

Medication details documented on hospital discharge: cross-sectional observational study of factors associated with medication non-reconciliation

Tamasine C. Grimes,^{1,2} Catherine A. Duggan,³ Tim P. Delaney,¹ Ian M. Graham,⁴ Kevin C. Conlon,⁵ Evelyn Deasy,¹ Marie-Claire Jago-Byrne⁶ & Paul O' Brien⁷

¹Pharmacy Department, Adelaide and Meath Hospital, incorporating the National Children's Hospital (AMNCH), Tallaght, Dublin 24, ²School of Pharmacy and Pharmaceutical Sciences, Trinity College, Dublin 2, Ireland, ³School of Pharmacy, University of London, 21 Russell Square, London WC1B 5EA, UK, ⁴Cardiology Department, AMNCH, Tallaght, Dublin 24, ⁵Professorial Surgical Unit, University of Dublin, Trinity College, Dublin 2 and ⁶Pharmacy Department, Naas General Hospital (NGH), Naas, Kildare, Ireland and ⁷Department of Medicine, NGH, Naas, Kildare, Ireland

WHAT IS ALREADY KNOWN ABOUT THIS SUBJECT

- Managing a patient's medication(s) at points around transfer of care is central to patient safety and high quality care.
- Medication use at these points carries the potential for miscommunication and medication error.
- Processes of reconciliation can help to reduce the prevalence of miscommunication and error, improve continuity of appropriate medication use and improve communication across different settings. However, such processes are resource intensive.

WHAT THIS PAPER ADDS

- Medication details documented at discharge from acute hospital care in Ireland frequently contain prescription writing errors or fail to communicate information regarding changes made during inpatient care (collectively referred to as non-reconciliations). This carries the potential to cause harm or unplanned re-admission.
- The medication classes that are more likely to be omitted at admission or discharge were identified, as were those involved in failure to document changes made during inpatient care, for example stopping or withholding.
- Patients experiencing chronic illness and using an increasing number of medications were identified as being at greatest risk of experiencing non-reconciliation, and it is recommended that processes of reconciliation should be prioritized for these patients.
- Processes that require the same medication details to be written more than once increase the likelihood of non-reconciliation.

Correspondence

Dr Tamasine C. Grimes, School of Pharmacy and Pharmaceutical Sciences, Panoz Institute, Trinity College, Dublin 2, Ireland.

Tel.: +353 1 896 2805

Fax: +353 1 896 2810

E-mail: tagrimes@tcd.ie

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AIMS

Movement into or out of hospital is a vulnerable period for medication safety. Reconciling the medication a patient is using before admission with the medication prescribed on discharge, and documenting any changes (medication reconciliation) is recommended to improve safety. The aims of the study were to investigate the factors contributing to medication reconciliation on discharge, and identify the prevalence of non-reconciliation.

METHODS

The study was a cross-sectional, observational survey using consecutive discharges from purposively selected services in two acute public hospitals in Ireland. Medication reconciliation, potential for harm and unplanned re-admission were investigated.

RESULTS

Medication non-reconciliation was identified in 50% of 1245 inpatient episodes, involving 16% of 9569 medications. The majority of non-reconciled episodes had potential to result in moderate (63%) or severe (2%) harm. Handwritten rather than computerized discharges (adjusted odds ratio (adjusted OR) 1.60, 95% CI 1.11, 2.99), increasing number of medications (adjusted OR 1.26, 95% CI 1.21, 1.31) or chronic illness (adjusted OR 2.08, 95% CI 1.33, 3.24) were associated with non-reconciliation. Omission of endocrine, central nervous system and nutrition and blood drugs was more likely on discharge, whilst omission on admission and throughout inpatient care, without documentation, was more likely for obstetric, gynaecology and urinary tract (OGU) or respiratory drugs. Documentation in the discharge communication that medication was intentionally stopped during inpatient care was less likely for cardiovascular, musculoskeletal and OGU drugs. Errors involving the dose were most likely for respiratory drugs.

CONCLUSIONS

The findings inform strategies to facilitate medication reconciliation on discharge from acute hospital care.

