

**An investigation into the learning and clinical reasoning
processes of independent prescribers**

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Abbreviations

AHCP	Allied Health Care Professionals
BEME	Best Evidence Medical and health professional Education
CD	Controlled Drug
CMP	Clinical Management Plan
CPD	Continuing Professional Development
DMP	Designated Medical Practitioner
DoH	Department of Health
GP	General Practitioner
GPhC	General Pharmaceutical Council
GSL	General Sales List
HEI	Higher Education Institute
IPT	Information Processing Theory
MAI	Medication Appropriateness Index
MDT	Multi-Disciplinary Team
MPharm	Master of Pharmacy
NHS	National Health Service
NMC	Nurse and Midwifery Council
NMP	Non-medical prescriber
NPC	National Prescribing Centre
NPC Plus	National Prescribing Centre Plus
NPEF	Nurse Prescribers' Extended Formulary
NPF	Nurse Prescribers' Formulary
P	P medicine
PLP	Period of Learning in Practice
POM	Prescription Only Medicine
RPS	Royal Pharmaceutical Society
UK	United Kingdom
UREC	University Research and Ethics Committee

Abstract

The prescribing rights of non-medical healthcare professionals in the United Kingdom (UK) are some of the most extensive in western medical practice. Nurses, pharmacists, physiotherapists, optometrists, chiropractors, podiatrists, therapeutic and diagnostic radiographers and dieticians, with appropriate training have the authority to prescribe. They are often referred to as non-medical prescribers (NMPs). These non-medical healthcare professionals should have a specified number of years of post-registration experience in order to undertake specific training in prescribing. There has been a limited amount of research exploring how non-medical healthcare professionals acquire their expertise during the prescribing programme. In addition, there is a gap in the literature on how NMPs apply their acquired expertise during the process of making clinical prescribing decisions.

A programme of research was conducted to explore the learning processes and decision-making skills of pharmacist and nurse independent prescribers working in secondary care. The research used current literature on pharmacist and nurse independent prescribing by conducting a systematic review to assess how their expertise development is reported in the literature. In addition, the learning experiences of secondary care pharmacists and nurses undertaking the independent prescribing programme was explored by employing a novel audio-diary technique followed by semi-structured interviews on 7 nurses and 6 pharmacists. Students were mainly recruited via their non-medical prescribing programme leaders at a number of accredited universities across the UK. There was little opportunity in this study to explore the clinical reasoning processes of students as they were learning to prescribe. Therefore, the final study aimed to explore how secondary care pharmacist and nurse independent prescribers make clinical prescribing decisions. A total of 21 independent prescribers working in secondary care took part in this study, mainly recruited via their non-medical prescribing lead and social media. This study employed a think-aloud protocol method using validated clinical vignettes followed by semi-structured interviews. Students and NMPs occupied a wide range of roles. Ethical approval from the University of Manchester Research Ethics Committee (UREC) and governance approvals from a number of National Health Service (NHS) hospitals were obtained before conducting the research.

NMPs were influenced by a number of intrinsic and extrinsic factors during the process of learning to prescribe and when making prescribing decisions. Students also experienced an affective phase of transition in which students became highly metacognitive as they began to form their identities as prescribers and reflect on their confidence and competence. There were notable differences between how pharmacists and nurses learned to prescribe, which were also seen during the process of clinical decision-making as independent prescribers. Despite this, pharmacists and nurses revealed a similar pattern in their decision-making processes as prescribers. Findings from this programme of research provide further insight into the specific training and support requirements of these healthcare professionals. Additional research with NMPs would be beneficial to contribute to the currently limited understanding of the learning and clinical reasoning processes of NMPs.

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To the end of the beginning.

Chapter One – Introduction

The purpose of this chapter is to introduce the topic of this programme of research and provide an outline of the organisation of this thesis.

1.1 Introduction

Prescribing is the most common intervention in the NHS, accounting for £14.4 billion in 2013/2014 of the overall NHS expenditure. ^[1] Moreover, prescribing is influenced by a vast array of factors, rendering the task of prescribing complex and error prone. ^[2, 3] It is, therefore, not surprising that there is a plethora of research focusing on the influences, clinical reasoning processes and impact of medical prescribing practice.

The extension of prescribing rights to a number of non-medical healthcare professionals since 1992 in the UK aimed to improve patient care and make better use of the skills of healthcare professionals. ^[4] There are currently an estimated 44,629 NMPs in England prescribing medications to the estimated value of approximately £224.5 million per month. ^[5, 6]

Research on non-medical prescribing has focused on evaluating services, contributing factors and barriers to implementing non-medical prescribing. ^[7, 8] This has also included research on the views of patients and stakeholders of non-medical prescribing. ^[9-11] In addition, the knowledge and experience of NMPs has been reported to enable or disable their prescribing practices. ^[12, 13] Despite such reports, very little recent research has focused on how NMPs acquire their knowledge and skills to develop their expertise when becoming a prescriber. In addition, no research has explored how NMPs use their expertise when making clinical prescribing decisions.

With the increasing numbers of NMPs taking on more roles in healthcare settings, it is important to understand how they acquire and apply their expertise using a

framework that addresses the complexities of prescribing. Such research will contribute to the currently limited understanding of how experienced healthcare professionals who become NMPs acquire their expertise and make clinical prescribing decisions. Further knowledge of this will provide further insight into the unique training needs and support requirements of these healthcare professionals.

1.2 Organisation of Thesis

Chapter Two provides the necessary background information about non-medical prescribing, a description of the current literature in the area of educational preparation of NMPs and the theoretical framework informing this programme of research. The end of the chapter outlines the current gap in knowledge that this programme seeks to address.

Chapter Three provides a rationale for the format of this thesis and an overview of the entire programme of research, which consists of three studies.

Chapter Four provides a rationale for the overall approach taken for this programme of research and a description of the methods employed in each study. Methodological issues and ethical considerations in this programme of research are also discussed.

Chapter Five, Six, Seven and Eight are written in the style of a journal article.

Chapter Five presents Study One, which is a qualitative systematic review assessing factors underpinning expertise development reported in literature on NMPs using the theoretical framework informing this programme of research.

Chapter Six presents Study Two which investigates how pharmacists and nurses working in secondary care learn and transition to become independent prescribers whilst undertaking the independent prescribing programme.

Chapter Seven and Eight present Study Three, which is split as Study Three (a) and Study Three (b). Study Three (a) explores how pharmacist and nurse independent

prescribers working in secondary care make clinical decisions. Study Three (b) explores the factors influencing pharmacist and nurse independent prescribers working in secondary care when clinically reasoning to reach a clinical decision.

Chapter Nine draws the programme of research to a conclusion. It summarises the key findings from each study in this programme of research, outlines the key strengths and limitations and discusses the contribution of findings to the literature. This chapter also outlines the implication of the findings for policy and suggests areas for further research.

Chapter Two – Background

The purpose of this chapter is to provide the necessary background information about non-medical prescribing, provide a description and critique of the current literature in the area of educational preparation of NMPs and state the current gap in knowledge that this programme seeks to address.

2.1 Background to Non-Medical Prescribing

The purpose of Section 2.1 of this chapter is to provide a historical account of non-medical prescribing in the UK, outline the training requirements for entry into the prescribing programme and provide a description of the competency framework used in prescribing.

2.1.1 Implementation of Non-Medical Prescribing

2.1.1.1 Prescribing for Community Nurses (Crown Report I)

In 1986, the Cumberlege report made recommendations for community nurses to take on the role of prescribing for a limited number of items such as wound dressings and ointments.^[14] Community nurses included nurses who held a district nurse or health visitor qualification. The report stated that the care provided by district nurses and health visitors to patients could be improved by ensuring that no time was wasted by nurses requesting prescriptions from general practitioners (GP). Following the publication of this report, an advisory group was set by the Department of Health (DoH) to examine nurse prescribing, resulting in the Crown Report.^[15] The Crown Report aimed to legitimise current practice where nurses were writing prescriptions and asking doctors to sign them. The Crown Report also recommended that suitably qualified community nurses should be able to prescribe a limited number of items.

In 1992, legislation for district nurses and health visitors to prescribe from a limited range of items was passed. By 1994, a national Nurse Prescribers' Formulary (NPF) was established for nurses to prescribe from. This was first piloted in eight demonstration sites in England which were evaluated and deemed a success.^[16] In 1998, all suitably trained district nurses and health visitors could prescribe from the NPF across the UK. Since 2005, district nurses and health visitors are now referred to as community practitioners. The community practitioner NPF contains 13 prescription-only medicines (POMs), some pharmacy (P) and general sales list (GSL) medicines, including a list of dressings and appliances relevant to their practice. All newly qualified community practitioners are entitled to undertake training, depending on the clinical need, to qualify them to prescribe from the NPF. This is because the prescribers' training programme had become integrated into the specialist practitioner programme for community practitioners.^[17]

2.1.1.2 Prescribing for other Healthcare Professionals (Crown Report II)

During the same time as legislative changes were occurring for community practitioners, Dr June Crown was appointed to chair a separate advisory group. The Crown Report II was a review published in two parts. The first, appraising the supply of medicines by healthcare professionals under group protocols and the second was a recommendation to extend prescribing rights to other healthcare professionals. The publication of the final Crown report led to several legislative changes allowing non-medical professionals such as nurses, pharmacists, physiotherapists, chiropodists, podiatrists, radiographers and optometrists to prescribe.^[18]

2.1.1.2.1 Patient Group Directions (Crown Report II – Part 1: 1998)

The second Crown Report, part 1, issued formal guidance on the supply and administration of medicines by nurses and other healthcare professionals under group protocols. This was because the legal position under which medicines were supplied or administered under group protocols in practice had become uncertain and was subsequently called into question. The Medicines Act 1968 states that, the supply and administration of medicines should be “in accordance with the directions of a doctor”,^[19] which could be applied under patient-specific protocols. The report

suggests that in order to avoid breaching the Medicines Act for group protocols, minimum discretion should be left to the healthcare professional involved. ^[20] This sets a specific guideline and criteria to ensure that patient safety is not put at risk and to ensure that practice is within the Medicines Act.

2.1.1.2.2 Independent and Dependent Prescribing (Crown Report II – Part 2: 1999)

The second and final Crown Report recommended that the role of prescribing in specific clinical areas be extended to other healthcare professionals through two types of prescribing models referred to as dependent and independent prescribing. The aim of introducing these prescribing models within multi-disciplinary teams (MDT) was to improve patient access to medicines and reduce doctors' workload by utilising the skills of non-medical healthcare professionals. ^[4, 21]

The implementation of the Crown Report began with the DoH introducing a wider formulary for nurse prescribing in 2002, referred to as the Nurse Prescribers' Extended Formulary (NPEF). This type of prescribing was referred to as Extended Nurse Prescribing. Registered nurses or midwives who had successfully completed the specific programme of training for extended formulary nurse prescribing were able to prescribe. ^[21] This formulary was initially limited. However, by May 2005, the formulary had included 240 POMs, including all P and GSL medicines that GPs are allowed to prescribe for certain medical conditions. ^[4]

In April 2003, the government authorised registered nurses, midwives and pharmacists with appropriate training to prescribe as supplementary prescribers (previously referred to as dependent prescribers). ^[22] Later that year, informal consultation meetings took place proposing the extension of supplementary prescribing to chiropodists, podiatrists, physiotherapists, radiographers and optometrists. Supplementary prescribing is “a voluntary partnership between an independent prescriber (a doctor or dentist) and a supplementary prescriber to implement an agreed patient-specific Clinical Management Plan (CMP) with the patient's agreement”. ^[22] This is a form of dependent prescribing where the

supplementary prescriber is responsible for the continued care of a patient after they have been clinically assessed by a doctor or dentist. By April 2005, Allied Healthcare Professionals (AHCP) such as chiropodists, podiatrists, physiotherapists and radiographers (therapeutic and diagnostic) became eligible to train as supplementary prescribers. In the late summer of 2005, optometrists were permitted to train and register as supplementary prescribers. More recently, in 2016, dieticians have also been able to train and register as supplementary prescribers.^[23] Supplementary prescribing allows the prescriber to prescribe and alter medicines within an agreed CMP. There is, therefore, no restriction on drug classes prescribed within the CMP.

In contrast, an independent prescriber is responsible for the clinical assessment of diagnosed or undiagnosed patients, including their CMP and prescribing authority.^[22] As mentioned above, nurse extended prescribing is a form of independent prescribing from a limited formulary. In May 2006, independent prescribing rights were extended to pharmacists.^[4] This meant that both pharmacist and nurse independent prescribers could prescribe any licensed medicine for any medical condition, within their competence. Further changes in December 2009 allowed pharmacist and nurse independent prescribers to prescribe unlicensed medicines.^[24, 25] Recent changes to the Misuse of Drugs Regulations 2001 now allows pharmacist and nurse independent prescribers to prescribe any controlled drug (CD) listed in schedule 2-5 except diamorphine, cocaine and dipipanone for the treatment of addiction.^[26]

Independent prescribing rights were also extended to optometrists in 2008.^[27] In 2013, independent prescribing rights were extended to physiotherapists, chiropodists and podiatrists, and to therapeutic radiographers in 2016.^[23] However, unlike pharmacist and nurse independent prescribers, optometrist independent prescribers cannot prescribe for any medical condition or any CD.^[28] They may only prescribe licensed medicines for ocular conditions affecting the eye and surrounding tissue. Chiropodists and podiatrist independent prescribers may prescribe any licensed medicine for any condition within their competence; however, it must be relevant to the treatment of foot, ankle and associated structures disorders. They may also

prescribe from a specified list of CD. This is also very similar to the rights of physiotherapist independent prescribers who can prescribe any licensed medicine within their competence and within the framework of human movement, performance and function. Physiotherapist independent prescribers also have a specified list of CDs they may prescribe from. ^[29] Therapeutic radiographer independent prescribers may prescribe any medicine for any condition within their area of expertise and competence, within the framework of cancer treatments. ^[23]

Figure 1.0 below is a summary timeline of the implementation of non-medical prescribing in the UK. This timeline has been updated from Maddox's timeline (p. 24). ^[3]

Date	Nurses and Midwives	Pharmacists	Allied Healthcare Professionals	Optometrists
1986	Cumberlege Report			
1989	Crown Report I – Community Nurse Prescribing			
1994	Community nurses (district nurses and health visitors) with appropriate qualification able to prescribe from Nurse Prescribers Formulary in 8 demonstration sites			
1996	Community nurse prescribing extended to further sites			
1998	Crown Report II, Part I – Patient Group Directions			
December 1998	Community nurse prescribing extended to all parts of the UK			
1999	Crown Report II, Part 2 – Independent and Dependent Prescribing			
2002	Extended nurse prescribing introduced from Nurse Prescribers' Extended Formulary			
April 2003	Supplementary prescribing introduced (previously termed as dependent prescribing)			
April 2005			Supplementary prescribing introduced	
July 2005				Supplementary prescribing introduced
May 2006	Independent prescribing introduced			
June 2008				Independent prescribing introduced (for ocular conditions)

December 2009	Independent prescribers authorised to prescribe unlicensed medicines			
April 2012	Independent prescribers authorised to prescribe any controlled drug from schedule 2-5 except diamorphine, cocaine and dipipanone for the treatment of addiction			
August 2013			Independent prescribing introduced for physiotherapists, chiropodists and podiatrists (for certain conditions only)	
February 2016			Independent prescribing introduced for dieticians and therapeutic radiographers (for certain conditions only)	

Figure 1.0 An Updated Summary Timeline of the Implementation of Non-Medical Prescribing in the UK ^[3]

2.1.2 University Entry Requirements and Training

In order to enter the prescribing programme, eligible healthcare professions must identify an area of clinical practice (specialty) to develop their prescribing skills. ^[30]

Those wanting to prescribe a broad range of medicines are still required to pick an area of specialty during the programme, but can prescribe a broad range of medicines within their competence after qualifying.

In order for registered nurses and midwives to prescribe from the NPEF, they had to have 3 years post-registration clinical nursing experience to enter the training programme. The training programme, at the time, comprised 25 days taught curricula and 12 days of a period of learning in practice (PLP) with a designated medical practitioner (DMP). The DMP ensures that agreed learning outcomes are met and the student has acquired the appropriate competencies set by the National Prescribing Centre (NPC) to be signed off. ^[31] This will be discussed further in Section 2.1.3.

Upon the implementation of the final Crown Report, an additional day of teaching was incorporated into the Extended Nurse Prescribers' training programme to allow

them to prescribe independently from the NPF *and* become supplementary prescribers.^[22] Nurses who were already qualified as Extended Nurse Prescribers' could attend a one to two day conversion course to become supplementary prescribers.

In order for pharmacists and AHCPs to enter the supplementary prescribing programme, they must have at least 2 and 3 years post-registration experience respectively.^[22, 23] They must also have the ability to study at a degree level. Supplementary prescribing training for pharmacists, nurses and AHCPs consisted of 25 (pharmacists) and 26 days (nurses and AHCPs) taught curricula and 12 days of PLP with their DMPs. Many Higher Education Institutes (HEI) offer multi-disciplinary supplementary prescribing programmes for pharmacists, nurses and AHCPs, with the exception of optometrists. The supplementary prescribing programme for optometrists is more specific to the eye.^[17]

Like the supplementary prescribing programme, in order for pharmacists to enter the independent prescribing programme, a minimum of 2 years post-registration experience is required.^[30] Since the introduction of independent prescribing, supplementary prescribers who are eligible to become independent prescribers may undertake a conversion programme. This consists of at least two days of taught curricula and two days of PLP.^[32, 33] The basis of the conversion programme emphasises on the increase in professional autonomy, responsibility, clinical assessment and legal/ethical implications of prescribing.^[32]

Pharmacists, nurses, AHCPs and optometrists must all be registered with their professional bodies and have a minimum of 2 (pharmacists) or 3 years (nurses, AHCPs and optometrists) post-registration experience.^[4, 23] In addition, nurses entering the independent prescribing programme need to have a minimum of 1 years' experience in the field they wish to prescribe in. All healthcare professionals wishing to enter the prescribing programme must also have support from their employers to enter the programme by confirming that there is a service need and there is access to

a prescribing budget. They should also have a specified DMP. Employers must ensure that healthcare professionals wishing to enter the programme are capable of studying at a degree level. The independent prescribing programme comprises of 26 taught curricula and 12 days/90 hours of PLP.

The non-medical prescribing programme is underpinned by the training philosophy that non-medical healthcare professionals who successfully complete the programme will be able to improve patient access to medicines, reduce doctors' workload and make better use of their own skills. Accredited independent prescribing programmes encompass learning outcomes set by the General Pharmaceutical Council (GPhC) and Nurse and Midwifery Council (NMC).^[34, 35] The learning outcomes ensure that successful pharmacist and nurse independent prescribers are able to:

- Understand their responsibility as independent prescribers and be aware of their own limitations by working within their professional competence
- Practice within a legal, ethical and professional framework of accountability and responsibility in relation to prescribing
- Understand and apply the relevant legislation to the practice of prescribing
- Develop an effective relationship and communication with patients, parents, carers and other members of the healthcare team
- Understand the influences that can affect their prescribing practices
- Describe the pathophysiology of the condition, recognise signs and symptoms of illness, undertake a thorough history including medication history and current medication, and carry out the relevant clinical assessments (e.g. use of diagnostic aid) where necessary to inform a working diagnosis
- Demonstrate a shared approach to decision-making by assessing the patients' needs and taking into account their wishes and values, including those of their carers, when making prescribing decisions

- Formulate a treatment plan, carry out a checking process to ensure patient safety, monitor response to therapy, review any differential diagnosis and consult or seek guidance as appropriate
- Prescribe safely, appropriately and cost effectively
- Critically appraise, use sources of information/advice and decision support systems in prescribing practice
- Maintain accurate, effective and timely records and ensure other healthcare staff are appropriately informed
- Participate regularly in continuing professional development (CPD) and maintain a record of CPD activity.

HEI offering the independent prescribing programme are expected to develop a detailed curriculum to meet the learning outcomes set by the GPhC and NMC. A range of teaching methods are used in the programme to develop the knowledge, skills and competency of learners to become competent prescribers. Examples of this include self-directed learning, problem-based learning, multi-disciplinary teaching and experiential learning from the PLP. In addition, a range of assessment methods are required to ensure that students demonstrate that they have met the learning outcomes relevant to their prescribing responsibilities.^[35] These include a portfolio that demonstrates reflective learning in practice, a rationale for prescribing decisions and the application of theory to practice, an objective structured clinical examination of practice within a simulated learning environment and a written examination. In addition, students are expected to demonstrate to their DMPs that they have acquired competence during their PLP. DMPs assess the competencies of students learning to prescribe during their PLP. DMPs often adhere to the competency framework described in Section 2.1.3 below to assess students during the PLP.

2.1.3 Prescribing Competency

The NPC Plus defines competency as *“a quality or characteristic of a person which is related to effective or superior performance. Competencies can be described as a combination of knowledge, skills, motives and personal traits. Competencies help individuals (and their managers) look at how they do their jobs”*.^[36]

Previously, the NPC had prescribing competency frameworks tailored for each healthcare prescriber. This framework set detailed competencies that should be fulfilled by anyone embarking on to prescribing or currently prescribing. This is now no longer the case, as the NPC has created a Single Competency Framework, to show that all prescribers should fulfil a number of prescribing competencies, regardless of the type of prescriber they are or their level of expertise.^[37] The framework was validated by a group of professional prescribers from different professions with different levels of experience. The NPC, which first developed the Single Competency Framework, is now part of the National Institute for Health and Care Excellence (NICE). In July 2016, the Single Competency Framework was reviewed, updated and renamed as “A Competency Framework for all Prescribers” by the Royal Pharmaceutical Society (RPS).^[38, 39] The competency framework for all prescribers sets detailed guidance on each individual competency. The framework is generic as it is difficult to contextualise competencies in diagnosing and prescribing due to the varied nature of medical cases. Nevertheless, it could be used by prescribers to aid in their development by identifying their strengths and weaknesses using a variety of methods, or to guide students during the process of learning to prescribe.

DMPs are required to assess the competencies of students learning to prescribe during the practical PLP of the programme. The NPC Plus describes two formal methods of assessing competencies: summative assessment and formative assessment.^[31] However, there is no specific method that should be used by DMPs to assess students’ prescribing competencies. Universities offering the non-medical prescribing programmes frequently utilise the competency framework to structure the learning and assessment of students on the programme.^[31, 37] DMPs can also adhere to the framework by using it to assess students during the PLP. This is to ensure that healthcare professionals training to become prescribers are deemed competent in their area of practice upon successful completion of the programme.

Competency is mentioned several times throughout the training and content in the prescribing programme. There is a strong emphasis in prescribers' training programmes on the competence of prescribers. Prescribers should be aware of their competence to ensure that they work within the limits of their professional competence. ^[11, 31] This was seen to not only introduce a culture of safety to prescribers, but also produce constraints on what NMPs are able to prescribe. ^[40] NMPs entering the prescribing programme are required to train in a specialised area of practice, in which they will prescribe in. In addition, the prescribing role entails that the prescriber take full responsibility for the clinical assessment and management of patients, and the appropriate prescribing involved when necessary.

2.2 Profile of Non-Medical Prescribers

In a recent report by i5 Health, the number of registered nurse and midwife prescribers in England as of March 2015 was 53,572. ^[5] As of October 2014, there were a total of 571 AHCP prescribers; and 118 optometrist independent prescribers in 2012. However, the reported numbers only reflect those registered as prescribers and do not reflect those currently prescribing. Nevertheless, i5 Health reports de-duplicating data from the eNurse database (currently showing 41,745 nurse prescribers in primary care) to arrive at a total of 30,928 NMP practitioners that are connected with cost centres in primary care which are likely to be actively prescribing. This report also estimated that there are approximately 9,674 non-medical prescribing practitioners in acute settings in England.

Based on their figures, which they believed were overstated, the i5 Health reports an estimated total of 44,629 NMP practitioners across all types of settings throughout England. The vast majority of NMP practitioners work in community settings (44%), followed by acute settings (34%) and GP practices (18%). According to the NHS Business Services Authority, the number of items prescribed by nurses in June 2015 was just over 21 million items costing just over £210 million. ^[6]

As of November 2015, the number of pharmacist prescribers in the GPhC register were 3,944 (2,567 independent prescribers; 425 supplementary prescribers; 952 both independent and supplementary prescribers) representing 8% of the total number of pharmacists on the register. ^[41] Six hundred and fifty one pharmacist prescribers responded to the GPhC's prescribers' survey, of which 46% reported working in hospitals and 29% worked in GP practices. Of 581 respondents, 41% reported prescribing every day, 34% prescribed at least once a week and 11% no longer prescribed. Of 518 respondents, 55% prescribed for up to 10 patients and of 516 respondents, 26% prescribed up to 5 items per week. Taking into account the difference in numbers between registered nurse prescribers and registered pharmacist prescribers, the volume of prescribing by pharmacists in June 2015 was just over 1.6 million items costing over £14.5 million, in comparison to nurses who prescribed over 21 million items costing over £210 million. ^[6]

Data from a representative number of NMPs (1,566) shows that the majority work in secondary, tertiary or quaternary care (40%), 31% work in community settings and 26% work in general practice. ^[5] In addition, the nursing discipline is seen as actively prescribing across all settings, with the majority in community care (50%, all °6) and secondary care (39%). In contrast, pharmacist prescribers are predominantly situated in secondary care (40%) and GP practices (32%). In comparison, a survey of nurse and pharmacist independent prescribers in 2010 found 41% of nurse independent prescribers in primary care and 28% in NHS trusts, compared to 55% of pharmacist independent prescribers working in primary care and 35% in NHS trusts. ^[42]

2.3 Impact of Non-Medical Prescribing

Literature on the expansion of prescribing rights to NMPs suggests that non-medical prescribing is becoming well-integrated into healthcare services. Section 2.3 of this chapter will discuss the views of patients, healthcare professionals and stakeholders on non-medical prescribing and the impact it has on the provision of healthcare services.

2.3.1 Patients' View of Non-Medical Prescribing

Many studies with patients have reported their views and experiences of non-medical prescribing. In an evaluation of nurse and pharmacist independent prescribing, patients reported valuing their services as an alternative to GPs in primary care. ^[42] Patients who had experienced consultations by nurse and pharmacist independent prescribers reported high levels of satisfaction with their service and established good relationships that consequently led to having confidence in their prescribing practices. In another study exploring the views of dermatology patients on nurse prescribing, patients described the convenience and flexibility of being able to access their specialist nurse prescribers for appointments or telephone consultations. ^[9] This was especially valued and described as reassuring when dermatology patients experienced flares of their condition. The nature of their skin conditions also meant that they valued the continuity of care with the same nurse prescriber over a period of time. This consequently improved their relationship and allowed patients to discuss sensitive or embarrassing issues.

Patients report being actively involved in decision-making about their treatment. ^[9] This is consistent with another study which reports that almost two thirds of primary care patients who have been treated by pharmacist or nurse independent prescribers have been involved in decisions about their medicines. ^[43] Another study exploring the views of specialist mental health service users with nurse prescribers reported the ease of accessing nurses and being able to frequently book appointments when required. ^[44] They also praised nurses' specialist knowledge and their use of different methods to educate patients on their medication, such as providing them with information leaflets or CDs. Patients in this study also reported that they would rather receive care from a specialised nurse prescriber and leave complex cases for doctors. This is not the only study to mention this. Dermatology patients also report that nurses were offering a superior service in comparison to GPs. ^[9] Patients report that nurse prescribers spent more time with them, describing their consultations as "*less rushed, more cared for*" with nurses being highly attentive. ^[9]

Despite the reported benefits, patients' attitudes and preference between NMPs and doctors differed. A study conducted in Scotland in 2006 which explored patients' experiences of pharmacist supplementary prescribers in primary and secondary care noted that patients reported positively on their consultations and the extent of information provided to them by pharmacist prescribers.^[45] Patients even reported that they would recommend others to see a pharmacist prescriber. However, if given the choice, 65% chose to be cared for by a doctor rather than a pharmacist prescriber. Another study conducted in 2008 by the same author exploring the views of patients in England and Scotland on independent/supplementary pharmacist prescribers working in GP or community settings found that 42.8% would prefer to consult a GP rather than a pharmacist prescriber, if given the choice.^[10] Although this is less than the previously reported 65%, it is still a significant number, given that patients reported extremely positive views on their experience with pharmacist prescribers. Nevertheless, this could be attributed to a number of reasons. Some patients have described NMPs as expert specialists in comparison to doctors who are expert generalists.^[9, 43] In Latter et al.'s study, patients had no particular preference over pharmacist or nurse independent prescribers when compared with their GPs.^[42] However, this was considered as patients valuing attributes of the consultation, such as prescribers listening to patients and providing explanations about medicines, rather than the profession of prescriber. A study conducted in 2009 also reported that some patients who had longer therapeutic relations with their nurse independent prescribers preferred them over pharmacist independent prescribers.^[43] This showed that patients' preference of prescribers is influenced by a number of factors, such as their personal experiences and relationship with prescribers.

On the other hand, some patients reported that doctors training and experience may be a contributing factor to why they prefer to see a doctor, in comparison to less experienced supplementary prescribers.^[9, 46, 47] Despite this, patients expressed less concern for NMPs treating chronic conditions. However, they expected doctors to treat acute conditions.

In addition, studies on the awareness, views and attitudes of the general public on non-medical prescribing in Scotland showed that members of the public recognised

the convenience and benefits of non-medical prescribing.^[47, 48] However, they believed that safety rather than convenience was more important. They, therefore, believed non-medical prescribing was more appropriate for repeat and low-risk medicines and minor ailments. They also expressed concern over the knowledge and skills of NMPs, stating that pharmacists are likely to be more knowledgeable in medicines and doctors more knowledgeable in diagnosis and applying a more holistic approach to patient care.

2.3.2 Healthcare Professionals and Stakeholders' View of Non-Medical Prescribing

A number of studies have reported doctors and stakeholders' positive attitudes towards NMPs. Nurse and pharmacist independent prescribers perceived that the doctors they worked with were supportive of their prescribing practices.^[42] A major component attributed towards the integration of NMPs into practice was the trust between NMPs, doctors and their organisation.^[49] This trust is established when prescribing roles and boundaries are clearly defined between NMPs and their working colleagues within the organisation they intend to prescribe in.

In a study exploring the views of pharmacist prescribers, doctors and patients on the implementation of pharmacist supplementary prescribing, doctors believed that pharmacist prescribers had contributed to improved patient care.^[48] The expert knowledge of pharmacists in medicines was believed to be an important factor in undertaking a detailed review of patients' medicines and a chance to educate patients in more detail about their medicines. Doctors in this study also believed that they were now able to focus on more acute conditions. Doctors had trusted pharmacists to manage patients, even in their absence, by agreeing on a model of care. However, despite this, doctors expressed their concern about pharmacists' competence in diagnosis when asked how they felt about the implementation of pharmacist independent prescribing. Another study, evaluating the expansion of nurse prescribing in Scotland aired similar views where doctors reported decreased workloads.^[50] However, doctors' decreased workloads meant an increase in workload, pressure and demands on nurse prescribers. Stakeholders expressed their

concern about patients expecting nurses to be less busy than doctors and demanding prescriptions.

2.3.3 Views of Non-Medical Prescribers on their Prescribing Practices

Extending prescriptive authority to non-medical healthcare professionals has reportedly brought benefits to their overall profession. In Stewart et al.'s study, pharmacist supplementary prescribers reported enhanced job satisfaction and autonomy in being able to complete an episode of care without doctors intervening. ^[48] Pharmacist supplementary prescribers believed that being able to prescribe has made them more integrated into the MDT. In another study conducted on nurse prescribers in Scotland, 80% of nurse prescribers reported being very satisfied or satisfied in their role as a prescriber. ^[50] Nurses reported contributing positively to the quality of care offered to patients by completing an episode of care autonomously and saving patient time by making the pathway of care for patients more seamless. Twenty-four percent of nurse prescribers believed the extended prescriptive authority had a negative effect on their time, for reasons such as spending large amounts of time on administrative work. Nevertheless, the more that nurses prescribed, the higher the chances of them reporting increased job satisfaction. Nearly 90% of nurse prescribers who issued more than 30 prescriptions per week believed their new job role as prescribers led to a positive effect on patient care.

A recent survey on pharmacist prescribers conducted by the GPhC in 2016 reported that pharmacists believe their prescriptive authority has allowed them to work more effectively and efficiently by providing patients with quicker access to their medicines, reducing the duration of hospital stays and making better use of their skills. ^[41] However, despite NMPs benefiting from their prescriptive authority and consequent career advancement, some NMPs report a fear of making mistakes due to the added accountability and responsibility in prescribing. ^[44, 51] This is also reported in a study conducted in 2013 exploring nurse prescribing in palliative care after legislative changes allowing them to prescribe CDs. ^[52] Despite the small number of participants (a mix between nurse independent prescribers, nurses training to become prescribers, recently qualified prescribers waiting to start prescribing and regular

nurses), 5/14 participants reported a lack of confidence in prescribing. Nevertheless, it is likely that more experience and support in prescribing will lead to an increase of confidence in prescribing.

As discussed above, doctors and patients have expressed some concerns over pharmacist and nurse non-medical prescribing. These concerns mainly involved the adequacy of NMPs' training, their diagnostic abilities and clinical assessment skills. A survey of pharmacist prescribers stated that they lack clinical and physical examination skills and report having no confidence in diagnosing.^[41] Analysis from this survey attributed this to the undergraduate Master of Pharmacy (MPharm) degrees not focusing on such skills in the past as they do now. In Latter et al.'s evaluation of nurse and pharmacists independent prescribing practices, it was found that both were making safe and clinically appropriate prescribing decisions.^[42] However, it was noted that their clinical assessment and diagnostic skills could be improved. Another study, conducted in Ireland, involving nurse and midwife prescribers found that despite making clinically appropriate prescribing decisions, further attention was needed in recognising drug-drug and drug-condition interactions, duplication of therapy and recording the duration of therapy.^[53] In this study, two reviewers analysed prescription records, which included 208 prescribing decisions. A tool referred to as the Medication Appropriateness Index (MAI) was used to evaluate the clinical appropriateness of nurse and midwife prescribers' decisions. Only two episodes of potentially inappropriate prescribing decisions and medication errors were noted. This was identified in vulnerable groups such as older adults, breastfeeding mothers and people with complex medical conditions.

Another study using the same MAI tool to evaluate the clinical appropriateness of pharmacist and nurse prescribing in England was undertaken with a larger and more varied group of independent raters using 100 audio-recorded consultations.^[54] In this study, the majority of pharmacist independent prescribers consultations were review consultations and nurse independent prescribers' consultations involved a mix between acute and long-term conditions. Overall, both independent prescribers were making clinically appropriate prescribing decisions. However, raters commented on over 25% of the consultation ratings stating that prescribers need to improve the

comprehensiveness in their history taking. This was due to noted inadequacies in the assessment and accuracy of diagnoses.

A study conducted in 2012 which focused on the nature of prescribing and prevalence errors by pharmacist prescribers in secondary care found an error rate of 0.3% from 1415 prescription orders generated by pharmacist prescribers. ^[55] However, this is the only study to date that focuses specifically on the prescribing errors of pharmacist prescribers. Further studies are required in order to validate the results from this study. In addition, it is crucial to explore the prevalence, incidence and nature of prescribing errors by NMPs. This is because prescribing is a complex skill that is error prone and influenced by a number of factors that may lead to prescribing errors. A central component to appropriate prescribing is having the knowledge and reasoning skills to be able to diagnose in order to recommend the most appropriate therapy.

Clinical reasoning is central to the practice of professional autonomy in healthcare professionals. ^[56] It is a process that encompasses a number of stages that are dynamic and fluid, owing to the complexity of this phenomenon. The reported concerns of NMPs' practice as described above, such as inadequate history taking and inaccuracy in diagnosis, are part of the clinical reasoning process which could potentially lead to prescribing errors. Clinical reasoning is discussed in further detail in the Section 2.4 below.

2.4 Clinical Reasoning

Clinical reasoning is a *“context-dependent way of thinking and decision-making in professional practice to guide practice actions...It occurs within a set of problem spaces informed by the practitioner’s unique frames of reference, workplace context and practice models, as well as by the patient’s or client’s contexts. It utilises core dimensions of practice knowledge, reasoning and metacognition and draws on these capacities in others”*. ^[57]

Clinical reasoning broadly encompasses analytical and non-analytical reasoning processes. ^[58-60] Analytical reasoning is the process of critical thinking based on slow, logical steps that are undertaken to reach an in-depth understanding using knowledge and memory to reach an outcome. Non-analytical reasoning is the automatic mode of retrieving information from experience using methods such as pattern recognition and intuition forming, that is usually faster and contextualised. ^[58, 59] Some authors have viewed analytical and non-analytical clinical reasoning to be of a bi-directional nature, and in some cases both types of reasoning can occur within the reasoner. ^[61-63] It is highly likely that the more experience gained, the more likely the diagnostician will use the non-analytical automatic form when reasoning. Moreover, there are some instances where unfamiliar medical cases are introduced to healthcare experts that require them to slow down their thinking and use a more analytical approach. ^[64] This means that despite the types of reasoning being generally attributed to the reasoners expertise, it is likely that even expert reasoners will alternate between the types of reasoning depending on the case. Alternating between analytical and non-analytical clinical reasoning is reported to lead to more accuracy diagnoses. ^[65]

2.4.1 Clinical Reasoning Models

Analytical and non-analytical reasoning have been depicted using a number of clinical reasoning models, three of which dominate clinical reasoning studies. These include the hypothetico-deductive reasoning model, Bayesian theory and pattern recognition. In the late 1970s, Elstein et al. presented the hypothetico-deductive reasoning model as a model in which a clinician generates a number of hypotheses based on their existing knowledge and experience when encountering a clinical case. ^[66] The clinician subsequently tests the generated hypotheses through further inquiry and deducts the hypotheses that are falsified, arriving at a final hypothesis. This model emerged as a result of observing experienced clinicians and medical students at various levels of expertise solving clinical problems. ^[66, 67] The hypothetico-deductive reasoning model usually begins with the clinician gathering a number of verbal and non-verbal cues from observation and patient communication during a

consultation. This allows the clinician to generate a number of hypotheses which are followed with the clinician requesting various medical examinations to further understand and interpret the cues. By identifying the problem, the clinician is able to frame the problem using their declarative and procedural knowledge to further evaluate the deducted hypotheses until a definitive diagnosis is accepted. Despite the early realisation that the hypothetico-deductive reasoning approach was mainly used by novices, it was also found that experts also used this approach when faced with difficult cases and uncertainty. However, experts generated better and more accurate hypotheses than did novices. It was also noted that achieving accuracy and success in one problem did not mean that candidates would achieve the same success in another problem. This was attributed to the ‘content specificity’ of each problem.

Unlike the hypothetico-deductive model, which is interactive and context-dependent, Bayes’ theorem is statistical and analytical. ^[56, 61] This form of clinical reasoning assumes that the clinician is aware of probabilities with a particular diagnosis (i.e. the pre-test probability which is either the known prevalence of a disease or the clinician’s belief of the probability of a disease) and the conditional probabilities associated with the diagnosis (i.e. the post-test probability, when new information is acquired of the associated disease). Bayes’ theorem is a mathematical rule applying these probabilities to reach a ratio of the likelihood that the patient has a disease. Another analytical form of reasoning based on probabilities is decision analysis theory, which is used to solve difficult clinical problems. ^[56] This method includes the use of Bayes’ theorem, decision trees, sensitivity and utility analysis. Objective and subjective probabilities are usually combined to quantify an unpredictable effect. Subjective probabilities, termed utilities, are a measure of the patients preference for the studied outcome e.g. 0 (death) and 1 (perfect health in life). ^[68] However, these mathematical methods do not take into account the individual patient and are instead based on probabilities from evidence-based medicine combining groups of people with certain characteristics. In addition, these methods are more concerned with what clinicians *should* do, rather than the complex realities of clinical settings and what they *do* do. ^[62, 69]

Pattern recognition is a form of non-analytical clinical reasoning. It is more commonly used by clinicians with more experience, as they are able to relate it to similar clinical cases they have experienced and managed in the past. ^[56] As the name suggests, this form of clinical reasoning involves the clinician comparing the patients presenting complaint, sign and symptoms, with a disease pattern that ‘matches’ the patients presentation. ^[61] This type of reasoning occurs with sufficient automaticity and is associated with inductive reasoning which is the movement from cue acquisition to hypothesis generation. Healthcare professionals approach clinical problems depending on the characteristics of the problem. ^[70] For example, pattern recognition is likely to occur in simpler tasks that can result in the direct automatic retrieval of similar examples from memory. In contrast, more difficult diagnostic problems would need a systematic and effortful generation of hypotheses, using a more analytical model such as the hypothetico-deductive model.

Clinical reasoning models were depicted and developed as a result of studies examining problem-solving approaches. ^[66, 67] Clinical reasoning is widely acknowledged as an essential part of health professional education and practice. However, studies published on clinical reasoning are published from multi-disciplinary perspectives with little consensus on the basic characteristics of clinical reasoning. ^[62] In addition, the validity and reliability of clinical reasoning models are often limited. ^[71] Nevertheless, clinical reasoning models have been frequently utilised in education, for example, as a framework for problem-based learning discussions. ^[72-74] Moreover, educationists have developed a range of tools to assess clinical reasoning. ^[75, 76] There is evidence to suggest that the clinical reasoning skills of students were enhanced through the use of clinical reasoning models as a framework for Problem-Based Learning. ^[75, 77, 78] Nevertheless, clinical reasoning is context specific and, therefore, educationists should not only rely on evidence to show that the clinical reasoning of students has enhanced, but to provide healthcare professionals with the opportunity for deliberate practice in a variety of clinical contexts and with appropriate feedback. This will be discussed further in Section 2.4.2 below.

2.4.2 Information Processing Theory

Regardless of the model healthcare professionals use to clinically reason when faced with varied clinical scenarios, the diagnostic accuracy involved in clinical reasoning is strongly related to the knowledge content of the reasoner, rather than the process undertaken to reach a clinical decision. ^[62] The information processing theory (IPT) is a theoretical framework which demonstrates how information from the environment is stored in our long-term memory to be accessed during the process of reasoning (Figure 2.0). ^[79] As seen from the figure, the theory focuses on three major memory stores which are involved during the process of clinical reasoning – the sensory, working and long-term memory.

Stimuli from the environment first enter the sensory store, which has little power to retain information. To ensure that information is moved from the sensory memory into the working memory, it should be processed by attaching meaning to it through attention and conscious engagement. Attaching meaning to the stored information results in the development of a unique perception for the stimulus, otherwise it is lost. The working memory also has a limited capacity. However, information stored in the working memory is “chunked” in order to reduce the cognitive load. Like the sensory memory, if the learner does not consciously engage this memory, it will also be lost. Once information stored in the working memory is chunked, it is rehearsed and encoded, to give meaning to it and create important linkages with prior knowledge that has been stored, to be processed and stored in the long-term memory. Metacognition is a way of self-regulation in which the learner reflects on their knowledge and understanding of the task. ^[56] Learners continuously reflect on their long-term memory during the input of new information when the learner deliberately engages their knowledge and skills.

Deliberate practice of one’s knowledge and skills is required if expert performance is to be achieved. ^[80] Deliberate practice is the process involved in which a subject attempts to continuously improve and find better methods of completing a task, by deliberately increasing their effort at performing the task. Ericsson explains that expert-performance, which leads to superior achievement, is not a result of

experience alone, or several years in a field. In the context of clinical practice, it is when a healthcare professional is exposed to a variety of clinical environments in which they deliberately challenge their knowledge and skills to reach an expertise level of achievement. Therefore, continuous exposure to clinical settings, having the diagnostic, clinical reasoning and prescribing skills, with the receipt of appropriate feedback, is vital to acquire the initial stages of expertise in diagnosing and prescribing.

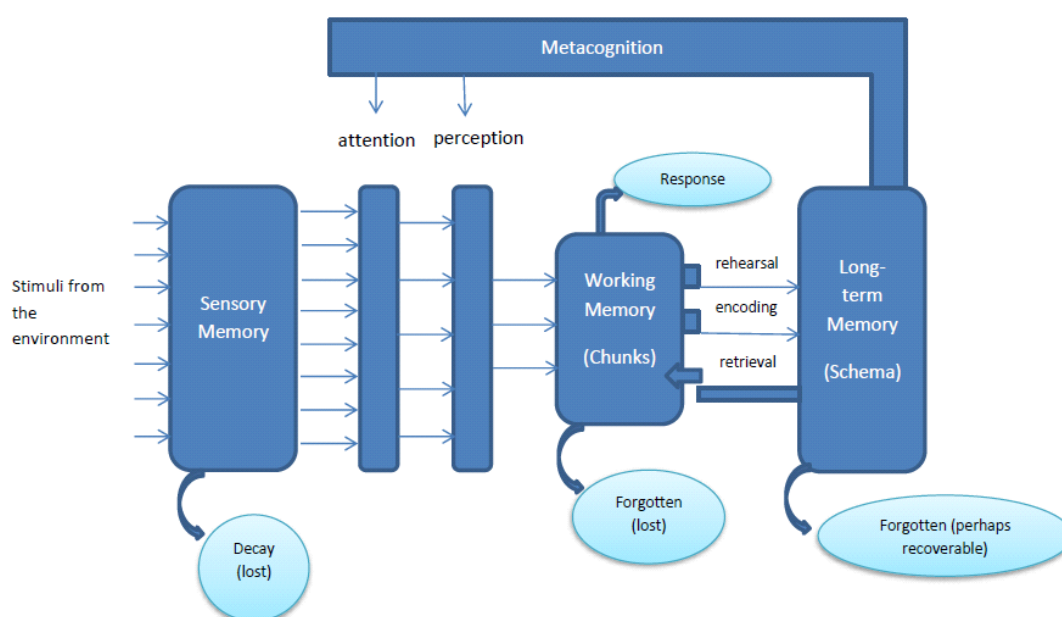


Figure 2.0 Information Processing Theory Model ^[81]

2.5 Literature Review

Section 2.1 to 2.4 of this chapter set the scene to understand the background of non-medical prescribing and its impact on the provision of healthcare services. It also outlined the need for NMPs to demonstrate competence and clinical reasoning skills in their prescribing areas and provided the background of clinical reasoning. However, the previous section does not outline how the non-medical prescribing programme prepares NMPs to demonstrate competence and their clinical reasoning skills for practice. Section 2.5 of this chapter provides a description of the current literature relating to the educational preparation and perceived competencies of NMPs.

2.5.1 Literature Search Strategy

A literature search was conducted using the terms provided in Box 1.0. The search terms were kept broad to avoid rejecting papers relevant to the topic. As this work focused on the educational preparation and learning experiences of students undertaking the non-medical prescribing programme in the UK the search was limited to studies conducted in the UK. This was because the aim, learning outcomes and prescribing competencies of NMPs in non-UK countries are different to the programmes offered in the UK. The literature search strategy in Box 1.0 was applied to the databases outlined in Appendix 1.0. Grey literature sources were also searched (Appendix 2.0). More recent papers were selected over less recent papers. Medical prescribers and dentists were not included in this search; however, medical literature is used to discuss and critique the literature on non-medical prescribing. The broad aim of the literature search was to identify a wide range of papers relating to non-medical prescribing students' experiences on the programme, how they acquire their competencies and how they apply these competencies to practice. This was to explore if the educational preparation of non-medical prescribing students in the UK addresses the realities and complexities of prescribing.

The search yielded a large number of papers that were broadly divided into papers that included the training, views and prescribing practices of NMPs. Forty-three papers related *only* to the training and development needs of NMPs. The vast majority of the papers focused on pharmacist and nurse non-medical prescribing. Literature on the educational preparation of physiotherapists, podiatrists, chiropractors and optometrists was limited. This could be due to the relatively small number of such prescribers as reported in Section 2.2. In addition, independent and supplementary prescribing by AHCPs is still in its infancy. Nevertheless, literature on their learning experiences and evaluations of their prescribing practices is likely to increase in the future. From the 43 papers relating to the training and development needs of NMPs, a total of 11 papers were about the pharmacology (n= 8), bioscience (n= 1) and the numerical abilities of nurses (n= 2); 1 paper included the consultation skills of pharmacists and 5 papers were about the CPD needs of NMPs. The

remainder (n= 27) explored the experiences, preparation and training, evaluation, attitudes, benefits and challenges of the education of NMPs. Only 2 of the 28 papers were published in the last 5 years, with the vast majority of experiences and evaluations of the training and development published between 2006-2007. This is no surprise, as it is likely these studies took place immediately after the extension of prescribing rights to pharmacists, AHCPs and optometrists between 2003 and 2006.

Papers in this literature review include papers on the training, views and prescribing practices of NMPs that contribute towards understanding how students acquire and apply their competencies to practice.

Box 1.0: Key Search Terms used for Literature Searches

Pharmacist OR nurse OR physiotherapist* OR radiographer* OR optometrist* OR podiatrist* OR chiropractist* OR non medical

AND

Acqui* OR know* OR skill* OR develop* OR competen* OR expert* OR period of learning in practice OR curricul* OR learn* OR train* OR educat* OR influenc* OR reasoning OR decision*

AND

Prescribe*

AND

United Kingdom OR UK OR England OR Ireland OR Scotland OR Wales OR NHS

Findings from the literature review in Section 2.5.1 to 2.5.6 will discuss the experiences of students on the non-medical prescribing programme, during their PLP and the influence of education on students' preparedness for practice. It will also cover the concept of transitioning from a non-prescriber to a prescriber and how the skill of clinical reasoning is used when making prescribing decisions.

2.5.2 Students' Experiences of the Non-Medical Prescribing Programme

The views of non-medical prescribing students' experience of the programme differed depending on the type of healthcare professional reporting their experience, the time of when the study was conducted and their previous qualifications and experiences. Earlier studies conducted after the extension of prescribing rights to pharmacists and AHCPs were more focused on exploring and evaluating the learning experiences of students and whether the programme prepared them for practice. ^[82-84]

A study exploring the learning experiences of non-medical prescribing students by assessing the quality of mentoring support from their DMP during the PLP found that 26.3% of students reported that their DMPs were not familiar with the performance criterion to evaluate students and relied on students to guide them. ^[82] In addition, some students struggled with the lack of understanding amongst colleagues about the programme and their responsibilities. DMPs not being fully aware of their role and responsibility during the PLP is also reported in another study which evaluates the PLP of pharmacist supplementary prescribers on the programme. ^[83] This also included DMPs struggling to assess the competencies of students. Nevertheless, DMPs who had previously mentored other students or who were involved in training had a better understanding of their roles during the PLP. This is no surprise, given that both studies had been conducted after the extension of prescribing rights to non-medical professionals. It is possible that a range of healthcare professionals had not yet been exposed to non-medical prescribing, what it entails and the roles and responsibility of those involved in the training programme. This subsequently created a culture of concern, where some DMPs had reservations regarding the prescribing authority extended to NMPs. ^[83] In contrast, DMPs who had previous working relations with their students reported strengthened working relations. In addition, DMPs believed that by working with NMP students, they were contributing towards "*something new*" in the healthcare system and were learning more about the roles of other healthcare professions. ^[83] A more recent study on a range of ex-non-medical prescribing students reports that they forged excellent working relations and valued the support they received from their colleagues during the PLP. ^[8] This emphasises the changes in professional culture towards non-medical prescribing and its impact on the learner and prescriber.

