerned with classifying medication errors based on the ways in which those errors may have occurred, such as omission, repetition, or substitution.

Aronson classified medication errors in various ways: prescription faults, such as ineffective prescribing and under-prescribing; writing faults; formulation faults, such as the wrong strength; and dispensing and administering faults (58). Another classification system developed by Ferner and Aronson classified medication errors according to whether they are mistakes, which are errors in planning or action (these can be knowledge-based or rule-based); or slips and lapses, which are errors occurring during an action (slips through erroneous performance, and lapses through erroneous memory) (59). Many studies have classified medication errors based on study purpose, and examples of different medication error classifications are provided in Figure 1.

There are evidently many ways to classify medication errors. They can also be based on a wide variety of other issues: such as whether a medication error is present or potential; on severity; preventability and ameliorability; on the level of disability caused; on the stage of medication; or based on the personal responsibility of the healthcare physician (60). Dean classified medication errors based on severity to the patient. She divided the assessment of severity vis-à-vis medication errors into three methods: actual patient outcome; subjective assessment of potential patient outcome; and on proxy indicators.

The objectives for creating a new assessment system for medication administration errors (MAEs) are to select an appropriate scale for measuring MAEs, to find the minimum number of stakeholders needed to make judgements, to determine how the profession of those stakeholder judges will affect the scores, and to assess the validity of the stakeholders' scores. Ten doctors, ten pharmacists, and ten nurses from different hospitals are recruited in Dean's study. Fifty cases are sent to them to assess, through the scoring system, and they are asked to make further comments. To measure the validity of the scoring system, the cases include five classified as minor, five moderate, and six severe; this to allow them to assess the scoring system. Two weeks after receiving the cases, each respondent was then sent ten of the original cases for reassessment.

Dean suggested that if any four stakeholder judges (pharmacists, doctors and nurses) are used to score the severity of the medication error, then the scoring results should be generalisable to the results of any other judges from the same population.(61).

Finally, The Care Home Use of Medicines Study (CHUMS) (62) investigated the prevalence, types and underlying causes of medication errors at residential and nursing care homes in three areas of England. They classified the errors into prescribing, monitoring, dispensing and administration errors. Within each of these areas there was more detailed classification such as omission, unnecessary drug, duplication, incorrect drug or dosage. Since the current study is focused on prescribing errors, CHUMS classification provided the most comprehensive classification for prescribing errors compared to other errors reporting and it was suitable after some improvement and adopted to this audit as it cover all types that may

occur whilst prescribing or dispensing the medicines (see Appendix A for classification of discrepancies).

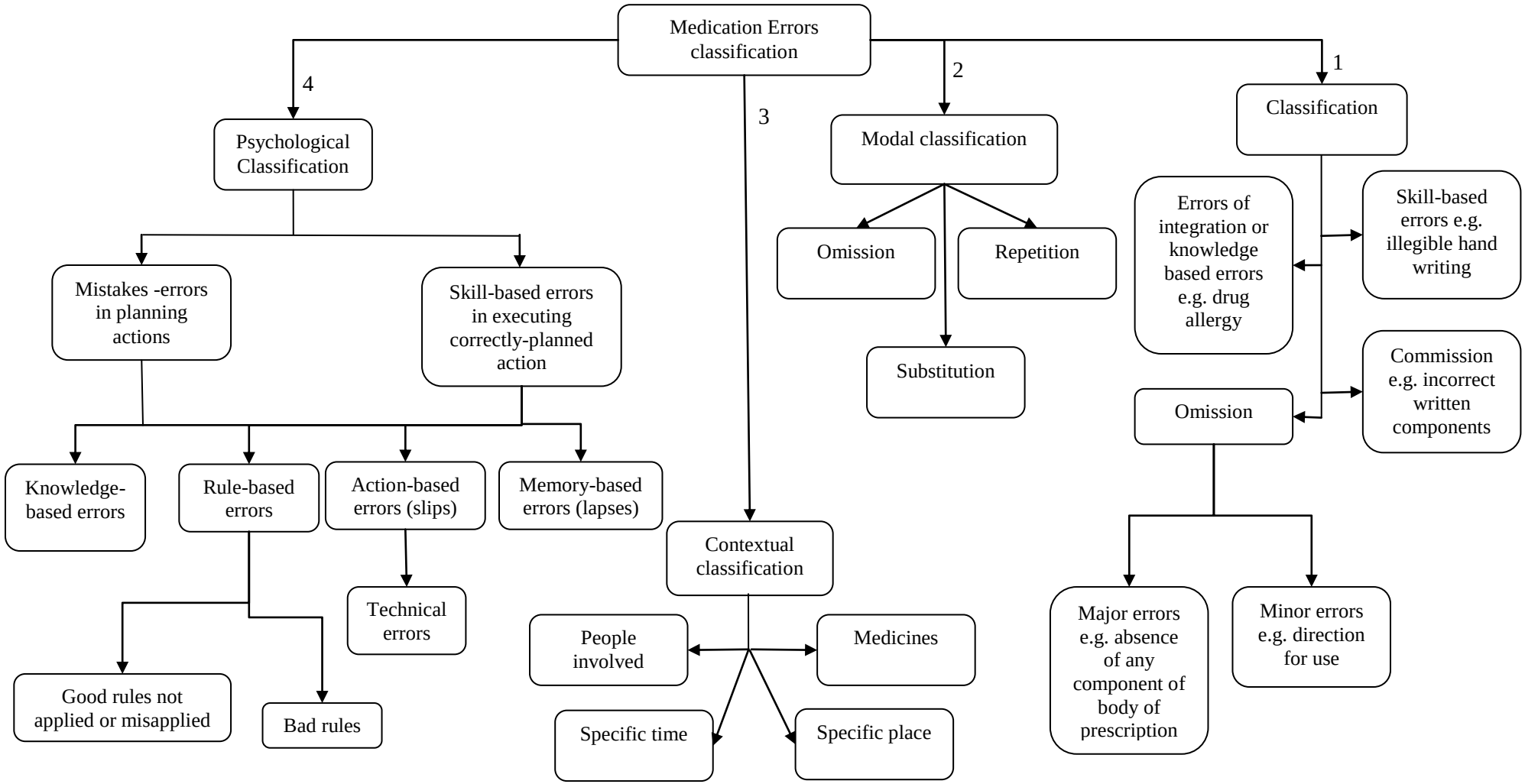

Figure 1 Examples of Medication Errors Classification Chart

2.2 Prescribing errors

Prescribing errors may be defined as the incorrect drug selection for a patient. Such errors can include the dose, quantity, indication, or prescribing of a contraindicated drug. Lack of knowledge of the prescribed drug, its recommended dose, or lack of patient details can contribute to prescribing errors. Other contributing factors include:

- Illegible handwriting.
- Inaccurate medication history taking.
- Confusion with the drug name.
- Inappropriate use of decimal points. A zero should always precede a decimal point (e.g. 0·1). Similarly, tenfold errors in dose have occurred as a result of the use of a trailing zero (e.g. 1·0).
- Use of abbreviations (e.g. AZT has led to confusion between zidovudine and azathioprine).
- Use of verbal orders(63).

In a four-week UK prospective study of 36,200 prescriptions, 2% were found to have a prescribing error, 25% of which were potentially serious (52). When only serious errors were examined, 58% of the errors originated in the prescribing decision and 42% in medication order writing. This distribution is different from that seen in non-serious errors. Of further concern was the fact that the majority of errors were made by relatively junior medical staff, who are responsible for the majority of prescribing duties in hospitals

2.3 Dispensing errors

Dispensing errors occur at any stage of the dispensing process, from the receipt of the prescription in the pharmacy to the supply of a dispensed medicine to the patient. Dispensing errors occur at a rate of 1–24 % and include selection of the wrong strength or product. This occurs primarily with drugs that have a similar name or appearance. Lasix® (frusemide) and Losec® (omeprazole) are examples of proprietary names which, when handwritten, look similar and further emphasise the need to prescribe generically. In the US, the Food and Drug Administration has insisted that the proprietary name of Losec® be changed as a result of a number of fatalities associated with this confusion. Elsewhere, the name Losec® remains. Other examples of pairs of drugs with similar names where confusion occurs include amiloride 5 mg and amlodipine 5 mg tablets. Other potential dispensing errors include wrong dose, wrong drug, or wrong patient, and the use of computerised labelling has led to transposition and typing errors which are among the most common causes of dispensing error(64) .

Approaches to reducing dispensing errors include(52):

- Ensuring a safe dispensing procedure.
- Separating drugs with a similar name or appearance.
- Keeping interruptions in the dispensing procedure to a minimum and maintaining the workload of the pharmacist at a safe and manageable level.
- Awareness of high risk drugs such as potassium chloride and cytotoxic agents.
- Introducing safe systematic procedures for dispensing medicines in the pharmacy.

2.4 Administration errors

Administration errors occur when a discrepancy occurs between the drug received by the patient and the drug therapy intended by the prescriber (52). Drug administration has long been associated with one of the highest risk areas in nursing practice, with the 'five rights' (giving the right dose of the right drug to the right patient at the right time by the right route) being the cornerstone of nursing education. Drug administration errors largely involve errors of omission, where the drug is not administered for a variety of reasons. Other types of drug administration error include an incorrect administration technique and the administration of incorrect or expired preparations (65).

Causes of administration error included a lack of perceived risk, poor role models, and lack of available technology. Mistakes tend to occur when drug preparation or administration involves uncommon procedures with causes including a lack of knowledge of the preparation or administration procedures and complex design of equipment. In contrast, a major error rate of 0·19% in 30,000 cytotoxic preparations has been reported, suggesting that medication error rates may be lower in situations where intravenous drugs are administered in specialised units (52, 65). While this rate may be interpreted as being low, if such a rate were to be extrapolated each year across a large clinical area, the numbers of patients affected would be significant. Contributing factors to drug administration errors include a failure to check the patient's identity prior to administration and the storage of similar preparations in similar areas (65).

Environmental factors such noise, interruptions whilst undertaking a drug round, and poor lighting may also contribute to these errors. The likelihood of error is also increased where more than one tablet is required to supply the correct dose or where a calculation to determine the correct dose is undertaken (52).

Approaches to reduce drug administration errors include (52):

- Checking the patient's identity.
- Ensuring that dosage calculations are checked independently by another health care professional before the drug is administered.
- Ensuring that the prescription, drug, and patient are in the same place in order that they may be checked against one another.
- Ensuring the medication is given at the correct time.
- Minimising interruptions during drug rounds.

Clinical pharmacists are key to ensuring the safe use of medicines, and the current system where wards are visited daily by clinical pharmacists places these professionals in a good position to recognise particular training needs that can be addressed (52).

2.5 Errors at discharge from hospital

Researchers have used many ways to detect errors, including direct observations, unannounced control visits, and chart reviews (38). Macaulay *et.al.* (66) ran a prospective audit for eight month intervals looking for errors in discharge summaries in the vascular surgical unit at the Aberdeen Royal Infirmary in the UK. They found that of the 637

discharge summaries, 63 contained errors. Of this number, 107 discharge summaries were produced by three consultants (2% of which contained errors), 200 were produced by one senior registrar (7% of which contained errors), 118 were produced by two registrars (10% of which contained errors), and 212 by senior house officers (junior doctors undergoing training within a certain specialty, 17% of which contained errors).

McMillan *et.al.* (14) ran a study to identify the severity of errors in handwritten discharge summaries. They compared the medications lists in referral letters from GP prior to admission with the medications used during admission. They then compared the medicines listed on a drug chart with the medications listed on the discharge summary and identified in any discrepancies. In that study, the errors were classified as potentially likely to cause readmission, potentially serious, potentially troublesome, and minor (unlikely to cause a significant problem). The study identified 222 medication errors; 24 (10%) as being potentially serious, and 4 (2%) as having the potential to cause readmission. The prescriptions were written by consultants, registrars, house officers and medical students; all of them made errors, in differing percentages, but the house officer score was the highest with 73 errors, and only one consultant wrote a prescription without errors. Many of the errors were preventable, and some of them had the potential to cause serious problems for the patient.

Although junior doctors makes more medication errors it can be seen that medication errors are not limited to junior doctors; even consultants can make them (66). When the medical team decided to send a patient home, a junior doctor usually took responsibility for writing

the discharge summary. It is clear that errors most often occurred when junior doctors wrote discharge summaries, more so than when consultants wrote them, so much care should be taken in reviewing a discharge summary before releasing it to the patient. As doctors were the main professionals who writes discharge summaries more than other professionals most studies were examined medication errors on TTOs written by doctors and no more study examined medication errors on other healthcare professionals TTOs.

2.6 Reasons for medication errors

To find appropriate solutions for medication errors, the researcher must find the root of the problems that cause medication errors to happen in the first place. There are many causes but most are related to pressured working environments, staff shortages, errors in patient medical histories, doctors with inadequate skills, knowledge or experience, and inadequate training to spot discrepancies (65). When doctors rely on pharmacists and nurses to identify and correct errors due to workload pressures, deficiencies in communication among the parties can ensue, leading to errors (37). Moreover, those being relied upon may misinterpret doctors' notes, compounding existing errors (65).

In order to overcome of medication errors, the healthcare professional roles (doctors, pharmacists and nurses) must be promoted to ensure appropriate involvement within the whole medication process. This may involve changes to the traditional role adopted by each healthcare professional.