Introduction

The period when patients move in and out of hospital is recognized as a vulnerable time for medication safety because non-intentional changes to medication and lapses in communication are common and can result in patient harm or unplanned utilization of healthcare resources [1–5]. Medication reconciliation was defined by the Institute for Healthcare Improvement (IHI) in the United States (US) as ‘the process of obtaining and maintaining an accurate and detailed list of all prescribed and non-prescribed drugs a patient is taking, including dosage and frequency, through all healthcare encounters and comparing the physician’s admission, transfer, and/ or discharge orders to that list, recognizing any discrepancies, and documenting any changes, thus resulting in a complete list of medications, accurately communicated’ [6]. In the United Kingdom (UK) (2007), the National Institute for Health and Clinical Excellence (NICE), together with the National Patient Safety Agency (NPSA), recommended that policies should be put in place for medicines reconciliation on admission to hospital, and outlined the aim of medicines reconciliation: ‘to ensure that medicines prescribed on admission correspond to those that the patient was taking before admission. Details to be recorded include the name of the medicine(s), dosage, frequency, and route of administration’ [7]. In 2008, the National Prescribing Centre in the UK went further to adopt both the recommendations of the IHI and NICE/NPSA and recommended that medicines reconciliation be put in place at all ‘transfer of care’ situations [8]. The need for reconciliation at discharge was endorsed by the report of the Care Quality Commission which identified that there was room for improvement in the quality of medicines information provided by UK hospitals to general practitioners (GPs) in discharge summaries [9]. In Ireland in 2008, the Report of the Commission for Patient Safety and Quality Assurance, commissioned by the Department of Health and Children, recommended that healthcare organizations prioritize the implementation of formal medication reconciliation systems at all points of transfer of care [10].

There is emerging evidence from Northern Ireland, Sweden, Holland and the US that undertaking medication reconciliation decreases the frequency of non-intentional changes and reduces the unplanned use of healthcare resources, including rate of and time to re-admission [11–15]. Whilst it is known that polypharmacy and complex drug regimens are associated with patients experiencing adverse drug reactions and drug related hospital admission, there is at present little evidence regarding the medication or process related factors that contribute to the challenge of reconciling medications [16, 17]. The predictors of potential adverse drug events (pADEs) amongst medical inpatients in a US hospital were identified as poor patient understanding of their medication, increasing number of changes to medication during the inpatient

episode and medication history being taken by an intern, rather than by a more senior resident or fellow colleagues [3]. This study found that the majority of pADEs were due to problems reconciling the medication history with the discharge medication list. However, the majority of studies regarding medication reconciliation provide little information on how best to target service delivery or the changes that could be made to underlying processes to facilitate more frequent medication reconciliation [5, 11, 13]. This study sought to address this gap by identifying the medication and process related factors which may increase a patient’s likelihood of experiencing reconciliation. This is important because medication reconciliation is a resource intensive activity and the availability of public finances and clinician’s time to invest in new services is ever tighter [18–20]. Furthermore high workload is perceived to be medication error producing [21].

In Ireland, the hospital discharge prescribing process typically involves producing two documents: a discharge prescription and a discharge summary containing a list of the patient’s medications on discharge and information regarding the inpatient episode, diagnoses and procedures. Over the course of this study, two processes were in place, handwritten and computer generated. The handwritten process involved transcribing the medication list onto both the discharge summary and the prescription and there is evidence that transcription can result in errors [21–23]. The handwritten process is typical for Ireland and was in place at both study sites. The computer generated process involved the use of an electronic patient record application (Tallaght Education and Audit Management System, TEAMS). TEAMS facilitates uniform recording of diagnoses, procedures and complications, it interfaces with the patient information management system and is supported by the International Classification of Diseases, version 10. Wireless access and use of tablet computers facilitate bedside input and retrieval of data, and each patient record is accessible during the hospital stay and after discharge. The application, in use in one of the study hospitals, includes a discharge prescribing module that requires the user to enter the discharge medication list once only. This is then automatically entered onto both discharge documents, the summary and the prescription. This process ensures that the details are identical on the two documents thereby reducing the risk of transcription error. It is not, however, an order entry system, it is not used for inpatient prescribing and, at present, only the discharge medication details are recorded.

The purpose of this paper was to investigate the process and medication related factors associated with medication non-reconciliation and to identify the prevalence and type of non-reconciliation on discharge from acute hospital care in Ireland. At the time of undertaking this study, medication reconciliation was not routinely delivered in the study hospitals and so the findings represent baseline evaluation data against which the benefits of

future interventions can be assessed. Pre-implementation evaluation is recommended as part of any patient safety improvement initiative [24].

