

**THE DEVELOPMENT OF A PRACTICAL PRESCRIBING TEACHING
AND LEARNING PROGRAMME FOR UK MEDICAL
UNDERGRADUATES**

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Abstract

The safe and effective use of medicines relies not only on an in-depth knowledge of clinical pharmacology and therapeutics (CPT), but also on clinical judgement and the application of prescription writing skills in practice. Clinical judgement is partially underpinned by experience, however medical graduates do not feel that undergraduate curricula adequately prepare them to prescribe safely and effectively.

The aim of this PhD research project was to gain an understanding of the current teaching and learning practices for practical prescribing in the UK by using a mixed methods approach. Questionnaires were used to capture quantitative data regarding current provisions. No validated questionnaires existed. Those used in this research followed a similar format to a study investigating CPT teaching provisions, and were subsequently validated internally at Brighton and Sussex Medical School. Focus groups were used to capture qualitative data to further explore views of students regarding practical prescribing skill acquisition.

Views from over 1000 medical students, from 24 medical schools are presented. The majority (94.3%) of final year medical students reported that there was teaching and learning in practical prescribing on their course (n=396, 95% Confidence Interval [CI] = 92-97%), with 86.8% of fourth years (n=328, CI=83-90%) and 73.8% of third years (n=166, CI=67-80%) reporting the same. Almost 6% of final year students (n=24) reported that they did not get taught any practical prescribing on their course or did not know if it would be provided. Self-directed learning was the most frequently reported mode of delivery (90.9%, n=809), followed by tutorials (n=786, 79 88.3%), and pre-prescribing seminars (n=725, 81.5%). Validated pre-prescribing, simulation and pre-prescribing seminars were perceived by each year group as the three most effective methods.

Three medical schools reported students do not practice practical prescribing. There was a lack of emphasis on feedback on prescribing, with 7 medical schools reporting they do not provide validated prescribing sessions to their students.

The final stage of the research project involved the assembly of a panel of experts in safe prescribing to achieve consensus on the core content, learning outcomes and potential modes of delivery of teaching and learning for a focused programme of study in practical prescribing for medical students, to supplement current undergraduate curricula. A two round modified Delphi method was used to seek consensus (>75% panel agreement). This method has been used previously in other areas of curricular development in UK medical education.

Thirty four out of 47 experts invited responded to round 1 (72.3% response rate) and reached consensus on all 17 core content items, and 22 of the 25 proposed learning outcomes. None were rejected outright. Twenty-eight of the 34 experts responded to round 2 (82.4% retention), and achieved consensus on 17 of the 25 proposed core content items, and all additional 16 learning outcomes. The panel also advised on the suitability of possible teaching and learning methods for practical prescribing at various stages of the undergraduate medical degree.

Implementing such a programme of study might optimise the acquisition of practical prescribing skills and reduce prescribing errors. Ultimately, patient safety might be improved.

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Abbreviations used throughout the thesis

ADE/ ADR	Adverse drug event/ adverse drug reaction
BPS	British Pharmacological Society
BSMS	Brighton and Sussex Medical School
BNF	British National Formulary
BOS	Bristol Online Surveys
CPT	Clinical pharmacology and therapeutics
DME	Division of Medical Education
EACPT	European Association for Clinical Pharmacology and Therapeutics
F1	Foundation doctor in the first year of postgraduate medical education
F2	Foundation doctor in the second year of postgraduate medical education
GMC	General Medical Council
GP	General Practitioner
GPhC	General Pharmaceutical Council
HEE	Health Education England
HEKSS	Health Education Kent, Surrey and Sussex
IP	Independent prescribing
IPE/ IPL	Inter-professional education/ inter-professional education
LO	Learning outcome
MDT	Multi disciplinary team
MSC	Medical Schools Council
MSCAA	Medical School's Council Assessment Alliance
NCD	Non-communicable diseases
NHS	National Health Service
NMP	Non-medical prescriber
NPC	National Prescribing Centre
PAs	Physician Associates
PBL	Problem based learning
PSA	Prescribing Safety Assessment
RGEC	Research, Governance and Ethics Committee

RPA	Regional prescribing assessment
SCF	Single Competency Framework
STFS	South Thames Foundation School
SpR	Specialist Registrar
TDM	Therapeutic drug monitoring
TDTS	Too difficult to say
VLE	Virtual learning environment
WHO	World Health Organisation

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Author's Declaration

I declare that the research contained in this thesis, unless otherwise formally indicated within the text, is the original work of the author. The thesis has not been previously submitted to this or any other university for a degree, and does not incorporate any material already submitted for a degree.

Signed:

Dated:

List of publications and presentations

Publications

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Kennedy MB, Haq I, Williams SE, and Okorie M. Student perceptions of practical prescribing teaching and learning in UK medical schools. The Ottawa & Australian and New Zealand Association for Health Professional Educators (ANZAHPE) joint-conference, Perth, Australia. March 2016

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Chapter 1: Introduction to the thesis

Prescribing medication is the most common therapeutic intervention made by doctors across all sectors of the National Health Service in the UK (NHS-Digital 2016). Used appropriately, medicines have the potential to improve patient outcomes and positively impact on quality of life. Conversely, when medicines are prescribed erroneously, they have the potential to significantly endanger patients and compromise safety. The accuracy and safety of a prescription is therefore crucial, and any efforts to maintain a high standard of prescribing are essential.

An ageing population and polypharmacy

The global population is ageing rapidly. The proportion of “older people”, those aged 60 or over, and the “oldest-old”, those aged 80 and over, in almost all countries and regions across the world has significantly increased in recent years (United Nations 2015a). The population of older people is predicted to reach 2.1 billion by 2050, and furthermore the population of the oldest-old, is projected to triple in numbers to reach 434 million in the same period (United Nations 2015b). Advances in public health, medicine, and living conditions have increased life expectancy, coupled with improved access to birth control, and reduced fertility have contributed to the observed shift in distribution of the world’s population towards the older ages (Suzman et al. 2015, United Nations 2015a).

The ageing population represents a major global challenge with respect to social care, social pensions, and healthcare (Beard and Bloom 2015). It is widely accepted that as people age, their health conditions tend to become more complex and chronic: non-communicable diseases (NCD), with multiple co-morbidities and disability becoming more prevalent (Beard and Bloom, 2015, World Health Organisation, 2015). Over 51% of older people are believed to be affected by multi-morbidity (that is the presence of 2 or more co-morbid chronic conditions). It is therefore no surprise that increasingly complex drug regimens are required to effectively manage chronic NCDs, such as diabetes mellitus, heart disease, arthritis, dementia and hypertension to name a few. This practice is called “polypharmacy”, a term, which can also be used to define the practice of over-

prescribing medication i.e. more medications than, are clinically indicated (Montamat 1992).

Over 10% of people in the UK aged over 65 take 5 or more drugs, with the corresponding figures for the over 75's being 15% (Gorard 2006). Figures from the USA and Europe show similar trends (Kaufman et al., 2002, Fialova et al., 2005, Hanlon et al., 1997). Studies have shown that there are an increased number of drugs prescribed over time, a trend that is seen in both primary and secondary care (Gorard 2006, Garfinkel et al., 2015).

The risks associated with polypharmacy are well documented: invariably associated with adverse effects, drug-drug interactions, increased morbidity, and therefore increased healthcare costs (Gorard 2006, Garfinkel 2013, Garfinkel et al., 2015). This has brought the safer use of medicines to even greater prominence with attention focused on reduction of prescribing errors. Efforts have been made to mitigate the risks associated with prescribing in elderly populations in particular, tending to focus on identification of inappropriate prescribing or medication omissions. Of the former category, the most prominent initiatives include the various iterations of Beer's criteria, which identifies medicines or classes of medicines that should be avoided or used in caution in elderly patients (Beers et al., 1991, Beers et al., 1997, Flick et al., 2003, & Flick et al., 2012). There is also the STOPP and START initiative, which are screening tools identifying potential errors of prescribing in older people, and potentially appropriate treatments that are currently omitted from older people's treatment regimen respectively (Gallagher et al., 2008). Both the STOPP and START criteria were developed to address and improve medication appropriateness in elderly patients, prevent adverse drug events (ADEs) and have been used to identify potential inappropriate prescribing across many care settings (O' Mahoney et al., 2010, Gallagher et al., 2008, Byrne et al., 2008, Barry et al., 2007, Ryan et al., 2009)

Safety and economic ramifications

With a growing population, particularly in the over 65 age group, it is not surprising that the number of medicines prescribed and dispensed in primary care in the UK

has risen year on year. In 2014-2015 the National Health Service (NHS)'s expenditure on medication was £15.5 billion, an increase of 7.8% from £14.4 billion in 2013-2014. After staffing, medication costs accounts for the highest area of expenditure in the NHS budget (Health and Social Care Information Centre, 2015). To put this in perspective the actual expenditure of the Department of Health (DoH) for 2014/2015 was £118.5 billion (DoH 2017). As expected most of the costs associated to prescribed medicines occurs in primary care. However there is a significant cost burden in hospitals too. Medications prescribed in the hospital setting accounted for 42.9% of these total costs, this is unsurprising as the initiation of many novel and specialist medicines is restricted to hospital and, typically, such drugs are of higher cost (Health and Social Care Information Centre, 2015).

There were in excess of 71,000 reports of medication related incidents occurring in all specialist and non-specialist NHS Acute Trusts and Community Trusts in England and Wales from 1st October 2015 to 31st March 2016, representing 10.8% of all incidents reported (National Reporting and Learning Systems, 2016). Medication incidents are defined as those where patient's suffered actual harm or potential harm due to an error in the prescribing, dispensing, administration or monitoring process, or issues with medication advice provision. Typically the most common errors are related to wrong dosage, omitted or delayed medication and wrong medication (National Reporting and Learning Systems, 2010). These data are separate to reports of adverse effects or side effects to the Medicines and Health Regulatory Agency (MHRA), so are likely to be underestimates of the actual number in practice. Reports of harm in primary care are harder to come by.

According to reports from the Medical Protection Society, medication errors account for 20% of clinical negligence claims in the primary and secondary setting (Medicines Protection Agency 2013). Reported estimates of the costs of inappropriate prescribing are disparate at best. Accurate figures are difficult to gauge as costs associated with litigation and those associated with medication-related hospital admissions (or resultant morbidity) are all reported separately.

An approximation of the cost of medication-related admissions to NHS hospitals by the Department of Health stood at £200-400 million per annum in 2004. It was also estimated that in the UK, 4.7% of all hospital admissions were due to harm from medication that was deemed to be avoidable (Pirmohamed et al., 2004). Updated estimates in 2007 put the costs associated with such admissions for adverse drug reactions and the cost due to medicine related harm during the hospital stay to be in excess of £700 million (NPSA 2007). A report of costs associated with unsafe care in the NHS from 2014 put estimates in excess of £1billion per annum (Fronteir Economics, 2014). Considering growing costs associated with healthcare provision, these figures are likely to be conservative in terms of actual expenses in the current climate.

Prescribing errors & the factors influencing error

Prescribing errors can broadly be categorised into those that arise when a good plan is executed erroneously or those that arise when a bad plan is executed correctly (Reason 1990). When a good plan is incorrectly executed this can be due to a slip, lapse or mistake. Slips and lapses tend to be associated with repetitive tasks involving minute cognitive input, where the perpetrator is often unaware of the deviation from standard practice (Reason 1990, in Glendon et al., 2006). Mistakes can be knowledge or rule based, and arises typically when a good rule is applied erroneously despite a base level of knowledge. A violation is a distinct type of error when the divergences from the rules are deliberate, often conducted to maintain safe operation. This is represented in Figure 1.1.

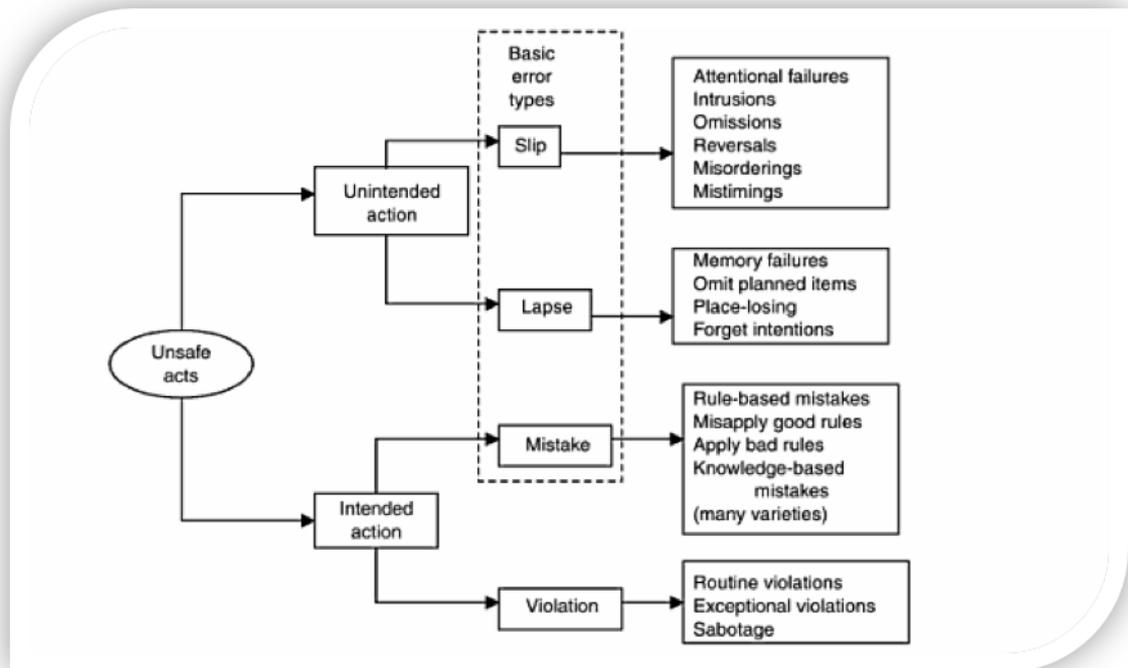


Figure 1.1: Summary of main error types: slips, lapses, mistakes and violations (Reason 1990, in Glendon et al., 2006, p115)

Historically, reports of prescribing error in the literature were inconsistent, ranging from 4.2-82% of prescriptions (Ross et al. 2008). This was due in part to the variability or lack of a proper definition taken by researchers in studying the subject (Dean et al. 2000). Dean et al. attempted to develop a definitive definition for a prescribing error by means of reaching consensus amongst a carefully selected panel of experts (Dean et al. 2000). This definition was to address the disparity in the literature and allow a true baseline of prescribing error in the UK to subsequently be determined. They decided upon:

“A clinically meaningful prescribing error occurs when, as a result of a prescribing decision or prescription writing process, there is an unintentional significant (1) reduction in the probability of treatment being timely and effective, or (2) increase in the risk of harm when compared with generally accepted practice”.

This definition captures the essence of all the elements of the prescribing process that can cause a patient harm, namely the decision making and prescription writing process itself (Dean et al., 2000).

A variety of internal, external and systems-based factors can feed into errors. Interestingly when asked about their practice, junior doctors throughout Scotland reported high levels of confidence in their prescribing abilities yet the majority conceded that they do in fact make errors (Ryan et al., 2013). The most common reasons cited for such errors included interruptions, pressure from other staff, high workload, and personal fatigue or stress, aspects of working in a dynamic ward environment that would be challenging to address in any meaningful manner. These findings do however mirror those previously published elsewhere (Tallentire et al., 2011, Illing et al., 2008). Much work has been done in relation to the additional contributory factors associated with risk. Common themes emerging as causative factors include, but are not limited to, increasing workload, a dynamic and hectic work environment, fatigue, influences of other members of the multidisciplinary team being cited most frequently (Dean et al., 2002, Dean et al., 2007, Dornan et al., 2009). They also perhaps highlight the need to incorporate stress coping strategies, or simulation of busy ward environment into any programme of study that would be designed to improve prescribing safety, in order to better prepare graduates for the stress-filled and dynamic environments in which their future practice will be based.

There are additionally certain individual inherent biases that have been associated with error. When faced with uncertainty, a person relies on certain principles (heuristics) to make a problem less complex and easier to judge. Although this can be useful in some circumstances, it can lead to systematic or predictable errors (Tversky 1974). There is recognition that when rational decision-making principles are violated the result is often sub-optimal (Hardman 2002) and since this appears to be an area that newly qualified doctors find difficult (Tallentire et al., 2011), it perhaps signals the need to incorporate more of the teaching and learning of therapeutic decision-making into the undergraduate medical curriculum.

