A MIXED METHODS INVESTIGATION OF BEHAVIOURAL DETERMINANTS RELATING TO MEDICATION ERROR REPORTING BY HEALTH PROFESSIONALS IN THE UNITED ARAB EMIRATES

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ABSTRACT

Improving the effectiveness and efficiency of medication error reporting is key to enhancing patient safety. The aim of this research was to explore medication error reporting in the United Arab Emirates (UAE), examining the attitudes, beliefs, behaviors and experiences of health professionals.

The first phase was a Joanna Briggs Institute registered systematic review of the beliefs, attitudes and experiences of health professionals relating to medication error reporting. Findings indicated the need for original research employing a mixed methods approach to quantify and generate in-depth information, grounded in theories of behaviour change.

In the second phase, a cross-sectional survey of health professionals in the UAE was conducted to determine the behavioural determinants and facilitators and barriers of medication error reporting. Principal component analysis of responses from 294 health professionals identified six components: knowledge and skills related; feedback and support related; action and impact related; motivation related; effort related; and emotions. Responses were neutral for the motivation and effort related components, but negative for the emotions component. Comparison of component scores identified that, nurses, females, those with greater experience and being older were more likely to be positive in their responses ($p<0.05$). In terms of emotions, the component with the lowest scores, older respondents with greater experience gave more positive responses ($p<0.05$).

In the final phase, face-to-face semi-structured interviews with 29 health professionals explored in-depth the behavioural determinants of medication errors reporting in the UAE.

The theoretical domains framework was employed in constructing the interview schedule and interpreting the findings. 'Goals' and 'intentions' were determinants which acted as facilitators while 'beliefs of the consequences', 'emotions',' 'social influences and environmental context' were barriers.

This doctoral research has generated original findings which can support the development of interventions, based on behaviour change techniques, to enhance medication error reporting. These changes could impact at the levels of the organisation, health professional and patient.

Keywords: medication errors; systematic review; cross-sectional survey; interviews; theoretical domains framework; barriers; facilitators; the United Arab Emirates.

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Dedication

I dedicate this thesis in memory of my mother (1961- 2007). Throughout my life, her voice has always whispered, 'you can do it'. She made so many sacrifices and emphasised the importance of education, shaping me into the person I now am. She would have been so proud in my completing a PhD.

EXTERNAL OUTPUT

The doctoral research has resulted in the following outputs to date.

Published peer reviewed papers

1. Alqubaisi M, Stewart D, Tonna A, Strath A. Health professionals' beliefs, attitudes and experiences of medication error reporting: a systematic review protocol. *The JBI Database of Systematic Reviews and Implementation Reports.* 2014; 12(10):109-120.
2. Alqubaisi M, Tonna A, Strath A, Stewart D. Behavioural determinants relating to health professional reporting of medication errors: a qualitative study using the Theoretical Domains Framework. *European Journal of Clinical Pharmacology* 2016; ;72:887-895.
3. Alqubaisi M, Tonna D, Strath A, Stewart D. Quantifying behavioural determinants relating to health professional reporting of medication errors: a cross-sectional survey using the Theoretical Domains Framework. European Journal of Clinical Pharmacology 2016;72:1401–1411.

The following paper is in development:

- A systematic review of health professionals' beliefs, attitudes and experiences of medication error reporting

Peer reviewed conference abstracts

1. Alqubaisi M, Strath A, Tonna A, Stewart D. Health professionals' beliefs, attitudes and experiences of medication error reporting: a systematic review. (Poster presentation at Patient Safety & Quality Congress, Middle East, March 2014. Awarded second prize).
2. Alqubaisi M, Strath A, Tonna A, Stewart D. Health professionals' beliefs, attitudes and experiences of medication error reporting: a systematic review protocol (Oral presentation at the European Society of Clinical Pharmacy symposium, Copenhagen, Denmark, October 2014).

3. Alqubaisi M, Strath A, Tonna A, Stewart D. Exploring the attitudes, beliefs, behaviours and experiences of health care professionals in the United Arab Emirates on medication error reporting. (Poster presentation at the European Society of Clinical Pharmacy Conference, Lisbon, Portugal, October 2015).
4. Alqubaisi M, Strath A, Tonna A, Stewart D. Exploring the attitudes, beliefs, behaviours and experiences of health care professionals in the United Arab Emirates on medication error reporting (Poster presentation at BMJ International Forum on Quality & Safety in Healthcare in Gothenburg, Sweden April 2016).

ABBREVIATIONS

BCTs	Behaviour change techniques
CINAHL	Cumulative Index of Nursing and Allied Health Literature
DARE	Database of Abstracts of Reviews of Effectiveness
HCPs	Health care professionals
HAAD	Health Authority Abu Dhabi
IOM	Institute of Medicine
IPA	International Pharmaceutical Abstracts
IQR	Interquartile range
JBI	Joanna Briggs Institute
MASTARI	Meta-Analysis of Statistics Assessment and Review Instrument
MEDLINE	Medical Literature Analysis and Retrieval System Online
MHRA	Medicines and Healthcare Products Regulatory Agency
MOH	Ministry of Health
MRC	Medical Research Council
NCCMERP	National Coordinating Council for Medication Error Reporting and Prevention
NRLS	National Reporting and Learning System
NPSA	National Patient Safety Agency
PCA	principal component analysis
PRISMA	Transparent Reporting of Systematic and Meta-Analyses
QARI	Quality assessment of five qualitative studies Abu Dhabi
RCUK	Research Councils United Kingdom
SEHA	Health Services Company
SEMP	Scottish Centre for Evidence-based Multi-Professional Practice
SPSS	Statistical Package for the Social Sciences
TDF	Theoretical Domains Framework
UAE	United Arab Emirates
UK	United Kingdom
US	United States
WHO	World Health Organization

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CHAPTER 1: GENERAL INTRODUCTION

This chapter commences with an overview of the global emphasis on patient safety in all healthcare settings, followed by description of Reason's model of error causation. The term 'medication error' and associated terms are defined along with coverage of key systematic reviews. Attention is then paid to medication error reporting, with the overall aim of the doctoral research and the aims of the research phases stated.

1.1 PATIENT SAFETY

1.1.1 To Err is Human

The United States (US) Institute of Medicine (IOM) in 1999 published the seminal report, 'To Err Is Human: Building a Safer Health System' which aimed to increase awareness of medical errors (errors in healthcare).[1] This report stimulated deeper examination of patient safety research and associated practices and has now been cited over 15,000 times in the academic literature. At the time of publication, it was described as 'groundbreaking', suggesting that 2-4% of all deaths in the US were attributed to medical errors.[2] The main content was based on the analysis of multiple studies which had been conducted by a variety of organisations, concluding that 44,000-98,000 people died each year as a result of preventable medical errors. The authors called for comprehensive, coordinated efforts by health care providers, governments, consumers and others to promote patient safety and set a minimum goal of 50 percent reduction in errors over the next five years. It was noted that preventing death and injury from medical errors would require dramatic, system wide changes and moving the focus from medical errors to patient safety.

The report recommended a four-tiered strategic approach to achieve a better safety record:

1. Establishing a national focus to create leadership, research, tools, and protocols to enhance the knowledge base about safety.

2. Identifying and learning from errors by developing a nationwide public mandatory reporting system and by encouraging health care organisations and practitioners to develop and participate in voluntary reporting systems.

3. Raising performance standards and expectations for improvements in safety through the actions of oversight organisations, professional groups, and group purchasers of health care.

4. Implementing safety systems in health care organisations to ensure safe practices at the delivery level.

It has been stated that the report impacted greatly the management of healthcare globally in that it 'brought the issues of medical error and patient safety to the forefront of national [and international] concern', attracting the attention of healthcare providers.[3]

1.1.2 Models of error causation

While there are many different models and theories of error causation, the two which are described mostly within healthcare are 'the Swiss Cheese Model' and 'Human Error Theory'. Orlandella and Reason (1990) proposed the 'Swiss Cheese Model of system failure and accident causation, which has gained widespread acceptance in many fields including healthcare.[4] The principle behind this model is based on layered security as shown in Figure 1.1. This illustrates that, while many layers of defence lie between 'hazards' and 'losses' (accidents or errors), there are flaws in each layer that, if aligned, can allow the losses to occur.

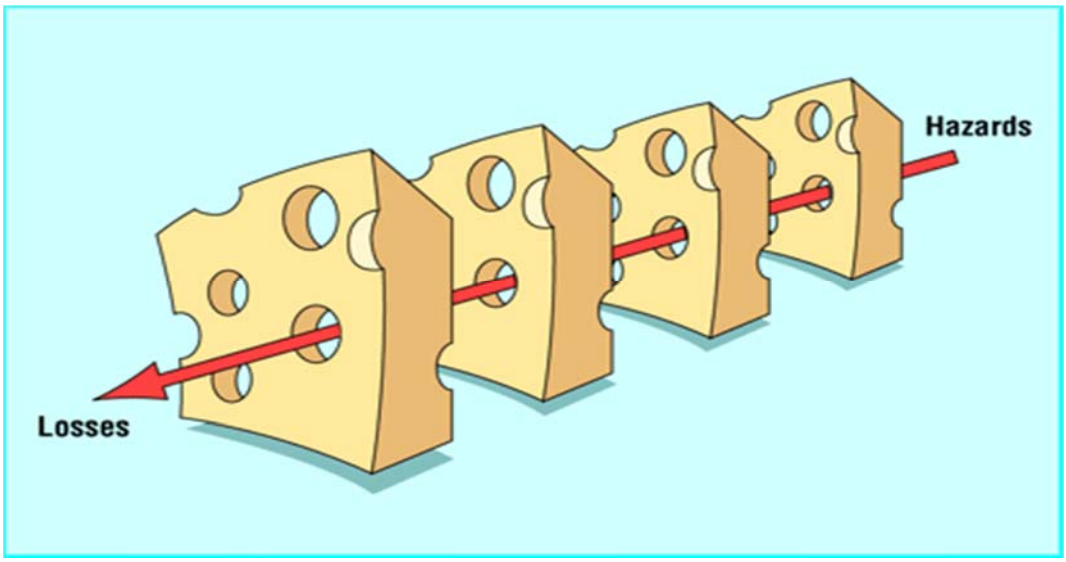


Figure 1.1: The 'Swiss Cheese Model' of how defences, barriers, and safeguards may be penetrated by an accident trajectory (adapted from Reason, 2000)[5]

Human error theory originated from the work of Reason (1990) in a range of industries including aviation and engineering.[4] Reason's human error theory has been applied widely to healthcare, considering institutional and strategic issues, influencing factors, unsafe acts and failed defences. The classification of errors based on a psychological approach is shown in Figure 1.2, highlighting four broad types of errors.

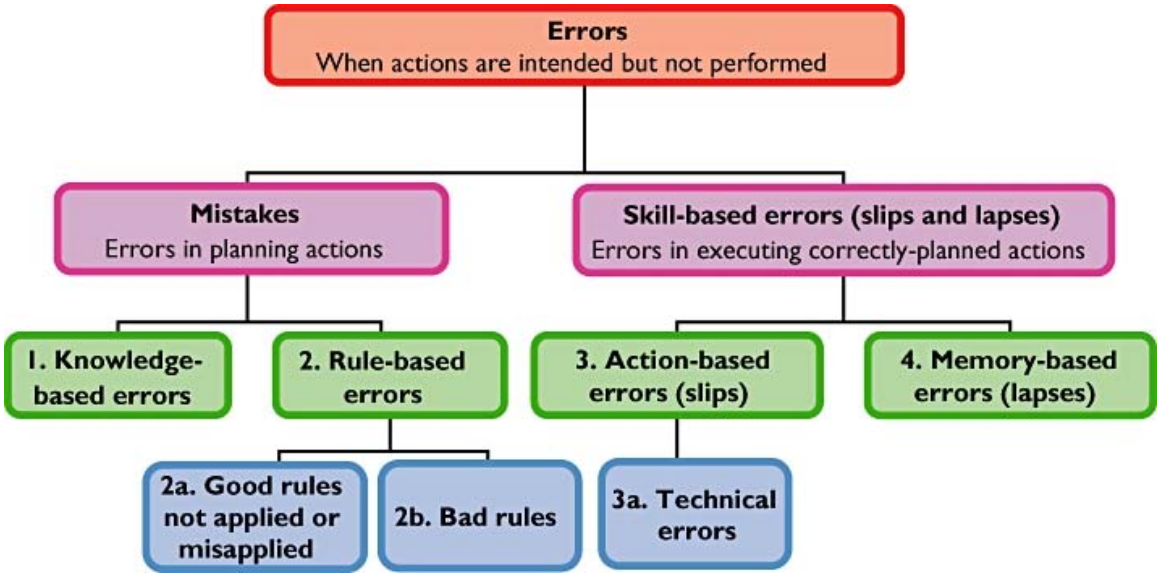


Figure 1.2: The classification of errors based on a psychological approach (adapted from Aronson et al, 2009)[6]

There are two broad categories of errors, which are mistakes and skill-based errors.

Mistakes are classified as:

(i) knowledge-based errors, due to deficient knowledge (general, specific, professional)

(ii) rule-based errors, the misapplication of a good rule or the failure to apply a good rule; and the application of a bad rule.

Failures of skill are classified as:

(iii) action-based errors, 'slips', the performance of an action that was not what was intended

(iv) memory-based errors, 'lapses', when something is forgotten.

1.2 MEDICATION ERRORS

1.2.1 Definitions

While 'To err is human' used the term 'medical errors', 'medication errors' is the term which is applied specifically to medication. The most widely used and accepted definition of the term 'medication error' is that of the United States (US) National Coordinating Council for Medication Error Reporting and Prevention (NCCMERP). A medication error is defined as, 'any preventable event that may cause or lead to inappropriate medication use or patient harm while the medication is in control of the health care professional, patient or consumer'.[7]

The United Kingdom (UK) National Patient Safety Agency (NPSA) proposes a similar definition of 'any incident where there has been an error in the process of prescribing, dispensing, preparing, administering, monitoring, or providing medicines advice, regardless of whether any harm occurred or was possible'.[8]

In a philosophical discussion on the construction of the term, Ferner and Aronson (2006) suggest a definition of 'failures in the treatment process that lead to, or have the potential to lead to harm to the patient'.[9] All definitions emphasise harm and prevention.

There is some overlap and often confusion between the terms 'medication error' and 'adverse drug reaction'. The United Kingdom (UK), Medicines and Healthcare products Regulatory Agency (MHRA) defines an 'adverse drug reaction' as 'a harmful and unintended reaction that occurs at a dose normally used for the prophylaxis, diagnosis or treatment of disease or the modification of physiological functions'[10]

Those adverse drug reactions which are deemed preventable are also considered to be medication errors.[11]

Whatever the definition of 'medication error', it is clear that these greatly affect patient care. According to a report published by the US Institute of Medicine in 2006, medication errors accounted for 1.5 million injuries annually at a cost of up to $1.35 billion in the form of lost productivity, wages, and additional medical expenses.[12] Data from the UK, collated and reported by the National Patient Safety Agency for the period from October 2010 to September 2011, illustrated that medication errors were the second most common cause of patient safety issues (following patient accidents) during hospital stay, contributing to 11% of all incidents, affecting 134,684 patients.[8]

The medication use process involves three key steps of prescribing, dispensing and administration of medication. These are generally considered to be the three classifications of medication errors and any errors arising during these processes are considered as medication errors, even if these are intercepted and corrected prior to reaching the patient (i.e. near misses).[13]

Prescribing errors are the most commonly occurring of all medication errors. Dean et al (2000) developed a comprehensive definition of the term 'prescribing error' using a consensus based approach.[14] The term 'prescribing error' is defined as, 'the result of a prescribing decision or prescription writing process that results in an unintentional but significant reduction in the probability of the treatment given being timely and effective or an increased risk of harm compared with generally accepted practice'. This definition encompasses the two distinct processes of decision-making and prescription writing.

The definition of a 'dispensing error' was proposed by Beso et al (2005) as, 'one or more deviations from an interpretable written prescription or medication order, including written modifications to the prescription made by a pharmacist following contact with the prescriber'.[15]

Keers et al (2013) proposed a definition of 'a medication administration error' as, 'a deviation from the prescriber's medication order as written on the patient's chart, manufacturers' instructions or relevant institutional policies'.[16]

1.2.2 Related systematic reviews

This section provides an overview of published systematic reviews related to medication errors, as highlighted in Table 1.1. Emphasis is placed on the limitations of the primary studies reviewed. Key limitations of the literature in this area are: the lack of consistent terminology and definitions of 'medication', 'prescribing', and 'administration' errors; and often poorly defined outcome measures. Furthermore, Alsulami et al (2013) noted that there was a paucity of high quality research which originated from the Middle East and none of the systematic reviews covered medication error reporting,[17] which is the focus of this doctoral research.

Table 1.1 Summary of systematic reviews relating to aspects of medication errors

Authors, year of publication	Stated review aim	Search terms	Databases	Literature inclusion dates	Stated key limitations of literature
Maisoon et al, 2006[18]	To systematically locate and review studies that have investigated the incidence of medication errors (MEs) in pediatric inpatients and identify common errors	medication error(s), administration error(s), prescribing error(s), dispensing error(s), drug error(s), drug mistake(s), drug mishap(s), medication mistake(s), medication mishap(s), administration mistake(s), dispensing mistake(s), prescribing mistake(s), wrong drug(s), wrong dose(s), incorrect drug, incorrect dose, incorrect route of administration, and drug death, combined with the following key words: pediatric(s), paediatric(s), child, infant(s), adolescent(s), neonates(s), and neonatal.	Medline, Embase, Pharmline, International Pharmaceutical Abstracts, CINAHL, British Nursing Index	Varied depending on database, generally 1951-2006	1. Literature was hindered by variation in definitions employed by different researchers, varying research methods and setting. 2. Lack of theory-based research. 3. The initial concern about MEs in pediatrics was validated but the actual size of the problem remained unknown.
Miller et al, 2007[19]	To synthesise peer reviewed knowledge on medication errors in paediatrics	paediatric and medication errors, preventable adverse event	PubMed, Embase, CINAHL	2000 - 2005	1. The definition of medication error was non-uniform across the studies. 2. Dispensing and administration errors were most poorly evaluated. 3. Unique recommendations for strategies to reduce medication errors were identified; none were based on evidence.
Ross et al, 2009[20]	In order to inform the design of an educational intervention, a systematic review of the literature on prescribing errors made by junior doctors was undertaken.	prescribing adj4 error$.tw, prescription adj4 error$.tw, prescription or prescribing adj4 mistake$.tw, drug adj1 error$.tw, medication adj error$.tw, adverse adj2 drug$ adj2 event$.tw, adverse adj2 drug$ adj2 reaction$, .tw, medication adj2 adverse adj2 event$.tw, exp Prescriptions, Drug, exp Medication Errors, Patient Care, exp Physicians, exp Medical Staff, exp Hospitals, exp Primary Health Care, junior.tw, doctor$.tw, medical staff.tw.	Medline, Embase, Science and Social Sciences Citation Index, CINAHL, Health Management Information Consortium, PsychINFO, ISI Proceedings, The Proceedings of the British Pharmacological Society, Cochrane Library, National Research Register, Current Controlled Trials	1990-2007	1. Considerable variation was seen in design, methods, error definitions and error rates reported.

Lewis et al, 2009[21]	To review the prevalence, incidence and nature of prescribing errors in hospital inpatients	error(s), medication error(s), near miss(es), preventable adverse event(s), prescription(s), prescribe, medication order(s), incident report(s), incidence, rate(s), prevalence, epidemiology, inpatient(s), hospital(s), hospitalization	Medline, Embase, CINAHL, International Pharmaceutical Abstracts	1985 - 2007	1. The reported rates of prescribing errors varied greatly due to variations in the definition of a prescribing error, the methods used to collect error data and the setting of the study. 2. Lack of standardization between severity scales prevented any comparison of error severity across studies.
Alsulami et al, 2013[17]	To review studies of the incidence and types of medication errors in Middle Eastern countries and to identify the main contributory factors involved.	Medication error(s), prescribing error(s), dispensing error(s), administration error(s), documentation error(s), transcribing error(s), medication mistake(s), drug mistake(s), prescribing mistake(s), dispensing mistake(s), administration mistake(s), transcribing mistake (s), wrong medication, wrong drug(s), wrong dose(s), wrong route of administration, wrong calculation(s), physician(s), pharmacist(s) and nurse(s)	Embase, Medline, Pubmed, the British Nursing Index, CINAHL	1980-2011	1. Most studies were of poor quality 2. There was a lack of standardisation of terms, methods and outcome measures.
Keers et al, 2013[16]	To systematically review and appraise empirical evidence relating to the causes of medication administration errors in hospital settings.	error(s), medication error(s), incident report(s), near miss(es), drug error(s), treatment error(s), medication safety, drug safety, preventable adverse event(s), adverse event(s), medical error(s), clinical incident(s), adverse drug event(s), adverse health care event(s), health care error(s), medication incident(s), cause(s), factor(s), reason(s), aetiology, etiology, causality, causalities, predictor(s), association(s) and drug/ medication/ medicine administration(s), dose/drug/medicine/medication preparation(s), drug/ medication/ medicine delivery, omission(s), drug utilisation, commission(s), drug/ medication/medicine supply, drug/medication/medicine handling	Medline, Embase, International Pharmaceutical Abstracts, ASSIA, PsycINFO, British Nursing Index, CINAHL, Health Management Information Consortium, Social Science Citations Index	1985-2013	1. Few studies sought to determine the causes of intravenous administration errors 2. Limited use of established error causation frameworks to analyse data and a focus on issues other than the causes of administration errors among studies.

Metsala et al, 2014[22]	To identify the types of medication errors which happen in elderly acute care.	pharmacy or drugs, medical error or deviation, elderly, nursing or acute care or intensive care	CINAHL, Medline, Cochrane, JBI Connect+ databases and Finnish healthcare databases Medic and Ohtanen	2001 -2011	1. Overall poor quality of studies included in the review
Karthikeyan et al, 2015[23]	To review studies of the incidence and types of medication errors and to identify the main contributory factors involved.	medication error(s), prescribing error(s), dispensing error(s), administration error(s), documentation error(s), transcribing error(s), medication mistake(s), drug mistake(s), prescribing mistake(s), dispensing mistake(s), administration mistake(s), transcribing mistake(s), wrong medication(s), wrong drug(s), wrong dose(s), wrong route of administration(s), wrong calculation(s), physician(s), pharmacist(s) and nurse(s)	Embase, Pubmed, EBSCO, Scopus, the British Nursing Index, CINAHL	Not stated	1. Limited number of studies 2. Lack of consistency in terminology of the studies included in the review
Salmasi et al, 2015[24]	To systematically identify and review research conducted on medication errors in Southeast Asian countries in order to identify common types of errors and estimate its prevalence in this region.	medication error(s), prescribing error(s), dispensing error(s), administration error(s), documentation error(s), transcribing error(s), medication mistake(s), drug mistake(s), prescribing mistake(s), dispensing mistake(s), administration mistake(s), transcribing mistake (s), wrong medication, wrong drug (s), wrong dose (s), wrong route of administration, wrong medication history taking, wrong calculation(s), physician(s), pharmacist(s) and nurse(s)	Embase, Medline, Pubmed, ProQuest Central and the CINAHL	Not stated	1. Lack of studies on errors in Southeast Asian countries
Aldhwaihi et al 2016[25]	To review published studies exploring the incidence and types of dispensing errors in hospital pharmacies and factors contributing to these errors.	Dispensing, Drug(s), Medication, Medicine(s), Error(s), Incident(s), Near miss(es), Mistake(s), Hospital, Secondary care, Inpatient, Outpatient, Pharmacy, Pharmacist, and Dispensary.	PubMed, Scopus, Ovid, and Web of Science	2000-2015	1. Limited number of studies 2. Lack of consistency in terminology

1.3 MEDICATION ERROR REPORTING

Effective and efficient medication error reporting systems and processes are key to promoting patient safety. Two key organisations within this field are the NCCMERP and the National Patient Safety Agency (NPSA) in the UK. Both the NCCMERP and the NPSA place much focus on medication error reporting. In 1995, the US Pharmacopeial Convention spearheaded the formation of the NCCMERP, the key role of NCCMERP is to lead 25 US national healthcare organisations collaborating and cooperating to address the interdisciplinary causes of errors and to promote the safe use of medication.[26]

The goals of NCCMERP are:

i. Stimulating the 'development and use of reporting and evaluation systems by individual health care organizations'
ii. Stimulating 'reporting to a national system for review, analysis, and development of recommendations to reduce and ultimately prevent medication errors'
iii. Examining and evaluating the causes of medication errors
iv. Increasing awareness of medication errors and methods of prevention throughout the health care system.
v. Recommending strategies for system modifications, practice standards and guidelines, and changes in packaging and labeling.

The strategies stated for achieving these goals in relation to medication error reporting are to:

i. Heighten awareness of reporting systems available to or within health care organizations
ii. Stimulate and encourage reporting and sharing of medication errors both nationally and locally
iii. Develop standardization of classification systems for the collection of medication error reports so that databases will reflect reports and categorization systems
iv. Encourage systems and provide targeted feedback so that appropriate prevention strategies can be developed and implemented in facilities.

In the UK, the NPSA was established in 2001 to develop the National Reporting and Learning System (NRLS), to collect information on reported patient safety incidents aiming to reduce risks to patients receiving NHS care and improve safety. The NPSA describes 'tools and guidance to help organizations improve their reporting levels'.[10] These include:

i. ensuring quality reports
ii. engaging frontline staff and management
iii. reporting regularly
iv. reporting serious incidents quickly
v. making reporting matter by reviewing the steps they can take to increase reporting and ensuring consistency

Adopting these tools and guidance into practice should increase reporting system efficiency with subsequent impact on the incidence, prevalence, nature and severity of medication errors thus improving patient safety and care.

1.4 HEALTHCARE IN THE UNITED ARAB EMIRATES

1.4.1 Background

This doctoral primary research was conducted in the United Arab Emirates (UAE), which comprises seven emirates: Abu Dhabi, Dubai, Fujairah, al-Qaywayn, al-Khaimah, Ajman and Sharjah (see Figure 1.3). The UAE neighbours Oman to the South East and North, and Saudi Arabia to the West and South. The UAE has one of the most well developed and wide ranging healthcare systems within the Asian region, aiming to meet the health needs of the society.[27] Hospital provision is a combination of private enterprises and government funded hospitals. According to the World Health Organisation (WHO), the government financial support for healthcare for the period 1999-2006 amounted to $43 billion.[28] About 2.9% of the UAE's gross domestic product is spent on the healthcare, in line with WHO standards and recently free healthcare has been made available for all citizens.[27]

There are five government healthcare regulators: the Ministry of Health; Ministry of Finance; Federal Health Insurance Authority; Dubai Health Authority (DHA); and the Health Authority Abu Dhabi (HAAD). As of 2016, the population in the UAE was estimated at 9,266,971, of which Emirati nationals represented 19%, with the remainder being expatriates, predominantly from south and southeast Asia (around 60% of the UAE population), and western Europe (around 10%). (National Bureau of Statistics 2014) While Arabic is the official language, English is spoken widely, particularly within professional settings. There are currently 104 hospitals throughout the seven Emirates and the World Health Organization (WHO) reports that there are currently 19.3 physicians and 40.9 nurses and midwives per 10,000 persons.[27]

Figure 1.3 Map of the United Arab Emirates

1.4.2 Medication error reporting in the UAE

The policy of medication error reporting in UAE (Abu Dhabi) was established in May 2009 by the health authority of Abu Dhabi (HAAD) (Appendix 1.1). The purpose of the policy is to provide guidance for the health care professionals to take responsibility in medication error detection, reporting, evaluation, and prevention. The NCCMERP definition of 'medication error' has been adopted and all health professionals are mandated to report all medication errors, including those which have 'been detected and corrected through intervention by another health care professional or patient, before actual medication administration'.

1.5 MEDICAL RESEARCH COUNCIL FRAMEWORK

Any intervention which are developed and implemented with the aim of enhancing medication error reporting is a 'complex intervention'. These are defined by the UK Medical Research Council (MRC) framework as 'interventions with several interacting components'.[29] The dimensions of complexity can be multiple, such as the:

- number of and interactions between components within the experimental and control interventions
- number and difficulty of behaviours required by those delivering or receiving the intervention
- number of groups or organizational levels targeted by the intervention
- number and variability of outcomes
- degree of flexibility or tailoring of the intervention permitted.

The MRC states that the process from development through to implementation of a complex intervention may take a wide range of different forms and emphasises the need for a good theoretical understanding of how an intervention could bring about change. The key elements of the development and evaluation process are illustrated in Figure 2.2.

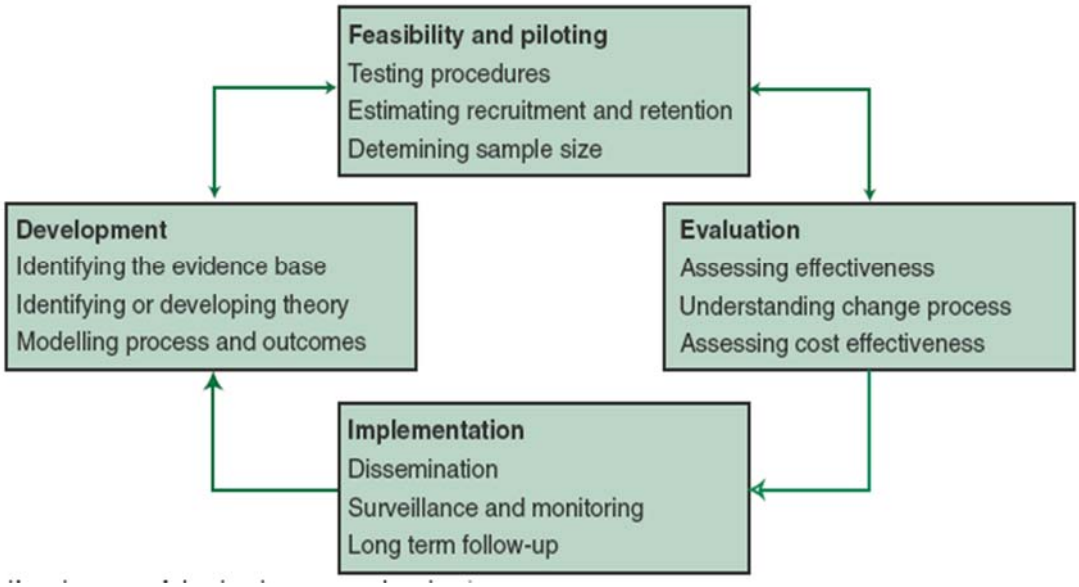


Figure 2.2: Elements of the development and evaluation process (adapted from Medical Research Council, 2008)[29]

This doctoral research focuses on the initial stages of the development of a complex intervention:

- Identifying the Evidence Base
- Identifying/Developing Appropriate Theory
- Modelling Process and Outcomes

1.6 STUDY AIMS

The overall aim of this research was to explore health professional reporting of medication errors in Abu Dhabi, the UAE, as a preliminary step to the development of interventions to improve and optimise the effectiveness and efficiency of medication error reporting thus impacting patient safety.