Methods

Study design, setting and sampling

This was a cross-sectional, observational healthcare record review survey using consecutive discharges from purposively selected services in two acute public hospitals in Ireland between January 2006 and May 2008. Both hospitals are academic teaching hospitals, and each operates a 24 h emergency department and delivers general medical and surgical secondary level care. Site 1 is a 600 bed hospital, located in South West Dublin and site 2 is a 300 bed hospital, located in County Kildare. Patient recruitment did not occur during the periods June to September each year, to facilitate medical staff turnaround, induction and adjustment into new roles. Consecutive adult (16 years and older) inpatients discharged from the chosen service and prescribed at least one regular medication (rather than once off or as required) on admission or discharge were included. The services studied were purposively selected to reflect a range of general medical and surgical care in both hospitals and the handwritten and computer generated processes used to generate the discharge prescription and summary.

Data collection and management

Demographic data and diagnostic information were collected from the healthcare record. The discharge process used, TEAMS or handwritten, was recorded. Using the World Health Organization's definition of chronic disease as 'a condition requiring continuous healthcare management over a period of years with chance of developing acute illness or episodes associated with the disease', each diagnosis recorded was categorized as chronic or acute [25]. Approximately one third of the Irish population are General Medical Services (GMS) card holders [26]. Eligibility for a GMS card is predominantly dependent on income and bearers are entitled to receive medical care and prescribed medication free of charge. In 2007, 45.5% of acute inpatient episodes in Ireland involved GMS card holders [27]. The patient's GMS card status was recorded. The sources of medication data comprised all medication lists and documentation across the inpatient episode, including the admission medication history, inpatient drug prescription and administration chart, entries in the patient's healthcare record, discharge summary and discharge prescription. This facilitated the most comprehensive snap shot of medication use. Data were collected by the main investigator, a clinical pharmacist, within 24 h of discharge (72 h following a weekend discharge). Medication reconciliation was performed and any medications

that were not reconciled were noted and categorized. Patients' own drugs (PODs) were not administered during the inpatient episode and the usual process of care saw that patients were advised to send their PODs home once information regarding the medication history was gleaned from them. Therefore, PODs were not used as part of the medication reconciliation by the main investigator at the discharge interface. Data were entered onto SPSS®, version 15, for support in analysis. During data entry, each case in the database represented an individual drug. Once data entry was complete, the data were aggregated to provide summary data for each inpatient episode. Findings could therefore be reported at the level of the individual drug or episode, as appropriate. Range and consistency checks were undertaken at all stages of data management and double data entry was undertaken on a random selection of cases to ensure data quality.

Definitions and measurements

The primary outcome measure was medication non-reconciliation, defined as a prescription writing error on the discharge communication or a failure to document or communicate medication changes on the discharge communication (prescription or summary). Each medication was categorized according to whether it was reconciled or not and if it was not reconciled it was further categorized as one of the following:

- A prescription writing error on the discharge communication, a 'Prescription writing process that results in an unintentional, significant reduction in the probability of treatment being timely and effective or increase in the risk of harm, when compared with generally accepted practice'[28]. These prescription writing errors included failure to communicate essential information or transcription error and were sub-categorized as:
 - Dose
 - Frequency
 - Choice of drug
 - Omission of an active medication
 - Prescription of a discontinued medication
- Failure to communicate or document changes made to medication during the inpatient episode on the discharge communication, sub-categorized as:
 - Stopping, defined as a lack of communication or documentation that a medication on the pre-admission medication (PAM) list was intentionally stopped during hospital stay;
 - Omitting a PAM, defined as intentional or non-intentional omission of a PAM during admission and on discharge, without communication or documentation;
 - Withholding, defined as intentional or non-intentional withholding of a medication on discharge in the absence of a decision either to restart or discontinue therapy and without communication or documentation.

Ethical considerations

When incidents which might have impacted on patient safety were observed, the main investigator, a clinical pharmacist, contacted the patient's consultant, or another member of the team, to facilitate remedial action. In Ireland, completion of the discharge communication is typically undertaken by non-consultant hospital doctors (NCHDs). Contact was preferentially made at consultant level, rather than NCHDs, to minimize reactive bias or the Hawthorne effect [29]. Ethics Committee approval was granted at both study sites for the study to proceed and the opinion of the Committees was that patient consent was not required as this was a survey of the existing services.