Nurses learning to prescribe were more likely to report that the non-medical prescribing programme was appropriate and largely met their learning needs, in comparison to pharmacists. ^[12, 85, 86] In contrast, an evaluation of the educational experiences of pharmacist and nurse independent prescribers found that 12.9% of nurse independent prescribers and 20.7% of pharmacist independent prescribers believed the programme only met their needs to a limited extent. ^[42] When asked more specifically to report on the adequacy of programme preparation in relation to acquiring specific competencies, nurses were more likely than pharmacists to report that the programme provided adequate preparation in clinical pharmacology and co-morbidities. In contrast, pharmacists were more likely than nurses to report that the programme had provided adequate training in prescribing within a team and in the public health context. Pharmacists also reported that the programme had not provided adequate preparation in physical assessment skills. ^[42] An earlier study using a questionnaire survey (circulated between 2008 and 2009 to nurse independent prescribers and non-medical prescribing leads) reported that 87% believed the training programme ‘completely’ or ‘largely met’ their learning needs and outcomes. ^[85] Nine hundred and seventy six nurse independent prescribers responded to the questionnaire, of which 81% reported that the programme adequately trained them in clinical pharmacology and the effects of co-morbidity.

Despite Tann et al. stating that the academic component of the non-medical prescribing programme does not intend on providing a knowledge base in an area in which the student will prescribe, ^[87] other studies have shown that the programme had provided nurses with a systematic understanding of pharmacology. ^[88] One could argue that a systematic understanding of pharmacology does not mean a new knowledge base has been created. However, a recent study exploring how the clinical competency of ex-university students reconciles with previous training or support found that nurses had concerns with remembering the theory underpinning the scientific approach to their prescribing practices which they gained from the programme. ^[8] Nurses also reported feeling anxious for a number of reasons, such as not keeping up to date in their areas of competence, making incorrect decisions,

difficulty recalling theory and lack of awareness of drug interactions. This may be attributed to students not experiencing the reality and complexity of prescribing on the non-medical prescribing programme and during the PLP. Another earlier study assessing the programme of education for nurse prescribers in Scotland in 2005 also reflected the importance of acquiring knowledge in pharmacology to stimulate “critical thinking about medication” not only for safe prescribing practices, but to facilitate communication with healthcare professionals and patients.^[88] NMPs in a Strategic Health Authority in England reported that despite the non-medical prescribing programme providing them with an appropriate knowledge base and confidence in their abilities to prescribe, there were still concerns regarding being able to apply their knowledge to practice and having confidence in their performance to do so.^[12] The vast majority of respondents in this study were district nurses and health visitors. It appears that, regardless of the limited formulary they prescribe from, concerns of their knowledge base and confidence are still reported.

Pharmacist reports about the non-medical prescribing programme differed to nurses. In a study conducted in 2007 on pharmacists who were learning to become supplementary prescribers, 82% of 411 pharmacists reported that non-medical prescribing training was most useful, with the majority stating that nothing should be added to the prescribing programme.^[84] However, despite reporting this, pharmacists were less positive regarding the content of the programme with 58% and 62% agreeing or strongly agreeing that they acquired the appropriate knowledge and skills required to prescribe. Even though pharmacists in this study were undertaking the supplementary prescribing programme, some expressed a desire to understand the treatment of patients more fully by training in diagnosis, physical examination and clinical skills. In addition, pharmacology was found to be least useful, too basic and a “waste of time”. This is consistent with another study conducted on the first wave of pharmacists undertaking the supplementary prescribing programme.^[87] Pharmacists believed the PLP contributed significantly to their development as prescribers. However, the academic part of the programme required more clinical input, was not mentally demanding and contained too much reflective learning.

Reflective learning amongst the pharmacy profession is a relatively new form of learning. In spite of this, a study analysing pharmacists written reflection on their consultation skills after a communication skills learning programme found pharmacists demonstrated a deep understanding of their skills through reflective writing.^[89] Pharmacists also reflected on the need to improve their consultation skills and the difficulty in shifting their focus from medication, to considering the patient holistically.

2.5.3 Experiences of Students Learning to Prescribe During the PLP

Conditions set in the workplace during the PLP to support students' prescribing education relied on working alongside the DMP or other colleagues and the support received by the organisation in providing study time and reducing workload pressures.^[8, 82, 83, 87] As mentioned previously, support from colleagues and having previous working relations with the DMP facilitated the learning that took place during the PLP.

Students undertaking the non-medical prescribing programme should receive 12 days of supervised learning during their PLP. Pharmacist supplementary prescribers felt that 12 days of PLP with their DMP was not enough if pharmacists had limited clinical experience.^[83] Pharmacists on the non-medical prescribing programme and DMPs believed that the duration of the PLP should be based on the background and experience of pharmacists. Nevertheless, Latter et al. reported that 73.1% of pharmacist independent prescribers and 55% of nurse independent prescribers received more than 12 days of supervised learning in practice.^[42] Students on the non-medical prescribing programme reported higher levels of satisfaction with their PLP if they spent more than 30% of that time under direct supervision by their DMP.^[82] This is likely to be due to students believing that the PLP was the most valuable part of the programme with some stating that it contributed significantly to their learning.^[42, 87]

The method of supervision during the PLP with or without the DMP varied. ^[42] Some students actively sought opportunities to work with a number of clinicians to observe their consultation and prescribing styles. Others gained knowledge and experience from non-prescribing colleagues, such as nurses discussing polypharmacy with pharmacists. In a study conducted on the first wave of pharmacists training to become supplementary prescribers, doctors reported that pharmacists were not passive observers. ^[87] Doctors gained valuable input from pharmacists with regards to drug information and also used pharmacists as a method of gaining feedback on their own consultation styles in comparison with other doctors. In addition, students report that observing doctors made them recognise the complexity in the process of diagnosis and the holistic nature of consultation styles when incorporating a broader perspective to patient care. ^[82, 87] More actively involved DMPs continuously discussed patient cases with their students, regularly monitoring their progress. ^[42] Some students were given the opportunity to take on their own clinic, under the supervision of the DMP, where an appropriate course of action for the patient was discussed between them.

Despite the few papers above reporting on how students acquire the necessary competencies and skills during their PLP, it is not entirely clear how this influences the learner as they transition into their roles as prescribers. It is also unclear whether students learning to prescribe experience the realities of prescribing during their PLP. In addition, no papers were found exploring the acquisition of clinical reasoning or decision-making skills during the process of learning to prescribe. Whilst one could argue that clinical reasoning is an inherent skill in a prescriber, this has not been investigated in the context of non-medical prescribing students learning to prescribe.

2.5.4 Influence of Educational Preparation on Preparedness to Prescribe

Prescribing is one of the most common interventions made to improve the health of patients. It is also a complex skill that requires the correct use of sound knowledge and skills within a dynamic environment that is influenced by a number of cognitive, psychological, social and environmental factors. ^[2, 3] In an in-depth study on the causes of prescribing errors by foundation medical trainees in relation to their

medical education, it was found that the highest number of prescriptions was written by Foundation Year 1 (FY1) doctors followed by Foundation Year 2 (FY2) doctors. ^[90] Although the highest number of written orders were by FY1 doctors (50,016 orders – 8.4% error rate), the highest prescription error rate were by FY2 doctors (34781 orders – 10.3% error rate). However, the focus in understanding the causes of prescribing errors was on FY1 doctors and not FY2 doctors, noting that FY1 doctors are likely to “*typify the wider culture of clinical care*”. Factors that led to prescribing errors were complex, as the context of every patient was different and predisposing conditions such as fatigue, stress and high workload all contributed to prescribing errors. Nevertheless, nearly half of the errors made were “rule-based” which was defined as “*apply(ing) the wrong rule or fail(ure) to apply the right one*”. ^[90] This was identified as a result of a lack in expertise due to being unable to apply their knowledge to a real-life prescribing context.

Dornan et al. identified 5 target interventions to reduce prescribing errors and improve patient safety. ^[90] These included interventions in clinical working environments, undergraduate medical education programmes, FY1 education, other parts of the medical education continuum and inter-professional education. Four of the five targets focus on the need to undertake complex educational interventions to improve the prescribing practices of doctors. This emphasises the importance of educational preparation in ensuring that students experience the realities of prescribing to improve their prescribing practices, whether they are doctors learning to prescribe or non-medical healthcare professionals.

Unlike FY doctors, healthcare professionals entering the non-medical prescribing programme should have a minimum number of post-registration clinical years of experience. However, there is a dearth of research exploring the prevalence, incidence, and nature of non-medical prescribing errors and whether their post-registration experience has any influence on error rates. In addition, NMPs’ education, previous experience as healthcare professionals, professional culture and attitudes are likely to differ from doctors. This is likely to influence their prescribing practices differently. However, this is yet to be explored.

Illing et al. describes prescribing as two distinct areas, “*the basic science and pharmacological knowledge required to understand drug effects and interactions, and the actual mechanics of prescribing, such as calculating dosage, and writing up a prescription and drug chart*”.^[91] A study on the transition of medical students to junior doctors describes how junior doctors felt under-prepared to prescribe, which consequently made them anxious about their knowledge.^[92] Dornan et al. argues that prescribing errors, in his study sample, which occurred due to lack of knowledge were not as a result of lack of knowledge in broad principles but the lack of applying their knowledge to the correct context.^[90] As described above regarding nurse prescribers’ previous education in Section 2.5.2, foundation trainees in Dornan et al.’s study also reported deficiencies in pharmacology education. However, pharmacology education is one factor, amongst many, that could cause prescribing errors.

In a systematic review of the literature on educational interventions to improve prescribing by medical students and junior doctors, it was highlighted that educational interventions assess single causes of prescribing errors.^[93] Yet, prescribing errors are not the result of one causal factor, and some researchers have stressed that prescribing is a complex skill that requires a more complex approach to improve preparedness in prescribing.^[90, 93, 94] Early learning experience introduced to undergraduate medical students has proved effective in allowing students to apply clinical knowledge to practice.^[95] This means that students are able to contextualise the knowledge they have learnt into the realities of clinical practice. In addition, encouraging students to be active learners through early learning experience can aid in the development of their attitudes (for example, increasing their confidence) in preparation for future practice. This will contribute towards a smoother transition from a medical student to a prescriber, who is responsible for the care and well-being of a number of patients. Transition is discussed in Section 2.5.5 below.

2.5.5 Transitioning in Prescribing

The importance of transition phases has been reported particularly in medical literature as a phase that is highly affective in practice.^[92, 96-98] Affectivity during the

transition of a non-prescriber to prescriber refers to the feelings and attitudes experienced during this transition. It is, therefore, crucial for educationists to focus on developing the attitude of a student learning to prescribe, in preparation for future practice. Transition is defined by Kilminster et al. as “*the process of change or movement between one state of work and another*”.^[96] Phases that result in high affectivity, if used correctly, can contribute to smoother transitional phases and better performance in the new tasks required in the new job status.^[96]

Latter et al. briefly explores the transition of nurse and pharmacist independent prescribers from training to practice, by asking them whether they were prepared for practice as prescribers at the end of the non-medical prescribing programme.^[42] The majority of pharmacist and nurse independent prescribers reported they were largely prepared. However, the pharmacists’ lower perceived preparedness for practice was attributed to their reports on inadequate training in history-taking, consultation and physical assessment skills. Moreover, the transition to prescribing practice was explored by investigating the length of time between completion of the non-medical prescribing programme and issuing their first prescription. Twenty-eight percent and 20.8% of nurse and pharmacist independent prescribers took four or more months after completion of the non-medical prescribing programme to issue their first prescription. Some reasons for these delays included awaiting prescriptions pads, organisational barriers, and awaiting registration.

Similarly, a study on mental health nurse independent prescribers also reported that 78% of the sample of nurses did not prescribe within a year of qualifying, with 79% reporting that their prescribing role was not included in their job description and 36% waited for over 14 months to receive their prescription pads.^[93] This was found to influence their transition from being a non-prescriber to prescriber, as it affected their confidence in prescribing. As a result, some reported they would probably not prescribe as they no longer felt competent.

A more recent study conducted in 2013 explored the impact of legislative changes in 2012 which allows nurse prescribers to prescribe some CDs.^[52] It also investigated the experience of transitioning from a non-prescriber to a prescriber in palliative care. This study investigated the concept of transition by questioning prescribers about the duration of time taken between qualifying and issuing their first prescription. Eight of the 14 respondents (57%) experienced a delay in issuing their first prescription between 2 and 4 months. Respondents were concerned about their current prescribing practices due to their lack of confidence, fear of making a prescribing error and lack of support from colleagues.

The phase of transition has been attributed as one of several factors that contribute to the lack of preparedness of junior doctors in practice. An in-depth exploration of why doctors experience high levels of affectivity during the phase of transition included the increase in responsibility, medical uncertainty (including uncertainty in diagnosing or prescribing), and lack of support from colleagues.^[92] This led to high levels of stress during this phase. In a study on first year medical students using learning diaries to explore medical uncertainty, results showed that medical students viewed their transition phase to FY doctor as a highly important stage in their learning process.^[99]

Kilminster et al. notes the importance of transition in her study when she emphasised the need to recognise that doctors are likely to under-perform in the beginning of their phase of transition.^[96] A significant part of transition is becoming familiar with the culture and working practices of the location in which the phase of transition occurs. Therefore, a process of learning takes place during the process of transitioning. Kilminster et al. identifies the phase of transition as a period of learning referred to as “*Critically Intense Learning Periods*” where learning takes place whilst delivering immediate patient care within a time-restrained period. It is, therefore, important that healthcare professionals within the working culture recognise this critical phase in order to contribute towards the performance of the doctor undergoing the transition.

Like doctors, it is likely that NMPs experiencing any change, such as becoming newly qualified prescribers, are to experience high affectivity during the phase of transition. This affectivity, associated with the process of transitioning, could potentially contribute to or inhibit the performance of the newly qualified NMP. In addition, it is unclear how long the “process of change” lasts during the transition phase of NMPs.

In a study exploring factors influencing whether nurse and pharmacist NMPs take responsibility for prescribing, participants reported that their decision to take responsibility was underpinned with a feeling of cautiousness.^[7] The cautiousness of NMPs was as a result of perceptions of their competence, their role as prescribers and the level of risk involved in each prescribing decision. NMPs in this sample had a varied number of prescribing years of experience, with the vast majority having less than 6 years prescribing experience and 4-9 years of experience as a healthcare professional. In addition to the subjective perception of participants’ competence was the non-medical prescribing programme encouraging cautiousness by emphasising the legal and ethical aspects of prescribing. In addition, some participants reported a lack of learning opportunities to maintain or improve their prescribing competence, which led to a loss in confidence and reluctance to prescribe. It is, therefore, important that NMPs are given the opportunities to continuously develop themselves professionally in order increase their confidence and performance.

A recent study which aimed to ascertain NMPs aspirations, priorities and the preferred mode of CPD, found that they experienced high levels of anxiety.^[8] This was due to not keeping up to date within their area of competence, making incorrect decisions or being unable to recall theory learnt from the non-medical prescribing programme. The main reason for reported anxieties in CPD was the need to maintain or improve their competence in fear of liability. It is considered essential that prescribers take responsibility for their own learning and CPD.^[100] Nurse independent prescribers report having support from their organisations in providing

study leave in order to undergo CPD. ^[12, 85, 101] This sometimes included in-house training courses from the organisation itself. However, some report difficulties in continuing their professional development due to the lack in funding, workload pressures and staffing levels, lack of appropriate courses and lack of organisational support. ^[13, 102] Similarly, other studies report that the main CPD needs included updates on prescribing policy and best practice in prescribing, new treatments, expanding knowledge in specific treatment areas, pharmacology, assessment and diagnosis, decision-making skills and treating patients with complex pain and comorbidities. ^[12, 13, 101]

2.5.6 Clinical Reasoning in Healthcare Professionals

On-going training is required to maintain or improve the competencies and decision-making skills of NMPs when treating patients. Clinical reasoning, which is used to make clinical decisions, as defined in Section 2.4, is a critical skill that is central to professional autonomy. ^[56] As mentioned previously in Section 2.3.3, the limited available literature shows that NMPs are making clinically appropriate decisions and are benefiting from access to a wide range of medication. ^[53, 93, 103] A significant part of the task of prescribing is the process of reaching a clinically appropriate decision which involves clinical reasoning. Making clinical decisions through reasoning requires the ability to balance clinical and non-clinical factors from the social and clinical environment. ^[7, 104-106] In addition, it involves combining knowledge and skills learnt from formal teaching, workplace practices and the ability to clinically assess and make a judgement in a clinical scenario.

A study conducted with 22 GPs and 6 nurse prescribers, investigating the diagnostic and antibiotic prescribing decisions made for children with respiratory tract infections, found no difference in the process of diagnosing and decision-making between GPs and nurse prescribers. ^[107] Both healthcare professionals used an initial rapid pattern recognition assessment by looking at the child to note certain signs and symptoms, such as their energy levels, interaction with the environment and skin pallor. This was followed by a formal deductive reasoning assessment method of history taking and physical examination to refine their diagnosis. However,

prescribers reported clinical uncertainty in children who were perceived to be of intermediate illness severity, with some prescribing antibiotics without a clear clinical justification. In addition, the previous experience of healthcare professionals greatly influenced their confidence in identifying the illness level of a child when deciding whether to treat or not. For example, less experienced GPs with secondary care paediatric experience were more confident in identifying seriously ill children and, henceforth, had more confidence in choosing not to prescribe for children who would recover without treatment, despite how serious their illness appeared. Non-clinical factors included knowing the patient, the number of times the parents consulted the prescriber for the same illness, concerns of parents not re-consulting if their child deteriorated, parent pressure and when the time of consultation took place (evening or a weekend).

The complexity and challenge of understanding how prescribing decisions are made is demonstrated in the in-depth qualitative approach taken to explore and test nurse prescribers' pharmacological knowledge and decision-making in Offredy et al.'s study.^[108] In this study, interviews and case scenarios were used to explore the process undertaken in decision-making by a number of nurse practitioners, including practice and district nurses, of whom 18 were prescribers and 7 were non-prescribers. The study highlighted the analytical and intuitive thinking nurse prescribers make during decision-making. Despite the majority of nurses rating themselves as confident, nurses failed to identify issues or provide acceptable solutions to the problems presented in the patient scenarios. Nurses were knowledgeable in their specialist areas of practice, but were unable to make decisions outside of this due to the lack in appropriate pharmacological knowledge and confidence. Authors of this study attribute certain correct responses to a mixture of intuitive thinking (such as providing the correct response without being able to explain why or basing their responses on their feelings and instincts), and analytical thinking (where a correct response is made with scientific reasoning). Analytical thinking with a correct response and scientific reasoning was attributed to nurses having information stored in their long-term memory that enabled them to make the correct decision. In some cases, weak analytical thinking also took place where nurse's simply re-iterated knowledge learnt without knowing the scientific reasoning behind it. For example,

one nurse did not know the relationship between aspirin and breast milk despite stating that aspirin should not be taken by breast feeding women. In addition, non-clinical influences on decision-making such as the professional boundaries of nurses and support from colleagues were noted. This study showed the importance of sound clinical knowledge, confidence in prescribing and making clinically justifiable prescribing decisions. It also showed the lack of appropriate pharmacological knowledge which is consistent with other reports on nurse prescribing. [8, 12, 88]

Evidence of how NMPs clinically reason and make prescribing decisions is limited. More empirical data on this could give insights into the knowledge, skills and attitudes of NMPs and how it is used when making prescribing decisions. This could support them in their training and development when providing patient care. However, a theoretical framework mirroring the complexity of making clinical decisions and developing expertise in prescribing is required to understand the whole-task of prescribing. McLellan et al. states that, “*educational theories provide perspectives on the nature of learning, which can then guide pedagogical research and practice*” (p.89). [109] This allows researchers to focus on methods to improve education and subsequently improve practice. The theoretical framework informing this programme of research is derived from educational theories. This will be discussed in Section 2.5.7 below.

2.5.7 Theoretical Framework Informing the Programme of Research

Educational theorists have been in conflict with regards to which paradigm best describes the acquisition and reproduction of knowledge during the process of learning. [110] Cognitive paradigms, branching from the study of cognitive psychology, focus on the acquisition of knowledge, skills and attitudes as separate components. In addition, research on expertise has focused on theories from cognitive psychology. One of the cognitive paradigm perspectives is the traditional view that knowledge is absolute and held as cognitive structures in the mind that are separate from “*the world beyond the skin*”. [110] This means that the process of learning is focused on the individual acquiring, retaining and *reproducing* their knowledge or skills. [109]

In contrast, social learning theories emphasise that the process of learning is situated (i.e. occurring within the context of an environment or situation) and dynamic. This means that the process of learning includes the context in which learning takes place, the social interactions between individuals in the environment and how knowledge is *produced*.

Billett proposed to draw upon both educational paradigms suggesting expertise should encompass cognitive, social and culture dimensions.^[110] In the context of medical education and the task of prescribing, McLellan et al. states that the task of prescribing is complex and that educational approaches fail to encompass cognitive, social and cultural dimensions, thereby limiting the development of newly graduated doctors' expertise.^[94]

Complex learning must be addressed holistically by not only combining what is learnt into an integrated knowledge base, but by facilitating the transfer of knowledge into real-life tasks.^[111] Van Merriënboer and Kirschner argue that educational approaches attempt to “*prepare graduates for the labour market*” in response to the demands posed by society, business and industry.^[111] This results in students often complaining of a disconnected set of modules and an unclear view of how the curriculum relates to their future professions. Van Merriënboer and Kirschner attribute this to educational programmes not providing the appropriate affordances for students to transfer what they have learnt into real-life workplace tasks. McLellan et al. argues that competency-based education is a major shortfall in the preparation of medical students to become prescribers due to its lack in mirroring the complexity of prescribing.^[94] In addition, students learning to prescribe are not legally able to prescribe and may only be provided with the affordance to practice their prescribing skills under close supervision.

The non-medical prescribing programme is not explicitly based on competency-based education. However, HEIs that offer the non-medical prescribing programme frequently utilise the ‘competency framework for all prescribers’ to assess non-medical prescribing students throughout the programme and PLP.^[31, 39]

Healthcare professionals embarking onto the non-medical prescribing programme are experienced healthcare professionals who are mature learners with diverse academic backgrounds. Upon completion of the non-medical prescribing programme, they are expected to demonstrate competence. However, Bereiter & Scardamalia argue that no matter what learners are expected to demonstrate or achieve, the outcome should be directed towards achieving expertise. ^[112] In order to acquire expert performance, continued deliberate practice, in the complex environment in which they work, is necessary to achieve and maintain expert performance. ^[80, 112] This also includes an individual reflecting on their thoughts and actions to maintain and improve their skills. In order to mirror the complexity of prescribing, McLellan et al. integrated various theories of expertise development and proposes an alternative approach for how “*prescribing education could work*” (Figure 3.0). ^[94] In addition, McLellan et al. uses her proposed model to examine empirical evidence from medical literature on prescribing to assess whether it fits with the different components of the theoretical model.

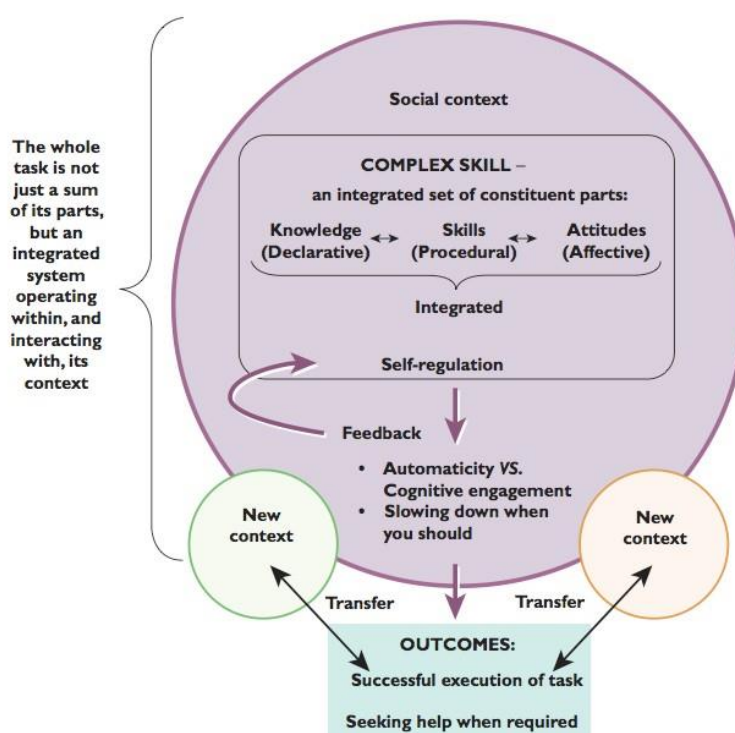


Figure 3.0 Theory of Expertise Development Model (the “Model”) ^[94]

These theories illustrate that in order for learners to develop, they should engage and integrate their knowledge, skills and attitudes within a social context. By reflecting on their knowledge, skills and attitudes, the learner should be able to adapt to the demands of the environment in order to successfully complete the task, in a process referred to in the figure as 'self-regulation'. In the process of self-regulation, the learner regulates how much cognitive engagement is required for the task in order to successfully execute the task, or seek help if required. The uniqueness of individual tasks dictates that the learner transfers what has been learnt from this task to multiple situations and contexts.

We are in agreement with McLellan et al.'s Model of prescribing which was developed by combining theories of expertise development and instructional design. [94, 111-113] An additional feature of expertise development is the ability to balance automaticity and cognitive engagement by recognising when one should slow down their thinking. [113] The Model was utilised by McLellan et al. to examine if empirical evidence on educational interventions for prescribing in medical literature acknowledge the different components of the Model to make suggestions for how prescribing education *could* work. [94] To our knowledge, this is the only model to specifically mention prescribing. The Model could be used to evaluate prescribing education for any healthcare professional, including NMPs, but this has not yet been done. This programme of research sets to assess whether the Model is suitable for use on NMPs in Chapter Five and Six of this thesis. In addition, in order to illustrate the cognitive component from the Model, the author from this programme of research used the IPT to explore the clinical reasoning processes of NMPs during the process of making clinical decisions. This is explored in this programme of research in Chapter Seven and Eight of this thesis.

2.6 Summary

This review of the literature has identified a gap in understanding how non-medical healthcare professionals acquire their expertise when undertaking the non-medical prescribing programme. Non-medical prescribing programmes are offered to a range of healthcare professionals with different prescribing rights, in which

multiprofessional education in these programmes is common. Despite the benefits of multiprofessional education, the reported concerns on the diagnostic and clinical examination skills of pharmacist prescribers and pharmacology knowledge of nurse prescribers could be attributed to their varied academic and experiential backgrounds. Research on the training and acquisition of NMPs knowledge and skills focused on the new wave of prescribers soon after the adoption of non-medical prescribing rights, which were mostly conducted or published between 2006-2007. This is likely to be out-dated with the increasing number of NMPs, their integration into the health workforce, and the acceptance and positive views of patients and colleagues. Changes in the professional culture as a result of this is likely to influence the attitudes of NMPs and make parts of the research conducted on the early-adopters of non-medical prescribing no longer applicable. It is, therefore, unclear to what extent students on the current non-medical prescribing programmes experience the reality and complexity of prescribing. There is also very little reported on how NMPs with extensive prescribing rights make clinical prescribing decisions in complex and dynamic environments. The purpose of this programme of research was to address these current gaps in research.

Before specifying the overall aim of the research, it is important to outline two key decisions that were made by the author about the programme of research. Firstly, due to the varying prescribing rights given to NMPs, this programme of research focused on pharmacist and nurse independent prescribers, as they have the most extensive prescribing rights. Second, it was decided that the research should focus on pharmacist and nurse independent prescribers who worked in secondary care. Ready access to patient records, including laboratory results and working within a MDT reduce the barriers to prescribing and provide an ideal environment to study how pharmacists and nurses acquire the expertise when learning to prescribe. It was also hoped that choosing a specific sector of prescribing will allow a more in-depth exploration of the contextual influences upon prescribing and make the research practically more manageable. Third, based on the theoretical framework informing this programme of research, the author chose to focus on the acquisition and development of expertise. This meant focusing on how pharmacists and nurses who are learning to prescribe acquire and develop their expertise, by focusing on the

components within the Model as an integrated system operating within a socio-cultural context. These three decisions led to the overall aim of this programme of research being as follows:

To explore the learning and clinical reasoning processes of independent prescribing students and prescribers working in secondary care.

A programme of research consisting of three studies (submitted for publication as four journal articles) was conducted in order to address this overall research aim. The structure of this programme of research is discussed in Chapter Three.

Chapter Three - Overview of Programme of Research

The purpose of this chapter is to provide a rationale for the format of this thesis and an overview of the entire programme of research, before describing the rationale for methodological choices in the next chapter.

3.1 Rationale for Submitting in Alternative Thesis Format

The alternative thesis format is used as the structure for this thesis. The overall aim of this programme of research was based on exploratory studies which were cumulative. Findings from each exploratory study dictated the design of the remaining studies. The construction of this programme of research, therefore, allowed for individual papers to be produced, which were written in the format of journal articles. In addition, the alternative format thesis was chosen because the author had been focused on preparing and submitting research papers since the start of the PhD. This was to ensure efficiency in the dissemination of her work prior to thesis submission.

3.2 Structure of Programme of Research

A programme of research was conducted to address the overall aim of this PhD. Data collection commenced in December 2013 and ended in December 2015. The theoretical framework (Theory of Expertise Development Model, referred to as the “Model”, Figure 3.0), presented in Section 2.5.7, informed this programme of research. The research began with a qualitative systematic review (Study One, Chapter Five) which explored how factors underpinning the expertise development of nurse and pharmacist independent learners and prescribers are reported in the literature. This was done using themes from the Model in order to assess whether the framework was as applicable to literature on non-medical prescribing as it is to literature on medical students learning to prescribe. Twenty-nine studies were

included in the systematic review, which were qualitatively synthesised and analysed using framework analysis. The findings from Study One are presented and discussed in Chapter Five. Findings from Study One confirmed that the Model is applicable to literature on non-medical prescribing, which included literature on pharmacists and nurses learning to prescribe. This informed the design of Study Two, in which the Model was used to analyse empirical data on pharmacists and nurses learning to prescribe.

The literature review in Section 2.5 had identified that there are no recent in-depth studies investigating the acquisition and development of the knowledge and skills of non-medical healthcare professionals learning to prescribe. The aim of Study Two was to conduct an exploratory study, using a qualitative methodology, to explore how secondary care nurses and pharmacists on the independent prescribing programme acquire and develop their expertise to become prescribers. This was to ensure that individual components, such as 'knowledge' and 'skills' are viewed as components within a complex integrated system as presented in the Model (Figure 3.0). Study Two employed a novel technique with nurses and pharmacists learning to prescribe, which used audio-diaries to record their learning experiences and decision-making processes when they encountered an event relating to the development of their prescribing skills during the programme, and more specifically during the PLP. Seven nurses and six pharmacists from varied specialties in secondary care who were undertaking the independent prescribing programme participated in the study. This was followed up with a semi-structured interview for participants to elaborate further on their learning experience and to ensure the researcher had interpreted their recordings accurately. The findings of Study Two are presented and discussed in Chapter Six. One of the findings from Study Two was that, despite some students recording their clinical decision-making processes during their PLP, not all students were provided with the affordance to prescribe under supervision. It was, therefore, difficult to explore the cognitive processes involved during their clinical decision-making with this group of participants.

Study Three, therefore, went on to explore how secondary care nurse and pharmacist independent prescribers clinically reason when provided with prescribing scenarios comparable to their usual prescribing practice. Eleven nurses and ten pharmacist independent prescribers who worked in secondary care settings participated in the study. Findings from this study was written in the form of two papers, referred to in this thesis as Study Three (a) and Study Three (b) in Chapter Seven and Chapter Eight.

As mentioned above, Study One used the Model to explore whether it was applicable to literature on pharmacists and nurses learning and practicing as prescribers. The Model was also used to analyse empirical data from pharmacists and nurses learning to prescribe in Study Two. However, results from Study Two did not reveal the cognitive processes of pharmacists and nurses learning to prescribe when making clinical decisions. Study Three focused on the cognitive processes of pharmacists and nurses when making clinical decisions, which is also present in the Model. Figure 4.0 shows how studies in this programme of research are based on the Model.

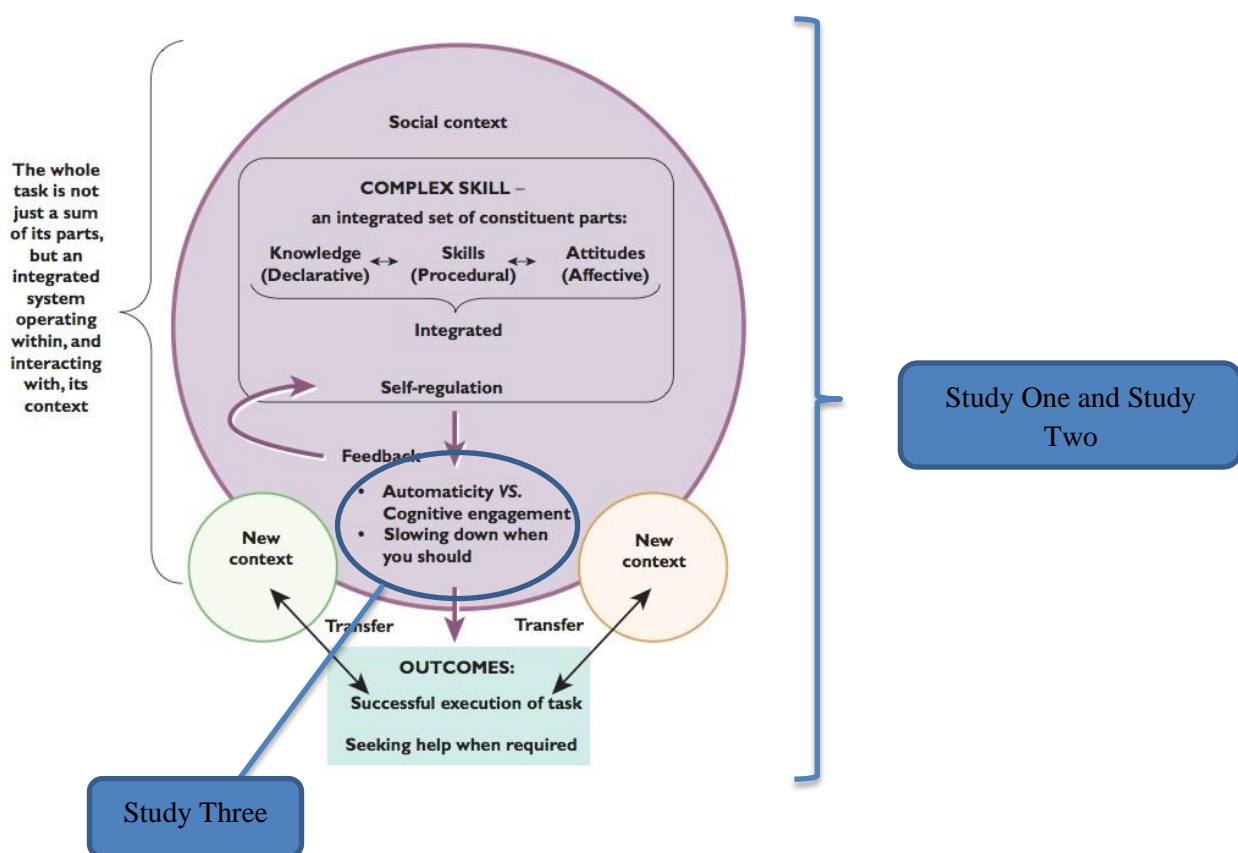


Figure 4.0 A Summary of This Programme of Research Based on the Theory of Expertise Development Model

Chapter Four – Methods

The purpose of this chapter is to provide a rationale for the overall approach taken for this programme of research and a description of the methods employed in each study. Methodological issues and ethical considerations in this programme of research are also discussed.

4.1 Theoretical Underpinnings of the Research Method

Qualitative research seeks to understand a phenomenon in a context-specific setting. An understanding of the phenomena requires that the researcher state implicitly or explicitly their underlying philosophical underpinnings, which state the nature of each paradigm and how they interpret their results.^[114] The ontological stance within this research is that of a relativist perspective. Braun and Clarke define it as, “*a theoretical position that holds that there are multiple, constructed realities, rather than a single, knowable reality*”.^[115] Guba and Lincoln pose the epistemological question: “*what is the nature of the relationship between the knower or would-be knower and what can be known?*”.^[116] This programme of research operated within the constructivist approach in which people construct knowledge out of their experience. This means that knowledge is socially constructed by multiple realities and may, therefore, change with time.^[114, 116] Therefore, to account for these multiple realities, a multimethod approach of data collection is required to understand the realities constructed out the experience of participants in this programme of research.

4.2 Rationale for Qualitative Research

The studies in this programme of research are all based on qualitative research. A qualitative approach was considered an appropriate method to address the objectives

of the studies which were concerned with understanding and exploring the learning and clinical decision-making processes of pharmacist and nurse independent prescribers.

Qualitative research allows the researcher to develop concepts, theories or hypotheses to help understand social phenomena by exploring how people behave and what respondents mean when they describe their views, experiences, attitudes and behaviours. ^[117] Bogdan et al. identifies five aspects of qualitative research that make it qualitative; “*naturalistic*”, “*descriptive*”, “*concern with process*”, “*inductive*” and “*meaning is the goal*”. ^[118] The in-depth nature of qualitative research makes it a suitable method to explore rich, descriptive data which can be used to develop theory. In some cases, participants are studied in their naturalistic settings to explore their behaviour in more detail. Study Two and Study Three were informed by the gap in research noted in the literature review, making it difficult to use a deductive method, which requires the researcher to prove or disprove a preconceived hypothesis. ^[119] Nevertheless, during the process of collecting data and looking for patterns to interpret the data, the deductive method could be used once initial theories have emerged from the inductive approach. ^[119]

The researcher used an inductive method for Study Two and Study Three. Green et al. described inductive reasoning as theory that is “*built from empirical observations*”. ^[120] A qualitative research design was preferred over quantitative due to the flexible nature in obtaining data. ^[120] As mentioned previously, qualitative research designs are concerned with understanding meaning and how a social phenomenon occurs. The use of audio-diaries in Study Two employed a naturalistic approach where participants recorded their learning experiences in their workplace during the PLP. Studying participants in their naturalistic settings allows for detailed exploration of their behaviour. ^[117] In addition, exploring how pharmacists and nurses learn to prescribe and how clinical decisions are made focuses on understanding the processes involved, making a qualitative research design fit for this purpose. Moreover, a quantitative approach was not seen as suitable for this

programme of research due to the complex nature of attempting to understand how pharmacists and nurses learn and make clinical decisions.

4.3 Study One Method

4.3.1 Study One Literature Search Strategy Method

Study One is a systematic review, which aimed to assess how the factors underpinning expertise development for pharmacist and nurse independent prescribers and those learning to prescribe is reported in the literature. This was done using themes from the Model to assess whether the Model was as applicable to literature on non-medical prescribing as it is to literature on medical students learning to prescribe.

A number of electronic databases were searched for 2006-2014 using a variety of keywords (Chapter 5). PRISMA guidelines were followed during the screening process. PRISMA guidelines ensure that systematic reviews and meta-analyses that are conducted are of high quality.^[121] Moreover, full-text articles were assessed for eligibility using the Best Evidence Medical and Health Professional Education (BEME) score ratings. The BEME collaboration, from which the BEME rating scale came about, aimed to conduct a *“logical and explicit appraisal of available information to determine the best evidence relating to an issue in health professional and medical education”*.^[122] The BEME rating scale used in this systematic review is a 1-5 rating scale based on the strength and trustworthiness of the findings. Articles that scored 3 or more were included in the qualitative synthesis, which employed the framework analysis technique based on the Model used.

Themes from the Model were taken to create the framework for analysis. These included ‘knowledge’, ‘skills’, ‘attitudes’, ‘metacognition’, ‘sociocultural context’ and ‘transfer’. Two additional themes, ‘learners’ reactions’ and ‘teachers’ reaction’ were also included for intervention studies. These were based on McLellan et al.’s inclusion of these themes in her review of intervention studies.^[94]

4.3.2 Study One Data Extraction Method and Analysis

A data extraction form was designed to extract details of each study such as year of publication, author, country of origin, study setting, study design, type and number of participants and the type of prescribing reported in each study (Chapter 5 – Appendix 2.0). In addition, extracts of data from each included study which mapped onto the themes taken from the Model were entered into the QSR NVivo 9® software. As this study set out to apply the Model (described in Section 2.5.7) to the literature, this meant that a deductive reasoning approach would be used. Framework analysis was chosen due to the availability of pre-defined themes from the Model and because it is a flexible tool that is not aligned with a theoretical approach. ^[123] In addition, framework analysis is not concerned with generating theory.

Study One tested whether the Model used in McLellan's study is a suitable framework for use on non-medical prescribing literature. ^[94] The results (provided in Chapter 5) confirmed that it is a suitable Model to capture the complexity involved in prescribing amongst NMPs and this informed the research question for Study Two.

4.4 Study Two Method

Study Two explored how secondary care pharmacists and nurses undertaking the independent prescribing programme learn to prescribe. In order to explore the learning experiences of pharmacists and nurses, an in-depth, descriptive and flexible method of data collection was necessary. Study Two used a qualitative research methodology by using audio-diaries and semi-structured interviews to collect in-depth data.

4.4.1 Audio-diary Justification

Hislop et al. defines audio-diaries as a *“form of narrative text in which the individual speaks in a monologue form to record their subjective impressions”* of the issues of interest to the researcher. ^[124] Language is central in qualitative research. Audiotapes

are used to record verbal forms of data, which are later transcribed to produce a transcript of qualitative data.

Like interviews, audio-diaries can be semi-structured or unstructured. A semi-structured audio-diary with prompts (Appendix 10.0) was given to participants in Study Two. This allowed participants to record their thoughts with more focus on the aims of the study but with room for the participants to elaborate on what they felt needed reporting. An unstructured audio-diary can provide very detailed accounts of experiences, with a potential lack of focus on the research interests, or can leave the participant feeling lost and unsure of how to start the recording.^[98, 124, 125] This relatively non-intrusive method of collecting data can be viewed as an advantage or disadvantage depending on the participant, regardless of whether prompts are provided or not. Some participants may not feel comfortable “*speaking to themselves*” resulting in very little descriptive data, a list of daily events, or simply no data at all.^[98] On the other hand, the one-way narrative may also rule out the bias that may be introduced from the presence of a researcher when recording audio-diaries.

As audio-diaries are a relatively non-intrusive method of obtaining data, the importance of the researcher remaining in contact with participants has been emphasised in the literature.^[98, 124, 125] The ‘Going Wireless Study’ was a study conducted on 19 novice mobile phone users for 6 weeks to discover their experience of using mobile phones.^[125] It included 3 interviews and an unstructured voice-mail diary, all of which included two investigators being involved full time in the study. A follow-up study called the ‘Wireless Life-Cycle Panel Study’ involved 200 participants over a 6-month period with two investigators that were only involved part-time. It used a mixed-method approach of qualitative and quantitative data, and a semi-structured voice-mail diary. Both studies included incentives, but the Wireless Life-Cycle Panel Study involved a larger incentive of \$2 per call rather than \$1 per day. In the ‘Wireless Life-Cycle Panel Study’, which used semi-structured voice-mail diaries, participant rates were found to be surprisingly lower than the ‘Going Wireless Study’, which used an unstructured voice-mail diary. The lower participant

rate was attributed to less investigator involvement, which may have left participants feeling less motivated with the research undertaken or forgetting to record frequently. It was, therefore, seen as important to have the researcher be involved in data collection stage of Study Two, even if a non-intrusive approach was taken.

The nature of narrative enquiry with audio-diaries makes it a subjective, monologue method of recording data.^[124] Notwithstanding the one-way narrative of audio-diary recordings, Monrouxe's study revealed that this method of collecting data can lead to the development of a participant-researcher relationship.^[98] Monrouxe undertook a longitudinal narrative research on medical students to investigate medical students' professional identity formation. The formation of a professional identity can be viewed as an emotionally turbulent transition phase for first year medical students entering the world of medicine. Due to the nature of the research question, some students treated the audio-diary recordings as a method of opening up about their personal experiences. On the other hand, some students reported feeling awkward speaking to no one and were therefore not compliant with the use of audio-diaries. Nevertheless, this is where the researcher should become involved to ensure that participants remain interested and to ensure the researcher reflects to the participants the scope and depth needed in the diary entries.

Moreover, audio-diaries can capture events either in real time or as close to the event as possible. Participants are, therefore, able to reflect on their thoughts, feelings and touch upon the social context surrounding them in a time efficient way.^[98, 124] The ability to carry the recording device can be seen as useful for those constantly moving from one location to another. Audio-diaries provide a descriptive narrative enquiry, which will include how things are said in order to obtain micro-level accounts of meanings, whilst also mirroring the social context, which will not necessarily be portrayed if written diaries were used. Audio-diaries used in Study Two can be carried around to capture the learning experiences of students as close to the event as possible using the prompts provided, rendering the preferred method of data collection a semi-structured audio-diary in combination with a follow-up semi-structured interview.^[124] The incorporation of a follow-up semi-structured interview

was to allow participants to elaborate further on their learning experience and to ensure the researcher had interpreted their recordings accurately.

4.4.2 Study Two Sampling and Recruitment Method

Universities across the UK offering the independent prescribing programme were contacted via email in order to recruit student pharmacists and nurses who were working in secondary care settings.

An invitation email containing the participant information sheet (Appendix 6.0), participant form (Appendix 7.0) and consent form (Appendix 8.0) was circulated to non-medical prescribing programme leaders to forward to students on the programme. In addition, a research participant flyer was also circulated to programme leaders and via Twitter to recruit participants (Appendix 13.0). Programme leaders running the non-medical prescribing programme circulated the email to students on the independent prescribing programme.

Purposive and snowball sampling was used to recruit into the study. Purposive sampling is a sampling method that is used when a pre-established criteria for recruitment has been identified. ^[126] Snowball sampling is a “*specific application of purposive sampling*” used as a method to recruit participants by asking one of the participants to identify others that meet the eligibility criteria. ^[119] The main inclusion criterion was secondary care pharmacists and nurses that were undertaking the independent prescribing programme, regardless of their clinical background. The researcher intended on recruiting 10 pharmacists and 10 nurses. However, 6 pharmacists and 7 nurses were recruited in total due to recruitment difficulties (Section 4.6.4). Pharmacists and nurses who were interested in participating contacted the researcher directly and were asked to sign the participant form and consent form prior to beginning their audio-diary recordings. The participant form was used to ensure that they fit the inclusion criteria for the study and for the researcher to obtain some background characteristics of each participant in the study.

4.4.3 Study Two Data Collection Method

Recruited participants were offered Dictaphones or the option of recording audio-diaries using their phones. They were also provided with audio-diary guidelines (Appendix 9.0) and prompts (Appendix 10.0) to aid students when recording their thoughts, feelings and experiences during the process of learning to prescribe. Students were asked to record any significant events related to the development of their prescribing skills during the programme, with an emphasis on the PLP. This was left deliberately broad to record their thoughts and feelings on what they perceived as significant events during their process of learning to prescribe. Initially, students were asked to record audio-diaries for two weeks. However, students had varying times for their PLP, which consequently led to some students spending months in the study. This was amended by requesting participants to record 2-3 minutes on approximately 5 different occasions. Students were also made aware that they could record more if they wished. Students were also reminded to protect the anonymity of patients and members of staff when recording their audio-diaries. In addition, participants were asked if they would like the researcher to remind them to record their audio-diaries. Those who agreed to this were sent weekly reminders.

Following the completion of audio-diaries, a follow-up interview was scheduled to further enrich the data. Audio-diaries were transcribed intelligent verbatim and a copy was sent to students prior to the interview. Written consent was obtained prior to the beginning of a face-to-face interview. Participants that preferred a phone interview gave verbal consent prior to the interview and written consent was obtained sent via mail to the researcher after conducting the interview. The semi-structured interview was tailored based on the audio-diary recordings to further enrich the data. Additional questions were also asked such as their experience on the programme and their experience of using audio-diaries as a data collection method (Appendix 12.0). All semi-structured interviews were recorded and lasted up to 71 minutes. Students who took part in the study were given a certificate of completion and a £10 high street voucher (Appendix 14.0). All data obtained from students in this study were anonymised.

4.4.4 Study Two Data Analysis

Study Two in this programme of research used a constructivist grounded theory approach. Charmaz bases the constructivist grounded theory approach on the assumption that social reality is constructed and therefore, the researcher is an inherent part of that reality, which should be taken into account during the stage of analysis.^[127] This means that researchers should be aware of their preconceptions and reflexivity in order to ensure accuracy in analysing the data. Charmaz states the constructivist term used in her approach to grounded theory is to “*acknowledge subjectivity and the researcher’s involvement in the construction and interpretation of data*”.^[127]

Charmaz’s constructivist grounded theory was chosen to analyse the data obtained from students learning to prescribe on the programme. The choice of audio-diaries to capture their subjective experiences, attitudes and behaviours during the PLP also allowed the researcher to gain an understanding of their social realities. This allowed the researcher to construct theory from the data obtained of students’ experienced realities when learning to prescribe. The researcher undertook line-by-line coding as the initial coding stage for Study Two. Line-by-line coding fits particularly well for studying empirical processes, as it ensures the researcher remains open to the data in order to identify “*implicit concerns*” and “*explicit statements*” made by participants.^[127] This stage of coding was done with a high level of detail to capture the context in which students are learning to prescribe. This was especially important due to the heterogeneous nature of students’ experience during the PLP.

The second stage of coding referred to as focused coding involved sifting, sorting and synthesising large amounts of data. Charmaz defines focused coding as making “*decisions about which initial codes make the most analytical sense to categorise your data incisively and completely*”.^[127] Codes were continuously refined whilst undergoing a detailed process of iteration as more data was obtained and revisited. Despite the researcher categorising codes, it became obvious that developing a theory from the codes and categories was difficult due to the complexity and the many influences involved during the process of learning. It also became evident that the Model informing the research was a suitable framework to present the complex

processes involved in learning to prescribe. The researcher chose to revisit the focused codes, rename and redefine them into the influences involved during the process of learning to prescribe in line with the Model used. For example, ‘learning transferred to practice’ and ‘learning transferred to way of thinking’ were codes that were categorised into ‘applying knowledge’. However, due to the many influences involved in the application of knowledge, this was later changed to ‘self-directed learning’. Self-directed learning here was defined by the author as the process in which the learner takes the initiative to act autonomously on their learning needs to apply the knowledge they gained to practice. This also included situations where students were undergoing self-directed learning, but could not apply their knowledge to practice due to the lack in affordance e.g. being unable to prescribe as a student, and instead described their thoughts as a prescriber. ‘Self-directed learning’ was a sub-category of ‘autonomy’, which was a focused code under ‘intrinsic factors’, influencing the process of learning to prescribe. Intrinsic factors were considered the internal processes influencing the learner. Based on the Model, this included the ‘knowledge’, ‘attitude’ and cognitive processes described by the learner. The researcher was able to verify concepts emerging from the data by categorising the major influences involved during the process of learning to prescribe when data saturation was reached.