The research was conducted in three phases, each with aims as described below.

Phase 1: To critically appraise, synthesize and present the available evidence on health professionals' beliefs, attitudes and experiences of medication error reporting.

More specifically, the review sought to answer the following questions in relation to health professionals (i.e. doctors, nurses and pharmacists):

- What are their beliefs and attitudes towards medication error reporting?
- What are their experiences of medication error reporting? (e.g. nature of feedback obtained, any subsequent changes in their practice, ease of use of the reporting system, any improvements required to optimize medication error reporting).
- What are the reasons given or factors which are associated with under-reporting of medication errors? (e.g. lack of awareness or understanding of the reporting system, fear of possible consequences of reporting, and forgetting to report).

Phase 2: To quantify the behavioural determinants of health professional reporting of medication errors in Abu Dhabi, the UAE.

The detailed research questions were:

- Which behavioural determinants impact error reporting,? Which of these are facilitators or barriers to error reporting?
- Are there significant differences in behavioural determinants between demographic variables?

Phase 3: To provide more depth to and explain the quantitative findings. In particular, this phase aimed to describe and understand the behavioural determinants of health professional reporting of medication errors in the Abu Dhabi, the UAE.

The detailed research questions were:

- How do specific behavioural determinants impact error reporting?
- Why do specific behavioural determinants impact error reporting?
- Are there any differences between health professions?
- How could error reporting be improved and optimised?

CHAPTER 2: METHODOLOGY

This chapter introduces research paradigms, methodologies and methods with justification for those selected for this doctoral research. Aspects of robustness in quantitative research and rigour in qualitative research are introduced, with emphasis on data validity, reliability, trustworthiness and bias.

2.1 RESEARCH PHILOSOPHY

There are four philosophical assumptions that impact the direction of all research:

1. **Ontology**, which relates to the nature of reality and its characteristics. Researchers embrace the idea of multiple realities and report on these multiple realities by exploring multiple forms of evidence from different individuals' perspectives and experiences;
2. **Epistemology,** how researchers know what they know. Researchers try to get as close as possible to participants being studied. Subjective evidence is assembled based on individual views;
3. **Axiology,** the role of values in research. Researchers make their values known in the study and actively report their values and biases; and
4. **Methodology**, the theoretical framework of the methods used in the research processes.[30]

2.1.1 Philosophical paradigms

Fossey et al refer to a 'paradigm' as, 'a system of ideas, or world view, used by a community of researchers to generate knowledge'.[31] Bowling (2009) and Cresswell (2013) state that a paradigm is the 'process of scientific practice based on people's philosophies and assumption about the world and the nature of knowledge.[30,32]

To ensure the most appropriate research design, the paradigm should be congruent with researcher beliefs in terms of the nature of reality.[33]

Research paradigms are traditionally classified into four philosophically distinct categories of positivism, constructivism, transformative and pragmatic. Each relates to accepted scientific frameworks, as illustrated in Table 2.1.

Table 2.1: Features of research paradigms (adapted from Guba and Lincoln 1990, Onwuegbuzie 2004, Bowling 2009, and Creswell 2013)[32,34-37]

	Positivism	Constructivism	Transformative	Pragmatic
Ontology	Naive realism. Researcher may not be able to understand it or get to it because of lack of absolutes	Relativism: local and specific constructed and co-constructed realities	Participation between researcher and communities/ individuals being studied. Often a subjective-objective reality emerges	Reality is what is useful, is practical, and 'works'
Epistomology	Reality can only be approximated. Interaction with research subjects is kept to a minimum. Validity comes from peers, not participants	Reality is co-constructed between the researcher and the researched and shaped by individual experiences	Co-created findings with multiple ways of knowing	Reality is known through using many tools of research that reflect both deductive (objective) evidence and inductive subjective) evidence
Axiology	Researchers' biases need to be controlled and not expressed in a study	Individual values are honoured, and are negotiated among individuals	Values need to be interrogated	Values are discussed because of the way that knowledge reflects both the researchers' and the participants' views
Methodology	Experiments/surveys Verification of hypotheses; chiefly quantitative methods	Researcher is a 'passionate Participant' within the world being investigated	Use of collaborative processes of research. Questioning of methods, highlighting issues and concerns	Research process involves both quantitative and qualitative approaches to data collection and analysis

This doctoral research was conducted in three specific phases aligned to the research aims. The field work of primary data collection and generation in phases two and three employed paradigms of positivism in phase two (cross sectional survey) and constructivism (phenomenological interviews) in phase three. The characteristics of these are given in Table 2.2.

Table 2.2: Summary of the distinct research paradigms employed in this research

Characteristic	Positivist	Constructivist
Research approach	Quantitative (deductive)	Qualitative (inductive)
Research methodology	Cross-sectional survey	Phenomenology
Research instrument/tools	Online questionnaire	In-depth semi-structured, face to face interviews
Study sample	Entire population studied. Detailed inclusion and exclusion criteria	Purposive sample
Data analysis	Descriptive and inferential analysis. Content analysis	Descriptive and framework approach

2.2 EVIDENCE SYNTHESIS THROUGH SYSTEMATIC REVIEW

The first phase of this research was a systematic review of the literature. This was conducted for several reasons: to identify and characterise gaps in the literature; to explore methodological strengths and weaknesses; and to inform later stages of the research. Furthermore, conducting systematic reviews is highlighted within the first stage of the MRC complex interventions framework described in Chapter 1.

The most commonly cited definition of evidence based practice is that of Sackett, 'the conscientious, explicit and judicious use of current best evidence in making decisions about the care of the individual patient. It means integrating individual clinical expertise with the best available external clinical evidence from systematic research.[38]

There is an accepted hierarchy of research evidence, with well-designed systematic reviews and meta-analyses of randomised controlled trials at the top of the pyramid as shown in Figure 2.1.

Figure 2.1: Hierarchy of evidence (adopted from Markman and Callanan 1984, Greenhalgh 1997)[39,40]

A systematic review is defined as a 'well-planned review to answer specific research questions using a systematic and explicit methodology to identify, select, and critically evaluate results of the studies included in the literature review'. Systematic review differs from more traditional (narrative) literature reviews in several ways, as described in Table 2.3.

Table 2.3 Comparison of narrative and systematic reviews (adapted from Cook et al, 1997)[41]

Feature	Narrative review	Systematic review
Question	Broad Scope, overview	Focussed, specific
Search	Not usually specified	Comprehensive and explicit
Appraisal	Variable	Robust and rigorous; checklist driven
Synthesis	Narrative only	Meta-analysis, meta-synthesis, narrative; answers question
Inferences	Sometimes evidence-based	Always evidence-based

Greenhalgh stated that systematic reviews have specific advantages as a result of using explicit methods. These include: limiting bias; generating reliable and accurate conclusions; delivering required information to healthcare providers, researchers, and policymakers; and generating new hypotheses about subgroups of the study population.[40]

Key characteristics of a systematic review are:

- a clearly defined question;
- an explicit, reproducible method with clear inclusion and exclusion criteria for studies;
- a systematic search that attempts to identify all studies that would meet the eligibility criteria;
- an assessment of the validity of the findings of the included studies, for example through the assessment of risk of bias; and
- a systematic presentation, and synthesis, of the characteristics and findings of the included studies, which includes the search methodology (adapted from Cochrane handbook)[42]

2.2.1 Systematic review organisations

There are several public and private sector organisations, including the Cochrane Collaboration, Campbell Collaboration and the Joanna Bridge Institute (JBI), which have been established with the specific aim of supporting systematic reviews.

The Cochrane Collaboration produces systematic reviews of healthcare interventions based largely on quantitative evidence (although there are moves to extend to qualitative evidence) while the Campbell Collaboration produces systematic reviews on the effects of social interventions based on quantitative evidence. JBI, however, has a more pluralistic view of evidence on quantitative and qualitative evidence,[43] hence the systematic review in this doctoral research was registered with JBI.

JBI was founded in 1996 and is an international not-for-profit, research and development arm of the school of the translational science based within the Faculty of Health Sciences at the University of Adelaide in South Australia. JBI specialises in evidence-based healthcare, producing systematic reviews of healthcare practices with an interest in improving healthcare internationally.[44]

JBI collaborates with more than 70 entities across the world including affiliates such as the Scottish Centre for Evidence-based Multi-professional Practice,[45] based at Robert Gordon University. The SEMP's activities include training in conducting systematic reviews, promoting and supporting the synthesis, transfer, and use of evidence through identifying feasible, appropriate, meaningful, and effective healthcare practice to assists in the improvement of healthcare globally.[45] The doctoral student (principal investigator) undertook JBI training prior to conducting this review; the principal supervisor is also an accredited trainer with the JBI.

2.3 QUANTITATIVE VERSUS QUALITATIVE METHODOLOGIES

Research methodologies are categorised as quantitative or qualitative (or mixed); key characteristics are provided in Table 2.4. Quantitative and qualitative research methodologies differ generally in their aim, research questions, objectives, data collection and generation instruments they use, and the forms of data they produce.[46]

Quantitative research has been described as, 'explaining phenomena by collecting numerical data that are analysed using mathematically based methods' and the data are usually collected to test a hypothesis, resulting in accepting or rejecting the null hypothesis of no difference[35] In contrast, qualitative research refers to inductive, holistic, subjective and process-oriented approaches to understand, interpret, describe and phenomena or to develop. It is a systematic, subjective approach used to describe life experiences and give them meaning.[47,48]

Phase two of this research employed a quantitative approach to quantify aspects of medication error reporting while a qualitative approach was employed in phase 3 to explore and describe the phenomenon of medication error reporting in greater depth.

Table 2.4: Comparison of qualitative and quantitative methodologies (adapted from Johnson and Onwuegbuzie 2004, Bowling 2009, Creswell 2013)[32,35]

Characteristic	Qualitative	Quantitative
Research aim	Focuses on providing a complete, detailed and rich description of the research topic	To quantify, classify, count, construct and test statistical models in an attempt to explain what is observed
Design	May be planned or emerge as the study unfolds	All aspects of the study are designed carefully before data are collected
Sample	Tend to be small sample sizes	Tend to be large sample sizes
Data gathering, collection	The researcher is the data-gathering instrument	The researcher uses tools (e.g. questionnaires, equipment) to collect data
Form of data	Data are in the form of words (interviews), pictures (videos) or objects (artifacts)	Data are in the form of numbers and statistics
Data	Qualitative data are more richer, time consuming, and should not be generalized	Quantitative data are more efficient, able to test hypotheses, but may miss contextual data

2.4 QUANTITATIVE METHODOLOGIES

The two main quantitative methodologies are those described as experimental and cross-sectional surveys. An experimental research design (correlational, causal) assumes that the cases being studied can be manipulated by the researcher in order to measure a change or a difference[49] These methodologies are described in Table 2.5.

Table 2.5: Quantitative research methodologies

Common quantitative methodologies	Description
Survey	Explores and describes phenomena in real-life situations to determine meanings and frequencies of the phenomenon under investigation, and describe and categorise information related to the phenomenon (Burns and Grove, 2011)
Experimental (correlational)	Explores relationships between variables to determine the degree of relationship between the two variables without introducing an intervention (Walker, 2005; Burns and Grove, 2011)
Experimental (causal)	The researcher manipulates an independent variable and observes the outcome on a dependent variable whilst keeping other unrelated variables constant (Walker, 2005)

Given the research aim of the phase two, the quantitative phase, a survey methodology was more appropriate. Creswell (2003) describes a survey design as one which 'provides a quantitative or numeric description of trends, attitudes, or options of a population by studying a sample of that population'.[34] Survey design is used to make inferences about certain characteristics, and to make claims about the study population. Surveys are commonly used in research, largely due to the ease of use, structured format, easily coded and quantifiable data, and the ability to statistically compare cases. However, there are disadvantages due to many inherent biases (see later).

2.4.1 Survey data collection tools

The questionnaire is the most commonly used tool in survey research, with the two main formats being paper based and online. While the popularity of the online approach is increasing, there are several advantages and disadvantages to consider, as highlighted in Table 2.5.

The online approach was selected for phase two for reasons of lower cost, ease of distribution and data entry.

Table 2.6: Advantages and Disadvantages of e-mail Survey Methods (adapted from Wright, 2005)[50]

Advantages	Disadvantages
The cost of data collection is low	Possibility of problems of cooperation
Participants can access and save the responses in real time	The researcher may not probe the respondents for further information
The method is convenient for respondents due to self-administration	Possibility of failing to reach the response target

2.4.2 Sampling and data analysis in quantitative research

Garson (2012) describes sampling as the process of selection of a particular group of participants for a study, noting that collecting data from a target population does not necessitate researching all members of that population.[51] Probability sampling techniques are most commonly employed in quantitative research and are described in greater detail in Table 2.6. However, as described in Chapter 4, the entire population of health professionals was researched, without sampling.

Table 2.7: Probability Sampling (adapted from Morgan, 2008)[52]

Probability Sampling	Procedure	Common Usage	Advantages	Disadvantages
Simple random	Selected from population according to chance. Each member has same probability of being selected.	Large, easily accessible populations.	High chance of being representative. Not much information about population required.	Can be inefficient, expensive.
Systematic	Similar to simple random sampling, but participants are chosen at specific intervals	Large, homogenous populations.	High chance of being representative.	Underlying patterns or non-random variations in the population can cause a sampling bias.
Stratified	Population is divided into homogenous subgroups, based on prior knowledge of the population, before randomly sampling from each subgroup.	Large, well-known populations.	More representative of population than simple random sampling, data can be more manageable, can control for regional differences in population size.	Requires accurate knowledge of subgroups and sizes.
Cluster	Similar to stratified sampling, but a sample of subgroups is first taken, and then samples within each selected subgroup are taken. Data is grouped according to subgroups, or 'clusters'.	Very large populations with known subgroups.	Often cheaper and more efficient than other techniques.	High chance of sampling error, a systematic bias in a particular cluster can influence the impression of the larger population.

2.5 QUALITATIVE METHODOLOGIES

Qualitative methodologies are viewed generally as 'naturalistic' or ethnographic, aiming to explore and explain the lived experience. Table 2.7 provides a comparison of the five methodologies most commonly employed in the qualitative, namely narrative, phenomenology, grounded theory, ethnography and case study methodologies.[30]

Table 2.8: Description of the five common qualitative methodologies (adapted from Czarniawska, 2004, Petty et al, 2012,Teddlie and Tashakkori, 2009 and Baxter and Jack, 2008)[53-56]

Methodology	Description
Narrative	Relates to spoken or written text of a single event or a series of events which are chronologically connected
Phenomenology	Provides an in-depth understanding of the distinctive lived experience of individuals by exploring the meaning of a phenomenon
Grounded theory	Attempts to develop a theory constructed from the data of participants with an experience of the phenomena under investigation, to explain these phenomena
Ethnography	Describes and interprets human cultures using methods such as participant-observation or interviews with the aim of getting an indepth understanding of a particular culture
Case study	Explores a case (or multiple cases) through in-depth data collection involving multiple sources of information rich in context

A qualitative, phenomenological approach was employed in phase three of this study. This was considered most appropriate to allow generation of in-depth, rich data to describe and understand participants' experiences and behaviours of the phenomenon of medication error reporting.

2.5.1 Qualitative methods

Van Maanen (1983) defines qualitative methods as an array of interpretive techniques which seek to describe, decode, translate and otherwise come to terms with the meaning, not the frequency of certain more or less naturally occurring phenomena in the social world.[57] The three most common qualitative methods are the use of participant observation, focus group discussions and in-depth interviews.[32,34]

Given that medication error reporting could be a highly sensitive topic, one-to-one interviews were selected as the method.

The most common types of interview are structured, semi-structured and unstructured, as summarised in Table 2.8. A semi-structured approach was selected for phase three.

Table 2.9: Features of structured, semi-structured and unstructured interviews (adopted from Bowling, 2009)[32]

Structured	Semi-structured	Unstructured
Set of questions asked in a standard way across all participants	Specific topic areas and a general set of questions but the interview flows like a conversation and topics are covered as they come up	Topic area to be explored but what gets covered is left up to the participant. An opening question might introduce the topic
Fixed questions with fixed order	Open questions, order can vary	Non-directive in-depth interview
Control lies with researcher	Control lies with both researcher and participant	Control lies with participant
Data will be probably coded in advance	Data will be probably coded and analysed after each interview (iterative development)	Data will probably be coded and analysed after interview (iterative development)
Data generation tool: questionnaire	Data generation tool: interview schedule	Data generation tool: interview guide

2.5.2 Sampling and data analysis in qualitative research

Qualitative research uses non-probability sampling as it does not aim to produce a statistically representative sample or draw statistical inference. Purposive sampling is one of the most common sampling strategies; it groups participants according to preselected criteria relevant to a particular research question.

Purposive sample sizes are often determined on the basis of theoretical saturation (the point in data collection when new data no longer brings additional insights to the research questions).[58] In this sense then generalizability is not sought by the researcher and the focus is less on sample size and more on sample adequacy.[59] Bowen argues that adequacy of sampling relates to the demonstration that saturation has been reached, which means that depth as well as breadth of information is achieved.

Francis et al (2010) described an approach to qualitative sample size determination as follows:[60]

i. initial analysis sample - researchers should specify in advance the sample size at which the first round of analysis will be complete;

ii. stopping criterion - researchers should specify in advance how many more interviews will be conducted, without new themes emerging, before the research team can conclude that the data saturation has been achieved (usually taken as three consecutive interviews);

iii. independent coders - the initial analysis sample should be reviewed independently; and

iv. the data saturation methods and findings should be reported so that the readers can evaluate the evidence.

Qualitative data analysis is a recursive process, where the researcher needs to move back and forth, as needed, to interpret and reinterpret the data throughout.[55] The Framework Approach is one of the broad families of analysis methods often termed thematic analysis or qualitative content analysis. It was developed by researchers, Ritchie and Spencer in 1980s and is used increasingly in healthcare research where the objectives and research questions are defined clearly in advance.[61]

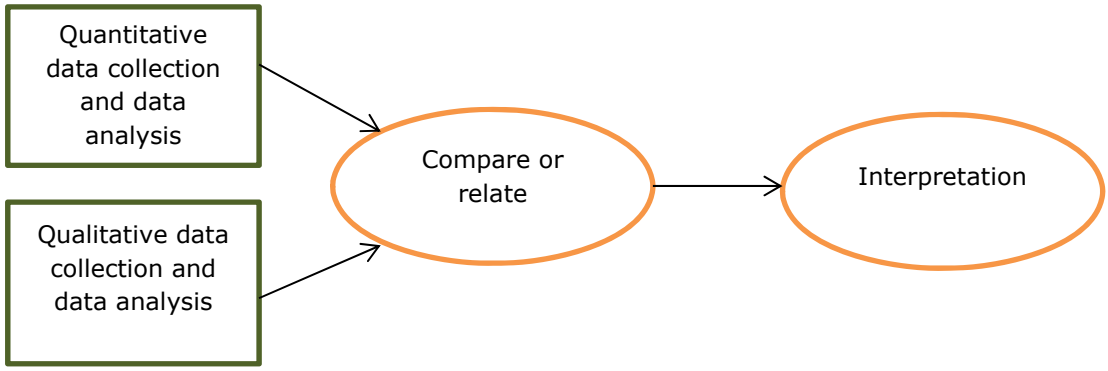
It is most commonly used for the thematic analysis of semi-structured interview transcripts and consists of steps of: familiarization; identifying a thematic framework; indexing; charting; and mapping and interpretation.[62]

2.6 MIXED METHODOLOGIES AND MIXED METHODS

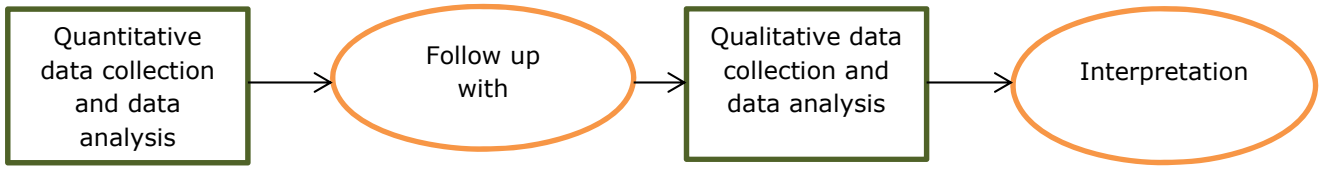
Many researchers such as Creswell (2003),[63] Thomas (2003),[64] and Krathwohl (1993)[65]have viewed quantitative and qualitative methodologies and methods as complementary and can be combined within one study.

A mixed method study has been defined as focusing on 'collecting, analyzing, and mixing both quantitative and qualitative data in a single study or series of studies'. The use of quantitative and qualitative approaches, in combination, provides a better understanding than either approach alone. There are four basic mixed methods designs, the convergent parallel design, explanatory sequential design, exploratory sequential design and the embedded design Creswell and Plano Clark (2011),[66] as illustrated in Figure 2.2

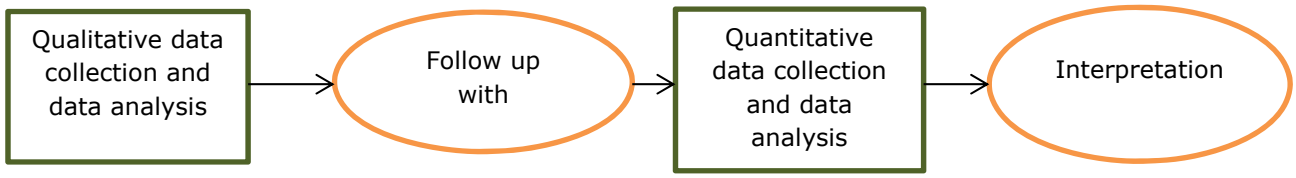
(a) The convergent parallel design



(b) The explanatory sequential design



(c) The exploratory sequential design



(d) The embedded design

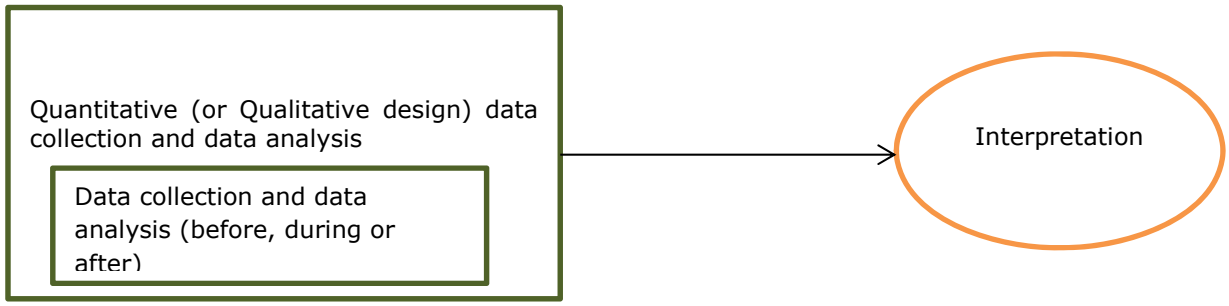


Figure 2.2: Mixed methods designs

Overall, this study employed a mixed methods sequential explanatory design, of survey (phase two) followed by in-depth, face-to-face interviews (phase three) with a purposively selected sample. The quantitative approach allowed collection of statistical data around facilitators and barriers to medication error reporting while the qualitative approach provided further explanation and rich data.

2.7 THE USE OF THEORY IN RESEARCH

Theories are formulated to explain, predict, and understand phenomena and, in many cases, to challenge and extend existing knowledge. The theoretical framework introduces and describes the theory that explains why the research problem under study exists.[67] Theories can connect pieces of research data to generate findings which fit into a larger framework of other studies. The MRC complex interventions highlight the need to consider theory as part of intervention design.[29]

2.7.1 The Theoretical Domains Framework

The Theoretical Domains Framework (TDF) was developed by a group of psychological theorists, health service researchers and health psychologists.[68] It is derived from 33 theories of behaviour change and comprises of 14 domains and 84 constructs that allows synthesis of a multitude of coherent behavior change theories into a single framework. TDF allows assessment and explanation of behavioral problems and associated barriers and enablers, and inform the design of appropriately targeted interventions.[69] TDF was applied throughout phases two and three. The TDF domains and their descriptors are outlined in Table 2.9.

Table 2.10: The Theoretical Domain Framework (adapted from Cane, O'Connor and Michie 2012)[69]

Domain	Examples
Knowledge	An awareness of the existence of something
Skills	An ability or proficiency acquired through practice
Social/Professional Role and Identity	A coherent set of behaviours and displayed personal qualities of an individual in a social or work setting
Beliefs about Capabilities	Acceptance of the truth, reality, or validity about an ability, talent, or facility that a person can put to constructive use
Optimism	The confidence that things will happen for the best or that desired goals will be attained
Beliefs about Consequences	Acceptance of the truth, reality, or validity about outcomes of a behaviour in a given situation
Reinforcement	Increasing the probability of a response by arranging a dependent relationship, or contingency, between the response and a given stimulus
Intentions	A conscious decision to perform a behaviour or a resolve to act in a certain way
Goals	Mental representations of outcomes or end states that an individual wants to achieve
Memory, Attention and Decision Processes	The ability to retain information, focus selectively on aspects of the environment and choose between two or more alternatives
Environmental Context and Resources	Any circumstance of a person's situation or environment that discourages or encourages the development of skills and abilities, independence, social competence, and adaptive behaviour
Social influences	Those interpersonal processes that can cause individuals to change their thoughts, feelings, or behaviours
Emotion	A complex reaction pattern, involving experiential, behavioural, and physiological elements, by which the individual attempts to deal with a personally significant matter or event
Behavioural Regulation	Anything aimed at managing or changing objectively observed or measured actions

2.8 ROBUSTNESS AND RIGOUR

2.8.1 Robustness in quantitative research

The traditional criteria to achieve the goal of robustness in quantitative research are internal validity, external validity and reliability.

Validity is referred to as, 'the accuracy and truth of the data being produced in terms of the concepts being investigated'.[70] The internal validity is concerned with the confidence placed in the processes and data collected, and external validity (generalizability) of the findings.[71] While there are a number of different approaches to determining validity (e.g. face, content, construct, criterion, concurrent, predictive etc.)[32,72-74] those employed in this study were face and content. Face validity considers the extent to which the tool (questionnaire) covers he concept it purports to measure in terms of transparency or relevance. Content validity considers the extent to which the tool represents all facets of a given construct.[75]

Reliability is referred to as, the extent to which results are consistent over time.[76] While there are several approaches to determining reliability of the tool (e.g. test-retest validity), these could not be applied due to the online nature of the method of data collection. Internal consistency was determined (see later).

2.8.2 Rigour in qualitative research

Guba 1981, proposed four criteria that need to be considered by qualitative researchers in pursuit of a trustworthy study,[77] as described in Table 2.11.

Table 2.11: Components of trustworthiness (Adapted from Guba 1981, Hasson and Keeney, 2011; Farrelly, 2013)[36,70,71,77]

Trustworthiness	Description
Credibility	Ensuring that findings are an accurate reflection of a wider reality by: employing well-established methodologies and methods; providing detailed description of the phenomenon under investigation; encouraging participant honesty through direct instructions, developing rapport, and giving opportunities for withdrawing from the study; and meeting with team members frequently for debriefing sessions and peer review
Dependability	Similar to reliability, described as the extent to which similar findings if the study were repeated with the same methods etc.
Transferability	Similar to external validity (generalisability) and is described as the extent to which the findings can be applied to other contexts and settings. Achieved by providing detailed information so that readers can judge the applicability of the study to their own setting etc.
Confirmability	Relates to the basis of the findings, and the extent to which they have arisen from data gathered rather than the biases and preconceived notions of the researcher, team etc.

2.8.3 Bias as a threat to validity, reliability and trustworthiness

Research bias arises when 'systematic error is introduced into sampling or testing by selecting or encouraging one outcome or answer over others'.[78] Quantitative, qualitative and mixed methods studies have particular methodological issues and constraints hence there is potential for bias. There are different forms of bias; the most common categories of bias are described in Table 2.12.

Table 2.12: Forms of bias (Adapted from Bowling 2009)[78]

Type of bias or error	Description
Acquiescence response set	Participants will more frequently endorse a statement than disagree, *'yes-saying'*
Design bias	Faulty methods, sampling and analysis
Evaluation apprehension	Participant anxiety may lead to giving responses which they think are expected
Interviewer bias	The interviewer may subconsciously, or consciously, bias by appearing to hold certain values or by asking leading questions
Non-response bias	Non-response reduces effective sample size. Differences between responders and non-responders reduces generalisability
Recall (memory) bias	Selective memories in recalling events
Reporting bias	Failure of the participant to reveal full information
Sampling bias	Non-representative selection of participants

Measures taken to minimize bias were considered and described throughout chapter 4 and 5.

2.9 SUMMARY

In summary, this chapter has presented many underlying methodological concepts which are applied in all phases of the research. The specific research methods are described in detail in Chapters 3, 4 and 5.

Figure 2.3 gives a schematic summary of the research paradigms, methodologies and methods employed for each phase of the research.