Assessment of implications on patient care

A random selection of those episodes where one or more non-reconciliation was identified was assessed to determine the implications on patient care using two classifications: potential for patient harm and for unplanned re-admission to hospital within 3 months of discharge. The former used a well known, validated and reliable tool [30], whereas the latter drew on a similar methodology and provided a robust, peer-reviewed assessment, although it was not validated. The assessment was carried out on a per-episode basis and each episode may have included one or more non-reconciled medication. Six assessors were recruited from primary and secondary care, including GPs, community pharmacists, hospital clinical pharmacists and consultants. Each assessor was asked to indicate, in their opinion, the potential for harm arising from the episode using a visual analogue scale (VAS) from 0 (no harm) to 10 (death). The mean score from all assessors was calculated and then categorized as minor (<3), moderate (3–7) or severe (>7). Similarly, regarding potential for unplanned readmission, the VAS ranged from 0 (no re-admission) to 10 (unplanned re-admission) and the mean scores was categorized as low potential (<3), moderate (3–7) and high (>7).

Statistical analysis

The types of medication (categorized by British National Formulary (BNF) chapter) associated with each category of non-reconciliation were explored using cross-tabulation and the chi-squared test, using the drug as the denominator, and the statistical significance was measured by the *P* value (set at 0.05). Binomial logistic regression was used to identify the independent variables associated with the occurrence of non-reconciliation, using the episode as the denominator. The dependent variable was binary: all medication reconciled during the episode or not. The candidate variables included the following categorical variables: GMS card status, hospital, process used (handwritten or computer generated), receiving medical or surgical care, experiencing chronic or acute illness and the following numeric

variables: age at discharge, length of stay and number of medications experienced during the episode of care. All numeric variables were increasing.

Results

Describing the study sample

A total of 9569 medication orders for 1245 episodes of care were surveyed, representing approximately 5% of the 24 000 adult inpatients discharged from the study hospitals during the recruitment period. Just over half (55%) the study population were male, the majority were under the care of a medical (77%) rather than surgical team and were discharged using the handwritten (71%) rather than computer process. The median age was 62 years, ranging from 16 to 96 years old. The greatest proportion of patients was discharged on a Friday (24%) and the least on a Sunday (3%) and the median length of stay was 7 days (range 1 to 153 days). Most patients (86%) experienced a chronic illness and the greatest proportion (41%) had a diagnosis related to the circulatory system. The median number of concurrent medications per patient on admission was five (range 0 to 22), whilst on discharge it was six (range 0 to 24). Using the definition of polypharmacy as taking five or more regular medications [31], 51.1% of patients on admission and 70.4% of patients on discharge experienced polypharmacy.

Prevalence and nature of non-reconciliation

At least one medication did not reconcile in 50.1% (*n* = 624) of inpatient episodes, representing 16.3% of the 9569 medications surveyed. The prevalence of each type of non-reconciliation is displayed and the most common were omission of an active medication at discharge, failure to communicate or document stopping or withholding a medication and failure to document or communicate omission of a PAM (Table 1).

Impact of non-reconciliation on patient care

Of the 624 non-reconciled inpatient episodes, 100 (16%) randomly selected episodes were assessed for their impact on patient care. A minority (2%) were judged to have the potential to cause severe harm or a high potential (1%) to cause unplanned re-admission within 3 months. The remainder were deemed to have the potential to cause moderate (63%) or minor (35%) harm, whilst 37% were regarded to have moderate and 62% low potential to cause unplanned re-admission. Examples are presented (Table 2).

