

**EXPLORING KEY RISKS IN THE MEDICAL ADMISSIONS PROCESS**

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## Abstract

This study investigated the hospital admission process in relation to two areas associated with known patient related risks, venous thromboembolism (VTE) risk assessment and medicines reconciliation in an English teaching hospital Acute Medical Unit (AMU). National guidance was available at the time of the study for both of these aspects of care. Government targets with associated financial penalties were set for VTE risk assessment in 2010, there were no similar targets for medicines reconciliation.

NHS ethics approval was granted. A novel mixed methodology was used involving direct observations of the patient admissions process, interviews with staff and an audit of case notes. Data were collected over four one-week periods between 2009 and 2011, 36 staff were observed admitting 71 patients, 44 staff were interviewed (25 VTE, 19 medicines reconciliation) and 930 sets of case notes were audited.

The observations showed that at the start of the study guidance was rarely followed for both VTE risk assessment and medicines reconciliation. Staff were unaware of its existence and ignorant of the both the associated risks and the level of guideline compliance within the organisation. There were low levels of compliance with local and national VTE guidance until national financial sanctions were introduced when significant increases in the rates of both VTE risk assessment and appropriate prescribing of prophylaxis were seen, however inappropriate prescribing also rose. Observations showed poor medication history taking and prescribing practices, during the study the proportion of items with a prescribing error increased, however the interviews showed that staff did know how to establish an accurate medication history and were aware of the potential problems.

A national financial sanction was associated with the effective implementation of VTE guidance however it remains to be seen whether standards can be maintained in a complex high pressure environment. Organisations must also be aware of the potential for unexpected adverse outcomes. Prescribing errors may be reduced if a mechanism can be found to ensure that theoretical knowledge is routinely

translated into practice, however greater pharmacy involvement before the admission prescription is written should also be considered.

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## Table of Contents

Abstract.....	i
Acknowledgements.....	iii
List of Figures .....	xi
List of Tables.....	xiii
List of Appendices .....	xv
List of Abbreviations .....	xvii
<b>Chapter 1 Introduction.....</b>	<b>1</b>
1.1 National Health Service context.....	1
1.2 Acute Medical Units .....	1
1.3 Royal Liverpool University Hospital.....	2
1.4 Hospital admission process via AMU .....	3
1.5 Other hospital AMUs.....	4
1.6 Mechanisms for improving patient safety .....	5
1.6.1 NHS guidance .....	5
1.6.2 NHS targets .....	6
1.7 VTE risk assessment practices at RLUH .....	7
1.8 Medicines reconciliation practices at RLUH.....	7
1.9 Purpose of study.....	8
1.10 Study aim .....	9
1.11 Study objectives.....	9
1.11.1 VTE risk assessment .....	9
1.11.2 Medicines reconciliation .....	10
1.12 Summary.....	10
<b>Chapter 2 Study Background .....</b>	<b>11</b>
2.1 Literature search strategy .....	11
2.1.1 VTE literature .....	11
2.1.2 Medicines reconciliation literature.....	11
2.1.3 Guideline literature .....	12

2.2	Venous thromboembolism.....	13
2.2.1	Definitions .....	13
2.2.2	Historical background .....	13
2.2.3	Risks associated with VTE .....	14
2.2.4	Long term consequences of VTE.....	14
2.2.5	VTE risk assessment tools .....	14
2.2.6	VTE risk factors and pharmacological prophylaxis.....	15
2.2.7	Risks associated with LMWH .....	16
2.2.8	Cost effectiveness of VTE prophylaxis .....	17
2.2.9	Prescribing of VTE prophylaxis.....	18
2.2.10	National guidance in England and Wales.....	18
2.3	Medicines reconciliation .....	19
2.3.1	Definitions .....	19
2.3.2	Medication history taking process.....	19
2.3.3	Risks associated with medication .....	20
2.3.4	Quality of medication histories.....	20
2.3.5	Causes of prescribing errors .....	21
2.3.6	Incidence and potential impact of prescribing errors on admission to hospital .....	21
2.3.7	Problems associated with medicines reconciliation.....	22
2.3.8	Time required for medicines reconciliation.....	22
2.3.9	Cost effectiveness of medicines reconciliation.....	23
2.3.10	National guidance in England and Wales.....	23
2.4	Implementation of guidelines .....	23
2.4.1	Guideline implementation rates .....	23
2.4.2	Potential barriers to guideline implementation .....	24
2.4.3	Potential strategies to improve guideline implementation.....	24
2.5	Summary.....	25
<b>Chapter 3</b>	<b>Methods .....</b>	<b>26</b>
3.1	Research design.....	26
3.2	Selection of methodology .....	28

3.3	Study risk assessment.....	30
3.4	Research instruments.....	30
3.5	Confidentiality .....	31
3.6	Sample size .....	32
3.6.1	Observations and interviews .....	32
3.6.2	Case notes .....	32
3.7	Data collection periods.....	33
3.8	Recruitment of study participants (hospital staff) .....	34
3.9	Selection of patient episodes .....	34
3.9.1	Observations .....	34
3.9.2	Selection of case notes.....	35
3.10	Ethical issues .....	35
3.11	Observations .....	36
3.12	Interviews .....	38
3.12.1	VTE risk assessment interviews .....	38
3.12.2	Medicines reconciliation interviews .....	39
3.13	Case note review .....	39
3.13.1	Review for VTE risk assessment.....	40
3.13.2	Review for medicines reconciliation .....	41
3.14	Data management and analysis.....	42
3.14.1	Data entry.....	42
3.14.2	Statistical methods.....	42
3.14.3	Data categorisation .....	42
3.14.4	Data analysis .....	44
3.15	Summary.....	45
<b>Chapter 4</b>	<b>Results and Discussion AMU Admission Process .....</b>	<b>46</b>
4.1	Introduction and overall sample characteristics.....	46
4.1.1	Details of staff observed included in the study .....	46
4.2	Observations.....	47
4.2.1	Admission time for observed patients.....	47
4.2.2	Waiting time and duration of clerking.....	48

4.2.3	Interruptions .....	50
4.2.4	Delays .....	52
4.2.5	Use of resources.....	54
4.2.6	General observations derived from field notes .....	55
4.3	Case note review .....	56
4.3.1	Presenting complaint .....	56
4.3.2	Admission route, time and day of the week .....	56
4.3.3	Length of stay .....	60
4.3.4	Discharge ward.....	60
4.4	Discussion .....	61
4.4.1	Patient demographics .....	61
4.4.2	Admission route and time of day.....	62
4.4.3	Waiting time and duration of clerking .....	62
4.4.4	Length of stay .....	64
4.4.5	Discharge from AMU.....	65
4.4.6	Interruptions .....	66
4.4.7	Recent operational changes.....	66
4.5	Summary.....	67

**Chapter 5 Results and Discussion: Venous Thromboembolism Risk Assessment and Prophylaxis ..... 68**

5.1	Overview.....	68
5.2	Context .....	69
5.3	Observations.....	71
5.3.1	Questions asked about VTE .....	71
5.3.2	VTE risk assessments.....	72
5.3.3	Prescribing of LMWH .....	73
5.4	Interviews .....	76
5.4.1	VTE training .....	76
5.4.2	VTE knowledge .....	77
5.4.3	Responsibility for VTE risk assessment .....	80
5.4.4	Prescribing of pharmacological VTE prophylaxis .....	80



5.4.5	VTE risk assessment process in the Emergency Department .....	81
5.4.6	Role of healthcare staff in VTE prevention .....	82
5.4.7	Reasons for low VTE risk assessment rates .....	83
5.4.8	Suggestions for improving VTE risk assessment rates .....	84
5.5	Triangulation of observation and interview data.....	84
5.6	Case Note Review .....	85
5.6.1	VTE and bleeding risk factors .....	85
5.6.2	VTE risk assessment .....	91
5.6.3	Prescribing of VTE prophylaxis .....	92
5.6.4	Monitoring of LMWH .....	96
5.6.5	Adverse outcomes.....	97
5.7	Triangulation of VTE interview and case note data .....	98
5.7.1	Ranking of VTE risk factors .....	98
5.7.2	Bleeding risks .....	99
5.8	Discussion .....	100
5.8.1	Awareness of VTE risk factors .....	101
5.8.2	Knowledge of VTE .....	101
5.8.3	Awareness of VTE policies.....	101
5.8.4	Proportion of patients with VTE risk factors and bleeding risk factors ... .....	102
5.8.5	VTE risk assessment .....	103
5.8.6	Prescribing of LMWH .....	105
5.8.7	Incidence of bleeding .....	106
5.8.8	Heparin induced thrombocytopenia.....	107
5.8.9	Incidence of VTE.....	108
5.8.10	Strategies to improve VTE prophylaxis .....	108
5.8.11	Effect of financial penalties.....	110
5.8.12	Recent developments .....	110
5.9	Summary.....	111

<b>Chapter 6</b>	<b>Results and Discussion: Medicines Reconciliation .....</b>	<b>112</b>
6.1	Overview.....	112
6.2	Observations.....	112
6.2.1	Questions asked about medicines .....	114
6.2.2	Problems observed during the admission process .....	118
6.2.3	Medication histories .....	121
6.2.4	Requests for pharmacist assistance.....	123
6.2.5	Prescribing errors witnessed.....	124
6.2.6	Prescription charts written .....	125
6.2.7	Medicines reconciliation by a pharmacist .....	126
6.3	Interviews .....	126
6.3.1	Training in taking a medication history.....	127
6.3.2	Awareness of the prevalence of prescribing errors.....	127
6.3.3	Knowledge of medication history taking .....	128
6.3.4	Current medication history taking practice .....	128
6.3.5	Problems in confirming medication histories .....	130
6.3.6	Documenting medication histories.....	131
6.3.7	Writing a medication chart .....	132
6.3.8	Discussion with patients .....	132
6.3.9	Checking of prescriptions.....	133
6.3.10	Suggestions to reduce prescribing errors .....	133
6.3.11	Ranking of sources commonly used for medicines reconciliation.....	134
6.4	Case note review .....	135
6.4.1	Difference between study periods.....	138
6.4.2	Medicines reconciliation by a pharmacist .....	138
6.4.3	Prescribing errors .....	140
6.4.4	Assessment of potential harm from prescribing errors.....	142
6.4.5	Rectifying prescribing errors .....	143
6.5	Discussion .....	143
6.5.1	Information sources .....	144
6.5.2	Communication with patients.....	144
6.5.3	Medicines reconciliation rates .....	145

6.5.4	Prescribing error rates .....	146
6.5.5	Training of medical staff.....	147
6.5.6	Impact of prescribing errors.....	148
6.5.7	Effect of admission at weekends .....	149
6.5.8	Suggestions for reducing prescribing errors .....	149
6.6	Summary.....	151
<b>Chapter 7</b>	<b>Overall Discussion and Conclusion .....</b>	<b>152</b>
7.1	Critique of methodology .....	152
7.1.1	Difficulties experienced in carrying out the study .....	152
7.1.2	Strengths .....	154
7.1.3	Limitations.....	154
7.2	Discussion of main findings .....	156
7.2.1	National guidance .....	156
7.2.2	Comparison of VTE and medicines reconciliation results.....	157
7.2.3	Guideline implementation .....	158
7.2.4	Financial incentives and penalties .....	160
7.2.5	Education and training .....	160
7.2.6	Admissions process .....	161
7.3	Personal reflections .....	161
7.4	Personal skills developed .....	162
7.5	Implications for research and practice.....	162
7.6	Suggestions for further research.....	164
7.7	Conclusion .....	166
<b>References</b>	<b>.....</b>	<b>167</b>
<b>Appendices</b>	<b>.....</b>	<b>186</b>

## List of Figures

Figure 2-1: Common VTE risk factors.....	15
Figure 2-2: Common bleeding risks.....	17
Figure 4-1: Level of practice of study participants (healthcare staff).....	47
Figure 4-2: Time of day of admission for observed patients .....	48
Figure 4-3: Median time taken to complete the medical clerking process .....	49
Figure 4-4: Number of interruptions per patient admission observed .....	50
Figure 4-5: Case study illustrating interruptions during the medical clerking process .....	52
Figure 4-6: Factors contributing to delays in the hospital admission processes .....	54
Figure 4-7: Number of study patients admitted to hospital by day of the week .....	57
Figure 4-8: Route of admission by day of the week – study data.....	57
Figure 4-9: Route of admission by day of the week – Trust data 2009 – 2011 .....	58
Figure 4-10: Admission time and route of admission– study data .....	59
Figure 4-11: Admission time and route of admission– Trust data 2009 - 2011 .....	59
Figure 4-12: Length of stay of study patients .....	60
Figure 4-13: Discharge ward for study patients.....	61
Figure 5-1: Local and national initiatives relating to venous thromboembolism (VTE) prophylaxis .....	70
Figure 5-2: Overview of VTE risks and prescription of LMWH on admission for observed patients .....	75
Figure 5-3: Demographics of staff participating in venous thromboembolism observations and interviews .....	76
Figure 5-4: Actual and perceived venous thromboembolism knowledge of participating staff .....	78
Figure 5-5: Number of venous thromboembolism risk factors identified per patient from case notes.....	89
Figure 5-6: Overview of VTE risks and treatment with LMWH for all study patients .....	94
Figure 5-7: Effect of number of venous thromboembolism risk factors per patient on prescribing of low molecular weight (LMWH) prophylaxis .....	95

Figure 5-8: Venous thromboembolism risk assessment rates in the study hospital and nationally.....	104
Figure 6-1: Overview of medicines reconciliation completed and prescription charts written for observed patients .....	113
Figure 6-2: Number of questions asked about medicines by different staff grades .....	115
Figure 6-3: Missing or incomplete information for patients on admission to hospital.....	119
Figure 6-4: Case Study - illustrating problems in documenting an accurate medication history .....	120
Figure 6-5: Problems observed in staff interpretation of GP summaries.....	122
Figure 6-6: Research pharmacist assistance sought during observations .....	123
Figure 6-7: Prescribing errors witnessed during observations and associated pharmacist interventions .....	125
Figure 6-8: Individual doctors estimate of proportion of prescription charts with a prescribing error .....	128
Figure 6-9: Doctors rating of how useful they find various sources for medication histories.....	135
Figure 6-10: Study numbers – medicines reconciliation case note review .....	137
Figure 6-11: Proportion of medication histories (MH) completed by study period	139
Figure 6-12: Percentage of medication histories checked within 24 hours by day of the week.....	140
Figure 6-13: Histogram showing number of prescribing errors per patient .....	141
Figure 6-14: Red (significant or catastrophic) / Major prescribing errors identified during the study .....	143

## List of Tables

Table 3-1: Reason for admission - categories .....	43
Table 4-1: Demographic details of patients included in case note reviews and observations.....	46
Table 4-2: Waiting time, duration of clerking and time to documentation of management plan for newly admitted patients .....	49
Table 4-3: Types of interruption observed during the medical clerking process .....	51
Table 5-1: Subject numbers in each study period - venous thromboembolism data .....	68
Table 5-2: Demographic details of patients included in case note reviews and observations ( <i>Reproduced here from Chapter 4, page 46 for ease of reference</i> ) .....	71
Table 5-3: Questions which patients were asked relating to venous thromboembolism (VTE) during observations.....	72
Table 5-4: Frequency of venous thromboembolism (VTE) risk assessment and appropriate / inappropriate prescribing of low molecular weight heparin (LMWH) during observations .....	73
Table 5-5: Grading of actual venous thromboembolism (VTE) knowledge of participating staff .....	77
Table 5-6: Ease of use of venous thromboembolism risk assessment tools reported by staff during interviews .....	79
Table 5-7: Staff Estimates of proportion of appropriate prescribing of venous thromboembolism prophylaxis reported during interviews .....	80
Table 5-8: Staff opinions regarding responsibility for venous thromboembolism risk assessment and prescribing prophylaxis .....	82
Table 5-9: Staff views of their personal roles in venous thromboembolism (VTE) prevention.....	83
Table 5-10: Extracts from interviews – suggestions for improving venous thromboembolism (VTE) risk assessment rates .....	84
Table 5-11: Frequency of venous thromboembolism (VTE) risk factors and bleeding risks identified from case notes .....	86

Table 5-12: Comparison of prevalence of venous thromboembolism risk factors documented on Trust risk assessment forms and those identified from case notes	88
Table 5-13: Comparison of prevalence of bleeding risk factors documented on risk assessment forms and those identified from case notes .....	90
Table 5-14 Frequency of venous thromboembolism (VTE) risk assessment and appropriate prescribing of low molecular weight heparin (LMWH) .....	92
Table 5-15: Reasons for delay in prescribing prophylactic low molecular weight heparin .....	96
Table 5-16: Staff ranking of venous thromboembolism risk factors by importance	99
Table 5-17: Staff ranking of bleeding risk factors by importance.....	100
Table 5-18: Comparison of Trust and study patient demographics .....	100
Table 5-19: Incidence of bleeding in Royal Liverpool & Broadgreen University Hospitals NHS Trust 2009 - 2011.....	107
Table 6-1: Subject numbers in each study period - medicines reconciliation data	112
Table 6-2: Demographic details of patients included in case note reviews and observations ( <i>Reproduced here from Chapter 4, page 46 for ease of reference</i> ) ...	114
Table 6-3 Number of questions asked about medicines by grade of staff observed .....	115
Table 6-4: Sources used by staff to obtain medication histories during observations .....	122
Table 6-5 Number of medical staff available on Acute Medical Unit (AMU) rota and number interviewed.....	127
Table 6-6: Extracts from interviews - reasons for using more than one source of information for medication histories .....	130
Table 6-7: Extracts from interviews – problems experienced in confirming medication histories.....	131
Table 6-8: Extracts from interviews – suggestions for reducing prescribing errors .....	134
Table 6-9 Medicines reconciliation completed by pharmacists for study patients	139
Table 6-10: Details of prescribing errors identified during the study.....	142

## List of Appendices

Appendix 1: Abstract for oral presentation – HSRPP conference 2009 .....	186
Appendix 2: RLUH Risk assessment form for study .....	187
Appendix 3: Admission process data collection form.....	191
Appendix 4: VTE interview schedule.....	195
Appendix 5: Medicines reconciliation interview schedule .....	197
Appendix 6: Case note data collection form.....	199
Appendix 7: Study information sheet – healthcare staff.....	201
Appendix 8: Study information sheet – patients .....	204
Appendix 9: Consent form – staff .....	206
Appendix 10: Case study template – patient admissions observed .....	207
Appendix 11: Flash card for VTE interviews.....	208
Appendix 12: Flash card for VTE interviews - answers .....	209
Appendix 13: VTE Ranking Form .....	210
Appendix 14: Medicines Reconciliation Ranking Form.....	211
Appendix 15: Case Summary template – LMWH contraindicated but prescribed.	212
Appendix 16: Case studies – patient admissions observed (71 patients).....	213
Appendix 17: Case Summaries for patients in whom LMWH was contraindicated but prescribed (33 patients) .....	261
Appendix 18: Validation Summary – Bleeding risks and prescribed LMWH (33 patients) .....	272
Appendix 19 No initial consultant consensus – bleeding risks and prescribed LMWH (9 patients) .....	273
Appendix 20: RLUBHT VTE Risk Assessment form – April 2010.....	276
Appendix 21: Abstract for oral presentation – HSRPP conference 2010.....	277
Appendix 22: Abstract for oral presentation – PRIMM conference 2011 .....	278
Appendix 23: Abstract for poster - PRIMM conference 2012 .....	279
Appendix 24: Abstract for oral presentation – RPS conference 2011 .....	280
Appendix 25: Abstract for poster - SAM conference 2011 .....	282
Appendix 26: Abstract for poster - SAM conference 2012 .....	283
Appendix 27: VTE paper published in BMJ Open 2012.....	284



Appendix 28: Medicines Reconciliation paper published in BMJ Quality and Safety 2013.....	292
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## List of Abbreviations

<b>Abbreviation</b>	<b>Meaning</b>
ACS	Acute Coronary Syndrome
AMU	Acute Medical Unit
BNF	British National Formulary
COPD	Chronic Obstructive Pulmonary Disease
CPN	Community Psychiatric Nurse
CQUIN	Commissioning for Quality and Innovation
CT	Computerised Tomography
DH	Department of Health
DVT	Deep Vein Thrombosis
ECG	Electrocardiogram
ED	Emergency Department
eGFR	estimated Glomerular Filtration Rate
EWTD	European Working Time Directive
F1	Foundation year 1 doctor (first year post registration)
GI	Gastrointestinal
GP	General Practitioner
HCA	Healthcare Assistant
HDU	High Dependency Unit
HEC	Heart Emergency Centre
HES	Hospital Episode Statistics

<b>Abbreviation</b>	<b>Meaning</b>
HIT	Heparin Induced Thrombocytopenia
HSRPP	Health Services Research and Pharmacy Practice
INR	International Normalised Ratio
IQR	inter quartile range
IV	Intravenous
LJMU	Liverpool John Moores University
LMWH	Low Molecular Weight Heparin
MAR	Medication Administration Record
MUR	Medicines Use Review
NHS	National Health Service
NICE	National Institute for Health and Care Excellence (formerly National Institute for Clinical Excellence)
NPSA	National Patient Safety Agency
NRES	National Research Ethics Service
NSAID	Non-Steroidal Anti-Inflammatory Drug
OTC	Over the Counter
PE	Pulmonary Embolism
PRIMM	Prescribing and Research in Medicines Management
PT	Prothrombin Time
RCP	Royal College of Physicians
RLBUHT	Royal Liverpool & Broadgreen University Hospitals NHS Trust

<b>Abbreviation</b>	<b>Meaning</b>
RLUH	Royal Liverpool University Hospital
RPS	Royal Pharmaceutical Society
SAM	Society for Acute Medicine
SHO	Senior House Officer (2-4 years post registration)
SPSS	Statistical Package for Social Sciences
ST1	Specialist Trainee doctor year 1 (3 years post registration)
TED	Thromboembolic Deterrent
UKMI	United Kingdom Medicines Information
VTE	Venous thromboembolism
WHO	World Health Organisation

## **Chapter 1 Introduction**

This study was carried out in a hospital in England; this chapter provides an overview of the development of hospital services, identification of the key risks to be investigated and concludes with the study aims and objectives.

### **1.1 National Health Service context**

The National Health Service (NHS) in England and Wales was established in July 1948, when the NHS Act 1946 came into effect, and is based on the principles that everyone is entitled to healthcare and that care is provided free of charge at the point of use of the service.<sup>1</sup> Over the past 65 years it has grown into the largest employer in the UK with a budget of over £105 billion and employs 146,000 doctors and 370,000 nurses.<sup>2</sup> In England there are 161 acute hospital Trusts which provided approximately 15,000 million individual episodes of care involving admission in 2010/11.<sup>2</sup>

### **1.2 Acute Medical Units**

Traditionally in the NHS emergency medical patients were admitted to hospital either from the Emergency Department (ED) or by direct referral from a General Practitioner (GP) to the ward under the care of the 'on take' physician.<sup>3</sup> The 'on take' physician usually changed daily in accordance with a rota and the specified consultant was responsible for the management of all patients admitted during the allocated period. Historically physicians were generalists and were therefore experienced in the treatment of all general medical conditions but specialisation for doctors developed in the 1970s and wards then became specialty based (e.g. cardiology, respiratory etc.) rather than 'general medicine'.<sup>3</sup> As the medical physicians were 'on take' for all patients in accordance with a rota this resulted in many emergency medical patients being admitted to an inappropriate specialty ward, which led to a delay in them receiving expert treatment and often necessitated another ward transfer following admission. This was in contrast to patients who were less acutely unwell who were referred by their GP to an appropriate specialist according to their medical complaint and were admitted directly to an appropriate specialty ward.<sup>4</sup> In the fifteen year period from 1997/98 to 2012/13 annual emergency hospital admissions in England increased from 3.6

million to 5.3 million, a rise of 47%, although the population only increased by 10% in the same period.<sup>5</sup> Over the same period, 1997/98 to 2012/13, the number of acute and general beds available in England decreased from 138,047 to 104,888, a reduction of over 24%.<sup>6</sup> The resulting increased pressure on hospital beds led to emergency medical patients being admitted to any available medical bed and in extreme circumstances to surgical beds. This presented operational difficulties for the medical teams as they were then responsible for the management of patients on many wards, compromising the care which they were able to provide.

Acute Medical Units have been developed over the past fifteen years in response to increasing numbers of medical admissions and concerns regarding the quality of care.<sup>7, 8</sup> In 2004 the Royal College of Physicians (RCP) recommended that all Trusts admitting acutely unwell medical patients should have a dedicated area for managing these patients and that to avoid confusion this area should be called an 'Acute Medical Unit' or 'AMU',<sup>9</sup> however this term is still not used universally throughout the NHS. This allows acutely unwell patients to be seen rapidly by a consultant specialising in acute medicine and if hospital admission is necessary, patients are transferred directly to the appropriate specialty ward enabling more efficient, disease specific care. Recent studies have shown that hospital re-organisation and the introduction of AMUs reduces the length of stay without affecting readmission rates,<sup>10-12</sup> and also reduces mortality.<sup>11</sup>

### **1.3 Royal Liverpool University Hospital**

This study is set in the Royal Liverpool University Hospital (RLUH), which is one of the largest and busiest acute hospitals in the North West of England and focuses on acute and complex care.<sup>13</sup> It has over 800 beds and provides services for all acute medical specialties. The ED sees over 88,000 patients annually<sup>14</sup> and over 12,000 medical patients each year are admitted via the AMU. The AMU at RLUH was established in 1999<sup>4</sup> and was one of the first in England. Over the years it has grown from an initial 20 beds to 37 beds and consultant staffing had increased from two to seven (5.3 whole time equivalents) at the time the study took place. Consultant availability was also extended on weekdays ensuring AMU consultant presence from 8am until 8pm Monday to Friday and for four hours each day at weekends.

Consultants with additional expertise in diabetes / endocrinology, rheumatology, pharmacology and gerontology were recruited to provide expert care to these patient groups and also to provide expert advice to fellow doctors in complex cases. The average length of stay is approximately 18 hours and about one third of patients seen are discharged home from AMU (2009/10 to 2012/13 data).

The AMU medical staffing at the time of the study comprised seven AMU consultants (4 full time, 3 part time), two daily 'post-take' consultant physicians, eight AMU based doctors (2 senior, specialist registrars, 6 junior), and five 'hot block' doctors (2 senior, 3 junior). The 'hot block' is a period of time when medical staff are released from their current medical rota and spend a few days taking responsibility for the new patients being referred to AMU. 'Hot block' periods run from 9am to 10pm Monday to Thursday inclusive and 9am to 10pm Friday to Sunday inclusive, a separate team operates overnight. One of the two specialist registrars from the 'hot block' team usually remains in ED seeing new medical patients, the remaining four doctors are responsible for seeing new patients on AMU.

At the time of the study two ward rounds on weekdays (one morning and one afternoon) and one ward round on Saturday and Sunday were led by the 'post take' consultant who was on call or on 'take' and as such responsible for providing advice to junior staff regarding any difficult clinical situations and if necessary reviewing complex patients. As the periods of medical 'take' ran 5pm to 9am and 9am to 5pm, this resulted in two different visiting consultants leading ward rounds on AMU each weekday. These consultants were drawn from a pool of around 20 consultant physicians who had a variety of expertise and each of whom led the AMU ward round once or twice a month. Another simultaneous ward round was carried out each morning by an AMU consultant to ensure that all patients had been reviewed by lunchtime.

#### **1.4 Hospital admission process via AMU**

On arrival at AMU patients are booked into the hospital by an AMU receptionist who records the necessary personal details and are then triaged by an experienced

nurse using a Modified Early Warning System (MEWS) score. MEWS scores used on admission have been shown to reliably identify those patients most in need of medical attention and also most susceptible to a sudden deterioration.<sup>15-17</sup> Nurse triage was originally used in EDs but its use has been expanded to AMUs where improvements in patient flow and more rapid clinical decision making by medical staff have been demonstrated as a result.<sup>18</sup>

Following nurse triage patients are seen by a doctor or a suitably trained nurse clinician. All doctors are trained to carry out an effective consultation with a patient as medical students, in accordance with the requirements of the General Medical Council (GMC).<sup>19</sup> There are many different consultation models, however the method routinely taught in UK medical schools and generally used is the 'hospital clerking model' otherwise known as 'the inductive method'.<sup>20, 21</sup> This model involves a consultation with the patient about the current medical problem taking into account any relevant past medical or surgical history, a physical examination, ordering and interpreting the results of investigations with the aim of making a diagnosis, developing a management plan and writing the admission prescription. Home circumstances are noted to facilitate the discharge process, alternative care arrangements may be required if patients are unable to manage at home. After this consultation has taken place in the AMU, patients together with their management plans are reviewed by a consultant on one of the twice daily ward rounds in accordance with RCP guidance.<sup>22</sup> The consultant will make a decision to admit the patient to a specialty ward, keep them on AMU for a short period of further observation or discharge them.

### **1.5 Other hospital AMUs**

AMUs vary in their layout, number and type of beds, staffing and operational procedures. A recent national audit involving 38 AMUs showed that on average they had 43 beds and a further 17 short stay beds.<sup>23</sup> To help identify some of the differences visits were made to two AMUs in the North West of England in 2011. A large district general hospital had a 32 bed AMU of which 16 beds were allocated to GP referrals. In this unit there were 2 consultant ward rounds daily and a there was a designated senior house officer (SHO – 2 to 4 years post qualification) to clerk GP



admissions. Another large acute teaching hospital AMU had 56 beds, 28 allocated to ED admissions, 20 short stay (patients expected to stay less than 24 hours) and 10 GP admission chairs / trolleys. This AMU operated two simultaneous ward rounds one to review the short stay patients and the other to see the remaining patients. The average length of stay was not known by the staff working in either of these units but pharmacy staff from both indicated that a significant proportion of patients stayed 48 hours.

## **1.6 Mechanisms for improving patient safety**

Healthcare is becoming increasingly complex as with the development of new technologies and new medicines it is possible to treat more patients and medical conditions than previously. However this increase in complexity is associated with an increased risk of a medical error to patients.<sup>24</sup> This was highlighted by the Department of Health (DH) in 2000 in the report 'An Organisation with a Memory'<sup>25</sup> which estimated that adverse healthcare events which cause harm to patients occur in 10% of hospital admissions and cost the NHS at least £2 billion a year in extended hospital stays. Subsequent DH documents provided a framework to guide changes necessary to improve patient safety.<sup>26, 27</sup> Adverse events are rarely the result of a single factor, more often there are a number of circumstances which together precipitate the error, usually the error is detected and prevented as a result of checks in the system. However on rare occasions all the checks in the system simultaneously fail as in Reason's Swiss cheese model of system accidents<sup>28</sup> and a major error occurs. In industries such as nuclear power and aviation, engineered safety devices may be used to minimise errors, however in healthcare it is frequently the personal skills and experience of the staff which are responsible for protecting the patient from harm.<sup>29</sup>

### **1.6.1 NHS guidance**

Each year the DH introduces new guidance, in response to identified risks or developments in treatment, which must be integrated into an already complex system. The Labour government elected in 1997 focused on quality in the NHS and established the National Institute for Clinical Excellence (NICE – now renamed National Institute for Health and Care Excellence) to improve the standards of

clinical care, reduce unacceptable variations in practice and ensure best use of resources.<sup>30</sup> Since its inception in 1999, NICE has published 181 clinical guidelines and 49 quality standards with many more in development,<sup>31</sup> all of which require implementation throughout the NHS. In addition the National Patient Safety Agency (NPSA), which was established by the DH in 2001 (and whose functions were transferred to the NHS Commissioning Board Special Health Authority in 2012 following reorganisation of NHS services) to identify patient safety issues and design solutions,<sup>32, 33</sup> has issued 72 alerts, all of which require implementation across the NHS in England and Wales.

This study investigates the implementation of two recent guidance documents which affect almost all adult patients on admission to hospital, risk assessment for venous thromboembolism (VTE)<sup>34</sup> and medicines reconciliation<sup>35</sup> in an NHS acute Trust. The DH VTE risk assessment tool states that all patients should be risk assessed for VTE on admission to hospital, the medicines reconciliation patient safety guidance states that medicines reconciliation should be carried out for all adult patients on admission to hospital, preferably within 24 hours of arrival.

### **1.6.2 NHS targets**

The first targets for NHS acute Trusts were introduced following the election of the Labour government in 1997 and were set out in the NHS plan of 2000.<sup>36</sup> Initial targets were generally around waiting times but these have been developed over the years to be more outcome focused and they now form part of the NHS outcomes framework.<sup>37</sup> The original VTE target set in 2010 was that 90% of patients should have had a VTE risk assessment on admission to hospital and was increased to 95% in 2013/14 to maintain momentum as most Trusts were achieving 90%. It is now one of four national Commissioning for Quality and Innovation (CQUIN) goals for NHS acute service providers, failure to achieve the target results in a financial penalty. There are no similar targets for medicines reconciliation, the Royal Pharmaceutical Society (RPS) hospital pharmacy standards<sup>38</sup> state that medicines reconciliation should ideally be carried out within 24 hours of admission, in line with the NICE/NPSA alert,<sup>35</sup> however this is guidance for service development not a mandatory target.

## **1.7 VTE risk assessment practices at RLUH**

A venous thromboembolism (VTE) is a clot which occurs in the body, venous thromboemboli usually occur in the deep veins of the leg,<sup>39</sup> a thrombosis in this location is therefore known as a deep vein thrombosis or DVT. If a DVT breaks free from the leg vein it is transported by the circulation to the lungs where it becomes trapped in the small vessels and is then known as pulmonary embolism or PE.<sup>40</sup>

A Health Select Committee inquiry in 2004 estimated that PE is responsible for approximately 25,000 deaths in English hospitals each year and is the immediate cause of death in 10% of patients who die in hospital.<sup>41, 42</sup> A number of factors increase the risk of patients admitted to hospital developing a VTE, therefore prophylaxis is generally advocated. The recommended prophylactic medication is daily injections of Low Molecular Weight Heparin (LMWH) or fondaparinux, which is an inhibitor of the clotting factor Xa.<sup>43</sup>

In 2004 an initial audit at the study hospital showed that prescribing of VTE prophylaxis for medical patients with identifiable risk factors was poor, only 18% of patients at risk were prescribed prophylactic LMWH. A protocol was developed for the risk assessment of medical patients in 2005 but subsequent audits showed poor compliance with the protocol and that many medical patients at risk of VTE were not receiving prophylactic treatment.

## **1.8 Medicines reconciliation practices at RLUH**

An accurate and comprehensive current medication history is essential for safe and appropriate management of all patients on admission to hospital.<sup>35</sup> The information documented should comprise all medication currently being taken by the patient together with doses and frequencies and include any medication recently started by the GP, Over the Counter (OTC) medicines and herbal remedies.<sup>35, 44</sup> Medicines reconciliation on admission to hospital, as defined by NICE, is the process of collecting information to prepare the patient's current medication history, verifying this list against the current hospital medication chart, identifying any discrepancies and taking appropriate action.<sup>35</sup> Errors in medicines reconciliation have an adverse impact on clinical care and may also have a financial impact.<sup>45</sup>

At RLUH the admitting doctor is responsible for taking a medication history and writing the initial prescription following admission to hospital as part of the clerking process. Pharmacists visit AMU seven days a week, according to a rota, and complete the medicines reconciliation process with as many patients as time allows. In addition to the resources available to the medical staff pharmacists are able to access EMIS web, which is the computer system used by the majority of GPs in Liverpool, enabling them to print a list of patients current medication. Discrepancies identified may be corrected by a pharmacist prescriber, immediately drawn to the attention of the medical staff or documented in the case notes for review at a later time depending on the likely clinical impact. Pharmacists aim to identify and correct medication errors as early as possible in the patients stay to minimise adverse events and facilitate best possible care. However resources do not allow a constant pharmacist presence on AMU on weekdays and are restricted further in times of staffing shortages. Fewer pharmacists are available at weekends which limits the number of patients who can be seen and difficulties often arise as primary care services (GPs, anticoagulant clinics, drug addiction services) are not generally available at weekends if information is required.

In 2004 a study carried out at the RLUH showed that 39% of medicines identified by pharmacists by interviewing the patient shortly after admission were not prescribed on the hospital medication chart<sup>46</sup> and subsequent audits have shown that this situation has not changed in recent years.

### **1.9 Purpose of study**

It is recognised that hospital admission is associated with a significant risk to patients and there was ample evidence from the local audits cited above that neither VTE risk assessment nor medicines reconciliation were being carried out in accordance with national guidance at the start of the study. Over the years preceding the study various initiatives had been tried in order to improve VTE risk assessment with limited effect including, education for junior doctors, development of an in house risk assessment tool and pre-printing medication charts with the appropriate prophylactic medication as an aide memoir so that only a date and signature were required to complete the prescription. Since 2005 pharmacists have

provided education sessions to medical students from Liverpool University but errors in prescribing for patients on admission remain a daily occurrence.

Evidence suggests that these problems are not unique to Liverpool but are seen both nationally and internationally.<sup>47-52</sup> Published studies of both VTE risk assessment and medicines reconciliation have generally focused on identifying and assessing the size of the problem. No published studies were located which have attempted to investigate and understand the root of the problem in order to suggest appropriate solutions.

There is thus considerable value in investigating how best to successfully integrate a novel process into hospital admission procedures. VTE risk assessment was one of the first NICE quality standards to be introduced in 2010; eventually these will number around 150 covering many aspects of patient care. It is therefore vital that NHS Trusts have systems in place to implement the necessary changes efficiently and effectively particularly in the current economic climate. Failure to implement evidence based guidance effectively has major implications for the NHS in terms of patient safety and financial governance. If barriers can be identified and overcome, this project may have benefits not just for RLUH but for the wider NHS.

### **1.10 Study aim**

To explore the hospital admission process at RLUH for acute medical patients in relation to VTE risk assessment and accuracy of medication history documented in order to identify barriers to good practice and make recommendations to improve patient safety.

### **1.11 Study objectives**

#### **1.11.1 VTE risk assessment**

- i. To explore and map the processes involved in VTE risk assessment and management.
- ii. To assess the frequency with which VTE prophylaxis is prescribed appropriately for medical patients at risk of VTE and the relevant clinical outcomes in these patients.

- iii. To compare the perceived and actual activities of healthcare professionals in the assessment and management of medical patients with respect to VTE.
- iv. To identify perceived barriers to and facilitators for the implementation of VTE guidance.
- v. To assess the impact of the introduction of government targets for VTE risk assessment.
- vi. To make recommendations which may help to increase the proportion of patients who are VTE risk assessed and have VTE prophylaxis prescribed if indicated.

#### **1.11.2 Medicines reconciliation**

- i. To explore and map the processes involved in taking a medication history and prescribing on admission to hospital.
- ii. To assess the frequency with which errors occur in prescriptions written on admission to hospital and their potential adverse clinical impact.
- iii. To compare the perceived and actual activities of healthcare professionals in the assessment and management of medical patients with respect to medicines reconciliation and prescribing.
- iv. To identify perceived barriers and facilitators to accurate prescribing on admission to hospital.
- v. To identify any changes in prescribing error rates over time.
- vi. To make recommendations which may help to increase the numbers of patients who have an accurate prescription written on admission to hospital.

#### **1.12 Summary**

This chapter has provided the background to the study setting including the evolution of the NHS, the introduction of AMUs into hospitals and NHS targets. The key risks to be investigated, VTE risk assessment and medicines reconciliation have been introduced and are discussed in more detail in the next chapter.

## **Chapter 2 Study Background**

This chapter provides the background to the two key risks on admission to hospital which are to be explored, VTE risk assessment and medicines reconciliation and also reviews the difficulties associated with guideline implementation.

### **2.1 Literature search strategy**

#### **2.1.1 VTE literature**

The literature for VTE was searched to identify current knowledge regarding the incidence of DVT and PE in medical patients, the potential long term consequences, the effectiveness of prophylaxis with LMWH, national and international guidelines for risk assessment and the proportion of patients both VTE risk assessed and prescribed prophylaxis. Both national and international literature was searched as death from VTE was likely to be a global health risk. MEDLINE was searched from 01.01.50 to 08.01.14, only publications in English were included. Initial search terms were 'venous thromboembolism medical patients', 'venous thromboembolism risk assessment', and 'venous thromboembolism pathophysiology'. Web of Science was also searched using the terms "venous thromboembolism risk assessment" but returned few additional relevant papers. Due to the significant growth in the published literature on this topic during the course of the study search criteria were later narrowed to include 'venous thromboembolism risk assessment admission', 'venous thromboembolism risk assessment observation', 'venous thromboembolism risk assessment medical patients', 'strategies to improve prophylaxis for venous thromboembolism', and 'venous thromboembolism guideline implementation'. National guidelines for England and Wales were identified using the NICE website, <http://www.nice.org.uk>, using search terms 'venous thromboembolism'. The search engine Google was used to search the UK grey literature for audits of VTE risk assessment carried out in NHS hospitals which had not been formally published; search terms used were 'audit venous thromboembolism medical NHS trust'.

#### **2.1.2 Medicines reconciliation literature**

For medicines reconciliation the literature was searched to identify national and international guidelines, the accuracy of prescriptions written on admission to

hospital and the potential causes of prescribing errors. Both national and international literature was search as it was assumed that prescribing errors were likely to be a risk worldwide. MEDLINE was searched from 01.01.50 to 08.01.14, only publications in English were included. Search terms were ‘medicines reconciliation’, ‘medication history pharmacist’, ‘medication history taking accuracy’, ‘drug history taking accuracy’, ‘prescribing error admission’, ‘medical admissions unit prescribing’, ‘prescribing training admission’ and ‘prescribing error prevalence’. Google scholar was also searched for articles relating to training for doctors in medicines reconciliation, search terms used were ‘medicines reconciliation training doctor’ but no useful papers were identified. The Student BMJ was searched for papers about the hospital clerking process using the search term ‘clerking’. National guidelines for England and Wales were again identified using the NICE website <http://www.nice.org.uk>.

### **2.1.3 Guideline literature**

As the study was investigating the implementation of guidelines for both VTE and medicines reconciliation the literature was searched separately to identify potential facilitators and barriers and to guideline implementation and any studies which had used direct observation to investigate guideline implementation. MEDLINE was searched from 01.01.77 to 19.12.13, only publications in English were included. Search terms for guideline implementation were ‘guideline implementation observation’, ‘clinical guidelines adherence barrier’, ‘incentives healthcare guideline implementation’, and ‘opinion leader guideline’.

Citations identified in the electronic databases were initially screened to identify potentially relevant papers, abstracts of these papers were then screened and those which were not relevant to the study were excluded. Full copies of papers were obtained for the remaining relevant articles. Key authors were identified from the principal papers located and MEDLINE was searched separately to identify further relevant papers by these authors. Further articles were also identified from the references lists of significant papers.



## 2.2 Venous thromboembolism

### 2.2.1 Definitions

A venous thromboembolism is a clot which occurs in the body in response to three principal factors, damage to a blood vessel, a reduction in the rate of blood flow and changes in the ability of the blood to clot, these three factors are generally known as Virchow's triad.<sup>39</sup> Venous thromboemboli usually occur in the deep veins in the calf of the leg,<sup>39</sup> a thrombosis in this location is therefore known as a deep vein thrombosis or DVT. If a DVT breaks free, is transported by the circulation through the heart and lodges in the pulmonary arteries this is known as pulmonary embolism or PE.<sup>40</sup>

### 2.2.2 Historical background

VTE was first described in detail in England 1676 in a patient who developed swelling and pain in one leg following childbirth, its association with debilitating medical illnesses was noted in 1810 and its association with surgery recognised in 1866.<sup>53</sup> During the 20<sup>th</sup> century, accumulating evidence of risk factors for VTE, especially those associated with surgery, led to the first consensus statement for preventing VTE and PE which was published in America in 1986<sup>54</sup> and recommended prophylaxis with unfractionated heparin for both medical and surgical patients. The THRIFT consensus group published similar recommendations in the UK in 1992.<sup>55</sup>

For surgical patients the adverse effects of trauma due to surgery and venous stasis due to immobility during and following surgery have been recognised for over a century.<sup>53</sup> National guidance for reducing the risk of VTE in patients undergoing surgery was published in England in 2007<sup>56</sup> and as a result prescribing of VTE prophylaxis for surgical patients is currently accepted as routine clinical practice throughout the UK. In contrast the situation for medical patients is more complex, less evidence is available, national guidance for England was published in 2010,<sup>43</sup> some years after that for surgical patients, and implementation for medical patients has taken longer.

### **2.2.3 Risks associated with VTE**

A House of Commons Health Select Committee inquiry in 2004 estimated that PE is responsible for approximately 25,000 deaths in English hospitals each year and is the immediate cause of death in 10% of patients who die in hospital.<sup>41, 42</sup> A review of post mortems carried out in a London hospital between 1991 and 2000 showed that death from PE is more likely to occur in medical patients than surgical patients.<sup>57</sup> Studies have also shown that a DVT may break free and lead to a PE without any clinical symptoms,<sup>58, 59</sup> approximately 50% of patients with proven DVT have a high probability of PE on ventilation-perfusion lung scanning.<sup>60</sup>

### **2.2.4 Long term consequences of VTE**

There are a number of long term consequences associated with VTE and therefore it is preferable to provide appropriate prophylaxis to minimise the number of patients developing a DVT or PE. Of patients with a DVT 30%-50% will develop post-thrombotic syndrome which in some cases causes severe leg pain, oedema and chronic leg ulcers.<sup>61, 62</sup> Between 2% and 4% of patients with a PE will develop chronic thromboembolic pulmonary hypertension which causes severe shortness of breath and may lead to death as a result of right ventricular failure.<sup>61, 62</sup> It has been shown that approximately 30% of PEs prove fatal within 7 days of diagnosis.<sup>63</sup>

### **2.2.5 VTE risk assessment tools**

The process of risk assessing patients for VTE initially involves identifying any predisposing factors. The first American consensus statement of 1986 included a list of known VTE risk factors for medical patients but noted that the combined impact of multiple risk factors was unknown,<sup>54</sup> the most recent version of these guidelines (8<sup>th</sup> edition) was published in 2008.<sup>64</sup> Many hospitals used the consensus statements to develop 'in house' risk assessment models or tools,<sup>65</sup> which generally consisted of a list of risk factors, and were refined when the criteria used in large studies such as MEDENOX<sup>66</sup> and PREVENT,<sup>67</sup> which assessed the efficacy of LMWH for VTE prophylaxis in medical patients, and ENDORSE<sup>68</sup> which investigated the proportion of at-risk medical patients who received prophylaxis, were published. Some studies have suggested the use of weighted scoring systems,<sup>69, 70</sup> these are

more complicated to use than simple lists of risk factors but may enable tailored prophylaxis in certain groups of high risk patients such as those with cancer.<sup>71</sup>

### 2.2.6 VTE risk factors and pharmacological prophylaxis

Medical patients acutely admitted to hospital may be at risk of VTE due to a number of factors including immobility, increasing age, and co-morbidities in addition to their presenting medical condition. The link between the inflammatory process and increased VTE risk was first proposed in 1974<sup>72</sup> and it is now recognised that many acute medical conditions which have an inflammatory component such as respiratory disease, inflammatory bowel disease, acute arthritis and acute infection are all associated with an increased risk of VTE.<sup>73</sup> Common VTE risk factors are shown in Figure 2-1.

**Figure 2-1: Common VTE risk factors**

- Age > 60 years
  - Acute or chronic lung disease
  - Chronic heart failure
  - Acute infectious disease (e.g. pneumonia)
  - Acute or chronic inflammatory disease
  - Active cancer or myeloproliferative disorder
  - Diabetic hyperosmotic hyperglycaemic state
  - Personal or family history of DVT<sup>a</sup> or PE<sup>b</sup>
  - Expected to be immobile for 3 days or more
  - Hormone therapy containing oestrogen (HRT<sup>c</sup> or OCP<sup>d</sup>)
  - Lower limb paralysis (excluding acute stroke)
  - Obesity: BMI > 30
  - Known thrombophilia
  - Varicose veins with phlebitis
  - Pregnant or ≤ 6 weeks post-partum
- <sup>a</sup>Deep vein thrombosis, <sup>b</sup>Pulmonary embolism, <sup>c</sup>Hormone replacement therapy, <sup>d</sup>Oral contraceptive pill

During the 1980s and 1990s increasing evidence became available regarding the many risk factors for VTE which are associated with medical conditions culminating with the publication of the MEDENOX study in 1999.<sup>74</sup> This large multinational study showed that the incidence of VTE in general medical patients aged over 40

years is almost 15% and that VTE was effectively prevented in 63% of cases by the use of a LMWH, in the MEDENOX study enoxaparin was the product used. In 2003 the PRINCE study from Germany showed that in medical patients with heart failure or severe respiratory disease enoxaparin is at least as effective as unfractionated heparin<sup>75</sup> and in 2005 the PREVENT study demonstrated the efficacy of a standard dose of the LMWH dalteparin for the prevention of VTE in acutely ill medical patients.<sup>67</sup>

Many medical patients have multiple risk factors, thus not surprisingly it has been shown that the proportion of patients who develop VTE increases as the number of risk factors increases,<sup>76</sup> over 80% of medical patients admitted to hospital have at least one risk factor.<sup>74, 77</sup> The risk of DVT in hospitalised medical patients if no thromboprophylaxis is given was shown to be approximately 20% in a meta-analysis of 17 randomised clinical trials.<sup>78</sup> Prophylaxis with the LMWH enoxaparin or dalteparin reduces the number of hospital-acquired VTEs in medical patients by up to 60%.<sup>66, 67, 74</sup> No studies have been published to support the use of tinzaparin, the third LMWH available in the UK, for VTE prophylaxis in medical patients and it is not currently licensed for this indication. Fondaparinux, an inhibitor for the clotting factor Xa, has also been shown to be effective in medical patients<sup>79</sup> reducing the incidence of VTE by almost 50%. Fondaparinux is recommended as an option for VTE prophylaxis in medical patients by both NICE<sup>43</sup> in the UK and the American College of Chest Physicians<sup>64</sup> however in practice it is usually reserved for patients with a heparin allergy due to its increased cost, around twice that of LMWH.<sup>80</sup>

### **2.2.7 Risks associated with LMWH**

As LMWHs are anticoagulants there was concern that their widespread use for VTE prophylaxis would be associated with an increased incidence of haemorrhage. However the large multinational studies such as MEDINOX<sup>74</sup> and PREVENT<sup>67</sup> showed a prevalence of major bleeding events of 1.7% and 0.43% respectively in patients receiving LMWH, which was not significantly different to the incidence in patients treated with placebo. A meta-analysis published in 2007 showed that 598 patients would have to be treated with LMWH prophylaxis for every case of major bleeding.<sup>81</sup> The IMPROVE study showed that as expected medical patients with

known bleeding, active gastrointestinal ulceration or a low platelet count ( $<50 \times 10^9$ ) were most likely to develop bleeding within 14 days of hospital admission when treated with prophylactic LMWH,<sup>82</sup> 1.2% developed a major bleed and 2.1% a less severe but clinically relevant bleed. Patients must be assessed for bleeding risk in accordance with NICE guidelines and LMWH should only be prescribed if the risk of VTE outweighs the individual risk of bleeding.<sup>43</sup> Common bleeding risks are shown in Figure 2-2.

**Figure 2-2: Common bleeding risks**

- Active bleeding
- Taking warfarin or other anticoagulant or antiplatelet therapy
- Haemophilia or other known bleeding disorder
- Acute stroke in past month (haemorrhagic or ischaemic)
- Blood pressure > 200 systolic or 120 diastolic
- Hypersensitivity to heparin
- History of Heparin Induced Thrombocytopenia (HIT)
- Lumbar puncture / spinal / epidural in previous 4 hours or indicated now

### 2.2.8 Cost effectiveness of VTE prophylaxis

A large study from America showed that treatment of patients with a VTE is associated with significant costs and that management of a second DVT costs 21% more than the initial event.<sup>83</sup> Another American study showed that appropriate VTE prophylaxis, for medical and surgical patients, is associated with a decreased length of hospital stay and the overall cost of care was significantly lower for patients who received appropriate prophylaxis with LMWH.<sup>84</sup> An Australian study also showed significant savings,<sup>85</sup> however no UK cost-effectiveness studies were located in the literature. This may be because healthcare costs have traditionally been carried out at individual patient level in the USA and Australia as required by private medical insurance companies, however in the UK the NHS has traditionally been funded according to block contracts, hence the mechanisms for accurately costing healthcare services to individual patient level are not well developed.

### **2.2.9 Prescribing of VTE prophylaxis**

In the 21<sup>st</sup> century there has been increasing international awareness of VTE risks as shown by studies assessing current prophylactic prescribing practice which have been published in Europe,<sup>86, 87</sup> Brazil,<sup>88</sup> the United States<sup>89, 90</sup> and Canada.<sup>91</sup> However the ENDORSE study, which was conducted in 32 countries worldwide in 2008, showed that prescribing rates of recommended VTE prophylaxis in medical patients varied between countries from 3% to 70%.<sup>68</sup> In the UK uptake was slow, a 2004 audit from Oxford showed that only 25% medical patients, for whom prophylaxis was indicated, received it,<sup>92</sup> a 2009 paper from Leeds showed an improvement to 56% following interventions<sup>93</sup> and a 2010 paper from Nuneaton showed 48% of medical patients received appropriate prophylaxis.<sup>94</sup> A more recent audit, published in 2013, showed that in some centres 98% of patients are now appropriately prescribed prophylaxis.<sup>95</sup>

### **2.2.10 National guidance in England and Wales**

In 2007 an independent expert working group, commissioned by DH, recommended a mandatory VTE risk assessment of every hospitalised patient on admission<sup>96</sup> and in autumn 2008 the DH introduced a screening tool for VTE which was recommended for use by all acute NHS trusts.<sup>34</sup> In early 2010 NICE published guidance on reducing the risk of VTE in patients admitted to hospital<sup>43</sup> which reiterates the need for all patients to be VTE risk assessed on admission. In March 2010 the DH announced that data collection relating to VTE risk assessment would be mandatory from June 2010 and this subsequently formed part of the DH CQUIN financial framework for 2010/11 for England.<sup>97</sup> In December 2010 the DH announced that the incidence of hospital acquired VTE was to be included in the new NHS Outcomes framework for England for 2011/12 in the domain of treating and caring for people in a safe environment and protecting them from avoidable harm.<sup>98</sup> The published national data show that it took 18 months for the national target of 90% of patients to be risk assessed on admission to hospital to be achieved by acute NHS trusts.<sup>99</sup> The national VTE risk assessment initiative has been effective as there has been a significant reduction in both deaths directly attributed to VTE and VTE related deaths in patients admitted to NHS hospitals in England for a period of less than four days since national targets were introduced.<sup>100</sup>

## 2.3 Medicines reconciliation

### 2.3.1 Definitions

Medication errors have been defined by the NPSA as *“incidents in which there has been an error in the process of prescribing, dispensing, preparing, administering, monitoring, or providing medicine advice, regardless of whether any harm occurred”*.<sup>101</sup> This is a broad definition which is generally accepted for use in the NHS.

Prescribing errors constitute one type of medication error and have been defined as occurring: *“when, as a result of a prescribing decision or prescription writing process, there is an unintentional significant (1) reduction in the probability of treatment being timely and effective or (2) increase in the risk of harm when compared with generally accepted practice”*.<sup>102</sup>

A medication history should comprise a list of all medication currently being taken by the patient together with doses and frequencies and include any medication recently started by the GP, Over the Counter (OTC) medicines and herbal remedies.<sup>35, 44</sup> Medicines reconciliation on admission to hospital, as defined by NICE, is the process of collecting information to prepare the patient’s current medication history, verifying this list against the current hospital medication chart, identifying any discrepancies and taking appropriate action.<sup>35</sup> The World Health Organisation (WHO) has defined unintentional medication discrepancies as those *“in which the prescriber unintentionally changed, added or omitted a medication the patient was taking prior to admission”*.<sup>103</sup>

### 2.3.2 Medication history taking process

Guidance suggests that at least two sources should be used when obtaining a medication history and where possible the patient should be involved.<sup>44, 104-106</sup>

Suitable sources suggested in the literature include: the patient’s own medicines, discussion with the patient or carer, GP repeat prescription order form, computer printout from GP clinical records system, case notes, community pharmacy, and medication administration records (MAR) from care homes.<sup>44, 103, 106</sup> The WHO has stated that a *“best possible medication history”* involves the use of more than one source and should include a patient interview where practical.<sup>103</sup>

### 2.3.3 Risks associated with medication

Medication errors are recognised as an important cause of morbidity and mortality and in 2000 the DH report “An Organisation with a memory”<sup>25</sup> noted that in general medical practice 25% of litigation claims related to medication errors. It recommended that action should be taken to reduce the number of errors associated with prescribed medicines by 40% over the next five years. The implementation guidance published in 2001 “Building a safer NHS for patients: implementing an organisation with a memory”<sup>26</sup> noted that some hospital pharmacists were already working to improve the quality of the medication history recorded when patients are admitted to hospital. The follow up report “Building a safer NHS: improving medication safety” was published in 2004<sup>107</sup> and noted the problems which arise with medication when patients transfer between care settings. These risks have also been recognised by the World Health Organisation (WHO) and international guidance has been published.<sup>103, 108</sup>

### 2.3.4 Quality of medication histories

Several studies in the literature show that medication histories taken by doctors during the hospital admission process are frequently inaccurate,<sup>47-50</sup> the proportion of histories with an error ranging from 23%<sup>49</sup> to 62%<sup>48</sup> of cases. A large study carried out in acute trusts in the North West of England in 2009 found that prescribing errors were most often made at the time of admission to hospital with 13.4% of prescriptions containing an error of which 1.74% were classified as being potentially lethal.<sup>109</sup> However none of these studies investigated the actual process of obtaining a medication history, data were collected retrospectively by reviewing medication charts.

Pharmacists have been shown to document medication histories more accurately than medical staff.<sup>46, 47, 110</sup> A recent American study which collected data from a computerised medicines reconciliation template found that pharmacists documented more prescribing changes on admission to hospital than doctors and also that pharmacists were more likely to document additional information such as indications for medicines and the rationale for changes made.<sup>111</sup>



### **2.3.5 Causes of prescribing errors**

The causes of prescribing errors are multifactorial but common themes include lack of time / workload pressures, poor communication and lack of knowledge and / or training.<sup>112, 113</sup> A study carried out in North West England which interviewed 30 junior doctors also found that these three factors were involved when errors occurred.<sup>109</sup> Results from a Scottish study in which 40 junior doctors from eight hospitals (four teaching, four district general) were interviewed provided more insight into the effect of time pressure. Doctors in this study felt that they had little time for checking, whether this involved checking sources during medicines reconciliation, checking reference sources such as the BNF or checking tasks which they had carried out.<sup>114</sup> Access to necessary information outside of normal working hours also caused difficulties as, although electronic systems were sometimes available, junior medical staff on call often did not have a password.<sup>114</sup>

### **2.3.6 Incidence and potential impact of prescribing errors on admission to hospital**

A systematic review of 63 published studies from countries worldwide found that 50% of patients admitted to hospital experience a prescribing error<sup>115</sup> and prescribing errors were found to affect approximately 15% of newly written medication orders in London.<sup>112</sup> An error in the medication history has been identified as the source of approximately 80% of the prescribing errors made on admission to hospital.<sup>116</sup> However the incidence of errors reported in the literature is variable due to the different ways in which results are expressed.<sup>117</sup> A systematic review of 24 studies found that prescribing error rates ranged from 4.2% to 82% of prescription charts reviewed.<sup>118</sup> Topical preparations such as eye drops seem to be most often omitted from admission prescriptions,<sup>119</sup> a check list highlighting common medicines which are not taken orally and those which are taken or used less frequently than once a day has been shown to be effective in reducing the number of medicines omitted from the prescription written on admission to hospital.<sup>120</sup>

A recent large study carried out in eight hospitals in Scotland showed that 60% of prescribing errors reached the patient,<sup>113</sup> although less than 1% resulted in harm or

required additional monitoring. Few studies have attempted to assess the impact of prescribing errors identified during medicines reconciliation and a variety of methods have been used. A Welsh study using an adapted version of a tool developed by the NPSA<sup>121</sup> classified 20% of errors as 'major' or 'moderate',<sup>48</sup> other studies using consensus panels to estimate impact have reported 32.9% of errors could potentially cause moderate discomfort or clinical deterioration<sup>122</sup> and a study from London concluded that 26% were potentially serious.<sup>123</sup> A Dutch study, using a scheme developed by the Netherlands Association of Hospital Pharmacists, found that preventable harm was caused by about 2% of prescribing errors,<sup>50</sup> and a French study using two pharmacists and a doctor to assess the impact of errors found that 6.4% had the potential to cause temporary patient harm, 20.8% may have resulted in a greater need for patient monitoring but the majority (72.8%) were unlikely to be harmful.<sup>124</sup> Overall all of the above studies concluded that the majority of prescribing errors identified during medicines reconciliation following admission to hospital were unlikely to cause serious harm despite the different methods used to assess the likely impact.

### **2.3.7 Problems associated with medicines reconciliation.**

Medicines reconciliation on admission to hospital is problematic as patients are often too unwell to provide any substantial information and the patient's own medication is often forgotten in the rush to get to hospital. Lists of medication from GP surgeries may be inaccurate<sup>125</sup> and between 10% and 50% of patients may not take their medicines as prescribed.<sup>126, 127</sup>

### **2.3.8 Time required for medicines reconciliation**

The costing template published by NICE/NPSA to support the implementation of the medicines reconciliation alert in 2007 suggests that 15 minutes is required to carry out medicines reconciliation for the 'average' emergency admission but acknowledges that complex patients are likely to require longer.<sup>104</sup> A UK study showed that the median time taken for medicines reconciliation in acute medical admissions was 15 minutes, interquartile range 10 to 20 minutes,<sup>126</sup> and a study from the USA found that the mean time required to complete both medicines reconciliation and make any necessary interventions was 21.2 minutes.<sup>116</sup> A French

study found that the time taken by pharmacists to determine the best possible medication history in accordance with the WHO definition<sup>103</sup> was 36 minutes.<sup>124</sup>

### **2.3.9 Cost effectiveness of medicines reconciliation**

A systematic review has shown that medicines reconciliation by pharmacists is a cost effective method of reducing prescribing errors on admission to hospital.<sup>45</sup> A study from Sheffield showed that pharmacist-led medicines reconciliation was most likely to be cost effective, when compared with pharmacy technicians or nurses using a standard medication history form and lists of medication faxed by GPs, and that savings made from preventable adverse drug reactions may be significant.<sup>128</sup>

### **2.3.10 National guidance in England and Wales**

National guidance for medicines reconciliation was introduced in England and Wales in late 2008 when NICE and the NPSA jointly published patient safety guidance.<sup>35</sup> Acute NHS Trusts were advised to ensure that policies were in place for medicines reconciliation and the guidance also stated that pharmacists should be involved in medicines reconciliation as soon as possible following the admission of patients to hospital. The RPS professional standards for hospital pharmacy services indicate that ideally pharmacy staff should carry out medicines reconciliation within 24 hours of admission.<sup>38</sup> Although most Trusts have carried out local audits and there has been at least one benchmarking study carried out in the south east of England<sup>129</sup> there have been no formal national audits and, in contrast to VTE, no national targets for medicines reconciliation have been introduced.

## **2.4 Implementation of guidelines**

### **2.4.1 Guideline implementation rates**

There is a significant gap in clinical practice between recognised best practice in line with available evidence and care actually received by patients. An American study found that patients received only 54.9% of the steps recommended in their care pathways.<sup>130</sup> A study from the Netherlands showed that even when knowledge of guidelines is good and there is wide acceptance of their benefits, implementation by GPs only occurred in 67% of relevant clinical situations.<sup>131</sup>

### **2.4.2 Potential barriers to guideline implementation**

A systematic literature review of 256 articles in 2007<sup>132</sup> investigated the barriers to integrating guidelines, evidence and research into clinical practice. This study identified seven categories of barriers: cognitive/behavioural, attitudinal, professional, guideline/evidence, patient, support/resource, and system/process. An earlier review identified physician related barriers including lack of awareness, lack of motivation and lack of agreement with the guideline or lack of belief that the intervention will lead to the desired outcome.<sup>133</sup> A recent investigation into the uptake of evidence from systematic reviews identified similar barriers including lack of awareness, lack of trust in the results and lack of motivation.<sup>134</sup>

### **2.4.3 Potential strategies to improve guideline implementation**

A review of guideline dissemination and implementation strategies from 1966 – 1998 showed an overall failure to adhere to guidelines and concluded that implementation strategies such as education, audit and feedback and reminders have a limited effect improving uptake by 4 – 34%.<sup>135</sup> A later study from Australia also showed a modest increase in uptake of guidance following the use of various implementation strategies. The most useful strategies were identified as being grand rounds, peer review sessions and informal discussions, reminder cards and information packs were deemed less useful.<sup>136</sup> However in another study personal timely reminders were effective in increasing the number of staff who wore gloves when inserting an intravenous cannula or taking a blood sample.<sup>137</sup>

The layout and content of guidelines may also affect uptake, a study in 2011 developed a framework consisting of 22 elements which, if included in guidelines, should improve the level of implementation.<sup>138</sup> These include usability, evidence of validity, tools for implementation and advice for monitoring. Thus modification of some existing guidelines in line with this framework may result in greater implementation rates.

Adoption of a guideline often starts with a small number of enthusiasts, it is then adopted by those who are respected in local networks including local opinion leaders and then spreads to the majority.<sup>139</sup> However identification of current

opinion leaders is not easy as it has been shown that these individuals change in a period of less than two years.<sup>140</sup>

Complex interventions such as VTE risk assessment and medicines reconciliation, which have a number of different components and require clinical judgement may present particular difficulties in implementation,<sup>141</sup> organisational factors are thought to be particularly important.<sup>142</sup> The successful integration of this guidance into the complex process required for unplanned admissions is likely to prove especially challenging. Therefore the study investigated the integration of these two interventions into the hospital admissions process and explored the various factors impacting on their implementation.

## **2.5 Summary**

This chapter has provided the background and rationale for both VTE risk assessment and medicines reconciliation to be carried out for all patients on admission to hospital. The difficulties associated with the implementation of clinical guidelines have also been reviewed. The methods used in the study to explore the implementation of both VTE and medicines reconciliation guidance are discussed in the next chapter.

## Chapter 3 Methods

This chapter discusses the research design, the methodology chosen for the study, the design of the research instruments, the conduct of the study and the data management and analysis.

### 3.1 Research design

The study was originally designed as a change management project focusing on VTE risk assessment involving an initial series of data collection periods, analysis of the data, design and implementation of interventions and a further series of data collection periods to identify any changes in practice. However due to political pressure the study Trust began introducing measures to improve VTE risk assessment starting with the appointment of a thrombosis nurse in February 2010. Since the original change management project was no longer viable and information regarding medication had been collected as part of the VTE project it was decided to change the study focus and investigate the implementation of two different pieces of guidance, VTE risk assessment and medicines reconciliation, on admission to hospital. Government pressure was being applied to improve the implementation of the VTE guidance, but not the medicines reconciliation guidance, so the effect of national targets on guideline implantation was felt to be worthy of investigation. As three large data sets had already been collected prior to VTE data collection becoming mandatory in June 2010 it was decided to have a final data collection period 12 months after government intervention commenced in order to detect any changes over time.

Pharmacy and medicine are healthcare disciplines which are rooted in science and hence an overall scientific approach was taken to the study. Scientific methods involve the systematic study of the area of interest including outcomes and aim to minimise the effects of external factors on the data collected and therefore usually involve quantitative methodologies. The principal philosophy on which quantitative scientific methods are based is positivism which assumes that phenomena are measurable.<sup>143</sup> However, not all aspects of healthcare are measurable, especially the opinions of individuals as in this study. Quantitative methods would provide the

outcomes in terms of how many patients received VTE prophylaxis or how many had an error in their prescription however it was important to try to understand the reasons behind the poor compliance with guidance. A pragmatic approach was therefore taken to developing the methodology,<sup>144, 145</sup> in order to find out how errors were occurring it was necessary to observe the admission clerking process and to understand why there was a problem it was necessary to speak to the individuals involved which required the inclusion of a qualitative approach. Mixed methods which include both qualitative and quantitative components enable a wider range of data to be collected and facilitate triangulation in which findings from one methodology may be supported or confirmed by findings from another methodology potentially strengthening the results.<sup>143, 146</sup>

As the problems in implementing both VTE risk assessment and medicines reconciliation guidance were likely to be multifaceted, a methodology was required which would enable information to be gathered not only about the processes involved but also the opinions of relevant staff and patient outcomes. A mixed methods approach was therefore chosen comprising direct observation of the admission process, interviews with healthcare staff and a retrospective review of case notes. Observations were chosen to obtain 'real life' data about what actually happens when a patient is admitted to hospital and interviews to gather information about the knowledge and opinions of staff to support and inform the findings of the observations. The case note review established what was documented in relation to VTE risk assessment and prescribing of medicines and enabled outcomes to be identified. The data collected were mainly quantitative from the case note reviews, the observations and the structured interviews. A small amount of qualitative data was gathered from the observations and from the limited number of open questions in the interviews, although this did not provide the rich data normally associated with qualitative studies the methodology still falls within the definition of mixed methods.<sup>145</sup>

In order to avoid the focus of the study becoming known observations were carried out first for each data collection period, interviews were scheduled and case notes reviewed once observations were complete. Interviews were completed as soon as

possible as medical staff rotate frequently, often to different hospitals, which may have compromised the completeness of the data had they been delayed. The case note review continued throughout the study, including weeks when observations were conducted, the rate of data collection being dependent on the rate of discharge of the patients and the availability of the notes.

