



تحديد ومنع الأخطاء الدوائية بقسم الطوارئ

رسالة مقدمة للحصول علي درجة الماجستير في العلوم الصيدلانية
(صيدلة اكلينيكية)

مقدمة من :

الصيدلانية/ لبنى سعد مصطفى

بكالوريوس الصيدلة ٢٠١٠
كلية الصيدلة - جامعة عين شمس

تحت اشراف :

أ.د/ نجوي علي صبري

رئيس قسم الصيدلة الاكلينيكية
كلية الصيدلة - جامعة عين شمس

أ.د/ علي محمد الأنور

أستاذ بقسم الجراحة عامة
كلية الطب - جامعة عين شمس

د/ ساره محمود ذكي

مدرس الصيدلة الاكلينيكية
كلية الصيدلة - جامعة عين شمس

كلية الصيدلة

جامعة عين شمس

٢٠١٩



Detection and Prevention of Medication Errors in Emergency Department

A Thesis Submitted for the Fulfillment of Master Degree
in Pharmaceutical Sciences (Clinical Pharmacy)

Submitted by:

Lobna Saad Moustafa

B. Pharmaceutical Sciences, 2010.

Faculty of Pharmacy - Ain Shams University

Under supervision of:

Prof. Dr. Nagwa Ali Sabri

Head of Clinical Pharmacy Department

Faculty of Pharmacy - Ain Shams University

Prof. Dr. Ali Mohammed El Anwar

Professor of General Surgery

Faculty of Medicine - Ain Shams University

Dr. Sara Mahmoud Zaki

Lecturer of Clinical Pharmacy

Faculty of Pharmacy - Ain Shams University

Faculty of Pharmacy

Ain Shams University

2019

Table of Contents

Content	Page
List of Abbreviations	i
List of Figures	ii
List of Tables	iv
Abstract	ix
Review of literature	
• Medication errors	1
• Hospital drug distribution system	21
• Emergency department	23
• Medication errors in emergency department	26
• Incorporation of clinical pharmacist into the emergency department	31
Aim of the work	42
Patients and Methods	43
Results	61
Discussion	123
Recommendations and limitations	135
Summary	137
Conclusion	141
References	142
Appendix	167
الملخص العربي	١

Acknowledgments

I am deeply thankful to "Allah", for by his grace and blessing; this work was possible.

*I would like to express my sincere appreciation to **Prof. Dr. Nagwa Ali Sabri**, Head of Clinical Pharmacy Department, Faculty of Pharmacy, Ain Shams University for her genuine help, valuable guidance, and continuous support in completing this work.*

*I am incredibly grateful to **Prof. Dr. Ali Mohammed El Anwar**, Professor of General Surgery, Faculty of Medicine, Ain Shams University for his great aid, precious advice, and valuable guidance in completing this work.*

*My deep appreciation goes to **Dr. Sara Mahmoud Zaki**, Lecturer of Clinical Pharmacy, Faculty of Pharmacy, Ain Shams University for her devoted aid and help.*

I would like to dedicate this work to my father for being the ultimate supporter and encourager from the first day, to my mother who loved and cared for me every step of the way, to my husband for his love, support and patience throughout the journey, and last, to my beloved son Malek, for his unconditional love and support, and letting me study. To all of you, I am greatly in debt.

List of Abbreviations

ACCP	The American College of Clinical pharmacy
ADEs	Adverse Drug Events
ASHP	The American society of health system pharmacists
BCMA	Bar-Code management
CDU	Clinical decision unit
CPOE	Computerized provider order entry
Crcl	Creatinine Clearance
ED	Emergency department
EM	Emergency medicine
EMW	Emergency medical wards
EPh	Emergency pharmacist
ICU	Intensive Care Unit
IM	Intramuscular
IOM	Institute of Medicine
IV	Intravenous
MEs	Medication errors
MAE	Medication administration errors
NCC MERP	The National Coordinating Council for Medication Error Reporting and Prevention
SSU	Short stay unit
US	United States
UK	United kingdom