Association between medication type and non-reconciliation

Associations between non-reconciliation type and the BNF category of the medication are displayed, taking account of the frequency of use of each drug class (Table 3). There

Table 1

Prevalence and type of medication non-reconciliation

	Per medication order <i>n</i> (%)	Per inpatient episode <i>n</i> (%)
Prescription writing error		
Omission of an active medication at discharge	609 (6.4)	233 (18.7)
Dose	128 (1.3)	101 (8.1)
Frequency	28 (0.3)	22 (1.8)
Prescription of discontinued medication at discharge	25 (0.3)	18 (1.4)
Choice of drug	33 (0.3)	23 (1.8)
Failure to communicate or document changes		
Stopping	402 (4.2)	268 (21.5)
Omitting a pre-admission medication	234 (2.4)	140 (11.2)
Withholding	84 (0.9)	67 (5.4)
Denominator	9569	1245

was a greater tendency for omission on discharge of endocrine, central nervous system (CNS), nutrition and blood and 'other' drugs. This included hypnotics, opioid and non-opioid analgesics, anxiolytics, drugs used to control epilepsy, SSRIs and related antidepressants, calcium and vitamin D, oral iron, drugs used in anaemia, insulin, thyroid drugs, preparations for tear deficiency and glaucoma. Failure to document or communicate the stopping of a PAM was most likely for musculoskeletal or joints system (MSk), obstetrics, gynaecology and urinary tract (OGU) or cardiovascular drugs. The most common classes included antiplatelets, calcium-channel blockers, β -adrenoceptor blockers, angiotensin converting enzyme (ACE) inhibitors, loop diuretics, lipid regulating drugs, anxiolytics, nitrates, non-steroidal anti-inflammatory drugs (NSAIDs), opioid analgesics, oral contraceptives and drugs for urinary retention or frequency. PAMs most likely omitted throughout the inpatient process and on discharge, and without documentation, were OGU, MSk or respiratory drugs, including oral contraceptives, NSAIDs and a variety of inhalers.

Identifying variables contributing to non-reconciliation

Binomial logistic regression identified the variables associated with the presence of one or more non-reconciled medication as patients experiencing chronic or acute illness, the discharge process used and the number of medications used (Table 4). Patients with a chronic illness were twice as likely to experience non-reconciliation as those with an acute condition (adjusted OR 2.08, 95% CI 1.33, 3.24). Those discharged using the handwritten process were more likely to experience non-reconciliation than those discharged using TEAMS (adjusted OR 1.60, 95% CI 1.11, 2.99). Patients using an increasing number of medications were more likely to experience non-reconciliation, meaning that for every additional medication, there was a 26% increase in the likelihood of experiencing non-reconciliation (adjusted OR 1.26, 95% CI 1.21, 1.31).

Discussion

The findings of this study were that incomplete or erroneous communication and documentation of medication details in discharge communications is common and may contribute to patient harm or unplanned re-admission to hospital. Consistent with international literature, lack of reconciliation on admission can be perpetuated through the inpatient episode and beyond discharge [3, 5]. The majority of the non-reconciliations identified resulted in the absence of a medication from the discharge communication, either because it was intentionally removed and not documented, or because it was unintentionally omitted. This concurred with published evidence that medication omission is the most common discrepancy on both admission and discharge and adds weight to the argument for undertaking medication reconciliation at these stages of care [3, 5, 32, 33].

Use of an increasing number of medications was associated with non-reconciliation, consistent with previous findings [34]. Every time a medication was prescribed or documented, there was an opportunity for miscommunication. Episodes involving chronic illness were identified as more likely to involve non-reconciliation than acute episodes. The challenge of reconciling medication in the acute hospital setting is compounded by the growing prevalence of polypharmacy and multi-morbidity [35]. These findings provide an evidence base to target medication reconciliation, a resource intensive activity, to the most vulnerable patients.

Use of the handwritten discharge process was more likely to result in one or more non-reconciliation than the computerized process. The handwritten process involved more transcription, and the link between transcription and medication error is well established [21, 23, 36]. This finding is important because the generation of both a handwritten prescription and summary is routine practice in Ireland, the US and Canada [3, 5]. TEAMS, or similar systems, should be more widely implemented.