### **3.2 Selection of methodology**

Various methods have been used to study how best to implement clinical guidelines and evidence has accumulated demonstrating the efficacy of many different methods. Several studies in healthcare have used a single methodology to investigate barriers to guideline implementation. For example semi structured interviews alone have been used to explore the use of antibiotics for the treatment of pneumonia<sup>147</sup> and the treatment of hypertension,<sup>148</sup> questionnaires alone have been used to investigate the implementation of guidelines relating to intravenous catheter insertion<sup>149</sup> hypertension<sup>150</sup> and maternity care.<sup>151</sup>

Non-participant observation has been used previously in healthcare research to investigate the interaction between healthcare professionals and patients, for example the assessment of nutrition,<sup>152</sup> and various aspects of direct nursing care.<sup>153-156</sup> The consultation skills of medical students and specialist registrars working in general practice have been assessed using direct observation.<sup>157, 158</sup> In relation to medication observation has been used to assess nurses' prescribing consultations,<sup>159</sup> explore various aspects of the supply of over the counter medicines from community pharmacies<sup>160, 161</sup> and investigate the recently introduced Medicines Use Review (MUR) service.<sup>162</sup> During the hospital admission process direct observation has been used to assess how data relating to children's allergies is ascertained and documented.<sup>163</sup> However no published studies were found in the literature to date which used non-participant observation for the investigation of any other aspects of the hospital admission process or for the purpose of managing guideline implementation. Given the potential need for changes to practice in order to implement both VTE and medicines reconciliation guidelines, observation of current practices is essential in order to understand what needs to change and the likely barriers to these changes.



Participant observation was considered but rejected as it was not possible for the researcher to collect the necessary detailed data while continuing to function as a consultant pharmacist. The literature highlights the possible conflicts between the various roles required of a participant observer in a healthcare study and the difficulties in satisfying the demands of both employee and researcher roles simultaneously.<sup>164</sup> In the present study there would have been a constant conflict between her pharmacist role and researcher role, the practicalities of observing medical staff in such an unpredictable and busy setting necessitated her presence to do research without any additional commitments or distractions.

The use of video as an alternative to direct observation was briefly considered as it has been used in healthcare research for example to assess the nursing care of cancer patients,<sup>165</sup> to assess the performance of anaesthesiologists<sup>166</sup> and to improve multidisciplinary team working in the discharge process.<sup>167</sup> However this approach posed additional ethical problems, was likely to prove technically difficult in such a fast moving complex clinical environment and may have deterred both staff and patient participation.

A systematic literature review in 2007<sup>132</sup> investigated the barriers to integrating guidelines, evidence and research into clinical practice. Of the 178 studies identified 44 were mixed method studies and only six involved the use of more than two methods of assessment. The authors note that mixed methods studies may yield more reliable results. It was therefore decided that, in order to obtain as much information as possible about current practices in relation to both VTE and medicines reconciliation, the study should have a mixed methodology including observations, interviews and a review of case notes, the latter also facilitating the determination of outcomes. This methodology was presented and discussed at the PhD forum held at the Health Services Research and Pharmacy Practice (HSRPP) Conference in March 2009 in order to seek the opinions of experienced researchers (Appendix 1). The proposal was well received; the problems associated with the researcher being a member of the AMU team in the study hospital were discussed. However a large, high turnover AMU was needed in order to enable sufficient data to be collected within the time available, other local units did not have sufficient

patient numbers. In addition recent audit data demonstrating the need for this research was available in the study hospital.

### **3.3 Study risk assessment**

A risk assessment was carried out and documented as required by RLBUHT (Appendix 2). As the project was to be carried out in the investigator's normal working environment and there were no alterations to the usual policies and procedures, it was not anticipated that participation in the study would incur any additional risks to any of the individuals involved (including patients); it was therefore scored as 'low'.

### **3.4 Research instruments**

The admission process data collection form (Appendix 3), the structured interview schedules (Appendix 4, VTE, Appendix 5, Medicines reconciliation) and the case note data collection form (Appendix 6), were designed by the investigator based on her NHS experience and the requirements of the study. They were reviewed by the supervisory team, which included both experienced health services researchers and a senior clinician working on the AMU, and amended in line with comments received. The admission process data collection form was designed as a booklet with very limited information documented on the front page to minimise the possibility of data entries being seen by staff and revealing the study focus. Once ethical approval was granted, the admission process data collection form was piloted in the Emergency Department (ED) at RLUH, which is a similar clinical setting to AMU, no further amendments were required. The case note data collection form was not piloted as the researcher was experienced in carrying out audits of case notes. The interview schedules were not piloted, the researcher's extensive clinical experience enabled suitable questions to be devised and as any doctor in the Trust may have been allocated to work on AMU during the course of the study this may have reduced the pool of staff available to participate and may also have resulted in the focus of the study becoming known. The information sheets for healthcare staff (Appendix 7) and patients (Appendix 8) and the consent form for staff (Appendix 9) were designed by the investigator in line with templates

provided by Liverpool John Moores University (LJMU). They were reviewed by the supervisory team and amended in line with comments received.

### **3.5 Confidentiality**

Patient confidentiality was maintained by the allocation of a unique study number to each patient for use throughout the study, to facilitate matching of data from observations and the case note audit. Each patient was allocated a unique study number in the format A1, A2, A3 and B1, B2, B3 etc. where A is the first data collection period and number 1 is the first patient in that period. A single master list cross referencing the unique study numbers to the patients' hospital numbers and names was held by the investigator.

Healthcare staff confidentiality was maintained in a similar way by use of a unique study number for each staff member throughout the study, to facilitate matching of data from observations and interviews. Each member of staff was allocated a unique study number in the format G1, G2, G3 and H1, H2, H3 etc. where G is the first data collection period and number 1 is the first member of staff recruited in that period. A single master list cross referencing the unique study numbers to staff names and contact numbers (bleep and/or telephone) was held by the investigator.

When not in use during the study period these reference lists were stored in a locked filing drawer within the Pharmacy department accessible only to the researcher. The pseudoanonymised study data were stored separately in a locked filing cabinet within the Pharmacy department. Access to the Pharmacy department is restricted to Pharmacy staff and those visiting senior pharmacy staff by appointment; the department is secure at all times. The reference lists remained on Trust premises at all times. Case notes were reviewed within the Trust and remained on Trust premises at all times. Pseudoanonymised data collection forms were taken to LJMU in batches for entry into SPSS databases and analysis. At LJMU they were securely stored in a locked filing cabinet in a locked office.

The study number cross reference lists containing staff or patient details were destroyed by shredding three months after the completion of the study. The original pseudo anonymised data collection forms will be retained for a period of 5

years from the end of the study in accordance with Records Management: NHS Code of Practice part 2.<sup>168</sup> This will allow further analysis by the original or other research teams subject to consent, and will support monitoring by regulatory and other authorities. At the end of this period these data will be destroyed in accordance with the prevailing Trust procedures for confidential waste.

## **3.6 Sample size**

### **3.6.1 Observations and interviews**

Staff were purposively selected from those available on the AMU rotas to ensure that all grades were represented and that a similar number of staff participated in both the VTE and medicines reconciliation interviews. As many staff as possible were included from those working on AMU during the study periods to maximise the range of views collected and also so that the outcomes identified from the case note audit could be related to the staff observed and interviewed.

### **3.6.2 Case notes**

A power calculation was performed based on previous VTE audit data and estimated potential improvement in the frequency of VTE risk assessment, following implementation of guidelines. The purpose was to determine whether the number of case notes available from patients admitted to AMU during a one week period, approximately 200 to 250, would provide sufficient statistical power to enable meaningful analysis. Following government intervention to improve VTE risk assessment the study design was changed to include a medicines reconciliation arm and the same case note samples were used for both arms, there were no audit data available regarding the frequency with which medicines reconciliation was performed to inform this part of the work.

The power calculations were carried out using the power and sample size routine in Minitab version 15 using the following criteria:

- Number of case notes = 200
  - Baseline number of documented VTE risk assessments = 5%
  - Minimum anticipated final number of documented risk assessments = 20%
- Statistical power calculated = 99%

Assuming 20% of patients have a contraindication to treatment:

- Number of patients who require LMWH treatment = 160
- Baseline number of patients treated with LMWH = 30%

If number of patients treated rises to 45%, statistical power = 79%

If number of patients treated rises to 50%, statistical power = 96%

As the AMU admits approximately 250 patients each week it was decided that following up all patients admitted during a series of one week periods should provide a sufficiently large sample to provide suitable power for the statistical analysis of the VTE arm of the study.

### **3.7 Data collection periods**

The study periods were spread over time, originally the study was designed as an interrupted time series so the first three data sets were at 12 week intervals. Following the changes necessitated by government intervention in VTE prophylaxis it was agreed that a final data collection period after an interval of 12 months should provide sufficient data regarding the effect of national targets and would also enable comparison of data from the same time of year. The spread of data collection periods helped overcome bias resulting from seasonal variations in healthcare workload, cardiac admissions have been shown to increase over the Christmas / New Year period,<sup>169</sup> thunderstorms increase acute asthma attacks<sup>170</sup> and heat waves are associated with increased mortality.<sup>171</sup> It also helped minimise bias due to experience of staff and allowed for comparison between the same period in two successive years. Foundation year 1 (F1) and 2 (F2) doctors (first and second year post registration) rotate every four months and specialist trainees (ST, 3 to 8 years post registration) rotate every six months. No data were collected within the two weeks following the rota changes in August, December, February or April, weeks including bank holidays were also avoided as different medical rotas operate to those on normal working days. The data collection periods were therefore selected to avoid observing medical staff who were new to AMU as this may cause undue pressure on the individuals and may also have had an adverse impact on the results if they had had insufficient time to become familiar with the usual working practices in the AMU and were not following normal procedures.

Data were collected during four one-week study periods: November 2009 (1), January 2010 (2), April 2010 (3) and April 2011 (4). Study periods were selected to enable the participation of as many medical staff as possible (one week involves two visiting staff rotations) within the constraints of the AMU rotas and to identify any changes in practice over time. Direct observation of a sample of admissions and case note review and was carried out for all four study periods. All staff observed in periods 1, 2 and 3 participated in a structured interview regarding VTE risk assessment, these interviews took place before government VTE initiatives were introduced. In order to apply the same methodology to the medicines reconciliation arm of the study as that for the VTE arm interviews regarding medicines reconciliation were required, therefore staff observed during period 4 together with further purposively selected staff participated in medicines reconciliation interviews.

### **3.8 Recruitment of study participants (hospital staff)**

Staff were purposively selected from rotas, some were working full time on AMU others were working a 'hot block' in which a group of doctors who are usually based on other wards in the Trust take responsibility for clerking the admissions to AMU for a period of three or four days at a time (9am -10pm). Staff were selected to ensure that all grades usually working on AMU were represented, they could chose to participate in either the observations and / or one interview (covering VTE or medicines reconciliation). The researcher personally approached staff and explained that she was undertaking a research project based on hospital admissions, no further details were given, a study information leaflet was provided (Appendix 7). Staff who agreed to participate were asked to complete a consent form (Appendix 9) which was retained by the researcher, they were free to withdraw at any time without the need to provide a reason.

### **3.9 Selection of patient episodes**

#### **3.9.1 Observations**

On arrival at the AMU, patients are initially triaged by an AMU nurse who will record a set of basic observations including temperature, blood pressure, and pulse. They are then seen by a doctor or nurse clinician who is responsible for taking a

history (including medication), assessing the patient, making a provisional diagnosis, documenting a management plan, ordering initial investigations and writing the admission prescription. This process is known as clerking. Acutely unwell patients are clerked as a priority and may be seen by a senior doctor prior to initial clerking, the remaining patients are clerked in order of arrival. The medical and nursing staff responsible for clerking simply select the next patient due to be seen. Hence patients whose admissions were observed were included by virtue of the member of staff who clerked them agreeing to participate in the study. A brief explanation of the study was provided for all patients whose admission was observed, or their carers, an information leaflet was provided (Appendix 8) and it was made clear that they could ask the researcher to leave at any time during the consultation. Observations were carried out on weekdays only, few patients are admitted to AMU from GPs at weekends as GP surgeries are closed and a primary care on call service has to be contacted.

### **3.9.2 Selection of case notes**

All patients admitted during the study week (7 days, Saturday to Friday) were included in the case note audit. Patients were identified daily during the study weeks using the AMU admissions register which is kept by the AMU reception staff.

### **3.10 Ethical issues**

A number of ethical issues were considered in the design of the study. If the staff involved had been aware of the specific areas of interest to the researcher then it is likely that they would have modified their behaviour such that the data collected would not reliably reflect current practice, the Hawthorne effect.<sup>172</sup> A recent study showed that hand hygiene compliance was significantly improved when staff were aware that it was being monitored.<sup>173</sup> Studies have also proposed that improvement in doctors assessment of their patients pain score<sup>174</sup> and reduction in inappropriate antibiotic prescribing<sup>175</sup> were due to the Hawthorne effect. For this reason participants were advised that the researcher was interested in the medical admissions process in general, all the necessary study documents simply stated 'Medical admissions study'. Any other staff who expressed an interest in the study both on AMU and those encountered elsewhere in the hospital during the data

collection including nurses, doctors, pharmacists, receptionists, medical secretaries, healthcare assistants, cleaners, physiotherapists, occupational therapists and electrocardiogram (ECG) technicians, were also told that the study was about medical admissions in general. The focus of the study (VTE or medicines reconciliation) was shared with participants at the start of the interviews and the need to withhold the specific details during the observations explained. The need for the purpose of the research to remain covert was discussed at the National Research Ethics Service (NRES) meeting and approved.

The researcher was a Consultant Pharmacist with considerable NHS experience who was therefore able to make a clinical judgement regarding actions or omissions observed during the clerking process and their potential to have an adverse impact on patient care. If such situations were encountered, she shared her concerns with the member of healthcare staff involved in a location remote from the patient and, if necessary, with an appropriate senior member of the AMU team as is her usual practice.

It was recognised that circumstances may arise in which the researcher felt that it would be unethical for her to remain as an observer particularly if she felt that she was having an adverse impact on either the member of healthcare staff being observed or the patient. In these situations it was agreed that she would withdraw.

The study was approved by the National Research Ethics Service ((Liverpool Central REC Ref 09/H1005/67), LJMU Ethics Committee (approval no 09/PBS/015); Research Governance approval was granted by RLUBHT (study no 3862).

During the course of the study annual reports were provided to NRES and a final report was provided once data collection was complete in accordance with NRES regulations, copies were sent to the RLUBHT Research Governance Manager.

### **3.11 Observations**

Staff gave informed consent for observations, patients or their carers could exclude the researcher at any time. During observations, data relating to both VTE risk assessment and medication were recorded on a standard form (Appendix 3) with additional field notes.



General details including the route of referral, reason for admission, and the time taken to complete the admission clerking were noted. For the VTE part of the study questions asked and patient responses relating to VTE were recorded and also whether or not a VTE risk assessment form was available and whether or not it was completed. Outcomes in terms of prescription of LMWH or thromboembolism deterrent (TED) stockings were also documented. For medicines reconciliation questions asked and patient responses were also noted, sources of information available and used for medication histories and outcomes in terms of prescribing were documented. Field notes included details of interruptions, problems encountered in the process and requests for pharmacist assistance.

For the purposes of the study interruptions were considered to be those made by either people or pagers which caused cessation of the activity in which the member of staff was involved. Situations in which a member of staff self-interrupted the task e.g. because they forgot to take the correct equipment with them when taking a blood sample, were not included. Distractions such as other staff entering the room, extraneous conversations or telephones ringing were not included.

All data, including some field notes, were entered into an SPSS database for analysis and all observations were later transcribed as case studies using a standard template (Appendix 10). Some data were categorised to facilitate analysis as detailed below (see section 3.14.3, page 42).

During observations the researcher positioned herself in such a way as to minimise her impact on the staff / patient interaction, in most cases this was achieved by standing behind the patient and so out of their line of view. She had only social interaction (non-work related conversation) with staff, any questions directed to her relating to medication were answered as succinctly as possible, to avoid issues relevant to the study being discussed and minimise the impact on the data collected, all such incidents were recorded. If the researcher felt that the interaction impacted significantly on either VTE risk assessment or medicines reconciliation then these cases were excluded from the analysis. Questions from

other members of the healthcare team who were not involved in the study were answered in the usual way.

### **3.12 Interviews**

Interviews with all staff took place as soon as practical following the associated observation periods at a mutually convenient time. Interviews had to be scheduled to fit in with the unpredictable nature of a hospital working day and were often both arranged and cancelled at very short notice. It was therefore impossible to book a room for an interview and the most suitable location available at the time was used. As these were often public areas of the hospital such as coffee bars or reception areas it was not appropriate to record interviews due to the risk of other unrelated conversations being accidentally recorded. In view of this restriction, structured interview schedules with a limited number of open questions were used, to which additional comments could be added as required. Two similar structured questionnaires were used to ascertain staff knowledge, training experiences, perceptions and practices on admission relating to either VTE risk assessment (Appendix 4) or medicines reconciliation (Appendix 5). In periods 1, 2 and 3 the focus was VTE and in period 4 it was medicines reconciliation. At the start of each interview the need for covert observations was explained to participants and staff were asked to keep the subject discussed confidential to avoid any impact on the data.

#### **3.12.1 VTE risk assessment interviews**

Basic demographic details of the staff member, including age and stage of training were recorded. A flash card (Appendix 11, answers Appendix 12) which listed causes of death in order of prevalence in the UK was used to establish awareness of the number of deaths caused by VTE. Staff were asked to spontaneously list VTE risk factors which they looked for in their patients and were also asked to list any circumstances in which they would withhold prophylactic treatment with LMWH. Questions were also asked to ascertain awareness of any local or national policies available at the time of the interview. Further questions elicited opinions regarding responsibilities for completing a VTE risk assessment and prescribing prophylaxis if indicated. Final questions asked for suggestions to improve the rate of VTE risk

assessment and increase the number of patients prescribed prophylaxis (Appendix 4). A list of common VTE risk factors was provided and participants were asked to rate them according to importance on a scale of 1 to 5, a similar exercise was carried out for bleeding risks (Appendix 13).

### **3.12.2 Medicines reconciliation interviews**

Basic demographic details of the staff member including age and stage of training were recorded. Staff were asked to estimate how many prescription charts written on admission would contain an error in order to gauge their awareness of the problem. Questions were asked regarding the availability of local or national policies pertaining to medicines reconciliation at the time of the interview. Participants were asked to list the sources which they commonly used to document a medication history and whether more than one source would be used. If the member of staff indicated that on occasion more than one source was used this was explored in more detail to ascertain the rationale for this action. Staff were also asked how frequently they would discuss the admission prescription with the patient and to provide examples of situations when this would not occur. Any problems which had been encountered in obtaining information about patients' medication on admission to hospital were documented. Checking of prescriptions was also explored; staff were asked who they considered should check prescriptions and the timeframe in which this should occur. Finally they were asked to make suggestions as to how the number of prescribing errors could be reduced (Appendix 5). A list of common sources for medication histories was provided and participants were asked to rate them on a scale of 1 to 5 according to their usefulness (Appendix 14).

### **3.13 Case note review**

Case notes for all patients admitted during each of the four study periods were reviewed retrospectively, following discharge or death and data were recorded on a standard form (Appendix 6). Patients who had been discharged were identified on a daily basis, using the pharmacy computer system, for approximately six weeks following each of the data collection periods. As far as possible the researcher visited the appropriate wards to review the case notes before they were returned

to the Trust case note library. This overcame difficulties in data collection and resulted in more complete data for these patients, since old medication charts were often located in filing trays on the ward and it is likely that on occasion notes were returned to the medical records library before all associated documents had been filed. Frequently considerable time was spent looking through boxes, shelves and piles of notes to locate those required. Case notes ran to several volumes on numerous occasions and were not always filed in chronological order. Many patients had frequent admissions so perseverance was needed to locate all the relevant documentation relating to a specific episode of care, it is possible that this contributed to some of the missing data. Case notes which had been returned to the library before the researcher reached the ward were retrieved at a later date with the assistance of the AMU medical secretaries.

For VTE data collected included all VTE risks and bleeding risks documented on the VTE risk assessment form, if available, and also all VTE risk and bleeding risks which could be identified from the case notes. Outcomes in terms of whether LMWH was prescribed and whether the patient developed a DVT or PE, or bleeding were recorded, case notes for all patients who died during admission were followed up to ascertain the cause of death. For medicines reconciliation data included whether medicines reconciliation of the admission prescription was completed by a pharmacist, any discrepancies identified, the medicines involved and the time taken to rectify the discrepancies. Data collected were entered into an SPSS database for analysis.

### **3.13.1 Review for VTE risk assessment**

For VTE risk assessment the purpose of case note review was to establish the frequency of both VTE risk assessment and prescribing of prophylactic LMWH and to identify evidence of VTE risk factors and bleeding risks in order to assess the appropriateness of prescribing. Any DVTs, PEs, deaths or episodes of bleeding during hospitalisation were also recorded to assess both the effectiveness and any adverse outcomes associated with LMWH prophylaxis.

For initial screening purposes inappropriate prescribing of LMWH was defined as “prescribing for patients with at least one known bleeding risk” and was subsequently assessed by an expert panel of four AMU consultant physicians. Each consultant independently reviewed a case summary for each patient with at least one bleeding risk who was prescribed LMWH. The case summary template (Appendix 15) included the presenting complaint, both VTE risk factors and bleeding risks and relevant results of investigations. Each consultant was asked to indicate that LMWH was either appropriate or inappropriate. The results were collated and if there was consensus i.e. all four consultants agreed, the decision was accepted. Where there was initial disagreement the cases were debated in a meeting, at which all four consultants were present, until consensus was reached.

### **3.13.2 Review for medicines reconciliation**

For medicines reconciliation the purpose of case note review was to establish whether a prescription was written on admission to hospital, whether medicines reconciliation was carried out by a pharmacist and if so the accuracy of the original prescription. If the original prescription was inaccurate, the medication errors were noted and the time from prescribing to these being rectified was recorded. If there was no documented medicines reconciliation by a pharmacist, the case notes were excluded from this part of the analysis. At the time of the study all prescriptions were hand written on paper charts.

For the purposes of the study, prescribing errors were defined as one of the following: unintentional omission of medication, unintentional prescribing of additional medication, prescribing of incorrect medicine devices (for inhalers, insulin etc.) and changes in doses for which no justification could be identified. Minor discrepancies such as errors in timing of doses, missing frequencies, and prescribing by generic name when the brand is required, or vice versa, were not included within the definition of prescribing errors, as it was not possible to reliably identify these retrospectively, and were not recorded. Errors of omission were subsequently classified as red (significant or catastrophic, long term patient impact), amber (significant, short term patient impact) or green (negligible patient impact) in accordance with the United Kingdom Medicines Information (UKMI) tool

for assessing harm from omitted or delayed medicines.<sup>176</sup> This tool has clearly defined categories, requiring minimal interpretation, hence coding was carried out by only one researcher. The remaining errors were classified using an adapted version of the NPSA risk assessment tool<sup>121</sup> as used in a Welsh study in 2007<sup>48</sup> which has been simplified to include only the number of patients affected, the consequences to the patient in terms of injury or death, the potential impact on the organisation and the potential for litigation. It has also been modified to provide timeframes for the resolution of injuries.

### **3.14 Data management and analysis**

#### **3.14.1 Data entry**

Two SPSS databases were created, the first for the case note data and the second for the observation and interview data, qualitative data including quotes was included in the observation/interview database. Data were entered by the researcher and once it was complete all columns were checked for both unexpected and missing values.

#### **3.14.2 Statistical methods**

Descriptive analysis was carried out using SPSS version 17. Statistical tests were carried out using SPSS and Minitab V.16, a p value of <0.05 was used to define a significant difference. A Student t-test was used to detect differences estimates of the proportion of prescribing errors between junior and senior doctors. Chi-square tests were used to detect differences in dependent variables such as proportion of VTE risk assessments or medicines reconciliations carried out between study periods. Mann-Whitney tests were used to identify any differences in actual VTE knowledge between staff with below average or average perceived knowledge and those with good perceived knowledge and also to highlight any differences in the number of questions about medicines asked by junior and senior doctors. Where case notes and/or prescription charts were missing these cases were excluded from the relevant analyses.

#### **3.14.3 Data categorisation**

Some data were categorised to enable quantitative analysis. Doctors were split into two groups “junior” which included foundation years 1 and 2 and “senior” which

included all other grades in order to generate two groups of a similar size. The reasons for patient admission were initially categorised according to the principal signs and /or symptoms where possible e.g. seizure, where there were several signs and /or symptoms they were categorised according to medical specialty e.g. cardiac see Table 3-1.

**Table 3-1: Reason for admission - categories**

<b>Signs / Symptoms</b>	<b>Medical specialties</b>
Infection	Gastroenterology
Pain	Neurology
Vomiting / diarrhoea	Social
Possible VTE	Rheumatology
Alcohol related	Endocrine
Falls	Mental health
Abnormal biochemistry	Renal
Cancer	Cardiac
Overdose	
Stroke / Transient Ischaemic Attack	
Falls	
Adverse drug reaction	
Respiratory disease exacerbation	
GI Bleed	
Collapse	
Seizure	
Confusion	

For the VTE analysis patients categorised as follows in order to ascertain whether patients were treated appropriately or inappropriately:

- VTE risk factors only
- Bleeding risk factors only
- Both VTE risks and bleeding risks
- Neither VTE risks nor bleeding risks

Prescribing errors were categorised according to the type of error:

- Medication unintentionally omitted
- Medication unintentionally restarted
- Incorrect medication prescribed
- Incorrect medicine device prescribed (for inhalers, insulin etc.)
- Incorrect dose prescribed

#### 3.14.4 Data analysis

The data from the observations were transcribed as case studies using a series of standard headings in a template to facilitate analysis (Appendix 10), where there had been a significant number of interruptions a timeline detailing the progress of the clerking was included. Outcome data relating to both VTE and medicines reconciliation from the case note review were added where this information was available (Appendix 10). Key words or phrases were identified both from the case study transcripts and from the observation/interview SPSS database. Some observation data were analysed quantitatively including duration of clerking, number of questions asked regarding VTE and medication and proportion of medication charts written. Activities which were observed during the clerking process but which were unrelated to VTE or medicines reconciliation were reported as background information.

The data from the interviews were analysed mainly quantitatively (using SPSS and Minitab V 16) but responses to open questions such as reasons for poor compliance with guidance and suggestions for improvement were analysed qualitatively. The data was read to identify key words and/or phrases from the SPSS database; these were then sorted into themes.

The case note data were analysed quantitatively using the SPSS database and Minitab V 16.

All data were considered to be of equal importance. The VTE datasets were analysed first as due to the rapidly changing national situation any conference presentations or publications needed to be timely. Observation and interview VTE data were analysed separately and then combined in order to compare observed practices with staff views about those practices, case note data which provided evidence of outcomes were analysed last. The process was repeated for the medicines reconciliation data, observation and interview data were analysed separately first, then combined during and case note data were analysed last. Finally the VTE data and medicines reconciliation datasets were compared to identify any common themes or differences. This has been described as a



convergent parallel type of mixed methods research in which the research components remain independent during data collection and analysis and are combined during interpretation.<sup>145, 177</sup>

### **3.15 Summary**

This chapter has detailed and justified the methodology used in the study, the results are presented in the following three chapters, chapter 4 details those for the AMU admission process, chapter 5 those for VTE risk assessment and chapter 6 those for medicines reconciliation.

## Chapter 4 Results and Discussion AMU Admission Process

### 4.1 Introduction and overall sample characteristics

During the four study periods a total of 71 patient admissions involving 36 staff were observed and 930 sets of case notes were reviewed. Although the study focused on VTE and medicines reconciliation some interesting additional observations relating to the admissions process itself were made which are reported in this chapter. The demographic details of the patients included in the study are shown in Table 4-1.

**Table 4-1: Demographic details of patients included in case note reviews and observations**

Characteristic	Case note review	Observations
Number of case notes retrieved	930	71
Relevant admission notes available	876	67
Sex - male (%)	381 / 876 (43.5%)	28 / 67 (39%)
Age range (mean)	16 -98 (64) years	16 – 98 (68) years
Average length of stay (median)	1 – 182 (5.5) days	1 – 47 (5.0) days
Most frequent presenting complaint (descending order of occurrence)	Infection (285; 32.5%) Pain (72; 8.2%) Cardiac cause (60; 6.8%) Shortness of breath (54; 6.2%) Abnormal biochemistry* (51; 5.5%) Possible VTE <sup>‡</sup> (46; 5.3%)	Infection (15; 22%) Pain (8; 12%) Abnormal biochemistry* (8; 12%) Possible VTE <sup>‡</sup> (7; 10%) Shortness of breath (5; 7%) Vomiting or diarrhoea (5; 7%)

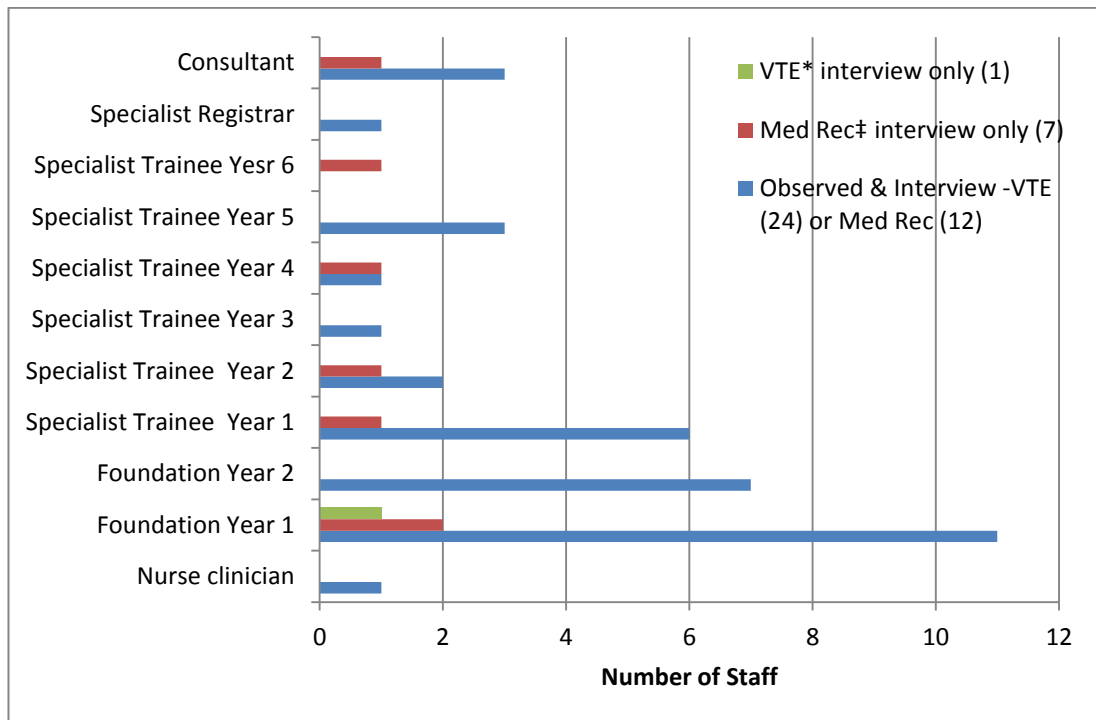
\*Results outside of the normal range for haemoglobin, glucose, thyroid hormones, sodium, potassium, magnesium, or calcium

<sup>‡</sup>Venous thromboembolism

#### 4.1.1 Details of staff observed included in the study

A total of 44 staff were included in the study, 36 were both observed and interviewed, eight participated in a single interview relating to either VTE or medicines reconciliation. Eighteen were based on AMU at the time of the study, 23 were part of the 'hot block' team and three were on call. The level of practice for all staff is shown in Figure 4-1, numbers of staff and patient admissions observed in each study period are shown in Table 4-2, page 49.

**Figure 4-1: Level of practice of study participants (healthcare staff)**



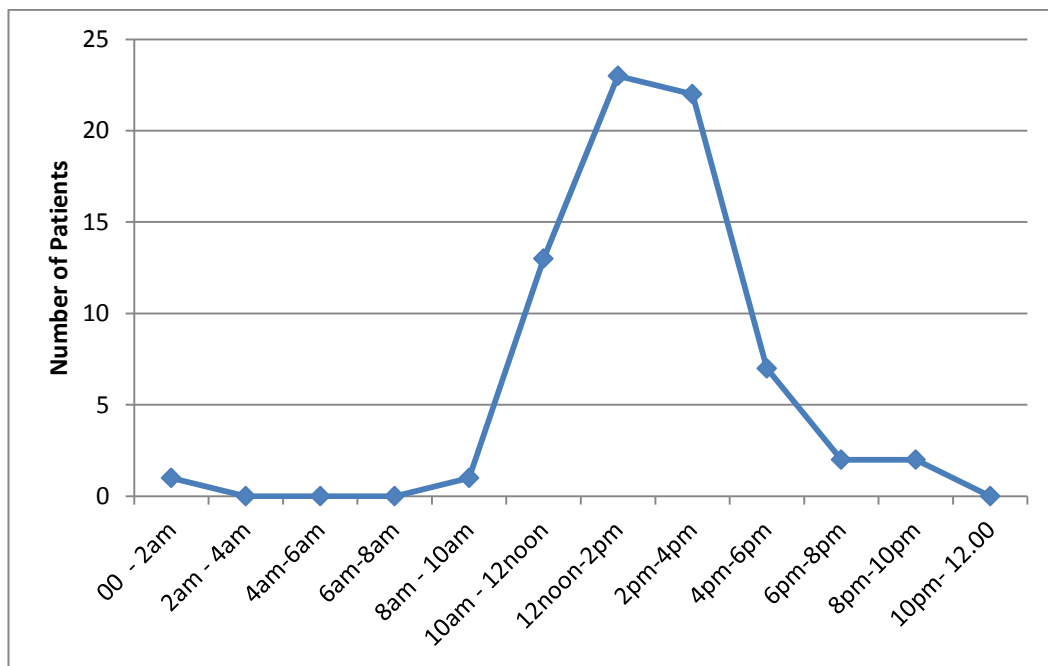
\* Venous thromboembolism      ‡ Medicines reconciliation

## 4.2 Observations

### 4.2.1 Admission time for observed patients

Observations took place on weekdays only, the majority of patients observed were admitted between 10am and 6pm (Figure 4-2) which is to be expected as most (66/71; 93%) were referred by their GP and therefore arrived during the late morning and afternoon following a GP consultation during normal surgery hours. Of the remaining patients two were referred by their Community Matron, one by a Walk in Centre, one by the Emergency Department (ED) and one by another hospital.

**Figure 4-2: Time of day of admission for observed patients**



#### **4.2.2 Waiting time and duration of clerking**

The waiting time to be first seen by a doctor or nurse clinician (from time of booking in by reception staff), duration of clerking and the total time taken for documentation of the initial management plan for each study period are shown in Table 4-2. Eighteen (18/71; 25%) patients were clerked by the most junior doctors, grade Foundation year 1 (F1), who have less than 12 months post qualification experience. For seven patients (7/71; 10%) the time from arrival at hospital to documentation of a clinical management plan took longer than the Society for Acute Medicine (SAM) four hour target, an F1 doctor was responsible for clerking two of these seven patients. All seven of these patients arrived on a weekday between 12.30 and 16:00. In total 48 (48/71; 68%) patients were clerked by an experienced nurse clinician or a doctor grade foundation year 2 (F2) or above within four hours of arrival at AMU. The overall median duration of clerking was 75 minutes (Interquartile range; IQR 40 minutes), there was no significant difference in duration between the four study periods (Kruskal-Wallis test  $P=0.202$ ). The overall median waiting time was 67 minutes (IQR 67) and increased significantly in periods 3 and 4 (Kruskal-Wallis test  $P=0.011$ ). Figure 4-3 shows the median duration of clerking by staff grade, when senior doctors (grade Specialist Trainee year 1; ST1

and above) were compared with junior doctors (grade F1/2) senior doctors were significantly quicker at clerking patients (Mann-Whitney U test  $P < 0.001$ ).

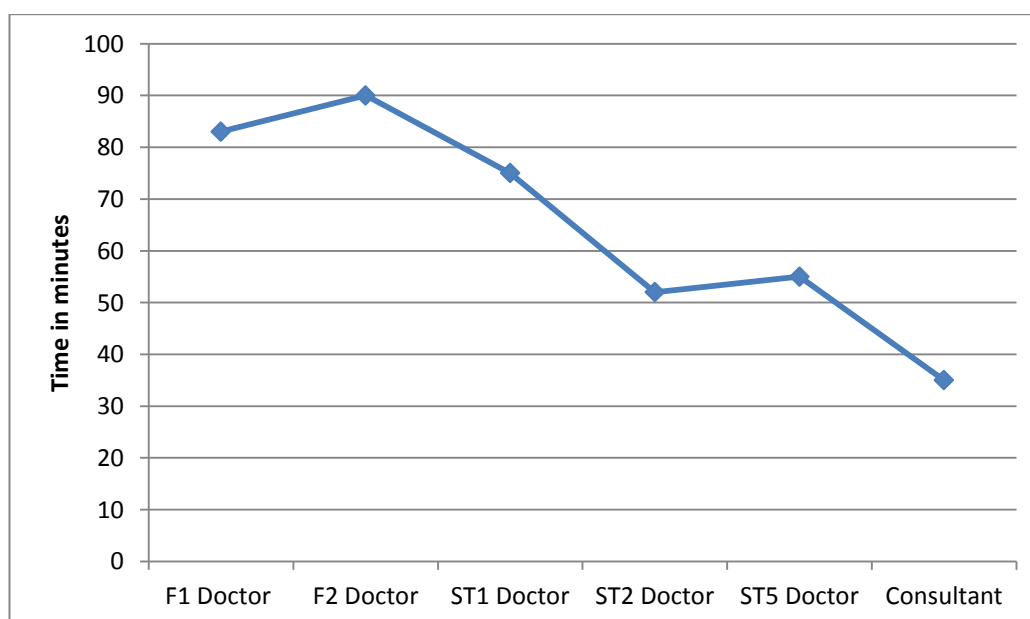
**Table 4-2: Waiting time, duration of clerking and time to documentation of management plan for newly admitted patients**

	Period 1 (Nov 2009)	Period 2 (Jan 2010)	Period 3 (Apr 2010)	Period 4 (Apr 2011)	Total
Total number of staff observed	8	7	9	12	36
Number of senior doctors observed (grade ST1 <sup>‡</sup> and above)	3	5	3	6	17
Number of patient admissions observed	16	21	14	20	71
Number of patients clerked by senior doctor (grade ST1 and above)	7	14	8	9	38
Median waiting time to be seen by doctor/nurse clinician minutes (IQR*)	44 (40)	67 (63)	101(89)	79 (50)	67(67)
Median duration of clerking – minutes (IQR*)	62 (55)	70 (38)	80 (29)	82 (51)	75 (40)
Median time to documentation of management plan -clerking + waiting time – minutes (IQR*)	124 (62)	136 (86)	183 (96)	160 (93)	141 (88)

\*interquartile range

<sup>‡</sup>Specialist trainee doctor – 2 years post qualification

**Figure 4-3: Median time taken to complete the medical clerking process**



F1/2 Foundation year doctor 1 -2 years post qualification

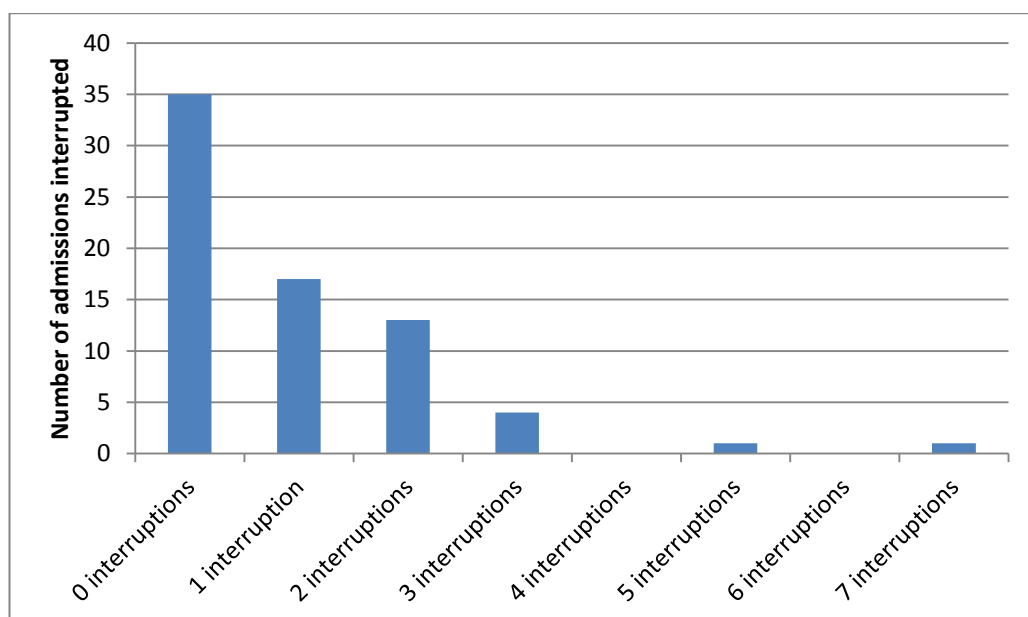
ST Specialist trainee doctor 3-5 years post qualification

Of the 71 patients admitted; 27 (38%) had a VTE risk assessment completed and documented as part of the admission process. However, there was no significant difference in the duration of clerking between those patients who did (27 patients, mean duration 81 minutes) and those who did not (44 patients, mean duration 71 minutes) have a VTE risk assessment completed (Mann-Whitney U test  $P=0.143$ ).

### 4.2.3 Interruptions

During the four study periods a total of 66 interruptions were observed during 36 of the 71 admissions (51%), of these 19 (53%) were interrupted more than once. Eighteen (18/35; 51%) doctors were interrupted during at least one patient clerking, however the nurse was not interrupted at all whilst clerking any of the three patient admissions observed. There was no difference in the number of junior doctors interrupted (17/30; 57%) when compared with senior doctors (19/38; 50%), chi-square test  $P=0.584$ . Interruptions generally occurred when the doctor was based in the office either reviewing or writing medical notes, the patients' privacy was respected when they were being examined or interviewed at the bedside. The number of interruptions per patient admission observed is shown in Figure 4-4, the most common types of interruption are shown in Table 4-3.

**Figure 4-4: Number of interruptions per patient admission observed**



**Table 4-3: Types of interruption observed during the medical clerking process**

Type of interruption	Junior doctor interrupted – number of instances	Senior doctor interrupted – number of instances	Total number of instances observed
General advice and assistance	6	18	24
Input to another patient	17	4	21
Input to patient clerked by this doctor	8	5	13
Other	4	4	8
Total	35	31	66

Interruptions from nursing staff included a request to review an inflamed venflon site, to speak to a patient’s family regarding a ‘Do not attempt resuscitation’ order, to write a medication chart for a patient clerked earlier, to insert a cannula for a patient prescribed intravenous (IV) antibiotics and to write a letter needed by a patient who was going home. Nine doctors were paged during the clerking process however it proved impossible to ascertain the reason for paging in most cases as only the observed doctor’s conversation could be heard so analysis of these calls was not possible. One F1 doctor was interrupted seven times whilst clerking a patient, the duration of this clerking was 120 minutes; details of the interruptions are shown in Figure 4-5. Senior doctors were more often interrupted for general advice and assistance whereas junior doctors were more often asked to input to another patient. During the interviews one ST1 doctor commented that “nurses often ask the wrong doctor” which leads to unnecessary interruptions. In nine of the 25 clerkings which were interrupted, patients (9/25; 36%) experienced a prescribing error on admission compared with eight (8/21; 38%) for patients whose clerking was not interrupted. It was not possible to assess the impact of the interruptions in detail due to the complexity of the environment, however there was no impact on prescribing error rates (chi –square test P=0.883).

**Figure 4-5: Case study illustrating interruptions during the medical clerking process**

<p>Patient clerked by F1* doctor</p> <p>Admitted at 14.12 on a Friday</p> <p>18.29: Clerking commenced</p> <p>18.29: Asked for incontinence pad by relative of another patient – provided from ward store</p> <p>19.45: Asked by nurse to prescribe co-codamol for another patient who is in pain – prescribed</p> <p>19.48: Asked by nurse to review ECG for another patient – asked F2 doctor to do this as in the process of writing medication chart</p> <p>20.00: Asked by nurse to take this patient’s blood samples so they can move this patient back to the foyer as there are no free cubicles to clerk patients</p> <p>20.18: Bleeped by Heart Emergency Centre (HEC)</p> <p>20.25: Nurse came from HEC with query about IV fluid (Digami) regimen</p> <p>20.30: Asked to prescribe PRN nebuliser for a different patient who is short of breath</p> <p>20.30: Clerking complete</p> <p>*Foundation year doctor – first year post qualification</p>
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#### 4.2.4 Delays

Thirty one of the 71 admissions (44%) were subject to a delay, 14 (45%) of these delays involved either an X-ray or an ECG; Figure 4-6. In five cases the patient was in radiology when the doctor needed to speak to them, on nine occasions the arrival of an ECG technician requiring immediate access to the patient interrupted the admission process. Problems with medical equipment / Trust documentation availability or operation resulted in a delay in six cases:

- Blood gas analyser out of order
- No ‘pods’ (plastic canisters) to send samples to laboratory via air tube system
- Ophthalmoscope could not be located when it was needed
- Hospital trolley could not be lowered sufficiently to examine a patient
- Tourniquet was not available so doctor improvised with a disposable glove
- No blank medication charts available for admission prescription to be written



On four occasions the ward / office space or computer availability were insufficient to enable efficient working:

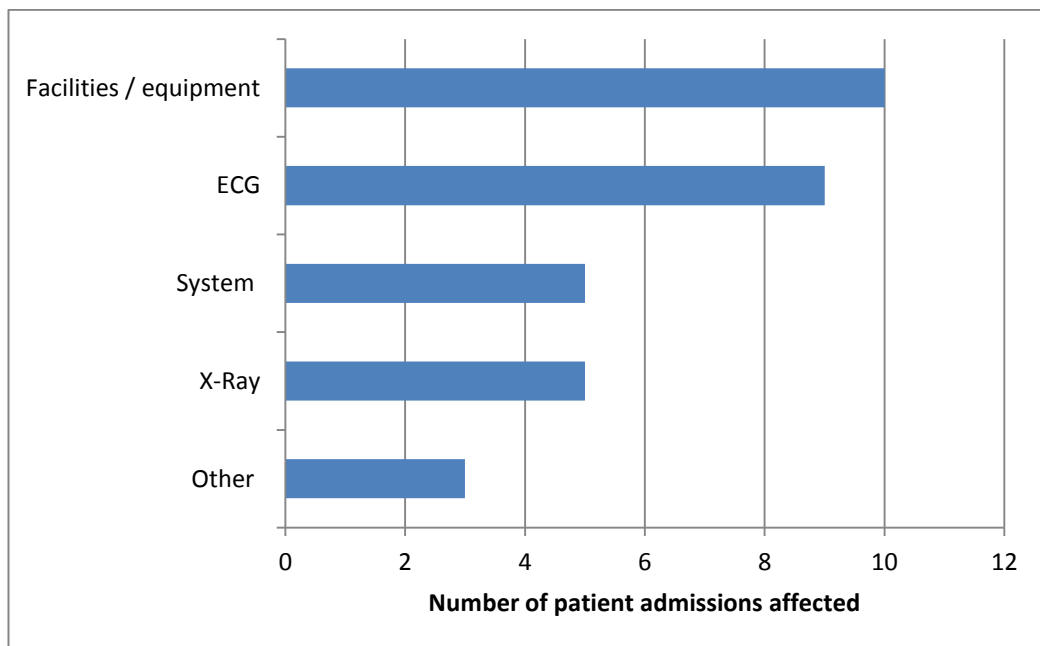
- Doctor unable to find anywhere suitable to review a patient's case notes
- No bed or trolley available to examine a patient
- No computer terminal available to review blood test results or X-Rays
- Only available computer had been locked by the previous user

A system problem, in which a difficulty was encountered as a result of a failure in the usual process, accounted for a further five delays:

- No referral letter provided by one GP
- Clerking doctor did not have a password for the electronic X-Ray system
- Two telephone calls required to the radiology department to order urgent scan
- Consultant responsible for leading post take ward round could not be located
- Delay in contacting the medical microbiology department regarding appropriate antibiotics

Other delays were noted in three cases, a Healthcare assistant (HCA) was attempting to take a blood sample from a patient when the doctor went to clerk, clarification of the sequence of events was needed from a relative who could not be located, and the doctor had to go to the radiology department to discuss another patient.

**Figure 4-6: Factors contributing to delays in the hospital admission processes**



#### **4.2.4.1 Taking blood samples**

Routine blood samples on admission to AMU are usually taken by a suitably trained HCA or a nurse prior to the patient being clerked so that the results are available to inform the patient management plan once clerking is complete. However if these staff are unavailable or are unsuccessful in obtaining a sample then this task falls to the doctor clerking the patient. In 22/71 (31%) of the admissions observed the doctor had to take the necessary blood samples leading to a delay in the clerking process.

#### **4.2.5 Use of resources**

Medical staff were observed using a number of resources to inform their decision making for the patient management plan and/or prescribing. An ST1 doctor contacted the pharmacology registrar for advice about a suitable anti-hypertensive medicine to start for an elderly patient with a very high blood pressure. An F1 doctor consulted the medical registrar regarding the need for blood cultures to be taken in a patient with a history of rigors, another F1 used a paper copy of the Oxford handbook of clinical medicine to check the signs and symptoms for temporal arteritis as she was considering this as a possible diagnosis. An F2 doctor was unsure of the indication for levetiracetam and used the British National Formulary (BNF) on line to check as the patient being clerked was prescribed this medicine.

The pharmacist researcher was asked for advice by the clerking doctor on thirteen occasions; these requests included the appropriate medicine, the appropriate dose and identification of medication. Details of these requests are shown in Figure 6-6, page 123. Use of the pharmacist researcher in this way may have slightly reduced the overall clerking time for these patients.

#### **4.2.6 General observations derived from field notes**

##### **4.2.6.1 Operational issues**

There appeared to be no formal induction to AMU working practices for new doctors, it was unclear who was in charge of the 'hot block' clerking team and there was little evidence of teamwork, principally because the four medical staff on the rota often did not know each other. Doctors appeared unsure which patient to see next and were often unable to interpret the various indicators used by nursing staff on the whiteboard to chart the patient's progress through the unit. Frequently the doctors themselves were unclear who was more senior in the 'hot block' clerking team and who to ask for advice, this wasn't always grade dependent as the F1 who had just completed a cardiology rotation may know more about dosing warfarin than the F2 who although qualified for longer hasn't yet worked in cardiology. Where the doctors had worked together before there was much more of a team spirit, they were aware of each other's previous experience and the workload was handled more efficiently.

Nursing staff frequently complained that there were 'no doctors' available as there were regular problems with all the doctors going for lunch / break at the same time. It seemed to depend on the personal skills of the most senior doctor available as to whether or not breaks were organised, the role did not appear to be explicit. The 3pm post take ward round created problems, sometimes the consultant was late; on one occasion the ST1 doctor spent considerable time trying to find the appropriate consultant to review the patients. All three AMU based 'hot block' doctors (the fourth doctor is usually busy in ED) generally went on the post take round which could take two hours and often resulted in no patients being clerked from 3pm to 5pm thus generating a backlog. Once again the nursing staff were aware of the problem but seemed powerless to change the situation.

Junior doctors often lacked the relevant background knowledge of the Trust relating to specialties. They did not know the ward or consultant specialties and so were unable to access relevant advice efficiently; this information did not appear to be readily available either in AMU or on the Trust intranet.

#### **4.2.6.2 Medical hierarchy**

The continuing existence of the medical hierarchy resulted in delays and difficulties in junior doctors seeking senior advice. The most junior doctors were clearly in awe of the seniors especially consultants and were reluctant to admit their ignorance. One junior doctor who had to clerk a very complex patient was clearly out of her depth but unwilling to seek help from the consultant on duty for fear of reprisal. To ensure appropriate management of this patient the pharmacist researcher sought assistance from the consultant.

### **4.3 Case note review**

#### **4.3.1 Presenting complaint**

Patients presented with a wide range of medical complaints (Table 4-1, page 46), however, the proportion of patients with cardiac symptoms is relatively low as in the study hospital these patients are usually admitted directly to the Heart Emergency Centre (HEC). When the HEC is full then cardiac patients are admitted via AMU following discussion with, and acceptance by, either an AMU consultant or the medical registrar.

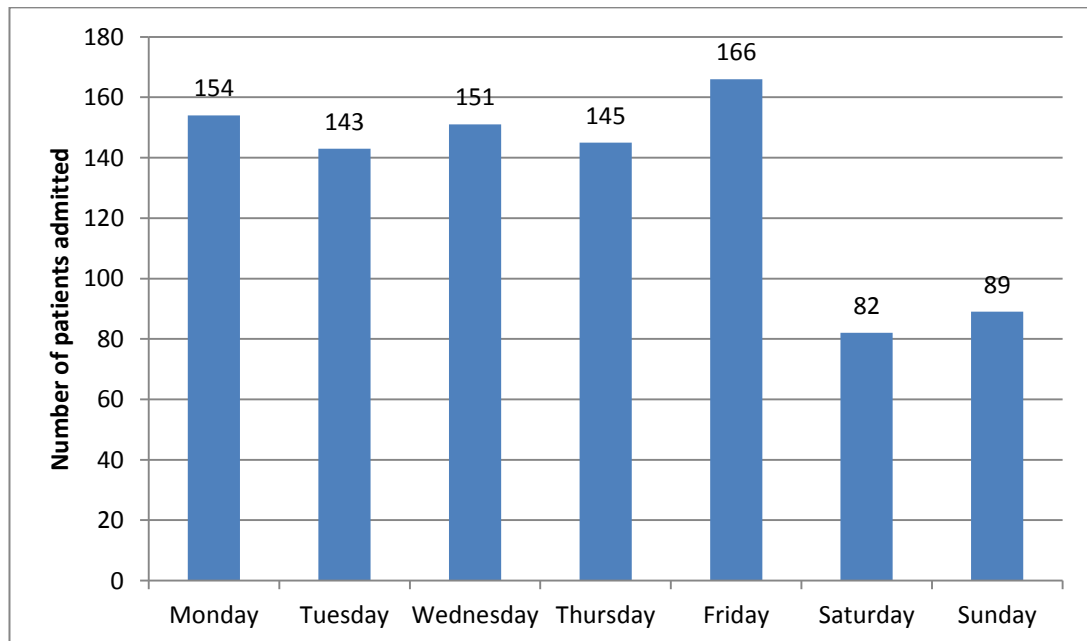
#### **4.3.2 Admission route, time and day of the week**

The majority of patients were admitted via the ED (56.0%) or directly from their GP (38.6%), the remaining patients were referred by out-patient clinics (1.9%), other hospitals (1.5%) walk in centres (1.4%), or specialist community nurses (0.6%).

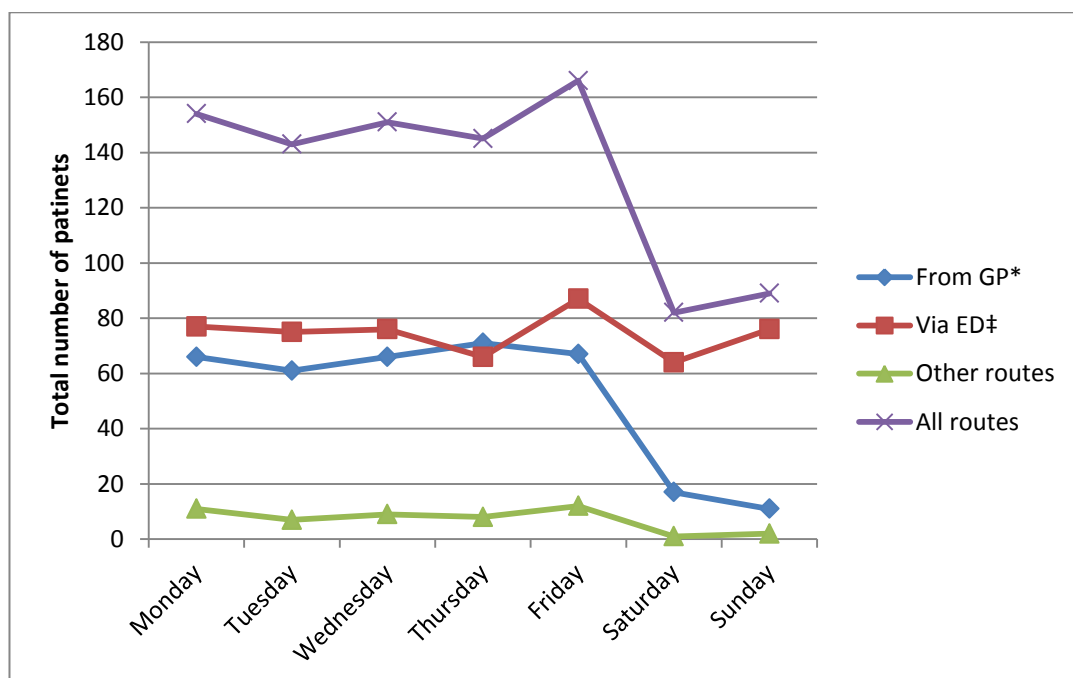
Similar numbers of patients were admitted to AMU on weekdays, Monday to Friday and fewer on Saturdays and Sundays as GP surgeries are closed at weekends and patients then have to access a primary care on call service or attend the ED prior to hospital admission, Figure 4-7 and Figure 4-8. Overall 81.6% of patients were admitted on a weekday and 18.4% at a weekend.

The daily admission patterns seen in the study generally matched those for all patients admitted to the Trust between 2009 and 2011, Figure 4-9.

**Figure 4-7: Number of study patients admitted to hospital by day of the week**



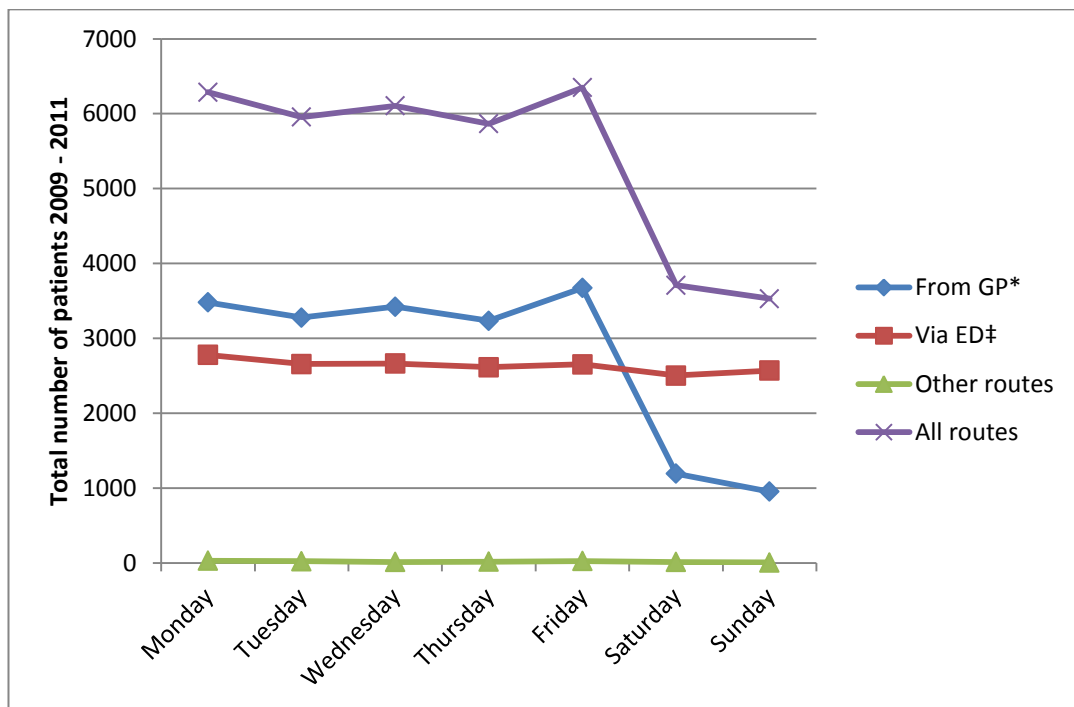
**Figure 4-8: Route of admission by day of the week – study data**



\*General practitioner

‡Emergency Department

**Figure 4-9: Route of admission by day of the week – Trust data 2009 – 2011**



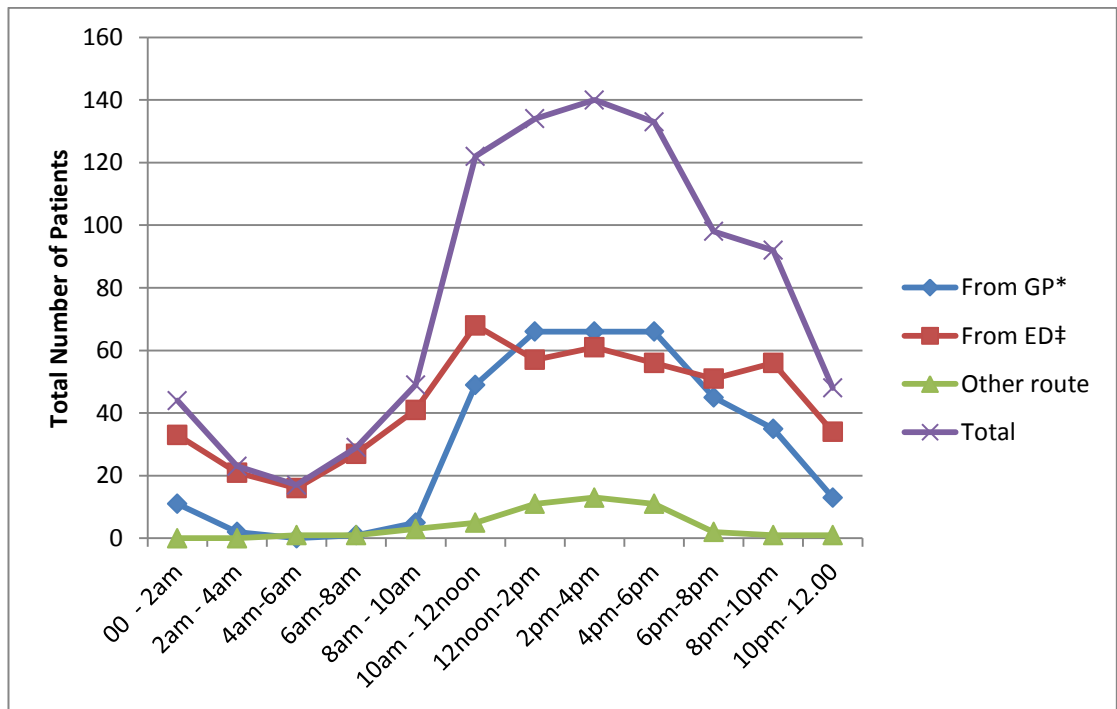
\*General practitioner

‡Emergency Department

The admission time peaks varied according to the route of admission. Admissions from GPs started to rise after 10am, remained steady throughout the afternoon, and decreased after 6pm. Few patients were admitted as a result of GP referral between 10pm and 10am.

The peak of patients arriving to AMU from the ED was between 10am and 12 noon, due to the Trust policy of limiting the movement of patients during the night where possible, to minimise the disturbance to other sleeping patients. Significant numbers of admissions continued to arrive from ED throughout the day until 10pm (Figure 4-10). This pattern of arrival by time mirrors that of the Trust data for all admissions from 2009 to 2011, Figure 4-11.

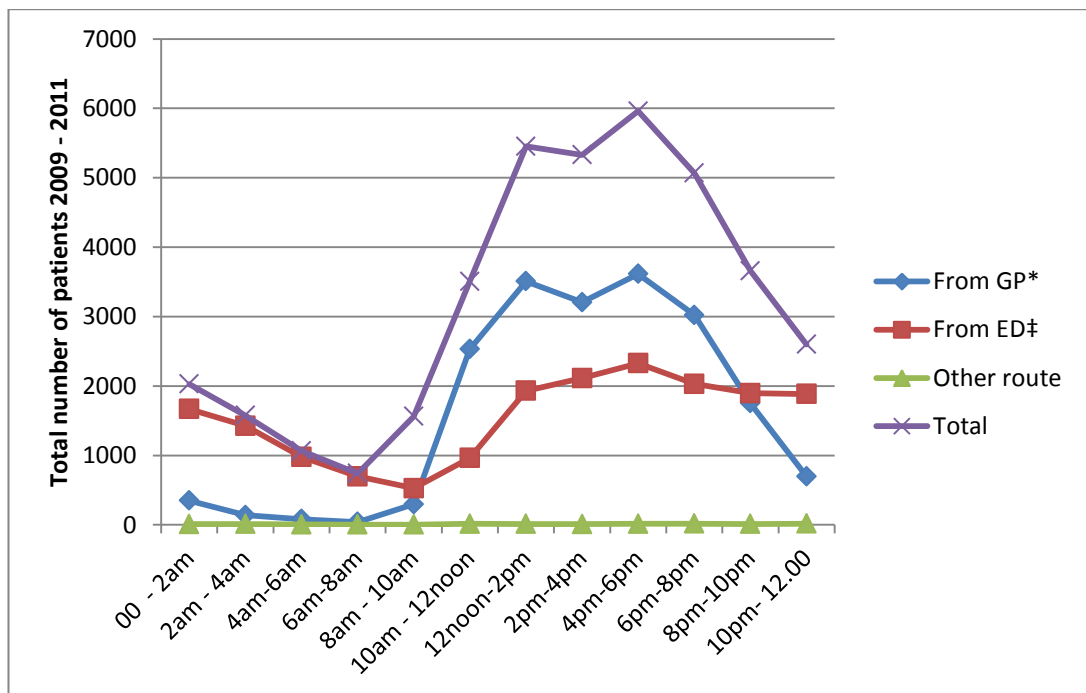
**Figure 4-10: Admission time and route of admission– study data**



\*General practitioner

‡Emergency Department

**Figure 4-11: Admission time and route of admission– Trust data 2009 - 2011**



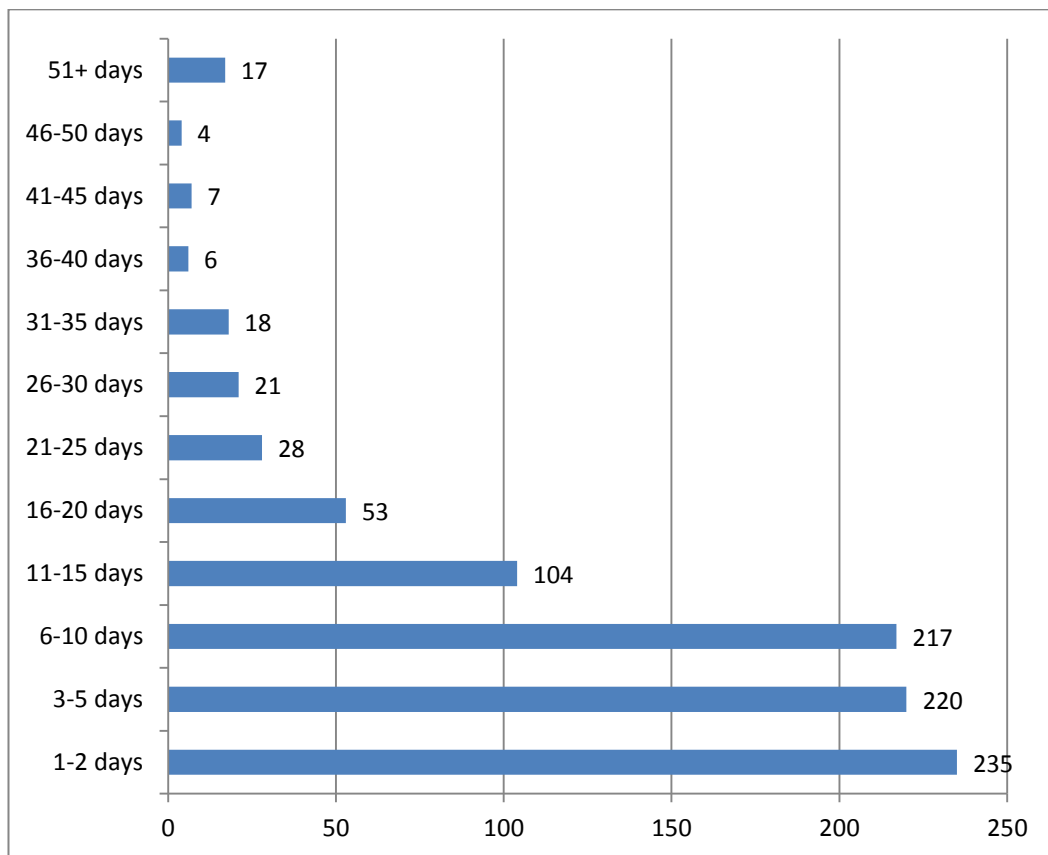
\*General practitioner

‡Emergency Department

### 4.3.3 Length of stay

The median length of stay was 5.5 days (mean 9.9 days; interquartile range 10 days), a quarter of patients (235/930; 25.3%) were discharged within 48 hours and a further quarter (220/930; 23.7%) within 5 days. However a significant minority (154/930; 16.6%) stayed in hospital for longer than 15 days, the reasons for these prolonged admissions were outside of the scope of the study and were not investigated (Figure 4-12).