List of Figures

Figure	Page
Figure (I): Floor stock system in emergency departments.	45
Figure (II): Unit dose system in emergency departments.	45
Figure (III):NCCMERP index for Categorizing Medication Errors.	52
Figure (IV):National Coordinating Council for Medication Error Reporting and Prevention Index for Categorizing Medication Errors algorithm.	54
Figure (1): A flowchart for the different study phases.	61
Figure (2): Different types of prescribing errors detected in all emergency departments in the pre-interventional phase of the study.	70
Figure (3): Illegible prescription that caused missed administration of Atrovent® ampoules.	75
Figure (4): illegible prescription that caused incorrect prescribing of Unasyn® instead of Uniphylline®.	75
Figure (5): Illegible prescription that caused missed prescribing of the last two medications.	76
Figure (6): Illegible prescription.	76
Figure (7): Illegible prescription.	77
Figure (8): Prescription contained use of abbreviations.	78
Figure (9): Different types of Administration errors detected in all emergency departments in the pre-interventional phase of the study.	80

Figure (10): Comparing the medication error rate among emergency departments in the pre and post-intervention phases of the study.	99
Figure (11): Comparing the prescribing error rate among different emergency departments in the pre and post-interventional phases of the study.	102
Figure (12): Comparing the number of prescribing errors per patients in the pre and post interventional phases of the study.	104
Figure (13): Comparing the administration errors rate among different emergency departments in the pre and post-interventional phases of the study.	107
Figure (14): Comparing the number of administration errors per patients in the pre and post interventional phases of the study.	109
Figure (15): Different types of prescribing errors detected in all emergency departments in post-interventional phase of the study.	112
Figure (16): Different types of administration errors detected in all emergency departments in the post-interventional phase of the study.	114
Figure (17): Comparing the outcome severity of prescribing errors in the pre and post interventional phases of the study.	119
Figure (18): Comparing the outcome severity of administration errors in the pre and post interventional phases of the study.	122

List of Tables

Table	Page
Table (I): Classification of seriousness of medication errors according to the NCCMERP.	53
Table (1): Medication errors and medication error rate detected among different emergency departments in the pre-interventional phase of the study.	63
Table (2): Demographics of patients with errors identified among different emergency departments in the pre-interventional phase of the study.	64
Table (3): Main complaint for patients with errors identified among different emergency departments in the pre-interventional phase of the study.	65
Table (4): Prescribing errors and prescribing error rate detected among different emergency departments in the pre-interventional phase of the study.	66
Table (5): Administration error and administration error rate detected among different emergency departments in the pre-interventional phase of the study	67
Table (6): Types of prescribing errors detected among different emergency departments in the pre-interventional phase of the study	69
Table (7): Description and examples of various types of prescribing errors identified among emergency departments.	71
Table (8): Types of administration errors detected among different emergency departments in the pre-interventional phase of the study.	78

Table (9): Description and examples of various types of administration errors identified among emergency departments.	81
Table (10): Prescribing errors classified according to personnel discovering the error at different emergency departments in the pre-interventional phase of the study.	85
Table (11): Administration errors classified according to personnel discovering the error at different emergency departments in the pre-interventional phase of the study.	86
Table (12): Prescribing errors classified according to their outcome severity among different emergency departments in the pre-interventional phase of the study.	87
Table (13): Administration errors classified according to their outcome severity among different emergency departments in the pre-interventional phase of the study.	88
Table (14): Medication errors and medication error rate detected among different emergency departments in the post-interventional phase of the study	95
Table (15): Demographics of patients with errors identified among different emergency departments in the post-interventional phase of the study.	96
Table (16): Main complaint for patients with errors identified among different emergency departments during the post-interventional phase of the study.	97
Table (17): Comparing the medication error rate among different emergency departments in the pre and post-interventional phases of the study.	98

Table (18): Prescribing errors and prescribing error rate detected among different emergency departments in the post-interventional phase of the study.	100
Table (19): Comparing the rate of prescribing errors among different emergency departments in the pre and post-interventional phases of the study.	101
Table (20): Comparing the number of prescribing errors per patients in the pre and post interventional phases of the study.	103
Table (21): Administration errors and administration error rate among different emergency departments in the post-interventional phase of the study.	105
Table (22): Comparing the rate of administration errors in the pre and post-interventional phases of the study.	106
Table (23): Comparing the number of administration errors per patients in the pre and post interventional phases of the study.	108
Table (24): Types of prescribing errors detected among different emergency departments in post-interventional phase of the study.	111
Table (25): Different types of administration errors detected among different emergency departments in the post-interventional phase of the study.	113
Table (26): Prescribing errors classified according to personnel discovering the error at different emergency departments in the post-interventional phase of the study.	115
Table (27): Administration errors classified according to personnel discovering the error at different emergency departments in the post-interventional phase of the study.	116

Table (28): Prescribing errors classified according to their outcome severity among different emergency departments in the post interventional phase of the study.	117
Table (29): Comparing the outcome severity of prescribing errors in the pre and post interventional phases of the study.	118
Table (30): Administration errors according to their outcome severity among different emergency departments in the post interventional phase of the study.	120
Table (31): Comparing the outcome severity of administration errors in the pre and post interventional phase of the study.	121

Abstract

Introduction:

Over recent years, the healthcare systems had reached the fact that medical treatment can cause patient harm. Almost every healthcare professional had at some time made a mistake resulting in patient injury. Medication errors can increase the length of hospitalization along with the need for corrective and unplanned interventions, as well as posing a risk of adverse outcomes and potential morbidity. Emergency department has high rate of medication errors that could lead to serious consequences.