Prescribing error studies

As discussed, the rates of prescribing errors reported in the literature have been variable. The most comprehensive investigation of the prevalence and nature of prescribing errors by foundation doctors in the UK was conducted by Dornan et al. (2009). This study included a review of 124,260 medication orders from 19 NHS hospital trusts (across 20 different sites in North-West England) on seven weekdays during the study period. A total of 11,077 errors were identified by pharmacists conducting their daily reviews of inpatient medication orders, which represented a mean error rate of 8.9% across all grades of doctor. Medication errors were more likely to be associated with orders written at the admission stage than upon discharge. Unsurprisingly the error rates were highest amongst the foundation doctors, who are responsible for the majority of the prescribing, a common trend observed in most NHS hospitals. Regression analysis showed that this grade of doctor was more than twice as likely to be responsible for a prescribing error as a consultant. 53% of the errors were judged potentially significant (53%). The study found that 5% of the medication errors were considered to be potentially serious, and furthermore fewer than 2% were deemed potentially lethal. These data are very worrying as in the absence of a pharmacist's intervention there may have been an adverse outcome for a patient. Most errors were deemed preventable and based on the authors' recommendations, education was highlighted as a prominent strategy to minimise these at various stages throughout the medical educational continuum (Figure 1.2).

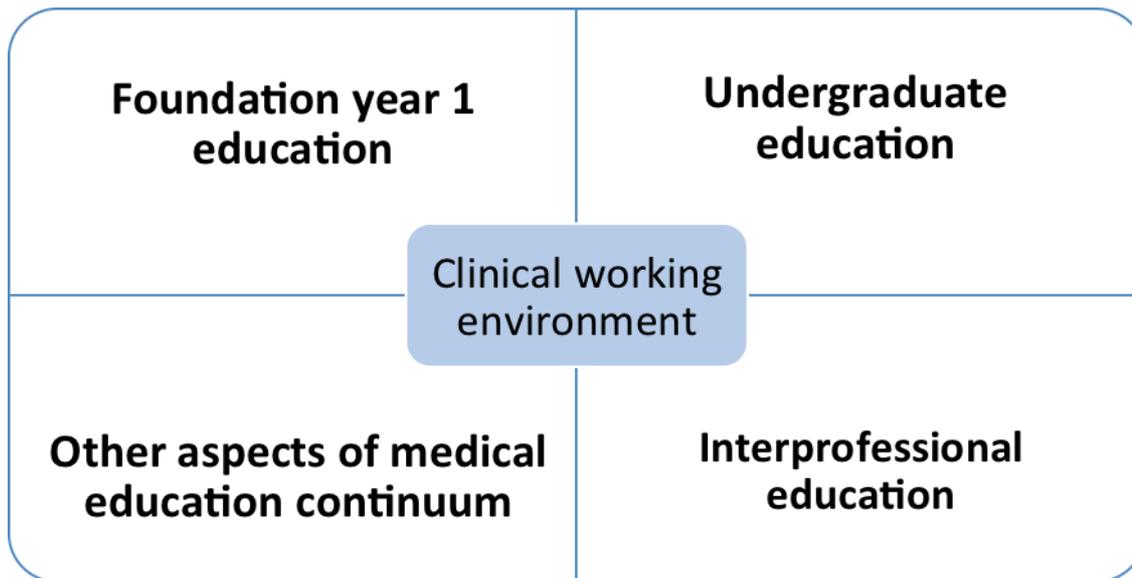


Figure 1.2: Recommendations from the EQUIP study of possible targets to help reduce prescribing errors

Notably, the error rates attributed to non-medical prescribers (NMPs), including nurses and pharmacist practitioners, was significantly lower than medical prescribers. Pharmacists had a 0% error rate, while the corresponding figure for nurses was 6.1%. One reason for this may be the environment they are prescribing in, i.e. fewer patients to review or less restraints on their time. Other reasons for the lower error rates may be due to the significantly fewer medication orders written by both groups of professionals or due to the narrow spectrum/scope of practice within which they work and prescribe. It is unknown if the training in practical prescribing provided to NMPs, who have amassed experience in their relative field before training to become prescribers, could potentially be an important factor as this was not investigated in this study. However there may be lessons learnt from the Single Competency Framework for all prescribers (SCF) and training of the NMPs that might optimise the prescribing of doctors.

Reports of errors in primary care are notoriously lacking. This in itself is worrying considering the majority of prescribing activity occurs in the community setting: 1000 million prescription items were dispensed in England in in 2014, an increase of 3.3% from the previous year (Prescribing and Medicines team Health and Social Care Information Centre, 2015). A General Medical Council (GMC) commissioned

study to investigate errors in primary care found that the prevalence of prescribing and monitoring errors was 12% for all patients included over the 12 months study period (Avery et al., 2012). 4.9% of all prescriptions studied contained an error, the majority of which were missing or incomplete information followed by dosing errors. Although it appears that educational interventions may need to be introduced for GPs, this alone would not be a sufficient solution. The future GPs will first have to undergo their Foundation Programme training in an NHS hospital, upon completion of their undergraduate degree. This highlights the importance of ensuring the teaching of safe prescribing is evaluated and optimised earlier in a medics' career, and continually supported throughout.

More recently studies in primary care in particular have focused on the impact of feedback on reducing prescribing errors or improving practices of so called "high risk prescribing". Studies from Scotland indicate that feedback on prescribing, in conjunction with education can improve prescribing practices (Byrne et al., 2017).

Decision maker versus the "scribe"

The EQUIP study did not account for scenarios where the decision maker and scribe for a prescription were different. Therefore instances where an unsuitable medication for a particular patient was prescribed in error, the blame was attributed to the person writing the medication order. As mentioned above, this is most likely to be a junior doctor, completing their foundation training (foundation doctors). A review of 236 prescribing decisions taken across 6 wards at a large UK teaching hospital, found that the person writing the prescription in 62% of cases was different to the physician deciding on the medication to be prescribed (Ross et al, 2012). Furthermore the researchers discovered that the decision to initiate new medication was in 99% of cases taken by a more senior doctor to the writer of the prescription. The drug name was the most frequently communicated piece of information (82%), but details of dose, frequency, route and duration being verbalised much less often (33.7%, 34.8%, 16.9% and 16.9% respectively).

It is worrisome that foundation doctors, despite prescribing most often, lack the expertise and knowledge to do so effectively. It is even more concerning that

foundation doctors do not question if in doubt and this may well be due to the hierarchical configuration and etiquette associated with medicine (Ross et al., 2012, Lewis & Tully 2009). This hierarchy is a potential barrier to patient safety as juniors are often reluctant to question the decision of their senior colleagues, so are not always as critical in their review of prescriptions as they should or could be (Dean et al., 2002), despite remaining legally accountable for any errors that may arise. Conversely, senior doctors may rely on more junior staff (of any grade) to prescribe medication appropriately based on general instruction especially if it outside their own scope of practice (Ross et al., 2012)

Findings of such studies are significant as they highlight the fact that interventions aimed solely at a single group of doctors will not suffice i.e. foundation doctors. The argument for the need to develop a robust approach to the teaching and learning of practical prescribing throughout the medical education continuum could be made. In order to develop teaching and learning activities, the current provisions need to be identified at the undergraduate and postgraduate phase, as this could inform on possible learning outcomes or possible methodologies.

Preparedness to practice and the transition

The transition from undergraduate to postgraduate can be fraught in any discipline. With regard to medical education this rings especially true: in a matter of weeks the individual goes from being an undergraduate medical student to a postgraduate foundation doctor. There is an expectation that one has to perform all the associated duties from day one of the job, with minimal supervision – a huge burden of responsibility they will not have been exposed to previously. Where prescribing is concerned, most new junior doctors have to write more prescriptions in their first days on the job than they have had the opportunity to practice throughout their medical degree (Maxwell 2012). A recent Europe-wide study found that students at over two-thirds of the 18 medical schools responding do not get to practice prescribing during their undergraduate degree (Brinkman et al., 2017). There have been calls within Europe for medical students to get more exposure to, and experience of, practical clinical skills earlier in their undergraduate education (the EMERGE group, 2009).

Preparedness for practice and this transition phase in medical education has been well researched. In general junior doctors feel well versed and ready for tasks that involve communication and basic clinical procedural tasks, but have serious apprehensions about prescribing, managing their workload, being on call and caring for acutely ill patients (Illing et al., 2008, Heaton et al., 2008, Tallentire et al., 2011, Geogheghan et al., 2017).

Foundation year 1 (F1) doctors have rated their knowledge of CPT as poor (30%), with just 8% describing it as “good” (Tobaiqy et al., 2007). It is unknown if there is a synergy between deficits in knowledge and skill and environmental factors in relation to prescribing errors. If this was indeed the case perhaps if the doctors had an improved knowledge and skill around prescribing and therapeutics the environmental factors (which are notoriously difficult to control) might have less of an impact on an individual.

Confidence in prescribing medication typically associated with patient morbidity and mortality was high, however this was more so associated with routine prescribing practice or a reflection of ward attachments, corroborating the findings that confidence in prescribing is due in part to practice (Tallintire et al., 2011, Ryan et al., 2014).

An investigation into the patterns of learning at UK medical schools and student/ recent graduate views regarding preparedness to prescribe highlighted the perceived lack of learning opportunities available to medical students in relation prescribing (Heaton et al., 2008). This study did not investigate specifically, which teaching and learning methods that medical students were exposed to, nor how effective students perceived these to be in improving their confidence or competence in practical skill acquisition. This is one gap in the literature this doctoral thesis will aim to address.

There is a well-established correlation between student engagement and positive outcomes on student development and achievement/ success. In other words, students are more likely to engage in and benefit from teaching and learning activities if they perceive these to be effective. (Trowler, 2010, Kuh et al., 2005 &

2007). The importance of the student voice in curriculum review and development will be discussed in more depth later in this thesis.

Medical students and recent graduates, who feel their undergraduate medical education was somewhat lacking, particularly in relation to developing prescribing skills, have called the teaching and learning of therapeutics into question. To better understand the issues of learning complex skills such as prescribing, and potentially understand shortcomings of medical undergraduate programmes, one must first have an appreciation of how students learn, which educational methods are used in higher education (and why) and what efforts have already been made to try improve prescribing skills. These issues will be discussed in the following pages with a view to being able to draw conclusions that could potentially inform the development of a programme of study to make doctors safer practitioners.

How do we learn?

In order to develop and implement effective ways to help others learn, one must first understand the ways in which people learn (Taylor and Hamdy, 2013), and the strategies that higher educational institutions employ in their curricula. The learning refers not just to the acquisition of knowledge but also of skills and attitudes.

Historical context of learning theories

Although it is now widely accepted that adults learn differently to children, this was not always the case. It was originally believed that the mind was a blank slate (a *tabula rasa*) and experience alone was responsible for acquisition of knowledge (Locke, 1690). This was developed in the twentieth century to emphasise the importance of the learner experiencing a positive effect from the learning – the law of effect, and the importance of repetition on reinforcement the learning - the law of exercise (Thorndike, 1911).

The theory of adult learning has developed much in the twenty-first century. Prior to this, pedagogy existed - the science of teaching children (Knowles et al., 2011).

This was the only educational model in existence in public schools in the nineteenth century, and was later adopted for use in adult education as there was no other framework specifically for this purpose. The outcome of this was adults being taught as if they were children.

However as the field of adult education grew, there was a shift from the use of teacher-centred pedagogical models used in higher education, towards more student-centred andragogical models. The emphasis increasingly was that students take responsibility for their own decisions about their learning (Knowles 2005, Knowles et al. 2011). Table 1.1 gives an overview of the assumptions made about these two models of education.

Table 2.1 Assumptions of pedagogy & andragogy (Knowles et al. 2011 p60-67)

ASSUMPTIONS	PEDAGOGICAL MODEL	ANDRAGOGICAL MODEL
The need to know	The learner only needs to know what the teacher tells them to learn and do not need to know the intended application	Adults need to know why they need to learn something before investing the time/ effort to undertake it
The learners self- concept	The learner develops a dependent personality, therefore do not adequately develop self-direction skills	Adults have a self-concept of being responsible for their own decisions, and need to be seen by their peers as being capable of self-direction
The role of the learner's experience	Emphasis placed on the transmittal techniques of the experience of the teacher, author of books or learning aids utilised	Having lived longer adults have accrued more and a different quality of experience than their younger counterparts which is key
Readiness to learn	This is dictated by the teacher, learners learn what they are told they need to	Adults are more ready to learn things which there is a need for them to know and be able to do in order to more effectively cope with real life situations
Orientation to learning	Learners have a subject centred approach to learning as they view learning as acquiring subject matter content	More problem or task centred in that learning will help deal with problems they routinely encounter in life
Motivation	External motivators such as grades, the teachers attitude, parents influence will impact on the learner's motivation	Primarily internal motivators such as self-esteem, and desire to continue growing, although external factors such as promotion, better job prospects exist

In more recent times however, it has been suggested that it is more appropriate to view education as a continuum throughout a person's life (Taylor & Hamdy, 2013). This takes into account different problems, approaches and focuses at different stages along the spectrum, rather than distinct entities whose differences are somewhat artificial (Taylor & Hamdy, 2013). Adults, as well as learning differently to children, may also be motivated by different factors and stimuli (Knowles et al., 2011). Rubin argues that this rings true for prescribing teaching too (Rubin, 2006). However his view of this continuum is that principles of prescribing are learnt and understood at university and only really put into practice during the foundation training. This is in stark contrast to other commentators who believe that it is vital to acquire and practice skills earlier on during medical school (the EMERGE group, 2009).

Regardless of the theoretical model of learning in question, McKimm and Jollie (2007) propose that all adult learning has the following characteristics in common: the learning is purposeful, participation is voluntary, and should be active rather than passive, expectations are clearly set out, feedback is a crucial element, and finally learners are afforded an opportunity for reflection.

One barrier to the acquisition of new knowledge in a discipline as complex and vast as medicine is that learners will become overwhelmed and this acts as a deterrent to engaging in learning: a concept termed liminality (Land et al., 2008). To overcome this, the learner needs a guide to help them become familiar with the relevant terminology and concepts i.e. cross the threshold. The structural things done by the teachers to bridge this gap and guide learners across the threshold is termed scaffolding (Taylor and Hamdy, 2013), and includes but is not limited to the syllabus outline, lectures, intended experiential learning and learning outcomes. Models to refine learning outcomes include those devised by Miller (1990) and Bloom (1954), and are both discussed in more detail in the section dealing with competency-based learning.

Learning skills versus factual information

One of the drivers for curriculum change in the early 90's and the subsequent publication of Tomorrow's Doctors was to place the patient at the centre of care. This was with a view to producing graduates who would be better equipped for clinical practice by improving problem solving and demonstrating skills for life long learning (Maxwell & Walley, 2003). The GMC guidance on medical school curricula moved away from students being required to learn a lot of factual scientific facts and regurgitate them in exams, but placed an emphasis on problem solving skills, that would be useful for future clinical practice treating patients (GMC, 1993).

Ker & Bradley outline how to go about teaching a technical, psychomotor or procedural skill (in Swanick, 2010). Put simply the learner must first understand why, when and how the skill is done, then they must see the skill being performed in its entirety. This step is repeated with a full explanation accompanying the visual experience. The learner then practices it himself or herself and is given feedback on performance to highlight areas for development before being encouraged to seek out further opportunities to practice the skill further (Joyce and Showers 1980 in Swanick, 2010, George and Dotto 2001). Although this lends itself more to clinical skills such as intubation, aspects of this approach could be used for teaching prescribing. However, there is no evidence in the literature of this specific approach being used in any formal manner for this purpose.

Undergraduate Medical education in the UK

Tomorrow's Doctors 1993

A big change to undergraduate medical training in the UK came in the wake of the publication of the GMC's Tomorrow's Doctors report (GMC, 1993). This promoted a shift from curricula that delivered large amounts of factual scientific information toward a more patient focused, and problem-based system, with a view to produce doctors with improved skills for lifelong learning (Maxwell & Walley, 2003). In order to achieve this, the GMC promoted the use of integrated systems based approaches. Integration organises the information to be learned vertically or

horizontally i.e. between the basic and clinical sciences or between various subject areas respectively (Grant, in Swanick 2010). A move towards integration was seen as a positive step: it facilitates the organisation of the learning materials to be situated around a unit, such as a body system, making them more relevant to practice, improves learning processes and lessens the divide between the basic and clinical sciences. If this is conducted in a spiral manner, the theme is revisited with increasing complexity at each consecutive stage. One of the downsides to integration is that if it is mismanaged, a loss of identity or visibility of certain departments within the curriculum can result (Maxwell & Walley, 2003). Also it is challenging to assess the component parts without allowing compensation, for example, it is difficult to say with certainty that the basic scientific knowledge standards have been satisfied if assessments are integrated into clinical practice.