**Figure 4-12: Length of stay of study patients**



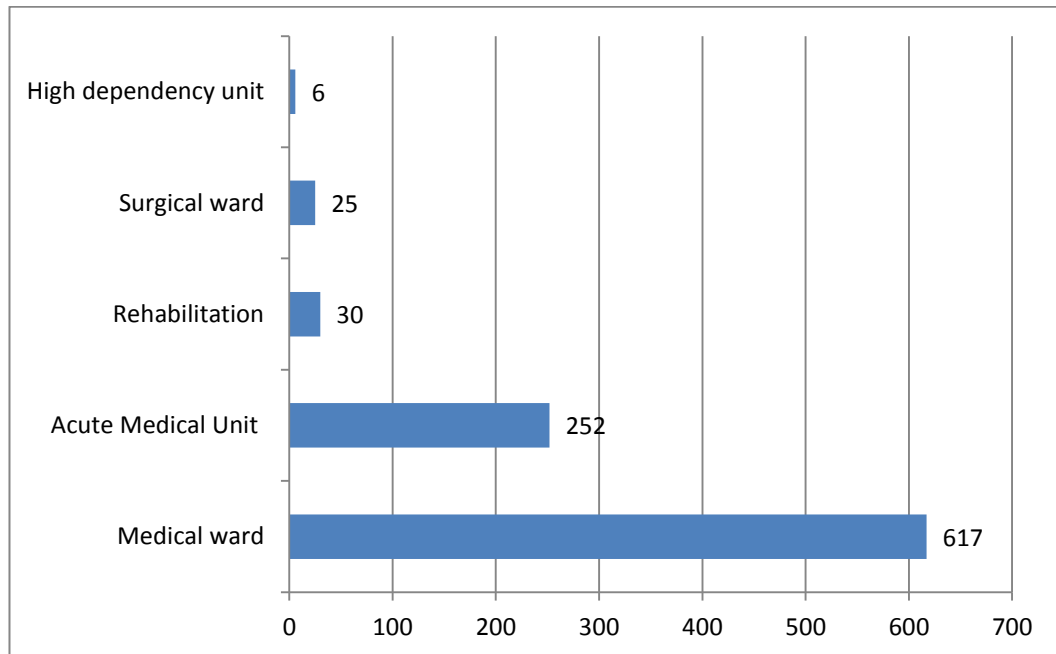
### 4.3.4 Discharge ward

Over a quarter of patients (252/930; 27.1%) stayed on AMU for the duration of their admission and the majority of these (210/252; 83.3%) were discharged within 48 hours, nine of these patients (9/210; 4.3%) died on AMU. Most of the remaining patients were admitted to and then discharged from a medical ward (617/930; 66.3%), a few were transferred to intermediate care rehabilitation beds at Broadgreen hospital (30/930; 3.2%), a small number were ultimately discharged



from a surgical ward (25/930; 2.7%) and six patients (6/930; 0.6%) were discharged from a high dependency unit (HDU), Figure 4-13.

**Figure 4-13: Discharge ward for study patients**



## 4.4 Discussion

### 4.4.1 Patient demographics

The results show that a greater number of female patients (56.5%) were admitted compared to male patients; however this is in line with the findings of other UK AMU studies.<sup>10, 23, 178</sup> The reasons for admission are broadly similar to those reported in other studies, allowing for direct referral of cardiac patients to the HEC in the study hospital, with significant numbers of patients being admitted as a result of infection, pain and respiratory diseases.<sup>179</sup> It proved impossible to compare the main causes of admission to those in other published studies in further detail due to the different groupings in diagnoses, for example some studies classified pneumonia as 'respiratory' rather than 'infection' as in this study. Comparison with Hospital Episode Statistics (HES) data also proved impossible as these data are based on the final diagnosis rather than the reason for admission and again the categories used are different to those used in the present study.

#### **4.4.2 Admission route and time of day**

Just over half (56%) of patients were admitted via the ED and 38.6% were referred by their GP. These proportions match the 2013 audit data from 38 AMUs which reported 56% and 38% respectively.<sup>23</sup> Admissions from GP surgeries tended to follow the usual opening hours of GP surgeries with admissions starting to arrive from 10am, remaining steady throughout the day until 6pm and then declining overnight. Few patients were admitted from GPs between 10pm and 10am which would require a referral from a GP urgent care service rather than the patients usual GP.

Overall admissions to AMU rose rapidly throughout the morning from 8am until lunchtime, remained at a high level throughout the afternoon and then declined after 6pm, this pattern mirrors the admission pattern recently reported in an AMU in Nottingham<sup>180</sup> and also the Trust data for all patients admitted between 2009 and 2011. A smaller study from Plymouth reported a similar pattern with a slight shift to later in the day the busy period being from 9am to 8pm,<sup>181</sup> this shift may be due to either differences in local working patterns such as GP opening hours or the smaller numbers involved.

Maximum numbers of medical admissions were seen on Mondays and Fridays with slightly lower numbers on other week days, smaller numbers of patients were admitted on Saturdays and Sundays. This is in line with data published by the National Audit Office in 2013<sup>5</sup> which shows the same trend for emergency admissions for the past five years.

#### **4.4.3 Waiting time and duration of clerking**

The waiting time for patients to be first seen increased significantly in periods 3 and 4, April 2010 and April 2011. However no particular reason could be reliably identified for this finding, the total number of admissions was similar for each period, the number of staff available to clerk was the same and there was no significant difference in the duration of clerking. During the course of the study the number of beds in the study hospital was reduced in preparation for the building of a new hospital due to open in 2017. This has resulted in an increased pressure on

beds and in the later study periods there may have been a delay in clerking as there were sometimes no beds free in AMU for patients to be examined.

The SAM quality standards for acute medical units state that a full clinical assessment should be undertaken and a clinical management plan initiated and documented by a competent decision maker (grade F2, ST1-3 or nurse practitioner) within four hours of the patients arrival on AMU.<sup>182</sup> The four hour targets were originally introduced in the NHS Plan in 2000 and stated that by 2004 no patient should wait more than four hours in an ED.<sup>36</sup> They have proved successful in ensuring that patients are assessed more rapidly<sup>183</sup> hence a similar target has been adopted for AMUs.<sup>182</sup> The results show that 10% of patients whose admissions were observed had not been clerked by a doctor or nurse within four hours of arrival and that all of these patients arrived between 12.30pm and 4pm on a weekday. The delay was therefore most likely to result from fewer staff being available to clerk over lunchtime, as mandatory education sessions are usually held between 12.30pm and 2pm, and the reduced number of doctors available between 3pm and 5pm due to attendance on the post take ward round. A recent study from Nottingham<sup>180</sup> showed the impact of breaks and ward rounds on the number of doctors available to clerk in AMU and used analysis of patient arrival time to redesign rotas to reduce patient waiting times. Further analysis showed that 68% of patients in the present study were seen by a competent decision maker within this four hour timeframe which exceeds the proportion of 48% reported in recent survey of 30 UK AMUs<sup>184</sup> however improvement is desirable as all patients should be seen within four hours.

Delays in the present study were also prolonged by equipment failure in four cases and lack of availability of the necessary facilities in an additional four cases. However it is not possible to assess the overall impact of these factors on the service due to the small numbers involved. Provision of hand held computers for all clinical staff may be an option in the future but currently it is not possible to run hospital systems such as those used for reporting blood tests results and X-Rays on devices such as iPads due to differences in the software.

The mean time spent waiting to be seen was 76 minutes which is less than the 112 minutes reported by researchers from an AMU in Plymouth who carried out a similar study in 2010.<sup>181</sup> However it is not possible to comment on the reasons for this difference as the Plymouth study gives no details regarding staffing levels.

The mean time taken for the medical clerking process was 75 minutes, this is very similar to the time of 76.7 minutes reported in the Nottingham AMU study,<sup>180</sup> no further comparative studies were identified in the literature. However the original Royal College of Physicians guidance for establishing AMUs<sup>9</sup> states that junior medical staff should be allowed one hour to clerk each new patient including carrying out interventional procedures, gathering results and writing a medication chart, and it is known anecdotally that some AMUs have a local target of one hour to clerk a patient. The Nottingham researchers<sup>180</sup> redesigned their rotas as a result of their findings and now allow 80 minutes to clerk a patient.

Senior doctors were found to be significantly quicker at clerking patients than junior doctors. It was thought that this may have been partly due to the 'see and treat' system which operates when the AMU is busy when patients identified by nursing staff as those unlikely to require admission are seen by a consultant with the aim of making a rapid diagnosis, providing treatment if necessary and discharging the patient within a few hours. However in the study observations only one patient was 'see and treat' and so this is unlikely to account for the difference in clerking times.

#### **4.4.4 Length of stay**

It proved impossible to compare the average length of stay to national data using Hospital Episode Statistics (HES) as HES data include all hospital admissions and the present study collected data for emergency medical admissions only. The results of the present study show that 49% of patients were discharged within 5 days of admission which is fewer than in a study carried out in Ipswich in 2005 which reported 57.9% of patients discharged within 5 days when an AMU consultant was present.<sup>10</sup> However the Ipswich study provides no information regarding the patient presenting complaints, in the study hospital patients presenting with cardiac complaints are triaged to the HEC rather than AMU which may explain the

difference. A 2010 study which was carried out in 91 AMUs in England reported a mean length of stay of  $8.5 \pm 1.3$  days<sup>185</sup> which is slightly less than the 9.9 days found in the present study. However the latter study used hospital episode statistics data which records length of stay in minutes whereas in the present study length of stay was rounded up to the next whole day as the time of discharge was not readily available at the time of data collection.

National reports in 2010/11 ranked Liverpool, the location of the study hospital, as the most socially deprived local authority area in England.<sup>186, 187</sup> Majeed *et al* showed that social deprivation is associated with increased hospital admission rates<sup>188</sup> and other studies have shown that social deprivation is associated with increased hospital admissions due to respiratory tract infections,<sup>189</sup> increased emergency admissions in older people<sup>190, 191</sup> and increased length of stay for patients with chronic obstructive pulmonary disease (COPD).<sup>192</sup> The 2013 health profile for Liverpool<sup>193</sup> shows not only a higher death rate for Liverpool residents but also a greater proportion of emergency hospital admissions when compared to the national average. This may indicate that fewer Liverpool patients seek early appropriate care in the community resulting in them being more unwell on admission to hospital which may explain the longer length of stay.

#### **4.4.5 Discharge from AMU**

The results show that 27% of patients in the study were discharged directly from AMU which is fewer than the 40% reported in the recent national survey of AMUs,<sup>184</sup> the difference is likely to be due to differing operational policies between units. Some Trusts may include ambulatory patients in their admission and discharge data, the study hospital includes only those who require hospital admission and excludes patients who are reviewed by the medical staff and discharged within a few hours without having been allocated a hospital bed. In addition the patients seen in the study hospital AMU may have been more unwell as discussed above. The duration of the initial care provided to medical patients on an AMU in the UK, prior to discharge or transfer to another ward, can vary from 12 to 72 hours<sup>11, 22, 179</sup> as short stay beds may be part of AMU in some hospitals but located elsewhere in others. The length of stay in the study hospital AMU has been

shown to be 15 to 21 hours<sup>4</sup> and varies across 19 Trusts in the North West of England from 12 to 72 hours.<sup>194</sup>

#### **4.4.6 Interruptions**

The results showed that senior doctors were more often interrupted for advice and junior doctors to resolve issues with patients whom they had not clerked, this may be indicative of nursing staff having greater respect for senior doctors. Interruptions to clinical tasks are of concern as doctors may delay or fail to complete the task which may compromise patient safety<sup>195</sup> and frequent interruptions may be associated with an increase in doctors' workload.<sup>196</sup> In the present study an interruption occurred during half of the observed patient admissions and therefore presents a considerable risk of error. Although an exhaustive literature search did not return any studies which evaluated the impact of interruptions during clerking due to the complexity of the healthcare environment<sup>197</sup> there is evidence that errors occur when nurses are interrupted during the medication administration process.<sup>198</sup> The types of interruption observed in the present study are broadly similar to those reported by Weigl *et al.*<sup>196</sup> with the majority of interruptions being made by nursing or medical colleagues either in person or via a pager. However it is difficult to compare the results of the present study with those in the literature as the definition used for an interruption is not always clear. There may be opportunity to schedule investigations differently in the study hospital in order to maximise use of staff time and minimise delays and risk to patients. Further work to determine practices in other Trusts regarding the interruption of clinical staff would be of benefit.

#### **4.4.7 Recent operational changes**

Since the data collection took place a number of changes have been made in the study hospital AMU, partly due to an interim report of the study findings provided to the Divisional Medical Director in October 2010. Grade F1 doctors now wear purple tunics and trousers making it easier for nursing staff to identify the correct grade of staff and minimising unnecessary interruptions. A whiteboard has also been introduced to show which consultants are on duty and the junior doctors allocated to them together with pager numbers again enabling staff to identify the

most appropriate individual to consult. The AMU has employed additional AMU consultants so there are no longer 'post take' ward rounds with visiting consultants from elsewhere in the Trust and junior rotas have been adjusted in order to better match the peaks of demand. All morning ward rounds are carried out by dedicated AMU consultants to improve continuity and newly admitted patients are reviewed throughout the day when the results of their investigations are available rather than having to wait for a formal ward round. As there is no afternoon ward round junior doctors are now available to clerk patients throughout the afternoon helping to minimise waiting times. There is also agreement that at least one doctor does not attend the lunchtime education sessions but remains on AMU to clerk new patients.

Two additional consultation rooms have been created, making a total of four; these are used for AMU clinic sessions on week day mornings but are free in the afternoons as additional areas for clerking patients to help relieve the afternoon bottlenecks.

The medical hierarchy in which doctors are reluctant to challenge the opinions of others<sup>199</sup> continues to exist, a Scottish study found that senior doctors felt that this was now confined to surgical specialties but junior doctors felt that it was a problem in all specialties.<sup>200</sup> In the present study it was noted that juniors were reluctant to speak to seniors on occasion. The presence of regular AMU consultants on 'the shop floor' should enable staff to interact informally on a day to day basis and thus make it easier for juniors to approach seniors when they require assistance.

#### **4.5 Summary**

The results relating to the admission process as a whole have been presented and discussed in this chapter, those pertaining to VTE risk assessment are discussed in the next chapter and the results for the medicines reconciliation arm are discussed in chapter 6.

## Chapter 5 Results and Discussion: Venous Thromboembolism Risk Assessment and Prophylaxis

This chapter presents the results for the VTE risk assessment arm of the study and discusses them in the context of the current published literature.

### 5.1 Overview

During the four data collection periods a total of 71 patient admissions, involving 36 staff, were observed and 930 sets of case notes were retrieved, the distribution over the four periods is shown in Table 5-1. Data from the 71 patient admissions were transcribed as case studies to facilitate analysis (Appendix 16). Interviews were carried out with a total of 25 staff including all 24 staff observed in periods 1, 2 and 3 and an additional member of staff who also volunteered to be observed but for whom no observations were conducted due to logistics. Staff were purposively selected to ensure that participants were representative of the range of grades of staff working on AMU during the course of the study. Similar numbers of admissions observed and case notes reviewed were included in all four periods.

**Table 5-1: Subject numbers in each study period - venous thromboembolism data**

	<b>Period 1 (Nov 2009)</b>	<b>Period 2 (Jan 2010)</b>	<b>Period 3 (Apr 2010)</b>	<b>Period 4 (Apr 2011)</b>	<b>Total</b>
Number of patient admissions observed	16	21	14	20	71
Number of staff observed	8	7	9	12	36
Number of staff interviewed	9	7	9	0	25
Number of staff both observed and interviewed	8	7	9	0	24
Number of patients admitted during study period	265	255	239	256	1015
Number of case notes retrieved	243 / 265 (91.7%)	232 / 255 (91.0%)	221 / 239 (92.4%)	234 / 256 (91.4%)	930 / 1015 (91.6%)
Number of patients with documentation available*	<b>207 / 243 (85.2%)</b>	<b>202 / 232 (87.1%)</b>	<b>190 / 221 (86.0%)</b>	<b>211 / 234 (90.1%)</b>	<b>810 / 930 (87.1%)</b>

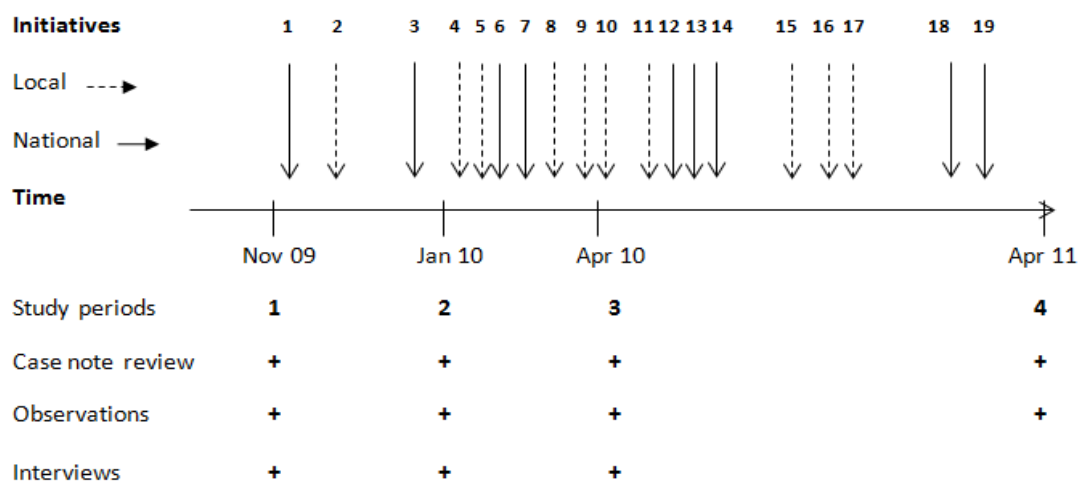
\*No significant difference between study periods chi-square P=0.391



## 5.2 Context

During the course of the study the DH continued to issue guidance<sup>34, 43, 98, 201-204</sup> to ensure that all patients were VTE risk assessed on admission to hospital and were prescribed appropriate prophylaxis. As a result there were numerous local and national initiatives to try to improve practice in this area. Local initiatives were introduced to increase staff awareness and facilitate the implementation of national guidance and included both education and provision of risk assessment tools. A thrombosis nurse was recruited to provide ward based training for nursing staff and education sessions were provided for medical staff at two of the weekly Grand rounds. Paper risk assessment forms were initially based on the available literature and those used by other local hospitals. These were modified during the course of the study in line with comments received from staff and to comply with the revised DH risk assessment tool introduced in March 2010.<sup>201</sup> They were printed on green paper to make them highly visible and easily distinguished from the copious number of forms that must also be completed for each patient as part of the admission process. An electronic risk assessment tool was introduced in April 2010 but proved very cumbersome, it was later simplified (new version 10/05/10) to electronic confirmation that VTE risk assessment had been completed and whether or not the assessment had taken place within 24 hours of admission (Figure 5-1).

**Figure 5-1: Local and national initiatives relating to venous thromboembolism (VTE) prophylaxis**



1. Nov 2009– All Party Parliamentary Thrombosis Group - Audit of acute trusts (National)
2. 24<sup>th</sup> Nov 2009 – Trust Risk Assessment (RA) forms placed with medication charts on AMU (Local)
3. 27<sup>th</sup> Jan 2010 – NICE guidance – national press & TV coverage (National)
4. 15<sup>th</sup> Feb 2010 – Thrombosis nurse employed (Local)
5. 26<sup>th</sup> Feb 2010 – VTE Grand round (1) – launch of Trust VTE policy (Local)
6. March 2010 – DH RA tool (version 2) (National)
7. 21<sup>st</sup> March 2010 – DH letter - Collecting of VTE RA data to be mandatory (National)
8. 1<sup>st</sup> April 2010 – electronic VTE RA (Local)
9. 15<sup>th</sup> April 2010 – VTE reminder posters on AMU (Local)
10. 27<sup>th</sup> April 2010 – Trust RA form version 4 (in line with DH / NICE guidance) (Local)
11. 10<sup>th</sup> May 2010 – electronic VTE RA – version 2 – simplified (Local)
12. 21<sup>st</sup> May 2010 – NICE guidance notes re VTE RA data collection (National)
13. 1<sup>st</sup> June 2010 – VTE data collection mandatory (National)
14. June 2010 NICE VTE quality standard (National)
15. 6<sup>th</sup> September 2010 – Trust VTE risk assessor of the week scheme (Local)
16. 22<sup>nd</sup> October 2010 – VTE Grand Round (2) (Local)
17. 26<sup>th</sup> October 2010 – VTE training – Pharmacists (Local)
18. 20<sup>th</sup> December 2010 – VTE RA in NHS outcomes framework 2011/12 (National)
19. 2<sup>nd</sup> February 2011 – How to guide for VTE risk assessment (National)

### 5.3 Observations

A total of 36 staff were observed during the four study periods 35 doctors (four consultant/specialist registrar, four specialist trainee year 4/5, nine specialist trainee year 1/2/3 and 18 foundation year1/2) and one advanced nurse practitioner.

The average age of the patients involved in the observed admissions was 68 years, 39% were male and the most common reasons for admission were infection, pain, abnormal biochemistry, shortness of breath and vomiting or diarrhoea, details are shown in Table 5-2.

**Table 5-2: Demographic details of patients included in case note reviews and observations (Reproduced here from Chapter 4, page 46 for ease of reference)**

Characteristic	Case note review	Observations
Number of case notes retrieved	930	71
Relevant admission notes available	876	67
Sex - male (%)	381 / 876 (43.5%)	28 / 67 (39%)
Age range (mean)	16 -98 (64) years	16 – 98 (68) years
Average length of stay (median)	1 – 182 (5.5) days	1 – 47 (5.0) days
Most frequent presenting complaint (descending order of occurrence)	Infection (285; 32.5%) Pain (72; 8.2%) Cardiac cause (60; 6.8%) Shortness of breath (54; 6.2%) Abnormal biochemistry* (51; 5.5%) Possible VTE <sup>†</sup> (46; 5.3%)	Infection (15; 22%) Pain (8; 12%) Abnormal biochemistry* (8; 12%) Possible VTE <sup>†</sup> (7; 10%) Shortness of breath (5; 7%) Vomiting or diarrhoea (5; 7%)

\*Results outside of the normal range for haemoglobin, glucose, thyroid hormones, sodium, potassium, magnesium, or calcium

<sup>†</sup>Venous thromboembolism

#### 5.3.1 Questions asked about VTE

Over the first three study periods, only eight of the 51 patients (16%) observed were asked questions relating to VTE, three of whom had presented with symptoms suggestive of VTE, whereas in period 4, six out of the 20 observed (30%) were asked VTE related questions, only one of whom presented with symptoms suggestive of VTE. Questions asked are shown in Table 5-3. Of the remaining 57 patients who were not asked VTE related questions four (4/57; 7%) presented with symptoms suggestive of VTE.

**Table 5-3: Questions which patients were asked relating to venous thromboembolism (VTE) during observations**

Question Asked	Proportion of total number of patients	Proportion of those with possible VTE
Have you ever had a clot?	13/71 (18%)	8/13
Has anyone in your family ever had a clot?	5/71 (7%)	4/5
Are you taking warfarin?	2/71 (3%)	2/2
Have you taken warfarin in the past?	2/71 (3%)	2/2
Have you had any recent surgery?	1/71 (1%)	0/1
Do you have varicose veins?	1/71 (1%)	1/1

As the number of patients seen by each of the more senior grades of staff was small the doctors were divided into two groups to enable analysis. A total of 14 patients were asked VRE related questions, junior doctors comprising grades F1 and F2 (18 staff) asked 8/30 patients whom they clerked and senior doctors grade ST1 and above (17 staff) asked 6/38 patients, the nurse was excluded from this part of the analysis. When the two groups were compared there was no significant difference between them in terms of the proportion of patients who were asked questions relating to VTE, chi-square test  $P=0.271$ . The three patients clerked by the nurse were not asked any VTE related questions.

### 5.3.2 VTE risk assessments

The numbers of observations, numbers of risk assessments performed and the numbers of patients for whom appropriate VTE prophylaxis was prescribed are shown in Table 5-4, for each study period. No risk assessment forms were completed in period 1, and while this increased in periods 2 and 3, a greater change was noted between periods 3 and 4. Placement of risk assessment forms with medication charts prior to period 2 resulted in only seven of 21 being completed, five being actively removed and nine being ignored. An electronic risk assessment form implemented prior to period 3 was not routinely used by staff, with only four of the 14 admissions assessed using this process.

**Table 5-4: Frequency of venous thromboembolism (VTE) risk assessment and appropriate / inappropriate prescribing of low molecular weight heparin (LMWH) during observations**

Study period	November 2009 (1)	January 2010 (2)	April 2010 (3)	April 2011 (4)
Number of admissions observed	16	21	14	20
VTE risk assessment form completed Confidence Interval	0/16 (0%) (0%-17%)	7/21 (33%) (15%-60%)	4/14 (29%) (8%-58%)	15/20 (75%) (51%-91%)
LMWH prescribed appropriately (including therapeutic & prophylactic doses initiated anytime during stay) Confidence Interval	9/16 (56%) (30%-80%)	12/21 (57%) (34%-78%)	7/14 (50%) (23%-77%)	12/20 (60%) (36%-81%)
LMWH prescribed inappropriately Confidence Interval	0/16 (0%) (0%-17%)	2/21 (10%) (1%-30%)	0/14 (0%) (0%-19%)	1/20 (5%) (0%-25%)

### 5.3.3 Prescribing of LMWH

A summary of VTE risks, bleeding risks and treatment with LMWH for the 71 admissions observed is shown in Figure 5-2, page 75. Only 19 of 32 patients for whom VTE prophylaxis with LMWH was indicated were prescribed this treatment by the admitting doctor. In addition three patients who had bleeding risks were prescribed LMWH potentially putting them at increased risk of haemorrhage. When these three cases were formally reviewed by the AMU consultant consensus group the decision was that the benefits of VTE prophylaxis did not outweigh the risks for any of these three patients (Appendix 17, Appendix 18 and Appendix 19).

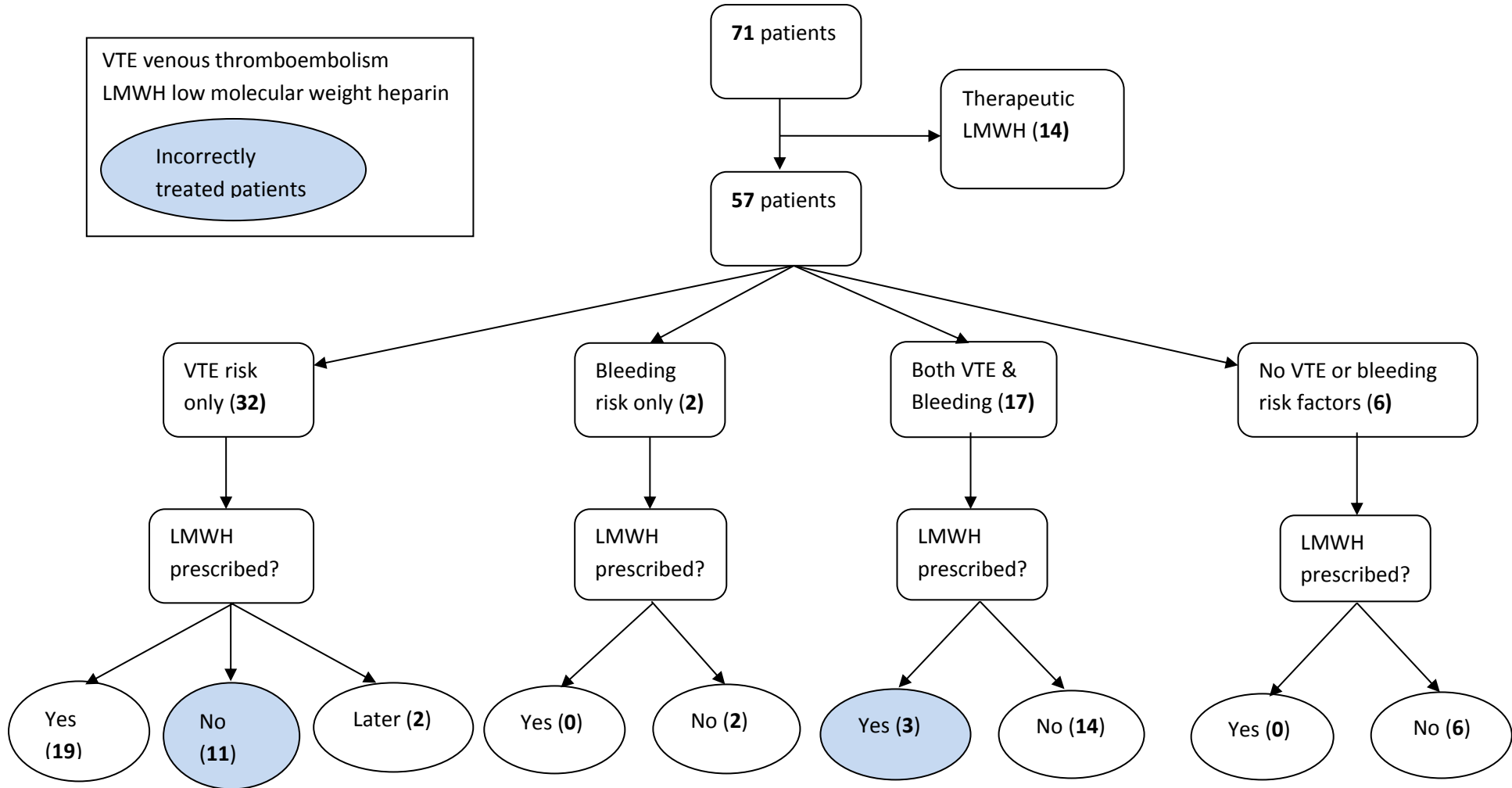
Of the 14 patients with both VTE and bleeding risks for whom LMWH was not prescribed six had a completed VTE risk assessment form in the case notes. However the rationale for a decision regarding VTE prophylaxis was very rarely documented and therefore it is not known whether a clinical decision was made not to prescribe LMWH was made for any of these patients.

#### 5.3.3.1 Dose of LMWH

The Trust formulary choice of LMWH for VTE prophylaxis in the study hospital is dalteparin, the licensed dose for prophylaxis in medical patients is 5,000 units

daily.<sup>205</sup> Two patients were prescribed a lower dose of 2,500 units daily which is recommended in the Trust policy for patients with an estimated glomerular filtration rate (eGFR) <30ml/min.<sup>206</sup> (A normal eGFR is above 90ml/min; an eGFR of <30ml/min indicates severe renal impairment). One patient had been transferred from another hospital and was already prescribed this dose so the prescription was continued; no rationale for the dose reduction was identified for the other patient. Both patients had an eGFR >30ml/min one being 75ml/min and the other >90ml/min.

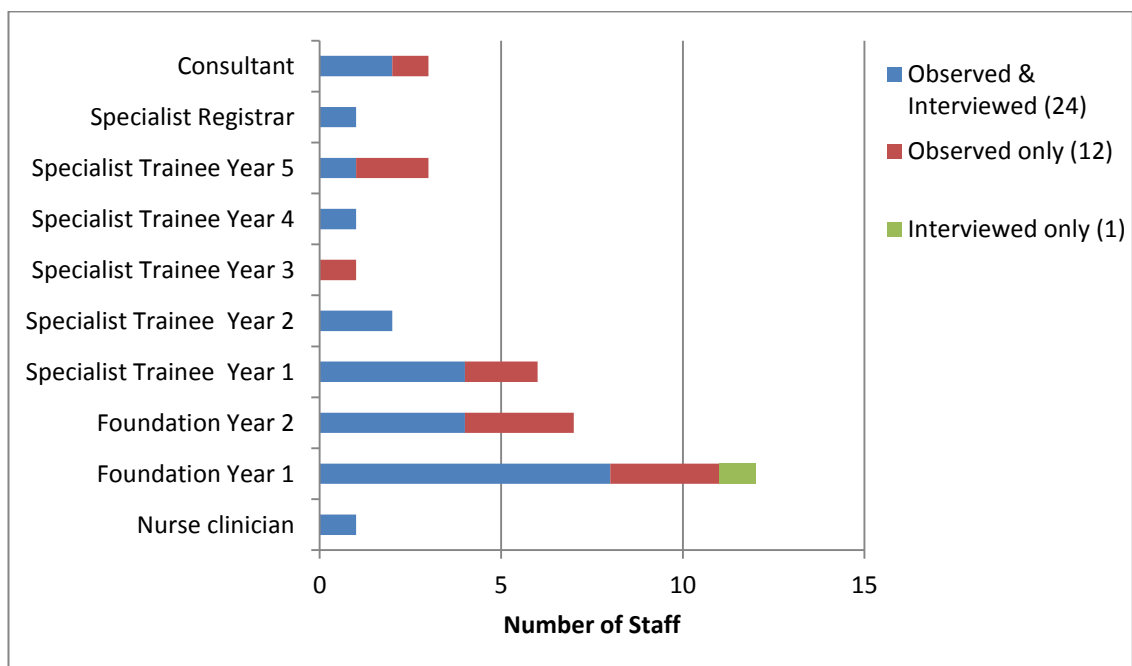
**Figure 5-2: Overview of VTE risks and prescription of LMWH on admission for observed patients**



## 5.4 Interviews

All 24 healthcare staff observed during periods 1, 2 and 3 were interviewed, three consultant/specialist registrar, two specialist trainee year 4/5, six specialist trainee year 1/2, 12 foundation and one advanced nurse practitioner. An additional F1 doctor who volunteered to participate in the study was also interviewed, it was not possible to observe this doctor for logistical reasons (Figure 5-3).

**Figure 5-3: Demographics of staff participating in venous thromboembolism observations and interviews**



### 5.4.1 VTE training

Of the 25 staff interviewed 14 (56%) reported having undergone VTE training, four doctors received undergraduate training and nine as postgraduates, five at the study hospital and four at another hospital. In the majority of cases (12/14; 86%) the duration was less than one hour, in one case it was one to two hours and in one case longer than two hours. Most staff (8/14; 57%) had been trained within the preceding 12 months but for six (6/14; 43%) training had been longer ago. Training had been received in a variety of formats both formal and informal including: at Trust induction, Grand rounds, from a VTE nurse, audit presentation, talk given by a medical representative, F1 teaching session, university lecture. Two staff indicated that they had “just picked it up on the job”. Only the nurse appeared to have had in depth training as she had attended a ‘Hot topic’ session about VTE at a SAM



conference. There was no correlation between staff receiving training and whether or not VTE risk assessment was completed (chi-square test,  $P=0.106$ ).

#### 5.4.2 VTE knowledge

Self-rated knowledge of VTE risk assessment was 'good' in nine cases (9/25; 36%), 'average' in fourteen (14/25; 56%) and 'below average' in two (2/25; 8%). The number of spontaneously listed VTE risk factors ranged from three to eight out of a possible 18, the most commonly cited in descending order were:

- Immobile for > 3 days (25 staff)
- Personal or family history of VTE (20 staff)
- Active cancer (16 staff)
- Age over 60 years (14 staff)
- Recent surgery (13 staff)

The number of spontaneously listed bleeding risks ranged from 1 to 3 out of a possible 12, the most commonly cited in descending order were:

- Actively bleeding (20 staff)
- Taking warfarin or another anticoagulant (10 staff)
- Haemophilia or other known bleeding disorder (9 staff)
- Acute stroke - in the last month (8 staff)
- Platelet count <100 (7 staff)

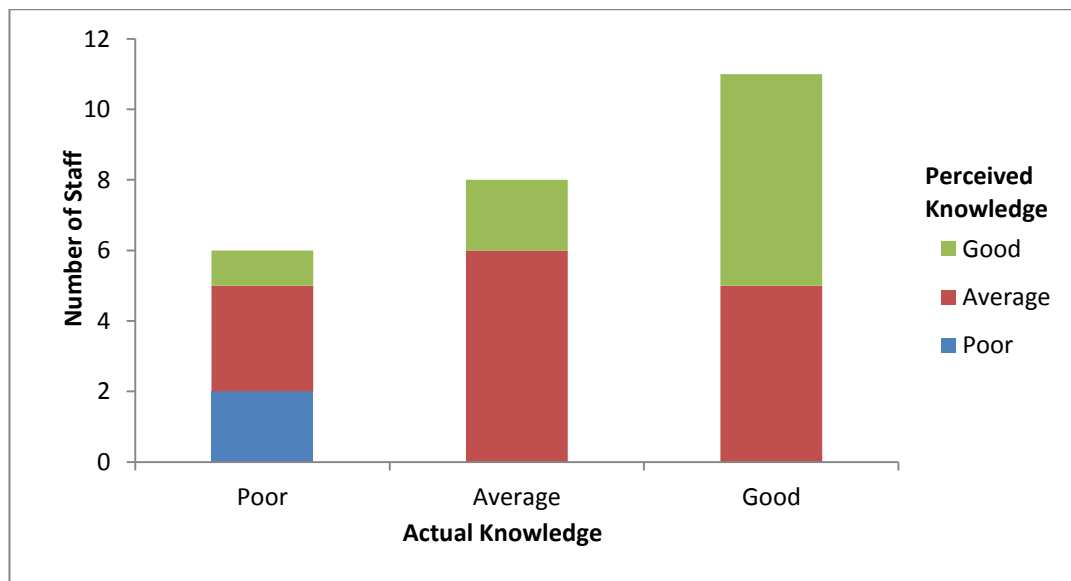
In order to assess actual knowledge, ability to spontaneously list VTE risk factors was graded as shown in Table 5-5.

**Table 5-5: Grading of actual venous thromboembolism (VTE) knowledge of participating staff**

Number of VTE risk factors spontaneously listed	Actual knowledge grading
3 or 4	Poor
5 or 6	Average
7 or 8	Good

There was no statistically significant evidence of any difference in actual knowledge between staff with below average or average perceived knowledge and those with good perceived knowledge (Mann-Whitney test,  $P = 0.2105$ ). The two staff whose knowledge was actually poor were aware of this but three staff who graded their own knowledge as average and one who graded their knowledge as good also had poor actual knowledge, Figure 5-4.

**Figure 5-4: Actual and perceived venous thromboembolism knowledge of participating staff**



#### **5.4.2.1 Estimates of proportion of patients at risk of VTE**

Staff estimates of the proportion of medical patients with VTE risk factors ranged from 30% to 90%, only 13/25 (52%) believed that over 80% would be at risk, while the majority (21 / 25; 84%) estimated that 20% or fewer of patients would have both VTE and bleeding risks.

Staff were shown a flash card which listed a number of common causes of mortality in the UK in descending order of prevalence and asked to indicate where in the list they would place VTE (Appendix 11; with answers Appendix 12). It was not possible to collect this data for one doctor. Fifteen (15/24; 63%) correctly placed the annual number of deaths from VTE as being lower than those from myocardial infarction but higher than those from breast cancer. Three (3/24; 12%) estimates were too high and six (6/24; 25%) too low.

#### **5.4.2.2 Awareness of policies**

Only eight staff (8/25; 32%) reported being aware of any national policies or guidance on VTE risk assessment, although the DH working group report was published in 2007 and the first DH VTE risk assessment tool was published in September 2008, data collection for the study commenced in 2009. None of the interviewees had actually seen either of these documents.

When asked about the Trust VTE risk assessment tool, in November 2009 seven out of nine staff, and in January 2010 six out of seven staff, were aware of its availability. In November 2009 and January 2010 a paper risk assessment tool was available; in April 2010 an electronic tool was in use. The views of staff regarding the ease of use of these tools are shown in Table 5-6. The electronic risk assessment tool in use in April 2010 proved very cumbersome as it simply transposed the RLUBHT paper version (Appendix 20) onto the computer and required a yes / no answer to each of 14 VTE risks and each of eight bleeding risks. Of the nine doctors interviewed in April 2010 following the introduction of this tool one thought that it was time consuming and one stated that it was complicated.

**Table 5-6: Ease of use of venous thromboembolism risk assessment tools reported by staff during interviews**

<b>Study Period</b>	<b>Type of tool</b>	<b>Easy</b>	<b>OK</b>	<b>Complicated</b>	<b>Time consuming</b>	<b>Not used</b>
Nov 2009	Paper	1/9	3/9	1/9	1/9	3/9
Jan 2010	Paper	2/7	1/7	2/7	0	2/7
April 2010	Electronic	3/9	2/9	1/9	1/9	2/9

Reasons for not using the risk assessment tool given by staff who were aware of its availability were that they hadn't seen any suitable patients (2), and that the tool wasn't available at the time of clerking (1), the reason was not recorded in one case.

#### **5.4.2.3 Awareness of current VTE prophylaxis prescribing practice**

To assess their knowledge of the current situation regarding prescribing of VTE prophylaxis, staff were asked to estimate the proportion of patients for whom VTE prophylaxis was indicated that were prescribed a LMWH. A Trust audit in January 2009 had shown that the proportion was 30%. Overall answers varied from 5% to

95% with a mean value of 42%, however, although both the mean and median values increased with time, (Table 5-7) this difference was not statistically significant, Kruskal-Wallis test P=0.281, indicating that there was no statistical improvement in the accuracy of estimates over time.

**Table 5-7: Staff Estimates of proportion of appropriate prescribing of venous thromboembolism prophylaxis reported during interviews**

Study Period	Number of responses	Minimum value	Maximum value	Mean value	Median value
Nov 2009	9	5%	95%	35%	30%
Jan 2010	7	15%	80%	44%	40%
Apr 2010	9	20%	80%	49%	60%

#### 5.4.3 Responsibility for VTE risk assessment

The majority of staff (22/25; 88%) felt that responsibility for VTE risk assessment should fall to the clerking doctor or nurse, but 16/25 (64%) felt the actual responsibility was unclear.

#### 5.4.4 Prescribing of pharmacological VTE prophylaxis

When asked who should prescribe VTE prophylaxis for patients clerked on AMU most (22/25; 88%) said that this should be the responsibility of the clerking doctor or nurse. The remaining three staff said that the person responsible for writing the first prescription chart following admission should prescribe. Regarding timing of the prescription the majority (23/25; 92%) spontaneously said that VTE prophylaxis should be prescribed when the first prescription chart was written following admission, one F2 doctor thought that this should take place on the post take ward round and an F1 doctor thought that the medical registrar should prescribe when the decision was made to admit the patient.

When asked which medicine they would prescribe for pharmacological VTE prophylaxis all 25 staff stated dalteparin which is the formulary choice in the study hospital. When asked the dose which they would prescribe 21/25 staff (84%) said 5,000 units daily which is the licensed dose for prophylaxis of VTE in medical patients<sup>205</sup>, one F2 doctor said 2,500 units daily and two were unsure and said that

they would look the dose up. Surprisingly the two doctors who were unsure were more senior an ST1 and an ST5, however this may reflect the fact that they were on 'hot block' on AMU and were not involved in clerking patients on a daily basis.

Dose reduction of dalteparin for medical prophylaxis is not recommended within the product licence in any circumstances, however the Trust Policy for Prevention of Thromboembolism<sup>206</sup> recommends a reduction to 2,500 units daily in patients who have renal impairment with an eGFR <30ml/min.

When asked about situations in which the dose requires reduction, two (2/25; 8%) doctors felt that a dose reduction would be appropriate for elderly patients, approximately half (12/25; 48%) said that they would reduce the dose in patients known to have severe renal impairment (chronic kidney disease stage 4 or 5, eGFR <30ml/min) and 12/25 (48%) also said that they would reduce the dose in patients with a low body weight. When asked to specify the weight below which they would reduce the dose responses varied from <80kg to <40kg.

#### **5.4.5 VTE risk assessment process in the Emergency Department**

The ED at RLUH is extremely busy and accepts all major emergencies, to meet government targets patients must be seen, assessed and either discharged home or admitted to hospital within four hours of arrival.

As approximately half of medical patients are admitted to AMU following initial presentation to the ED, staff were asked whether the VTE risk assessment process should be different for these patients and if so in what way. Patients who are seen in ED and thought to require hospital admission must be referred to and accepted by the medical registrar on call; the initial medication chart is written by the doctor who clerks the patient in ED. The additional steps in this admission process appeared to make the responsibility for VTE risk assessment less clear than for patients admitted directly to AMU, as there was greater variation in views expressed by interviewees regarding both who should complete the risk assessment and who should prescribe any prophylaxis required (see Table 5-8).

**Table 5-8: Staff opinions regarding responsibility for venous thromboembolism risk assessment and prescribing prophylaxis**

Grade of staff	Who should complete VTE risk assessment?		Who should prescribe VTE prophylaxis?	
	AMU* admission	ED <sup>‡</sup> admission	AMU* admission	ED <sup>‡</sup> admission
Clerking doctor /nurse	22 (88%)	17 (68%)	22 (88%)	14 (56%)
Doctor who writes medication chart	1 (4%)	3 (12%)	3 (12%)	4 (16%)
Medical registrar accepting patient	Not applicable	2 (8%)	Not applicable	4 (16%)
Doctor referring patient to medical registrar	Not applicable	1 (4%)	Not applicable	2 (8%)
Senior review doctor	0	1 (4%)	0	0
First doctor to see patient in AMU	Not applicable	1 (4%)	Not applicable	1 (4%)
Triage nurse	1 (4%)	0	0	0
Anyone suitably trained	1 (4%)	0	0	0
Total number responses	25 (100%)	25 (100%)	25 (100%)	25 (100%)

\*Acute Medical Unit

<sup>‡</sup>Emergency Department

Comments of relevance made relating to the ED environment were:

- *“The ED is very busy so the process should be different” (ST2 doctor)*
- *“I can’t see how the risk assessment would be done in ED” (F2 doctor)*
- *“Patients are sicker so there is more chance of it [VTE risk assessment] getting missed” (F1 doctor)*

#### **5.4.6 Role of healthcare staff in VTE prevention**

Staff were asked to identify their own perceived role in preventing medical patients developing a VTE, their responses are shown in Table 5-9. In general junior medical staff felt that their role was to complete the VTE risk assessment and prescribe prophylaxis if appropriate, senior medical staff felt that their role was to check that the patient had been risk assessed and that any prophylaxis prescribed was appropriate. One consultant commented that his role was also to lead good practice.

**Table 5-9: Staff views of their personal roles in venous thromboembolism (VTE) prevention**

<b>Role</b>	<b>Grade of staff</b>
Both complete the VTE risk assessment and prescribe prophylaxis if appropriate	11 Foundation 1/2 doctors 6 Specialist trainee 1/ 2 doctors
Complete the VTE risk assessment and prescribe prophylaxis if results available	1 Foundation 2 doctor
Highlight patients at risk and identify the need to consider VTE prophylaxis to senior medical staff	1 Nurse clinician (not prescriber) 1 Foundation 1 doctor
Check that risk assessment has been completed and that any prophylaxis prescribed is appropriate	2 Specialist trainee 4 / 5 doctors 1 Specialist Registrar 1 Consultant
Lead good practice	1 Consultant

F1/2 Foundation year doctor 1 -2 years post qualification

ST Specialist trainee doctor 3-5 years post qualification

#### 5.4.7 Reasons for low VTE risk assessment rates

The most frequent reasons given as explaining the low VTE risk assessment rates were lack of training (11/25) and lack of clarity regarding the individual(s) responsible for completing the assessment (10):

*“This is a senior doctor’s decision but F1s are expected to do it. Juniors are wary of prescribing medicines not requested by a consultant” (F1 Doctor)*

Three staff felt the tool was complicated and four said that the process was time consuming:

*“[The clerking process is] rushed - anything that isn't active treatment gets missed, regular medication gets missed too” (F2 Doctor)*

Five doctors alluded to the complexity of patient care contributing to the failure:

*“Complex patients, [there is] lots to think about, lack of awareness [of VTE], [you] focus on [the] history, [and] investigations” (F1 Doctor)*

*“Importance [of VTE risk assessment and prophylaxis is] underestimated in AMU – [the] patient comes in with several problems and you concentrate on [the] reason for admission” (F1 Doctor)*

Senior doctors also felt that the initial clerking of patients was complicated and risk assessment forms were a useful prompt:

*“Green sheets [VTE risk assessment forms are] very helpful... Too much to remember, patients are very complex - thinking about diagnosis, treatment, investigations, results” (ST2 Doctor)*

However two comments from senior doctors demonstrated that personal beliefs and values may also have an impact:

*“[VTE risk assessment] doesn't save lives, prophylaxis isn't treatment, [there has been] no litigation” (Consultant)*

*“[I] can't be bothered, [it's] yet another form [to fill in], I didn't realise the risk” (ST1 Doctor)*

#### 5.4.8 Suggestions for improving VTE risk assessment rates

Recommendations for improving VTE risk assessment rates related mainly to increasing training and raising awareness of the risks (8/25). However the need to clarify roles (1/25) and for strong leadership (1/25) were also identified. One F1 Doctor said that VTE risk assessment should be mandatory and nurses should be empowered to refer the patient back to the doctor if it has not been completed. Examples of interview responses are shown in Table 5-10.

**Table 5-10: Extracts from interviews – suggestions for improving venous thromboembolism (VTE) risk assessment rates**

Key themes	Extracts from VTE interviews
Training / raising awareness	<p><i>“Add to [Trust] induction – lecture style teaching is OK – but [it] must be short” – ST1 doctor</i></p> <p><i>“All doctors should do [the] e-learning module” – ST5 doctor</i></p> <p><i>“More publicity needed – education campaign” - Consultant</i></p>
Clarify roles	<p><i>“Put large posters in the doctors’ office”-F2 doctor</i></p> <p><i>“Clarify about whose job it is” – F2 doctor</i></p>
Leadership	<p><i>“you need strong leadership to re-enforce” – Nurse</i></p>

F1/2 Foundation year doctor 1 -2 years post qualification

ST Specialist trainee doctor 3-5 years post qualification

#### 5.5 Triangulation of observation and interview data

A total of 51 patients, admitted by 24 staff, were observed. All of these observed staff participated in the interview pertaining to VTE risk assessment and prophylaxis. Data from the doctor who was interviewed but not observed have been excluded



from this part of the analysis. Eleven VTE risk assessments were carried out by seven doctors (two F1, one F2, two ST1, one ST2 and one consultant), five of whom reported having had VTE training and assessed knowledge of VTE was good for three and average for four. Of the 17 staff who did not complete a VTE risk assessment eight reported having had training and assessed knowledge of VTE was good for six, average for nine and poor for two. There was no statistical difference in the number of staff who reported receiving VTE training between those who did, and those who did not, complete a VTE risk assessment (chi-square  $P=0.276$ ). The numbers were too small to enable a statistical analysis of assessed knowledge and completion of VTE risk assessment.

Prophylactic LMWH was indicated for 20 of the 51 patients for whom both observation and staff interview data were available. Prescribing of LMWH by seven doctors for nine (9/20; 45%) of these patients was witnessed during observations, four of these doctors also completed the risk assessment for five of the nine patients. Three of the seven doctors who prescribed LMWH reported having had VTE training and actual knowledge of VTE was assessed as good for four and average for three.

## **5.6 Case Note Review**

A total of 1015 patients were identified during the four study periods of which 930 (91.6%) were followed up. Case notes were followed up until an attempt had been made to review those of at least 90% of the patients admitted in each data collection period and the target of 200 available sets of notes for each period was exceeded. In 54 cases the relevant admission documentation was not available in records, leaving 876 cases suitable for analysis. The prescription chart was missing for a further 73 cases resulting in their exclusion from the analysis relating to prescription of LMWH prophylaxis.

### **5.6.1 VTE and bleeding risk factors**

The numbers of patient notes reviewed in each study period are shown in Table 5-11, together with details of risk factors present. Of the 876 patients, 719 (82.1%) had at least one VTE risk factor and 222 (25.3%) had at least one bleeding risk on admission. Almost a fifth of all admissions (171; 19.5%) had risk factors for both VTE

and bleeding (Table 5-11), therefore 23.8% (171/719) of the patients admitted with a VTE risk factor also had a bleeding risk, requiring additional clinical judgment before prescribing prophylaxis. However it was noted that the rationale for the decision to prescribe or withhold LMWH was very rarely documented in the case notes, although these details were not specifically recorded during the study.

**Table 5-11: Frequency of venous thromboembolism (VTE) risk factors and bleeding risks identified from case notes**

Study period	November 2009 (1)	January 2010 (2)	April 2010 (3)	April 2011 (4)	Totals
Total admitted	265	255	239	256	1015
Case notes available	232/265 (87.5%)	216/255 (84.7%)	204/239 (85.4%)	224/256 (87.5%)	876/1015 (86.3%)
At least 1 VTE risk factor*	192/232 (82.8%)	172/216 (79.6%)	161/204 (78.9%)	195/224 (87.1%)	719/876 (82.1%)
95% Confidence interval	(77.3%-87.4%)	(73.6% - 84.8%)	(72.7%-82.3%)	(82.9%-91.1%)	(79.4-84.6%)
At least one bleeding risk factor*	44/232 (19.0%)	62/216 (28.7%)	53/204 (26.0%)	63/224 (28.1%)	222/876 (25.3%)
95% Confidence interval	(14.1% - 24.6%)	(22.8%-35.2%)	(20.1%-32.6%)	(22.3%-34.5%)	(22.5%-28.4%)
Risk factors for both VTE and bleeding*	34/232 (14.7%)	44/216 (20.4%)	43/204 (21.1%)	50/224 (22.3%)	171/876 (19.5%)
95% Confidence interval	(10.4%-19.9%)	(15.2%-26.4%)	(15.7%-27.3%)	(17.0%-28.3%)	(16.9%-22.3%)
VTE risk and no bleeding risk*(LMWH <sup>‡</sup> indicated)	158/232 (68.1%)	128/216 (59.3%)	118/204 (57.8%)	145/224 (64.7%)	549/876 (62.7%)
95% Confidence Interval	(61.7%-74.1%)	(52.4%-65.9%)	(50.7%-64.7%)	(58.1%-71.0%)	(59.4%-65.9%)

\* No significant difference between study periods

<sup>‡</sup>Low molecular weight heparin

There appeared to be an increase in the proportion of patients who had both VTE and bleeding risk factors during the course of the study however when the study periods were compared (all groups in a single analysis) this did not reach statistical significance (chi-square P = 0.170). Over the period of the study there was a gradual increase in the complexity of patients treated, as bed pressures resulted in more patients with minor conditions receiving ambulatory care which may explain this trend.

#### *5.6.1.1 Prevalence of VTE risk factors*

The prevalence of individual VTE risk factors in the 876 patients for whom case notes were available is shown in Table 5-12. The majority of risk factors were identified from the case notes as VTE risk assessment forms often could not be located or were incomplete, factors which were identified more frequently on risk assessment forms than in the case notes were obesity and probability of remaining immobile for >3 days. The most common factors in decreasing order of occurrence were: age over 60 years (64.2%), acute infection (36.4%), acute or chronic lung disease (21.9%) and active cancer (11.2%). It proved difficult to verify the immobility and obesity risk factors documented on the VTE risk assessment forms with the case notes.

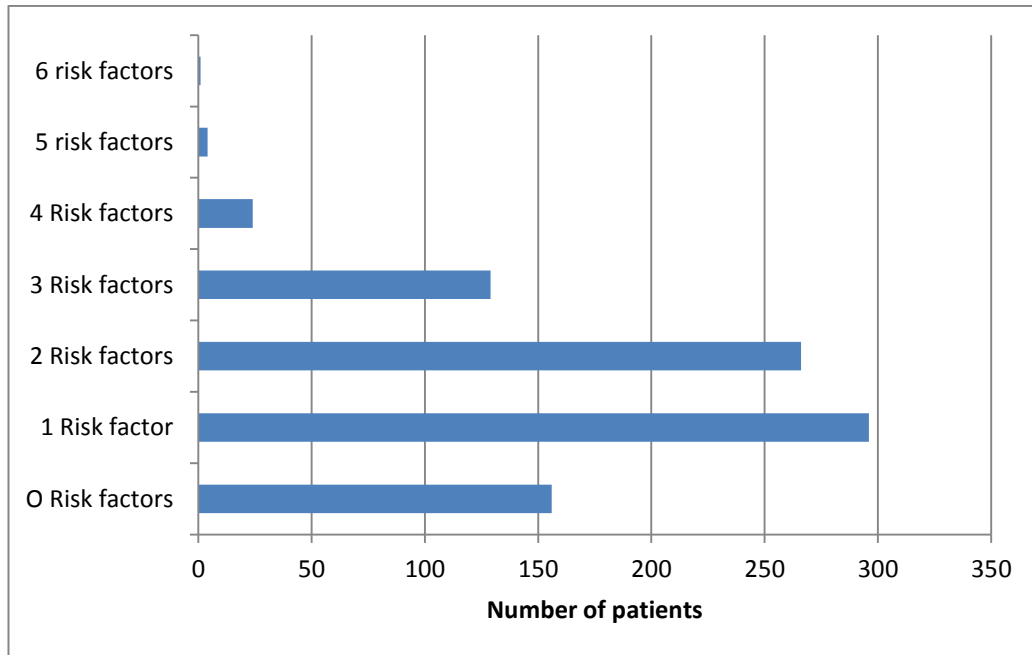
**Table 5-12: Comparison of prevalence of venous thromboembolism risk factors documented on Trust risk assessment forms and those identified from case notes**

Risk Factor	Number of patients affected- from case notes	Documented on risk assessment form and verified from case notes	Documented on risk assessment form but NOT verified from case notes	Total number of patients affected
Age > 60 years	562/876 (64.2%)	137/562 (24.3%)	1/876 (0.1%)	563/876 (64.3%)
Acute infectious disease (e.g. pneumonia)	319/876 (36.4%)	17/319 (5.3%)	0	319/876 (36.4%)
Acute or chronic lung disease	192/876 (21.9%)	32/192 (16.7%)	0	192/876 (21.9%)
Active cancer or myeloproliferative disorder	97/876 (11.1%)	15/97 (15.5%)	1/876 (0.1%)	98/876 (11.2%)
Acute or chronic inflammatory disease	28/876 (3.2%)	9/28 (32.41%)	1/876 (0.1%)	29/876 (3.3%)
Personal or family history of DVT <sup>a</sup> or PE <sup>b</sup>	23/876 (2.6%)	7/23 (30.4%)	0	23/876 (2.6%)
Expected to be immobile for 3 days or more	23/876 (2.3%)	10/23 (43.5%)	46/876 (5.3%)	69/876 (7.9%)
Chronic heart failure	16/876(1.8%)	7/16 (43.8%)	0	16/876 (1.8%)
Obesity: BMI > 30	11/876 (1.3%)	2/11 (18.2%)	15/876 (1.7%)	26/876 (3.0%)
Diabetic hyperosmotic hyperglycaemic state	8/876 (0.8%)	1/8 (12.5%)	0	8/876 (0.8%)
Hormone therapy containing oestrogen (HRT <sup>c</sup> or OCP <sup>d</sup> )	2/876 (0.2%)	0	1/876 (0.1%)	3/876 (0.3%)
Varicose veins with phlebitis	2/876 (0.2%)	0	0	2/876 (0.2%)
Pregnant or ≤ 6 weeks post-partum	2/876 (0.2%)	1/2 (50%)	0	2/876 (0.2%)
Known thrombophilia	1/876 (0.1%)	0	1/876 (0.1%)	2/876 (0.2%)
Nephrotic syndrome	1/876 (0.1%)	0	0	1/876 (0.1%)
Lower limb paralysis (excluding acute stroke)	0	0	0	0

<sup>a</sup>Deep vein thrombosis, <sup>b</sup>Pulmonary embolism, <sup>c</sup>Hormone replacement therapy, <sup>d</sup>Oral contraceptive pill

Overall 720/876 (82.2%) of patients had at least one VTE risk factor, see Figure 5-5, the mean number ( $\pm$  standard deviation) of risk factors per patient was  $1.53 \pm 1.07$ .

**Figure 5-5: Number of venous thromboembolism risk factors identified per patient from case notes**



#### ***5.6.1.2 Prevalence of bleeding risk factors***

As for VTE risk factors, bleeding risk factors were more often identified from the case notes than VTE risk assessment forms. However interestingly nine cases of active bleeding were documented on risk assessment forms but it proved impossible to confirm this with documentation in the case notes. The prevalence of individual bleeding risk factors is shown in Table 5-13, the most common factors in decreasing order of occurrence were: active bleeding (7.4%), low platelet count (6.4%), taking warfarin or other anticoagulant (5.0%) and severe liver disease (4.9%).

**Table 5-13: Comparison of prevalence of bleeding risk factors documented on risk assessment forms and those identified from case notes**

Risk Factor	Number of patients affected- from case notes	Documented on risk assessment form and verified from case notes	Documented on risk assessment form but NOT verified from case notes	Total number of patients affected
Active bleeding	65/876 (7.4%)	17/65 (26.2%)	9/876 (1.0%)	74/876 (8.4%)
Known platelet count < 100	56/876 (6.4%)	3/56 (5.4%)	1/876 (0.1%)	57/876 (6.5%)
Taking warfarin or other anticoagulant or antiplatelet therapy	44/876 (5.0%)	5/44 (11.4%)	2/876 (0.2%)	46/876 (5.3%)
Severe liver disease (PT* raised above normal or known varices)	43/876 (4.9%)	2/43 (4.6%)	0	43/876 (4.9%)
Severe renal disease (eGFR <30ml/min)	38/876 (4.3%)	0	0	38/876 (4.3%)
Acute stroke in past month (haemorrhagic or ischaemic)	8/876 (0.9%)	1/8 (12.5%)	0	8/876 (0.9%)
Lumbar puncture in previous 4 hours or indicated now	4/876 (0.5%)	0	0	4/876 (0.5%)
Blood pressure > 200 systolic or 120 diastolic	4/876 (0.5%)	2/4 (50.0%)	0	4/876 (0.5%)
Hypersensitivity to heparin	1/876 (0.1%)	0	0	1/876 (0.1%)
Haemophilia or other known bleeding disorder	0	0	0	0
History of Heparin Induced Thrombocytopenia (HIT)	0	0	0	0
Infective endocarditis	0	0	0	0

\*Prothrombin time

Overall 222/876 (25.3%) patients were at risk of bleeding, 187 had just one bleeding risk factor, 29 had two and six had three risk factors.

### 5.6.2 VTE risk assessment

The proportion of patients with a documented completed VTE risk assessment rose from 6.9% in study period 1 to 18.5% and 19.6% in periods 2 and 3 respectively, following local initiatives, but to 98.7% in period 4 following the imposition of payment-related government targets (Table 5-14). These changes were statistically significant (chi-square test  $P < 0.001$ ). Three sub-analyses showed that comparisons of periods 1 to 2 and 3 to 4 both gave  $P < 0.001$  and these were therefore statistically significant even when the Bonnferroni correction was applied. The comparison of period 2 to 3 was non-significant ( $P = 0.884$ ).

**Table 5-14 Frequency of venous thromboembolism (VTE) risk assessment and appropriate prescribing of low molecular weight heparin (LMWH)**

Study period		November 2009 (1)	January 2010 (2)	April 2010 (3)	April 2011 (4)
Total admitted	All admissions	265	255	239	256
Case notes available		232/265 (87.5%)	216/255 (84.7%)	204/239 (85.4%)	224/256 (87.5%)
VTE risk assessment completed*		16/232 (6.9%)	40/216 (18.5%)	40/204 (19.6%)	221/224 (98.7%)
Prescription charts <b>and</b> case notes available		205/265 (77.4%)	201/255 (78.8%)	189/239 (79.1%)	209/256 (81.6%)
LMWH indicated		147/205 (71.7%)	115/201 (57.2%)	115/189 (60.8%)	135/209 (64.6%)
Confidence Interval		(65.0%-77.8%)	(50.1%-64.3%)	(53.5%-67.8%)	(57.7%-71.1%)
LMWH prescribed appropriately* (Patient has VTE risk factors and no bleeding risks)		73/147 (49.7%)	71/115 (61.7%)	78/115 (67.8%)	126/136 (92.6%)
Confidence interval		(41.3%-58.0%)	(52.2%-70.6%)	(58.5%-76.2%)	(86.9%-96.4%)
LMWH contra indicated	32/205 (15.6%)	49/201 (24.4%)	39/189 (20.6%)	43/209 (20.6%)	
Confidence Interval	(10.9%-21.3%)	(18.6-30.9%)	(15.1%-27.1%)	(15.3%-26.7%)	
LMWH prescribed inappropriately**	1/32 (3%) (0%-16%)	9/49 (18%) (9%-32%)	3/39 (8%) (2%-21%)	14/43 (33%) (19%-49%)	
Confidence Interval					
Number of admissions observed	Observations	16	21	14	20
VTE risk assessment completed		0/16 (0%) (0%-17%)	7/21 (33%) (15%-60%)	4/14 (29%) (8%-58%)	15/20 (75%) (51%-91%)
Confidence Interval					
LMWH prescribed appropriately		9/16 (56%) (30%-80%)	12/21 (57%) (34%-78%)	7/14 (50%) (23%-77%)	12/20 (60%) (36%-81%)
Confidence Interval					
LMWH prescribed inappropriately	0/16 (0%) (0%-17%)	2/21 (10%) (1%-30%)	0/14 (0%) (0%-19%)	1/20 (5%) (0%-25%)	
Confidence Interval					

Significant differences between study periods \* P < 0.001; \*\* P = 0.002

### 5.6.3 Prescribing of VTE prophylaxis

The proportion of patients with VTE risk factors and no bleeding risks that were appropriately prescribed LMWH rose from 49.7% in November 2009 to 61.7% and 67.8% in January and April 2010 respectively and finally to 92.6% in April 2011. This



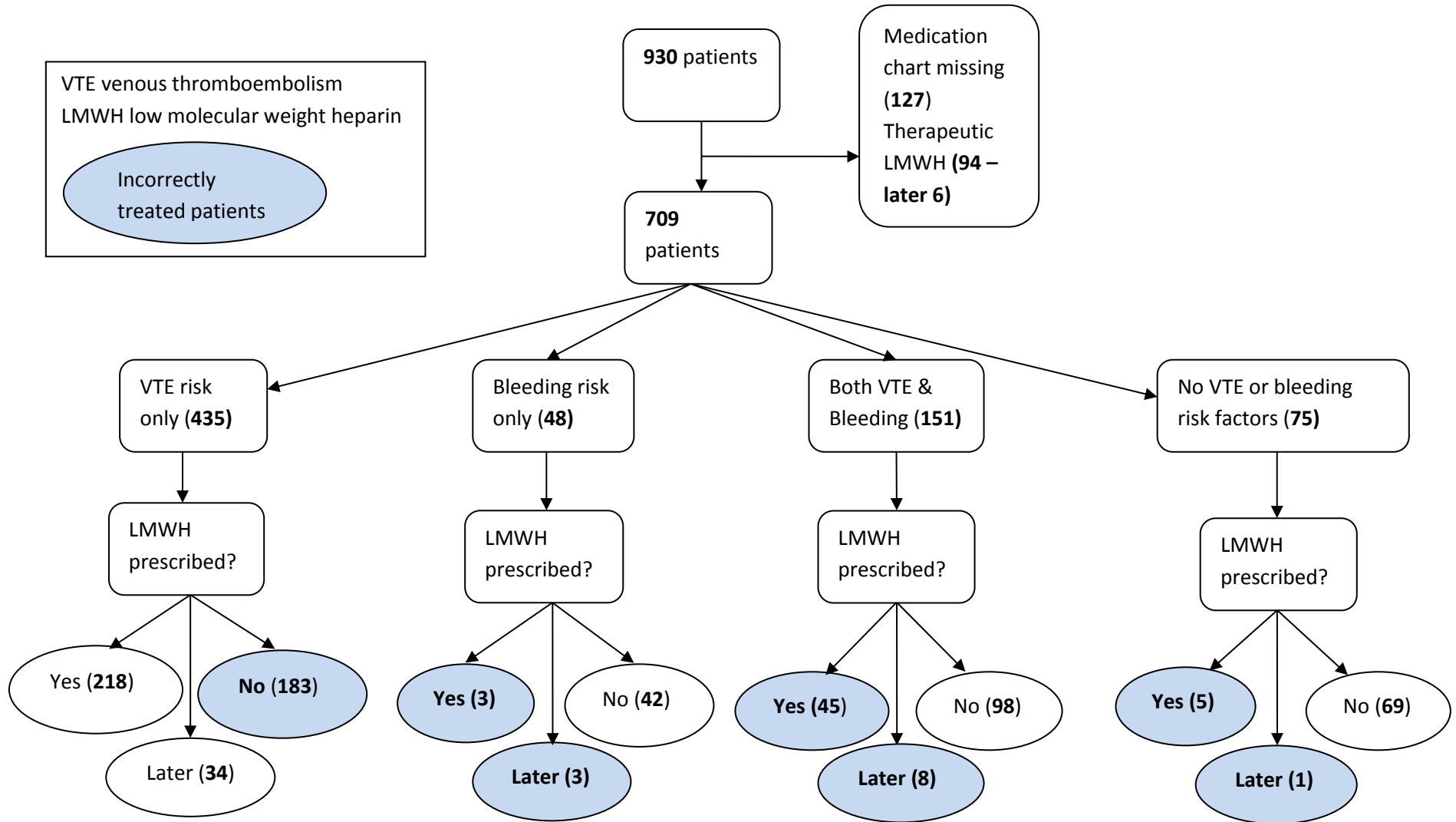
change was statistically significant between periods 3 and 4 (chi-square test,  $P < 0.001$ ). However there was also a statistically significant rise in the proportion of patients who had bleeding risks and were prescribed LMWH when the data from April 2011 were compared with the three earlier study periods, chi-square test  $P = 0.002$  (Table 5-14). Three sub-analyses of periods 1, 2 and 3 to period 4 were carried out with Bonnferroni correction. Comparison of periods 1 to 4 and 3 to 4 were statistically significant ( $P = 0.002$  and  $P = 0.006$  respectively). The comparison of period 2 to 4 was non-significant ( $P = 0.117$ ).

Twelve patients for whom VTE prophylaxis did not appear to be indicated on admission were prescribed this later in their hospital stay following review of the patient and results of their investigations by a senior doctor. None of these patients were straightforward as eight had evidence of both VTE risks and bleeding risks therefore a clinical decision was required to decide whether the patients individual risk of VTE was higher than their risk of bleeding or vice versa. For three patients evidence of bleeding risk was found in the case notes but no clear evidence of VTE risk and for one patient no evidence of either VTE risk or bleeding risk was identified from the case notes (Figure 5-6).