Chapter 3

Role of pharmacist

3.1 Introduction

While traditionally doctors and dentists were the only prescribers of medication, now other healthcare professionals have gained prescribing rights. Pharmacist prescribing was first introduced in California in the late 1970s and was gradually extended to other American states. In 1998, pharmacists were allowed to prescribe under certain protocols in 17 states, and in Florida, pharmacists were able to prescribe from a limited range of medicines. In the late 1990s, Dr June Crown wrote her final report for the NHS in the UK regarding the supply and administration of medicines; she recommended extending the authority to prescribe to other professionals (pharmacists and nurses), claiming this would be beneficial for all health services (67). This authority to prescribe had been controlled so that each profession had a clearly specified range as to what could be prescribed. Previously, pharmacists in the UK were not allowed to write discharge prescriptions (TTOs), and doctors still had to sign and bear responsibility for the prescription (18, 68, 69). However, the role of pharmacists in the UK began to change in the late 1990s in order to provide better services to patients, and one suggestion at that time was for pharmacists and other healthcare professionals to be involved in transcribing discharge prescriptions (TTOs) (68, 70).

The initial results were positive; when pharmacists were involved in the discharge process and wrote discharge summaries, according to many studies, the pharmacists' intervention reduced the number of medication errors in discharge summaries (71). However, there is a

degree of variability between hospitals in the role of pharmacists writing discharge summaries for example each hospital has a different internal protocol for pharmacists to write discharge summary (68), and there is also variability in other healthcare professionals in accepting the new situation that pharmacists writing the discharge summaries for example some consultants may accept a medication 'transcriptions' signed by a pharmacist, especially one already prescribed by their team (72).

Hospital discharge is a part of general discharge planning, and pharmacists can contribute to each part with other professionals. The public conception of the pharmacy is that it involves dispensing at the point of discharge only; however, studies have shown that the pharmacist's role begins at the point of admission. Therefore, clinical pharmacists are in a position to help improve the discharge procedure by providing high quality information about the patient throughout his/her stay. Brady *et.al.* defined pharmacy discharge as: *"the discharge of a patient with the assurance that all pharmaceutical requirements including information are communicated in a safe, efficient and user-friendly manner"* (73).

Pharmacists have extensive and specialist knowledge regarding medication, and this allows them to intervene at various stages along the patient's medical progression:

1 Pre-admission (taking drug history) (74)

2 In-patient (pharmacy round and counselling) (75)

3 Out-patient pharmacy (dispensing and counselling) (75)

4 During discharge process (reviewing discharge medication, transcribing discharge medication and writing discharge summary) (76)

5 Post-discharge (extra counselling by phone (28, 77, 78) and home visits)

6 Community pharmacist (ensure medication adherence and regime) (79)

In general, one role of the pharmacist is medicine reconciliation and this study will concentrate on one part of medical reconciliation process which is the role of pharmacists in discharge. Pharmacists need more consideration regarding their role in writing discharge summaries, especially the section related to medication (the discharge medication list).

3.2 Involvement of pharmacists in discharge summary and discharge prescription

There has been positive feedback with regard to involving pharmacists in writing discharge summaries, encouraging those who work in pharmacy practices and pharmacy management to focus on the benefits when pharmacists write discharge prescriptions (TTO). Other professionals may produce safer TTO and so further studies maybe needed to compare TTOs written by pharmacists to those written by others (doctors and nurses), also the disadvantages of pharmacists writing a discharge summary need to be determined. The Audit Commission's report "A Spoonful of Sugar" recommended that the duties of clinical pharmacists should include prescribing TTOs, however a clinical pharmacist has less patient contact than doctor and nurse, therefore it is possible that the pharmacists may be more likely to omit medication which patient have received on the ward.(80). Many studies have examined this. Hobson, Sewell (81) developed a questionnaire based on a literature review and reported on the advantages of pharmacist discharge prescription (TTO) transcription services (PDPTS). The questionnaire included open and closed questions, which were designed to examine the overall impact of pharmacists writing discharge prescriptions (TTO). The questionnaire was sent to 206 NHS Trusts, and the response rate was 66%; 63%

of the Trusts had at least one prescribing pharmacist, and 44% did not have any prescribing pharmacists. However, in those Trusts that had prescribing pharmacists, those pharmacists wrote fewer than five prescriptions per day for their own wards. This study showed that early in 2002, as a percentage, pharmacists were not greatly involved in writing discharge summaries, and about 23% of prescriptions needed contact with a doctor, either to correct errors or to clarify medication changes (75). Woolfrey *et.al.* found that pharmacists prescribe drugs in 5% of cases after referral to a doctor, and in 10% of cases without reference to a doctor (82). It is clear that pharmacists should contact the doctor regarding some medication while prescribing TTO therefore the prescribing process may be a team work process rather than individual process and each professional (doctors, nurses and pharmacists) may contribute in writing or correction the TTO.

Marriott and Bessell (18) sent 167 questionnaires to 53 hospitals across Australia to explore the involvement of pharmacists in the discharge process. In each hospital, the questionnaire was sent to two doctors, four pharmacists, two nurses and two administrators. Three focus groups were created, and included pharmacists, doctors, nurses and administrators. Most of the responses were obtained from medium-sized hospitals, but most of the pharmacists who worked in large hospitals responded. The authors reported that the pharmacists' highest priority was discharge, compared to other healthcare professionals who rated discharge as medium-to-high priority. They also found that inadequate communication and transfer of information between all groups dealing with the discharge summary was clearly one of the weaknesses in the discharge summary process. In these hospitals, the focus group identified the pharmacist as the most suitable person to starts the discharge process and control the

whole discharge medication process. In general, the study stated that the increased involvement of pharmacists in the discharge process was generally accepted, however, the researchers provided four questionnaires for pharmacists but only two questionnaires for other staff, and this may derail the results.

Even though pharmacists pay more priority to the TTO among other professionals (doctors and nurses) it does not mean that they will not make mistakes while writing TTOs. Nevertheless, pharmacists currently contribute to the discharge process by checking the prescription, contacting the doctor prior to dispensing in order to clarify the orders, delivering medication to the patient, and counselling. Additionally, pharmacists in some large public hospitals provide post-discharge and hospital-community pharmacy liaison services (18).

Rahman *et.al*. conducted a study comparing discharge summaries written by doctors with those written by pharmacists. The study consisted of two phases. In Week One, the doctors wrote 128 discharge prescriptions (TTO), and in Week Two, the pharmacists wrote 133 discharge prescriptions (TTO). In Week One, all discharge prescriptions (TTOs written by doctors) were checked by the pharmacists before dispensing, and in Week Two, the doctors checked all the prescriptions written by the pharmacists for any errors before sending them to the normal dispensing process. The pharmacists made 755 interventions in the doctors' prescriptions, and the doctors made 76 interventions in pharmacists' ones (83). In its conclusion, the study stated that the pharmacists were better at writing discharge prescriptions (TTO); however, as the pharmacists have more experience in spotting errors, it

seems normal that they would spot errors in the doctors' discharge prescriptions (TTO). Also, the doctors may have had a heavy workload and were not able to spend sufficient time on spotting errors in the pharmacists' prescriptions in addition to low experience in spotting errors.

Other evidence shows that pharmacists are five times more accurate in writing discharge summaries than doctors, and that pharmacists' intervention can reduce drug-related-problems (DRP) (84, 85). Moreover, Wood argued that discharge planning is better when pharmacists write discharge prescriptions (TTO), and that medical and nursing staff prefer pharmacists to write discharge prescriptions (TTO). Wood also found that the estimated cost savings would be £3,900 every year for the two wards included in his trial because the pharmacists only requested medicines that were needed (75).

The involvement of pharmacists in the discharge process is problematic, as there is a shortage in the number of qualified clinical pharmacists who can be involved; also, it means that the workload of the pharmacists will be increased (18). However, increasing the involvement of pharmacists in the discharge process has some potential benefits for the health system. It will: decrease need to contact doctors to ask for permission to write a discharge prescription (TTO) or to ask for correction and clarification of a prescription; decrease time pressure for both doctors and pharmacists; decrease patient waiting time for discharge medication; discontinue medication that is no longer required; decrease the time needed to discharge a patient; improve bed availability (18); and, critically, decrease medication errors in discharge prescription (TTO) (68). Another suggestion mentioned is

that there is the chance to involve pharmacists, not only in the discharge process, but also in making advanced decisions regarding discharge.

The above studies are also a stimulus to further examine the possibility of pharmacy prescribing, and to assess the general view of all stakeholders (pharmacists, nurses and doctors) about transferring the responsibility of writing and signing discharge prescriptions (TTO) from doctors to pharmacists (advantages and disadvantages).

3.3 Pharmacist discharge counselling

Al-Rashed (86) *et.al.* conducted a study to evaluate the value of pharmacist counselling prior to discharge for 43 study and 40 control patients. They found that when a pharmacist counselled a patient about their medication and compliance, prior to discharge, it resulted in reductions in unplanned visits to the doctor and in readmission rates.

Pharmacy services provided to patients vary from hospital to hospital, and there are no standards for the provision of such services (87). Grimes *et.al.* conducted a trial examining the pharmacy services provided to patients by Accident and Emergency (A&E) departments from 36 public hospitals (87), by using semi-structured telephone interviews, and these showed that each hospital provides different pharmacy discharge services. One quarter 25% of the A&E departments reported that they delivered clinical pharmacy services, and 15% reported that pharmacists were involved in admission and in noting the patient's medication history. In one case, the hospital was able to communicate with the community pharmacy. However, there were marked differences in the location of the hospitals involved in the trial, and subsequently there were significant differences in the number of the cases admitted to

each hospital. Thus, those hospitals receiving high numbers of cases may not have been able to provide full clinical pharmacy services during discharge. Nevertheless, studies claimed that pharmacist discharge counselling shows promise in decreasing short-term readmission and decreasing medication errors, as well as decreasing drug side effects. However no study examined the benefit of nurse advice during discharge and it is affect on quality of discharge.

3.4 Post discharge counselling

Some studies have stated that providing post-discharge support, such as home visits or frequent telephone contact, when combined with discharge planning, reduces unplanned readmission (7, 88). As the discharge summary is part of the discharge planning process, and as pharmacists are involved in discharge summaries by transcribing the TTO, pharmacists may contribute to reducing hospital readmission, but further study needs to be conducted to prove this.

Schnipper *et.al.* conducted a randomised trial that included 178 patients, all of whom were discharged from the Birmingham and Women's Hospital, Boston (77). The intervention group received pharmacist counselling on discharge and a phone call follow-up three to five days after discharge. The control group proceeded through the usual care process-medications were reviewed by a ward-based pharmacist and the patients received medical counselling by a nurse at the time of discharge. The pharmacist interventions were focused on clarifying regimes, and potential and early side-effects, ensuring adherence, and providing patient counselling and/or physician feedback when possible. The result was that preventable adverse drug events (ADEs) occurred in about 11% of the patients in the control

group but these decreased to about 1% in the intervention group. However, in this study, the researchers' follow-up was based on updates from GP appointments via a standardised e-mail form. Consequently, those patients who visited their GP often and regularly may have had a better chance of eliminating medication errors due to more frequent GP advice.

Similarly, in Melbourne, Australia, Vuong *et.al.* conducted a trial that included 160 patients in each patient group, and they aimed to identify the pharmacy services that improved the continuity of patient care (89). The control group received standard care, which included discharge counselling, provision of compliance aids, and communication with healthcare providers if needed. The intervention group received standard care plus a home visit within five days of discharge in addition to a telephone call eight to 12 weeks after discharge in order to assess the impact of the intervention on adherence and medication knowledge. The study showed that adherence had improved in the intervention group, which minimised medication misadventure after patient discharge.

3.5 Community pharmacy

Community pharmacists should co-ordinate with other pharmacy services provided by secondary or primary care services to ensure that patients receive appropriate healthcare. This co-ordination should supply the community pharmacists with information that ensures continuity of the patient care process (90). Munday *et.al.* posted a questionnaire to all community pharmacists within the catchment area of Glasgow Royal Infirmary University NHS Trust. A high 94% of community pharmacists wanted to receive reasons for drug therapy changes, but most of them did not receive the desired information (90). Recently, studies have shown that GPs are still unaware of the supplementary role of community

pharmacists and their effect on healthcare services. Al-Rashid showed that 9% of GPs agreed that the community pharmacist should receive a copy of the discharge information (91). However, it seems that communication between hospital pharmacists and community pharmacists is weak (92), and this lack of information creates gaps in the information exchanged about a patient between the hospital and the community pharmacist. In general, current levels of communication between hospital pharmacists and community pharmacists vis-à-vis patient data are low.

Paulino *et.al.* conducted a trial that included 112 community pharmacists in several European countries: Austria, Denmark, Germany, the Netherlands, Portugal and Spain (93). They studied the effect of community pharmacist intervention in preventing and resolving drug related problems (DRPs). The patients were asked to identify DRPs through filling in a questionnaire. Among the 435 patients included in this trail, 277 were identified as having DRPs; and the community pharmacists recorded 305 interventions for DRPs in 205 patients. However, applying such a study in a group of countries, which may have very different healthcare systems, may have biased the results. Moreover, the community pharmacists only documented DRPs as provided by the patients, without clear explanations of whether or not these problems really were drug-related. However, this study reveals the effect of community pharmacists in reducing DRPs.

In general, community pharmacists need more information about patient medication, and the reasons for stopping or adding any new medications to a patient's list. Updating community

pharmacists with new diagnoses (if they change) will give them more knowledge and confidence in serving their patients.

At the end it is questionable whether involving pharmacists in discharge process can overcome many problems. For example both pharmacists and doctors waste time checking and correcting prescriptions; this increases the workload for both pharmacists and doctors (and for nurses as well), decreases patient satisfaction, increases the patient's waiting time for a prescription (75), and increases the hospitalisation period, consequently wasting financial resources. Such problems act as a stimulus for pharmacists to increase their involvement in the discharge process, and in particular in writing discharge summaries. Also, Cattell *et.al.* argued that when pharmacists transcribe discharge prescriptions (TTO), the dispensing time decreases from 240 to 177 minutes, which decreases the time of the discharge process from 460 to 322 minutes; this saves about £6 per patient through reissuing the patient's own drugs (PODs) (94). However most of the previous study investigated the role of pharmacists in hospital discharge by using questionnaires which is not reflect the true situation. Therefore more studies are needed to investigate the pharmacy role in writing discharge summaries by checking and comparing errors percentage appears on the discharge summaries that written by different transcribers (doctors, pharmacists and nurses).