It appears that the post Tomorrow's Doctors' reshuffle in the UK, many basic science disciplines suffered this exact fate, with CPT departments in particular struggling to identify and track their influence in the new "improved" curricula (Maxwell & Walley, 2003). This is a worrying trend considering it is widely accepted that the foundations of safe prescribing lie on a sound knowledge and understanding of not just the pathophysiology of diseases but also the pharmacology of those medicines used to treat them (Routledge, 2012).

Hence it appears that such efforts to restructure undergraduate medical education in the UK may have inadvertently created a void in terms of skill and knowledge acquisition relating to safe prescribing. This is demonstrated by evidence from studies that have shown that graduates do not feel that they are adequately prepared to perform the complex task of prescribing, and furthermore that knowledge in pharmacology and therapeutics is often somewhat lacking, discussed in detail above (Tobaiqy et al., 2007, Heaton 2008, Tallentire et al., 2010, Rothwell et al., 2011, Brinkman et al., 2018). It is not possible however to determine what effect, if any, such changes have had on actual prescribing error rates in clinical practice.

Tomorrow's Doctors 2002

The need for effective CPT teaching was further highlighted in a review of Tomorrow's Doctors in 2002, where the GMC was more prescriptive in their objectives with respect to effective and safe use of medicines (GMC, 2002). The GMC also made reference to valid and reliable assessments to ensure students have met the desired outcomes. Although this update from the GMC referred to prescribing and CPT knowledge and skills that graduates should attain, it did not support the re-emergence of specific disciplines that had been previously lost, such as CPT (Maxwell & Walley, 2003).

Tomorrow's doctors 2009

The 2009 iteration of Tomorrow's Doctors considers the outcomes for graduates within four domains: the doctor as a scientist, scholar, practitioner and a professional. There is little added to its predecessor regarding prescribing teaching. Outcome 17 relates to "prescribing safely, effectively and economically" In addition to this, outcome 21 states that graduates should systematically reflect on practice, taking action when necessary and encourages the critical review of other practitioner's prescriptions (GMC, 2009). However aside from these there is no mention of this vital skill in the remainder of the document.

Outcomes for graduates 2016

The standards set out in Tomorrow's Doctors that medical graduates had to demonstrate prior to graduation, were superseded by the Outcomes for Graduates in 2016 (GMC, 2016). It stated that graduates were expected to be able to select appropriate management options for common illnesses, and in addition demonstrate knowledge of drug action (including interactions and side effects). As an update from Tomorrow's Doctors there was little addition given to the outcomes with respect to prescribing. Communicating effectively with the patient and careers seems to take prominence. (GMC, 2016.)

Teaching and learning of CPT in UK medical schools

Efforts have been made to address the feeling of unpreparedness felt by graduates by a variety of teaching methods: pharmacotherapy context-learning programmes (Vollebregt et al., 2006) practical prescribing courses (Tittle et al., 2014), pre-prescribing process (Conroy-Smith et al., 2012), to name but a few. Although these educational interventions seem to be well received, and have some positive effect on prescribing safety or confidence, the long-term implications of such schemes remains to be seen, and would require longitudinal studies to facilitate more in depth analysis.

Dedicated programmes of study have been trialled and demonstrated an improvement in prescribing assessment scores and prescribing confidence amongst medical students, however error was not eradicated completely (Sandilands et al., 2011). It is not known if this was because the educational programme was not sustained for a long period because the errors that did persist were due to the environmental or psychological causes of prescribing errors that are harder to control for. It is possible that the solution to reducing prescribing error lies in a multi-modal approach, where education is one component.

There are no studies specifically looking at student perceptions to the various educational interventions they are exposed to or their medical undergraduate curricula. This doctoral thesis seeks to address this gap in the literature.

A study by O'Shaughnessy et al. commented on the diversity of the teaching of pharmacology and therapeutics to undergraduate medical students in the UK in 2009, and that of those providing such teaching. It is not known to what extent the different medical schools utilise the various educational methods for prescribing within their curricula. By gaining a better understanding of current practices and the associated value that students place on them, it may be possible to develop a programme of study for practical prescribing which is sanctioned by a panel of experts, and furthermore advise on possible methodologies that students find both effective. This is one of the aims of this doctoral thesis,

In the wake of the publication of the Shape of Training document by the GMC in 2013 (Greenway et al., 2013), the training and education of doctors has come under further scrutiny. This document proposes that in the future, assuming adequate measures have been put in place that full registration be moved to the point of graduation from medical school. This raises obvious questions about the value of optimising the teaching provided by each medical school, particularly in specific and fundamental skills such as prescribing and rational use of medication.

Competency based learning and prescribing

Becoming a doctor, or indeed any healthcare professional, not only requires the acquisition of new knowledge and skills but there is also a process of maturing into the relevant professional community (Taylor & Hamdy, 2013). At the point of graduation, a medical student should have acquired the relevant competencies in prescribing and safe use of medicines.

Competency is the ability to perform a specified task (Grant in Swanick, 2010). In relation to skills such as prescribing, it is often too difficult to measure competence due to their complex and multifarious nature. A skill may therefore have to be broken down into its constituent parts, in its teaching or assessment. Ross and Maxwell, working on behalf of the British Pharmacological Society (BPS), break the task of prescribing down into a set of complex sub competencies (Table 1.2).

Table1.2: Sub competencies of prescribing proposed by Ross & Maxwell 2012.

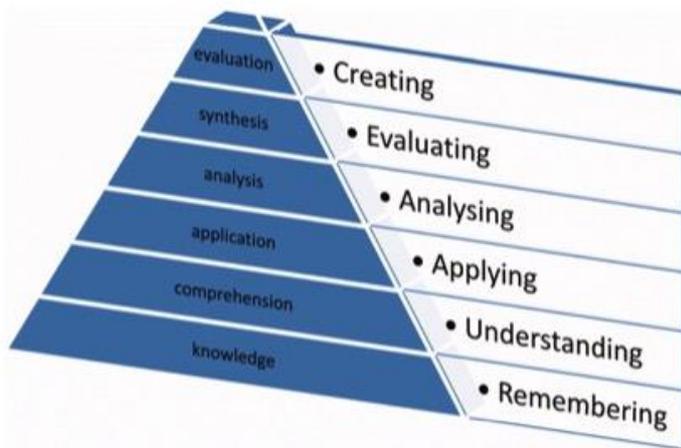
THE ACT OF PRESCRIBING IS COMPRISED OF:	
1. Make a diagnosis	6. Select appropriate duration of treatment
2. Establish therapeutic goal	7. Physically write the prescription
3. Chose therapeutic approach	8. Communicate with patient
4. Choose the drug to prescribe	9. Monitor the therapy – for benefit or harm
5. Select how the drug is to be given – route, frequency and dose	10. Review and make amendments as necessary

Although knowledge underpins all the sub-competencies listed, clinical judgement, consideration of individual patient factors and skill are required to perform the task

safely and effectively. However, when a complex task is broken down in such a way, it is difficult to account for the demanding environmental factors associated with performing the task i.e. prescribing, hence this can skew the assessment and it can be difficult to demonstrate competence in the overall skill rather than its' component parts.

Clinical log books are an example of medical education competency based learning, where a student has a list of particular skills that they are required to perform under the supervision of a qualified professional and if they do so satisfactorily they get signed off as being competent. However, criticism of this approach is many fold - firstly there is a risk that students could perceive they have achieved competency prematurely, leading to incompetency, and secondly it risks becoming a tick box exercise and the true learning value is lost (Dornan et al., 2011)

Miller's triangle (1990) and Bloom's original taxonomy (1956) are two models, which have been used to refine learning outcomes. Bloom arranged individual attributes relating to learning outcomes in a hierarchical structure (Figure 1.3(a)), the learner is required to do things with the newly acquired knowledge.



(a). Bloom's taxonomy, after Atherton (2011)

(b). Miller's pyramid after Miller (1990)

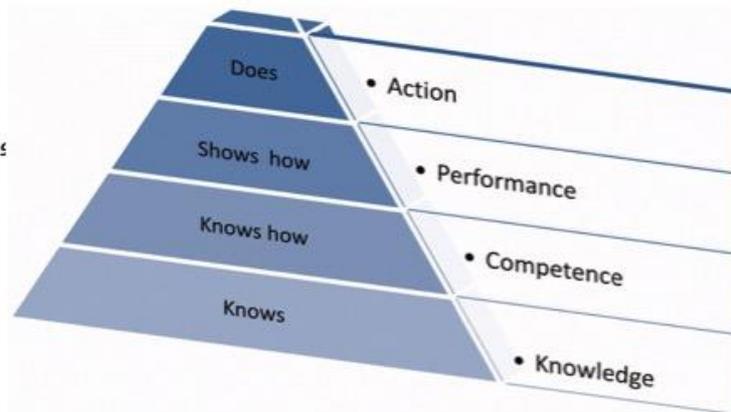


Figure 1.3: Bloom's Taxonomy & Miler's Triangle (Taylor & Handy 2013)

Miller's triangle (Figure 1.3(b)), derived from Bloom's original work, was developed in order to represent the various stages of attainment of competence one goes through from acquiring knowledge to demonstrating its' application in practice (Miller, 1990). In order to achieve competence in a particular level one must first acquire competence in the preceding level. Although there appears to be a natural progression from "knows" to "knows how", the progression from "shows" to "does" can be more complicated; and one must demonstrate that they can encompass that particular aptitude into everyday situations. In relation to prescribing this means applying the underlying principles of CPT for a therapeutic patient problem and prescribing under uncertainty and in an often, dynamic environment. One of the biggest flaws identified in Miller's original proposal is that there is no allowance made for the external factors that influence performance such as the environment, time pressures, individual patient factors, which themselves are known to be implicated in prescribing error (Dean et al., 2008,

Ross et al., 2009, Dornan et al., 2009). Miller's triangle has since found a place as a guide for assessment within medical curricula.

Safe and effective prescribing: teaching and learning methods

A recent multi-centre European study found that the undergraduate teaching of CPT is not adequate in many medical schools across the continent (Brinkman et al. 2016). There was some evidence that students taught within a problem based curricula had acquired better prescription writing skills than those taught via more traditional methods.

To fully appreciate the various educational interventions used (primarily) by medical schools, a broad understanding of teaching and learning methods used in higher education in general is essential. These will be discussed in broad terms in the following paragraphs to give an overview of the relative merits of each, to facilitate a discussion as to the relative merits of each in respect to safe prescribing.

Lectures

Although theories of learning and curricular development have evolved over the years in most spheres of higher education, lectures have remained a constant. Typically didactic in nature, lectures are accepted as being an effective and economical means to transmit large amounts of factual information to a passively receptive audience (Long & Lock in Swanick, 2010,). Although they can be thought provoking and on occasion stimulate debate, their impact on deep learning, behaviour modification and inspiring interest however are less well documented. This is the main shortcoming of lectures. Structure, preparation and use of visual aids can be key to help optimise the success of a lecture and subsequent experience for the students. Active learning, a student-focused learning theory, forces students to think about and engage more with what they are doing in order to learn effectively (Bonwell & Eison, 1991). Students appear to prefer didactic teaching that incorporates active learning techniques, however in practice this can be difficult to achieve (Luscombe & Montgomery, 2016).

With regard to the safe use of medicines, lectures have an important role to play in helping students to develop the underpinning knowledge (i.e. pathophysiology of disease and fundamentals of CPT) that is a prerequisite to selecting and prescribing appropriate medication. Although useful in their own right, lectures are perhaps best used as part of multifaceted educational interventions, in conjunction with other methods that promote and bring active learning to the forefront. An example would be whereby a lecture is used initially to lay the foundations or set the scene for the proceeding part of the intervention such as case study, Inter Professional Education (IPE), simulation, which are discussed individually below.

Problem Based Learning (PBL)

Problem based learning has become a mainstay within medical education internationally. In PBL, a form of collaborative learning, in which a patient problem takes a central role: it acts as a stimulus for group discussion, during which, students utilise problem solving and clinical reasoning skills prior to identifying their own learning needs (Albanese in Swanick, 2010). A period of self-study follows to seek out the knowledge necessary to solve the problem and a group discussion to refine and summarise what has been learned (Albanese in Swanick p37). The process allows students to not only acquire new knowledge but understand the relevance of the underlying scientific knowledge and their application in clinical practice (Wood in Cantillon & Wood, 2010). The group-work aspect of PBL also helps prepare students for working in inter-professional teams for their future careers as junior doctors and beyond.

There are some variations of PBL detailed in the literature; however the common characteristics according to Dolmans et al. are:

1. Learning stimulated by a problem
2. A tutor to facilitate the learning
3. Interaction stimulated by group work

The theoretical basis of context learning primarily supports PBL, and is most probably one of the reasons it has grown in popularity and shown dominance within medical curricula: the basic premise for its use is that when material is learnt in the context of how it will be used in future clinical practice it promotes learning and improved ability to utilise what was learned in future practice (Albanese in Swanick p46). Simulation and case-based learning have close links with PBL, and are discussed individually below.

Simulation

There is a common misconception that simulation is concerned only with technology exclusively being used to mimic the clinical experience i.e. computer controlled patient simulators. It actually involves techniques that focus on cognitive and affective processes in addition. When used appropriately it can be used for novices or expert safe practitioners and learners at every stage in between (Ker & Bradley in Swanick, 2010).

Simulation can take many forms and although may utilise technology; it is - not dependent on this. Furthermore, simulation is not limited to physical space or setting, a set of clinical skills, interactions between learners, etc. Arguably the most important driver for simulation development has been improving patient safety, however a number of factors are also implicated too: namely political, social and professional pressures. (Ker & Bradley in Swanick 2010)

It is no surprise that the use of simulation in medical education is becoming more widespread as it provides a safe, learner-centred approach to learning. In addition it can be used to prepare students to agreed levels before they have contact with patients in clinical years, or fill the gap where due to changes of healthcare delivery within the NHS, students may not be exposed to as many learning opportunities in practice.

In the past, the usefulness of learning opportunities for prescribing during final year clinical placements where students assist F1 doctors has been recognised (Monrouxe et al., 2014). However, with an ever-increasing reliance on electronic

prescribing systems in NHS hospitals, the potential negative consequences on the availability of such learning opportunities for medical students cannot be overlooked. Medical schools therefore have a duty to address this barrier to prescribing skill acquisition within the curriculum. One solution to this may lie in providing more targeted teaching, using simulation for practical prescribing at the undergraduate level, which could lead to an improvement in patient safety and fewer prescribing errors in the future.

Case based Learning

Case based learning is another form of collaborative learning. It is more flexible than PBL, but has many commonalities with it, and can help with the development of clinical reasoning and judgement skills (Cantillon & Wood, 2010, p13). The group sets to work on cases, which are typically based on real patients, in a similar manner as PBL to discuss the background of the case, presentation, differential diagnosis, subsequent investigations and potential treatments. The cases are usually selected to encourage students to learn about a particular condition. Learners value the relevance of the cases and they can be tailored by teachers to illustrate specific learning points (McKimm & Jollie, 2010).

Workplace based learning

With certain complex skills it is often best for students to learn by observation and by doing i.e. experiential learning. Klob (1984) derived his theory of experiential learning from Lewin's initial conclusions that learning occurs best in an environment, where concrete experiences, reflections and subsequent conceptual models are considered (Kaufman & Mann in Swanick, 2010). Klob (1984) suggests that rather than being fixed, ideas are influenced by past experiences, and it is this belief that underpins reflective practice, which along with practicing skills and receiving constructive feedback on performance, helps the student develop as a professional (McKimm & Jollie, 2007)

Peer teaching

Peer teaching is the practice of one or more student (usually a senior) being involved in the teaching of more junior undergraduate students, and can occur in either the classroom or clinical setting (Cantillon & Wood, 2010). Although growing in popularity in medical undergraduate education, its use with regard to prescribing is less certain. Much has been written and discussed previously about how unprepared final year medical students feel about undertaking the task of prescribing, despite it being a fundamental skill required of junior doctors (Heaton et al., 2012, Illing et al., 2008, Tallentire et al., 2011). It would therefore seem inappropriate to task senior students with teaching something they themselves struggle with to their junior counterparts. They could offer advice in a more informal manner on what resources would be useful instead, but it is difficult to justify peer teaching beyond this until such a time that evidence emerges showing its use in relation to prescribing.

e-Learning

Invariably, the emergence of novel technologies coincide with claims that teaching will be enhanced and the learning process will become almost effortless (McKendree in Swanick, 2010). Electronic learning, more commonly known as e-learning, can certainly, and when used appropriately, enhance the experience for teachers and students alike. The term itself is quite broad and can refer to any computer-aided approach in the delivery of related content i.e. virtual learning environments (VLEs), content from the internet, software packages.