Thirty-three patients had at least one bleeding risk, but received LMWH. Independent review of all 33 case summaries by four AMU consultants achieved consensus agreement in 24 cases, with the remaining nine requiring discussion before consensus was reached. In six cases it was agreed that LMWH was appropriate, but was inappropriately prescribed in the remaining 27, (Appendix 17, Appendix 18 and Appendix 19).

Patients taking oral anticoagulants on admission are included in those for whom LMWH was contra-indicated in Table 5-14. Six patients were prescribed TED stockings in addition to LMWH, two in period 1, one in period 2 and three in period 4, no patients used foot pumps during the study.

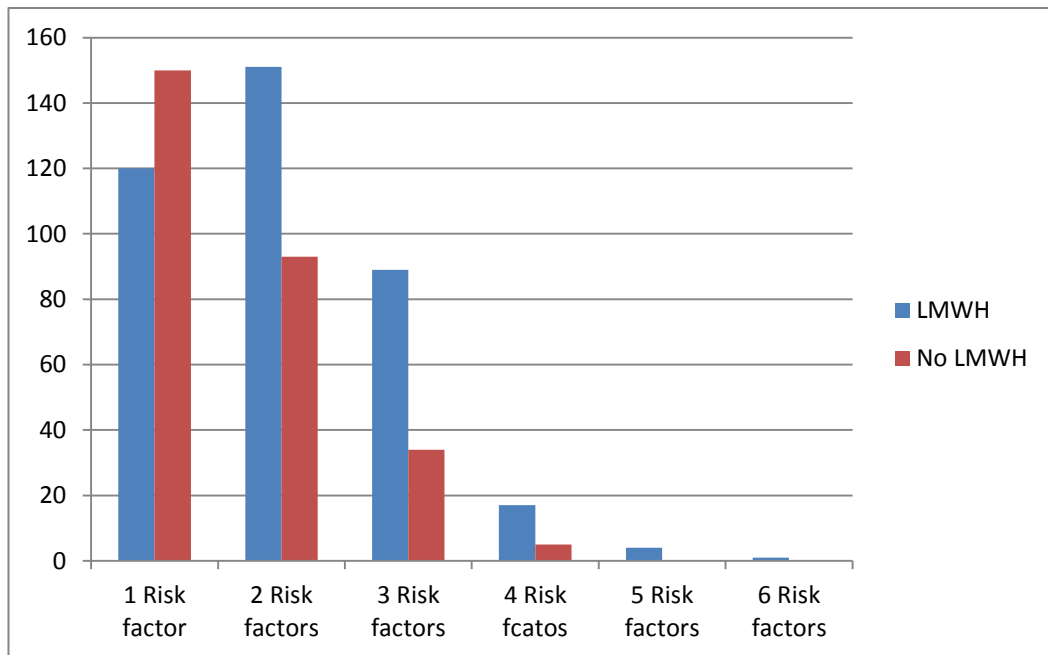
**Figure 5-6: Overview of VTE risks and treatment with LMWH for all study patients**



### 5.6.3.1 Effect of number of VTE risk factors per patient on prescribing of prophylaxis

Prescribing of VTE prophylaxis increased as the number of VTE risk factors increased. This change was statistically significant as the number of risk factors increased from 1 to 2 (chi-square  $P < 0.001$ ) and 2 to 3 (chi-square  $P = 0.047$ ) but non-significant when patients with three risk factors were compared with those with four risk factors (chi square  $P = 0.632$ ), see Figure 5-7.

**Figure 5-7: Effect of number of venous thromboembolism risk factors per patient on prescribing of low molecular weight (LMWH) prophylaxis**



### 5.6.3.2 Dose of LMWH prescribed

The licensed dose of dalteparin for VTE prophylaxis for medical patients<sup>205</sup> is 5,000 units daily, the manufacturers make no specific recommendations regarding reduction of dose in patients with renal impairment but the Trust policy<sup>206</sup> recommends a dose of 2,500 units daily for patients with an  $eGFR < 30 \text{ ml/min}$ .

Of the 317 patients prescribed prophylaxis 230 (72.6%) were prescribed dalteparin 5,000 units daily and 87 (27.4%) 2,500 units daily, 20/87 (23%) of these patients had both VTE and bleeding risk factors. Of the patients prescribed a reduced LMWH dose six had a low body weight (28-48kg), 20 patients had impaired renal function ( $eGFR < 30 \text{ ml/min}$ ) and 22 were elderly, age range 74 -95 years mean age 85 years.

No reason for the dose reduction could be identified from the case notes for the remaining 39 patients so it is likely that overall 67 patients were undertreated.

### 5.6.3.3 Rationale for delay in prescribing LMWH

For 52 patients LMWH was not prescribed on admission but was prescribed sometime later during their hospital stay. Seven patients required a computerised tomography (CT) scan of the head, to identify any intracranial haemorrhage which may have explained their presenting symptoms, before LMWH could be safely prescribed. Other reasons for the delay in prescribing VTE prophylaxis were identified for a further ten patients (see Table 5-15) but no justification for the delay could be found for the remaining 35 patients.

**Table 5-15: Reasons for delay in prescribing prophylactic low molecular weight heparin**

Reason	Number of patients
Invasive investigation required	3
Abnormal clotting –prolonged Prothrombin time (PT) or raised international normalised ratio (INR)	3
Investigated for bleeding	3
Acute kidney injury	1

### 5.6.4 Monitoring of LMWH

The use of heparin is associated with a low incidence of heparin induced thrombocytopenia (HIT) and therefore current guidance<sup>207</sup> states that all patients who are to receive heparin should have a baseline platelet count. The first NICE VTE risk assessment tool issued in September 2008<sup>34</sup> indicated that a platelet count of  $<100 \times 10^3 / \text{mm}^3$  was considered a bleeding risk, however this was subsequently reduced to a platelet count of  $<75 \times 10^3 / \text{mm}^3$  in the revised version published in March 2010.<sup>201</sup> Medical patients receiving LMWH do not require routine monitoring however if the platelet count falls by more than 30% between days 4 and 14 of treatment a diagnosis of HIT should be considered.<sup>207</sup>

The results show that 347/359 (96.7%) patients who received LMWH had a baseline platelet count, of these 13 were less than  $100 \times 10^3 / \text{mm}^3$  and therefore these patients were classified as having a bleeding risk. Of these only four had a platelet

count of  $<75 \times 10^3$  /mm on admission and the consultant consensus was that the benefits of prophylaxis outweighed the risks in three of these four patients. The fourth patient had metastatic breast cancer and had previous pulmonary emboli, she was treated with therapeutic LMWH and factor Xa levels were monitored to minimise the risk of bleeding.

Over half of patients stayed in hospital five days or longer (578/930; 57.8%). Repeat platelet monitoring was carried out for 90 patients (90/347; 25.9%), there had been a fall of more than 30% in eight (8/90; 9%) of these patients. Four had not received any heparin as it was not prescribed; two were very unwell and later died one due to metastatic lung cancer and the other due to multi-organ failure. One patient had a high platelet count on admission and received a single dose of LMWH; the fall to the normal range is more likely to be due to the stabilisation of their clinical condition than the effect of the LMWH. The final patient was admitted to a respiratory ward for 17 days as a result of a viral respiratory infection and received prophylactic LMWH throughout, during this time their platelet count dropped from 285 to 157 (45%) however there was no suggestion that this was due to HIT.

### **5.6.5 Adverse outcomes**

Adverse outcomes in terms of VTE, PE or bleeding during admission were recorded in order to detect the risks, and or benefits, associated with administration of LMWH as DVT prophylaxis. Sixty nine patients of the total of 930 admitted during the study died in hospital (7.4%), case notes were retrieved for 60 of these patients the remaining nine could not be retrieved.

#### **5.6.5.1 DVT and PE**

Three patients developed a DVT, three developed a PE, and one developed both a DVT and a PE during their admission. This latter patient died two days after admission, the primary cause was cardiac arrest but secondary causes were listed as DVT and PE. One of the three patients who developed a DVT died a month after admission, the primary cause of death was decompensated dilated cardiomyopathy but again VTE was cited as a secondary cause. Two of the three patients who developed PE died a week after admission, prostate cancer was the primary cause

of death in one and multiple organ failure in the other but in both cases PE was cited as a contributory factor.

All seven patients had at least one VTE risk factor; all patients who developed a DVT had received prophylactic LMWH. However one patient who subsequently developed a PE was not prescribed prophylaxis on admission, he had three VTE risk factors (age > 60 years, acute infection, active cancer) but also had a raised prothrombin time of 29.1 seconds (normal range 9 – 13 seconds) and was therefore at risk of bleeding if given LMWH, TED stockings were not used.

#### **5.6.5.2 Bleeding**

Three (3/876; 0.3%) patients who were prescribed prophylactic LMWH developed bleeding while in hospital, one had a gastrointestinal bleed, one had epistaxis and one bleeding from a femoral line. The patient who developed the gastrointestinal bleed was given dalteparin 5,000 units daily for six days; the patient who had epistaxis had 2,500 units daily for two days and the patient who had the femoral line bleed 2,500 units for nine days.

### **5.7 Triangulation of VTE interview and case note data**

#### **5.7.1 Ranking of VTE risk factors**

Staff were asked to rank 16 VTE risk factors in order of importance where a score of 1 was not very important and a score of 5 was extremely important to ascertain whether patients who had risk factors perceived to be more important were more likely to be prescribed prophylaxis, (Appendix 13). The results are shown in Table 5-16 in decreasing order of importance.

**Table 5-16: Staff ranking of venous thromboembolism risk factors by importance**

Risk Factor	Mean Score (max 5)
Active cancer or myeloproliferative disorder	4.76
Known thrombophilia	4.76
Personal or family history of DVT <sup>a</sup> or PE <sup>b</sup>	4.56
Expected to be immobile for 3 days or more	4.52
Pregnant or ≤ 6 weeks post-partum	4.48
Lower limb paralysis (excluding acute stroke)	4.44
Diabetic hyperosmotic hyperglycaemic state	4.24
Obesity: BMI > 30	3.92
Hormone therapy containing oestrogen (HRT <sup>c</sup> or OCP <sup>d</sup> )	3.92
Acute or chronic inflammatory disease	3.88
Nephrotic syndrome	3.88
Varicose veins with phlebitis	3.80
Chronic heart failure	3.60
Acute infectious disease (e.g. pneumonia)	3.48
Acute or chronic lung disease	3.36
Age > 60 years	3.32

<sup>a</sup>Deep vein thrombosis, <sup>b</sup>Pulmonary embolism, <sup>c</sup>Hormone replacement therapy, <sup>d</sup>Oral contraceptive pill

There were 110 patients who had at least one of the top five most important risk factors identified by staff and required LMWH prophylaxis, active cancer 66, known thrombophilia 0, personal or family history of VTE 22, immobility 21, pregnant 1. However of these only 82 (75%) actually received it. Of the remaining patients who had VTE risk factors but no bleeding risks 266/403 (66.0%) were prescribed LMWH. There was no significant difference in the prescribing of LMWH between these two patient groups, chi-square test P=0.089.

### 5.7.2 Bleeding risks

Similarly staff were asked to rank 12 bleeding risk factors in order of importance where a score 1 was not very important and 5 was extremely important, to ascertain whether patients with bleeding risks thought to be more important were less likely to be prescribed LMWH prophylaxis, (Appendix 13), the results are shown in Table 5-17. The number of patients with bleeding risks who were prescribed LMWH was too small to enable further analysis.

**Table 5-17: Staff ranking of bleeding risk factors by importance**

Risk Factor	Mean Score (max 5)
Active bleeding	4.96
Taking warfarin or other anticoagulant or antiplatelet therapy	4.56
Haemophilia or other known bleeding disorder	4.56
Hypersensitivity to heparin	4.48
History of Heparin Induced Thrombocytopenia (HIT)	4.36
Severe liver disease (PT* raised above normal or known varices)	4.28
Acute stroke in past month (haemorrhagic or ischaemic)	4.00
Known platelet count < 100	3.68
Lumbar puncture in previous 4 hours or indicated now	3.60
Severe renal disease (eGFR <30ml/min)	3.60
Blood pressure > 200 systolic or 120 diastolic	3.52
Infective endocarditis	2.88

\* Prothrombin time

## 5.8 Discussion

This part of the study provides an interesting insight into changing practices with regard to VTE risk assessment during a period in which increasing government pressure was applied to drive up standards of care. Patient demographics during the study periods were very similar to the Trust data<sup>208</sup> for the years in which the data were collected. The Trust mean length of stay is slightly shorter as in the study the length of stay was rounded up, (0 to 24 hours = 1day, >24 hours – 48 hours = 2 days etc.) whereas length of stay in the Trust is recorded to the nearest minute, Table 5-18.

**Table 5-18: Comparison of Trust and study patient demographics**

Data collection period	Mean Age	Minimum Age	Maximum Age	% Male	Mean Length of Stay (days)
Study periods 2009, 2010 and 2011	64	16	98	43.5	9.9
RLBUHT 2009	62	16	106	44.8	9.0
RLBUHT 2010	64	16	102	45.6	8.3
RLBUHT 2011	64	16	106	47.5	7.8

The patient demographics differed from those in a large international VTE study<sup>68</sup> in that a smaller proportion of patients were male and the average age in the present study was slightly lower possibly due to national variations. The most common causes for admission also differed; this was most likely due to the local policy of



directing patients with acute cardiac conditions to a HEC. They also differed from those in a UK VTE study,<sup>209</sup> partly as the latter study excluded patients younger than 40 years of age and also as a result of the local cardiac triage policy; however this was unlikely to affect staff behaviour.

### **5.8.1 Awareness of VTE risk factors**

In general the VTE risk factors ranked by the staff as being most likely to be associated with development of a clot i.e. active cancer, known thrombophilia, personal or family history of DVT or PE and pregnancy, matched those which have been shown to be associated with a high risk for medical patients in the literature.<sup>76, 210-212</sup> Anticipating that the patient was likely to be immobile for three days or more was ranked fourth in order of importance for VTE by staff. However the significance of immobility is difficult to assess as many studies do not define immobility and differing periods of immobility have been used in published papers.<sup>213</sup> In addition it has been shown that acute but not chronic immobility is associated with increased risk of DVT.<sup>211, 214</sup> Therefore staff were generally aware of the major risk factors for VTE.

### **5.8.2 Knowledge of VTE**

Researchers from Nottingham in 2002 interviewed 21 junior medical staff and concluded that their knowledge of VTE was good<sup>65</sup> which contrasts with the results of the present study which show that only 9 / 25 (36%) of staff had good knowledge. This is likely to be due to the small numbers involved in both studies and the differences way in which knowledge was assessed. The Nottingham researchers based their conclusions on a very limited number of questions in a questionnaire, in the present study staff were asked to spontaneously list risk factors as it was felt this would be more representative of their ability to identify patients at risk. Overall the present study showed that staff knowledge of VTE was average to good with only two staff assessed as having poor knowledge.

### **5.8.3 Awareness of VTE policies**

The present study showed that only about one third of staff interviewed were aware of any local or national policies in contrast to a study carried out in Southampton in 2008<sup>215</sup> which showed that 90% of staff were aware of local VTE

guidelines. However in Southampton the guidelines had been introduced six months prior to the audit and there had been associated Trust wide educational VTE sessions, whereas in the study hospital there had been very little local education provided and VTE awareness was generally poor during the course of the study.

#### **5.8.4 Proportion of patients with VTE risk factors and bleeding risk factors**

Overall 82.2% of patients in the present study had at least one VTE risk factor, a finding which is in line with other published studies which have shown that over 80% of medical patients admitted to hospital have at least one risk factor.<sup>74, 77</sup> A significant proportion of patients (25.3%) had at least one bleeding risk factor, 19.5% had risk factors for both VTE and bleeding. This finding is in line with the findings of researchers from Italy who reported that 25% of patients for whom VTE prophylaxis was indicated had a contraindication.<sup>86</sup> The UK national guidance<sup>43, 202</sup> states that if the patient has both VTE and bleeding risk factors then prophylaxis with LMWH should not be prescribed unless there is a low risk of major bleeding and the benefits outweigh the risks, no further advice is offered about how this judgement should be made. As patients are often clerked on admission by the most junior doctors who often lack the necessary skills to make this judgement this may explain both the low initial LMWH prescribing rates and the inappropriate prescribing of LMWH for patients with both VTE and bleeding risks.

##### ***5.8.4.1 Importance / ranking of VTE risk factors***

There is currently no published comprehensive list of the relative risk associated with VTE risk factors. However there is general agreement in the literature that the risk factors ranked first, second and third in order of importance by the staff interviewed (thrombophilic disorders, personal or family history of VTE and active cancer) are all associated with high risk for medical patients.<sup>70, 76, 210, 216, 217</sup> The staff ranked age over 60 years as having the lowest risk of the 18 VTE risk factors listed. However, age over 40 years is known to increase VTE risk and it has been reported that the risk approximately doubles with each subsequent decade of life,<sup>76</sup> those aged 85 and older have 15 fold increase in risk of VTE when compared to those

aged 45 to 54 years.<sup>218</sup> Hence studies which used a lower aged limit of over 40<sup>76</sup> rate the importance of age as a risk factor lower than studies which used age over 75 years as their criterion.<sup>216</sup>

The use of a scoring system for risk factors to identify those patients at greatest risk of VTE has been considered<sup>70</sup> however it has been shown that junior staff may not be able to use such tools reliably.<sup>216</sup>

## **5.8.5 VTE risk assessment**

### ***5.8.5.1 Improvement in VTE risk assessment***

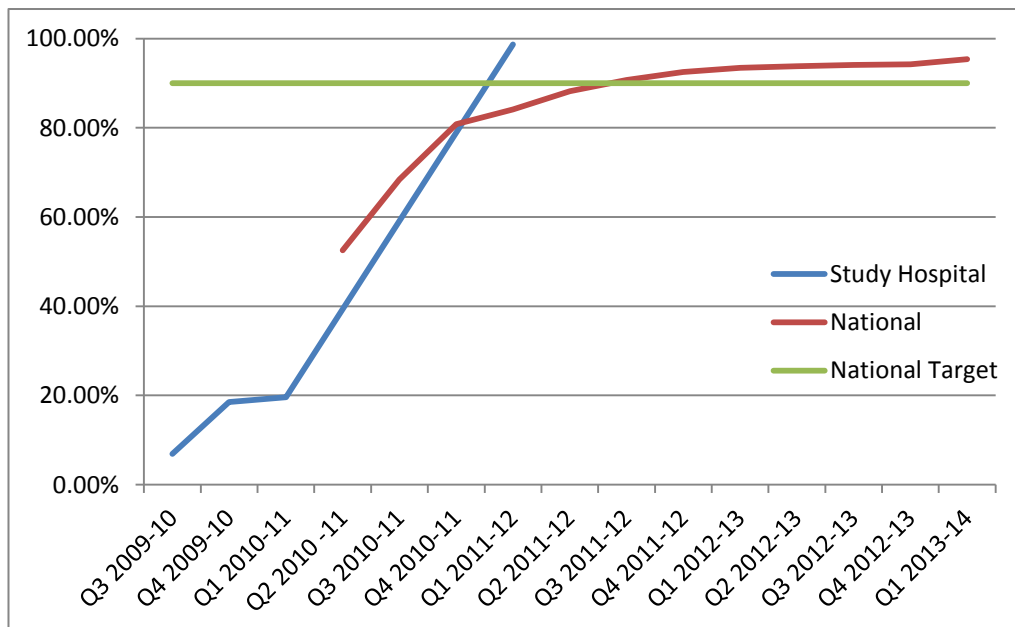
During the first three observation periods, from November 2009 until April 2010, VTE risk assessments were not routinely carried out during the hospital admission process and on occasion staff made a deliberate decision not to complete an assessment, as shown by forms being discarded. There was no evidence that staff who had received VTE training were any more likely to carry out risk assessments. Despite this, the majority of the staff interviewed felt that the admitting doctor or specialist nurse was the most appropriate person to conduct the VTE risk assessment due to the complexity of data needed and the clinical interpretation necessary for safe, appropriate prophylaxis.

The dramatic increase in both the number of patients risk assessed for VTE and the number appropriately treated with LMWH in period 4, April 2011, followed the introduction of national mandatory data collection in June 2010. A similar increase was seen by researchers at Kings College Hospital in London, where in the first nine months following the launch of the national programme in 2010 documented VTE risk assessment rates rose from 40% to 90%.<sup>219</sup> In the present study there was an associated increase in the number of patients who received LMWH inappropriately. However as there were a minimum of three initiatives between each of the data collection periods it is difficult to attribute the changes to any particular intervention. The apparent impact of national mandatory data collection may have been as a result of increased uptake of local initiatives, see Figure 5-1, page 70 and section 5.2, page 69.

### 5.8.5.2 National change in VTE risk assessment

Mandatory collection of VTE risk assessment figures was introduced in England as part of the NHS Outcomes Framework in June 2010.<sup>98</sup> This government led approach had limited success, with uptake of VTE risk assessment guidance slow and many NHS hospitals struggling with its implementation. The published national data show that it took 18 months for the national target of 90% of patients to be risk assessed on admission to hospital to be achieved by acute NHS trusts.<sup>99</sup> A comparison between the rate of uptake of VTE risk assessment in the study hospital and the national uptake is shown in Figure 5-8. The study hospital achieved the 90% national target several months ahead of the national average and the Trust quality accounts show that it was sustained throughout 2011/12 and 2012/13.<sup>13, 220</sup> A study carried out in four hospitals in the NHS South of England region showed similar significant increases in the proportion of patients VTE risk assessed when 2009 data were compared with that from 2010 for the three teaching hospitals, the fourth hospital a smaller foundation trust had significantly better rates in 2009 and showed a small improvement in 2010.<sup>221</sup>

**Figure 5-8: Venous thromboembolism risk assessment rates in the study hospital and nationally**



### 5.8.6 Prescribing of LMWH

The present study showed an increase in the proportion of patients appropriately prescribed LMWH as VTE prophylaxis from 49.7% to 92.6%. This is in contrast to the similar study carried out in NHS South of England which collected data in 2009 and 2010 for comparative purposes and showed little change in the proportion of patients who appropriately received prophylaxis despite a significant increase in those with a documented risk assessment.<sup>221</sup> However in the latter study 80% patients received VTE prophylaxis in 2009, as two of the hospitals were exemplar sites for VTE, compared to 50% in the present study resulting in less opportunity for improvement to be demonstrated. Thus it would seem that initiatives in the study hospital were successful in reducing the risk of patients developing a VTE following hospital admission.

However the present study also showed an associated increase in inappropriate prescribing (from 3% to 33%) for patients who had bleeding risks, an Italian study showed a similar increase following implementation of VTE guidelines, the number of patients with minor contraindications (history of peptic ulcer, renal disease, and liver impairment) who received LMWH rose from 29.4% to 55.2%.<sup>222</sup> The NHS South of England study showed little change in the number of patients with contraindications who received LMWH which remained at about 15%.<sup>221</sup> This is not surprising as there was minimal change in the proportion of patients prescribed LMWH overall. A study from London<sup>223</sup> also reported an increase in patients in AMU being prescribed prophylactic LMWH although they were not eligible according to the Trust policy. However this study does not specify whether these patients had no VTE risk factors and so LMWH was not indicated or whether they were at risk of bleeding and so LMWH was contraindicated. The authors note that there appeared to have been a change in culture such that patients who did not need VTE prophylaxis were prescribed it, which has financial consequences and may also have patient safety implications. Therefore although the implementation of the VTE risk assessment had benefits for most patients there were some unexpected adverse outcomes and for a small number of patients the bleeding risk was increased by the prescribing of LMWH.

In the study hospital an early initiative (January 2009) involved the use of pre-printed stickers stating “Dalteparin 5,000 units daily” attached to medication charts as a reminder for medical staff. The intention was that this “prescription” would either be completed by a prescriber, by signing and dating, if appropriate for the patient or it would be discontinued. Unfortunately this initiative resulted in a number of incident reports citing situations in which nursing staff had administered LMWH although the prescription on the sticker had not been signed. As it was only a matter of time before a major bleed resulted, this scheme was withdrawn in mid-2009.

#### **5.8.6.1 Dose prescribed**

The dose of dalteparin recommended by the manufacturers for medical patients is 5,000 units daily irrespective of age or body weight.<sup>205</sup> However over a fifth of patients who were prescribed dalteparin received a lower dose of 2,500 units daily, and for almost half (39/87; 45%) of these no valid rationale could be identified from the case notes. Approximately a quarter (20/87; 23%) had both VTE and bleeding risks and a lower dose may have been used in an attempt to balance the risks and benefits of LMWH in this patient group. The remaining patients who were prescribed the lower dose were elderly age >75 years, had a low body weight <50kg or had severe renal impairment. As during the interviews two doctors said they would prescribe a reduced dose for elderly patients and approximately half of interviewees said they would reduce the dose for patients with a low body weight it appears that there is some confusion regarding the appropriate dose of dalteparin for medical patients. This may be partly due to the medical rotas as F1 doctors spend some of their first year working in surgery where 2,500 units of dalteparin is used for lower risk patients / procedures, educational input may therefore be beneficial to improve prescribing practice.

#### **5.8.7 Incidence of bleeding**

In the present study significant bleeding was seen in six patients, 0.3% of the total. This is in line with a meta-analysis (which included the PRIME,<sup>224</sup> PRINCE<sup>75</sup> and PREVAIL<sup>225</sup> studies) published in 2011<sup>226</sup> which reported major bleeding rates of 0.3% - 1.1% in patients treated with enoxaparin, another LMWH licenced for VTE

prophylaxis. The PREVENT study which investigated the use of dalteparin for VTE prophylaxis in medical patients reported a bleeding incidence of 0.49%.<sup>67</sup> An American study which investigated the unintended consequences of implementing routine VTE prophylaxis found that there was a significant rise in bleeding events following implementation.<sup>227</sup>

Trust data for incidence of gastro intestinal (GI) haemorrhage as a discharge diagnosis for the duration of the study are shown in Table 5-19. This shows a significant increase in GI haemorrhage from 2009 to 2011 (chi-square test  $P < 0.001$ ). This is interesting as the increase appears to mirror the increase in the prescription of prophylactic LMWH in the Trust, however much more detailed analysis of the individual cases would be required to ascertain whether this increase can be attributed to the use of LMWH or some other factor. It is not known from these data whether the bleeding was present on admission and therefore not attributable to LMWH or whether it occurred during admission and therefore potentially attributable to prescription of LMWH.

**Table 5-19: Incidence of bleeding in Royal Liverpool & Broadgreen University Hospitals NHS Trust 2009 - 2011**

Discharge diagnosis	2009	2010	2011
Gastro intestinal haemorrhage (% of total)	91 (0.7%)	126 (1.0%)	163 (1.3%)
Total number of diagnoses	12,856	12,349	12,504

### 5.8.8 Heparin induced thrombocytopenia

The use of heparin is associated with a low incidence of HIT and therefore current guidance<sup>207</sup> states that all patients who are to receive heparin (unfractionated or LMWH) should have a baseline platelet count. The results show compliance with this guidance as over 95% of patients who received LMWH had their platelet count measured on admission. Medical patients do not require routine monitoring however if the platelet count falls by more than 30% between days 4 and 14 of treatment a diagnosis of HIT should be considered. Almost half of patients were discharged within five days and therefore did not require monitoring, the results showed that only 8/90 patients who had repeat platelet monitoring had a platelet

count fall of >30% and none were thought to be due to HIT. This is to be expected as HIT only affects approximately 0.5% of patients treated with LMWH.<sup>207</sup>

### **5.8.9 Incidence of VTE**

A meta-analysis in 2008<sup>81</sup> which included all seven major studies of VTE prophylaxis in medical patients showed that the incidence of VTE in medical patients could be halved by the use of prophylactic LMWH or fondaparinux. During the present study seven patients (0.8%) developed a VTE, three DVT, three PE and one both a DVT and a PE, six of these seven patients had received prophylactic dalteparin during their admission. This is in line with the findings of the PREVENT study which reported a rate of 0.56% symptomatic VTE at day 21 despite prophylactic dalteparin.<sup>67</sup> Higher rates of VTE have been reported in medical patients treated with enoxaparin as prophylaxis, 5.5% in the MEDENOX trial<sup>66</sup> and 8.3% in the PRINCE study.<sup>75</sup> However these trials used venography to identify any possible VTE rather than clinical symptoms and it is known that 50% to 80% of DVTs and PEs are asymptomatic,<sup>228</sup> hence the significant difference in the reported incidences.

### **5.8.10 Strategies to improve VTE prophylaxis**

Meta-analyses of strategies to improve VTE prophylaxis found that passive dissemination of guidelines was generally ineffective<sup>229</sup> and the use of multiple rather than single strategies<sup>229, 230</sup> were more effective which supports the findings of the present study that the individual initiatives prior to June 2010 resulted in limited improvement. Multiple strategies including policy dissemination, education, use of a VTE risk assessment tool and reminder sticker on medication charts and audit feedback increased both documented VTE risk assessment and appropriate prescribing of prophylaxis in an Australian study.<sup>231</sup> Education alone has been shown to have a modest benefit.<sup>232</sup> A large study carried out in Australia and New Zealand<sup>233</sup> evaluated the impact of a dedicated nurse educator who provided education sessions, paper and verbal reminders and fed back audit results. This strategy improved the proportion of acutely ill medical patients who appropriately received LMWH prophylaxis from 37.9% to 54.1% which, although a significant increase, still resulted in almost half of patients failing to receive effective prophylaxis. A similar increase (from 43% to 58%) was shown in an American



study<sup>234</sup> which used both formal education sessions and clinical pharmacists on ward rounds to promote the VTE message. A recent Cochrane review<sup>232</sup> concluded that an approach with multiple strands including alerts appeared to be more effective than the use of either education or alerts alone.

Other work has demonstrated the value of opinion leaders in guideline implementation,<sup>139</sup> which was the most likely reason for the significant improvement achieved in the last study period, one interviewee also identified strong leadership as a necessity for improved practice. A recent study from Nottinghamshire<sup>95</sup> found that attaching a prompt sheet to the medication chart increased the proportion of patients appropriately prescribed prophylaxis from 75% to 98%, however in the present study VTE risk assessment forms placed inside medication charts as a reminder proved unsuccessful as they were either not completed or actively removed. Other strategies used in London which proved successful in improving VTE risk assessment rates were the use of checklists on ward rounds and e-mail messages to medical staff.<sup>223</sup> In the study Trust junior medical staff do not routinely use their Trust e-mail accounts as they rotate hospitals every few months, maintaining a list of current personal e-mail addresses for all junior doctors was deemed impractical. Following the introduction of mandatory data collection, government targets and associated financial penalties in June 2010, VTE risk assessment became consultant-led as a result of pressure from Trust managers. This, together with continuous reminders during ward rounds, frequently by a pharmacist, emphasised the importance of VTE risk assessment to junior staff and the target of at least 90% of patients having a risk assessment performed on admission was exceeded. In addition, a Trust requirement for risk assessment to be completed by a senior doctor in the event of its omission during initial admission resulted in almost 100% of patients having been assessed within 24 hours. An American study published in 2012<sup>235</sup> has shown that introduction of a mandatory computerised decision support tool had a similar significant beneficial effect on both VTE risk assessment and prescription of appropriate prophylaxis.

### **5.8.11 Effect of financial penalties**

VTE risk assessment was one of the first quality standards with a financial sanction to be issued by the Department of Health in 2010. While the results show that the 90% VTE risk assessment target was achieved in April 2011, this standard will need to be maintained in a culture of organisational change and additional targets. Financial targets are a relatively new concept in secondary care in the NHS: they have been used more widely in primary care. A recent Cochrane review<sup>236</sup> found that there was little evidence either for or against their use in primary care and it has been suggested that there may be unintended consequences,<sup>236, 237</sup> for example MRSA targets may increase the risks to patients with other healthcare associated infections.<sup>238</sup> In the present study there was a significant increase in patients with known bleeding risks receiving LMWH prophylaxis.

A study carried out in four Trusts in the south west of England showed that all four hospitals showed an improvement in VTE risk assessment following the introduction of the national target, three hospitals received a financial reward whilst the fourth hospital noted that as their VTE CQUIN was linked to another factor it was impossible for them to be rewarded for their efforts in VTE risk assessment.<sup>239</sup> In addition an analysis of Commissioning for quality and innovation (CQUIN) targets in London published in 2012 showed that only 38% of London Trusts achieved the full payment for the VTE CQUIN in 2010/11 and that performance in a CQUIN indicator does not always correlate with other quality indicators.<sup>240</sup> However researchers from London<sup>223</sup> felt that in their Trust VTE risk assessment was likely to remain a priority due to the significant funding associated with achieving the target. A checklist has recently been published<sup>241</sup> to help decide whether a financial incentive is appropriate in a particular clinical scenario and if so provide some guidance for the development of a successful initiative.

### **5.8.12 Recent developments**

The VTE CQUIN has been strengthened for the 2013/14 financial year. The proportion of patients who must be VTE risk assessed on admission to hospital has been increased from 90% to 95% and all cases of hospital acquired VTE, those who develop a VTE while in hospital or within 90 days of discharge, are to be subject to a

root cause analysis.<sup>242</sup> However as it is known that 50% to 80% of DVTs and PEs are asymptomatic<sup>228</sup> and LMWH is only effective for the prevention of VTE in approximately 50% medical patients,<sup>81</sup> both the practicality and value of this requirement are unclear. In addition as patients may be admitted to several different hospitals within a short timeframe, each of which may be unaware of previous admissions to neighbouring hospitals due to the lack of a single patient record, accurate data collection is likely to prove challenging. Interestingly no data are required regarding the number of patients prescribed LMWH, the appropriateness of the dose, whether or not prescribed doses were administered or the incidence of acute haemorrhage.

The present study shows that a national financial sanction resulting in a consultant led approach was associated with significant improvement in the number of patients VTE risk assessed and prescribed LMWH prophylaxis. However it remains to be seen whether the level of achievement can be maintained as existing targets are increased and new ones are added in a culture of organisational change. VTE risk assessment and appropriate prescribing of LMWH has proved to be more complex than originally thought due to the significant proportion of patients who have both VTE and bleeding risk factors and therefore clinical judgement is required to decide whether or not LWMH is indicated.

## 5.9 Summary

The results relating to VTE risk assessment and prescribing of LMWH prophylaxis have been discussed above; the results relating to medicines reconciliation are presented in the next chapter.<sup>a</sup>

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<sup>a</sup> Some of the findings in this chapter have been published in BMJ Open in 2012: Basey AJ, Krska J, Kennedy TD, Mackridge AJ. Challenges in implementing government-directed VTE guidance for medical patients: a mixed methods study. BMJ Open. 2012;2(6). Available from: <http://bmjopen.bmj.com/content/2/6/e001668.full>

## Chapter 6 Results and Discussion: Medicines Reconciliation

This chapter presents the results for the medicines reconciliation arm of the study and discusses them in the context of the current published literature.

### 6.1 Overview

During the four data collection periods a total of 71 patient admissions involving 36 staff were observed and 930 sets of case notes were reviewed, details are shown in Table 6-1. Interviews were carried out with a total of nineteen staff including all 12 staff observed in period 4 and an additional seven staff who were purposively selected to ensure that all grades of staff working on AMU at that time were represented. Similar numbers of admissions observed and case notes reviewed were included in all four periods, a larger number of medication histories were checked in period 4 as more rotational pharmacist hours were allocated to AMU in this period to provide this service.

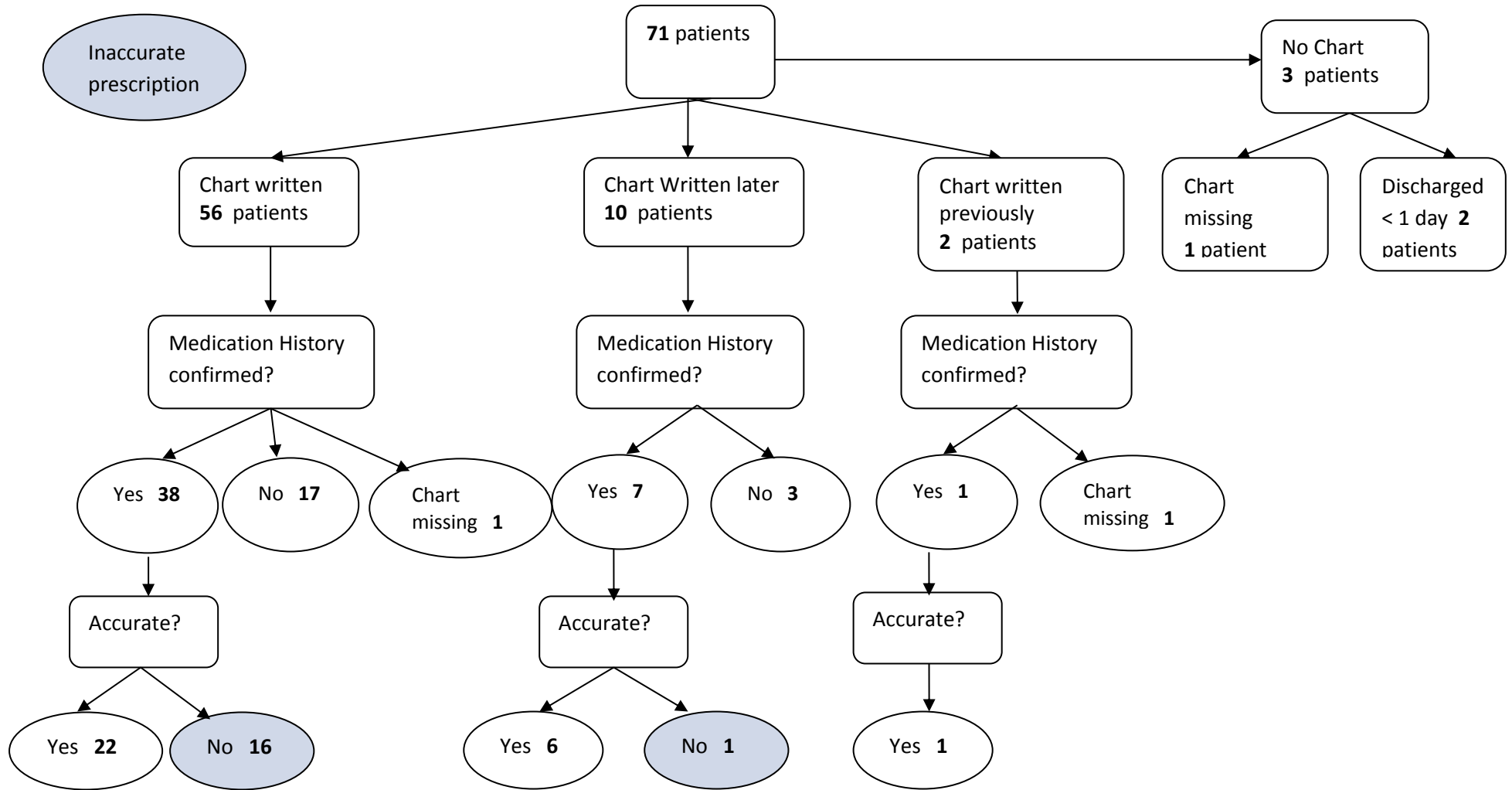
**Table 6-1: Subject numbers in each study period - medicines reconciliation data**

	Period 1 (Nov 2009)	Period 2 (Jan 2010)	Period 3 (Apr 2010)	Period 4 (Apr 2011)	Total
Number of patient admissions observed	16	21	14	20	71
Number of staff observed	8	7	9	12	36
Number of staff both observed & interviewed	0	0	0	12	12
Total number of staff interviewed	0	0	0	19	19
Number of patients admitted	265	255	239	256	1015
Number of case notes reviewed	243 / 265 (91.7%)	232 / 255 (91.0%)	221 / 239 (92.4%)	234 / 256 (91.4%)	930 / 1015 (91.6%)
Number of patients with documentation available	<b>207</b> / 243 (85.2%)	<b>202</b> / 232 (87.1%)	<b>190</b> / 221 (86.0%)	<b>211</b> / 234 (90.2%)	<b>810</b> / 930 (87.1%)

### 6.2 Observations

During the four data collection periods a total of 71 patient admissions were observed, involving one nurse clinician and 35 doctors (four consultant/specialist registrars, four specialist trainees (ST) year 4/5, nine specialist trainees year 1/2/3 and 18 foundation (F)). All staff who were approached to be observed gave informed consent, however two finished their AMU shifts before a suitable opportunity arose. An overview of the observation data is shown in Figure 6-1.

Figure 6-1: Overview of medicines reconciliation completed and prescription charts written for observed patients



The mean age of the patients was 68 years, 39% were male and the most frequent presenting complaints were infection, pain, abnormal biochemistry, shortness of breath and vomiting or diarrhoea, details are shown in Table 6-2

**Table 6-2: Demographic details of patients included in case note reviews and observations (Reproduced here from Chapter 4, page 46 for ease of reference)**

Characteristic	Case note review	Observations
Number of case notes retrieved	930	71
Relevant admission notes available	876	67
Sex - male (%)	381 / 876 (43.5%)	28 / 67 (39%)
Age range (mean)	16 -98 (64) years	16 – 98 (68) years
Average length of stay (median)	1 – 182 (5.5) days	1 – 47 (5.0) days
Most frequent presenting complaint (descending order of occurrence)	Infection (285; 32.5%) Pain (72; 8.2%) Cardiac cause (60; 6.8%) Shortness of breath (54; 6.2%) Abnormal biochemistry* (51; 5.5%) Possible VTE <sup>†</sup> (46; 5.3%)	Infection (15; 22%) Pain (8; 12%) Abnormal biochemistry* (8; 12%) Possible VTE <sup>†</sup> (7; 10%) Shortness of breath (5; 7%) Vomiting or diarrhoea (5; 7%)

\*Results outside of the normal range for haemoglobin, glucose, thyroid hormones, sodium, potassium, magnesium, or calcium

<sup>†</sup>Venous thromboembolism

### 6.2.1 Questions asked about medicines

The number of questions asked of patients about their medicines ranged from zero (14 patients) to four (4 patients), details of grade of staff and medicine-related question frequency are shown in Table 6-3 and Figure 6-2. As the number of patients seen by the more senior grades of staff was small the doctors were divided into two groups to enable analysis, junior doctors comprising grades F1 and F2 and senior doctors grade ST1 and above, the nurse was excluded from this part of the analysis. When the two groups were compared there was no significant difference between them in terms of the number of questions asked relating to medicines, Mann-Whitney U test P=0.069. The Mann-Whitney test was chosen as the data cannot be assumed to be normally distributed.

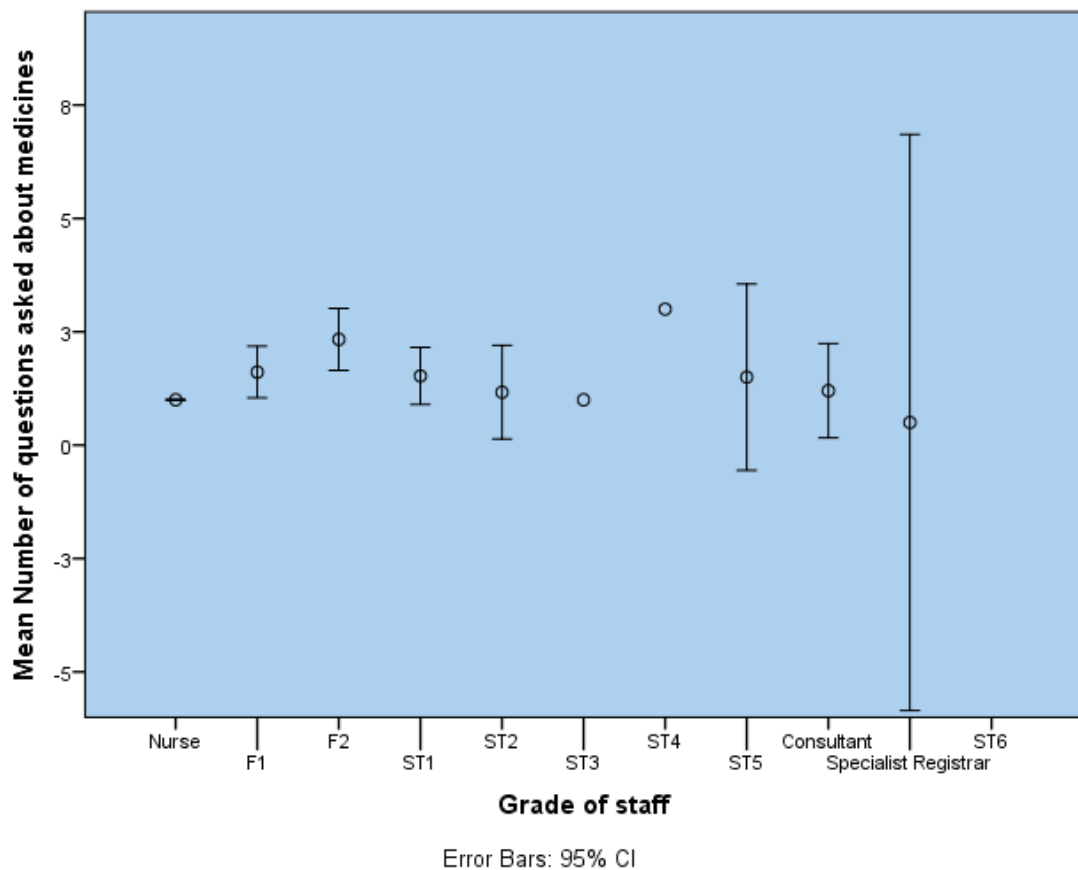
**Table 6-3 Number of questions asked about medicines by grade of staff observed**

Grade of staff	Number of Staff	Number of patients admitted	Mean number of questions asked per patient
Nurse clinician	1	3	1.0
F1 doctor	11	18	1.6
F2 doctor	7	12	2.3
ST1 doctor	6	19	1.5
ST2 doctor	2	6	1.2
ST3 doctor	1	1	1.0
ST4 doctor	1	1	3.0
ST5 doctor	3	4	1.5
Specialist Registrar	1	2	0.5
Consultant	3	5	1.2

F1/2 Foundation year doctor 1 -2 years post qualification

ST Specialist trainee doctor 3-5 years post qualification

**Figure 6-2: Number of questions asked about medicines by different staff grades**



Most patients (57/71; 80%) were asked at least one question about their medicines by the member of staff clerking their admission to hospital:

- “Do you take any regular medication?” (41; 69%)
- “Do you have your medicines with you?” (20; 28%)
- “Do you have a list of your medicines with you?” (13; 18%)
- “Do you know which medicines you take?” (4; 6%)
- “Do you buy any medicines ‘Over the Counter’ – from community pharmacies or herbal preparations?” (5; 7%)
- Doses and /or frequencies of administration clarified (14; 20%)
- “Why are you taking [name of medicine]?” (5; 7%)

The majority of questions asked were closed although patients often responded with additional information such as responding “yes – blood pressure tablets” or providing a written list of medicines, or their own medicines. Open questions were used to clarify indications or doses and /or frequencies.

Of the five patients asked about OTC medicines one had taken aspirin during the previous 2 weeks for phlebitis, another had taken paracetamol for a headache following a ‘blackout’ and the remaining three patients had not taken any OTC medicines recently.

Healthcare staff were sometimes unable to interpret the responses given by patients for example one patient said she used “blue, grey and purple inhalers” and the member of staff was unfamiliar with the standard colours used for different types of inhalers. Another patient had his medicines in a ‘blister’ pack but indicated that he didn’t take “the yellow one or the white one”; the doctor was unable to identify these tablets from the information on the blister pack. In both of these instances the pharmacist was asked for assistance to resolve the problem. Some patients were obviously frustrated by the routine questions repeatedly asked on admission to hospital one stated “you always ask the same questions” and another said “there is a list in the file”. In both of these cases the way in which the questions were asked probably contributed to the unhelpful patient response. In the first case



the doctor spoke very quickly and used medical terminology which the patient had difficulty in following, in the second case the doctor's first language was not English, she was tired as she was working an extra shift and the patient had difficulty in comprehending the questions asked.

Six patients were asked if they had taken any new medicines recently to ascertain whether this may have explained their presenting complaint or symptoms, three of these patients were clerked by the same ST1 grade doctor. Potential side effects prompted this question in most cases, a patient who presented with 'black vomit' could have experienced a gastrointestinal bleed due to a non-steroidal anti-inflammatory drug (NSAID), a patient's headache could have been drug-induced, a patient who presented with chest pain and was gasping for breath could have had an allergy to a new medicine, acute onset of confusion could have been explained by a new medicine as could new onset of diabetes. A possible drug interaction prompted the doctor to ask a patient about new medicines as his raised international normalised ratio (INR) could have been explained by interaction between warfarin and another medicine. However the cause of the symptoms was not thought to be medication related in any of these cases.

On two occasions patient responses were not followed up, the first patient was asked if she took any medication and responded "not at the moment". The member of staff clerking the patient did not ask any further questions to clarify this statement. This patient presented with shoulder pain following a fall and had severe arthritis which restricted her ability to walk and climb stairs; she stated that she drove whenever possible to avoid having to walk. It would have been useful to know which medicines she had tried and why they had been stopped in order to prescribe appropriate analgesia. The second patient indicated that she had not taken her fluoxetine for a few days; the doctor did not ask her why. She had been sent to AMU as she was short of breath and was found to have low serum haemoglobin; it is possible that she was suffering from a gastro intestinal bleed due to fluoxetine.

The dose and/or frequency of medicines were clarified with 14 patients. Regimens for medicines which were prescribed to be taken less frequently than daily were clarified as there was insufficient detail in the General Practitioner (GP) summaries provided e.g. the days of the week for alfacalcidol capsules and co-trimoxazole tablets taken three times a week on Mondays, Wednesdays and Fridays, the day of the week for a weekly dose of alendronate. Two patients had two different strengths of the same medicine (digoxin and olanzapine) listed on their GP summary so the member of staff had to confirm with the patient whether they were taking just one of the strengths of these tablets or both.

Five patients were asked why they were taking one or more of their regular medicines and in one case, the patient was asked to provide the indication for all nine of their regular medicines. One patient was asked why he was taking lansoprazole and amoxicillin, the remaining three patients were asked about buprenorphine patches, prednisolone tablets and pyridostigmine tablets.

Sixteen patients (23%) were not asked any questions relating to medicines despite this being an integral part of the standard hospital clerking model,<sup>20</sup> for five of these patients information from either a care home MAR chart or the referring hospital medication chart was used. All but one of these 16 patients was taking regular medication.

In 69 (97%) cases, the researcher assessed that the patient or their carer was able to discuss medication issues; two patients were too unwell to do so. However, 14 (20%) of the patients or their carers who were able to provide information were not asked any questions relating to their medicines and 13 (93%) of these were taking regular medication. Of the two patients unable to provide verbal information, the nursing home MAR chart was used for one and the medication chart from the referring hospital for the other.

### **6.2.2 Problems observed during the admission process**

Numerous problems were observed during the process of obtaining a medication history for patients involving communication, missing or incomplete medication information and out of date information.

### 6.2.2.1 Communication

Difficulties in communication were observed when either the doctor or the patient's first language was not English, a friend interpreted for one patient who spoke limited English. A doctor spoke particularly quickly and patients had difficulty in following the questioning, another used medical terminology which a patient had difficulty comprehending. Intoxication due to alcohol also proved a challenge when clerking another patient as he was unable to provide consistent responses to questions asked.

### 6.2.2.2 Missing or incomplete information

Problems relating to the sources provided by either GPs or patients to inform the admission prescription were also noted, information was often missing or incomplete see Figure 6-3.

**Figure 6-3: Missing or incomplete information for patients on admission to hospital**

<p><b>Letters from GP Practices:</b> No letter provided, patient referred by telephone Missing medication doses and types of inhaler in hand-written letter Medication which patient has not used for several months listed as current</p> <p><b>Letters from Community Matron:</b> Acute medication only listed (antibiotics, steroids, nebulas) – no repeat medication details</p> <p><b>From Patients:</b> Out of date GP repeat form (5 months old) – doses had changed</p> <p><b>Patients Own Medicines:</b> Dispensing labels missing – especially inhalers Dosette Box unlabelled Medication very old and label illegible Loose / strips of tablets – no box or dispensing label Incomplete – blister pack with patient but inhalers left at home All medicines accidentally left in ambulance</p>
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### 6.2.2.3 Other healthcare providers

Obtaining an accurate medication history for patients who had recently received care from healthcare providers other than their GP proved particularly challenging. In one case the patient's son contacted the Community Psychiatric Nurse (CPN) to find out her dose of donepezil which wasn't listed in the GP summary, in another the patient's old case notes had to be retrieved to ascertain the correct dose of prednisolone which had been prescribed at a previous outpatient appointment, unfortunately as these prescriptions are dispensed by a community pharmacy this information is not available on the hospital pharmacy computer system.

A sample case study illustrating some of the problems encountered in documenting an accurate medication history for one patient in whom it proved particularly difficult is shown in Figure 6-4, details of all 71 case studies are available in Appendix 16.

**Figure 6-4: Case Study - illustrating problems in documenting an accurate medication history**

<p><b>Patient clerked by F2 doctor</b> Patient takes 9 regular medicines</p> <p><b>Sources available for medication history</b> Patient's verbal information - used GP repeat prescription order form - used Patient's own hand written list – not used Patient's own medicines – not suitable for use (see below)</p> <p><b>Problems encountered</b> Initially no referral information, GP summary later found beside fax machine Patient's own medicines in unlabelled Dostette box Patient initially gave the doctor just page 2 of the GP repeat prescription order form, the doctor had to ask for page 1. GP repeat prescription order form not current, dose of one medicine has been reduced</p> <p>F2 Foundation year doctor 2 years post qualification</p>
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### 6.2.3 Medication histories

No medication history was completed for one patient. Some information about their current medication was brought into hospital by 27 (27/65; 42%) patients who were admitted from their own homes. Twenty three (23/65; 35%) had their own medicines with them, of these four (4/65; 6%) had their own medicines and their GP repeat order form and one patient (1/65; 1%) had their own medicines together with a hand written list. Two patients had their GP repeat order form with them and two had a handwritten list of their medication. The most common sources used to obtain the medication history for the remaining patients were: printed letters from the GP, Community Matron or Walk-In Centre (34; 48%), the patient themselves (29; 41%) the patient's own medicines (19; 27%) and hand written letters from the GP (14; 20%), see Table 6-4. Of the 14 hand-written letters received, nine were incomplete, five did not contain any information about the patient's current medication and four listed the drug names only, no doses and / or frequencies were stated. The information provided in printed GP summaries was misinterpreted on four occasions leading to prescribing errors, as shown in Figure 6-5. Only six patients had their GP repeat prescription with them, five of these were used by medical staff.

**Table 6-4: Sources used by staff to obtain medication histories during observations**

Source	Available and used (Total no. patients of 71)	Available but not used (Total no. of patients 71)	Total available (Total no. of patients 71)
GP Summary	34 (48%)	8 (11%)	42 (59%)
Handwritten letter	14 (20%)	6 (8%)	20 (28%)
Patients verbal list	29 (41%)	8 (11%)	37 (52%)
Patients own written list	2 (3%)	1(1%)	3 (4%)
Relatives / carer provided verbal list	6 (8%)	1(1%)	7 (10%)
Other hospital drug chart / letter	3 (4%)	1(1%)	4 (6%)
EMIS Web <sup>1</sup>	5 (7%)	Not known	Not known
ICE discharge prescription <sup>2</sup>	3 (4%)	Not known	Not known
Old medication chart / discharge prescription from case notes	2 (3%)	2 (3%)	4 (6%)
GP repeat order form	5 (7%)	1(1%)	6 (8%)
Renal Proton system <sup>3</sup>	1 (1%)	Not known	Not known
Patients own medicines	19 (27%)	4 (6%)	23 (32%)
Medication Administration Record (MAR) chart	3 (4%)	2 (3%)	5 (7%)

1. EMIS Web is an electronic web based system which enables authorised medical, nursing and pharmacy staff to view the patient's medication history held on the GPs computer system.
2. ICE is an electronic pathology results system
3. Proton is an 'in house' hospital system used to record medication and test results for patients of the renal directorate

**Figure 6-5: Problems observed in staff interpretation of GP summaries**

- Summary states Fragmin (dalteparin) 25,000 units /ml 0.6ml daily  
Doctor initially prescribed 2,500 units daily and when challenged changed this to 25,000 units daily, dose should be 15,000 units daily (pharmacist intervened)
- Buprenorphine patch 5mcg/hour weekly 4  
Doctor interpreted as 4 patches every week rather than 1 patch every week, 4 weeks supply
- Spironolactone 2 od (daily) on at the bottom of page 1, strength 25mg at the top of page 2 of GP summary  
Doctor assumed strength was 100mg and prescribed 200mg daily, should be 50mg daily
- Fluticasone 250mcg / salmeterol 25mcg inhaler (Seretide 250 evohaler)  
2puffs twice daily  
Prescribed as fluticasone 250mcg inhaler 2 puffs twice daily

A single source of information was used to document the medication history in almost half of cases (32/70; 46%) although for 17 of these additional information sources were overtly available but not used. Two sources were used in 29 cases, three in eight cases and four sources in one case. There was no evidence of any difference in the number of sources used when F1/F2 doctors were compared with more senior doctors (Mann-Whitney U test, P=0.904). Further sources of information regarding medication were overtly available during the observations for a total of 23 of the 71 patients but were not used by staff. Details are shown in Table 6-4.

#### 6.2.4 Requests for pharmacist assistance

The pharmacist researcher was asked for assistance with prescribing on 13 occasions during the four study periods, three queries related to the prescribing of parenteral anticoagulation. All queries were answered as succinctly as possible to reduce the possibility of the focus of the study becoming known to participants, details are shown in Figure 6-6.

**Figure 6-6: Research pharmacist assistance sought during observations**

- Dose therapeutic dalteparin based on body weight
- Dalteparin dose reduction for a patient with renal impairment
- Identifying inhalers from patient descriptions of colour and shape
- Confirming appropriateness of medication: Oramorph (morphine sulphate oral liquid) for breathlessness in patient with severe chronic obstructive pulmonary disease
- Identification of white and yellow tablets in a blister pack
- How to prescribe tiotropium inhaler 18 micrograms daily
- Identification of new diabetes tablet beginning with 'S' – sitagliptin
- How to prescribe calcium carbonate 1.5g / cholecalciferol 400units – Adcal D3
- To access GP summary using EMIS web<sup>1</sup> – passwords not issued to rotational medical staff
- Dose of paracetamol in liver disease?
- Appropriate non-steroidal anti-inflammatory drug (NSAID) to be started
- Dose of fondaparinux for probable pulmonary embolism as patient is allergic to dalteparin
- Appropriate antibiotic for patient who has a chest infection, penicillin allergy and had recent course of erythromycin from GP
- <sup>1</sup> Web based computer system used by many GPs

### 6.2.5 Prescribing errors witnessed

Prescribing errors were witnessed during nine of the observations, one ST1 doctor made an error in the prescription of four out of the five patients whose admissions were observed. As an experienced clinical pharmacist the researcher was able to intervene if she felt that the error was likely to result in a significant adverse clinical impact and felt that it was appropriate to do so on three occasions. One patient was prescribed Calcichew tablets instead of cinacalcet tablets, Calcichew is a calcium supplement and cinacalcet is used for the treatment of hypercalcaemia caused by secondary hyperparathyroidism in patients with end-stage renal disease. The second patient was admitted on dalteparin for the treatment of a known DVT, at first the doctor prescribed a subtherapeutic dose and when challenged changed this to a dose in excess of the maximum recommended by the manufacturer, the details are shown in Figure 6-7. Errors occurred particularly when dosing regimens were less frequent than once a day and when generic names rather than brand names were used for combination products such as inhalers and calcium and vitamin D preparations. The third patient was penicillin allergic and had had a recent course of erythromycin from her GP. The doctor prescribed clarithromycin however since this was unlikely to be effective following a recent course of erythromycin the pharmacist suggested levofloxacin as an alternative in line with Trust policy.



**Figure 6-7: Prescribing errors witnessed during observations and associated pharmacist interventions**

- Tiotropium inhaler missed off prescription (F2 doctor)
- MST (morphine sulphate SR tabs) prescribed as 40mg Mane and 30mg Nocte using a blister pack, should be 30mg BD but 40mg BD on Mondays and Thursdays when the patient has dressing changes (Consultant)
- Ramipril prescribed 5mg daily, should be twice daily and furosemide 20mg 3od prescribed as 20mg mane (ST2 doctor)
- Tacrolimus prescribed, should be prescribed by brand – Prograf (ST1 doctor)\*
- Calcichew prescribed, should be cinacalcet (**pharmacist intervened**) (ST1 doctor)\*
- Calcichew prescribed should be Calcichew D3 Forte (ST1 doctor)\*<sup>†</sup>
- Regular medication fluoxetine and vitamin B compound strong omitted for no apparent reason (ST1 doctor)\*
- Patient is allergic to penicillin, has had recent course of erythromycin from GP., Has pneumonia – clarithromycin prescribed, changed to levofloxacin (**pharmacist intervened**) (ST1 doctor)
- GP summary states Fragmin (dalteparin) 25,000 units /ml 0.6ml daily Doctor initially prescribed 2,500 units daily and when challenged changed this to 25,000 units daily, dose should be 15,000 units daily (**pharmacist intervened**) (ST1 doctor)\*<sup>†</sup>

\*Same ST1 doctor                   <sup>†</sup> Same patient

F1/2 Foundation year doctor 1 -2 years post qualification

ST Specialist trainee doctor 3-5 years post qualification

### 6.2.6 Prescription charts written

A prescription chart was written by the admitting doctor during the admission process for 56 (79%) patients, for 13 (18%) patients no chart was written and in two (3%) cases a chart had been written by another doctor elsewhere in the hospital prior to clerking. A prescription chart was written by another prescriber later in the patient's stay for 10 of these 13 patients. The nurse specialist was not registered as a prescriber at the time of the study therefore prescriptions were not written during clerking for any of the three patients whom she clerked. In the 56 cases where the prescription was written on admission, this was confirmed with the patient in only 12 cases (21%), while in 37 cases (66%) the prescriber made no attempt to confirm with the patient that the prescription written matched the

medicines which they were actually taking. In two (4%) only urgently required medication was prescribed and one patient was taking only acute medication prior to admission, in five (9%) cases patient confirmation was not possible due to illness.

#### **6.2.7 Medicines reconciliation by a pharmacist**

Medicines reconciliation was carried out by a pharmacist independent of the admission process for 42 of the 56 prescription charts written on admission during the observations, 25 charts (59%) were found to be accurate, eight (19%) contained one prescribing error, seven (17%) two errors and two (5%) had three errors.

### **6.3 Interviews**

Twenty doctors were approached to participate in the interviews, 14 had agreed to be both observed and interviewed; 12 were actually both observed and interviewed. The remaining two doctors completed their AMU shifts before a suitable opportunity for observation arose however both participated in the interviews. A further six were asked to participate in the interviews in order to ensure that each grade working in AMU was represented, all agreed. Unfortunately one of these six doctors had a prolonged period of annual leave (honeymoon) and then moved Trusts so was unable to participate. Interviews were carried out as soon as possible following the observations in study period 4 to try to minimise the opportunities for discussion about the content between participants.

A total of nineteen doctors were interviewed, two consultants, five ST years 3/4/5/6, four ST years 1/2 and eight F years 1/2 (Table 6-5). Two of the six AMU consultants involved in admissions had already participated in earlier VTE interviews and were as such not eligible for this part of the study in accordance with the study protocol, a third consultant was part of the research team and hence also ineligible. The group interviewed comprised 76% of the 25 doctors working on AMU during study period 4, 12 of the 19 interviewed were responsible for admitting 20 of the patients observed in the study. The group had a wide range of experience covering both medical and surgical disciplines, their chosen or proposed specialties were also varied, general medicine (8), GP (3), AMU or ED (4), surgery (2), psychiatry (1), and histopathology (1).

**Table 6-5 Number of medical staff available on Acute Medical Unit (AMU) rota and number interviewed**

Grade of Staff	Number on AMU rota per week	Number interviewed
Junior ( F1,F2,ST1,ST2)	12	12
Senior (ST3, ST4, ST5, ST6)	6	5
Consultant	7 (4 part time)	2 (4 ineligible)
Total	25	19

F1/2 Foundation year doctor 1 -2 years post qualification

ST Specialist trainee doctor 3-6 years post qualification

### 6.3.1 Training in taking a medication history

Sixteen doctors (84%) reported having received training in taking a medication history at university; however three were unable to recall having any training, two of whom were aged less than 30 years. Most (9/16; 56%) were unable to recall the details, three said that the duration of training was less than 2 hours, four said it lasted longer than 2 hours. Training had been received at a variety of medical schools mostly in the North of England: Liverpool (5), Manchester (4), Leeds (3), Oxford (1), Swansea (1), and Sudan (1). Two doctors said that training to take a medication history was included in the general medical history taking training, two specifically mentioned pharmacists being involved in their training one from Liverpool University and the other from Leeds University.

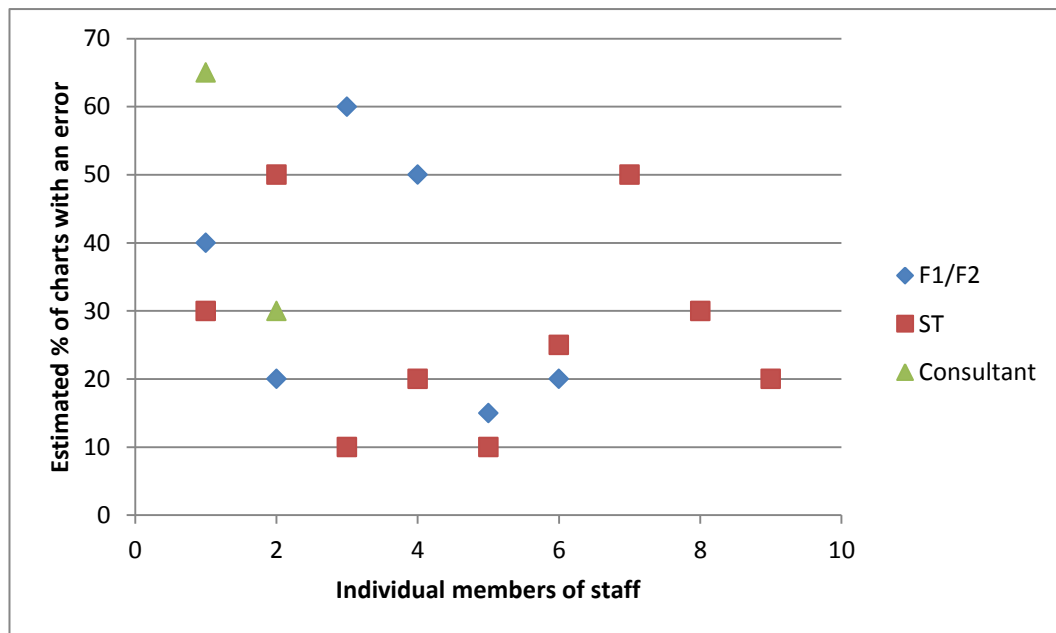
Of the 14 doctors who were able to recall some details of the training which they had received 12 said that they felt that it was adequate but two felt that it was inadequate. One doctor indicated that they had to “learn on the job”, another said that they were “not prepared for prescribing”, they were able to take drug history but “lacked of pharmacological knowledge regarding interactions etc.” These two individuals had attended different universities.

### 6.3.2 Awareness of the prevalence of prescribing errors

The majority of doctors were unaware of the proportion of patients at risk of prescribing errors with 13/19 estimating that no more than 30% of medication charts written on admission would have a prescribing error and 16/19 estimating that 10% or fewer of these errors would have the potential to have a serious impact.

There was no obvious correlation between the grade of doctor and their estimate of the prevalence of prescribing errors on admission, Figure 6-8. There was no significant difference in the estimates of F1/F2 doctors in comparison to other doctors (t-test; P=0.852, equal variances assumed).

**Figure 6-8: Individual doctors estimate of proportion of prescription charts with a prescribing error**



F1/2 Foundation year doctor 1 -2 years post qualification

ST Specialist trainee doctor 3-6 years post qualification

### 6.3.3 Knowledge of medication history taking

Self-rated knowledge of medication history taking was 'good' in seven (37%) and 'average' in twelve (63%), no one felt that their knowledge was 'below average'. As a prescribing error was identified for only three of the 20 patients admitted by these doctors it was not possible to draw any conclusions as to whether or not perceived knowledge of medicines reconciliation correlated with accuracy of prescribing. When asked about local and national guidance relating to medicines reconciliation only one doctor was aware of the local Trust policy and two thought that there was national guidance but were unable to recall any details.

### 6.3.4 Current medication history taking practice

When asked to list the sources they used to obtain a medication history the most common responses were the patient (17; 89%), patients own medicines (16; 84%), GP repeat medicines form (15; 79%), previous discharge prescription (14; 74%),

telephone GP for information (13; 68%), GP / Walk In centre letter (10; 53%). The total number of sources cited as being used ranged from four to eight.

When asked if they would ever use more than one source for a medication history fourteen of the 19 interviewees indicated they would sometimes use more than one source and a further four said that they would always do so. Reasons given for using more than one source were that information given by patients alone was not reliable (6 doctors) and that patients may not take their medication as listed in GP summaries (3 doctors). Five interviewees stated that clinical anomalies also prompted them to check medication more thoroughly, examples they gave were: a patient with a history of epilepsy who has brought their own medication into hospital but has no antiepileptic medicines with them, a patient taking letrozole but no history of breast cancer. Extracts from the interviews are shown in Table 6-6.