3.6 Different healthcare prescriber

Historically, doctors were the only authorized professionals allowed to write discharge medications, they already cover knowledge and skills for prescribing during them study and trained for prescribing one year after their degree. However, motivations were raised to encourage other people to write discharge summaries (TTO). Those motivations includes, doctors were making errors while writing TTO. Increasing the doctors workload as they need to spend more time in diagnosing and treating the patients. The cost of prescribing was another motivation for involving other professionals in writing discharge summaries, as those other health professionals cost less in terms of wages. Tonna argued that the main driver for pharmacists prescribing in the UK is to make greater use of their pharmacological skills and specialization, which should make the prescribing system more flexible.

Legally, before, pharmacists in the UK were not allowed to write discharge prescriptions, and doctors still had to sign and bear the responsibility for the prescription (18, 68, 69). However, the role of pharmacists in the UK began to change in the late 1990s in order to provide better services to patients, and one suggestion at that time was for pharmacists to be involved in transcribing discharge prescriptions (70).

Subsequently, in the late 1990s, the Crown report recommended extending the authority to write a discharge summary to other health professionals. She removed the legal barrier for pharmacists to write discharge summaries (68). Since then, prescribing augments the GPs and both independent and dependent prescribers have been authorized and society now

accepts both pharmacist and nurses being involved in the new process of writing discharge summaries.

The prescribing activity and the health care includes are outlined below (95):

1 Independent prescriber (doctors, dentist, some nurse and pharmacists)

2 Patient Group Direction (PGDs), supply medication to a group of patient e.g. emergency contraception for females.

3 Supplementary prescriber (pharmacists, nurses, chiropodists/podiatrists, physiotherapists, optometrists and radiographers)

4 Specific exemptions foe example (registered midwife)

In order to be qualified for independent or supplementary prescribing doctors get training at Mandatory training and supported by their teams or pharmacists as they can prescribe from day one. Both pharmacists and nurses they should attend a higher education institutions prepare course for prescribing for example nurses supplementary must attended at least 26 days university tuition and 12 days of supervised practice learning in addition to self-directed study elements (96).

3.7 Local situation of Norfolk and Norwich University Hospital (NNUH)

Currently, at the Norfolk and Norwich University Hospital (NNUH) all admitted patients are given an estimated discharge date (EDD). At discharge the unauthorised discharge prescription can be prepared by doctors, pharmacists or nurses, depending on the ward. The unauthorised discharge summary is clinically checked by the pharmacy department and

authorised before the medication is dispensed and the patient discharged. The discharge summary is typically sent after the patient had left the hospital, so the hospital has started to provide a discharge prescription (TTO) copy for the patient to hand directly to their GP. In the hospital both manual and electronic systems are used to write the TTO. However, only electronic TTOs are included in this study.

There seems to be agreement that pharmacist must be involve in the discharge process with evidences strongly demonstrating that when pharmacists authorised or check doctor written discharge letters errors are significantly reduced. The change in legislation following the Crown report has provided the opportunity for pharmacists to independently prescribe discharge medicines without authorisation. The same legislation also enables nurses to prescribe independently. The effect of this change on discharge medication errors is unknown. Therefore the aim of this project is to determine whether this has changed the nature of discharge medication error in a positive or negative manner and to identify which factors are now predictors of discharge medication errors.

3.8 Aims and objectives

To compare the quality of discharge prescriptions (TTOs) written by doctors, nurses and pharmacists and adherence to audit standards.

3.8.1 Objectives

1 To determine the numbers of discrepancies in the TTOs between different transcribers (doctors, pharmacists and nurses)

2 To determine the relationship between type of transcriber and discrepancies

3 To determine the relationship between the discrepancies and the type of medication prescribed

4 To determine the relationship between the discrepancies and time that needed to authorised the TTOs

5 To determine the relationship between the discrepancies and patients age/number of transcribed medication

Chapter 4

Method

4.1 Audit approval

Before data collection commenced a research passport and appropriate approval for the audit was obtained from Research & Development department at the Norfolk and Norwich University Hospital Trust (NNUH).

4.2 Audit standards

100% of unauthorised discharge summaries contain no discrepancies identified by pharmacy when compared to authorised To Take Out (TTO) discharge summaries, medical notes and drug chart by researcher (see Appendix A for classification of discrepancies)

4.3 Audit method

The audit was carried out on three wards, A (Surgical), B (Urology/Elective cardiology) and C (Medicines for the Elderly) wards. These wards were selected because discharge prescriptions (TTO) are written by doctors, pharmacists and nurses and they cover a wide range of specialities. On these wards it is estimated that approximately 12 discharge summaries are transcribed by doctors, 12 by pharmacists and 3 by nurses each day. However the discharge rate between these three wards was different, this discharge rate difference because of the patient in ward B usually admitted with pre-plan medication process and therefore patients stay was short and the discharge rate was high. The length of stay is assumed to be shorter than Ward C because patients usually stay shorter in surgery than on

elderly wards thus a lower discharge rate was expected from ward C than ward B and ward A. It was therefore expected that fewer TTOs would be collected from ward C which is medicine for elderly.

Before starting the audit the researcher piloted 30 discharge summaries among them 10 were written by doctors, 10 by pharmacists and 10 by nurses in November 2010 to determine the feasibility of data collection. After piloting the audit no changes were made to the data collection sheet or audit method. The researcher undertook one week's training to understand the working procedures that existed within the hospital and to identify the best way to find the information needed to complete the audit. During the training the researcher spent time with a clinical pharmacist being shown how to identify discrepancies. A flow chart of the audit design is included in Figure 2.

4.3.1 Inclusion criteria

The inclusion criteria of selected participants are:

- Patient aged 18 or over years
- Patients who have been discharged with medication
- Wards, A (Surgical), B (Urology/Elective cardiology) and C (Medical for the Elderly)

4.3.2 Exclusion criteria

The exclusion criteria of selected participants are:

- Full notes and prescription chart not available at time of discharge

4.4 Unauthorised TTO: Audit of medication discrepancies in unauthorised summaries

This audit compares unauthorised TTOs (discharges summaries sent to pharmacy to be authorised) and authorised TTOs (discharge summaries ready to be sent to primary care). All discrepancies will be categorised for research purposes using the modification of errors classification adapted on Care Home Use of Medicines Study(62) (CHUMS). The CHUMS classification classified errors to omission, patient incorrect, unnecessary drug, duplication, allergy error/contraindication, interaction, dose/strength, and formulation error, frequency error, timing error, information incomplete, Medication Administration Record (MAR chart) transcription error, other and linked error. Within CHUMS classification the researcher divided the unexplained discrepancy into omission, extra medication dose/strength, duplication, formulation, frequency, timing and any other discrepancy while explained discrepancies were classified to addition, patient refusal

Unexplained discrepancies are the discrepancies that occur in TTOs without any clear reason for changes correctly in the available notes and are usually removed/corrected in the authorised TTO. These included omission (when the prescriber omitted any medication that already exist in patient documents), extra medication (when prescribed medication that is no longer used or needed), dose/strength (any discrepancy with dose or strength of the medication), duplication, formulation, frequency, timing and any other discrepancy that does not fit into one of the previous groups. Explained discrepancies are the discrepancies where the transcriber does know about the reason that produced the discrepancy and they include addition of a medication needed by the patient but not documented elsewhere and patient

refusal to take a medication previously prescribed but still written on the TTO. As unexplained discrepancies represent true discrepancies on TTOs, this study focuses on unexplained discrepancies during analysis.

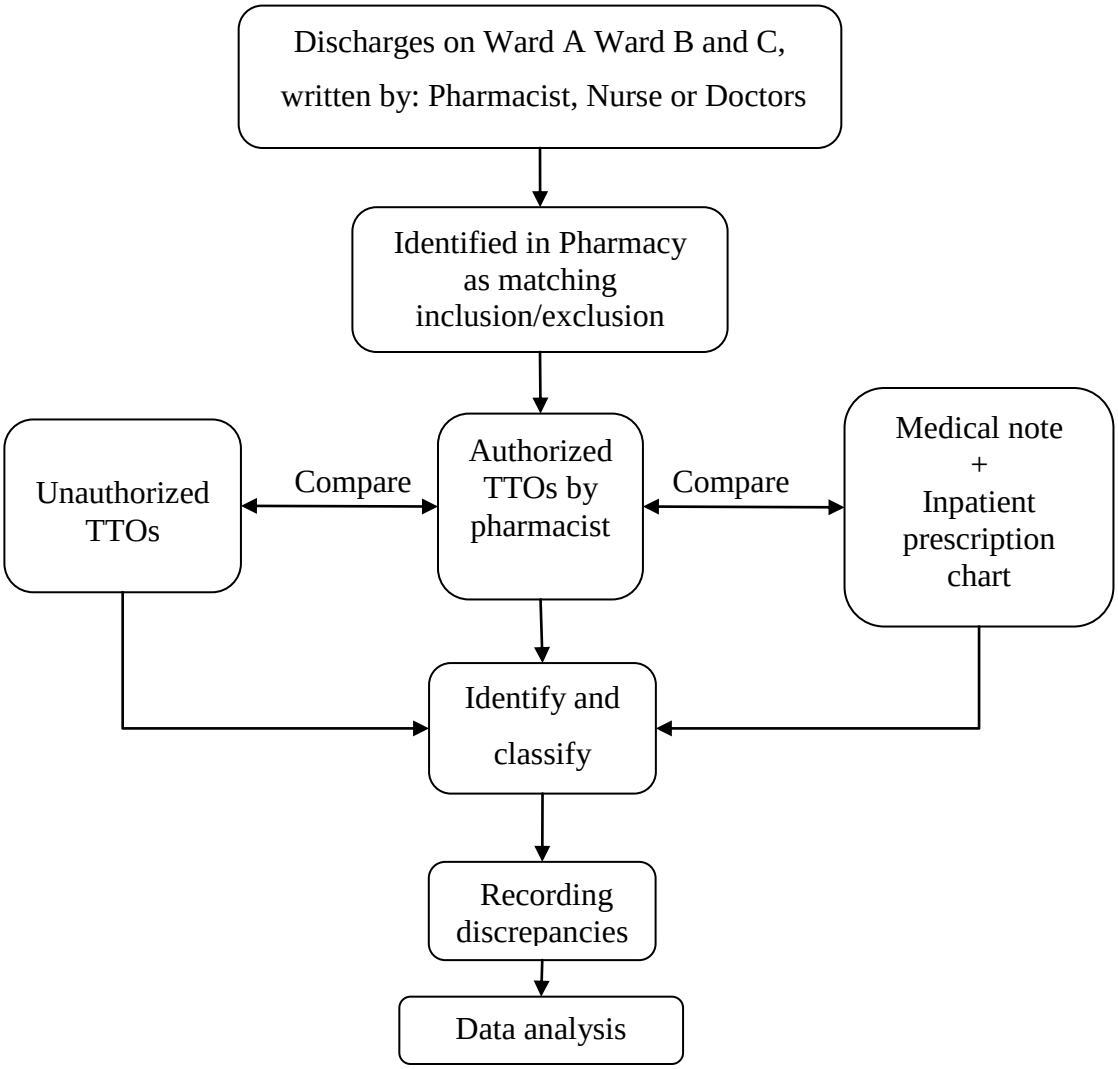

Figure 2 Research Design Flow Chart

4.4.1 Data collection

All original unauthorised discharge prescriptions (TTOs) were retained by the pharmacy department under current procedures (original unauthorised discharge prescriptions (TTOs) for data collection even if they are reprinted prior to dispensing due to significant changes during clinical check). During data collection these were not destroyed until they have been reviewed by the researcher. The researcher reviewed unauthorised discharge prescriptions (TTOs) between 1-3pm each week day. Every third TTO from each study ward, stratified by transcriber and meeting the inclusion criteria was selected for audit inclusion. For each included TTO, copies of the inpatient prescription chart and the last five days of their medical notes were taken and anonymised in addition to a copy of their authorised discharge summary. Dates of unauthorised discharge prescription (TTO) were extracted from the hospital's audit log held on the hospital's electronic records.

The researcher created an audit number for each patient, and for all included patients the following information obtained from the discharge summary, medical notes and inpatient prescription chart:

- Audit Number
- Time and date of admission
- Time and date of estimated discharge (EDD)
- Date of discharge
- Patient's age
- Patient's gender
- Number of regular medications

- Number of PRN medications
- Details of medicines prescribed
- Grade/Band of TTO transcriber (Accurate details of these were not available at the time of analysis)

This information was collected using a data collection sheet (Appendix B). The patient's hospital number and audit number were recorded on a separate encryption form (Appendix C) which was stored in the pharmacy department in the rare event that notes need to be referred back to at a later date. Only anonymised data on the data collection form left the hospital.

4.5 Sample size estimation

To detect a 20% of differences in errors based on assumption that the error rate in one group is 10% and the other is 30%; then data from 59 patients is required in each group to detect the differences with 80% power at 5% significant level.

4.6 Patient confidentiality and data storage

All patients were coded with an audit number using the encryption form (Appendix C) which links to patient identifiable information; this was stored in the pharmacy department under normal storage procedures. All documents used in this audit (unauthorized and authorized discharge prescriptions (TTO), medical notes, inpatient prescription chart) and any copies of them were stored in the hospital. Only encrypted data on the data collection sheet was taken

away for analysis. Once the audit is completed and data verified all copied data will be placed in the pharmacy department confidential waste.