As with any educational intervention, the success of many of these technologies will depend not only on the quality of the resource itself but also on the degree of student engagement, and the level of deep learning that is subsequently undertaken by the learner.

With regard to safe prescribing many e-learning resources have been developed to supplement learning, including the BPS's Prescribe online resource, electronic drug Formularies (Maxwell et al., 2006), and the Script package an NHS Health Education England (HEE) resource utilised locally in the postgraduate arena in the

Kent Surrey and Sussex (HEKSS) region. Various medical schools also have their own in house online safe prescribing resources available to support student learning, such as BSMS' SmartDrug.

Practical prescribing and simulation

Dornan et al. concluded that the paucity of training in practical prescribing coupled with doctor's unfamiliarity with drug charts are both contributing factors that can bring about prescribing errors. It was recommended that education in practical prescribing be offered to all foundation year one trainees, and furthermore practices related to prescribing should be provided during induction (Dornan et al. 2009). This would be seen to tackle the active failure to address the association between theory and practice. One shortcoming of this however is that the recommendation was made for F1 training only, despite F2s having the highest prescribing error rate. Although there is a body of evidence to suggest that junior doctors' confidence increases with greater exposure, familiarity and knowledge (Conroy-Smith, 2011, Tobaiqy et al., 2007, Vollenberg et al., 2006), this does not eliminate error completely and conversely may result in an ill placed sense of confidence amongst more experienced F2s. Caution has been advised when using confidence as a predictor to competence, as these have been poorly demonstrated in the past (Ryan et al., 2013, Brinkman et al., 2015).

Junior doctors as teachers

A study in Scotland investigated the effectiveness of a programme of prescribing tutorials led by junior doctors i.e. near peers (Gibson et al., 2013). The junior doctors underwent dedicated tutor training prior to facilitating the tutorials to the final year medical students. Group numbers were controlled to maximise educational benefit for participants. Sessions began with a group discussion of the clinical case at hand before the principles of a management plan were agreed. Students then had to prescribe their plan onto drug and fluid administration charts before these were reviewed by the tutors and individual feedback given, as well as a group de-brief. The study demonstrated that prescribing confidence (albeit self-reported), knowledge and skills increased amongst students after the tutorial, and performance in end of year assessment tended to improve in those attending more

than one tutorial. Almost all student participants expressed a preference of junior doctors providing prescribing training over more senior and clinically experienced colleagues. This finding is not surprising as in theory the junior doctors are well placed in clinical practice to help develop medical students prescribing skills, and would have a better understanding of expectations of the medical students upon graduation. However, one must bear in mind that working within a busy and dynamic ward environment and having larger lists of ill patients to care for than ever before, it is not always possible for junior doctors to find dedicated time to provide this teaching. Medical schools may need to look at adopting more formal sessions such as those used in the Scottish study. Other obstacles to the delivery of effective prescribing teaching, as the researches acknowledged, are that junior doctors are early career professionals and as such lack prescribing and in particular formal professional teaching experience. Medical schools would have a responsibility to mitigate these factors before they rely on junior doctors to teach prescribing more formally.

Postgraduate medical education:

The transition from undergraduate student to postgraduate junior doctor has been discussed above. Considering that junior doctors not only prescribe the majority of prescription in NHS hospitals, but they routinely do so with minimal supervision from their seniors, it is concerning that there are no agreed national or regional standards for the training of junior doctors in safe prescribing. The UK Foundation Programme Curriculum 2012 specifies a list of competencies that must be achieved but a great deal of autonomy is afforded to each NHS Trust as to how they ensure that trainees meet these learning outcomes and demonstrate themselves to be proficient practitioners capable of appropriate management of common and important presentations, capable of prescribing accurately and unambiguously. There are no accounts in the literature documenting the training provisions for prescribing or safe use of medicines to the foundation doctors in the UK, hence it is impossible to comment further on the appropriateness of this.

Fortunately, it appears that learning in the applied setting helps boost confidence in prescribing, (Rothwell et al., 2011, Conroy-Smith et al., 2011), although this is

often reflective of the routine and prescribing norms forming part of the particular attachments (Tobaiqy et al., 2007).

In cognitive science confidence in decision-making can broadly be paralleled with “self-efficacy” which was first suggested by Bandura (1986). This concept relates to a person’s judgement of their own abilities to manage and implement a plan in order to accomplish a particular performance. It is believed that self-efficacy is a manifestation of an individual’s evaluation of their or their colleagues’ knowledge, experience either positive or negative in nature, and an awareness of the likelihood of adverse events occurring (Smith et al., ch8 p94).

Accounts in the literature documenting attempts to enrich the teaching and learning of safe prescribing in the post-graduation phase are sparse. In a systematic review of educational interventions to improve prescribing safety, the authors found only 2 trials that focused interventions on postgraduate paediatric residents in the USA and Canada (Ross & Loke, 2009), although the efficacy of such interventions was only proven in one of these studies.

There is a need to develop more innovative techniques such as the “check and correct” used on post take ward rounds in a West Sussex Hospital (Conroy-Smith et al., 2011). This technique not only seeks to identify errors in prescribing thus enhancing patient safety, but also aims to utilise such errors as educational episodes in a non- hostile or judgemental environment to help make the junior doctors more aware and become better, safer prescribers. Eleanor Roosevelt is credited with coining a phrase, which seems quite applicable in this setting; she said, “Learn from the mistakes of others. You can’t live long enough to make them all yourself”.

The effect of education interventions on improving prescribing

A number of educational interventions developed to improve prescribing in the undergraduate and postgraduate domains have been discussed. Ross and Loke (2009) conducted a rigorous systematic review in an attempt to evaluate their efficacy. A total of 15 trials met inclusion criteria from 3189 records identified

initially. Of these, 11 were controlled trials, and 4 were before-and-after studies. Interventions of these trials were aimed at prescribing as a whole, dose calculation and administration or a focus on prescribing errors. Six of the studies were based on the World Health Organisation (WHO) Good Prescribing Guide (de Vries et al., 1994), and although it appeared that this model improved prescribing across a range of medical schools internationally, authors concluded that further work was needed to improve study with respect to rigour of design and validity of assessment designs to conclusively determine it's true efficacy as an intervention.

The majority of studies included in the review were of poor quality due to reasons such as low participant numbers and interventions aimed at just one aspect of the prescribing process or used at a single centre thus affecting generalisability of findings.

The overall finding of the review showed moderate evidence to inform which educational interventions medical schools could include in their curricula to improve prescribing practices amongst their undergraduates.

The finding that the quality of the evidence reviewed was insufficient to draw clear definitive conclusions, prompted McLellan et al. (2012) to explore the extent to which undergraduate prescribing education prepares students for prescribing in the workplace. In seeking to identify what makes an intervention “successful” or not they developed a theoretical model to represent the intricacies associated with conducting complex skills. The authors argue that because graduates are required to prescribe immediately from the point of graduation that it is not acceptable that they are merely “adequate” in the atomized components of the prescribing process, but should have demonstrated expertise: meaning that they can adapt to uncertainty, think strategically and have the ability to respond to the related qualities of different workplaces while all the time scrutinising and self-regulating their own performance (Figure 1.4). The model they developed, was refined from existing theories of expertise development (Batalden et al., 2002, Bereiter et al., 1986 & 1993, Moulton et al., 2007), and takes into account the intrinsic complexities associated with prescribing, the social context and how the two are

related. The educational interventions were examined on the basis of what components of their theoretical model that the intervention addressed.

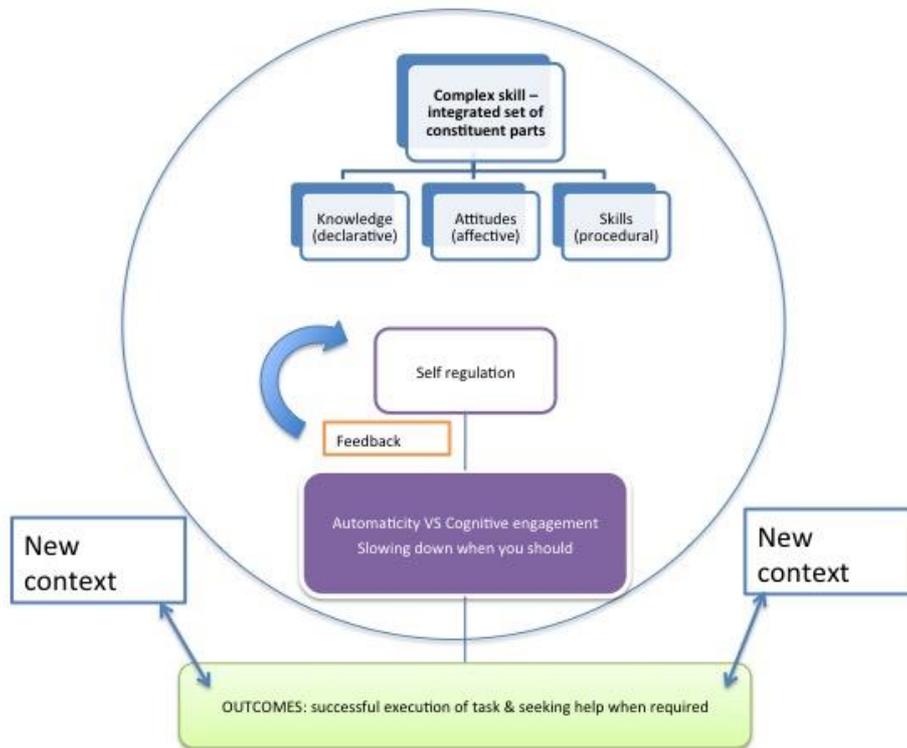


Figure 1.4 : Theoretical model for complex skills based on theories of expertise development (McLellan et al., 2012)

Findings indicated that educational interventions mainly focus on improving skills and knowledge, but ignored the context in which these are applied in practice (McLellan et al., 2012), despite acknowledging the importance of the “transfer of context” effect.

The various methods introduced in the undergraduate and postgraduate setting to address poor prescribing standards have been discussed previously, and it has already been stated that the long-term benefits of such methods remain to be proven. However considering the nature of many common errors made in both primary and secondary care, education `remains an obvious strategy to minimise those deemed preventable (Dornan et al., 2009).

Lack of standards in training in safe/ practical prescribing for junior doctors

Both the General Medical Council (GMC) and the British Pharmacological Society (BPS) have developed guidelines which underpin the teaching and learning of safe prescribing at undergraduate level but surprisingly, there are no regional or nationally agreed standards for the training of junior doctors in safe prescribing, considering the scale of prescribing errors in the NHS hospitals. The UK Foundation Programme Curriculum 2012 specifies a list of competencies that must be achieved but autonomy is afforded each NHS trust as to how they ensure that trainees meet these learning outcomes and demonstrate themselves to be proficient practitioners capable of appropriate management of patients and prescribing accurately and unambiguously.

In addition, the National Prescribing Centre (NPC) has developed a single competency Framework for all prescribers (NPC 2012), which has been superseded by Royal Pharmaceutical Society's Framework for all Prescribers (RPS, 2016). The framework shown below in Figure 1.5 demonstrates what good prescribing entails. There are now two over-arching domains (previously three), within which sit contain ten competencies. These ten competencies are further elaborated on to describe the activities the society deems underpin effective prescribing. This competency framework is used in the training of non-medical prescribers, who were found to have a lower error-prescribing rate than foundation doctors (Dornan et al., 2009). Interestingly, it is not clear to what extent, if any, the competency framework has been embedded into medical prescribing educational programmes.



- THE CONSULTATION**
1. Assess the patient
 2. Consider the options
 3. Reach a shared decision
 4. Prescribe
 5. Provide information
 6. Monitor and review

- PRESCRIBING GOVERNANCE**
7. Prescribe safely
 8. Prescribe professionally
 9. Improve prescribing practice
 10. Prescribe as part of a team

Figure 1.5 Competency Framework for all prescribers (Royal Pharmaceutical Society, 2016)

Curriculum design

Much is written about curricula in the literature, however finding a definitive definition as to what embodies one is a more difficult task. The process of curriculum design itself is no exception, being described as “an imprecise and arbitrary rubric” (Jolly & Rees, 1998). In its simplest form a curriculum is everything that a learner experiences to allow them to attain their intended achievements from the course. (Grant, in Swanick, 2010) It should outline the course structure, intended learning outcomes, content, teaching and learning, supervision and feedback, and assessment procedures of that educational programme, i.e. it should outline what is expected of both the teachers and the students. However the way in which a curriculum develops will depend on the designer’s views about

how students learn, societal needs, developments in the subject area i.e. how medicine is developing and being practiced.

Little evidence exists for the supremacy of a particular design of a curriculum or indeed for individual teaching and learning approaches.

UK medical schools prescribing curriculum

The British Pharmacological Society (BPS) has been, and continues to exert a huge influence on CPT education in the undergraduate and postgraduate arenas in the UK; taking a particular interest in the development of prescribing skills. The BPS has worked alongside the General Medical Council (GMC) and Medical Schools Council (MSC) to develop curricula to support more effective teaching of this crucial skill to medical students, as well as been central to the development of the national Prescribing Safety Assessment (PSA), which will be discussed in more detail below. The proceeding paragraphs will discuss the development of the core curriculum in CPT specifically and its subsequent refinement over the years.

A core curriculum for safe and effective use of medicines

Guidance from the GMC in the early 90's, resulted in undergraduate curricular changes in medical schools across the UK, previously discussed. Outcomes relating to safe use of medication were broad and referred to principles of therapy: including drugs action, their prescription and administration [paragraph 42] (GMC 1993). As discussed above, the visibility of CPT within undergraduate medical courses diminished. In an effort to maintain some prominence therein, the clinical branch of the BPS developed a core curriculum for CPT to help guide medical schools and their students as to the essential skills, knowledge and attitudes to not only become safer prescribers, but to remain so throughout their professional medical career (Walley & Webb 1997). This was based on research from the USA, and used a Delphi process, which is a renowned method for achieving group consensus on a topic, whose expert panel consisted of clinical pharmacologists with a special interest in education (Walley & Webb, 1997). A summary of the core curriculum produced is given in the following table (1.3).

Table 1.3. Overview of first BPS core curriculum (Walley & Webb, 1997)

Knowledge (16 items)	Skills (14 items)	Attitudes (4 items)
1) Core knowledge (including mechanisms of action of drugs) 2) Clinical pharmacokinetics 3) Monitoring drug therapy 4) Adverse drug reactions 5) Drug interactions 6) Pharmacogenetics 7) Prescribing in paediatric patients 8) Prescribing in the elderly 9) Prescribing in pregnancy or breastfeeding women 10) Prescribing in renal disease 11) Prescribing in hepatic disease 12) Generic approach to treating a poisoned patient 13) Regulations of prescribing 14) Process of drug development (including testing and approval processes) 15) Practical criteria selecting drugs within a therapeutic area 16) Routes of administration	1) Clinical pharmacokinetics 2) Adverse drug reactions 3) Drug allergy (including recognition and management) 4) Drug interactions 5) Seeking information i.e. reference sources 6) Therapeutic drug monitoring 7) Prescribing for elderly patients 8) Prescribing for pregnant and breastfeeding women 9) Routes of administration and various drug formulations 10) Writing a prescription and keeping records 11) Evidence based use of medicines 12) Learning about new drugs 13) Communicating with patients 14) Understanding about patient adherence to therapy	1) The process of optimal therapeutics i.e. developing a logical approach 2) Balanced approach to drug prescribing i.e. between benefit and risk 3) Learning for the future i.e. adapting to changes in CPT 4) The prescription as an experiment i.e. treat each prescription on its own merits

An update to guidance published in Tomorrow's Doctors was issued by the GMC in 2002, and although this provided clearer direction with respect to CPT outcomes, the guidance was nonetheless still quite broad, with overarching outcomes listed rather than specific skills and knowledge, such as:

- Item 16: Basis of prescribing being effective and safe use of medicines (GMC 2002)

- Item 18: Evidence based medicine, how patient views impact therapy (GMC 2002)
- Item 19: Be able to work out drug dosages, write a safe prescription for various drugs (GMC 2002)
- Item 4 and 26: Recognition of how drug errors happen and their management (GMC 2002)

Recognising a need for expanding these statements, the BPS, a key driver of the publication of the core curriculum in 1997, put forward their view on how the learning objectives as set out by the GMC (2002) could be achieved, and so extended the core curriculum in 2003 (Maxwell & Walley, 2003). The main additions to the curriculum was (a) advice on how CPT could be delivered within existing curricula and (b) the element of using a student formulary so students could focus their learning rather than become overwhelmed by the number of medicines encountered in clinical practice. They proposed this list would comprise of 80-100 commonly used drugs to be selected by the students, and for each, the student should know the class, understand the mechanism of action, indications and contraindications, common interactions, side effects, know how to prescribe it i.e. frequency and duration, be able to name an alternative, know how to monitor the effects of the drug (harmful and beneficial), and finally be able to communicate the relevant information to the patient or their carer. They stressed the importance of newly qualified doctors not being expected to know specific doses but rather look them up in appropriate reference sources.