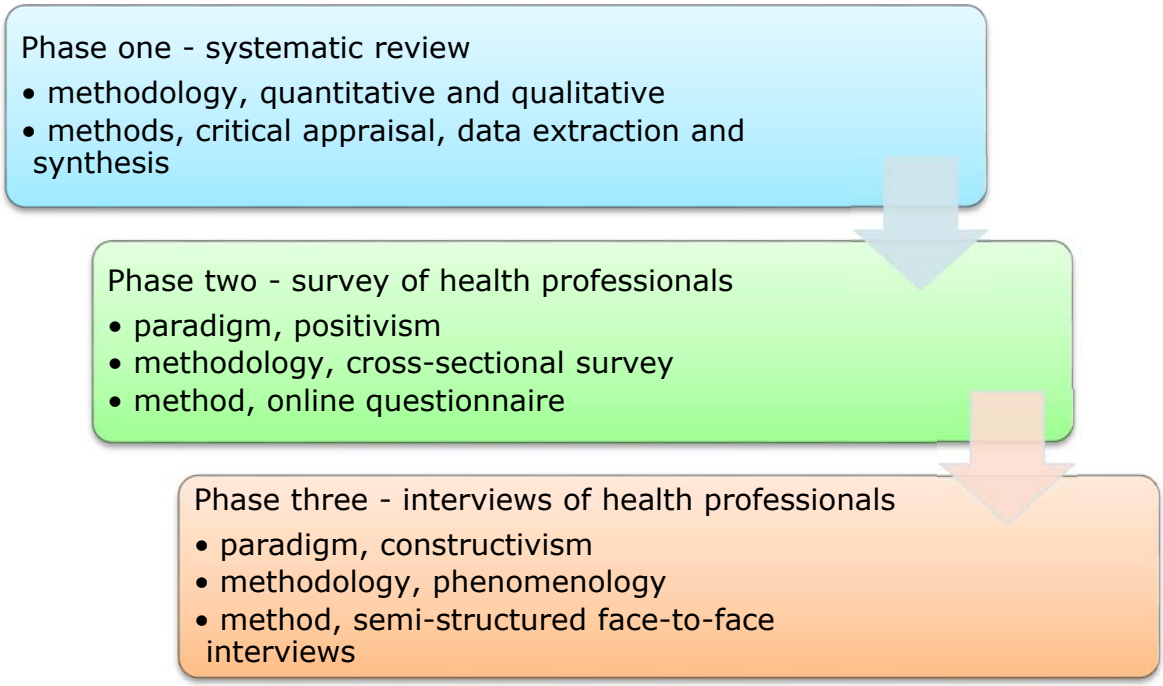


Figure 2.3: Methodological phases of current research

CHAPTER 3: A SYSTEMATIC REVIEW OF HEALTH PROFESSIONALS' BELIEFS, ATTITUDES AND EXPERIENCES OF MEDICATION ERROR REPORTING

3.1 INTRODUCTION

This chapter provides the aim, method, results and discussion of a Joanna Briggs Institute (JBI) registered systematic review of health professionals' beliefs, attitudes and experiences in relation to the medication error reporting.

As illustrated in Chapter 1, a number of systematic and narrative reviews have been published which focus on the incidence, nature and causes of medication errors (including classifications of prescribing, administration and dispensing errors). There is, however, a lack of any review which focuses on any aspect of medication error reporting by health professionals.

A preliminary search of the JBI Database of Systematic Reviews and Implementation Reports, the Cochrane Library and the Centre for Reviews and Dissemination revealed that there was neither a systematic review published nor underway on this topic. This indicates a major gap in the literature in terms of the beliefs, attitudes and experiences of health professionals in relation to medication error reporting. In order that error reporting systems operate efficiently and optimize their positive contribution to medication errors and thus patient safety, it is vital that all health professionals understand the reporting processes. This includes key components such as appropriate errors reporting and feedback at the individual practitioner and organizational level to allow reflection on and implementation of changes to practice to further improve patient safety.

This systematic review focused on these aspects and synthesized the available literature on issues of beliefs, attitudes and experiences, with specific attention to issues around under-reporting of medication errors by health professionals. At this stage, any studies, which focus on patient reporting of medication errors, were excluded.

3.1.1 Review aim and questions

The aim of this review was to critically appraise, synthesize and present the available evidence on health professionals' beliefs, attitudes and experiences of medication error reporting.

More specifically, the review sought to answer the following questions in relation to health professionals (i.e. doctors, nurses and pharmacists):

- What are their beliefs and attitudes towards medication error reporting?
- What are their experiences of medication error reporting? (e.g. nature of feedback obtained, any subsequent changes in their practice, ease of use of the reporting system, any improvements required to optimize medication error reporting).
- What are the reasons given or factors which are associated with under-reporting of medication errors? (e.g. lack of awareness or understanding of the reporting system, fear of possible consequences of reporting, and forgetting to report).

3.2 METHODS

A review protocol was developed according to best practice.[79] Following peer review within RGU, subsequent modification and further peer review within JBI, the protocol was registered with the JBI Database of Systematic Reviews and Implementation Reports and published.[80]

3.2.1 Inclusion criteria

Types of participants

This review only considered studies that included health professionals, specifically doctors, nurses and pharmacists, as these are the health professionals involved in the patient medication journey and in the processes of prescribing of medicines (doctors, nurses and pharmacists all have prescribing rights in certain countries, e.g. the UK), administering medicines (all are involved) and dispensing medicines (all may be involved to some extent in different countries).

Phenomena of interest

While there was no intervention (as would be the case in reviews of effectiveness or cost-effectiveness), the qualitative component of this review considered studies that investigated the phenomenon of medication error reporting from a number of different health professional perspectives (i.e. doctors, nurses, pharmacists). The quantitative component considered studies (most likely survey-based) which measured attitudes and beliefs using tools such as Likert-type scales.

Types of outcomes

This review only considered studies which reported beliefs, attitudes and experiences of health professionals (doctors, nurses, pharmacists) in relation to medication error reporting.

Types of studies

This review considered any research design (quantitative, qualitative and mixed). Quantitative studies were included with outcomes around attitudes and beliefs, while qualitative with outcomes around attitudes, beliefs and experiences. Quantitative studies focused on observational (e.g. cross-sectional surveys to measure attitudes and beliefs using Likert type scales) and qualitative included ethnography, phenomenology and grounded theory studies most likely using either interview (e.g. structured, semi-structured, unstructured) and focus group approaches for data generation. No studies were excluded on the basis of the design or approach to data generation.

3.2.2 Search strategy

The search strategy aimed to find published studies. A three-step search strategy was utilized in this review as follows:

1. An initial scoping search of MEDLINE and CINAHL was undertaken, using search terms of [‘belief*’ or ‘attitude*’ or ‘experience*’] and ‘medication error reporting’;

2. To ensure that all relevant papers were captured, the keywords, main title and abstract words/phrases were identified. Searches of all databases were undertaken. The search string was:

a. ‘medication error*’ or ‘prescribing error*’ or ‘transcribing error*’ or ‘dispensing error*’ or ‘administration error*’

and

b. ‘report*’

and

c. ‘health professional*’ or ‘healthcare professional*’ or ‘doctor*’ or ‘general practitioner*’ or ‘physician*’ or ‘consultant*’ or ‘nurse*’ or ‘pharmacist*’

and

d. ‘belief*’ or ‘view*’ or ‘experience*’ or ‘opinion*’ or ‘attitude*’;

3. The search string was applied with results and exceptions recorded. The reference lists of all identified papers were reviewed for additional studies. Studies were identified from the bibliographic databases described in Table 3.1.

Table 3.1 Scope of selected bibliographic databases

Searched databases	Scope
Medline	Medical Literature Analysis and Retrieval System Online, or MEDLARS Online is a bibliographic database of life sciences and biomedical information. It includes bibliographic information for articles from academic journals covering medicine, nursing, pharmacy, dentistry, veterinary medicine, and health care.it contains over 14 million records.[81]
Cumulative Index of Nursing and Allied Health Literature	CINAHL is the largest and most in-depth nursing research database. The CINAHL Plus with Full Text database provides full text for 734 journals, and indexing for 5,000 journals from the fields of nursing and allied health.[82]
International Pharmaceutical Abstracts	IPA is an online database produced in conjunction with the American Society of Health-System Pharmacists. It provides a comprehensive collection of information on drug use and development from 1971 to the current day.[83]
Embase	Embase is a biomedical and pharmacological database of published literature designed to support information managers and pharmacovigilance in complying with the regulatory requirements of a licensed drug.[84]
Scopus	Scopus is a bibliographic database containing abstracts and citations for academic journal articles. It covers nearly 22,000 titles from over 5,000 publishers, of which 20,000 are peer-reviewed journals in the scientific, technical, medical, and social sciences (including arts and humanities).[85]
Psycharticles	A robust database offering complete access to the full text of more than 80 landmark journals in behavioural science and related fields spanning education, nursing, business and neuroscience[85,86]
Cochrane Database of Systematic Reviews	Cochrane Reviews are systematic reviews of primary research in human health care and health policy, and are internationally recognised as the highest standard in evidence-based health care.[87]
JBI Database of Systematic Reviews	The JBI Database of Systematic Reviews and Implementation Reports is a peer-reviewed, online journal that publishes systematic review protocols and systematic reviews of healthcare research following the JBI methodology.[88]
Database of Abstracts of Reviews of Effectiveness (DARE)	DARE, is focused primarily on systematic reviews that evaluate the effects of health care interventions and the delivery and organization of health services.[89]

All studies identified during the database search were assessed for relevance to the review aim and questions by two independent reviewers (principle researcher and principal supervisor). The full article was retrieved for all those that appeared to meet the inclusion criteria. A search of Google Scholar (online search engine) was undertaken to ensure that all relevant studies have been identified. Only studies published as peer reviewed papers were included; abstracts, conference proceedings and letters etc. were excluded. The search included peer reviewed studies published in English between 1992 and 2013 (i.e. a 20-year timeframe as the scoping search identified a body of literature published within that time period).

3.2.3 Assessment of methodological quality

All studies identified during the database search were assessed for relevance to the review protocol based on information via the title, abstract and full study review by two independent reviewers.[80]

Quantitative papers selected for review were assessed by the two independent reviewers for methodological validity prior to inclusion in the review using standardized critical appraisal instruments from the JBI Meta-Analysis of Statistics Assessment and Review Instrument (JBI-MAStARI) (Appendix 3.1).

Qualitative papers selected for retrieval were assessed by the two independent reviewers for methodological credibility prior to inclusion in the review using standardized critical appraisal instruments from the JBI Qualitative Assessment and Review Instrument (JBI-QARI) (Appendix 3.2).

3.2.4 Data collection

Quantitative and qualitative data were extracted independently by the two reviewers from papers included in the review using standardized data extraction tools. The data extracted included specific details about the populations, study methods and outcomes of significance to the aim and specific review questions.

3.2.5 Data synthesis

It was considered that pooling of data derived from quantitative studies was likely to be inappropriate due to an observational study design; hence the findings were presented in narrative form including tables and figures to aid in data presentation where appropriate.

Qualitative research findings were, where possible, pooled using JBI-QARI. This involved the aggregation or synthesis of findings to generate a set of statements that represent that aggregation, through assembling the findings (Level 1 findings) rated according to their quality, and categorizing these findings on the basis of similarity in meaning (Level 2 findings). These categories were then subjected to a meta-synthesis in order to produce a single comprehensive set of synthesized findings. Where textual pooling was not possible, the findings were presented in narrative form.

3.3 RESULTS

3.3.1 Hits

Table 3.2 shows the number of 'hits' generated through applying the search string.

Table 3.2 Number of hits generated from applying the search string

1	medication error*	21,107
2	prescribing error*	1,402
3	transcribing error*	51
4	dispensing error*	899
5	administration error*	1,996
6 (types of medication errors)	1 or 2 or 3 or 4 or 5	14,704
7	health professional*	77,243
8	healthcare professional*	14,471
9	doctor*	109,064
10	general practitioner*	37,129
11	physician*	426,933
12	consultant*	30,933
13	nurse*	463,528
14	pharmacist*	58,247
15 (health professionals)	7 or 8 or 9 or 10 or 11 or 12 or 13 or 14	990,181
16 (reporting)	report*	2,092,366
17 (experiences etc.)	experience* or opinion* or view* or belief* or attitude*	1,190,547
18 **(review questions)**	6 and 15 and 16 and 17	724

3.3.2 Description of studies

The Transparent Reporting of Systematic and Meta-Analyses (PRISMA) flowchart is given in Figure 3.1. Database searching yielded 724 titles, 100 of which were duplicates. Title, abstract and full paper screening resulted in 13 papers for critical appraisal. The 13 papers reported 13 studies; eight of these were quantitative in design (survey methodology) and five qualitative (methodology not stated but methods of focus groups (n=3) and semi-structured interviews (n=2)).

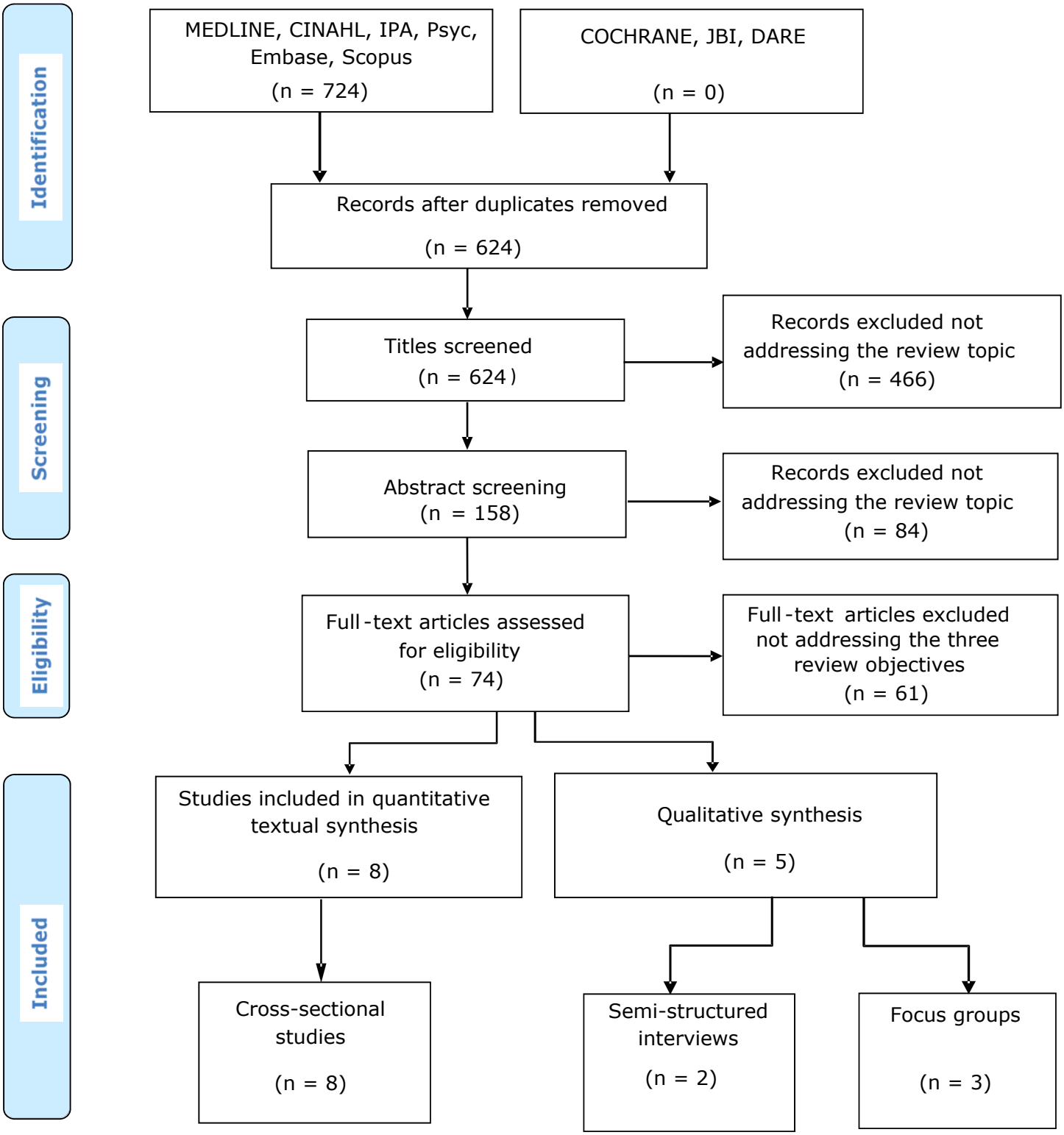


Figure 3.1 PRISMA flowchart for the search and study selection process

3.3.3 Methodological quality

The methodological quality of the 13 studies, based on application of JBI MASTARI and JBI-QARI by the two independent reviewers, is reported in Tables 3.3 and 3.4.

The quantitative studies were generally robust with respect to all of the stated criteria. Limitations included the absence of clearly defined inclusion and exclusion criteria and any strategies to deal with confounders[90] Notably, the outcomes were measured using objective criteria with consideration of data validity. All quantitative studies were considered appropriate to include in the stages of data extraction and synthesis.

The key limitations of all five qualitative studies surrounded the absence of description of study philosophy (e.g. constructivism) and methodology (most presumed to be phenomenology since none included any aim around the generation of new theory as would be the case for grounded theory methodology or appeared to employ case study methodology). All studies were considered to be sufficiently rigorous to be included in data extraction and synthesis.

3.3.4 Data extraction

Data extraction of these 13 studies is given in Tables 3.5 and 3.6 for the quantitative and qualitative studies respectively.

Table 3.3: JBI-MASTARI quality assessment of eight quantitative studies

Criteria / Author, Year	Wakefield et al (1999)[91]	Stratton et al (2004)[92]	Wild et al (2005)[93]	Evans et al (2006)[94]	Patrician et al (2009)[95]	Sarvadikar et al (2010)[96]	Chiang et al (2010)[97]	Bahadori et al (2013)[90]
Was study based on a random or pseudo-random sample?	U	U	U	Y	Y	Y	Y	Y
Were the criteria for inclusion in the sample clearly defined?	Y	Y	Y	Y	Y	Y	Y	N
Were confounding factors identified and strategies to deal with them stated?	Y	Y	Y	Y	Y	Y	Y	N
Were outcomes assessed using objective criteria?	Y	Y	Y	Y	Y	Y	Y	Y
Was follow up carried out over a sufficient time period?	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Were the outcomes of participants who withdrew described and included in the analysis?	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Were outcomes measured in a reliable way?	Y	Y	Y	Y	Y	Y	Y	Y
Was appropriate statistical analysis used?	Y	Y	Y	Y	Y	Y	Y	Y

Y, yes; N, no; U, unclear; N/A, not applicable (cross-sectional design hence no follow-up)

Table 3.4: JBI-QARI quality assessment of five qualitative studies

Criteria / Author, Year	McArdle et al (2003)[98]	Kingston et al (2004)[99]	Sanghera et al (2007)[100]	Hartnell et al (2013)[101]	Williams et al (2013)[102]
There is congruity between the stated philosophical perspective and the research methodology	U	U	U	U	U
There is congruity between the research methodology and the research question or objectives	U	U	U	U	U
There is congruity between the research methodology and the methods used to collect data	U	U	U	U	U
There is congruity between the research methodology and the representation and analysis of the data	U	U	U	U	U
There is congruity between the research methodology and the interpretation of the results	U	U	U	U	U
There is a statement locating the researcher culturally and theoretically	N	N	Y	N	N
The influence of the researcher on the research, and vice versa, is addressed	U	U	U	U	U
Participants, and their voices, are adequately represented	Y	Y	Y	Y	Y
The research is ethical according to current criteria or, for recent studies, there is evidence of ethical approval by an appropriate body	Y	Y	Y	Y	Y
Conclusions drawn in the research report do appear to flow from the analysis, or interpretation, of the data	Y	Y	Y	Y	Y

Y, yes; N, no; U, unclear

Table 3.5 Data extraction of quantitative studies

Authors, year	Specified aim / objective	Setting (country, institution)	Design	Participants	Key findings	Conclusion
Wakefield et al 1996	To analyse and assess nurses' perceptions of why medication administration errors may go unreported	United States (Iowa) Acute care hospitals	Cross-sectional survey	Nurses in 24 hospitals No sample size stated; responses from 1384	Factor analysis revealed four factors explaining why may not report errors: fear; disagreement over whether an error occurred; administrative responses to errors; and effort required to report errors	Potential changes to systems and management responses could improve current practice Changes need to take into account influences of organisational, professional and work group culture
Stratton et al 2004	To obtain nurses' reasons why medication administration errors are not reported	United States (Colorado) Hospitals	Cross-sectional survey	No sample size stated; responses from 284 nurses	The fear of adverse consequences was the primary reason for not reporting errors	There is a need to explore both individual and systemic safeguards to focus on the reported causes and underreporting of errors

Wild & Bradley 2005	To suggest differing needs for training and other interventions to enhance error reporting	United States (Connecticut) Community hospital	Cross-sectional survey	No sample size stated; responses from 24 residents and 36 nurses	Fewer residents than nurses knew of and had used the reporting system Residents were less likely than nurses to report being comfortable discussing errors with supervisors and to rate the hospital administration as non-supportive of error reporting	Error reporting systems may give a biased picture of errors Hospitals may need to initiate other interventions to improve reporting
Evans et al 2006	To assess awareness and the use of the current incident reporting system and to identify factors inhibiting reporting of incidents in hospitals	Australia (south) Principal referral hospitals, major referral hospital, rural base hospitals	Cross-sectional survey	263 doctors and 799 nurses in 6 hospitals 773 responses, 72.8%	Most were aware of the reporting system More likely to report incidents which were habitually reported, often witnessed and associated with immediate outcomes Most frequently reported barrier to reporting was lack of feedback	To improve incident reporting clarification is needed of which to report, the process should be simplified and feedback given

Patrician & Brosch 2009	To assess nurses' perceptions of the reasons for not reporting errors and the extent of underreporting	Assume United States, although not stated explicitly One hospital	Cross-sectional survey	268 nurses in one hospital 43 responses, 16%	The top 5 reasons for not reporting were: perceptions that the administration focused on the individual and not the system; blame attributed; fear of adverse consequences; peer will consider the reporter incompetent; and error not important enough	A positive organisational culture, or perception thereof, prevents truthful reporting
Sarvadikar et al 2010	To investigate attitudes of health professionals in reporting medication errors	United Kingdom (Aberdeen) Tertiary referral hospital	Cross-sectional survey	98 health professionals (doctors, nurses and pharmacists) surveyed 56 responses, 57%	Doctors were unlikely to report less serious errors Nurses and pharmacists were likely to report less serious as well as serious errors despite fears of disciplinary action All were more likely to report an error as clinical scenarios had worsening patient outcomes	There are differing attitudes to reporting errors hence different approaches are required to encourage reporting

Chiang et al 2010	To examine the factors that influence the failure to report medication adverse events by nurses	Taiwan (southern) Tertiary hospitals	Cross-sectional survey	1000 nurses in 5 hospitals 872 responses, 87.2%	The strongest predictors of not reporting were the experience of making errors, differences in attitude of reporting self and co-workers and perceived error rate	Educating nurses about the goals of reporting and using reporting data to enhance patient safety culture is recommended
Bahadori et al 2013	To study the factors influencing not reporting medication error, from nurses' viewpoints	Iran (Miandoab) University hospital	Cross-sectional survey	100 nurses in one hospital 83 responses, 83%	The most important reasons for not reporting were related to managerial factors, factors related to the process of reporting and fear of the consequences of reporting	Establishing a mechanism to improve quality rather than focus solely on finding the culprits and blaming them can result in improving patient safety

Table 3.6 Data extraction of qualitative studies

Authors, year	Specified aim / objective	Setting (country, institution)	Design	Participants	Key findings (level 1 themes)	Conclusion
McArdle et al 2003	To investigate doctors' attitudes and beliefs about medication error reporting	Assume United Kingdom, although not stated explicitly One hospital	Semi-structured interviews	15 doctors of varying grades	Key themes were the importance of reporting, the use of the reporting process, fear of disciplinary action, loss of peer respect and lack of feedback	Errors should be a learning experience but only if relevant and timely feedback is given
Kingston et al 2004	To examine attitudes of medical and nursing staff towards reporting incidents (adverse events and near-misses), and to identify measures to facilitate incident reporting	Australia (Adelaide) Metropolitan public hospitals	Focus groups	14 medical and 19 nursing staff in 5 focus groups conducted in 3 hospitals	Key themes were lack of knowledge, time constraints and complexity of the process, lack of feedback, culture of blame, and no value	Strategies to improve incident reporting must address cultural issues
Sanghera et al 2007	To explore the attitudes and beliefs relating to the reporting of medication errors	United Kingdom Hospital intensive care unit	Semi-structured interviews	13 health professionals (doctors and nurses) who had committed a medication error	Key themes were not being aware an error had occurred, process of reporting, no benefit, motivational and cultural factors	Greater feedback on errors seems essential to improve current practice and increase reporting

Hartnell et al 2013	To enhance the understanding of barriers to medication error reporting in healthcare organisations	Canada (Nova Scotia) Community hospitals	Focus groups and in-depth interviews	One focus group at each of 4 hospitals with 30 health professionals (doctors, nurses and pharmacists) Interviews with the director of risk management at each hospital	Key themes identified incentives to reporting of patient and provider protection and professional compliance Themes of barriers were reporter burden, professional identity, information gap, organisational factors and fear	Reporting should be made as easy as possible with timely feedback and up to date education
Williams et al 2013	To explore and understand the attitudes of hospital pharmacists to reporting medication incidents	United Kingdom (Manchester) Hospitals	Focus groups	One focus group conducted at each of 4 hospitals with 17 pharmacists	Key themes were around the working environment, anxieties, the incident, the reporting system and learning	The decision to report was a complex process that depended on the severity of patient harm, anxieties about harming interprofessional relationships, prior experience of the outcomes from reporting, and the perceived effort required to use reporting forms

3.3.5 Data synthesis

This was a systematic review which encompassed studies employing quantitative and qualitative methodologies and methods. None of the individual studies were mixed methods (i.e. combining both approaches within the same study).

The majority of studies were conducted in the USA,[92,93,95,103] and the UK,[96,98,100,102] with fewer in Australia,[94,99] Taiwan,[97] Canada,[101] and Iran.[90]

Quantitative studies

The eight quantitative studies were all of cross-sectional design, all of which focused on aspects of awareness, knowledge and experiences of the medication error reporting system, as well as attitudes towards and beliefs of reporting, with emphasis on barriers to reporting.

All studies were based in hospital; five included nurses only,[90,92,95,97,103] two were of doctors and nurses,[93,94] and one of doctors, nurses and pharmacists[96] The number of respondents varied from 43 (16% response rate)[95] to 1384 (no response rate stated).[103]

A range of terms was used to describe the phenomenon under study. These were 'medication errors',[90,96] 'errors',[93,95] 'medication administration errors',[92,103] 'medication adverse events',[97] and 'incidents'.[94]

Studies did not report clearly aspects of awareness, knowledge, experiences, attitudes and beliefs, and focused largely on barriers towards reporting. These were:

- Fear of adverse consequences following reporting[90,92,95,97,103]
- Disagreement over error identification;[92,95,103]
- Managerial factors;[90,97]
- Aspects of knowledge and awareness;[94,96]
- Lack of feedback;[94] and
- Training.[93]

Qualitative studies

Five qualitative studies met the inclusion criteria and were included in the systematic review. Of these five studies, two used semi-structure interviews to generate the data,[98,100] and three focus groups.[99,101,102]

Studies were based in hospital settings. One studied doctors, pharmacists and nurses,[101] two doctors and nurses,[99,100] one doctors only,[98] and one pharmacists only.[102] The number of participants ranged from 13,[100]to 33,[99] with a combined total of 108 participants.

The phenomena under study were 'medication errors',[98,100,101] 'medication incidents',[102] and 'incidents'.[99]

Table 3.7 summarises the level 2 findings.

Table 3.7 Level 2 findings derived from the five qualitative studies

Study	Aspects of the working environment and culture	Knowledge and skills related	Aspects of the reporting process	Fear of consequences of reporting	Time constraints	Aspects of reporting feedback
McArdle et al 2003	✓					
Kingston et al 2004	✓	✓	✓	✓	✓	✓
Sanghera et al 2007	✓	✓	✓			
Hartnell et al 2013	✓	✓	✓	✓		✓
Williams et al 2013	✓		✓	✓		✓

3.4 DISCUSSION

3.4.1 Key findings

The aim of this review was to critically appraise, synthesize and present the available evidence on health professionals' beliefs, attitudes and experiences of medication error reporting. While a number of studies were identified employing quantitative and qualitative approaches, no individual study employed mixed methods approaches. Most studies were conducted within Europe and the USA, with only one study based in the Middle East. That cross-sectional study, which was based in Iran, reported only data from 83 nurses.[90] One key limitation of the studies reviewed is the absence of any behavioural change theories in the development of the data collection and generation tools, data analysis or interpretation of study findings. While most studies did not clearly separate attitudes, beliefs and experiences, there were similarities in terms of the barriers around reporting, the main ones of which being aspects of fears of the consequences of reporting, disagreement over what constituted an error worthy of reporting, aspects of the environment and culture, knowledge and skills related, and training related.

3.4.2 Review strengths and weaknesses

One strength of this review is that it was conducted using the standardised JBI approaches, with the review protocol being peer reviewed through JBI and published,[80] prior to the review being conducted. This highlighted the need for the review and a gap in the literature, evidencing the originality of the review. Best practice was followed in conducting the review in that two reviewers working independently conducting both the quality assessment and data extraction phases.

However, there are several limitations to this review and hence the findings should be interpreted with caution. None of the qualitative studies described the research paradigm or research methodology prior to describing the study methods in detail.

As described earlier, the data extraction and synthesis is derived from only 13 studies, none of which used a mixed methods approach nor grounded the research in established theories of behaviour and behaviour change. There is therefore a need for further research in this field.