4.5 Study Three Method

Study Three aimed to explore how pharmacist and nurse independent prescribers in secondary care make clinical decisions. In order to explore this complex phenomenon, validated clinical vignettes (Appendix 22.0) were used to obtain verbal protocols using the think-aloud approach, followed by a semi-structured interview.

4.5.1 Think-Aloud Protocol Justification

The IPT model (Figure 2.0) described in Section 2.4.2 forms the basis of the think-aloud method, which has its roots in psychological research. The think-aloud technique is a method in which participants are asked to verbalise their thoughts out loud in an attempt to understand the mechanisms and internal structures of cognitive processes.^[128] The IPT model was used by Ericsson and Simon as a method to

interpret verbal data obtained from subjects using a method such as the think-aloud technique. ^[128] According to Ericsson and Simon, the verbalisation of thought processes is based on the information held in the short and long-term memory. This depends on the amount and type of information retained in the short and long-term memory, as well as the conditions and contextual influences for accessing them. Moreover, being able to access these memory stores means that the time in which verbalisation occurs is a significant determinant to which memory store a participant is likely to draw their information from.

Depending on the type of protocol used, the process of verbalisation in the think-aloud technique is based on information that is accessed in the short, working or long-term memory and put into words. Someren et al. states that “*the output of this process is the spoken protocol*”. ^[129] The protocol can be spoken concurrently, introspectively or retrospectively. Concurrent think-aloud protocol is the process in which participants are given a task and asked to think-out-loud whilst performing the task. Introspective think-aloud is a form of concurrent think-aloud in which the subject is prompted to report their thoughts at certain points during the task. Finally, retrospective think-aloud is the protocol of a subject after they have performed a task, for example, by asking a subject how they solved a particular problem.

Study Three undertook a concurrent think-aloud approach using validated clinical vignettes. Thinking aloud whilst performing a task is thought to reveal information available in the working memory. ^[130] Unlike the introspective method in which cognitive processes are disturbed and the possibility of recall bias with the retrospective method, the concurrent method does not run into either issue. Moreover, retrospective think-aloud leads subjects to describe interpretations of their cognitive processes that are retrieved from the long-term memory and verbalised, therefore, not producing all the information available in their working memory. ^[129]

Nevertheless, the think-aloud technique produces rich and extensive data that reveal the processes and methods used to solve a task, as well as what aspects of the task

the subject would concentrate on. ^[128, 130, 131] However, this technique has been criticised due to the limited capacity of memory as described in the IPT (Section 2.4.2). The limited capacity of memory could influence the process of thinking aloud when subjects are presented with a task that leads to a high cognitive load. ^[132] In addition, insufficient instructions could result in an inappropriate level of verbalisation. ^[128] Despite Ericsson and Simon stating that concurrent think-aloud protocols are more valid and reliable than retrospective think-aloud protocols, threats to the validity of concurrent think-aloud protocol have also been reported. ^[133]

Someren et al. states that some subjects report that their verbalisation does not keep up with their cognitive process. ^[129] This leads subjects to slow-down their cognitive process in order to be able to verbalise it clearly, resulting in the verbalisation of cognitive processes that have been thought out more thoroughly. Reducing such limitations of the think-aloud protocol method used in Study Three is discussed in Section 4.6.1.

4.5.2 Study Three Sampling and Recruitment Method

An email containing a letter of invitation (Appendix 15.0), participant form (Appendix 17.0) and participant information sheet (Appendix 16.0) was circulated via email to a number of non-medical prescribing leads at various hospitals across the UK. A survey link (Appendix 20.0), containing the letter of invitation, participant form and participant information sheet was also circulated on Twitter, Facebook and LinkedIn. The GPhC also circulated the survey link to registered pharmacist independent prescribers (Appendix 19.0). Purposive sampling was used to recruit participants into this study to ensure maximum variability in the experiences of pharmacists and nurses as independent prescribers. The main inclusion criterion was to recruit *active* pharmacist and nurse independent prescribers that worked in secondary care. An active prescriber was defined by the researcher as prescribing at least once a week.

4.5.3 Study Three Data Collection Method

The participant form, which included a recruitment questionnaire, contained a number of questions enquiring their number of years of experience as prescribers, the number of hours worked as a prescriber and the number and type of prescriptions prescribed. In addition, participants were asked to choose up to 3 clinical therapeutic areas they felt sufficiently competent prescribing in. Participants were aware from the participant information sheet and participant form that clinical vignettes presented to them on the day of the interview would be based on the clinical therapeutic areas they chose.

Due to the busy lifestyles of pharmacist and nurse independent prescribers, this study also faced recruitment issues, especially in scheduling an interview date. Recruitment became easier when the option of phone interviews was offered to potential participants.

The interview was completed over two stages, beginning with the think-aloud protocol and immediately followed by the semi-structured interview. Participants were given a detailed orientation regarding what will be involved and expected prior to the interview.^[128] Despite the researcher explaining to potential participants that the use of clinical vignettes and methodology does not involve testing their knowledge, some participants expressed their concern. Participants who expressed their concerns were given examples of clinical vignettes as part of that orientation.

Participants were presented with 3 clinical vignettes in the first stage of the interview and asked to read and think out loud whilst going through each clinical vignette. Some participants were also asked to physically prescribe onto a pre-printed kardex if they had chosen to prescribe based on the clinical scenario presented in the clinical vignette. However, using a kardex was not possible with participants who were interviewed via the phone. The use of kardex was, therefore, not used with other participants. Participants that chose to be interviewed over the phone were emailed the clinical vignettes at the beginning of the phone call and asked not to look at them

until the start of the interview. The researcher did not interfere or prompt participants during the think-aloud protocol stage, unless participants paused and required prompting. ^[128] After the completion of each clinical vignette, the researcher asked the participant to elaborate further on the think-aloud protocol stage to further enrich the data. After completion of the think-aloud protocol stage for all 3 clinical vignettes, the researcher conducted a semi-structured interview (Appendix 21.0). This included questioning participants how and why they chose a certain clinical decision if that was unclear during the think-aloud protocol stage, what influenced their decision-making and what they believe enabled or was a barrier to their decision-making. Data collection lasted up to 80 minutes, which were recorded and transcribed intelligent verbatim. Participants who took part in Study Three were also given a certificate of completion (Appendix 23.0).

4.5.4 Study Three Data Analysis

Study Three used a constant-comparative approach to arrive at a theory explaining how pharmacist and nurse independent prescribers working in secondary care make clinical decisions. At the time of the analysis, the researcher was aware of the clinical decision-making and reasoning models in the literature. It was, therefore, important to choose a method that develops a theory grounded in the data, but also takes into account the availability of other reasoning models in the literature to compare and contrast with. Glaser describes the constant-comparative method in four stages; *“comparing incidents applicable to each category”*, *“integrating categories and their properties”*, *“delimiting the theory”* and *“writing the theory”*. ^[134] Despite Glaser describing the constant-comparative method, Boeije states that, *“the literature does not make clear how one should ‘go about’ constant comparison, nor does it address such issues as whether different types of comparison can be distinguished”*. ^[135]

It is important to note that the coding of transcripts from clinical vignettes was separated from the coding of transcripts from semi-structured interviews. However, they were later combined during the analysis process in Study Three (b) to add context to the process of clinical reasoning by describing the influences of clinical

reasoning from the questions asked during the semi-structured interview (Appendix 21.0).

The researcher undertook line-by-line coding for each transcript and compared and contrasted the following; different incidents within a single interview, interviews with similar participant characteristics and briefly compared differences between pharmacist and nurse interviews. Emerging codes were written in the format of a sentence, in order for the researcher to gain an understanding of the context in which the participant spoke in. Codes were continuously compared and refined, with similar codes being placed into categories. In addition, the researcher wrote memos containing thoughts, ideas and her understanding of what the codes and categories meant, with reference to the data, throughout the ongoing analysis. Categories were then integrated by ensuring that they all had similar properties. Finally, they were placed into a theme which was continuously defined and refined to ensure that all data from the codes and categories were consistent with the defined theme. The researcher also noted during the process of data analysis that data saturation was reached.

For example, initial line-by-line coding resulted in the following codes: assessing severity; checking past medical history; confirming or reviewing signs and symptoms; patient examination. These codes were later categorised into 'investigations'. However, after careful inspection, the codes were explored again. With the addition of more data as new interviews were transcribed and coded, the researcher noted that all these codes involved the prescriber describing themselves liaising with the patient either by looking at them or describing how they would undertake a consultation. The category was later named as 'liaising with patient'. This later fell into a theme referred to as 'case assessment' which was defined as "any instance in which the prescriber describes interacting with patients (or their family, friends or carers) and the MDT for the purposes of investigating the clinical case further. This includes prescribers describing the use of tools to assist them in the assessment of a clinical case". Categories under this theme included, 'liaising with

patient', 'liaising with MDT', 'use of assessment tools', 'investigating medical notes' and 'investigating extra check-ups' (such as laboratory results).

The creation of categories made the comparison process much easier using the QSR NVivo® 9 software in which quotations from different participants were compared. “*Delimiting*” and “*writing*” the theory as proposed by Glaser occurred when the researcher noted a distinct pattern in the process of clinical reasoning.^[134] Categories were delimited and a focus on the major themes was noted in the order of clinical reasoning. Despite Glaser describing that there is no need to add further codes once theoretical saturation is reached, the researcher continued coding in detail to ensure that the analysis process did not eliminate any additional influences to the clinical reasoning processes of participants. The “*writing of theory*” resulted in the researcher presenting the distinct clinical reasoning pattern as a prescribing model, where each theme interacted with other themes throughout the process of clinical reasoning (Figure 1 - Chapter 7).

4.6 Key issues in the programme of research

4.6.1 Trustworthiness of the Research

Reliability in quantitative research refers to results which are similar, consistent and stable over time, regardless of the number of times the method is repeated.^[136] By ensuring that a stable measure remains consistent, results should be similar with a high degree of reliability that is repeatable. However, ensuring reliability in qualitative research has been called into question. This is because the term ‘reliability’ in quantitative research is used for testing repeatability, making it an uncertain and, in some cases, an irrelevant measure in qualitative research.^[137] Instead, in order to ensure ‘reliability’ in qualitative research, researchers should demonstrate trustworthiness in their studies.^[114]

Merriam states that, “*the question of trustworthiness becomes how well a particular study does what it is designed to do*”.^[138] In addition, qualitative researchers have

recognised that there is a need for a qualitative measure of their research. Trustworthiness in this programme of research was demonstrated using a number of methods. In Study Two and Study Three, multiple methods of data collection were used to confirm the emerging findings.

In Study Two, participants recorded their audio-diaries, which were transcribed and returned to participants prior to a semi-structured follow-up interview. The researcher sought to confirm her interpretations of the recordings and enrich the data with the perspective of the participant by asking for more details about the audio-diary recordings during the semi-structured interview. This is consistent with Lincoln and Guba's '*member checks*' where the preliminary interpretation of the data is checked with study participants to ensure validity.^[139]

Study Three also used a follow-up semi-structured interview immediately after completion of the clinical vignettes in order to enrich the data by understanding how and why participants made certain clinical decisions during the think-aloud protocol. However, as mentioned in Section 4.5.1, there have been threats to the validity of concurrent think-aloud protocols.^[129] In order to reduce the limitations of the think-aloud method, the researcher ensured that participants were given detailed instructions prior to the interview, with examples of clinical vignettes, before recording the interview. In addition, participants were asked to choose up to 3 clinical therapeutic areas they perceived themselves to be sufficiently competent in. This was an attempt to reduce the cognitive load that participants may experience when reasoning using complex clinical vignettes. It was felt particularly important to ensure that participants were comfortable with their clinical vignettes and the method used to explore their clinical reasoning processes to limit the number of influences that may interfere with their cognitive processes, for example, feeling anxious or uncomfortable. Clinical vignettes used in Study Three were taken from validated exam scenarios from a pharmacy postgraduate diploma or created using the same format as the exam scenarios and validated by two consultant doctors. The participant information sheet emphasised that exploring the clinical reasoning processes of participants was not a test of their knowledge. It was, therefore,

important to ensure that the clinical vignettes used were relatively simple clinical scenarios to reduce the cognitive load and influence of attitude on cognition. It is likely that exam scenarios taken from the undergraduate medical degree would contain more complex scenarios and medical jargon that NMPs may not be familiar with.

An audit trail was recorded for all three studies which included how the data was collected and how themes emerged from the data, to ensure consistency and demonstrate dependability in the research. In addition, peer examination took place to check the plausibility of emerging themes and interpretation of data. This was over a number of stages in which the author's PhD supervisors checked the themes and interpretations of the data until all were satisfied. This process included the researcher reflecting on how her experience and biases may have impacted on the interpretation of the data.

4.6.2 Governance Approvals

Study Two recruited pharmacists and nurses who were undertaking the independent prescribing programme. Despite pharmacists and nurses working as healthcare professionals in secondary care settings, Study Two did not require NHS ethical approval. Instead, it required University Research Ethics Committee (UREC) approval which was obtained in December 2013 (Appendix 3.0).

Study Three recruited pharmacist and nurse independent prescribers who worked in secondary care settings. The researcher obtained UREC approval in March 2015 (Appendix 4.0), followed by NHS Research and Development approval by virtue of their professional role and the potential need to access NHS premises or facilities for the purpose of conducting interviews there.

4.6.3 Ethics Issues

A number of ethical issues were considered during the design and conduct of this programme of research. This included informed consent, self-determination, confidentiality and recruitment issues.

Polgar and Thomas state that, “*research participants must be fully informed about the purposes of the research, any risks associated with their participation and the uses to which the collected research data will be put*” (p 44).^[140] Before consenting to take part in Study Two and Three, potential participants were provided with a participant information sheet that outlined the aims, requirements and duration of the research, what happens to the data collected and if participants change their mind after data has been collected, how confidentiality is maintained, where the research will be conducted and details on what to do if the participant experiences any issues regarding the research (Appendix 6.0 and 16.0). Potential participants were also given the opportunity to contact the researcher if they had any further enquiries before committing to their involvement. This gave participants the self-determination (i.e. freedom of choice) to decide whether they would like to participate or not.^[140] Moreover, to ensure their self-determination was not influenced by the researcher, the researcher addressed the risk of coercion through a number of methods. Whilst the concept of coercion may seem intentional, it commonly occurs unintentionally where participants may feel uncomfortable saying no and, therefore, inclined to agree to take part in a research study.^[141]

Information about Study Two was emailed to independent prescribing programme leaders to circulate to students on the programme. This ensured that there was no risk of coercion. Information on Study Three was also emailed to non-medical prescribing leads at a number of hospitals and directly to registered independent prescribers by the GPhC to maximise recruitment numbers and minimise coercion. Participants who showed interest in the study were asked to contact the researcher directly. Participants who fit the inclusion criteria, read the participant information sheet and agreed to take part in the study were asked to sign a consent form (Appendix 8.0 and 18.0). Two participants requested certain information from their

transcript be removed or asked not to sign point 5, 6 and 7 of the consent form (concerned with using data collected for further research on non-medical prescribing). Their requests were granted after the researcher discussed this with her supervisors. Participants in Study Two were asked to sign the consent forms twice, one for the audio-diary recordings and the other for the semi-structured interview. Participants who wished to withdraw after recording audio-diaries were made aware that data from the audio-diaries would be used, unless requested otherwise.

It was also vital to ensure that confidentiality was maintained by keeping manual and electronic data secure. Data were safeguarded in compliance with faculty procedures from the University of Manchester. Participants in Study Two who used a Dictaphone to record their audio-diaries either sent the Dictaphone by recorded mail back to the researcher, or the researcher picked it up directly from the participant. Recordings were automatically transferred to the researcher's university computers secure network drive which is encrypted and recordings were deleted from the Dictaphone. Participants in Study Two who used their mobile phones to record their audio-diaries were asked to email them to the researcher's university email which was also transferred to the university's secure network drive. The same procedures took place for the interviews in Study Two and Three.

Polgar and Thomas state that *“the risks of identifying individuals in research are increased in the study of small, specialised sub-populations and in qualitative studies where direct quotation of the words of the research participant may be used in the publications”*.^[140] Participant names in Study Two and Study Three were anonymised by marking them with a pseudonym or reference number. Any patient, colleague or organisation names that were accidentally mentioned, in both studies, by the participant were deleted.

4.6.4 Recruitment Issues in Study Two

Study Two lasted for 24 months due to recruitment issues. Study Two received UREC approval in December 2013 with the intention of completing the study

September 2014. The aim was to recruit 10 pharmacists and 10 nurses who work in secondary care and are undertaking the independent prescribing programme from 11 accredited universities. The researcher felt that the limited uptake of participants was influenced by the method of recruitment chosen. This included the use of a gatekeeper (independent prescribing programme leaders) to send details of the study to potential participants who did not always access their university emails. In addition, the workload from the programme and working as healthcare professionals during non-university days made it difficult for potential participants to consider participating in the research study. Moreover, Study Two initially involved 2 weeks of audio-diary recordings. This caused issues as most potential participants worked with their DMP once a week, which meant having little opportunity to record their learning experiences. This resulted in some participants taking part in the study for a number of months which meant a high level of commitment to the study.

In order to reduce the recruitment issues faced in the study, the researcher created a participant flyer which was circulated to potential participants via independent prescribing programme leaders and in some cases, uploaded onto the university intranet to make students more aware of the research study. In addition, the researcher visited four universities to present the research study in a 5-minute presentation for the purposes of recruitment. To avoid the risk of coercion, as mentioned in Section 4.6.3, the researcher left participant forms and her details for potential participants to contact the researcher if they were interested in taking part in the research study.

By May 2014, after 6 months, only 4 participants were recruited. The researcher requested from the UREC to extend the study to September 2015, include all accredited universities offering the independent prescribing programme in the UK and to change the audio-diary wording in the participant information sheet from 2 weeks' worth of recordings to "a minimum of 2-3 minutes on approximately 5 different occasions". In October 2014, the researcher had only recruited 3 pharmacists and 7 nurses to the study. The researcher created an online survey (Appendix 11.0), which included details about the study and a participant form,

extended the study till the end of December 2015 and circulated the survey link and participant flyer via the Manchester Pharmacy School Drug Usage and Pharmacy Practice division Twitter account (@MPSPPharmPrac). This finally resulted in the inclusion of 6 pharmacists and 7 nurses in the study, which resulted in data saturation after coding the data.

4.6.5 Recruitment Issues in Study Three

Study Three achieved UREC approval in March 2015, with the aim of completing data collection on the 1st July 2015. However, due to the inclusion of pharmacist and nurse independent prescribers who work in secondary care, Research and Development approval was also required which took a total of 2 months to obtain. Initially, Study Three was intended to continue from Study Two, by recruiting active pharmacist and nurse independent prescribers with up to 3 years registration as prescribers to explore how relatively new prescribers make clinical decisions. During the time in which the researcher was applying for Research and Development approval, the researcher undertook pilot studies with pharmacist and nurse independent prescribers with more than 3 years' experience and primary care pharmacist and nurse independent prescribers. Data from the pilot studies is not included in this programme of research. The researcher noted at an early stage of the pilot studies that the context influenced the clinical reasoning process of independent prescribers. The researcher, therefore, noted that the potential inclusion of pharmacist and nurse independent prescribers from primary care would affect the results of the overall aim of the PhD, which was focused on secondary care independent prescribers.

By July 2015, the researcher requested to extend the study to the end of December 2015, include the option of phone interviews and include pharmacist and nurse independent prescribers with any number of years of experience as a prescriber. This was because the pilot study identified little difference in the clinical reasoning skills between independent prescribers with more than 3 years of prescribing experience and independent prescribers with up to 3 years of prescribing experience. This is consistent with research in clinical reasoning which identifies that experienced

clinicians and students with various levels of experience undertook similar approaches to clinical reasoning.^[142] However, experts were found to generate more accurate hypotheses. Nevertheless, the researcher acknowledged that the aim of Study Three was to explore the clinical reasoning processes of independent prescribers and not to attribute differences in the clinical reasoning process to participants' number of years of experience as prescribers, or assess the accuracy of their hypotheses during clinical reasoning. The use of phone interviews in the think-aloud approach is not common, as the lack of observation results in the loss of non-verbal cues. Despite this, the think-aloud approach is a form of cognitive interviewing, which reports using phone interviews as a method of data collection.^[143, 144] In addition, cognitive phone interviews which use the think-aloud approach are thought to be more appropriate for participants with a higher level of education due to their ability to articulate their thoughts more easily.^[143, 145] The researcher felt that participants who chose to have their think-aloud interviews over the phone were more focused on the clinical vignettes than were the participants in the face-to-face interviews, who felt the need for continuous acknowledgement of their think-aloud process. This is consistent with think-aloud interviews that were conducted over the phone with clinicians.^[143] Researchers who conducted the phone interviews felt it was much easier, convenient, cheaper and required less prompting.^[143]

As this thesis is presented in the alternative format, the next section will present the programme of work in the format of journal articles for Study One, Study Two and Study Three in Chapter Five, Six, Seven and Eight. Study Three is written as two journal articles, which are in Chapter 7 and 8, referred to as Study Three (a) and Study Three (b) throughout the thesis.

Chapter Five

Chapter type:	Journal article
Article title:	Practice makes perfect: a systematic review of expertise development by non-medical prescribers
Submission status:	Submitted

***Note.** As this paper has been submitted, the formatting and layout are consistent with the requirements for the journal. For this chapter, references will be placed at the end of the chapter rather than at the end of the thesis.*

Practice makes perfect: a systematic review of expertise development by non-medical prescribers

ABSTRACT

Background Prescribing is a complex and error-prone task that demands expertise. The theory of expertise development model (“the model”), developed to assess medical literature on prescribing by medical students, proposes that individuals deliberately engage their knowledge, skills and attitudes within a social context. Its applicability to non-medical prescribers (NMP) is unknown.

Aim A systematic review was conducted to explore whether the model is applicable to non-medical prescribing and assess the factors underpinning expertise development reported in the literature.

Method Six electronic databases (EMBASE, Medline, AMED, CINAHL, IPA and PsychInfo) were searched for articles published between 2006-2014, reporting empirical data on non-medical prescribing education or practice. Data were extracted using themes from the model and analysed using framework analysis.

Results Twenty-nine studies met the inclusion criteria. Knowledge, pre-registration education, experience, support and confidence were some of the intrinsic and extrinsic factors influencing NMPs. Difficulty transferring theory to practice was attributed to lack of basic pharmacology and bioscience content in pre-registration nursing rather than the prescribing programme. Students saw interventions using experiential learning, compared to re-enforcing knowledge, as more useful with long-term benefits. All studies demonstrated how engaging knowledge and skills affected individuals’ attitude by, for example, increasing professional dignity. NMPs were able to develop their expertise when integrating their competencies in a workplace context with support from colleagues and adherence to guidelines.

Conclusion This is the first study to synthesise data systematically on expertise development from studies on NMPs using the model. The model showed the need for stronger foundations in scientific knowledge amongst some NMPs, where continuous workplace practice can improve skills and strengthen attitudes. This could facilitate a smoother transfer of learnt theory to practice, in order for NMPs to be experts within their fields and not merely adequately competent.

Keywords: non-medical prescribing, prescribing, pharmacist, nurse; expertise; competence.

INTRODUCTION

Prescribing is a complex process which involves a thorough understanding of clinical pharmacology and diseases, the ability to make judgements on the risks and benefits of treatment, intuition and attention to detail, within a dynamic and unpredictable environment.^[1-3]

In the United Kingdom (UK), prescribing by healthcare professionals who are not doctors is referred to as non-medical prescribing. Non-medical prescribers (NMPs) include nurses, pharmacists, optometrists and allied healthcare professionals (physiotherapists, chiropodists, podiatrists, dieticians and diagnostic or therapeutic radiographers).^[4] In order to prescribe, non-medical healthcare professionals are required to successfully complete the non-medical prescribing programme. Non-medical prescribing is categorised into independent and supplementary prescribing. Independent NMPs are responsible for the clinical assessment of diagnosed or undiagnosed patients, prescribing autonomously for any condition within their clinical competence.^[5] Supplementary NMPs are responsible for the continued care of patients who have already been diagnosed by an independent prescriber. This care is delivered under an agreed Clinical Management Plan (CMP) between the supplementary NMP, independent prescriber and patient.^[6]

In 2006, independent prescribing rights were given to pharmacists and nurses in the United Kingdom who successfully completed the independent prescribing programme. Independent prescribing allows the prescribing of “any medicine for any medical condition within their competence”, including any controlled drug except diamorphine, cocaine and dipipanone for the treatment of addiction.^[7, 8]

The independent prescribing programme is a part-time course that consists of at least 26 days of taught curricula and a minimum of 90-hours or 12 days of learning in practice. Learning in practices takes place under the direct or indirect supervision of a Designated Medical Practitioner (DMP). DMPs are registered medical practitioners with at least 3 years of recent clinical experience in the field the prescribing student wishes to train in. They provide a role in training prescribing students to meet their

learning objectives and assess the students to ensure they are competent in prescribing.^[9]

Independent prescribing programmes take on a multi-faceted mixed method approach to teaching students how to prescribe. A significant part of developing the knowledge, judgement and skills of students is based on assessing their competencies. A competency framework for all prescribers originally developed by the National Prescribing Centre and updated by the Royal Pharmaceutical Society lists competencies that underpin all prescriber's responsibility towards prescribing.^[10]^[11] Independent prescribing programmes also use that framework to assess students' competence.

In medical literature, assessing competencies has been described as insufficient measure of professional aptitude because it breaks a complex skill into individual exercises to be assessed.^[12-14] Given the complexity of prescribing, individual competencies should be merged into the context of professional practice to define excellence rather than adequacy.

Newly registered independent NMPs are deemed competent by their educators upon completion of the independent prescribing programme. Independent NMPs also have experience in their own domains of practice from prior to registration as prescribers, but have little experience in the process of diagnosing and prescribing post-registration. McLellan et al. argues that true competence in prescribing demands expertise, regardless of the simplicity of the task at hand.^[13] Expertise in this context is not defined by what or who the expert is, but by the process and development of expertise in practice. According to Ericsson, this process involves the ability to keep up to date with evidence based practice, to continuously evolve and transition into the field of practice and to adapt to uncertainty.^[15] Adapting to uncertainty during practice involves engaging more cognitive, effortful processes where the prescriber is able to control their own performance within the context of the environment.^[13, 16] This gives the definition of expertise fluidity and an appreciation for the complexity of the process of expertise development.^[17]

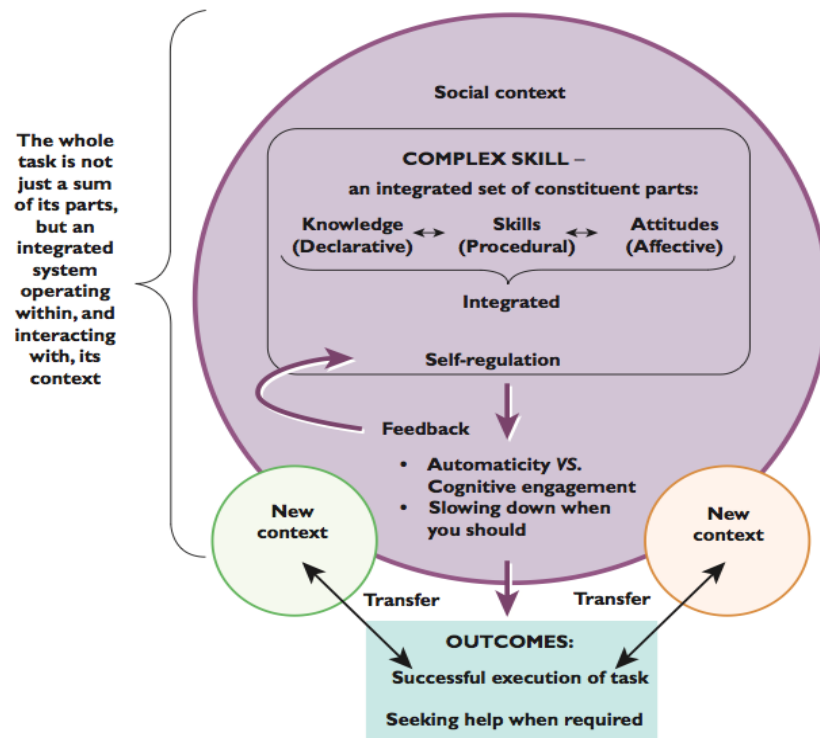


Figure 1 The theory of expertise development model (“the model”) based on expertise development and instructional design theory for complex skills ^[13]

McLellan et al. proposes a theoretical model using theories of expertise development and instructional design theory for complex skills. ^[13] This model reflects the main cognitive and social elements that come to play during the process of learning and practicing as a prescriber.

Studies have reported concerns on the diagnostic, physical examination skills and pharmacological knowledge of pharmacist and nurse independent prescribers. ^[18-22] To date, there have been no attempts to synthesize data systematically from studies on NMPs’ expertise development using this theoretical model. This model can help view expertise using a multi-dimensional lens and assess how NMPs (learners or prescribers) expertise are reported in the literature. The aims of this study are to explore whether this model is applicable to literature on NMPs and to assess how their expertise development is reported in the literature.

LITERATURE SEARCH METHOD

Search Strategy

The following electronic databases were searched: EMBASE, MEDLINE, AMED, CINAHL, International Pharmaceutical Abstracts and PsychInfo, all from 2006-2014. Search terms included non-medical prescribe*/non medical prescribe*, independent prescrib*, nurs* independent prescrib*, pharmac* independent prescrib*, education, curriculum, courses, training, clinical competen*, competen*, diagnos*, assess*. When all database searches were conducted, duplicate citations were identified and excluded.

Inclusion and Exclusion Criteria

Abstracts and titles were screened for relevance and eligibility from the title and abstract. Studies containing empirical data on themes from the model, published in English, from the United Kingdom, on nurse and/or pharmacist students on the independent prescribing programme or qualified independent NMPs between 2006-2014 were included.^[13] Studies that were a mix of independent and supplementary NMPs were also included. Stakeholders' views on independent NMPs were included as stakeholders are also involved in providing healthcare services in collaboration with independent NMPs. It was therefore seen as important to take their views on independent NMPs' expertise development into consideration.

The model refers to the subjective views of individuals that are deliberately engaging their expertise. Incorporating the views of stakeholders will give a more rounded view of independent prescribers to eliminate the chances of bias in self-reporting. Articles written by health care professionals about their own experiences as prescribers were classed as narrative data and were included.

Articles that were commentaries, editorials, reviews, news, opinions or guidelines were regarded as non-empirical data and not included. Articles reporting only empirical data that mentioned no themes from the model were excluded. Articles that included other types of non-medical prescribing, *with no mention of independent prescribing*, such as supplementary prescribing and extended independent prescribing were excluded. Studies that only included patients' views on pharmacist and nurse NMPs were excluded. Although patients do influence prescribers'

decision-making, they do not normally have an explicit role in the assessment of prescribers' expertise.

The screening process was reported according to the PRISMA guidelines (Figure 2). Studies that scored a Best Evidence Medical Education (BEME – Figure 3) rating of less than 3 or whose 'strength of findings' were not clear or ambiguous were excluded. This meant that studies which included empirical data reporting on themes from the model that were regarded as ambiguous were excluded. Non-intervention studies that showed results that are clear or unequivocal were also included in the data analysis.

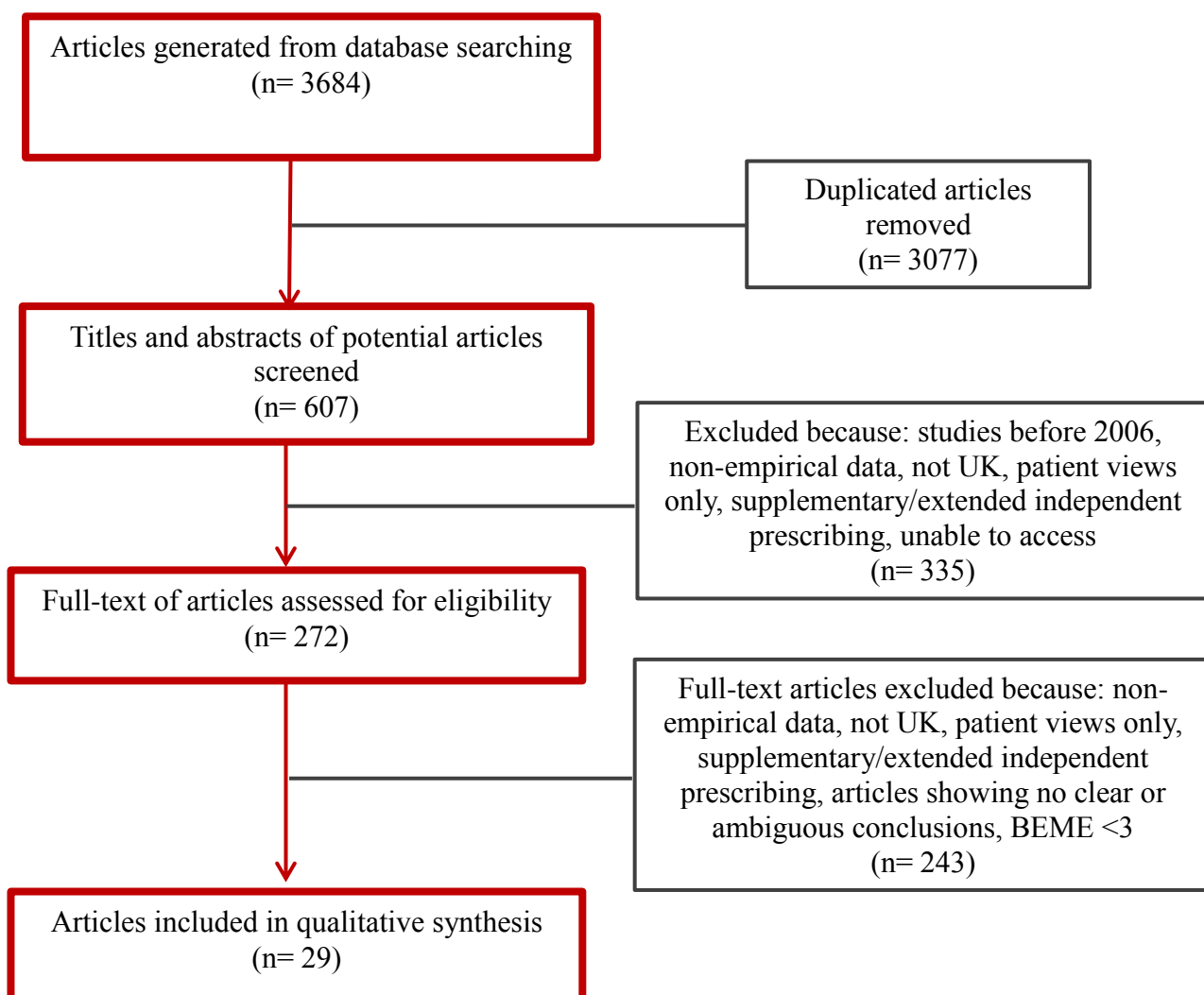


Figure 2 Flow chart of search strategy and study selection based on PRISMA guidelines.

Data Extraction and Analysis

A data-extraction form was designed to extract the following information: core details (year of publication, author, country of origin; study background (setting: primary/secondary/tertiary care, study design, setting, type of participants, number of participants, type of prescribing); themes from the model (knowledge, skills, attitudes, metacognition, sociocultural context, transfer, learners' reaction, teachers' reactions). Studies that fit the inclusion criteria were given a BEME score using the BEME score table (Figure 3). Those that scored 3 or above were included in the data analysis.^[23] Data were extracted independently by ASA and PJJ and critically appraised in order to give each included study a BEME score. All authors met to resolve any differences in their results by discussion. The 'strength' of studies was defined as Yardley et al.'s definition: *"strength equates with critical appraisal and is a statement of your confidence that the results of the study are credible. Having considered the study design, the way the study was performed and the data analysis, we rated the outcome"* as the BEME rating scale. ^[23]

BEME ratings scale for strength of research findings

1. **No clear conclusions can be drawn, not strong.**
2. **Results ambiguous; there seems to be a trend.**
3. **Conclusions can probably be based on the results.**
4. **Results are clear and very likely to be true.**
5. **Results are unequivocal.**

Figure 3 BEME ratings scale for strength and research findings ^[23]

The studies retrieved by the search were heterogeneous, due to the aim of the study. It was therefore important to standardise the data extraction method for studies that fit the inclusion criteria, to establish a systematic method of coding the data. Table 1 shows how reported competencies and themes from the model were identified within the text. These were coded using QSR NVivo 9 ®.

Table 1 Data extraction method for themes from the model on expertise development in empirical data

THEMES	Data Extraction Method
Knowledge	<p>Keyword search within the text: ‘knowledge’, ‘pharmacology’, ‘interaction’, ‘medicine, medication’, ‘know...’</p> <p>Any occasion of a student or NMP “knowing” something or a stakeholder commenting on students/ NMPs knowledge</p>
Skills	<p>Keyword search within the text: ‘skill’, ‘consultation’, ‘counselling’, ‘communication’, ‘history taking’, ‘assessment’, ‘decision making’, ‘practice, practical’, ‘training’, ‘holistic’, ‘guidelines’, ‘test results’, ‘experience’</p> <p>Any occasion of a student or NMP describing “how to” do something, or describing a task undertaken during the entire prescribing process, or the interpretation of knowledge to apply; or a stakeholder commenting on students/ NMPs skills</p>
Attitudes	<p>Keyword search within the text: ‘confidence’, ‘feels/felt’, ‘competence/competency’, ‘challenge/challenging’, ‘responsible/responsibility’</p> <p>Any occasion of a student or NMP mentioning or describing feelings or perception; or a stakeholder describing how they feel about students/ NMPs actions</p>
Metacognition	<p>Any occasion where the student/ NMP self-reflects or any occasion where the researcher codes data as self-reflection, students/ NMPs interpretation of knowledge or a formulary or an event. Students/ NMPs awareness of limits and competency, identification of needs (also self-reflection), Continuing Professional Development (CPD) needs</p>
Sociocultural Context	<p>Any mention of the environment in which the task was taking place was classed as sociocultural context. This included the</p>

	<p>professional culture of certain health care professionals, e.g. where NMPs were seen to have longer consultation times and a more holistic approach to consultation process in comparison to doctors. Multidisciplinary environments and interdisciplinary uses during the process of prescribing was also seen as the sociocultural context in which the task is taking place, e.g. receiving support or asking for advice from other health care professionals. This also included stakeholders' views on the influence of the social context on students/prescribers.</p>
Transfer	<p>This refers to the transfer of learning to new social contexts or situations, e.g. use of clinical guidelines to a prescribing task. Comments on how the programme was applied to practice were also classed as transfer, although this would also fall under skill. Intervention studies where students improve or not is also an example of whether something learnt has been transferred to a new context or not. Setting an objective based on metacognition/reflection, in order to transfer a new piece of information to practice is also seen as transfer. This also included stakeholders' views on the ability of students/ NMPs to transfer their learning to practice.</p>
Learners' Reactions	<p>The reaction, attitudes and/or opinions of learners on interventions e.g. how students felt after using pharmacology podcasts to improve their knowledge in pharmacology.</p>
Teachers' Reactions	<p>The reaction, attitudes and/or opinions of teachers implementing the interventions e.g. how teachers felt after implementing pharmacology podcasts on the students' ability in pharmacology.</p>

Data from students learning to prescribe, independent NMPs and stakeholders' views on independent prescribing were coded into the themes in Table 1 taken from the model. The model is highly subjective and therefore all data from the subject is considered as self-reports. Stakeholders' views were included in the model in order to portray how they viewed prescribers' expertise when delivering a healthcare service.

Data were analysed in order to identify key concepts and make associations between these concepts and themes. The interpretation of data and scored ratings of the extracted studies were discussed by all authors to reflect the plausibility of analysis. This was a continuous process in which analysis and the challenge of assumptions and decisions took place until all were satisfied with the analysis. Even though the process of framework analysis required all themes to be coded separately, the results showed how interconnected each theme was, as presented in the model (Figure 1).

RESULTS

A total of 3,684 articles were generated from database searching, resulting in 607 potential articles that were screened based on their titles and abstracts after duplicated articles were removed (n= 3,077). A total of 272 full-text articles were assessed for eligibility of which 29 studies were included in this systematic review. Fourteen of the 29 studies included nurse NMPs of which 1/14 also included occupational therapists; 5/29 included nurses undertaking the non-medical prescribing programme; 1/29 included a mix between undergraduate nursing students and nurses undertaking the non-medical prescribing programme; 6/29 included a mix of nurse and pharmacist NMPs of which 3/6 included other disciplines, and 2/29 included pharmacist NMPs (Appendix 1.0). Other disciplines included optometrists and allied health professionals such as physiotherapists, radiographers, chiropodists and podiatrists. Study designs included 7 mixed method, 7 qualitative (1 narrative study), 7 survey designs, 4 case studies, 3 cross-sectional studies (1 cross-sectional review; 1 cross-sectional survey; 1 correlational cross-sectional survey) and 1 descriptive survey study. Study authors for 9 papers were contacted to clarify data; two authors did not answer.

Appendix 1.0 shows details of each study, including the BEME rating for intervention studies or the 'strength of findings' for non-intervention studies. One intervention study scored a BEME rating of 3 and three other intervention studies scored a BEME rating of 4. From the non-intervention studies, 16 studies were rated as 'conclusions can probably be based on the results'; and 9 studies were rated as 'results are clear and very likely to be true'.

The results below show how integrated each theme is to other themes within the model. They will be presented based on three major findings: the application of theory to practice, competence and the prescribing practices of nurse and pharmacist independent NMPs. The application of theory to practice includes students' views on the independent prescribing programme and their ability to apply taught information to practice. The section on competence includes NMPs' self-perceived competence, how they maintain it and prescribe within their competence as well as stakeholders' views on NMPs' competence. The final section includes NMPs' practices and their reported competencies. The influence of attitude on prescribing practice is covered throughout these sections, as it was found to overlap with other themes in the model.

The application of theory to practice

Views on programme

Two studies focused on the relevance of the non-medical prescribing programme content to practice and how an intervention could improve students' pharmacology.^[24, 25] A third study described the influence of the pre-registration nursing programme on NMPs knowledge, skills and attitudes.^[26]

NMPs viewed the prescribing programme as one that provided them with adequate knowledge to be able to practice. Those who argued otherwise described it as generic and with little emphasis on pharmacology. Inadequate pharmacology content was identified by all three studies, based on the views of nurse students or NMPs (except for one pharmacist supplementary prescriber).^[24] This explains why pharmacology in prescribing programmes has been described as, "complex" or a, "foreign language".^[26]

Application of theoretical knowledge to practice by students

The application of theoretical knowledge to practice was reported as important during the course of the programme. This is addressed using intervention studies such as pharmacology podcasts^[25] and virtual patients via computer software^[27].

Both sets of participants stated the benefit of each intervention, with the virtual patient intervention resulting in students describing long-term benefits in history taking and decision-making skills 6-months after the programme. ^[27] The pharmacology podcasts aided the recall of information by knowledge reinforcement. ^[25] However, it is possible that, even after the intervention, recalling of information may still be an issue in the long-term.

Educational interventions that focused on developing students' skills and pharmacology helped them focus on their learning content and identify their learning needs. Students emphasised that the repetition of key concepts in different sessions and the continuous familiarisation of content within the workplace helped improve confidence and the understanding of concepts. ^[25, 28]

Another study comparing nursing students to registered nurses embarking on the non-medical prescribing programme showed that both groups were poor in basic numerical skills. ^[29] Speculated reasons for this were that the sample of registered nurses worked in primary care and have not been performing such calculations in their daily work. Another reason was their reliance on technology to perform calculations. Multiple regression analysis indicated that age, regardless of status or experience was a significant predictor as to why registered nurses performed better than nursing students. The author attributed this to the level of education and the reliance on mental maths for the sample of registered nurses who were approximately 35 years old. ^[29] Nurses who no longer practiced certain calculations, such as infusion rates, reported their mathematical ability in these areas as "*rusty*" and "*without practice they lost their expertise*". ^[29]

This suggests that consistent practice and a better foundation in theory influences the application of knowledge to practice and consequently, the competence of the NMP. It also shows how contextual factors influence the learner and prescriber.

Influence of context on learning

The influence of context on learning showed how experience situated in the workplace impacts positively on the learner. Educational intervention studies

highlighted how experience facilitated students' understanding of taught theory, which consequently aided them in their ability to relate it to practice:

“Answers to the questionnaire showed that all participants learned bioscience knowledge best when it related to experiences in their workplace, whether this occurred before registration as a nurse, or afterwards.”^[26]

The effect of relating knowledge to practice resulted in a student's ability to implement *“a systematic patient assessment, confidence in decision-making, a prescription writing, ethical/legal issues, evidence-based practice, gaining new knowledge and team-working”*.^[27] However, in some cases, the lack of relating knowledge to practice could have resulted in detrimental effects to patient care.^[26] This was evident when a nurse was described in the latter study as being unaware that a gastrointestinal bleed meant an internal bleed, with no wound visible to the naked eye. It could be argued that, even with sound theoretical knowledge, students find it difficult to apply their theoretical knowledge to practice.

The model is based on the deliberate practice of knowledge, skills and feelings in the context of practice.^[13] Results from the above intervention studies emphasise the influence of the sociocultural context on learning. The sociocultural context helps the learner engage their knowledge, skills and feelings by applying their knowledge to practice. With that in mind, one student described the importance of using different methods to facilitate their learning. This shows that mix-method teaching is influential on the application of theory to practice and keeps students engaged in the learning process:

“I just found that it [pharmacology podcasts] was another way of being able to learn without having to be sitting at a desk doing it...so you could get on with your life as well while you were learning.”^[25]

Nevertheless, nurse prescribers showed a sufficient level of pharmacology knowledge through the application of this knowledge to practice during patient

consultations.^[30-32] Nurses were also able to use clinical findings to reach a diagnostic decision and manage symptoms using their consultation skills.^[33]

Factors influencing transfer of theory to practice

Several factors were found to influence the transfer of theory to practice. Nurses used guidelines to discuss prescribing decisions within the multi-disciplinary team (MDT).^[34] Independent prescribers felt more confident to prescribe when using guidelines to support their prescribing decisions.^[34] However, some NMPs found the beginning of their new role as a prescriber difficult to practice due to the professional responsibility in the decision-making process of prescribing.^[34] This could be attributed to the feelings and attitudes associated with the process of transitioning from a non-prescriber to a prescriber. Nevertheless, time since qualifying was a factor which influenced the transfer of theory to practice. Experience consequently increased knowledge, skills and attitudes such as confidence to be able to prescribe:

“I have had 3 years to become comfortable. I think it would be a bit difficult with the new nurse prescribers, I know they will have the supervision and the support, but I feel a lot more comfortable now and I think that that is the time factor, it has given us time to adjust to things.”^[35]

Another study showed that the number of items prescribed by a NMP was significantly affected by their job title, employer, care setting, qualification, and time since qualifying.^[36] Courtenay et al. did not investigate the reason behind this influence.^[36] On the other hand, Ross et al. showed that confidence was a recurrent theme that influenced NMPs' prescription numbers.^[37] Respondents in the Ross et al. study who had to wait for their employer's permission to prescribe felt they were no longer competent.^[37] Another study by Green et al. attributed NMPs' reduced confidence in prescribing to the "lack of knowledge, experience and confidence, never having prescribed and needing to update and insufficient support from colleagues".^[24]

Taught knowledge was not the only factor influencing the application of theory to practice. In some cases, experience gained through practice also led to the transfer of new knowledge to practice:

“Thirty-four respondents (9.5 %) reported that following their Yellow Card submission they subsequently avoided prescribing that particular drug.”^[38]

Prescribers who had undertaken training (specialist training, accredited study days or otherwise) were found to prescribe more items and a wider range of products.^[39] It is clear that the influence of transferring theory to practice is multifactorial. The subjective feelings of those undertaking the task and the context in which it takes place could be used to facilitate the transfer of theory to practice.

Influence of context on prescribing practice

The influence of context resulted in extrinsic and intrinsic factors affecting prescribing practice. Extrinsic factors included time pressure,^[33] consultations not thoroughly documented,^[31] prescribing within a team^[40] or prescribing restrictions influencing practice^[35, 37, 40, 41]. Prescribers updated their prescribing practices by using extrinsic factors such as discussions with peers, medical colleagues and regular meetings.^[42] Intrinsic factors included the effects of knowing the patient^[41] or interpreting guidelines based on individual patients^[34].

Support from the MDT was the most commonly mentioned influence on prescribers. This included using the MDT to maintain knowledge and competence by discussing patients and using this method to enhance patient safety.^[30, 31, 33, 34, 41-44] In other cases, the influence of support was reported in the context of recognition from patients and the MDT.^[45] This resulted in improved working relations within the MDT increasing their “*professional dignity*” and feelings such as empowerment.^[34, 46] Prescribers expressed the value of the MDT for support when they felt they are working outside of their competence and expertise.^[33] In addition, NMPs stressed the

importance of support, especially when clinics become busy and stress levels rise due to the short consultation time available. Some viewed support from the MDT as a method of assurance:

“Prescribing raises confidence but would still always check with the doctor.”^[44]

On the other hand, some referred to the use of support as a preference for not working autonomously or independently:

“It appears that whilst pharmacists have taken on the role of prescriber, they have less desire to take on the role of diagnostician and would prefer to prescribe within a team context.”^[40]

In some cases, prescribers who felt less confident in their new roles attributed this to the lack of support.^[24, 33, 37] This could consequently hamper the process of transitioning to practice as a prescriber. Others did not receive support due to management issues or difficulties finding staff that were willing to supervise those embarking on the programme.^[24, 37]:

“Medical colleagues are not willing to mentor as fear of nursing staff prescribing (Respondent 8). I had little choice of suitable supervisor (Respondent 6). Supervision is non-existent (Respondent 5). No satisfactory supervision (Respondent 3).”^[37]

Some prescribers reported experiencing conflict with members of the MDT and lack of support when prescribing. In addition, some prescribers believed there is a need for better communication within MDTs.^[41, 47] Rowbotham et al. reported, “GPs (general practitioners) prescribing antibiotics to patients following a no-prescribing decision from an NP (nurse prescriber)” as the GP did not have the confidence to refuse patients’ requests.^[33]

Competence

Self-perception of competence

Nurse independent prescribers viewed themselves as competent in the areas of diagnostic assessment and knowledge of disease but had difficulties maintaining knowledge on prescribing policies, pharmacology, the management of associated disease complication ^[48] and pharmacovigilance ^[38]. Pharmacists also viewed themselves as adequately competent in undertaking physical examination skills and rarely 'excellent'.^[40]

The job role of individuals also affected their perception of competence, which in turn affected their prescribing practices. For example, nurses at a higher grade and who were more specialised were likely to report high levels of competence.^[49] Consequently, they spent a longer time practicing in their areas of care and were confident enough to consult and make treatment alterations over the telephone in comparison to those who reported lower levels of competence.^[49]

Maintaining competence

Self-perception of one's competence, and their continuous reflection to develop, leads individuals to find ways of maintaining their competence by identifying CPD needs. Assessment and diagnosis ^[39, 48], less familiar conditions or medicines ^[39] and pharmacology ^[48] were amongst the CPD needs of nurses reported in the literature. Pharmacists' reported CPD needs included the need for updates on prescribing policy.^[24, 38, 42, 45, 48] Nevertheless, not all prescribers undertook additional training in their area of practice or kept up to date on their prescribing practices.^[48] Those who did keep up to date achieved it in a variety of ways, from regularly reflecting and updating themselves with guidelines,^[30] to the use of colleagues and study days.^[42]

Prescribing within competence

NMPs' prescribing practices showed that they were personally ensuring they were working within the limits of their competence,^[24, 30, 33, 34, 41, 42, 44, 45, 47, 50] regardless of pressures from others such as members of the MDT or patients.^[45] Studies reporting this were mainly based on nurse independent prescribing due to the scarce literature on pharmacist prescribing. Nurse independent prescribers adhered well to guidelines, local formularies and used consultation models to assist in the assessment of patients.^[30, 32, 43] They also made use of the MDT for second opinions, when necessary, and worked towards ensuring a clinically justifiable rationale to the management of their patients.^[33] Prescribers would use the MDT if they felt their prescribing practice was outside their professional competence^[43, 45].