The notion of a personal list or formulary has been shown to be effective (de Vries et al., 2008). Findings from a study indicated that the use of personal drug lists (formularies) and subsequent prescribing information improved prescribing skills amongst undergraduates (de Vries et al., 2008). Findings were irrespective of the list being initiated by students or teachers. One criticism of the tutor led lists was that they were typically not derived with a focus on drugs commonly used in clinical practice. Baker et al. (2011) developed a list of 100 drugs that are commonly prescribed, and associated with prescribing error, by looking at

prescribing patterns in primary and secondary care, and those associated with acute care guidelines in a London hospital. The list they developed had been stable over a period of at least 2 years, but would require regular updates to reflect changes in prescribing patterns. It remains to be seen what the optimal time to introduce such lists to students during their undergraduate degree would be.

The authors of the 2003 core curriculum supported the integration of CPT within the undergraduate curriculum, however, in recognition of the challenges associated with acquiring prescribing skills, called for greater visibility and having CPT identified vertically whilst integrating within horizontal modules. This would be the basis of grounding students in core knowledge, skills and attitudes required for the high fidelity task of prescribing (Maxwell & Walley, 2003).

The BPS Core curriculum 2012

In 2009 The BPS began work on producing learning outcomes specifically for prescribing for UK medical students to meet prior to graduation (Ross & Loke, 2009). They used a 2 round, modified Delphi approach to reach consensus on 50 learning outcomes, which were derived from the literature and suggestions from panel members, for the curriculum. Six new outcomes were listed that were not present in the 2003 curriculum, and related mainly to individual patient factors that may affect therapy choice, and the need to review prescriptions.

The results of this study, in conjunction with the previously proposed curricula, culminated in the form of the BPS curriculum in clinical pharmacology and prescribing for medical students in 2012 (Ross & Maxwell, 2012). This provided the clearest outline of learning outcomes relating to CPT and prescribing, and outlined how curricula could enable graduates to meet these outcomes. Authors discuss the potential delivery within PBL and more traditional medical courses, but are not descriptive in what exact teaching and learning methods would best be employed, except references to pre-prescribing (final year medical students writing prescriptions on actual drug charts which need to be validated by a doctor), tutorials, and simulation in augmenting prescribing at the undergraduate phase (Ross & Maxwell, 2012).

Prescribing Assessments

The need for valid and reliable assessments of prescribing competence is multi-fold. First and foremost from an educational point of view, assessments have many uses. It is a longstanding axiom that assessment drives learning. However this is not the sole purpose, as they can also be utilised to measure the success of teaching provided, identify future training needs, and indeed gaps in current teaching programmes (Mucklow et al., 2012). Furthermore, such assessments afford a degree of assurance to patients and employers that their doctors are equipped with the necessary knowledge and skills to safely prescribe medication. Issues of patient safety and clinical governance in the UK are under scrutiny now more than ever in the wake of damaging reports of poor standards of care within the NHS (Francis 2012), hence assessments could act as a driver to nurture higher standards of accomplishment in regards to safe and effective prescribing.

Prescribing is a complex, multifarious skill that occurs in a dynamic environment. To prescribe safely and effectively, one must possess the underpinning knowledge whilst simultaneously applying clinical judgement and carrying out the practical aspects of the skill (Ross and Loke, 2009). This multifaceted process makes assessment more difficult. Theoretically prescribing assessments conducted in practice would be the most effective method and the most representative of real life scenario, it would not be safe nor ethical to do so in reality. Assessment of safe prescribing has come under much scrutiny, and efforts have been made on local and national level to address this.

According to Tomorrow's Doctors assessments should be fit for purpose so that graduates are robustly assessed at appropriate time points during the curriculum ensuring only those who fully meet the outcomes for graduates are permitted to practice. If full registration is to move to the point of graduation from medical school, as proposed by the GMC (Greenway et al., 2013), then adequate assessment of safe prescribing will be of paramount importance.

The National Prescribing Safety Assessment

The British Pharmacological Society in collaboration with the MSC Assessment division have developed a validated, national assessment for ensuring that graduates can competently and safely prescribe. The Prescribing Safety Assessment (PSA), is as an open book, online, pass/fail assessment for final year medical students, of the skills, judgement, knowledge required to safely prescribe medication in the NHS in the UK (Maxwell et al., 2017). It covers the main competencies expected of a newly qualified doctor such as writing new and reviewing existing prescriptions, dose calculations, identifying and avoiding medication errors and adverse drug events, across 8 sections (Figure 1.6).

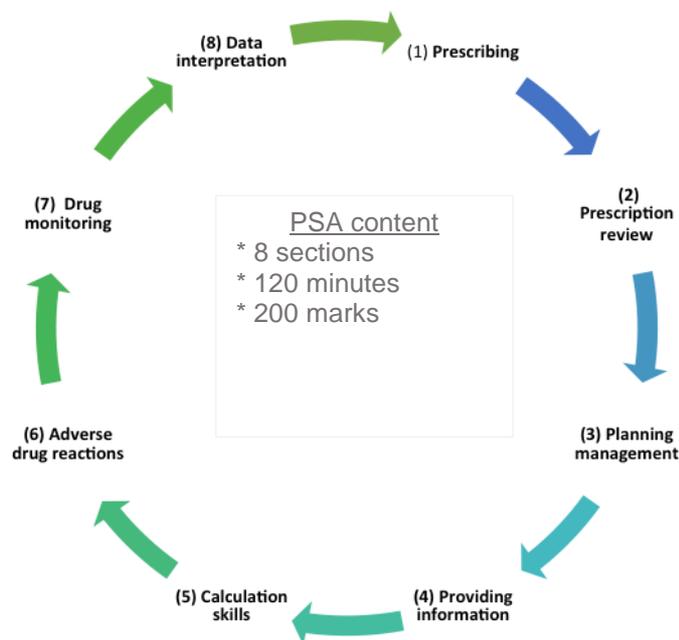


Figure 1.6: Structure of the national PSA in the UK

Many see an assessment as the endpoint or final piece of the curricular puzzle. However it would seem more astute to consider assessment much earlier in the process of developing a curriculum, and place it at the heart of what and how the subject at hand is taught. There are two prominent educational credos regarding assessment: “assessment drives learning” and “students do not learn what you expect, students learn what you inspect”. It would therefore stand to reason that having an awareness of this aspect of human behaviour i.e. motivation, could

facilitate educators designing assessments that would ensure students were learning what and how they wanted to. (Schuwirth & van der Vleuten in Swanick, 2010). With this in mind, the advancement of the national PSA takes on a more important slant. Organisers must ensure that these assessments are frequently refined and continue to inspect those aspects of the prescribing process that medical teachers feel need most attention as these will invariably be the things that medical students focus on in preparing for the assessment. There is currently no data in the literature documenting student views about the PSA, and their perceptions as to how the PSA helps with practical skill acquisition. This thesis will aim to fill this gap in the literature.

However the impact of acquiring practical experience on prescribing safety cannot be under-stated. Findings by Ryan et al. (2013), act to reinforce previous findings by Rothwell et al. (2011), which demonstrated that confidence increases with increased exposure, familiarity and knowledge as discussed previously. Historically, clinical attachments and placements afforded the medical undergraduates exposure to and the opportunity to undertake certain prescribing tasks such as transcribing drug charts. With the implementation of electronic prescribing systems in many NHS hospitals now underway, this will pose obvious challenges to the undergraduates' development that medical schools need to be aware of and respond to. Medical schools will therefore need to recognise this as a potential barrier and be prepared to look at methods which might address this void in terms of practical prescribing skill acquisition.

Student engagement

As with any aspect of curricular design, or methodology a medical school may employ, the key in successfully using any of these tools is not about using a resource simply because it is in vogue without it being fit for the educational purpose within that particular context, i.e. will the tool actually enhance or support the student's understanding on a given topic. By serving a purpose its appeal to the students is likely to be greater, as will the motivation to engage with the resources/ learning materials. The matter of student engagement becomes relevant because ultimately the success of the curriculum, a teaching method, or

an educational intervention will depend on the primary users of the service (Ellis et al., 1993).

The correlation between student engagement and achievement or success is well established (Trowler, 2010), with motivation and academic preparation being cited as some of the best indicators as to whether students will graduate or not (Pascarella & Terenzini, 2005). When background student characteristics are controlled for, student engagement is the next best predictor of success and satisfaction in higher education (Kuh et al., 2005, Kuh et al., 2007, Pascarella & Terenzini, 2005).

Student engagement is defined in terms of two key components. The first is, “the amount of time and effort students spend on academic activities and other activities that lead to the experiences and outcomes that constitute student success. The second is the ways in which institutions allocate resources and organise learning opportunities and services to induce students to participate in and benefit from such activities” (Kuh et al., 2005).

It has been said that to achieve quality in higher education teaching one must chiefly satisfy the primary user of the service, i.e. the students (Ellis et al., 93). Although the issues regarding the reliability of student perceptions of teaching provisions are documented, they cannot be overlooked completely. Identifying what students believe is being taught is arguably as important an aspect of curriculum review as any other. For instance, if students do not believe that the curriculum is actually delivering what it purports to i.e. face validity, then this could negatively impact on their engagement with and subsequent success of the curriculum. This thesis will look at student views on the teaching and learning activities they are exposed to during the undergraduate degree.

Evidence for standardising teaching

In relation to prescribing, the European Association of Clinical Pharmacology and Therapeutics (EACPT) have called for improved and more harmonised teaching at both the undergraduate and post-graduate phases across Europe (EACPT 1993).

They have not only highlighted the variation in teaching practices both across and within countries in Europe (Brinkman et al., 2016, Brinkman et al. 2017), but also the lack of prescribing competency amongst final year medical students (Brinkman et al. 2017).

There is no literature to support the dominance of adopting a standardised curriculum. However harmonising the approach adopted by medical schools could be a beneficial approach, and is one supported by the EACPT.

Relevance of this research project - a summary

Despite the work done to try address poor prescribing practices in the UK, it remains a significant problem and threat to patient safety. Research has identified some of the causative factors for poor prescribing as environmental and related to demanding workloads. Considering the current economic climate, and the fact that the NHS is facing further funding cuts it is unlikely that already over worked and stretched junior doctors will see improvements in working conditions in the foreseeable future. Evidence has shown that technology can have a positive impact on errors in the various stages of the prescribing process (Agrawal, 2009), however one must not become complacent in thinking that electronic prescribing will eliminate error completely. It is possible that the types of errors seen after the widespread introduction of electronic prescribing systems will be different in type to those seen on paper based drug charts. Efforts must instead be targeted towards gaps in prescribing education and in helping to prepare them for working in such demanding environments when they graduate.

The BPS developed a core curriculum for CPT, in which they do focus on the teaching of prescribing within the undergraduate course (Ross and Maxwell 2012). This was devised using an expert panel via the Delphi method, however the student voice was not part of its development. As discussed above better engagement with learning activities could result in better outcomes, and perhaps an improvement in prescribing skills.

The publication of the Shape of Training report, proposing to move the point of full registration of doctors to graduation from medical school (Greenway et al.), has further put the teaching and learning of practical prescribing under scrutiny. Proposing such a radical change to doctors' registration raises the obvious question of how to optimise the teaching and learning of practical prescribing in the UK, particularly as there are fewer learning opportunities on electives as discussed above. Now is hence an optimal time to consider the introduction of a focused programme of study that would not only outline core content and learning outcomes, but advise on possible methods that are both acceptable to students, and deemed appropriate by educators, and a group of experts in the field of prescribing and medical education.

A prelude to achieving this may lie in gaining a better understanding of the current state of affairs in the UK as reported by the medical students, prescribing leads at the medical schools, junior doctors and those responsible for prescribing training in NHS hospitals. It should be noted that it was not possible to obtain the feedback given by students regarding the national PSA so other strategies had to be investigated. Once a clearer picture of current practices is obtained it is possible to propose a set of learning objectives and core content items for a programme of study for practical prescribing to an expert panel to achieve consensus in order to advise on appropriate methodologies.

Overall aims of this thesis

This research project set out to identify the current teaching and learning methods with regard to practical prescribing in the UK, and to ascertain their perceived value to the stakeholders at the undergraduate and postgraduate level. Following on from this, consensus regarding the content of a dedicated programme of study for practical prescribing for medical undergraduates was sought. To achieve these aims the overarching project was subdivided into 3 separate studies: undergraduate provisions nationally, postgraduate provisions locally, and finally derivation of a programme of study for practical prescribing using the Delphi group method.

Research questions arising from the review?

1. What teaching and learning methods are currently utilised in the UK, and what is the perceived value of these to students/ educators?
2. Is it feasible to construct a consensus strategy and curriculum on “Safe Prescribing”?

What issues will be discussed throughout the thesis (brief description for each chapter)

- This thesis will follow the stages involved in the development of a programme of study for practical prescribing. This chapter has provided an overview of prescribing errors, an overview of higher education and the merits of various educational interventions trialled in relation to safer prescribing to address these and where this piece of work fits in to this picture.
- Chapter 2 will outline the methodologies utilised throughout the completion of this doctoral thesis, and where these fit in with the philosophical views of the researcher.
- Chapter 3 will explore the current teaching and learning provisions of practical prescribing in the UK medical schools from the medical student’s perspective. Results of the nationwide questionnaire and subsequent focus groups with a sample of medical students from the south east of England will be reported. The provisions and perceptions of practical prescribing teaching and learning from the students’ point will be discussed in relation to existing curricula described for CPT in the UK.
- Chapter 4 will expand on the findings from chapter 3, but focus on the provisions of practical prescribing teaching and learning from the medical schools viewpoint. Again results will be discussed with current recommendations and proposed curricula in mind, and differences between what students reported will be highlighted.

- Chapter 5 will evaluate the provisions of practical prescribing training locally within the South East of England for Foundation Year doctors. The views of the foundation doctors themselves and the Prescribing Leads at the NHS Trusts in the area will be presented
- Chapter 6 will describe the Delphi study conducted, in which a panel of experts in safe prescribing teaching and learning was formed to achieve consensus on the core content and learning outcomes for a dedicated programme of study for practical prescribing. Views from the experts regarding possible methodologies will also be presented.
- Chapter 7 will provide an overall discussion from the findings of the individual studies that make up this doctoral thesis, including a commentary on the extent to which the overall study aims have been achieved. Limitations of the research will be presented, and the final conclusions.

Chapter 2 – Methodology

Introduction

The discussion of how research is done and knowledge created is an important one. In the generation of new knowledge one must justify the logic behind the research approach selected and be transparent while generating it. The research approach encompasses the research design and rigorous processes required to capture, analyse and interpret data in order to answer the research question (Creswell, 2014). Determination of the research methods adopted is dependent on the study subject, and is underpinned by the philosophical assumptions not only governing the available techniques, but those held by the researcher. In other words, the researcher must process their philosophical assumptions, the research design which relates to this viewpoint and the associated methods. Therefore, when describing methodology, one must address these underlying philosophical assumptions as well as the specific set of steps taken to collect and analyse data, and translate the approach into practice (Creswell, 2014).