3.4.3 Interpretation

The barriers to reporting medication error reporting identified in this review highlight the need for the development, implementation and evaluation of interventions which aim to enhance and improve medication error reporting. The process described by the UK Medical Research Council for the development and implementation of complex interventions,[29] describes clearly a staged approach. A key element of this is identifying theory on which to base this intervention. While not specifying specific theory, TDF would appear to be appropriate as it is derived from 33 behavioural theories and is also for use by non-specialist health psychology experts.[69] Using TDF to aid the identification of behavioural determinants will result in an intervention to target specific determinants.

The specific factors leading to suboptimal reporting identified in this review align to determinants of:

- knowledge;
- beliefs of consequences; and
- emotions.

However, there is a need for research which is designed based on TDF at the outset and incorporated into processes of data collection and generation, analysis, and interpretation. Such research should also employ a mixed methods approach and provide clear definition of the term (e.g. 'medication errors') and scope (e.g. prescribing, dispensing, administration etc.)

3.4.4 Further research phases

This systematic review has identified the paucity of research conducted within the Middle East. Given the cultural diversity, there is a need for original research which employs a mixed methods approach to quantify issues around medication error reporting, while at the same time providing depth and richness of data derived from qualitative research. Such research should be grounded in theories of behaviour and behaviour change. This will be the focus for the remainder of the doctoral research.

CHAPTER 4: CROSS-SECTIONAL SURVEY OF HEALTH PROFESSIONALS IN THE UNITED ARAB EMIRATES

4.1 INTRODUCTION

The findings of the systematic review presented in chapter 3 highlighted that while a number of cross-sectional surveys have been conducted on aspects of medication error reporting, most were based within Europe and the USA, with only one in the Middle East. One further key limitation is that none of these made any reference to behavioural theories throughout the processes of research data collection, analysis or interpretation. This chapter presents the method, results and discussion of a cross-sectional survey of beliefs, behaviours and experiences of health care professionals relating to the reporting of medication errors.

4.1.1 Study aim and research questions

To aim was to quantify the behavioural determinants of health professional reporting of medication errors in Abu Dhabi, the UAE.

The detailed research questions were:

- Which behavioural determinants impact error reporting?
- Which of these are facilitators or barriers to error reporting?
- Are there significant differences in behavioural determinants between demographic variables?

4.2 METHOD

4.2.1 Design

A quantitative, cross-sectional survey of health professionals was employed in this phase of the study to achieve the study objectives. As described in chapter 2, cross-sectional approaches provide a snapshot at one point in time. The collection and analysis of quantitative data would provide an opportunity to generate novel findings which could be used to develop an intervention to impact the effectiveness and efficiency of the medication error reporting systems and processes.

4.2.2 Governance

A detailed research protocol was prepared and reviewed by the team members, following which the protocol was approved four weeks later by the ethical review panel of the School of Pharmacy and Life Sciences, Robert Gordon University (Appendix 4.1).

All three hospitals in which the research was conducted had independent ethical review processes, documentation, requirements and committees. Prior to commencing any field work in the UAE, approval was also sought and obtained from each of the hospitals involved as follows:

i. The Ethics and Research Committee of Al Mafraq Hospital (Appendix 4.2). This required an online application submission along with evidence of approval at RGU.

ii. The Ethics and Research Committee of Zayed Military Hospital (Appendix 4.3) this required an online application submission along with evidence of approval at RGU. In addition, a face-to-face interview was conducted with the ethics committee with the principal researcher, during which questions focused on the recruitment process and protection of participants.

iii. The Al Ain Medical District Human Research Ethics Committee in Tawam Hospital (Appendix 4.4). This required submission on an online application along with evidence of approval at RGU. In addition, the principal researcher had to present for a face-to-face interview with the committee, during which questions focused on the appropriateness of online recruitment. After detailed discussion on precautions included to protect anonymity, the research was approved.

The process lasted six months from the time of submission to RGU to obtaining approval from the third hospital. Throughout the research, attention was paid to the research governance policies of RGU [104], the School of Pharmacy and Life Sciences and the UAE [105].

4.2.3 Setting

The research was conducted within the Abu Dhabi emirate of the UAE. This emirate was selected for several reasons:

i. Abu Dhabi is the largest emirate, both in terms of geographical size and population hence researching health professionals in Abu Dhabi was likely to produce research findings which could be generalised to other emirates.

ii. For logistical reasons as the principal researcher was based in Abu Dhabi.

While the sampling frame for the study was all 22 hospitals in Abu Dhabi, the following three major hospitals were selected:

i. Tawam Hospital, with a bed capacity of 461 and professional staff numbering around 3400.

ii. Al-Mafraq Hospital, with a bed capacity of 451 and professional staff numbering almost 2000.

iii. Zayed Military Hospital, with a bed capacity of 365 and professional staff numbering almost 2000. It provides medical services to the families of the UAE Armed Forces.

These three study hospitals provide care for 72.8 % of the Abu Dhabi population[106]

4.2.4 Participant inclusion and exclusion criteria

All health professionals (doctors, nurses and pharmacists) working within the three study hospitals were included in the study; there were no exclusions.

4.2.5 Participant sampling

The entire population of health professionals (doctors, nurses and pharmacists) was used, with no sampling. This was estimated to be around 7,400 health professionals, although the hospitals were unable to give the exact number of health professionals. The reason for using the entire population was simply a matter of logistics in that the recruitment method (see later) was via email from hospital administrators. It was considered easier to email all health professionals rather than the administrators carrying out the sampling using a simple or stratified sampling approach.

In terms of sample size, a response from 370 health professionals was required to give a margin of error of 5% and confidence intervals of 95%.[107]

4.2.6 Questionnaire development and review

A draft questionnaire was developed in relation to the research aim and objectives informed by the literature presented in the systematic review in Chapter 3 and based on the TDF (as described in Chapter 2). The Determinants of Implementation Behavior Questionnaire was used as a basis for the development of the individual items, adapted as relevant to medication error reporting.[108] These items were presented as 5-point Likert scales (strongly agree to strongly disagree). In addition, demographic items were developed as appropriate to health professionals in the UAE.

The draft questionnaire was reviewed for face and content validity (see Chapter 2) by a panel of experts in medication error reporting, health professional practice and health services research in the UK and the UAE. Responses were received from:

i. Sherine EL Din, Head of the Quality Management Department in Zayed Military Hospital in Abu Dhabi.

ii. Mohamad Alsaiari, Consultant in Respiratory Medicine, American Board of Medical Quality, UAE.

iii. Katie MacLure, Senior Research Fellow, Robert Gordon University.

iv. Cristin Ryan, Senior Lecturer, Royal College of Physicians of Ireland.

v. Gordon Rushworth, Lead Pharmacist, Highland Pharmacy Education and Research Centre.

Detailed comments were received from each, mainly in relation to specific wording of items. The draft questionnaire was revised accordingly prior to piloting. The pilot questionnaire was developed in Snap 10 Professional® (software for web and email questionnaire design, publication, data entry and analysis).

A participant information leaflet was developed to provide information on study purpose, selection of participants, benefits of taking part, estimated duration to complete, and confidentiality and anonymity.

4.2.7 Pilot study

A pilot study was conducted for several reasons:

i. to estimate likely response rates;

ii. to identify and resolve any issues with the process of administering the questionnaire particularly since this was an electronically administered questionnaire;

iii. to obtain feedback to allow refining of the open-ended questions;

iv. to familiarise the researcher with process of content analysis;[109] and

v. to overall increase study robustness thereby increasing the likelihood of a well-constructed and content-valid questionnaire.[110,111]

The pilot sample was conducted in three different hospitals in Abu Dhabi, with a convenience sample of 29 HCPs (9 doctors, 10 nurses, 10 pharmacists). Findings indicated that no amendments to the questionnaire were necessary as the questions were clear, not too difficult, taking around 20 minutes to answer and the process of administration was appropriate.

4.2.8 Full study recruitment

Data collection was conducted from June 2014 to September 2014. Email invitations (Appendix 4.5) were sent by the human resources departments in each hospital to all doctors, nurses and pharmacists. The email contained a link to the participant information leaflet and questionnaire (Appendix 4.6), with respondents submitting the questionnaire electronically.

At the end of the questionnaire, respondents were invited to express interest in participating in the interview phase of the study. Two reminder emails were sent by the hospital administration to the entire population at two weekly intervals. An instruction was given asking those who had already completed and submitted the questionnaire to ignore the reminder.

Several evidence based strategies were employed to maximize the response rate:

i. providing information which clearly stated the research aim and potential benefits;

ii. assuring confidentiality and anonymity;

iii. the research originated from an academic institution;

iv. a well-designed and attractive questionnaire; and

v. two email reminders at 2-weekly intervals.[112]

4.2.9 Data analysis

The survey instrument generated anonymised emails of online submissions which were imported into Snap before direct export to SPSS,[113] and cleaned prior to analysis.

Descriptive statistics (e.g. frequencies, percentages, mean (standard deviation), median (interquartile range) were used to describe respondent demographics and their responses. Inferential statistics (see later) were used in the study to explore and compare the differences in responses between variables of health profession, gender and years of experience.

Principal component analysis

All items included in the questionnaire was subjected to exploratory factor analysis (principal component analysis (PCA) with varimax rotation), to identify a smaller number of factors (or components) of interrelated variables. The number of factors to be retained was decided based on the Kaiser criterion (eigenvalues greater than 1), the screen plot and meaningfulness of the results according to the theoretical framework.[114,115] The analysis included items that were not freestanding, cross-loading or decreasing the scale's internal consistency, and that displayed acceptable communalities, with factor pattern/structure coefficients above 0.4.[114,116-118]

In performing PCA, the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy and the Bartlett's Test of Sphericity were used to assess the suitability of the sample for PCA.[119]

Internal consistency

Following PCA, an internal consistency analysis (a form of reliability) was performed by determining the Cronbach's coefficient alpha for each component identified.[120] This statistic provides an indication of the average correlation among all of the items that make up the component scale. Values range from 0 to 1, with higher values indicating greater reliability.[113] Nunnally (1978) suggests a minimum level of 0.7 for the component scale to be considered reliable.[121]

If shown to be reliable, total component scores were obtained by assigning scores of 1 (strongly agree) to 5 (strongly disagree) to each of the Likert statement responses, with negatively worded items being reverse scored.

Comparison between groups

The Mann-Whitney U test was used to explore any relationship between demographic variables (health profession, gender and years of experience) and component scores. This statistic is a comparison of medians and rankings across the two groups. A probability value (p) less than or equal to 0.05 was considered statistically significant.[113]

4.2.10 Promoting quality in research: validity and reliability

A number of measures were implemented to promote validity and reliability and thus study robustness:

i. questionnaire items were developed from the results of systematic review, published literature, the theoretical frameworks, and together with using established measurement scales, enhanced criterion validity;

ii. the draft questionnaire was reviewed for face and content validity;

iii. a pilot study was carried out to ensure robustness; and

iv. statistical testing was undertaken to determine the component scale reliability.

A number of measures were taken to reduce bias and thus improve data validity and reliability:

i. attention and social desirability bias were minimised by emphasising the purpose of the research;

ii. questionnaire items were mainly in the form of Likert scales and close-ended questions to prevent acquiescence response set bias; and

iii. questionnaires responses were anonymous to minimise evaluation apprehension.

A summary of the methodological steps is provided in Figure 4.1

Figure 4.1 Summary of all methodological steps in cross-sectional survey

4.3 RESULTS

A total of two hundred and ninety-four responses were received over the study period.

4.3.1 Respondent Demographics

Respondent demographics are given in Table 4.1. Just over half of the respondents (53.1%) were nurses, female (59.5%), almost two thirds were 35 years of age and above (63.7%), and had been registered as health professionals for over ten years (65.9%).

Table 4.1: Respondent demographics (N=294)

Characteristic	Percentage	Frequency, n
Profession		
Doctor	27.6	81
Nurse	53.1	156
Pharmacist	15.6	46
Missing	3.7	11
Gender		
Male	37.4	110
Female	59.5	175
Missing	3.1	9
Age, years		
<25	1.0	3
25-34	33.0	97
35-44	36.1	106
45-54	18.4	54
>54	9.2	27
Missing	2.4	8
Years registered as health professional		
< 6 years	10.5	31
6-10 years	22.1	65
11-15 years	24.8	73
16-20 years	17.3	51
> 20 years	23.8	70
Missing	1.4	4

4.3.2 Behavioural determinants

Responses to items within each of the TDF domains (as per questionnaire development and validation) are given in Tables 4.2-4.15.

1. Knowledge

(An awareness of the existence of something; constructs of knowledge and role clarity).

While almost all respondents strongly agreed or agreed with items such as awareness of medication error definition (96.6%) and awareness of responsibilities for medication error reporting (92.2%), there was slightly less agreement around awareness of the reporting policy in Abu Dhabi hospitals (77.2%).

Table 4.2: Responses to statements around knowledge related to medication error reporting (N=294)

Statements	Strongly Agree % (n)	Agree % (n)	Unsure % (n)	Disagree % (n)	Strongly Disagree % (n)	Missing % (n)
I am aware of the definition of a medication error	63.6 (187)	33.0 (97)	2.0 (6)	0	0	1.4 (4)
I am aware of the distinction between a medication error and an adverse drug reaction	66.0 (194)	30.6 (90)	2.0 (6)	0	0	1.4 (4)
I am aware of my responsibilities for medication error reporting	43.9 (129)	48.3 (142)	3.7 (11)	0.3 (1)	0.7 (2)	3.4 (9)
I am aware of what is expected of me in relation to medication error reporting	38.4 (113)	47.6 (140)	10.2 (30)	0.7 (2)	0.7 (2)	2.4 (7)
I am aware of which medication errors should be reported	34.4 (101)	45.9 (135)	11.9 (35)	3.7 (11)	2.4 (7)	1.7 (5)
I am aware of the policy relating to medication error reporting in Abu Dhabi hospitals	33.7 (99)	43.5 (128)	17.7 (52)	3.1 (9)	0.7 (2)	1.4 (4)

2. Skills

(An ability or proficiency acquired through practice)

While the majority of the respondents strongly agreed or agreed that they had the ability to report medication errors (86.8%) and had the necessary experience to report (80.3%), there was less agreement around having received sufficient training in medication error reporting (66.0%).

Table 4.3: Responses to statements around skills related to medication error reporting (N=294)

Statements	Strongly Agree % (n)	Agree % (n)	Unsure % (n)	Disagree % (n)	Strongly Disagree % (n)	Missing % (n)
I have received been sufficient training in medication error reporting	22.1 (65)	43.9 (129)	13.6 (40)	16.3 (48)	1.4 (4)	2.7 (8)
I have the ability to report medication errors	36.1 (106)	50.7 (149)	7.5 (22)	2.7 (8)	0.7 (2)	2.4 (7)
I have the necessary experience to report medication errors	29.6 (87)	50.7 (149)	10.5 (31)	5.4 (16)	0.3 (1)	3.4 (10)

3. Social / professional role and identity

(A coherent set of behaviours and displayed personal qualities of an individual in a social or work setting)

Almost all strongly agreed or agreed with both statements regarding professional duty to report errors they had made (94.2%) or that others had made (87.0%).

Table 4.4: Responses to statements around social/professional role and identity related to medication error reporting (N=294)

Statements	Strongly Agree % (n)	Agree % (n)	Unsure % (n)	Disagree % (n)	Strongly Disagree % (n)	Missing % (n)
I believe that it is my professional duty to report medication errors which I have made	47.6 (140)	46.6 (137)	2.7 (8)	0.3 (1)	0	2.7 (8)
I believe that it is my professional duty to report medication errors which others have made, irrespective of their professional background	38.4 (113)	48.6 (143)	8.5 (25)	2. 0 (6)	0	2.4 (7)

4. Beliefs about capabilities

(Acceptance of the truth, reality, or validity about an ability, talent, or facility that a person can put to constructive use)

The majority of the respondents strongly agreed or agreed with statements around their confidence in their ability to recognise (90.5%) and report (86.4%) medication errors, less respondents strongly agreed or agreed that they found the policy straightforward to apply in practice (73.8%). Just under half (41.9%) strongly agreed or agreed that they found it difficult to accept that they had made an error.

Table 4.5: Responses to statements around beliefs about capabilities related to medication error reporting (N=294)

Statements	Strongly Agree % (n)	Agree % (n)	Unsure % (n)	Disagree % (n)	Strongly Disagree % (n)	Missing % (n)
I am confident in my ability to recognise all medication errors	42.2 (124)	48.3 (142)	8.2 (24)	0.3 (1)	0	1.0 (3)
I am confident that I will report medication errors even if others I work with do not	35.8 (102)	50.5 (144)	11.6 (33)	2.1 (6)	0	3.1 (9)
I report medication errors even if there is very little time available	32.3 (95)	48.0 (141)	12.2 (36)	3.4 (10)	1.4 (4)	2.7 (8)
I find the policy straightforward to interpret	26.5 (78)	50.7 (149)	17.7 (52)	2.4 (7)	0.7 (2)	2.0 (6)
I find the policy straightforward to apply in practice	27.9 (82)	45.9 (135)	22.1 (65)	2.4 (7)	0.3 (1)	1.4 (4)
It is sometimes difficult for me to accept that I have made a medication error	10.9 (32)	31.0 (91)	9.5 (28)	35.4 (104)	11.6 (34)	1.7 (5)

5. Beliefs about consequences

(Acceptance of the truth, reality, or validity about outcomes of a behaviour in a given situation)

The majority of respondents strongly agreed or agreed in terms of the contribution of medication error reporting to aspects such as their professional practice (94.9%) and to patient care (91.2%). There was, however a perception that there was, less appreciation of their error reporting by other members of the multidisciplinary team (54.7%), and their seniors (63.2%). 52.4% felt that they got professional reassurance by medication error reporting (52.4%).

Table 4.6: Responses to statements around beliefs about consequences related to medication error reporting (N=294)

Statements	Strongly Agree % (n)	Agree % (n)	Unsure % (n)	Disagree % (n)	Strongly Disagree % (n)	Missing % (n)
I believe that each medication error report I submit can make a significant contribution to my professional practice	56.1 (165)	38.8 (114)	3.1 (9)	0	0	2.4 (7)
I believe that each medication error report I submit can make a significant contribution to the professional practice of others	48.3 (142)	40.5 (119)	7.5 (22)	1.0 (3)	0	2.0 (6)
I believe that each medication error report I submit can make a significant contribution to patient care	47.3 (139)	43.9 (129)	6.1 (18)	0.3 (1)	0	2.4 (7)
I believe that each medication error report I submit can make a significant contribution to patient safety	55.4 (163)	37.8 (111)	3.7 (11)	0.7 (2)	0	2.4 (7)

I believe that each medication error report I submit can make a significant contribution to my organisation	48.3 (142)	41.2 (121)	7.1 (21)	0.7 (2)	0	2.7 (8)
I believe that each medication error report I submit will be appreciated by my peers	47.3 (139)	43.9 (129)	6.1 (18)	0.3 (1)	0	2.7 (8)
I believe that each medication error report I submit will be appreciated by my multidisciplinary team	19.0 (56)	35.7 (105)	29.3 (86)	11.2 (33)	2.0 (6)	2.4 (7)
I believe that each medication error report I submit will be appreciated by my seniors	22.4 (66)	40.8 (120)	26.5 (78)	5.1 (15)	2.7 (8)	2.7 (8)
I get professional reassurance from each medication error report that I submit	16.3 (48)	36.1 (106)	34.4 (101)	8.2 (24)	2.0 (6)	2.4 (7)

6. Motivation and goals

(Mental representations of outcomes or end states that an individual wants to achieve)

More than three quarters of the respondents (77.3%) strongly agreed or agreed that they prioritised reporting errors that they considered to be serious and a similar proportion strongly disagreed or disagreed that error reporting was low priority compared to other professional duties (79.0%) and that they were too busy to report errors (69.8%).

Table 4.7: Responses to statements around motivation and goals related to medication error reporting (N=294)

Statements	Strongly Agree % (n)	Agree % (n)	Unsure % (n)	Disagree % (n)	Strongly Disagree % (n)	Missing % (n)
I prioritise reporting those medication errors which I consider to be more serious	25.9 (76)	51.4 (151)	6.5 (19)	9.9 (29)	3.1 (9)	3.4 (10)
For me, reporting medication errors is low priority compared to other professional duties	1.4 (4)	11.2 (32)	8.4 (24)	61.8 (176)	17.2 (49)	3.1 (9)
I am too busy to report medication errors	3.7 (11)	13.9 (41)	9.9 (29)	51.4 (151)	18.4 (54)	2.7 (8)

7. Memory, attention and decision processes

(The ability to retain information, focus selectively on aspects of the environment and choose between two or more alternatives)

Less than half of the respondents (48.3%) strongly agreed or agreed that they seldom forgot to report medication errors and one fifth (20.7%) strongly agreed or agreed that they had to be constantly reminded by others to submit error reports.

Table 4.8: Responses to statements around memory, attention and decision processes related to medication error reporting (N=294)

Statements	Strongly Agree % (n)	Agree % (n)	Unsure % (n)	Disagree % (n)	Strongly Disagree % (n)	Missing % (n)
Reporting medication errors is something I seldom forget	12.6 (37)	35.7 (105)	14.3 (42)	24.1 (71)	8.5 (25)	4.8 (14)
I need to be constantly reminded by others to submit a medication error report	5.4 (16)	15.3 (45)	10.9 (32)	46.6 (137)	18.0 (53)	3.7 (11)

8. Environmental context and resources

(Characteristics of the innovation, socio-political context, characteristics of the organisation and participants)

Around half strongly agreed or agreed that reporting medication errors took very little time (53.7%) and effort (53.0%). Just under two thirds strongly agreed or agree that there was a positive organisational safety culture (65.9%); less than half that there was a no blame culture (44.0%).

Table 4.9: Responses to statements around environmental context and resources related to medication error reporting (N=294)

Statements	Strongly Agree % (n)	Agree % (n)	Unsure % (n)	Disagree % (n)	Strongly Disagree % (n)	Missing % (n)
For me, reporting medication errors takes very little time	9.5 (28)	44.2 (130)	21.4 (63)	20.4 (60)	1.7 (5)	2.7 (8)
For me, reporting medication errors takes very little effort	8.8 (26)	44.2 (130)	21.8 (64)	21.1 (62)	1.4 (4)	2.7 (8)
Reporting medication errors is compatible with my daily practice	13.0 (37)	61.8 (176)	17.5 (50)	7.4 (21)	.4 (1)	3.1 (9)
I receive sufficient encouragement and support from my organisation to report medication errors	14.3 (41)	48.1 (138)	25.8 (74)	9.4 (27)	2.4 (7)	2.4 (7)
I feel that there is a positive safety culture in my organisation in relation to medication errors	18.9 (54)	47.0 (134)	23.2 (66)	6.0 (17)	4.9 (14)	3.1 (9)
I feel that there is a 'no blame' culture in my organisation in relation to medication errors	11.1 (32)	32.8 (94)	30.7 (88)	18.5 (53)	7.0 (20)	2.4 (7)

9. Social influences

(Those interpersonal processes that can cause individuals to change their thoughts, feelings, or behaviours)

While more than half of respondents strongly agreed or agreed with items such as receiving sufficient encouragement and support from their multidisciplinary team (56.0%), seniors (66.7%) and peers (80.7%) to report medication errors, less than half strongly agreed or agreed others would think less of them if they submitted an error report they (41.6%) or their peers (41.6%) had made.

Table 4.10: Responses to statements around social influences related to medication error reporting (N=294)

Statements	Strongly Agree % (n)	Agree % (n)	Unsure % (n)	Disagree % (n)	Strongly Disagree % (n)	Missing % (n)
I receive sufficient encouragement and support from my multidisciplinary team to report medication errors	10.6 (30)	45.4 (129)	30.6 (87)	9.2 (26)	4.2 (12)	3.4 (10)
I receive sufficient encouragement and support from my seniors to report medication errors	15.1 (43)	51.6 (147)	19.6 (56)	9.8 (28)	3.9 (11)	3.1 (9)
I receive sufficient encouragement and support from my peers to report medication errors	20.0 (57)	60.7 (173)	15.1 (43)	3.9 (11)	0.4 (1)	3.1 (9)
I am likely to report medication errors even if my peers do not	20.0 (57)	60.7 (173)	15.1 (43)	3.9 (11)	0.4 (1)	3.1 (9)
I am likely to report medication errors even if my seniors do not	18.8 (54)	61.3 (176)	15.0 (43)	4.2 (12)	0.7 (2)	2.4 (7)
Others I work with will think less of me if I submit a report for a medication error I have made	7.6 (22)	34.0 (98)	29.9 (86)	22.9 (66)	5.6 (16)	2.4 (7)
Others I work with will think less of me if I submit a report for a medication error they have made	7.6 (22)	34.0 (98)	29.9 (86)	22.9 (66)	5.6 (16)	2.0 (6)

10. Emotional regulation

(A complex reaction pattern, involving experiential, behavioural, and physiological elements, by which the individual attempts to deal with a personally significant matter or event)

Around half of the respondents strongly agreed or agreed with items of concern around medication error reporting relating to potential impact on career (55.6%) and reprimand following reporting (54.9%). Similar proportions strongly agreed or agreed with concern around naming patients (49.7%) and health professionals (59.0%) as part of the report.

Table 4.11: Responses to statements around emotional regulation related to medication error reporting (N=294)

Statements	Strongly Agree % (n)	Agree % (n)	Unsure % (n)	Disagree % (n)	Strongly Disagree % (n)	Missing % (n)
I feel uncomfortable about submitting a medication error report for an error others have made	6.3 (18)	29.1 (83)	13.3 (38)	40.7 (116)	10.5 (30)	2.0 (6)
I feel uncomfortable about submitting a medication error report for an error I have made	7.3 (21)	30.9 (89)	20.1 (58)	32.6 (94)	9.0 (26)	3.1 (9)
I am concerned about the potential impact on my career following submission of a medication error report	11.2 (32)	44.4 (127)	15.4 (44)	26.2 (75)	2. 8 (8)	3.4 (10)
I am concerned about patient confidentiality by having to include the patient name on a medication error report	10.5 (30)	39.2 (112)	16.1 (46)	29.0 (83)	5.2 (15)	2.7 (8)
I am concerned about the potential consequences of having to include the name of the professional on a medication error report	15.5 (44)	43.5 (123)	17.0 (48)	21.2 (60)	2.8 (8)	3.7 (11)
I am concerned about any potential reprimand following submission of a medication error report	10.9 (31)	44.0 (125)	23.2 (66)	19.0 (54)	2.8 (8)	3.4 (10)

11. Behavioural regulation

(Anything aimed at managing or changing objectively observed or measured actions)

The majority of respondents strongly agreed or agreed that they were clear about how to submit medication error report (82.0%) and had a clear plan of those circumstances when a medication error report should be submitted (81.9%).

Table 4.12: Responses to statements around behavioural regulation related to medication error reporting (N=294)

Statements	Strongly Agree % (n)	Agree % (n)	Unsure % (n)	Disagree % (n)	Strongly Disagree % (n)	Missing % (n)
I have a clear plan of how to submit a medication error report	32.7 (96)	49.3 (145)	12.9 (38)	2.4 (7)	1.0 (3)	1.7 (5)
I have a clear plan of under what circumstances I should submit a medication error report	31.6 (93)	50.3 (148)	12.9 (38)	2.0 (6)	0.7 (2)	2.4 (7)

12. Nature of the behaviour

(The nature of the aggregate of all responses made by an individual in any situation)

Just over three quarters of respondents strongly agreed or agreed that submitting a medication error report was something they do automatically (76.9%).

Table 4.13: Responses to statements around nature of the behaviour related to medication error reporting (N=294)

Statements	Strongly Agree % (n)	Agree % (n)	Unsure % (n)	Disagree % (n)	Strongly Disagree % (n)	Missing % (n)
For me, submitting a medication error report is something I do automatically	31.3 (92)	45.6 (134)	11.9 (35)	8.8 (26)	0.3 (1)	2.0 (6)

13. Optimism

(The confidence that things will happen for the best or that desired goals will be attained)

Around two thirds of respondents strongly agreed or agreed with items on their confidence in receiving feedback from their organisation following reporting (63.6%), but less that feedback would be rapid (53.1%), constructive (53.8%), focusing on the system (54.6%) and appropriate to the severity of the error (64.1%).

Table 4.14: Responses to statements around optimism related to medication error reporting (N=294)

Statements	Strongly Agree % (n)	Agree % (n)	Unsure % (n)	Disagree % (n)	Strongly Disagree % (n)	Missing % (n)
When I submit a medication error report, I am confident that I will receive feedback from the medication error reporting organisation	10.5 (30)	53.1 (152)	23.8 (68)	8.4 (24	4.2 12	2.7 (8)
When I submit a medication error report, I am confident that I will receive rapid feedback from the medication error reporting organisation	9.4 (27)	43.7 (125)	30.1 (86)	12.6 (36)	4.2 (12)	2.7 (8)
When I submit a medication error report, I am confident that I will receive constructive feedback from the medication error reporting organisation	7.7 (22)	46.1 (131)	31.3 (89)	10.9 (31)	3.9 (11)	2.7 (8)

When I submit a medication error report I am confident that I will feedback from the medication error reporting organisation which focuses on the system and not the individual	11.2 (32)	43.4 (124)	31.5 (90)	9.1 (26)	4.9 (14)	3.4 (10)
When I submit a medication error report I am confident that I will feedback from the medication error reporting organisation which is appropriate to the severity of the error	8.5 (24)	55.6 (158)	28.5 (81)	4.9 (14)	2.5 (7)	3.4 (10)

14. Intentions

(A conscious decision to perform a behaviour or resolve to act in a certain way)

The majority of respondents strongly agreed or agreed with their intention to report all medication errors (86.0%).