“Finally, on one occasion, I felt the patient should be seen by the doctor—the patient was eventually transferred to the intensive care unit.”^[43]

Pharmacist and nurse prescribers strive to work within their competence which was, in part, due to the associated feelings of cautiousness and responsibility. The legal implications or lack of legal protection when prescribing was one of the reasons for this.^[34, 38, 47] Most prescribers recognised that independent prescribing is associated with a high level of responsibility,^[34, 40, 45] and because of this prescribing might not be for everyone,^[34] while others viewed this responsibility positively:

“In this present study most pharmacists ‘disagreed’ or ‘strongly disagreed’ that pharmacist prescribing increased responsibility and accountability of a pharmacist prescriber in a negative way.”^[40]

NMPs viewed prescribing as challenging, with some describing the challenge in different contexts. Some prescribers described working within their competence as

challenging due to particular patient demands and others enjoyed the challenge of independent prescribing, which kept them motivated and engaged.

Stakeholders' perception of NMP competence

NMPs' perception of their competence was one indicator of how they choose to use their knowledge and skills yet are liable to bias. Stakeholders' views of NMPs' knowledge, skills and attitudes, as a way of minimising such bias, were investigated.

Two papers reported on stakeholder's perception of NMPs' competence.^[41, 44] One paper focused on mental health nurse independent prescribing and reported that stakeholders viewed NMP training to be too brief and narrow,^[41] with some voicing concerns over patient safety.^[41] Stakeholders stated that nurse independent prescribing could only be of benefit if continuously reviewed by medical staff and if certain work was delegated to them. This study used a focus group of psychiatrists and nurses to explore their views on the application of mental health nurse independent prescribing. The stakeholders in this paper were sceptical; nevertheless, their views moved from total scepticism towards acceptance if work was delegated to them and under the condition of strictly working within their competence. Data generated from this focus group is likely to have been collected prior to September 2007, when independent prescribing was still relatively new, which might explain the tone of discussion in this paper,

A more recent paper on stakeholders' views of pharmacist independent prescribing, presented these NMPs as highly competent in their specialty areas.^[44] Some doctors expressed confidence in pharmacist's knowledge, stating that pharmacists may even know more than them. It is difficult to compare the views of both papers, as the timeline and type of participant's differ.^[41, 44]

Prescribing practices

The attitude of prescribers was found to be one of the most influential themes determining how NMPs practiced. The greater the confidence of the prescriber, the more likely they were to prescribe. Time since qualifying,^[37] training,^[37, 46] good grounding in knowledge,^[24, 25, 27, 38, 47] continuous practice,^[24, 35, 38] support^[24] and the use of formulary and guidelines in initial stages of prescribing^[35] were factors which influenced confidence which in turn, influenced their prescribing practice.

All papers reporting on the type of prescriptions issued (acute or chronic prescriptions) showed that the majority of prescriptions were either to alter, titrate, review, recommend or stop treatment.^[31, 36, 42, 47, 51] Papers reporting on prescribers initiating treatment were fewer than those reporting on them reviewing medicines.^[42, 47] Few papers investigated why prescribers rarely initiated treatment. However, one paper associated it with experience and familiarity.^[47] Experience within a certain clinical speciality was seen to lead to a greater familiarity with medicines and a higher probability of prescribing regularly.^[47]

Autonomy also led to convenience, patient recognition and patient benefits consequently resulting in job satisfaction.^[37, 45] NMPs prefer independent prescribing over supplementary prescribing due to the autonomous nature of the role. This led to greater job satisfaction and hence a higher chance of making use of their prescribing qualification.^[45] On the other hand, only one paper reported job dissatisfaction, and this was due to the lack of financial incentive in the new role:

“We should be jumping up and down saying I’ve done the course I’ve got the responsibility, I want a reward for it – but we don’t (Respondent 2). I know the job is not all about the money but I am doing the service a favour and why shouldn’t I be financially compensated? (Respondent 8)”^[37]

Another significant influence on prescribing practice was the use of guidelines. The National Prescribing Centre states that prescribers should ensure they "understand and work within local frameworks for medicines use as appropriate".^[52] It is unclear whether guidelines are in fact used as a 'guide' or as a rule in prescribing. NMPs always used guidelines and formularies, followed by the use of the British National Formulary if unsure of anything.^[24, 34, 35, 43] Alternatively, guidelines were used for shared decision-making with patients.^[33]

Prescribers who felt supported by the MDT were more comfortable approaching them to discuss their prescribing decisions.^[24, 31, 34] NMPs discussed their clinical prescribing decisions as a method to promote confidence and competence to the MDT.^[34]

Prescribers preferred and also used their independent prescribing qualification more and in comparison to using their supplementary prescribing qualification.^[36] NMPs viewed the independent prescribing qualification as a method of enhancing their role due to working autonomously.^[24, 37, 45] NMPs also viewed it as a more convenient way of prescribing due to "*not chasing the GP for a prescription*".^[24] The many influences on prescribing practice shows the importance of considering subjective characteristics, such as knowledge, skills and attitudes, within a social context when assessing competencies. The model identifies these features collectively, as one is likely to influence the other.

Consultations and assessments

Prescribers were keen to use consultation models and different methods to educate patients when counselling, such as drawings or demonstrating techniques.^[30, 31, 33] Intuitive skills such as interpreting body language and empathising during communication aided patient care.^[30] History-taking and general documentation of events was found to be brief and could be improved.^[51, 53] Only papers that showed raters' comments on prescribers' consultations commented on gaps in prescriber's

skills.^[31, 32, 51, 54] An example of such gaps were the lack of counselling and patient education,^[32, 51] lack of documenting medication allergies^[54] and lack of thorough history taking^[51, 54]. This may be due to the perception of self-competence being inaccurate in judging one's competence. In a study evaluating nurse and pharmacist prescribing decisions, a rater comments on the need for improvement in history-taking and patient centred therapy:

“History-taking too brief. Penicillin V is indicated for tonsillitis but only if that’s what the patient wants after discussion of natural history of the condition and risks/benefits of antibiotics. In this case, there was no discussion.”^[51]

Prescribers were holistic in their approach when conducting a clinical assessment. Only one study considered consultations and assessments by pharmacists; this made it difficult to evaluate reports on pharmacists’ competence.^[51] One paper in which the author rated a nurse prescriber's consultation and assessment noted the lack of detail during the clinical assessment stage.^[32] The author observed the nurse suggesting treatment to the patient without reaching a shared agreement. In this scenario, and according to the model, the NMP did not reflect a sufficient level of skill during the consultation and clinical assessment stage. This study emphasised the need for more qualitative approaches when assessing prescribing practices amongst NMPs. Previous studies that have used more quantitative approaches to evaluate prescribing practices often assumed a thorough clinical examination had been conducted and a correct diagnosis made.^[51] This resulted in studies evaluating the drug of choice based on the diagnosis made as an indicator of the accuracy of prescribing practices of NMPs.

DISCUSSION

From the results, it is clear that the process of learning to prescribe, transitioning as a prescriber and practicing as a prescriber is complex and influenced by a number of overlapping intrinsic and extrinsic factors. Intrinsic factors included the knowledge,

skills, attitudes and clinical reasoning abilities of the learner and prescriber. Extrinsic factors were considered the social context in which learning and prescribing takes places, which includes social interactions. We believe that the theory of expertise development model demonstrates this complexity by incorporating the factors that influence NMPs' learning and prescribing practices. It is, therefore, important to consider this complexity during the evaluation of students learning to prescribe and as an aid in the development of expertise of pharmacist and nurse independent prescribers.

Studies reporting on the competencies of NMPs' mainly relied on self-reported competence. Research in psychology suggests that people have biased perceptions of themselves and evaluate themselves more highly than when assessed by others.^[55] This is seen in a study determining the breadth of final year medical students' clinical experience and their confidence, as indicators of competence, which found no correlation between the two.^[56] Moreover, egocentric biases are also influenced by subjective experiences of the individual. An example of this is the availability heuristic that Tversky et al. define as when one "estimates frequency or probability by the ease with which instances or associations could be brought to mind".^[57] In other words, a nurse independent prescriber would experience an availability heuristic if their experience in diagnostic assessment was good, making it easily remembered. This availability heuristic will influence one's perception of their competency based on their past experiences. Studies in this review that identified areas for improvement in the competence of NMPs were based on raters' evaluation, rather than self-assessment. A more accurate presentation of students competence would be comparing self-reports with raters' comments to mirror their prescribing practices and identify areas for improvement.

Nurses in this review reported that the non-medical prescribing programme provided them with adequate knowledge to be able to prescribe. However, those who argued otherwise believed the programme contained inadequate pharmacology content, to compensate for the lack of adequate grounding in pharmacology and other related

sciences in the undergraduate programme.^[58, 59] It is therefore important that the prescribing practices of nurses are grounded in sound clinical knowledge by ensuring that educators address these gaps in bioscience and pharmacology.

Whilst it is important to ensure that students and NMPs have strong foundations in clinical knowledge, it is also vital that they are able to apply this to practice. This review identified that students may be unable to apply taught theory to practice for two reasons: a lack of understanding of the theory and the inability to implement it into the context of practice. This was also seen in a study exploring junior doctor's prescribing errors where 'rule-based mistakes (such as when a rule is not applied in the correct context) accounted for 40% of the prescribing errors discussed.'^[60] This type of mistake was attributed to a lack in expertise,^[60] which reflects the importance of experiential learning during the process of prescribing. Results from this review also found that reinforcement of knowledge assisted in the recollection of information. Moreover, intervention studies that involved the application of taught theory to practice using virtual patients led to long-term benefits in history-taking and decision making skills six months after the programme. On the other hand, an intervention study using pharmacology podcasts only aided in the recalling of information. Research on the brain and learning reports that this may be because memory is malleable; the more students engage different parts of their brain, the better and sharper the recall of memory.^[61] In the above intervention studies, podcasts are likely to engage declarative or semantic memory, in contrast to the virtual patients' intervention which is likely to engage episodic memory. According to Jensen, declarative memory (developed when we are taught or spoken to) has little chance of being retained.^[62] On the other hand, episodic memory which is highly contextual based will engage more parts of the brain leading to a higher chance of recalling this memory. Experience, therefore, facilitates the understanding of taught theory and the ability to apply it to practice. In addition, evidence in this systematic review identifies a link between experience, confidence and the professional context in which prescribing takes place. This was found to influence the transfer of theory to practice.

Transitioning from a non-prescriber to a prescriber is considered a highly affective phase in medical literature. In the case of NMPs, one of the reasons attributed to this affectivity was the added responsibility that prescribing entails. Experience was found to increase the knowledge, skills and confidence of prescribers. This finding is consistent with other studies which looked at the correlation between experience, confidence and competence or performance.^[56, 63] A study determining whether the breadth of clinical experience of final year medical students' and their levels of confidence were indicators of competence found a significant correlation between experience and confidence.^[56] The attitude of NMPs was a major factor determining their prescribing practices. Increased confidence for prescribers was likely to result in issuing a greater number of prescriptions.^[37] Focusing on the attitudes of learners and prescribers transitioning into their new roles as prescribers could help ensure more efficient use of NMPs and their practice.

It may be useful to use a more integrated and complex approach to the evaluation of prescribing using the theory of expertise development model to identify areas for the continuous development of expertise for NMPs. For example, the model could be used as a reflective tool for students and educators to continuously develop their expertise by being more conscious of the themes within the model. Themes within the model represent the overlap and complexity involved when learning to prescribe and how themes should not be evaluated as separate components. For example, having the knowledge and skills to prescribe is likely to influence the attitude of the learner when applying it to practice. Students or prescribers utilising the theory of expertise development model and obtaining appropriate feedback from educators could allow for the development of expertise in NMPs. Furthermore, we aim to use this model as a theoretical framework informing a study on how pharmacist and nurses undertaking the independent prescribing programme learn to prescribe in order to apply it to empirical data.

CONCLUSION

The model demonstrates how knowledge, skills and attitudes are an integral part of learning and prescribing within a complex social context. Results from this

systematic review demonstrated that the model is applicable to literature on NMPs. Competencies reported in the literature were influenced by a number of intrinsic and extrinsic factors which consequently influenced the learning and prescribing practices of pharmacists and nurses. This means that the prescribing concerns of NMPs should be addressed using a model that addresses this complexity, such as the theory of expertise development model. It is therefore important that competencies are not assessed individually to appreciate the complexity and uncertainty of clinical scenarios situated in a social context. The expansion of prescribing rights to NMPs also requires an evolution in undergraduate education. This is to ensure stronger foundations in sound scientific knowledge and to begin experiential learning and expertise development in a workplace environment from an early stage. This could facilitate a smoother transfer of learnt theory to practice in order for prescribers to be experts within their fields and not merely adequately competent.

DECLARATION OF INTEREST

Conflicts of interest: none.

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Appendix 1.0

Author, year	Pharmacists	Nurses	Other	Students	IP	IP&SP
Bishop, 2008 ^[30]		✓			✓	
Black, 2013 ^[54]		✓			✓	
Boreham, 2013 ^[46]		✓		✓	✓	
Carey, 2007 ^[49]		✓				✓
Carey, 2010 ^[48]		✓				✓
Carey, 2013 ^[39]		✓				✓
Courtenay, 2012 ^[36]	✓	✓	✓			✓
Cousins, 2012 ^[45]		✓			✓	
Crew, 2010 ^[43]		✓			✓	
Davis, 2010 ^[26]		✓		✓		✓
Dobel-Ober, 2013 ^[35]		✓				✓
Goodwin, 2011 ^[42]		✓				✓
Goswell, 2009 ^[34]		✓			✓	
Green, 2009 ^[24]	✓	✓	✓			✓
Gumber, 2011 ^[47]	✓	✓			✓	
Hart, 2013 ^[31]		✓			✓	
Hill, 2014 ^[44]	✓				✓	
Hurst, 2011 ^[27]		✓		✓	✓	
Jones, 2008 ^[41]		✓			✓	
Jones, 2009 ^[64]		✓	✓		✓	

Latter, 2012 ^[65]	✓	✓			✓	
Lymn, 2010 ^[28]		✓		✓		✓
McCann, 2011 ^[40]	✓					✓
McMullan, 2010 ^[29]		✓		✓		✓
Meade, 2011 ^[25]		✓		✓		✓
Ross, 2012 ^[37]		✓				✓
Rowbotham, 2012 ^[33]	✓	✓	✓		✓	
Roy, 2012 ^[32]		✓			✓	
Stewart, 2013 ^[38]	✓	✓				✓

Table 2 Showing studies that include pharmacist and/or nurse prescribers; pharmacist and/or nurse students on the NMP programme and the type of prescribing used (Independent Prescribing or Supplementary Prescribing) **IP** = Independent Prescribing; **SP** = Supplementary Prescribers

Appendix 2.0

Coding Sheet

Citation Information

Author: Bishop R. and Redman S.

Title: Improving smoking cessation services for patients

Year: 2008

Context

Number of subjects: 1

Country of study: Scotland

Profession: Nurse

Type of Prescribing: Independent Prescribing

Aim of Study

Objective ☒ Stated ☐ Not

Available

To discuss how nurse independent prescribing addresses the increased demand on services

Ties to theoretical/conceptual framework ☒ Stated ☐ Not

Available

Model of reflection (Gibbs, 1988) used to evaluate and analyse the consultation and prescribing process

Based on relevant literature ☒ Stated ☐ Not

Available

Evaluation Methods

Study Design: Case study

Data Collection Method: Interview

Data Sources: Nurse independent prescriber and patient

Strength of Findings: Results are clear and very likely to be true

Coding Sheet

Citation Information

Author: Black, A. and Dawood, M.

Title: A comparison in independent nurse prescribing and patient group directions by nurse practitioners in the emergency department: A cross sectional review

Year: 2013

Context

Number of subjects: 10

Country of study: United Kingdom

Profession: Nurses

Type of Prescribing: Independent Prescribing and Patient Group Direction

Aim of Study

Objective ☒ Stated ☐ Not Available

To explore the application and safety of nurse prescribing in an emergency department using patient group directions versus independent nurse prescribing

Ties to theoretical/conceptual framework ☐ Stated ☒ Not Available

Based on relevant literature ☒ Stated ☐ Not Available

Evaluation Methods

Study Design: Cross sectional review

Data Collection Method: Case notes

Data Sources: Nurse prescribers

Strength of Findings: Conclusions can probably be based on the results

Coding Sheet

Citation Information

Author: Boreham, N.; Coull, A. F.; Murray, I. D.; Turner-Halliday, F.; Watterson, A.

Title: Education programmes preparing independent prescribers in Scotland: An evaluation

Year: 2013

Context

Number of subjects: 186 students [171 Nurses; Health Visitors 6; Midwives 5; Nurse and Midwife 4] and 10 programme leaders

Country of study: Scotland

Profession: Nurses, health visitors, midwives, programme leaders

Type of Prescribing: Independent Prescribing

Aim of Study

Objective ☒ Stated ☐ Not
Available

To assess if programmes of education for nurse prescribing in Scotland were fit for purpose, from both the student and educator perspective with recommendations for future educational delivery

Ties to theoretical/conceptual framework ☐ Stated ☒ Not
Available

Based on relevant literature ☒ Stated ☐ Not
Available

Evaluation Methods

Study Design: Mixed method

Data Collection Method: Questionnaire; focus group; interviews

Data Sources: Program participants (students) and programme leaders

Strength of Findings: Conclusions can probably be based on the results

Coding Sheet

Citation Information

Author: Carey, N. and Courtenay, M.

Title: Service delivery by nurse prescribers for diabetes care

Year: 2007

Context

Number of subjects: 439

Country of study: United Kingdom

Profession: Nurses

Type of Prescribing: Independent and Supplementary Prescribing

Aim of Study

Objective ☒ Stated ☐ Not

Available

Provide a national evaluation of Nurse Independent and Nurse Supplementary Prescribing in diabetes in the United Kingdom

Ties to theoretical/conceptual framework ☐ Stated ☒ Not

Available

Based on relevant literature ☒ Stated ☐ Not

Available

Evaluation Methods

Study Design: Survey design

Data Collection Method: Questionnaire

Data Sources: Nurse Independent and Nurse Supplementary Prescribers in diabetes

Strength of Findings: Conclusions can probably be based on the results

Coding Sheet

Citation Information

Author: Carey, N. and Courtenay, M.

Title: An exploration of the continuing professional development needs of nurse independent prescribers and nurse supplementary prescribers who prescribe medicines for patients with diabetes

Year: 2010

Context

Number of subjects: 439

Country of study: United Kingdom

Profession: Nurses

Type of Prescribing: Independent and Supplementary Prescribing

Aim of Study

Objective ☒ Stated ☐ Not Available

To examine the continuous professional development needs of nurses who prescribe medicines to patients with diabetes

Ties to theoretical/conceptual framework ☐ Stated ☒ Not Available

Based on relevant literature ☒ Stated ☐ Not Available

Evaluation Methods

Study Design: Survey design

Data Collection Method: Questionnaire

Data Sources: Nurse Independent and Supplementary Prescribers

Strength of Findings: Conclusions can probably be based on the results

Coding Sheet

Citation Information

Author: Carey, N.; Courtenay, M. and Stenner, K.

Title: The prescribing practices of nurses who care for patients with skin conditions:
a questionnaire survey

Year: 2013

Context

Number of subjects: 186

Country of study: United Kingdom

Profession: Nurse and Community Practitioners

Type of Prescribing: Independent, Supplementary and Community Practitioner
Prescribing

Aim of Study

Objective ☒ Stated ☐ Not
Available

To explore the practice of nurses who prescribe medication for patients with skin
conditions

Ties to theoretical/conceptual framework ☐ Stated ☒ Not
Available

Based on relevant literature ☒ Stated ☐ Not
Available

Evaluation Methods

Study Design: Cross-sectional survey

Data Collection Method: Questionnaire

Data Sources: Nurse Independent and Supplementary Prescribers and Community Practitioners

Strength of Findings: Conclusions can probably be based on the results

Coding Sheet

Citation Information

Author: Courtenay, M.; Carey, N. and Stenner, K.

Title: An overview of non medical prescribing across one strategic health authority: a questionnaire survey

Year: 2012

Context

Number of subjects: 883 [Nurses 826; pharmacists 36; allied health professionals 9; optometrist 1]

Country of study: United Kingdom

Profession: Nurses, pharmacists, allied health professionals, optometrist

Type of Prescribing: Independent, Supplementary and Community Practitioner Prescribing

Aim of Study

Objective ☒ Stated ☐ Not
Available

Provide an overview of non medical prescribing across one strategic health authority

Ties to theoretical/conceptual framework ☐ Stated ☒ Not
Available

Based on relevant literature ☒ Stated ☐ Not
Available

Evaluation Methods

Study Design: Descriptive survey

Data Collection Method: Questionnaire

Data Sources: Nurses, pharmacists, allied health professionals and optometrists

Strength of Findings: Conclusions can probably be based on the results

Coding Sheet

Citation Information

Author: Cousins, R. and Donnell, C.

Title: Nurse prescribing in general practice: a qualitative study of job satisfaction and work-related stress

Year: 2012

Context

Number of subjects: 6

Country of study: United Kingdom

Profession: Nurse

Type of Prescribing: Independent Prescribing

Aim of Study

Objective ☒ Stated ☐ Not Available

To investigate the impact of independent prescribing for experience nurse practitioners working in general practice

Ties to theoretical/conceptual framework ☐ Stated ☒ Not Available

Based on relevant literature ☒ Stated ☐ Not Available

Evaluation Methods

Study Design: Qualitative study

Data Collection Method: In-depth semi-structured interviews

Data Sources: Nurses

Strength of Findings: Results are clear and very likely to be true

Coding Sheet

Citation Information

Author: Crew, S.

Title: Non-medical prescribing in secondary care: an audit

Year: 2010

Context

Number of subjects: 1

Country of study: England

Profession: Nurse

Type of Prescribing: Independent Prescribing

Aim of Study

Objective ☒ Stated ☐ Not Available

Auditing nurses independent prescribing within a secondary care setting to assess the effectiveness of the role within a centre for elective orthopaedic surgery

Ties to theoretical/conceptual framework ☐ Stated ☒ Not Available

Based on relevant literature ☒ Stated ☐ Not Available

Evaluation Methods

Study Design: Qualitative

Data Collection Method: Case notes

Data Sources: Nurse

Strength of Findings: Results are clear and very likely to be true

Coding Sheet

Citation Information

Author: Davis, G. M.

Title: What is provided and what the registered nurse needs – bioscience learning through the pre-registration curriculum

Year: 2010

Context

Number of subjects: 42

Country of study: United Kingdom

Profession: Nurses

Type of Prescribing: Students on non-medical prescribing programme

Aim of Study

Objective ☒ Stated ☐ Not Available

Explore the bioscience knowledge of registered nurses entering a Non-Medical Prescribing programme

Ties to theoretical/conceptual framework ☒ Stated ☐ Not Available

Interpretive paradigm

Based on relevant literature ☒ Stated ☐ Not Available

Evaluation Methods

Study Design: Case study

Data Collection Method: Structured questionnaire and semi-structured interviews

Data Sources: Nurses

Strength of Findings: Results are clear and very likely to be true

Coding Sheet [INTERVENTION STUDY]

Citation Information

Author: Dobel-Ober, D.; Bradley, E. and Brimblecombe, N.

Title: An evaluation of team and individual formularies to support independent prescribing in mental health care

Year: 2013

Context

Number of subjects: 20

Country of study: United Kingdom

Profession: Nurses

Type of Prescribing: Independent and Supplementary Prescribing

Aim of Study

Objective ☒ Stated ☐ Not Available

An evaluation of the development of formularies for prescribers and there utilisation; assessing its impact on the number of independent prescribers and identifying barriers to the full implementation of independent mental health nurse prescribing locally.

Ties to theoretical/conceptual framework ☐ Stated ☒ Not Available

Based on relevant literature ☒ Stated ☐ Not Available

Evaluation Methods

Study Design: Qualitative

Data Collection Method: Semi-structured Interviews

Data Sources: Nurses

Strength of Findings: 4

Coding Sheet

Citation Information

Author: Goodwin, M.; Higgins, S. and Lewis, S.

Title: Epilepsy specialist nurse prescribing practice in the United Kingdom: A national questionnaire survey

Year: 2011

Context

Number of subjects: 29

Country of study: United Kingdom

Profession: Nurses

Type of Prescribing: Independent and Supplementary Prescribing

Aim of Study

Objective ☒ Stated ☐ Not Available

To review the role of epilepsy specialist nurses as prescribers and the problems that they encountered in their prescribing practice

Ties to theoretical/conceptual framework ☐ Stated ☒ Not Available

Based on relevant literature ☒ Stated ☐ Not Available

Evaluation Methods

Study Design: Survey

Data Collection Method: Questionnaire

Data Sources: Nurses

Strength of Findings: Conclusions can probably be based on the results

Coding Sheet

Citation Information

Author: Goswell, N. and Siefers, R.

Title: Experiences of ward-based nurse prescribers in an acute ward setting

Year: 2009

Context

Number of subjects: 2

Country of study: United Kingdom

Profession: Nurse

Type of Prescribing: Independent Prescribing

Aim of Study

Objective ☒ Stated ☐ Not
Available

Exploring the experiences of two nurse non-medical prescribers based in the acute cardiac ward setting to present the impact of this role on patients, their competence and the development of prescribing.

Ties to theoretical/conceptual framework ☐ Stated ☒ Not
Available

Based on relevant literature ☒ Stated ☐ Not
Available

Evaluation Methods

Study Design: Narrative

Data Collection Method: The authors write of their experiences as prescribers

Data Sources: Nurses

Strength of Findings: Results are clear and very likely to be true

Coding Sheet

Citation Information

Author: Green, A.; Westwood, O.; Smith, P.; Peniston-Bird, F. and Holloway, D.

Title: Provision of continued professional development for non-medical prescribers within a South of England Strategic Health Authority: a report on a training needs analysis

Year: 2009

Context

Number of subjects: 281 [Nurses 67; Nurse Practitioners 23; Health Visitors 76; District Nurses 66; Pharmacist 1; Other 37; 11 Stakeholders (clinical managers, nurse consultants, nurse educators, pharmacists and independent medical prescribers)]

Country of study: England

Profession: Nurses, Nurse Practitioners, Health Visitors, District Nurses, Pharmacist and other non-medical prescribers and key stakeholders (clinical managers, nurse consultants, nurse educators, pharmacists and independent medical prescribers)

Type of Prescribing: Independent and Supplementary Prescribing; Limited and Extended Nurse Formulary

Aim of Study

Objective ☒ Stated ☐ Not Available

A report on a Training Needs Analysis for Non-Medical Prescribers commissioned by a south of England Strategic Health Authority

Ties to theoretical/conceptual framework ☐ Stated ☒ Not Available

Based on relevant literature ☒ Stated ☐ Not Available

Evaluation Methods

Study Design: Mixed Method

Data Collection Method: In-depth questionnaires and structured interviews

Data Sources: Pharmacist, nurse and “other” prescribers and key stakeholders

Strength of Findings: Results are clear and very likely to be true

Coding Sheet

Citation Information

Author: Gumber, R.; Khoosal, D. and Gajebasia, N.

Title: Non-medical prescribing: audit, practice and views

Year: 2011

Context

Number of subjects: 20 [18 Nurses; 2 Pharmacists]

Country of study: United Kingdom

Profession: Nurses and Pharmacists

Type of Prescribing: Independent Prescribing

Aim of Study

Objective ☒ Stated ☐ Not Available

To review compliance with existing UK standards for Non-Medical Prescribing practice in a UK mental health trust – elicit views and influences of Non-Medical Prescribing

Ties to theoretical/conceptual framework ☐ Stated ☒ Not Available

Based on relevant literature ☒ Stated ☐ Not Available

Evaluation Methods

Study Design: Survey design (not explicitly mentioned)

Data Collection Method: Questionnaire

Data Sources: Pharmacist and Nurse prescribers

Strength of Findings: Conclusions can probably be based on the results

Coding Sheet

Citation Information

Author: Hart, M.

Title: Investigating the progress of community matron prescribing

Year: 2013

Context

Number of subjects: 18 [13 Nurses and 5 Patients]

Country of study: United Kingdom

Profession: Nurses

Type of Prescribing: Independent Prescribing

Aim of Study

Objective ☒ Stated ☐ Not
Available

To evaluate the prescribing decisions of community matrons using a validated tool and answer the question: is community matron independent nurse prescribing as safe and effective as that of GPs in terms of clinical appropriateness and cost effectiveness?

Ties to theoretical/conceptual framework ☐ Stated ☒ Not
Available

Based on relevant literature ☒ Stated ☐ Not Available

Evaluation Methods

Study Design: Mixed Method

Data Collection Method: Questionnaire and Audio-Recorded Consultations (between patient and prescriber)

Data Sources: Nurses and Patients

Strength of Findings: Conclusions can probably be based on the results

Coding Sheet

Citation Information

Author: Hill, D. R.; Conroy, S.; Brown, R. C.; George, A. B. and Campbell, D.

Title: Stakeholders views on pharmacist prescribing in addiction services in NHS Lanarkshire

Year: 2014

Context

Number of subjects: 97 [86 Patients; 5 Pharmacist Prescribers; 4 Medical Prescribers]

Country of study: Scotland

Profession: Pharmacists and Doctors

Type of Prescribing: Independent Prescribing

Aim of Study

Objective ☐ Stated ☒ Not Available

Establish the opinions of the prescribers and stakeholders within NHS Lanarkshire Alcohol and Drug Services

Ties to theoretical/conceptual framework ☐ Stated ☒ Not Available

Based on relevant literature ☒ Stated ☐ Not Available

Evaluation Methods

Study Design: Mixed Method

Data Collection Method: Questionnaires and Interviews

Data Sources: Pharmacists, Doctors and Patients

Strength of Findings: Conclusions can probably be based on the results

Coding Sheet [INTERVENTION STUDY]

Citation Information

Author: Hurst, H. M. and Marks-Maran, D.

Title: Using a virtual patient activity to teach nurse prescribing

Year: 2011

Context

Number of subjects: 34

Country of study: United Kingdom

Profession: Nurses

Type of Prescribing: Independent Prescribing

Aim of Study

Objective ☒ Stated ☐ Not Available

Using Virtual Patient activity to enable students to consolidate their learning and to practice the range of skills that the students have been developing related to prescribing.

Ties to theoretical/conceptual framework ☐ Stated ☒ Not Available

Based on relevant literature ☒ Stated ☐ Not Available

Evaluation Methods

Study Design: Descriptive Case Study

Data Collection Method: Reflective accounts and questionnaire

Data Sources: Nurse students on the independent prescribing programme

Strength of Findings: 4

Coding Sheet

Citation Information

Author: Jones, A.

Title: Exploring independent nurse prescribing for mental health settings

Year: 2008

Context

Number of subjects: 25 [22 Nurses and 3 Psychiatrists]

Country of study: United Kingdom

Profession: Nurses and psychiatrists

Type of Prescribing: Views on independent prescribing

Aim of Study

Objective ☒ Stated ☐ Not Available

Explore issues relating to the implementation of independent nurse prescribing in mental health settings

Ties to theoretical/conceptual framework ☐ Stated ☒ Not Available

Based on relevant literature ☒ Stated ☐ Not Available

Evaluation Methods

Study Design: Qualitative

Data Collection Method: Focus group

Data Sources: Nurses and psychiatrists

Strength of Findings: Conclusions can probably be based on the results

Coding Sheet

Citation Information

Author: Jones, A. and Harborne, G. C.

Title: Independent mental health nurse prescribing

Year: 2009

Context

Number of subjects: 119 [68% Nurses; 10% Support Workers; 9% Social Workers; 8% Consultants/F2s; 5% Occupational Therapists]

Country of study: United Kingdom

Profession: Nurses, support workers, social workers, consultants/F2s, occupational therapists

Type of Prescribing: Views on independent prescribing

Aim of Study

Objective ☒ Stated ☐ Not Available

To develop a survey based on the results of the researcher carried out by Jones, (2008)^[41] and to collect quantitative views on independent prescribing application for adult, older people and substance misuse services

Ties to theoretical/conceptual framework ☐ Stated ☒ Not Available

Based on relevant literature ☒ Stated ☐ Not Available

Evaluation Methods

Study Design: Survey design

Data Collection Method: Questionnaire

Data Sources: Nurses, support workers, social workers, consultants/F2s, occupational therapists

Strength of Findings: Conclusions can probably be based on the results

Coding Sheet

Citation Information

Author: Latter, S.; Smith, A.; Blenkinsopp, A.; Nicholls, P.; Little, P. and Chapman, S.

Title: Are nurses and pharmacist independent prescribers making clinically appropriate prescribing decisions? An analysis of consultations

Year: 2012

Context

Number of subjects: 464 [389 Nurses and 75 Pharmacists]

Country of study: England

Profession: Nurses and Pharmacists

Type of Prescribing: Independent Prescribing

Aim of Study

Objective ☒ Stated ☐ Not Available

Evaluate the clinical appropriateness of prescribing by nurse and pharmacist independent prescribers

Ties to theoretical/conceptual framework ☐ Stated ☒ Not Available

Based on relevant literature ☒ Stated ☐ Not Available

Evaluation Methods

Study Design: Mixed Method

Data Collection Method: Questionnaire and audio-recorded consultations

Data Sources: Pharmacist and nurse independent prescribers

Strength of Findings: Results are very clear and likely to be true

Coding Sheet [INTERVENTION STUDY]

Citation Information

Author: Lymn, J. S. and Mostyn, A.

Title: Audience response technology: Engaging and empowering non-medical prescribing students in pharmacology learning

Year: 2010

Context

Number of subjects: 33 [33 students used questionnaires and 5 of them participated in a focus group]

Country of study: England

Profession: Nurses

Type of Prescribing: Not specified

Aim of Study

Objective ☒ Stated ☐ Not
Available

Investigate the use of audience response technology, specifically the KeePad System, to engage Non-Medical Prescribing students in pharmacology teaching

Ties to theoretical/conceptual framework ☐ Stated ☒ Not
Available

Based on relevant literature ☒ Stated ☐ Not
Available

Evaluation Methods

Study Design: Mixed Method

Data Collection Method: Questionnaire and Focus Group

Data Sources: Nurse non-medical prescribing students

Strength of Findings: 3

Coding Sheet

Citation Information

Author: McCann, L.; Haughey, S.; Parsons, C.; Lloyd, F.; Crealey, G.; Gormley, G. J. and Hughes, C. M.

Title: Pharmacist prescribing in Northern Ireland: a quantitative assessment

Year: 2011

Context

Number of subjects: 100

Country of study: Northern Ireland

Profession: Pharmacists

Type of Prescribing: Independent and Supplementary Prescribing

Aim of Study

Objective ☒ Stated ☐ Not Available

To capture and evaluate the clinical areas, practice settings, working arrangements and barriers to prescribing of pharmacist independent prescribers in Northern Ireland

Ties to theoretical/conceptual framework ☐ Stated ☒ Not Available

Based on relevant literature ☒ Stated ☐ Not Available

Evaluation Methods

Study Design: Survey design

Data Collection Method: Questionnaire

Data Sources: Pharmacist supplementary and/or independent prescribers

Strength of Findings: Results are clear and very likely to be true

Coding Sheet

Citation Information

Author: McMullan, M.; Jones, R. and Lea, S.

Title: Patient safety: numerical skills and drug calculation abilities of nursing students and Registered Nurses

Year: 2010

Context

Number of subjects: 273 [229 second year nursing students and 44 registered nurses attending NMP programme]

Country of study: United Kingdom

Profession: Nurse

Type of Prescribing: Not specified

Aim of Study

Objective ☒ Stated ☐ Not Available

Examine the relations of age, status, experience and drug calculation ability to numerical ability of nursing students and registered nurses

Ties to theoretical/conceptual framework ☐ Stated ☒ Not Available

Based on relevant literature ☒ Stated ☐ Not Available

Evaluation Methods

Study Design: Correlational cross-sectional design

Data Collection Method: Calculation tests

Data Sources: Nursing students and registered nurses on the NMP programme

Strength of Findings: Conclusions can probably be based on the results

Coding Sheet [INTERVENTION STUDY]

Citation Information

Author: Meade, O.; Bowskill, D. and Lymn, J. S.

Title: Pharmacology podcasts: a qualitative study of non-medical prescribing students' use, perceptions and impact on learning

Year: 2011

Context

Number of subjects: 7

Country of study: United Kingdom

Profession: Nurses

Type of Prescribing: Not specified

Aim of Study

Objective ☒ Stated ☐ Not Available

Explore the experiences of non-medical prescribing students who had access to podcasts of key pharmacology lectures as supplementary learning tools to their existing course materials

Ties to theoretical/conceptual framework ☐ Stated ☒ Not Available

Based on relevant literature ☒ Stated ☐ Not Available

Evaluation Methods

Study Design: Qualitative

Data Collection Method: Semi-structured interviews

Data Sources: Nurses on the non-medical prescribing programme

Strength of Findings: 4

Coding Sheet

Citation Information

Author: Ross, J. D. and Kettles, A. M.

Title: Mental health nurse independent prescribing: what are nurse prescribers' views of the barriers to implementation?

Year: 2012

Context

Number of subjects: 45

Country of study: Scotland

Profession: Nurse

Type of Prescribing: Independent and Supplementary Prescribing

Aim of Study

Objective ☒ Stated ☐ Not Available

To ascertain mental health nurse prescribers' views of the barriers to their prescribing independently and include perceptions of barriers to supplementary prescribing

Ties to theoretical/conceptual framework ☐ Stated ☒ Not Available

Based on relevant literature ☒ Stated ☐ Not Available

Evaluation Methods

Study Design: Mixed Method

Data Collection Method: Questionnaire [n=33] and focus group [n=12]

Data Sources: Nurse independent and/or supplementary prescribers

Strength of Findings: Conclusions can probably be based on the results

Coding Sheet

Citation Information

Author: Rowbotham, S.; Chisholm, A.; Moschogianis, S.; Chew-Graham, C.; Cordingley, L.; Wearden, A. and Peters, S.

Title: Challenges to nurse prescribers of a no-antibiotic prescribing strategy for managing self-limiting respiratory tract infections

Year: 2012

Context

Number of subjects: 36 [34 Nurse Prescribers; 1 Pharmacist Prescriber; 1 Physiotherapist Prescriber]

Country of study: United Kingdom

Profession: Nurses, pharmacists, physiotherapists

Type of Prescribing: Independent Prescribing

Aim of Study

Objective ☒ Stated ☐ Not Available

To report a qualitative study of the experiences of nurse prescribers in managing patients with self-limiting respiratory tract infections

Ties to theoretical/conceptual framework ☐ Stated ☒ Not Available

Based on relevant literature ☒ Stated ☐ Not Available

Evaluation Methods

Study Design: Qualitative

Data Collection Method: Semi-structured interviews and focus groups

Data Sources: Nurses, pharmacists and physiotherapists

Strength of Findings: Results are clear and very likely to be true

Coding Sheet

Citation Information

Author: Roy, D. and Snowden, A.

Title: Concordance in action: case study of medication management

Year: 2012

Context

Number of subjects: 1

Country of study: United Kingdom

Profession: Nurse

Type of Prescribing: Independent Prescribing

Aim of Study

Objective ☒ Stated ☐ Not
Available

A critical appraisal of the aims of non-medical prescribing as presented by the Department of Health in relation to mental health services using a case study of a mental health nurse prescriber as an example.

Ties to theoretical/conceptual framework ☒ Stated ☐ Not
Available

Case study presented in a situation, background, assessment and recommendation format (SBAR) ^[66]

Based on relevant literature ☒ Stated ☐ Not
Available

Evaluation Methods

Study Design: Case study

Data Collection Method: Observation

Data Sources: Observer (author) and community mental health nurse independent prescriber

Strength of Findings: Conclusions can probably be based on the results

Coding Sheet

Citation Information

Author: Stewart, D.; MacLure, K.; Paudyal, V.; Hughes, C.; Courtenay, M. and McLay, J.

Title: Non-medical prescribers and pharmacovigilance: participation, competence and future needs

Year: 2013

Context

Number of subjects: 613 [293 Nurse Prescribers and 320 Pharmacist Prescribers]

Country of study: United Kingdom

Profession: Nurses and Pharmacists

Type of Prescribing: Independent and Supplementary Prescribing

Aim of Study

Objective ☒ Stated ☐ Not Available

To determine current participation and competence of non-medical prescribers in pharmacovigilance, and their perceptions of training and future needs

Ties to theoretical/conceptual framework ☐ Stated ☒ Not Available

Based on relevant literature ☒ Stated ☐ Not Available

Evaluation Methods

Study Design: Survey design

Data Collection Method: Questionnaire

Data Sources: Pharmacist and nurse independent and/or supplementary prescribers

Strength of Findings: Conclusions can probably be based on the results

Chapter Six

Chapter type:	Journal article
Article title:	A qualitative investigation into how pharmacists and nurses working in secondary care learn and transition to become independent prescribers
Submission status:	Submitted

***Note.** As this paper has been submitted, the formatting and layout are consistent with the requirements for the journal. For this chapter, references will be placed at the end of the chapter rather than at the end of the thesis.*

A qualitative investigation into how pharmacists and nurses working in secondary care learn and transition to become independent prescribers

ABSTRACT

Background

Pharmacists and nurses who have completed the independent prescribing (IP) programme in the UK have authority to prescribe. Little is known about how they develop their prescribing expertise compared to medical students. The theory of expertise development model (TEDM) describes how the latter deliberately engage their knowledge, skills and attitude within a socio-cultural environment.

Aim

To explore how secondary care pharmacists and nurses on the IP programme acquire and develop their expertise to become prescribers.

Method

The prescribing-related experiences and decision-making processes for 7 nurses and 6 pharmacists when learning to prescribe were investigated using audio-diaries followed by a semi-structured interview. Data were analysed using constructivist grounded theory and the TEDM.

Results

Findings showed students were influenced by intrinsic, social and contextual factors. Pharmacists acquired clinical skills, whilst nurses acquired pharmacology and knowledge of medicines. Students described difficulty coping with their transition from a non-prescriber to a prescriber. The experience, attitude and job role played a major role in determining the ease of this transition and the likelihood of students choosing to take responsibility in executing a prescribing task. The TEDM needed minor modifications to fit with this dataset.

Conclusion

This is the first study to identify, in-depth, IP students experiencing a phase of transition during the process of learning to prescribe. The TEDM, with minor modifications, could be used as a reflective tool for IP students to ensure they are conscious of their competence to facilitate a smoother transition from an experienced healthcare professional to a prescriber.

Keywords: audio-diary; education; expertise; non-medical prescribing; nurse; pharmacist

INTRODUCTION

Independent prescribing (IP) rights, introduced in 2006, allows nurses and pharmacists with the appropriate qualification to prescribe. Independent prescribers are responsible for the clinical assessment of diagnosed or undiagnosed patients, including their clinical management plan and prescribing authority (Department of Health, 2006). This was introduced in order for patients to gain quicker, more efficient access to medicines and for professionals to make better use of their skills. The IP programme entails 26 days of taught curricula and at least 12 additional days of learning in practice, known as the Period of Learning in Practice (PLP). The PLP requires a medical practitioner known as the Designated Medical Practitioner (DMP) to supervise students and assess their competence. DMPs can assess students' competencies using the "competency framework for all prescribers" originally developed by the National Prescribing Centre (Royal Pharmaceutical Society, 2016). To enter the IP programme, pharmacists and nurses must have a minimum of two and three years' post-registration experience, including one year of experience for nurses in the clinical field they intend to prescribe preceding application. The UK and Ireland have the lowest entry requirements to non-medical prescribing programmes and the most extensive prescribing rights, in comparison to North America, the Antipodes and Western European countries (Kroezen et al., 2011). Despite this, the IP programme is a rigorous programme with students reporting that it prepared them for practice and provided them with adequate knowledge to be able to prescribe (Smith et al., 2014, Meade et al., 2011, George et al., 2007).

Literature on the prescribing practices of non-medical prescribers have shown that they are making clinically appropriate prescribing decisions (Baqir et al., 2014, Latter et al., 2012, Naughton et al., 2013). However, there have been reported concerns regarding the pharmacology knowledge of nurses and the clinical examination skills of pharmacists (Latter et al., 2012, Naughton et al., 2013, Lim et al., 2014). Moreover, there is little *recent* literature published in the last 5 years exploring how pharmacists and nurses undertaking the non-medical prescribing programme acquire and develop their expertise in prescribing. Research on the training and acquisition of knowledge and skills of pharmacist and nurse prescribers focused on the new wave of prescribers after the initial adoption of extended prescribing rights in 2003 (Ahuja, 2009, Boreham et al., 2013, Cooper et al., 2008b, George et al., 2008, Tann et al., 2010).

Transitioning from a non-prescriber to a prescriber has been identified as a highly affective phase influencing prescribers due to the attitudes and feelings associated with the process of transition (Kilminster et al., 2010, Monrouxe, 2009). A study on newly qualified doctors reported that the transition phase is stressful due to the added responsibility of prescribing, managing medical uncertainty and working in multi-disciplinary teams (MDT) (Brennan et al., 2010). However, literature on non-medical prescribers explore the phase of transition as how prepared non-medical prescribing students are for practice and the length of time taken between completing the prescribing programme and issuing their first prescription (Latter et al., 2011, Black, 2013, Ziegler et al., 2015).

Transition phases are contextualised and situated in the workplace. This means that contextual influences, such as the professional culture and the expectations that come with it are likely to influence the transition phase. In a study on pharmacists who have become doctors, pharmacists reflected on the *need* to be confident and the difficulty of transitioning from a pharmacist to a doctor (Austin et al., 2007). Yet, we know little about the transition from pharmacist or nurse to prescriber.

The theoretical model informing this research was the theory of expertise development model which addresses the complexity of learning and becoming a prescriber (McLellan et al., 2012). This model was originally developed to assess the literature on medical students learning to prescribe. It proposes that the development of expertise takes place by individuals deliberately engaging their knowledge, skills and attitudes within a social environment. We, therefore, aimed to explore how pharmacists and nurses who work in secondary care and are currently on the IP programme acquire and develop their expertise when learning to prescribe.

METHOD

Sampling and recruitment

A purposive sample of pharmacists and nurses working in secondary care, who were undertaking the independent prescribing programme, were recruited. We aimed to recruit 10 pharmacists and 10 nurses who met the inclusion criteria. An invitation email containing the participant information leaflet, participant form and consent form was circulated to course leaders of the independent prescribing programme

across the United Kingdom. Due to difficulties in recruitment, information about the study was also circulated via Twitter. The first author (AA) also presented the study for the purposes of recruitment to a number of universities.

Data collection

Exploring how secondary care pharmacists and nurses on the IP programme acquire and develop their expertise required a qualitative methodology to allow us to gain an in-depth understanding of how pharmacists and nurses learn to prescribe. Data were collected using audio-diaries and semi-structured interviews. The use of audio-diaries to explore the learning experiences of pharmacists and nurses undertaking the IP programme is a novel technique. Audio-diaries provide rich and descriptive data that can capture the narrative reflection of students' learning experiences in real-time, or as close to the event as possible (Hislop et al., 2005). Students were provided with Dictaphones for their audio-diaries or the choice of using a voice recording feature on their phone. We asked students to record their thoughts, experiences and decision-making processes whenever they encountered an event related to the development of their prescribing skills during their PLP or any other time. They were to try to record these events as close as possible to the time of learning. This was to reduce any recall bias when describing their thoughts and feelings close to the event. By using audio-diaries, students were able to provide us with contextualised accounts of their experiences, opinions and feelings. Students were asked to record for at least 2-3 minutes on approximately 5 different occasions and were provided with audio-diary guidelines and prompts to assist them. Students were also given the option to be sent a weekly reminder via email, text-message or telephone, to record their audio-diaries.

Audio-diary recordings were transcribed verbatim and sent back to each student to refresh their memory prior to a semi-structured interview. Semi-structured interviews took place within approximately a month after the audio-recordings were transcribed. The semi-structured interview involved the use of an interview schedule and tailored questions for each participant based on their audio-diary recordings. The interview schedule was developed to further explore what participants perceived to contribute and enhance their learning experience, what skills they perceived to have developed, the difficulties they faced and the influence of feedback on their learning experience, and overall preparation to becoming prescribers. Moreover, tailoring additional questions based on participants' audio-diary recordings were used to enrich the data by allowing participants to elaborate further on their experiences and establish validity of the audio-diary recordings. Semi-structured interviews were recorded and lasted up to one hour. They were conducted either face-to-face or over the telephone and recorded with consent. Students who took part in the study were provided with a copy of their transcribed audio-diaries to assist them with their reflective portfolios or for continuous professional development entries; a certificate of completion and a £10 high street voucher. Students gave verbal, followed by written consent for their audio-diary recordings and interview. Participants were given pseudonyms based on their gender and ethnicity.

Ethical approval

The study obtained ethical approval from the University of Manchester Research Ethics Committee, 13263 – research ethics committee 3.

Analysis

Data collected from the audio-diaries and semi-structured interviews were analysed using Charmaz's constructivist grounded theory approach (Charmaz, 2006), and coded using NVivo[®] version 9. This study operated within a constructivist approach whereby subjects construct knowledge based on their experiences. The audio-diary recording technique used in this research allowed the researcher to hear students' socially constructed learning experiences. Analysis began as audio-diaries and interviews were received and transcribed. The initial findings from the data collected lead to further areas of enquiry in subsequent interviews with other participants. The PLP experiences of students were heterogeneous due to the different workplace contexts they were learning in. The researcher, therefore, undertook detailed line-by-line coding to capture the context in which students were learning to prescribe. Codes which were created were compared with data obtained from participants throughout the data analysis in order to define and refine categories in an iterative way. In addition, to establish validity of an account, 'member checks' consistent with Lincoln and Guba, took place by asking participants questions during the semi-structured interview to ensure that the researcher interpreted their data correctly (Lincoln and Guba, 1985). Co-authors also checked and discussed the emerging codes and analysis interpretations to ensure plausibility. Concepts that were emerging from the data were categorised based on the influences of students' learning experiences. To our knowledge, this is the first study to explore how secondary care pharmacists and nurses on the IP programme acquire and develop their expertise when learning to prescribe. Despite this study being informed by the theory of expertise development model, theory regarding how pharmacists and nurses learn to prescribe was derived from the data using the constructivist grounded theory approach. This was then compared with the theory of expertise development

model to see if the emerging concepts from the data fit with the theoretical model informing this research.