Table 2
Examples of non-reconciled inpatient episodes

Patient demographic and diagnostic information: 60-year-old female presented with unstable angina on a background of ischaemic heart disease, dyslipidaemia, raised body mass index, asthma/chronic airways obstruction and hiatus hernia.	Changes made	Final inpatient prescription and administration chart	Discharge prescription	Discharge summary
Pre-admission medication list				
Elantam LA [<i>Isosorbide mononitrate long acting (LA)</i>] 25 od	Discontinued	\\	Nil mentioned	Nil mentioned
Becotide 250 inh (Beclomethasone inhaler) 2 puffs bd	0	Becotide 250 inh 2 puffs bd	Becotide 250 inh 2 puffs bd	Becotide 250 inh 2 puffs bd
Spiriva (<i>Tiotropium</i>) 18 mcg 1 puff od	0	Spiriva 18 mcg 1 puff od	Spiriva 18 mcg 1 puff od	Spiriva 18 mcg 1 puff od
Omeprazole 20 mg od	Increased to 40 mg od	Omeprazole 40 mg od	Omeprazole 40 mg od	Omeprazole 40 mg od
Atenolol 25 mg od	0	Atenolol 25 mg od	Atenolol 25 mg od	Atenolol 25 mg od
Detrusitol (<i>Tolterodine</i>) 1 mg bd	0	Detrusitol 1 mg bd	Detrusitol 1 mg bd	Detrusitol 1 mg bd
Aspirin 75 mg od	0	Aspirin 75 mg od	Aspirin 75 mg od	Aspirin 75 mg od
Omacor (<i>Omega III</i>) 1 caps od	0	Omacor 1 caps od	Omacor 1 caps od	Omacor 1 caps od
Flurazepam 30 mg no	0	Flurazepam 30 mg no	Omitted	Omitted
Diazepam 5 mg tds	0	Diazepam 5 mg tds	Diazepam	Diazepam 5 mg bd
Pravastatin 20 mg no	0	Pravastatin 20 mg no	Pravastatin 20 mg no	Pravastatin 20 mg no
Potential for patient harm			Minor	
Potential for unplanned re-admission within 3 months			Low	
Discharge summary				
Patient demographic and diagnostic information: 75-year-old male presented with ischaemic heart disease on a background of atrial fibrillation, diabetes and congestive cardiac failure.				
Pre-admission medication list				
Changes made				
Clopidogrel 75 mg od	0	Clopidogrel 75 mg od	Clopidogrel 75 mg od	Clopidogrel 75 mg od
Protium (<i>Pantoprazole</i>) 40 mg od	0	Protium 40 mg od	Protium 40 mg od	Omitted
Atorvastatin 40 mg od	0	Atorvastatin 40 mg od	Atorvastatin 40 mg od	Atorvastatin 40 mg od
Amlodipine 10 mg od	0	Amlodipine 10 mg od	Amlodipine 10 mg od	Amlodipine 10 mg od
Aspirin 75 mg od	0	Aspirin 75 mg od	Aspirin 75 mg od	Aspirin 75 mg od
Bisoprolol 5 mg od	0	Bisoprolol 5 mg od	Bisoprolol 5 mg od	Bisoprolol 5 mg od
Warfarin	Held	'Hold'	Nil mentioned	'Wa'
Birinex (<i>Bumetanide</i>) 1 mg od	Changed to furosemide	Furosemide 40 mg od	Furosemide 40 mg od	Furosemide 40 mg od
Perindopril 4 mg od	0	Perindopril 4 mg od	Perindopril 4 mg od	Perindopril 4 mg od
Insulin Novorapid (<i>Aspart</i>) 18 units tds	0	Insulin Novorapid 18 units tds	Insulin Novorapid 18 units tds	Insulin Novorapid 18 units tds
Spirinolactone 25 mg od	0	Spirinolactone 25 mg od	Spirinolactone 25 mg od	Spirinolactone 25 mg od
+ Iron 1 bd	+ Iron 1 bd	Iron 1 bd	Iron 1 bd	Iron 1 bd
Potential for patient harm			Moderate	
Potential for unplanned re-admission within 3 months			Medium	
Discharge summary				
Patient demographic and diagnostic information: 89-year-old female presented with malaena, diagnosed with gastric carcinoma and liver metastases on a background of aortic stenosis, mitral regurgitation, hypothyroidism and atrial fibrillation.				
Pre-admission medication list				
Changes made				
Pravastatin 40 mg od	0	Pravastatin 10 mg od	Pravastatin 10 mg od	Pravastatin 10 mg od
Warfarin	Discontinued by consultant geriatrician	\\	\\	Warfarin
Bisoprolol 2.5 mg od		Bisoprolol 2.5 mg od	Bisoprolol 2.5 mg od	Bisoprolol 2.5 mg od
Eltroxin (<i>Levothyroxine</i>) 50 mcg od	+ Losec (<i>Omeprazole</i>) 'Consider bone protection on discharge' + Digoxin	Eltroxin 50 mcg od Losec 40 mg od Nil Digoxin 62.5 mcg od	Eltroxin 50 mcg od Losec 40 mg od Nil Digoxin 125 mcg od	Eltroxin 50 mcg od Omitted Nil mentioned Omitted
Potential for patient harm				Severe
Potential for unplanned re-admission within 3 months				High