Table 4.15: Responses to statements around intentions related to medication error reporting (N=294)

Statements	Strongly Agree % (n)	Agree % (n)	Unsure % (n)	Disagree % (n)	Strongly Disagree % (n)	Missing % (n)
I intend to report all medication errors	42.5 (125)	43.5 (128)	9.5 (28)	2.7 (8)		1.7 (5)

4.3.3 Principal component analysis

All items were subjected to PCA to identify a smaller number of factors (or components) of interrelated variables. This was considered appropriate for a number of reasons:

a) the number of responses (294) was greater than the required 150;
b) the number of responses (294) was greater than five times the number of items (58x5=290);
c) the Kaiser–Meyer–Olkin measure of sampling adequacy (0.884) and Bartlett's test of sphericity (significance <0.001) confirmed the factorability of the items; and
d) the correlation matrix scores were all greater than 0.3.

Using Varimax rotation, the Scree plot shown in Figure 4.1 was obtained

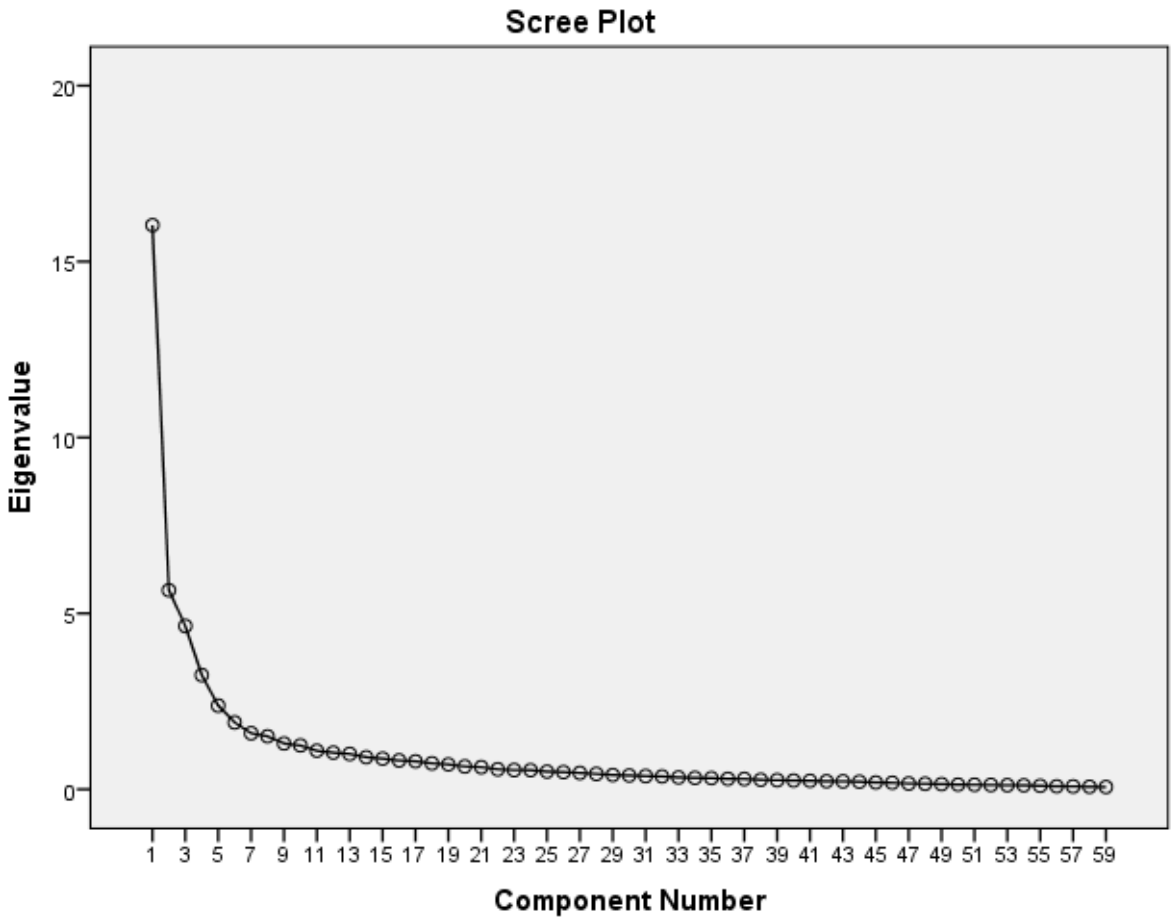


Figure 4.1: Scree plot

Thirteen components with eigenvalue of greater than 1.0 explained 72% of the variance. Table 4.16 gives the eigenvalues for each of the components and the number of items per component. As many of the components had only a very small number of items loading, only those components with more than six items loading were retained (eigenvalues ≥ 1.9), explaining 57% of the variance.

Table 4.16: Components, items and eigenvalues following Varimax rotation

Component number	Number of items	Eigenvalues
1	51	16.037
2	25	5.657
3	14	4.642
4	10	3.247
5	7	2.378
6	8	1.900
7	3	1.593
8	3	1.506
9	1	1.304
10	1	1.245
11	2	1.095
12	4	1.043
13	2	1.005

Tables 4.17-4.22 list the items within each component, the matrix scores for each item and the TDF domain as per the original questionnaire.

Table 4.17: Component 1 items related to knowledge and skills (n=15)

Component 1, knowledge and skills related		
Statements	**Matrix score**	**Original TDF**
I am aware of the policy relating to medication error reporting in Abu Dhabi hospitals	0.795	Knowledge
I have a clear plan of how to submit a medication error report	0.781	Behavioural regulation
I have a clear plan of under what circumstances I should submit a medication error report	0.762	Behavioural regulation
I find the policy straightforward to interpret	0.750	Beliefs of capabilities
I have the ability to report medication errors	0.741	Skills
I am confident in my ability to recognise all medication errors	0.712	Beliefs of capabilities
I have received sufficient training in medication error reporting	0.705	Skills
I find the policy straightforward to apply in practice	0.703	Beliefs of capabilities
I have the necessary experience to report medication errors	0.701	skills
I am aware of what is expected of me in relation to medication error reporting	0.667	Knowledge
I am aware of which medication errors should be reported	0.654	Knowledge
I am aware of my responsibilities for medication error reporting	0.616	Knowledge
I am aware of the definition of a medication error	0.599	Knowledge
I am aware of the distinction between a medication error and an adverse drug reaction	0.518	Knowledge
For me, submitting a medication error report is something I do automatically	0.466	Nature of behaviour

Fifteen items loaded onto component 1 and these originated largely from TDF domains of knowledge, skills and beliefs of capabilities. This component was therefore named 'knowledge and skills related'.

Table 4.18: Component 2 items related to feedback and support (n=15)

Component 2, feedback and support related		
Statements	**Matrix score**	**Original TDF**
When I submit a medication error report, I am confident that I will receive feedback from the medication error reporting organisation	0.801	Optimism
When I submit a medication error report ,I am confident that I will receive rapid feedback from the medication error reporting organisation	0.791	Optimism
When I submit a medication error report I am confident that I will receive constructive feedback from the medication error reporting organisation	0.791	Optimism
When I submit a medication error report I am confident that I will receive feedback from the medication error reporting organisation which is appropriate to the severity of the error	0.752	Optimism
When I submit a medication error report I am confident that I will receive feedback from the medication error reporting organisation which focuses on the system and not the individual	0.746	Optimism
I feel that there is a positive safety culture in my organisation in relation to medication errors	0.653	Environmental context and resources
I receive sufficient encouragement and support from my multidisciplinary team to report medication errors	0.652	Social influences
I believe that each medication error report I submit will be appreciated by my multidisciplinary team	0.647	Beliefs about consequences
I feel that there is a 'no blame' culture in my organisation in relation to medication errors	0.623	Environmental context and resources
I receive sufficient encouragement and support from my peers to report medication errors	0.620	Social influences
I get professional reassurance from each medication error report that I submit	0.585	Beliefs about consequences
I believe that each medication error report I submit will be appreciated by my seniors	0.579	Beliefs about consequences
I believe that each medication error report I submit will be appreciated by my peers	0.578	Beliefs about consequences

I receive sufficient encouragement and support from my seniors to report medication errors	0.532	Social influences
I receive sufficient encouragement and support from my organisation to report medication errors	0.532	Environmental context and resources

Fifteen items loaded onto component 2 and these originated largely from TDF domains of optimism, beliefs about consequences, social influences and environmental context and resources knowledge, skills and beliefs of capabilities. This component was therefore named 'feedback and support related'.

Table 4.19: Component 3 items related to actions and impact (n=10)

Component 3, actions and impact related		
Statements	**Matrix score**	**Original TDF**
I believe that each medication error report I submit can make a significant contribution to my professional practice	0.825	Beliefs about consequences
I believe that each medication error report I submit can make a significant contribution to patient care	0.824	Beliefs about consequences
I believe that each medication error report I submit can make a significant contribution to patient safety	0.820	Beliefs about consequences
I believe that each medication error report I submit can make a significant contribution to the professional practice of others	0.788	Beliefs about consequences
I believe that each medication error report I submit can make a significant contribution to my organisation	0.775	Beliefs about consequences
I believe that it is my professional duty to report medication errors which I have made	0.612	Social/professional role and identity
I believe that it is my professional duty to report medication errors which others have made, irrespective of their professional background	0.594	Social/professional role and identity
I am confident that I will report medication errors even if others I work with do not	0.493	Beliefs about capabilities
I report medication errors even if there is very little time available	0.475	Beliefs about capabilities
I intend to report all medication errors	0.440	Intentions

Ten items loaded onto component 3 and these originated largely from TDF domains of beliefs about social/professional role and identity, and consequences. This component was therefore named 'actions and impact related'.

Table 4.20: Component 4 items related to motivation (n=8)

Component 4, motivation related		
Statements	**Matrix score**	**Original TDF**
I need to be constantly reminded by others to submit a medication error report	0.779	Memory, attention and decision processes
I am too busy to report medication errors	0.739	Motivation and goals
For me, reporting medication errors is low priority compared to other professional duties	0.579	Motivation and goals
Others I work with will think less of me if I submit a report for a medication error I have made	0.527	Social influences
It is sometimes difficult for me to accept that I have made a medication error	0.467	Beliefs about capabilities
Others I work with will think less of me if I submit a report for a medication error they have made	0.454	Social influences
Reporting medication errors is something I seldom forget	0.449	Memory, attention and decision processes
I prioritise reporting those medication errors which I consider to be more serious	0.342	Motivation and goals

Eight items loaded onto component 4 and these originated largely from TDF domains of motivation and goals, and memory, attention and decision processes. This component was therefore named 'motivation related'.

Table 4.21: Component 5 items related to effort (n=5)

Component 5, effort related

Statements	Matrix score	Original TDF
Reporting medication errors is compatible with my daily practice	0.596	Environmental context and resources
For me, reporting medication errors takes very little time	0.579	Environmental context and resources
For me, reporting medication errors takes very little effort	0.537	Environmental context and resources
I am likely to report medication errors even if my peers do not	0.491	Social influences
I am likely to report medication errors even if my seniors do not	0.475	Social influences

Five items loaded onto component 5 and these originated largely from TDF domains of environmental context and resources, and social influences. This component was therefore named 'effort related'.

Table 4.22: Component 6 items related to emotions (n=6)

Component 6, emotions

Statement	Matrix score	Original TDF
I am concerned about any potential reprimand following submission of a medication error report	0.837	Emotion regulation
I am concerned about the potential impact on my career following submission of a medication error report	0.827	Emotion regulation
I am concerned about patient confidentiality by having to include the patient name on a medication error report	0.769	Emotion regulation
I am concerned about the potential consequences of having to include the name of the professional on a medication error report	0.705	Emotion regulation
I feel uncomfortable about submitting a medication error report for an error I have made	0.504	Emotion regulation
I feel uncomfortable about submitting a medication error report for an error others have made	0.368	Emotion regulation

Six items loaded onto component 6 and these all originated from the TDF domain of emotion regulation and was therefore named 'emotions'.

Internal consistency values (Cronbach's alpha) were calculated for each of the six components, aiming for values over 0.7, with all negatively worded items reversed. Tables 4.23-4.28 give the item responses and Cronbach's alpha values for each component along with median and IQR values.

Table 4.23: Component 1, knowledge and skills related item responses (N=294)

Component 1, knowledge and skills related

Statements	Strongly Agree % (n)	Agree % (n)	Unsure % (n)	Disagree % (n)	Strongly Disagree % (n)	Missing % (n)
I am aware of the policy relating to medication error reporting in Abu Dhabi hospitals	33.7 (99)	43.5 (128)	17.7 (52)	3.1 (9)	0.7 (2)	1.4 (4)
I have a clear plan of how to submit a medication error report	32.7 (96)	49.3 (145)	12.9 (38)	2.4 (7)	1.0 (3)	1.7 (5)
I have a clear plan of under what circumstances I should submit a medication error report	31.6 (93)	50.3 (148)	12.9 (38)	2.0 (6)	0.7 (2)	2.4 (7)
I find the policy straightforward to interpret	26.5 (78)	50.7 (149)	17.7 (52)	2.4 (7)	0.7 (2)	2.0 (6)
I have the ability to report medication errors	36.1 (106)	50.7 (149)	7.5 (22)	2.7 (8)	0.7 (2)	2.4 (7)
I am confident in my ability to recognise all medication errors	42.2 (124)	48.3 (142)	8.2 (24)	0.3 (1)	0	1.0 (3)
I have received sufficient training in medication error reporting	22.1 (65)	43.9 (129)	13.6 (40)	16.3 (48)	1.4 (4)	2.7 (8)
I find the policy straightforward to apply in practice	27.9 (82)	45.9 (135)	22.1 (65)	2.4 (7)	0.3 (1)	1.4 (4)

I have the necessary experience to report medication errors	29.6 (87)	50.7 (149)	10.5 (31)	5.4 (16)	0.3 (1)	3.4 (10)
I am aware of what is expected of me in relation to medication error reporting	38.4 (113)	47.6 (140)	10.2 (30)	0.7 (2)	0.7 (2)	2.4 (7)
I am aware of which medication errors should be reported	34.4 (101)	45.9 (135)	11.9 (35)	3.7 (11)	2.4 (7)	1.7 (5)
I am aware of my responsibilities for medication error reporting	43.9 (129)	48.3 (142)	3.7 (11)	0.3 (1)	0.7 (2)	3.4 (9)
I am aware of the definition of a medication error	63.6 (187)	33.0 (97)	2.0 (6)	0	0	1.4 (4)
I am aware of the distinction between a medication error and an adverse drug reaction	66.0 (194)	30.6 (90)	2.0 (6)	0	0	1.4 (4)
For me, submitting a medication error report is something I do automatically	31.3 (92)	45.6 (134)	11.9 (35)	8.8 (26)	0.3 (1)	2.0 (6)
Cronbach's alpha score		0.934				
Median		28				
Interquartile range		21-32				

The Cronbach's alpha value at 0.934 is in excess of 0.7 hence the scale is considered to be reliable. The minimum possible value for the scale is 15 (representing most positive responses) and the maximum possible value for the scale is 75 (representing least positive responses) and a midscale point of 45. With a median value of 28 and IQR of 21-32, respondents generally gave positive responses.

Table 4.24: Component 2, feedback and support related item responses (N=294)

Component 2, feedback and support related						
Statements	**Strongly Agree % (n)**	**Agree % (n)**	**Unsure % (n)**	**Disagree % (n)**	**Strongly Disagree % (n)**	**Missing % (n)**
When I submit a medication error report, I am confident that that I will receive feedback from the medication error reporting organisation	10.5 (30)	53.1 (152)	23.8 (68)	8.4 (24	4.2 12	2.7 (8)
When I submit a medication error report ,I am confident that I will receive rapid feedback from the medication error reporting organisation	9.4 (27)	43.7 (125)	30.1 (86)	12.6 (36)	4.2 (12)	2.7 (8)
When I submit a medication error report I am confident that I will receive constructive feedback from the medication error reporting organisation	7.7 (22)	46.1 (131)	31.3 (89)	10.9 (31)	3.9 (11)	2.7 (8)
When I submit a medication error report I am confident that I will feedback from the medication error reporting organisation which is appropriate to the severity of the error	8.5 (24)	55.6 (158)	28.5 (81)	4.9 (14)	2.5 (7)	3.4 (10)

When I submit a medication error report I am confident that I will feedback from the medication error reporting organisation which focuses on the system and not the individual	11.2 (32)	43.4 (124)	31.5 (90)	9.1 (26)	4.9 (14)	3.4 (10)
I feel that there is a positive safety culture in my organisation in relation to medication errors	18.9 (54)	47.0 (134)	23.2 (66)	6.0 (17)	4.9 (14)	3.1 (9)
I receive sufficient encouragement and support from my multidisciplinary team to report medication errors	10.6 (30)	45.4 (129)	30.6 (87)	9.2 (26)	4.2 (12)	3.4 (10)
I believe that each medication error report I submit will be appreciated by my multidisciplinary team	19.0 (56)	35.7 (105)	29.3 (86)	11.2 (33)	2.0 (6)	2.4 (7)
I feel that there is a 'no blame' culture in my organisation in relation to medication errors	11.1 (32)	32.8 (94)	30.7 (88)	18.5 (53)	7.0 (20)	2.4 (7)
I receive sufficient encouragement and support from my peers to report medication errors	20.0 (57)	60.7 (173)	15.1 (43)	3.9 (11)	0.4 (1)	3.1 (9)
I get professional reassurance from each medication error report that I submit	16.3 (48)	36.1 (106)	34.4 (101)	8.2 (24)	2.0 (6)	2.4 (7)

I believe that each medication error report I submit will be appreciated by my seniors	22.4 (66)	40.8 (120)	26.5 (78)	5.1 (15)	2.7 (8)	2.7 (8)
I believe that each medication error report I submit will be appreciated by my peers	47.3 (139)	43.9 (129)	6.1 (18)	0.3 (1)	0	2.7 (8)
I receive sufficient encouragement and support from my seniors to report medication errors	15.1 (43)	51.6 (147)	19.6 (56)	9.8 (28)	3.9 (11)	3.1 (9)
I receive sufficient encouragement and support from my organisation to report medication errors	14.3 (41)	48.1 (138)	25.8 (74)	9.4 (27)	2.4 (7)	2.4 (7)
Cronbach's Alpha	0.934					
Median	35					
Inter-quartile rate	30-42					

The Cronbach's alpha value at 0.934 is in excess of 0.7 hence the scale is considered to be reliable. The minimum possible value for the scale is 15 (representing most positive responses) and the maximum possible value for the scale is 75 (representing least positive responses) and a midscale point of 45. With a median value of 35 and IQR of 30-42, respondents generally gave positive responses.

Table 4.25: Component 3, action and impact related item responses (N=294)

Component 3, actions and impact related						
Statements	**Strongly Agree % (n)**	**Agree % (n)**	**Unsure % (n)**	**Disagree % (n)**	**Strongly Disagree % (n)**	**Missing % (n)**
I believe that each medication error report I submit can make a significant contribution to my professional practice	56.1 (165)	38.8 (114)	3.1 (9)	0	0	2.4 (7)
I believe that each medication error report I submit can make a significant contribution to patient care	47.3 (139)	43.9 (129)	6.1 (18)	0.3 (1)	0	2.4 (7)
I believe that each medication error report I submit can make a significant contribution to patient safety	55.4 (163)	37.8 (111)	3.7 (11)	0.7 (2)	0	2.4 (7)
I believe that each medication error report I submit can make a significant contribution to the professional practice of others	48.3 (142)	40.5 (119)	7.5 (22)	1.0 (3)	0	2.0 (6)
I believe that each medication error report I submit can make a significant contribution to my organisation	48.3 (142)	41.2 (121)	7.1 (21)	0.7 (2)	0	2.7 (8)
I believe that it is my professional duty to report medication errors which I have made	47.6 (140)	46.6 (137)	2.7 (8)	0.3 (1)	0	2.7 (8)

I believe that it is my professional duty to report medication errors which others have made, irrespective of their professional background	38.4 (113)	48.6 (143)	8.5 (25)	2. 0 (6)	0	2.4 (7)
I am confident that I will report medication errors even if others I work with do not	35.8 102	50.5 144	11.6 33	2.1 6	0	3.1 (9)
I report medication errors even if there is very little time available	32.3 (95)	48.0 (141)	12.2 (36)	3.4 (10)	1.4 (4)	2.7 (8)
I intend to report all medication errors	42.5 (125)	43.5 (128)	9.5 (28)	2.7 (8)	0	1.7 (5)
Cronbach's Alpha	0.910					
Median	17					
Interquartile rate	12-20					

The Cronbach's alpha value at 0.910 is in excess of 0.7 hence the scale is considered to be reliable. The minimum possible value for the scale is 10 (representing most positive responses) and the maximum possible value for the scale is 50 (representing least positive responses) and a midscale point of 30. With a median value of 17 and IQR of 12-20, respondents generally gave positive responses.

Table 4.26: Component 4, motivation related item responses (N=294)

Component 4, motivation related						
Statements	**Strongly Agree % (n)**	**Agree % (n)**	**Unsure % (n)**	**Disagree % (n)**	**Strongly Disagree % (n)**	**Missing % (n)**
*I need to be constantly reminded by others to submit a medication error report	5.4 (16)	15.3 (45)	10.9 (32)	46.6 (137)	18.0 (53)	3.7 (11)
*I am too busy to report medication errors	3.7 (11)	13.9 (41)	9.9 (29)	51.4 (151)	18.4 (54)	2.7 (8)
*For me, reporting medication errors is low priority compared to other professional duties	1.4 (4)	11.2 (32)	8.4 (24)	61.8 (176)	17.2 (49)	3.1 (9)
*Others I work with will think less of me if I submit a report for a medication error I have made	7.6 (22)	34.0 (98)	29.9 (86)	22.9 (66)	5.6 (16)	2.4 (7)
*It is sometimes difficult for me to accept that I have made a medication error	10.9 (32)	31.0 (91)	9.5 (28)	35.4 (104)	11.6 (34)	1.7 (5)
*Others I work with will think less of me if I submit a report for a medication error they have made	7.6 (22)	34.0 (98)	29.9 (86)	22.9 (66)	5.6 (16)	2.0 (6)
Reporting medication errors is something I seldom forget	12.6 (37)	35.7 (105)	14.3 (42)	24.1 (71)	8.5 (25)	4.8 (14)
I prioritise reporting those medication errors which I consider to be more serious	25.9 (76)	51.4 (151)	6.5 (19)	9.9 (29)	3.1 (9)	3.4 (10)

Cronbach's Alpha	0.560
Median	21 (6 items reverse scored*)
Interquartile rate	18-23

The Cronbach's alpha value at 0.560 is lower than 0.7 hence the scale may lack reliability. The minimum possible value for the scale 8 (representing most positive responses) and the maximum possible value for the scale is 40 (representing least positive responses) and a midscale point of 24. With a median value of 21 and IQR of 18-23, respondents gave more neutral responses.

Table 4.27: Component 5, effort related item responses (N=294)

Component 5, effort related						
Statements	**Strongly Agree % (n)**	**Agree % (n)**	**Unsure % (n)**	**Disagree % (n)**	**Strongly Disagree % (n)**	**Missing % (n)**
Reporting medication errors is compatible with my daily practice	13.0 (37)	61.8 (176)	17.5 (50)	7.4 (21)	0.4 (1)	3.1 (9)
For me, reporting medication errors takes very little time	9.5 (28)	44.2 (130)	21.4 (63)	20.4 (60)	1.7 (5)	2.7 (8)
For me, reporting medication errors takes very little effort	8.8 (26)	44.2 (130)	21.8 (64)	21.1 (62)	1.4 (4)	2.7 (8)
I am likely to report medication errors even if my peers do not	20.0 (57)	60.7 (173)	15.1 (43)	3.9 (11)	0.4 (1)	3.1 (9)
I am likely to report medication errors even if my seniors do not	18.8 (54)	61.3 (176)	15.0 (43)	4.2 (12)	0.7 (2)	2.4 (7)
Cronbach's Alpha	0.751					
Median	11.5					
Interquartile rate	10-14					

The Cronbach's alpha value at 0.751 is higher than 0.7 hence the scale is reliable. The minimum possible value for the scale 5 (representing most positive responses) and the maximum possible value for the scale is 25 (representing least positive responses) and a midscale point of 15. With a median value of 11.5 and IQR of 10-14, respondents generally gave positive responses.

Table 4.28: Component 6, emotions item responses (N=294)

Component 6, emotions						
Statements	**Strongly Agree % (n)**	**Agree % (n)**	**Unsure % (n)**	**Disagree % (n)**	**Strongly Disagree % (n)**	**Missing % (n)**
*I am concerned about any potential reprimand following submission of a medication error report	11.2 (32)	44.4 (127)	15.4 (44)	26.2 (75)	2. 8 (8)	3.4 (10)
*I am concerned about the potential impact on my career following submission of a medication error report	10.5 (30)	39.2 (112)	16.1 (46)	29.0 (83)	5.2 (15)	2.7 (8)
*I am concerned about patient confidentiality by having to include the patient name on a medication error report	15.5 (44)	43.5 (123)	17.0 (48)	21.2 (60)	2.8 (8)	3.7 (11)
*I am concerned about the potential consequences of having to include the name of the professional on a medication error report	10.9 (31)	44.0 (125)	23.2 (66)	19.0 (54)	2.8 (8)	3.4 (10)
*I feel uncomfortable about submitting a medication error report for an error I have made	6.3 (18)	29.1 (83)	13.3 (38)	40.7 (116)	10.5 (30)	2.0 (6)
*I feel uncomfortable about submitting a medication error report for an error others have made	7.3 (21)	30.9 (89)	20.1 (58)	32.6 (94)	9.0 (26)	3.1 (9)

Cronbach's Alpha	0.820	
Median	20	(All items reverse scored*)
Interquartile rate	16-23	

All the statements in component 6 were reversed in score therefore, the minimum score (6) represent the disagreement of participants to all statement and the maximum score (30) present the agreement of all participant in the study for all statement in component 6

The Cronbach's alpha value at 0.820 is higher than 0.7 hence the scale is reliabile. The minimum possible value for the scale 6 (representing most positive responses) and the maximum possible value for the scale is 30 (representing least positive responses) and a midscale point of 18. With a median value of 20 and IQR of 16-23, respondents generally gave negative responses.

4.3.4 Exploring relationships between demographic variables and component scores

Mann-Whitney U test was used to compare the component scores for the demographic variables

- the null hypotheses were that there were no differences in scores
- the alternative hypotheses were that there were differences in scores.

Health profession

Table 4.29: Comparison of component scores for different health professions (N=294)

Component	Profession	Median	IQR	P-value	Decision
1, knowledge and skills related	Doctors	34	28-39	<0.001	Reject the null hypothesis; the nurses were most positive and the doctors the least
	Nurses	24	18-30		
	Pharmacists	29	23-32		
2, feedback and support related	Doctors	39	32-44	0.001	Reject the null hypothesis; the nurses were most positive and the doctors the least
	Nurses	34	30-39		
	Pharmacists	37.5	32-49		
3, action and impact related	Doctors	18	13.25-21	<0.001	Reject the null hypothesis; the nurses were most positive and the pharmacists the least
	Nurses	14	10.75-20		
	Pharmacists	20	15.75-22		
4, motivation related	Doctors	21	18-24	0.003	Reject the null hypothesis; the nurses were most positive and the pharmacists the least
	Nurses	20	17-22.25		
	Pharmacists	22	19.25-25.75		

5, effort related	Doctors	12	10-15	0.004	Reject the null hypothesis; the nurses were most positive and the doctors the least
	Nurses	11	10-13		
	Pharmacists	12	10-14		
6, emotions	Doctors	19	15-22	0.129	Retain the null hypothesis of no difference
	Nurses	20	16-23		
	Pharmacists	20.5	17-23		

Gender

Table 4.30: Comparison of component scores for different genders (N=294)

Components	Gender	Median	IQR	P-value	Decision
1, knowledge and skills related	Male	31	24-35	<0.001	Reject the null hypothesis; the females were most positive and the males least
	Female	26.50	19-30		
2, feedback and support related	Male	31	24-35	0.028	Reject the null hypothesis; the females were most positive and the males least
	Female	26.50	19-30		
3, action and impact related	Male	31	24-35	0.007	Reject the null hypothesis; the females were most positive and the males least
	Female	26.50	19-30		
4, motivation related	Male	31	24-35	0.026	Reject the null hypothesis; the females were most positive and the males least
	Female	26.50	19-30		
5, effort related	Male	31	24-35	0.017	Reject the null hypothesis; the females were most positive and the males least
	Female	26.50	19-30		
6, emotions	Male	31	24-35	0.342	Retain the null hypothesis of no difference
	Female	26.50	19-30		

Years registered as a health professional

Table 4.31 Comparison of component scores for different years of registration as health professionals (N=294)

Components	Years registered as health professional	Median	IQR	P-value	Decision
1, knowledge and skills related	< 6 years	31.50	24-37.25	0.003	Reject the null hypothesis; those registered the longest were most positive
	6-10 years	28	21-32		
	11-15 years	29	23-34		
	16-20 years	27	20.50-29.75		
	> 20 years	24	16-30.50		
2, feedback and support related	< 6 years	41	33-43	0.019	Reject the null hypothesis; those registered the longest were most positive
	6-10 years	35	31-41.75		
	11-15 years	39	31-47		
	16-20 years	35	30-39		
	> 20 years	33	30-40		
3, action and impact related	< 6 years	20	16.25-21	<0.001	Reject the null hypothesis; those registered the longest were most positive
	6-10 years	18	12-20.75		
	11-15 years	17	13-21		
	16-20 years	16	11.75-20		
	> 20 years	13	10-18		
4, motivation related	< 6 years	21	19-23.5	0.002	Reject the null hypothesis; those registered the longest were most positive
	6-10 years	21	19-25		
	11-15 years	22	18.75-24		
	16-20 years	19	17-22.5		
	> 20 years	19	15.5-22		
5, effort related	< 6 years	12.5	11.75-14	<0.001	Reject the null hypothesis; those registered the longest were most positive
	6-10 years	12	10-14		
	11-15 years	12.5	10-15		
	16-20 years	11	10-12		
	> 20 years	10	8-13		
6, emotions	< 6 years	21	18-23	0.002	Reject the null hypothesis; those registered the longest were most positive
	6-10 years	21.5	17.25-24		
	11-15 years	20	18-22		
	16-20 years	18	14-22		
	> 20 years	19	13-21.5		

Age

Table 4.32 Comparison of component scores for different age of health professionals (N=294)

Components	Age, years	Median	IQR	P-value	Decision
1, knowledge and skills related	<25	28.5	25-28.5	0.090	Retain the null hypothesis of no difference
	25-34	30	23-34		
	35-44	28	22.75-33		
	45-54	26	19.5-30		
	>54	23	16-31		
2, feedback and support related	<25	47.5	29-47.5	0.199	Retain the null hypothesis of no difference
	25-34	36	31.75-43		
	35-44	34	30-43		
	45-54	36	31-40		
	>54	30.5	27-39.25		
3, action and impact related	<25	15	13-15	<0.001	Reject the null hypothesis; those older were most positive
	25-34	20	13-21		
	35-44	17	12-20		
	45-54	14	11-20		
	>54	11	10-17.75		
4, motivation related	<25	25	17-25	0.004	Reject the null hypothesis; those older were most positive
	25-34	21	20-25		
	35-44	21	18-23		
	45-54	19.5	18-23		
	>54	18.5	15-22		
5, effort related	<25	8	7-8	0.012	Reject the null hypothesis; the youngest were most positive
	25-34	12	10-14		
	35-44	11	10-14		
	45-54	11	9-14		
	>54	10	8-12		
6, emotions	<25	22.5	22-22	<0.001	Reject the null hypothesis; those older were most positive
	25-34	21	18-24		
	35-44	20	16-23		
	45-54	18	14-20		
	>54	19	12.5-21.5		

4.3.5 Analysis of textual responses to open questions

A content analysis approach was used to analyse the textual responses given in response to the open questions. The goal of content analysis is 'to provide knowledge and understanding of the phenomenon under study'.[122] Comments were received from 25 out of the 294 respondents; these given responses were mapped to the six components as shown in table 4.33.