**Table 6-6: Extracts from interviews - reasons for using more than one source of information for medication histories**

Key theme	Extracts from medicines reconciliation interviews
Unreliable patient information	<p><i>"If you [just] talk to the patient you often find they are wrong" - - ST1 doctor</i></p> <p><i>""When talking to patients [you] find they are not sure or there is some contradiction"- ST3 doctor</i></p> <p><i>"Unwell patients are unreliable"- F1 doctor</i></p>
Patient may not take medicine as listed in GP summary	<p><i>"Patients don't take medicines as they are supposed to, [you need]run through list with patient and make sure they are taking them all" -ST1 doctor</i></p> <p><i>"[The] patient may not be taking all medicines [listed]" - ST5 doctor</i></p>
Clinical anomalies	<p><i>""If there are discrepancies e.g.[the] patient says they take antiepileptics but they are not in patients bag of medicines"- Consultant</i></p> <p><i>"If there is a contradiction e.g. they are on a beta blocker and [rate controlling] calcium channel blocker"- ST5 doctor</i></p> <p><i>"... miss match of condition and medication" - ST6 doctor</i></p> <p><i>"If [there is]discrepancy between patient history and medication e.g. on letrozole but no history of breast cancer".- F1 doctor</i></p>

F1/2 Foundation year doctor 1 -2 years post qualification  
 ST Specialist trainee doctor 3-6 years post qualification

### 6.3.5 Problems in confirming medication histories

Interviewees were asked to describe any problems which they encountered when trying to ascertain patients' medication histories. Difficulties were experienced when patients were unable to provide information and did not have their usual medication with them. One doctor commented on the problems when information has not been documented in the ED notes and the necessary documents or medicines are then lost in the transfer process between ED and AMU. Warfarin and insulin were cited as causing particular problems in identifying the current dosage regimen, as this information is not usually included on the pharmacy dispensing

label, and the difficulties in obtaining accurate information outside of normal working hours when GP surgeries are closed were highlighted. Extracts from the interviews are shown Table 6-7.

**Table 6-7: Extracts from interviews – problems experienced in confirming medication histories**

Key theme	Extracts from medicines reconciliation interviews
Not all medication with patient	<p><i>“Patient has no medication with them and doesn’t know” – ST5 doctor</i></p> <p><i>“ - they have no drugs with them” – ST3 doctor</i></p> <p><i>“Patients don’t always bring everything in”- Consultant</i></p>
Patient unable to recall information about medication	<p><i>“Patient can’t remember [which medicines they take]” – ST3 doctor</i></p> <p><i>“Patient doesn’t have accurate knowledge [of medication] – [he / she is] confused” – ST4 doctor</i></p> <p><i>“Patient doesn’t know what they are taking” – ST1 doctor</i></p> <p><i>“Confused patients” – 2 F1 doctors</i></p>
Difficulties ‘out of hours’	<p><i>“At night – no GP letter – no information out of hours” – ST4 doctor</i></p> <p><i>“[There are] problems if it’s after 5pm” - ST1 doctor</i></p> <p><i>“In the middle of the night – can’t contact GP” – F1 doctor</i></p> <p><i>“ [You] can only phone the GP 9am to 5pm” – F2 doctor</i></p>

F1/2 Foundation year doctor 1 -2 years post qualification  
 ST Specialist trainee doctor 3-5 years post qualification

### 6.3.6 Documenting medication histories

As there was evidence from the observations that medication histories are not always documented in the case notes in the study hospital participants were asked if there were any situations when they wouldn’t document a medication history in the case notes. Fifteen doctors stated that they would always document a medication history even if the patient was taking no regular medication; two

doctors said that this may be omitted if the patient was very ill in the resuscitation suite when the focus would be on the current acute problem. One doctor stated that this may not be possible due to lack of information and another said that when working busy nights and if feeling tired she may leave a space in the notes for the medication history when clerking a patient at the bedside and forget to complete it later. When asked what action they would take if it was not possible to complete a medication history at the time of clerking most doctors (16/19) indicated that this was only likely to happen “out of hours” and they would document in the case notes that the medication history needed to be completed for action either by the medical team or pharmacy staff when information from the GP was available. One experienced doctor stated that “[you] can usually find something if you try hard enough”.

### **6.3.7 Writing a medication chart**

As the observations had shown that a medication chart was not always written for patients on admission doctors were asked to describe situations in which they felt a medication chart was not necessary. Ten doctors thought that all patients should have a medication chart written, one commented that a chart was needed so that any medication allergies could be recorded. Six doctors thought that a chart was unnecessary if the patient was unlikely to be admitted and would be discharged within a few hours, two said it would be unnecessary if the patient was taking no regular medication and no new medication was indicated and one said that if a DVT proforma was used (for patients admitted with a suspected DVT) no medication chart was necessary.

### **6.3.8 Discussion with patients**

Over half of doctors (11; 58%) indicated that they would confirm medication with patients at least sometimes before writing the admission prescription, two stated that they would discuss newly initiated medicines but not the patients ‘regular’ medicines. Reasons given for not discussing with patients were generally if patients were incapacitated due to illness, however one doctor indicated that this would take too much time.



### **6.3.9 Checking of prescriptions**

All doctors thought that prescriptions should be checked, 18/19 indicated that a check should be carried out within 24 hours of prescribing and that pharmacists were the most appropriate staff group to perform the check. However it was recognised that anyone involved with the patients medication should also take the opportunity to check e.g. doctors on the post take ward round and nurses administering medicines. Five doctors indicated that they had a responsibility to self-check any prescriptions which they had written.

### **6.3.10 Suggestions to reduce prescribing errors**

Suggestions for reducing prescribing errors included better access to GP prescription data (6 doctors) especially out of hours possibly by the use of an integrated IT system and improved training for medical students and F1 doctors (10 doctors). Two senior interviewees suggested that increased availability of a pharmacist 'at the front door' to obtain an accurate medication history before the patient was clerked by a doctor may be the solution. Examples of interview responses are shown in Table 6-8.

**Table 6-8: Extracts from interviews – suggestions for reducing prescribing errors**

Key theme	Extracts from medicines reconciliation interviews
Improved access to GP prescription data	<p><i>“Access to GP records for admitting doctors” – ST3 doctor</i></p> <p><i>“Easier access of information between AMU and GP – if GP refers he should send a patient summary” – ST1 doctor</i></p> <p><i>“GPs to send information routinely about medicines” – ST2 doctor</i></p> <p><i>“Make sure an up to date list [of medicines] comes with the patient from the GP” – F1 doctor</i></p> <p><i>“Central record of medication for hospital and GP use – electronic with access at all times” – ST1 doctor</i></p>
Training	<p><i>“Better training for doctors, there is too much information given at induction. Maybe early teaching session after induction” – F2 doctor</i></p> <p><i>“Do a refresher for F1s on medicines reconciliation” – F1 doctor</i></p> <p><i>“Re-education at Grand Round and F1 teaching [sessions]” –F1 doctor</i></p> <p><i>“Training on induction, continue risk sessions on Grand Round, increase training at medical school” –ST5 doctor</i></p>
Pharmacist involvement	<p><i>“Could a pharmacist do a medication history at the front door before the doctor clerks?” – ST6 doctor</i></p> <p><i>“Have a pharmacist 24 hours a day on AMU” -Consultant</i></p>

F1/2 Foundation year doctor 1 -2 years post qualification  
 ST Specialist trainee doctor 3-6 years post qualification

### **6.3.11 Ranking of sources commonly used for medicines reconciliation**

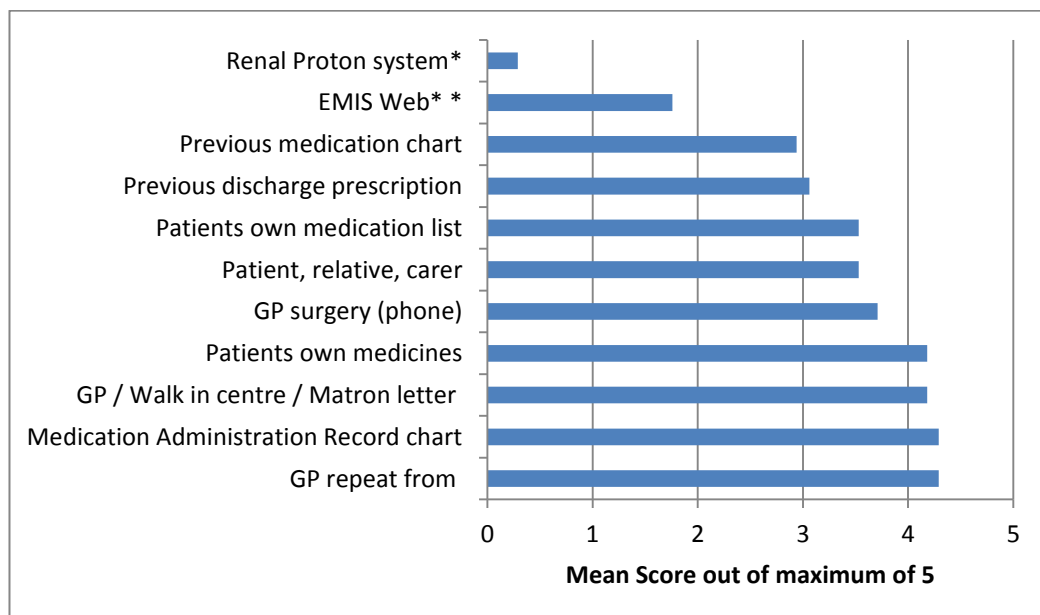
At the end of the interview staff were asked to indicate how often they would use sources commonly used for medicines reconciliation, assuming they were available, using a list provided. They were then asked to rank a list of sources on a scale of 1 to 5 where 1 is not very useful and 5 is extremely useful (Appendix 14).

The six sources most commonly cited as being used, in decreasing order of frequency of use were: referral letter from primary care, GP repeat prescription order form, MAR chart from nursing home, patients own medicines, information provided by the patient, relative or carer and patients own medication list. The

least frequently used sources were the renal Proton system which provides some information including medication for renal patients at RLUH and EMIS Web which allows access to GP medication records for the majority of GPs in Liverpool provided the patient gives consent for their record to be accessed. Only one doctor had previously worked in the renal directorate and therefore had access to the Proton system, most doctors were either unaware of the information available via EMIS Web or were unaware that pharmacists were able to access this system. Access to EMIS Web is restricted to consultant medical staff and pharmacists.

The most useful sources in decreasing order were: GP repeat prescription order form, MAR chart, primary care referral letter, GP surgery; information provided by the patient, relative or carer; patients own medication list. The least useful were the renal proton system or EMIS Web for the reasons stated above, see Figure 6-9.

**Figure 6-9: Doctors rating of how useful they find various sources for medication histories**



\*Proton is an 'in house' hospital system used to record medication & test results for renal patients of the renal directorate

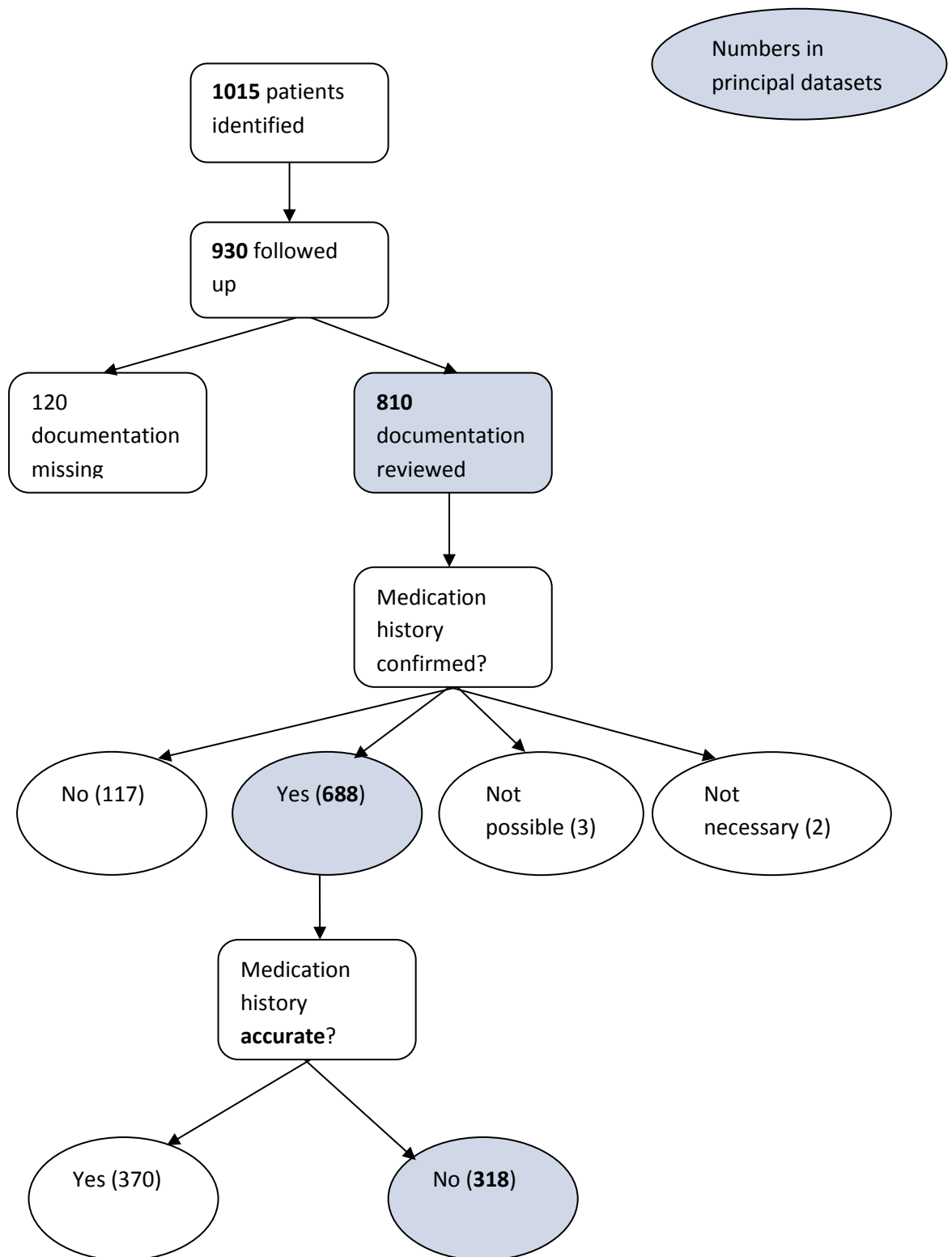
\*\*EMIS Web is an electronic web based system which enables authorised medical, nursing and pharmacy staff to view the patient's medication history held on the GPs computer system

#### 6.4 Case note review

Study participation is shown in Figure 6-10 and the demographic details of the patients admitted during the study are shown in Table 6-2, page 114. A total of 1015 patients were identified during the study periods 930 (91.6%) were followed

up. Cases were followed up until an attempt had been made to review the notes of at least 90% of the patients admitted in each data collection period and the target of 200 available sets of notes for each period, which was calculated for the VTE part of the study, was exceeded. In 120 cases the relevant admission documentation was not available in records, either the case notes relating to the admission or the original medication chart or both were missing, leaving 810 cases suitable for analysis. The majority of patients were admitted via the Emergency Department (ED) (56.0%) or directly from their GP (38.6%), the remaining patients were referred by out-patient clinics (1.9%), other hospitals (1.5%) walk in centres (1.4%), or specialist community nurses (0.6%).

Figure 6-10: Study numbers – medicines reconciliation case note review



#### 6.4.1 Difference between study periods

The dataset for period 4 is slightly larger as more pharmacist hours were allocated to AMU resulting in more medication histories being checked, the difference between the study periods was statistically significant (chi-square test  $P=0.035$ ) and more patients who experienced an error were identified (chi-square test  $P=0.025$ ), but other than this similar numbers of admission observations, interviews and case note reviews were included in all four periods (Table 6-1, page 112 and Table 6-9, page 139). The number of patients experiencing an error of omission and the proportion of red, amber and green errors were also broadly similar in all four periods (chi-square test  $P=0.201$ ), the data were therefore pooled for analysis.

#### 6.4.2 Medicines reconciliation by a pharmacist

Medicines reconciliation was completed by a pharmacist for 688 (84.9%) patients overall. It was attempted for three further patients but was not possible as they were admitted and discharged between Friday evening and Monday morning when their GP surgery was closed and no other sources of information were available, two patients were transferred from another hospital within the Trust so a new medication chart was not required. Prescriptions for the remaining 117 patients were not reviewed by a pharmacist prior to discharge or death, about a third of these patients (42; 35.9%) stayed in hospital for less than 24 hours, 51; 43.6% for 24-48 hours (see Figure 6-10) and 30 (25.6%) were admitted on a Friday. The proportion of patients for whom medicines reconciliation was completed rose from 80.2% in period 1 to 82.7% in period 2, 87.9% in period 3 and 89.1% in period 4, this change was statistically significant when all groups were tested in a single analysis (chi square test  $P=0.011$ ).

Medicines reconciliation should be carried out within 24 hours of hospital admission according to both national<sup>35</sup> and international<sup>108</sup> guidelines. Over the course of the study this proportion varied from 43.0% in period 1 to a maximum 67.4% in period 3 (see Table 6-9 and Figure 6-11), the change from period 1 to period 4 was statistically significant (chi-square  $P<0.001$ ). The increase in the number of medication histories checked from period 1 to 4 was also statistically significant (chi-square  $P=0.035$ ). The number of pharmacist hours allocated to AMU

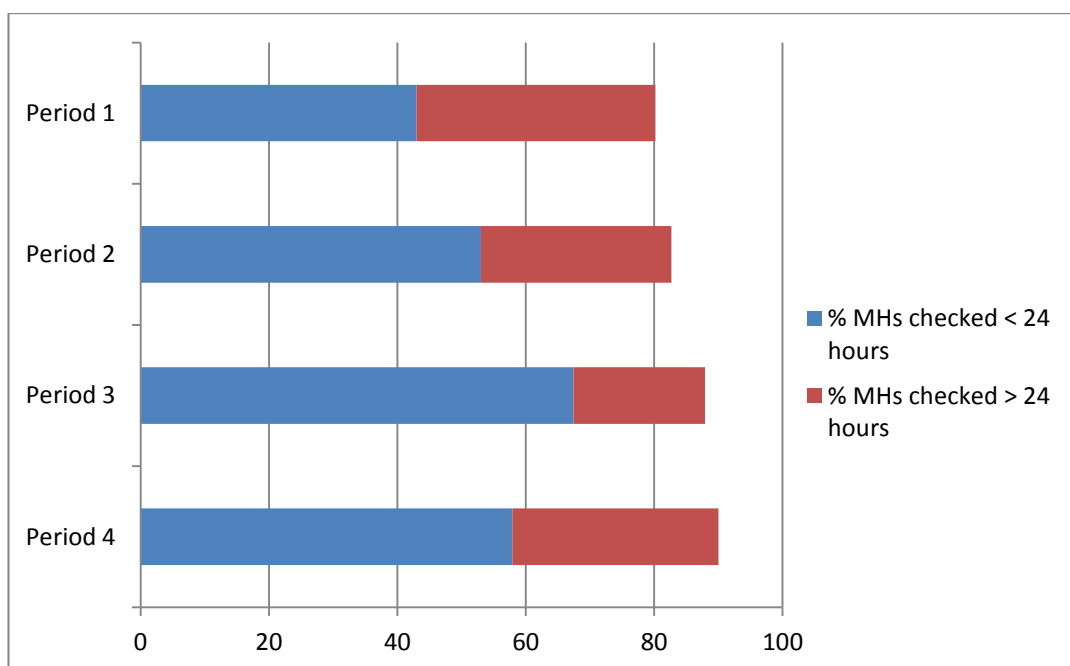
on the pharmacy rota increased from 33 to 60 per week over the period of the study.

**Table 6-9 Medicines reconciliation completed by pharmacists for study patients**

	Period 1 (Nov 2009)	Period 2 (Jan 2010)	Period 3 (Apr 2010)	Period 4 (Apr 2011)	Total
Number of case notes reviewed	243 / 265 (91.7%)	232 / 255 (91.0%)	221 / 239 (92.4%)	234 / 256 (91.4%)	930 / 1015 (91.6%)
Number of patients with documentation available	<b>207</b>	<b>202</b>	<b>190</b>	<b>211</b>	<b>810</b>
Number of pharmacist hours allocated to AMU during study week	33	35	35	60	
Number of medication histories checked*	166 / 207 (80.2%)	167 / 202 (82.7%)	167 /190 (87.9%)	188 / 211 (89.1%)	688 / 810 (84.9%)
Medication histories checked within 24 hours	89 / 207 (43.0%)	107 / 202 (53.0%)	128 / 190 (67.4%)	137 / 211 (64.9%)	461 / 810 (56.9%)
Number of prescribing errors identified/number items which should be prescribed	163 / 897 18.2%	201 / 1016 19.8%	190/961 19.8%	297/1281 23.2%	851/4155 20.5%

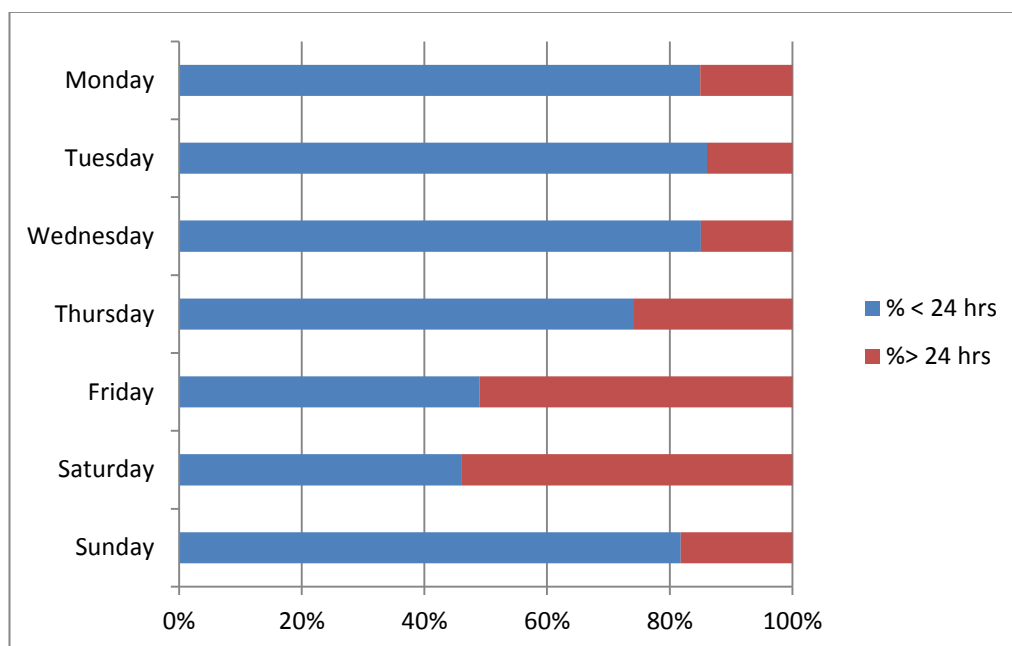
\*Number restricted by number of rotational pharmacist hours allocated to AMU

**Figure 6-11: Proportion of medication histories (MH) completed by study period**



The percentage of patients for whom medicines reconciliation was completed within 24 hours varied according to their admission day of the week. Fewer patients were likely to have their medication checked by a pharmacist if they were admitted on a Friday or Saturday than if they were admitted on other days of the week (Figure 6-12). This difference was statistically significant when Fridays and Saturdays were compared with Mondays (chi-square test  $P < 0.001$ ; chi-square test  $P < 0.001$ ).

**Figure 6-12: Percentage of medication histories checked within 24 hours by day of the week**



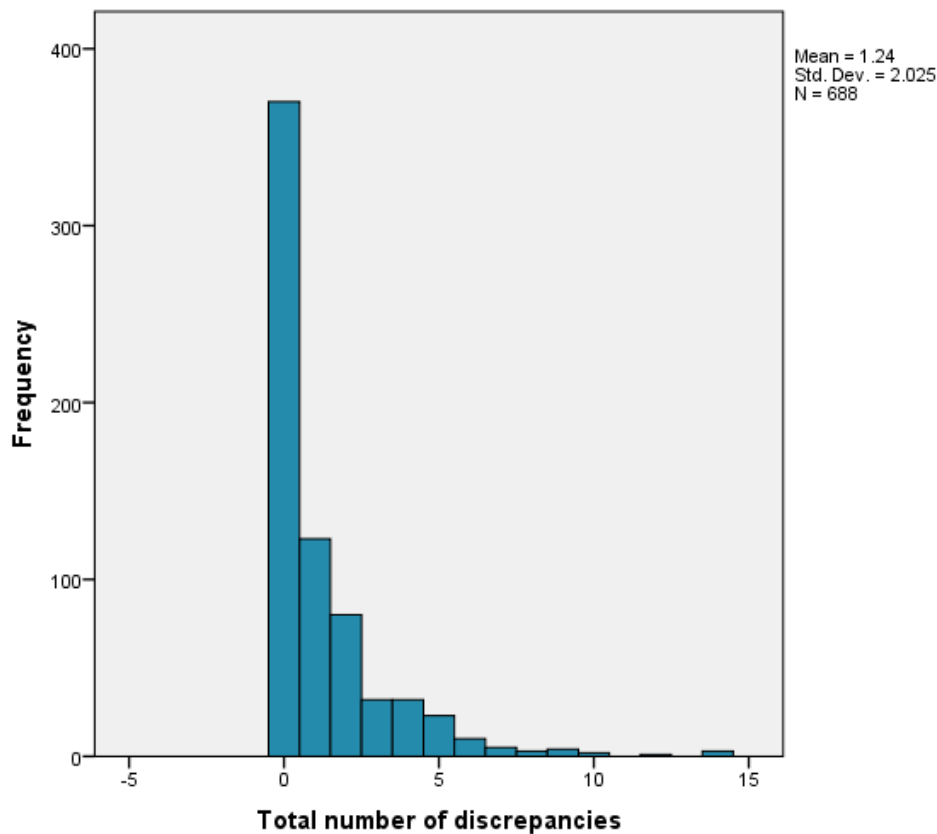
### 6.4.3 Prescribing errors

From the 688 medication charts for which a pharmacist completed medicines reconciliation, 4,155 medicines should have been prescribed (mean 6.0 per patient) and 851 errors were identified, therefore 20.5% of items which should have been prescribed had an error. The errors involved 318 (46.2%) patients, each of whom experienced a mean of 2.7 errors, the most common type of error was unintentional omission of a medicine (737; 86.7%). Other errors identified were dosage error (86; 10.1%), medicine accidentally restarted (14; 1.7%), medicine device error (11; 1.3%) and wrong medicine prescribed (2; 0.2%) see Table 6-10, page 142. The overall error rate for individuals where medicines reconciliation was carried out was 1.2 errors per patient (see Figure 6-13).



The proportion of items with a prescribing error increased from 18.2% in period 1, to 19.8% in periods 2 and 3, and finally to 23.2% in period 4 (see Table 6-9, page 139). This change was statistically significant (chi-square test  $P=0.026$ ). Three sub analyses showed no significant difference between periods 2 and 4 and periods 3 and 4 when the Bonnferroni correction was applied (chi-square test  $P=0.049$  and  $P=0.052$  respectively). However there was a significant difference between periods 1 and 4 even when the Bonnferroni correction was applied (chi-square test  $P=0.005$ ).

**Figure 6-13: Histogram showing number of prescribing errors per patient**



A slightly higher proportion of errors per item was associated with patients admitted via the ED who were then transferred to AMU (522/2433; 21.4%; 95% confidence interval 19.8% - 23.1%) when compared with other routes of admission (328/1722; 19.0%; 95% confidence interval 17.2% - 21.0%). However this difference was not statistically significant (chi-square test,  $P=0.058$ ). Patients admitted via ED were statistically no more likely to experience a prescribing error (201; 49.2%)

when compared with other routes of admission (117; 41.8%) (Chi-square test P=0.053).

#### 6.4.4 Assessment of potential harm from prescribing errors

As the majority (86.7%) of the prescribing errors in the present study were omissions, the UKMI tool<sup>176</sup> which was specifically developed to estimate the potential impact of omitted medicines was used to categorise them. Using this tool 94/737; 12.8% were assessed as red or amber and as such had the potential for a significant long or short term effect on the patient. Details of the types of prescribing errors identified in the 688 charts for which a pharmacist completed medicines reconciliation and the potential impact are shown in Table 6-10.

**Table 6-10: Details of prescribing errors identified during the study**

	Number of errors (proportion of total)	Number of patients with error (some patients had more than 1 type of error)	Number of prescribed items with error (proportion)
<b>Error type</b>			
Omitted medicines	737 / 851 (86.7%)	252 / 688 (36.6%)	737 / 4,155 (17.7%)
Dosing error	86 / 851 (10.1%)	73 / 688 (10.6%)	86 / 4,155 (2.1%)
Re-started in error	14 / 851 (1.7%)	11 / 688 (1.6%)	14 / 4,155 (0.3%)
Incorrect device	11 / 851 (1.3%)	11 / 688 (1.6%)	11 / 4,155 (0.3%)
Wrong medicine	2 / 851 (0.2%)	2 / 688 (0.3%)	2 / 4,155 (0.05%)
Totals	851 (100%)	688 (100%)	4,155 (100%)
<b>Potential impact of omitted medicine (UKMI tool)</b>			
Red (significant or catastrophic, long term patient impact)	7 / 737 (1.0%)	6 / 252 (2.4%)	7 / 4,155 (0.2%)
Amber (significant, short term patient impact)	87 / 737 (11.8%)	66 / 252 (26.2%)	87 / 4,155 (2.1%)
Green (negligible patient impact)	643 / 737 (87.2%)	239 / 252 (94.8%)	643 / 4,155 (15.5%)
<b>Potential Impact of other errors (Adapted NPSA tool)</b>			
Major	2 / 113 (1.8%)	2 / 91 (2.2%)	2 / 4,155 (0.1%)
Moderate	67 / 113 (59.3%)	55 / 91 (60.4%)	67 / 4,155 (1.6%)
Minor	44 / 113 (38.9%)	34 / 91 (37.4%)	44 / 4,155 (1.1%)

A small proportion of errors of omission (7; 1.0%) were as classified as red (significant or catastrophic, long term patient impact), most of these involved omission of antiepileptic medicines (5/7). The remaining errors were classified using

an adapted version of the NPSA risk assessment tool<sup>121</sup> as used in a Welsh study in 2007.<sup>48</sup> Two were classified as having the potential to have major adverse effects Figure 6-14.

**Figure 6-14: Red (significant or catastrophic) / Major prescribing errors identified during the study**

Omission	Wrong dose / medicine
<ul style="list-style-type: none"><li>• Azathioprine</li><li>• Carbamazepine x 2</li><li>• Humalog insulin</li><li>• Sodium valproate x 3</li></ul>	<ul style="list-style-type: none"><li>• Calcichew should be cinacalcet</li><li>• Dalteparin - too low - pt has pulmonary embolism</li></ul>

#### 6.4.5 Rectifying prescribing errors

The majority of errors (502; 59.0%) were rectified within 24 hours and over two-thirds (587; 69.0%) within 48 hours of being identified and documented in the case notes by pharmacists. Therefore errors identified were corrected within 24 hours for 224/318 (70%) patients. Both the 'NPSA major' errors were rectified as soon as they were identified and four of the 'red' errors (all antiepileptic medicines) within 24 hours. However it took between 24 and 48 hours for carbamazepine, an antiepileptic medicine, to be prescribed for one patient who had been admitted following a stroke and longer than 72 hours for azathioprine, an immunosuppressant, to be prescribed for a patient who was admitted with an infective exacerbation of COPD. It was impossible to determine the time taken to rectify the Humalog insulin error as either the medicines reconciliation record or the prescription had not been dated.

#### 6.5 Discussion

This part of the study provides a novel insight into how prescriptions are written on admission to hospital and the possible causes of prescribing errors on admission, which are widely reported in the literature as forming a significant proportion of all prescribing errors.

### 6.5.1 Information sources

The sources actually used for obtaining medication histories during the observations matched those most frequently cited by staff during the interviews as being sources they commonly used. Although almost all of doctors interviewed indicated that they would sometimes or always use more than one source to confirm medication histories the observations showed that a single source was used in almost half of cases. This is at variance with national guidance for England and Wales from NICE<sup>35</sup> and other published guidance<sup>44, 105, 106</sup> which suggests that at least two sources should be used. The WHO definition for “Best Possible Medication History” also states that the patient should be interviewed where possible and that the medication currently being taken by the patient should be verified with more than one source.<sup>103</sup> The observations showed that even when printed information is provided this can be misinterpreted leading to prescribing errors, further supporting the published guidance which states that more than one source should be used whenever possible. The observations provide useful information about the actual sources used by doctors when determining medication histories as there are no data available in published literature.

### 6.5.2 Communication with patients

From the observations it was apparent that several patients or their carers were able to provide information but were asked no questions relating to medicines, despite this being an integral part of the standard hospital clerking model.<sup>20</sup> The numbers in the study were too small to suggest any particular reason for this omission however during the interviews six doctors did allude to the perceived unreliability of information provided by patients.

Although seven of the twelve doctors interviewed who were also observed indicated that they would confirm current medication with the patient, the observations showed that these doctors only did so in two of the 20 patients they admitted between them, suggesting that although the theory is understood, application in practice is less simple. Overall, confirmation of the prescription with the patient occurred infrequently despite overt acknowledgement by three doctors that patients may not take their medicines as prescribed. A UK study has shown

that as many as 11% of errors identified on admission may be as a result of a patient decision to alter their treatment regimen.<sup>126</sup> It has been shown that patients make decisions about taking medication based on personal experience, financial issues and their relationship with their GP over time.<sup>243</sup> Other studies have also highlighted the differences between the perceived and actual practices of healthcare professionals.<sup>244, 245</sup> One doctor commented that time pressures were an issue when talking to patients about their medication. A recent study showed that medication history taking for medical patients takes a considerable length of time,<sup>126</sup> NICE suggests that 15 minutes will be needed for the 'average' non elective patient,<sup>104</sup> complex medical patients are likely to require longer. As the RCP states that all patients should have an action plan together with review criteria in place within four hours of arrival on AMU,<sup>22</sup> at busy times of the day medical staff may struggle to achieve this goal. Both the EQUIP study<sup>109</sup> and the PROTECT programme<sup>114</sup> reported time pressures and high workload as being contributory factors to prescribing errors.

### **6.5.3 Medicines reconciliation rates**

The present study showed that overall pharmacists completed medicines reconciliation for 84.9% of patients and that 56.9% were carried out within 24 hours of admission. These results are similar to those found in a study carried out 50 acute Trusts in East and South East England in 2010 which found that medicines reconciliation was completed for 87% of patients, with 52% within 24h of admission,<sup>129</sup> in 2013 a large Welsh study showed that 55% were complete within 24 hours.<sup>246</sup> Delays arise particularly when patients are admitted between Friday night and Monday morning when most hospital pharmacies offer a limited service which often does not include medicines reconciliation. There is currently no benchmarking figure for the proportion of medicines reconciliations which should be carried out within 24 hours of admission. The technical patient safety solution published by NICE in 2007<sup>35</sup> simply states that medicines reconciliation should be carried out on admission to hospital, no time frame is specified, however the associated costing template is based on the assumption that it will be completed within 24 hours of admission.<sup>104</sup> The RPS published professional standards for

hospital pharmacy services in 2012 and state that ideally medicines reconciliation should be completed within 24 hours,<sup>38</sup> key performance indicators are currently in development. The current data both from the present study and the South East of England study which show that medicines reconciliation is completed for only 50% of patients within 24 hours of hospital admission is unlikely to remain acceptable, local or national targets are likely to be much higher but achievement of near 100% is likely to require a move to 7 day a week shift patterns in line with government policy.<sup>247</sup> Any targets will need to define clearly the time of hospital admission to enable accurate comparison of Trusts as this may be defined as the time the patient arrived at the hospital or the time at which it was decided that they required admission, these times may differ by several hours.

#### **6.5.4 Prescribing error rates**

The error rates found in the present study are similar to those reported elsewhere, although there are difficulties in making comparisons between studies as 'prescribing error' is not always defined<sup>248</sup> and the results may be expressed in different ways e.g. number of errors per 100 bed days, number of errors per admission.<sup>115, 117</sup> The present study found an overall error rate of 1.2 errors per patient admitted which is slightly higher than the rate of 0.93 per patient reported in a Canadian study by Cornish et al.<sup>122</sup> However in the latter study data were collected 48 hours after admission to enable usual practices in the hospital to correct any errors made whereas in the present study the data collected included all errors made on admission, whether or not they had been corrected at the time of the case note review, which may account for the difference. The present study showed a much lower error rate 48 hours after admission, 264 errors affecting 94/688 patients, 0.38 errors per patient admitted possibly due to pharmacists' vigilance in highlighting errors to medical staff. The present study found prescribing errors in 20.5% of the medicines which should have been prescribed which is comparable to results published in a recent English study which reported a rate of 16.3% for medical admissions.<sup>112</sup> A systematic review found that overall prescribing errors affect 50% of patients<sup>115</sup> which is similar to the rate of 46.2% found in the present study. The average number of medicines which should have been

prescribed per patient was 6.0 which is slightly higher than the figure of 5.4 reported in a Dutch study by Lau et al,<sup>249</sup> the data for this study were collected between 1993 and 1995 which may account for the difference, but is identical to the number quoted in a similar study carried out in the study hospital in 2004.<sup>46</sup> The most common error in the present study was omission of a medicine usually taken by the patient, 737/851; 86.6% of cases, which is in line with the findings of studies from Belgium,<sup>47</sup> Sweden<sup>250</sup> and Wales.<sup>48</sup> Patients admitted to AMU via the ED rather than being referred directly to AMU from primary care were no more likely to experience a prescribing error. This was a surprising finding as it has been suggested in the literature that patients in the ED may be at greater risk of an error.<sup>251, 252</sup> This may be partly explained by the fact that EMIS-Web, the prescribing system used by the majority of GPs in Liverpool is available in the ED department although a limited number of staff are able to access it.

Although the error rate in the present study is similar to that in the published literature and the majority of errors were unlikely to cause significant harm to the patient it is unacceptable that one in every two patients is likely to experience a prescribing error on admission to hospital. The present study showed that a third of errors which had the potential to have a significant clinical impact on patients involved either insulin or antiepileptic medication. Highlighting the increased potential for a serious error to medical and nursing staff and prioritising these patients for early pharmacist review may help minimise the risk of a long term patient impact.

#### **6.5.5 Training of medical staff**

All doctors on qualification should be able to establish an accurate medication history,<sup>19</sup> and this has been highlighted as a core skill necessary for safe prescribing by the British Pharmacological Society curriculum for teaching safe and effective prescribing.<sup>253, 254</sup> Limited information is available in the literature regarding the most effective way to train medical students to prescribe,<sup>255, 256</sup> and only two papers providing specific guidance about medicines reconciliation for medical students or junior doctors have been identified.<sup>44, 105</sup> These papers confirm the need for at least two sources to be used for medicines reconciliation and highlight

some of the common pitfalls. In the present study two of the doctors did not feel that their training had prepared them adequately for their prescribing role. Similarly an Australian study in 2008<sup>257</sup> found that medical students felt ill-prepared to undertake prescribing and concluded that more work is needed to prepare them for this role. A recent (2010) study from New Zealand showed that a campaign targeted at junior medical staff including teaching sessions, reminders and posters was effective in reducing prescribing errors on admission to hospital.<sup>258</sup>

### **6.5.6 Impact of prescribing errors**

As the majority (737/851; 86.7%) of the prescribing errors in the present study were omissions, a tool specifically developed to estimate the potential impact of omitted medicines was used to categorise these errors,<sup>176</sup> 12.8% were assessed as red or amber and as such had the potential for some clinical impact on the patient. However the majority of omissions were likely to have a minimal impact on patient care which is in line with the findings of a recent meta-analysis.<sup>259</sup>

Few studies have attempted to assess the impact of prescribing errors and those that have used different tools. A study from Wales using an adapted version of a tool developed by the NPSA<sup>121</sup> classified 20% of errors as 'major' or 'moderate',<sup>48</sup> other studies using consensus panels to estimate impact have reported 32.9% of errors could potentially cause moderate discomfort or clinical deterioration<sup>257</sup> and 26% were potentially serious.<sup>123</sup> The majority of doctors interviewed were unaware of the proportion of patients at risk of prescribing errors with the majority underestimating error rates as below 30%, in contrast to the 50% reported in the literature<sup>115</sup> and the proportion in the present study of 46.2%. Dean et al<sup>260</sup> note that this may be partly due to the fact that pharmacists frequently identify and correct errors without reference to the prescriber. Following up errors takes considerable time and if prescriptions are handwritten it may be difficult to identify the prescriber from the medication chart.<sup>261</sup> Doctors may prescribe for patients on many different wards when on call so signatures may be unfamiliar to the regular ward staff, the increasing use of electronic prescribing systems in the NHS should overcome this difficulty. In addition the restriction of doctors working hours by the



European Working Time Directive (EWTB)<sup>262</sup> means that they have often gone off duty when their errors are discovered.

### **6.5.7 Effect of admission at weekends**

The present study showed that patients were significantly less likely to have their medication reconciled by a pharmacist within 24 hours of admission if they were admitted on a Friday or a Saturday. The Doctor Foster report published in 2011<sup>263</sup> showed that patients who are admitted to hospital on a Saturday or Sunday when fewer senior doctors are available have an increased mortality rate when compared with patients admitted on weekdays. As the process of clerking a patient on admission takes several hours medicines reconciliation by pharmacists is frequently carried out on the day following admission, on a Saturday for Friday admissions and on a Sunday for Saturday admissions. The pharmacy in the study hospital has a reduced service on Saturdays and Sundays which explains the delay in medicines reconciliation for many patients admitted on Fridays or Saturdays. A study carried out in 56 Acute Trusts in England in 2008<sup>129</sup> found that limited weekend availability of pharmacy services had a limited impact on both the extent and time scale of delivery of medicines reconciliation. However it is difficult to make a direct comparison with this study due to the differences in methodology, in addition this study was carried out shortly after the NICE alert was issued and enthusiasm may have faded in the interim. It is possible that lack of accurate information regarding patients' medication is a contributory factor in the increased weekend mortality rate but further research is needed to investigate the impact.

### **6.5.8 Suggestions for reducing prescribing errors**

Some simple procedural changes may help reduce errors for example keeping any medication which patients bring into hospital with them throughout their journey through the hospital. In ED doctors often use the patient's own medicines to write the initial prescription and then return it to the relatives and advise them to take it home. However it is extremely difficult to ensure that patients' own medicines are not sent home in a large organisation in which medical staff change jobs frequently, the study hospital ED has over 20 junior doctors who rotate every four months.

A meta-analysis published in 2012 concluded that there are limited data regarding the most effective interventions to improve medicines reconciliation<sup>264</sup> however the present study did suggest some actions which may prove particularly successful. Raising awareness of both the level of risk and the potential seriousness of many errors may help to achieve a reduction, but doctors may also require practical guidance regarding the need to check more than one source, and especially the need to confirm the medication history with the patient before prescribing, whenever possible. Training in areas in which knowledge was found to be lacking for example different colours and types of inhaler, preferably by supervising medical students while taking medication histories and providing feedback information to staff about actual errors may also be beneficial. Education is also needed to ensure that medication histories are written up fully in the case notes and a prescription chart is prepared for each patient who is admitted, even if no regular medication is taken, as considerable time can be wasted searching for missing charts and finding an appropriate doctor to prescribe. However, training alone may not result in a significant reduction in errors as doctors appeared to know the theory but failed to apply it in practice which suggests that some other factors are contributing to the problem. Two other studies in the literature highlight the differences between perceived and actual practice, the first involves dentists and their treatment practices and used questionnaires and audit of the actual records,<sup>244</sup> the second, a large international study, used semi-structured interviews and case note review and showed that the knowledge of primary care physicians of the symptoms of heart failure was not reflected in the audit of their practice.<sup>245</sup> Staff comments about difficulties arising out of normal working hours when access to GP information was limited are also important considerations. Expanding the use of systems such as EMIS web<sup>265</sup> or a system similar to the emergency care summary (ECS) used in Scotland<sup>266</sup> which enable all authorised NHS staff to view the patients current medication and any allergies, may go some way to addressing this issue. Access should be extended to junior grades of staff who provide the 'out of hours' services in hospitals, frequently it is restricted to 'consultant only'.

Earlier involvement of the pharmacy team in the admission process was suggested by two of the doctors. Studies from Scotland,<sup>267</sup> Australia<sup>268</sup> and the USA<sup>269</sup> have shown that fewer doses are missed if a pharmacist completes a medication history in the ED, before relatives depart home, taking with them the vital information available from patients own medication. In addition studies in the UK,<sup>46, 270</sup> USA<sup>110</sup> and Belgium<sup>47</sup> have repeatedly demonstrated that pharmacist–documented medication histories are more accurate than those gathered by doctors. This finding is supported by the request for assistance from the pharmacist researcher during 13 (19%) of the 68 admissions observed and the need to intervene on two occasions to prevent a serious prescribing error.

## 6.6 Summary

The results relating to medicines reconciliation have been discussed above; this concludes the presentation of the results of the study, the final discussion and suggestions for further research are presented in the next chapter.<sup>b</sup>

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<sup>b</sup> Some of the findings in the chapter have been published in BMJ Quality and Safety 2013: Basey AJ, Krska J, Kennedy TD, Mackridge AJ. . Prescribing errors on admission to hospital and their potential impact: a mixed-methods study. BMJ Qual Saf. 2014;23:17-25. Available from: <http://qualitysafety.bmj.com/content/early/2013/08/06/bmjqs-2013-001978.full>

## **Chapter 7 Overall Discussion and Conclusion**

The previous three chapters have presented and discussed the findings of the study for the medical admissions process, VTE risk assessment and medicines reconciliation. This chapter draws together these results and provides the overall conclusions for the study.

### **7.1 Critique of methodology**

It has been suggested that qualitative methods, particularly observation, are valuable when investigating errors in healthcare.<sup>271</sup> However although non-participant observation of the consultation process has been used in studies of various aspects of healthcare, such as patient dignity and patient mealtimes,<sup>152, 153, 155, 156, 272, 273</sup> there are few studies in which this methodology has been used to gain insight into the hospital admission process. One study, investigating the documentation of allergies in children on admission to hospital,<sup>163</sup> has used similar methodology during the admission process. However there are no studies in the literature which have used non-participant observation to investigate the admission process as a whole or specifically either VTE risk assessment or medicines reconciliation, non-participant observation is therefore a novel methodology in this setting. A recent study used observations, questionnaires and audit to investigate organisational safety cultures and quality of care<sup>274</sup> but no studies in healthcare using observations, staff interviews and audit of case notes were identified.

In order to gain as much information as possible the present study employed both qualitative methods in the observations and interviews and quantitative methods for the case note audit. In depth information about current practices on admission to hospital was gained by triangulation of the findings from these three methodologies.

#### **7.1.1 Difficulties experienced in carrying out the study**

Observing a significant number of patient admissions during a shift proved difficult to achieve, considerable time was spent waiting for a member of staff to commence clerking as the process takes over an hour and it was impossible to predict when a doctor or nurse would be free to see the next patient. As patients

referred by GPs generally arrived between 11am and 6pm and few patients were clerked between 3pm and 5pm due to the post-take ward round, it was frequently necessary to stay late into the evening to complete the data collection. Early in the study it became apparent that patients would often refer to the pharmacist researcher rather than the clerking doctor / nurse, probably due to her seniority, so whenever possible she stood out of the line of vision of the patient to minimise her impact on the staff / patient interaction.

Arranging interviews proved challenging as appointments were often cancelled at very short notice due to the unpredictable nature of hospital work. Securing an interview often involved bleeping staff on multiple occasions to see if they were free at that time, even when this strategy was used on occasion by the time the researcher arrived on the ward there had been an unexpected development which resulted in cancellation. Venues therefore could not be booked in advance and so the most suitable available location close to the relevant ward area had to be used, frequently waiting areas, coffee bars and changing rooms which were not ideal.

The most effective method of retrieving information from case notes proved to be visiting the ward on the day of or the day after patient discharge, before the case notes were returned to the Trust case note library. As the library is off site notes which had been returned to file had to be ordered and frequently the correct volume and /or the medication chart were missing. Auditing the notes on the ward allowed desks and filing trays in the ward area to be searched for missing medication charts enabling a more complete data collection than would otherwise have been achieved but necessitated working several seven day weeks.

As the researcher was a regular member of AMU staff she was frequently asked for advice or to carry out tasks such as authorising discharge prescriptions while she was waiting to observe staff. Where possible questions were answered and short tasks carried out, where this would not compromise data collection, in order to maintain good working relationships, otherwise an apology and explanation about the research project was given.

### **7.1.2 Strengths**

The research instruments were developed in a robust way with input from both experienced health services researchers and a senior clinician working on the AMU, they were piloted prior to the study to ensure that they were of an appropriate standard to meet the study requirements.

The case note review provided real outcome data and included all the observed patients plus the population admitted during study periods and enabled the representativeness of the observed patients to be assessed. The main strength of this study is in the triangulation of data derived from interviews with a proportion of the staff observed, for both the VTE and medicines reconciliation arms, helping to explain some of the findings from the observations. This is in contrast to many published VTE studies which focus on audits of risk assessments and less frequently appropriate prescribing of prophylaxis rather than investigating the possible causes for poor compliance with guidance. Similarly the majority of papers about prescribing errors focus on the number of prescribing errors rather than investigating the cause of such errors.

A power calculation was carried out for the VTE case note audit to estimate the minimum necessary sample size necessary to facilitate statistical comparison between study periods; this was exceeded for all four study periods with a very high percentage of case notes being successfully followed up.

Adequate numbers of observations and interviews were completed to characterise practices relating to VTE risk assessment and documenting of medication histories in the study hospital.

A recently introduced national tool was used to assess the impact of errors of omission which may allow direct comparison with other published studies in the future. Its objective rather than subjective nature is a further strength.

### **7.1.3 Limitations**

Limitations are that the study was carried out in one hospital, therefore the practices observed and opinions expressed may not be representative of other hospitals. Only doctors observed in period 4 were interviewed about medicines

reconciliation, but additional interviews maximised the proportion of AMU staff included in this arm. All the interviews were carried out sequentially and although all staff agreed to keep the subject matter confidential and no evidence was found to suggest that it was breached, it is impossible to be certain that confidentiality was maintained. The researcher is a regular member of the AMU staff which may have impacted on staff behaviour during observations. Staff responsible for clerking patients may have modified their usual behaviour as they were aware that they were being observed, this is known as the Hawthorne effect.<sup>172</sup> The time taken to clerk patients was recorded, with hindsight it would have been useful to know the time taken to complete a VTE risk assessment and also to write the admission prescription. However as these tasks were often carried out in a fragmented way throughout the admission process it is likely to have proved difficult to collect accurate data.

The interview schedules were not piloted however the researcher's extensive clinical experience enabled suitable questions to be devised, no problems or potential additions were identified during their use.

For the VTE arm of the study, the staff interviewed were not asked about any recent changes to their practice regarding VTE risk assessment. Practices may have changed during the study due to local and national pressure, however all VTE interviews were completed before the NICE guidance was released or data collection became mandatory.

For the medicines reconciliation arm minor discrepancies such as missing SR or EC preparations were excluded from the definition of a prescribing error used in the study, which may have resulted in a reduced number of prescribing errors being recorded in comparison to other published studies. Independent pharmacist medicines reconciliation was only available for 67% of the total number of patients admitted during the study periods, due in part to limitations in the capacity of the pharmacy service and unavailability of the necessary documentation. However as patients' mean age was very similar for those patients for whom medicines reconciliation was and was not completed and the three most common presenting

complaints were identical for both groups, there is no reason to suspect that either the number of regular medicines or the number of prescribing errors would differ between those patients whose prescriptions were, and those whose were not, reviewed by a pharmacist.

## **7.2 Discussion of main findings**

### **7.2.1 National guidance**

VTE and medicines reconciliation were selected for investigation as they are both known to present particular risks to patients on admission to hospital. The first national guidance was issued for both of these risk factors at around the same time, an NPSA/NICE patient safety alert was issued for medicines reconciliation in December 2007<sup>35</sup> and the first VTE risk assessment tool was issued by DH in September 2008.<sup>34</sup> Early audits in the study Trust in 2008/09 showed that compliance with both sets of guidance was poor.

NICE was established in 1999 to minimise the variation in procedures and treatments available in the NHS and to promote evidence based practice through the issue of clinical guidelines.<sup>30</sup> There are now 181 published clinical guidelines all of which require implementation across the NHS. In addition 49 quality standards have been published with many more in development.<sup>31</sup> Whilst not all guidance is relevant to all clinical areas a large majority will require implementation in AMUs where patients with a wide range of medical conditions are treated.

This study enabled a comparison to be undertaken in a single setting of the implementation of national guidance in two areas, where the source, form and nature of the guidance differed. Although the study was limited to one AMU in one hospital, it has relevance to hospitals throughout England. National bodies in several countries<sup>275-279</sup> have also issued similar guidance on these two topics; hence the work is also of relevance beyond England.

#### **7.2.1.1 Venous thromboembolism**

Following publication of the initial VTE risk assessment tool in 2008, NICE guidance for VTE risk assessment<sup>43</sup> was launched in January 2010 with associated press and TV coverage to raise awareness, a revised tool for risk assessment<sup>201</sup> was issued in



March 2010. Monthly collection of VTE audit data was made mandatory by the government in June 2010 and VTE risk assessment was one of the first quality standards,<sup>280</sup> with financial penalties for failure to achieve the target, to be issued by the DH in the same month. Implementation of VTE guidance in acute hospital Trusts has been audited annually by the All-Party Parliamentary Thrombosis Group since 2007, the most recent report being for 2012,<sup>281</sup> and VTE has been included in the NHS outcomes framework from 2001/12<sup>98</sup> to date (2013/14).<sup>37</sup>

#### **7.2.1.2 Medicines reconciliation**

Following the circulation of the NICE/NPSA medicines reconciliation alert<sup>35</sup> and associated costing template<sup>104</sup> in 2007, there has been no further guidance or audit requirements issued by the government. There is no national target and no mandatory audits are required. Medicine reconciliation was included in the professional standards for hospital pharmacy services published by the RPS in 2012<sup>38</sup> which state that this should take place within 24 hours of admission. However these standards are to aid service development, they do not include mandatory targets.

#### **7.2.2 Comparison of VTE and medicines reconciliation results**

The study observations showed that policies and guidelines were frequently ignored, at the start of the study no patients had a VTE risk assessment completed, contrary to national guidance<sup>34</sup> and Trust policy. Medication histories were confirmed using a single source by almost half of doctors with the admission prescription being checked with the patient in only 21% of cases, again contrary to national guidance.<sup>35</sup>

The VTE and medicines reconciliation interviews in the present study identified some similar themes, doctors were generally unaware of local and national guidance for both VTE and medicines reconciliation, they were ignorant of the risks of VTE and were oblivious of the proportion of patients who experience a medication error on admission to hospital. Lack of time was raised as an issue in relation to both completing VTE risk assessment and when discussing medication histories with patients.

The results of the case note audit show that both the number of patients VTE risk assessed and the number who received prophylaxis with LMWH appropriately rose significantly following the introduction of mandatory risk assessment. Medicines reconciliation also improved over the course of the study, there was a significant increase in both the number of patients for whom medicines reconciliation was carried out and the proportion completed within 24 hours. This was attributed to the increased number of pharmacist hours allocated to AMU as there were no local or national initiatives or changes in procedure to account for the increased rates.

However, there were also some adverse outcomes noted in the results. There was a statistically significant increase in the number of patients who were inappropriately prescribed LMWH prophylaxis as they had bleeding risks. In addition the Trust data showed a statistically significant increase in the number of patients with a discharge diagnosis of GI haemorrhage from 2009 to 2011 which may be associated with the increased use of LMWH. In the medicines reconciliation arm of the study the proportion of items with a prescribing error rose, indicating deterioration in the quality of medication history taking by medical staff, with a significant difference between periods 1 and 4 which is of concern. It is difficult to explain this difference, there was no change in workload as the weekly number of admissions in the study periods remained constant and there was no change in the staff numbers. It is possible that there were differences the competence of the staff group in period 4 or it could be postulated that the Trust focus on VTE resulted in a lack of focus or accuracy in other areas.

### **7.2.3 Guideline implementation**

Implementing clinical guidelines in practice is recognised as being difficult.<sup>282, 283</sup> Various systematic reviews have examined the difficulties of implementing guidelines, one concluding that there is no 'magic bullet' in terms of the most effective strategy for implementation in hospitals.<sup>283</sup> In addition an international survey of agencies responsible for guideline development showed that few had dedicated staff or financial resources for implementation.<sup>284</sup> Barriers identified to guideline implementation have been classified into three broad categories, knowledge, including lack of familiarity and awareness, attitudes, including failure

to believe that the intervention will have the desired outcome and behavioural factors, such as lack of time.<sup>133</sup>

It has also been shown that awareness of personal adherence may be a factor in implementation of guidelines,<sup>285</sup> in the present study many staff were shocked to learn of audits showing poor compliance with VTE guidelines and the considerable proportion of patients experiencing a prescribing error on admission to hospital. Therefore more regular audits together with personal feedback where possible may improve guideline implementation. This may be facilitated by electronic prescribing systems which should allow prescribers to be identified with ease.

A meta-analysis published in 2004 showed that single strategies such as dissemination of education materials, audit together with feedback and reminders led to a small improvement in guideline implementation.<sup>286</sup> A study from 2008 suggested that dissemination of printed materials alone is of limited benefit in changing professional practice,<sup>287</sup> which is in line with findings of the present study as policies for both VTE prophylaxis and medicines reconciliation were initially circulated in isolation. For VTE guidance implementation it has been shown that multiple strategies are more effective than single strategies.<sup>229, 230</sup> As early strategies to improve VTE risk assessment in the study were introduced sequentially (Figure 5-1, page 68), this may explain why they proved ineffective.

Small group training with active participation has been found to be effective in policy implementation in contrast to courses alone which had mixed effects.<sup>288</sup> In the present study, most staff had received training in lecture format, whether for VTE prophylaxis or medicines reconciliation, which may explain the failure to comply with guidelines.

A recent study from Israel highlights the benefits of verbal reminders from colleagues when staff deviate from agreed guidelines.<sup>137</sup> In the latter study the proportion of staff who wore gloves when inserting an IV cannula or taking a blood sample rose from 55% to over 80% when reminded to do so by colleagues. Champions or opinion leaders to lead guideline implementation have been identified as important facilitators to a successful outcome,<sup>289</sup> and appear to be as

effective as other strategies to implement evidence based practice.<sup>290</sup> In the present study VTE risk assessment improved dramatically when the AMU consultants took responsibility for leading practice and constantly reminded junior staff during ward rounds that VTE risk assessments must be completed for each patient.

#### **7.2.4 Financial incentives and penalties**

NHS England is currently reviewing financial incentives and sanctions and has published a discussion document for stakeholders<sup>291</sup> in order to determine how to ensure that the incentives and penalties deliver both the desired outcomes and high quality care. This should help address some of the issues identified by the Cochrane review<sup>236</sup> and the London analysis of the CQUIN scheme<sup>240</sup> such as the fact that quality may not equate with performance as comments about this aspect are specifically requested. The discussion document also asks whether the current range of sanctions is manageable for NHS Trusts which goes some way to recognising the resources required to effectively implement change and collect audit data.

#### **7.2.5 Education and training**

A recurrent theme identified during the interviews for both VTE and medicines reconciliation was the paucity of specific training provided. Almost half of those interviewed about VTE had had no training and although the majority of doctors said that they had received training in taking a medication history at university the majority were unable to recall any details. The outcomes to be delivered by undergraduate medical training are published by the GMC<sup>19</sup> however each medical school designs its own curriculum to deliver training. Hence students may have had very different levels of training or experience in specific aspects of medicine depending on the medical school attended, their time since graduation and also their clinical placements. The training outcomes to be delivered for newly qualified doctors who are provisionally registered are also published by the GMC<sup>292</sup> and postgraduate medical deaneries are responsible for ensuring that outcomes are met, however once again individual experience is variable. If new guidance is to be implemented effectively then a comprehensive education strategy is required to

ensure that all appropriate staff understand the rationale behind it and their role in its implementation.

### **7.2.6 Admissions process**

There appeared to be no formal induction for medical staff working on the study AMU which resulted in reduced efficiency and contributed to delays in the admission process and implementation of guidelines and best practice. The introduction of a brief induction for all staff in which they are given an overview of the AMU working procedures, shown the location of key items such as paperwork and the equipment store and the meanings of the various symbols on the whiteboard explained should help to improve the situation. As doctors rotate very frequently inductions would be required on an on-going basis and would be most effective if carried out by a regular AMU staff member such as the nurse clinician and/or the senior AMU nurses. A checklist of important tasks to be carried out for each patient including VTE risk assessment may also be useful. At the start of their first AMU ward round an explanation by the lead consultant of the format of the ward round, the reason for the various mandatory risk assessments including VTE and the individual's responsibility in the process may be effective. In the longer term moving to a greater proportion of AMU based staff rather than 'hot-block' rotational doctors would ensure that those responsible for clerking were more familiar with the AMU working environment and therefore less likely to make errors.

### **7.3 Personal reflections**

For both VTE risk assessment and medicines reconciliation the poor compliance with national guidance appeared to stem partly from a lack of awareness, both of the guidance and the associated risks, by staff and partly from unwillingness to complete additional paperwork. As expected targets imposed by government resulted in a focus on VTE by the Trust board, consultants were required to explain why results were poor and as a consequence they took a greater interest in VTE and led implementation of the guidance. The increase in prescribing errors is more difficult to explain. It seems unlikely to be due to a change in the competence of medical staff as the numbers and grades remained constant throughout the study. The number of patients admitted via AMU also remained constant so it was unlikely

to be due to workload pressure. However as the study progressed more beds in the hospital were closed resulting in an increasing shortage. It is possible that doctors were under pressure to clerk patients more rapidly, so that the bed could then be made available for the next waiting patient, resulting in a reduction in attention to detail and more prescribing errors. The increased number of pharmacist hours available for medicines reconciliation in the final study period may also have had an impact. This additional time may have enabled pharmacists to be more diligent in the medicines reconciliation process and allowed identification and/or documentation of more errors.

#### **7.4 Personal skills developed**

As an experienced hospital pharmacist during my career I had gained significant experience in five of the six clusters of competencies required for a consultant pharmacist<sup>293</sup> namely expert professional practice, building working relationships, leadership, management and education and training. However I had little experience of the final cluster, research and evaluation. As a result of completing a PhD I have gained skills in planning a research study, submitting an ethics application, using different research methodologies, using data analysis tools such as SPSS and Minitab, preparing abstracts and posters and presenting research findings orally at conferences. I have also learnt how to write for publication having had two papers published prior to submitting my thesis. I have used my research skills to help two post graduate pharmacy diploma students to develop proposals for audits and hope to assist a newly recruited PhD student with her studies. In the future I hope to be able to continue to do some research as part of my consultant pharmacist role, publish my findings and further develop my skills.

#### **7.5 Implications for research and practice**

The use of observations, interviews and audit of case notes proved to be a successful methodology for gaining a broad, yet in depth picture of staff perceptions, practices and outcomes in relation to the implementation of VTE and medicines reconciliation guidance. The use of this methodology may be useful for investigating other aspects of healthcare when effecting a change in practice is proving difficult and the contributory factors are unknown.

Since data collection was completed the study Trust has made a number of changes to improve both efficiency and patient safety as a result of a brief report, based on incidental observations made during the study, which was provided at the request of the Divisional Medical Director (see section 4.4.7, page 66). However further changes, such as providing a brief induction for all new staff and having a nominated team leader for 'hot block' doctors would also help to improve working practices. Staff in Nottingham<sup>180</sup> analysed their workload and changed the medical rotas to match the peaks in demand, the data presented in the results of this study may help the study Trust to make similar changes.

Implementing national guidance proved to be suboptimal, which is of concern given the quantity of guidance issued by NICE requiring implementation and the number of quality standards which have to be adhered to by NHS Trusts. When implementing guidance it should not be assumed that all outcomes will be positive as this study showed that although implementation of VTE guidance did reduce the risk of developing a clot for the majority of patients, there was an increase in the number of patients who received LMWH inappropriately and a small minority developed bleeding as a result of prophylaxis with LMWH.

Staff knowledge was part of the reason for failure to implement guidance and providing appropriate education in a timely way remains a challenge when staff change jobs every few months. The mandatory Trust induction programme is very intensive and much of the information provided is soon forgotten as staff have to learn their new roles. Information is more likely to be remembered if it is provided when needed, an introduction to AMU in general by nursing staff and ward round procedures by a consultant as described above may be more effective. Training in medicines reconciliation is more likely to be effective if it takes place on the wards so that medical students / junior doctors see the real problems, learn how to overcome them and the potential adverse outcomes can be discussed. However this is very labour intensive for pharmacy staff, who are the medicines experts and therefore best placed to provide this training, and so may not be a practical solution in all Trusts.

Both VTE risk assessment and medicines reconciliation are patient safety issues and thus it is extremely important to the study Trust that these risks are minimised. A government focus has resulted in a significant reduction in the VTE associated risks on admission to hospital although regular audits are required to ensure that standards are maintained. However the medicines reconciliation results show that almost half of patients have an error in their admission prescription and this proportion has increased over time. Both the proportion of patients for whom medicines reconciliation was carried out overall and the proportion completed within 24 hours of admission out increased when a greater number of pharmacist hours were allocated to AMU. This should prompt a review of the provision of pharmacy clinical services within the study Trust with a greater focus on newly admitted patients to ensure that medication errors are resolved as early as possible in the patient's admission. A recent document published by the Academy of Royal Colleges should support reconsideration of pharmacy weekend services.<sup>294</sup>

## **7.6 Suggestions for further research**

Further research is required to assess the applicability of the results from this study to different hospital environments e.g. district general hospitals and the private sector. Visits to two other local AMUs during the study period demonstrated a number differences including bed allocation, such as the inclusion of 'short stay' beds within the AMU, staffing levels, shift patterns and frequency and duration of ward rounds. Investigation of the characteristics and operational procedures of different AMUs may help to identify those factors which constitute the 'ideal' AMU in order to provide the best possible care within the available NHS resources.

No publications were identified in the literature which used the UKMI tool for omitted medicines<sup>176</sup> to assess the impact of prescribing errors of omission therefore further work is required to validate the results from this study.

Trust data showed that there was a significant increase in GI bleeds from 2009 to 2011 when routine VTE prophylaxis with LMWH was introduced for medical patients. This requires further investigation of the patients involved to ascertain whether the use of LMWH is causative or whether other factors are involved.



Staff in both the VTE and medicines reconciliation arms of the study appeared to know the theory but failed to apply this in practice, further research is needed to understand why this happens in order to improve patient care. A study from The Netherlands involving physiotherapists<sup>285</sup> investigated the role which personal awareness of behaviour has in guideline implementation, those who were aware of their own adherence to low back pain guidelines were more likely to comply with the guidance. It would be interesting to carry out a similar study to investigate prescribing on admission to hospital. As electronic prescribing systems become more widely used it should be possible to identify prescribers more easily and provide individual feedback on prescribing error rates. The prescribing error rates of those who were given personal feedback and those who were not could potentially be compared.

The study raised some issues regarding medical education and how staff keep up to date with new guidance and recommended changes in practice. Further research is required to better understand the processes involved in implementing new guidance effectively including barriers and facilitators. Despite new ways of delivering medical education, such as problem based learning, a recent study shows that new doctors still feel inadequately prepared for managing acutely unwell patients and prescribing,<sup>295</sup> hence further research into the most effective methods of teaching these skills would be beneficial. Some medical schools including Liverpool are now involving pharmacists in medicines reconciliation training, it would be interesting to investigate whether or not new doctors who have received ward based pharmacy training are able to generate a more accurate medication history or make fewer prescribing errors.

The pharmacist researcher was in demand throughout the data collection period, especially when conducting observations outside of pharmacy opening hours, to answer a wide variety of queries. In addition once pharmacists had identified omissions and/or errors in prescriptions it took considerable time for these to be resolved. Research is needed to investigate the potential value of a pharmacist confirming the patient's medication history either shortly before or immediately after the clerking process and also the potential value of having a pharmacist

available on the ward for extended periods of the day to answer queries and provide advice. Pharmacist prescribers are increasing in number and their potential value working in an AMU is another area where there is limited published data. Pharmacist prescribers are able to review case notes and prescribe or withhold omitted medication, taking account of results of investigations and the patient's clinical condition. However one potential drawback of providing a pharmacy prescribing service may be the deskilling of junior medical staff.

## **7.7 Conclusion**

For VTE risk assessment the study shows that a national financial sanction resulting in a consultant led approach was associated with effective implementation of guidance. However it remains to be seen whether the level of achievement can be maintained as new targets are added in a culture of organisational change. Strong clinical leadership appeared to be the most effective way of implementing the change in clinical practice. Hospitals should take note of the amount of time, energy and effort needed to implement new guidance effectively and be mindful of the potential for adverse outcomes as this study showed not only an increased uptake of VTE risk assessment but also an increase in the number of patients who were inappropriately prescribed LMWH and therefore at increased risk of bleeding.

The study interviews showed that medical staff have the necessary knowledge to establish an accurate medication history and are aware of the potential pitfalls, but observations showed that theoretical knowledge is frequently not put into practice. Therefore a reduction in prescribing errors could be achieved if a mechanism can be found to implement existing guidance effectively. Improved awareness training highlighting the extent of the problem may be beneficial, but improving access to patient medication histories and alternative strategies for involving pharmacists should also be considered.