RESULTS

Seven nurses and six pharmacists participated in the study. Despite the small number of participants, the methodological design provided rich data resulting in data saturation per profession. Saturation per profession was determined when no new patterns in the data had emerged. Participants worked in a variety specialties in secondary care and were recruited from a number of different universities offering the IP programme. The number of years of experience as registered healthcare professionals ranged from 5 to 29 years. Table 1 shows the demographics of students who have taken part in this study.

Pseudonym	Age	Nurse (N) / Pharmacist (P)	Prescribing Specialty	Years of experience as a pharmacist/nurse
Analyn	33	N	Cardiology	12
Bethany	37	N	Acute medicine	11
Hanneke	49	N	Palliative care	29
Judy	43	N	Oncology	26
Robert	37	N	Mental health	8
Samantha	40	N	Oncology	15
Viji	38	N	Pain management	10

Andrew	28	P	Cardiology/acute medicine	5
Antonio	36	P	Anticoagulation/acute surgery	8
Arsalan	33	P	Renal anaemia	10
Craig	37	P	Urology/orthopaedics/surgery	12
Gary	46	P	Mental health	23
Kate	34	P	Acute medicine	10

Table 1 Demographics of pharmacist and nurse participants

Students recorded between 3 and 19 audio-diaries (median= 5) ranging in length between 21 seconds and 17 minutes (median= 3 minutes). Interviews lasted between 21 and 71 minutes (median= 25 minutes).

All students described how intrinsic factors and the context in which learning took place influenced how they acquired their knowledge and skills during the programme. This consequently resulted in students reflecting on what they learned (referred to as the “learning outcome”) achieved as part of this complex process of learning to prescribe. Intrinsic factors were identified, which were defined as individual factors influencing the learner, such as their professional background and attitude. Contextual factors were identified, defined as social interactions and the environment in which the learning process took place. Examples of the latter include interacting with the DMP and using resources from the learning environment such as

laboratory results. These intrinsic and contextual factors influencing students learning to prescribe were found to be closely interlinked. They are highlighted throughout the results in bold, and this demonstrates how integrated and complex is the process of learning to prescribe. Quotations that have been cut are shown as [...]. Figure 1 shows schematically the factors influencing students' learning.

Findings from this study have been presented in the order of students' views of the independent prescribing programme, how they learned to prescribe and what influenced their transition when learning to become prescribers. It is important to note that students were asked to describe how they were making clinical decisions during their process of learning to prescribe. Due to students not being able to formally make prescribing decisions, students described what they would do after becoming prescribers.

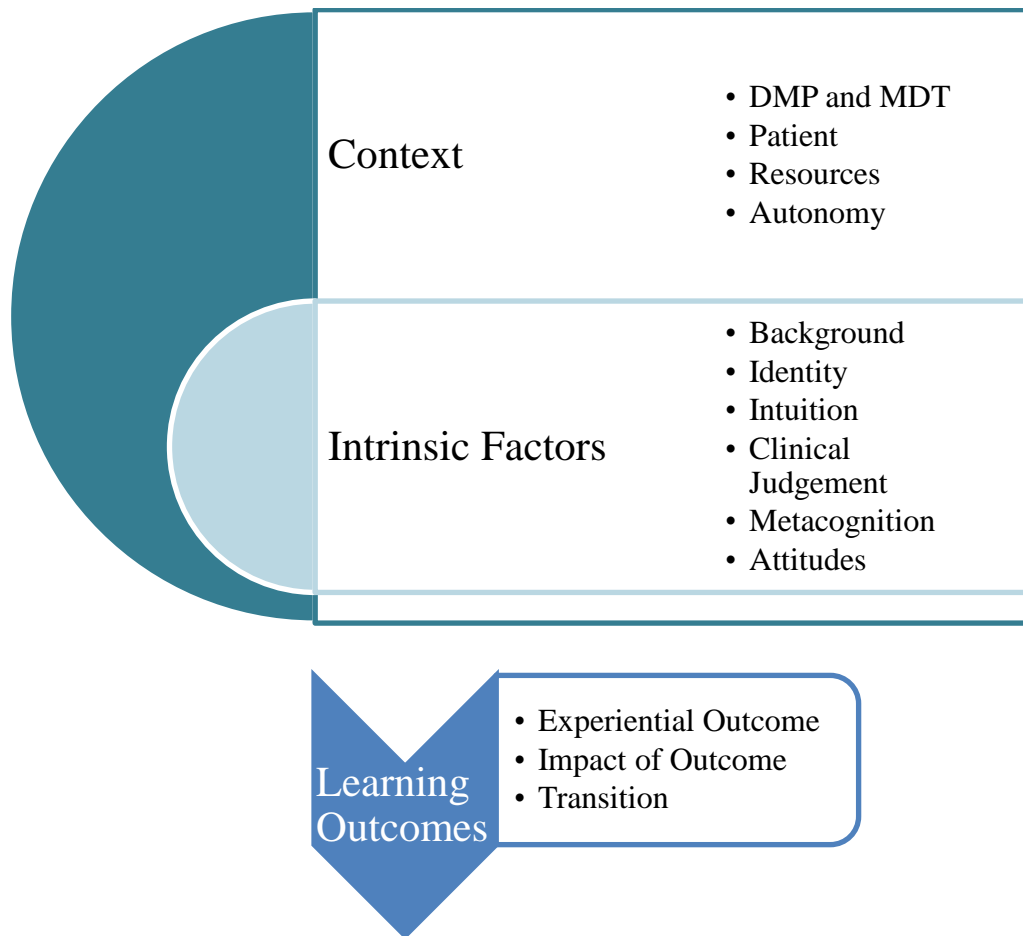


Figure 1 Intrinsic and contextual factors influencing the learning and the associated learning outcomes

Views of the IP programme

Students had mixed views on the programme. All nurses stated that the course was useful, interesting and organised; describing its content as heavy, in-depth and relevant to practice. Nurses acknowledged the pharmacology taught in the programme as a “*steep learning curve*” (Judy, Nurse) and believed it gave their decisions a stronger clinical rationale. Nurses described how they had suggested drugs in the past to doctors and how the pharmacology in the course taught them the theory behind their suggestions: “*now I know why I’m suggesting these drugs*” (Viji,

Nurse). Nurses attributed their basic knowledge in pharmacology to only brief teaching of the subject in their nursing degree program.

In contrast, pharmacists' feelings about the programme were mixed. Only two pharmacists had similar views to nurses, affirming the course as stimulating and engaging. The majority of pharmacists described the course as unorganised, repetitive, 'too basic' for pharmacists and geared towards nurses. Pharmacists described entering the programme with certain expectations that were not met. One pharmacist had expected to be taught how to clinically assess and physically examine patients. Although some programmes did teach this, pharmacists felt that the time allocated for this was not enough. Nevertheless, those who were taught this felt they had acquired some of these skills and found it interesting.

All students described how difficult it was to manage their time during the programme. Students on the independent prescribing programme are expected to complete 90 hours of their PLP with their DMP. For everyone on the programme, this meant completing these hours during their normal working hours as healthcare professionals. However, in some cases, students found difficulty being released from their general duties to complete work from their course and had to work around this.

Students valued the importance of having support from their **DMP** and **MDT** during the process of learning and being given time by their organisation to manage their study times and PLP during working hours. Some students had also taken advantage of online non-medical prescribing forums to learn from the experiences of other

students on the programme. Students stated that they had benefitted most from **DMPs** who were pro-active and accessible, describing how their feedback influenced their confidence (**attitudes**) and development (**learning outcome**). Moreover, students described how working alongside their **DMPs** kept them engaged (**attitudes**) in the process of learning: *“making me think on my feet”* (Samantha, Nurse). Students also valued working alongside the **DMP** and **MDT** in recognising patterns and rules around prescribing. This made students recognise the importance of experience by observing what works for patients, being exposed to different specialties and having the privilege of asking questions during this process (**context**). Observation was also seen to *“stay in your mind for longer”* (Bethany, Nurse) reflecting the importance of procedural knowledge. Students emphasised the need to learn in practice in order to become familiar and increase their confidence (**attitude**) in workplace tasks.

Learning to prescribe

Students believed they had acquired a number of skills, the majority of which were taught through formal teaching during the independent prescribing programme and were applied to practice during the PLP. Nonetheless, students also identified that learning mainly took place in practice: *“I think being on the course was great, but the learning really took place in practice.”* (Viji, Nurse).

Students explained how the course emphasised consultation models, holistic thinking and concordance and how this influenced their thinking process. Consultation models were seen to assist them in undertaking a structured and comprehensive approach to reach a decision and treatment plan for patients. Similarly, a holistic approach in

thinking also aided students in obtaining a comprehensive clinical history and making a clinical decision.

Students were motivated (**attitude**) to successfully complete the programme because they had identified an outcome (**learning outcome**) of it and its impact on both their career pathway and patient care. Nurses gained a deeper appreciation of the pharmacology of medication from the course, recognising that they were not aware of this (**metacognition**) and the impact this knowledge may have on patient safety (**impact of outcome**):

“....if I hadn't learnt this [prescribe dual anti-platelet therapy for someone already on warfarin], I would have not immediately given those patients anti-platelet therapy, and that would have been life-threatening for them, if they're going to the cath lab [catheterisation laboratory].” (Analyn, Nurse)

Nurses had relied on their experience and pattern recognition when recommending medicines for doctors to prescribe in the past. However, they began to recognise during the course that there was a need to provide a clinical rationale for their recommendations:

“You recommend it thinking that this has worked for the previous patient, but now I'm just thinking has it really worked for this patient in a pharmacology point of view.” (Bethany, Nurse).

Amongst the attributes that contributed to their learning was the influence of previous training, experience and their professional culture (**background**). An

example of professional culture is the characteristics that students had acquired as healthcare professionals that influenced their learning:

“I think pharmacists generally are quite careful prescribers anyway. They have a lot of second checks installed. It’s the way we work isn’t it?” (Kate, Pharmacist).

In other situations, students attributed their insufficient knowledge to their **background** prior to commencing the programme:

“The consultant obviously gathered that my knowledge of the subject is limited and I felt very disappointed in myself that I should have known this, for I have been in cardiology for more than five years. But then again I am a nurse and I felt that it is not much of a benefit to me to know further in depth the different drugs and their pharmacodynamics and pharmaco-kinetics. I just have the very basic knowledge of the drugs.” (Analyn, Nurse).

One pharmacist had debated the investigative stage with a consultant before diagnosing a patient with haematuria. The patient had been taking warfarin for atrial fibrillation and the consultant wanted to exclude any physical damage as a cause for the bleeding. However, the pharmacist was more concerned about the warfarin and wanted to send the patient for an INR test. Although the patient was sent for a cystoscopy of the urethra to exclude physical damage, the pharmacist later became aware how his background as a pharmacist had influenced his clinical decision-making:

“My pharmacist brain is thinking, you know, you’re on warfarin and you’re bleeding, then it’s the warfarin that’s causing the bleeding, not the surgical damage and the real answer probably is somewhere in the middle” (Craig, Pharmacist).

The pharmacist described how this experience made him appreciate the wider context involved in prescribing. In addition, it showed how his perceived **identity** influenced his clinical decision making process and the difference between thinking like a pharmacist or a prescriber.

The experience of pharmacists and nurses as healthcare professionals embarking onto the programme proved of use especially when faced with clinical scenarios that required them to use the complex skill of clinical judgement. One complex clinical scenario, faced by a pharmacist, was of a patient who was admitted to hospital due to a fall and who was on maximal treatment for chronic angina. The pharmacist “Andrew” described how he and the consultant had settled on the diagnosis of a fall due to hypotension, secondary to his medication. Due to the complexity involved in making a decision, the pharmacist had to **use resources**, information from the **patient** and exercise his **clinical judgement** alongside the consultant (**DMP**) to reach a treatment decision:

“I suppose the most significant thought or reflection in this case was dealing with this patient does not fit any guidelines, he does not have a mass of evidence base in terms of people are not studied on three anti-anginal drugs. A lot of it is interpretation, and that is something that is relatively new to me” (Andrew, Pharmacist)

Students on the programme were given the opportunity to apply their knowledge and skills to practice and contribute to patient care (**outcome**). In many instances, this resulted in positive **attitudes**, motivating students to expand their learning opportunities and contribute to patient care. In one clinical scenario, a pharmacist had monitored a hypertensive patient's observations (**use of resources**) because the patient was not able to take his anti-hypertensive medication orally and had no intravenous access. The pharmacist had noticed that the patient's blood pressure was rising significantly within a short period and was worried that the patient may experience a hypertensive crisis. The pharmacist was also watching the **patient** for any visible signs of hypertensive crisis. The pharmacist had checked the evidence available (**use of resources**) in order to look for an alternative route of administration of an anti-hypertensive and exercise his **clinical judgement** as to what would be most suitable for this patient. However, the alternate routes available were unlicensed medicines. He discussed the options available with the **patient** and suggested to the MDT an alternative to be prescribed, contributing to the patient's care and safety (**outcome**) and reflecting on his feelings (**attitude**):

"...my main concern was related to the patient's safety. So not only I wanted to try to manage and control the hypertension to avoid death, a complication is a physical condition in a particular time when the patient was waiting for the insertion for a central line and was going to have parenteral nutrition, therefore I didn't want to add any complicating factors to his management in hospital. On the other hand I was aware of the legal implications of prescribing an unlicensed drug, but I felt quite confident in suggesting this alternative as there were no other alternatives that I

deemed were suitable for the patient and I put in place the system in order to monitor the patient for any side effects for response to treatment by liaising with other healthcare professionals.” (Antonio, Pharmacist).

Metacognition was influenced by the knowledge, skills and attitudes of students. Metacognition was triggered by a number of clinical scenarios. These included situations in which students had learnt something new (**context**) or situations in which students reflected on knowledge that was acquired from formal teaching or self-directed learning (**autonomy**) that was applied to practice (**context**). Students reflected on their current knowledge, skills and attitudes after new knowledge was gained. This motivated students to gain further knowledge by using **resources**, seeking help from the **MDT** or observing a member of the MDT applying it:

“She is on slow release morphine and breakthrough morphine and I realise that I really don't understand the difference between the different types of slow release, modified release morphine... I realised that I need to read up a lot more about that, when I was administering them. It's very different to giving the drugs out as they're prescribed from the cupboard without really thinking about the differences between them... because if it ever comes that I'll be prescribing those I'll need to know a lot more detail about it and also I'll need to work with our palliative care team, they're quite prolific in prescribing these drugs and more specialised so I'll work with them to get some specialist knowledge” (Samantha, Nurse).

In the above example, the nurse Samantha was taking care of a patient who was on different types of morphine. This clinical scenario triggered her to reflect on her

current knowledge of morphine (**metacognition**) where she states that she does not know the difference between the different types of morphine. At this point, Samantha becomes motivated (**autonomy**) to make use of her **resources** in order to gain more knowledge on this subject from self-directed learning and use of the MDT. She also reflects on what is behind this motivation and the need to gain more knowledge on this subject as she begins to form her new **identity** as a prescriber, rather than a nurse. In this case, Samantha did not have the chance to apply the new knowledge gained to practice. However, she reflected on applying this new knowledge to her way of thinking as a prescriber. This is referred to as **transition**, where she forms her **identity** as a prescriber and transitions her way of thinking to fit the requirements of becoming a prescriber.

Learning to become a prescriber

Students were becoming consciously aware that their thinking process was beginning to change (**metacognition**) and in some cases, expressed difficulty in coping with this **transition**:

“I'm aware perversely that I'm behaving less and less like a pharmacist and more and more like a medic and I'm not sure I necessarily see that as a wholly positive thing, but I'm also struggling to work out how I can change it. I don't mean to say that being a medic is bad and being a pharmacist is good, it's not as simply binary as that. I think it's more a reflection of when you are acting as a prescriber, irrespective of what profession you are, you are taking on more responsibility. You are being held more accountable for what you are doing. You've got more to think about than when I was just a pharmacist (Gary, Pharmacist).

The process of **transition** from a non-prescriber to a prescriber was greatly influenced by the **attitude** and **metacognition** of the learner. Students were becoming consciously aware of their decisions due to the responsibility and accountability involved in becoming a prescriber:

“I think the anxiety relates to the realisation that on completion and hopefully being successful in passing the course the responsibility that being a prescriber brings. I also reflect that with any new additional responsibility in a role of developing new skills there is always an element of awareness, of being more consciously aware of the activities that are being performed and I hope and expect, as I become more familiar with patient assessment with regards particularly to prescribing practice, that I will become more confident and less anxious.” (Judy, Nurse).

Familiarity and continuous practice resulted in positive **attitudes** which consequently made students feel more able to transition into this new role, that of being a prescriber:

“So afterwards on reflection this is an area that I feel quite confident in. If it was me to prescribe it I would feel quite confident to do that. I felt that what I was asking the doctor to do I could have done myself” (Samantha, Nurse).

Through familiarity with these medicines and upon reflection (**metacognition**), Samantha was able to ascertain whether she would be able to prescribe this as a

prescriber in the future (**transition**) by reflecting on her feelings (**attitude**). In some cases, the **outcome** of applying new knowledge to practice or identifying a learning need also influenced the **attitude** of the learner, motivating them to further develop their expertise (**autonomy**):

“I just have the very basic knowledge of the drugs. The situation pushed me to learn more on the guidelines and other drugs that I may not be very familiar with.”
(Analyn, Nurse).

Students also expressed anxiety (**attitude**) after realising what the process of prescribing entails:

“I also have found that the knowledge gained on my university course with pharmacokinetics and pharmacodynamics has given me knowledge, which is power. However, it has also given me a lot of anxiety, where I think I may have been a bit more relaxed with my prescribing thoughts. Whereas now, with the knowledge and theory behind me, this has made me quite anxious.” (Viji, Nurse).

In some cases, nurse students expressed concern in their practice as nurses and the impact of patient safety due to insufficient knowledge in medicines:

“As a palliative care nurse, I usually say, rationalised medication, which means just, “chuck them all out!”. Who cares? This lady is gonna die in the next 4 days, which she did. 5 days. And she stopped them (the medication). And today I wrote down all

the medications and looked them up, which I never do, because, to be honest, I have no idea what this clopi..do..grel or dogrel is [struggling to pronounce clopidogrel]. And I have no idea what carbocysteine does, and I have no idea what that, by the way, if you just stop venlafaxine suddenly, you can have withdrawal symptoms! And I had this sudden fear that at some point, I will, kind of, cross them all off. But then, get miserable withdrawal symptoms from the venlafaxine. And it was a bit scary really. Because I, usually, other people take the blame.” (Hanneke, Nurse).

In the above example, Hanneke reflects on how she used to practice as a palliative care nurse (**background**). She also describes her expectation that the patient is likely to pass away in 4 days (**intuition**), which was considered a skill gained from experience. After looking up the patient’s medicines through self-directed learning (**autonomy**), she realised the consequence on patients of making decisions with no clinical rationale (**outcome**) and reflected on how that made her feel (**attitude**). She also describes that the reason for her insufficient knowledge in medication was because it was never her responsibility. Students, therefore, recognised that their **background** and experience were likely to influence their decisions and emphasised the need to provide a clinical rationale when treating patients. Students felt that their PLP had challenged their preconceptions of medicines and enabled them to take control of **contextual** influences in decision-making, such as the influence of **patients** on prescribing:

“I suppose you bring your preconceptions with you as well about certain drugs. So you have to put those to one side and go back to basics as well and you’re influenced by other people, they have their own different types of drugs that they prefer and that

sort of thing. So I think you have to be just wary that you bring those preconceptions with you.” (Samantha, Nurse).

The students’ **background** (the influence of profession, clinical specialty or job role on learning) resulted in choosing to focus on knowledge and skills specific to that background through self-selection. For example, a pharmacist working in emergency medicine believed it was not part of her role to diagnose as an independent prescriber. She, therefore, chose to obtain the necessary information from the medical documents available on the ward:

“...the physical exam which isn’t relevant, but I’d use the diagnostic, kind of, documentation from the medics and blood results at that point.” (Kate, Pharmacist).

This example shows that Kate’s role in acute medicine dictated whether she will use her physical examination and diagnostic skills in her prescribing role.

DISCUSSION

Principal findings and meanings

Our results found prescribing to be a complex skill that is influenced by intrinsic factors from the learner and interactions with patients and members of the MDT and their DMP, which were situated within a dynamic social environment. Students commonly reflected on their knowledge, skills and attitudes during the PLP after gaining new knowledge during the process of acquiring and developing their

expertise when learning to prescribe. The attitude of students was a trigger determining whether students were able to execute a task and decide whether to incorporate new information into their prescribing practice. This could mean that the attitude of students determines their willingness to apply knowledge to practice as prescribers. Whilst students made every effort to apply knowledge gained to practice during their PLP, this naturally made students more aware of their current knowledge and skills. This suggested that students may be consciously or unconsciously incompetent in certain areas of practice. Nurses were only aware of their insufficient knowledge of medication after being taught pharmacology during the programme, through self-directed learning or during their PLP. This suggests that there is a need for stronger foundations in clinical knowledge for the skills of students to be utilised effectively as prescribers.

In order to ensure that students and independent prescribers develop their expertise, it is important to view the task of prescribing as an integrated process of individual, social and contextual factors. Our analysis presents how complex and integrated the interaction is between the individual learner and the environment in which learning takes place. Intrinsic and contextual factors influenced students, resulting in learning outcomes that fed back into these factors during the process of learning to prescribe. This was found to fit well with the theory of expertise development model which was originally developed to assess literature on medical students learning to prescribe from a number of theories of expertise development (McLellan et al., 2012). Based on the results from this study, we propose to refine the theory of expertise

development model so that it applies to secondary care pharmacists and nurses learning to independently prescribe (Figure 2).

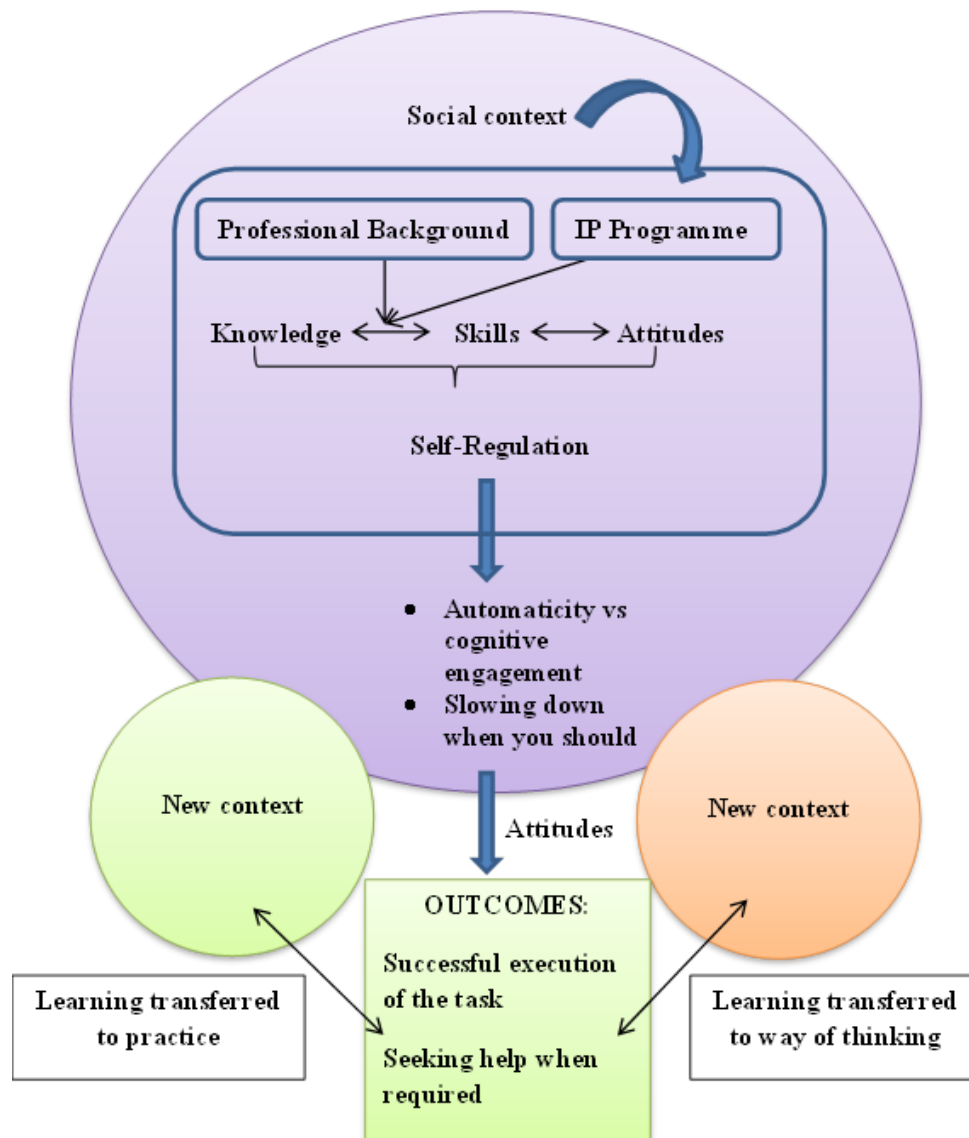


Figure 2 Modified theory of expertise development model for secondary care pharmacists and nurses learning to independently prescribe

The outer circle represents the ‘social context’ in which learning to prescribe takes place. This is referred to above, in our results, as the **contextual factors** influencing students learning to prescribe. This includes social interactions and the environment in which learning to prescribe takes place. The inner box which includes the ‘knowledge’, ‘skills’ and ‘attitudes’ are considered the **intrinsic factors** which are integrated and embedded in a feedback loop within the social context. Pharmacists in this study gained more ‘skills’ from the ‘IP programme’ such as consultation models and holistic thinking in comparison to nurses who gained more ‘knowledge’ in pharmacology and medication from the ‘IP programme’. Nurses reflected on their practice, understanding the rationale behind their advisory roles after gaining knowledge from the ‘IP programme’ in comparison to pharmacists. This meant that student nurses were learning basic science and reflecting back on their practice as nurses.

‘Self-regulation’ is referred to as **metacognition** in the results and is considered part of the intrinsic factors influencing students learning to prescribe. Self-regulation enables students to cognitively reflect on their knowledge, skills and attitudes within a social context. This allows them to adapt to the task and determine the level of cognitive engagement required to complete the task. Executing a learning task was largely dependent on the **attitude** of the student and the **transition** involved in thinking and acting like a prescriber. Subsequently, the outcome of the task is transferred to a new context either by applying it to the new context, or by having the intention of applying it to new contexts. This is specifically applicable in situations where students are not allowed to write a prescription yet and therefore have to

incorporate what has been learnt into their way of *thinking* as a prescriber, before completing the programme and engaging in the *behaviour* of a prescriber.

This proposed model for secondary care pharmacists and nurses learning to prescribe illustrates how integrated the intrinsic and contextual influences are on this process. It is, therefore, important to assess the competencies of students as a whole, in a variety of clinical scenarios in order to develop their expertise and ease the transition from a non-prescriber to a prescriber.

We anticipate that the proposed model (figure 2) could be used as framework to create an evaluation tool for teachers to identify areas where students could develop themselves in a variety of clinical environments. We propose that this model could also be used as a reflective tool for students themselves to use when developing their expertise. This model could be used as a complementary approach to competency-based education to develop the expertise of non-medical students learning to prescribe by focusing on the knowledge, skills and attitudes of students within a clinical environment. Competency-based education would be more useful and efficient for the assessment of specific skills, such as clinical examination skills. We anticipate that the complexity of the model would allow for a useful tool to evaluate and note the progression of expertise development during the process of learning to prescribe.

Relation to other publications

This study sought to explore how students learn to prescribe by exploring their experiences when learning to prescribe. This included the ways in which students execute tasks in a clinical setting. The dynamic of clinical settings and the method of obtaining these experiences gave us insight into the influences that affect how students execute tasks. Acquiring the knowledge and skills to be able to prescribe encompassed a range of influences on their learning process which dictated the path of transitioning from a non-prescriber to a prescriber. Kilminster et al. 2010 defines transition as “the process of change or movement between one state of work and another” (Kilminster et al., 2010). Transitions are reported to be highly emotional phases (Brennan et al., 2010, Kilminster et al., 2010). This was consistent with findings in this study where students’ transition was influenced by the attitude and metacognition of students. To our knowledge, this is the first study to identify, in-depth, IP students experiencing a phase of transition during the process of learning to prescribe, similar to doctors learning to prescribe. Transition in this study revolved around the formation of a new identity as a prescriber, where the thinking process of students changed due to the added accountability and responsibility prescribing entails. Unlike medical doctors thinking that they were risking their professional credibility when seeking help (Kennedy et al., 2009), students in this study believed it was part of their training to refer patient cases if they believed they were working outside of their competence. In addition, students chose to refer patient cases if it involved executing tasks, such as clinically examining patients, if they believed it was not part of their job role as a prescriber. This is consistent with findings from a study in which pharmacist and nurse non-medical prescribers’ choice to prescribe

was influenced by their perception of their competence, job role and risk (Maddox et al., 2016).

Students stated that more practice and familiarity with medicines and patient assessments would increase their confidence and ease the transition to become a prescriber. However, this did not determine a students' performance as prescribers. Despite students reflecting on their preparedness to practice as prescribers, they are not yet able to behave as prescribers. In a study identifying links between work transitions and doctor's performance, foundation year one doctors learnt "prescribing by prescribing" (Kilminster et al., 2010). Students in this study were more conscious of their activity, such as assessing patients, and the changes occurring to their thinking process. However, this could be an artefact of using audio-diaries as a method for data collection. In some cases, students exhibited analytical reasoning mechanisms which involved using slow, logical steps to reach a clinically justifiable course of action. This occurred when students were unfamiliar with certain clinical scenarios during their PLP. Nevertheless, it is likely that with practice, students who will become prescribers will alternate between analytical and non-analytical clinical reasoning depending on the clinical scenario. This is consistent with literature that describes analytical and non-analytical clinical reasoning as a process in which one can switch between either (Eva, 2005, Norman et al., 1994). In order for students to develop their expertise, Ericsson 2004, explains that 'deliberate practice' is required for experts to develop and reach superior achievement (Ericsson, 2004). Deliberate practice requires the performer to continually challenge their knowledge, skills and

attitudes in varied environments for the development of expertise to occur as seen in figure 2.

It is important that students have sound knowledge and sufficient clinical skills to ensure their effort at deliberate practice results in the development of their expertise. Nurses in this study gained knowledge in pharmacology from the IP programme, helping them understand the clinical reasons behind their practice as nurses prior to the programme. The work of Lim et al 2014 also reported similar findings where nurses were able to quickly grasp new knowledge and apply it to practice (Lim et al., 2014). Whilst it is an advantage to be able to grasp new knowledge based on previous practice, there is a need for stronger foundations in their pharmacology knowledge prior to the IP programme. Nurses in this study attributed the gaps in their knowledge of pharmacology and bioscience to their pre-registration nursing degrees. This could be because it was only since 2013 that new nurses have to complete their education to a nursing degree level and receive basic pharmacology as part of their pre-registration curriculum (Department of Health, 2009). This means that nurses prior to 2013 entering IP programme may continue to struggle with the pharmacology and bioscience content due to previous nursing degrees being less focused on academic theory and more focused on the students' practical ability.

Similar concerns have been reported emphasising the importance of pharmacology education in building the knowledge and skills required to prescribe safely and competently (Davis, 2010, Lim et al., 2014, Green et al., 2009). Despite this, nurse independent prescribers self-reported that the IP programme provided them with

adequate preparation in this area and generally as a prescriber (Smith et al., 2014). One could argue that nurse independent prescribers prescribe in certain specialties and have adequate knowledge to prescribe safely in their specialty area. However, Banning argues that “we should be educating nurses to be capable practitioners rather than merely competent to undertake specific skills” (Banning, 2004). The reality of clinical practice is that polypharmacy is increasing and the prevalence of drug-drug interactions rises significantly with the number of drugs dispensed (Guthrie et al., 2015). This could mean that although pharmacist and nurse independent prescribers will work in their specialist areas, they will need sound knowledge in assessing the patient and their polypharmacy. Both pharmacist and nurse students on the independent prescribing programme and independent prescribers should be trained to continually develop their expertise in practice. In addition, adding a compulsory prerequisite pharmacology and bioscience course for nurses and a compulsory prerequisite advanced skills training programme for pharmacists may compensate for the inconsistency of knowledge and skill in students due to their backgrounds as healthcare professionals.

Pharmacists in this study gained skills from the IP programme which resulted in high levels of affectivity when transitioning in their identity. Unlike nurses, pharmacists reflected more on the challenge of shifting their clinical reasoning from an “all medicine” approach to a holistic approach in assessment. Pharmacists on the programme learnt skills that helped shift their current knowledge rather than gain knowledge. In order to attend to the needs of pharmacists and nurses on the IP programme, it may be more beneficial to separate the disciplines or include modules

that provide separate training for the disciplines. Pharmacists in this study believed the IP programme was geared towards nurses, which is consistent with other reports of the programme being too nurse orientated (Cooper et al., 2008a, Banning, 2004, George et al., 2007). However, they did find the “nursing side” of the programme (clinical examination and diagnostics) interesting, even suggesting that not enough time was spent to develop this skill.

Findings in this study show the content in degrees and modules undertaken and their varied backgrounds influence the learning of pharmacist and nurse independent prescribers. This should be accounted for not only in the development of their expertise, but in the evaluation of their skills. Paterson and colleagues point out that whilst objective structured clinical exams (OSCEs) which tests clinical performance and competence are a valid and reliable tool for the evaluation of skills of students learning to prescribe, there are a number of limitations to this for non-medical prescribing students (Paterson et al., 2015). This is because of the varied background of students and the difficulty in designing a “one size fits all” prescribing scenario.

Just as prescribing is recognised as a complex skill, prescribing education programmes and evaluation tools should mirror this complexity. This could be done by students using the theory of expertise development model as a reflective tool by engaging their knowledge, skills and attitude during the process of learning to prescribe. Moreover, this should be evaluated as a potential educational intervention prior to students using the model as a reflective tool. We propose that the theory of

expertise development and the influences on pharmacists and nurses learning to prescribe from this study could be used to further develop non-medical prescribers.

Strengths and limitations

This study is one of the first studies to explore, in-depth, the learning experiences of pharmacists and nurses learning to prescribe. The strengths of our study lie in our methodological design. The use of audio-diaries resulted in rich detailed data of their personal reflections in practice. Follow-up interviews allowed us to tailor our interviews based on the audio-diaries and validate our interpretation of the audio-diaries. The constructivist grounded theory approach ensured that our analysis and interpretation was grounded in the data. Whilst audio-diary reflections are cognitively driven, participants recorded their experiences which were situated in practice drawing upon contextual influences on learning.

The main limitation of our research is the small number of participants. This study lasted 24 months due to difficulties in recruiting participants, because of the workload commitment required to participate in this study and the competing commitments during the programme. Nevertheless, the rich data resulted in data saturation.

CONCLUSION

It is important that students on the non-medical prescribing programme have sound clinical knowledge and skills to ensure they develop their expertise in prescribing appropriately. In addition, the attitude of the individual learner and the surrounding environment is equally important for developing their expertise. This study used a

novel method to investigate the thoughts, feelings and prescribing experiences of students on the independent prescribing programme. In addition, this is the first study to identify, in-depth, IP students experiencing a phase of transition during the process of learning to prescribe. This allowed for the modification of the theory of expertise development model which could be used as a reflective tool for those learning to prescribe to ensure students are conscious of their competence.

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Chapter Seven

Chapter type:	Journal article
Article title:	A qualitative study exploring how pharmacist and nurse independent prescribers make clinical decisions
Submission status:	Submitted

***Note.** As this paper has been submitted, the formatting and layout are consistent with the requirements for the journal. For this chapter, references will be placed at the end of the chapter rather than at the end of the thesis.*

A qualitative study exploring how pharmacist and nurse independent prescribers make clinical decisions

ABSTRACT

Aim

To explore how secondary care pharmacist and nurse independent prescribers clinically reason when making clinical decisions.

Background

Clinical reasoning is a central component of prescribers' competence and professional autonomy when reaching a clinically appropriate decision. Like doctors, pharmacist and nurse independent prescribers in the United Kingdom have extensive prescribing rights, but little is known about their clinical reasoning.

Design

A constructivist approach using a think-aloud methodology and semi-structured interviews

Methods

Eleven nurse and 10 pharmacist independent prescribers were asked to think-aloud about validated clinical vignettes prior to interview, between March and December 2015. Data were analysed using a constant-comparative approach.

Results

A strong link between clinical knowledge, grounded in previous experience, and clinical reasoning was found. Despite prescribers approaching the clinical vignettes holistically, their focus varied according to professional background and job role. Nurses were more likely to describe interacting with patients, compared to pharmacists who were more focused on medical notes and laboratory results. Think-aloud protocol analysis revealed a distinct pattern in the process undertaken to reach a clinical decision. This is presented as a prescribing model, encompassing case familiarisation, generating hypotheses, case assessment, final hypotheses and decision-making stages, which oscillated throughout the model.

Conclusion

This is the first study to explore the clinical reasoning processes of secondary care pharmacist and nurse independent prescribers. The resultant prescribing model shows clinical reasoning as a complex and dynamic process. This model could inform the training of independent prescribers to become accurate problem solvers and continue making clinically appropriate decisions.

Keywords: non-medical prescribing, independent prescribing, pharmacists, nurses; decision-making, clinical reasoning; clinical competence

SUMMARY STATEMENT

Why is this research or review needed?

- Pharmacist and nurse independent prescribers in the United Kingdom have extensive prescribing rights, but little is known about how they clinically reason to arrive at a clinical decision.
- Knowledge of pharmacist and nurse independent prescribers' clinical reasoning processes could contribute towards developing their clinical decisions to ensure patient safety.

What are the key findings?

- The clinical knowledge, experience, professional background, context and attitudes of independent prescribers in this study greatly influenced their clinical reasoning and decision-making.
- A distinct pattern was found in the process undertaken to reach a clinical decision, which is presented as a prescribing model.

How should the findings be used to influence policy/practice/research/education?

- The influences and clinical reasoning process of secondary care pharmacist and nurse independent prescribers can inform educators to train independent prescribers to develop their assessment, diagnostic and clinical reasoning skills.

INTRODUCTION

Independent prescribers are responsible for the clinical assessment of diagnosed or undiagnosed patients, including their clinical management and prescribing (Department of Health, 2006). Like doctors, pharmacist and nurse independent prescribers in the United Kingdom (UK) have extensive prescribing rights but differ in their professional background and experience. Literature on the prescribing practices of pharmacist and nurse prescribers report that they are making clinically appropriate prescribing decisions (Baqir et al., 2015, Latter et al., 2012, Naughton et al., 2013). However, there have been concerns over their pharmacology knowledge, history taking, clinical assessment and diagnostic skills (Latter et al., 2012, Naughton et al., 2013, Lim et al., 2014, General Pharmaceutical Council, 2016). A central component to the task of prescribing is the process of reaching a clinically appropriate decision by clinically reasoning. Prescribers in the UK follow a single competency framework for all prescribers (Royal Pharmaceutical Society, 2016). In addition, multiprofessional education in independent prescribing programmes offered by Higher Education Institutes is common. This means that despite differences in the professional background and experience between pharmacist and nurse independent prescribers, both professions receive homogenous prescribing training.

Background

Independent non-medical prescribing rights, introduced in the UK in 2006, allow experienced pharmacists and nurses with the appropriate prescribing qualification to prescribe within their competence. In order to enter the independent prescribing programme, pharmacists are required to have at least two years post-registration

experience and nurses three years post-registration experience, including one-year in the clinical field in which they intend to prescribe (Department of Health, 2006). Clinical reasoning is a central component of prescribers' competence and is defined as a "context-dependent way of thinking and decision-making in professional practice to guide practice actions" (Higgs, 2008).

Research attempting to understand clinical reasoning began, using the Information Processing Theory (Newell and Simon, 1972), as the theoretical basis for the creation of clinical reasoning models. The Information Processing Theory, developed from cognitive psychology studies, characterises the "normal" human thought process. This resulted in the creation of a number of clinical reasoning models (e.g. Hypothetico-Deductive reasoning, Bayesian Theory, Pattern Recognition, etc.) (Norman, 2005, Coderre et al., 2003, Bartels, 2013). Clinical reasoning literature has focused on two main concepts, the process involved in reaching a clinical decision and the measurement of the accuracy of the outcome of a final decision. However, at an early stage of understanding clinical reasoning, it was found that expert clinicians and medical students both used the same hypothetico-deductive method in problem solving (Elstein AS, 1978, Neufeld et al., 1981). Nonetheless, experts generated better hypotheses during clinical reasoning in comparison to novices (Barrows and Feltovich, 1987). Studies then began to research the influence of memory (Patel and Groen, 1986), mental representations and knowledge organisation (Barrows and Feltovich, 1987, Bordage et al., 1997), direction of reasoning (Arocha et al., 1993) and accuracy in decision-making to understand how healthcare professionals think. More recent studies have focused on educational interventions to contribute towards promoting clinical reasoning (Ark et al., 2007, Harris et al., 2011, Radomski and

Russell, 2010, Stieger et al., 2011). However, there is little research exploring how pharmacists and nurse independent prescribers clinically reason to arrive at a clinically appropriate decision. Findings from this study can inform educators to train less experienced prescribers how to assess their expertise and use the information available to them to guide their decision-making. This study will also lead to further inquiries which may improve the process of diagnosis and prescribers' rationale.

THE STUDY

Aim

The aim of this study was to explore how pharmacist and nurse independent prescribers in secondary care clinically reason when addressing prescribing scenarios. Independent prescribers working in secondary care were chosen because they are used to having ready access to medical records and laboratory results. This is likely to reduce the barriers in prescribers' clinical reasoning and decision-making process to understand more clearly the process involved in clinical reasoning.

Design

A constructivist approach was used to understand the realities constructed out of the experience of participants in this study (Guba and Lincoln, 1994, Golafshani, 2003).

Sampling and recruitment

Active pharmacist and nurse independent prescribers working in secondary care were recruited into the study. The researcher defined ‘actively prescribing’ as prescribing at least once a week. A survey link containing a letter of invitation and recruitment questionnaire, with an attached participant information sheet, was sent via email by the General Pharmaceutical Council (GPhC) and non-medical prescribing leads at various hospitals across the UK. The survey link was also circulated via social media, such as Twitter, Facebook and LinkedIn. The recruitment questionnaire in the survey link contained a number of questions such as the years of experience, number of hours worked and the number and type of prescriptions issued as a prescriber. In addition, participants were also asked to choose up to 3 clinical therapeutic areas they felt sufficiently competent prescribing in. Purposive sampling of participants ensured a maximum variability sample of pharmacist and nurse independent prescribers based on their experience and specialist areas as prescribers.

Data collection

Data collection took place between March and December 2015. Data about how pharmacist and nurse independent prescribers make clinical decisions were collected in two ways. A think-aloud protocol using verbal reports, as suggested by Ericsson and Simon (Ericsson and Simon, 1980), was followed immediately by a semi-structured interview. The think-aloud protocol technique is a method in which participants are asked to verbalise their thoughts out loud to understand their cognitive processes. Both carried out face-to-face or over the phone.

The verbal protocols used were clinical vignettes either taken (with permission) from validated exam scenarios from a pharmacy postgraduate diploma or created using the same format as the exam scenarios and validated by two consultant doctors. The clinical vignettes all followed the same format in presentation with minute differences from one vignette to another. Participants were sent a list of clinical therapeutic areas and asked to choose up to 3 areas they felt sufficiently competent prescribing in. Clinical vignettes in the chosen areas were presented to participants, who were asked to read them and think out loud. The researcher did not interfere or prompt participants during the think-aloud protocol stage of the study. However, the researcher made notes to ask further questions regarding participants' thought process and to investigate what influenced their decision-making process during the semi-structured interview. This enabled participants to clarify and elaborate on their thoughts to ensure that the researcher had interpreted the think-aloud process correctly.

Data collection lasted between 30 and 80 minutes (approximately 1 hour for the think-aloud stage and 30 minutes for the semi-structured interview) in a private area at the participant's place of work or over the phone. Participants consented, in writing, to the study after full explanation of what was involved. Participants who undertook a phone interview gave verbal consent, followed by written consent after the interview took place. Participants who chose to be interviewed over the phone were emailed the clinical vignettes at the beginning of the phone call and asked not to look at them until the start of the interview. The think-aloud method is a form of

cognitive interviewing, which uses phone interviews. Despite phone interviewing in think-aloud methods being relatively uncommon, it is thought to be more appropriate with participants with a higher level of education, due to their ability to articulate their thoughts more easily (Fowler, 1995, Noel, 2013). The think-aloud stage and interview were audio-recorded after informed consent was obtained. All data were transcribed verbatim.

Ethical Considerations

Potential participants were provided with a participant information sheet outlining details of the study and the opportunity to contact the researcher if they had any enquiries before committing to their involvement. To ensure their self-determination to participate in the study was not influenced by the researcher, the risk of coercion was addressed by sending details of the study through gatekeepers, such as the GPhC and non-medical prescribing leads. Participants had to either contact the researcher directly or complete the survey to show interest in taking part in the study. Data obtained from participants were anonymised and safeguarded in compliance with faculty procedures from the university. The study obtained ethical approval from a University research ethics committee.

Data analysis

The computer software program NVivo[®] was used to assist in the organisation of the data. This allowed the researcher to interconnect categories emerging from the data using open and axial coding. Codes were continuously defined and refined in an

iterative way as new data were analysed. The broader themes generated were compared with previous data from the same study and other previous studies using the constant-comparative method (Glaser and Strauss, 1965). This also included comparing different stages within a single interview, comparing interviews with similar participants, and briefly comparing pharmacist and nurse interviews until data saturation was reached. Interpretation of the data was discussed in detail with both co-authors (MPT and PJJ) to ensure plausibility of the analysis.

Validity and reliability

Audit trails were recorded from the point of data collection to analysis to ensure consistency and dependability in the research. Peer examination by both co-authors took place over a number of stages to check plausibility of emerging themes and interpretation of the data. In addition, clinical vignettes were checked to ensure they are valid and medically correct by two consultant doctors.

FINDINGS

Ten pharmacists and eleven nurse independent prescribers who work in secondary care participated in this study. They worked in a variety of specialities and all were actively prescribing. Table 1 shows the demographics of the participants.

Participant	Gender	Age	Specialty	C/A/B	Prescribed Items/day	Prescribed Items/week	Hours/week as IP	Registration as IP	Actively Prescribing
P1	M	32	Medical Admissions	B	100	500	35	Jul-14	Oct-14
P2	F	34	Nutrition	B	12	60	20	Aug-13	Aug-14
P3	F	58	Medical Admissions	C	15-17	60-70	4	Aug-07	Dec-07
P4	F	37	Mental Health	B	1	5	2	Aug-06	Aug-06
P5	F	60	Surgery	C	20	40-50	15	Jul-07	Jul-07
P6	F	50	Nutrition	B	8-13	30-50	14	Nov-10	Nov-10
P7	F	55	Acute Medicine	C	30-35	150-175	22	Sep-06	Sep-06
P8	F	38	HIV	C	0-1	1	0.5	Jun-15	Jun-15
P9	F	30	Medical Admissions	B	10	50	7	Sep-12	Jan-13
P10	M	32	Critical Care	B	15	75	25	Jun-15	Aug-15
N1	F	41	Pain Management	A	6-8	12	15	Sep-14	Sep-14
N2	M	31	Immunology & Haematology	B	0-3	2-3	37.5	Feb-12	Feb-12
N3	M	43	Acute Oncology	B	50-100	350-700	37.5	Sep-10	Nov-10
N4	F	41	HIV	C	10	30	18	Sep-11	Mar-12
N5	M	46	Nephrology	B	30	150	14	Sep-10	Oct-10
N6	F	35	Emergency Medicine	A	0-50	250	37.5	Nov-12	Jan-13
N7	M	44	Acute Medicine	A	5	15	10	Jul-13	Jan-14
N8	F	52	Stroke	B	10	50	37.5	Dec-10	Jan-11
N9	M	32	Mental Health	B	2	10	15	Aug-12	Oct-12
N10	F	53	Pain Management	B	2	10	37.5	Jul-10	Jul-10
N11	F	50	Palliative Care	A	5-10	15-30	22.5	Aug-14	Nov-14

Table 1 Participant demographics P (n) = Pharmacists; N (n) = Nurses; C/A/B = Chronic/Acute/Both prescriptions; IP =

Independent Prescriber

Pharmacists and nurses chose up to 3 clinical therapeutic areas they felt sufficiently competent prescribing in. These choices dictated the clinical vignettes presented to the participants, which may be a factor influencing their decision-making. The findings revealed a distinct pattern in the process of decision-making. This is presented as a prescribing model (Figure 1).

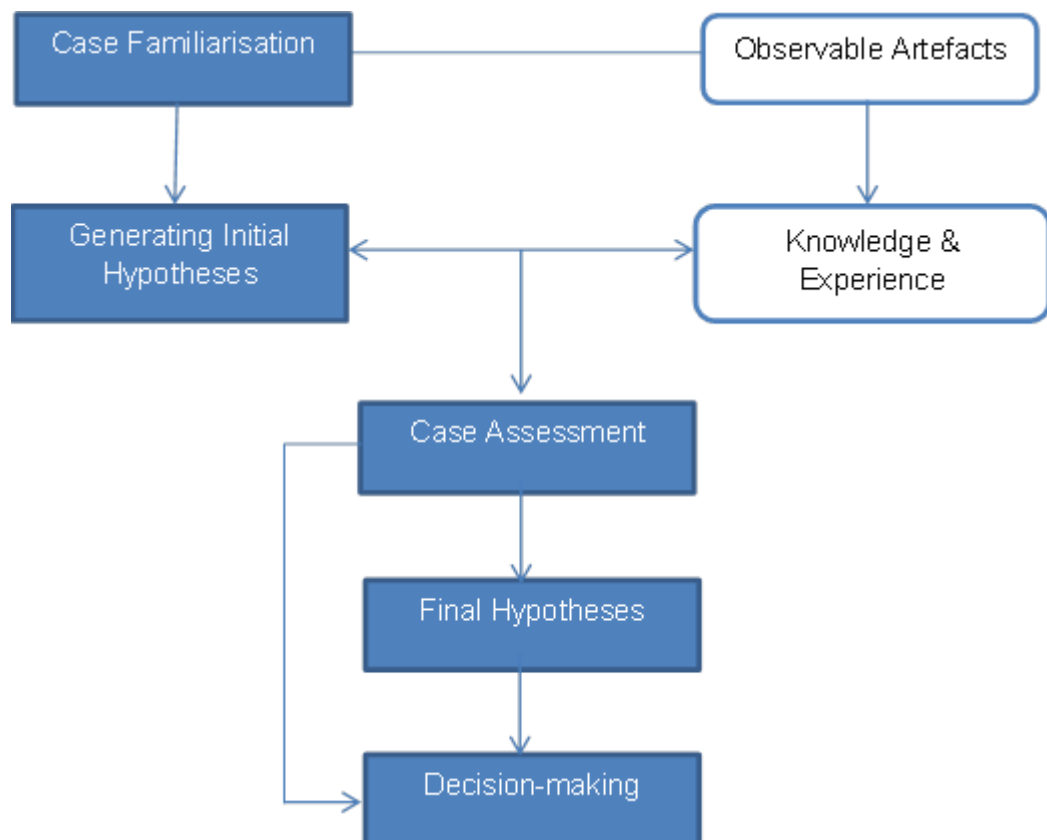


Figure 1

**Prescribing model for pharmacist and nurse independent prescribers working
in secondary care**

Case Familiarisation

Participants began by reading the clinical vignettes out loud to familiarise themselves with the patient presented in the case. Aspects which would have been considered as environmental or contextual in a real-life scenario are referred to in the model as observable artefacts. A stage of case familiarisation and cue acquisition occurred *prior* to generating a hypothesis. Cue acquisition, in this context, is the intention of gathering information prior to explicitly generating a hypothesis. The participant below states that she needs to literally "see" the patient to familiarise herself further with the case before generating any hypotheses:

"The next thing obviously would be I need to see this patient because generally there is not a clear-cut indication for TPN." P6, Think-Aloud

Cue acquisition in the stage of 'observable artefacts' was viewed as the first verbal reflection of cognition. During this stage, participants linked the information read to their knowledge and experience. This showed participants implicitly or explicitly referring to their declarative and procedural knowledge.