Table 4.33 Respondents illustrative quotes mapped to the six PCA components

Components	Illustrative quotes
1. Knowledge and skills related	*"…not aware of written policy. I haven't been given any training or orientation" (physician)* *"…and offer training and awareness to other healthcare professional about medications error reporting types" (physician)*
2. Feedback and support related	*"Lack of feedback reduces the importance of medication error reporting as well as lack of a constructive response for the upgrading the quality of the whole hospital system" (physician)*
3. Action and impact related	*"We do not have the culture of constructive medication error reporting at all" (pharmacist)* *"There is a hostile culture against reporting as if I am reporting to intelligence not quality department" (physician)* *"Still the mentality in our culture/Institutions is to not accept any error in medicine, very hard and serious when it comes to taking action against whoever commits the error" (nurse)*
4. Motivation related	*" there is every possibility that patient safety will be enhanced by prompt reporting, so we should encourage the reporting and feedback to the reporters is a must" (pharmacist)* *"I think medication error reporting is one of the indicators of the level of culture of safety which is required the support from both the regulatory body and the decision makers as well as the leaders of the organizations" (physician)*
5. Effort related	*"…this will need sufficient time with constant effort to show the support for the health care providers and build the trust" (nurse)* *"…it is improving but it will take time…" (pharmacist)*
6. Emotions	*"… the fear of blame and job security are the main reason of not reporting medication errors (the culture)" (physician)* *"…there is always a fear of what to do and what will happen if something ever goes wrong" (nurse)* *"I am very concerned about the perception and acceptance of this organisation, my department peers and other colleagues in my clinical work area as when I have done a drug error" (pharmacist)*

4.4 DISCUSSION

4.4.1 Statement of main findings

The aim of this study was to quantify the behavioural determinants of health professional reporting of medication errors in Abu Dhabi, the UAE.

A cross-sectional survey approach was used with responses from 294 health professionals. PCA identified six components, the scales of which were found to have high internal consistency. These six components were: knowledge and skills related; feedback and support related; action and impact related; motivation related; effort related; and emotions.

Respondents generally gave positive responses in terms of knowledge and skills, feedback and support, action and impact related components. Responses were more neutral for the motivation related component and the effort related component, while respondents generally gave negative responses for the emotions component.

Comparison of component scores across professions, genders, years of professional experience and age identified that, in general, nurses, females, those with greater experience and being older were more likely to be positive in their responses. In terms of emotions, the component with the lower scores those older respondents with greater experience gave more positive response.

4.4.2 Strengths and weaknesses

Prior to considering and interpreting the quantitative findings, it is important to reflect on the key strengths and weaknesses of the research.

There are a number of strengths to this research. As noted earlier the questionnaires were developed from evidence generated through the previous systematic review research phase. Furthermore, the questionnaires questions were mapped to the domains of the TDF hence the questionnaire items were grounded in behavioural theories. The questionnaire was subjected to extensive pretesting and review prior to the full study.

Furthermore, the systematic review identified a limited number of cross-sectional survey, none of which were grounded in theory hence this study is an original contribution to knowledge.

There are, however, several weaknesses and hence the results should be interpreted with caution. The study was carried out in three tertiary hospitals in Abu Dhabi hence the findings may not be generalisable to the UAE, the Middle East or beyond. Despite the number of measures taken to maximize the response rate, the number of questionnaires submitted was low and a precise response rate could not be determined. There are a number of factors which may have contributed to the low response rate. The email invitation was not sent from the principal researcher, who was unable to confirm that that the email had been sent to all doctors, nurses and pharmacists. Furthermore, medication error reporting is a sensitive area hence the nature of the study may have deterred participation. This may be reflected in the survey results which identified issues around emotions to be important in deterring error reporting. Biases around recruitment and response may therefore have impacted the findings. Ideally the demographics of the respondents and non-respondents would have been compared but this was not possible due to the absence of information on the non-respondents. The online method of questionnaire completion meant that a test-retest reliability check could not be completed. In addition, the findings are all based on self-reported data which could not be validated.

These weaknesses and biases are potential threats to internal validity and limit the degree of generalisability (external validity) of the findings.

4.4.3 Interpretation of findings

Principal component analysis identified that the responses to the 14 behavioural determinants of TDF formed six components, with collapsing of some TDF domains such as knowledge and skills. These six components were: knowledge and skills related; feedback and support related; action and impact related; motivation related; effort related; and emotions.

The findings relating to each of these will be discussed in turn, and compared to the cross-sectional surveys described in the systematic review.

Knowledge and skills related

While the scores for this component were generally low, indicating positive responses, there were significant differences in terms of profession (nurses most positive), gender (females most positive), and years of experience (greater experience most positive). Several studies identified in the systematic review also reported issues related to knowledge. Wild and Bradley (2005) noted that fewer doctors than nurses knew of and had used the reporting system;[93] and Evans et al (2006) that most nurses and doctors were aware of the reporting system.[94]

Feedback and support related

Similar to knowledge and skills, the scores for issues of feedback and support were also low, indicating positive responses. There were significant differences in terms of profession the (nurses most positive), gender (females most positive) and years of experience (greater experience most positive). Notably, responses to the individual items within this component identified that around one third of respondents were unsure/disagreed/strongly disagreed with items relating to feedback following submitting a report to be given at all, that it was constructive, appropriate and rapid.

These findings around feedback are similar to those of McArdle et al (2003)[98] Sanghera et al (2007),[100] and Hartnell et al (2012).[101]

Action and impact related

The responses to items within this component were similar to the previous two with generally positive responses and also significant differences in terms of profession the (nurses most positive), gender (females most positive) years of experience (greater experience most positive) and age (older most positive). Almost all respondents strongly agreed or agreed with all statements. None of the cross-sectional studies in the systematic review placed emphasis on these aspects.

Motivation related

In comparison to the previous three components, the responses relating to the motivation component were more neutral. These higher scores were derived largely through responses to items relating to others thinking less of those reporting errors. There were significant differences scores in terms of profession (nurses most positive), gender (females most positive), years of experience (greater experience most positive) and age (older most positive). Patrician & Brosch (2009) also identified that peers would consider the reporter incompetent and that this was a barrier to reporting.[95]

Effort related

As with motivation related, the scores for the effort related component were also neutral, with significant differences in terms of profession (nurses most positive), gender (females most positive) and years of experience (greater experience most positive). Interestingly, however, the younger health professionals were found to be the most positive which appears to be at odds with the findings for years of registration. These more neutral scores were derived largely from items around the time and effort to report.

While this is surprising given the relative ease of submitting an error report, similar findings were reported by Wakefield et al (1996),[103] and Chiang et al (2010).[97]

Emotions

The scores for the emotion component were the highest of all six components, indicating that respondents generally gave much more negative responses. Respondents were concerned over submitting reports for errors committed by themselves or others, with worries over potential reprimand and implications for their careers. Interestingly, the only significant differences were in terms of years of registration (greater experience most positive) and age (older most positive) but with no differences in terms of profession or gender. Fear of reporting for various reasons was also identified by Wakefield et al (1996),[90] Stratton et al (2004),[92] Patrician & Brosch (2009),[95] and Bahadori et al (2013).[103]

Intervention development

The most negative responses were given in relation to the items within the emotions component, with particularly negative responses given in relation to the potential impact of error reporting on reprimand, career progression. While several others have also noted fear of reporting for various reasons (Wakefield et al (1996),[90] Stratton et al (2004),[92] Patrician & Brosch (2009),[95] and Bahadori et al (2013).[103]), this is the first study which has used behaviour theories and also quantified scores.

Based on these quantitative findings, interventions to modify emotions should be prioritised in an effort to enhance reporting and be targeted at all professions, particularly the younger and less experienced. While component scores within the components of motivation and effort were generally neutral, there were negative responses to items relating to colleagues and peers thinking less of those reporting errors and also the time and effort to complete and submit a report. The responses for the three remaining components of knowledge and skills, feedback and support and action and impact were generally positive.

It therefore appears that the key barrier to medication error reporting identified in this phase of the study relates to the behavioural determinant of emotions.

Multimodal interventions may be required to promote behavioural change, particularly in areas such as emotions, a complex process that takes place over time at individual, population and organisational levels.

Any intervention developed and implemented with the aim of enhancing medication error reporting would be classed as a 'complex intervention'. These are defined by the UK MRC as 'interventions with several interacting components'.[29] Behaviour change interventions, can be defined as 'co-ordinated sets of activities designed to change specified behaviour patterns'. These are often complex, consisting of many interacting components known as 'behaviour change techniques' (BCTs), 'observable and replicable components designed to change behaviour'.[123]

Michie et al (2013) carried out a Delphi type consensus exercise to develop a cross-disciplinary taxonomy of BCTs.[124] Further research carried out by the same group developed and tested a methodology for linking BCTs to TDF domains.[125]

As discussed earlier, one of the benefits of applying TDF to the survey and interview research phases is that the behavioural determinants could be mapped to specific BCTs as part of the development of interventions.

Those BCTs mapped to emotions are:

- Reduce negative emotions, for example by advising on ways of reducing negative emotions to facilitate performance of the behaviour
- Emotional consequences, for example by providing information (e.g. written, verbal, visual) about emotional consequences of performing the behaviour
- Social support (emotional), for example by advising on, arranging or providing emotional social support (e.g. colleagues, 'buddies' or staff) for performance of the behaviour

4.5 CONCLUSION

The quantitative data from this cross-sectional study has highlighted specific behavioural determinants which may be impacting medication error reporting practices. Furthermore, significant differences were identified in terms of health professions, gender, age and experiences of respondents. Findings of this study would indicate that interventions to enhance medication error reporting should be directed to all health professionals, the priorities being to target doctors and pharmacists rather than nurses, and those less experienced health professionals. In terms of the behavioural determinants, interventions which address determinants of emotional related aspects should also be prioritised. Development of interventions will be considered in the final chapter.

4.6 REFLECTIONS AND FUTURE DIRECTION

As part of the mixed methods approach, qualitative research employing a phenomenological methodology will therefore be conducted on a sample of survey respondents to provide greater depth and an explanation of the findings prior to intervention development.

CHAPTER 5: QUALITATIVE INTERVIEWS WITH HEALTH PROFESSIONALS IN THE UNITED ARAB EMIRATES

5.1 INTRODUCTION

As noted in the systematic review presented in chapter 3, few qualitative studies (employing methods of semi-structured interviews and focus groups) have explored reporting of medication errors by health professionals. One key limitation is that none of these made any reference to behavioural theories throughout the processes of research data collection and generation, analysis or interpretation.

This chapter follows on from the quantitative cross-sectional survey study presented in chapter 4. This mixed methods approach of quantitative data collection and analysis followed up with qualitative data generation and analysis is referred to as an explanatory sequential design.[34] The purposes of the qualitative element are to provide further depth and interpretation to the quantitative data.

5.1.1 Study aim and research questions

The aim of this study was to provide more depth to and explain the quantitative findings. In particular, this phase aimed to describe and understand the behavioural determinants of health professional reporting of medication errors in the Abu Dhabi, the UAE.

The detailed research questions were:

- How do specific behavioural determinants impact error reporting?
- Why do specific behavioural determinants impact error reporting?
- Are there any differences between health professions?
- How could error reporting be improved and optimised?

5.2 METHOD

5.2.1 Design

A qualitative interpretative phenomenological methodology of face-to-face semi-structured interviews was employed in this phase of the study to achieve the study objectives. As described in chapter 2, phenomenological studies examine human experiences through the descriptions provided by the people involved.[126] The phenomenon in question was health professional reporting of medication errors. Streubert and Carpenter propose that the phenomenological methodology is rigorous, critical, and systematic.[127] Describing and understanding perspectives on error reporting would provide an opportunity to generate novel data. This could inform the development of an intervention to impact the effectiveness and efficiency of the medication error reporting systems and processes.

Face-to-face interviews were considered more appropriate than other forms of data generation. Use of methods such as focus groups may have inhibited some individuals, particularly those with less experience or those with negative experiences, from expressing their views, with implications for data credibility and research trustworthiness.

5.2.2 Governance

The study was approved, as described in chapter 4. Signed informed consent (Appendix 5.1) was received from each participant prior to the interview taking place. All consent forms, transcripts and reports were stored in secured areas in accordance with the standard operating procedure of the School of Pharmacy and Life Sciences, Robert Gordon University.

5.2.3 Setting

The research setting was described in chapter 4.

5.2.4 Inclusion and exclusion criteria

Those health professionals (doctors, nurses and pharmacists) who completed the survey phase of the research and declared an interest in participating in the interview phase were included. Those participating in the pilot interviews were excluded from the full study.

5.2.5 Sampling and recruitment

Those health professionals declaring an interest were requested to complete an online sampling survey providing demographic information (Appendix 5.2) which was submitted at the same time as the online questionnaire. A sampling approach was employed with strata of profession and years of experience. Those sampled for interview were contacted individually via telephone to organise the date, time and location of the interview.

5.2.6 Sample size

The approach to determining the sample size in qualitative research differs from that employed in quantitative research in many respects. While sample sizes for qualitative research are generally much smaller than those used in quantitative studies, there is no one specific scientific calculation which can be applied. Sampling and data generation were continued to the point of data saturation. The approach to determining the point of saturation recommended by Francis et al,[60] as described in chapter 2, was employed. The initial analysis sample was five from each profession, with interviews progressing until no new themes were identified from three further consecutive interviews.

5.2.7 Interview schedule development

A draft interview schedule was developed as a guide for the principal researcher to use when conducting the interview to ensure a consistent and systematic approach, while allowing the opportunity to probe further. The schedule was developed in relation to the research aim and objectives, the literature presented in the systematic review in chapter 3 and the main findings of the survey phase. Questions focused on medication error reporting, facilitators, barriers, experiences and suggestions for improving effectiveness and efficiency. The schedule was reviewed for credibility by four individuals in the UK with expertise in patient safety and qualitative research, with minor modifications to the wording of some questions. Three pilot interviews were then conducted (one nurse, pharmacist and physician) to determine participant understanding of questions, to provide an estimate of interview duration and to build researcher confidence.[128] The final interview schedule is given in Appendix 5.3.

5.2.8 Data generation

Interviews were conducted in English by the principal researcher who had extensive work experience in hospital settings in the UAE and training in qualitative interviewing. The interviews took place between July and September 2014, with each lasting around 45 minutes.

The interviews were audio-recorded (with permission) and transcribed in full, using a naturalistic approach in which every utterance is transcribed in as much detail as possible.[129] Schegloff states that with a naturalized approach, language represents the real world.[130] All interviewees were afforded the opportunity to review their transcripts prior to analysis. DS reviewed the first five audio-recordings to ensure high quality interviewing skills and thus promote data credibility, and checked the reliability of transcribing of each interview. Furthermore, a very clear audit trail was maintained with documented details of data gathering to promote dependability.

5.2.9 Data analysis

Analysis was carried out using the framework approach, as described in chapter 2. NVivo Version 10 software was used as a data management tool. The six phases were applied as follows:

Phase 1: data familiarization, which involved listening repeatedly to all or parts of the audio-recordings and reading repeatedly the transcripts to promote researcher immersion in the data.

Phase 2: generating initial codes, using the TDF domains as headings, which was carried out independently by the principal researcher and DS. These codes were subsequently discussed and agreed.

Phase 3: identification of themes within each of the TDF domains. Again, this was conducted independently by the principal researcher and DS.

Phase 4: reviewing themes, which involved discussion between the principal researcher and DS.

Phase 5: defining, naming and mapping themes.

Phase 6: producing the report, which involved producing the narrative analysis of the data. Quotes were selected which best represented each of the themes, labeling each by profession to protect anonymity.

5.2.10 Promoting quality in research: trustworthiness

Throughout research planning and conduct, many steps were taken to enhance rigour and hence the trustworthiness of the findings.
According to Lincoln and Guba, trustworthiness refers to the "truth value" of the study's findings or how accurately the investigator interpreted the participant's experiences.[37,77] Generally, rigour in qualitative research is established through the study's credibility, transferability, dependability and confirmability.

The following steps were taken to promote trustworthiness:

1. the principal researcher was trained in qualitative interviewing and data analysis by attending qualitative interview data analysis and research ethics courses, promoting credibility;
2. the principal researcher's position and stance (as a pharmacist in the UAE interested in medication error reporting) was described clearly to promote dependability;
3. the research setting and participants were described to promote consideration of transferability;
4. the interview schedule developed based on the research objectives and main findings of survey, followed by expert panel review to promote credibility;
5. a clearly described sampling strategy was adopted to enhance credibility;
6. interviewees were given the opportunity to review and comment on the transcripts (member checking) to enhance credibility;
7. all analysis was undertaken independently by two researchers to promote credibility and dependability; and
8. there was constant reflection and reflexivity to promote credibility and dependability.

A summary of the methodological steps is provided in Figure 5.1

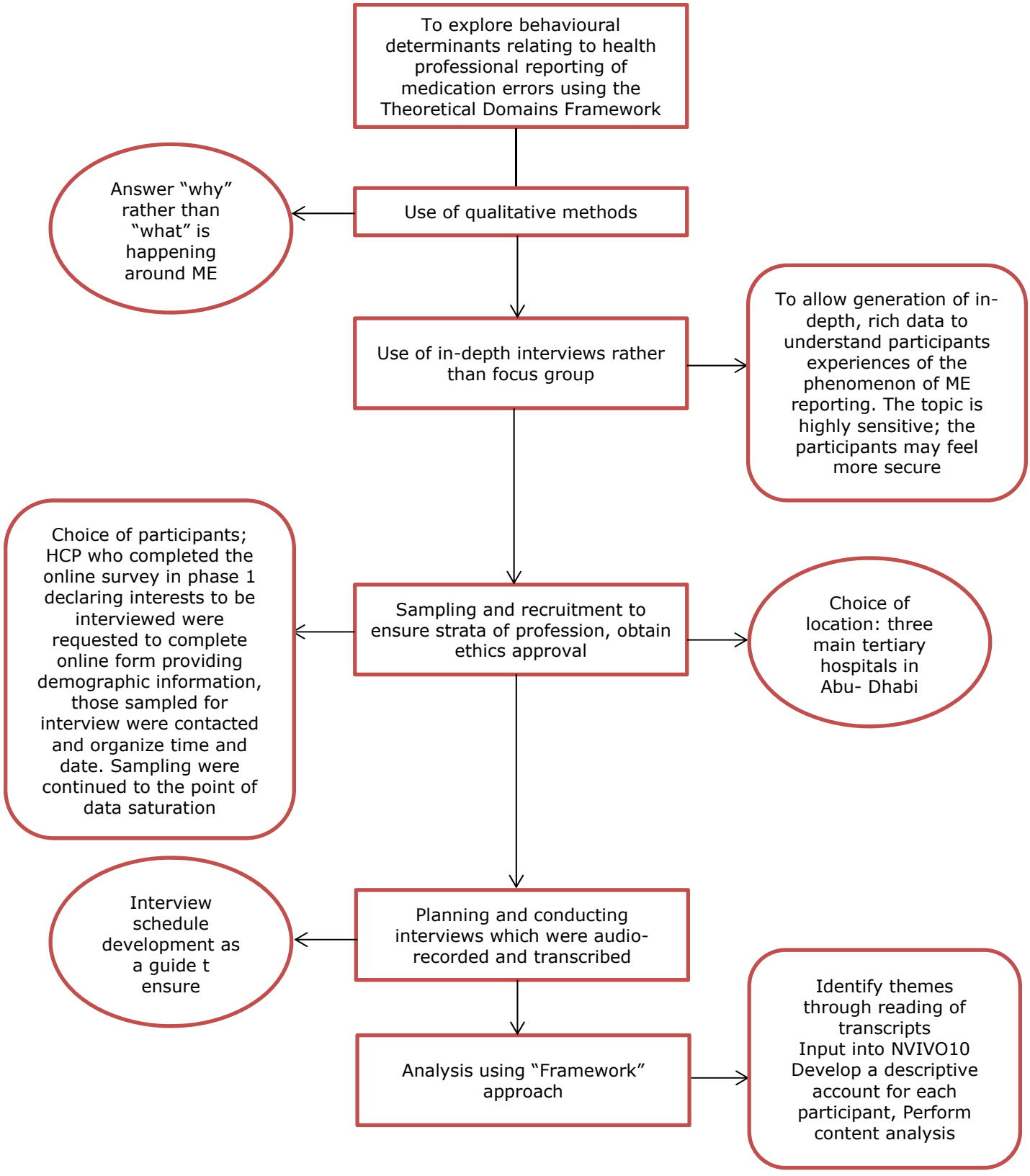


Figure 5.1 Summary of all methodological steps in qualitative phase

5.3 FINDINGS

Forty-three health professionals agreed to be interviewed, with data saturation being achieved after interviewing ten nurses, ten pharmacists and nine physicians. The demographics of the 29 interviewees are given in Table 5.1.

Table 5.1 Interviewee identifier codes and demographics

Interviewee	Code	Profession	Years of practice
1	K5	Physician	11-15
2	S2	Physician	11-15
3	T2	Physician	> 20
4	T5	Physician	11-15
5	M5	Physician	< 6
6	Y2	Physician	> 20
7	F1	Physician	11-15
8	H2	Physician	16-20
9	B4	Physician	< 6
10	S2	Nurse	11-15
11	B2	Nurse	16-20
12	P2	Nurse	6-10
13	K2	Nurse	11-15
14	J2	Nurse	6-10
15	K5	Nurse	16-20
16	M2	Nurse	> 20
17	R5	Nurse	< 6
18	P7	Nurse	16-20
19	U2	Nurse	>20
20	H2	Pharmacist	11-15
21	A5	Pharmacist	11-15
22	L5	Pharmacist	6-10
23	F1	Pharmacist	11-15
24	B1	Pharmacist	11-15
25	S2	Pharmacist	16-20
26	C1	Pharmacist	11-15
27	A2	Pharmacist	16-20
28	G5	Pharmacist	11-15
29	N8	Pharmacist	11-15

5.3.1 Thematic analysis

Key themes identified from the analysis of the transcripts of the semi-structure face-to-face interviews were mapped to TDF domains.

DOMAIN 1 – Goals

(Mental representations of outcomes or end states that an individual wants to achieve)

At the outset of the interview, all interviewees were asked to describe their thoughts on the aim and purpose of the medication error reporting system which operated within their hospitals. The two main themes which emerged were patient safety and developing and improving the healthcare system and practices.

a. Patient safety

Physicians, nurses and pharmacists all commented on the improvement in patient safety which could be achieved through reporting medication errors,

"That is the fact for the patient's safety. Because you are losing a lot of opportunities and areas for improvement."

[Physician K5]

"Yeah, the good point of having reporting system is that it lessens the number of errors and improves the quality of patient care."

[Physician S2]

"The purpose of the reporting system, in general, is to decrease the recurrence of making mistakes and to increase the safety of the patient which will ultimately improve the quality of the health system in the hospital."

[Nurse S2]

Some interviewees noted that the patient benefit of reporting outweighed the negative implications of reporting the practices of colleagues,

"I am not doing it to be nasty to have an outcome on that level. I am doing it for the benefit of the patient."

[Nurse B2]

One pharmacist voiced the professional prestige of the authority to report medication errors but that the overriding aim was focused on safety,

"It is not only for the prestige that we are acquiring. It is for the safety of the patient, of course."

[Pharmacist H2]

b. Developing and improving healthcare systems and practices

Physicians, nurses and pharmacists described additional aims of reporting medication errors around highlighting issues or flaws in either professional practice, systems or processes. Once these had been identified, corrective action could be implemented which would result in improvement and prevention of further error,

"The aim is to just whenever we identify a problem it just will be more easy to solve it and it is about development of system just to see what errors the system has and just to fill the gaps."

[Physician T2]

"You want to see where are the gaps that are hidden maybe and then try to improve our processes, our system, our polices, through investigating and checking what was the reason behind these incidents. So the main purpose is to improve, of course."

[Pharmacist A5]

"Well, I know that the main purpose is to initiate action regarding these errors to develop the area. You want to see where are the gaps that are hidden maybe and then try to improve our processes, system, polices, through investigating and checking what was the reason behind these incidents."

[Pharmacist L5]

"The goal of reporting system is to improve the quality of service. That means, you are providing good service to the patients and their safety will become your priority."

[Physician T5]

One physician explained further that such improvement could lead to raising practice to be at international standards of excellence,

"I think that is the main goal of reporting errors that I do not need this error to occur later, not to blame, not to shame. It is just for improving a practice, so that we have a safer or we excel with whatever we are doing, we get in line with international standards."

[Physician M5]

One nurse noted, while reporting should lead to the overall goal of improving efficiency and reducing errors, this did not occur in practice,

"we should see improvement in the overall reporting process which means we don't see the error happening over and over again despite me reporting it two, three, four times, this is disappointing. I will not report it anymore assuming that they already knows about it and no action was taken. It is a non-efficient system".

[Nurse P2]

DOMAIN 2 – Knowledge

(An awareness of the existence of something)

Two key subthemes emerged which related to the domain of knowledge.

a. General lack of knowledge of medication error reporting policy and systems

Interviewees were generally unaware of the medication error reporting policies and systems in their hospitals. While this lack of awareness was widespread amongst all health professions, it appeared to be more marked in relation to physicians,

"Am not aware of that policy which explains the reporting process, frankly no."

[Physician Y2]

"No, to be honest I did not, have not seen policy in this hospital clarifying what to report. I have not seen any reporting form or tools yet."

[Physician S2]

One physician, who was aware of the existence of the policy, was aware of his lack of understanding and implementation of the policy in terms of the types of errors to report,

"In regards to what to report and not to report in the policy, it is not very well explained yet. The near miss, but I am trying to update myself."

[Physician H2]

This lack of awareness was also apparent in the other health professions,

"I had never attended an education session in 15 years on error reporting, on how it should be, how it should be written. So, you know, that needs to be follow through."

[Nurse K2]

Several were adamant that there was no system or policy around self reporting medication errors,

"*Well usually, if I discovered my mistake I will verbally solve it. I have made an error and here is the correction, but there is no self-reporting system."*

[Pharmacist F1]

"I have an error. I need to report it. Can you give me guidelines on doing it?"

[Nurse K2]

In contrast, very few interviewees were aware of the policies and systems,

"First of all, like our policy in the hospital here, If you will see any kind of medication error, you will write incident report, which is going to be supplied to the head nurse, from the head nurse to the in-charge, the supervisor, then they will send, I think, to the quality…"

[Nurse J2]

"We became acquainted with the policy before that because there was like a meeting for the dissemination of information."

[Pharmacist G5]

b. Need for education and training to improve knowledge

Interviewees across all of the health professions, and at all levels of seniority, highlighted the need for enhanced education and training as one step in improving medication error reporting,

"To create a workshop or teaching people how to deal with reports, how to report things, or how do we do with outcomes, and problem solving. This would really help."

[Nurse M2]

"Education needed about how to report and what about next after reporting, because anyone of us, I am in supervisory level, I know what is going on, but if you ask anybody else, they don't know after reporting what will happen."

[Pharmacist B1]

"I believe there is lack of communication and awareness in the implementation policy of medication management and use especially the part related to the reporting error process. There is definitely problem with education to implement such a practice."

[Pharmacist S2]

"For successful implementation and results of reporting system or other system awareness is a must. You have to tell the people when to do it, how to do it, why to do it, and what to do it".

[Pharmacist C1]

Several interviewees, however, had contrasting views and experiences of the education and training providing around reporting policy, systems and practice,

"It is part of the staff orientation programme, the quality and patient's safety and I think, everyone when they are recruited are trained how to use the PSN

[Provider Service Network established and organized by healthcare provider] *and how to report."*

[Physician S2]

"*As I am talking about the nursing, the quality department are doing very good job with them, by giving lectures, courses as part of nursing skills development. we have very clear form to be fill it up in case of error happened."*

[Nurse J2]

"We acquainted with the policy before that because there was like a meeting in the dissemination of information. So when I get into the incident, I asked for a form."