This chapter provides an introduction to the methodologies employed throughout this thesis, with a brief discussion and critique of the three traditional approaches to research: quantitative, qualitative and mixed methods research. There will be exploration of factors that informed the use of the methods chosen to conduct the individual studies that form this doctoral research project.

The three research approaches

Many see quantitative and qualitative approaches as distinct, rigid and dichotomous, however it has been argued that the two are merely opposing ends on a continuum (Newman & Benz, 1998, Barbour, 2014). Mixed methods research lies somewhere in the middle incorporating rudiments of the two. Creswell argues that the most appropriate way to differentiate between qualitative and quantitative research is not to look at how the two are described, but rather look at the basic philosophical viewpoints held by the researchers (Creswell, 2014). The philosophical viewpoint of the researcher is discussed below.

Quantitative research

Quantitative research seeks to objectively test well-defined theories or hypotheses, by examining the relationships between two or more variables, which are measured using standardised instruments. The resulting numerical data is subsequently scrutinised using statistical tests, which can help to explain the relationships between these variables (Creswell, 2014). It assumes that there exists a single “reality” within the phenomenon being studied, which can only be identified when that reality is measured objectively without interference from the researcher (Guba & Lincoln, 1994). This is the basis of positivist philosophy. Variables are measured objectively and without interference or any interaction between the researcher and the variables being studied. Although this philosophy has been the dominant paradigm in traditional “science” disciplines such as mathematics and chemistry i.e. within evaluation research, and contributed significantly to the growth of scientific knowledge, it does not always lend itself well to the study of the social sciences, where often humans are the subjects being studied (Guba & Lincoln 1994, McEvoy & Richards 2003, Polgar & Thomas 2013).

An acknowledgement of the limitations and impractical nature of positivism for the purpose of studying human behaviour heralded the emergence of post-positivism. This alternative philosophy, whilst retaining the fundamentals of the positivist paradigm (the assumption of a single reality), challenges the notion that the absolute truth can ever be fully attained, particularly when studying the actions or behaviour of humans (Phillips & Burbules, 2000). Post-positivists recognise the existence of different perspectives of “reality” and acknowledge that the researcher’s personal or social context can influence the judgement of what is deemed to be true or false (Polgar & Thomas, 2013).

Research designs within the quantitative paradigm

Quantitative research most often starts with a theory. Data are collected on instruments based on measures made by the participants or observations made by the researcher. The data are summarised, analysed and supports or fails to support the original hypothesis; which subsequently may need to be further refined

or abandoned altogether. Being objective is crucial, hence steps must be taken to correct for bias during all stages of the research (Phillips & Burbules, 2000). Research design approaches in quantitative research broadly include: traditional experimental, quasi-experimental (which are typically less rigorous in nature) or non-experimental (such as causal-comparative or correlational design) methods.

Experimental research within the context of health science tries to determine if a particular intervention or treatment has an impact on a particular outcome i.e. drug treatment on a disease state or physiological function. The design of the experiment can ensure that external variables that could interfere with the results (confounding factors) are controlled for. Randomisation, when it is ethically feasible and practical to use, ensures certain biases are controlled for, affording a high degree of reliability that the outcomes can only be attributed to the interventions being scrutinised, and yield high-grade evidence (Creswell, 2014, Peat, 2002). However by being too stringent about trying to control for confounding factors one can inadvertently limit the external validity of the results, that is, how they could be applied to the wider population (Trochim, 2006). Although superior in terms of merit of evidence, a randomised controlled trial would not suit the needs of this research project for various reasons. Firstly, and most importantly, it would not be ethical to randomly allocate medical students to different teaching designs and study the outcomes. Secondly, the research questions for this doctoral thesis sought to identify the current teaching and learning provisions for practical prescribing within UK medical schools, and ascertain the views of the stakeholders concerning the development of a dedicated programme of study in the field. Similarly, quasi-experiments that use non-randomised allocation into control and test groups would also not be suitable. This left the realm of non-experimental research design, principally survey research.

Survey research

Survey research incorporates questionnaires and individual interview techniques. It can be analytical or descriptive in nature, with data collection occurring with the respondents at a particular point in time i.e. cross sectional, or amongst the same

group of respondents at different intervals of time i.e. longitudinal (Calder, 1998). The selection of which is in part dependent on the specific research question being answered. Survey research does not afford the benefit of control associated with experimental research, and hence is not as suited to exploring causal relationships. It has been argued, however, that surveys can yield data that are closer to ‘reality’ than that achieved from controlled studies because surveys scrutinise phenomena in their natural setting (Oppenheim 1998).

The standard instrument for data collection within survey research is a questionnaire; which can deliver a numeric description of behaviours, attitudes, preferences, opinions and intentions of large representative samples of the population to be studied (Fowler, 2008, Creswell, 2014, Artino et al., 2014). They have been widely used in the disciplines of pharmacy practice (Smith, 2004) and medical education (O’Shaughnessy et al., 2010), and for purposes such as facilitating student feedback on courses, self-assessment and patient evaluations (Artino et al., 2014). Despite their prominence in medical education research and published work in this area, there is limited guidance on appropriate survey design. One consequence of this is lack of rigour, with poorly designed or worded questionnaires and the potential to impact the validity and reliability of results (Gehlbach et al., 2010, Sullivan, 2011). This issue is discussed in more detail below. The benefits and limitations of questionnaires are summarised in Table 2.1.

Table 2.1 Advantages and limitations of questionnaires

Advantages	Limitations
Allows for large amounts of information to be collected from a large sample of the population quickly and cheaply	By asking a limited amount of information without explanation data are artificially created by the researcher
Results can be quickly and easily quantified, made easier by use of dedicated computer packages	No way to measure or control for how truthful the responses are
Analysis takes more objective and scientific approach than other methods	Does not easily facilitate capture of some types of information
Once quantified, data can be used in critical analysis of other research or measure of change	Many questions require subjectivity in responding
All participants given equally opportunity to give their feedback anonymously	Respondents may read, interpret and therefore respond to questions differently

Questionnaires can be administered in person or remotely via the Internet or telephone, and can be completed by the respondent themselves or by the researcher (Fowler, 2009). By removing the face-to-face interaction between researcher and respondent, self-completion questionnaires remove researcher bias or influence, and this was the approach adopted for questionnaires throughout the completion of this doctoral research. Questionnaires must undergo extensive quality assurance to ensure the data collected are valid.

Validity of questionnaires

Validity refers to an estimate of the accuracy of the data or study results, and can be classified broadly as internal or external. Internal validity refers to the extent to which the data collection tool captures the data it set out to (face validity and content validity being two important aspects of this). On the other hand, external validity is the extent to which the results obtained are a true reflection of and can be applied to the wider population (Peat, 2002).

Prior to dissemination, questionnaires need to be quality assessed by a panel to ensure that the questions being asked are relevant, acceptable and appropriate to

help answer the research question. Ensuring internal validity enables the researcher to be assured that the respondents will not find themselves in a position where they are unwilling or unable to answer certain questions (Peat 2002 p108). Throughout this doctoral project, all questionnaires used were scrutinised not only by the research supervisory team but also by an independent ethics panel, providing appropriate internal (face and content) validity.

Questionnaire design in this doctoral research project

Semi structured questionnaires were utilised throughout this doctoral research project, with greater emphasis being placed on closed questions. The reason for this is that the researcher sought to capture specific information on teaching and learning provisions, with answers being restricted to those that fit into categories pre-defined by the research team, i.e. place and year of study/ work, whether particular teaching and learning methods are offered or not. Use of a rating scale (Likert scales) facilitated the capture of ordinal data: these were used to determine level of agreement or the measure of attitudes or emotions i.e. rank of perceived effectiveness of various teaching methods. Open-ended questions were included to yield richer feedback and allow participants to elaborate on the quantitative responses, i.e. allowing the participants the freedom to explain their views or thoughts using their own words. Typically, open-ended questions reap a greater qualification in response as they allow for issues or themes to emerge from the respondents that were not foreseen by the research team and included as part of the pre-set answer options.

For the purposes of this doctoral research project it was decided to utilise electronic questionnaires where possible (although paper copies were available upon request). Questionnaires were developed using Bristol Online Surveys software. Electronic surveys afford the benefits of being both time and cost effective in comparison to paper-based formats, therefore facilitated the dissemination throughout the UK in a cost and environmentally neutral manner. In addition, this medium has not been found to have a negative impact on response rate in comparison to traditional paper based questionnaires (Walt et al 2008.). Bristol Online Surveys (BoS) is a purpose built website to facilitate development

and deployment of e-questionnaires for academic research, education and public sector organisations (BoS website). It was selected as it has a number of advantages, including having a “.ac.uk” url, which its main competitor, “Survey-monkey” lacks. This was considered important as the doctoral thesis was investigating teaching practices and provisions at higher education institutions throughout the UK, and the researcher felt an academic url added credibility. Most importantly, BoS also is fully compliant with UK data protection laws meaning the data collected is owned by the researcher not BoS. In addition, it had successfully been used previously by researchers at BSMS Division of Medical Education (DME), and was freely available via an institutional license agreement.

The specific questionnaires and associated data analysis used throughout the various stages of this doctoral project will be discussed within each data chapter (Chapters 3 to 5), in the context with the specific research questions for that particular study.

Qualitative research

Qualitative research aims to explore and gain an understanding of the meaning participants place on their own experiences of the world around them. It asks and answers different types of questions about beliefs, understanding and processes, but is not concerned with outcomes or causal links (Barbour 2014). The processes involved in conducting qualitative research are more iterative. It is not uncommon for the researcher to review the design, methods or research questions as the project progresses. Its’ use is common across many disciplines and has also been used to investigate causes of prescribing errors by use of interviews (Dean et al. 2008, Lewis et al 2014).

The key to the success of qualitative research is an acknowledgement of how one’s previous life experiences, research experience, and personal/ professional background can influence how the research is framed or conducted. This is termed as being “reflexive” (Barbour, 2014). Reflexivity marks the departure between the positivist focus on attempting to be objective or neutral and the constructivists’ focus on being subjective. By acknowledging or setting out one’s

position from the beginning this allows transparency so others can determine to what extent such views may have impacted how the research was conducted or analysed in an informed way (Barbour, 2014).

The underpinning philosophical viewpoints surrounding qualitative research are more complex than that surrounding quantitative research. Qualitative research has no distinct paradigm or methods that are entirely its own (Denzin & Lincoln 2000, and 2011). The topic of qualitative traditions is contentious; dividing opinion across different disciplines of practice. This is reflected in the variation observed in how research is carried out across the different disciplines. Barbour comments that this stems from:

“different disciplines focusing on their own theoretical and substantive concerns and developing their own distinctive styles of engaging with the broad traditions outlined”

One categorisation in qualitative analysis concerns itself with ontology, which is the nature of reality. There are two overarching ontological positions: realism and idealism. Realism is based on the notion that there is a distinction between the way the world is, and of people’s beliefs or understanding of that external reality. Idealism, on the contrary, states that no external reality exists independent of our understanding or beliefs (Ritchie et al., 2013).

Historically qualitative research originates from anthropology, sociology, and the humanities. Denzin and Lincoln (1994) categorises the four interpretative paradigms underpinning qualitative research as feminist, critical, positivist and constructivist. An alternative set of paradigms underpinning social science specifically was proposed by Lincoln et al.; positivism, post-positivism, critical theory, constructivism and participatory (Lincoln et al., 2011). However, an in depth discussion of individual paradigms traditionally associated with qualitative research is beyond the scope of this doctoral thesis, as the qualitative strand forms only a minor part of the narrative throughout the research. Additionally, the usefulness of actually doing so has been called into question (Barbour, 2014). Some of the common qualitative methods are therefore discussed below, with a focus on those used in the individual studies within this research project.

Research designs within the qualitative paradigm

Techniques such as observational field studies are less often employed as a stand-alone method in modern qualitative research. Observation is the main method used within ethnography. The main benefit of this approach is that it allows the researcher to directly observe the phenomena being studied in its natural setting (Barbour 2014). This once popular method has lost favour due to increasing ethical requirements, particularly issues surrounding consent. They do however still have roles to play in understanding aspects of professional practice or leisure activities (Barbour 2014). This method was not deemed suitable for the purposes of this doctoral thesis, as a “fly on the wall approach” would not lead to a better understanding of the teaching and learning practices for prescribing in the UK. The method would be too time consuming to gather a wide enough sample.

Another qualitative approach is called the nominal group technique. The participants in this technique are individually interviewed, do not interact, and often do not meet, with the other participants (Stewart & Shamdasani, 1990). This approach would yield uncontaminated individual responses and would not fall foul of group influence. However, it was felt that the group interaction and synergy that characterises some other methods (focus groups in particular), would yield a richer discussion and broader overview of the teaching provisions being investigated in this doctoral thesis.

The decision to use focus groups or interviews depends largely on the data the researcher is aiming to gather; interviews are generally the preferred method when the individual experience or narrative is being sought or eliciting a timeline of events. Some believe that interviews are best suited when the topic being investigated is of a sensitive nature, however Crabtree et al. argue that focus groups have an important role to play in creating a safe and supportive environment for participants to openly discuss topics that may be taboo within society (Crabtree et al., 1993).

Focus groups

Focus groups are a form of qualitative research that use semi-structured group discussion techniques to gather opinion or explore how the carefully selected, homogenous, group think or feel about a given issue (Krueger and Casey, 2015). They are characterised by inter group discussion, communication and interactions. First emerging in the field of communication studies exploring views regarding television and film in the 1940s, their use spread quickly to various forms of marketing, and in recent times have been used successfully in health related research (Threlfall, 1999, Wilkinson, 1998). Academics initially dismissed focus groups as a research methodology. It was felt that a group discussion setting could lead to contamination of responses, by participants knowingly or unknowingly influencing other participants, particularly dominating figures within the group, leading to a more complicated dataset (Krueger and Casey 2015). However, drawing from their experience of interview techniques and content analysis, academics slowly began to adopt this methodology to suit their own scope of practice. This was achieved by incorporating greater transparency throughout the process, introducing rigour in how data are transcribed/ recorded, coded and analysed. In addition sufficient time was allowed for the research to be conducted in comparison to those utilising the method for market research purposes (Krueger and Casey 2015). Focus groups are now more widely accepted as research methodology within academic research (Vaughn et al. 1996, Bloor et al., 2002 in Barbour 2014). The advantages and limitations of focus groups are given in Table 2.2 below.

It can be difficult to know how many groups to conduct for a given research question. It is generally accepted that the “required” number is that needed to reach saturation, which is the point when you have heard a variety of ideas but no new concepts are emerging (Krueger and Casey 2015). Three to four groups are usually planned for each category of participant, however this must also be balanced with the available resources, both time and budgetary (Krueger and Casey 2015).

Table 2.2 Advantages and limitations of focus groups (Stewart et al. 2007 P42-43).

Advantages	Limitations
Allows the researcher and the respondents to directly interact so responses can be clarified or probed more deeply when required	People may be reluctant to go against the views of the group so results may be biased towards the views of a very opinionated or dominant participant
Facilitates a synergistic effect and allows participants to respond to and build on the responses of others within the group	Researcher has less control over data generated or the group interactions
Flexible method that can be used to examine a broad range of topics	Difficult to assemble a group that is truly representative of the sample therefore results can be more difficult to generalise
Can help interpret previously obtained quantitative data	Responses from within the group are not independent of each other so may not be easy to generalise
Generate a large amounts of often rich data more quickly than would be the case with individual interviews	Open ended nature of focus groups can make summarising or interpreting the data difficult
Participants who are unable to read or write are not discriminated against i.e. useful for children or those not particularly literate	The moderator can introduce bias by deliberately or undeliberate giving cues about the types of responses that are desirable or may lead to group consensus

The composition of the group is key to its' success. As mentioned above groups should be homogenous in that they have something in common with each other, about which the researchers interested i.e. use of a programme of study. For this reason purposive sampling is the most appropriate sampling technique as it ensures that the participants are selected because they have experience of the topic under investigation (Cooper et al., 2009). Focus groups usually aim to recruit six to eight participants per group for non-commercial topics, but this number can be larger or smaller depending on the nature of the topic and the expertise of the participants, as few as 5 or as many as 10 could be optimal (Krueger and Casey 2014). Additional "mini-focus groups" with even fewer participants are becoming more popular in recent times due to being easier to recruit for.