The participant below refers to her knowledge that calcium channel blockers and beta-blockers should not be prescribed together. She makes it clear that despite these recommendations, which may be based on declarative or procedural knowledge, these combinations of medicines are regularly used in practice. This showed that participants were linking the information read to their knowledge with experience.

“There’s an argument we shouldn’t use calcium channel blockers at the same time as bisoprolol although he has survived on felodipine and bisoprolol and we regularly use those.” P3, Think-Aloud

Generating Initial Hypotheses

Participants used their knowledge and experience to arrive at a number of initial hypotheses to explain the reasons behind the patient's presenting complaints. Some participants used their initial hypotheses to arrive at a final decision following the case assessment stage. Nevertheless, the generation of initial hypotheses resulted in participants associating information gained from the clinical vignette with their knowledge and experience or with information from within the vignette itself. In the example below, the participant associated the presenting complaint with the patient's current medication based on their knowledge and experience, to generate an initial hypothesis:

“So already I'm thinking "what other medication is she already on", because it's well known that falls can be associated with polypharmacy. Past medical history, so hypertension, so that tells me that she's probably on some kind of antihypertensive, and I'm already thinking was her fall due to the fact that she's dropping her blood pressure when she's standing up.” N2, Think-Aloud

Other participants did not explicitly make associations to generate an initial hypothesis. Nonetheless, participants still referred back to their existing knowledge and experience to explain the hypothesis:

“So from the history, I’m thinking so increased confusion, she doesn’t obviously normally have a history of confusion if she lives at home with her husband, self-caring, so confusion is an indicator for sepsis and infection. The increased urinary frequency, you would maybe think that she’s probably got a UTI which is making her feel like this” N6, Think-Aloud

Participants generating initial hypotheses were more likely to request further information to reach a more definitive hypothesis before deciding on the course of action. This is referred to in the prescribing model as the ‘case assessment’ stage.

Case assessment

Participants described how they would interact with patients, the MDT and how they would use tools to assist them in the assessment of each clinical case leading to the acceptance or rejection of the initial hypotheses generated.

Participants did not solely rely on the information presented to them. They described how they would involve the patient by taking their own extensive medical and drug history as well as reviewing the patients' signs and symptoms. Participants described many questions they would ask to inform their thought processes on understanding the patients' presentation. Many of these questions alluded to obtaining a more detailed medical history:

“My question is, how much of this medication? Because she’s sleeping all the time for two days. Has the MST® (morphine sulphate) affected that? Is it the seizures causing that? How much of her medication has she been having over the last two

days? Because if she has been sleeping all the time, she most likely will not have had the MST® (morphine sulphate) BD (twice a day) and, hence, her sleepiness hasn't been caused by the opioids because that should have worn off by this time.” N11, Think-Aloud

The description of how they would interact with patients also included conducting clinical assessments, which would include physical examination skills. Seven nurses stated that they would conduct physical examinations on the patient. Nurses were also more likely to describe interacting with patients more than pharmacists. Only two pharmacists, both of which prescribed in the specialty of nutrition, stated that they would physically examine patients. However, this either involved looking at the patient or searching for certain signs on the patient based on their specialty. On the other hand, five pharmacists who mentioned physical examination skills during the think-aloud stage stated they would not do this themselves. Pharmacists focused and relied on medical notes and patient's medicines when clinically reasoning more than nurses, who were keen to describe how they would involve the patient. Pharmacists expected to have other colleagues within the MDT performing such examinations and documenting this in the medical notes. One pharmacist reflected on her knowledge and skills in physical examination skills, stating that she “*wouldn't feel comfortable doing that*” herself (P9).

Participants viewed prescribing as a team-based activity, where prescribers would make use of the skills of the MDT to reach a decision in each clinical case. Liaising with the MDT was to either discuss and obtain their opinions or to refer certain

aspects of the patient's presentation or history to someone more specialised in the area:

"I would hold the eye drops at the moment and speak to the ophthalmology colleagues to see if there are any other alternatives for her glaucoma." N5, Think-Aloud

In other cases, participants lacked knowledge or skills in an area and therefore sought help from the MDT:

"The blood gases: I'm not really up in blood gases so I would refer to somebody else to discuss blood gases." P5, Think-Aloud

Much of the role of prescribers was dictated by their job role or what was expected of them within a team. Even though the prescribers were able to prescribe independently, in some cases, this depended on whether the patient was "*theirs*" or "*someone else's*". They would only advise on treatment if the patient was under the care of another prescriber or team. This then dictated whether they would use their prescribing qualification autonomously or act as an advisor who happened to have the ability to prescribe.

In addition to interacting with patients and the MDT to further explore each case, participants also referred to medical notes that would be available. Participants also described how and why they would request further information such as recent

laboratory test results. Requesting extra check-ups was done to examine trends or to clinically review medicines for dose adjustments. A process of elimination also occurred during this exploratory stage, where the participant ruled any other causes for the presenting complaint, before reaching a decision. In the example below, the participant requested further investigations in order confirm or reject the presence of a urinary tract infection:

“So we would need to do a full set of obs (observations) on this lady, and check what her heart rate, what ECG is showing, what her blood pressure is doing, and also send off a full set of bloods to check her T3, T4 levels. And that’s it, really I think, but she could have an infection of unknown origin. We’d also need a urine sample, for a dip and CNS.” N8, Think-Aloud

Assessing cases resulted in the participant either reaching a relatively definitive hypothesis about the presenting complaint or deciding to refer the patient to a respective member of the MDT.

Final Hypotheses and Decision-Making

Decision-making occurred at all stages of the prescribing model, depending on the number of issues presented in each clinical case. In this study, decision-making was defined as the decision to treat and, if applicable, prescribe. Prescribing included initiating, altering and removing medicines. Participants choosing to refer the case to other members of the MDT decided this based on the severity of a condition, their normal prescribing practice, or competence.

Participants viewed themselves as embodying two separate roles. Participants who chose to make decisions for the presented case acted as prescribers. On the other hand, participants who chose to refer the case to a member of the MDT acted as advisors based on their profession of either nursing or pharmacy. Clinical competence, familiarity and confidence were found to be largely interlinked when participants chose to refer. In the example below, the participant is not familiar with naproxen and chooses only to advise due to her lack of confidence:

“And if he wasn't finding it helpful I might suggest that they stop it, although I think that would be a decision that I would make a suggestion rather than actually doing it myself, because I'm not confident to know exactly how all that interacts” N1, Think-Aloud

Conversely, some participants chose to refer patients based on the severity of the patient's condition and their ability and confidence in dealing with the case:

“I would get a palliative care consultant or a palliative care registrar and I would say, please help me because in this situation it's very critical, I know a bit but I would not take that responsibility. I wouldn't feel safe enough in my decision.” N11, Interview

Many factors influenced the decisions of participants who were happy to commence treatment or an action plan for patients. This was largely based on the nature of the presenting condition, which consequently determined the choice of treatment. The nature of the condition also led to more complex decision-making. Participants were

found to weigh the benefits against the risks, and in some cases, use their knowledge and experience to make a decision:

"So a breakthrough dose with fentanyl patch would be 40mg of morphine PRN (when required), but I think that's quite a high dose, and I wouldn't be happy to do that. I would probably have a little bit of an opiate saving and range it between 10 and 20, or 5 to 10 of oxycodone" N10, Think-Aloud

Decision-making by participants did not result in one single decision, but many. This depended on the nature of the condition and treatment pathway. Even though independent prescribers are autonomous, the process of reaching a decision was not. Participants described how they made use of the skills of the MDT to discuss patient cases and consequently reach a treatment plan:

"I'm quite a junior member of the team, even though I do prescribe, I would discuss this patient with my consultant, or somebody more senior to me, the registrar, to guide the best treatment..." N8, Interview

Regardless of decisions made, participants recognised the importance of reaching concordance with patients before commencing or altering treatment. The alteration of treatment to fit the patient's individual needs also meant a stage of 'elimination' in the prescribing model. Seeking to achieve concordance tied in with the opportunity to educate patients on the treatment plan and their medicines along with health promotion and support.

DISCUSSION

Findings from this study present a prescribing model grounded in data from pharmacist and nurse independent prescribers think-aloud processes in making clinical decisions. Despite the proposed prescribing model being presented as linear, each theme often oscillated with other themes, owing to the complexity of presenting a cognitive model on paper.

Clinical reasoning in this study encompassed all types of clinical decisions, which included diagnostic, prescribing, managing and referral decisions. It was, therefore, informed by declarative and procedural knowledge and skill. Participants were asked to choose the areas of specialty in which they felt sufficiently competent prescribing. This was done to ensure prescribers were not hampered with uncertainty when presented with the clinical vignettes. Elstein *et al.* (Elstein AS, 1978) and Barrows *et al.* (Barrows and Feltovich, 1987) both showed that the same physician may show different levels of competence for different cases due to clinical reasoning being highly dependent on the reasoner's knowledge and experience. Participants however, approached heterogeneous cases using a similar method in overall clinical reasoning, albeit differences in the content of the think-aloud reasoning. Differences arose from prescribers' knowledge, skills, attitudes and the influence of context its application. The prescribing model is similar to Elstein and Schwarz's hypothetico-deductive approach in generating hypotheses, which undergoes a case assessment stage to test out these hypotheses (Elstein and Schwarz, 2002). However, participants implicitly combined other cognitive and interactive models during the process of clinical reasoning. For example, participants used the hypothetico-deductive approach as the

general clinical reasoning process but also used the interactive multidisciplinary reasoning model (Higgs, 2008) to guide their decision-making. Nevertheless, this study aimed to explore how independent prescribers clinically reasoned and could not extrapolate current models taken from a different study sample.

Pharmacists and nurses began a process of cue acquisition as a means of synthesising information, in order to conceptualise and analyse the information provided by reflecting on their own knowledge and experience. Pharmacists focused more on clinically reviewing medicines and using medical notes to guide their thought process. On the other hand, nurses described involving the patient by obtaining a more extensive medical history and examining the patient. These differences were attributed to the influence of professional background and experience of participants in this study.

Elstein and Schwartz state that the accuracy of decisions is based on the ability to master its content and not on the strategy or thoroughness used to reach its content (Elstein and Schwarz, 2002). This is more evident with studies that explore methods of problem-solving or diagnostic decision-making. These studies investigate both the process of reaching the decision and what the final decision is. In this study, participants synthesised the information presented to them and verbalised cue acquisitions to consider several hypotheses. However, participants had trouble mastering the data to reach an *autonomous* final decision. This could be attributed to participants' expertise, the influence of a team-based healthcare system or as a limitation of using clinical vignettes. Participants preferred involving the MDT with

their prescribing decisions due to the influence of competence and confidence on their decision-making. This is consistent with previous work on non-medical prescribers. Non-medical prescribers working in primary care preferred to not take responsibility for prescribing decisions if they were not both confident and competent. This was due to the risk of errors in prescribing and doubts in receiving support by their regulators or the possibility of exposure and criticism (Maddox et al., 2016).

Participants began by familiarising themselves with information from the vignettes followed by a stage of cue acquisition prior to the generation of initial hypotheses. Like the hypothetico-deductive processing model, this resulted in prescribers generating initial hypotheses at an early stage which guided the lines of inquiry during case assessment. These overlapping stages reflected how participants retrieved information from their long-term memory which informed their cue acquisition. Some participants used semantic qualifiers which the author interpreted as participants conceptualising the cases to reflect meaning from the data. For example, “*pain in lower back like electricity shooting down the right buttock*” was later referred to as “*neuropathic pain*” (N1, Think-Aloud). Semantic qualifiers are adverbs or adjectives that translate a collection of symptoms into syndromes or disease representations (illness scripts). These are "chunked" into the working memory to facilitate access to the information and make sense of the bigger picture during the assessment stage (Bordage et al., 1997).

Clinical vignettes in this study contained little information to allow the participants to reason freely. Some participants generated an initial hypothesis almost immediately after reading the first signs and symptoms of the patient before undertaking a case assessment stage. This suggested that they may be relating the patients' presentation with a disease representation from their working memory. Some may argue that the fast and efficient hypothesis generation, characteristic of an expert, may be forward reasoning (Arocha et al., 1993). However, this study did not test the clinical reasoning methods of differentiating novices' from experts.

Nevertheless, the majority undertook a thorough clinical assessment stage, which became highly interactive, with descriptions of liaising with the MDT and the patient. The National Prescribing Centre emphasises the need to involve the patient throughout the consultation and prescribing process (National Prescribing Centre, 2012). This was clear with all participants who undertook the case assessment stage by interacting with the patient. Information that would have been gained from the patient or caregivers also influenced the clinical reasoning process. Patient interaction brought case specificity, reflecting the importance of undertaking a holistic assessment to pick the most appropriate treatment option. The use of the MDT during the case assessment stage could also be attributed to the change in the National Health Service (NHS) healthcare system which encourages multidisciplinary teamwork (NHS England, 2015).

Nurses described how and why they would physically examine patients based on their existing expertise. However, pharmacists who did describe physically

examining patients chose to only "look" at the patient for specific signs. Studies report the need for improvement in pharmacists' undertaking of physical examination skills and diagnosis (Latter et al., 2011, Medical Education England, 2010). In this study, some pharmacists stated that it is not part of their job role as independent prescribers, whilst others said they were not competent and comfortable undertaking this. Unlike pharmacists, it is considered good practice for nurses to be assessed as competent in undertaking a clinical assessment, diagnoses and history from patients, prior to commencing the independent prescribing programme (Department of Health, 2006). This could be one of the reasons for why pharmacists report a lack of confidence in performing such examinations. Additionally, this could also be attributed to the professional culture of pharmacy. Pharmacists report they are not used to any physical contact with patients and view themselves as the experts in medicine and not diagnoses (Buckley et al., 2006). Gaining an understanding of what influences independent prescribers decision-making can help educators to train prescribers how to challenge these influences. Expertise development (Bereiter and Scardamalia, 1993) is a useful method for independent prescribers to deliberately engage their knowledge, skills and attitude in areas which require development to improve the process of diagnosing and prescribing.

Requesting further investigations in the case assessment stage was interpreted as a clear hypothetico-deductive stage. Participants were found to deduct hypotheses using propositional representations (IF x THEN y) (Patel et al., 1991). They reflected on their knowledge and experience in order to make a final decision on whether to treat this patient or refer them. This was a highly metacognitive stage, as participants were seen to self-regulate their long-term memory to assess whether they felt

competent and confident to treat or refer the patient. Similarly, non-medical prescribers working in primary care report that support from their MDT increased their confidence and competence. They believed this would eventually lead them to taking full responsibility for patients in their prescribing practices (Maddox et al., 2016). The implementation of independent prescribing dictates that all prescribers should work within the limits of their competence (Department of Health, 2006). This resulted in participants viewing themselves with two separate roles of either a pharmacist/nurse, or as independent prescribers. According to the Information Processing Theory, metacognition reflects on one's long-term memory, which would include the knowledge, experience and associated attitudes with such memories (Elstein AS, 1978). In summary, participants followed the proposed prescribing model during the process of clinical reasoning using clinical vignettes. Clinical reasoning was influenced by many factors based on the declarative and procedural knowledge of participants, and attitudes associated with it. This consequently influenced whether they would make treatment decisions autonomously or refer to the MDT. The multiprofessional work and professional culture of appreciating the expertise of each health professional was a major driver to reaching a clinical decision.

Limitations

A limitation of this study was that the think-aloud process did not take place in a real-life setting and may not cover, in-depth, contextual influences on the clinical reasoning process such as the limited time available to make a clinical decision or the patient being uncommunicative. However, to understand the underlying cognitive

processes using the think-aloud technique, a method that results in minimal cognitive load is required. In addition, reading and articulating thoughts out loud forces subjects to use a considerable amount of mental effort. Researchers in this study ensured that the clinical vignettes were basic, with enough information to allow participants to verbalise their thoughts with ease. In addition, allowing participants to choose the clinical vignette therapeutic areas meant they were addressing prescribing scenarios that they perceived themselves to be competent in to minimise barriers to their prescribing decisions and focus on the process involved to reach a decision.

CONCLUSION

This is the first study to explore how secondary care pharmacist and nurse independent prescribers make clinical decisions when provided with prescribing scenarios. Findings from this study show that the clinical reasoning of pharmacist and nurse independent prescribers is a highly complex and dynamic process that is influenced by the knowledge, skills, attitudes and context in which prescribing would take place. This study does not examine the difference between the expert and novice independent prescriber. However, it emphasises the importance of sound clinical knowledge that is grounded in experience and how it influences clinical reasoning. This model could inform the training of independent prescribers to become accurate problem solvers and continue making clinically appropriate decisions.

CONFLICT OF INTEREST

No conflict of interest has been declared by the author(s)

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Chapter Eight

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***Note.** As this paper has been submitted, the formatting and layout are consistent with the requirements for the journal. For this chapter, references will be placed at the end of the chapter rather than at the end of the thesis.*

Factors influencing secondary care pharmacist and nurse independent prescribers' clinical reasoning

ABSTRACT

In the United Kingdom, pharmacist and nurse independent prescribers are responsible for both the clinical assessment and prescribing of patients. Prescribing is a complex skill that entails the application of knowledge, skills and clinical reasoning to arrive at a clinically appropriate decision. Decision-making is influenced and informed by many factors. This study explores what factors influence pharmacist and nurse independent prescribers during the process of clinical reasoning. A think-aloud methodology immediately followed by a semi-structured interview were conducted with 11 active nurse and 10 pharmacist independent prescribers working in secondary care. Each participant was presented with validated clinical vignettes for the think-aloud stage. Participants chose the clinical therapeutic areas for the vignettes, based upon their self-perceived competencies. Data were audio-recorded and a constant-comparative approach was used for analysis. Influences on clinical reasoning were broadly categorised into themes: individual influences, context and interactions. These themes showed that individual and socio-cultural aspects of prescribing heavily influenced the prescribers. For example, prescribers were aware of treatment pathways but chose to refer patient cases to avoid making the final prescribing decision. Exploration of this behaviour in the interviews revealed that previous experience and attitudes such as confidence and cautiousness associated with responsibility were strong influencers within the decision-making process.

These findings can be used to inform the education, training and practice of independent prescribers to improve their professional development and subsequently improve patient care.

Keywords: pharmacist; nurse; non-medical prescribing; clinical reasoning; influences; think-aloud

INTRODUCTION

Prescribing by healthcare professionals other than doctors in the United Kingdom (UK) is termed non-medical prescribing. One type of non-medical prescribing that has extensive prescribing rights similar to doctors is independent prescribing. Pharmacist and nurse independent prescribers have the most extensive prescribing rights in comparison to other non-medical healthcare professionals in the UK.

Studies have shown that non-medical prescribing is viewed positively by patients, healthcare professionals and stakeholders (Courtenay, Carey, Stenner, Lawton, & Peters, 2011; Latter et al., 2011; D. Stewart et al., 2009). Non-medical prescribers (NMP) believe that their services provide many benefits, such as faster access to medicines and better patient care (i5 Health, 2015). NMPs also believe they are utilising their skills with their new job role as prescribers, leading to greater job satisfaction, albeit an increase in workload (Watterson, Turner, Coull, Murray, & Boreham, 2009). Moreover, they believe they are able to improve patient management and complete a care episode from the provision of services to patients, to their discharge from care. This is consistent with findings from a clinicians audit conducted in 2014 which showed that clinicians also supported these beliefs, as 95% of care episodes provided by NMPs were completed, resulting in less general practitioner (GP) appointments and follow-ups (i5 Health, 2015). However, other reports indicated that clinicians who were supporting NMPs in their prescribing decisions and practice faced a significant amount of added time to their job roles (Hacking & Taylor, 2010; Watterson et al., 2009). This is no surprise as prescribing entails taking responsibility for the clinical decisions made. A study on NMPs found

that they were reluctant to take responsibility for prescribing decisions for reasons such as their self-perceived competence and the risk of making a prescribing error (Maddox, Halsall, Hall, & Tully, 2016). In addition, many factors such as time since qualifying (Ross & Kettles, 2012), knowledge (Gumber, Khoosal, & Gajebasia, 2012), training (Boreham, Coull, Murray, Turner-Halliday, & Watterson, 2013) and support from the multi-disciplinary team (MDT) (Green, Westwood, Smith, Peniston-Bird, & Holloway, 2009) are reported to influence the prescribing practices of NMPs.

Background

Independent prescribers in the UK are responsible and accountable for the assessment of patients, which includes the decision-making and prescribing involved in their management. Independent prescribers can prescribe autonomously for any condition within their competence (Department of Health, 2006). The aim of introducing this type of prescribing practice was to make better use of the skills of healthcare professionals by providing a more flexible health service and improving patients access to medicines without compromising their safety (Department of Health, 2006).

It is estimated that there are currently 53,572 registered nurse and midwife prescribers and 3,845 registered pharmacist prescribers in the UK (i5 Health, 2015). It is also estimated that 9,674 of NMPs work in acute settings across 160 hospital trusts in England only. This equates to 34% of NMPs working in acute care settings, with the remainder working in community (44%), general practice settings (18%), mental health (3%) and social care (1%).

Clinical reasoning is a central component to prescribers' competence and professional autonomy. It is the process involved to arrive at a clinical decision. Higgs et al. define clinical reasoning as a, "context-dependent way of thinking and decision-making in professional practice to guide practice actions." (Higgs, Jones, Loftus, & Christensen, 2008). Clinical reasoning has its roots in cognitive psychology. Past research in clinical reasoning focused on the influence of memory, mental representations and knowledge organisation in an attempt to understand how healthcare professionals reason and make clinical decisions. The interest in clinical reasoning processes amongst healthcare professionals is to find methods to train students to become accurate problem solvers and reduce the chances of errors. More recently, research in clinical reasoning is incorporating socio-contextual factors which influence clinical reasoning, such as patient characteristics and the environment in which clinical reasoning takes place. There is little research exploring what influences pharmacist and nurse independent prescribers decision-making when clinically reasoning. This can inform their training and practice to benefit further from their unique skills and improve patient care.

Aim

The aim of this study was to explore what influences secondary care pharmacist and nurse independent prescribers during the process of clinical reasoning when addressing prescribing scenarios. The availability of medical records and laboratory results in secondary care settings reduces the environmental barriers impacting on the process of clinical reasoning. Therefore, independent prescribers working in

secondary care who are used to accessing medical records and laboratory results were chosen as the sample of participants for this study.

METHODS

Sampling and recruitment

An invitation to take part in the study (including a web link to a recruitment questionnaire) and participant information sheet was sent via email by the General Pharmaceutical Council (GPhC) and non-medical prescribing leads at hospitals across the UK. The invitation was also circulated via social media, such as Twitter, Facebook and LinkedIn. Participants interested in taking part in the study answer questions in the recruitment questionnaire regarding their prescribing practices (Table 1). They were also asked to identify up to 3 clinical therapeutic areas they believed they were competent prescribing in.

Participants were considered to be appropriate for inclusion if they were registered as nurse and pharmacist independent prescribers with their professional body and actively prescribing in secondary care (acute care settings). The researcher defined ‘actively prescribing’ as prescribing at least once a week. Purposive sampling of participants ensured a maximum variability sample in clinical specialties and number of years of experience as independent prescribers.

Data Collection

Data collection took place between March and December 2015. A think-aloud protocol using verbal reports, as developed by Ericsson and Simon (Ericsson, 1984), immediately followed by a semi-structured interview was carried out with pharmacist and nurse independent prescribers working in secondary care. The think-aloud protocol technique is a method of cognitive interviewing in which participants are asked to verbalise their thoughts out loud in an attempt to understand the underlying cognitive processes taking place when undertaking a task. Clinical vignettes validated by academic pharmacists or consultant doctors were categorised according to the British National Formulary's (BNF) clinical therapeutic areas (e.g. cardiovascular disease, respiratory disease, etc.). As mentioned above, participants were asked in the recruitment questionnaire to identify up to 3 clinical therapeutic areas they felt competent prescribing in. The clinical vignettes were picked according to the therapeutic areas they chose and used as the verbal reports to be presented to participants during the think-aloud protocol.

On the day of the interview, participants were presented with 3 clinical vignettes from their chosen clinical therapeutic areas and asked to read and think out loud, by speaking their thoughts in detail for each case. This was immediately followed with a semi-structured interview, where the researcher asked the participants to elaborate on their thought process and decision-making they had verbalised during the think-aloud stage. The researcher also asked participants questions to investigate what influenced their decision-making and discuss any enablers or barriers. Data collection lasted between 30 and 80 minutes (up to 1 hour for the think-aloud stage and 30 minutes for

the semi-structured interview) and took place either at the participant's place of work or over the telephone (Collins, 2014; Noel, 2013). This was audio-recorded and transcribed verbatim.

Data Analysis

Data was analysed using the constant-comparative method (Glaser, 1965) with the aid of the computer software program NVivo[®] version 9, to assist in the organisation of data and codes. Codes were continuously refined in an iterative way as new data were analysed until data saturation was reached. Interpretation of the data was discussed with both co-authors (MPT and PJJ) to ensure plausibility in the analysis.

Ethical Considerations

The study was approved by the University Research Ethics Committee and individual hospital trusts from which the survey link was circulated to participants. This was circulated either through the GPhC, NMP leads or social media to minimise the risk of coercion. Informed consent was obtained from all participants before the start of the interview. Participants who chose to be interviewed over the phone gave verbal consent, followed by written consent after the interview had taken place. Participants were made aware that they are free to withdraw from the study, up to two weeks after completing the interview. Data were anonymised after the 2 week time frame had passed. Data was safeguarded in compliance with faculty procedures from the university

RESULTS

Ten pharmacist and eleven nurse independent prescribers who work in secondary care participated in this study. Pharmacists and nurses worked in a variety of specialties and all were actively prescribing. Table 1 shows the demographics of participants in this study obtained from the recruitment questionnaire.

Participant	Gender	Age	Specialty	C/A/B	Prescribed Items/day	Prescribed Items/week	Hours/week as IP	Registration as IP	Actively Prescribing
P1	M	32	Medical Admissions	B	100	500	35	Jul-14	Oct-14
P2	F	34	Nutrition	B	12	60	20	Aug-13	Aug-14
P3	F	58	Medical Admissions	C	15-17	60-70	4	Aug-07	Dec-07
P4	F	37	Mental Health	B	1	5	2	Aug-06	Aug-06
P5	F	60	Surgery	C	20	40-50	15	Jul-07	Jul-07
P6	F	50	Nutrition	B	8-13	30-50	14	Nov-10	Nov-10
P7	F	55	Acute Medicine	C	30-35	150-175	22	Sep-06	Sep-06
P8	F	38	HIV	C	0-1	1	0.5	Jun-15	Jun-15
P9	F	30	Medical Admissions	B	10	50	7	Sep-12	Jan-13
P10	M	32	Critical Care	B	15	75	25	Jun-15	Aug-15
N1	F	41	Pain Management	A	6-8	12	15	Sep-14	Sep-14
N2	M	31	Immunology & Haematology	B	0-3	2-3	37.5	Feb-12	Feb-12
N3	M	43	Acute Oncology	B	50-100	350-700	37.5	Sep-10	Nov-10
N4	F	41	HIV	C	10	30	18	Sep-11	Mar-12
N5	M	46	Nephrology	B	30	150	14	Sep-10	Oct-10
N6	F	35	Emergency Medicine	A	0-50	250	37.5	Nov-12	Jan-13
N7	M	44	Acute Medicine	A	5	15	10	Jul-13	Jan-14
N8	F	52	Stroke	B	10	50	37.5	Dec-10	Jan-11
N9	M	32	Mental Health	B	2	10	15	Aug-12	Oct-12
N10	F	53	Pain Management	B	2	10	37.5	Jul-10	Jul-10
N11	F	50	Palliative Care	A	5-10	15-30	22.5	Aug-14	Nov-14

Table 1 Participant demographics

P (n) = Pharmacists; N (n) = Nurses; C/A/B = Chronic/Acute/Both prescriptions; IP = Independent Prescriber

The clinical vignettes presented to participants differed depending on the chosen therapeutic areas participants believed themselves to be sufficiently competent in. The analysed transcripts from participants thinking out loud when reading the clinical vignettes revealed a number of factors influencing the process of clinical reasoning. In addition, participants were also asked during the follow-up interview what they believed were enablers or barriers to their decision making. Quotations that have been cut are shown as [...]. Table 2 below presents the main themes and sub-themes which were identified as factors which influence their clinical reasoning.

Table 2 Themes identified showing factors which influence the clinical reasoning of secondary care pharmacist and nurse independent prescribers

Themes	Sub-themes
Individual	Education
	Experience
	Metacognition
	Identity
	Attitudes
Context	Resources
	Prescribing settings
	Trust requirements
	Cost
	Meetings
Interactions	MDT
	Patient/carers/family and friends

The most obvious influence on clinical reasoning was participant's knowledge and experience during the think-aloud protocols. Upon questioning, nurses spoke of the pharmacology gained from the prescribing programme in comparison to their previous education. Nurses also described the benefits of undertaking an advanced clinical skills training programme to improve their examination and diagnostic skills:

"In hindsight I probably would have done the exam and diagnostics before I did the prescribing, because I think the knowledge that I gained from the systems point of view on the exam and diagnostics has been more helpful than what I got on the prescribing course." N2, Interview

Participants emphasised the importance of clinical experience and practice prior to commencing the independent prescribing programme. This was evident during the process of clinical reasoning, as participants were more confident describing their decision-making process and chose to prescribe autonomously when they were familiar with the presented case. Explicit intuition also played a part in participants' reflections on familiar scenarios. Intuition is defined as "the decision to act on a sudden awareness of knowledge that is related to previous experience, perceived as a whole, and difficult to articulate" (Rew, 2000). This is seen in the below example:

"[I've] got a feeling clarithromycin and theophylline interact. I'm almost certain they do. Just checking the interactions. Yes, clarithromycin increases theophylline level, that's great." P1, Think-Aloud

Familiarity which consequently led to confidence was largely interlinked with participants reflecting on their competence. Reflecting on one's competence was more likely to occur when participants were faced with the decision of whether to treat the patient or refer them to a member of the MDT:

“And if he wasn't finding it helpful I might suggest that they stop it, although I think that would be a decision that I would make a suggestion rather than actually doing it myself, because I'm not confident to know exactly how all that interacts” N1, Think-Aloud

The importance of clinical practice *after* completing the IP programme was emphasised when participants complained of the gap between completing the programme and registering to become prescribers. Participants described their worries of forgetting the information learnt from the programme and the need for supervision after completing the programme. This showed the influence of participant's attitudes on their new roles as independent prescribers.

Depending on the scenario, participants reflected on their knowledge and skills to identify whether they were able to act as independent prescribers or not. Participants that chose to refer patients identified themselves as their main profession of either nurses or pharmacists:

“I’d want him to see a medic and I’d want him to have a chest x-ray and I’d want him to have bloods, but obviously we would need to treat him symptomatically. If he needed oxygen or salbutamol nebuliser we would treat him, but I wouldn’t prescribe it. I would want a medic to be seeing this person...I may pass on some pharmacy advice, but prescribing-wise no, I wouldn’t.” P4, Think-Aloud

In other cases, participants often advised because their job role would not involve the initiation of medicines, even though they were able to:

“I wouldn’t normally initiate medicines. If the doctors said that they thought it was a UTI and agreed with me and they wanted to prescribe an antibiotic, I would say that nitrofurantoin would be a suitable first choice, according to our Trust policy, the sensitivities, the patient’s eGFR and the documented allergies.” P7, Interview

Even though participants were aware of the treatment pathway, choosing to become advisors in their professional background could be attributed to their attitudes and metacognition. It may be that participants did not feel confident or competent enough to take responsibility in the given scenario. This showed how interlinked metacognition, competence and attitudes are to the individual.

The influence of the individual, therefore, encompassed their declarative and procedural knowledge and skills obtained from education, self-directed learning and

clinical experience. This was continuously self-regulated by participants using their metacognition and attitudes to assess their competence in given scenarios. Participants consequently identified themselves as their professional background and what they specialised in, or as prescribers, depending on the context on the scenario.

Context was defined as the area in which the act of clinical reasoning would take place, using the given scenario. Participants used many resources to guide their decision-making, such as medical notes, laboratory results, guidelines and assessment tools. One participant described the influence of electronic prescribing as a safety mechanism on her practice:

“Having handwritten prescriptions, I find, is more difficult now that I’ve done electronic prescribing, because the electronic prescribing has lots of safety mechanisms in there, like if you prescribe something which also needs, like lansoprazole, prescribing next to it, it will flag it up for you, whereas if you’re doing a paper prescription, you don’t have those safety mechanisms there, so you have to do the thinking, everything for yourself.” N8, Interview

Participants’ choice in the treatment pathway was influenced by the prescribing setting. This included the type of patient (inpatient, outpatient), what ward the patient came from, the urgency of the condition, prescriber’s job role within the setting and time pressures. The nurse below prescribes in an outpatient setting and describes how this influences his prescribing practices:

“Generally the patients are a bit weller [sic], which gives you a bit more time to consider what you're going to do from a prescribing point of view. There isn't that kind of urgency on making snap decisions.” N2, Interview

Knowing what ward patients came from also influenced their clinical reasoning either by focusing on certain therapeutic areas or by deducing some of the wider issues that might be pertinent to the patient in order to tailor their prescribing to the individual patient:

“I do always ask which ward are you working on, because although everybody's individual, if you're working on an eating disorders unit the patients are less likely to want mirtazapine, but if you're looking on an older person's unit where they're presenting like the first patient with a loss of appetite and they're losing weight they could see mirtazapine as a benefit to help them to put on a little bit of weight.” P4, Interview

This also included being aware of medical colleagues' habits and preferences in treatment choice:

“So I would accept this patient on the grounds of post op nausea and vomiting, i.e. ileus and also the pancreatectomy, depending on which surgeon he'd be under, some of our surgeons do not want to orally feed or to NG feed, so on that grounds I would accept the patient on TPN.” P6, Think-Aloud

Participants often referred to their trust requirements and the cost of medicines as an influence dictating their decision-making. The trust requirements included prescribers using a personal prescribing list to ensure they prescribe safely and receive prescribing feedback.

In addition, participants described how their prescribing setting and MDT encouraged a culture of safety, influencing the attitude of participants towards prescribing:

“...it’s a no blame culture but it’s also a very supportive area, so if you’re not sure about something then you just ask or you look it up or you refer to trust policy, so that’s why I do feel very comfortable.” N7, Interview

In contrast, some participants described situations where they were pressured to prescribe. All participants emphasised working within their competence and their refusal to prescribe if they were uncomfortable. In other instances, pharmacists mentioned refusing to prescribe if there was no other pharmacist around to check prescriptions.

Participant’s described the process of obtaining a history and examining patients which showed how such interactions with patients influenced their clinical reasoning. Participants ensured they viewed treatment options in a holistic manner and included the patient when suggesting treatment plans.

Differences between pharmacists’ and nurses clinical reasoning were noted briefly during the think-aloud protocol. Seven nurses stated that they would conduct

physical examinations on the patient in comparison to only 2 pharmacists. Pharmacists who stated they would not physically examine patients themselves believed that they did not have the necessary skills and would expect other colleagues to undertake this task.

Pharmacists and nurses placed an emphasis on different aspects of the clinical vignettes. Pharmacists focused on the medication of patients, their adherence to it and trends in blood results. On the other hand, nurses were more focused on the patient and their health status and undertaking an extensive history. This showed that although participants undertake the same IP programme, their professional background influences how they reason and approach cases. Below is an example showing how a HIV nurse and pharmacist emphasised on different aspects from the same clinical vignette. The nurse immediately wanted details on the presenting signs and symptoms of the patient and a detailed past medical history:

“...again, at this point you’d be wanting to know what the generally unwell feelings were and how long the penile discharge was; what actually...is it there all the time, what colour is it, are there any other...is there any dysuria, are there are rectal symptoms, any pharyngeal symptoms. What sex was the person you had sex with, was it a male or female partner, and what type of sex you were having...from a sexual health point of view there were a few tests missing...was there any vaccination history before...With the diabetes type 2, I’d want to know...quite young for those two conditions at 35, so I’d want to, sort of, know probably a little bit more about the family history as well and when they started, how they were diagnosed,

how they are presenting, how long been on the treatment. Is it related to weight and diet; what support has Mr Starkey been getting for that.” N4, Think-Aloud

On the other hand, the pharmacist automatically states her hypotheses in a systematic manner, without investigating the patient or case any further:

“...there are two issues going on here I think, we may be looking at perhaps a gonorrhoea which has not responded to treatment, or perhaps another STI going on, as well as the fact that he may be undergoing...if he had contracted HIV whilst in Thailand, he maybe seroconverting which may be the cause of him feeling generally unwell, so he would be certainly indicated for an HIV test, at this point, if he hadn't already had one when he attended the GUM clinic and had a full sexual health screen at that point.

His lifestyle and his medical history, and drug history, would all have implications for his treatment with antivirals, but at this point he's not even got an HIV diagnosis. So we would need, like I say, an HIV test, and he'd need to be re-tested for gonorrhoea and probably for a full sexual health screen, just to get a confirmed diagnosis as to what's going on with him. Like I say, he could be seroconverting. So, any interpretation of a viral load, would need to be treated with caution, if he is undergoing the seroconversion process, because it could be misleading.” P8, Think-Aloud

Conversely, the specialty of participants also influenced what they focused on in the cases. For instance, participants working in mental health and pain management focused more on the patient by describing how they would interact with the patient to obtain a thorough medical history, regardless of their professional background.

To elaborate further on influences on participants' prescribing practices, participants were asked during the semi-structured interview to identify what enabled their decision-making and what they perceived as barriers to their decision-making. Experience, access to notes/resources and availability of the MDT were perceived as enablers to pharmacists and nurses clinical decision making process. In addition, having enough time to make a clinical decision and establish concordance with the patient was also perceived as an enabler and barriers to their decision-making. In addition, pharmacists reported that not being able to physically examine patients was a barrier to their clinical decision-making. Table 3 and 4 below provide a list of all the perceived enablers and barriers to clinical decision-making by pharmacists and nurses.

Table 3 Summary of reported factors that enable pharmacist and nurse independent prescribers' decision-making in a secondary care setting

Enabling Factors	Participants
Access to notes and results	Pharmacists and Nurses
Experience	Pharmacists and Nurses
Availability of MDT	Pharmacists and Nurses
Access to resources (e.g. BNF, guidelines, etc.)	Pharmacists and Nurses
Time to make decisions	Nurses
Type of patient (e.g. in-patient, out-patient)	Nurses

Table 4 Summary of reported barriers to pharmacist and nurse independent prescribers' decision-making in a secondary care setting

Perceived Barriers	Participants
Experience	Pharmacists and Nurses
Knowledge (in speciality, medication or general breadth of knowledge)	Pharmacists and Nurses
Unclear clinical history	Nurses
Hierarchy of Doctors	Nurses
Type of patient (e.g. in-patient, out-patient)	Nurses
Time during concordance stage	Pharmacists
Balancing between trust guidance and concordance	Pharmacists
Undergo a full clinical assessment (including physical examination)	Pharmacists

DISCUSSION

Clinical reasoning was found to be context-dependent and, therefore, likely to be influenced by a number of factors. This study found influencing factors from the clinical reasoner, the social context in which prescribing was taking place and the interactions between the reasoner and those involved in the scenario. However, this study has limitations. Data collection relied on participant's verbalised working memory resulting in an incomplete account of all underlying cognitive processes in clinical reasoning. Participants treated each clinical vignette as a real-life scenario, however, it is likely that clinical reasoning in practice is more complex and influenced by rapidly changing situations and unpredictable environments. Highly metacognitive situations, such as the decision to treat or refer patients, in paper based scenarios may have also reduced the influence of attitude on autonomously prescribing. Concurrent think-aloud protocol may, therefore, be limited in its representation of prescribing in practice. However, using concurrent think-aloud in a

clinical setting may have resulted in a high cognitive load on participants, hindering verbalisation. Moreover, relying on retrospective prescribing experiences may have resulted in recall bias. Although participants complained about the lack of detail in the clinical vignettes, researchers involved in the study ensured that enough information was available to build a clinical picture. A positive aspect to this approach was to allow participants to elaborate more on their thought processes.

Independent prescribers are responsible and accountable for the assessment of patients, which includes the decision-making and prescribing involved in their management. It is expected that prescribing would be carried out in practice within a MDT (Department of Health, 2006). Even though the term ‘independent prescribing’ implies autonomy, results from this study found the process of reaching a decision, and in some cases the decision itself, not autonomous. Participants who chose to prescribe, but with the aid of the MDT, did so for a number of reasons. This included seeking guidance from the MDT or making use of the MDTs expertise in specialist areas. In addition, those seeking support from their MDT in their decision-making was, in some cases, due to having little experience in the area or in order for the MDT to validate their decisions. This study revealed the importance of understanding why independent prescribers seek support in certain prescribing scenarios. It could, therefore, be hypothesised that the reasons behind seeking this support could be used to improve their expertise to gain confidence to work independently. Participants who had recently completed the independent prescribing programme were being mentored continuously and given a personal prescribing list to apply their prescribing skills into practice. This was found to be influential and beneficial especially when they received feedback about their prescribing practices,

as seen in previous research (Bowskill, Meade, & Lymn, 2014). However, many of the participants in this study had been actively prescribing for many years, reflecting how influential attitudes are on the practice of prescribing and what it entails.

Metacognition, competence and attitudes were found to be highly interlinked when participants chose to refer patients to the MDT. Participants ensured they only prescribed within their competence as required by their regulatory bodies and the National Prescribing Centre (Council., 2006; Royal Pharmaceutical Society, 2016). Many of the reasons for choosing to refer concurred with previous research findings, such as referring critically ill patients or dealing with medicines they rarely prescribe in practice (Latter et al., 2011; Naughton et al., 2013).

The study also found participants referring to the terms confidence and competence regularly. In some cases, participants knew the treatment pathway, however chose to refer to avoid making the final decision. Being aware of the treatment pathway and referring could be attributed to the attitude of the prescriber, for example, choosing to not take responsibility or having insufficient previous experience in the given scenario. The use of the terms confidence and competence interchangeably has been echoed in a study which used the terms as a self-evaluation measure amongst medical house officers (J. Stewart et al., 2000). Medical house officers perceived competence as their ability to perform a task based on previous experience. Confidence was perceived as an influence to whether the individual was willing to undertake the task or not. In the case of participants in this study who knew the treatment pathway, it is likely they chose to not undertake the decision-making

involved in the task due to their perceived confidence or not having first-hand experience in the given scenario. This is consistent with a study in which doctors expressed discomfort in prescribing a drug without any experience, despite having evidence and literature to support its use (Lewis & Tully, 2009). Nevertheless, findings in this study did not explore whether they were able to perform the task. In other cases, participants would only prescribe once their decisions had been validated by the MDT. This was regardless of their years of experience. A possible solution to this is for independent prescribing programmes to teach the theoretical frameworks underpinning expertise development (Bereiter & Scardamalia, 1993; McLellan, Tully, & Dornan, 2012). This may help prescribers ensure they continuously self-reflect on their abilities and attitudes to develop their expertise. For example, participants who are aware of treatment pathways and identify that it is issues of confidence hindering their ability, could be supervised or mentored by experienced NMPs to develop this area. Alternatively, participants who feel they have insufficient experience in a particular area could practice in that area to increase their familiarity and improve their abilities with experience.

CONCLUSION

NMP's clinical reasoning is influenced by many factors, all of which are interlinked and likely to overlap with one another. In order to make complete use of independent prescribers in secondary care, it is important to focus on these influences throughout their training and practice to improve their expertise and professional development.

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DECLARATION OF INTEREST

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of the article.

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Chapter Nine – Discussion

This chapter draws the programme of research to a conclusion. The purpose of this chapter is to summarise the key findings from each study in this programme of research and show how this addresses the overall aim of the thesis. It also outlines the key strengths and limitations and discusses the contribution of findings from this programme of research to the literature. Finally, this chapter outlines the implication of the findings from this programme of research for policy and suggests areas for further research.

The overall aim of this programme of research was to explore the learning processes and decision-making skills of secondary care pharmacist and nurse students and independent prescribers. The aim of each study presented in this programme of research was met. The next section will present a summary of the findings from each study and how each study contributed towards addressing the overall aim of the thesis.

9.1 Summary of Findings

The programme of research presented within this thesis aimed to explore the learning processes and decision-making skills of independent prescribing students and prescribers. There were two over-arching aims that address the *acquisition* and *application* of expertise in prescribing. First, to investigate the complex skill of prescribing, a systematic review was conducted exploring how factors underpinning the expertise development of pharmacist and nurse independent prescribers, including those learning to prescribe, are reported in the literature. Second, an exploratory study was conducted to explore how pharmacists and nurses on the independent prescribing programme acquire and develop their expertise to become

prescribers. The third study explored how pharmacist and nurse independent prescribers make clinical decisions by investigating how they apply their expertise to achieve appropriate prescribing. To recap, the studies that make up this PhD are presented in Figure 5.0.

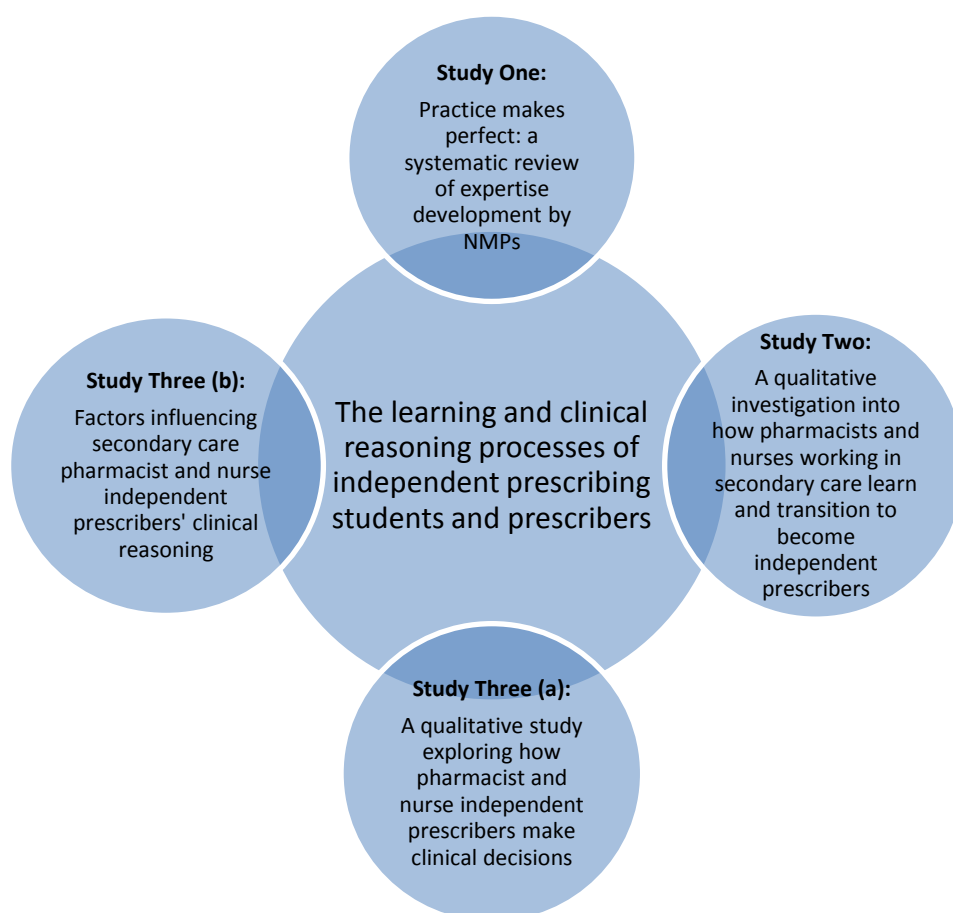


Figure 5.0 The Three Studies Included in this Programme of Research

A systematic review of the literature (Study One) highlighted a body of evidence suggesting an overlap between intrinsic and extrinsic factors which influence the process of learning to prescribe, transitioning as a prescriber and practicing as a prescriber. The reviewed literature identified difficulties in applying theory to practice. This was attributed to an insufficient understanding of the theory and the lack in affordances to apply theory to practice. This occurred in students who were learning to prescribe or prescribers who were reflecting on their learning process. Experience was found to facilitate the understanding of taught theory and allowed students and newly qualified prescribers to apply theory to practice. The systematic

review identified links between experience, attitudes and the sociocultural context in which prescribing took place. This was highlighted in independent prescribers who had newly qualified and were transitioning into their roles as prescribers, and in independent prescribers' prescribing practices. The attitude of prescribers was a major determining factor of their prescribing practices. Prescribers were influenced by their attitude due to the added responsibility that prescribing entails. Findings from the systematic review highlighted the complexity of learning, transitioning and becoming a prescriber, which fit with the Model. The Model was originally developed to examine empirical evidence from medical literature on prescribing to assess whether it fits with the different components of the Model. However, the Model showed that it is also suitable for use on literature from non-medical prescribing students and prescribers. Therefore, the Model could potentially be a method for the evaluation of prescribers to identify areas for the development of their expertise.

The application of the Model on non-medical prescribing literature informed its use in the exploratory study conducted in Study Two. Study Two aimed to explore how pharmacists and nurses who were learning to prescribe, acquired and developed the necessary skills to become independent prescribers. Pharmacists and nurses undertaking the independent prescribing programme were working in secondary care settings, to mirror the context in which medical students were learning to prescribe, around which the Model was developed. Findings from this study revealed a number of intrinsic and extrinsic factors, similar to the systematic review, which influenced students learning to prescribe. Moreover, two phases of learning occurred within students – how they learn to prescribe and acquire the necessary skills required and what influences their transition when learning to *become* prescribers.