This table presents *verbatim* the entries made in the patient's healthcare record. Details in italics represent information added by the authors for explanatory purpose. The bold font indicates where non-reconciliations were identified. Bd, twice daily; mcg, microgram; mg, milligram; nocte, at night; od, once daily; tds, three times daily.

Table 3
Non-reconciliation type by BNF chapter

BNF chapter	n	Prescription writing error n (%)				Choice of drug				Frequency				Prescription of discontinued medication at discharge				Failure to document or communicate n (%)			
		Omission of an active medication at discharge		Dose		Non-rec		Rec		Non-rec		Rec		Non-rec		Rec		Non-rec		Rec	
		Non-rec	Rec	Non-rec	Rec	Non-rec	Rec	Non-rec	Rec	Non-rec	Rec	Non-rec	Rec	Non-rec	Rec	Non-rec	Rec	Non-rec	Rec	Non-rec	Rec
Gastro-intestinal system	1179	84 (7.1)	1095 (92.9)	9 (0.6)	1172 (99.4)	2 (0.2)	1177 (99.8)	1 (0.1)	1178 (99.9)	1 (0.1)	1178 (99.9)	20 (1.7)	1159 (98.3)	14 (1.2)	1165 (98.8)	3 (0.3)	1176 (99.7)				
Cardiovascular system	3974	165 (4.2)	3809 (95.8)	49 (1.2)	3925 (98.8)	12 (0.3)	3962 (99.7)	11 (0.3)	3963 (99.7)	12 (0.3)	3962 (99.7)	238 (6.0)	3736 (94.0)	70 (1.8)	3904 (98.2)	60 (1.5)	3914 (98.5)				
Respiratory system	835	54 (6.5)	781 (93.5)	30 (3.6)	805 (96.4)	2 (0.2)	833 (99.8)	3 (0.4)	832 (99.6)	8 (0.6)	833 (99.4)	20 (2.4)	815 (97.6)	41 (4.9)	794 (95.1)	1 (0.1)	834 (99.9)				
Central nervous system	1447	138 (9.5)	1309 (90.5)	20 (1.4)	1427 (98.6)	4 (0.3)	1443 (99.7)	9 (0.6)	1438 (99.4)	8 (0.6)	1439 (99.4)	55 (3.8)	1392 (96.2)	48 (3.3)	1399 (96.7)	6 (0.4)	1441 (99.6)				
Infections	451	19 (4.2)	432 (95.8)	0	451 (100)	2 (0.4)	449 (99.6)	0	451 (100)	0	451 (100)	10 (2.2)	441 (97.8)	1 (0.2)	450 (99.8)	1 (0.2)	450 (99.8)				
Endocrine system	554	54 (9.7)	500 (90.3)	14 (2.5)	540 (97.5)	6 (1.1)	548 (98.9)	1 (0.2)	553 (99.8)	2 (0.4)	552 (99.6)	23 (4.2)	531 (95.8)	13 (2.3)	541 (97.7)	7 (1.3)	547 (98.7)				
Obstetrics, gynaecology and urinary tract	100	4 (4.0)	96 (96.0)	1 (1.0)	99 (99.0)	0	100 (100)	1 (1.0)	99 (99.0)	0	100 (100)	6 (6.0)	94 (94.0)	15 (15.0)	85 (85.0)	0	100 (100)				
Nutrition and blood	603	55 (9.1)	548 (90.9)	3 (0.5)	600 (99.5)	4 (0.7)	599 (99.3)	1 (0.2)	602 (99.8)	0	603 (100)	8 (1.3)	595 (98.7)	17 (2.8)	586 (97.2)	1 (0.2)	602 (99.8)				
Musculoskeletal and joint	237	17 (7.2)	220 (92.8)	2 (0.8)	235 (99.2)	0	237 (100)	1 (0.4)	236 (99.6)	0	237 (100)	17 (7.2)	220 (92.8)	12 (5.1)	225 (94.9)	2 (0.8)	235 (99.2)				
Other	173	17 (9.8)	156 (90.2)	2 (1.2)	171 (98.8)	1 (0.6)	172 (99.4)	0	173 (100)	0	173 (100)	5 (2.9)	168 (97.1)	1 (0.6)	172 (99.4)	3 (1.7)	170 (98.3)				
Chi-square		84.9	53.2	9	13.8	9	11.2	10.7	80.7	9	127.5	9	41.6	9	9	9	9				
d.f.		9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9				
P		<0.05	<0.05	<0.05	<0.05	<0.05	NS	NS	NS	NS	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05				