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## Appendices

### Appendix 1: Abstract for oral presentation – HSRPP conference 2009

#### Is the management of medical patients admitted to hospital and at risk of DVT optimal?

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#### Introduction

A Health Select Committee inquiry in 2004 stated that venous thromboembolism (VTE) is the immediate cause of death in 10% of patients who die in hospital (1). Audits in a large teaching hospital in recent years have shown poor compliance with Trust policy and medical patients remain at risk of VTE. In 2007 an independent expert working group recommended a mandatory VTE risk assessment of every hospitalised patient on admission (2) and in autumn 2008 the Department of Health (DoH) introduced a screening tool for VTE which is recommended for use by all acute trusts. There is significant literature available regarding the risks and benefits of VTE prophylaxis for surgical patients (3) there is much less published data available relating specifically to medical patients.

#### Objectives

The project will investigate the impact of routine use of the recommended screening tool on the identification and management of patients at risk of VTE on admission to hospital in terms of the risks and benefits associated with prophylactic treatment.

Ultimately it is anticipated this will lead to the development and testing of a framework to ensure all medical patients receive appropriate assessment of their individual risk of VTE on admission to hospital and appropriate treatment.

#### Methodology

- A literature search will be carried out to identify and assess the risk factors associated with VTE in medical patients and evaluate the available risk assessment tools.
- It is proposed to follow a group of patients throughout their hospital in-patient stay and on discharge to identify whether or not screening for risk factors was carried out, whether prophylactic treatment was prescribed, how many patients developed adverse effects as a result and how many patients developed VTE.
- The study will also investigate how healthcare staff interpret and implement national guidance probably using one or more semi structured interviews.
- The risks and benefits of using a screening tool to prevent VTE in medical patients will be assessed in economic terms.

#### Benefits of Session

I have no previous experience of undertaking research. I would welcome advice regarding:

- Is it possible / practical to 'grade' risk factors for VTE either from the literature or from an observational study?
- What is the most effective way to obtain the views of hospital medical staff?
- What is the most efficient way of following up patients once they have been discharged from hospital?
- How to get an NHS ethics submission 'right first time'.

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3. National Collaborating Centre for Acute Care; Reducing the risk of venous thromboembolism (deep vein thrombosis and pulmonary embolism) in patients undergoing surgery April 2007

## Appendix 2: RLUH Risk assessment form for study

<b>Project Acronym:</b>	VTE	<b>Summary</b>	Changing practice to reduce the risk of medical patients developing venous thromboembolism (VTE)
<b>Project full name</b>	3862		
<b>R&amp;D number</b>			
<b>Chief Investigator (CI):</b>	Miss Basey	<b>Employer of CI:</b>	RLBUHT
<b>Intervention:</b>		<b>Sponsor(s):</b>	RLBUHT + JMU
		<b>Funder:</b>	
<b>ISRCTN (if applicable)</b>		<b>Funder Ref:</b>	
<b>Date of Assessment</b>		<b>21/08/2009</b>	
<b>Number of Risk Categories Identified</b>		<b>6</b>	
<b>Range of scores per category (min-max)</b>		<b>2-6</b>	
<b>Minimum Possible Total Score</b>		<b>6</b>	
<b>Maximum Possible Total Score</b>		<b>150</b>	
(Sum maximum score possible i.e. 25 x number of categories)			
<b>Total Score for Trial</b>		<b>23</b>	
(Sum of scores from all Categories)			
<b>Mean Score for Trial</b>		<b>3.8</b>	
(Calculated as total score/number of categories)			
<b>Overall % Risk</b>		<b>15%</b>	
(Calculated as [Total score/maximum possible score] x 100)			
<b>Category of Risk (circle)</b>		<b>Low</b>	If score ≤ 20%
		Moderate	If score ≥20 to ≤ 50%

				High	If score $\geq 50$ to $\leq 100\%$
Specific Hazard	Impact (I) 1 Low 2 Moderate 3 Significant 4 Severe 5 Catastrophic	Likelihood of it happening (L) 1 Remote 2 Unlikely 3 Possible 4 Likely 5 Certain	Risk (I X L)	Management strategies of sponsor	Management strategies of CI/PI
<b>Intervention risk to Patient</b>  Questionnaire  Tissue sample Interview  X-ray	1	2	2	Interview schedule will be ethically approved  Staff will be consented for observation and interview	Should the observer see bad practice the observation will be stopped and the manager informed  If the patient or staff appear agitated or ask the PI to leave they will do so
<b>Inexperienced clinical Research team</b> Lack of staff training  Adverse events from wrong administration of intervention  Withdrawal  Poor or no consenting  Breach of patient confidentiality	3	2	6	Academic supervision for PhD  All data to be held on NHS computer, anonymised data only to JMU	Withdrawals to be reviewed  PI doing all data collection
<b>Organisational complexity of</b>					



Specific Hazard	Impact (I) 1 Low 2 Moderate 3 Significant 4 Severe 5 Catastrophic	Likelihood of it happening (L) 1 Remote 2 Unlikely 3 Possible 4 Likely 5 Certain	Risk (I X L)	Management strategies of sponsor	Management strategies of CI/PI
<p><b>study</b> Protocol violations/deviations</p> <p>Communication issues Departments/other members of health care team not aware of study. Randomisation</p> <p><b>Value of study / rigor</b> Insufficient study power Poor recruitment Fraudulent data Violation of eligibility criteria Missing outcome results Missing data</p> <p><b>Service impact</b> Departments not approached for their involvement Opportunity costs not accounted for Insufficient resources available Appropriate licenses not in place</p> <p><b>Organisational Hazards</b> Intellectual property opportunities overlooked.</p>	<p>2</p> <p>3</p> <p>3</p> <p>1</p>	<p>2</p> <p>1</p> <p>2</p> <p>2</p>	<p>4</p> <p>3</p> <p>6</p> <p>2</p>	<p>PI undertaking all data collection</p> <p>Pharmacy has given permission for study.</p> <p>AMU to be approached</p> <p>Academic supervision from JMU as part of PhD</p> <p>Recruitment for 1 week per 3 months for a total of 6 weeks, if necessary can be repeated next week.</p> <p>Pharmacy and AMU to give approval prior to start of study</p> <p>Research part of PI job description</p>	<p>As above</p> <p>To report any IP if found</p>

Specific Hazard	Impact (I) 1 Low 2 Moderate 3 Significant 4 Severe 5 Catastrophic	Likelihood of it happening (L) 1 Remote 2 Unlikely 3 Possible 4 Likely 5 Certain	Risk (I X L)	Management strategies of sponsor	Management strategies of CI/PI
Adverse publicity for Trust Insufficient Insurance Insufficient finance				PI feels IP unlikely  NHSLA insurance in place  Pharmacy has agreed time with PI	PI to advise Trust R&D department of any publications prior to submission to publishers

The following signatories have reviewed and approved this risk assessment

On Behalf of RLBUHT

.....

Signature

Print Name

Date

The Chief Investigator

.....

Signature

Print Name

Date

## Appendix 3: Admission process data collection form

### Medical Admissions Study

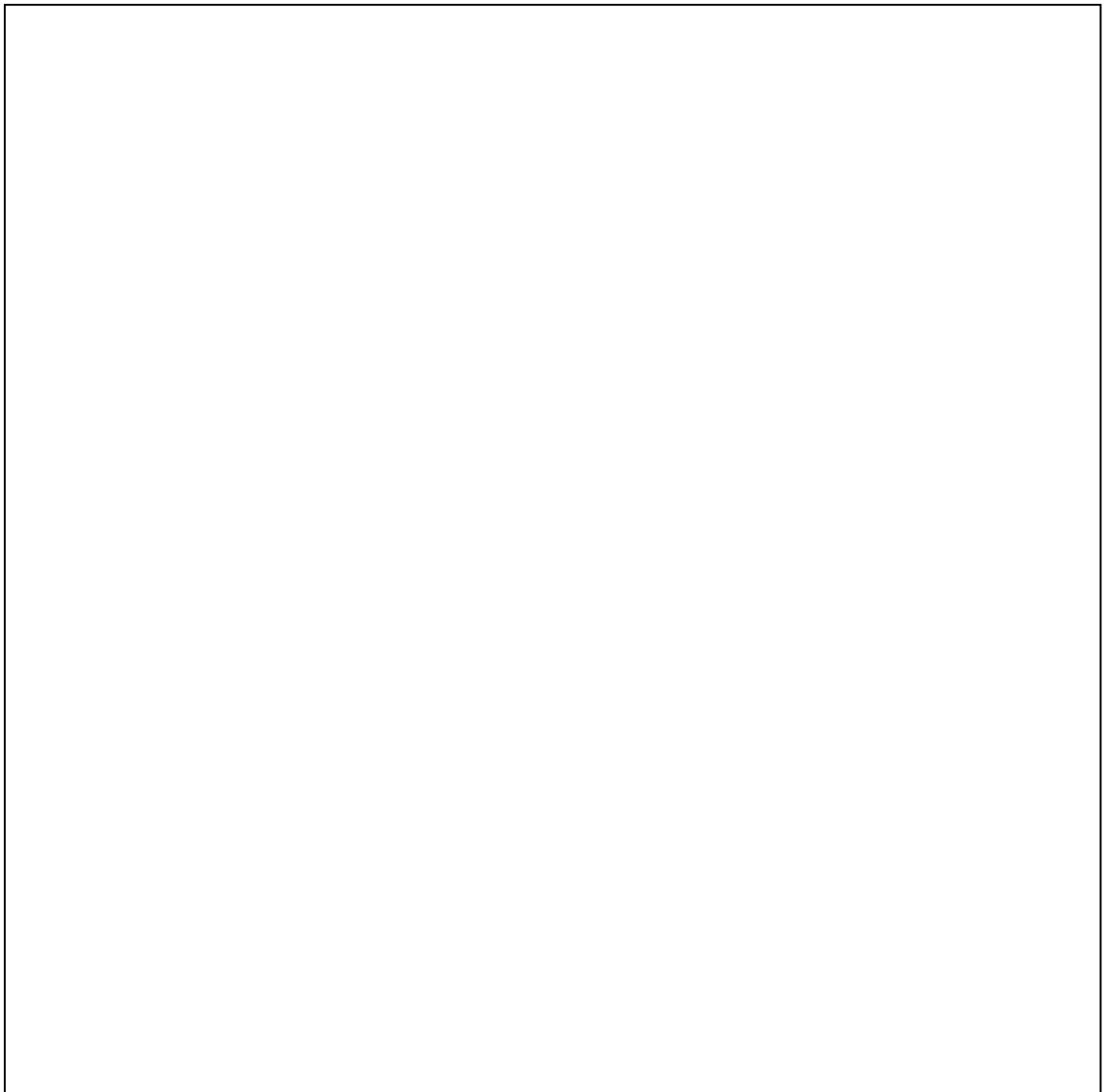
#### Admission Process Data Collection Form

Date :.....

Start Time: .....Finish time: .....

Doctor / nurse number: .....

Patient Study Number: .....

A large, empty rectangular box with a thin black border, occupying the lower half of the page. It is intended for the collection of admission process data.

**Sources of information**

Information provided by GP / Matron / Walk in centre/ NH / Other? .....

What information was asked of the patient?

What information was taken from the patient's own medicines?

Sources of information	Available?	Used?	For RA or Rx?
GP repeat form	Y / N	Y / N	RA / Rx
MAR chart	Y / N	Y / N	RA / Rx
EMIS Web	Y / N	Y / N	RA / Rx
Previous TTO / Drug chart	Y / N	Y / N	RA / Rx
Telephone GP surgery	Y / N	Y / N	RA / Rx
ICE	Y / N	Y / N	RA / Rx
Old notes	Y / N	Y / N	RA / Rx
Other .....	Y / N	Y / N	RA / Rx

Details

**Trust Risk assessment form:**

Available in admission pack?      Yes       No

Completed?      Yes       No       Partial .....

Any other evidence of risk assessment?

**Outcome**

Prophylaxis indicated? Y / N / Lack of information / clinically unclear

Details

Any contraindications identified? Y / N

Details

Dalteparin prescribed? Y / N      5,000 units od       2,500 units od

Reason for dose reduction?.....

Alternative prophylaxis prescribed? .....

TED stockings prescribed? Y / N      Appropriate? Y / N .....

Regular medication prescribed? Y / N      Time of Rx: .....

Accurate? Y / N

Complete? Y / N

Appropriate? Y / N

## Appendix 4: VTE interview schedule

### Medical Admissions Study

#### Interview Schedule for Healthcare Professionals

Date of interview: ..... Doctor / Nurse Study Number: .....

Age:            22-25            26-30            31-35            36-40            40+

Grade: AfC6   AfC7   F1   F2   ST1   ST2   St3   ST4   ST5   Cons  
Other.....

Are you:                      Based in AMU?            How long have you worked in AMU? .....

Hot block?                      On-call?            Other.....

Specialty experience in last 2 years: .....

Which are you going to specialise in: .....

My research project is about VTE but I would be grateful if you don't tell other AMU staff this information

#### Training:

Have you had any training in VTE risk assessment?                      Where: .....

Duration: .....How long ago: .....            Details.....

How do you rate your current knowledge of VTE risk assessment and prophylaxis?

Below average                      average                      good

#### Understanding

i. How many deaths do you think are caused by VTE in the UK each year? (Show flash card and ask interviewee to indicate position of death due to VTE in the list provided)

ii. In your experience what proportion of medical patients do you think have risk factors for VTE..... %

iii. In your experience for what proportion of those at risk do you think have a contraindication to LMWH? .....%

iv. Which VTE risk factors do you look for in your patients?

.....

v. Are there any situations where you would withhold VTE prophylaxis?

.....

**Policy**

- vi. Tell me which policies/ guidance for the prevention of Thromboembolism you are aware of?  
 local?.....national?.....
- vii. Have you read them? .....or used them? .....
- viii. Have you seen the Trust VTE risk assessment form? Y / N
- ix. Have you used it? Y / N If not why? .....
- x. How easy do you find it to use? .....  
 Complicated? Time consuming?
- xi. What would you prescribe for VTE prophylaxis? .....Dose? .....  
 Are there any situations when you would use a reduced dose? .....

**Roles**

Thinking about patients admitted directly to AMU from GP / Walk in centre:

- xii. Whose job do you think it is to complete the risk assessment? .....
- Is the responsibility clear? .....
- xiii. Who should prescribe prophylaxis? .....
- xiv. At what stage in the admissions process should prescribing take place? .....
- xv. What do you think your role is in the prevention of VTE for these patients? .....
- If the patient is admitted via ED: Should the process be any different.....
- xvi. Who should complete the risk assessment? .....
- xvii. At what stage should prophylaxis be prescribed? .....By whom?.....

**Current position**

- xviii. What proportion of medical patients for whom VTE prophylaxis is indicated do you think currently have it prescribed? ..... %
- xix. Tell them RLUH audit January 2009 showed dalteparin prophylaxis was prescribed for approximately 30% of patients for whom it was indicated Does this surprise you?
- xx. Why do you think getting VTE prophylaxis right is proving difficult? .....
- RA tool? Time? Responsibility unclear? Training? Access to policy?
- xxi. Have you any suggestions as to how we can increase the number of patients who receive appropriate prophylaxis?



## Appendix 5: Medicines reconciliation interview schedule

### Medical Admissions Study

#### Medicines Reconciliation Interview Schedule for Healthcare Staff

Date of interview: ..... Doctor / Nurse Study Number: .....

Age:            22-25            26-30            31-35            36-40            40+

Grade: AfC8    F1        F2        ST1    ST2    St3    ST4    ST5    Cons Other :.....

Are you:                      Based in AMU?                      How long have you worked in AMU? .....

Hot block?                      On-call?                      Other.....

Specialty experience in last 2 years: .....

Which are you going to specialise in: .....

My research project is about Med Rec but I would be grateful if you don't tell other staff this information

#### Training:

Have you had any training in taking medication histories?                      Where: .....

Duration: .....How long ago: .....                      Details.....

Do you think the training you received was adequate? .....

#### Understanding

i.    What proportion of hospital prescriptions do you think contain an error .....%

ii.   What proportion of the above errors in do you think could potentially have serious consequences.....%

Tell them GMC report (North West) 2009 13.4% prescriptions contained an error, of which 1.74% potentially lethal

iii.   How do you rate your current ability to document an accurate medication history?

Below average                      average                      good

#### Policy

iv.   Tell me which policies/ guidance for the documentation of medication histories you are aware of?

local?.....national?.....

v.    Have you read them.....

**Current Practice**

vi. Which sources do you use when you are documenting a medication history?

.....

vii. Do you ever use more than one source to cross check?

Never    Sometimes    Always

viii. Why do you sometimes use more than one source?

ix. Are there any situations when you wouldn't use the patient as a single source?.....

x. Describe any problems you find in documenting accurate medication histories.....

.....

xi. Are there any situations where you wouldn't document a medication history?.....

.....

xii. What action do you take if you are unable to document a medication history?.....

.....

xiii. How often do you discuss medicines with the patient before prescribing?

Always          Usually          Sometimes          Rarely          Never

Are there any situations when you wouldn't discuss medicines with the patient before prescribing? .....

xiv. Are there any situations when a medication chart is unnecessary? .....

**Roles**

xv. Do you think that prescriptions should be checked? .....

xvi. By whom? .....

xvii. How soon after they are written? .....

**Current position**

xviii. What proportion of prescriptions written in AMU do you think contain an error ..... %

Tell them RLUH audit 2009 / 2010 showed 37% had an error (208 / 553)

xix. Does this surprise you? .....

xx. Have you any suggestions as to how we can reduce the number of prescribing errors?

## Appendix 6: Case note data collection form

### Medical Admissions Study

#### Case Note Data Collection form

Patient study number: ..... Age: ..... M / F

Admission date: ..... Time: .....

Admission from: GP    ED    Walk in centre    Community Matron    OPD    Other hosp.

Principal diagnosis: .....

Risk assessment form completed    Yes     No     Partial.....

Any other documented risk assessment?    Yes     No     Date ....Time: ....

Details: .....

<b>VTE risk factors identified:</b>	<b>Documented on form</b>	<b>Verified from notes</b>
Age > 60 years	<input type="checkbox"/>	<input type="checkbox"/>
Acute or chronic lung disease	<input type="checkbox"/>	<input type="checkbox"/>
Chronic heart failure	<input type="checkbox"/>	<input type="checkbox"/>
Acute infectious disease (e.g. pneumonia)	<input type="checkbox"/>	<input type="checkbox"/>
Acute or chronic inflammatory disease	<input type="checkbox"/>	<input type="checkbox"/>
Active cancer or myeloproliferative disorder	<input type="checkbox"/>	<input type="checkbox"/>
Diabetic hyperosmotic hyperglycaemic state	<input type="checkbox"/>	<input type="checkbox"/>
Nephrotic syndrome	<input type="checkbox"/>	<input type="checkbox"/>
Hormone therapy containing oestrogen (HRT or OCP)	<input type="checkbox"/>	<input type="checkbox"/>
Expected to be immobile for 3 days or more	<input type="checkbox"/>	<input type="checkbox"/>
Personal or family history of DVT or PE	<input type="checkbox"/>	<input type="checkbox"/>
Lower limb paralysis (excluding acute stroke)	<input type="checkbox"/>	<input type="checkbox"/>
Obesity: BMI > 30	<input type="checkbox"/>	<input type="checkbox"/>
Known thrombophilia	<input type="checkbox"/>	<input type="checkbox"/>
Varicose veins with phlebitis	<input type="checkbox"/>	<input type="checkbox"/>
Pregnant or ≤ 6 weeks post partum	<input type="checkbox"/>	<input type="checkbox"/>

<b>Bleeding Risk identified</b>	<b>Documented on form</b>	<b>Verified from notes</b>
Active bleeding	<input type="checkbox"/>	<input type="checkbox"/>
Taking warfarin or other anticoagulant or antiplatelet therapy	<input type="checkbox"/>	<input type="checkbox"/> .....
Haemophilia or other known bleeding disorder	<input type="checkbox"/>	<input type="checkbox"/>
Acute stroke in past month (haemorrhagic or ischaemic)	<input type="checkbox"/>	<input type="checkbox"/>
Blood pressure > 200 systolic or 120 diastolic	<input type="checkbox"/>	<input type="checkbox"/> .....
Infective endocarditis	<input type="checkbox"/>	<input type="checkbox"/>
Hypersensitivity to heparin	<input type="checkbox"/>	<input type="checkbox"/>
History of Heparin Induced Thrombocytopenia (HIT)	<input type="checkbox"/>	<input type="checkbox"/>
Lumbar puncture in previous 4 hours or indicated now	<input type="checkbox"/>	<input type="checkbox"/>
Known platelet count < 100	<input type="checkbox"/>	<input type="checkbox"/> .....
Severe liver disease (PT raised above normal or known varices)	<input type="checkbox"/>	<input type="checkbox"/> .....
Severe renal disease	<input type="checkbox"/>	<input type="checkbox"/> .....

**Outcome**

**Prescription**

Dalteparin prescribed? Yes  No  No chart  Other: .....

Dose? 5,000 units od  2,500 unit od

Date of first dose: ..... Date of last dose: .....

Reason for delay in treatment? LP  CT scan  None  Other .....

Reason for dose reduction: Elderly   
Low body weight  ..... kg  
↓ Renal function  ..... creatinine mmol / l  
None identified

TED stockings prescribed? Yes  No

Discharge date ..... Length of Stay ..... days

While in hospital developed:

DVT Yes  No  Unknown

PE Yes  No  Unknown

Bleeding Yes  No  Details.....

Date of Death: ..... Cause.....

**Monitoring**

Platelet count: On admission: ..... After 5 days / on discharge..... Date :.....

**Medication History taken by doctor / nurse** Yes  No

Accurate? Yes  No

Medication history confirmed by pharmacist Yes  No  Date: .....

Within 24 hours? Yes  No

Number of discrepancies: significant: ..... trivial ..... out of a total of ..... Items which should be Rx

Details: .....

Date discrepancies rectified ..... Delay: .....

## Appendix 7: Study information sheet – healthcare staff

**Liverpool John Moores University  
and  
Royal Liverpool and Broadgreen  
University Hospitals NHS Trust**



### **Study Information Sheet for Healthcare Staff**

## **Medical Admissions Study – Observations & Interviews**

*You are being invited to take part in a research study. Before you decide it is important that you understand why the research is being done and what it involves. Please take time to read the following information. Ask me if there is anything that is not clear or if you would like more information. Take time to decide if you want to take part or not.*

#### **1. What is the purpose of the study?**

*The study is looking at the admissions process and the roles of the various healthcare staff. Patients may be seen by several healthcare professionals, have numerous investigations and require various treatments. The process is complex; by gaining a better understanding of what happens on admission we hope to improve patient care. The study is being carried out as part of a PhD research project.*

#### **2. What do I have to do if I agree to take part?**

*You will be observed while you clerk in patients to the AMU. You will also be interviewed about your thoughts on the admissions process at a later, mutually convenient date. You don't have to do anything differently when admitting patients; the researcher will simply document*

*what she observes if you feel the researcher's presence is having an adverse effect on patient care you can ask her to leave at any time. If the researcher observes anything which she considers may have a serious adverse impact on patient care she will draw this to your attention.*

*You may choose to participate in the observations, the interview or both.*

### **3. How much of my time will be needed?**

*The observation part of the study will have no impact on your time as the researcher will simply observe what happens; you will not be interrupted or asked questions. You will be observed for a maximum of four hours. It is estimated that the interview will take approximately 30 minutes and it is proposed that this is carried out in the hospital at a mutually convenient time.*

### **4. Are there any risks / benefits involved?**

*This is not an assessment of your competence. There are no risks to you and there will be no changes to your usual routine. You may find it beneficial to discuss the admissions process with the researcher. As a result of the project we hope to improve the admissions process for patients and staff.*

### **5. Will my taking part in the study be kept confidential?**

*The data collected will be anonymised, so that it will be impossible to identify individuals who have participated in the study from any of the reports or publications. All details recorded will be kept secure and confidential. The information collected will be analysed at Liverpool John Moores University. It will be destroyed in line with Trust policies for confidential data when it is no longer needed.*

*If there is a serious breach of Trust policy this will be reported to the appropriate person.*

**6. Do I have to take part?**

*No. It is up to you to decide whether or not to take part; you may choose to participate in the observations or the interviews or both. If you do agree to participate please complete the attached consent form. If you do not want to take part just tell the researcher who gave you this leaflet. You are still free to withdraw at any time and without giving a reason. A decision to withdraw will not affect your employment by the Trust in any way.*

**Who should I contact if I have a question?**

**Miss A J Basey**

**Consultant Pharmacist - Acute Admissions**

**Royal Liverpool University Hospital**

**0151 706 2097**

**Who should I contact if I have a problem with the study?**

**Dr T D Kennedy**

**Consultant Physician & Rheumatologist**

**Royal Liverpool University Hospital**

**0151 706 5897**

**Professor J Krska**

**School of Pharmacy and Biomolecular Sciences**

**Liverpool John Moores University**

**Tel 0151 231 2404**

## Appendix 8: Study information sheet – patients

**Liverpool John Moores University  
and**

**Royal Liverpool and Broadgreen  
University Hospitals NHS Trust**

### **Study Information Sheet for Patients**



### **Medical Admissions Study**

*This sheet gives you some information about the above study. Please take time to read it. Ask me if there is anything that is not clear or if you would like more information.*

#### **1. What is the purpose of the study?**

*We are looking at how doctors and nurses do their jobs when patients come into hospital to make the process easier for everyone.*

#### **2. What will I have to do?**

*Nothing, the study will not affect you in any way. The researcher will watch what happens and make notes about how the doctors and nurses do their job.*

#### **3. Are there any risks involved?**

*There are no risks to you and the study will not affect the treatment you receive.*



**4. Will my taking part in the study be kept confidential?**

*All details recorded will be kept secure and confidential. The information collected will be studied at John Moores University. All personal data will be destroyed within 3 months of completing the study.*

**5. What should I do if I'm not happy with you being here?**

*Just tell the doctor or nurse and I will leave.*

**Who should I contact if I have a question?**

**Miss A J Basey**

**Consultant Pharmacist - Acute Admissions**

**Royal Liverpool University Hospital**

**0151 706 2097**

**Who should I contact if I have a problem with the study?**

**Ask to speak to the Senior Nurse on duty for the Acute Medical Unit**

**Appendix 9: Consent form – staff**

**Liverpool John Moores University  
and**

**Royal Liverpool and Broadgreen  
University Hospitals NHS Trust**



**Consent Form for Healthcare Staff**

**Medical Admissions Study – Observations & Interviews**

**Initial**

1. I confirm that I have read and understand the information provided for the above study. I have had the opportunity to consider the information, ask questions and have had these answered satisfactorily
2. I understand that my participation is voluntary and that I am free to withdraw at any time, without giving a reason and that this will not affect my legal rights.
3. I understand that any personal information collected during the study will remain confidential and that anonymised quotes may be used in publications.
4. I agree to take part in the **observations** for the above study
5. I agree to take part in the **interviews** for the above study

Name of Participant ..... Signature: ..... Date: .....

Name of Researcher: .....Signature: .....Date: .....

*Researcher :*

Miss A J Basey  
Consultant Pharmacist - Royal Liverpool University Hospital  
and PhD Student - School of Pharmacy and Biomolecular Sciences  
Liverpool John Moores University

*Note: When completed 1 copy for participant and 1 copy for researcher*

## **Appendix 10: Case study template – patient admissions observed**

**Patient Study Number:**            **Patient age:**

**Admission time:**

**Duration of clerking:**

**Staff grade:**

**Information provided:**

**Interruptions:**

**Summary of case:**

**VTE RA details:**

**Outcome:**

**VTE**

**Meds rec:**

**Timeline:**

## Appendix 11: Flash card for VTE interviews

The following causes of death in the UK are listed in order of prevalence in the UK – number 1 is the most prevalent.

Where would you place **death due to VTE** in this list?

a

1. Death from Myocardial Infarction

b

2. Death from Breast Cancer

c

3. Death from Road Traffic Accidents

d

4. Death from MRSA infection

e

## Appendix 12: Flash card for VTE interviews - answers

The following causes of death in the UK are listed in order of prevalence in the UK – number 1 is the most prevalent.

Where would you place **death due to VTE** in this list?

a

1. Death from Myocardial Infarction (33k per annum)

b (VTE 25k per annum)

2. Death from Breast Cancer (11k per annum)

c

3. Death from Road Traffic Accidents (6k per annum)

d

4. Death from MRSA infection (1.5k per annum)

e

## Appendix 13: VTE Ranking Form

### Ranking Form for Risk Factors

Interview Date.....

Study no .....

Rank the following VTE risk factors where 1 is not very important and 5 is extremely important:

	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
Age > 60 years	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Acute or chronic lung disease	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Chronic heart failure	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Acute infectious disease (e.g. pneumonia)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Acute or chronic inflammatory disease	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Active cancer or myeloproliferative disorder	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Diabetic hyperosmotic hyperglycaemic state	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Nephrotic syndrome	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Hormone therapy containing oestrogen (HRT or OCP)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Expected to be immobile for 3 days or more	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Personal or family history of DVT or PE	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Lower limb paralysis (excluding acute stroke)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Obesity: BMI > 30	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Known thrombophilia	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Varicose veins with phlebitis	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Pregnant or ≤ 6 weeks post partum	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

Do the same for the following bleeding risk factors – 1 is not very important and 5 is extremely important:

	<b>1</b>	<b>2</b>	<b>3</b>	<b>4</b>	<b>5</b>
Active bleeding	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Taking warfarin / anticoagulant or antiplatelet therapy	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Haemophilia or other known bleeding disorder	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Acute stroke in past month (haemorrhagic or ischaemic)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Blood pressure > 200 systolic or 120 diastolic	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Infective endocarditis	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Hypersensitivity to heparin	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
History of Heparin Induced Thrombocytopenia (HIT)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Lumbar puncture in previous 4 hours or indicated now	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Known platelet count < 100	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Severe liver disease (PT above normal or known varices)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Severe renal disease	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

## Appendix 14: Medicines Reconciliation Ranking Form

### Medicines Reconciliation Ranking Form

Interview Date.....

Study no .....

How often would you use the following sources of information when documenting a medication history?

Source	Never (Why not?)	Sometimes	Always
GP / Walk in centre / Matron / Summary or Letter			
GP repeat form (green)			
GP surgery (by telephone)			
Patient			
Relative / Carer			
Patients own medication list			
Patients own medicines			
MAR chart from Nursing Home			
Previous medication chart			
Previous TTO			
EMIS web			
Renal Proton system			
Other source (please state)			

Rank the following information sources according to how useful you find them; 1 is not very useful and 5 is extremely useful:

	1	2	3	4	5
EMIS web	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
GP / Walk in centre / Matron / Summary or Letter	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
GP repeat form (green)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
GP surgery (by telephone)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
MAR chart from nursing home	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Patient / Relative / Carer	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Patients own medication list	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Patients own medicines	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Previous medication chart	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Previous TTO	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Renal proton system	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

**Appendix 15: Case Summary template – LMWH contraindicated but prescribed**

**Patient number:**            **Patient age:**

**Medical problems:**

**Number of VTE risk factors:**

Details:

**Numbers of bleeding risk factors:**

Details:

**Benefit outweighs risk: Yes / No**



## **Appendix 16: Case studies – patient admissions observed (71 patients)**

### **Patient A1** (46 M)

**Admission time:** 11.26 (Monday)

**Clerking time:** 11.55 – 12.45 (50 minutes)

**Staff:** F2 doctor

**Information provided:** GP proforma

**Interruptions:** None

#### **Summary**

Patient presented with pain in calf; hot red leg. Previous DVT following knee surgery 15 years ago. The doctor asked if the patient had taken any painkillers however when they patient indicated that they had taken analgesia no further questions were asked at this stage. The doctor asked if the patient had ever had warfarin, they said not and were unsure when asked if they had ever had Fragmin before. When asked, the patient said they took no regular medication but had taken OTC aspirin 300mg 4 hourly for the past 2 weeks  
Doppler ordered – ICE confirmed previous thrombus

**VTE RA** – not available

**MH** – Nil regular; medication chart not written

#### **Outcome**

Dalteparin not prescribed as doctor was not sure if therapeutic dalteparin would be needed. Asked for my advice re the use of therapeutic dalteparin; I explained the need for the patients weight and asked the nurse to weigh the patient. Dalteparin was had not been prescribed when the clerking was completed. Length of stay 8 days.

### **Patient A2** (57 M)

**Admission time:** 11.37 (Monday)

**Clerking time:** 12.45 – 13.55 (70 minutes)

**Staff:** F2 doctor

**Information provided:** GP proforma

**Interruptions:** None

#### **Summary**

Presented with painful left knee, 3 – 4 weeks duration. Has an orthopaedic appointment at Broadgreen in 2 weeks time. Pain affecting quality of life as unable to walk Patient listed medicines diclofenac 50mg bd to tds, tramadol 100mg BD, co-codamol 3/500 approx 4 od, Nexium / ? omeprazole 20mg od; patient not sure of product.

**VTE RA** – not available

**Outcome**

Doppler results awaited before prescribing dalteparin – may need therapeutic dose. Regular medication prescribed – no errors 5 items. Length of stay 2 days.

**Patient A10** (63 M)

**Admission time:** 12.40 (Wednesday)

**Clerking time:** 15.25 – 17.05 (90 minutes)

**Staff:** F2 doctor

**Information provided:** GP summary

**Interruptions:** 15.55 by colleague re patient seen earlier – returned at 16.15  
16.15 by consultant re ECG for patient seen earlier – had to order investigations on ICE  
Pt with sore venflon site – nurse asked doctor to review

**Summary**

Patient was seen with carer; carer provided information. Patient has had recent fall and has had a headache since. Also complaining of whistling in ears and numbness in arms and legs. When asked about medicines, the carer produced some Venalinks and said the patient also uses inhalers. The doctor made no notes during the interview but took patients own medicines to the doctors office at the end of the examination and copied the details from the labels into the case notes

**VTE RA** – not available

**Outcome**

Dalteparin not indicated ?sub dural haematoma following fall however drug chart was not written at the time of clerking. Medication history was not checked by a pharmacist but comparison of prescription with MAR chart from NH – tiotropium inhaler missing. Length of stay 1 day.

**Patient A3** (77F)

**Admission time:** (16.39 Monday)

**Clerking time:** 17.15 – 17.50 (35 minutes)

**Staff:** Consultant

**Information provided:** GP letter

**Interruptions:** None

**Summary**

Patient has not been eating and drinking - ?UTI. Dehydrated and drowsy. Patients daughter present and has Venalink containing MST 30mg BD + 10mg om Mon & Thurs am (dressing changes). Daughter also offered information re recent antibiotics – flucloxacillin for infected leg ulcers

VTE RA – Not available

**Outcome**

Dalteparin not prescribed – regular medication prescribed. 1 error out of 4 items MST prescribed as 40mg om and 30mg nocte; should be 30mg BD except Mon and Thurs when 40mg BD. Length of stay 47 days.

**Patient A4** (61 F)

**Admission time:** 18.00 (Monday)

**Clerking time:** 17.50 – 18.25 (35 minutes)

**Staff:** Consultant

**Information provided:** GP letter

**Interruptions:** None

**Summary**

Had leg swelling last week, GP prescribed antibiotics. Previous DVT, scan today shows clots. For lifelong warfarin

VTE RA – Not available

**Outcome**

Therapeutic dalteparin, warfarin loading dose prescribed on OP form, referral to anticoagulant clinic. Length of stay 1 day.

**Patient A5** (86 F)

**Admission time:** 21.38 (Tuesday)

**Clerking time:** 09.40 – 10.15 (35 minutes)

**Staff:** SpR

**Information provided:** GP summary and MAR chart

**Interruptions:** None

**Summary**

Patient had been admitted previous day and was seen by SpR for a Senior review. Had hip operation June 2009. Admitted with vomiting (black) and diarrhoea. The doctor asked if the patient had started any new medicines; patient was not able to respond.

VTE RA – Not available and no evidence of RA carried out by admitting doctor

**Outcome**

VTE risk assessed, although not documented, dalteparin prescribed. No drug chart - regular medication copied from MAR chart onto drug chart; unable to assess accuracy as chart not available in case notes at time of audit. Length of stay 9 days.

## Patient A6 (72 M)

**Admission time:** 08.46 (Tuesday)

**Clerking time:** 10.20 – 10.55 (35 minutes)

**Staff:** SpR

**Information provided:** MAR chart

**Interruptions:** Bleep – Patient in resus needs SpR review  
Bleep – ED referral / advice (10 mins)

### Summary

Patient admitted with acute SOB from NH. The patient was confused and had had a previous stroke so communication was with his wife. Diagnosis was CAP – CURB 65 = 3 (no urea available). There was no discussion regarding medication.

**VTE RA** Not available and no evidence of RA carried out by admitting doctor

### Outcome

The medication chart had been written by the ED doctor, the SpR added Fragmin 5,000 units. There were no blood results available on ICE so a note was made to check his renal function later. The medication had been prescribed accurately 0 errors out of 9 items. Length of stay 32 days.

## Patient A7 (65 F)

**Admission time:** 12.21 (Tuesday)

**Clerking time:** 13.10 – 14.00 (50 minutes)

**Staff:** Nurse

**Information provided:** GP summary

**Interruptions:** None

### Summary

Presented with shoulder pain following a fall; right arm is also numb - ? stroke. Patient has arthritis in hips and knees – unable to walk to bus stop and avoids climbing stairs – drives if possible. Asked: “Do you take painkillers?” – Response: “No – I prefer not to” “Do you take any routine medication?” – response “Not at the moment” Patient said that she had tried glucosamine for her knees; she thinks it may have helped but she stopped taking it in July

**VTE RA** – Not available

### Outcome

Blood results not available at the end of the clerking. Paracetamol stat dose prescribed on AMU chart. Medication chart not written as patient will probably go home later and nurse cannot prescribe – patient actually was admitted for 3 days – medication chart written later – 0 errors out of 0 items of regular medication. Length of stay 3 days.

### **Patient A8** (55 F)

**Admission time:** 13.51 (Tuesday)

**Clerking time:** 14.10 – 15.15 (65 minutes)

**Staff:** Nurse

**Information provided:** GP summary

**Interruptions:** None

#### **Summary**

Patient admitted with tingling in arms and legs, pins and needles and numbness, she has reduced grip strength. It starts in her fingers then moves to her hands and face. It started 90 minutes ago today. She has had similar symptoms when she was given pamidronate and developed hypocalcaemia; she now has to take calcium tablets before she has pamidronate. Asked "What do you take for pain?" – response "Solpadol"

GP had provided a list of medicines although it was not accurate when I checked with the patient; the nurse didn't look at the list of medication. The patient had some loose tablets in a pill box which were probably Solpadol.

**VTE RA** – Not available

#### **Outcome**

Medication chart not written, nurse cannot prescribe and patient will probably go home later today. The patient did go home the same day; there was no medication chart in the case notes when they were audited. Length of stay 1 day.

### **Patient A14** (64 M)

**Admission time:** 11.25 (Friday)

**Clerking time:** 11.50 – 12.25 (55 minutes)

**Staff:** Nurse

**Information provided:** Letter from Clatterbridge

**Interruptions:** Charge Nurse came to take patient's blood  
ECG during clerking

#### **Summary**

Known prostate cancer – treated with Zoladex implant and radiotherapy at Clatterbridge. Presented with jaundice for the last 4 days. Also has dry mouth and is SOB, blood results show abnormal LFTs. Initially no questions were asked re medication, nurse went back to ask while she was writing up the clerking – PRN paracetamol

**VTE RA** – Not available

**Outcome**

No VTE RA or prophylaxis prescribed – patient at risk due to age and active cancer but results not yet available. Nurse cannot not prescribe; no medication chart written. 0 errors in 0 items when case notes audited. Length of stay 7 days.

**Patient A13** (71 F)

**Admission time:** 16.30 (Thursday)

**Clerking time:** 17.10 – 20.10 (180 minutes)

**Staff:** F1

**Information provided:** GP repeat dated 24.08.2009 (5 months ago)  
Blue copy of TTO dated 15.09.2009 (4 months ago)  
Patients own medicines

**Interruptions:** 17.30 Daughter arrived  
17.55 Doctor went to take blood sample but patient was on her way to X-Ray  
19.15 Doctor asked to prescribe blood for a different patient  
19.20 Patient with a low K+ needs IV potassium prescribing

**Summary**

No letter. Patient referred by ? Community Matron. Information from triage nurse illegible. Letter from Community Matron found with patients own medicines during consultation. Presented with SOB, tired, can't lie flat – worse over last month. Had headaches for last 3 days.

Doctor asked re medicines “Blue, grey, purple inhalers” Doctor asked about previous antibiotics – unclear how to find out whether she has recently had antibiotics and if so which. Medicines were transcribed from GP repeat complete with doses into the case notes (the TTO was actually more up to date). The doctor did not refer to the patient so listed Movelat Gel and Chlorhexidene mouthwash which the patient had not used for some months. At 20.00 the F1 discussed the patient with the SHO; it was agreed to monitor blood gases then refer to a senior doctor possibly for antibiotic treatment

**Outcome**

Drug chart written; pharmacist prevented prescription of 2 items not currently being taken; 2 further errors out of 16 items identified when MH completed – Nicotinell patch and dihydrocodeine missed off. No consideration of VTE risk, prophylaxis indicated (age, COPD) but not prescribed. Length of stay 5 days.

**Patient A9** (77 M)

**Admission time:** 10.39 (Wednesday)

**Clerking time:** 11.40 – 13.55 (135 minutes)

**Staff:** ST1

**Information provided:** GP summary

**Interruptions:** To supervise LP

**Summary**

Presented with cough / fever /lethargy for last 7 days. Gasping for breath, chest feels tight. Wife volunteered “Steroids and inhaler from GP” – doctor did not follow up. Doctor asked if he had taken any antibiotics recently – response “No” Has had previous MI patient said he is on clopidogrel not aspirin. Says he also has hypertension and is on medication doctor said “we have a list from your GP”.

Previously had a beta blocker which made him pass out due to a slow pulse rate – patient doesn’t know what the beta blocker was for – he doesn’t think he has a heart rhythm problem. Doctor asked re family history of clots – None. Asked if patient on warfarin – No. Explained that patient has AF which increases risk of clots explained need for Fragmin (treatment dose) to patient.

Doctor started writing drug chart before seeing patient, while reading notes. Completed after watching F2 perform LP

**VTE RA** – Not available

**Outcome**

Therapeutic Fragmin for AF

Regular medication prescribed – 0 errors out of 9 items. Length of stay 6 days.

**Patient A11** (67F)

**Admission time:** (11.12 Thursday)

**Clerking time:** 11.40 – 13.20 (100 minutes)

**Staff:** ST1

**Information provided:** GP summary, LHCH medication chart

**Interruptions:** None

**Summary**

Patient transferred from Wd 9 LHCH with decreased oxygen saturation. Consultation difficult as patient unwell. Patient known to have RA – previously treated with methotrexate – not taking currently. Patient needs urgent blood gases – ST1 asked the other SHO to take the blood as access is difficult. Doctor rang radiology for an urgent chest X-ray then went to ED X-Ray to arrange– yesterday there was 2 hours delay; this patient can’t wait 2 hours. Discussed with Med Reg at 12.55 – admit to 6x for BIPAP. 13.00 spoke to ID registrar – recent admission to 3x. ID reg knows patient well – very sensitive to oxygen – type 2 respiratory failure – oxygen stopped. Med Reg arrived 13.05 – patient handed over. 13.10 went to discuss with patients relative 13.20 complete

**VTE RA** – Not available

**Outcome**

No LMWH on copy of chart from LHCH – admission date 30/10/09 (6 days ago) – 14.05 ?PE – wt 35kg dalteparin 7,500 units od prescribed; 14.30 – not PE changed to 2,500 units od Regular medication prescribed from LHCH chart – no case notes from Nov 2009 unable to confirm accuracy.

## Patient A12 (76F)

**Admission time:** 13.52 (Thursday)

**Clerking time:** 14.40 – 16.15 (95minutes)

**Staff:** ST1

**Information provided:** GP summary

**Interruptions:** None

### Summary

Patient from Ghana; consultation via friend acting as interpreter as patient doesn't speak English. Presenting complaint hypertension. Patient did not attend appointment at hypertension clinic yesterday – went to the GP for tablets and the GP sent her to hospital. BP 218/99 Left arm; 232 / 100 right arm. Blood tests and cardiac ECHO ordered – doctor then rang Medical Reg for advice. The doctor did not ask any questions regarding medication.

**VTE RA** - Not available

### Outcome

LMWH contra indicated due to current hypertension – not prescribed. Medication chart written using GP summary - no strength on alendronate and day of week not noted. Adcal D3 missed off – 2 errors out of 7 items. Length of stay 5 days.

## Patient A15 (67M)

**Admission time:** 12.25 (Friday)

**Clerking time:** 13.25 – 14.25 (100 minutes)

**Staff:** F2

**Information provided:** Matron's letter, patients own medicines

**Interruptions:** 13.45 – discussion with CT1 re paracentesis for another patient  
14.00 – personal telephone call in foreign language

### Summary

Matrons letter provided – details of recent antibiotics and steroids but no information re current medication. The doctor was tired having just worked nights the patient had difficulty in comprehending the questions asked (doctors first language not English) and became frustrated and “fed up” – “you always ask the same questions” Patient has been admitted with SOB, when asked about current medication he answered “inhalers” but had his own medicines with him which the doctor said she would look at later. Following the history and examination the doctor wrote up the case notes leaving a space for medication. She then started to write the medication chart but had to go back to the patient to retrieve his medicines – inhalers, Venalink, co-amoxiclav and prednisolone. The medicines were used to write the drug history in the case notes; she struggled with the prednisolone as there was no dose on the carton, I suggested that she opened the carton and looked on the actual container – which was labelled. The medication chart was then written using the list in the case notes. The patient took



Oramorph 5mg PRN for breathlessness, the doctor was surprised as she hadn't come across this before and had to confirm with me that this was appropriate before prescribing.

**VTE RA** – Not available

**Outcome**

LMWH not prescribed, indicated due to age and respiratory disease however blood results not available. Medication chart 2 errors out of 7 items – salbutamol and Spiriva inhalers missed off but patient was prescribed nebulas on admission. Length of stay 13 days.

**Patient A16** (82F)

**Admission time:** 14.38 (Friday)

**Clerking time:** 15.45 – 16.50 (65 minutes)

**Staff:** F1

**Information provided:** GP summary

**Interruptions:** None

**Summary**

Consultation rushed as slot booked for CT head. Presented with weakness of face and slurred speech. Fell over and has large bruise as taking warfarin. Seen initially by Stroke Nurse and went for CT scan with Stroke Nurse at 16.05

Medication copied from GP summary into case notes – no confirmation with patient as they were in CT scan. Warfarin dose of 3 – 4mg copied from Stroke Nurse clerking – unclear where this was from.

**VTE RA** – Not available

**Outcome**

No evidence of VTE RA but patient on warfarin and? Stroke so LMWH not indicated. Regular medication not prescribed initially but remembered as an afterthought – prescribed at 16.45 – 0 errors out of 7 items. Length of stay 5 days.

**Patient B1** (61M)

**Admission time:** 13.53 (Tuesday)

**Clerking time:** 15.45 – 17.05 (80 minutes)

**Staff:** F1

**Information provided:** GP summary

**Interruptions:** To write drug chart and TTO for another patient (10 minutes)

**Summary**

Referred with pain in leg and foot; had back pain for 5 days. Doctor gave a good explanation of what would happen during the examination. Right leg only affected – swollen. Doctor asked re previous clots – none, asked re family history of clots – patient said there was a history of “cardiac problems”. The doctor asked for the patient’s medicines but he hadn’t brought any with him. The doctor took notes while interviewing the patient and then used these to write the case notes; the patient was complicated so the information was not in a logical order.

**VTE RA** – Paper – available and completed – all VTE and Bleeding risks considered

**Outcome**

Patient at VTE risk due to age but possibility of haematoma on spine; LMWH not prescribed at this time. Regular medication prescribed – accurate. (MH not confirmed by pharmacist). Length of stay 1 day.

**Patient B5** (81F)

**Admission time:** 14.55 (Thursday)

**Clerking time:** 16.10 – 17.25 (75 minutes)

**Staff:** F1

**Information provided:** None (pt referred by GP)

**Interruptions:** To take ‘difficult’ blood (5 minutes)

**Summary**

Patient complaining of lack of energy has had 2 recent courses of antibiotics. Coughing up green phlegm and SOB, struggling to get washed and dressed. Patient had brought in own medication but frusemide had no label. I used EMIS to confirm the dose of frusemide. EMIS and pt own used to write DH in notes – accurate with doses.

**VTE RA** – Paper available and completed

**Outcome**

LMWH indicated – discussed dose with me – calculated GFR – 33ml/min – reduce dose below 30ml/min (Local arrangement not in SPC) Prescribed 5,000units dalteparin od. CURB score calculated = 2 – I asked re X-Ray – shows consolidation therefore treatment for pneumonia required amoxicillin and clarithromycin.

Medication chart written 2 errors out of 7 – vitamin B Co strong prescribed instead of vitamin B compound and Cacit D3 missed off.

Length of stay 10 days.

## Patient B2 (67F)

**Admission time:** 14.11 (Wednesday)

**Clerking time:** 14.40 – 15.10 (90 minutes)

**Staff:** ST2

**Information provided:** GP house visit report, CPN letter

**Interruptions:** None

### Summary

Patient has dementia so history from son. Presenting complaint falling asleep, not eating or drinking, Examination was difficult as patient was unable to comply. Doctor asked re medication, son said that the CPN had sent them possibly left in ambulance. Son said that the patient takes donepezil which wasn't listed on the home visit report – son telephoned CPN to confirm – donepezil 10mg nocte, mirtazapine 30mg nocte.

**VTE RA** – Paper available and completed

### Outcome

LMWH heparin indicated (age, dehydrated) and prescribed 5,000 units od. Regular medication prescribed – donepezil mane – should be nocte. Length of stay 1 day.

## Patient B3 (76F)

**Admission time:** 14.36 (Wednesday)

**Clerking time:** 16.10 – 16.55 (45 minutes)

**Staff:** ST2

**Information provided:** GP summary

**Interruptions:** 16.45 AMU reg to complete previous clerking – patient needs PR examination  
16.55 junior doctor re patient seen earlier in the day

### Summary

Patient unable to stand or walk due to pain in legs and neck. Discharged yesterday but legs have become numb and patient is drowsy. History was from husband, patient has dementia. There was difficulty with the examination, patient unable to comply. GP letter states problem is that patient can't stand or walk but husband says that this is not new. Husband is not always able to understand what the patient is saying.

Patients own medication brought into hospital – Oxcontin and oxynorm in original packs plus blister pack. The doctor copied the doses from the patient own medicines into the case notes and then onto the medication chart.

Patient seemed very drowsy, previous thyrotoxicosis, ? treatment. I wondered if now hypothyroid and suggested TFTs

**VTE RA** – Paper available and completed

**Outcome**

? myeloma, ? fracture. Medication chart written, aspirin should be EC, ISMN written instead of isosorbide mononitrate. LMWH not prescribed, patient immobile and aged over 60, previous DVT in 2007 on GP summary therefore indicated. MH not confirmed by pharmacist. Length of stay 3 days.

**Patient B4** (88F)

**Admission time:** 13.55 (Thursday)

**Clerking time:** 14.20 – 15.05 (45 minutes)

**Staff:** ST2

**Information provided:** GP summary – received by fax while doctor was clerking patient

**Interruptions:** None

**Summary**

Doctor communicated with daughter rather than patient. GP called patient house bound, unwell 2-3 days, crying. ? Ability to cope at home. Patient says she doesn't feel unwell now. ECG shows AF, doctor explained risks re stroke and need for warfarin – patient doesn't want to stay in hospital. Daughter had brought in patients own medicines; doctor looked at briefly to identify any current medical conditions as no information from GP. GP summary used to write medication history in case notes – drug and dose recorded but no frequency. GP summary then used to write medication chart.

**VTE RA** – Paper available and used

**Outcome**

AF ?needs therapeutic LMWH then warfarin .Dalteparin 5,000 units od prescribed. Medication chart – 2 errors – ramipril prescribed od should be BD, frusemide 20mg 3od prescribed as 20mg om – should be 60mg om. Corrected by pharmacist. Length of stay 9 days.

**Patient B6** (65F)

**Admission time:** 13.50 (Friday)

**Clerking time:** 13.45 – 14.30 (90 minutes)

**Staff:** Consultant

**Information provided:** From Gastro clinic

**Interruptions:** None

**Summary**

See and Treat. Presented with SOB and weakness, ?subphrenic collection, ?PE. Doctor asked "Have you a list of your medicines". Doctor asked me to log into EMIS for medication as he has forgotten password.

VTE RA – Paper available and completed

**Outcome**

LMWH not prescribed as clinically unclear – abscess may need draining  
Medication chart written from copy I printed from EMIS. Letter from gastro states prednisolone but not on EMIS list, I suggested confirming with ICE TTO – patient said 10mg od – correct. Seretide inhaler prescribed as Fluticasone. Length of stay 17 days.

**Patient B7 (79F)**

**Admission time:** 13.38 (Friday)

**Clerking time:** 14.35 – 15.05 (30 minutes)

**Staff:** Consultant

**Information provided:** GP summary

**Interruptions:** None

**Summary**

Patient presented with vomiting, everything including water, also passing large volumes of urine, feels unwell. The doctor asked the patient for a list of their medicines – not available. The doctor asked about allergies, when the patient indicated penicillin he asked “what happens”, the patient said that her face swells up. Diagnosis UTI.

VTE RA – Paper available and completed

**Outcome**

Dalteparin not prescribed as patient takes warfarin. Regular medication prescribed – buprenorphine with held as patient is vomiting. 3 errors out of total 8 items. I confirmed – dose of warfarin, day of week for buprenorphine patch, and alfacalcidol not being taken (not had supply from GP for a while). Length of stay 7 days

**Patient B8 (67M)**

**Admission time:** 14.49 (Friday)

**Clerking time:** 15.40 – 17.05 (85 minutes)

**Staff:** ST4

**Information provided:** GP summary

**Interruptions:** None

**Summary**

Complicated history; symptoms developed over several months. Oct / Nov – aching legs, lost weight, night sweats, decreased appetite, unable to walk very far. The doctor asked “do you take tablets” – “Yes – for increased blood pressure”. The doctor copied the medication listed in the GP summary into the case notes; she asked the patient “which day do you change your oxybutynin patch”; the patient said that he wasn’t using them anymore. She asked when the

lansoprazole was started and why, the patient said “yesterday”. She asked about OTC medicines e.g. aspirin, ibuprofen, the patient said “none”. The doctor discussed the priority of scans with a consultant (it was Friday afternoon) and then had to ring a radiologist twice to arrange.

**VTE RA** – Paper available but not completed

**Outcome**

Regular medication prescribed but most items stopped as not indicated in current acute clinical situation, 0 errors in total of 5 items prescribed. No LMWH prescribed – Hb 8.9g/dl – patient possibly bleeding. Final diagnosis vasculitis. Length of stay 15 days.

**Patient B45** (65M)

**Admission time:** 11.08 (Monday)

**Clerking time:** 12.15 – 12.55 (40 minutes)

**Staff:** ST1

**Information provided:** GP summary

**Interruptions:** 12.50 – by another doctor re patient in ED (while writing drug chart)

**Summary**

Difficult history – non specific symptoms. Tired, dizzy, cold, SOB. Went for endoscopy last week but BP was too low. The doctor asked if the patient had any medication with him, he didn't and didn't know what he was taking. The doctor copied the medication from the GP summary into the case notes and then from the GP summary onto the drug chart; researcher advised that Prograf brand should be prescribed rather than tacrolimus as the different products available have differing bioavailabilities

**VTE RA** – Paper available – removed and discarded

**Outcome**

LMWH not prescribed. Pt had low Hb and possibly bleeding so it wasn't indicated. 1 error out of 12 items prescribed; ferrous sulphate 200mg od missed off. Length of stay 8 days.

**Patient B46** (48F)

**Admission time:** 11.30 (Monday)

**Clerking time:** 12.55 – 13.50 (55 minutes)

**Staff:** ST1

**Information provided:** GP letter – no information re medicines

**Interruptions:** None

**Summary**

GP referred patient as he is concerned that patient still has cough and SOB despite 3 courses of antibiotics. Renal transplant patient; acute rejection Aug 2009, started on steroids. Doctor didn't ask the patient about medicines, no information provided by GP, I checked EMIS – patient not on EMIS. I went back to ask the patient – he had his own medication with him. Alfacalcidol wasn't labelled – he said 0.25 micrograms on Mon, Wed and Fridays, he had a loose strip of tacrolimus 1mg he indicated 1mg BD, his dose of sodium bicarbonate (5grams BD) and cinacalcit also had to be confirmed. The drug history was written in the case notes and then copied onto the drug chart. The doctor went back to ask which antibiotics the patient has had, he said flucloxacillin but also said he was allergic to penicillin, he had also had ciprofloxacin. The doctor wrote the history and examination from memory; no notes were taken during the examination.

**VTE RA** – Paper available – removed and discarded

**Outcome**

LMWH not prescribed – no results back so clinically unclear. Calcichew prescribed instead of cinacalcit. PPI written in plan in notes but not prescribed. Length of stay 5 days.

**Patient B48 (81F)**

**Admission time:** 14.21 (Monday)

**Clerking time:** 15.50 – 17.00 (70 minutes)

**Staff:** ST1

**Information provided:** GP summary

**Interruptions:** 15.50 Results received for previous patient – went to tell her that she can go home

**Summary**

Known DVT – on dalteparin; now has back pain, painkillers don't work, GP now suspects PE. Doctor asked "which painkillers" – morphine given in ED on Saturday caused vomiting. Patient was also given trimethoprim on Saturday for ?UTI but hasn't taken today due to vomiting. Medication copied from GP summary into case notes, Calcichew D3 forte written as Calcichew

**VTE RA** – Paper available not completed

**Outcome**

Patient is already prescribed therapeutic dalteparin for DVT. Patient is prescribed dalteparin 25,000 units / ml 0.6ml od. The doctor first prescribed 2,500 units od, when asked to check this dose she prescribed 25,000 units od (Maximum recommended daily dose 18,000 units). She had difficulty in calculating the correct dose of 15,000 units od from the information provided. Length of stay 4 days.

### **Patient B86** (68F)

**Admission time:** 13.14 (Tuesday)

**Clerking time:** 13.45 – 14.35 (50 minutes)

**Staff:** ST1

**Information provided:** GP hand written letter

**Interruptions:** None

#### **Summary**

GP handwritten letter provided – no past medical history or medication listed. Patient has presented SOB, and was prescribed immediate nebulas and prednisolone. The doctor took no notes during the examination; the history and examination were written from memory. The patient had her own medication with her although I had to ask her the doses of her inhalers as these were not labelled (as a diversion while the doctor took arterial blood gases)

**VTE RA** – Paper available but not completed

#### **Outcome**

The doctor asked the researcher about the VTE risk assessment – the patient has 2 risk factors – age and CPOD, she was prescribed dalteparin 2,500 units od as prophylaxis (no apparent reason for dose reduction). There was no attempt by the doctor to prescribe the regular medication until prompted to do so. No medication chart available from Nov 2009 so unable to assess accuracy.

### **Patient B161** (36F)

**Admission time:** 12.10 (Thursday)

**Clerking time:** 13.20 – 15.00 (100 minutes)

**Staff:** ST1

**Information provided:** GP hand written letter

**Interruptions:** 14.10 by F1 re patient clerking  
14.10 by nurse needing a doctor to speak to a patients family re DNAR order

#### **Summary**

Handwritten letter from GP has no details of patient's medication. Patient has had stomach pain for the past 5 days, has been off her food for 3 days, has a swollen abdomen and is jaundiced. She has brought her some of her own medication with her: fluoxetine 20mg od, omeprazole 20mg od, Cerazette 1 od (the doctor had to ask what this was – OCP), the patient states that she also usually takes vitamin B compound strong 2 od, multivitamins and thiamine.

**VTE RA** – paper available but not completed



**Outcome**

The doctor stated that she would not prescribe Fragmin due to the likelihood of deranged clotting; this was not documented in the case notes. Blood samples had not been taken as there was no HCA available; the doctor took the samples at the end of the clerking process. 3 errors out of 3 items which should have been prescribed – fluoxetine and vitamin B compound strong omitted, omeprazole prescribed 20mg od, patient takes 20mg BD. Length of stay 3 days.

**Patient B119 (72M)**

**Admission time:** 13.16 (Wednesday)

**Clerking time:** 13.35 – 14.50 (75 minutes)

**Staff:** F1

**Information provided:** None

**Interruptions:** None

**Summary**

Patient has a pain behind their eye – went to GP who said go to the opticians. Has had spectacles from the optician but there is no improvement in the pain so sent to hospital; unclear who sent the patient. Patient can't concentrate for more than 10 minutes without pain, suffers many episodes a day – whenever reading or writing, the top of his head is sore to the touch. Patient was asked if they take regular medication from the GP – had 'diarrhoea tablets' 1 week ago – now finished. The doctor wrote a detailed history during history and examination and then used to write case notes, various potential diagnosis were looked up on the internet.

**VTE RA** – Paper available – removed and discarded

**Outcome**

Dalteparin not prescribed. Patient on no regular medication – medication chart written and aspirin 300mg started – diagnosis embolus of retinal artery. Length of stay 14 days.

**Timeline**

13.35: start – nowhere to review case notes; doctors' office full

14.25: forgot to test cerebellar function – hand clap – had to go back

14.35: handed patient over to registrar

14.35: Ordered investigations on ICE: cholesterol, carotid Doppler, cardiac echo, and documented in notes

14.50: drug chart and clerking complete

**Patient B120 (75M)**

**Admission time:** 14.00 (Wednesday)

**Clerking time:** 14.55 – 16.10 (75 minutes)

**Staff:** F1

**Information provided:** GP letter and summary - faxed

**Interruptions:** None

### **Summary**

Patient confused. Has UTI resistant to ciprofloxacin and has had recent course of both trimethoprim and nitrofurantoin. Admitted on Fragmin 18,000 units od for PE diagnosed 4/4/2009; this should actually have been stopped by the GP after 3 months but had been continued. Difficult history as patient was both deaf and confused. Microscopy report shows sensitivity to Tazocin and gentamicin – patient is allergic to penicillin so the only suitable option seems to be gentamicin. As this will probably require inpatient treatment I suggested contacting medical microbiology to see if an alternative oral antibiotic can be found. The doctor tried telephoning at 15.25 – med micro engaged twice. He got through at 15.55 and was told to ring back in 20 minutes! I rang ward 3y (infectious diseases) and spoke to an ID SpR for some advice – I suggested IV ertapenem as this is more likely to be accepted by the home IV team than gentamicin, the ID registrar agreed but suggested confirming with medical microbiology.

**VTE RA** – Paper available – not completed

### **Outcome**

Medication copied from GP summary onto medication chart – patient confused but no attempt made to confirm medication with patient. 14 items prescribed – no errors. Dalteparin dose reduced from 18,000 units od to 5,000 units od as prophylaxis ( age, previous PE, infection) Length of stay 7 days.

### **Timeline**

14.55: start  
15.25: tried to contact Med Micro – engaged x 2  
15.55: spoke to med micro – asked to ring back in 20 minutes  
16.00: I spoke to an ID registrar re appropriate IV antibiotics  
16.00 drug chart written  
16.10 clerking complete

## **Patient B122 (77F)**

**Admission time:** 18.30 (Wednesday)

**Clerking time:** 18.30 – 19.27 (60 minutes)

**Staff:** F1

**Information provided:** GP hand written letter, listed medications but no doses or frequencies

**Interruptions:** None

### **Summary**

Doctor checked blood results on ICE first before speaking to patient. Patient has 3 day history of diarrhoea; no blood passed, was vomiting 3 days ago, hasn't eaten for a week and has cramping stomach pain. Has COPD – cough – greenish sputum. During the history and examination I chaperoned for the PR examination. No medication was obviously available but when asked the patient had their own inhalers x 3 with them. The inhalers were not labelled so I asked the patient how she used them.

**VTE RA** – Paper available but not completed

**Outcome**

Dalteparin prophylaxis not prescribed; patient has at least 4 risk factors – age, COPD, dehydrated, immobile. Regular medication prescribed 1 error out of 4 items Calcichew should be BD not OD. Length of stay 6 days.

**Patient B162** (64M)

**Admission time:** 14.34 (Thursday)

**Clerking time:** 16.00 – 17.20 (80 minutes)

**Staff:** F1

**Information provided:** None

**Interruptions:** 16.15: Had to do blood test requests for another patient  
16.40 ECG technician arrived – doctor in the middle of clinical examination

**Summary**

Patient admitted from K clinic – clerking and plan already in case notes. Yesterday was sweaty and shaky around lunchtime; felt worse as the night went on – had to turn heating off, fine now. Doctor talked very quickly and used medical terminology so the patient didn't always follow. The patient said that the doctor in the clinic wanted 'tests'. The doctor explained that he probably had an infection, he had been on cyclophosphamide since October 2009, and we needed to find the source hence chest X-Ray, urine sample. When asked about current medication the patient said there was a "list in the file". The list was a printout from Proton, the renal patient management system; unfortunately this is not always updated with medication changes. Doctor took notes during history and examination and used to write history in case notes.

**VTE RA** – Paper available – discarded

**Outcome**

Regular medication prescribed; the doctor attempted to check the days of the week for the co-trimoxazole taken three times a week and the alendronate. Dalteparin was not prescribed. Case notes from January 2010 missing; unable to confirm accuracy of medication history. Length of stay 2 days.

**Timeline**

16.00: start  
16.05: asked Registrar about the need for blood cultures  
16.25: Asked Registrar what was needed for 'cardiology work up' – Troponin T, ECG, echo  
16.40: ECG technician arrived in the middle of the clinical examination  
16.58: Ordered investigations on ICE – echo  
17.15: Drug chart written  
17.20: Clerking complete

### **Patient B163** (50F)

**Admission time:** 15.42 (Thursday)

**Clerking time:** 17.25 – 19.00 (95 minutes)

**Staff:** F1

**Information provided:** GP letter

**Interruptions:** 18.10: went to BC to take blood cultures for sick patient  
18.40: nurse asked to write drug chart for patient clerked earlier

#### **Summary**

Patient presented with left sided facial pain and collapse; has already been seen by the stroke nurse. Woke on Saturday with pain in forehead which moved to eye then ear. Monday still had pain – relieved by hot flannels. Wednesday at work felt dizzy had chest pains and collapsed. Afterwards was confused, didn't know where she was, the room was spinning, her speech was funny and she felt disorientated. She was speaking half in English and half in Spanish – lasted for the rest of the morning. The doctor asked if she was on any medication, patient said "No"; however list form GP states zopiclone and lansoprazole. The patient says that she doesn't take these regularly. CNS examination showed leg weakness, she had migraine as a child. Working diagnosis ?migraine – needs MRI scan

**VTE RA** – paper available with drug chart but drug chart not written

#### **Outcome**

Dalteparin not prescribed – no risk factors identified. Medication chart had no errors out of a total of one item. Length of stay 5 days.

### **Patient B197** (37M)

**Admission time:** 14.17 (Friday)

**Clerking time:** 14.45 – 15.20 (35 minutes)

**Staff:** ST2

**Information provided:** Walk in centre proforma

**Interruptions:** None

#### **Summary**

Presenting complaint – burning / sharp pain in chest. Coughing or laughing makes him SOB; pain is worse when lying down. Patient says he is asthmatic but when asked if he takes any medicine she stated "none". The doctor asked about inhalers; the patient says he last used an inhaler about 10 years ago; he says a wheeze is normal for him. The doctor took his own blood samples; he used a glove as a tourniquet as a tourniquet wasn't available. Patient was asked to do a peak flow but was unable to comply due to pain.

**VTE RA** – Paper available but drug chart not written. Need blood results and X-Ray to decide on treatment indicated

**Outcome**

Dalteparin not prescribed, drug chart written later, prescriber not known. Risk factors asthma and infection. Medication history not checked by pharmacist; length of stay 1 day.

**Patient B198 (75F)**

**Admission time:** 14.22 (Friday)

**Clerking time:** 16.30 – 17.30 (60 minutes)

**Staff:** ST2

**Information provided:** None – sent by GP

**Interruptions:**

16.35: called to radiology to discuss another patient

16.51: interrupted by stroke nurse re patient seen earlier

**Summary**

No information provided so doctor consulted old notes, 3 volumes, for past medical history; arthritis, mitral valve replacement 2007 – on warfarin. Patient says he had “bleeding into his brain” prior to MVR. Patient says he came to hospital because his blood level was too high yesterday – INR 19.4. He denied taking any new tablets or changing his diet. He had his medication with him in a blister pack but had been told not to take “the yellow one or the white one” – bumetanide and spironolactone; the doctor was unable to identify these from the information on the blister pack. He didn’t know why he had been told to stop them. I used EMIS to see if he had been prescribed any acute medication; he had a diagnosis of cellulitis on 20/01/10 but denied being prescribed antibiotics. The EMIS printout was used to transcribe the patient’s current medication into the case notes. The patient was advised that he will have to stay in hospital until his INR is <5.

**Outcome**

The medication chart was not written during the clerking despite the patient being told that he will have to stay in hospital; the chart was written later 0 errors out of a total of 5 items. Therapeutic dalteparin was prescribed on 01/02/10 to be continued as the patient has a MVR and is no longer considered suitable for warfarin. Length of stay 5 days.

**Timeline**

16.30: start

16.35: called to radiology to discuss another patient

16.50: returned from X-Ray

16.51: interrupted by Stroke Nurse re patient seen earlier

17.30: clerking complete

## Patient B199 (84F)

**Admission time:** 16.18 (Friday)

**Clerking time:** 18.50 – 20.20 (90 minutes)

**Staff:** ST2

**Information provided:** GP hand written letter and printed summary, MAR chart from care home

**Interruptions:** 18.52 went to start clerking – nurse doing ECG (no ECG technician)  
19.30 doctor bleeped by biochemistry

### Summary

History provided by member of staff from care home. Until recently patient was quite mobile, for the past 2 days unable to talk, walk, feed herself and is now incontinent. Patient responds to pain but no communication was possible.