Students learning to prescribe noted the influence of previous training, experience and their professional background as attributes that contributed to their learning. Students were also given the affordances during their PLP to apply their expertise to practice. However, few were allowed to write a prescription under close supervision, with their DMP countersigning it. Results from this study also revealed that

pharmacists were acquiring skills to shift their current knowledge to ‘think’ like a prescriber. Nurses also stated similar experiences; however, nurses were also gaining knowledge in pharmacology and reflecting on the need for a clinical rationale when advising treatment.

Gaining knowledge and skills from the programme led students to continuously self-reflect on their competence. Consequently, this also made them consciously aware of their thinking, decision-making and pre-conceptions. This resulted in them beginning a process of transition to learn to *become* prescribers. The process of transitioning to become a prescriber overlapped with students’ metacognition and attitude. This involved the formation of a new identity, as a prescriber, with the added responsibility and accountability of prescribing in the near-future. Naturally, the more familiar students were with clinical practice, the more their attitude allowed them a smoother transition into the role of a prescriber. Through metacognition, students identified their learning needs and were motivated to develop their expertise further.

On the other hand, students also believed that it was part of their training to refer patients if they were working outside their competence. In addition, students referred tasks if they believed it was not part of their job role. Choosing to prescribe or refer reflected the attitude of the learner, which fed back into their transition into the role of a prescriber. Findings from this exploratory study revealed the complexity of and influences on learning and transitioning. This was found to fit well with the theoretical framework informing this study (the Model). However, the differences between medical and non-medical students in the acquisition of declarative and procedural knowledge from their experience and the independent prescribing programme were noted. The Model was, therefore, modified to fit with secondary care pharmacists and nurses learning to prescribe. However, a limitation of this study was that students were not all provided with affordances to prescribe under supervision. We were, therefore, unable to explore the cognitive clinical reasoning processes involved in clinical decision-making. This informed Study Three which explored how secondary care pharmacist and nurse independent prescribers clinically reason when provided with prescribing scenarios.

Study Three (a) aimed to explore the cognitive processes involved in the clinical reasoning process of secondary care pharmacist and nurse independent prescribers when given prescribing scenarios. Clinical reasoning in this study encompassed clinical decisions which included diagnostic, prescribing, managing and referral decisions. Findings from this study revealed a pattern in the process undertaken to reach a prescribing decision. This resulted in the development of a prescribing model. The prescribing model included a process of cue acquisition, based on prescribers' declarative and procedural knowledge to generate initial hypotheses. This subsequently guided the lines of enquiry, referred to as the case assessment stage. The case assessment stage was highly interactive in that it included the context of the environment in which the case assessment would take place, as well as descriptions of the social interactions with patients and members of the MDT. Prescribers described how they would involve the patient during the case assessment stage, to ensure case specificity. However, pharmacists were more focused on using resources from within the environment, such as medical notes, and clinically reviewing patients' medicines to guide their decisions in comparison to nurses. Nurses described how they would involve the patient by obtaining an extensive medical history and examining the patient. On the other hand, pharmacists believed other members of the MDT were more qualified to undertake physical examinations. Pharmacists stated they were either not comfortable undertaking physical examinations or believed it was not part of their job role. Prescriber's decision of whether to treat or refer patients was a highly metacognitive stage that involved them assessing their competence and confidence. Prescribers either chose to refer patients and to act as advisors, or treat them and act as prescribers. The resultant pattern obtained from prescribers' clinical reasoning was developed into a prescribing model. However, this model only reflected the cognitive element of clinical decision-making. Results from this study also revealed factors which influenced clinical reasoning. This was analysed further in Study Three (b) to investigate the factors which influenced pharmacists and nurses' clinical reasoning.

Prescribers in Study Three were presented with written prescribing scenarios in the form of clinical vignettes and asked to speak their thoughts out loud. Prescribers were asked to identify what they believed influenced their decision-making for each scenario. Additionally, factors influencing their clinical reasoning were also analysed from their verbal protocols. Notwithstanding the lack of context in the prescribing scenarios, influencing factors from within the clinical reasoner, from the environment in which they imagined themselves prescribing in and from interactions between them and the environment were noted. Prescribers emphasised the importance of clinical knowledge, skills and experience when prescribing. As described in previous studies, nurses in this study also explained that they had gained knowledge in pharmacology from the independent prescribing programme. Nurses also described the benefits of undertaking the advanced skills training programme to improve their diagnostic and examination skills, which they believe complimented the independent prescribing programme. Experience was seen as important before and after the independent prescribing programme. Upon questioning, the importance of experience was noted due to its direct link with familiarity in clinical scenarios and consequently the influence of attitude on their role as prescribers.

In addition, prescribers' professional background and specialty influenced how they reasoned and approached individual cases, including what they focused on. This was especially clear when pharmacists were found to focus more on the medication of patients, their adherence to it and trends in blood results. On the other hand, nurses were more likely to state that they would conduct physical examinations on the patients and obtain an extensive medical history. Furthermore, pharmacists and nurses who specialised in mental health and pain management also focused more on the patient regardless of their professional background. Subsequently, the choice in treatment pathway was also influenced by the prescribing settings and support from members of the MDT. As dictated by the need for prescribers to work within their competence, prescribers may choose to treat or refer patients. However, in the case of independent prescribers, those who chose to refer also acted as advisors in their professional fields. This meant that, in some cases, prescribers were aware of the treatment pathway, but chose to become advisors based on their attitude, competence and metacognition. In other cases, prescribers chose to become advisors if they

believed it was not part of their job role to initiate prescriptions. This study showed that whilst clinical reasoning is a central component to prescribers' competence, it is also important to be aware of factors that influence clinical reasoning.

9.2 Key Strengths and Limitations of the Studies

In order to explore the learning process and decision-making skills of independent prescribing students and prescribers, an in-depth, descriptive and flexible method of obtaining data was required. A qualitative approach to the research allowed us to explore and describe complex phenomena in which dynamic processes in learning and prescribing took place. Despite the overall samples being relatively small, each participant from Study Two and Study Three contributed towards a rich amount of data resulting in data saturation. The wide range of experiential backgrounds and varied specialty of participants resulted in theoretical generalisability that may be transferrable to other non-medical independent prescribers.

Study One is the first, in-depth, qualitative systematic review exploring how the expertise development of pharmacist and nurse learners and independent prescribers is reported in the literature. This PhD set a broad research question of how pharmacists and nurses learn and independently prescribe. To understand the complex phenomena of how they learn and prescribe, we needed a theoretical approach to define and explain this phenomenon.^[146] This informed the first study, which used the Model to construct a framework, leading to framework analysis of the literature on pharmacist and nurse learners and independent prescribers. By testing whether the Model is applicable to literature on pharmacist and nurse learners and prescribers, we were able to design the methodology for Studies Two and Three. Constructivist grounded theory and the constant-comparative method were used to analyse data from Study Two and Study Three respectively. Both methods are iterative and inductive processes that generate theory, which ensures that the interpretation is grounded in empirical data.

Using a novel qualitative technique of audio-diary recordings allowed us to explore the under researched area of how pharmacists and nurses on the independent prescribing programme acquire the necessary knowledge and skills to be able to prescribe. A strength in using audio-diaries as a data collection method was the monologue nature of students recording their subjective impressions of an experience. Students recording about their subjective experiences was a one-way narrative, which meant that the technique was non-intrusive and ruled out the bias that may be introduced from the presence of a researcher. However, this was also a limitation of the method used in Study Two, as some participants felt strange speaking to themselves and felt lost with what to record, despite being given audio-diary prompts and guidelines. Nevertheless, this did not influence what they chose to record in their audio-diaries. In addition, the non-intrusive nature of audio-diary recordings meant that the researcher had to ensure she remained in contact with participants to remind them (on a weekly basis) to record their audio-diaries. Audio-diary recordings required compliance and commitment from the participants, as the majority of recordings took place during the PLP which was spread over a number of weeks. However, this meant that audio-diary recordings were either captured in real-time or as close to the event as possible reducing any recall bias. Audio-diary recordings during or close to the PLP event also meant that participants were able to reflect on their thoughts, feelings and the social context surrounding them. Despite the small number of participants involved in the study, recordings from the audio-diaries, followed by semi-structured interviews meant that there was a rich amount of data recorded.

The key strength of Study Three lies in the method used to explore clinical reasoning. Study Three used think-aloud protocols to explore how pharmacist and nurse independent prescribers clinically reason when addressing prescribing scenarios. Despite using the Model as the methodology informing Studies One and Two, Study Three used the IPT (Section 2.4.2). This theory was used to explore the cognitive part of the Model (Figure 4.0). The use of think-aloud protocols ensured that independent prescribers were only verbalising their thoughts without theorising about their cognitive processes. It is the responsibility of the researcher to theorise the cognitive processes taking place (p. 83).^[147] The theorisation of cognitive

processes was done using the constant-comparative analysis method to ensure that any emerging theory was grounded in empirical data. Moreover, independent prescribers were asked to choose up to three clinical therapeutic areas they felt sufficiently competent prescribing in. This ensured that prescribers were presented with prescribing scenarios from clinical vignettes that they were comfortable with to allow the researcher to capture their clinical reasoning process.

A limitation of Study Three was that the think-aloud process did not take place in a real-life setting. However, in order to understand participants' underlying cognitive processes, a method resulting in minimal cognitive load was needed that was simultaneous in nature (subjects reporting their thoughts while reading the tasks rather than retrospective protocols where subjects report previous situations). Nevertheless, the nature of think-aloud protocols forces subjects to use a considerable amount of mental effort when going through each prescribing scenario. Another limitation included the need to undergo the think-aloud interview over the phone for some participants. Think-aloud interviews are a form of cognitive interviewing. Despite the consequence of being unable to note down non-verbal cues from phone interviewing, conducting interviews over the phone was more suitable for this sample of participants due to their busy life styles as independent prescribers. Nevertheless, a study conducted with cognitive interviewers using cognitive phone interviews found this form of interviewing more suitable for clinicians.^[143] This was because the clinicians were able to articulate their thoughts during the think-aloud protocols with less prompting from the interviewer. This was also the case with participants in Study Three, who were found to be more focused on the clinical vignettes when interviewed over the phone, without the need for prompting by the interviewer.

9.3 Contribution of Thesis Studies to the Literature

Taken together, the results of this programme of research suggest that learning to prescribe, becoming a prescriber and prescribing itself are influenced by cognitive, psychological, social and contextual factors. All studies identified a link between the socio-cultural context, experience, metacognition, attitudes and transition of learners

and prescribers. A closer look at the findings suggested that there is a need to address the pharmacological knowledge of nurses, the physical examination skills of pharmacists and the attitudes of learners and prescribers. The key findings are discussed in the order of students' acquisition of expertise to prescribe, transitioning in identity to become prescribers and applying their expertise to prescribe.

9.3.1 Acquiring Expertise When Learning to Prescribe

Nurses and pharmacists on the independent prescribing programme acquired declarative and procedural knowledge in different proportions. Students benefitted from the use of consultation models, holistic thinking and the notion of concordance to assist them in undertaking a structured and comprehensive approach in decision-making. Acquiring this knowledge from the programme allowed them to apply it to practice during their PLP. Knowles states that adult learners bring to their learning experiences a rich amount of knowledge and skills from their prior experiences (p. 45).^[148] This allows the learner to give meaning to new information. This was the case when nurses in Study Two reflected on authentic scenarios from their experiences, describing how they now understand the clinical rationale behind their advisory roles when asking doctors to prescribe. However, nurses only became aware of their insufficient knowledge in pharmacology after learning pharmacology from the independent prescribing programme. This meant that nurses were acquiring basic knowledge from the programme, which they were developing their prescribing skills on.

Upon questioning, nurses in Study Two attributed their basic knowledge in pharmacology to their nursing qualifications. The standards for pre-registration nursing education set by the NMC states that programme providers should ensure the teaching of pharmacology as a basic science in the curriculum.^[149] However, it was only until recently that all newly registered nurses from 2013 have to complete their education to a nursing degree level.^[150] Nurses entering the independent prescribing programme who do not have an undergraduate nursing degree have to show the ability that they are able to study at a degree level.^[151] In such cases, it is up to the nurses' line manager or employer to sign the non-medical prescribing form

application stating that the nurse is able to study at a degree level. Nurses in Study Two who attributed their basic knowledge in pharmacology to their nursing qualification were experienced nurses who had attained their qualifications prior to 2013. Whilst the researcher is aware of the limitations in generalising the findings from qualitative research, we recommend that the independent prescribing programme undergoes a rigorous selection process on students wishing to enter the programme to ensure that their knowledge in basic sciences such as pharmacology is to a university degree level, if they are to safely prescribe in the future. Ideally, line managers and educators should view the independent prescribing programme as one that develops the expertise of a healthcare professional and not a programme where foundations in bioscience and pharmacology are acquired. However, given that nursing degrees prior to 2013 were based less on academic theory and more on the students practical ability, it may be a challenge to develop nurses expertise in the understanding and application of academic theory to practice. Moreover, it may be that the new wave of nurses post 2013 who enter the independent prescribing programme will struggle less with the basic pharmacology taught on the independent prescribing programme. Nevertheless, undergraduate nursing curricula will need to ensure it evolves its teaching in basic sciences and pharmacology to ensure that nurses reflect expertise when commencing the independent prescribing programme.

We argue that whilst intervention studies (included in Study One) which aimed to improve the acquisition of pharmacology amongst nurses have their benefits, nurses need to have a strong foundation in their basic knowledge of pharmacology. We believe there needs to be more focus on ensuring nurses have a sound clinical foundation in basic knowledge of pharmacology and bioscience, especially for nurses with degrees prior to 2013. In order for this to be achieved, an additional pharmacology and bioscience course could be added as a compulsory prerequisite to entering the independent prescribing programme. Alternatively, an intensive module in pharmacology and bioscience for nurses could be added to the independent prescribing programme. In addition, educators and DMPs need to ensure that nurses are able to apply taught knowledge in pharmacology and bioscience to their clinical working environments during their PLP. This will help facilitate the understanding of theory.

In contrast, pharmacists stated that not enough time was allocated to developing their clinical examination and diagnostic skills. This could explain why pharmacists choose not to diagnose or undertake clinical examinations on patients.^[40] Unlike pharmacists, it is a desirable prerequisite for nurses to undertake the advanced skills training programme prior to the independent prescribing programme.^[17] Ensuring that pharmacists also undertake the advanced skills training programme prior to the independent prescribing programme may allow pharmacists more focused and allocated time to acquire clinical examination and diagnostic skills in the context of a clinical or simulated environment. In addition, the undergraduate pharmacy degree should also focus on pharmacy students attaining these skills at an early stage with the addition of early learning experience to apply their knowledge to practice. This may change the attitudes associated with applying newly acquired knowledge and skills to practice.

Pharmacists on the programme focused less on declarative knowledge and more the application of skills acquired from the programme and its influence on their practice. Both pharmacists and nurses continuously self-reflected on their acquired knowledge and skills throughout the independent prescribing programme. Biggs argues that *“high quality performance inevitably requires metacognitive as well as cognitive components”* (p. 143).^[152] This means that through the input of knowledge, subjects with the intention of developing their expertise, should be able to monitor and regulate their knowledge through cognitive processes when undertaking a task. Whilst nurses were metacognitive of their declarative knowledge, pharmacists were becoming more cognitive of their procedural knowledge when clinically reasoning. This was especially prominent when undertaking a holistic approach with patients.

Dornan et al. argued that in order for knowledge to be effective and available for use, knowledge needs to be developed (p. 23).^[153] This is done by ensuring that structures in the memory, which contain knowledge, are connected to other networks of knowledge. A richer network of interconnections in the memory allows the learner

to elaborate on their knowledge in a more adaptable manner resulting in knowledge encapsulation. Schmidt and Boshuizen suggested that through clinical exposure and training, biomedical knowledge becomes encapsulated.^[154] However, nurses in this study described encapsulated procedural knowledge where they attempted to incorporate biomedical knowledge, learnt from the programme, to understand the scientific basis behind their procedural knowledge.

Results from the systematic review in Study One suggested that students found difficulty in applying theory to practice due to an insufficient understanding of the theory. This could result in knowledge based mistakes (KBMs) and rule based mistakes (RBMs). It has been reported in many studies on doctors that the causes of prescribing errors are multi-factorial; this includes the lack of drug knowledge.^[155-158] In a study exploring the causes of junior doctors' prescribing mistakes, contra-indications and interactions in medicines were common RBMs.^[2] It was also noted that RBMs were more likely to reach the patient. Worryingly, Lewis et al. attributed the RBMs of doctors to them being unconsciously incompetent.^[2] However, there is currently a dearth of research regarding the prevalence, incidence and nature of prescribing errors by NMPs and this is yet to be explored.

9.3.2 Transitioning to Become a Prescriber

Findings from this programme of research revealed that a phase of transition occurred during the process of learning to become a prescriber and when newly qualified independent prescribers began their prescribing practices. As mentioned in Section 2.5.5, previous studies briefly describe a phase of transition experienced by non-medical prescribing students by asking them if they are prepared for practice or by investigating the length of time between completing the prescribing programme and issuing their first prescription.^[42, 52, 93] Study Two explored how non-medical prescribing students acquire and develop their expertise during the process of transitioning to become a prescriber. To our knowledge, this is the first study to identify, in-depth, NMPs phase of transition during the process of learning to prescribe.

The highly affective phase of transitioning into the identity and role of a prescriber was ultimately dictated by the added responsibility and accountability of prescribing. The experience, attitude and sociocultural context influenced the transition phase of learners and prescribers. This is consistent with a study which explored the medical experiences of junior doctors as they transitioned into their first year of clinical practice.^[92] Brennan et al. found that the transition from the role of a student to that of a practicing doctor as a very stressful phase.^[92] However, the stress associated with this transition was reduced if students had gained clinical experience during their undergraduate years. Nevertheless, self-reported attitudes of students and prescribers should not be used as an indicator for performance. In a study examining the factors influencing first year medical students' communication skills, students' judgement of their ability to communicate effectively was poor.^[159] Therefore, while it is important for students and prescribers to influence their attitudes positively by gaining clinical experience, providing detailed feedback is necessary to develop their expertise.

Learners transitioning in this programme of research were developing their identities as prescribers, based on the experiences they observed during the PLP. Students on the independent prescribing programme cannot prescribe until they have successfully completed the programme. However, some students were allowed to "prescribe" under the supervision of their DMP who would countersign the prescription. The lack in formal affordances on the independent prescribing programme could explain the reason why some students described difficulty in applying their knowledge to practice during the process of prescribing. Although students on the independent prescribing programme observe prescribers in clinical settings, this is only likely to trigger their metacognitive skills in how they will think and act as prescribers. It is important to ensure that students experience prescribing through complex clinical encounters, such as simulated environments, or through DMPs countersigning students' prescriptions. This is to ensure students are not "*enchanted*" during the observation of prescribers when foreseeing themselves as prescribers upon completion of the programme.^[160] Meyer and Land describe "*enchantment*" as the notion where learners are provided with a false sense of security from the oversimplification of clinical procedures.^[160]

Previous training, experience and the professional culture of learners influenced the phase of transitioning from a non-prescriber to a prescriber. Students who had previous experience with clinical scenarios which they were familiar with were more likely to state that they would be confident to prescribe in this scenario. In a study investigating the relationship between medical students' confidence and their clinical experience, prior clinical experience was found to be a contributing factor. ^[161] However, hands-on clinical experience was found to be more important than any other variable for the building of confidence in medical students.

As mentioned previously, students were becoming more consciously aware of their knowledge, skills and actions as they began to form their identities as prescribers. Pharmacists specifically described the challenge of shifting their clinical focus from an 'all medicines' approach, to a holistic, all-rounded approach as they formed their identities as prescribers. This difficulty was attributed to the influence of their professional background, and more importantly, their professional culture. A study conducted in Canada which analysed hospital pharmacists' perceptions of their role in patient care found pharmacists primarily viewed themselves as "*guardians of medication*". ^[162] Pharmacist supplementary prescribers in the UK also view themselves as the experts in medicine and prefer to not get their "*hands dirty*" by physically examining and diagnosing patients. ^[40] Al Hamarneh et al. adds that pharmacists are probably not consciously aware that their attention is on medicines rather than the patient. ^[162] This implies that there is a need for a cultural change which will influence the behaviours of healthcare professionals learning to become prescribers. Implementing the role of NMPs into the NHS to improve patient care will not necessarily shift cultural traits and behaviours that have been acquired over years amongst healthcare professionals. Fein and Corrato state that "*culture trumps strategy every time*". ^[163] By viewing culture as malleable, the experiences of individuals and the interpretations of their profession could potentially change the manifestation of culture (p. 134). ^[164] It is, therefore, no surprise that the professional culture of healthcare professionals, which is largely based on their experience within that culture, is interlinked with the context and attitude of the individual.

9.3.3 The Application of Expertise to Prescribe

Findings from the systematic review (Study One) in this programme of research revealed the complexity involved in the prescribing practices of pharmacist and nurse independent prescribers. A number of intrinsic and extrinsic factors were found to overlap and influence the prescribing practices of independent prescribers. Examples of this include time pressure during consultations, patient expectation and clinical uncertainty. This showed the importance of being able to clinically practice the physical act of prescribing in a dynamic and uncertain clinical environment.

Study Two revealed the influence of previous training, experience and professional culture on the knowledge and way of thinking when clinically reasoning during the process of learning to prescribe. This was no surprise as students were acquiring the necessary knowledge and skills during the process of transitioning to become a prescriber, by thinking and acting like a prescriber. However, Study Three revealed that whilst prescribers were approaching clinical scenarios holistically, their focus was still based on their professional background and job role. This occurred during cue acquisition, hypotheses generation and the case assessment stage of clinical reasoning.

During the process of clinical reasoning, nurses were more likely to describe interacting with patients than pharmacists. In contrast, pharmacists were more focused on medical notes, patients' medicine, their adherence to it and trends in blood results. Pharmacists also stated that they were either uncomfortable undertaking a physical examination of patients or believed it was not part of their job role to do so. In contrast, pharmacists and nurses who prescribed in mental health or in pain management were more likely to include the patient during their consultations, regardless of their professional backgrounds. Bearing in mind that medical clinical reasoning encompasses different domains of knowledge and procedural tasks (p. 36),^[147] this showed that the clinical specialty of prescribers was also likely to influence their reasoning processes. This also highlighted that the

influence of professional background, their job role and professional culture is malleable and could be shifted during the training process.

Pharmacists and nurses entering the independent prescribing programme are adult learners with a lot of experience. As experienced healthcare professionals, they would have developed a professional identity based on their knowledge, skills and inherent values from their profession. Nursing is known as a scientific profession that has developed its professionalisation through nursing theory, research and practice. ^[165] Nursing is also centred on the art of caring and achieving health outcomes for individual patients. The caring nature amongst the nursing profession is one of the most influential factors in the development of nurses' professional identity. ^[166, 167] A study exploring nurses' values in their professional identity showed their values as embedded in the care for the health and well-being of the patient. ^[166] This included ensuring patients' dignity was maintained by focusing on the patients' physical care needs. This also included patients' mental health needs, such as understanding their situation from their perspective and treating them as "*persons in their individuality*" rather than as medical cases. This could be one of the reasons for why nurses in Study Three focused more on involving the patient during the process of clinical reasoning than did pharmacists.

This was also the case with pharmacists who focused more on medicines, than did nurses, due to the nature of their education, experience, professional culture and identities. This is seen in a study where a doctor approached clinical scenarios holistically, in comparison to pharmacist prescribers who had a more holistic approach in terms of their knowledge in medication. ^[168] In contrast to the notion of professional backgrounds influencing the focus in their clinical reasoning, pharmacists and nurses also shifted their focus depending on their clinical specialty. Pharmacists and nurses who prescribed in pain management and mental health led their think-aloud consultations in a subjective manner, focusing on the patient. This is likely to be due to the difference in ontologies between biomedical domains such as cardiovascular medicine and domains that are considered more subjective, such as pain management and mental health.

Like the transition phase, the decision-making stage during clinical reasoning in Study Three was highly influenced by the metacognitive skill of the prescriber and their attitudes towards it. This was due to the responsibility and accountability of making a prescribing decision. Prescribing amongst pharmacist and nurse independent prescribers was viewed as a team-based activity. While it is somewhat expected that supplementary prescribers undergo prescribing as a team-based activity,^[40] this was still the case amongst independent prescribers in Study Three. Nevertheless, this may be a limitation of Study Three, as undertaking a team-based approach to make a prescribing decision for every patient would require an efficient system of communication in place. The dynamic and uncertain nature of clinical environments may result in pressures on the independent prescriber to make a prescribing decision or refer the patient, if a team member is not around to assist with the decision-making.

Independent prescribing entails that prescribers work within their competence. However, in Study Three, some prescribers referred patients and also acted as advisors in their professional fields. This implied that some independent prescribers were aware of the treatment pathway, but chose to become advisors based on their attitude, competence or lack of experience when going through the clinical vignettes. This was explored in a study on the influences of uncomfortable prescribing decisions by doctors.^[169] Doctors in that study described feeling uncomfortable making a prescribing decision if they had no prior experience, regardless of the existence of empirical evidence-based medicine to support the prescribing decision. This reinforces the need for supervised affordances where prescribers can gain further experience in the act of prescribing to deal with the associated attitudes involved in prescribing within a clinical environment.

Nevertheless, in other cases, independent prescribers chose to become advisors if they believed it was not part of their job role to initiate prescriptions. This was attributed to the organisational culture, professional culture and associated attitudes

of independent prescribers. For example, independent prescribers working in the accident and emergency department amongst a readily available team are more likely to prescribe within a team or refer patients to doctors that are accessible. On the other hand, an independent prescriber working autonomously in a clinic may feel more inclined to initiate a prescription. Moreover, an independent prescriber may feel it is not their responsibility to physically examine, diagnose a patient and subsequently initiate a prescription.^[40]

9.4 Implications for Policy and Practice

Findings from this programme of research suggest areas that educators and stakeholders need to focus on, in order to ensure that pharmacists and nurses develop their expertise.

It is important to note that not all nurses that are undertaking the independent prescribing programme have an undergraduate nursing degree. As mentioned in Section 9.3.1, from September 2013, nurse training programmes must be at a university degree level. Moreover, current nursing degrees may need to evolve with a stronger focus on the content of bioscience and pharmacology throughout all years of the degree. In addition, students should be made aware of professional cultures and its influence on the holistic assessment of patients and clinical reasoning. Early experiential learning in the application of pharmacology and clinical skills during the undergraduate years of nurses and pharmacists is required if independent prescribing is to be an optional career pathway post-registration.

Independent prescribing programmes offered by universities undergo accreditation from the GPhC and NMC to ensure programmes follow the required learning outcomes to become an independent prescriber. However, the delivery and assessment methods vary across universities and need to be more uniform. This will ensure that the pharmacists and nurses on the independent prescribing programme have thoroughly understood the acquired knowledge and skills from the programme, for example, assessing students using descriptive pharmacology questions versus

multiple choice questions. This PhD did not seek to investigate the differences in the delivery and assessment methods of the independent prescribing programme curricula. This may be an area worth investigating in order to ensure that educators assess students' acquired knowledge and skills during the programme more thoroughly.

We suggest that nurses who do not have an undergraduate nursing degree and are embarking on the independent prescribing programme should undergo an intense pharmacology and bioscience module during the programme or as a compulsory prerequisite course prior to entering the independent prescribing programme. In addition, we suggest that the independent prescribing programme should also have an intense module focusing on clinical skills during the programme. Alternatively, undertaking the advanced skills training programme (which teaches diagnostic, clinical and physical examination skills) could be made as a compulsory prerequisite for pharmacists, prior to entering the independent prescribing programme.^[170] The inclusion of these modules could be applied to independent prescribing programmes that are multi-disciplinary, where nurses and pharmacists separate to undertake these modules and are brought together for more generic modules.

In contrast, some universities have separate non-medical prescribing programmes for pharmacists and nurses. A successful example of this is the non-medical prescribing programme offered at the University of Cumbria.^[171, 172] The non-medical prescribing programme for nurses, midwives and specialist community public health nurses includes a pre-programme numeracy test where students should successfully attain at least 80%. This non-medical prescribing programme focuses mainly on pharmacology, principles of prescribing in the context of nurses, midwives and specialist community public health nursing and the development of clinical skills. The non-medical prescribing programme for pharmacists also asks students to attain at least 80% on the numeracy test and requires that they complete a pre-programme pharmacology assessment to a satisfactory level. This is because pharmacists on the programme are not taught pharmacology. Instead, the programme focuses on the

consultations skills of pharmacists, principles of prescribing in the context of pharmacists and developing clinical skills.

In addition to ensuring that the knowledge and skills of pharmacists and nurses mirrors the development of their expertise is the need to take advantage of the experiential affordances available during the PLP. It is important to acknowledge that knowledge and skills alone are not enough to ensure that students are able to apply it in the context of practice. It may be beneficial to allow students to have prescriptions countersigned by their DMPs during the PLP. This will provide students with hands-on experience in the process of prescribing where they are likely to be highly metacognitive of their knowledge, skills and attitudes in the context of a clinical environment. Educators could also ensure that students are able to differentiate between their competence and confidence during the transition phase of forming their identities as prescribers under supervision, and with constructive feedback.

It may also be beneficial to make pharmacists and nurses on the independent prescribing programme aware of clinical reasoning models and the importance of deliberate practice to ensure that they are continuously developing their expertise. Making students aware of clinical reasoning models and how to self-regulate their knowledge, skills and attitudes through metacognition can provide structure to their own decision-making. In addition, clinical reasoning is context-dependent. By making students on the programme aware of contextual factors influencing clinical reasoning, this can help them by training them to be critical on the sources of their procedural knowledge acquired during practice to ensure their decisions are clinically justifiable.^[173]

By teaching the basics of clinical reasoning in an academic setting, students could be provided with the affordances during their PLP to apply it to practice and discuss it with their DMP to obtain feedback. A study involving allied health clinical educators and students, in which clinical educators were asked to develop a tentative heuristic of their own clinical reasoning to trial with students found that it helped students to

clinically reason. ^[174] This method resulted in both the student and educators reflecting on their clinical reasoning and teaching techniques. Having the opportunity to listen to students' clinical reasoning shifted the focus of educators from "*what their students should know and do*" to "*what students currently understood and did*" and "*how to enable students to move from their current understandings and behaviours to the desired learning outcomes*". This allowed students to engage in independent clinical reasoning in a clinical setting.

9.5 Future Research

This programme of research was conducted as part of a PhD. It was, therefore, limited by time and resource constraints. Below is a description of further research that could be conducted.

- **Primary and community care settings**

This programme of research focused on pharmacists and nurses working in secondary care. Resource limitations meant that it was not possible to explore pharmacists and nurses working in all healthcare settings. Nevertheless, exploring the PLP in a secondary care setting was found as a suitable environment for learning a broad range of experiences due to the availability of the MDT and the ease of accessing medical notes and laboratory findings. However, it is not clear whether pharmacists and nurses learning to prescribe who work in primary care settings are provided with the same affordances. Therefore, exploring how pharmacists and nurses who work in primary care and are undertaking the independent prescribing programme could be explored. This could be done using the same methodology as that in Study Two of this thesis, using audio-diaries and semi-structured follow-up interviews.

Study Three also noted a number of extrinsic factors which influenced the clinical reasoning processes of pharmacist and nurse independent prescribers. It is unclear whether the same factors, such as access to medical notes and colleague support from the availability of MDT, would be reported by independent prescribers working in primary care, where they are generally

more isolated from colleagues than secondary care. In addition, primary care could be an ideal area for exploring uncomfortable decision-making made by pharmacist and nurse independent prescribers. Exploring clinical reasoning processes and decision-making could be achieved by using an introspective think-aloud methodology in the context of clinical practice, as well as observational field notes and utilising the MAI tool ^[54] to confirm the appropriateness of the final decision made.

- **Audio-diary recordings of PLP experiences for AHCP**

The literature review in this programme of research revealed limited literature on the impact of prescribing practices and learning experiences of AHCPs. It may be worth undertaking an in-depth exploratory study to investigate the subjective learning experiences of AHCPs using audio-diaries. This could help set the foundation towards understanding the influences that may later be noted when exploring the impact of their prescribing practices. Audio-diaries would be a suitable method because it can capture events in real-time or as close to the event as possible and is a rich source of narrative enquiry to help explore the experiences of students on the non-medical prescribing programme.

- **Further research comparing the clinical reasoning influences of pharmacist and nurse independent prescribers and doctors**

Study Three discussed some potential differences between the clinical reasoning influences of pharmacist and nurse independent prescribers and the literature about clinical reasoning amongst doctors. A research study that directly compares pharmacist and nurse independent prescribers and doctors' clinical reasoning processes would contribute significantly to this area and potentially allow for inter-professional education to take place within MDTs. This could be done using the same method as Study Three, by using clinical vignettes and the think-aloud technique. However, it may be worth changing the format of clinical vignettes from structured vignettes to ones that are cut into categories, such as current medication, medical notes etc. This will allow

the researcher to note down what healthcare professionals view as a priority to check or investigate during the process of clinical reasoning and why it was explored. It may also be worth adding a rating score for the clinical reasoning prescribing scenarios, to explore how prescribers reach decisions, what final decision they make, why they make this final decision and whether this decision is medically appropriate. The findings of this research could note down the clinical areas needed for improvement in each prescribing group and help target any intervention directly to the type of prescriber or could help suggest areas for CPD.

- **Exploring the attitudes of NMPs – differences between confidence, competence and performance**

All studies in this programme of research identified the attitude of non-medical learners and prescribers as a major factor determining their prescribing practice. Findings from this programme of research revealed that some pharmacists and nurses referred prescribing tasks to other members of the MDT because they did not feel competent, confident, or they believed it was not part of their job role to undertake certain tasks involved in prescribing. It would be worth exploring the interplay between “competent” and “confident” in identifying whether NMPs are able to perform certain tasks or not. In addition, this may reveal other factors influencing their attitudes, such as the influence of their job role on the prescribing task.

9.6 Final Conclusions

This programme of research has provided insight into the acquisition, transition and application of expertise by pharmacist and nurse independent prescribers working in secondary care. It has also provided insights into the factors that influence students’ learning to prescribe and their clinical reasoning when making prescribing related decisions. This area has been, until now, under-researched in pharmacist and nurse independent prescribers. This programme of research has also identified that, like medical students, pharmacists and nurses on the independent prescribing programme

undergo a transition phase whilst forming their identities as independent prescribers. The research has enabled recommendations to be made about the training requirements for pharmacist and nurse independent prescribers before and after qualifying. It has also made a contribution to understanding the influences of pharmacist and nurse independent prescribers to help target any intervention directly to the type of prescriber.

This research is timely with the increasing demand and tightened financial support of *“having to do more with less”*.^[5] This is likely to mean that NMPs, especially independent prescribers with their expansive prescribing rights, will have a greater role in providing prescribing services to patients. An example of this would be using pharmacist and nurse independent prescribers to provide prescribing services for the management of patients with long-term conditions. By being aware of the contributing factors that influence pharmacist and nurse independent prescribers, educators can train them appropriately to ensure the development of their expertise. This will ensure that pharmacist and nurse independent prescribers provide a service reflecting their expertise as part of a successful evolving NHS.

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Appendix 1.0 – Databases Searched in Literature Searches

International Pharmaceutical Abstracts

Web of Science

OVID Medline

EMBASE

PsychInfo

Scopus

Appendix 2.0 – Grey Literature Sources Searched in Literature Searches

Manual searches of a number of internet sites relevant to the topic were conducted.

The internet sites searched included the following:

- Department of Health website
- Nursing and Midwifery Council website
- The General Pharmaceutical Council website
- Royal Pharmaceutical Society of Great Britain website
- The National Prescribing Centre website
- NHS – Business Services Authority Prescription Pricing Division website
- Pharmaceutical Services Negotiating Committee
- i5 HealthHealth and Social Care Information Centre

Appendix 3.0 – Study Two - University Research Ethics Committee Approval Letter

The University
of Manchester



Faculty of Engineering and
Physical Sciences (B42)
The University of Manchester
Sackville Street Building
Manchester M13 9PL

+44(0)161 306 3084
Adrian.Jarvis@manchester.ac.uk

Ref: AJ/ethics/2711/13

Miss. Abuzour
Manchester Pharmacy School
5th December 2013

Dear Miss. Abuzour

Research Ethics Committee 3

Abuzour, Tully, Lewis: Qualitative investigation into how secondary care pharmacists and nurses undertaking the Independent Prescribing course learn to prescribe (ref 13263)

I write to confirm that the Chair is now satisfied that you have addressed the concerns of the Ethics Committee of the 27th of November 2013 and has therefore given the above research project a favourable ethical opinion.

This approval is effective for a period of five years and if the project continues beyond that period it must be submitted for review. It is the Committee's practice to warn investigators that they should not depart from the agreed protocol without seeking the approval of the Committee, as any significant deviation could invalidate the insurance arrangements and constitute research misconduct. We also ask that any information sheet should carry a University logo or other indication of where it came from, and that, in accordance with University policy, any data carrying personal identifiers must be encrypted when not held on a university computer or kept as a hard copy in a location which is accessible only to those involved with the research.

Finally, I would be grateful if you could complete and return the attached form at the end of the project or by December 2014.

We hope the research goes well.

Yours sincerely

Adrian Jarvis
Ethics Committee 3 Secretary

Appendix 4.0 – Study Three – University Research Ethics Committee Approval Letter

The University of Manchester



Ref: ethics/15076

Dr Mary Tully
Manchester Pharmacy School
1.31 Stopford Building

5th March 2015

Dear Dr Tully

Research Governance, Ethics and Integrity
2nd Floor Christie Building
The University of Manchester
Oxford Road
Manchester
M13 9PL
Tel: 0161 275 2206/2674
Email: research.ethics@manchester.ac.uk

Study title: Exploring the clinical reasoning processes of pharmacist and nurse independent prescribers in secondary care

Research Ethics Committee 6

I write to thank you and Miss Abuzour for coming to meet the Committee on 23rd February 2015. I am pleased to confirm a favourable ethical opinion for the above research on the basis described in the application form and supporting documentation as submitted and approved by the Committee.

This approval is effective for a period of five years. If the project continues beyond that period an application for amendment must be submitted for review. Likewise, any proposed changes to the way the research is conducted must be approved via the amendment process (see below). Failure to do so could invalidate the insurance and constitute research misconduct.

You are reminded that, in accordance with University policy, any data carrying personal identifiers must be encrypted when not held on a secure university computer or kept securely as a hard copy in a location which is accessible only to those involved with the research.

Reporting Requirements:

You are required to report to us the following:

1. [Amendments](#)
2. [Breaches and adverse events](#)
3. [Notification of Progress/End of the Study](#)

Feedback

It is our aim to provide a timely and efficient service that ensures transparent, professional and proportionate ethical review of research with consistent outcomes, which is supported by clear, accessible guidance and training for applicants and committees. In order to assist us with our aim, we would be grateful if you would give your view of the service that you have received from us by completing a feedback sheet [<https://survey.manchester.ac.uk/pssweb/index.php/535286/lang-en>]

We hope the research goes well.

Yours sincerely,

Ms. Genevieve Pridham
Secretary to University Research Ethics Committee 2 and 6

Appendix 5.0 – Study Two – Invitation Email

Dear students,

I would like to invite you to take part in a research study to help us to understand how secondary care pharmacists and nurses, undertaking the Independent Prescribing course, both learn to prescribe and develop expertise in prescribing.

What are we investigating?

We are investigating how secondary care pharmacists and nurses, such as yourself, build skills in prescribing before registering and becoming active pharmacist and nurse prescribers. During the course, we would like to identify and reflect on how you (a) acquire prescribing skills and (b) your decision-making process on deciding on diagnosis or treatment options for a patient. We hope that findings from this research will suggest areas for potential curriculum development and further research in order to facilitate the development of expertise and clinical competence in diagnosis and prescribing for future students. All of your responses will remain confidential. This study is not compulsory – you are entitled to say no and it will not affect your studies in any way.

What is involved if I take part?

If you decide to take part in this study, you will be asked to audio-record your thoughts, experiences and decision-making process during the course of learning how to prescribe. You will make audio-recordings, reflecting on what you have learnt and how you can apply this into context. You will need to record for 2-3 minutes on approximately 5 different occasions. You may also choose to record for longer than 3 minutes if you wish, as there is no maximum time limit to the length or number of recordings. Recordings will be made using a Dictaphone or a voice-recording feature on your phone. This will be followed-up with an interview lasting up to 1 hour. If you decide to take part in the interview, you will be provided with your transcribed audio recording to elaborate further on your recordings.

What are the benefits to me if I do get involved?

You will receive a certificate of completion for your portfolio for completing the audio-diary recordings and a £10 Amazon.co.uk voucher for participating in the

follow-up interview. You can also request the transcribed version of your recorded reflective audio diary to assist you with your university learning portfolio requirement and any feedback about the research once completed.

How do I get involved?

Please read the attached Participant Information Sheet, which describes the study in more detail and tells you what you will be asked to do if you choose to participate in our study.

If you have any questions regarding the study, please do not hesitate to contact Aseel Abuzour at aseel.abuzour@postgrad.manchester.ac.uk. If you have any complaints about the study, please contact Dr Mary Tully at Mary.P.Tully@manchester.ac.uk.

Thank you very much for your time in considering participating, and we wish you the very best of luck with your upcoming placements and general experience of the Independent Prescribing course.

Best Regards,

Aseel Abuzour

PhD Student, on behalf of the research team – Dr Mary Tully and Dr Penny Lewis

Appendix 6.0 – Study Two – Participant Information Sheet

Introduction

You are being invited to take part in this research study. Before you decide whether you wish to take part, it is important for you to understand why the research is being done and what it involves. Please take the time to read the following information to hopefully give you a good understanding of what the research is about and how your participation will help. If however, you have any other questions or clarification, please do not hesitate to contact me on the telephone number or email address provided below. Please take the time to decide whether or not you wish to take part.

What is the purpose of the study?

As a pharmacist or nurse learning to prescribe, you are soon to make the transition from being a pharmacist or nurse to a prescribing pharmacist or nurse in your area of work. Independent prescribing courses for pharmacists and nurses have not been around for long, and therefore research on expertise development amongst pharmacists and nurses, and how they develop to become prescribers has proven scarce. This research aims to explore how the current Independent Prescribing courses prepare you for prescribing in clinical practice and how you learn to prescribe. We are interested more specifically in your thought process during clinical decision-making throughout the practical side of the course, or when applying the knowledge learnt to any other situation. We are not assessing your knowledge and skills in prescribing; we are interested in your learning opportunities and experiences. It is hoped that, through this research, more knowledge will be gained on how this cognitive and social learning process occurs, which can be used to inform future pharmacy and nurse education research, as this is an area that is currently under-investigated.

Why have I been chosen?

You have been chosen as you are a qualified secondary care pharmacist or nurse in the process of undertaking the Independent Prescribing course.

What will happen to me if I decide to take part?

If you decide to take part in this study you will be asked to audio-record your thoughts, experiences and decision-making process for 2-3 minutes on approximately 5 different occasions. You may choose to record for longer than 3 minutes if you wish, as there is no maximum limit to the length or number of recordings. We are also interested in how you feel about the process of learning to prescribe during your Period of Learning in Practice, or any other time you feel you have learnt something that will require reflection on your part. Audio recording can either be done using a Dictaphone provided or using your mobile phones if they have a voice-recording

feature or application that may be downloaded. Prompts to help give you more focus on what to talk about during the process of audio recording will be provided. No specific patient information is needed. If you are unable, for any reason, to complete the 2-3 minutes on approximately 5 different occasions of audio-diary recordings, please make the researcher aware of this. You may still participate in the follow-up interview even if you have only been able to make a few recordings.

If later you wish to participate in the interview, the interview will also be audio recorded with your permission and will last approximately one hour. Interviews can also take place via telephone, if a one-to-one interview cannot be scheduled. If you object to the recording, then I will just take notes. You may request the audio recorder to be turned off or stopped at any point during the interview. The audio-recordings will be anonymised and stored securely. They will also be destroyed at the end of the study.

Are there any risks or benefits to taking part?

As a student, you may benefit from the use of the audio tape recording and interview as a method to help with any reflective learning portfolios or Continuing Professional Development requirements to be completed during the course. In the highly unlikely event that you disclose information in the audio tape or interview that may reveal a serious patient safety issue, then we will contact you to discuss informing the relevant trust governance officers. Only in the most serious event would confidentiality be broken to allow details of the disclosure to be given to the relevant authority.

Do I have to take part?

No, participation is entirely voluntary.

Will the information about me remain confidential?

Except in the above situation where a serious patient safety issue is disclosed, all information obtained remains strictly confidential. Other than my supervisors, your participation in the study will not be disclosed to any other person. Any direct quotes used for publication will be completely anonymised; this will also include anonymising the university you study at. You will be asked not to mention any colleague or patient names during the audio recording or interview. However, if identifying information is mentioned it will be removed from the audio recording and interview data.

In the event that you withdraw at any early stage from the study and do not continue to the interview stage, audio-diary data will be used unless otherwise requested not to.

What do I do next?

If you decide you would like to take part in the study then please complete the attached Participant Form which will provide me with information about your experience, what area you wish to prescribe in and your contact details to send you any further information. Completing the Participant Form does not mean you are agreeing to take part in this study and you may decline any further involvement at a later stage. It is possible that you may not be selected if we have already reached the sample number or variance in backgrounds of participants. In this event, you will be notified by letter that no further participation is required and your personal details will be destroyed.

What if there is a problem?

If, after taking part in this research, you are unhappy with any aspect of the process you can telephone the University of Manchester's research governance co-ordinator on 0161 2758093 or email them at research-governance@manchester.ac.uk.

Thank you for your time

Aseel Abuzour

Email: aseel.abuzour@postgrad.manchester.ac.uk

Tel: 07841519900

1st Floor, Stopford Building

School of Pharmacy and Pharmaceutical Sciences

University of Manchester

Manchester

M13 9PT

If you need further information please do not hesitate to contact me or if you would rather talk to my supervisors about this project please feel free to do so.

Dr Mary Tully: 0161 2754242 or email: mary.p.tully@manchester.ac.uk

Dr Penny Lewis: 0161 2751806 or email: penny.lewis@manchester.ac.uk

Appendix 7.0 – Study Two – Participant Form

If you would be willing to participate in this research please fill in the form below. The details you provide on this form will be used to by the researcher to gain a better understanding of the background of participants in the study. Participants will be using audio-diaries during specific periods of learning in practice and will be called for an interview using the contact details you provide. This form does not assume you are consenting to the research and a further Consent Form will need to be signed before the study is started. The information you provide on this form is strictly confidential.

Name:	
Gender:	
Age:	
Address:	
Contact telephone number:	
Email address:	
Preferred method of contact:	Telephone Email Letter Text Messages
Would you like to be reminded to record in your audio-diary?	Yes : Telephone or Text Message No
Current job title:	
Area of specialty:	
Years of experience:	
Specialty to be undertake for prescribing course:	
Estimate of period of learning in practice dates:	

Thank you for taking the time to fill in the questionnaire

Please return the questionnaire in the stamped address envelope provided or email to
aseel.abuzour@postgrad.manchester.ac.uk

Appendix 8.0 – Study Two – Consent Form

If you are happy to participate please complete and sign the consent form below

Please
initial box

1. I confirm that I have read the attached information sheet on the above project and have had the opportunity to consider the information and ask questions and had these answered satisfactorily.	
2. I understand that my participation in the study is voluntary and that I am free to withdraw at any time without giving a reason and without detriment to any treatment/service.	
3. I understand that the interviews will be audio-recorded	
4. I agree to the use of anonymous quotes in publications of the research	
5. I agree that any data collected may be passed as anonymous data to other researchers	

I agree to take part in the above project:

Name of participant	Date	Signature
Name of person taking consent	Date	Signature

Appendix 9.0 – Study Two – Audio-Diary Guidelines

What is the research about?

As a pharmacist or nurse learning to prescribe, you are soon to make the transition from being a pharmacist or nurse to a prescribing pharmacist or nurse in your area of work. Independent prescribing courses for pharmacists and nurses have not been around for long, and therefore research on expertise development amongst pharmacists and nurses, and how they develop to become prescribers has proven scarce. This research aims to explore how the current Independent Prescribing courses prepare you for prescribing in clinical practice and how you learn to prescribe. We are interested more specifically in your thought process during clinical decision-making throughout the practical side of the course, or when applying the knowledge learnt to any other situation. We are not assessing your knowledge and skills in prescribing; we are interested in your learning opportunities and experiences.

When should I make my recordings and what should I talk about?

We would like you to make a recording about any prescribing-related experiences that you come across in the clinical environment. This could be during your Period of Learning in Practice with your Designated Medical Practitioner during the course or any other time of practice. We are interested in situations where you learn something new about prescribing either from building on your own prescribing skills or past experiences or when observing someone else prescribe. Examples could include being asked what the diagnosis and suitable drug treatment is for a patient during a ward round, observing when someone else writes a prescription or simply attempting to apply the knowledge learnt to your way of thinking whilst practicing as a pharmacist or nurse outside of university. Please describe what happened, how did you reach any clinical decisions (if any), if the experience was helpful to your learning, and how you felt about the experience. Prompts are provided to help with the recording process. It would be best to record the experience as soon as possible so that you can recall it accurately.

How long do the recordings need to be?

As long as you like. There is no maximum or minimum time limit for recordings.

Do I need to record everything all at once?

We encourage you to record your individual experiences as it occurs. You can make recordings later if it isn't possible at the time. Make as many recordings as you like; there is no maximum or minimum.

Does it need to be word perfect?

No. We are interested in finding out about your experiences, we do not mind if it is not word perfect or if you are struggling to find the right words to express yourself.

How do I get started?

If you would like us to provide you with a Dictaphone, please email me at aseel.abuzour@postgrad.manchester.ac.uk. If you own a smartphone, it may already have a voice recording feature. Below are instructions on how to find and use the voice recording feature for iPhone/iPad and Samsung users. Alternatively, if you own a smartphone and it does not have a voice recording feature, please follow the instructions below to download a free application, which allows you to use your phone as a recording device and email the recordings directly to me. If you own a Dictaphone or any other recording device then please feel free to use your own device and upload the recordings to send as an email attachment. Please do not hesitate to get in touch if you have any technical difficulties.

What should I do when I have finished recording?

After two weeks of recording, please upload them onto a computer and send them to me as an email attachment at: aseel.abuzour@postgrad.manchester.ac.uk. If you have used the smartphone application to make your recordings, you will be able to send them directly from your phone using the instructions below. You can send individual recordings as you make them, or can send several together when you have finished your audio diary whether you have used a Dictaphone or smartphone.