4.7 Data analysis

Statistical analysis was carried out using SPSS 18. Patient demographics were described using descriptive data analysis.

Discrepancies identified in unauthorised TTO were analysed using, Chi-square analysis to compare the number and type of errors between each healthcare professional, ward location, patient gender and BNF chapters in the audit. Mann-Whitney U analysis was used for discrepancies according to patient's age and length of stay.

Logistic regression was used to identify predictors of unexplained discrepancies using the dichotomised dependant variable (discrepancies). All potential predictors were considered, scatter plots of ordinal data were used to identify if there was a linear relationship, in this instance all factors were entered in to the model. If there was no clear linear relationship variables were dichotomised at the point where the relationship changed. Within each level of factors the one with the lowest percentage of discrepancies was removed and used as a comparator. The final stage of backwards conditional logistic regression was reported as this is exploratory analysis to identify potential predictors.

Chapter 5

Results

5.1 Patients demography

The wards included in the audit A (surgical), B (urology/elective cardiology) and C (medicine for elderly) produced 624 TTOs. From these 227 TTOs were included in the audit, 12 were excluded because of missing information, the drug chart was missing from 3 patients and medical notes were missing from 9 patients. Therefore 215 discharge summaries which matched the inclusion/exclusion criteria were included in this audit.

Table 5.1 presents the demographic data for audit patients. It can be seen that there are differences between doctors, pharmacists and nurses in transcribing activity. On Ward B (urology/elective cardiology) pharmacists transcribed medication for more patients (93%) than doctors and nurses. Nurses transcribed for the most patients on ward A (surgical) (94%).

Regarding gender, in general there are more male patients seen in the audit than female patients. Pharmacists transcribed TTO's for more male patients than doctors and nurses, while doctors prescribed more TTO's for female patients than nurses and pharmacists. There is no difference in patient age between transcribers with the median age 73 years. Nurses transcribe more TTO's for patient with a longer length of stay. The longest time between writing the unauthorised TTO and the authorised one is with nurse transcribers, compared to pharmacists TTO which are automatically authorised at the time of transcribing.

Table 5.1 Comparison of discharge summaries by transcriber

Characteristics	Transcriber			
	Pharmacist (n=85)	Doctor (n=81)	Nurse (n=49)	Total (n=215)
Ward (N (%))				
Ward A	3 (3.7)	32 (39.5)	46 (56.8)	81
Ward B	78 (66.7)	37 (31.6)	2 (1.7)	117
Ward C	3 (17.6)	13(31.6)	1(11.8)	17
Female Gender (N(%))	19 (22.6)	31 (37.8)	26 (53.1)	76 (35.3)
Age (median(IQ))	70.0 (51.0-80.0)	75.0 (64.8-84.0)	74.0 (60.0-80.0)	73.0 (61.0-82.0)
Total Number of prescribed medication	473	535	349	1357
Median of medication (IQ)	5.0 (3.0-7.0)	6.0 (4.0-9.0)	7.0 (5.0-9.0)	6 (4.0-8.5)
TTOs with at least one discrepancy (N(%))	36 (42.9)	38 (47.0)	31 (63.3)	105 (48.8)
TTOs with at least one unexplained discrepancy (N(%))	11 (12.9)	24 (29.6)	20 (40.8)	55 (25.6)
Length of stay (day) (median(IQ))	2.0 (1.2-4.7)	4.5 (2.0-9.0)	7.0 (3.0-12.5)	4.0 (2.0-8.0)
Time between writing un-authorised and authorised TTO (hours) median (IQ)	0.0 (0.0-0.0)*	0.8 (0.3-3.1)	1.7 (0.7-5.0)	50 (25.0-75.0)

*Median (IQ) pharmacists write authorised and unauthorised TTO on the same time

Ward A is a surgical ward, patients tend to be abdominal aortic aneurysm (AAA), amputations, carotid endarterectomy (CEA) and endovascular abdominal aortic repair (EVAR) and common medicines used in this ward were Aspirin, Statins and antihypertensive

medicines. Ward B is a urology and most of the patients are admitted due to Trans urethral resection prostate (TURP), Trans urethral resection bladder tumour (TURBT), ureteroscopy and nephrectomy-kidney removal. In such ward the transcriber usually prescribes analgesic (paracetamol, codeine and oramorph), Dalteparin prophylaxis and antibiotic such as (Gentamicin and Co-amoxiclav). However ward C is medicine for the Elderly and the most common admissions were for Pneumonia, Urinary tract infection (UTI) and falls cases and the medication patients received was mostly Aspirin, Furosemide and Adcal D3.

The comparison of the medication types transcribed according to the British National Formulary (BNF) chapters between the transcribers is shown in Table 5.2. The most commonly transcribed medication comes from the central nervous system chapter (30%). The next most commonly transcribed medication was for the cardiovascular system (26%), where according to the table doctors write more medication from the cardiovascular chapter than the rest of the BNF chapters.

Table 5.2 Comparison of medication types (BNF chapter) Used by each transcribers

BNF chapter (Type of medication)	Transcriber			
	Pharmacist (n=473)	Doctor (n=535)	Nurse (n=349)	Total (n=1357)
BNF chapter of discharge medication (N(%))[a]				
Gastro-intestinal system	50 (10.6)	69 (12.9)	47 (13.5)	166 (12.2)
Cardiovascular system	91 (19.2)	168 (31.4)	89 (25.5)	348 (25.6)
Respiratory system	33 (7.0)	26 (4.9)	27 (7.7)	89 (6.3)
Central nervous system	161 (34.0)	156 (29.2)	93 (26.6)	410 (30.2)
Infections	35 (7.4)	26 (4.9)	23 (6.6)	84 (6.2)
Endocrine system	31 (6.6)	39 (7.3)	25 (7.2)	95 (7.0)
Obstetrics, gynaecology[b]	18 (3.8)	12 (2.2)	5 (1.4)	35 (2.6)
Nutrition and blood	12 (2.5)	16 (3.0)	14 (4.0)	42 (3.1)
Musculoskeletal[c]	21 (4.4)	7 (1.3)	9 (2.6)	37 (2.7)
Other [d]	21 (4.4)	16 (3.0)	17 (4.8)	54 (4.0)

[a]Only illustrated if prescribed more than 5% of the time, [b]and urinary-tract disorders, [d]e.g. Malignant disease and immunosuppression, musculoskeletal and joint diseases, eye, ear, nose, and oropharynx, skin, anaesthesia, [c]and joint diseases.

5.2 Transcriber

The wards in the study were surgical, urology/elective cardiology and medicine for elderly, all transcribers were trained in the same way pharmacist did prepare course, training and accredited to become a prescriber, doctors had the usual rotation and training to prescribe from day one and nurses had done their training and tuition to be a qualified independent prescriber

5.2.1 TTOs

Table 5.3 illustrates discrepancies according to type of prescriber based on total number of transcribed medication. From the table it is clear that pharmacists have fewer discrepancies

than doctors and nurses. The most common unexplained discrepancy is omission. The most common explained discrepancy was when a patient refuses to take medication but it was still transcribed in the TTO.

Table 5.3 Comparison of discrepancies to number of medication (Un-authorised TTOs)

Type of discrepancies	Total number of medication/professional				P-value*
	Pharmacist (n=473)	Doctor (n=535)	Nurse (n=349)	Total (n=1357)	
Unexplained discrepancies (N(%))					
Omission	8 (1.7)	17 (3.2)	16 (4.6)	41(3.0)	0.055
Extra medicine	5 (1.1)	11 (2.1)	7 (2.0)	23 (1.7)	0.411
Dose/strength (N(%))	1 (0.2)	5 (0.9)	1 (0.3)	7 (0.5)	0.073
Other[c]	1 (0.2)	12 (2.1)	6 (1.8)	19 (1.4)	0.006
Total no. of unexplained (N(%))	15 (3.2)	45 (8.4)	30 (8.6)	90 (6.5)	0.001
Explained discrepancies (N(%))					
Addition	3 (0.6)	12 (2.2)	0 (0.0)	15 (1.1)	0.004
Patient refusal	27 (5.7)	29 (5.4)	26 (7.4)	82 (6.0)	0.433
Total no. of discrepancies in unauthorised TTO (N(%))	45 (9.5)	86 (16.1)	56 (16.0)	187 (13.8)	0.004

[c]E.g. Duplication, formulation, frequency, timing and any other discrepancy, *Chi-square test

Table 5.4 compares discrepancies according to the type of prescriber based on the total number of discrepancies made by each transcriber. There are 43 patients that had more than one error in their TTO. It is clear that pharmacists have fewer discrepancies than doctors and nurses and doctors made the most unexplained discrepancies. Omission was the most common unexplained discrepancy and patient refusal the most common explained discrepancy.

Table 5.4 Comparison of discrepancies to transcriber (Un-authorised TTOs)

Type of discrepancies	Total number of discrepancies made by each professional				
Type of error	**Pharmacist (n=45)**	**Doctor (n=86)**	**Nurse (n=56)**	**Total (n=187)**	**P-value***
Unexplained discrepancies (N(%))					
Omission	8 (17.8)	17 (19.8)	16 (28.6)	41 (22.0)	0.159
Extra medicine	5 (11.1)	11 (12.8)	7 (12.5)	23 (12.3)	0.585
Dose/strength (N(%))	1 (2.2)	5 (5.8)	1 (1.8)	7 (3.7)	0.023
Other[a]	1 (2.2)	12 (14.0)	6 (10.7)	19 (10.2)	0.021
Total no. of unexplained discrepancies (N(%))	15 (33.3)	45 (52.3)	30 (53.6)	90 (48.1)	0 001
Explained discrepancies (N(%))					
Addition	3 (6.7)	12 (14.0)	0 (00.0)	15 (8.0)	0.349
Patient refusal	27 (60.0)	29 (33.7)	26 (46.4)	82 (43.9)	0.339

[a]E.g. Duplication, formulation, frequency, timing and any other discrepancy, *Chi-square test

5.2.2 Wards

Table 5.5 compares discrepancies according to the wards based on total number of medication transcribed in each ward. As shown in the table there are differences between the wards in number of medication that was prescribed ward A (surgical) has more discrepancies than ward B (urology/elective cardiology) and ward C (medicine for elderly). Across the three wards the most common unexplained discrepancy was omission. The most common explained discrepancy was when a patient refused to take medication but it was still transcribed in the TTO.

Table 5.5 Comparison of discrepancies to the wards (Un-authorised TT)

Type of discrepancies	Total number of medication transcribed in each ward				
	Ward A (n=602)	**Ward B (n=645)**	**Ward C (n=110)**	**Total (n=1357)**	**P-value***
Unexplained discrepancies (N(%))					
Omission	28 (4.7)	12 (1.9)	1 (1.0)	41 (3.0)	0.006
Extra medicine	12 (2.0)	7 (1.1)	4 (3.6)	23 (1.6)	0.119
Other[a]	18 (3.0)	7 (1.1)	1 (1.0)	26 (2.0)	0.036
Total no. of unexplained discrepancies (N(%))	58 (9.6)	26 (4.0)	6 (5.4)	90 (6.6)	<0.001
Explained discrepancies (N(%))					
Addition	7 (1.2)	8 (1.2)	0 (00.00)	15 (1.1)	0.508
Patient refusal	37 (6.1)	43 (6.7)	2 (1.8)	82 (6.0)	0.141
Total no. of discrepancies in unauthorised TTO (N(%))	102 (17.9)	77 (12.0)	8 (7.3)	187 (13.8)	0.004

[a]E.g. Duplication, dose/strength formulation, frequency, timing and any other discrepancy, *Chi-square test

5.2.3 Gender

Table 5.6 illustrates the type of discrepancies in comparison to medication used by gender. It is shown that there are differences in total number of unexplained discrepancies according to gender. Omission was the most common discrepancy and there was a greater proportion in discrepancies in female campier to male.

Table 5.6 Comparison of discrepancies to gender (Un-authorised TTOs)

Types of discrepancies	Total number of medication implicated with gender			
	Male (n=879)	Female (n=478)	Total (n=1357)	P-value*
Unexplained discrepancies (N(%))				
Omission	22 (2.5)	19 (4.0)	41 (3.0)	0.006
Extra medicine	11 (1.3)	12 (2.5)	23 (1.7)	0.119
Other[a]	14 (1.6)	12 (2.5)	26 (2.0)	0.036
Total no. of unexplained discrepancies (N(%))	47 (5.3)	43 (9.0)	90 (6.6)	<0.001
Explained discrepancies (N(%))				
Addition	8 (0.9)	7 (1.5)	15 (1.1)	0.508
Patient refusal	58 (6.6)	24 (5.0)	82 (6.0)	0.141
Total no. of discrepancies in unauthorised TTO (N(%))	113 (13.0)	74 (15.5)	187 (13.8)	0.004

[a]Only illustrated if discrepancy frequency lees than 5 of one of the following types (duplication, dose/strength formulation, frequency, timing and any other discrepancy), *Chi-square test

5.2.4 Type of medication (BNF chapter)

Table 5.7 compares the type of discrepancies according to medication used of each BNF chapter. As shown from the table there are a difference between discrepancy frequencies in comparison to BNF chapter with cardiology medicines having the highest percentage of unexplained discrepancies and most of these were omissions. Central nervous system medication is the most common explained refused of medication.