[Pharmacist A2]

DOMAIN 3 - Social Professional and Role Identity

(Those interpersonal processes that can cause individuals to change their thoughts, feelings, or behaviours)

a. Professional obligation

Many interviewees considered that it was their professional obligation to report medication errors,

"the existence of the reporting system is to incorporate our facility with a system of discovering errors in order to improve overall services that we have, any error happen while prescribing, dispensing and administrating it has a serious consequences and it needs to be reported so that doctors are more aware of their mistakes, without reporting it the error will just pass and no benefit will be taken out of the incidence"

[Physician B4]

"I think who is responsible and like concerning about the patients' safety they will do it, just they will go for it , like there is any kind of error they will come across, they will report it and the big motivator behind that is the patient's safety. Like, we need to do that, because we need to care about the patient's safety."

[Nurse K5]

"Reporting should be a multi-departmental. When you report error, the same error could be repeated anywhere across the hospital and it could be anybody. So as professional, has to be nursing in combination with nurses, pharmacist and doctors, reporting has to be across all departments…"

[Nurse M2]

One of the pharmacists commented that, in his experience, physicians never reported medication errors,

"Usually, the reporting comes from nurses and pharmacists. I never saw a physician reporting anything."

[Pharmacist H2]

DOMAIN 4 - Intentions

(A conscious decision to perform a behaviour or a resolve to act in a certain way)

a. Selectivity of errors reported

Several interviewees explained that they were more likely to report certain types of medication errors or errors committed by certain individuals.

Pharmacists and nurses highlighted the tendency to report only the more serious errors and not those considered to be near misses,

"I think they will report any serious incidents, but they don't really see that near misses are more important or errors that about to be happened are more important."

[Pharmacist A2]

"Yeah, but sometimes due to familiarity There are some errors that 'no need', to report but there are errors that can push you hard like 'you have to report'".

[Nurse R5]

Others highlighted their intentions or observed intentions of others to report only those errors were blame could not be attributed to an individual,

"Nurses can report an incident where there is nobody to blame. But if there is a clear error from a specific person, they don't report these things. No. usually, they don't…."

[Pharmacist L5]

DOMAIN 5 - Belief of Consequences

(Acceptance of the truth, reality, or validity about outcomes of a behaviour in a given situation)

a. Lack of feedback following reporting

One key recurring theme in relation to the beliefs of consequences was the lack of any feedback following submitting a medication error report. This was a major barrier to reporting further medication errors. This lack of feedback was apparent throughout the different health professions,

"I have found that my expectation has not been made. It has not been made. In that, I have written a report. It is gone to Quality and I have not heard anything about it."

[Nurse P2]

"…and also someone to follow up the error and to do something about the errors. They have to try to improve the system."

[Physician S2]

"He expects that incident will go back to this particular person who will investigate the incident and then you will give him a feedback on what action and what contributing factors."

[Pharmacist G5]

One of the pharmacists described experiences of receiving informal, verbal feedback from the quality department in regards to the submission of the incident report.

"Usually, the feedback you get it like verbal or just through meeting or talk. You don't get a formal feedback about what you have reported."

[Pharmacist F1]

While unable to provide specific examples and details, a few of the physicians described feedback provided to those reporting medication errors,

"Yeah, it is usually…They are giving the feedback, the quality control actually that I think to the people who are involved in that process, usually they interview."

[Physician B4]

"Even if there is such a thing [feedback]*, they will have a meeting with the nurse, the in-charge, even with the consultants, and it should be pointed out, so that nothing happens, so even nurse or doctor is more confident because of this system."*

[Physician Y2]

In terms of the feedback, one physician highlighted that positive, encouraging; no-blame feedback should be provided,

"The more the staff is encouraged in a positive way and if the hospital has adapted a 'no-blame' culture and anonymous reporting and… that will help, so that the staff feels that I am reporting anonymously."

[Physician S2]

Avoiding any negative feedback following reporting was also described by one pharmacist,

"It has to be that at least the reporting person should not get a negative feedback."

[Pharmacist A5]

b. Impacting professional reputation

Many interviewees were concerned over the impact of reporting medication errors on their professional reputations. This concern was heightened by the lack of anonymity in the reporting process and hence colleagues would get to know of their errors,

"All people make mistakes, but some old people are concerned about the reaction what will happen if I report myself or anybody reports me, yes, the outcome of the report and what will happen next is the only point of concern."

[Physician T5]

"If you report it that somebody made a mistake, anybody can know who reported, whom the report was referred to, and who is the person did the mistake, and what happened everybody will come to know."

[Nurse P7]

"They will not think actually what happened, how they can improve. Instead of that, in a meeting, in the ward meeting, they are telling it to all, you feel shame sometimes. They may publish it like that."

[Physician Y2]

c. Impacting professional relationships

As well as impacting their professional reputation, another recurring theme was how reporting medication errors could impact professional working relationships. Many described their reluctance to report medication errors committed by their colleagues and friends. These concerns existed at both interprofessional and intraprofessional levels,

"Yes, I am concerned. Because, if you report error. We are reporting names or caring person. So he may be thinking that he is being targeted …which is a bit uncomfortable as it limits your relationship with colleagues, if it is a nurse or my colleague I always reassure them by saying "this is not something to harm or blame you, it helps to improve the system and patient safety" and I have experienced such a thing, this makes him feel like that he is not doing good, that is why he's been reported."

[Physician S2]

"If it is like a physician, it could at least get negative comments, maybe harsh interaction, and maybe uncooperative interaction in the future, maybe just waiting for them to make a mistake in order to really get back to them."

[Pharmacist A5]

"It is a tendency of blame. People are feeling that they don't want to report the error because then the person that you are basically accusing of the error is going to get back to you and they in turn is going to be retaliative."

[Nurse K2]

"But it is there, abrasive, repercussion in that 'why did you report, you know? You did not have to report me. You could have come in and just told me, you know. You don't have to put on a piece of paper. Now it is going to another department.' So I think that is the….So it is abrasive."

[Nurse J2]

One nurse also added that there were cultural issues of nurses from different ethnic backgrounds which was an extreme barrier to them reporting medication errors committed by physicians,

"Again, we go back to a culture thing. The Indian nurse will never confront the doctors. But me, oh, yes, I will, because I am professional about it. They respect me. They respect me for my knowledge, for my experience, for who I am. I have a presence whereas the little Indian nurse and the little Filipino nurse, they are not going to listen [to him/her]*."*

[Nurse M2]

d. Impacting career progression

Many interviewees discussed their concerns over how reporting medication errors could impact their career and indeed, in some instances, their job security,

"…I have heard other people talking, I reported this and now I am battling, you know. I have been transferred else and …"

[Nurse K2]

"Only they will concentrate about this first one incident only and he will lose the job. That is why, maybe, they are not reporting."

[Physician F1]

"There are always consequences. Maybe minor, maybe major. One of the drawbacks that everybody knows everything happened is that it becomes a kind of public opinion or public issue that everybody."

[Pharmacist C1]

"Whenever we report, the first thing, we are getting some performance focus like or we are worried whether our appraisal will be affected."

[Physician T2]

One physician offered an alternative view that, as errors were largely due to human error, that there was an no-blame culture,

"I think it is safe to report errors. As we have, like in our hospital, incident report, if thing like this happens and it is not like something threatening the individual or who is dealing who had made the mistake because those are human errors, but just to make it highlighted, that is why it does not happen again. It should be applied to improve the services."

[Physician K5]

DOMAIN 6 – Emotion

(A complex reaction pattern, involving experiential, behavioural and physiological elements, by which the individual attempts to deal with a personally significant matter or event)

a. Fear and worry

The behavioural determinant domain of 'emotions' emerged as a key theme in relation to reporting medication errors and was described by physicians, nurses and pharmacists as generating fear and worry. Furthermore, different aspects of fear emerged within this domain from the perspectives of health care professionals and management,

"…because, I was shocked and I was afraid and I was afraid she will inform the unit manager and everybody.

[Pharmacist B1]

"That goes back to trust. Fear of losing job. Fear of 'no performance'".

[Physician M5]

"They are afraid because I heard, usually mostly nurses tell, 'you tell'. For example, the ratio between the nurse and the patient is not enough, then they cannot even nibble their food, then I said, 'you just tell your in-charge to report' and then they said 'it might go back to us'. It is just like more punishment. They are afraid.

[Nurse J2]

"Fear is always there. It is a part of our personality. There is always fear, and nobody like to have this, to be blamed."

[Pharmacist S2]

Several interviewees indicated that while they tried to reassure their colleagues of the overall aim of improving medication safety, there was still an over-riding fear,

"Yes, I am concerned. Because, if you report error, we are reporting names or caring person. So he may be thinking that he is being targeted or…So this is the thing, which is a bit uncomfortable as it limits your relationship with colleagues, if it is a nurse or my colleague i always reassure them by saying "this is not something to harm or blame you, it helps to improve the system and patient safety and I have experience such a thing, this make him feels like that he is not doing good, that is why he's been reported."

[Physician F1]

One pharmacist described at length the negative impact of an organizational change in relation to the blame free culture,

"In the beginning, they were called blame-free error reporting. So nobody was blamed, but just two-three months back, they said, healthcare system cannot afford to be blame free. If you made an error, you will be accountable for it. So they did not clarify that much. They try to make it as soft as possible, but… people took this into account".

[Pharmacist L5]

DOMAIN 7 - Environmental Context and Resources

(Any circumstance of a person's situation or environment that discourages or encourages the development of skills and abilities, independence, social competence, and adaptive behaviour)

Several subthemes emerged relating to the environment in which they were practising and the resources available to them.

a. Time commitment

Many interviews described a lack of time to report medication errors and many other competing priorities,

"But sometimes I have the reason to not to report, just like one afternoon I am alone, I will do the IV. I have incidents to report, but no time. I will just take my snack instead of reporting. So that is time limit and I am alone."

[Nurse M2]

"No time to report if I would leave the patient to report an incident, I will be asked to come back and report later which usually you tend to forget or its already too late you have to go home."

[Pharmacist H2]

Some also linked the time take to report to the paper based reporting system and issues around access to the reporting forms,

"Basically, we are paper-base system. So it is time consuming definitely."

[Nurse P2]

"…reporting error takes a lot of time and consumption. There are no forms that are readily available for everybody."

[Physician Y2]

Some interviewees, however, expressed contrary views in relation to the time commitment,

"It is not time consuming. If we are used to it is not consuming. If we are doing first time or like that, you will feel, you know, it is time consuming. For me, it is ok".

[Pharmacist N8]

One nurse explained that while the reporting form was simple, there was some ambiguity in terms of the actual detail to be recorded and the categorization of the events,

"Here in the hospital, the documentation is very simple. It is very basic; the questions are asked and the document is filled in. It is very vague…There are no directions or categorization for the events."

[Nurse P2]

b. Electronic system

Several interviewees commented on the lack of electronic reporting systems in their hospitals and that the paper based system was a major deterrent to reporting,

"Again, the lack of the electronic system is one of our big challenges that we haven't in our hospital. So in order for us to do a reporting, we have to go through many steps of getting the paperwork, manually reporting the system and waiting for the results and implementing and how do you advertise everybody in your hospital that this error did happen, lack of internal communication - we do not have an email. It is the lack of education, awareness, and general communication that we do struggle in our hospital results in under-reporting errors in our hospital."

[Pharmacist C1]

Many others noted that implementing such an electronic system would facilitate medication error reporting,

"… electronic system, simple reporting from, not time consuming, easy to the point, post the results for everybody that will encourage everybody to report."

[Physician T2]

"So the lack of having an electronic system and make it easy just to report it right there on a computer where no papers involve, it is a lot easier".

[Nurse B2]

One nurse summarized that whatever the system is, it must be accessible and easy,

"This is it, whatever is easy, people will do. If it is an easy paper and it is a hard site, they will do the paper. If it is an easy paper and easy site, they will do whatever is accessible, maybe they don't have the net access, maybe they don't have whatever. Or if they have internet access, but they don't have a copier machine, they will do the internet. So it depends on the availability of the resources and the reporting and the actions should be communicated."

[Nurse R5]

DOMAIN 8 - Social influences

(Those interpersonal processes that can cause individuals to change their thoughts, feelings, or behaviours)

Many interviewees described their thoughts on the influences of others on their likelihood of reporting medication errors.

a. Professional hierarchy

The perceived professional hierarchy and power of physicians was a major issue, as described by nurses and pharmacists,

"Especially, when you report physicians in the higher hierarchy and they know who reported. Then they come back to you "why did you report that? You did not have to. You should have talked to me. This is small thing…". Then you are in a poor situation what the correct action of plan is actually. Should I report, should I go back to him and try to solve it on a friendly basis or unofficial, at least unofficial basis. I don't know."

[Pharmacist A5]

"So I think it is a big [issue]*, which I think is, also could be a reason why not to apply and practice reporting what needs to be reported, the encouragement from superior staff."*

[Nurse P7]

"I did report do not use abbreviation in one of our physicians and I did complete the report, sent it out to that Quality Control, the physician did receive it, and I think it was a week after he is like 'oh, you are the one reported. You know me?' and I am like…you know, 'yes, I did' and he again took that negative teeth from me and to be honest with you was more of a clash in the beginning and…."

[Pharmacist G5]

Some physicians described the issue relating to the potential negative impact of reporting their colleagues,

"…if you report error, we are reporting names or caring person. So he may be thinking that he is being targeted which is a bit uncomfortable for the reporter to report and pressure as it limits your relationship with colleagues. if it is a nurse or my colleague I always reassure them by saying 'this is not something to harm or blame you, it helps to improve the system and patient safety' and I have experience such a thing, this make him feels like that he is not doing good, that is why he's been reported".

[Physician H2]

"He feels like it is an insult, although may be she or he is very good in caring and so…"

[Physician K5]

DOMAIN 9 – Reinforcement

(Increasing the probability of a response by arranging a dependent relationship, or contingency, between the response and a given stimulus)

Several of the more senior interviewees described various incentives which had been implemented to increase the likelihood of reporting medication errors.

a. Incentives to report medication errors

One senior physician described a scheme to reward the member of staff reporting the highest number of medication errors,

"Another thing is that we are rewarding the highest reporter, so that we say that 'he is the reporter of the month, not only on numbers, but he has catch-up [identified] *an incident that could have caused this and this', so we try to somehow encourage them".*

[Physician T5]

However, this individual was not able to provide any information on the uptake or success of the scheme. A senior pharmacist discussed an approach to reinforcing and encouraging medication error reporting by engaging the reporter on any action taken, particularly improvements made,

"The way that we do it is that we thank the staff who reports following their report with an email saying "'thank you for reporting" and we keep them engaged on the analysis, the contributing factors, and we report back to them what improvement have we done out of his report".

[Pharmacist L5]

A similar approach was described by a senior nurse from the same hospital,

"We have internally a patient recognition or employee recognition system, which is…you can send the employee 'E–Thank You' card for contributing and one of the elements is creating a patient safety environment".

[Nurse U2]

Table 5.2 provides a summary of the themes mapped to the TDF domains, highlighting each as either a facilitator and/or barrier.

Table 5.2 Key themes mapped to TDF domains

TDF domains	Themes	Facilitator or barrier to reporting
Goals	a) Patient safety	Facilitator
	b) Developing and improving healthcare system and practices	Facilitator
Knowledge	a) General lack of knowledge of medication error reporting policy and systems	Barrier
	b) Need for education and training to improve knowledge	Barrier
Social professional and role identity	a) Professional obligation	Facilitator
Intentions	a) Selectivity of errors reported	Barrier
Belief of consequences	a) Lack of feedback following reporting	Barrier
	b) Impacting professional reputation	Barrier
	c) Impacting professional relationships	Barrier
	d) Impacting career progression	Barrier
Emotion	a) Fear and worry	Barrier
Environmental context and resources	a) Time commitment	Barrier
	b) Electronic system	Facilitator
Social influences	a) Professional hierarchy	Barrier
Reinforcement	a) Incentives to report medication errors	Facilitator

The following TDF domains were **not** represented in the thematic analysis: skills; beliefs about capabilities; optimism; memory, attention and decision processes; and behavioral regulation.

5.4. DISCUSSION

5.4.1 Statement of main findings

The aim of this phase of the research was to provide more depth to and explain the quantitative findings. In particular, this phase aimed to describe and understand the behavioural determinants of health professional reporting of medication errors in the Abu Dhabi, the UAE.

A qualitative approach was used to elucidate the key behavioural determinants around medication error reporting in a sample of 29 health professionals in the UAE. While it appeared that patient safety and organisational improvement goals, and intentions were determinants which facilitated reporting, there were key determinants which deterred reporting. These included the beliefs of the consequences of reporting, emotions, social influences and issues related to the environmental context.

5.4.2 Strengths and weaknesses

Prior to considering and interpreting the qualitative findings, it is important to reflect on the key strengths and weaknesses of the research.

There are a number of strengths to this research. As noted earlier, only a few studies have used qualitative methodologies to study medication error reporting and none used a theoretical approach. This doctoral research has therefore provided original findings.

The steps taken to promote research trustworthiness, particularly the elements of credibility and dependability and hence rigors are key strengths:[61]

- the documented operational detail of data gathering and analysis;
- member checking; and
- ensuring a skilled interviewer.

Furthermore, it is likely that data saturation was achieved, using the process recommended by Francis et al.[131]

However, there are several limitations and as such the findings should be interpreted with caution. The research was conducted within three major hospitals of the UAE and the findings may not necessarily be transferable to other settings in the UAE, and beyond. Nevertheless, it is likely that the findings will resonate widely, given the acknowledged and demonstrated scale of under-reporting of medication errors.[98-102]

Although there were attempts to promote the credibility (i.e. that the findings were congruent with reality), it is possible that some interviewees may not have described truly their perspectives and experiences. It is also possible that those agreeing to participate were not representative of all health professionals. Notably, only a small number of the survey respondents were willing to participate in a face-to-face interview. While the reasons for the low uptake of interviews are unknown, the sensitivity of the subject matter and the identification of interviewees may have been influencing factors.

5.4.3 Interpretation of findings

This research extends the knowledge base, particularly those findings highlighting those behavioural determinants which are facilitators and barriers to medication error reporting. While some of the barriers, such as selective reporting depending on perceived error severity, anxieties of reporting, and lack of feedback are similar to other qualitative studies, [99,101,102] this research has provided rich detail around specific TDF behavioural determinants which impacted reporting.

Furthermore, this phase of the study was the quantitative element of a mixed methods (quantitative, qualitative) study and as such extends the knowledge base beyond the quantitative findings of emotional issues impacting reporting.

The qualitative findings have extended those of the quantitative phase in that there were three key behavioural determinants which acted as barriers to reporting. In addition to emotions, these were the health professionals' beliefs of the consequences of reporting and social influences.

Overall, there were few key differences identified between the professional groupings, other than perceived hierarchies.

Many interviewees of all professions and years of experience reported their fears and worries of reporting. These in turn were linked to their beliefs of the consequences of reporting impacting their professional standing, inter and intraprofessional relationships and working, and their career progression. There appeared to be a hierarchical, social influence based upon the perceived power of certain physicians by nurses and pharmacists which deterred reporting of physician errors by these other professions. These issues are all complex and related to the culture within which the health professionals are working. Indeed, the entire field of safety culture is complex with an acknowledged lack of consistency in terms such as 'culture' and 'climate' and no standardised definitions. A recent literature review identified the most common definition of safety culture as, 'the product of individual and group values, attitudes, competencies and patterns of behaviour that determine the commitment to, and the style and proficiency of, an organisation's health and safety programmes. Organisations with a positive safety culture are characterised by communications founded on mutual trust, by shared perceptions of the importance of safety, and by confidence in the efficacy of preventive measure [132]. Mutual trust and confidence are key within this definition and the findings of this study demonstrate that much work is required to promote a safety culture in relation to medication error reporting. Two systematic literature reviews have explored interventions to promote safety culture in hospitals and acute hospitals specifically [133,134]. Both reviews noted that studies were generally of poor quality but that interventions may improve perceptions of safety culture.

However, none of the studies within these reviews had focus on perceptions of culture around medication error reporting.

Barriers such as knowledge gaps around the reporting policies, specifically what to report, and issues relating to the environmental context and resources (time commitment, burden) have been described in quantitative [90-97] and qualitative studies [98-102] . Similarly, selective reporting of errors perceived by the health professional to be more serious has been highlighted previously. While this may be understandable to some extent, it is not congruent with the reporting policy in place in the Health Authority of Abu Dhabi which requires all errors and near misses to be reported [135]. Reporting and learning from near misses may be particularly valuable in providing feedback at practitioner and organisation levels to develop safer systems of practice. However, one further key theme which emerged in this study was the lack of feedback following reporting which deterred further reports being submitted.

As highlighted in Chapter 4, one of the many benefits of using TDF to identify key behavioural domains is that these can then be used as intervention targets, as suggested by the MRC [29]. The BCTs mapped to emotion are as described in Chapter 4. Those relating to beliefs of consequences are:

- Salience of consequences, such as using methods specifically designed to emphasise the consequences of performing the behaviour with the aim of making them more memorable (goes beyond informing about consequences); and
- Anticipated regret, inducing or raising awareness of expectations of future regret about performance of the unwanted behaviour.

Those relating to social influences are:

- Social comparison, drawing attention to others' performance to allow comparison with the person's own performance;
- Social support (emotional); advising on, arranging or providing emotional social support (e.g. from colleagues, 'buddies' or staff) for performance of the behaviour; and

- Vicarious reinforcement, prompting observation of the consequences (including rewards and punishments) for others when they perform the behaviour.

5.5 CONCLUSION

This qualitative study has identified key behavioral determinants of the beliefs of the consequences of reporting, emotions and issues related to the environmental context which all negatively impact medication error reporting. These determinants can be mapped to behavior change strategies facilitating the development of an intervention, centering on organizational safety and reporting culture, to enhance medication error reporting effectiveness and efficiency with implications for healthcare practice and patient safety. The final chapter discusses these findings in light of the systematic review and cross-sectional survey.

CHAPTER 6: DISCUSSION

6.1 AIMS AND KEY FINDINGS

The overall aim of this research was to explore health professional reporting of medication errors reporting in Abu Dhabi, the UAE, as a preliminary step to the development of interventions to improve and optimise the effectiveness and efficiency of medication error reporting thus impacting patient safety. The research was conducted in three phases, each with specific aims and key findings as described below.

Phase 1 aimed to critically appraise, synthesize and present the available evidence on health professionals' beliefs, attitudes and experiences of medication error reporting. The JBI registered systematic review identified 13 published papers, which highlighted a number of facilitators and barriers relating medication error reporting. However, none of the studies reviewed employed a mixed methods (quantitative, qualitative) approach and there was a notable absence of the use of theories of behaviour change in the data collection and generation tools, data analysis and interpretation.

Since completing the systematic review, several primary research studies have been published which match this review inclusion criteria. Mostafaei et al (2012) conducted a cross-sectional survey of nursing staff in one hospital in Iran, aiming to determine the level of importance of factors in refusal to report medication errors.[136] The response rate was 85% (85/100), with data indicating that the most important factors in refusal to report medication errors respectively were: lack of medication error recording and reporting system; lack of appropriate feedback; and lack of a clear definition for a medication error.

Castel et al reported a cross-sectional survey of 2319 physicians and 386 nurses (response rate not stated) in Canada, aiming to examine the influence of clinician demographics, organisation demographics and leadership factors on fear of repercussions following error reporting.

Results indicated absence of any association between these factors and fear, with the authors concluding the need for further research in this field.[137]

These two additional studies do not alter the findings of the systematic review presented in Chapter 3.

Phase 2 aimed to quantify the behavioural determinants of health professional reporting of medication errors in Abu Dhabi, the UAE. This was the first stage of an explanatory sequential mixed methods design, with behavioural theories (TDF) embedded throughout. A cross-sectional survey methodology conducted in Abu Dhabi elicited responses from 294 health professionals. PCA identified six components, the scales of which were found to have high internal consistency. These six components were: knowledge and skills related; feedback and support related; action and impact related; motivation related; effort related; and emotions. Respondents generally gave positive responses in terms of knowledge and skills, feedback and support, action and impact related components. Responses were more neutral for the motivation related component and the effort related component, while respondents generally gave negative responses for the emotions component.

Comparison of component scores across professions, genders, years of professional experience and age identified that, in general, nurses, females, those with greater experience and being older were more likely to be positive in their responses. In terms of an emotion, which was the component with the lower scores, older respondents and those with greater experience gave more positive responses.

Phase 3 aimed to provide more depth to and explain the quantitative findings. This qualitative, phenomenological phase explored further medication error reporting in a purposive sample of survey respondents.

In depth face to face interviews were undertaken with 29 health professionals in relation to the determinants of behaviour. The most dominant domains were: goals, intentions, beliefs of the consequences of reporting, emotions, social influences and issues related to the environmental context. While it appeared that patient safety and organisational improvement goals, and intentions were determinants which facilitated reporting, there were also key determinants which deterred reporting. These included the beliefs of the consequences of reporting, emotions, social influences and issues related to the environmental context.

6.2 ORIGINALITY OF THE RESEARCH

These three phases of research have generated original findings which extend the knowledge base around medication error reporting and have potential to impact professional practice and patient care.

The phase one systematic review protocol was registered with and published by JBI, which provides evidence of originality. Most of the studies reported in this review were conducted within Europe and the USA, with only one from the Middle East. Phases two and three, conducted in the Middle East, therefore generated original data in terms of the geographical setting. Furthermore, these phases employed a mixed methods approach and incorporated behavioural theory. The benefits of using theory were described in Chapter 2 and also highlighted as part of the MRC Framework of the development of complex interventions. The use of TDF has allowed determination of the behavioural determinants of mediation error reporting (or not reporting) and will aid the development of interventions to enhance reporting (see later).

6.3 IMPLICATIONS OF RESEARCH

Table 6.1 summarises the results of determinants of medication error reporting, highlighting these as barriers and facilitators derived from phases one to three. These are presented in relation to the TDF domains (and the PCA components) in phases two and three. It is clear that the behavioural determinants which are dominating as barriers are around the beliefs of consequences of reporting and emotions, with social influences also important. The quantitative data also indicate that those with less experience, males, doctors and pharmacists should be prioritised for intervention.

	PCA components from survey (TDF domains)	TDF domains from interviews	Systematic review
Barriers	1.Motivation related component - Social influences - Memory, attention and decision processes - Goals - Beliefs about capabilities 2. Effort related component - Social influences - Environmental context and resources 3. Emotions component - Emotions	1. Beliefs of the consequences of reporting 2. Emotions 3. Social influences 4. Issues related to the environmental context	Fear, reporting effort, lack of awareness and understanding of reporting policies, fear of disciplinary action, loss of peer respect and lack of feedback, complexity of the process, culture of blame, no value, reporter burden, professional identity, information gap and organisational factors
Facilitators	1. Knowledge and skills related component - Knowledge - Skills - Behavioural regulation - Beliefs of capabilities 2. Feedback and support related component - Optimism - Environmental context and resources - Social influences - Beliefs about consequences 3. Action and impact related component - Beliefs about consequences - Social/professional role and identity - Intentions	1. Goals (patient safety and organisational improvement) 2. Intentions	Safety culture, effective, timely system changes in response to error review and analysis, simplified reporting process, timely feedback to reporter, training on reporting medication error

Table 6.1: Barriers and facilitators identified from the three research phases (some were both barriers and facilitators)

6.3.1 Intervention development

As described in the discussions of Chapters 4 and 5, multimodal interventions are required to promote behavioural change; a complex process that takes place over time at individual, population and organizational levels.

Evans et al reported the evaluation of an intervention aimed at improving voluntary incident reporting in hospitals.[94] The intervention was a package including intense education, a range of reporting options, changes in management and enhanced feedback. The study was conducted in Australia, with the design being a non-randomised controlled trial in ten intervention and ten control units across four hospitals. Intervention development was based on the findings of focus group research with doctors and surveys of doctors and nurses. The outcome measures were the changes in the reporting rates. Results demonstrated significant improvement in reporting rates in certain hospital areas (e.g. emergency departments) but there was considerable variation. Key limitations of the study are the lack of attention to any behavioural change theories in the development of the intervention and the focus on the number of reports rather than quality of reports. In addition, there was no attempt to measure the sustainability of the intervention.

In this doctoral research, many research participants of all professions and years of experience reported in the quantitative and qualitative phases their fears and worries of reporting. These in turn were linked to their beliefs of the consequences of reporting impacting their professional standing, inter and intraprofessional relationships and working, and their career progression. These issues are all complex and related to the culture within which the health professionals are working.

As discussed earlier, any intervention developed and implemented with the aim of enhancing medication error reporting would be classed as a 'complex intervention' as defined by the MRC.[29]

While the BCTs linked to the specific behavioural determinants were highlighted in Chapters 4 and 5, these are summarised in Table 6.2.

Table 6.2: BCTs mapped to TDF domains relating to medication error reporting[123]

TDF determinants	BCTs	Description of each BCT
Emotion	Reduce negative emotions	Advise on ways of reducing negative emotions to facilitate performance of the behaviour
	Emotional consequences	Provide information (e.g. written, verbal, visual) about emotional consequences of performing the behaviour
	Social support (emotional)	Advise on, arrange or provide emotional social support (e.g. colleagues, 'buddies' or staff) for performance of the behaviour"
Belief of consequences	Salience of consequences	Use methods specifically designed to emphasise the consequences of performing the behaviour with the aim of making them more memorable (goes beyond informing about consequences)
	Anticipated regret	Induce or raise awareness of expectations of future regret about performance of the unwanted behaviour
Social influences	Social comparison	Draw attention to others' performance to allow comparison with the person's own performance
	Social support (emotional)	Advise on, arrange or provide emotional social support (e.g. from colleagues, 'buddies' or staff) for performance of the behaviour
	Vicarious reinforcement	Prompt observation of the consequences (including rewards and punishments) for others when they perform the behaviour

The ideal intervention relating to medication error reporting should align to these BCTs, with elements of:

- reducing the emotions and beliefs of consequences by providing reassurance (written, verbal, visual) to health professionals that reporting is confidential and anonymous;
- highlighting that a 'fair blame' culture is operating at all levels of the organisation;
- providing emotional support and reassurance around reporting;
- highlighting key memorable patient cases of the benefits of reporting in terms of patient safety, health professional practice and the organisation;
- highlighting the missed opportunities to improve patient safety if reports are not submitted;
- highlighting the reporting behaviours of peers, seniors etc (anonymized);
- considering rewards for reporting (e.g. continuing professional development credits); and
- providing appropriate feedback to the reporter.