BNF, British National Formulary; Non-rec, non-reconciled; Rec, reconciled.

It is known that doctors might omit details from a discharge communication if they think the GP might 'work it out for themselves' from the details in the clinical history, or if they do not perceive the treatment to be 'risky' [37]. This may go part of the way to explain the frequency of omission and absence of communication or documentation of changes made to medication during hospital care. In this study oral contraceptives, NSAIDs and inhalers were the PAMs most likely to be omitted, possibly because they were not considered 'valid' medicines [1, 38].

Although the findings of this paper contribute to understanding the process and medication related factors associated with medication reconciliation, much remains to be learnt regarding the interplay between organizational culture and medication reconciliation. Understanding the causes of non-reconciliation from the perspective of error management and organizational culture is recommended to achieve sustainable change [39]. We undertook semi-structured interviews with community and hospital based clinicians involved in the process investigated here and analyzed the data using Reason's model of accident causation, adapted for use in healthcare settings, and Schein's teachings regarding organizational culture [21, 40, 41]. The findings of that study will be reported elsewhere.

Strengths and limitations

This was the first study of its kind in Ireland and the findings support the undertaking of further investigation into the clinical and economic benefits of delivering medication reconciliation services. Identification of the factors associated with non-reconciliation is novel and should inform strategies to minimize miscommunication and error in Ireland, the UK and beyond. The episodes surveyed represented approximately 5% of activity over the study period, and this, together with the use of non-randomized sampling, limits the external validity of the findings. However, the demographic characteristics of the study sample were consistent with national data regarding acute hospital admissions and it is expected that the findings are generalizable to similar settings in Ireland [27]. All of the data collection and medication reconciliation was performed by the main investigator. Whilst this strengthened the reliability of the approach, the validity could have been improved by blinded, independent panel confirmation of the presence of non-reconciliation in a random selection of episodes. It was not possible to rule out the Hawthorne effect, resulting in an underestimation of the actual prevalence of non-reconciliation [42]. However clinicians were not aware of the exact purpose of the study and this should have lessened any reactive bias.

In conclusion, lack of reconciliation of medications on discharge from acute public hospital in Ireland is frequent and can contribute to patient harm or unplanned re-admission. Opportunities to facilitate reconciliation include eliminating the need for transcription through use

Table 4

Binomial logistic regression output

Independent variable	Beta	SE	Wald	d.f.	Significance	Exp(B)	95% CI for Exp(B)	
							Lower	Upper
GMS card status	0.16	0.14	1.30	1	0.254	1.18	0.89	1.55
Hospital	-0.32	0.18	3.44	1	0.064	0.72	0.51	1.02
Discharge process	0.47	0.19	6.30	1	0.012	1.60	1.11	2.99
Medical/surgical care	0.02	0.20	0.01	1	0.932	1.02	0.69	1.51
Age at discharge	0.01	0.01	1.03	1	0.311	1.01	1.00	1.01
Length of stay	-0.01	0.00	3.42	1	0.065	0.99	0.98	1.00
Chronic or acute illness	0.73	0.23	10.39	1	0.001	2.08	1.33	3.24
Number of medications	0.23	0.02	116.85	1	<0.001	1.26	1.21	1.31
Constant	-2.71	0.40	45.17	1	<0.001	0.07		

of computerization and prioritizing delivery of care to patients on an increasing number of medications or experiencing chronic illness. There is evidence to support the delivery of medication reconciliation at both admission and discharge.

Competing interests

There are no competing interests to declare.

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