Table 5.7 Comparison of discrepancies to type of medication (Un-authorised TTOs)

Types of discrepancies	Total number of medication prescribed from each medication types (BNF chapter)					P-value*
	Gastro[1] (n=166)	Cardio[2] (n=348)	[3]Central- (n=410)	Other[a] (n=433)	Total (N=1357)	
Unexplained error (N(%))						
Omission	3 (1.8)	13 (3.7)	14 (3.4)	11 (2.5)	41 (3.0)	0.055
Extra medicine	3 (1.8)	6 (1.7)	6 (1.5)	8 (1.8)	23 (1.7)	0.411
Other[a]	4 (2.4)	7(2.0)	8 (2.0)	7 (1.6)	26 (2.0)	0.006
Total no. of unexplained discrepancies (N(%))	10 (6.0)	26 (7.5)	28 (6.8)	26 (6.0)	90 (6.6)	0.001
Explained discrepancies (N(%))						
Addition	4 (14.3)	4 (1.1)	3 (0.7)	4 (0.9)	15 (1.1)	0.004
Patient refusal	14 (8.4)	10 (3.0)	41(10.0)	17 (3.9)	82 (6.0)	0.433
Total no. of discrepancies in unauthorised TTO (N(%))	28 (17.0)	40 (11.5)	72 (17.6)	47 (11.0)	187 (13.8)	0.004

[1]Gastro-intestinal system, [2]cardio vascular system, [3]central nervous system, [a]e.g. infections, endocrine system, respiratory system, obstetrics, gynaecology, and urinary, nutrition and blood, musculoskeletal and joint diseases, ear, nose, and oropharynx and skin, [a]e.g. duplication, dose/strength, formulation, frequency, timing error and any other discrepancy, *Chi-squared test

5.2.5 Age and length of stay

Table 5.8 compares type of discrepancies to patient's median age and it is clear that there is no difference in discrepancy frequency in comparison to patient ages.

Table 5.8 Comparison of discrepancies to age (Un-authorised TTOs)

Types of discrepancies	Age (median(IQR))		P-value*
	Discrepancy	No discrepancy	
Unexplained discrepancies			
Omission	72.0(62.0-85.0)	74.0(58.0-81.0)	0.533
Extra medicine	78.0(68.0-84.5)	73.0(60.0-81.5)	0.240
Dose/strength discrepancie	75.0(60.0-81.0	73.0(61.0-82.0)	0.776
Other[a]	74.0(59.5.0-79.5))	73.0(61.0-82.5)	0.865
Explained discrepancies			
Addition	67.5(55.0-81.5)	74.0(61.0-82.0)	0.886
Patient refusal	73.5(62.5-81.0)	73.0(58.0-82.5)	0.912

[a]E.g. Duplication, formulation, frequency, timing and any other discrepancy, *Mann-Whitney test

Table 5.9 compares the type of discrepancies to the patient's median length of stay. The table shows a difference in discrepancy number in comparison to patient stay. Patient with long stay median (IQ) 9.0 (5.5-18.5) days have more dose and strength discrepancies than those patient who stay for a short time with median (IQ) 3.5 (2.0-8.0) days in hospital.

Table 5.9 Comparison of discrepancies to patient length of stay (Un-authorised TTOs)

Types of discrepancies	Length of stay/days (median(IQR))		P-value*
	discrepancies	No discrepancies	
Unexplained discrepancies			
Omission	5.0(2.0-12.0)	3.5(2.0-7.0)	0.173
Extra medicine	5.5(2.5-10.0)	3.0(2.0-8.0)	0.181
Dose/strength error	9.0(5.5-18.5)	3.5(2.0-8.0)	0.032
Other[a]	5.0(4.0-11.5)	3.0(2.0-8.0)	0.059
Explained discrepancies			
Addition	4.5(3.0-6.0)	4.0(2.0-8.0)	0.593
Patient refusal	4.0(2.0-8.5)	3.0(2.0-8.0)	0.076

[a]E.g. Duplication, formulation, frequency, timing and any other discrepancy, *Mann-Whitney test

5.3 Regression analysis

The logistic regression binary entered method was used to analyse the data related to unexplained discrepancies and the results were extracted from the Backward Conditional summary.

5.3.1 Factors predicting unexplained discrepancies

Table 5.10 illustrate the factors which may predict unexplained discrepancies. The unexplained discrepancies were the dependent variable. In this study there were many independent variables that may have a relation to the unexplained discrepancies. These variables include: gender, age, patient length of stay, the transcriber, wards, time difference between writing the un-authorised TTO and the authorised TTO and the number of medication that prescribed for each patient.

Table 5.10 Factors which may predict unexplained discrepancies

Factors	Total No. of patients	Patient had at least one unexplained discrepancy	% of patients had at least one unexplained discrepancies
Gender			
Male	139	31	22.3%
Female	76	24	31.6%
Age			
≤ 40	19	4	21.0%
41-49	15	1	6.7%
50-60	19	7	36.8%
61-70	38	9	23.7%
71-80	63	17	27.0%
≥ 80	61	17	27.9%
Length of stay/days			
1-3	105	17	16.2%
4-10	70	21	30.0%
11-30	35	14	40.0%
≥ 31	5	3	60.0%
Transcriber			
Doctor	81	24	29.6%
Nurse	49	20	40.8%
Pharmacists	84	11	13.1%
Wards			
Ward A	81	31	38.3%
Ward B	117	19	16.2%
Ward C	17	5	29.4%
Time difference between writing TTOs/hours			
0 hr	75	3	4.0%
0.1-1 hr	65	18	27.7%
1.1-3 hr	30	11	36.7%
3.1-10 hr	13	8	61.5%
≥ 10 hr	32	15	46.9%
No of medication/patient			
≤ 3	48	6	12.5%
4-10	143	37	25.9%
11-15	21	10	47.6%
≥ 16	3	2	66.7%

5.3.2 Grouping and comparator

Within each factor the researcher determined which variable should be entered into a regression model and within each level of factors the one with the lowest percentage with discrepancies were removed and used as comparator.

5.3.2.1 Gender

For gender the percentage of discrepancies with female patients was higher than male patients showing that the female patients are more likely to have unexplained discrepancies than male patients. Therefore gender was selected as independent factor to enter into regression analysis.

5.3.2.2 Age

Among 55 TTOs have at least one unexplained discrepancy, the total number of TTOs for patients who under 50 year was 34 and five of these have at least one unexplained discrepancy (15%). However, the total number of TTOs for patients who ≥ 50 year was 181 and 50 of these have at least one unexplained discrepancy (28%). Consequently, it is clear that there was a difference in the percentage of unexplained discrepancies between patients under 50 year and patients over 50 year. Therefore age was classified as a dichotomous variable.

5.3.2.3 Length of stay

For length of stay there is a linear relationship with percentage of unexplained discrepancies and therefore they were all entered in the regression analysis.

5.3.2.4 Transcriber

Previous research has suggested that pharmacists made less errors than doctors while writing discharge prescription (TTO) (83). In addition there was a different in the percentage of unexplained discrepancies between the prescriber. Therefore two prescriber (doctor and nurses) were used as variables in the logistic regression.

5.3.2.5 Wards

The percentage of unexplained discrepancies is different between wards. Therefore the type of the ward was elected as a variable to be entered into the regression analysis.

5.3.2.6 Time difference between writing un-authorised TTO and authorised TTO

As the gap time between writing the un-authorised TTO and the authorised TTO increases, the number of unexplained discrepancies also increased. The initial descriptive analysis Table 5.10 demonstrate a clear variation in the percentage of unexplained discrepancies between less than 3 hr (19%) and over 3.1 hr (15%) time gap. Therefore to clarify this relationship the time difference classified as two variables to enter into regression analysis.

5.3.2.7 Number of medication

The number of medication prescribed has a linear relationship with the percentage of unexplained discrepancies. Consequently, the number of medication was elected as a variable to enter to the regression method.

Table 5-11 reveal the group of variables that were entered into the regression analysis, all variables have value of 0 or 1 except gender which is had value 1 (male) and 2 (female). It is clear that when patient stay at hospital longer the probability of unexplained discrepancies to be appeared increased. From odds ratio it is clear that doctors and nurse likelihood to make unexplained discrepancies. When the time gap is increased between writing the un-authorised TTO and the authorised TTO the percentage of unexplained discrepancies increased and this was similar when there was an increase in the number of medication prescribed for the patient.

Table 5.11 Variables to be entered to regression analysis

Variables	P-value	Exp (B)
Gender	0.607	1.219
Age		
≥50	0.525	1.435
Length of stay/days		
4-10	0.694	1.187
11-30	0.202	1.970
≥ 31	0.151	4.389
Transcriber		
Doctors	0.139	2.124
Nurses	0.101	2.973
Wards		
Ward A	0.792	0.869
Ward C	0.744	0.788
Times difference between writing TTOs/hr		
≥ 3.1hr	0.005	3.177
No. of medication		
4-10	0.469	1.459
11-15	0.097	3.125
≥ 16	0.160	7.945

The binary dependent variable was the presence of at least one unexplained discrepancy or no discrepancy at all. Transcriber, times difference between writing the un-authorised TTO and authorised TTO and the number of medication (11-15 medicines/patient) were the predictors introduced within the model. Table 5.12 described the codes used on the analysis.

Table 5.12 Categorical codes employed in logistic regression model predicting unxplaned discrepencies

Category	**Code**
Transcriber	
Doctor	1
Non doctor	0
Nurse	1
Non nurse	0
Time	
Time difference between writing TTOs/hr ≥ 3.1hr	1
Time deference between writing TTOs/hr < 3.1hr	0
Medication	
Between 11-15 medication/patient	1
Other number of medication	0

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Table 5.13 Summary of the final step in the logistic regression analysis. Three significant predictors were identified. The model explains 21% of the variance in the model to predict unexplained discrepancies in TTOs.

Table 5.13 Summary for logistic regression model to identify predictors of reporting unexplained discrepancies

Variables	Beta (SE)	Wald	P-value
Constant	-2.29 (0.36)	41.67	<0.001
Age 50-60	0.97 (0.55)	3.2	0.075
Prescriber			
Doctors	0.82 (0.43)	3.70	0.054
Nurses	1.23 (0.46)	7.30	0.007
Times difference between writing TTOs/hr			
≥ 3.1 hr	1.36 (0.38)	12.64	<0.001
No. of medication			
11-15	0.91 (0.51)	3.12	0.076

Note R^2=0.10 (Hosmer & Lemeshow), 0.207 (Nagelkerke)

Table 5.14 Adjusted odds ratios for predictors of reporting unexplained discrepancies

Variables	95% Confidence interval for exp b		
	Lower	Exp b	Upper
Age 50-60	0.90	2.65	7.75
Prescriber			
Doctors	0.98	2.26	5.21
Nurses	1.40	3.45	8.46
Times difference between writing TTOs/hr			
≥ 3.1 hr	1.84	3.88	8.20
No. of medication			
11-15	0.91	2.47	6.73

Doctors and nurses are likely to makes unexplained discrepancies OR, 95% CI (2.26, [0.98-5.21]) and OR, 95% CI (3.45, [1.40-8.46]), respectively in comparison to pharmacists which is appeared statistically significant (P-value < 0.05). A time gap of more than 3.1 hr between writing the un-authorised and authorised TTO was appeared statistically significant to

increase the likelihood of unexplained discrepancies OR 3.88, 95% CI [1.84-8.20]. Patients who are prescribed > 11 medicines were more likely to have unexplained discrepancies, beyond 15 medicines, there is still an increase but less pronounced change, which was not statistically significant.

Chapter 6

Discussion

6.1 Summary of main findings

This was one of the first studies to investigate the discrepancies between hospital to take out prescriptions (TTOs) transcribed by different healthcare professionals in a UK hospital. The discrepancies were identified by an independent researcher who reviewed the original transcribed TTOs, known as the unauthorised TTO, which is the prescription that traditionally is checked and dispensed by pharmacy. The researcher used the final checked prescription, authorised TTO, drug chart and medical notes to identify discrepancies. Therefore the discrepancies identified are potential discrepancies and do not represent the final prescription that was actually given to the patient.

6.2 Selection of unauthorised TTO

The study was conducted as an audit and therefore data was collected retrospectively from TTOs written by different healthcare professionals and therefore it is more difficult to clarify the information. When designing the audit, consideration was given to try and minimise the variation in patient demographics in TTOs transcribed by different healthcare professionals. Ideally one ward would have been identified where TTOs are written by doctors, nurses and pharmacists because this would minimize variation between the patients. In this instance errors could then more clearly be attributed to the different professionals; unfortunately this was not possible. While doctors transcribe TTOs in all clinical areas, the situation was not the same for pharmacists and nurses. At the NNUH the pharmacists transcribe TTOs in

different wards in the hospital, mainly to improve turnaround times for discharge of patients. The focus has been ward areas where this has historically been problematic at the hospital, mainly urology wards and medicine for the elderly wards. Nurses only transcribe TTOs where there are nurse prescriber which is mainly on general surgical wards. Therefore, the only way to include a significant number of TTOs from each transcriber was to include urology/elective cardiology, a general surgical ward and medicine for the elderly.

In designing the study, attempts were made to maximise variation in the sample included, therefore all TTOs from the study wards were reviewed and every third TTO from each transcriber type (doctor, pharmacist or nurse) were selected. This was to minimise the chance of large number of TTOs written by the same transcriber at the same time being included. Therefore the types of discrepancy should vary and any effects of a transcriber having a 'bad day' minimised.

A sample calculation found that 59 TTOs from each transcriber was required to detect a 20% difference in discrepancies from a baseline of 10% discrepancies with one transcriber to 30% in another transcriber. In the available time, obtaining 59 TTOs from each transcriber group was thought to be feasible based on the predicted number TTOs to be written by each. However, nurses wrote less TTOs that could be included in the audit and so the required sample size for nurses was not achieved. The TTO's for pharmacists and doctors exceed the target for 59 as the audit was still running to try to achieve the sample size for nurses. Due to time constraints the audit was stopped with a total of 215 TTOs included, therefore the study was underpowered with respect to identify differences in discrepancies between transcribers.