6.4 FURTHER RESEARCH

There are many potential future research studies which have emerged from this doctoral research. Further work now should focus on key priority areas which can lead to optimizing medication error reporting, impacting health professional practice and patient care. The following outlines key, prioritised research studies aligned to the MRC framework phases of feasibility and piloting interventions based on specific BCTs.

Study 1, Intervention development

Findings of the doctoral research in terms of the BCTs, should now be used to design and develop the intervention. This is a crucial phase in translating the findings into practice. One key factor is to ensure that the key stakeholders are represented in this, and indeed, all future stages. The key stakeholders will include representation from policy makers (in this case HAAD) and health profession leaders. It is, however, important to include practitioners at all levels of experience and patients. Other key stakeholder groups could include educators, academics and student health professionals. Those involved in managing the reporting system must also be involved as the intervention may involve in developing aspects such as reporting feedback. A snowball sampling approach could be utilised to identify the most appropriate individuals and all must consent to take part and commit to the design and development phases. An appropriately qualified individual should lead the design and development phases and while there are no specific research outcome measures, the approach should be as robust and rigorous as possible. This phase should be completed within a maximum of three months.

Study 2, feasibility testing

Following the design and development phase, the next is testing the feasibility of the intervention.

The aim of this stage is to explore health professionals' views of the intervention targeting the improvement of medication error reporting behaviours in UAE hospitals. A constructivist approach is the most appropriate, based on a qualitative, phenomenological methodology. While several different methods would be appropriate, the most appropriate is likely to be focus groups of to provide rich and in-depth discussion. Ideally the focus groups will be multidisciplinary with purposively sampled participants (i.e. those who are likely contribute most to data generation). It is important that those involved in phase 1 are excluded from participating in this phase. Focus group sampling and recruitment will continue to the point of data saturation.

Following transcribing and data analysis using the Framework Approach, in-depth views of the likely feasibility, practicability, benefits and drawbacks of the intervention will be described. These can then be used by intervention design and development group to reflect on the intervention, and improve if necessary.

Study 3, pilot testing

Prior to launching the intervention widely, it is essential to conduct a pilot study in selected clinical areas of medicine and surgery. This phase aims to test the effectiveness of the intervention on a small scale prior to wide scale implementation, while at the same time determining the likely effect sizes for a randomised controlled trial. A pragmatic, mixed methods approach will be employed. In the quantitative phase, a before and after study will determine the impact of the intervention on the quality and the quantity of medication error reports submitted, accepting the very high levels of bias associated with this approach. The quality of the reports can be assessed in terms of the completeness of the report and the depth of information provided on the events leading up to the error, the specific details of the error and the outcomes arising from the error. In addition to the quantitative phase, there will be a qualitative phase (similar to phase 2 but with different participants) of focus groups of purposively sampled health professionals who have experienced the intervention. This will provide further in-depth data on how the intervention actually worked in practice, any benefits and drawbacks.

Phase 4, randomised controlled trial

Following successful piloting, the intervention can be tested using a randomised controlled trial (RCT) to provide the highest levels of evidence of effectiveness of the intervention. Some of the most problematic issues in conducting the RCT are:

1. randomization. The randomization will have to be at the ward or unit level rather than the individual practitioner level given that practitioners work in multidisciplinary ward based teams. This does mean that there will be a cluster sampling approach and that any differences may be as a result of differences within the clusters (e.g. leadership in different wards etc.)
2. even with cluster randomization, there is a chance that the details of the intervention may spread throughout the hospital with an effect on the standard approach control group.
3. the leadership and management in the organisation may not support an RCT approach, favouring widespread implementation. This issue will have to be discussed and resolved, with the argument that only an RCT can provide the highest level of evidence of effectiveness.
4. probably the most difficult issue will be around determining the most appropriate outcome measures. The ultimate aim of the reporting system, as described in Chapter 1 is the promotion of safe care without harm. Valid and reliable outcome quantitative outcome measures of the absence of harm are problematic and cannot be easily derived from submitted medication error reports. Even with the ideal intervention, it is unlikely that there will be 100% adherence to any reporting policy, or to the developed intervention. It may be necessary to conduct a systematic review to answer the review question around the most valid, reliable, appropriate and feasible outcome measures.
5. the RCT needs to be adequately powered to determine an important difference.
6. embedded qualitative research should still be included to generate in-depth information as to why the intervention was effective or not.

6.5 IMPACT OF RESEARCH

Research Councils UK (RCUK) defines research impact as 'the demonstrable contribution that excellent research makes to society and the economy'. Impact from this doctoral research is described at the levels of the organisation, health professional and patient.

Organisation

By considering the behavioural determinants and the barriers (and facilitators) of medication error reporting, the organisation will benefit from reviewing the medication error reporting policies, structures and processes. Developing and delivering interventions in line with this research will result in more effective and efficient error reporting. In terms of the organisation, patient care and safety and professional practice will be improved leading to the attainment of key organisational goals. There will also be economic benefits from reduced patient harm leading to consequences such as reduced hospital stay. The overall safety culture of the organisation will be enhanced.

Health professional

The research will impact health professionals (doctors, nurses and pharmacist in the UAE). Key barriers (determinants of under-reporting) identified can be altered through theory derived interventions. Combined with the enhanced safety culture, health professionals can be more confident and less concerned over errors committed by themselves or others. Appropriate and rapid feedback from submitted reports should lead to changes in health professional education, training and practice. There is also opportunity for health professionals to be involved in research relating to patient safety with academic impact.

Patient

The most important impacts should be in terms of patient care and patient safety. Chapter 1 highlighted the scale of medication errors and the consequences of medication errors. There is potential for this research to translate into practice and real benefits for patients, as a direct result of optimizing medication error reporting.

Academic impact

In addition, this research has impacted academia through presentation of research findings at national and international conferences and publication in peer reviewed journals. Further publications are planned and the results will also be disseminated locally, within the UAE.

Overall impact

The overall impact of this research is that by using the results and findings to design, develop, feasibility test, pilot test, full scale test and implement on a wide scale an intervention which results in safer work practices with less harm to patients.

As highlighted in Chapter 1, key goals of NCCMERP are:

i. Stimulating the 'development and use of reporting and evaluation systems by individual health care organisations';

ii. Recommending strategies for system modifications, practice standards and guidelines;

iii. Heightening awareness of reporting systems available to or within health care organisations;

iv. Stimulating and encouraging reporting and sharing of medication errors both nationally and locally; and

v. Encouraging systems and providing targeted feedback so that appropriate prevention strategies can be developed and implemented in facilities.

Effective and efficient reporting systems are fundamental to each of these goals, hence this doctoral research has provided original findings which can act as a starting point in intervention development. Effective and efficient reporting systems will lead to:

- Staff working in environments where they can report without concern over the consequences to their careers and professional reputations;
- Rapid reporting following an error (the level of errors to be reported dictated by the reporting policy);
- Full details of errors reported to allow consideration of causes, influencing factors etc.;
- Appropriate response from the reporting organisation; and
- Appropriate changes to practice where necessary leading safer working making it less likely that the error will recur.

In terms of layered 'Swiss Cheese Model' described in Chapter 1, more effective and efficient reporting will lead to strengthening of the layers and reducing the flaws in each layer as a direct result of improvements to practice following reporting and feedback. In turn, it will then be less likely that flaws in the layers will align leading to less loss in terms of patient harm and safer care.

6.6 CONCLUSION

This doctoral research has generated original findings in relation to the medication error reporting literature. In conclusion, several key behavioural determinants impact medication error reporting and specifically under-reporting. Interventions to optimise the effectiveness and efficiency of error reporting should involve specific BCTs mapped to these determinants. Though many determinants were identified, the key determinants in both quantitative and qualitative research were around emotions, beliefs of consequences and social influences. Interventions are likely to take the form of provide training and education, positive reinforcement (fair blame culture), and reduce negative emotions (explaining that reporting medication error is an opportunity to improve the system and patient safety) as part of BCTs.

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APPENDICES

Appendix 1.1: Medication Error Reporting Policy, Health Authority, Abu Dhabi

Health Authority – Abu Dhabi		هـئيـــة الـصحة بأبوظبي
Division/Department/Section: **PHP/PHM**		**Reference Number: PHP/PHM/P0002/09**
Subject: Reporting Medication Errors.		**Issue Date**: **May 2009**
		Revision Date: May 2011
		Version: 1

1. PURPOSE

The purpose of the policy is to provide guidance for the health care professionals to take responsibility in medication error detection, reporting, evaluation, and prevention.

The policy also intends to delineate specific measures that should be adopted by healthcare providers for promoting the development and use of a continuous quality improvement (CQI) system to detect and document, evaluate, report, and prevent medication errors.

.2. POLICY STATEMENT

2.1 Health Authority Abu Dhabi (HAAD) mandates all health care providers to develop organizational policies and procedures for tracking, identifying, documenting and reporting medication errors to HAAD.

2.2 Medication errors (see appendix 1) originating in all stages of medication use process should be reported, especially which are during:

a) Writing of the prescription order
b) Filling the order in the pharmacy
c) Preparing the medication dose at the nursing station, or
d) Administering the medication at the patient's bedside.

2.3 Errors that have been detected and corrected through intervention by another health care professional or patient, before actual medication administration should also be reported.

2.4 Health care professionals should adopt the standard 'Medication Error Severity' categorization as detailed in Appendix 2 to document medication error severity in order to facilitate better management of follow up activities upon detection of the medication error.

2.5 Medication errors of severity level category G, H and I (see appendix 2) should be reported within 24 hours of identifying and documenting the error. All other errors (severity level category A to category F) should be reported on a monthly basis to HAAD.

2.6 Health care providers should continuously monitor actual and potential errors and investigate the root causes of errors to identify the ways of improving the medication use process to prevent future errors and patient harm.

2.7 Using the principles of formulary system, a 'Pharmacy and Therapeutic Committee' (or its equivalent) composed of physicians, pharmacists, nurses and other health care professionals should be established in all organized health care settings to be responsible for formulating policies regarding medication error prevention, evaluation and therapeutic use of drugs.

2.8 It is imperative for the institutional pharmacies and community pharmacies under common control or ownership to develop quality assurance programme aimed at monitoring, tracking and evaluating medication errors. The pharmacy should also develop and follow procedures designed to prevent recurrences and periodically submit medication error reports to HAAD as per the time frame outlined in the policy.

2.9 Any information related to the identity of the patient and/or the reporter of the ME will be protected to the fullest extent of law and will not be used in any way against him.

4. APPLICABILITY

The policy is applicable to all health care providers (private and public) in the Emirate of Abu Dhabi.

5. RESPONSIBILITY

It is the responsibility of all health care professionals and health facility management to comply with the requirements of the policy.

HAAD to monitor the compliance of ME reporting by health care providers through regular audit and inspection visits.

6. PROCEDURE

3.1 The HAAD Pharmacovigilance Center will oversee the reporting of all medication errors within the Emirate of Abu Dhabi.

3.2 All reporting should be made in the ME reporting form. (see Appendix 3). The ME reporting form is made available by HAAD to all health care facilities (private and public) in the Emirate of Abu Dhabi. It is the responsibility of the health care facility management to ensure the availability of the concerned ME forms in their facilities. The reporting form can also be accessed electronically via http://www.health.ae/pdic, and is also available from HAAD Pharma/ Medicines and Medical Products Department.

3.3 Applicable sections of the ME reporting form should be filled in as complete as possible. A separate form should be used for each patient and additional pages may be attached if more space is required. If more than one patient was affected by the same medication error, multiple reports for the same incident must be completed and submitted.

3.4 The completed ME reporting form may be submitted directly to HAAD Pharmacovigilance centre or forwarded electronically via email or by fax (Please see contact information below). HAAD will acknowledge the receipt of medication error reports by fax and / or email. Any follow up for an already reported ME case should be made by mentioning the unique 'report number' provided in the acknowledgement letter.

3.5 The Pharmacovigilance Center will perform in-depth analysis of the individual reports with the goal of identifying common causal factors. Based on the findings, HAAD will develop an established mechanism for tracking and identifying drugs or drug class that are commonly involved in medication errors.

3.6 Related facts that will be determined and documented by the Pharmacovigilance Center include what happened, where the incident occurred, why the incident occurred, how the incident occurred and who was involved. Correlation between errors and the current drug prescribing, filling, dispensing, administering and distribution practices (unit dose, floor stock, or bulk medications; premixed or extemporaneously compounded products; and oral or injectable products) etc. will also be reviewed.

3.7 Regulatory agencies and manufacturers are notified of needed changes in products when safety is of concern. If necessary, appropriate product evidence (packaging and labeling) will be retrieved and retained for future reference.

3.8 HAAD will also propose corrective measures on organizational system changes and individual practice changes, as necessary, to prevent medication errors in future. It will also collaborate with health care facilities to develop and implement best practices / non punitive actions and regulations that are aimed to promote patient safety and medication error reduction.

3.9 For more information on ME reporting, additional copies of ME reporting forms or to report a ME, health care providers, professionals and patients are invited to contact the following address through any of their preferred means:

Health Authority Abu Dhabi Pharma /Medicines and Medical Products Department.
Pharmacovigilance Center.Phone: 02 4193 586, 348, 580.
Fax: 02 449 6679
Email:pv@haad.ae.

4. DEFINITION AND ABBREVIATIONS

HAAD	Health Authority Abu Dhabi.
ME	Medication Error
Medication Error	A Medication Error is defined as any preventable event that may cause or lead to inappropriate medication use or patient harm, while the medication is in the control of 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.
Potential Error	Errors that have been detected and corrected through intervention by another health care professional or patient, before actual medication administration.
Non punitive actions	Non punitive action means there will be no disciplinary action taken against an employee for a medication error that is reported as per the time frame outlined in the policy. Under this policy, nothing will be placed in the employees' permanent employee record or used during the performance appraisal process. Continuing education, remedial training or an individualized action plan is not considered punitive or disciplinary action. Any information gathered through audits of medical records, intentional acts by the employee, (ie not an "error" or not the result of "negligence"), wrongful / unlawful consumption of medications / controlled substances by the employee making the error, employees who knowingly fail to report a medication error are considered exceptions to Non punitive actions.

Appendix 3.1: Appraisal instruments

QARI appraisal instrument

JBI QARI Critical Appraisal Checklist for Interpretive & Critical Research

Reviewer _____ Date _____

Author _____ Year _____ Record Number _____

	Yes	No	Unclear	Not Applicable
1. Is there congruity between the stated philosophical perspective and the research methodology?	☐	☐	☐	☐
2. Is there congruity between the research methodology and the research question or objectives?	☐	☐	☐	☐
3. Is there congruity between the research methodology and the methods used to collect data?	☐	☐	☐	☐
4. Is there congruity between the research methodology and the representation and analysis of data?	☐	☐	☐	☐
5. Is there congruity between the research methodology and the interpretation of results?	☐	☐	☐	☐
6. Is there a statement locating the researcher culturally or theoretically?	☐	☐	☐	☐
7. Is the influence of the researcher on the research, and vice- versa, addressed?	☐	☐	☐	☐
8. Are participants, and their voices, adequately represented?	☐	☐	☐	☐
9. Is the research ethical according to current criteria or, for recent studies, and is there evidence of ethical approval by an appropriate body?	☐	☐	☐	☐
10. Do the conclusions drawn in the research report flow from the analysis, or interpretation, of the data?	☐	☐	☐	☐

Overall appraisal: ☐ Include ☐ Exclude ☐ Seek further info. ☐

Comments (Including reason for exclusion)

_____

_____

_____

MAStARI Appraisal instrument

JBI Critical Appraisal Checklist for Descriptive / Case Series

Reviewer _____ Date _____

Author _____ Year _____ Record Number _____

	Yes	No	Unclear	Not Applicable
1. Was study based on a random or pseudo-random sample?	☐	☐	☐	☐
2. Were the criteria for inclusion in the sample clearly defined?	☐	☐	☐	☐
3. Were confounding factors identified and strategies to deal with them stated?	☐	☐	☐	☐
4. Were outcomes assessed using objective criteria?	☐	☐	☐	☐
5. If comparisons are being made, was there sufficient descriptions of the groups?	☐	☐	☐	☐
6. Was follow up carried out over a sufficient time period?	☐	☐	☐	☐
7. Were the outcomes of people who withdrew described and included in the analysis?	☐	☐	☐	☐
8. Were outcomes measured in a reliable way?	☐	☐	☐	☐
9. Was appropriate statistical analysis used?	☐	☐	☐	☐

Overall appraisal: Include ☐ Exclude ☐ Seek further info ☐

Comments (Including reason for exclusion)

Appendix 3.2: Data extraction instruments

QARI data extraction instrument

JBI QARI Data Extraction Form for Interpretive & Critical Research

Reviewer _____ Date _____

Author _____ Year _____

Journal _____ Record Number _____

Study Description

Methodology

Method

Phenomena of interest

Setting

Geographical

Cultural

Participants

Data analysis

Authors Conclusions

Comments

Complete Yes ☐ No ☐

Findings	Illustration from Publication (page number)	Evidence		
		Unequivocal	Credible	Unsupported

Extraction of findings complete Yes ☐ No ☐

MAStARI data extraction instrument

JBI Data Extraction Form for Experimental / Observational Studies

Reviewer _____ Date _____

Author _____ Year _____

Journal _____ Record Number _____

Study Method

RCT ☐ Quasi-RCT ☐ Longitudinal ☐

Retrospective ☐ Observational ☐ Other ☐

Participants

Setting

Population

Sample size

Group A _____ Group B _____

Interventions

Intervention A

Intervention B

Authors Conclusions:

Reviewers Conclusions:

Appendix 4.1: The ethical review panel of the School of Pharmacy and Life Sciences at Robert Gordon University- Phase 2 & 3

ROBERT GORDON UNIVERSITY ABERDEEN

School of Pharmacy and Life Sciences Research Ethics Committee

COMPLETED **24 March 2014**

Research Student Name	Mai Alqubaisi
Principal Supervisor	Professor Alison Strath
Research Project Title	Exploring medication error reporting in the United Arab Emirates

Dear Mai,

We have reviewed your ethics application (Title above).The panel recommends that it is of sufficient standard for you to proceed. We wish you well in your researches.

If there are any questions please do not hesitate to get in touch.

Regards

Dr Lesley Diack
Chair of the School Ethics Review Panel

Appendix 4.2: Ethics and Research Committee in Al Mafraq Hospital

مستشفى المفرق
Mafraq Hospital

30 June 2014

Ms. **Mai Al Qubaisi**
Institute for Health & Welfare Research (IHWR)
Robert Gordon University

Administrative Approval:

Exploring medication error reporting in the United Arab Emirates: examining the attitudes, beliefs, behaviors and experiences of health care professionals

Dear Ms. **Mai,**

Please be informed that your proposal was approved, and there are no ethical concerns of the project.

Regards,

د. مصطفى المعيني
نائب مدير دائرة الشؤون الطبية
Dr.Mustafa Al Maini
Deputy Chief Medical Officer

Dr. Mustafa Al-Maini
Deputy Chief Medical Officer
Chairman of Research Ethics Committee
Mafraq Hospital

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P.O.Box 2951,Abu Dhabi - United Arab Emirates Tel:+971 2 501 1111,5823100 Fax:+971 2 582 1549

Appendix 4.3: Ethic and Research Committee in Zayed Hospital

MEDICAL SERVICES CORP

NOTIFICATION OF APPROVAL OF A PROPOSED RESEARCH STUDY

Date: 19/6/2014.

To: Dr Mai AlQubaisi

study titled: Exploring medication error reporting in UAE: examining the attitudes, beliefs, behaviors & experience of health care professionals.

Study reference number : 2014.06

The Committee has given a favorable ethical opinion for the above project based on the application form, protocol and supporting documentation that comply with the conditions and principles established by (ICH GCP) according to HAAD regulations

Yours Sincerely

Asma Al Nuaimi Consultant

Dr Asma Ali Al Nuaimi
Ethical Committee Chair

Dr Sherine Naser .
Ethical committee co chair

On receiving this notification please sign below and return the original copy to the Ethics Committee and keep a copy for your records.

I Dr: MAI ALQUBAISI (primary researcher) hereby accept and agree to the Ethical Committees.

decision and I confirm that I will abide with all specific instructions as requested by the

Ethics Committee and according to

Signed: _____ Date: 30/06/2014

Appendix 4.4: Al Ain Medical District Human Research Ethics Committee in Tawam Hospital

UAEU College of Medicine and Health Sciences

جامعة الإمارات العربية المتحدة
United Arab Emirates University

2nd July, 2014

Ms Mai Al Qubaisi
Zayed Military Hospital
Al Ain, UAE

Dear Dr. Mai,

Re: Al Ain Medical District Human Research Ethics Committee - Protocol No. 14/64 (CRD 345/14)- Exploring medication error reporting in the United Arab Emirates: examining the attitudes, beliefs, behaviors and experiences of health care professionals.

Thank you very much for submitting your application to the Ethics Committee.

Your submitted documents were reviewed by the committee and I am pleased to provide you ethical approval of your project with the following conditions:

1. Audio files collected from participants need to be preserved on a CD and may be audited by the Ethics Committee in granting permission as an exception to the rule.
2. Provide approval letters of other UAE Ethics Committees.

May I reiterate, should there be any ethical concern arising from the study in due course the Committee should be informed.

Annual reports plus a terminal report are necessary and the Committee would appreciate receiving copies of abstracts and publications should they arise.

I wish to take this opportunity to wish you success with this important study.

This Ethics Committee is an approved organization of Federal Wide Assurance (FWA) and compliant with ICH/GCP standards.

With kind regards,

Yours sincerely,

Fawaz Chith Tor

Dr. Fawaz Torab

Chair, Al Ain Medical District Human Research Ethics Committee

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www.cmhs.uaeu.ac.ae

Appendix 4.5: Email Invitation

Dear Health Care Professionals,

You have been selected to participate in a survey conducted by research student Mai Alqubaisi, from Robert Gordon University, funded by UAE government. The survey is about "Exploring medication error reporting in the United Arab Emirates: Examining the attitudes, beliefs, behaviours and experiences of health care professionals". It is short and should take you only 5-7 minutes to complete. All of your answers will be kept strictly confidential and will be used only for legitimate research purposes. Your valuable participation will contribute towards identifying health care professionals' perceptions of any facilitators and barriers towards medication error reporting, and to explore health care professionals' perceptions of change to optimize medication error reporting.

To take the Survey, click on this link:

http://www.rgu.ac.uk/medical-errors-uae .

Thank you for your participation!

Sincerely,

Mai Alqubaisi, MPharm
PhD Student
Institute for Health & Welfare Research (IHWR)
Riverside East, Robert Gordon University
Garthdee Road, Aberdeen
AB10 7GJ

Appendix 4.6 – Participant information

Exploring medication error reporting in the United Arab Emirates: Examining the attitudes, beliefs, behaviours and experiences of health care professionals.

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

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

What is the purpose of the study?

The aim of the research is to explore the attitudes, beliefs, behaviours and experiences of health care professionals in the UAE on reporting of medication errors.

Study aim

This research aims to investigate the attitudes and beliefs of health care professionals towards medication error reporting, explore the behaviours and experiences of health care professionals in medication error reporting, describe health care professionals' perceptions of any facilitators and barriers towards medication error reporting, and to explore health care professionals' perceptions of change to optimize medication error reporting.

A researcher (Mai Alqubaisi) from the UAE and former employee at Zayed hospital will carry out the study. Mai is currently studying at Robert Gordon University and this work will form part of a submission towards a Doctor of Philosophy qualification from Robert Gordon University.The student is supported by a team of experienced RGU academics, the principal supervisor Professor Derek Stewar thas vast experience in researching the area of medication errors; Professor Alison Strath has strategic and policy development expertise;; Dr Antonella Tonna has expertise in secondary care practice and associated research; and Dr Shereen Nasr, Head of Quality Department in at Zayed Military Hospital, UAE, has a key role in medication error reporting and associated research.

Why have I been chosen?

You have been chosen because you are a doctor, nurse, pharmacist working in hospital practice in Abu Dhabi in the UAE. You therefore have experience in relation to strategic and operational approaches around medication error reporting in public or private hospitals in Abu Dhabi.

Do I have to take part?

No. It is up to you to decide whether or not to take part. If you do, you will be given this information sheet to keep and be asked to sign an informed consent form. You are still free to withdraw at any time and without giving a reason. A decision to withdraw at any time, or a decision not to take part, will not affect any way your employment with Health Authority of Abu Dhabi (HAAD).

What will happen to me if I take part?

If you interested, you will be invited to complete an online questionnaires with one reminder email. For each questionnaire you will be asked to rate your level of agreement or disagreement with statements around attitudes and beliefs, facilitators and barriersof medication error reporting in respect to healthcare professional in the UAE. When the questionnaire will be completed you will be invited to take a part in phase two of this research with face to face interview for further explanation round behaviours, experiences and potential for changes to optimize reporting medication error in UAE.

All information provided during the questionnaire and interview will be anonymous and confidential. Your name will not appear on the questionnaire or any report of the research. This information may be used anonymously in any publication or presentation of the study results.

What do I have to do?

If you decide to take part in the study, you will be asked to sign an informed consent form and to take part in the interview as described above.

What are the possible benefits of taking part?

There are no direct benefits to you by taking part in the study. However, your participation may assist in the future development of medication error reporting in hospitals practice in United Arab Emirates.

Any complaint about the way you have been dealt with during the study will be addressed. If you have any complaints or would like further information about the study please contact:
Professor Derek Stewart
School of Pharmacy & Life Sciences
Robert Gordon University
Aberdeen
AB10 7QJ
Scotland
+44 (0)1224 262432
a.strath@rgu.ac.uk

Will my taking part in the study be kept confidential?

Yes. All the information about your participation in this study will be kept confidential. Any data relating to your participation will be stored securely at all times and can only be accessed by the researcher.

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

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

RESEARCH TEAM

Robert Gordon University (RGU):
Mai Alqubaisi
Professor Derek Stewart
Professor Alison Strath
Dr AntonellaTonna (Supervisor)
United Arab Emirates (UAE):
Dr Shereen Nasr (Head of Quality Department, at Zayed Military Hospital)

Appendix 5.1 – participant consent form

Exploring medication error reporting in the United Arab Emirates: Examining the attitudes, beliefs, behaviours and experiences of health care professionals

Researcher
Mai Alqubaisi
PhD Student
Robert Gordon University
UK
E-mail: m.m.alqubaisi@rgu.ac.uk
Participant Study Number.....

	Please INITIAL box
I confirm that I have read and understand the information sheet for the above study and have had the opportunity to ask questions.	☐
I understand that my participation is voluntary and that I am free to withdraw at any time, without giving reason.	☐
I agree to take part in the above study.	☐
I agree to the interview being audio recorded.	☐
I agree to the use of anonymised quotes in publications.	☐

_____	_____	_____
Name of Participant	Date	Signature

_____	_____	_____
Name of Researcher	Date	Signature

Appendix 5.2: Request to complete an online sampling survey providing demographic information for interviewee

If you are interesting in possibly taking part in an interview, please click here. You will be taken to a separate sheet which cannot be linked to your questionnaire responses in any way. Please complete the following

Name _____

Email contact _____

Phone contact _____

We will use these details to contact you

Please complete the following. If we receive many responses, we will use these data to select those for interview

Your profession is

□Doctor

□Nurse

□Pharmacist

You have been registered as a health professional for

□<6 years □6-10 years □11-15 years □16-20 years

□>20 years

Appendix 5.3: Semi-structured interview schedule

Exploring medication error reporting in the United Arab Emirates: Examining the attitudes, beliefs, behaviours and experiences of health care professionals

Participant Number:

Date:

Start time:

Introduction

Hello, thanks for agreeing to be interviewed for this project. Please, can I check you have read the participant information sheet?
If not, here is a copy to read before we begin.

The main purpose of this interview is to find out your views, experiences and perceptions of medication error reporting in the United Arab Emirates (UAE).

Your participation is voluntary and you may withdraw at any point. If you do not want to answer a specific question, then please let me know. There is no right or wrong answers and I am interested in your personal opinions. Your identity will remain strictly confidential and it will not be possible to identify individuals from the study results.

The interview should take approximately 30 to 45 minutes. Are you ok to go ahead?

IF NO: That's okay. When would be more convenient? Thanks I'll see you on day/date/time at .....location. Bye. Write the new day/date/time here and in the diary chart:
IF YES continue: That's great, thank you.

Recording: As you are aware from the information sheet and consent form, this conversation is being audio recorded but I would emphasise that it is confidential. Please do not use names of patients or hospital staff during this interview. It is ok to refer to "a patient", "another doctor", "a nurse", "a pharmacist" etc. Are you still OK with that?

IF NO: That's fine. I'll need a bit more time to write down notes as we go through the sections and I may ask you to repeat some answers so I don't miss anything.
Reminders

- Take time to write detailed notes
- If in doubt, ask the interviewee for clarification before you move on to the next section

Note: If you decide after the interview you no longer wish to be a part of the research, please let me know. The contact details are on the information sheet.

Can I start by asking you about your thoughts on the aims/purpose of the reporting system?

Can you tell me about the safety of reporting medication error in the hospital culture?

No-blame culture, negative feedback, encouragement

What is your experience of the incident /medication error reporting system?

Definition, recognition of error

Why/why not report

When report

What reported

Reporting process – ease, time, memory,

do you have sufficient time and resources

Expectations

Concerns – fear, blame, competence etc

Feedback

Differences to them, profession, organisation

What are your thoughts on the good points of the system?

Consider patients, them, profession, other professions, organisation

Why

Describe

What about negative points

Consider patients, them, profession, other professions, organisation

Why

Describe

How you handle it

Is there any what in which the system could be improved?

Consider patients, them, profession, other professions, organisation

Why

How

Anything else you would like to add?

Well that's all of my questions. You've been very helpful and I appreciate you taking the time to speak to me. If you think of anything else you would like to add, please get in touch. Thank you very much. Goodbye!

Interview concluded at:00:00