As a methodological approach it is recognised that focus groups can facilitate the interpretation of previously obtained quantitative data (Stewart et al. 1990). Based on this focus groups were used as a follow up to add depth to the responses from the structured survey (described in detail in Chapter 3).

The Delphi technique

The Delphi survey technique first originated in the 1960s from the Californian Rand corporation, who used expert panels for the purpose of technological forecasting. The thinking behind this approach was that a group of experts, largely in agreement, were more likely to be correct about issues in their immediate field of expertise than a group of non-experts. Recognising the problems associated with group discussions and decision making, Olaf Helmer and colleagues at the Rand corporation developed the Delphi technique (Helmer & Rescher 1959).

It became the favoured approach where group consensus or judgement was being sought. Described as a “controlled debate”, this technique addresses the problems associated with group decision-making: the identity of members is protected, and opinions are weighted equally, thereby facilitating meaningful debate, irrespective of personality type (Gordon – millennium project).

The Delphi process has been used successfully in a variety of fields, including defence, business and education, but its use has increasingly been adopted for nursing, medical and health services (Kirk et al., 1996, Gibson 1998, Keeney 2000). Numerous Delphi processes are described in the literature but despite its widespread use there are many variations/ modifications to the approach (McKenna 1994, Crisp et al., 1997, Beretta 1996), and no gold standard for conducting one.

In relation to curriculum development, a modified Delphi process has been used to successfully produce various iterations of the BPS CPT core curriculum (1997, 2002, 2009, 2012), a curriculum for basic and clinical pharmacology in Sweden (Midlov et al., 2015) and more recently the in the development of an anatomy

curriculum for the UK and Ireland (Smith et al., 2016), and CPT curriculum within Europe (Brinkman et al., 2018).

The Delphi technique is an iterative multi-stage group facilitation process that utilises a number of structured questionnaires, combined with controlled feedback that translates opinions into group consensus on a particular issue. Put simply, it pools expert opinion on complex topics (Hasson et al. 2000 and 2001, McKenna 1994, Whitehead and Schneider 2012). A classic Delphi begins with soliciting the subject-specific information from the experts via qualitative methods (Hsu & Sandford 2007a, Hsu & Sandford 2007b, Linstone et al. 2002). Panellists are next asked to rate or prioritise given items, hence highlighting areas of agreement and disagreement (Lugwig 1994 in Hsu & Sandford 2007a).

In the second iteration, results are typically fed back in a quantitative manner to the panel (Hasson et al. 2000). A common and widely accepted variation of this is to use qualitative data generated from focus groups, interviews, or a review of the literature to develop a more structured, quantitative first round (Hsu & Sandford 2007a).

Kerlinger commented on the appropriateness of adopting the modified approach where basic information on the subject matter being scrutinised was available and usable (1973 in Hsu and Sandford 2007 a&b). The lack of formal or agreed guidance concerning the use of the technique and lack of standardisation is often central to criticisms concerning the rigour of the method (Sackman 1975 in Keeney et al. 2000). The key attributes of conducting a Delphi are anonymity and feedback (Gordon 1994).

Delphi versus traditional survey technique

Although the Delphi technique uses questionnaires similar to those used in survey studies, it is generally considered a more robust methodology for the rigorous enquiry of a panel, which have expert knowledge and a deep understanding of the topic in question (Okoli & Pawlowski 2004). The Delphi technique seeks to investigate questions of uncertainty and because of this will carefully select the

panel for participation to reach group consensus, where a survey often uses a random sampling technique that is representative of the wider population in question. In addition, a Delphi's panel size does not rely on statistical power calculations that are required in survey administration; it has been suggested that the knowledge held by the expert panel in relation to the phenomenon being studied is a more important factor than the size of the panel (Atkins et al. 2005). For this reason, the exact number of panellists "required" is not well defined in the literature, and is cause of much debate, with significant differences reported (Powell 2003).

Additionally, the Delphi technique facilitates the production of a consensus derived from a group decision process, which has shown to be superior to the average of individual responses that are generated from surveys (Hasson et al. 2000, McKenna 1994). The Delphi technique has the added advantage of not requiring the group to meet in person, which may not always be possible or practical. The advantages and disadvantages of the Delphi technique are summarised in Table 2.3 below. This method was employed in the final stage of the research project, and is discussed in more detail in Chapter 6.

Table 2.3: Advantages and limitations of the Delphi technique

Benefits	Limitations
Panel members can answer truthfully without judgement from other panel members	Can be time consuming process i.e. one iteration can take 3-4 weeks
Gathers opinion without need for the group to physically be brought together	There lacks a consistent approach to conducting the Delphi process so as a method has been accused of lacking methodological rigour
Systematic process to synthesise judgements of a group of experts	Can be difficult to execute well – care and attention must be paid in selecting the panel members, etc.
Iterations of questionnaires and feedback allow members to judge where their views lie in relation to the consensus of the group	Can be difficult to keep panel members engaged and have good retention rates throughout subsequent rounds
	Poorly designed questionnaires can alter the output from a Delphi i.e. ambiguous questions

Mixed Methods Research

As discussed, quantitative and qualitative research sets out to answer different questions. The commonality lies in both trying to understand a particular phenomenon. Mixed methods research acknowledges that the two approaches can, in some circumstances, be complementary (Barbour 2014). Mixed methods research involves the collection, and subsequent integration of both qualitative and quantitative data, and is based on the assumption that the combination of these two approaches affords a more comprehensive understanding of the research question than either approach, used alone, would facilitate (Cresswell 2014). It has been recognised that all methods in research, irrespective of their philosophical origins, are not without their limitations. Utilising a “multi-method matrix” affords the benefits of neutralising any inherent biases associated with either individual approach. i.e. qualitative or quantitative), facilitated triangulation of data sources (Cresswell 2009), and generally facilitates a broader scope of the research, more

robust explanation and a more holistic picture of human behaviour (Mayoh et al. 2012, Tashakkori & Teddie 2003).

One of the first descriptions of using a mixed methods approach was a 1959 study investigating psychological trait validity (Campbell and Fiske 1959). More recently many types of mixed methods designs have been described in the literature in fields such as nursing, education research and policy, public health and social/behavioural studies (Creswell 2014, pg 219). The nomenclature describing mixed method studies appears to be dependent on which aspects are combined and the order in which this occurs in the research, but generally fall into one of three categories: sequential, concurrent or transformative mixed methods (Morse 1991). Additionally, each study design will have its own accepted way to analyse interpret and present the results of the study (Cresswell 2014).

Mixed method research is underpinned by a pragmatic philosophy, as this recognises that collection of a diverse array of data and subsequent joint discussion will provide a more holistic understanding of the research problem under investigation (Tashakkori & Teddie, 2003, Creswell 2003, Creswell 2014). Pragmatism therefore permits the use of any combination of approaches that will help to understand and answer the research question, and is not committed to a sole philosophy. Hence researchers are not tied to using a particular set of methods for data collection, interpretation or analysis, but may choose methods that complement each other, methods such as those described above (Creswell 2014 pg10-11).

The explanatory sequential mixed method approach adopted for part of this research project will be described in detail in the following chapter.

Analysing qualitative data – thematic analysis

Qualitative data is typically dense in nature. Identifying themes is at the heart of qualitative analysis, and making sense of it involves segmenting or taking apart the data to identify these patterns or themes (Clarke & Braun 2013, Creswell 2014). In its most basic form thematic analysis involves searching across a range

of texts that form your dataset and identifying patterns of meaning contained and repeated within in them (Braun and Clark 2006). One such way of doing this is identifying codes within the data that are subsequently categorised into similar groups, forming the basis of the themes. A code is typically:

“a word or short phrase that symbolically assigns a summative, salient, essence-capturing, and/or evocative attribute for a portion of language based or visual data.” (Saldana 2013, pg3).

Thematic analysis was first described as an approach in 1975 by Merton and has been widely used as a qualitative analysis method since. A number of approaches have been suggested since (Clarke & Braun 2013) Thematic analysis is applicable to many research interests due to its theoretical flexibility, and independence of theory and epistemology (Braun & Clarke 2006). However, the flexibility it affords does not mean the method is integrally flawed nor that the process is not well characterised.

It is recognised that as a basic method for qualitative analysis it is well suited, particularly to novice qualitative researchers (Braun & Clarke 2006, Clarke & Braun 2013). Considering the strong quantitative background of the researcher, this method was deemed most appropriate and would be fit for the purposes of answering the research questions within this doctoral thesis.

Braun and Clarke highlight that there are 6 stages of thematic analysis:

(1) Familiarisation with the data – this step involves immersion in the data to become familiar with its’ contents. The researcher will be somewhat familiar with the data if they have carried out the collection phase themselves, but actively and repeatedly reading is crucial to understanding the breadth and depth of the data in question, and searching for meaning within it.

(2) Initial coding – the data should have been read through at least once before commencing this step, which starts the process of organising the data into groups by systematically working through the dataset (either manually or with the aid of software) in search of repeated patterns. Coding

should generate as many themes/ patterns as possible, keeping them in context within the surrounding text (Bryman 2001 in Braun and Clark 2006).

(3) Searching for themes – this step involves the grouping of similar items from the long list of codes into possible categories which will form the basis of the principal themes or their sub themes. The related text within the data set is also retrieved and studied.

(4) Reviewing the themes – Once the provisional themes have been identified, the next step involves refining them. Patton states that data within a single theme needs to fit together in a meaningful way for its' narrative but at the same time, should be distinguishable from that in other themes (Patton 1990). For this reason, some of the proposed themes from the previous stage may be collapsed into an overarching theme, or may be discarded altogether.

(5) Naming the themes – it can be useful to represent the themes and sub themes identified in the preceding step visually using a map. The themes then need final refining and defining the salient points of what each one is about and what story it tells.

(6) Writing up - this stage brings together the themes that have emerged, along with their supportive statements, and how these fit into the narrative of the data and the subject as a whole in context to the available literature (Braun and Clarke 2006).

It is important to stress that the relationship between each step described above is not hierarchical as it may appear at first glance, but rather characterised by a more interactive process of revisiting stages as required throughout the progression of the analysis (Creswell 2014 p196-197, Braun & Clarke 2006). It is also acknowledged that some of these steps are not exclusive to thematic analysis alone but other forms of qualitative analysis that share similar terminology (Braun & Clarke 2006). Other coding processes have been proposed (Tesch 1990 p142-145), however no researcher can claim absolute authority on the best way to

analyse qualitative data (Saldana 2013, pg2), and so some flexibility can be exercised. Coding is not an exact science, but an interpretative construct generated by the researcher to give interpreted meaning to the data to represent its' essence or content (Saldana 2013 p4).

As discussed above, the coding process can be conducted manually or with the use of dedicated computer packages. Manual processes tend to be very time consuming and labour intensive, and have been accused of lacking rigor with no trail of how themes emerged. Computer assisted analysis of qualitative data does not always however result in a superior or more rigorous analysis than one conducted manually (Barbour 2014). Coffey et al. (1996) argues that the researcher cannot be pardoned from their conceived account simply by using a computer package to help with the analysis. The importance lies in how systematic and thorough the researcher conducts the analysis process itself. Computer packages such as NVIVO can support the researcher in their interrogation of the data in making this process more time efficient (Bazeley & Jackson 2013) by the following:

- Helping to organise all the data that makes up a qualitative project such as previously published research, transcripts, audio files, photographs, observational fieldwork, researcher memos, rough notes, etc.
- Helping to manage and record ideas by allowing retrieval of themes or codes and their associated supportive statements from the data within the context of the overall dataset
- Facilitating interrogation of the data quickly by a rapid retrieval of the data required to answer these questions asked of it
- Visually represent the content/ structure of, or relationships between, the identified themes or linked segments of data
- Make the process more transparent as all actions (coding, memos, interrogations or data retrieval) taken with the data within the project can be recorded and attributed to a particular researcher (particularly important if multiple researchers are collaborating on a project)

Further details of how the themes were identified at various stages of this doctoral thesis will be discussed in context, in the individual data chapters.

Researcher's perspective

The previous experiences of the researcher have mainly been in the quantitative paradigm, which forms the majority of this research thesis. However, the researcher acknowledges that in order to answer some of the research questions, a qualitative paradigm would need to be considered in some form. Qualitative methods have therefore been used to complement quantitative methods in order to gain a better understanding of the experiences of medical students.

Having trained and worked as a pharmacy technician and subsequently a pharmacist, the researcher brings certain biases towards the qualitative arm of this doctoral thesis. Every effort was made to ensure objectivity; certain intrinsic biases however may shape how some data have been understood or interpreted. Where bias has crept in, it can be argued that any resultant subjectivity does not necessarily undermine the research, but is essential for good qualitative practice (Clarke and Braun 2013). That said, all qualitative data analyses conducted by the researcher were verified independently by a second source (specific details are given in each chapter where applicable).

Chapter 3 – Current provisions for practical prescribing teaching and learning at the undergraduate level in UK medical schools

Introduction

Recent graduates and students have highlighted shortcomings in terms of teaching and assessment of prescribing in UK and Irish medical schools, reporting that they feel inadequately prepared to undertake the task of prescribing (Geoghegan et al., 2017, Heaton et al., 2009, Illing et al., 2008). One study in particular, undertaken to investigate the patterns of learning amongst medical students and recent graduates regarding preparedness to prescribe in the UK, highlighted a perceived lack of learning opportunities available to medical students in relation to prescribing (Heaton et al. 2009). This study, however, did not investigate which teaching and learning methods medical students were exposed to, nor how effective students perceived these to be in improving their confidence or competence in practical skill acquisition.

Medicines are integral in disease management - whether being used to actively treat or prevent disease or alleviate symptoms. Prescribing is fundamental for newly qualified junior doctors, who are responsible for writing the majority of prescriptions and medication orders in NHS hospitals in the UK, and are also responsible for the highest prescribing error rates (Dornan et al. 2009).

Effective prescribing is underpinned by an in-depth knowledge of clinical pharmacology and therapeutics (CPT), and clinical judgement. Yet the teaching provisions for CPT in the UK are diverse (O'Shaughnessy et al. 2009); a problem that is not unique to the UK (Keijsers et al., 2015, Brinkman et al., 2016, and Brinkman et al., 2017). Brinkman et al highlighted that over two thirds of medical schools participating in their European study do not offer students the chance to practice prescribing skills prior to graduation (2017). The apparent lack of focus on skill acquisition raises obvious concerns about patient safety. It has long been recognised that curricula focus too much on knowledge acquisition, at the expense of experiencing its application in clinical practice (the EMERGE group 2009).

In the UK, collaboration between the British Pharmacological Society (BPS) and Medical Schools' Council (MSC) resulted in the development of the national Prescribing Safety Assessment (PSA). First piloted in 2013, this is an online pass/fail assessment for final year medical students assessing the skills, judgement and underpinning knowledge required to prescribe medicines safely and effectively (Maxwell et al. 2015). Although proving to be a more reliable means to assess prescribing competence (Maxwell et al., 2017), it remains to be seen to what extent the PSA has reduced prescribing errors of newly qualified doctors in NHS hospitals. To date, medical students' views on the impact of the PSA on their learning of practical prescribing and skill acquisition have not been explored. Although reports of students and graduates being ill-prepared to undertake prescribing are well documented, this area has not been revisited since the introduction of the dedicated PSA.

The publication of the Shape of Training report, proposing to move the point of full registration of doctors to graduation from medical school (Greenway et al. 2013), has further put the teaching and learning of undergraduate practical prescribing under scrutiny. Proposing such a radical change to doctors' registration raises the question of optimising the teaching and learning of practical prescribing in the UK. A recent Europe-wide study found the teaching of CPT to be inadequate (Brinkman et al., 2016, Brinkman et al., 2017). The first step to determining what improvements are necessary lies in gaining a better understanding of current teaching and learning practices across the UK. As the primary users of the undergraduate curriculum, medical students have a role to play in improving and developing the teaching and learning practices in medical schools. Therefore, the views of medical students were sought. Furthermore, there is a well-established correlation between student engagement and positive outcomes on student development and achievement/success (Trowler, 2010, Kuh et al., 2005 & 2007). Therefore, the importance of the student voice in curricular review and development cannot be understated.

Aim

The aim of this study was to examine the range of teaching and learning methods related to practical prescribing in UK medical schools. This was with a view to

identifying the methods undergraduates felt were most effective in helping them in practical prescribing skill acquisition. This might inform the development of a programme of study, for UK medical undergraduates, with appropriate minimum standards for teaching and learning of practical prescribing.