When comparing this study to previous study results it appears this study is underpowered, however previous studies have included administration and monitoring errors in their results. This study shows only prescribing errors, this may explain why this study provides less discrepancies and therefore may not be underpowered.

Despite efforts to minimise variation in patient demographics this audit included significant intra and inter transcriber variation. While it is accepted that pharmacists are recognised as medicine experts (97) and their standard training, skills and knowledge may make them suitable for identifying discrepancies, however they do not usually follow a patient throughout their care and may not be completely familiar with their case when transcribing the TTO and consequently will mainly rely on the drug chart and medical notes. Nurses are trained to provide nursing care which traditionally focuses on assisting individuals with recovery to health (or peaceful death), while they are familiar with the patient they may be less familiar with medication. Doctors have the appropriate knowledge and training to diagnose and treat the patient. They are much closer to the patient and know the patients case more in depth than pharmacists, however they have less knowledge about medicines.

The traditional system of prescribing in hospital means that nurses and doctors look after the patients and write the TTO which then gets checked and authorised by the pharmacist (figure 3). However this system can cause a number of delays while the pharmacy department check the prescriptions and amend any errors, which decreases the efficiency of discharge. Allowing pharmacists to transcribe is believed to make this more efficient (see figure 3). However it is not known if using pharmacist transcribers, practitioners more distant from the

patients daily care, will affect discrepancies and hence the efficiency and safety of the discharge procedure. Overall this audit suggests that pharmacists make fewer discrepancies than other transcribers and consequently the newer system should be more efficient and safer. However this audit does not identify errors in authorised TTOs and therefore it is possible that when a pharmacist transcribed TTO is checked by the doctor and dispensed by the pharmacy department less errors are identified at this stage as these practitioners assume it is correct (pharmacists are usually the professional checking TTOs). While knowing which practitioners are more prone to discrepancies is important it is far more important to identify the best way for all healthcare professionals to work together to reduce errors.

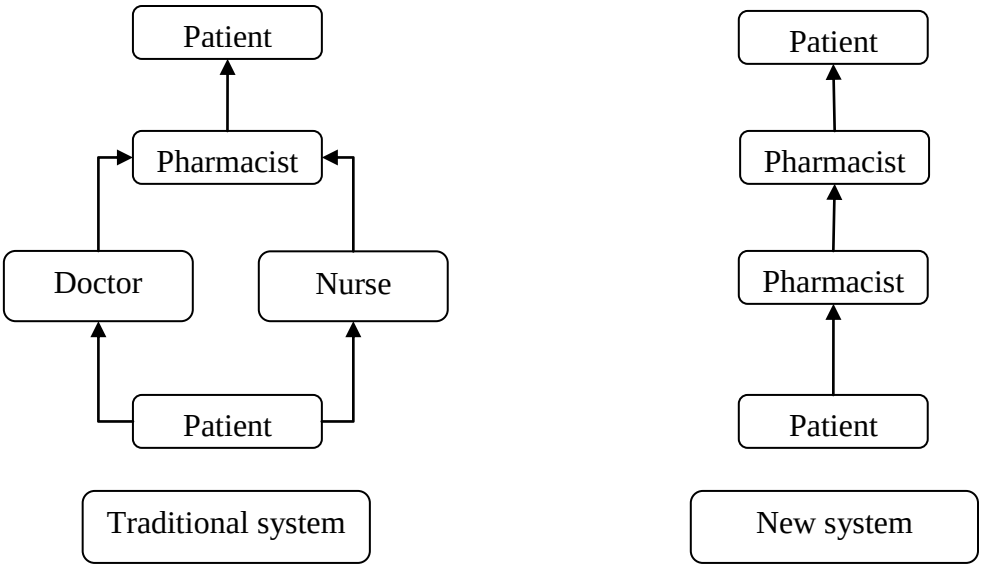

Figure 3 Old system and new approach in writing the TTO

Although not formally recorded this audit sample also included pharmacists with significant variation in experience, doctors from diverse teams, specialities, grade and experience, but only included a very small number of nurses. While the majority of doctors included were junior doctors, it is not appropriate to generalise these results across a whole profession. Low knowledge, experience and inadequate training for medical staff can produce discrepancies. For example, MacAulay *et al*. reported that the junior doctors make more errors when writing discharge summaries (17%) than consultants (2%) (65, 66).

As well as intra-transcriber and inter-transcriber differences, there were differences in the patient demographics that the three groups of transcriber wrote TTOs for. Participants were from different ward which are different specialities, therefore, suffering different conditions and receiving different types and number of medications and had varying lengths of stay. Consequently there was not equal spread of transcriber over the different patient types and it is hard to compare between these groups (14, 98).

6.3 Discrepancies

Medication errors are commonly found in discharge prescriptions (called now To Take Out (TTOs)). This type of error is one of the major reasons for mortality worldwide, and is the most common type of medical error, which undoubtedly affects the quality of care (99). This audit identified two types of discrepancies, explained and unexplained. The total percentage of discrepancies was 49% of these discrepancies 23 % were explained and 27% were

unexplained. All of the unexplained discrepancies identified in this audit were corrected before medication was dispensed to the patients.

When the number of discrepancies in the TTOs increases the chance that errors can reach the patient increases (100). A high rate of discrepancies in TTOs has significant implications for the patient and the hospital. For the patient's, medication errors may cause harm or even death (101), though often this is not the case. The patient's time is also wasted while waiting for TTO, if a number of discrepancies have to be checked and corrected this will also increases costs for the hospital (discharge delays) (76, 102, 103).

Delays in obtaining an authorised TTO may delay the release of beds which are required for new patients (104), thereby hindering hospital admission efficiency (105). Increase the length of stay (74) or even readmission to hospital due to errors which can also impact on bed availability. All of this also comes at a financial cost for the hospital (103), as well as being costly in terms of rankings and reputation which could have subsequent effects on the hospital.

Hospitals have tried a variety of approaches to reduce errors such as converting to electronic systems for admission, discharge, reporting patient cases, writing TTOs and introducing electronic transcribing (48). This study audited an electronic discharge prescription system, these do not automatically decrease discrepancies but merely change the type of discrepancies made from previous handwritten systems. Although that the electronic system

is facilitating the extraction of patient and medication information, however the user (e.g. training), computer and transcription factors still contributes to errors (19, 26).

This study identified a significant number of discrepancies in unauthorised TTOs, however the significance of the discrepancies was not reported. The CHUMS classification system used in this audit does not consider the significance of discrepancies. For example, an omission of digoxin for heart failure is more significant than an omission of paracetamol for a headache. Having neither a clinical pharmacist nor a computer system available, rating the significance of the discrepancies seen in the audit was not possible.

In comparison to the CHUMS study which included 256 patients in care home and recorded 153 discrepancies. The CHUMS study used three techniques to identify discrepancies; observation, interview and checking the discrepancies between patients' records. However, in this study the researcher checked the unauthorised TTOs against authorised TTOs, drug charts and medical notes. This study also looked for discrepancies that occurred while transcribing TTOs, while the CHUMS study errors were noted in the wider process and errors were recorded during the prescribing, monitoring, dispensing and administering processes. The environmental and methodology variations between this audit and CHUMS study may be responsible for the differences in the frequency of discrepancies between this study and the CHUMS study. Therefore, it is hard to compare, even though the same classification system was used. Despite of variation between this audit and other studies reporting medication errors in TTOs, the proportion of discrepancies that reported by this

audit is located within the range of general errors (4.2-82%) reported from a systemic review studies of previous studies (106).

Explained discrepancies are an intended addition or when a patient refuses their medication. These discrepancies are difficult to spot and may happen after the transcribers has written the unauthorised TTO. To identify these discrepancies the pharmacists need to clarify the details on the unauthorised TTO with the doctor. Unexpected addition of drug were classified as discrepancies because they were not documented, however, the reason for this being an explained discrepancy is because these are often added because the doctor would speak directly to the person writing the authorised TTO and would have agreed to add it and therefore it impossible to classify in any other way. In three cases doctors added medication that was not documented on the drug charts or medical notes, to TTO's written by pharmacists. Reasons for these additions included a reasonable patient request for medication such as painkillers, a change in the patient clinical condition or extra medication was required to those originally prescribed.

Patient refusal is any situation where it was documented that the patent refused medication throughout their stay and it was still written on the TTO. Often, if a patient refuses medication there is little hospital personnel can do to change their mind, therefore, it is questionable whether a patient refusal should be classes a discrepancy. Hospital policy at NNUH tells the pharmacists to "use their professional judgement and available sources of information to review the appropriateness of the current medication on the inpatient drug chart and intention to continue on discharge" (107). If they are unsure about removing a

refused medication, or making other amendments to the drugs they will consult a doctor. In some cases the patient's doctor still insists this medication is transcribed on the TTO. This may create wastage in the future as the General Practitioner (GP), may re-prescribe since the patient was discharged from hospital with that medication (108-110). Previous research into the discrepancies on TTO's have not discussed patient refused medications (during in-patient time). This audit has considered patient refusal. Since all the explained discrepancies are not always the fault of the transcribers and one could question if these should be classified as discrepancies. These were therefore excluded from the final regression analysis.

Of the unexplained discrepancies, omission was the most common. One reason for required medications being omitted is that they are missed of the admission prescription and admission notes (111). Other reasons for omissions are when medications are missed from the drug history or the drug chart. Omission can occur when necessary medication for the appropriate care of hospitalised individuals is not prescribed (112). Unexplained discrepancies have been explored further in the (section 4.4).

6.3.1 Discrepancies and wards

The audit, transcribing activity and discrepancies was noted to be different between the wards. For example, most of the omissions were produced from the surgical ward and nurses transcribe mainly in this location. Also, most of patient refusals appear on the surgical ward, as most medication in surgical ward includes antibiotic and painkillers. Painkillers are often refused by patients when they are not in pain or are concerned about addiction from pain

medication (113). There were a smaller percentage of discrepancies on the urology and elective cardiology ward. Most of the cases on this ward were admitted under a preadmission plan (114). Therefore, it could be that planned admission may be associated with fewer discrepancies.

Each clinical specialism varies in complexity and while this study did not capture the true nature of the complexity of each case, this may have contributed to the potential for discrepancies and variation between wards.

6.3.2 Discrepancies and length of stay

As the length of stay increased there were a greater number of discrepancies, particularly dose/strength discrepancies. A possible reason for this, is the longer a patients stays in hospital the larger their medical notes and the amount of information on their stay, this may make it harder for transcribers to identify and interpret the correct medication, dose and strength.

6.3.3 Discrepancies and type of medication

The audit included a wide variety of medication from the majority of chapters of the BNF. The frequency of prescribing the different types of medication is probably linked to the clinical specialism of the wards included in the audit, but also links to the common medicines prescribed on discharge from hospital (115). While the proportion of explained discrepancies was highest with central nervous system medication this is likely to be a result

of pain killers and the issues discussed in section 6.3.1. Medicines prescribed from the cardiology chapter of the BNF had the highest number of unexplained errors and further research is needed to understand the reasons for this. Possible explanations include patients with conditions requiring cardiology medicines are more complex; or that on non cardiology ward areas, these medicine are not considered by transcribers and thus results in more discrepancies.

6.3.4 Discrepancies and transcribers

Ideally, highly experienced transcribers (in the doctor, pharmacist and nurse groups) should make fewer mistakes. However, paying experienced professionals is more expensive than paying those with less experience. This audit consists of TTO's written by transcribers of varying levels of experience but analysis of experience was not possible. Therefore alternative considerations for variation in discrepancies need to be considered.

The audit was mainly reliant on the outcomes of the pharmacist's checks when authorising the TTO to identify discrepancies due to the limited clinical experience of the researcher. The study results show that fewer discrepancies were made by pharmacists but we should consider the potential for bias in this approach. Pharmacists checking TTOs written by other transcribers follow a standard approach to complete the clinical check which is completely independent of the transcriber. When a pharmacist authorises (clinical checks) a TTO written by themselves they are not independent of the process and in practice the doctors authorisation of this TTO is usually automatic, without following a full checking procedure

similar to the pharmacist's clinical check. Therefore pharmacists transcribed TTOs rely on pharmacy technicians performing a technician/dispensing check to identify any discrepancies. This audit has not investigated errors which were dispensed to the patient and therefore there may be more errors from pharmacist transcribing at this stage. Since authorisation of TTOs by pharmacists was conducted by a large number of pharmacists with varying levels of experience there may not be consistency in the number of discrepancies identified, even though the researcher tried to standardise this limitation.

Another consideration for variation in transcriber discrepancies could be the work environment. Factors such as noise, distractions and comfort may contribute to discrepancies not captured by this audit. In addition, the general workload and time constraints of the transcriber may influence their ability to focus on transcribing and consequently contribute to more discrepancies. Previous research has identified that because doctors are aware the TTO will have a second check by a pharmacist they don't always give their full attention to transcribing (65). Although in general, longer stays in hospital resulted in greater discrepancies, wards with particularly high turnover (short stay) may also contribute to discrepancies due to work load. Pharmacist on ward B (urology/elective cardiology, a short stay ward) made more discrepancies that other ward areas and in busy wards doctors often use alternative transcribers to save their own time (82).

Throughout this audit the variation between the patients is the likely to be the major reason for variation in discrepancies. Factors such as ward type, length of stay and type of medication have already been discussed but one must also consider the number of medication

prescribed. Patient prescribed more medication are at risk of more discrepancies as each individual medication could be incorrect. Nurses prescribed for patients with the highest median number of medications and they made the most discrepancies.

The final major consideration for variation in discrepancies between the different healthcare professionals is the professional skills, knowledge and training. Since pharmacists are used to identify issues with prescriptions, they may be better at transcribing them as they are familiar with the common problems that occur. Larkin *et al.* reported that 56% of prescriptions written by a doctor needed amendments when clinical checked by a pharmacist (116). In the only other study which has tried to directly compare different transcribers of discharge prescriptions (TTO), Rahman *et al.* identified that pharmacists made fewer errors than doctors however this study also had a number of limitations as the method of detecting discrepancies in each group was not the same (83).