Instructions for smartphone users

iPhone or iPad Users	Samsung Users	Any Other Smartphone User
<p>Select the 'Voice Memos' application</p> <p>Press the red button to record</p> <p>When you have finished, press the black stop button</p> <p>You will find that once the black stop button has been pressed, it will be replaced with a button that appears as three horizontal lines. Click on that button.</p> <p>You recording will be automatically saved as the date and time the recording happened.</p> <p>Click on the blue right sided arrow and click again on the next arrow that appears</p> <p>Select 'Custom' and type your initials and the recording number, e.g. for Aseel Abuzour, type AA1, AA2, AA3...</p> <p>Go back and click 'Share', 'Email' and type aseel.abuzour@postgrad.manchester.ac.uk to send it directly to me.</p>	<p>Select the 'Voice Recorder' application.</p> <p>To record, press the red button. If you need to pause, you may also press the pause button.</p> <p>When finished, press the stop button.</p> <p>Select 'Menu' to display several options.</p> <p>Select 'Rename' to save the recorded file as your initials and the recording number, e.g. for Aseel Abuzour, type AA1, AA2, AA3...</p> <p>Select 'Share via' and email it to aseel.abuzour@postgrad.manchester.ac.uk to send it directly to me.</p>	<p>Note: This will depend on the type of phone you have. Below is a rough guide to download an application on your phone.</p> <p>Go to the Application Store and search for an application called 'Dictaphone' and download it.</p> <p>Select the 'Dictaphone' application once it has been downloaded</p> <p>Press the large rectangular red button to record. Press the green pause button if you need to pause.</p> <p>Once you are finished, click on the red button again.</p> <p>Name the file as your initials and recording number, e.g. Aseel Abuzour would be AA1, AA2, AA3... and save.</p> <p>Swipe the screen to your left and click on the white square box to select the recordings you would like to send.</p> <p>Click on the green arrow button at the bottom of the screen located near the red trash button. Select email and type aseel.abuzour@postgrad.manchester.ac.uk to be sent directly to me.</p> <p>Please note that this is a free application and you will only be able to send your recordings as .aif files</p>

Appendix 10.0 – Study Two – Prompts for Audio-Diaries

Please record your thoughts at, or as close as possible, to the time of the learning experience.

During the process of learning how to prescribe:

Reflect on your learning experience including your thoughts and feelings on a task you have learnt

During your learning experience or when encountering patients, describe the first thought that came to mind when hypothesising on a diagnosis and/or treatment of a patient

Can you describe your thought process during the diagnosis and decision-making?

How did you reach the decision that something should be prescribed at all?

How do you decide as to which drug should be prescribed, if one needed to be prescribed?

What is the most significant thought or feeling when deciding on what to prescribe?

Appendix 11.0 – Study Two – Online Survey



How do secondary care pharmacists and nurses undertaking the Independent Prescribing course learn to prescribe?

Page 1 of 4

Dear Students,

I would like to invite you to take part in a research study to help us to understand how **secondary care pharmacists** and **nurses** undertaking the **independent prescribing course**, both learn to prescribe and develop their expertise in prescribing. This will help us to understand how pharmacists and nurses build skills in prescribing before registering to become active independent prescribers.

During the course, we would like to identify and reflect on how you (a) acquire prescribing skills and (b) your decision making process when deciding on diagnosis or treatment options for a patient.

This survey will allow us to identify if you fit the inclusion criteria for the study and for the researcher to gain a better understanding of your job role.

If you decide to take part in this study, you will be asked to audio-record your thoughts, experiences and decision-making process during the course of learning how to prescribe. You will make audio-recordings, reflecting on what you have learnt and how you can apply this into context. **We ask you to record for 2-3 minutes on approximately 5 different occasions.** You may also choose to record for longer than 3 minutes if you wish, as there is no maximum time limit to the length or number of recordings. Recordings will be made using a Dictaphone or a voice-recording feature on your phone. This will be followed-up with an interview lasting up to 1 hour, which will be audio-recorded. If you decide to take part in the interview, you will be provided with your transcribed audio recording which we will discuss during the interview.

You will receive a certificate of completion for your portfolio from the University of Manchester for completing the audio-diary recordings and a £10 high street voucher for participating in the follow-up interview. You can also request the transcribed version of your recorded reflective audio-diary to assist you with your university learning portfolio requirement.

If you would be willing to participate in this research, please click the 'next' button below. This survey will last no more than 5 minutes to complete. This form does not assume you are consenting to the research. After completing this form, the researcher will contact you and provide you with a study participant information leaflet and audio-diary guidelines.

All information provided in this form will remain strictly confidential. All information you submit in this questionnaire will be deleted if you decide to not take part in this research, or if you do not fit the inclusion criteria.

Best Regards,

Aseel Abuzour, PhD Student

Manchester Pharmacy School
University of Manchester
aseel.abuzour@postgrad.manchester.ac.uk

1. Are you a pharmacist or nurse working in secondary care?*

☐ Pharmacist working in secondary care

☐ Nurse working in secondary care

2. Area of specialty

3. Years of experience **since registration** as a pharmacist/nurse*

Years

4. Specialty to be undertaken for prescribing course

Prescribing
specialty

Back

Next

Save

Cancel

5. Name/Initials

6. Age

7. Contact telephone number
 A contact telephone number will allow us to speed up communication. All information submitted in this form will remain strictly confidential.

8. Email address*

9. Preferred method of contact
☐ Telephone
☐ Email
☐ Text messages

10. Would you like to be reminded to record in your audio-diary and how?
☐ Yes
☐ Telephone
☐ Text message
☐ No

Back Next Save Cancel

Thank you for taking the time to fill in the participant form. The researcher will contact you directly to discuss the research in more detail. All information provided in this questionnaire will be destroyed if you decide you do not wish to take part in this study, or if your answers do not fit the inclusion criteria.

Back Done Save Cancel

Appendix 12.0 – Study Two – Semi-structured Interview Questions

Start with a brief informal discussion about how the Independent Prescribing course has been going to break the ice before asking interview questions.

Ask the participant how they felt about using audio-diaries to record their experiences and if it has helped as a method of reflecting on their personal learning experiences.

The audio-diary data will be used to tailor the questions asked to each participant. This will include questions to elaborate or clarify things mentioned in the audio diary.

Below are general questions that will be asked, as more specific questions can only be tailored when there is data available from audio diaries:

Questions	Rationale for questions/notes
What skills do you think you have learnt and developed since starting your prescribing course?	This is to gain an understanding of what the pharmacist or nurse believes they have learnt and developed during the prescribing course. Responses can be compared to current literature on skills developed from the prescribing course.
What difficulties did you experience during the process of learning how to prescribe? Can you give an example?	This can also be used as a comparator to the lack of competencies reported in literature and to gain an understanding of why the participant has experienced difficulties.
What do you believe has contributed most in your ability to learn how prescribe? (For example, previous experience, education, personal qualities...etc.)	This can explore factors that influence their learning process in prescribing.
Do you think prior practice as a pharmacist or nurse has helped prepare you to become a pharmacist or nurse prescriber? How and in what areas?	To explore the influence of previous experience on the learning process and transitioning phase.
Have you actively tried to improve your knowledge and/or practical skills since starting the prescribing course?	To explore any self-regulation or motivation taking place during learning process.
Did you receive feedback during your Period of Learning in Practice? If yes, what kind of feedback? Can you give an example? How did this benefit your development in learning to prescribe if it benefited you?	This can be used to understand the influence of feedback on learning from the point of view of expert-performance.
How prepared do you feel to practice as an Independent Prescriber?	To explore the area of preparedness to prescribe and what areas can be improved.
Are there any areas where you feel unprepared to prescribe?	

Appendix 13.0 – Study Two – Participant Flyer

ARE YOU TRANSITIONING TO BECOME A PRESCRIBER?

Are you acquiring new skills and exploring your decision making process in diagnosis or treatment?

Join us in this research exploring how you reflect & build on these skills.
Bring what you learn to open your eyes into how you develop your expertise
when adding a new dimension to your job role.

The flyer features a central horizontal timeline with a large purple arrow pointing right. On the left, a sign reads 'What we need' above an illustration of a pharmacist and a nurse with the word 'OR' between them. Below this is the text 'Secondary care pharmacists and nurses undertaking the Independent Prescribing course'. The timeline has two orange banners: 'Stage 1' with a microphone icon and 'Audio-diary Recordings' text, and 'Stage 2' with an 'interview' icon showing two people. Below Stage 2 is the text 'When both stages are completed'. On the right, a sign reads 'What we offer' above a 'Certificate of Completion' and a '£10 voucher' icon. The certificate text reads: 'This is to certify that [blank] has taken part in the Manchester Pharmacy School PhD research of "A qualitative investigation into how secondary care pharmacists and nurses undertaking the Independent Prescribing course learn to prescribe"'. At the bottom, contact information and the Manchester Pharmacy School logo are provided.

Secondary care pharmacists and nurses undertaking the Independent Prescribing course

When both stages are completed

For more information please email:
Aseel.abuzour@postgrad.manchester.ac.uk

RESEARCH PROJECT
Manchester Pharmacy School

MANCHESTER
1824
The University of Manchester

Appendix 14.0 – Study Two – Certificate of Completion



MANCHESTER
1824
The University of Manchester

THIS CERTIFIES THAT

Participant Name

was a research participant in the following study on the reflection of thoughts,
experiences and decision-making processes in learning how to prescribe:

‘Qualitative investigation into how secondary care
pharmacists and nurses undertaking the Independent
Prescribing course learn to prescribe.’

December 2013 – September 2015



Dr Mary Tully
Reader in Pharmacy Practice



Aseel Abuzour, Principal Investigator
PhD Student

Appendix 15.0 – Study Three – Invitation Email

Dear prescriber,

I would like to invite you to take part in a research study to help us to understand how pharmacist and nurse independent prescribers in secondary care make clinical prescribing decisions.

We are investigating how pharmacist and nurse independent prescribers working in secondary care make clinical prescribing decisions. We are particularly interested in nurses and pharmacists who are independent prescribers and are actively prescribing. During the study, we would like to (a) discover the process of your clinical decision-making when presented with a clinical case and (b) identify what influences this clinical decision-making. We hope that findings from this study will inform future research in order to facilitate the development of expertise and clinical competence in diagnosis and prescribing for students learning to prescribe and novice prescribers.

Participants will be involved in a single interview at a time and place of your choosing. You may also choose to be interviewed over the telephone and outside of your working hours. If you decide to take part in this study, you will be sent a list of clinical therapeutic areas and asked to choose up to 3 that you feel sufficiently competent prescribing in, for example, respiratory system, cardiovascular system, etc. The researcher will meet you at a place convenient for you to commence the study. The researcher will provide you with 3 clinical case vignettes from the therapeutic areas you chose and ask you to think out loud whilst going through each vignette. After each vignette, you will be given the option of writing a prescription for the patient presented in the vignette, if you think that is appropriate for the patient. A BNF will be available, if you wish to use it. This will be followed with a quick set of interview questions to clarify and elaborate on the thoughts that were said during the first part of the interview. This study will be audio-recorded and will last up to 90 minutes. **This study is not a test of your knowledge** and you will not be judged on it. All information obtained will remain strictly confidential.

Please read the attached Participant Information Sheet, which describes the study in more detail and tells you what you will be asked to do if you choose to participate in our study. If you have any questions or if you want to take part, please do not hesitate to contact Aseel Abuzour by replying to this email.

Thank you very much for your time in considering participating.

Best Regards,

Aseel Abuzour

PhD student, on behalf of the research team – Dr Mary Tully and Dr Penny Lewis

Appendix 16.0 – Study Three – Participant Information Sheet

Dear prescriber,

You are being invited to take part in a research study to help us to understand how pharmacist and nurse independent prescribers in secondary care make clinical prescribing decisions. This research study is part of a PhD degree. Before you decide to take part it is important for you to understand why the research is being done and what it will involve. Please take time to read the following information carefully and discuss it with others if you wish. Please ask 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. Thank you for reading this.

Who will conduct the research?

Aseel Abuzour, PhD student.

Room 1.132, 1st Floor

Manchester Pharmacy School

Stopford Building

Oxford Road

Manchester, M13 9PT, UK

Title of the research

Exploring the clinical reasoning processes of pharmacist and nurse independent prescribers working in secondary care. This is the process of exploring how clinical decisions are made.

What is the aim of the research?

As a pharmacist or nurse independent prescriber working in secondary care, you have transitioned from being a non-prescriber to a prescriber in your area of work. Independent prescribing courses for pharmacists and nurses have not been around for long, and, therefore, research on expertise development amongst pharmacists and nurses, and how they develop to become experienced prescribers has proven scarce. We are investigating how pharmacists and nurse independent prescribers working in secondary care, such as yourself, make clinical prescribing decisions. During the study, we would like to (a) discover the process of your clinical decision-making

when presented with a clinical case and (b) identify what influences this clinical decision-making. We hope that findings from this research will suggest areas for further research in order to facilitate the development of expertise and clinical competence in diagnosis and prescribing for students learning to prescribe and novice prescribers. All of your responses will remain confidential.

Why have I been chosen?

You have been chosen as you are a qualified pharmacist or nurse independent prescribers working in secondary care.

What would I be asked to do if I took part?

If you decide to take part in this study, you will be requested to complete a Participant Form. The researcher will then confirm your eligibility as a candidate for this research. Next, you will be sent a list of clinical therapeutic areas and asked to choose up to 3 that you feel sufficiently competent in prescribing for, for example, respiratory system, cardiovascular system etc. The researcher will meet with you at a place convenient for you to conduct the interview which will last approximately 1 hour and a half. Alternatively, you may choose to be interviewed over the telephone outside of working hours. You will need a computer to access the clinical vignettes, which will be sent via email prior to the interview taking place. Before beginning the interview, the researcher will give you a 5-minute orientation about the study and what is involved in detail. The researcher will also ask you to sign a Consent Form for participating in this study. If a telephone interview is conducted, the researcher will obtain verbal consent before the interview takes place.

Three clinical case vignettes from the therapeutic areas of your choosing will be presented to you, and you will be asked to think out loud by speaking your thoughts, in detail, on each vignette, including whether you decide to prescribe and what you are going to prescribe. During this part of the study the researcher will not be interfering and will only be taking field notes. **This study is not a test of your knowledge**, it is merely a way of understanding the thinking *process* involved in reaching clinical decisions. There may be instances where you forget to speak out loud in which the researcher will remind you to continue speaking your thoughts out loud. After each clinical case vignette, you will be given the option of writing a prescription for the patient presented in the case, if you decide that a prescription is the appropriate action. A BNF will be available on the day, if you wish to use it.

Following this, the researcher will conduct a quick interview to clarify and elaborate the thoughts that were said during the first part of the study and ensure that the researcher has interpreted your thinking process correctly. The think-aloud and interview will be audio-recorded.

What happens to the data collected?

Data collected from this study will be stored for 10 years after completion of the research. Anonymous data collected from this study may be used by other researchers within our group for future research on non-medical prescribing.

How is confidentiality maintained?

All information obtained, including the audio-recorded feature of the study, will remain strictly confidential. Other than my supervisors, your participation in the study will not be disclosed to any other person. Any direct quotes used for publication will be completely anonymised. The audio-recording feature of the interview is recorded and stored on encrypted devices.

What happens if I do not want to take part or if I change my mind?

It is up to you to decide whether or not to take part. If you do decide to take part you will be given this information sheet to keep and be asked to sign a Consent Form. If you decide to be interviewed on the telephone, the researcher will read the Consent Form out loud and obtain verbal consent. Following the interview, the researcher will email or post a Consent Form for you to sign and return to aseel.abuzour@postgrad.manchester.ac.uk or in a pre-paid envelope. If you decide to take part you are still free to withdraw at any time, up to 2 weeks after the interview takes place, without giving a reason and without detriment to yourself

Will I be paid for participating in the research?

No, you will not be paid for participating in this research. On the other hand, a certificate of completion from the University of Manchester will be given to you if you decide to participate in the study. This may be used as part of your continuous professional development as an independent prescriber. You can also request the transcribed version of your recorded reflective think-aloud protocol and any feedback about the research once completed.

What is the duration of the research?

The interview will last up to 90 minutes.

Where will the research be conducted?

The research will be conducted at a location of your choice. If you chose to be interviewed on NHS premises, the researcher will need to ensure that arrangements with the research and development department have taken place and a letter of access has been granted. Alternatively, you may choose to be interviewed over the

telephone and outside of working hours. Arrangements can be made if you chose to be interviewed at the University of Manchester.

Will the outcomes of the research be published?

It is highly likely that outcomes of the research will be published following completion of this study. Any direct quotes used for publication will be completely anonymised.

Who has reviewed the research project?

This project has been reviewed by the University of Manchester Research Ethics Committee 6.

Contact for further information

If you have any questions regarding the study, please do not hesitate to contact Aseel Abuzour at aseel.abuzour@postgrad.manchester.ac.uk or on 07716469207. If you have any complaints about the study, please contact Dr Mary Tully at Mary.P.Tully@manchester.ac.uk.

What if something goes wrong?

If there are any issues regarding this research that you would prefer not to discuss with members of the research team, please contact the Research Governance and Integrity Team by either writing to 'The Research Governance and Integrity Manager, Research Office, Christie Building, The University of Manchester, Oxford Road, Manchester M13 9PL', by emailing: Research.Complaints@manchester.ac.uk, or by telephoning 0161 275 7583 or 275 8093.

If you feel that the interview has drawn your attention to certain areas that may need to be developed, it may be beneficial to undertake continuous professional development (CPD) in a certain clinical area or contact your institution for advice on personal development courses

What do I do next?

If you decide you would like to take part in the study, please complete the attached Participant Form which will provide me with information about your experience, what area you prescribe in and your contact details to send you any further information. Completing the Participant Form does not mean you are agreeing to take part in this study and you may decline any further involvement at a later stage. It is possible that you may not be selected if we have already reached the sample number or variance in backgrounds of participants. In this event, you will be notified

by email that no further participation is required and your personal details will be destroyed.

Thank you very much for your time in considering participating, and we wish you the very best of luck with your valuable job role as an independent prescriber.

Best Regards,

Aseel Abuzour

PhD student, on behalf of the research team – Dr Mary Tully and Dr Penny Lewis

Appendix 17.0 – Study Three – Participant Form

If you would be willing to participate in this research, please fill in the form below. The details you provide on this form will be used to by the researcher to gain a better understanding of the background of participants in the study. This form does not assume you are consenting to the research and a further consent form will need to be signed before the interview is started. The information you provide on this form is strictly confidential and will be held securely at the university until the end of the study.

Name:	
Gender:	
Age:	
Address:	
Contact telephone number:	
Email address:	
Preferred method of contact:	<input type="checkbox"/> Telephone <input type="checkbox"/> Email <input type="checkbox"/> Letter <input type="checkbox"/> Text Messages
Current job title:	
Area of specialty:	
Months/Years of experience since registration as a prescriber:	
Months/Years of experience as an active prescriber:	
Estimate of number of prescriptions on a daily and/or weekly basis:	Prescriptions per day Prescriptions per week
Estimate of number of hours worked as a prescriber per week:	
What type of prescriptions do you usually give to your	<input type="checkbox"/> Acute prescriptions

patients? (Acute and/or chronic prescriptions)	<input type="checkbox"/> Chronic prescriptions <input type="checkbox"/> Both
What type/class of medicine do you often prescribe?	

Clinical Therapeutic Areas

Below is a list of clinical therapeutic areas that will be given to you on the day of the interview as clinical case vignettes. **Please tick up to 3 clinical therapeutic areas that you feel sufficiently competent prescribing for.** Remember that the vignettes presented to you on the day of the interview are not a test of your knowledge; they are a way of understanding your thinking and clinical decision-making process.

Participant Identifier:

Please tick 3	Clinical therapeutic areas you feel sufficiently competent prescribing for
<input type="checkbox"/>	Gastro-intestinal system
<input type="checkbox"/>	Cardiovascular system
<input type="checkbox"/>	Respiratory system
<input type="checkbox"/>	Central nervous system
<input type="checkbox"/>	Infections
<input type="checkbox"/>	Endocrine system
<input type="checkbox"/>	Malignant disease and immunosuppression
<input type="checkbox"/>	Nutrition and blood

Thank you for taking the time to fill in the questionnaire

Please return the questionnaire in the stamped addressed envelope provided or email to aseel.abuzour@postgrad.manchester.ac.uk

Appendix 18.0 –Study Three – Consent Form

If you are happy to participate please complete and sign the consent form below

Please initial box

1. I confirm that I have read the attached information sheet (Participant Information Leaflet V1.0: 27.04.2015) on the above project and have had the opportunity to consider the information and ask questions and had these answered satisfactorily.	
2. I understand that my participation in the study is voluntary and that I am free to withdraw any time, up to 2 weeks after the interview takes place, without giving a reason and without detriment to my professional role.	
3. I understand that the think-aloud protocol and interview will be audio-recorded	
4. I agree to the use of anonymous quotes in publications of the research	
5. I agree that any data collected may be used as anonymous data by other researchers at Manchester Pharmacy School for research on non-medical prescribing	
6. I agree that data collected from this research will be stored for 10 years after the completion of the research and will be anonymised if used for further research on non-medical prescribing.	
7. I understand that data collected during the study, may be looked at by individuals from the University of Manchester, from regulatory authorities or from the NHS Trust, where it is relevant to my taking part in this research. I give permission for these individuals to have access to my data.	

I agree to take part in the above project:

Name of participant	Date	Signature
Name of person taking consent	Date	Signature

Appendix 19.0 – Study Three – GPhC Invitation Email

**General
Pharmaceutical
Council**

Research study :
Independent prescribing


Dear <<Salutation>> <<Last Name>>,

We are sending this email on behalf of the University of Manchester to invite you to take part in a research project looking into how pharmacist and nurse independent prescribers make clinical prescribing decisions. The project focusses on professionals with up to three years' experience as an annotated independent pharmacist or nurse prescriber in secondary care.

At the GPhC, we occasionally help academic researchers carry out survey research where the subject is relevant to our regulatory aims. This project will generate information that may help us review the learning outcomes of the pharmacist independent prescribing programmes, to ensure that it fully prepares pharmacists to become an independent prescriber.

Find out more and take part

Please note that our policy is not to share registrants' contact details with external researchers. Participation in the research is entirely voluntary and any information you provide to the researcher will remain confidential and will be stored securely at the University of Manchester. Beyond sending this email, the GPhC will not participate in the project and any information shared with us by the researcher will be anonymised.



Matthew Hayday
Head of Governance

Appendix 20.0 – Study Three – Online Survey



Exploring the Clinical Reasoning Processes of Pharmacist and Nurse Independent Prescribers Working in Secondary Care

Page 1 of 5

Dear prescriber,

I would like to invite you to take part in a research study to help us to understand how pharmacist and nurse independent prescribers in secondary care make clinical prescribing decisions.

We are particularly interested in nurses and pharmacists who are independent prescriber and are **actively** prescribing.

This survey will allow us to identify if you fit the inclusion criteria for the study and for the researcher to gain a better understanding of your job role. In the survey you will be asked to choose up to 3 clinical therapeutic areas that you feel sufficiently competent prescribing in, for example, respiratory system etc.

If you decide to take part in this study, you will be involved in a single interview where you will be presented with 3 clinical case vignettes from the therapeutic areas you chose in this survey and asked to think out loud whilst going through each vignette. After each vignette, you will be given the option of writing a prescription for the patient presented in the vignette, if you think that is appropriate for the patient. A BNF will be available, if you wish to use it. You may also choose to be interviewed over the telephone and outside of your working hours.

This study will be audio-recorded and will last up to 90 minutes. This study is not a test of your knowledge and you will not be judged on it. All information obtained will remain strictly confidential.

You will be given a certificate of completion from the University of Manchester at the end of the interview. This may be used as part of your continuous professional development as an independent prescriber.

If you would be willing to participate in this research, please click the 'next' button below. This survey will last no more than 5 minutes to complete. This form does not assume you are consenting to the research. After completing this form, the researcher will contact you and provide you with a participant information leaflet about the study.

All information provided in this form will remain strictly confidential. All information you submit in this questionnaire will be deleted if you decide to not take part in this research, or if you do not fit the inclusion criteria.

Best Regards,

Aseel Abuzour, PhD Student

Manchester Pharmacy School
University of Manchester
aseel.abuzour@postgrad.manchester.ac.uk

Next

Save

Cancel

1. Are you a pharmacist or nurse independent prescriber?*

☐ Pharmacist independent prescriber

☐ Nurse independent prescriber

2. Area of specialty*

3. Months/years of experience **since registration** as a prescriber*

Months

Years

4. Months/years of experience as an **active** prescriber*

Years

Months

5. Estimate of number of prescriptions on a daily and/or weekly basis*

Prescriptions per day

Prescriptions per week

6. Estimate of number of hours worked as a prescriber per week*

7. What type of prescriptions do you usually give to your patients?

☐ Acute prescriptions

☐ Chronic prescriptions

☐ Both

8. What type/class of medicine do you often prescribe?*

Back

Next

Save

Cancel

9. Please tick up to 3 clinical therapeutic areas that you feel sufficiently competent prescribing in: *

- ☐ Gastro-intestinal system
- ☐ Cardiovascular system
- ☐ Respiratory system
- ☐ Central nervous system
- ☐ Infections
- ☐ Endocrine system
- ☐ Malignant disease and immunosuppression
- ☐ Nutrition and blood

[Back](#) [Next](#) [Save](#) [Cancel](#)

10. Name/Initials

11. Age

12. Contact telephone number

A contact telephone number will allow us to speed up communication. All information submitted in this form will remain strictly confidential.

13. Email address*

14. Preferred method of contact

- ☐ Telephone
- ☐ Email
- ☐ Text messages

[Back](#) [Next](#) [Save](#) [Cancel](#)

Thank you for taking the time to fill in the participant form. The researcher will contact you directly to discuss the research in more detail. All information provided in this questionnaire will be destroyed if you decide you do not wish to take part in this study, or if your answers do not fit the inclusion criteria.

Back

Done

Save

Cancel

Appendix 21.0 – Study Three – Semi-structured Interview Questions

Start with a brief informal discussion about their experience with the think-aloud protocol method, such as how they found the exercise, how easy or difficult it was to think-aloud during prescribing decisions.

The think-aloud results and field notes will be used to tailor the questions asked to each participant. This will include questions to elaborate or clarify things mentioned during the think-aloud protocol.

Below are general questions that will be asked, as more specific questions can only be tailored when there is field notes available from the think-aloud protocol results:

Questions	Rationale for questions/notes
How did you decide to start them on drug x?	This is to gain an understanding behind the rationale for certain drug-prescription scenarios.
How did you decide whether to increase/decrease this person's medicine?	
Did you have another medicine in mind? If so, what held you back from deciding on that and why?	By understanding if another medicine was in mind, this can further elaborate the thinking process and rationale behind the drug-decision made.
What influenced you to take this decision?	This will help to gain an understanding of what influences decisions being made.
What do you think enabled your decision-making or made it easier?	By understanding the enablers and barriers to decision-making, this can also further elaborate what influences decisions being made.
What do you think was a barrier to your decision-making or made it more difficult?	
Based on what you said in clinical case x, how did you know that?	Gaining an understanding on how knowledge was gained and applied in the context of the think-aloud protocol can be a factor that also influences decisions and is a major part of understanding the process of clinical reasoning.
What factors were involved in this decision?	This is to allow the participant to reflect on their decision and the context within which the decision took place.
Would you have made a different decision if the case was a real-life patient? Why?	To understand how they feel about the decision that was made.
On reflection, what do you think about the decision that you made? How did this decision make you feel?	

Appendix 22.0 – Study Three – Clinical Vignettes

Below are the clinical vignettes presented to participants in Study Three according to their choice of clinical therapeutic areas.

CASE

Name	Mrs Marshall
Sex	Female
Age	74 years
Weight	55 Kg
Presenting complaint	Chest pain – crushing in nature and radiating to the jaw. Chest pain increases on exertion over the preceding weeks
Past medical history	Myocardial Infarction 1997 Angina Type II Diabetes Mellitus Gastro-oesophageal Reflux Disease
Medication on admission	<u>Via oral route</u> Aspirin 75mg daily Simvastatin 40mg at night Atenolol 50mg daily Isosorbide mononitrate LA 25mg daily Omeprazole 20mg daily Metformin 1g twice daily
On examination	ECG shows T-wave inversion ST-segment depression Blood pressure 90/54 mmHg

Heart Rate 49 beats per minute

Please Turn Over Once Completed

Blood Results		
Parameter	Results	Normal Range
Sodium	139 mmol/l	135-145 mmol/l
Potassium	4.5 mmol/l	3.5-5.3 mmol/l
Urea	6.2 mmol/l	1.7-8.3 mmol/l
Creatinine	135 µmol/l	60-140 µmol/l
Haemoglobin	13.4 g/dl	13.0-18.0 g/dl
Platelets	267 x10 ⁹ /l	150-400 x10 ⁹ /l
Cholesterol	5.7 mmol/l	1.5-5.0 mmol/l
Glucose	13 mmol/l	2.5-7.7 mmol/l
LFTs	Normal	
Troponin T level (12 hours post chest pain)	1.54 ng/ml	<0.01 µg/l

Please Turn Over Once Completed

On Examination in Accident and Emergency

Temperature	37.6°C
Blood pressure	110/70 mmHg
Heart rate	68 beats per minute
Respiratory rate	18 breaths per minute
Chest examination	Chest clear

Blood Results

Test	Result	Laboratory Reference
WCC	14.8	(4 – 11 x 10 ⁹ /L)
Neutrophils	15.0	(1.7-7.5×10 ⁹ /L)
CRP	15	(0-10 mg/l)
Albumin	31	(34-48 g/dl)
Urea	12.8	(2.5-7.5 mmol/L)
eGFR	70	(>90 mls/min)

Urine Dipstick Results

Nitrites	+
Leucocyte	+++
Blood	+
Protein	Trace

MSSU Results

WBC	157
RBC	20
Squames	0

Escherichia coli

x 10⁶/L

Antibiotic Sensitivity Results	
Amoxicillin	Resistant
Cefalexin	Sensitive
Co-amoxiclav	Sensitive
Nitrofurantoin	Sensitive
Trimethoprim	Resistant

CASE

Name	Mrs Walker
Sex	Female
Age	65 years
Presenting complaint	<p>Slightly breathless on presentation but not breathless now at rest.</p> <p>On questioning, slight breathlessness occurs when walking quickly and climbing stairs.</p> <p>Presented with similar complaint 6 weeks ago</p>
Social history	<p>Lives at home with husband</p> <p>Both self-caring with no social problems</p> <p>Non-smoker</p>
Family history	Nil of note
Past medical history	<p>Mild hypertension</p> <p>Two previous myocardial infarctions – one at 38 years of age and other at 56 years of age</p> <p>Congestive cardiac failure (ejection fraction 45% on echo October 2012)</p> <p>Mild osteoarthritis of the knees</p>
Allergy status	No known drug allergies
Medication on admission	<p><u>Oral route</u></p> <p>Furosemide 40mg – 80mg daily when required</p> <p>Ramipril 2.5mg twice a day</p> <p>Naproxen 500mg twice a day</p>

Aspirin 75mg each morning

Simvastatin 40mg at night

Please Turn Over Once Completed

Blood Results		
Test	Result	Laboratory Reference
Sodium	140	(135-145 mmol/l)
Potassium	3.9	(3.5-5.3mmol/l)
Urea	2.5	(1.7-8.3mmol/l)
Creatinine	95	(60-140 micromol/l)
T Cholesterol	3.9	(< 4 mmol/L)
Triglycerides	2.0	(0.2-2.2mmol/l)
HDL	1.1	(1-3mmol/l)
Haemoglobin	12	(14-18 g/dL)
Weight in clinic	65	(usual weight 60-65kg)
Blood pressure	130/90	

CASE

Name	Mr Robertson
Sex	Male
Female	78 years
Presenting complaint	Watery diarrhoea 9/7 Had 3 cycles of chemotherapy secondary to gastric carcinoma with metastasis 10/7. Next day post-chemotherapy, felt unwell, weak and tired, followed by watery diarrhoea
Past medical history	Gastric carcinoma with metastasis Cerebrovascular accident with left sided residual weakness Postpartum haemorrhage Hypertension Osteoarthritis Gastrointestinal reflux disease
On examination	No abdominal pain No PR bleeding No high temperature
On questioning	No vomiting No recent travel No recent antibiotics taken
Medication on admission	Aspirin 75 mg OD Finasteride 5mg OD Ramipril 2.5 mg OD Tamsulosin 400 mcg OD Ferrous Sulphate 200mg TDS Amitriptylline 75mg OD Furosemide 40mg OD

Please Turn Over Once Completed

Blood Results		
Parameter	Results	Laboratory reference
Sodium	126	135-145 mmol/l
Potassium	2.4	3.5-5.2 mmol/l
Urea	7.6	2.5-7.5 mmol/l
Creatinine	69	60-110 micromol/l
Calcium	2.02	2.2-2.6 mmol/l
Haemoglobin	113	135-175 mg/dl
WCC	4.9	4.0-11.0 $\times 10^9/l$
Platelets	131	150-400 $\times 10^9/l$

CASE

Name	Mrs Jackson
Sex	Female
Age	86 years
Presenting complaint	Shortness of breathe Productive cough Approximately 5/7 history of increasing shortness of breath and productive cough with yellow green sputum
Past medical history	Advanced COPD Chronic kidney disease Gastrointestinal reflux disease Osteoarthritis Anxiety and depression Ischaemic heart disease Diverticular disease IBS
Allergy status	Citalopram Pregabalin Simvastatin Co-amoxiclav
Medication on admission	Doxazosin 4mg OD Paracetamol 1g QDS Prednisolone 5mg OD Ranitidine 300mg OD Salbutamol inhaler 100mcg prn and salbutamol nebs prn Seretide 250 Inhale 2 puffs BD Spiriva 18mcg OD Mirtazapine 45mg OD Folic acid 5mg OD Diazepam 2mg BD Adcal D3 Chew ONE tablet OD
On examination	No chest pain No red flag symptoms Looked breathless Oxygen Saturation 85% Chest bilateral widespread crackles and wheeze

Please Turn Over Once Completed

Blood Results		
Parameter	Results	Laboratory reference
Sodium	129	135-145 mmol/l
Potassium	3.9	3.5-5.2 mmol/l
Urea	5.9	2.5-7.5 mmol/l
Creatinine	83	60-110 micromol/l
Calcium	2.29	2.2-2.6 mmol/l
Haemoglobin	122	135-175 mg/dl
WCC	22.8	4.0-11.0 $\times 10^9/l$
Platelets	320	150-400 $\times 10^9/l$

Chest x-ray showed bilateral multiple lobal pneumonia

CASE

Name	Mrs Smith
Sex	Female
Age	66 years
Presenting complaint	Seizure on and off affecting right side Sleeping all the time for 2 days and having seizure activities most of the time
On examination	No headache No systemic symptoms
Past medical history	Cerebral glioma Thrombocytopenia Cervical spondylosis Osteoarthritis Glaucoma
Past medical history	Maxitrol eyedrops Dexamethasone 16mg OD Levetiracetamol 500mg TWO to be taken BD Dorzolamide 2% Bumetanide 1mg OD Lansoprazole 30mg OD Paracetamol 1g QDS PRN MST 20mg BD Oramorph PRN Cyclazine 50mg PRN
On admission	Underwent radiotherapy and chemotherapy for glioma – failed to improve her condition

Referred to palliative care

Please Turn Over Once Completed

Blood Results		
Parameter	Results	Laboratory reference
Sodium	136	135-145 mmol/l
Potassium	3.7	3.5-5.2 mmol/l
Urea	8.9	2.5-7.5 mmol/l
Haemoglobin	114	135-175 mg/dl
WCC	4.3	4.0-11.0 $\times 10^9/l$
Platelets	28	150-400 $\times 10^9/l$

CASE

Name	Mr Green
Sex	Male
Age	78 years
Presenting complaint	Uncontrolled atrial fibrillation
Social history	Non Smoker Alcohol intake (45 units /week) Retired solicitor Lives with wife in a house
Past medical history	Type 2 diabetes Hypertension Paroxysmal AF with failed attempt to cardiovert in past Bleeding peptic ulcer 5 years ago Diabetic Nephropathy Chronic Kidney Disease (eGFR = 35 ml/min)
Allergy status	Ranitidine – causes rash
Medication on admission	Glimepiride 3mg daily Metformin 1g twice a day Linagliptin 5mg daily Pravastatin 40mg daily Lisinopril 40mg daily Felodipine 10mg daily Bisoprolol 10mg daily

On Examination	
Blood pressure (mmHg)	125/75
Heart Rate (beats per minute)	75
Weight (Kg)	75
Height	1.7m

Please Turn Over Once Completed

Blood Results		
Parameter	Results	Normal Ranges
HbA1c	6.9%	6.5-7.5%
Creatinine (micromole/L)	124	60-140
Urea (mmol/L)	3.9	2.5-7.5
Sodium (mmol/L)	143	135-145
Potassium (mmol/L)	4.4	3.5-5.5
T Cholesterol (mmol/L)	3.9	<4

CASE

Name	Mr Smith
Sex	Male
Age	75 years
Presenting complaint	Confusion Breathlessness
Social history	Smokes 20 cigarettes per day BMI > 30 – Weighs 98 kg
Past medical history	COPD Has been admitted to hospital on 3 other occasions this year with similar symptoms
Past medical history	Salbutamol - 5mg nebs four times a day Tiotropium respimat - 2puffs daily Carbocysteine - 750mg three times a day Theophylline M/R - 200mg twice a day Furosemide - 40mg each morning Seretide 500 accuhaler - 1puff twice a day Prednisolone - 5mg daily Salbutamol 100mcg MDI - 2puffs when required
On examination	Cyanosed Tachycardic, Respiratory rate 35 breaths/minute ↑ JVP

Please Turn Over Once Completed

Blood Results		
Parameters	Results	Laboratory reference
Haemoglobin (g/dl)	17.7	13-18
Haematocrit	0.57	0.36-0.46
WCC	18.1	4-11 x 10 ⁹ / L
Sodium (mmol/l)	141	135-145
Potassium (mmol/l)	3.7	3.5-5.3
Urea (mmol/l)	7.3	2.5-7.7

Arterial Blood Gases		
Parameters	Results	Laboratory reference
PaCO ₂	8.4	4.67-6.4 kPa
PaO ₂	9.3	11.1-14.4 kPa
pH	7.35	7.35-7.45
HCO ₃ ⁻	40	22-30 mmol/l

Chest X-ray shows consolidation at the left base and cardiomegaly

CASE

Name	Mr Robertson
Sex	Male
Age	25 years
Presenting complaint	Unwell for a number of days Complaining of abdominal pain and severe diarrhoea
Past medical history	Crohn's Disease, diagnosed in 2005. This is his second hospital admission in 6 months due to Crohn's Disease
Medication on admission	Pentasa (Mesalazine) tabs 1g twice a day Hydrocortisone Foam Enema (Colifoam) 1 application at night

Please Turn Over Once Completed

Blood Results		
Parameter	Results	Laboratory reference
Sodium	142	135-145 mmol/l
Potassium	3.9	3.5-5.2 mmol/l
Urea	9.2	2.5-7.5 mmol/l
Creatinine	101	60-110 micromol/l
CRP	56	0-10 mg/l

CASE

Name	Mr Blake
Sex	Male
Age	70 years
Allergies	NKDA
Presenting complaint	Known to have spinal vertebrae compression fractures at multiple levels Pain worsened over last 3 or 4 days Pain similar to what he normally feels but more intense
Past medical history	Myeloma multiplex – treated under haematologist Mild hypertension One previous myocardial infarction at the age of 57 years Mild osteoarthritis of the knees
Medication on admission	Tramadol 50 mg QDS PRN Fentanyl patch 100 mcg every 72 hours Ramipril 2.5mg twice a day Naproxen 500mg twice a day Aspirin 75mg each morning Simvastatin 40mg at night
On examination	X-ray of spine shows no new fractures

CASE

Name	Mrs Anderson
Sex	Female
Age	35 years
Allergies	NKDA
Presenting complaint	Severe back pain – started after lifting a heavy object at work 2 months ago. Pain constant with no significant improvement. Pain in lower back (10/10) like “electricity shooting down the right buttock” Very distressed and admits to feeling depressed
Past medical history	Imaging didn’t show any chord compressions or discus herniation – neurosurgeon’s advised conservative treatment and analgesia
Medication on admission	Paracetamol 1g QDS PRN Celebrex 100mg BD Lyrica 75mg BD

CASE

Name	Mrs Anwar
Sex	Female
Age	37 years
Allergies	NKDA
Presenting complaint	Chronic back pain - She has had a lifelong right hip pain related to an injury in childhood. Patient had a hip replacement in August of 2002. She reports that at the end of 2002, she began having low back pain radiating down the anterior legs bilaterally to the feet. This pain is daily and unremitting. She has been entered into a pain management program and she has been on various medications including paracetamol, Durogesic DTrans patch, gabapentin and amitriptyline.
Social history	Smoker, marijuana use in the past Homeless and living at a place where drugs are abused
Past medical history	Diabetes Mellitus Type 2 Depression Four C-sections
Medication on admission	Paracetamol 1g QDS PRN Durogesic DTrans 75 mcg patch every 72 hours Gabapentin 300 mg TDS Amitriptyline 30 mg ON Insulin 70/30 Sitagliptin 100 mg OD Sertraline 100 mg OD
On examination	The patient had an electromyography (EMG) of her right leg, and this was normal. MRI of the lumbar spine was done recently and was completely normal.

CASE

Name	Mrs Jones
Sex	Woman
Age	88 years
Presenting complaint	<p>Fall at home</p> <p>Presented with similar event 6 weeks ago – GP prescribed codeine, paracetamol and diclofenac for shoulder pain</p> <p>Addition of amitriptyline 10mg 2 weeks ago for what the GP thought was neuropathic pain</p>
Social history	<p>Reported as independent and self-caring</p> <p>Main carer for her husband</p> <p>No formal social care support</p>
Past medical history	<p>Hypertension</p> <p>Glaucoma</p> <p>Polymyalgia rheumatic</p> <p>Hypothyroidism</p>
Allergy status	Penicillin anaphylactic reaction reported in 1983
Medication on admission	<p><u>Via oral route</u></p> <p>Codeine phosphate 60mg four times a day</p> <p>Paracetamol 1g four to six hourly when required</p> <p>Diclofenac 50mg three times a day</p> <p>Prednisolone 4mg each morning</p> <p>Amitriptyline 10mg at night</p> <p>Levothyroxine 150micrograms each</p>

morning

Amlodipine 10mg each morning

Timolol eye drops 0.5% 1 drop twice a day in both eyes

Observations during admission

Patient very agitated

Visibly underweight

Very confused

Difficult to communicate with

Wandersome

Refusing to co-operate with any medical or nursing interventions

Swollen ankles

Please Turn Over Once Fully Completed

		Laboratory reference
WCC	16	(4 – 11 x 10 ⁹ /L)
CRP	40	(0-10mg/l)
Creatinine	100	(60-140µmol/l)
eGFR	39	(>90 ml/min)
Hb	8.8	(14-18 g/dL)
Albumin	28	(34-48 g/dl)
Urea	13	(2.5-7.5 mmol/L)
Blood Pressure	90/55 mmHg	

CASE

Name	Mrs Peterson
Sex	Female
Age	25 years
Allergies	NKDA
Presenting complaint	Referred from psychiatric department Dehydrated
Past medical history	Not managing continuous loss of weight Known to decline NG tube Known bulimic and anorexic Depression Gastroenteritis resulting in diarrhoea and vomiting
Medication on admission	Sertraline 100mg OD

Please Turn Over Once Completed

Blood Results		
Test	Result	Laboratory Reference
Sodium	128	(135-145 mmol/l)
Potassium	2.9	(3.5-5.3mmol/l)
Urea	9.0	(1.7-8.3mmol/l)
Creatinine	170	(60-140 micromol/l)
CRP	40	(0-10mg/l)
MCV (fl)	71	76-96
Calcium	1.1	(1-3mmol/l)
Haemoglobin	9.0	(14-18 g/dL)
Corrected calcium (mmol/l)	2.23	2.10-2.6
Magnesium (mmol/l)	0.4	0.8-1.2
Phosphate (mmol/l)	0.55	0.8-1.4
LFTs	Normal	Normal

CASE

Name	Mr Hulme
Sex	Male
Age	60 years
Allergies	NKDA
Presenting complaint	Nausea and vomiting Severe abdominal pain following binge drinking
Past medical history	Known alcoholic excess Duodenal ulcer 5 years ago
On examination	Slightly jaundiced Tenderness in left upper quadrant and abdomen
Medication on admission	Sertraline 100mg OD

Please Turn Over Once Completed

Blood Results		
Test	Result	Laboratory Reference
ALT	110	(7-56 U/l)
ALP	670	(44-147 IU/l)
Urea	6.0	(1.7-8.3mmol/l)
Bilirubin	3.27	(0.3-1.9 mg/dl)
CRP	60	(0-10mg/l)
WBC	12.5	(4-11 x 10 ⁹ / L)
Albumin	31	(34-48 g/dl)
LDH	700	(140-280 U/l)
Corrected calcium (mmol/l)	2.23	(2.10-2.6)
Amylase	710	(23-85 U/l)
Blood glucose	6.2	(4.4-6.1 mmol/l)
LFTs	Normal	Normal

During admission	Urgent CT scan obtained → severe pancreatitis with biliary stones
	Operated and pancreatectomy done due to necrosis and cholecystectomy (removal of gall bladder)
	Patient experiencing post-operative nausea and vomiting

CASE

Name	Mr Kenneth
Sex	Male
Age	59 years
Presenting complaint	Swallowing problem Little or no nutritional intake over the last 7 days Unable to eat or drink Lost 10 kg over last 3 months
Social history	Drinks a bottle of wine a day with meals
Allergy status	No known drug allergies
Medication on admission	No regular medicines Occasional paracetamol for headache
Provisional diagnosis	Oesophageal cancer

Please Turn Over Once Completed

Blood Results

Parameter	Results	Normal Ranges
Creatinine (micromole/L)	71	60-140
Urea (mmol/L)	2.1	2.5-7.5
Sodium (mmol/L)	139	135-145
Potassium (mmol/L)	3.3	3.5-5.5
Albumin (g/dl)	28	34-48
Corrected calcium (mmol/l)	1.99	2.10-2.6
Magnesium (mmol/l)	0.6	0.8-1.2
Phosphate (mmol/l)	0.65	0.8-1.4

On examination

Parameter	Results	Normal range/values
Weight on admission	50 kg	Normal weight 60 kg
BMI (Body Mass Index)	17 m ²	19.5- 25 m ²

CASE

Name	Ms Poppins	
Sex	Female	
Age	71 years	
Presenting complaint	Regularly tests blood sugars but has recently been feeling faint and light headed pre-meals	
Social history	Ex smoker (40 pack year history) No alcohol Lives alone but family live close by	
Past medical history	Type 2 Diabetes for the last 10 years Hypertension Dyslipidaemia Diabetic Peripheral Neuropathy Bronchiectasis Narcolepsy Urinary incontinence and recurrent UTIs Chronic Sinusitis Recently diagnosed and successfully treated lung cancer	
Allergy status	No known drug allergies	
Medication on admission	Repaglinide	1mg three times a day
	Metformin	500mg twice a day
	Aspirin	75 mg daily
	Perindopril	8mg daily
	Modafinil	200mg daily
	Amitriptyline	50mg at night
	Senna	15mg at night
	Oxycodone	10mg twice a day

Oxazepam 20mg at night
 Trospium 20mg twice a day

On examination

Parameters	Jan 2014	March 2013
Blood pressure	175/86	135/79
Weight	60	70
Height	1.5 m	

Please Turn Over Once Completed

Blood Results

Parameter	Jan 2014	March 2013	Normal Ranges
HbA1c	5.9	7.7	6.5-7.5%
Creatinine (micromole/L)	159	140	60-140
Urea (mmol/L)	11	6.9	2.5-7.5
Sodium (mmol/L)	140	135	135-145
Potassium (mmol/L)	4.0	4.6	3.5-5.5
T Cholesterol (mmol/L)	6.1	3.9	<4
Triglycerides (mmol/L)	1.5	1.0	0.2-2.2
HDL	0.8	1.1	1-3

Urine Dipstick Results

Blood	+
Microalbuminuria	+

CASE

Name	Mr Wilson
Sex	Male
Age	32 years
Allergies	NKDA
Presenting complaint	Admitted to MAU - headache and generally unwell. He had unprotected sexual intercourse 3 months ago, and been feeling unwell for 2 weeks
Medical history	Previously treated as a HIV positive
Medication	Truvada 245mg OD Efavirenz 600mg OD
On examination	Lumbar puncture was negative; he continued to have headache and feeling generally unwell.

Please Turn Over Once Completed

On Examination	
Parameters	Results
HIV 1	Wild Virus
Viral Load	1536452
CD4	280 (500-1500 cells per mm ³)
HLA-B* 5701	Negative

CASE

Name	Mrs Kaan
Sex	Female
Age	37 years
Allergies	NKDA
Presenting complaint	Admitted feeling generally unwell.
Medical history	HIV positive since 2003 – never had any treatment as she refused to accept the diagnosis Schizophrenic
Medication	Olanzapine 20 mg OD
On examination	Looked cachectic and jaundice

Please Turn Over Once Completed

On Examination	
Parameters	Results
Resistance tests	Negative
Viral Load	114207
CD4	160 (500-1500 cells per mm ³)
HLA-B* 5701	Negative

CASE

Name	Mr Starkie
Sex	Male
Age	35 years
Allergies	NKDA
Social history	Works shifts as a lorry driver
Presenting complaint	Admitted feeling generally unwell with penile discharge – had visited Thailand 2 months ago and had unprotected sexual intercourse.
Medical history	Seen by GUM clinic and treated as gonorrhoea. Hepatitis B and C negative Diabetes Mellitus Type 2 Hyperlipidaemia
Medication	Metformin 500mg TDS Simvastatin 40mg ON

Please Turn Over Once Completed

On Examination	
Parameters	Results
HIV	Positive – wild virus
Viral Load	12345201
CD4	320 (500-1500 cells per mm ³)
HLA-B* 5701	Positive

CASE

Name	Mrs Moss
Sex	Female
Age	61 years
Allergies	NKDA
Presenting complaint	Pain in her stomach and feeling full over the last 2 weeks. Pain in stomach has progressed to severe sharp pain – main reason for admission. Loss of weight over last 3 months
On examination	Has lost 10 lbs over last 3 months from 144 lbs to 134 lbs. Upon examination, revealed a tumour in her stomach – malignant with metastases. Chemotherapy and radiation therapy commenced. Unable to tolerate enteral feeding.

Please Turn Over Once Completed

Blood Results		
Test	Result	Laboratory Reference
Haemoglobin	11	(11.5-15.5 g/dl)
Haematocrit	35%	(33-44%)
Sodium	145	(135-145 mEq/l)
Potassium	3.6	(3.7-5.2 mEq/l)
Blood Urea Nitrogen	11	(8-18 mg/dl)
Albumin	28	(34-48 g/dl)
Blood glucose	5.1	(4.4-6.1 mmol/l)
SGOT (Serum glutamic oxaloacetic transaminase)	19	(7-27 U/l)
SGPT (Serum glutamic pyruvic transaminase)	15	(1-21 U/l)

Appendix 23.0 – Study Three – Certification of Completion



MANCHESTER
1824
The University of Manchester

THIS CERTIFIES THAT

Participant Name

was a research participant in the following study on how clinical decisions are made and what influences them:

‘Exploring the clinical reasoning processes of pharmacist and nurse independent prescribers working in secondary care.’

March 2015 – December 2015



Dr Mary Tully
Reader in Pharmacy Practice



Aseel Abuzour, Principal Investigator
PhD Student