Aim of the work:

The current study was designed to detect medication errors that occur at different stages of medication use process in emergency department and to assess these errors and identify methods for their prevention as well as to evaluate the impact of clinical pharmacist interventions used for medication error prevention.

Patients and methods:

The study was a three phase interventional study performed on patients admitted to emergency departments. A total number of 2049 patients were included during the pre and post-interventional phases.

Pre and post-interventional phases involved prospective detection and analysis of all medication errors occurring to patients admitted to the emergency departments during a period of six months.

Interventional phase, involved the application of educational tools in order to increase the overall awareness about the existing medication errors and ways to overcome and correct them.

Results:

The overall rate of medication errors was declined from 48.9% pre-intervention to 32.1% post-intervention (p value <0.001). A significant reduction of medication error rate in all emergency departments was observed post intervention. The overall rate of prescribing errors was declined from 27.3% pre-intervention to 22.3% post-intervention (p-value =0.008), while the overall rate of administration errors was declined from 34.2% pre-intervention to 15.3% post-intervention (p-value <0.001). Results of outcome severity of prescribing and administration errors in the pre and post intervention phases of the study showed that the intervention resulted in a significant reduction in the percentages of all errors outcome severity.

Conclusion:

The study findings showed that interventions that focus on improving drug knowledge and awareness of errors were shown effective in reducing the rate of prescribing and administration errors and their potential severity in emergency departments.

Key words:

Medication errors, Emergency department, clinical pharmacist role, educational tools.

MEDICATION ERRORS

Over the past years, many definitions have been used to describe medication errors (MEs). However, inconsistency in defining MEs has been confirmed. It appears that definitions are subjected to the individual researcher's preferences. Thus, application of a clear-cut definition, standardized terminology and reliable methods has the potential to greatly improve the quality and consistency of medication error reporting. Efforts to achieve a common accepted definition that defines the scope and content are therefore needed (**Lisby et al., 2010**). A clear and unambiguous definition of MEs is important so that patients, prescribers, manufacturers, and regulators can all understand each other (**Aronson, 2009a**).

Medication errors can be defined as 'a failure in the treatment process that leads to, or has the potential to lead to harm to the patient' (**Ferner and Aronson, 2006; Aronson, 2009a**). The term 'failure' in the definition implies that certain standards should be set, against which failure can be judged and that all those who deal with medicines should establish or be familiar with such standards (**Aronson, 2009b**). The definition does not specify who makes the error as it could be a physician, a nurse, a pharmacist, a care giver, or another; it does not specify who is responsible for preventing errors (**Aronson, 2009a**).

According to the National Coordinating Council for Medication Error Reporting and Prevention (NCC MERP), medication error is "any preventable event that may cause or

lead to inappropriate medication use or patient harm while the medication is in the control of the health care professional, patient, or consumer. Such events may be related to professional practice, health care products, procedures, and systems, including prescribing; order communication; product labeling, packaging, and nomenclature; compounding; dispensing; distribution; administration; education; monitoring; and use" (**Cousins and Heath, 2008**).

Data from the United Kingdom (UK), collated and reported by the National Health Service Patient Safety Agency for the period from October 2010 to September 2011, illustrated that MEs are the second most common cause of patient safety issues during hospital stay; contributing to 11 % of all incidents and affecting 134,684 patients (**Tobaiqy and Stewart, 2013**). Researchers estimated that MEs that result in harm are the number one cause of inpatient fatalities. While error rates vary widely among facilities, experts Believe at least one ME occurs per hospital patient every day (**Anderson and Townsend, 2010**).

Overall, in the third world and developing countries, it is difficult to obtain accurate estimates of errors due to lack of a proper recording and reporting system, as well as shortage of information for research. However, experts speculate that the rate of these errors is high, and the increasing number of complaints against health care team in courts and to judicial authorities also confirms that (**Ehsani et al., 2013; Cheragi et al., 2014**).