6.4 Regression

To try to overcome lack of comparability between the groups, regression analysis was used to enable adjustments for potential predictors of discrepancies and identify the significant predictors of discrepancies in light of considering all other factors. Two significant predictors of discrepancies were identified following the logistic regression which was nurse transcribers compared to pharmacist and the time delay between writing the unauthorised and authorised TTO being greater three hours.

The first significant predictor of discrepancies was if there was a delay of more than three hours between writing the unauthorised TTO and it being authorised. It is hospital policy for ward pharmacists to check every unauthorised TTO. Once the TTO has been checked, the pharmacist must authorise it. The authorised TTO is then sent to the pharmacy to be dispensed if it cannot be dispensed on the ward. This means when a doctor or nurse creates a TTO, it should be held on the ward for a pharmacist to authorise. This policy has a direct impact on the time between the unauthorised TTO being created and the TTO being authorised. The time between unauthorised TTOs being authorised for doctors was 0.8 hours and 1.7 hours for nurses. TTOs created by pharmacists were authorised straight away, which incurred no delay to the subsequent activities (such as patient discharge). There are a number of possible reasons why a TTO may not be authorised for a long time, many of these are genuine delays such as: pharmacists are not available or the pharmacists are not contacted to authorise the TTO in a timely manner and a change in patient circumstances alters planned discharge and pharmacists are told not to authorise the TTO. It is also important to consider that the more discrepancies within an unauthorised TTO will result in the TTO taking longer to correct before it can be authorised, increasing the time between unauthorised and authorisation from the pharmacist.

When there is a long delay between an unauthorised TTO being authorised there is an increased chance of changes in the patient which will require other medicine changes. In addition, the original transcriber/prescriber will be harder to contact as they are less likely to be available with the TTO. This is why many hospitals offer an on call/bleep discharge pharmacy team to try to provide a more rapid discharge service and reduce the time between

unauthorised and authorised TTO (117). When TTO are not authorised by the usual ward pharmacist it is likely that the process will take longer as alternative pharmacists will be less familiar with the patients.

Secondly, when nurses write TTOs it seem that the odds of them making a discrepancy is three times more likely than if pharmacists had written the TTO. This may be a results of many reasons such as, the lack of experience that nurse have when writing TTOs, they may need more training, they may have other important work to do in the ward or they may rely on pharmacists to check the TTO prior authorisation. While the small sample size of nurses transcriber cannot make this result generalisable to nurses, other possible considerations should be made. Nurses transcribers were mainly working on surgical wards which may focus their attention on medication associated with the surgical procedures experienced by the patient. Therefore the majority of the discrepancies may be associated with the patients' long term medication which is not considered by the surgical team.

Finally, while doctors did not quite reach the usual convention for statistical significance they remained in the model and were two times more likely to have discrepancies than pharmacists. Other important predictors to consider from the model were patients prescribed between 11-15 medications or aged between 50 to 60 years has an increased change of discrepancies. Therefore future studies which investigate different transcribers of TTOs should consider these factors if a full randomised trial is not feasible.

6.5 Limitation of the study

This study found pharmacists making fewer discrepancies on discharge prescriptions (TTO) in comparison to doctors and nurses. However, a number of limitations mean that our results should be interpreted with caution.

Despite the researcher undertaking one week of training in spotting discrepancies and extracting information from patients medication documents at the beginning of the audit, there was still the potential for the researcher to miss discrepancies due to their limited clinical experience. Only the researcher reviewed the TTOs – having at least one other researcher review them, ideally with more clinical experience, would have increased the accuracy of the audit.

Pharmacists were aware of the audits aims and knowing that their TTOs were to be reviewed may have increased their attention to detail, thus affecting the results in favour of pharmacists making fewer discrepancies. Bias may have been introduced due to doctors and nurses being less aware of the audit, thus they did not give as much attention to detail as the pharmacists.

The training, experience (i.e. grades) and number of TTOs between the three groups of transcriber vary and cause confusion when making comparisons. Pharmacists are not eligible for qualifying as independent prescribers until two years post-registration and nurses have to have three years post-registration clinical experience. Pharmacist should have at least two

years experience in hospital pharmacy and/or a post-graduate certificate/diploma in clinical pharmacy in order to be able to write the TTO. Both pharmacists and nurses undergo a supervised twelve day prescribing course. Doctors are able to prescribe from day 1 of being a junior doctor.

Pharmacists will have learnt more about medicines than nurses throughout their career and by working in pharmacy, are likely to be aware of common discrepancies; their experience may make them less likely to make the same discrepancies. Nurses may also have been exposed to common discrepancies in their career prior to qualification as a nurse independent prescriber. Junior doctors may be disadvantaged in that they do not spend as long time on a particular ward (and area of medicine) than the pharmacists and nurses, and are less aware of discrepancies commonly made.

The audit does not necessary account for which transcriber group makes the most discrepancies when working independently; the transcriber groups may have sought help when transcribing from a colleague in either their own transcriber group, or another. It is well known that junior doctors are helped a lot by nurses in hospital, and pharmacists often comment that they help junior doctors with medicine related issues.

There was a only a small difference in the median number of medications transcribed from the three transcriber groups, however the three groups of transcriber predominately transcribed medicines from different BNF chapters (i.e. different types of medication). It is

difficult to say with certainty whether the results of this audit are related to these differences or the accuracy of the transcriber groups.

The three wards in the audit differed in their speciality and rate of admission and discharge, with a significant difference in patient length of stay. A different clinical circumstance on each ward, as well as an unequal number of TTOs reviewed by each type of transcriber from each ward, makes comparison between the three groups difficult. In some cases the maximum transcribed medication was twenty-four, with the minimum being one. In polypharmacy each medicine included has potential discrepancies, so transcribers prescribing larger quantities of medication intrinsically had more potential discrepancies

Chapter 7

Conclusion

Overall this study demonstrates the using pharmacist transcribers is at least as safe as previous systems and is unlikely to introduce additional discrepancies. However the variation in the sample and the methods employed limit the generalisaibility of the result and the conclusions which can be made. The regression analysis has however identified important variables which must be considered when designing any future studies. Nurse transcribers appear three times more likely to introduce discrepancies than pharmacist and therefore addition support is particularly needed for this transcriber group, since they cannot be reliant on the pharmacist second check all the time. Alternative approaches which support the healthcare team to work closer together at the time of discharge should reduce delays authorising the TTO and reduce discrepancies.

7.1 Recommendations

7.1.1 Recommendations for hospital

The main findings of this audit are supported by previous research, with promising results seen for pharmacists; they wrote fewer TTOs containing discrepancies in comparison to doctors and nurses. Therefore, it can be said that pharmacists should transcribe TTOs to improve patient safety, this is likely to lower costs and improve efficiency.

Many patients refuse to take one or more of their medications during their in-patient period. Despite this, transcribers still transcribe these medications on TTOs wanting the patients to go home with them. This study recommends that transcribers do not include such medication on TTOs and communicate the situation to the patients GP. Should a patient then decide that they will take their medication; the GP can prescribe it to them. This approach is likely to reduce medicine wastage.

Taking the drug history of patients at the beginning of admission helps prescribers prescribe appropriate medication and to stop medication no longer required. The drug histories ensure the continuity of medicines for those who are admitted with serious health problems and delays are avoided where patients are unable to remember their medication details or unable to communicate. The drug chart appears to be the key document in the transcribing of TTOs and therefore it is vital this is up to date and correct. Therefore hospitals should follow the recommendations for medicines reconciliation from National Patient Safety Agency/National Institute for Health and Clinical Excellence NPSA/NICE (118, 119).

It would appear that long delays in authorising TTO may contribute to an increased risk of discrepancies and therefore the faster the hospital can authorised TTO the fewer discrepancies should occur. Greater resources in rapid discharge teams may support this process.

7.1.2 Recommendations for further study

For future studies to identify the transcriber who produces the least discrepancies in TTOs a randomised controlled trial design would be ideal. However it is unlikely that this study design would be feasible, therefore future studies need to consider the important predictors of discrepancies identified in this study and control for them as far as possible (other than transcriber). This may be a matched cohort design where cases are matched retrospectively for patient age, number of medication, and as far as possible ward and clinical condition of the patient. It would also be more appropriate to consider the experience of the transcriber, however this may be best captured in an economic evaluation.

An additional study should consider the economics of different models of transcribing to determine the cost of the different transcribers and the discrepancies made. The most cost efficient service may use staff with higher salaries or experience because this results in less discrepancies or the converse may apply. Other factors to consider in an economic evaluation are the impact of patient refused medication and including this on a TTO.

The relationship between drug chart quality and TTO quality should be investigated as well as whether the drug charts contain all the required information to produce accurate TTOs. This further work to explore the benefit of medicines reconciliation is required.

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Appendix A

Classification of discrepancies

Table A-1 Classification of errors

Type	Code	Sub type	Code
(1) Omission	**1**	**Failure to prescribe a drug that has been previously prescribed or had been initiated by another health care professional and which was not intentionally stopped by prescriber, or failure to prescribe a drug that was clinically indicated**	**1 Drug is documented in drug chart and medical note**
			2 Drug is not documented in drug chart and medical note
(2) Patient incorrect	**2**	**Prescribing for the wrong patient**	**3**
(3) Unnecessary drug	**3**	**Prescribing a drug for which there is no indication. Note that not all diagnoses are always written in the notes. Excludes when residents and/or relatives put pressure on the GP to prescribe an unnecessary drug**	**4 Patient refusal**
			5 Extra medication
(4) Duplication	**4**	**Two drugs which have the same action are prescribed together in error e.g. generic and branded, two different statins, two different forms of the same drug. Excludes intentional prescribing e.g. anti-Parkinsonism drugs**	**6**

Table A-2 Classification of errors

Type	Code	Sub type	Code
(5) Drug incorrect	**5**	**Choosing the wrong drug e.g. when two drugs have similar names**	**7**
(6) Allergy error Contraindication	**6**	**Prescribing a drug for which the patient has a known drug allergy**	**8**
		Prescribing a drug which is contraindicated because of a coexisting clinical condition	**9**
(7) Interaction	**7**	**Prescribing a drug which may cause a serious drug interaction, unless this was a recognised risk and appropriate action taken to reduce risk e.g. if two interacting drugs were both considered essential for patient and dose adjustments had been made or a further drug added to address this**	**10**

Table A-3 Classification of errors

Type	Code	Sub type	Code

(8) Dose/strength error	**8**	**Prescribing a drug in a dose above or below that appropriate for that patient and/or for their clinical condition**	**11**
(9) Formulation error	**9**	**Prescribing a drug in a formulation that is unsuitable for the route of administration including modified release preparations for administration via a PEG tube**	**12**
(10) Frequency error	**10**	**Prescribing a drug for which the frequency is inappropriate and would result in a sub-therapeutic effect or risk of toxicity**	**13**
(11) Timing error	**11**	**Prescribing a drug for a time which is unsuitable for that preparation e.g. prescribing Simvastatin in the morning**	**14**
(12) Information incomplete	**12**	**Omission of strength for drugs available in more than one strength.**	**15**
		Omission of route for drugs that can be given by more than one route e.g. eye, ear and nose drops.	**16**
		Patient name omitted.	**17**
		Omission of maximum daily dosing frequency for an "as required " medicine when overdose could result in harm.	**18**

Table A-4 Classification of errors

Type	Code	Sub type	Code
(12) Information incomplete	**12**	**Omission of directions for correct administration (eg prescribing GTN tablets "as directed"**	**19**
(13) MAR transcription error	**13**	**Poor transcription on to the MAR by the prescriber which results in an error e.g. use of Latin abbreviations on MAR in a residential home**	**20**
(14) Other	**14**	**Record anything else that is not covered in the above**	**21**
(15) Linked error	**15**	**To be used if a prescribing error is linked to another error e.g. prescription and dispensing of penicillin to a penicillin allergic patient**	**22**

Appendix B

Data Collection sheet

Audit No: Age: Gender: Male ☐ Female ☐ date:___/___/_____ Time:
Prescriber: (1-doctor, 2 = nurse, 3 - pharmacist) Grade / Band: No of reg. medicines: ____ No. of PRN medicines: ___
Admission Date: ___/___/_____Admission Time: Discharge Date: ___/___/_____ Discharge Time:
EDD: ___/___/_____ Length of Stay: _____ days
Unauthorised TTO Date:___/___/____Unauthorised TTO Time: Authorised TTO Date:___/___/____Authorised TTO Time:

Unauthorised TTO information						**Authorised TTO information** TTO information				**Errors classification**						**No of errors/medication**
No	**Name**	**Dose**	**Frequency**	**Route**	**Duration**	**Dose**	**Frequency**	**Route**	**Duration**	**Error**		**Error**				
										Error	**Sub,type**	**Error**	**Sub,type**			
1																
2																
3																
4																
5																
6																

Authorised TTO information						Inpatient prescription chart / medical note discrepancies	Errors classification						No of errors/medication
TTO information							Error		Error				
No	Name	Dose	Frequency	Route	Duration		Error	Subtype	Error	Subtype			
1													
2													
3													
4													
5													
6													
7													

Audit No

Appendix sheet C

Encryption sheet

Audit No.	Hospital No.	NHS No.