**VTE RA** – paper available but drug chart not written

### Outcome

Dalteparin not prescribed on admission but CT scan ordered to exclude an intracranial bleed as the cause of the symptoms. When the chart was written, prescriber unknown, there were 0 errors out of 8 items prescribed. Dalteparin prophylaxis was prescribed on ward 7a on the day following admission; length of stay 7 days.

### Timeline

18.50: start

18.52: nurse doing patients ECG

19.40: doctor rang X-Ray re need for urgent CT scan

20.00: started writing in case notes

20.20; rang biochemistry re results

20.20: clerking complete

## Patient C1 (77F)

**Admission time:** 15.32 (Wednesday)

**Clerking time:** 18.20 – 20.02 (100 minutes)

**Staff:** Locum SHO (?F2)

**Information provided:** GP letter and printed GP summary with current medication

**Interruptions:** 19.00: Discussed complicated patient seen earlier with senior doctor  
19.24: asked to put cannula in – patient need IV antibiotics  
19.24: asked to request R leg Doppler for complicated patient

### Summary

Patient had an episode of unresponsiveness; head went back, became vacant, eyes open. The relative said it lasted about 4 minutes and the patient was confused for about 20 minutes afterwards. Patient doesn't remember the episode. When asked about other health problems

the patient indicated that she is on warfarin and says she has her INR checked regularly. She had her own medicines with her which the doctor looked at briefly – warfarin, digoxin, atorvastatin. The patient also had her yellow warfarin booklet with her. The doctor copied the information from the patient's own medicines into the case notes and then returned them to the patient.

**VTE RA** – Available on ICE – not completed

### **Outcome**

Dalteparin not indicated as the patient is on warfarin. Regular medication was prescribed 0 errors out of 3 items; however warfarin was not prescribed in the regular medication section of the chart. No dose of warfarin was prescribed as the doctor was unable to find current INR on ICE. Length of stay 10 days.

### **Timeline**

18.20: start

18.25: nurse brought in patients own medicines

19.00: discussed complicated patient seen earlier with Registrar

19.20: discussed problem with blood taken earlier – incorrect information on form, will have to take another sample

19.24: asked to put in a cannula for patient who needs IV antibiotics

19.24: asked to request Doppler of leg for complicated patient seen earlier

19.30: ordered X-Ray on ICE and blood tests – printed forms

19.40: finished writing up case notes

19.40 wrote drug chart

19.45: went to take blood samples

19.50: ordered more blood tests on ICE and printed forms

20.02: clerking complete

## **Patient C2 (80M)**

**Admission time:** 16.48 (Thursday)

**Clerking time:** 18.50 – 19.47 (60 minutes)

**Staff:** ST5

**Information provided:** Hand written GP letter, GP repeat form (provided by patient)

**Interruptions:** 19.33: To review chest X-Ray and discharge patient

### **Summary**

Presenting complaint SOB, possibly due to anaemia, Hb 7.9 from GP. Patient drinks significant amount of alcohol, 2 whiskies and 2 bottles of Becks per night – possible upper GI bleed. When asked about medication the patient produced a GP repeat form (date unknown) which the doctor copied into the case notes and then returned to the patient. He also had foil strips of medication with him.

**VTE RA** – Available on ICE – not completed

**Outcome**

Dalteparin not indicated – HB 7.9. Regular medication prescribed, one error out of 12 items, isoosrbide mononitrate SR 60mg om prescribed; should be 120mg om. Length of stay 2 days.

**Timeline**

18.50: start  
19.22: investigations ordered on ICE  
19.30: drug chart started  
19.33: interrupted to review chest X-Ray and discharge patient  
19.35: Drug chart completed  
19.35 OGD ordered on ICE  
19.47: clerking complete

**Patient C3 (98F)**

**Admission time:** 16.25 (Friday)

**Clerking time:** 18.20 – 20.20 (120 minutes)

**Staff:** F1

**Information provided:** Hand written GP letter, on a patient record card, patient had GP repeat form

**Interruptions:** 19.55: To write TTO and book ETT for another patient

**Summary**

Patients son present during history taking. Fell over 2 weeks ago and banged head, now has a funny headache – different to usual, top of head is sensitive to touch. Also has had blurred vision over the last couple of weeks. When asked about medicines the patient said she took senna and Movelat (probably Movicol) now and again; GP repeat listed 12 items.

The doctor took notes during the interview then examined the patient,

19.30 ordered necessary tests blood tests, X-Ray, ECG, VTE RA on ICE

19.40 wrote drug chart – I was asked to clarify dose of digoxin as 125 microgram and 62.5 microgram tablets on GP repeat. The medicines were copied from the GP repeat into the case notes and then initially from the case notes onto the medication chart. Half way through the process the doctor started copying the medicines directly from the GP repeat onto the medication chart. There was no frequency stated for the Celluvisc eye drops so I asked the patient

19.50 doctor went to take blood samples but patient in X-Ray

20.10 patient returned from X-Ray but no suitable location to take blood samples; another doctor using the interview room; samples were taken at 20.20

**VTE RA – Completed on ICE while ordering blood tests etc**

**Outcome**

VTE – patient aged over 60 but BP 200 / 92, and to have CT head. Dalteparin not prescribed. Medication prescribed 0 errors out of 12 items but digoxin and Celluvisc clarified at point of prescribing. Length of stay 3 days.



**Timeline**

18.20 start – read case notes  
18.55: clinical examination  
19.30: investigations ordered on ICE, blood tests, X-Ray, ECG, VTE RS  
19.40: drug chart written  
19.50: went to take blood sample – patient in X-Ray  
19.55: asked to write TTO and book exercise tolerance test for a different patient  
20.03: discussed patient with consultant  
20.10: ordered CT brain on ICE  
20.10: patient returned from X-Ray but interview room occupied  
20.20: clerking complete but blood samples not taken

**Patient C68 (58F)**

**Admission time:** 10.25 (Monday)

**Clerking time:** 12.40 – 14.15 (95 minutes)

**Staff:** F2

**Information provided:** Very brief hand written GP letter; medicines listed no doses or type of inhalers

**Interruptions:** 13.31: To prescribe antiemetic for a different patient  
13.41: Pyrexial patient need paracetamol prescribing

**Summary**

Patient presented with back pain, made worse by breathing ?PE. GP letter stated medication as salbutamol, tiotropium, mucodyne, seretide. When asked about medication the patient said she also took co-codamol 30/500 for arthritis. The doctor asked for clarification of the doses of inhalers. This doctor said that they usually write notes during history taking but on this occasion forgot to take some paper with them.

**VTE RA –** Doctor found a green form (they were all supposed to have been removed); the doctor was advised that the RA should be completed on ICE – an ICE RA was completed

**Outcome**

Dalteparin not prescribed; has 2 VTE risk factors – age and COPD but BP 193/91. 5,000 units od prescribed later. Medication history not confirmed by pharmacist, doctor asked about appropriate NSAID for back pain – ibuprofen not diclofenac, and asked how to prescribe tiotropium inhaler 18 micrograms od. Length of stay 2 days.

**Timeline**

12.40: start – read notes – confusion – nursing documentation for a different patient  
13.15: ECG shows ? pace maker not working. Started writing up case notes  
13.30: went to take arterial blood sample – patient in X-Ray  
13.31: interrupted to prescribe anti-emetic for different patient  
13.37: drug chart started  
13.41: interrupted – pyrexial patient needs paracetamol prescribing  
13.41: VTE RA completed on ICE  
13.50: Drug chart completed; went to take arterial blood sample  
14.05: cannula inserted and venous blood samples taken  
14.15: clerking complete – consultant came to discuss patient

## Patient C69 (91M)

**Admission time:** 15.55 (Monday)

**Clerking time:** 17.10 – 19.00 (110 minutes)

**Staff:** F1

**Information provided:** GP summary

### Interruptions:

#### Summary:

When the doctor initially went to clerk the patient he was having a blood sample taken; however the EPA was unsuccessful so the doctor had to take the samples after the history and examination. The history was given by the patients niece as the patient had early dementia. Presenting complaint, falls, not eating, ?dehydration, ?CVA. the patient has been getting worse over the past 6 months but has not carers as he won't allow anyone into the home to help. The patients 2 sons then arrived and conformed that the patient has refused help / hospital admission in the past. The doctor asked water tablets, the patient's niece said he was not currently taking any medicines.

**VTE RA** – Available on ICE – not completed

### Outcome

Patient has 2 VTE risks, age, dehydration and possibly an infection. Bleeding risk – creatinine 158. Dalteparin not prescribed; later entry in notes states “hold dalteparin pending CT scan”. Unable to locate medication chart to assess accuracy of prescribing. Length of stay 33 days.

### Timeline

17.10: start

17.14: went to see patient; EPA trying to take blood sample but unsuccessful

17.50: started writing case history (from memory no notes taken)

18.05: went back to complete clinical examination – needed assistance from nurse

18.20: successfully inserted butterfly to obtain blood samples

18.50: ordered ECG, X-Rays on ICE

19.00: clerking complete

## Patient C104 (63F)

**Admission time:** 13.17 (Tuesday)

**Clerking time:** 14.00 – 15.20 (80 minutes)

**Staff:** ST1

**Information provided:** GP home visit report

**Interruptions:** 13.44: Bleeped

**Summary**

Patient suddenly became confused 3 days ago; also complained of diarrhoea and vomiting. Husband said she kept leaving taps running. Diagnosed with lung cancer November 2009. The patient had her own medication with her; the doctor checked that these were the same as listed in the GP summary. The patient said that she doesn't use inhalers anymore, she has home oxygen instead; she doesn't take the sleeping tablets (zopiclone) anymore – she last had them in February.

**VTE RA** – Available and completed on ICE

**Outcome**

Patient has VTE risks, age and cancer, no bleeding risks identified; dalteparin not prescribed. Medication prescribed 0 errors out of 3 items. Length of stay 3 days.

**Timeline**

14.00: start – read case notes and checked ICE for results  
14.15: ECG technician came to do ECG  
14.23: ECG complete  
14.44: bleeped  
14.45: reviewed previous scans on ICE – CT, X-Ray, PET  
14.55: wrote up clerking  
15.10: wrote drug chart  
15.15: ordered investigations on ICE  
15.20: clerking complete

**Patient C105** (37F)

**Admission time:** 15.09 (Tuesday)

**Clerking time:** 15.45 – 17.00 (75 minutes)

**Staff:** ST1

**Information provided:** GP referral proforma

**Interruptions:** 15.50: bleeped  
16.07: bleeped  
16.46: bleeped – number unobtainable

**Summary**

Presenting complaint cough and SOB; patient known to be IVDU and drink excess alcohol. The doctors asked the patient about medication; she said that she doesn't take any medicines. Working diagnosis ?PE, patient has had previous DVT. Patient indicated that she has an allergy to LMWH so a therapeutic dose of fondaparinux was prescribed.

**VTE RA** – Available on ICE – not completed

**Outcome**

Therapeutic fondaparinux prescribed for ?PE, patient has had previous DVT and high risk as IVDU. Clotting studies requested as patient drinks 40+ units of alcohol per week. Medication history 0 errors out of 0 items, length of stay 4 days.

**Timeline**

15.45: start – read case notes  
15.50: bleeped  
15.52: consultant for 15.00 post take ward round has not arrived – tried to contact via secretary  
15.55: went to see patient – having ECG  
16.07: bleeped  
16.10: returned from answering bleep  
16.15: took blood samples difficult access – butterfly used, 2 sites tried  
16.35: ordered investigations on ICE  
16.45: started writing up case notes  
16.46: bleeped – number unobtainable  
16.55: drug chart written  
17.00: clerking complete

**Patient C134** (71F)

**Admission time:** 12.45 (Tuesday)

**Clerking time:** 13.45 – 15.15 (90 minutes)

**Staff:** ST1

**Information provided:** None

**Interruptions:** 14.30: nurse came to discuss patient from morning ward round re ENT clinic appt

14.33: nurse practitioner asked doctor to request ultrasound – doctor gave nurse ICE access

14.40: spoke to ENT re above patient – needs Cantonese interpreter

**Summary**

Doctor wrote brief notes on the back of addressograph label sheet during interview. Patient says she was sent in by her GP as her sugar levels were very high; no letter received from GP. Patient was complaining of tiredness over the past 2 weeks, decreased appetite, drinking lots of fluid. When asked which medicines she usually takes she gave the nurse a list which she had written. The patient was advised that she will probably need treatment with insulin.

**VTE RA** – Available on ICE – not completed

**Outcome**

Dalteparin was indicated – 2 VTE risk factors, diabetes and dehydrated, but was not prescribed. Medication was copied from patients own list onto the medication chart. Length of stay 4 days.

### **Timeline**

14.43: start  
14.05: went to take blood gases; no syringes on trolley had to get from treatment room  
14.07: went to take blood for blood gas analysis  
14.15: blood silt on blood gas machine – had to clean – infection risk  
14.20: checked insulin regimen in Trust formulary  
14.30: nurse came to discuss patient from the morning post take round – needs to go to ENT clinic  
14.33: nurse practitioner asked doctor to request ultrasound for patient she was seeing; doctor gave nurse appropriate access to ICE to make request  
14.35: drug chart written  
14.40: had to speak to ENT re above patient; need Cantonese interpreter and ultrasound  
14.53: returned to writing up case notes  
14.55: supposed to be on 3pm post take ward round; went to look for consultant  
15.04: ordered chest X-Ray on ICE  
15.08: went to cannulate patient – 2 staff unsuccessful  
15.15 clerking complete and patient cannulated

### **Patient C135 (82F)**

**Admission time:** 15.09 (Wednesday)

**Clerking time:** 15.15 – 16.25 (70 minutes)

**Staff:** ST1

**Information provided:** Case notes – patient referred from G clinic, entry from haematology SpR

**Interruptions:** 16.05: F1 – to discuss another patient

### **Summary**

Doctor took no notes during the interview. Presenting complaint, collapse in toilet on G clinic, patient was seen with her daughter. Patient was in haematology clinic, has NHL and is due to start chemotherapy. When asked about medication her daughter said she takes: blood pressure tablets, metformin, bendrofluazide, allopurinol and a new tablet for diabetes beginning with S – sitagliptin.

**VTE RA** – Available on ICE – not completed

### **Outcome**

Patient has 2 VTE risk factors, age and cancer. Enoxaparin was prescribed as ACS is a possible diagnosis. Regular medication was confirmed using recent TTO and EMIS and prescribed; 0 errors out of 6 items prescribed. Length of stay 2 days.

### **Timeline**

15.15: start – read case notes and reviewed ECG  
15.43: history taking and examination complete – asked nurse to start telemetry  
15.50: drug chart written  
16.00: results on ICE reviewed; X-Ray ordered  
16.05: discussed another patient with F1  
16.23: clerking complete

## Patient C167 (62F)

**Admission time:** 11.43 (Thursday)

**Clerking time:** 12.12 – 12.52 (40 minutes)

**Staff:** ST1

**Information provided:** GP letter – very brief

**Interruptions:** None

### Summary

No notes taken during interview. Presenting complaint, patient has recently returned from Tenerife – had diarrhoea. Visited GP who diagnosed UTI and prescribed trimethoprim which caused nausea so was changed to cefalexin. Now she has a headache. The doctor asked what she had taken for the headache, the patient said 'paracetamol and Brufen'. The doctor asked the patient if the GP had said why they wanted her to go to hospital; the patient said that the GP was worried about a 'brain bleed'.

**VTE RA** – Available on ICE – not completed

### Outcome

2 VTE risks – age and UTI; dalteparin not prescribed. No regular medication taken; drug chart not written, no medicines reconciliation by pharmacist. Length of stay 1 day.

### Timeline

12.12 Start

12.34 Asked HCA to take blood

12.40 Prescribed co-dydramol for headache

12.52 clerking complete

## Patient C168 (51F)

**Admission time:** 12.10 (Thursday)

**Clerking time:** 14.45 – 15.35 (50 minutes)

**Staff:** ST1

**Information provided:** Hand written GP letter listing medication

**Interruptions:** None

### Summary

Presenting complaint, back pain and possible reaction to doxycycline – swollen tongue. Has been wheezing and having night sweats, SOB Has been taking Solpadeine for back pain. When asked about regular medicines she said that she takes 'lots' and the GP has sent a list. Possible PE, d dimer ordered.

**VTE RA** – Available on ICE – not completed

**Outcome**

No VTE risk factors; dalteparin not prescribed. Drug chart written, oxybutynin patch prescribed but no strength, no medicines reconciliation by pharmacist so accuracy unknown. Length of stay 1 day.

**Timeline**

14.45: start  
15.10: history taking and examination complete  
15.25: wrote drug chart  
15.35: reviewed results; blood tests, chest X-Ray, WTU, ordered d-dimer  
15.35: complete

**Patient C136 (76M)**

**Admission time:** 17.16 (Wednesday)

**Clerking time:** 18.10 – 19.35 (85 minutes)

**Staff:** F1

**Information provided:** Handwritten GP letter with details of medication on reverse

**Interruptions:** 18.47: bleeped – letter needed for patient – asked nurse to bring the case notes

18.55: bleeped – electronic TTO for wd 7b won't print, needs completing

19.05: bleeped – took nurse from 7b back to lift

**Summary**

Presenting complaint, pain in shoulder and anaemia. Pain only occurs when walking, not at rest, has to stop every 10 minutes or so. When asked if he takes any medication the patient said 'a statin, felodipine, bendroflumethiazide and has just started iron tablets', patient hasn't brought his medicines with him.

**VTE RA** – Available on ICE not completed, green form completed later. Hb 6.5 on admission, dalteparin not indicated.

**Outcome**

Dalteparin not prescribed. Medicines confirmed with EMIS; no drug chart written. Usual medication prescribed later and VTE RA completed ? by whom, 0 errors out of 3 items. Length of stay 3 days.

**Timeline**

18.10: start  
18.47: bleeped – discharge letter needed for patient – nurse asked to bring case notes  
18.48: started writing up clerking  
18.55: nurse arrived electronic TTO for 7b required won't print, doctor completed  
19.05: took nurse back to lifts  
19.12: registrar came to discuss patient  
19.20: reviewed results on ICE and ordered more investigations  
19.30: patient needs PR examination  
19.35: patient has gone to X-Ray – clerking complete

## Patient C169 (96F)

**Admission time:** 15.28 (Thursday)

**Clerking time:** 18.10 – 19.30 (80 minutes)

**Staff:** ST1

**Information provided:** Handwritten list of medicines from patients daughter

**Interruptions:** 18.57: nurse from HEC came to ask dose of Premarin prescribed earlier

### Summary

Patient referred by GP; history from daughter, patient has vascular dementia. Patient lives alone but has carers three times a day. Presenting complaint cellulitis, needs IV antibiotics.

**VTE RA** - available on ICE and completed; doctor forgot to ask about personal and family history of VTE and asked me to go and ask the patients daughter. RA was not correctly completed on ICE as it entry could not be verified later (Dec 2010).

### Outcome

Three VTE risk factors, age, immobile, cellulitis. Dalteparin prescribed. Regular medicines prescribed using patients own hand written list and TTO from December 2009 (4 months ago). 0 errors out of 4 items prescribed. Length of stay 36 days.

### Timeline

18.10: start

18.35: had to remove dressings from legs to assess

18.45: reviewed results on ICE

18.55: went to ask patient for list of medication but patient had gone to X-Ray

18.57: nurse from HEC came to clarify dose of Premarin prescribed earlier

19.10: antibiotics and dalteparin prescribed

19.15: reviewed chest X-Ray

19.20: went to insert cannula for IV antibiotics

19.30: clerking complete

## Patient C205 (81M)

**Admission time:** 14.03 (Friday)

**Clerking time:** 16.15 – 17.30 (75 minutes)

**Staff:** F1

**Information provided:** GP summary

**Interruptions:** 16.55: doctor came to say that patient seen earlier needs DNAR

### Summary

Presenting complaint – swollen leg for past 2 weeks. Fell this morning. Also has pain in hip and no analgesia seems to work. Provisional diagnosis ?DVT

**VTE RA** – available on ICE - not completed



**Outcome**

Therapeutic dalteparin prescribed, had to confirm dose with me, estimated patient's weight. Regular medication prescribed using GP summary. Case notes from April 2010 missing; unable to confirm accuracy of medication history. Length of stay 54 days.

**Timeline**

16.15: start – read case notes  
16.20: went to interview patient  
16.25: doctor came to say post take ward round starting  
16.40: completed writing history (started during patient interview)  
16.42: went back to check allergies with patient  
16.55: interrupted by F1 re patient seen earlier – needs DNAR  
17.10: ordered investigations on ICE – blood tests, Doppler, drug chart written  
17.15: went to check patients weight to dose Fragmin  
17.18: reviewed ECG  
17.25: printed out blood test forms; ICE was down earlier  
17.30 clerking complete

**Patient D35 (76M)**

**Admission time:** 10.22 (Monday)

**Clerking time:** 11.45 – 12.45 (60 minutes)

**Staff:** ST1

**Information provided:** GP summary

**Interruptions:** 12.20: porter came to take patient for CT scan

**Summary**

Sudden headache and blurred vision 3 days ago - can't focus, can't read. Previous stroke – lost some vision as a result. Used list of medicines written by Stroke nurse and asked if had taken any more – had telephoned GP who had advised paracetamol for headache. Asked re OTC ? herbal medicines 'Holland & Barrett'. Ophthalmoscope beside bed not working – couldn't find a mobile one. CT scan showed new stroke.

**VTE RA** – completed on ICE – paper just bleeding risks ticked – no VTE RFs ticked

**Outcome**

Dalteparin contra indicated – new stroke – not prescribed. MH accurate – 0 errors out of 4 items prescribed. Length of stay 3 days

**Timeline**

Patient seen by stroke nurse first  
11.50: Went to start clerking – patient in toilet  
11.55: start clerking  
12.20: Porter came to take patient for CT scan  
12.27: started writing up clerking  
12.45: clerking complete

## Patient D36 (66F)

**Admission time:** 11.45 (Monday)

**Clerking time:** 13.30 – 15.25 (115 minutes)

**Staff:** ST1

**Information provided:** GP referral proforma

**Interruptions:** 13.52: Bleeped re referral made at weekend by SHO on call – bleep passed on

15.20: Bleeped – didn't answer it

### Summary

Presenting complaint – chest pain. Went shopping, suddenly felt terrible hot and cold, felt confused. Pain was crushing and lasted a couple of hours, GTN spray didn't work. Kept going hot and cold, nauseated, had palpitations. Patient says she takes esomeprazole – not on GP summary. Checked on EMIS – also on atorvastatin, montelukast, ezetimibe, bezafibrate; none in GP summary! Doctor confused with buprenorphine patches – from summary thought patient was applying four patches at a time not one each week. Diagnosis PE.

**VTE RA** – Completed on ICE and paper; ICE the day after the paper

### Outcome

Dalteparin not prescribed initially as surgical review requested. Therapeutic dalteparin prescribed 13.04.11 once PE diagnosed. Regular medication prescribed but not confirmed with patient. 0 errors out of 17 items prescribed. Length of stay 16 days.

### Timeline

13.31: No computer to review bloods

13.52: Bleeped re referral made at weekend by SHO on call – bleep passed on

14.10: Stared writing up clerking

14.40: Bleeped surgical SHO

14.42: Surgical SHO answered – will review when results available

14.55: Rang biochemistry to add amylase and LFTs to blood tests

15.15: PR examination

15.20: Bleeped – didn't answer it

## Patient D37 (86F)

**Admission time:** 14.57 (Monday)

**Clerking time:** 16.15 – 17.35 (80 minutes)

**Staff:** ST1

**Information provided:** GP handwritten letter – partly illegible; medication list incomplete

**Interruptions:** 16.20: Interrupted about another patient

17.32: Bleeped – didn't answer it

**Summary**

Patient was very deaf and seen with niece: niece 'talked over' the patient throughout the interview.

Presenting complaint – leg swelling over last 2 weeks. Bendroflumethiazide changed to furosemide 5 days ago by GP. Also taking amoxicillin for ? cellulitis – has all her own medication with her. Differential diagnoses – DVT or cardiac cause, not cellulitis.

**VTE RA** – Completed on ICE and paper

**Outcome**

Dalteparin 5,000 units daily prescribed. Regular medication prescribed but not confirmed with patient. 0 errors out of 3 items prescribed. Length of stay 25 days.

**Timeline**

16.20: Interrupted about another patient

17.22: Ordered tests on ICE

17.32: Bleeped – didn't answer it

**Patient D61 (77F)**

**Admission time:** 10.29 (Tuesday)

**Clerking time:** 11.35 – 12.45 (70 minutes)

**Staff:** ST5

**Information provided:** Kent Lodge notes and copy of medication chart

**Interruptions:** None

**Summary**

Son present during interview but didn't interrupt. Presenting complaint SOB, cough and legs have swollen over last 2 weeks. Doctor checked list of medication provided by Kent Lodge with patient; explained that omeprazole was to be stopped as it has little benefit and causes problems with infections. Diagnosis infective exacerbation of COPD – doxycycline prescribed.

**VTE RA** – VTE RA available in office and ICE – neither completed. Both completed next day.

**Outcome**

Dalteparin prescribed 2,500 units od pt wt 45kg approximately - same dose as Kent Lodge. Doctor asked about dose reduction in elderly – no evidence for reduction in elderly. Doctor checked list of medication provided by Kent Lodge with patient before prescribing. 1 error out of 5 items Length of stay 31 days.

**Timeline**

11.50: Took arterial blood for blood gas (difficult – had to try twice)  
Inserted cannula for IV antibiotics and took venous blood and blood for cultures  
12.17: AMU blood gas machine not working – had to go to ED  
12.19: Went back to check allergies as will need antibiotics  
12.20: Ordered tests on ICE; blood cultures, chest X-Ray  
12.27: Blood samples podded to labs – no pods – had to go to ED. None in ED left blood in ED to be sent when pods available  
12.30: Started writing up clerking  
12.40: Started writing up drug chart

**Patient D62 (60F)**

**Admission time:** 13.10 (Tuesday)

**Clerking time:** 14.30 – 15.45 (75 minutes)

**Staff:** ST1

**Information provided:** GP summary

**Interruptions:** 15.05: Had to chaperone registrar

**Summary**

Presenting complaint – SOB, cough, chest pain. Seen by GP last week for chest infection, went to GP for a sick note and GP sent to hospital as has been unwell for 9 days; has had several chest infections Paracetamol makes the chest pain better also takes ' blood pressure' tablets. Doctor asked for a list of medication; patient doesn't have one but says she takes bendroflumethiazide. Doctor prescribed clarithromycin, pharmacist intervened – patient has had erythromycin recently from GP, penicillin allergic – anaphylaxis, levofloxacin 500mg od suggested and prescribed.  
. Diagnosis ?PE ? pneumonia

**VTE RA – Completed on ICE and paper**

**Outcome**

Dalteparin 5,000 units daily prescribed. Regular medication prescribed but not confirmed with patient. 0 errors out of 2 items prescribed. Length of stay 1 day.

**Timeline**

14.45: Ordered chest X-Ray and did VTE on ICE  
14.50: Went back to examine patient  
15.00: Stared writing up clerking  
15.05: Went to chaperone registrar  
15.15: Returned  
15.19: Wrote drug chart

## Patient D63 (84F)

**Admission time:** 13.453 (Tuesday)

**Clerking time:** 15.45 – 17.25 (100 minutes)

**Staff:** F1

**Information provided:** GP summary

**Interruptions:** 16.00: Technician came to do ECG

### Summary

Presenting complaint – SOB, lack of energy. Been away for a few days and felt unwell since coming home – shivering and sweating. Patient has neuralgia – takes carbamazepine and is allergic to cefaclor – face swells. Doctor asked for list of medication; patient has her GP repeat with her. Diagnosis PE.

**VTE RA** – Completed on ICE and paper.

### Outcome

Dalteparin 10,000 units stat prescribed for ?PE. No regular medicines prescribed just nebulas and dalteparin, prescription not discussed with patient; no medicines reconciliation by pharmacist. Length of stay 2 days.

### Timeline

15.50: Blood gases – may need oxygen

16.00: Technician came to do ECG; took blood gas to analyser

16.10: Went to see patient – HCA taking blood

16.40: Discussed oxygen concentration with senior doctor 28% asked nurse to give

16.45: Ordered chest X-Ray – started writing up clerking

17.05: Discussed with registrar – to have steroids and nebulas

17.15: Patient in X-Ray – doctor needs to ask social history

17.25: handed over to registrar

## Patient D97 (71M)

**Admission time:** 15.49 (Wednesday)

**Clerking time:** 16.01 – 17.31 (90 minutes)

**Staff:** F2

**Information provided:** GP summary

**Interruptions:** None

### Summary

Presenting complaint – very breathless for past 2 weeks. Doctor asked the patient if he had his medicines with him – he had; the doctor said that they would look at them later. Asked if the patient used nebulas at home –he does – salbutamol and Atrovent. Information from the labels on the patient's own medicines was used to prescribe, the prescription was not confirmed with the patient. The Seretide inhaled had no label but was prescribed as 2 puffs

BD – the dose was not confirmed with the patient. The drugs on the medication chart were copied into the DH in the case notes.

Diagnosis infective exacerbation COPD.

**VTE RA** – Completed on ICE only – no paper RA

### **Outcome**

Dalteparin not prescribed by clerking doctor; 5,000 units od prescribed later the same day. Regular medication was prescribed but was not confirmed with the patient. 0 errors out of 8 items prescribed. Length of stay 8 days.

### **Timeline**

16.01: Nurses have admission notes; checked old results on ICE

16.28: Ordered tests on ICE then went to interview patient

16.37: Arterial blood gas

16.40: Blood gas taken – ECG technician arrived

16.43: Went to get patients own medicines – asked about ITU admissions and BIPAP

16.56: Went to take venous blood – technician still doing ECG

17.01: Took blood

17.08: Started writing up clerking

## **Patient D254** (85F)

**Admission time:** 11.37 (Tuesday)

**Clerking time:** 14.05 – 15.37 (90 minutes)

**Staff:** F2

**Information provided:** GP handwritten letter – legible; current repeat prescription faxed

**Interruptions:** 15.12: By another doctor asking how to make a spinal team referral on ICE

### **Summary**

Presenting complaint – legs give way so unable to walk. Been putting on weight over last 6 months; previously walked with a trolley. Patient said that she has her medication in her handbag; the doctor said that her GP has sent a list. The doctor copied the GP repeat into the case notes; doses but no frequencies were recorded. The doctor checked BNF on line to find out the indications for levetiracetam.. Diagnosis heart failure.

**VTE RA** – Completed on ICE and paper

### **Outcome**

Dalteparin 5,000 units prescribed . Therapeutic dalteparin prescribed 13.04.11 once PE diagnosed. Regular medication prescribed but the prescription was not checked with either the patient or her own medicines. 0 errors out of 8 items prescribed. Length of stay 4 days.

**Timeline**

14.05: Reviewed notes – no GP letter; I retrieved from fax machine  
14.11: Rang cardio respiratory regarding ECHO which GP letter says patient had 2 weeks ago  
14.55: Doctor finished seeing patient – booked chest X-Ray on ICE  
14.57: Rang clinical chemistry to add LFTs to blood tests  
14.59: Rang LHCH for copy of ECHO report to be faxed  
15.01: Started writing up  
15.12: Interrupted by another doctor re making a referral to the spinal team on ICE  
15.20: Wrote drug chart  
15.22: VTE done on ICE  
15.33: Rang LHCH back to see if they have found the ECHO report  
15.37: Consultant came to discuss

**Patient D138** (46F)

**Admission time:** 13.07 (Thursday)

**Clerking time:** 14.06 – 15.57 (110 minutes)

**Staff:** F2

**Information provided:** GP handwritten letter and summary

**Interruptions:** None

**Summary**

Presenting complaint – low haemoglobin. Hb 9.3g/dl on ferrous sulphate now feels short of breath when going up and down stairs. Has had 2 periods in the last month. When asked about medication the patient was able to list her medication with doses: domperidone 10mg TDS, omeprazole 40mg BD, ferrous sulphate 200mg TDS, fluoxetine – but she hasn't taken this for the last few days. The doctor correctly documented this information in the case notes and discussed with me whether or not to prescribe fluoxetine. I suggested that she ask the patient why she stopped taking it; the doctor did not discuss this with the patient. Diagnosis anaemia ? cause.

**VTE RA** – Completed on ICE and paper.

**Outcome**

Dalteparin not prescribed – no risk factors and ?PV bleed. Regular medication prescribed but not confirmed with patient. No medicines reconciliation by pharmacist. Length of stay 1 day.

**Timeline**

14.06: Read GP letter and nurse triage notes  
14.35: Started writing up clerking – had to stand up – no seats in doctors office  
14.40: Checked old blood results on ICE  
15.07: Finished writing up clerking  
15.17: Discussed plan with consultant  
15.33: Completed clerking – plan agreed with consultant  
15.45: Took blood – first attempt unsuccessful

## Patient D139 (80M)

**Admission time:** 15.59 (Thursday)

**Clerking time:** 17.31 – 20.10 (160 minutes)

**Staff:** F2

**Information provided:** GP summary

**Interruptions:** 18.30: Nurse from Obs ward asking about a patient with ?DVT

### Summary

Presenting complaint – has chest infection; has stopped drinking fluids and now can't stand up. Has cough, SOB and sweats. The patient has his own medication with him, the doctor used to write drug chart and DH in notes. There was no label on the Seretide inhaler; advised to check GP summary for dose. Asked about the need to write doses in the DH in the case notes – explained problems in the drug chart goes missing. Patient came in on flucloxacillin; showed how to prescribe the remaining 8 doses.. Diagnosis pneumonia.

**VTE RA** – Completed on ICE and paper. No paper RA forms in doctors' office – doctor asked where supplies were kept and went to get more from ED with nurse practitioner.

### Outcome

Dalteparin 5,000 units od prescribed. Regular medication prescribed but not confirmed with patient .1 error out of 7 items prescribed – ferrous sulphate missed off. Length of stay 8 days.

### Timeline

17.31: Reviewed notes and previous results on ICE, X-Rays on PACS

17.45: Went to see patient

18.15: Stared writing up clerking – had to get VTE forms and drug charts from ED

18.41: Went to get patients own medicines to write DH

18.55: Ordered ECG on ICE

19.17: Chest X-Ray ordered on ICE

19.25: Went to take blood and put in venflon; 3<sup>rd</sup> attempt successful, couldn't get blood sample from it

19.50: Went to take venous blood as unable to get via venflon – unsuccessful – I suggested that someone else should try

20.00: F2 successfully took blood

## Patient D256 (82F)

**Admission time:** 12.59 (Wednesday)

**Clerking time:** 14.35 – 16.45 (130 minutes)

**Staff:** F2

**Information provided:** GP summary and GP repeat

**Interruptions:** 16.27: F2 came to hand over a patient with pneumonia who needs monitoring



### **Summary**

Initially no GP letter – I found beside the fax machine after the patient interview. Presenting complaint – GP telephoned patient at home as she has a low Hb 6.1g/dl. Feels light headed, has to sit down regularly and gets very SOB. Symptoms have developed over last 2 – 3 months; previously able to go out to hairdresser etc. now has to sit down on the way from lounge to kitchen. Patient takes 'water tablets' and laxatives, has raised cholesterol and takes 'takes two little tablets' ; doctor didn't pursue. She has been told not to take aspirin as 'it will make her bleed inside' Doctor asked 'how often do you use your GTN?' Doctor asked if patient has her own medicines – she has but they are in an unlabelled Dosette box but she also has her GP repeat; initially she only gave the doctor page 2 which was discovered when she was writing the DH in the clerking – she had to back and ask for page 1. However the patient is only taking half of one of the tablets – GP repeat has the old dose listed. The patient is also prescribed inhalers but wasn't aware that she had either asthma or COPD. She also takes co-codamol for 'bones / cramp' Doctor asked 'have you ever had clots in your legs or lungs?'  
Diagnosis iron deficiency anaemia

**VTE RA** – Completed on ICE and paper.

### **Outcome**

Dalteparin 5,000 units od prescribed. Regular medicines prescribed but not confirmed with patient, clopidogrel and dipyridamole withheld. 0 errors out of 7 items prescribed. Length of stay 4 days.

### **Timeline**

15.09: Started writing up clerking – I found GP fax beside fax machine  
15.55: Finished writing clerking and went to discuss patient with registrar  
15.57: Ordered blood tests on ICE  
16.05: Wrote drug chart  
16.10: Went to insert cannula and take blood  
16.27: F2 came to hand over a patient with pneumonia who needs monitoring  
16.40: Ordered blood for transfusion – had to go and ask patient about transfusion history to complete the form. Blood samples podded

## **Patient D180 (62F)**

**Admission time:** 13.12 (Friday)

**Clerking time:** 14.22 – 15.23 (60 minutes)

**Staff:** F2

**Information provided:** GP summary

**Interruptions:** None

### **Summary**

Presenting complaint – very SOB – talking, walking and eating make it worse. When asked about medication the patient says she has a Seretide inhaler and uses home nebulas, Ventolin TDS when her chest is bad. She has taken ciprofloxacin for the last 10 days and also steroids when she tried to stop these her chest became worse. Patient also says that she takes bendroflumethiazide 2.5mg od and 'vitamins'. The doctor asked if she has a list; she

hasn't but has her own medicines with her. Medicines from GP summary copied into case notes – Seretide inhaler without form and strength.

Diagnosis non infective exacerbation COPD.

**VTE RA** – Completed on ICE and paper.

### **Outcome**

Dalteparin not prescribed; no contra indications identified. Regular medication prescribed but not confirmed with patient. Doctor asked whether it's better to prescribe fluticasone / salmeterol or Seretide inhaler (better to use brand) and how to prescribe calcium carbonate 1.5g / cholecalciferol – Adcal D3. Doctor had to ask patient which days she took her twice weekly alfacalcidol – Tues and Sat – days correctly crossed out on drug chart. No medicines reconciliation by pharmacist. Length of stay 1 day.

### **Timeline**

14.38: Ordered tests and chest X-Ray on ICE

14.46: Asked consultant difference between bronchiectasis and COPD

14.50: Stared writing up clerking

15.11: Wrote drug chart

15.22: went back to speak to patient to complete history

## **Patient D181 (64M)**

**Admission time:** 15.59 (Friday)

**Clerking time:** 16.45 – 18.12 (85 minutes)

**Staff:** F1

**Information provided:** GP short typed letter re current problem – no information re medicines

**Interruptions:** 18.03: Nurse – to write up IV fluids for another patient

### **Summary**

Presenting complaint –severe vomiting – GP has prescribed cyclizine and buccal prochlorperazine – patient has run out of tablets today but were not effective. OK lying down but standing or sitting up causes vomiting. Had a similar episode about 3 years ago – gastroparesis diagnosed – discharged on erythromycin. Doctor asked about medication – patient has his own with him; doctor asked for a list – patient doesn't have a list. Doctor asked if anything missing – just antiemetics as he has run out. Patients own medicines used to write DH in case notes. Patient had an old bottle with illegible label ? vitamins. Diagnosis gastroparesis

**VTE RA** – Completed on ICE and paper..

### **Outcome**

Dalteparin 5,000 units od prescribed. Regular medication prescribed later; dose of Isotard XL confirmed with patient – no dose on label .0 errors out of 3 items prescribed. Length of stay 14 days.

**Timeline**

17.15: Reviewed chest X-Ray on PACS; ordered X-Rays chest & abdo and ECG  
17.25: PR examination  
17.30: Started writing drug chart – PRN cyclizine prescribed and given  
17.52: Went back to ask pt about weight loss  
17.55: Prescribed regular medicines  
17.57: Went back to confirm dose of Isotard XL  
18.03: Interrupted by nurse to prescribe IV fluids for another patient

**Patient D182 (79F)**

**Admission time:** 14.12 (Friday)

**Clerking time:** 18.29 – 20.30 (120 minutes)

**Staff:** F1

**Information provided:** GP proforma – not used

**Interruptions:** 18.29: Asked by patients relative for incontinence pad  
19.45: By nurse to prescribe co-codamol for a different patient  
19.48: By nurse to review ECG – asked another F2 to look at it as writing up drug chart  
20.00: Nurse asked doctor to take blood so they can move the patient as they have no space to see any more patients. Went to take blood  
20.18: Bleeped by HEC  
20.25: Nurse came from HEC with query about Digami regimen  
20.30: Asked to prescribe PRN nebuliser for a different patient

**Summary**

Presenting complaint – sharp pain in leg from buttocks to ankle when moving; OK sitting or lying down. Nothing makes it better has tried: Voltarol, paracetamol, amitriptylline – all no effect. Recently stopped taking atorvastatin – been on it for about a year but wondered if it was causing the pain. Doctor asked if there was any history of clots in the legs or lung. Patient had a large bag of medication with him which the doctor used to write the drug chart. The drug chart was not checked with the GP summary.  
Diagnosis ?Sciatica

**VTE RA** – Completed on ICE and paper.

**Outcome**

Dalteparin 5,000 units od prescribed. Regular medication prescribe but not confirmed with patient. Medication chart misplaced. Length of stay 7 days.

**Timeline**

18.29: Asked by a relative for incontinence pad while retrieving notes from trolley  
18.30: Read GP letter and nurse triage information  
18.33: Went to see patient  
18.55: Needed help to lower trolley to examine patient – Stroke nurse assisted  
19.20: PR examination  
19.23: Examination finished  
19.27: Ordered blood test on ICE

19.28: Discussed patient with SpR  
19.35: Went back to ask patient re bowel / bladder problems  
19.36: Ordered X-Ray spine  
19.45: Interrupted to prescribe co-codamol for a different patient  
19.47: Wrote drug chart  
19.48: Asked by nurse to review ECG – asked another F2 to look at it as busy writing drug chart  
19.50: Started writing up clerking  
20.00: Nurse came to ask doctor to take this patient's blood as no space for other patients to be seen – went to take blood  
21.10: Continued writing history  
20.18: Bleeped by HEC  
20.25: Nurse from HEC with query about Digami regimen  
20.27: Rang X-Ray re lumbar spine X-Ray  
20.30: Asked to prescribe nebuliser for different patient

### **Patient D251 (73M)**

**Admission time:** 15.37 (Monday)

**Clerking time:** 16.20 – 16.49 (30 minutes)

**Staff:** Consultant

**Information provided:** GP proforma

**Interruptions:** 16.40: Another patient waiting to see the doctor in the interview room

#### **Summary**

Presenting complaint – ascites and swelling of legs and feet. Patient known to have cirrhosis – needs ascetic tap. Doctor asked patient 'Do you take any tablets?' – Patient said 'water tablets – but I haven't had any for a while' Doctor asked why the patient was taking pyridostigmine – for myasthenia gravis. Doctor explained the need to take medication regularly to stop abdomen swelling.

Diagnosis ascites

**VTE RA** – Not completed on ICE or paper.

#### **Outcome**

Dalteparin not prescribed probably has abnormal clotting and for paracentesis Regular medication prescribed using GP proforma – not confirmed with patient as all items 'no issue' other than pyridostigmine .1 error out of 5 items prescribed; spironolactone prescribed 50mg BD should be 100mg BD. Proforma badly formatted – 2 daily at the bottom of 1 page and 100mg at top of next page. Confirmed calcium carbonate 1.25g / cholecalciferol 10mcg with me – Calcichew D3 Forte Length of stay 4 days.

**Timeline**

16.20: Technician doing ECG so read notes  
16.25: Ordered chest X-Ray  
16.33: Examination finished  
16.36: Went back to ask pt about allergies  
16.37: Started writing up history  
16.40: Nurse to say there is another patient to see the doctor in the interview room  
16.46: Drug chart written

**Patient D252 (86M)**

**Admission time:** 16.58 (Monday)

**Clerking time:** 18.05 – 19.40 (95 minutes)

**Staff:** F1

**Information provided:** GP summary

**Interruptions:** None

**Summary**

Presenting complaint – Fall – not dizzy, no palpitations, didn't lose consciousness. Had PR bleeding for past 3 weeks – happened a few years ago and needed blood transfusion. Doctor asked 'Do you take any regular medicines' Patient responded 'about ten a day'  
Diagnosis PR bleed, CCF Hb 8.8g/dl

**VTE RA** – Completed on ICE and paper. – bleeding risks only filled in

**Outcome**

Dalteparin not prescribed – need discussed with F2 – Hb dropped from 12g/dl 6 months ago to 8.8 now – decision to withhold. Regular medication prescribed; but not confirmed with patient. 0 errors out of 12 items prescribed; clopidogrel not prescribed but should be withheld PR bleed Length of stay 14 days.

**Timeline**

18.05: Read GP letter  
18.12: Went to find patients wife to clarify sequence of events  
18.35: PR examination  
18.40: Started writing up history  
18.55: Ordered X-Rays on ICE  
19.00: Went to insert cannula and take blood – 2<sup>nd</sup> attempt but not sufficient for all tests  
19.35: Drug chart  
19.40: VTE on ICE

## Patient D257 (16M)

**Admission time:** 15.26 (Wednesday)

**Clerking time:** 17.15 – 18.10 (55 minutes)

**Staff:** F1

**Information provided:** None - GP summary promised but not received.

**Interruptions:** None

### Summary

Presenting complaint – nausea, weakness and cramps. Recent admission with Addisonian crisis – diagnosed 3 weeks ago. Pt has polyendocrinopathy type 1. Blood test at GP – Na 129mmol /l – accepted by endocrine registrar. Patients own medicines available and used to write DH in clerking and then copied onto drug chart – two strengths of olanzapine 5mg labelled 2 nocte and 2.5mg labelled 1 nocte. Doctor checked dose with patient's mother – 12.5mg nocte. Doctor unsure re diagnosis and management and unwilling to ask AMU consultant for help so I asked him.

Diagnosis – worsening of polyendocrine syndrome

**VTE RA** – Completed on ICE and paper. – bleeding risks only filled in

### Outcome

Dalteparin 5,000 units od prescribed. Regular medication prescribed. 0 errors out of 5 items prescribed. Length of stay 2 days.

### Timeline

17.40: Documented DH in clerking using patient own medicines

17.44: Ordered blood tests on ICE

17.50: Insert cannula and take blood

18.00: Discussed with F2 doctor

18.02: Wrote drug chart

18.05: Discussed with AMU consultant (I asked for help)

## Patient D258 (50M)

**Admission time:** 13.52 (Thursday)

**Clerking time:** 14.50 – 15.40 (50 minutes)

**Staff:** ST5

**Information provided:** GP summary

**Interruptions:** 14.52 Bleeped  
15.12 Bleeped

**Summary**

Presenting complaint – series of blackouts, 5 episodes in last 2 weeks while reading, watching TV, no warnings. Doctor asked re medication – cream for eczema, doesn't know the name (Fucibet cream according to GP summary); asked 'what tablets do you take?' Patient responded 'none'. Asked about OTC medicines – only paracetamol for headache following blackout. The doctor asked 'have you ever had clots in your legs or lungs?'  
Diagnosis recurrent collapse ?why. Needs 5 day ECG recording

**VTE RA** – Completed on ICE and paper.

**Outcome**

Dalteparin not prescribed – no risk factors. Regular medication prescribed; but not confirmed with patient – didn't check is patient currently using Fucibet. No medicines reconciliation by pharmacist Length of stay 1 day.

**Timeline**

14.52: Bleeped  
15.12: Bleeped  
15.15: Ordered ECG on ICE  
15.17: VTE and chest X-Ray on ICE  
15.26: Started writing up history  
15.34: Ordered chest X-Ray for patient seen earlier  
15.36: Drug chart

**Patient D259 (47M)**

**Admission time:** 13.20 (Thursday)

**Clerking time:** 16.18 – 16.55 (35 minutes)

**Staff:** ST5

**Information provided:** GP summary

**Interruptions:** None

**Summary**

Presenting complaint – abdominal pain for last 2 days, coughing up blood. Clerking difficult as patient with a friend and both were drunk. The doctor asked 'Are you taking any regular medication?' Patient responded ' lansoprazole and vitamins' Patient says he has asthma and takes blue, green and brown inhalers. The doctor asked me about the green inhaler – possibly Serevent. The doctor asked 'have you had any problems with clots in your legs?' The patient responded 'Yes, in my arm'  
Diagnosis LRTI

**VTE RA** – Completed on ICE and paper.

**Outcome**

Dalteparin not prescribed – no risk factors. Regular medication prescribed; but not confirmed with patient as patient had gone outside for cigarette. No medicines reconciliation by pharmacist. Length of stay 1 day.

**Timeline**

15.41: Went to start clerking but patient not in waiting room  
15.55: EPA taking blood  
16.12: Technician doing ECG  
16.35: Started writing up history  
16.50: VTE RA and drug chart

**Patient D255 (17M)**

**Admission time:** 16.36 (Tuesday)

**Clerking time:** 17.12 – 17.58 (45 minutes)

**Staff:** ST3 (Only been in Trust 2 weeks)

**Information provided:** GP letter

**Interruptions:** 17.16: By SHO to discuss another patient with low sats  
17.55: Hand over from day registrar  
18.00: To assist the other registrar

**Summary**

Presenting complaint – From gastro clinic – patient has ulcerative colitis and needs IV steroids. The doctor asked the patient if he takes any medicines, patient responded 'Pentasa 2g BD, prednisolone 40mg od for the last 10 days'. Doctor used 'Up to date' to find the dose of steroids  
Diagnosis PR bleed, CCF Hb 8.8g/dl

**VTE RA –** VTE RA available on paper and ICE; neither completed on admission. Both completed next day

**Outcome**

Dalteparin not prescribed – no apparent contra indications. Regular medication prescribed; Adcal D3 prescribed as 1 od, should be 2 od; not confirmed with patient. 1 error out of 5 items prescribed. Length of stay 4 days.

**Timeline**

17.12: Read notes from clinic  
17.16: Interrupted by SHO about another patient with low sats  
17.34: Interview and examination finished  
17.50: Drug chart  
17.55 Handover from day registrar  
17.55: Computer locked – doctor has no password – I unlocked  
18.00: Interrupted to assist the other registrar

Patient still needs cannula



**Appendix 17: Case Summaries for patients in whom LMWH was contraindicated but prescribed (33 patients)**

**Dalteparin Contra indicated but prescribed (Consultants consensus decision 22.03.12)**

**Patient A82** (76 M)

**Medical problems:** Glioblastoma – newly diagnosed

**VTE risk factors: 2**

Age, active cancer

**Bleeding risk factors: 1**

PT 14.9 (9 – 13 seconds)

**Benefit outweighs risk: Yes**

**Patient A95** (34 F)

**Medical problems:** Overdose Syndol (paracetamol, codeine, caffeine)

**VTE risk factors: 0**

**Bleeding risk factors: 1**

PT 15.7

**Benefit outweighs risk: No**

**Patient A231** (68 M)

**Medical problems:** cellulitis, cardiomyopathy

**VTE risk factors: 2**

Age, acute infection - cellulitis

**Bleeding risk factors: 1**

Platelets 79

**Benefit outweighs risk: Yes**

**Patient B3** (76 F)

**Medical problems:** Pain ? due to fracture as a result of myeloma. CVA possible on CT scan

**VTE risk factors: 2**

Age, active cancer

**Bleeding risk factors: 1**

CVA possible on CT scan

**Benefit outweighs risk: No**

**Patient B43** (75 M)

**Medical problems:** Pr bleed, known thrombus right arm came in on dalteparin 7,500 units od

**VTE risk factors: 1**

Age

**Bleeding risk factors: 1**

PR bleed

**Benefit outweighs risk: No**

**Patient B76** (68 F)

**Medical problems:** Decompensated alcoholic liver disease

**VTE risk factors: 1**

Age

**Bleeding risk factors: 2**

PT 21 on admission, ?PR bleed

**Benefit outweighs risk: No**

**Patient B109** (79 F)

**Medical problems:** Social – not coping at home

**VTE risk factors: 2**

Age, COPD

**Bleeding risk factors: 1**

On warfarin INR 2.3 on day 5; no earlier result on ICE

**Benefit outweighs risk: No**

**Patient B123** (74 M)

**Medical problems:** Known pancreatic Ca, acute renal failure requiring haemofiltration

**VTE risk factors: 2**

Age, active cancer

**Bleeding risk factors: 1**

Admission creatinine 1056, creatinine day 4 392

**Benefit outweighs risk: Yes**

**Patient B164** (85 M)

**Medical problems:** Collapse, ?PUD, ?Bleed. Transfused 3 units 28.1.10, 2 units 5.2.10, 9.2.10 and 16.2.10

**VTE risk factors: 1**

Age

**Bleeding risk factors: 2**

?bleed Hb 7.5, PT 15.2

**Benefit outweighs risk: No**

**Patient B178** (45 M)

**Medical problems:** Upper GI bleed

**VTE risk factors: 0**

**Bleeding risk factors: 3**

GI bleed, platelets 73, PT 17.9

**Benefit outweighs risk: No**

**Patient B184** (62 F)

**Medical problems:** Infective exacerbation COPD

**VTE risk factors: 3**

Age, chronic lung disease, infection

**Bleeding risk factors: 1**

PT 25.1

**Benefit outweighs risk: No**

**Patient B198** (75 F)

**Medical problems:** Increased INR 19

**VTE risk factors: 1**

Age

**Bleeding risk factors: 1** - On warfarin for MVR - INR 19 on admission

Day 1 INR 19.0

Day 2 INR 10.0

Day 3 INR 1.7

Day 4 INR 1.2

Day 5 INR 1.3

**Benefit outweighs risk: No**

### **Patient B204** (90 F)

**Medical problems:** From Kent Lodge; ?upper GI bleed, haematuria, sepsis, new AF, pelvic abscess, developed DCT diarrhoea

**VTE risk factors: 6**

Age, chronic lung disease, chronic heart failure, infection – HAP, immobile, obesity

**Bleeding risk factors: 1**

Haematuria ? GI bleed

**Benefit outweighs risk: No**

### **Patient C44** (84 F)

**Medical problems:** Back pain – referred to physio

**VTE risk factors: 1**

Age

**Bleeding risk factors: 1**

Severe renal disease creatinine 523 - chronic

**Benefit outweighs risk: Yes**

### **Patient C57** (76 F)

**Medical problems:** AKI secondary to dehydration – K 6.6mmol/l

**VTE risk factors: 1**

Age

**Bleeding risk factors: 1**

Warfarin INR 10.3 on day 3; 1.3 on day 10

**Benefit outweighs risk: No**

**Patient C84** (90 F)

**Medical problems:** Confusion and aggression; AF, acute stroke

**VTE risk factors: 1**

Age

**Bleeding risk factors: 1**

Acute CVA on CT scan

**Benefit outweighs risk: No**

**Patient C92** (83 F)

**Medical problems:** SOB, anaemia - transfused

**VTE risk factors: 1**

Age

**Bleeding risk factors: 1**

Bleeding risk Hb 6.3g/dl

**Benefit outweighs risk: No**

**Patient C200** (81 M)

**Medical problems:** Collapse, sepsis secondary to leg ulcer, AKI

**VTE risk factors: 2**

Age, infection

**Bleeding risk factors: 1**

PT 18.2

. Day 2 – creatinine 220 and PT 16.0; day 6 creatinine 175 and PT 14.6; day 9 creatinine 91

**Benefit outweighs risk: Yes**

### Patient D21 (52 M)

**Medical problems:** Collapse, seizure ? due to alcohol withdrawal, ? vasovagal, ? haematemesis, ear infection

**VTE risk factors: 1**

Infection

**Bleeding risk factors: 1**

?haematemesis Hb 14.6 on admission; Hb 15.2 on day 3

**Benefit outweighs risk: No**

### Patient D29 (47 M)

**Medical problems:** Alcohol related seizure

**VTE risk factors: 0**

**Bleeding risk factors: 1**

Platelets 30 on day1; 58 on day 11

Day 11 platelets 58

Day 18 72

Day 22 63

Day 27 59

**Benefit outweighs risk: No**

### Patient D44 (72 M)

**Medical problems:** Known lung Ca. SOB ?PE, ? infection. Neutropenic sepsis

**VTE risk factors: 4**

Age, infection, lung cancer, thrombophilia

**Bleeding risk factors: 1:** Platelets 50

**Benefit outweighs risk: No**

**Patient D64** (80 F)

**Medical problems:** Diarrhoea & vomiting

**VTE risk factors: 1**

Age

**Bleeding risk factors: 1**

On warfarin INR 3.3 on day 1

**Benefit outweighs risk: No**

**Patient D66** (59 M)

**Medical problems:** Haematemesis, malaena

**VTE risk factors: 0**

**Bleeding risk factors: 1**

?bleeding Hb 9.2

**Benefit outweighs risk: No**

**Patient D71** (83 F)

**Medical problems:** Seizure following a fall ? sub dural haematoma

**VTE risk factors: 1**

Age

**Bleeding risk factors: 1**

? sub dural haematoma

**Benefit outweighs risk: No**



**Patient D75** (44 F)

**Medical problems:** SOB, known COPD - ?DVT / PE

**VTE risk factors: 4**

COPD, immobility, personal / family history DVT / PE, obesity

**Bleeding risk factors: 1**

Platelets 94

**Benefit outweighs risk: Yes**

**Patient D113** (38 M)

**Medical problems:** ?Gi bleed, alcoholic hepatitis

**VTE risk factors: 0**

**Bleeding risk factors: 1**

?GI bleed Hb 16.4 day 1 and 4.3 day 3

Day 1 Hb 16.4

Day 3 4.3

Day 6 13.9

Day 12 15.3

**Benefit outweighs risk: No**

**Patient D116** (49 F)

**Medical problems:** SOB ?PE

**VTE risk factors: 1**

leukaemia

**Bleeding risk factors: 2**

Hb 6.4; platelets 69

**Benefit outweighs risk: No**

**Patient D183** (56 F)

**Medical problems:** Self neglect, secondary to alcohol excess, fall, peripheral neuropathy

**VTE risk factors: 0**

**Bleeding risk factors: 1**

Platelets 50; day 6 platelets 107

**Benefit outweighs risk: No**

**Patient D226** (76 F)

**Medical problems:** Ascites ? cause

**VTE risk factors: 1**

Age

**Bleeding risk factors: 3**

Drain needed for ascites, platelets 35, PT 17.4; platelets 43 on day 27

**Benefit outweighs risk: No**

**Patient D229** (75 F)

**Medical problems:** Increasing SOB on exercise, oedema, fluid overload

**VTE risk factors: 2**

Age, obesity

**Bleeding risk factors: 1**

Warfarin for AF

Day 4 INR	2.7	Day 11	2.5
Day 5	3.1	Day 13	2.8
Day 8	3.1	Day 14	3.3

**Benefit outweighs risk: No**

**Patient D230** (39 M)

**Medical problems:** Jaundice, ascites, encephalopathic, due to alcohol excess. Sub-acute bacterial peritonitis

**VTE risk factors: 1**

Infection

**Bleeding risk factors: 2**

Platelets 82, PT 24.5

**Benefit outweighs risk: No**

**Patient D253** (74 M)

**Medical problems:** SOB LVF secondary to pneumonia

**VTE risk factors: 3**

Age, chronic heart failure, infection

**Bleeding risk factors: 1**

Warfarin

INR 2,9 on day 2, 2.4 on day 3, 1.8 on day 4. INR in range on day 1

**Benefit outweighs risk: No**

**Patient D256** (82 F)

**Medical problems:** Hb 6.1 ? bleeding ? iron deficiency anaemia

**VTE risk factors: 1**

Age

**Bleeding risk factors: 1**

Hb 6.1 ? bleeding      Hb 6.8 day 2, no evidence of bleeding

**Benefit outweighs risk: No**

## Appendix 18: Validation Summary – Bleeding risks and prescribed LMWH (33 patients)

### Validation of Patients with bleeding risks who were prescribed LMWH (13.02.12)

Patient No	Observed	Cons 1	Cons 2	Cons 3	Cons 4	Lack of initial consensus	Consensus Decision 22/03/12
A82		N	Y	N	N	**	Yes
A95		N	Y??	N	N	**	No
A231		Y	Y	Y	Y		Yes
B3	✓	N	N	N	Y	**	No
B43		N	N	Y	Y	**	No
B76		N	N	N	N		No
B109		N	N	N	N		No
B123		Y	Y	Y	Y		Yes
B164		N	N	N	N		No
B178		N	N	N	N		No
B184		N	N	N	Y	**	No
B198	✓	N	N	N	N		No
B204		N	N	N	N		No
C44		Y	Y	Y	Y		Yes
C57		N	N	N	N		No
C84		N	N	N	??	**	No
C92		N	N	N	N		No
C200		Y	Y	Y	Y		Yes
D21		N	N	N	??	**	No
D29		N	N	N	N		No
D44		N	N	N	Y	**	No
D64		N	N	N	N		No
D66		N	N	N	N		No
D71		N	N	N	N		No
D75		Y	Y	Y	Y		Yes
D113		N	N	N	N		No
D116		N	N	N	??	**	No
D183		N	N	N	N		No
D226		N	N	N	N		No
D229		N	N	N	N		No
D230		N	N	N	N		No
D253		N	N	N	N		No
D256	✓	N	N	N	N		No

**Appendix 19 No initial consultant consensus – bleeding risks and prescribed LMWH (9 patients)**

**Dalteparin Contra indicated but prescribed (no consensus) – Consultant decision 22.03.12**

**Patient A82** (76 M)

**Medical problems:** Glioblastoma – newly diagnosed

**VTE risk factors: 2**

Age, active cancer

**Bleeding risk factors: 1**

PT 14.9 (9 – 13 seconds)

**Benefit outweighs risk: Yes**

**Patient A95** (34 F)

**Medical problems:** Overdose Syndol (paracetamol, codeine, caffeine)

**VTE risk factors: 0**

**Bleeding risk factors: 1**

PT 15.7

**Benefit outweighs risk: No**

**Patient B3** (76 F)

**Medical problems:** Pain ? due to fracture as a result of myeloma. CVA possible on CT scan

**VTE risk factors: 2**

Age, active cancer

**Bleeding risk factors: 1**

CVA possible on CT scan

**Benefit outweighs risk: No**

**Patient B43** (75 M)

**Medical problems:** Pr bleed, known thrombus right arm came in on dalteparin 7,500 units od

**VTE risk factors: 1**

Age

**Bleeding risk factors: 1**

PR bleed

**Benefit outweighs risk: No**

**Patient B184** (62 F)

**Medical problems:** Infective exacerbation COPD

**VTE risk factors: 3**

Age, chronic lung disease, infection

**Bleeding risk factors: 1**

PT 25.1

**Benefit outweighs risk: No**

**Patient C84** (90 F)

**Medical problems:** Confusion and aggression; AF, acute stroke

**VTE risk factors: 1**

Age

**Bleeding risk factors: 1**

Acute CVA on CT scan

**Benefit outweighs risk: No**

**Patient D21** (52 M)

**Medical problems:** Collapse, seizure ? due to alcohol withdrawal, ? vasovagal, ? haematemesis, ear infection

**VTE risk factors: 1**

Infection

**Bleeding risk factors: 1**

?haematemesis Hb 14.6 on admission; Hb 15.2 on day 3

**Benefit outweighs risk: No**

**Patient D44** (72 M)

**Medical problems:** Known lung Ca. SOB ?PE, ? infection. Neutropenic sepsis

**VTE risk factors: 4**

Age, infection, lung cancer, thrombophilia

**Bleeding risk factors: 1:** Platelets 50

**Benefit outweighs risk: No**

**Patient D116** (49 F)

**Medical problems:** SOB ?PE

**VTE risk factors: 1**

leukaemia

**Bleeding risk factors: 2**

Hb 6.4; platelets 69

**Benefit outweighs risk: No**

## Appendix 20: RLUBHT VTE Risk Assessment form – April 2010

Patient's Name.....

The Royal Liverpool and   
Broadgreen University Hospitals  
NHS Trust

Date of Birth.....

<b>Thrombosis Risk Assessment Form</b>	Tick
Regard patients as being at increased risk of VTE if they have one or more of the following risk factors:	
<ul style="list-style-type: none"> <li>active cancer or cancer treatment</li> </ul>	
<ul style="list-style-type: none"> <li>acute surgical admission with inflammatory or intra-abdominal condition or admission to critical care</li> </ul>	
<ul style="list-style-type: none"> <li>age &gt; 60 years</li> </ul>	
<ul style="list-style-type: none"> <li>dehydration</li> </ul>	
<ul style="list-style-type: none"> <li>expected to be immobile for 3 days or more (medical patients) or expected significant reduction in mobility (surgical patients)</li> </ul>	
<ul style="list-style-type: none"> <li>known thrombophilia</li> </ul>	
<ul style="list-style-type: none"> <li>obesity (BMI &gt; 30 kg/m<sup>2</sup>)</li> </ul>	
<ul style="list-style-type: none"> <li>one or more significant medical co-morbidities (such as heart disease, metabolic, endocrine or respiratory pathologies, acute infection or inflammatory conditions)</li> </ul>	
<ul style="list-style-type: none"> <li>personal or family history of VTE</li> </ul>	
<ul style="list-style-type: none"> <li>pregnancy or ≤ 6 weeks post partum AND any of additional risk factors from: age &gt;35 years, excess blood loss or blood transfusion, pregnancy-related risk factors (ovarian hyperstimulation, hyperemesis gravidarum, multiple pregnancy, pre-eclampsia)</li> </ul>	
<ul style="list-style-type: none"> <li>surgical procedure with a total anaesthetic and surgical time of more than 90 minutes, or 60 minutes if the surgery involves the lower limb or pelvis</li> </ul>	
<ul style="list-style-type: none"> <li>use of hormone replacement therapy</li> </ul>	
<ul style="list-style-type: none"> <li>varicose veins with phlebitis.</li> </ul>	
<ul style="list-style-type: none"> <li>use of oestrogen-containing contraceptive therapy</li> </ul>	
<b>Bleeding Risk</b>	Tick
Regard patients as being at risk of bleeding if they have any of the following risk factors:	
<ul style="list-style-type: none"> <li>active bleeding or a risk of bleeding (for example, stroke)</li> </ul>	
<ul style="list-style-type: none"> <li>surgery expected within the next 12–24 hours (depending on the half-life of the anticoagulant used)</li> </ul>	
<ul style="list-style-type: none"> <li>surgery within the past 48 hours and/or a risk of clinically important bleeding</li> </ul>	
<ul style="list-style-type: none"> <li>concurrent use of anticoagulants (e.g. warfarin with INR &gt;2) known to increase the risk of bleeding</li> </ul>	
<ul style="list-style-type: none"> <li>Acquired bleeding disorders (e.g acute liver failure), thrombocytopenia (platelets &lt;75 x 10<sup>9</sup>/L), untreated inherited bleeding disorders</li> </ul>	
<ul style="list-style-type: none"> <li>any spinal intervention (contraindicated for 12hours before or 4 hours after procedures such as epidural catheter insertion or lumbar puncture).</li> </ul>	
<ul style="list-style-type: none"> <li>uncontrolled systolic hypertension (230/120 mmHg or higher)</li> </ul>	
<ul style="list-style-type: none"> <li>new-onset stroke within 14 days in line with 'Stroke: diagnosis and management of acute stroke and transient attack (TIA)' (NICE CG 68)</li> </ul>	

Completed by..... Bleep..... Date.....

Completed forms to be filed in patient's medical record



## Appendix 21: Abstract for oral presentation – HSRPP conference 2010

### Factors influencing appropriate prescription of VTE prophylaxis for medical patients

Basey A J, Pradham S, School of Pharmacy and Biomolecular Sciences, Liverpool John Moores University, Liverpool L3 3AF [A.Basey@2009.ljmu.ac.uk](mailto:A.Basey@2009.ljmu.ac.uk)

#### Introduction

Venous thromboembolism (VTE) accounts for 10% of deaths in hospital (1). Estimates suggest that 25,000 patients a year die from VTE in English hospitals (2). In 2007 VTE risk assessment was recommended for every patient on admission to hospital (2) and in 2008 the Department of Health (DoH) recommended that all acute trusts use a VTE screening tool.

This study evaluated compliance with DoH guidance in a large teaching hospital and the impact of a sticker, designed to facilitate prescribing by its completion, attached to medication charts in the Acute Medical Unit (AMU).

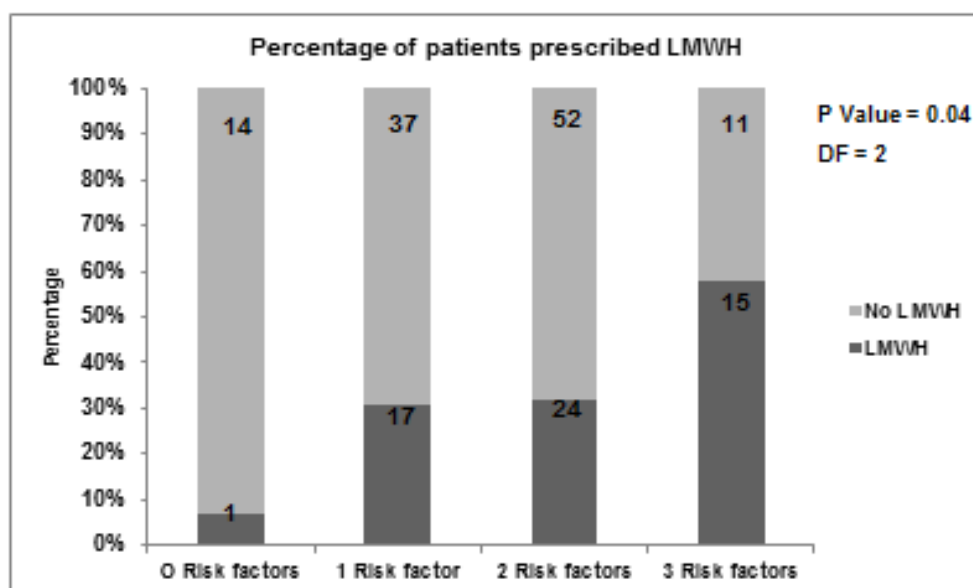
#### Method

The study was conducted for four weeks in January 2009. Medical records of patients admitted to six wards, representing a range of medical specialties, were reviewed. Number of stickers attached and completed was recorded. Data were analysed using Excel, statistical significance was calculated using chi-squared in Minitab version 15. Ethical approval was not required as this study was classed as an audit under GAFREC.

#### Results

Medical records of 171 medical patients were reviewed, 156 (91%) had at least 1 VTE risk factor. As the number of risk factors increased a greater proportion of patients were prescribed prophylaxis. However 14 patients received the standard dose of dalteparin, a low molecular weight heparin (LMWH), inappropriately; five had renal impairment (creatinine clearance < 30ml/min), nine had liver impairment (prothrombin time > 14 seconds) and one had an Activated Partial Thromboplastin Time Ratio > 1.5.

Stickers were only attached to 19 of the 95 charts of patients admitted via AMU. They resulted in a statistically significant ( $p = 0.016$ ) increase in appropriate prescription from 33% (25/76) to 63% (12/19).



#### Conclusion

Compliance with the DoH requirement for VTE risk assessment was poor. Stickers on medication charts appeared to be effective in increasing the proportion of patients prescribed prophylactic treatment for VTE. Reasons for stickers not being attached or completed require investigation. While the number of risk factors increases the chances of receiving prophylaxis, all patients with any risk factor should have been treated, unless contra-indicated. Therefore mechanisms for improving risk assessment and VTE management require further investigation.

1. The prevention of Venous Thromboembolism in Hospitalised Patients Second Report of Session 2004 - 2005. House of Commons Health Committee.
2. Report of the Independent expert working group on the prevention of venous thromboembolism in hospitalised patients. Department of Health; 2007.

## Appendix 22: Abstract for oral presentation – PRIMM conference 2011

### VTE risk assessment – What really happens on admission to hospital?

Basey A J<sup>†</sup>, Kennedy T D<sup>\*</sup>, Krska J<sup>†</sup> and Mackridge A J<sup>†</sup>, <sup>†</sup>School of Pharmacy and Biomolecular Sciences, Liverpool John Moores University, Liverpool UK <sup>\*</sup>Royal Liverpool University Hospital, Liverpool UK

#### (Poster presentation)

#### Introduction

Venous thromboembolism (VTE) accounts for 10% (25,000 per annum) of English hospital deaths (1, 2). In 2010 the Department of Health (DH) linked VTE risk assessment on admission to payment by its inclusion as an indicator within the NHS Commissioning for Quality and Innovation framework (CQINS).

This study investigated how VTE risk assessment is integrated into the admission process and compliance with DH guidance in a large teaching hospital.

#### Method

NHS ethical approval was granted. Data were collected over three periods; November 2009, January 2010 and April 2010. Twenty-four staff were observed clerking 51 medical patients; 25 staff participated in a structured interview.

#### Results

One nurse and 24 doctors (foundation year to consultant) participated.

14 (56%) had attended VTE training, 12 (86%) for less than one hour. Three had attended within the preceding six months; five within 12 months and six over 12 months previously. Four doctors received undergraduate training and nine as postgraduates; five at the study hospital and four at another hospital.

Participants rated their own knowledge of VTE as good (9; 36%); average (14; 56%); and below average (2; 8%). They were able to spontaneously list between three and eight VTE risk factors from a possible 16, and one to four bleeding risks from a possible 12.

Eight patients (16%) were asked questions relating to VTE during admission, three of whom presented with symptoms suggesting possible VTE.

No risk assessment form was available for any of the 16 admissions observed in November 2009. In January 2010, a form was available for all 21 admissions observed, however only seven (33%) were completed, nine (43%) were ignored; five (24%) were discarded. In April 2010 electronic risk assessment was introduced; this was completed for only four out of 14 (29%) of admissions observed later that month and generated complaints.

#### Conclusion

At the time of the study VTE training had been lacking, staff knowledge of VTE and bleeding risks was poor, but staff were conscious of their lack of knowledge. VTE risk assessment appeared to be a low priority for admitting staff. Systems introduced to improve the rate of risk assessment were largely ineffective and electronic recording proved counterproductive.

1. Report of the independent expert working group on the prevention of venous thromboembolism in hospitalised patients. Department of Health; 2007.
2. The prevention of Venous Thromboembolism in Hospitalised Patients Second Report of Session 2004 - 2005. House of Commons Health Committee; 2005

## Appendix 23: Abstract for poster - PRIMM conference 2012

### VTE – Who gets prophylaxis on admission to hospital?¶

Basey A-J<sup>†</sup>, Kennedy T-D<sup>\*</sup>, Krska J<sup>†</sup> and Mackridge A-J<sup>†</sup>, →<sup>†</sup>School of Pharmacy and Biomolecular Sciences, Liverpool John Moores University, Liverpool UK →<sup>\*</sup>Royal Liverpool University Hospital, Liverpool UK¶

#### ¶ Introduction¶

Venous thromboembolism (VTE) accounts for 10% (25,000 per annum) of English hospital deaths (1, 2) and over 80% of medical patients have at least one VTE risk factor (3, 4). In 2010 the Department of Health (DH) linked VTE risk assessment on admission to payment by its inclusion as an indicator within the NHS Outcomes framework (5).¶

This study investigated the number of risk factors for VTE present in medical patients admitted to hospital, plus healthcare staff opinions on the most important risk factors and attempted to correlate opinions with practice in terms of which patients received prophylaxis with low-molecular weight heparin (LMWH).¶

#### ¶ Method¶

NHS ethical approval was granted. Data were collected over three periods; November 2009, January 2010 and April 2010. Healthcare staff who admitted patients during these periods and were therefore responsible for assessing VTE risk were interviewed using a structured questionnaire. This included asking respondents to grade VTE risk factors according to their importance. All records of patients admitted during these periods were reviewed to assess actual risk factors present and whether or not prophylaxis was prescribed.¶

#### ¶ Results¶

25 staff were interviewed, of whom only 13 thought that over 80% of medical patients would have at least one VTE risk factor. The top risk factors identified in order of importance were known thrombophilia, cancer, personal history of VTE and immobility, with infection, lung disease and age over 60 being considered of lesser importance.¶

652 sets of case notes were reviewed. 81% of patients had at least one risk factor, 32% had two, 13% had three and 1% had four or more. The most prevalent risk factors were: age over 60 (63%), acute infectious disease (37%), lung disease (21%), and cancer (12%), with known thrombophilia, personal history of VTE and immobility occurring in only 26 patients.¶

Prescribing of prophylaxis increased as the number of risk factors increased ( $p < 0.01$ ). Of the 62 patients with one of the top four most important risk factors identified by staff for whom prophylaxis was indicated, only 36 (58%) received LMWH. Overall only 232 of all 400 patients at risk of VTE for whom prophylaxis was indicated (58%) actually received it.¶

#### ¶ Conclusion¶

Patients who had risk factors identified by staff as being of most importance were no more likely to receive prophylactic treatment than patients with other risk factors.¶

1. → Report of the independent expert working group on the prevention of venous thromboembolism in hospitalised patients. Department of Health; 2007.¶
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3. → Rashid ST, Thursz MR, Razvi NA, Voller R, Orchard T, Shlebak AA. Venous thromboprophylaxis in UK medical inpatients. *Journal of the Royal Society of Medicine*. 2005; 98(11):507–12.¶
4. → Samama MM, Cohen AT, Darmon JY, Desjardins L, Eldor A, Janbon C, et al. A comparison of enoxaparin with placebo for the prevention of venous thromboembolism in acutely ill medical patients. Prophylaxis in Medical Patients with Enoxaparin Study Group. *New England Journal of Medicine*. 1999 Sep 9; 341(11):793–800.¶
5. → The NHS Outcomes Framework 2011/12. Department of Health; 2010.¶

## Appendix 24: Abstract for oral presentation – RPS conference 2011

### Title:

From admission to prescription: medicines reconciliation or the lack of it

### Abstract:

#### Focal points

This study explored the processes used by doctors and nurses when taking a medication history and prescribing on admission to hospital, using direct observation of patients admitted to an Acute Medical Unit over 3 one-week periods.

Only 39 (76%) of 51 patients observed were asked any medication-related questions; in 25 (49%) no attempt was made to confirm the medication history with the patient before documenting in case notes or prescribing.

Despite medicines reconciliation guidance, there are still failures in the processes, which may require greater effort to educate those involved.

**Introduction** An accurate, comprehensive current medication history is essential for safe and appropriate management of patients on admission to hospital. NICE defines medicines reconciliation on admission to hospital as: the process of collecting information to prepare the patient's current medication history, verifying this list against the current hospital medication chart, identifying any discrepancies and taking appropriate action.<sup>1</sup> Errors in medicines reconciliation have an adverse impact on clinical care and financial resources.<sup>2</sup> Several studies have shown doctors' medication histories are inaccurate and a large study in North West England found prescribing errors were mostly made at the time of hospital admission.<sup>3</sup> However no studies have investigated the actual processes doctors and nurses use to obtain a medication history and prescribe on admission to hospital; this study explored these processes.

**Methods** Approval was granted by the National Research Ethics Service and NHS Trust. The admission process was directly observed for patients admitted to the Acute Medical Unit (AMU) at a large teaching hospital over three one-week periods. Consent was obtained from the staff involved; however to prevent behaviour change, they were advised only that the research covered the admission process and staff roles. Patients could refuse permission for observation at any time.

**Results** A total of 23 doctors and one nurse practitioner (non-prescribing) were observed as they clerked 51 medical patients on admission to AMU. The most common source used for the medication history was information provided by the GP, either a hand written letter or a printed patient summary (33 admissions; 65%); however in 8 (15%) admissions this information was available but not used.

Only 39 of the 51 patients (76%) were asked any medication-related questions. Of the remaining 12, three had complete medication records (two from nursing homes, one from

another hospital) and communication with one was via an interpreter. Only 19 patients (37%) could provide verbal information regarding their medication, which was incomplete in eight cases. 14 patients (26%) had some/all their medication with them; however the clerking doctor/nurse did not realise this in two cases. In 25 (49%) cases no attempt was made to confirm the medication history with the patient prior to documentation in the case notes and / or on the medication chart.

Of the 37 patients for whom a medication chart was written on admission, the medication history was confirmed with only nine (29%) of a possible 31 patients; five were too ill for discussion and one patient was taking no medication prior to admission. For 14 patients no medication chart was written; two already had a chart, two were discharged the same day; for the remaining 10 the reasons were unclear.

**Discussion** Despite guidance on the importance of medicines reconciliation, doctors and nurses often fail to ask patients about medicines on admission to hospital or confirm the accuracy of medications prescribed with patients. While pharmacy staff subsequently identify most errors within 24 hours, according to guidance, increased educational initiatives for admitting staff, covering the importance of medicines reconciliation and medication history taking, may reduce patient risk.

#### **References**

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2. Campbell F, Kamon J, Czoski-Murray C, Jones R. A systematic review of the effectiveness and cost-effectiveness of interventions aimed at preventing medication error (medicines reconciliation) at hospital admission: University of Sheffield. 2007.
3. Dornan T, Ashcroft D, Heathfield H et al. Final Report - An in depth investigation into causes of prescribing errors by foundation trainees in relation to their medical education. EQUIP study. General Medical Council 2009.

## Appendix 25: Abstract for poster - SAM conference 2011

### AMU admission – A fly on the wall

Basey A J<sup>†\*</sup>, Kennedy T D<sup>\*</sup>, Krska J<sup>†</sup> and Mackridge A J<sup>†</sup>, <sup>†</sup>School of Pharmacy and Biomolecular Sciences, Liverpool John Moores University, Liverpool UK <sup>\*</sup>Royal Liverpool University Hospital, Liverpool UK

#### Aim

Complex healthcare systems, such as admission processes are associated with increased patient risk (1). Interruptions and delays may result in tasks being incomplete (2) leading to errors and/or omissions in prescribing. This study explored the nature and extent of interruptions and delays in a teaching hospital Acute Medical Unit (AMU).

#### Methods

NHS research governance procedures were followed. The admission process was directly observed for patients admitted to the AMU over four one-week periods. Consent was obtained from staff involved; patients could refuse permission for observation at any time.

#### Results

35 doctors and one nurse practitioner were observed admitting 71 medical patients. The mean duration of admission was 75 minutes (range 30 to 180 minutes). The admission process was subject to a delay and/or interruption for 49 of the 71 patients (69%).

66 interruptions were observed in 36 of the 71 admissions (51%); of these 19 (53%) were interrupted more than once. The most common interruptions; (13/66; 20%) involved queries about previously admitted patients.

31 of the 71 admissions (44%) were subject to a delay, 14 (45%) of these delays involved either an X-ray or an ECG. In five cases the patient was in radiology when the doctor needed them; on nine occasions the need for an ECG interrupted the admission process.

#### Conclusion

The AMU admission process involved a high percentage of interruptions and delays, resulting in considerable potential for errors and omissions in prescribing. Work is ongoing to evaluate the impact of such problems on clinical outcomes.

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2. Westbrook JI, Coiera E, Dunsmuir WT, Brown BM, Kelk N, Paoloni R, et al. The impact of interruptions on clinical task completion. *Qual Saf Health Care*. 2010 Aug;19(4):284-9.

## Appendix 26: Abstract for poster - SAM conference 2012

### How long does it take to get the right prescription on admission to hospital?

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#### Background

A recent study has shown that prescribing errors are most likely to occur on admission to hospital and that the most common type of error is omission of one or more of the patients' usual medicines.(1) Delays in patients receiving appropriate medication may have both clinical and financial consequences.(2)

#### Aim

This study investigated the accuracy of prescribing and the delay in rectifying any errors following admission to hospital via the Acute Medical Unit (AMU).

#### Methods

NHS ethical approval was granted. Data were collected over four periods; November 2009, January 2010, April 2010 and April 2011. Patients case notes and corresponding medication charts were reviewed to identify the date and time of admission, whether a pharmacist had confirmed the patients medication history, whether any prescribing errors had been identified and if so the type of error and the time taken for these to be resolved.

#### Results

810 case notes and corresponding medication charts were reviewed; a medication history was completed by a pharmacist for 685 patients (84.6%). 851 prescribing errors were identified involving 319/685 (46.6%) patients; 737/851(86.6%) were omissions. The delays in rectifying these errors are shown in the table; 64 patients, 20% of those affected, experienced a delay of more than 24 hours.

Delay in rectifying prescribing errors	Number of patients affected (Total 319)
Rectified Immediately	3
Rectified < 24 hours	186
Rectified 24 – 48 hours	30
Rectified 48 – 72 hours	7
Longer than 72 hours	27
Not rectified	25
When clinically appropriate	7
Not known when rectified	27
No longer appropriate	7

#### Conclusion

There may be significant delays in an accurate prescription being written when medical patients are admitted to hospital; the causes, possible adverse consequences and potential solutions require further investigation to minimise the risk to patients.

#### References

1. Dornan T, Ashcroft D, Heathfield H, P. L, Miles J, Taylor D, et al. Final Report - An in depth investigation into causes of prescribing errors by foundation trainees in relation to their medical education. EQUIP study: General Medical Council; 2009.
2. Technical patient safety solutions for medicines reconciliation on admission of adults to hospital. National Institute for Health and Clinical Excellence; National Patient Safety Agency; 2007.

## Challenges in implementing government-directed VTE guidance for medical patients: a mixed methods study

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### ABSTRACT

**Background:** Implementing venous thromboembolism (VTE) risk assessment guidance on admission to hospital has proved difficult worldwide. In 2010, VTE risk assessment in English hospitals was linked to financial sanctions. This study investigated possible barriers and facilitators for VTE risk assessment in medical patients and evaluated the impact of local and national initiatives.

**Setting:** Acute Medical Unit in one English National Health Service university teaching hospital.

**Methods:** This was a mixed methods study; National Research Ethics Service approval was granted. Data were collected over four 1-week periods; November 2009 (1), January 2010 (2), April 2010 (3) and April 2011 (4). Case notes for all medical patients admitted during these periods were reviewed. Thirty-six staff were observed admitting 71 of these patients; 24 observed staff participated in a structured interview.

**Results:** 876 case notes were reviewed. In total, 82.1% of patients had one or more VTE risk factors and 25.3% one or more bleeding risks. VTE risk assessment rose from a baseline of 6.9–19.6%, following local initiatives, and to 98.7% following financially sanctioned government targets. A similar increase in appropriate prescribing of prophylaxis was seen, but inappropriate prescribing also rose. No staff observed in period 1 conducted VTE risk assessment, risk-assessment forms were largely ignored or discarded during period 2; and electronic recording systems available during period 3 were not accessed. Few patients were asked any VTE-related questions in periods 1, 2 or 3.

Interviewees' actual knowledge of VTE risk was not related to perceived knowledge level. Eight of the 24 staff interviewed were aware of national policies or guidance: none had seen them. Principal barriers identified to risk assessment were: involvement of multiple staff in individual admissions; interruptions; lack of policy awareness; time pressure and complexity of tools.

**Conclusions:** National financial sanctions appear effective in implementing guidance, where other local measures have failed.

### ARTICLE SUMMARY

#### Article focus

- Implementing venous thromboembolism (VTE) risk assessment (RA) on admission to hospital is proving difficult.
- What are the barriers and facilitators for carrying out VTE RA when admitting medical patients?
- What was the impact of national and local initiatives designed to maximise VTE RA and appropriate prophylaxis with low-molecular-weight heparin (LMWH)?

#### Key messages

- A variety of locally designed initiatives proved ineffective in improving performance in carrying out VTE RA whereas a centrally imposed financial sanction appeared effective.
- Increased frequency of VTE RA resulted in an increase in both appropriate and inappropriate prescribing of LMWH.
- Staff knowledge of VTE risk factors and policy was poor possibly contributing to poor performance.

#### Strengths and limitations of this study

- The observations and interviews provide rich real-time data supporting and informing the findings of the case note review.
- The numbers of case notes reviewed were sufficiently large to provide statistically significant comparisons between study periods.
- The study was carried out in one hospital; the practices observed and opinions expressed may not reflect those in other hospitals.
- The researcher is a regular member of the AMU staff which may have impacted on behaviour during observations.
- The interviews were carried out sequentially and although all staff agreed to keep the subject matter confidential to avoid invalidating the results, it is impossible to be certain that confidentiality was not breached, but no evidence suggests that this occurred.
- Staff interviewed were not asked about any recent changes to their practice regarding VTE RA.



**INTRODUCTION**

Venous thromboembolism (VTE) was first described in 1676 and its association with surgery recognised in 1866.<sup>1</sup> During the 20th century, accumulating evidence of risk factors for VTE, especially those associated with surgery, led to the first consensus statement for preventing VTE and pulmonary embolism (PE) in 1986.<sup>2</sup> The link between inflammation and increased VTE risk was first proposed in the 1970s<sup>3</sup> and the increased risk of VTE associated with medical conditions which have an inflammatory component, such as respiratory disease and acute infection, is now recognised.<sup>4</sup> Not surprisingly, the proportion of patients developing VTE increases with the number of risk factors present,<sup>5</sup> but over 80% of medical patients admitted to hospital have at least one risk factor.<sup>6,7</sup> The risk of deep vein thrombosis (DVT) in hospitalised medical patients if no thromboprophylaxis is given was approximately 20% in a meta-analysis of 17 randomised clinical trials.<sup>8</sup> Prophylaxis with low-molecular-weight heparin (LMWH) reduces the number of hospital-acquired VTEs in medical patients by up to 60%.<sup>9,10</sup>

Increased international awareness of VTE risks is shown by studies assessing current practice in Europe,<sup>11,12</sup> Brazil,<sup>13</sup> the USA<sup>14,15</sup> and Canada.<sup>16</sup> In England and Wales this awareness has been seen at government level, through the commissioning of reports in 2004<sup>17</sup> and 2007,<sup>18</sup> the National Institute For Health and Clinical Excellence (NICE) published guidance on risk assessment (RA) in 2010<sup>19</sup> and most recently mandatory collection of VTE RA figures as part of the National Health Service (NHS) Outcomes Framework in June 2010.<sup>20</sup> This top down approach has had limited success, with uptake of VTE RA guidance slow and many NHS hospitals struggling with its implementation.<sup>6,21-25</sup> The report based on the Commissioning for Quality and Innovation payment framework (CQUIN) data collection for July-September 2011 shows that 12 months after mandatory implementation some English NHS hospitals were still unable to fully comply with the target that 90% of patients should be assessed within 24 h of admission. Overall only 88% of all patients (medical and surgical) were VTE risk assessed on admission and in September 2011, 18% of hospitals failed to meet the 90% target.<sup>24</sup> This problem is not

unique to England and Wales. The ENDORSE study, which was conducted in 32 countries worldwide in 2008, showed that recommended VTE prophylaxis in medical patients varied between countries from 3% to 70%.<sup>25</sup>

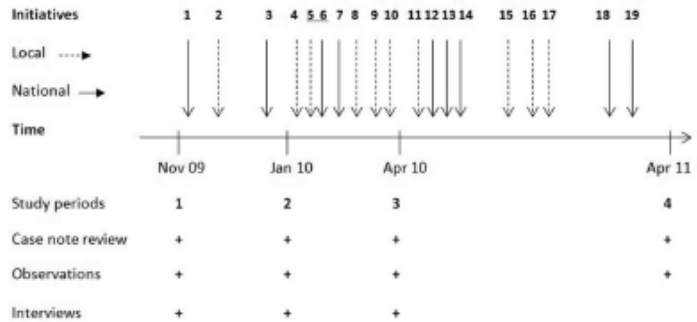
Given the difficulties in implementing guidance, this study aimed to (1) identify possible barriers and facilitators for carrying out VTE RA and appropriate prophylactic prescribing in medical patients and (2) assess the impact of these national initiatives and other local initiatives on VTE RA on admission and prophylaxis in one English NHS university teaching hospital.

**METHODS**

A triangulated mixed methods approach was used involving review of case notes, observation of the admission process and interviews with healthcare staff. There were four 1-week study periods: November 2009 (1), January 2010 (2), April 2010 (3) and April 2011 (4). Case note review and direct observation of a sample of admissions was carried out for all four study periods. Interviews were undertaken with all admitting staff observed during periods 1, 2 and 3. The data collection periods were selected to assess the impact of both local and national initiatives occurring during the study and also to avoid the weeks when junior doctors change jobs to minimise bias due to lack of familiarity with the role (figure 1).

1. November 2009—All Party Parliamentary Thrombosis Group—Audit of acute trusts (National)
2. 24 November 2009—Trust RA forms placed with medication charts on AMU (Local)
3. 27 January 2010—NICE guidance—national press & TV coverage (National)
4. 15 February 2010—Thrombosis nurse employed (Local)
5. 26 February 2010—VTE Grand round (1)—launch of Trust VTE policy (Local)
6. March 2010—Department of Health (DH) RA tool (V2) (National)
7. 21 March 2010—DH letter—Collecting of VTE RA data to be mandatory (National)
8. 1 April 2010—electronic VTE RA (Local)

**Figure 1** Overall study design, illustrating local and national initiatives relating to venous thromboembolism prophylaxis.



9. 15 April 2010—VTE reminder posters on AMU (Local)
10. 27 April 2010—Trust RA form V.4 (in line with DH/NICE guidance) (Local)
11. 10 May 2010—electronic VTE RA—V.2—simplified (Local)
12. 21 May 2010—NICE guidance notes re VTE RA data collection (National)
13. 1 June 2010—VTE data collection mandatory (National)
14. June 2010 NICE VTE quality standard (National)
15. 6 September 2010—Trust VTE risk assessor of the week scheme (Local)
16. 22 October 2010—VTE Grand Round (2) (Local)
17. 26 October 2010—VTE training—Pharmacists (Local)
18. 20 December 2010—VTE RA in NHS outcomes framework 2011/12 (National)
19. 2 February 2011—How to guide for VTE RA (National)

Local initiatives were introduced to increase staff awareness of and facilitate the implementation of national guidance and included both education and provision of RA tools. A thrombosis nurse was recruited to provide ward based training for nursing staff and education sessions were provided for medical staff at two of the weekly Grand rounds. Paper RA forms were initially based on the available literature and those used by other local hospitals. These were modified during the course of the study in line with comments received from staff and to comply with the revised DH RA tool introduced in March 2010. The initial electronic RA tool introduced in April 2010 was very cumbersome as it required a yes/no answer to each VTE risk and each bleeding risk. This was later simplified to electronic confirmation that VTE RA had been completed and whether or not the assessment had taken place within 24 h of admission.

#### Ethical approval

The study was approved by the National Research Ethics Service (Liverpool Central REC Ref 09/H1005/67), Liverpool John Moores University Ethics Committee (approval no 09/PBS/015); Research Governance approval from Royal Liverpool University Hospital (study no 3862) and was carried out in the Acute Medical Unit (AMU) of an English university teaching hospital.

#### Case note review

Case notes for patients admitted during each study period were reviewed retrospectively, following discharge or death, to establish the frequency of VTE RA and prescribing of prophylactic LMWH, evidence of VTE risk factors and bleeding risks to assess the appropriateness of prescribing and DVTs, PEs, deaths or episodes of bleeding during hospitalisation.

A power calculation was performed to determine the number of records required for detecting a difference of 15% in the proportion of patients risk assessed

between study periods, with a power of 99%. Using a baseline proportion of documented RAs of 5%, derived from an earlier case note audit, 200 patient records per study period were required. Assuming that 20% of patients have a contraindication to treatment and using a baseline proportion of 30% patients receiving appropriate prophylaxis, proportions again derived from earlier data, 160 patients per study period would provide 96% power to detect an increase of 20% in patients treated appropriately.

In accordance with Trust policy all patients requiring pharmacological DVT prophylaxis should receive LMWH; those with renal impairment (eGFR <30 ml/min) receive a lower dose. Inappropriate prescribing of LMWH was defined as 'prescribing for patients with at least one known bleeding risk' and was assessed by an expert panel of four AMU consultant physicians. Each consultant independently reviewed a case summary for each patient with at least one bleeding risk who was prescribed LMWH and indicated that LMWH was either appropriate or inappropriate. If there was consensus among all four consultants the decision was accepted. Where there was initial disagreement, all four consultants debated the cases until consensus was reached.

#### Observations

Staff gave informed consent for observations; patients or their carers could exclude the researcher at any time. Patients observed were purposively selected to maximise both the range of staff observed and variation in time and day of admission. Staffs were aware that the study related to the hospital admission process but not specifically to VTE RA. During observations, data relating to VTE RA and prescribing of prophylactic therapies were recorded on a standard form with additional field notes. The pharmacist researcher had only social interaction with staff, but was able to identify any inappropriate clinical management with the potential to seriously adversely impact on patient care and intervene if required.

#### Interviews

Interviews with staff took place as soon as practical following observations, using a structured questionnaire to ascertain their knowledge, perceived knowledge, training experiences and views on implementing VTE RA.

#### Data analysis

Data from the observations and interviews were coded into themes where necessary. Descriptive analysis was carried using SPSS V.17; statistical tests (t tests and  $\chi^2$  tests treating the groups as simple categories) were carried out using Minitab V.16. Where case notes and/or prescription charts were missing these cases were excluded from the relevant analyses.

**Table 1** Demographic details of patients included in case note reviews and observations

Characteristic	Case note review	Observations
Number	930	71
Case notes available	876	67
Sex: male (%)	381 (43.5%)	28 (39%)
Age range (mean)	16–98 (64) years	16–98 (68) years
Average length of stay (mean)	1–182 (9.9) days	1–54 (8.7) days
Main causes of admission (descending order of occurrence)	Infection (285; 32.5%) Pain (72; 8.2%) Cardiac cause (60; 6.8%) Shortness of breath (54; 6.2%) Abnormal biochemistry* (51; 5.5%) Possible VTE (46; 5.3%)	Infection (15; 22%) Pain (8; 12%) Abnormal biochemistry* (8; 12%) Possible VTE (7; 10%) Shortness of breath (5; 7%) Vomiting or diarrhoea (5; 7%)

\*Results outside of the normal range for haemoglobin, glucose, thyroid hormones, sodium, potassium, magnesium or calcium.

**RESULTS**

**Case note review**

The demographic details of the patients admitted during the study are shown in table 1.

A total of 1015 patients were recruited, 930 (91.6%) were followed up. In 54 cases the relevant admission documentation was not available in records, leaving 876 cases suitable for analysis. The prescription chart was missing for a further 72 cases resulting from their

exclusion from the analysis relating to prescription of prophylaxis. Statistical analyses showed that there were no significant differences between the patients whose case notes were reviewed and the remainder in terms of gender ( $\chi^2$  test;  $p=0.534$ ) or length of stay (t test;  $p=0.326$ ). Observed patients were slightly older than those not observed (t test;  $p=0.045$ ) and the main causes of admission were broadly similar (table 1). The numbers of patients reviewed in each study period are shown in table 2, together with details of risk factors present.

Of the 876 patients, 719 (82.1%) had at least one VTE risk factor and 222 (25.3%) had at least one bleeding risk on admission. Almost a fifth of all admissions (171; 19.5%) had risk factors for both VTE and bleeding (table 2), therefore 23.8% of the patients admitted with a VTE risk factor also had a bleeding risk, requiring clinical judgement before prescribing prophylaxis.

There was an increase in the proportion of patients who had both VTE and bleeding risk factors during the course of the study however this did not reach statistical significance ( $\chi^2$   $p=0.170$ ). Over the period of the study there was a gradual increase in the complexity of patients treated as bed pressures resulted in more patients with minor conditions receiving ambulatory care which may explain this trend.

The proportion of patients with a documented completed VTE RA rose from 6.9% in study period 1 to 18.5% and 19.6% in periods 2 and 3, respectively; following local initiatives, but to 98.7% in period 4 following the imposition of payment-related government targets (table 3). These changes were statistically significant ( $\chi^2$  test;  $p<0.001$ ). Three subanalyses showed that comparisons of periods 1 to 2 and 3 to 4 both gave  $p<0.001$  and these were therefore statistically significant even when the Bonferroni correction was applied. The comparison of period 2 to 3 was non-significant ( $p=0.884$ ).

**Table 2** Frequency of VTE risk factors and bleeding risks

Study period	November 2009 (1)	January 2010 (2)	April 2010 (3)	April 2011 (4)	Totals
Total admitted	265	255	239	256	1015
Case notes available	232/265 (87.5%)	216/255 (84.7%)	204/239 (85.4%)	224/256 (87.5%)	876/1015 (86.3%)
At least 1 VTE risk factor*	192/232 (82.8%)	172/216 (79.6%)	161/204 (78.9%)	195/224 (87.1%)	719/876 (82.1%)
95% CI	(77.3% to 87.4%)	(73.6% to 84.8%)	(72.7% to 82.3%)	(82.9% to 91.1%)	(79.4 to 84.6%)
At least one bleeding risk factor*	44/232 (19.0%)	62/216 (28.7%)	53/204 (26.0%)	63/224 (28.1%)	222/876 (25.3%)
95% CI	(14.1% to 24.6%)	(22.8% to 35.2%)	(20.1% to 32.6%)	(22.3% to 34.5%)	(22.5% to 28.4%)
Risk factors for both VTE and bleeding*	34/232 (14.7%)	44/216 (20.4%)	43/204 (21.1%)	50/224 (22.3%)	171/876 (19.5%)
95% CI	(10.4% to 19.9%)	(15.2% to 26.4%)	(15.7% to 27.3%)	(17.0% to 28.3%)	(16.9% to 22.3%)
VTE risk and no bleeding risk* (LMWH indicated)	158/232 (68.1%)	128/216 (59.3%)	118/204 (57.8%)	145/224 (64.7%)	549/876 (62.7%)
95% CI	(61.7% to 74.1%)	(52.4% to 65.9%)	(50.7% to 64.7%)	(58.1% to 71.0%)	(59.4% to 65.9%)

\*No significant difference between study periods. LMWH, low-molecular-weight heparin; VTE, venous thromboembolism.

**Table 3** Frequency of VTE risk assessment and appropriate prescribing of LMWH

Study period		November 2009 (1)	January 2010 (2)	April 2010 (3)	April 2011 (4)
Total admitted	All admissions	265	255	239	256
Case notes available		232/265 (87.5%)	216/255 (84.7%)	204/239 (85.4%)	224/256 (87.5%)
VTE risk assessment completed*		16/232 (6.9%)	40/216 (18.5%)	40/204 (19.6%)	221/224 (98.7%)
Prescription charts and case notes available		205/265 (77.4%)	201/255 (78.8%)	189/239 (79.1%)	209/256 (81.6%)
LMWH indicated		147/205 (71.7%)	115/201 (57.2%)	115/189 (60.8%)	135/209 (64.6%)
95% CI		(65.0% to 77.8%)	(50.1% to 64.3%)	(53.5% to 67.8%)	(57.7% to 71.1%)
LMWH prescribed appropriately* (patient has VTE risk factors and no bleeding risks)		73/147 (49.7%)	71/115 (61.7%)	78/115 (67.8%)	126/136 (92.6%)
95% CI		(41.3% to 58.0%)	(52.2% to 70.6%)	(58.5% to 76.2%)	86.9% to 96.4%
LMWH contra indicated		32/205 (15.6%)	49/201 (24.4%)	39/189 (20.6%)	43/209 (20.6%)
95% CI		(10.9% to 21.3%)	(18.6 to 30.9%)	(15.1% to 27.1%)	(15.3% to 26.7%)
LMWH prescribed inappropriately**		1/32 (3%)	9/49 (18%)	3/39 (8%)	14/43 (33%)
95% CI		(0% to 16%)	(9% to 32%)	(2% to 21%)	(19% to 49%)
Number of admissions observed	Observations	16	21	14	20
VTE risk assessment completed		0/16 (0%)	7/21 (33%)	4/14 (29%)	15/20 (75%)
95% CI		(0% to 17%)	(15% to 60%)	(8% to 58%)	(51% to 91%)
LMWH prescribed appropriately		9/16 (56%)	12/21 (57%)	7/14 (50%)	12/20 (60%)
95% CI		(30% to 80%)	(34% to 78%)	(23% to 77%)	(36% to 81%)
LMWH prescribed inappropriately		0/16 (0%)	2/21 (10%)	0/14 (0%)	1/20 (5%)
95% CI		(0% to 17%)	(1% to 30%)	(0% to 19%)	(0% to 25%)

Significant differences between study periods \* $p < 0.001$ ; \*\* $p = 0.002$ .  
LMWH, low-molecular-weight heparin; VTE, venous thromboembolism.

Thirty-three patients had at least one bleeding risk, but received LMWH. Independent review of all 33 case summaries by four AMU consultants achieved consensus agreement in 24 cases, with the remaining nine requiring discussion before consensus was reached. In six cases it was agreed that LMWH was appropriate, but was inappropriately prescribed in the remaining 27.

Patients taking oral anticoagulants on admission are included in those for whom LMWH was contraindicated in table 3. Six patients were prescribed antiembolism stockings and no patients used foot pumps during the study. The proportion of patients appropriately prescribed prophylaxis with LMWH (those with VTE risks but no bleeding risks) rose from 49.7% in period 1 to 61.7% and 67.8% in periods 2 and 3, then to 92.6% in period 4 (table 3). The change was statistically significant between periods 3 and 4 ( $\chi^2$  test;  $p < 0.001$ ). There was also a statistically significant increase in the proportion of patients who were prescribed LMWH inappropriately in period 4 compared with the three earlier study periods ( $\chi^2$  test  $P = 0.002$ ). Three subanalyses of periods 1, 2 and 3 to period 4 were carried out with Bonferroni correction. Comparison of periods 1 to 4 and 3 to 4 were statistically

significant ( $p = 0.002$  and  $0.006$ , respectively). The comparison of period 2 to 4 was non-significant ( $p = 0.117$ ).

### Observations

During the four data collection periods a total of 71 patient admissions were observed, involving 35 doctors (four consultant/specialist registrar, four specialist trainee year 4/5, nine specialist trainee year 1/2 and 18 foundation) and one advanced nurse practitioner. Patient details are shown in table 1.

The numbers of observations, plus numbers of RAs performed and appropriate VTE prophylaxis prescribed are shown in table 3. No RA forms were completed in period 1, and while this increased in periods 2 and 3, a greater change was noted between periods 3 and 4. Placement of RA forms with medication charts prior to period 2 resulted in only seven of 21 being completed, five being actively removed and nine being ignored. An electronic RA form implemented prior to period 3 was not used by staff, with only four of the 14 admissions assessed using this process. Over the first three study periods, only 8 of the 51 patients (16%) observed were asked questions relating to previous personal or family history of VTE or warfarin use, three of

whom had presented with symptoms suggestive of VTE, whereas in period 4, 6 of the 20 observed (30%) were asked VTE-related questions, only one of whom presented with symptoms suggestive of VTE.

### Interviews

All 24 healthcare staff observed during periods 1, 2 and 3 were interviewed; (three consultant/specialist registrar, two specialist trainee year 4/5, six specialist trainee year 1/2, 12 foundation and one advanced nurse practitioner), of whom 13 (58%) had undergone VTE training. There was no correlation between staff receiving training and whether or not VTE RA was completed ( $\chi^2$  test,  $p=0.106$ ). Self-rated knowledge of VTE RA was 'good' in nine (38%), 'average' in 14 (58%) and 'below average' in 1 (4%). The number of spontaneously listed VTE risk factors ranged from 3 to 8 of a possible 18 and of bleeding risks, 1 to 3 of 12. There was no statistically significant evidence of any difference in actual knowledge between staff with below average or average perceived knowledge or those with good perceived knowledge (Mann-Whitney test,  $p=0.2105$ ). Staff perceptions of the proportion of medical patients with VTE risk factors ranged from 30% to 90%, only 13 believed that over 80% would be at risk, while the majority (20/24; 83%) estimated that less than 20% of patients would have both VTE and bleeding risks. Only eight staffs were aware of any national policies or guidance on VTE RA, although the DH working group report was published in 2007 and the first DH VTE RA tool was published in September 2008, none of the interviewees had actually seen these documents.

The majority of staffs (22; 88%) felt that responsibility for VTE RA should fall to the clerking doctor or nurse, but 15 (63%) felt the actual responsibility was unclear. Open questions elicited suggestions that the involvement of multiple staff in individual admissions, interruptions, lack of awareness, time pressures and the lack of user-friendliness of the tools provided may contribute to failure to conduct the assessment. Recommendations for improving performance related mainly to increasing training and raising awareness, the need for strong leadership and empowerment of nurses.

### DISCUSSION

During the first three observation periods, from November 2009 until April 2010, VTE RAs were not routinely carried out during the hospital admission process and on occasion staff made a deliberate decision not to complete an assessment, as shown by forms being discarded. There was no evidence that staff who had received VTE training were any more likely to carry out RA. Despite this, the majority of the staff interviewed felt that the admitting doctor or specialist nurse was the most appropriate person to conduct the VTE RA due to the complexity of data needed and the clinical interpretation necessary for safe, appropriate prophylaxis.

The dramatic increase in both the number of patients risk assessed for VTE and the number appropriately treated with LMWH in period 4, April 2011, followed the introduction of national mandatory data collection in June 2010. There was an associated increase in the number of patients who received LMWH inappropriately. However, as there were a minimum of three initiatives between each of the data collection periods it is difficult to attribute the changes to any particular intervention. The apparent impact of national mandatory data collection may have been as a result of increased uptake of local initiatives.

### Comparison with other studies

The patients in our study differed in the most common causes for admission from those in a large international study;<sup>25</sup> due to the local policy of directing patients with acute cardiac conditions to a Heart Emergency Centre, however we believe this was unlikely to affect staff behaviour.

Implementing guidelines in practice is recognised as being difficult.<sup>25-27</sup> The staff interviewed in this study considered that the admitting doctor was the most suitable person to carry out the VTE RA and prescribing, which concurs with the findings of a study conducted in the USA.<sup>26</sup> Various systematic reviews have examined the difficulties of implementing guidelines, one concluding that there is no 'magic bullet' in terms of the most effective strategy for implementation in hospitals.<sup>27</sup> Barriers identified to guideline implementation have been classified into three broad categories; knowledge, including lack of familiarity and awareness; attitudes, including failure to believe that the intervention will have the desired outcome and behavioural factors, such as lack of time.<sup>28</sup> The interviews in the present study identified similar factors; doctors were unaware of local and national guidance, they lacked motivation, they were unaware of the risks of VTE and commented that the time taken to carry out a RA was an issue. Small group training with active participation has been found to be effective in policy implementation in contrast to courses alone which had mixed effects.<sup>29</sup> In our study, just over half of admitting staff had received training in VTE RA, which was in lecture format whether provided at medical school or at the hospital, which may contribute to the lack of association between training in and carrying out RAs.

A meta-analysis of strategies to improve VTE prophylaxis carried out in 2005 found that passive dissemination of guidelines was generally ineffective<sup>30</sup> which supports our findings that the initiatives prior to June 2010 resulted in limited improvement. Other work has demonstrated the value of opinion leaders in guideline implementation,<sup>31</sup> which was most likely the reason for the significant improvement achieved in the last study period. Following the introduction of mandatory data collection, government targets and associated financial penalties in June 2010, VTE RA became consultant-led

as a result of pressure from Trust managers. This, together with continuous reminders during ward rounds, emphasised the importance of VTE RA to junior staff and the target of at least 90% of patients having a RA performed on admission was exceeded. In addition, a Trust requirement for RA to be completed by a senior doctor in the event of its omission during initial admission resulted in almost 100% of patients having been assessed within 24 h. An American study published in 2012<sup>32</sup> has shown that introduction of a mandatory computerised decision support tool had a similar significant beneficial effect on both VTE RA and prescription of appropriate prophylaxis.

VTE RA was one of the first quality standards with a financial sanction to be issued by the DH in 2010. While the results show that the 90% VTE RA target was achieved in April 2011, this standard will need to be maintained in a culture of organisational change and additional targets. Financial targets are a relatively new concept in secondary care in the NHS: they have been used more widely in primary care. A recent Cochrane review<sup>33</sup> found that there was little evidence either for or against their use in primary care and it has been suggested that there may be unintended consequences.<sup>33–34</sup> In addition, an analysis of CQUIN targets in London published this year showed that only 38% of London Trusts achieved the full payment for the VTE CQUIN in 2010/11 and that performance in a CQUIN indicator does not always correlate with other quality indicators.<sup>35</sup> A checklist has recently been published<sup>36</sup> to help decide whether a financial incentive is appropriate in a particular clinical scenario and if so provide some guidance for the development of a successful initiative.

## CONCLUSION

This study shows that a national financial sanction resulting in a consultant-led approach was associated with effective implementation of guidance. However, it remains to be seen whether the level of achievement can be maintained as new targets are added in a culture of organisational change.

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## Implementing VTE guidance

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## Prescribing errors on admission to hospital and their potential impact: a mixed-methods study

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### ABSTRACT

**Background** Medication errors are an important cause of morbidity and mortality and adversely affect clinical outcomes. Prescribing errors constitute one type of medication error and occur particularly on admission to hospital; little is known about how they arise.

**Aim** This study investigated how doctors obtain the information necessary to prescribe on admission to hospital, and the number and potential impact of any errors.

**Setting** English teaching hospital—acute medical unit.

**Methods** Ethics approval was granted. Data were collected over four 1-week periods; November 2009, January 2010, April 2010 and April 2011. The patient admission process was directly observed, field notes were recorded using a standard form. Doctors participated in a structured interview; case notes of all patients admitted during study periods were reviewed.

**Results** There were differences between perceived practice stated in interviews and actual practice observed. All 19 doctors interviewed indicated that they would sometimes or always use more than one source of information for a medication history; a single source was used in 31/68 observed cases. 7/12 doctors both observed and interviewed indicated that they would confirm medication with patients; observations showed they did so for only 2/12 patients. In 66/68 cases, the patient/carer was able to discuss medication, 14 were asked no medication-related questions. Of 688 medication charts reviewed, 318 (46.2%) had errors. A total of 851 errors were identified; 737/851 (86.6%) involved omission of a medicine; 94/737 (12.8%) of these were potentially significant.

**Conclusions** Although doctors know the importance of obtaining an accurate medication history and checking prescriptions with patients, they often fail to put this into practice, resulting in prescribing errors.

### INTRODUCTION

Medication errors are recognised as an important cause of morbidity and mortality in hospitals. In recent years, awareness has been raised in England through government reports published in 2000,<sup>1</sup> 2001<sup>2</sup> and 2004.<sup>3</sup> International guidance regarding the problems arising when patients transfer between care settings has been published by WHO.<sup>4,5</sup> Medication errors, especially omission of prescribed medicines,<sup>6</sup> have an adverse impact on clinical care and may also have a financial impact.<sup>7,8</sup> Prescribing errors constitute one type of medication error and have been defined as occurring: ‘when, as a result of a prescribing decision or prescription writing process, there is an unintentional significant (1) reduction in the probability of treatment being timely and effective, or (2) increase in the risk of harm when compared with generally accepted practice’.<sup>9</sup>

WHO has defined unintentional medication discrepancies as those ‘in which the prescriber unintentionally changed, added or omitted a medication the patient was taking prior to admission’.<sup>5</sup>

A medication history should comprise a list of all medication currently being taken by the patient including any medication recently started by the general practitioner (GP), over the counter (OTC) medicines and herbal remedies.<sup>8,10</sup> Medicines reconciliation on admission to hospital is the process of collecting information to prepare the patient’s current medication history, verifying this list against the current hospital medication chart, identifying any discrepancies and taking appropriate action. Guidance is available for good medicines reconciliation practice which should result in an accurate prescription.<sup>5,10</sup>



however, there is little published data indicating how prescribers ensure that the prescription written on admission to hospital is correct.

This study investigated how doctors obtain the information necessary to write a prescription on admission to hospital. Outcomes were assessed in terms of the inpatient prescribing error prevalence (unintentional medication discrepancies) together with the potential patient impact.

## METHODS

### Setting and overall methodology

The study was carried out in the acute medical unit (AMU) of a large English teaching hospital. On arrival at the AMU, patients are seen by a doctor who is responsible for taking a history (including medication), assessing the patient, making a provisional diagnosis, documenting a management plan, ordering initial investigations and writing the admission prescription. This process is known as clerking. Ward pharmacists routinely carry out medicines reconciliation as soon as possible following admission; they document and follow-up any discrepancies identified. At the time of the study, all prescriptions on admission were hand written by doctors on paper charts.

A triangulated mixed-methods approach was used involving: direct observation of the admission process, interviews with healthcare staff and case note review. There were four one-week study periods: November 2009 (1), January 2010 (2), April 2010 (3) and April 2011 (4). Study periods were selected to enable the participation of as many medical staff as possible within the constraints of the AMU rotas and to identify any changes over time. The range of study periods also helped overcome any bias resulting from seasonal variations in healthcare workload and experience of staff. Case note review and direct observation of a sample of admissions was carried out for all four study periods. Interviews were undertaken with all admitting staff observed during period 4 and further purposively selected staff to ensure that all grades working on AMU were included.

### Observations

Staff gave informed consent for observations; patients or their carers could exclude the researcher at any time. They were purposively selected to maximise both the range of grades involved and variation in time and day of admission. Doctors clerk patients in order of arrival; hence patients whose admissions were observed were included if the clerking doctor agreed to participate in the study. Hospital staff were aware that the study concerned the hospital admission process but not specifically prescribing. During observations, data about medication were recorded on a standard form with additional field notes. The

pharmacist researcher interacted socially with staff, but there was no professional interaction, unless inappropriate clinical management with potential for serious adverse consequences was detected. Any questions directed to the pharmacist researcher about medication were answered to avoid the focus of the study becoming known; all such incidents were recorded.

### Interviews

Interviews with staff took place as soon as practical following observation period 4, using a structured approach to ascertain their training experiences, perceptions of prescribing error rates and usual practices when taking a medication history and prescribing on admission (schedule available online).

### Case note review

Case notes for all patients admitted during each study period were reviewed retrospectively, following discharge or death, to establish whether medicines were prescribed on admission, and whether any discrepancies were identified by the ward pharmacist during medicines reconciliation. All prescribing errors identified were documented in the case notes for review by medical staff; the appropriate doctor was alerted immediately by the ward pharmacist if urgent action was necessary, in accordance with routine pharmacy practice. If no medicines reconciliation had been carried out by a pharmacist during the hospital stay the notes were excluded from the analysis.

For the purposes of the study, prescribing errors were considered to be: unintentional omission of medication; unintentional prescribing of medication; incorrect medicine devices; and dose changes for which no justification could be identified. Minor discrepancies such as missing details for sustained release (SR) or enteric coated (EC) preparations, were not included as it was not possible to reliably identify these retrospectively.

The medicines reconciliation documentation in the case notes and pharmacist endorsements on prescriptions were reviewed and prescribing errors noted. All errors of omission were coded as red (significant or catastrophic, long-term patient impact); amber (significant, short-term patient impact), or green (negligible patient impact) using the UK Medicines Information (UKMI) tool for assessing possible harm from omitted or delayed medicines.<sup>11</sup> This tool has clearly defined categories, requiring minimal interpretation, hence coding was carried out by only one researcher.

### Data analysis

Data from case note reviews and observations from all four data collection periods were pooled, as there were no significant variations in working practices or procedures between the study periods. Data from the

observations and interviews were categorised where necessary. Descriptive analysis was carried out using SPSS V17; statistical tests were carried out using Minitab V16. Where case notes and/or prescription charts were missing these cases were excluded from the relevant analyses.

## RESULTS

The dataset for period 4 is slightly larger as more pharmacist hours were allocated to AMU resulting in more medication histories being checked ( $\chi^2$  test  $p=0.035$ ) and more patients experiencing an error being identified ( $\chi^2$  test  $p=0.025$ ), but other than this, similar numbers of admission observations, interviews and case note reviews were included in all four periods (table 1). The number of patients experiencing an error of omission and the proportion of red, amber and green errors were also broadly similar in all four periods ( $\chi^2$  test  $p=0.201$ ); the data were therefore pooled for analysis.

### Observations

A total of 68 admissions were observed, involving 35 doctors (four consultant/specialist registrar, four specialist trainee ST4/5 (6–7 years postregistration), nine specialist trainee ST1/2 (3–4 years postregistration) and 18 foundation F1/2 (0–2 years postregistration)).

In 66/68 (97%) cases, the pharmacist researcher assessed that the patient or carer was able to discuss medication issues; two patients were too unwell to do so. However, 14/66 (21%) of the patients or their carers able to provide information were not asked about medicines; all but one of these were taking regular medication. Of the two patients unable to provide verbal information, the care home Medication Administration Record (MAR) chart was

used for one and the medication chart from the referring hospital for the other.

No medication history was documented in the case notes for one patient who was discharged within a few hours. The most common sources used to obtain the medication history for the remaining 67 patients were: printed letters from the GP or Walk-In Centre (33/67; 49%); verbal information provided by patient (26/67; 39%); patients' own medicines (19/67; 28%) and hand written letters from the GP (14/67; 21%). Only six patients had their GP repeat prescription order form with them; these were used in five cases. A single source was used to determine the medication history in almost half the cases (31/67; 46%); for 16/31 (52%) of these, additional sources were overtly available but not used. Two sources were used in 27/67 (40%) cases, three in eight (12%) cases and four in just one case. There was no significant difference in the number of sources used by F1/F2 doctors in comparison with other doctors (Mann–Whitney U test;  $p=0.904$ ). The printed information provided in GP summaries was misinterpreted on nine occasions during eight patient admissions; examples are shown in box 1. The pharmacist researcher was asked for assistance with prescribing on 13 occasions (box 2), and prescribing errors witnessed are shown in box 3.

A prescription chart was written by the admitting doctor for 56/68 (82%) patients; no chart was written for 10/68 (15%) patients, and another doctor had already written the chart elsewhere in the hospital in 2/68 (3%) cases. The prescription written on admission was confirmed with the patient in only 12/56 (21%) cases; in 37/56 (66%) cases, the prescriber made no attempt to confirm that the medicines prescribed matched those which the patient was actually taking. In two (2/56; 4%) cases, only urgently

**Table 1** Details of datasets and number of prescribing errors in each study period

	Period 1 (Nov 2009) (%)	Period 2 (Jan 2010) (%)	Period 3 (Apr 2010) (%)	Period 4 (Apr 2011) (%)	Total (%)
Number of patient admissions observed	13	21	14	20	68
Number of doctors observed	7	7	9	12	35
Number of case notes reviewed	243/265(91.7)	232/255(91.0)	221/239(92.4)	234/256(91.4)	930/1015(91.6)
Number of patients with documentation available	207/243(85.2)	202/232(87.1)	190/221(86.0%)	211/234(90.2)	810/930(87.1)
Number of pharmacist hours allocated to AMU during study week	33	35	35	60	
Number of medication histories checked by ward pharmacists	166/207(80.2)	167/202(82.7)	167/190(87.9)	188/211(89.1)	688/810(84.9)
Number of patients having one or more prescribing errors	73/166(44.0)	74/167(44.3)	67/167(40.1)	104/188(55.3)	318/688(46.2)
Number of prescribing errors identified	163	201	190	297	851
Number of errors of omission	129/163(79.1)	167/201(83.1)	171/190(90.0)	270/297(90.9)	737/851(86.6)
Number of red (significant or catastrophic, long-term patient impact) errors (% of total errors of omission)	1/129(0.8)	3/167(1.8)	0/171(0.0)	3/270(1.1)	7/737(1.0)
Number of amber (significant, short-term patient impact) errors	19/129(14.7)	22/167(13.2)	12/171(7.0)	34/270(12.6)	87/737(11.8)
Number of green (negligible patient impact) errors	109/129(84.5)	142/167(85.0)	159/171(93.0)	233/270(86.3)	643/737(87.2)
Number of errors other than omissions	34/163(20.9)	34/201(16.9)	19/190(10.0)	27/297(9.1)	114/851(13.4)

AMU, acute medical unit.

## Original research

**Box 1 Prescribing errors observed as a result of misinterpretation of printed general practitioner (GP) summaries**

- ▶ Summary states Fragmin (dalteparin) 25000 units/mL 0.6 mL daily.
- ▶ Doctor initially prescribed 2500 units daily, and when challenged, changed this to 25 000 units daily; dose should be 15 000 units daily (research pharmacist intervened).
- ▶ Buprenorphine patch 5 mcg/h weekly 4.
- ▶ Doctor interpreted as four patches every week rather than one patch every week; 4 weeks supply.
- ▶ Spironolactone two daily at the bottom of page 1; strength 25 mg at the top of page 2 of GP summary.
- ▶ Doctor assumed strength was 100 mg and prescribed 200 mg daily; should be 50 mg daily.
- ▶ Fluticasone 250 mcg/salmeterol 25 mcg inhaler (Seretide 250 evohaler) 2 puffs twice daily.
- ▶ Prescribed as fluticasone 250 mcg inhaler 2 puffs twice daily.

required medication was prescribed, and in five (5/56; 9%) cases confirmation was not possible due to illness. Seven of the 12 (58%) doctors both observed and interviewed indicated that they would confirm medication with the patient before prescribing; however, the observations showed they did so for only 2/12 (17%) patients whom they admitted.

Medicines reconciliation was completed by a pharmacist for 42 of the 56 (75%) medication charts written during the observations; 25/42 (59%) were accurate, eight (8/42; 19%) contained one prescribing error, seven (7/42; 17%) had two errors and two (2/42; 5%) had three errors.

**Interviews**

Nineteen doctors were interviewed, comprising 73% of the 26 working on AMU during study period 4: two consultants, nine specialist trainees and eight foundation years. Twelve of the 19 were responsible for admitting 20 of the patients observed in the study. Sixteen (16/19; 84%) reported receiving undergraduate training in medication history-taking; however, 9/16 (56%) were unable to recall the details. The majority of doctors were unaware of the proportion of patients at risk, with 13/19 (68%) estimating that no more than 30% of medication charts written on admission would have a prescribing error, and 16/19 (84%) estimating that fewer than 10% of such errors may be potentially serious.

When asked to list the sources they usually use to obtain a medication history, the most common responses were the patient (17/19; 89%), patients' own medicines (16/19; 84%), GP repeat medication

**Box 2 Research pharmacist assistance sought**

- ▶ Dose therapeutic dalteparin based on body weight
- ▶ Dalteparin dose reduction for a patient with renal impairment
- ▶ Identifying inhalers from patient descriptions of colour and shape
- ▶ Confirming appropriateness of medication: Oramorph (morphine sulfate oral solution) for breathlessness in patient with severe COPD
- ▶ Identification of white and yellow tablets in a blister pack
- ▶ How to prescribe tiotropium inhaler 18 micrograms daily
- ▶ Identification of new diabetes tablet beginning with 'S'—sitagliptin
- ▶ How to prescribe calcium carbonate 1.5 g/cholecalciferol 400 units—Adcal D3
- ▶ To access general practitioner (GP) summary using EMIS web\*—passwords not issued to rotational medical staff
- ▶ Dose of paracetamol in liver disease?
- ▶ Appropriate non-steroidal anti-inflammatory to be started
- ▶ Dose of fondaparinux for probable pulmonary embolism as patient is allergic to dalteparin
- ▶ Appropriate antibiotic for patient who has a chest infection, penicillin allergy and had recent course of erythromycin from GP

\*Web-based computer system used by many GPs.

order form (15/19; 79%), previous discharge prescription (14/19; 74%), telephone GP for information (13/19; 68%), GP/Walk-In Centre letter (10/19; 53%).

**Box 3 Additional prescribing errors witnessed during writing of admission prescription**

- ▶ Tiotropium inhaler missed off prescription
- ▶ MST (morphine sulfate sustained release) prescribed as 40 mg Mane and 30 mg Nocte using a blister pack; should be 30 mg twice daily but 40 mg twice daily on Mondays and Thursdays when the patient has dressing changes
- ▶ Ramipril prescribed 5 mg daily; should be twice daily and furosemide 20 mg three daily prescribed as 20 mg mane
- ▶ Tacrolimus prescribed; should be prescribed by brand—Prograf
- ▶ Calcichew prescribed; should be cinacalcet (research pharmacist intervened)
- ▶ Calcichew prescribed should be Calcichew D3 Forte
- ▶ Regular medication fluoxetine and vitamin B compound strong omitted for no apparent reason

**Table 2** Details of type of prescribing errors identified during case note review and potential impact of errors of omission

Error type	Number of errors (proportion of total) (%)	Number of patients with errors (some patients had more than 1 type of error) (%)	Number of prescribed items with errors (proportion) (%)
Omitted medicines	737 (86.6)	252 (36.6)	737 (17.7)
Dosing error	86 (10.2)	73 (10.6)	86 (2.1)
Restarted in error	14 (1.7)	12 (1.6)	14 (0.3)
Incorrect device	11 (1.3)	11 (1.6)	11 (0.3)
Wrong medicine	2 (0.2)	2 (0.3)	2 (0.05)
Totals	851 (100)	688 (100)	4155 (100)
Potential impact of omitted medicine (UKMI tool)			
Red (significant or catastrophic, long-term patient impact)	7 (1.0)	6 (2.4)	7 (0.2)
Amber (significant, short-term patient impact)	87 (11.8)	66 (26.2)	87 (2.2)
Green (negligible patient impact)	643 (87.2)	239 (94.8)	643 (15.9)
Totals	737 (100)	252 (100)	4042 (100)

UKMI, UK Medicines Information.

Fourteen of the 19 interviewees indicated they would sometimes use more than one source to check a medication history; a further four said that they would always do so. Common reasons given for using more than one source were: information given by patients is not reliable (6/19; 32%) and patients may not take their medication as prescribed (3/19; 16%). Five interviewees stated that clinical anomalies also prompted them to check medication thoroughly. Examples were: a patient with epilepsy who has brought their own medicines but none are antiepileptic medicines; a patient taking letrozole but no history of breast cancer. Warfarin and insulin were cited as causing particular problems in identifying the current dosage regimen, and the difficulties in obtaining accurate information outside of normal working hours when GP surgeries are closed were highlighted.

The majority (11/19; 58%) said that they would 'sometimes' confirm all regular medication taken with patients before writing the admission prescription, and some (6/19; 32%) said that they would discuss newly initiated medicines but not the patients' 'regular' medicines. Reasons given for not discussing with patients were: incapacity due to illness (8/19; 42%) and too time consuming (1/19; 5%).

All 19 doctors thought that prescriptions should be checked for accuracy and appropriateness; 17/19 (89%) indicated that this should take place within 24 h of prescribing, and 18/19 (95%) felt that pharmacists were the most appropriate professionals to perform the check. One doctor felt that checking on the next working day would be adequate, and another that 24–48 h after prescribing was appropriate. However, it was recognised that anyone involved with medication should also take the opportunity to check, for example, doctors on ward rounds and nurses administering medicines. Five doctors spontaneously

indicated that they had a responsibility to self-check prescriptions that they had written.

Suggestions for reducing prescribing errors included: better access to GP prescription data (6/19; 32%) especially out of hours; integrated Information technology (IT) systems (2/19; 11%) and improved training for medical students and F1 doctors (10/19; 53%). Two senior interviewees suggested that increasing availability of pharmacists to provide accurate medication histories prior to patients being clerked by a doctor may be helpful.

#### Case note review

A total of 1015 patient case notes were identified of which 930 (91.6%) were followed-up. In 54 cases, the relevant admission documentation was not available, and for a further 66 the original medication chart was missing, leaving 810 cases suitable for analysis. Medicines reconciliation was completed by a pharmacist for 688/810 (84.9%) of patients; 4155 medicines should have been prescribed (average 6.0 per patient) and 851 errors were identified, therefore, 20.5% of items which should have been prescribed had an error. The errors involved 318/688 (46.2%) patients; each of whom experienced an average of 2.7 errors; the most common error was omission of a medicine (737/851; 86.6%). The overall error rate was 1.2 errors per patient for whom medicines reconciliation was completed.

Details of the types of prescribing errors identified and the potential impact of omissions are shown in table 2; 94/737 (12.8%) of omissions were classified as having the potential to have a significant long-term or short-term effect. Most of those classified as red (significant or catastrophic, long-term patient impact) involved antiepileptic medicines (5/7). The majority of errors (502/851; 59%) were rectified within 24 h, and

over two-thirds (587/851; 69.0%) within 48 h of being identified and highlighted by pharmacists.

## DISCUSSION

This study provides a novel insight into how prescriptions are written, and the possible causes of prescribing errors on admission to hospital. It adds to the published literature regarding the proportion of medical patients who experience a prescribing error, and the potential impact of these errors.

The sources actually used for obtaining medication histories during the observations matched those most frequently cited by staff during the interviews as being sources they commonly used. Although almost all doctors interviewed indicated that they would sometimes or always use more than one source to confirm medication histories, the observations showed that a single source was used in almost half the cases. This is at variance with national guidance for England and Wales<sup>8</sup> and other published guidance<sup>10 12 13</sup> which suggests that at least two sources should be used. WHO definition for 'Best Possible Medication History' states that the patient should be interviewed where possible, and advocates the use of more than one source.<sup>5</sup>

From the observations it was apparent that several patients or carers were able to provide information about medicines but were asked no relevant questions, despite this being an integral part of the standard hospital clerking model.<sup>14</sup> The numbers in the study were too small to suggest any particular reason for this omission, however, during the interviews six doctors did allude to the unreliability of information provided by patients.

Although seven of the 12 doctors both interviewed and observed indicated that they would confirm current medication with the patient, the observations showed that these doctors only did so in two of the 12 patients they admitted between them, suggesting that although the theory is understood, application in practice was not simple. Overall, confirmation of the prescription with the patient occurred infrequently despite overt acknowledgement by three doctors that patients may not take their medicines as prescribed; a UK study has shown that up to 11% of errors identified on admission may result from a patient decision to alter their treatment regimen.<sup>15</sup> One doctor commented that time pressures were an issue when talking to patients about medication. A recent study showed that medication history-taking for medical patients takes 10–20 min<sup>15</sup>; national guidance for England and Wales suggests that 15 min is needed for the 'average' non-elective patient.<sup>16</sup> Both the EQUIP study<sup>17</sup> and the PROTECT programme<sup>18</sup> reported time pressures and high workload as being contributory factors to prescribing errors.

The error rates found in the present study are similar to those reported elsewhere, although there

are difficulties in making comparisons between studies as 'prescribing error' is not always defined<sup>19</sup> and results may be expressed in different ways.<sup>20 21</sup> The present study found prescribing errors in 20.5% of the medicines which should have been prescribed which is comparable with results published in a recent English study which reported a rate of 16.3% for medical admissions.<sup>22</sup> A systematic review found that overall prescribing errors affect 50% of patients<sup>20</sup> which is similar to the 46.2% of patients affected in the present study. The most common error in the present study was omission of a medicine usually taken by the patient (86.6%), which is in line with the findings of studies from Belgium,<sup>23</sup> Sweden<sup>24</sup> and Wales.<sup>25</sup>

All doctors, on qualification, should be able to establish an accurate medication history<sup>26</sup>; this has been highlighted as a core skill necessary for safe prescribing by the British Pharmacological Society.<sup>27 28</sup> Limited information is available in the literature regarding the most effective way to train medical students to prescribe<sup>29 30</sup>; only two papers providing specific medicines reconciliation guidance for medical students or junior doctors have been identified.<sup>12 13</sup> These papers confirm the need for at least two sources to be used and highlight some of the common pitfalls.

As the majority of the prescribing errors in the present study were omissions, a tool specifically developed to estimate the potential impact of omitted medicines was used to categorise them<sup>11</sup>; 12.8% of omissions were assessed as red or amber and, therefore, had the potential for some clinical impact on the patient. However, the majority of omissions were likely to have a minimal impact which is in line with the findings of a recent meta-analysis.<sup>31</sup> Few studies have attempted to assess the impact of prescribing errors and those that have used different tools. A study from Wales using an adapted version of a tool developed by the National Patient Safety Agency<sup>32</sup> classified 20% of errors as 'major' or 'moderate',<sup>25</sup> other studies using consensus panels to estimate impact have reported 32.9% of errors could potentially cause moderate discomfort or clinical deterioration,<sup>33</sup> and 26% were potentially serious.<sup>34</sup> The majority of doctors interviewed were unaware of the proportion of patients at risk of prescribing errors, with most estimating error rates of below 30%, in contrast with the 50% reported in the literature<sup>20</sup> and 46.2% found in the present study.

A meta-analysis published in 2012 concluded that there are limited data regarding the most effective interventions to improve medicines reconciliation,<sup>35</sup> however, the present study did suggest some actions which may prove particularly successful. Raising awareness of both the level of risk and the potential seriousness of many errors may help to reduce error rates, but doctors may also require practical guidance

regarding the need to check more than one source, and especially the need to confirm the medication history with the patient before prescribing, whenever possible. Training in areas where knowledge was found to be lacking, for example, colours and types of inhaler, preferably by supervising medical students while taking medication histories and providing feedback to staff about actual errors may also be beneficial. However, training alone may not result in a significant reduction in errors as doctors appeared to know the theory but failed to apply it in practice, which suggests that other factors are contributing to the problem. Staff comments about difficulties arising outside of normal working hours when access to GP information was limited are also important considerations. Expanding the use of electronic systems, such as EMIS web,<sup>36</sup> or a system similar to the emergency care summary used in Scotland,<sup>37</sup> and facilitating access to GP records for junior staff who provide the 'out of hours' services in hospitals, may go some way to addressing this issue.

Earlier involvement of the pharmacy team in the admission process was suggested by two senior doctors. Studies from Scotland,<sup>38</sup> Australia<sup>39</sup> and the USA<sup>40</sup> have shown that fewer doses are missed if a pharmacist completes a medication history in the ED, before relatives leave, taking with them the vital information available from patients' own medication. Studies in the UK,<sup>41</sup> USA<sup>42</sup> and Belgium<sup>23</sup> have demonstrated that pharmacist-documented medication histories are more accurate than those gathered by doctors. This finding is supported by the requests for assistance from the pharmacist researcher during 13 (19%) of the 68 admissions observed and the need to intervene on two occasions to prevent a serious prescribing error. Perhaps it is time to rethink the patient journey on admission to hospital, and involve pharmacy staff in obtaining a medication history on AMU before the patient is seen by the doctor, to prevent prescribing errors arising rather than identifying and correcting them later.

#### Strengths and limitations

The main strength of this study is in the triangulation of data derived from interviews with a proportion of the staff observed, helping to explain some of the findings from the observations, while the case note review provided real outcome data. This is in contrast with many published studies which focus on the number of prescribing errors rather than investigating the cause of such errors.

Limitations are that the study was carried out in one hospital and involved relatively small numbers of observations and interviews, therefore, the results may not be representative of other hospitals. Only doctors observed in period 4 were interviewed, but additional interviews maximised the proportion of AMU staff included. The interviews were carried out

sequentially, and although all staff agreed to keep the subject matter confidential, it is impossible to be certain that confidentiality was maintained, however there is no evidence that this impacted on the data integrity.

Minor discrepancies, such as missing SR or EC preparations, were excluded, which may have resulted in a reduced number of prescribing errors being recorded. Independent pharmacist medicines reconciliation was only available for 67% of the total number of patients admitted during the study periods, due, in part, to limitations in the capacity of the pharmacy service and unavailability of the necessary documentation. However, as patients' mean age was very similar for both groups, and the three most common presenting complaints were identical, there is no reason to suspect that either the number of regular medicines or the number of prescribing errors would differ between those patients whose prescriptions were, and those whose were not, reviewed by a pharmacist.

The researcher is a member of the AMU staff which may have impacted on behaviour during observations.

#### CONCLUSION

The study interviews showed that medical staff have the necessary knowledge to establish an accurate medication history and are aware of the potential pitfalls, but observations showed that theoretical knowledge is frequently not put into practice. Therefore, a reduction in prescribing errors could be achieved if a mechanism can be found to implement existing guidance effectively. Improved awareness training highlighting the extent of the problem may be beneficial, but improving access to patient medication histories and alternative strategies for involving pharmacists should also be considered.

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