Appendix D

Audit protocol

University of East Anglia

Norfolk and Norwich University Hospitals NHS
NHS Foundation Trust

Protocol

November 2010

Writing Discharge Prescription (TTO): An audit of different healthcare professionals

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1. Introduction

Medication error is one of the major reasons for mortality worldwide, and is the most common type of medical error. Medication error is defined as any error in the process of prescribing, dispensing or administering a drug, whether there are adverse consequences or not (1). In the United States, it is the eighth leading cause of death and is responsible for between 44,000 to 98,000 deaths each year (2). The consequence of medication error is – in many cases – the patient's life; with the financial cost for 450,000 preventable medication related incidents in American hospitals estimated to be US$3.5 billion each year (2).

In the UK, one of the divisions of the National Patient Safety Agency (NPSA), the National Reporting and Learning Services (NRLS), aims to improve patient safety and reduce risk to patients receiving NHS services through its national reporting system. They define a medication errors as "an error in the process of prescribing, dispensing, preparing, administrating, monitoring or providing medicine advice, regardless of whether any harm has occurred" (3). They classify medication errors into two groups: adverse events and near misses (meaning no harm was caused or the incident was averted). It is estimated that about 9% of inpatients are exposed to medication-related harm at some point, but most of these cases could and should be prevented (4). Between January 2005 and June 2006, the number of medication error incidents reported by NPSA was 60,000, a figure that costs the NHS more than £750 million a year (4). However there is probably significant under reporting of medication errors, often because staff may be unaware that medication errors have occurred (4).

At the time of hospital discharge, medication discrepancies, lack of information and clarity and inaccuracies in discharge summaries are common and may affect the quality of care (5). Callen *et al.*

performed a retrospective study of discharge summaries in an Australian metropolitan hospital in 2009 (6). They compared 966 handwritten to 842 typed discharge summaries. In both types of discharge summary the medication section had been transcribed from inpatient records. An independent review of these records identified 12.1% error rate in handwritten summaries and 13.3% in typed summaries. Consequently 25% of discharge summaries contained medication errors. The authors support the role of the hospital pharmacist in checking prescriptions to reduce errors. Similar results were identified in Canada (7) where approximately 25% of patients had adverse within five weeks of leaving hospital and in Ireland, a review of 139 discharges identified medication errors in 11% of prescriptions (5). Greater concern are the results from a study in Denmark (8) where the authors suggest there is a 75% chance of a medication error occurring in a discharge prescription.

In the UK research has been limited by small sample sizes, but they still highlight the problems of medication errors at discharge. A small study in Kent investigated medication errors during transfer of 43 patient from primary care to secondary care (9). This study examined the medication list before and during admission, the medication list used for dispensing by pharmacy and the medication list on discharge summary. Among 43 patients, medication errors were founded in 39 patients at one or more stages of the transfer of information between primary and secondary care. The above studies demonstrate that errors in discharge prescriptions are common and universal.

Pharmacist play an important role in checking patient medication before discharge and they detect most of the medication errors in discharge summaries (10, 11). In Landskrona hospital in Sweden, after the physician had completed the discharge summary, clinical pharmacists evaluated the discharge summary including the medication report by comparing it to a developed checklist. By giving feedback to the physician, this practice reduced medication errors on the final discharge summary by 45% (12). There

are numerous reasons why a discharge summary may contain errors when written by a doctor which include: routine violations of prescribing rules, work load pressures, miscommunication, deficiencies of knowledge or skill and moreover a reliance on pharmacists and nurses to correct errors (13). While pharmacy has always provided a second check to discharge summaries, there have recently been increases in the number of pharmacists and nurses who perform the transcribing role for medication on discharge summaries (14, 15).

Pharmacists are the medicines experts, and their training, skills and knowledge make them suitable to transcribe discharge prescriptions. On other hand nurses is taking a role in transcribing discharge summaries and reducing medication errors from 22 to 8%(120). While this process has been implemented in many hospitals to increase the speed of discharge, few studies have investigated the quality of these discharge summaries (17, 18). Rahman *et al.* compared discharge summaries written by pharmacists to those written by doctors (19). The study occurred in two phases; phase one (week one) doctors wrote 128 discharge prescriptions that were checked for errors by study pharmacists before going to the pharmacy dispensary for the usual checks and dispensing. In phase two the clinical pharmacist wrote 133 discharge summaries, these were checked for errors by the study doctors before being sent to pharmacy for their usual checks and dispensing. In the first phase there were 755 interventions, compared to only 76 interventions in the second phase. The authors concluded that pharmacists are better than doctors in writing discharge prescription. However the study design means that patient groups may not have been comparable and the identification of errors would have been limited in phase two as this does not form part of the usual work of a doctor.

Currently, at the Norfolk and Norwich University Hospital (NNUH) all patient admitted are given an estimated discharge date (EDD). At discharge the unauthorised discharge prescription can be prepared

by doctors, pharmacists or nurses, depending on the ward. The unauthorised discharge summary is clinically checked by the pharmacy department and authorised before the medication is dispensed and the patient discharged. The aim of this audit is to compare the quality of the discharge summaries written by different healthcare professionals. Although there are many systems used to classify errors (20, 21) the American Society of Health System Pharmacy (ASHP) provides a classification system (appendix 1) which is widely adopted (22) and will therefore be used in this audit.

2. Aim and audit standards

- To compare the quality of discharge prescriptions (TTOs) written by doctors, nurses and pharmacists and adherence to audit standards.

2.1 Audit standards

1. 100% of unauthorised discharge summaries contain no errors identify by pharmacy (authorised discharge summary) (see appendix 1 for classification of errors)
2. 100% of authorised discharge summaries contain no errors identify by researcher from medical notes and inpatient prescription chart (see appendix 1 for classification of errors)

3. Method

Appropriate approvals will be obtained before commencing this audit at the Norfolk and Norwich University Hospital (NNUH) on three wards A, B and C. These wards have been selected because between these wards they already have discharges written by doctors, pharmacists and nurses and cover a wide range of specialisms. On these wards it is estimated that approximately 12 discharge summaries are transcribed by doctors, 12 by pharmacists and 3 by nurses each day.

Pilot data collection will take place in November 2010 and 10 discharge summaries written by a doctor, pharmacist and nurse will be included. Following pilot data collection a total of 60 discharge summaries will be included in this audit. A flow charge of the audit design is included in figure 1. The inclusion and exclusion criteria of selected participants are:

Inclusion criteria:

- Aged over 18 years
- Patients who have been discharge with medication

Exclusion criteria:

- Full notes and prescription chart not available at time of discharge

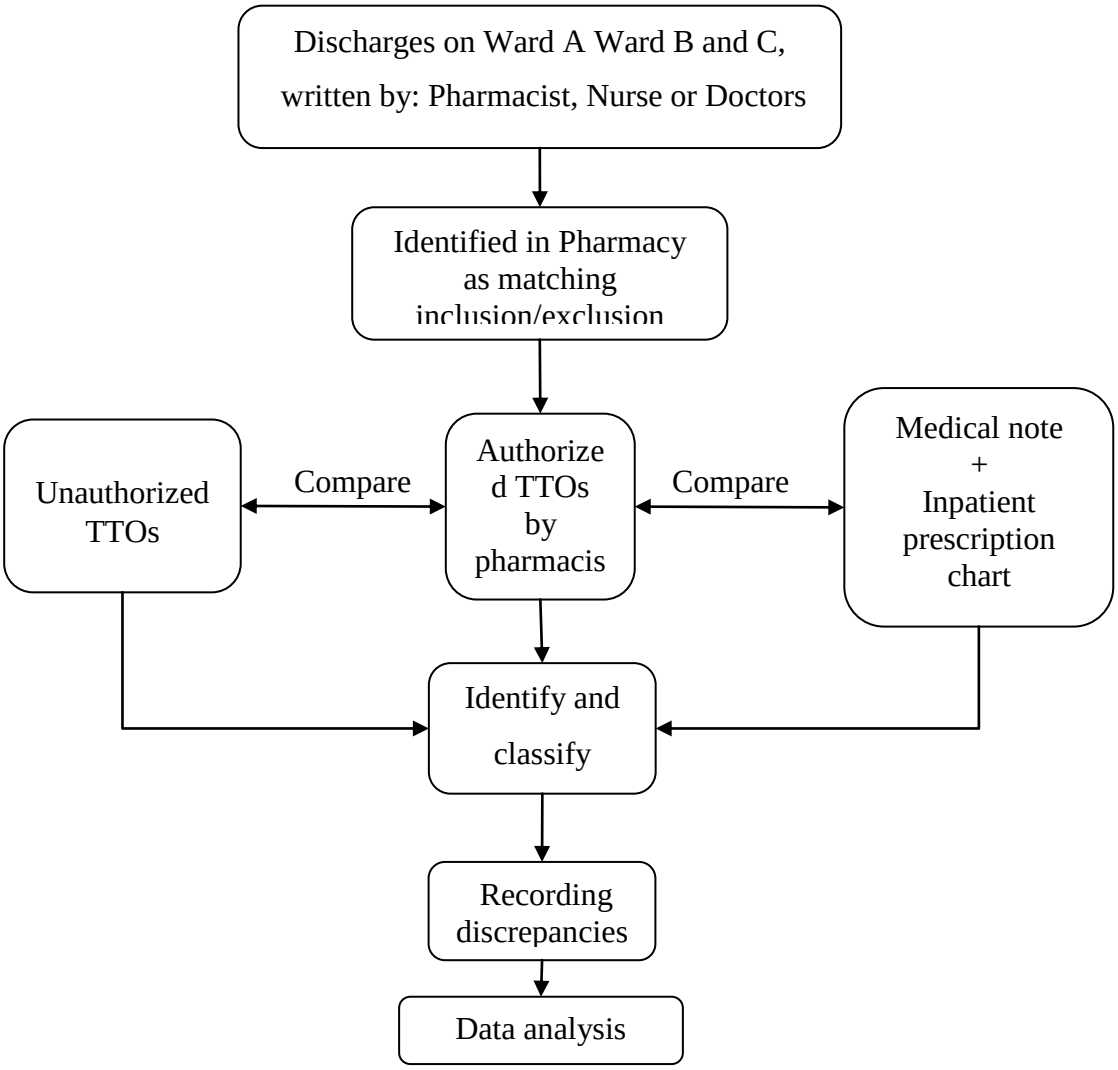

Figure 1 Research Design Flow Chart

The audit will be divided in to two phases.

3.1 Phase 1: Audit of medication errors in unauthorised summaries

An audit will be performed which compares unauthorised discharge summaries (discharges summaries sent to pharmacy to be authorised) and authorised summaries (discharge summaries ready to be sent to primary care). All errors/discrepancies will be categorised for research purposes using adapted ASHP classification (22).

Audit standards

3.1.2 Data collection

All original unauthorised discharge prescriptions will be retained by the pharmacy department following current procedures (Original unauthorised discharge prescriptions will be retained in data collection even if they are reprinted prior to dispensing due to significant changes during clinical check). During data collection these will not be destroyed untill they have been reviewed by the researcher. The researcher will review unauthorised discharge prescriptions between 1-3pm each week day. Every third discharge summary from each healthcare professional which matches the inclusion/exclusion criteria will be included in the audit. For each included discharge summaries copies of the inpatient prescription chart and last five days of their medical notes will be taken and anonymised in addition to a copy of their authorised discharge summary. Dates of unauthorised discharge prescription will be extracted from the audit log on the electronic hospital records.

For all included patients the following information will be obtained from the discharge summary, medical notes and inpatient prescription chart:

- Audit Number
- Time and date of admission
- Time and date of estimated discharge (EDD)
- Date of discharge
- Patient's Age
- Patient's gender
- Number of Regular medications
- Number of PRN medications
- Details of medicines prescribed
- Grade/Band of discharge prescription transcribe (obtained from consultation with hospital staff)

This information will be collected on a data collection sheet (appendix 3). The patient's hospital number and audit number will be recorded on a separate encryption form (appendix 2) which will be stored in the pharmacy department in the rare event that notes need to be referred back to at a later date. Only anonymised data on the data collection form will leave the hospital.

3.2 Phase 2: Independent audit of authorised discharge summaries

Utilising the same data and patients as identified in phase one. A researcher will compare authorised discharge summaries with the inpatient prescription charts and medical notes to

identify if any errors have occurred., Identified errors will be communicated to the clinical pharmacist and categorised for research purposes using adapted ASHP classification (22). A random sample of 10% of researcher audits will be verified by a clinical pharmacist for accuracy.

3.2.1 Data collection

No additional data will be collected in Phase two, all anonymised copies of medical notes and inpatient prescription charts will be stored in the pharmacy department for verification as required. Any errors identified in phase two will be reviewed by a senior hospital clinical pharmacist and appropriate action taken if necessary. A 10% sample of reviewed prescriptions will be verified for accuracy by a senior clinical pharmacist at the hospital.

3.3 Sample size estimation

The pilot will not allow detailed analysis of errors. This pilot is designed to determine the feasibility of data collection and determine if there is any significant bias in the patient populations discharge by the different healthcare professionals. It is anticipated that pilot data collection will take no longer than one week to complete.

To detect a 20% of differences in errors based on assumption that the error rate in one group is 10% and the other is 30%; then data from 59 patients is required in each group to detect the differences with 80% power at 5% significant level.

3.4 Patient confidentiality and data storage

All patients will be coded with an audit number using the encryption form (appendix 2) which links to patient identifiable information; this will be stored in the pharmacy department under normal storage procedures. All documents used in this audit (unauthorized and authorized discharge prescriptions, medical notes, inpatient prescription chart) and any copies of them will also be stored in the hospital. Only encrypted data on the data collection sheet will be taken away for analysis. Once the audit is completed and data verified all copied data will be placed in the pharmacy department confidential waste.

3.5 Data Analysis

Patient demographics will be described using descriptive data analysis and compared between different healthcare professionals using observation of the confidence intervals. Errors identified in phase 1 and phase 2 will also be described with descriptive statistics and compared using observation of the confidence intervals. Chi squared analysis will compare the number and type of errors between each healthcare professional in each phase of the audit.

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