The main objectives of this study were to:

- Determine whether each UK medical school offers specific teaching in safe and effective prescribing to its medical undergraduates
- Determine the differences between the provision of practical prescribing teaching and learning at each UK medical school, and what differences exist at the different stages of the undergraduate medical degree
- Determine who is responsible for delivering practical prescribing teaching, and to determine the mode of delivery, i.e. face-to-face, practical prescribing sessions, pre-prescribing, etc.
- Determine the views of medical undergraduates on what the most effective methods of teaching practical prescribing are
- Determine if there is a perception amongst the medical undergraduates that preparing for the PSA helps to improve practical prescribing skill acquisition
- Determine if the medical undergraduates attempted to gain insight from recently graduated peers about the expectations of doctors to prescribe safely in clinical practice
- Determine if there is a belief amongst students that undergraduate medical education (particularly regarding practical prescribing) should be more standardised across all medical schools in the UK, and how they think the curriculum could be improved to enable graduates to become more competent in practical prescribing.

Methods Overview

The study sought to determine teaching and learning provisions for practical prescribing, and explore student views about these provisions, and so was based

in both a qualitative and quantitative paradigm. Mixed method research, which has been discussed in chapter 2, was deemed to be the most appropriate methodological approach, as a combination of numerical and narrative data were required to achieve the study aims. A sequential mixed methods study was therefore conducted. It was decided to first launch a questionnaire exploring the teaching and learning provisions for practical prescribing within the UK that would generate large amounts of both qualitative and quantitative data that would be used to orientate the focus of the follow-up focus groups, and allow triangulation of the data. Figure 3.1 is an illustrative representation of the overall study design.

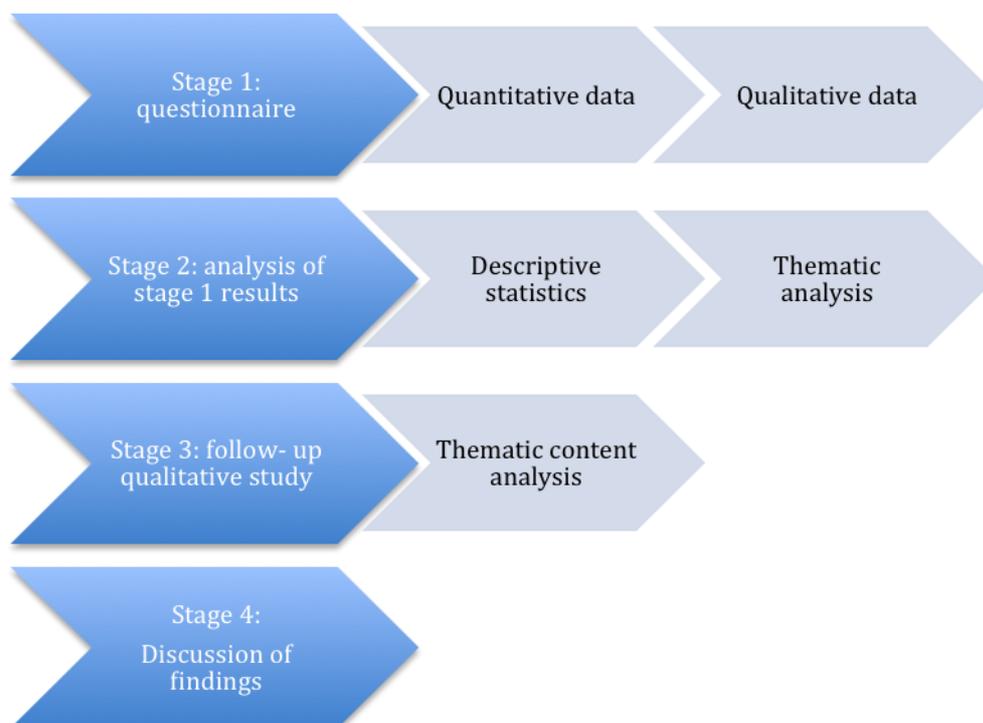


Figure 3.1: Overview of study design

Part A: Questionnaires

Respondents and setting

Respondents had to be current UK medical undergraduate students in the third, fourth or final year of their studies. It was felt that inclusion of these 3 years would

give sufficient insight into the teaching and learning provisions at all stages of the undergraduate course: beginning, middle and end of their undergraduate course, as they prepare for the final year assessments. The exclusion of year 1 and 2 undergraduates was an active decision as it was felt that this cohort would have had minimal exposure and experience of practical prescribing.

A university email address was a requirement for participation and this was to facilitate distribution of the questionnaire to enable its completion.

Questionnaire design

The questionnaire utilised a variety of question styles: open ended questions, closed questions in the single best answer or multiple-choice format. Open-ended questions were used where richer feedback or elaboration of quantitative responses was sought, and allowed the participants the freedom to explain their views or thoughts using their own words. This allowed the capture of data that, without their inclusion, would have otherwise not be generated.

The questionnaire (Appendix A) was divided into 4 sections, with a total of 28 mandatory questions. A brief summary of each section is given in Table 3.1.

Table 3.1. Summary of questionnaire structure

Section	Subject matter	No. of questions
I	Place & year of study	2
II	Teaching of practical prescribing	17
III	Preparedness for practice	5
IV	The national PSA	4

Questions asked about specific teaching and learning methods that students had experienced throughout their curriculum, and about those responsible for delivering this teaching. The list of teaching and learning methods presented was generated from a combination of those commonly employed in Higher Education and some more novel methods from the literature (Baker et al., 2011, Maxwell et

al., 2006, Kamarudin et al., 2013, Ross and Loke 2009, Kozer et al., 2006, Sandilands et al. 2011, McKimm & Jollie, 2007).

Students had to select if each method was employed in the teaching and learning of practical prescribing at their medical school. For each method selected, respondents were subsequently asked to rank how effective they felt each was in improving practical prescribing. A 5-point Likert scale was used to determine this perceived effectiveness, with a value of 5 and 1 representing very effective, and very ineffective respectively. Respondents had the opportunity to include any other methods that they had encountered that were not listed in the questionnaire.

They were also asked who teaches practical prescribing and how effective they perceived them to be. Further questions focused on the national PSA and its' impact on practical skill acquisition and preparation for practice. The questionnaires were developed and delivered using Bristol Online Surveys software as discussed in chapter 2.

Questionnaire validation

No validated questionnaire existed for the purpose of answering the research questions. A study conducted in 2009 to determine the content and nature of CPT teaching at UK medical schools (O'Shaughnessy et al., 2009) was used to guide in the development of this questionnaire in terms of question format, as the current study was investigating current practical prescribing teaching provisions. The questionnaire was peer reviewed by the research supervisory team and the research governance and ethics committee prior to ethical approval being granted. Both processes provided a degree of content and face validity.

Pilot and distribution procedure

It was decided to adopt an electronic distribution approach, for ease of administration, as the sample population was geographically widespread. Furthermore, this afforded convenience for potential participants to complete in their own time, although paper copies were available upon request.

Prior to launching the study, the researcher piloted the questionnaire amongst members of the Division of Medical Education (DME), and a sample of PhD students at Brighton and Sussex Medical School, not directly involved in the research. The purpose of the pilot was to test for usability, how the survey read and to identify the approximate timings required to complete. The questionnaire itself was not altered after the pilot (with the exception of typographical errors),

A link to the final online questionnaire was e-mailed to the individual lead for teaching and learning in the undergraduate curriculum at each UK medical School (33 in total) for dissemination to their undergraduates in the final 3 years of study at their institution. The e-mail contained a brief description of the study and its aims, and contact details for the researcher should they have required further information. Reminder e-mails were sent to the undergraduate lead for onward dissemination, at fortnightly intervals for the first two months and at monthly intervals thereafter. The questionnaire was available for completion from November 2014 to May 2015.

Data analysis

Completed responses of the closed and multiple-choice questions were transferred to Microsoft Excel (Version 2011) to facilitate the completion of descriptive statistics and confidence intervals.

SPSS (Version 20 & 22) was used to perform Kruskal-Wallis (KW) tests and Chi-squared tests of association to determine if differences observed between the groups (i.e. year groups) were statistically significant.

Responses to the open ended questions were transferred to the qualitative data analysis software NVIVO (Version 11) to facilitate content analysis. The researcher coded the responses: these codes were subsequently used to identify the themes within the dataset. A member of the supervisory team verified the themes from the data independently before final themes were decided upon.

Ethical requirements

The study was granted approval by the Research Governance and Ethics Committee (RGEC) at BSMS on 20/03/2014, approval reference 14/015/OKO (Appendix H). It was not feasible to obtain consent from participants prior to completion of the survey, so the invitational e-mail explicitly stated that completion and submission of a response was the mechanism in place for obtaining consent.

Part B: Focus groups

It was decided to utilise focus groups to further explore data emerging from the national questionnaire, to elicit medical undergraduates thoughts on the curriculum with respect to practical prescribing, and offer them the opportunity to suggest improvements. It was the favoured group technique because it was felt that the intra-group interaction and synergy that characterises focus groups (Krueger & Casey, 2015) would yield a richer discussion and broader overview of the teaching provisions. Other group techniques, such as interviews, were not deemed to be suitable because the researcher was not familiar with individual practical prescribing teaching sessions at all the medical schools being studied so could not prompt about specific learning experiences, hence group interaction and discussion was of utmost importance.

Participants

Participants also had to be in their third, fourth or final year of a medical undergraduate degree in one of 3 chosen UK medical schools: Guy's, King's College and St. Thomas Medical School, St. George's Medical School and Brighton and Sussex Medical School. These 3 medical schools were chosen as they all fell within the local South Thames Foundation School (STFS), and included students coming from both the undergraduate and graduate entry routes, however the particular entry route of the participants was not recorded in this study. It was decided to stay within the boundary of this foundation school for logistical and economical reasons.

Sampling

The initial sample for participants identified were UK medical undergraduate students in years 3 to 5 from 3 particular medical schools in the STFS region. Random sampling from within this pool of students was subsequently conducted, i.e. a stratified sampling approach.

Recruitment procedure

An e-mail was sent to the Lead for the undergraduate curriculum at each of the 3 chosen medical schools to organise dissemination of the invitational/promotional e-mail to each medical undergraduate in their third, fourth or final year of study. The e-mail gave a brief overview of the study, and attached was the participant information sheet and consent forms (Appendices B and C respectively). Contact details for the researcher were included in case of further enquiries, and to register interest in participating. Students were given a deadline of two weeks from receipt of the e-mail to register interest in participating in a focus group, by contacting the researcher directly. Once the participants had committed to participating in a focus group, a mutually convenient date and time was set between the participants and the researcher directly. This was the procedure for the groups at two of the medical schools. For the focus groups being organised at third medical school, the dates and times were pre-selected for students on the advice for the curriculum leads who had more in-depth knowledge of their timetable and other academic commitments and subsequent availability.

Participants were e-mailed a reminder 1 to 2 days before the scheduled group to re-confirm attendance, reiterate location and time of the focus group.

Derivation of question topics

Planning for the focus groups began before the midpoint stage of the nationwide questionnaire was reached. The responses from the free text questions within the questionnaire were analysed manually for themes that would form the basis of group discussion at the subsequent focus groups. This was done by the researcher and independently verified by a second undergraduate researcher who was helping with data collection. A summary of the findings of this stage is given

in Appendix M. The themes that emerged were discussed and final topics for focus group questions agreed upon by consensus. A member of the supervisory team oversaw this step. As the findings from the 2 independent analyses were similar, the reliability between these data was not assessed any further.

The topics of discussion at all focus groups were:

1. Perceptions of the importance of knowledge of pharmacology and therapeutics and its application within the curriculum
2. Student expectations of the medical school in preparation for safe practical prescribing
3. Perceptions of the drugs requiring focus within the curriculum and the core content list
4. Student experiences of practical prescribing teaching and learning
5. Student recommendations regarding the amount of practical prescribing teaching within the curriculum
6. Role of undergraduate and postgraduate curricula in preparation for safe prescribing

These topics were used to synthesise the 6 opener questions (Appendix N). Related topics formed sub-questions to be used as prompts should they not emerge in the natural flow of the conversation. All focus groups were asked the same series of questions. Sub questions were used as prompts for the discussion if topics were not occurring throughout the natural flow of the conversation.

Logistical set up

Room bookings were made directly with each medical school, with a request for a room that would accommodate 6-15 people with the potential to move tables to facilitate group discussion. The room was set up similarly for all focus groups (Figure 3.2). There was a table in the centre of the room, around which the participants sat, and upon which the recording device was placed.

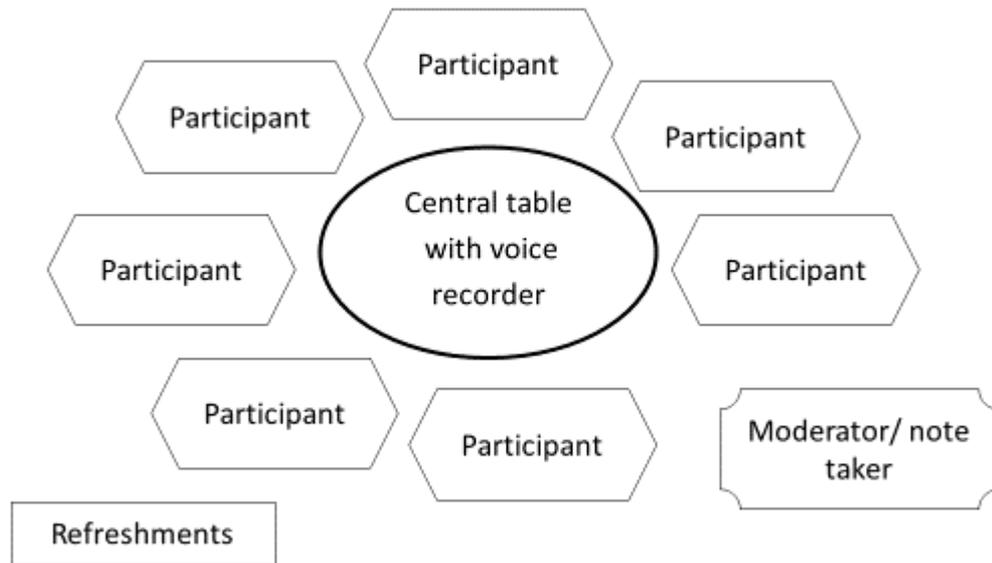


Figure 3.2. Setting of the room for focus groups

The focus groups that took place at BSMS had a facilitator and moderator present, who sat at either end of the table, amongst the participants. The moderator led the group discussion and the recorder took notes and was responsible for recording the discussion. The recorder did not participate in the focus group in any way outside this scope described, all of the questions and probing was done solely by the moderator.

The focus groups that took place in London did not have a second facilitator (recorder) present, as the undergraduate that was helping with data collection was not available and it was not possible to recruit a replacement at short notice, so the moderator took notes as well as leading the discussion. For these groups the moderator sat to one side of the group so that participants could hear clearly, but the moderator was not perceived to be part of the group in expectation that participants would engage with each other in dialogue rather than with the moderator.

Upon arrival students signed in and the moderator collected participant consent forms. Refreshments were provided prior to the start of the focus group, affording

the opportunity for the researcher and participants to chat informally before the group discussion began.

The focus groups began with the generic introduction and a brief outline of what the session would involve. Ground rules were laid out during this introduction, which covered conduct, confidentiality and respect of other participant vies. It is known that in focus groups, the longer the time before a participant takes to speak, the less likely it is they will say something (Krueger & Casey e5, p44). To help combat this the opening question was designed to get everyone in the group talking from the onset, so participants were asked in turn to answer the same question “Why do you enjoy studying medicine?”. Responses to this question did not form part of any analysis.

Each focus group was taped using a digital voice recorder, which participants were informed of and consented to prior to starting the group. Immediately after each session, the audio was transferred to the researcher’s password protected laptop. Once the audio on the laptop was tested to ensure the transfer was successful, the original was deleted from the voice recorder.

Transcription

A third party conducted the transcription process verbatim. It was decided to allow for the correction of grammatical errors for the purposes of transcriptions. The transcripts were subsequently checked against the recordings for accuracy by the researcher, and this helped the researcher to become more familiar with the data (Braun and Clarke 2006). Familiarity with the data is an important step in thematic analysis as discussed in the chapter 2.

Thematic analysis

The thematic analysis followed the 6 stages described by Braun and Clarke (2006), discussed in detail in chapter 2. Silverman argues that analyses of focus group data are more correctly termed content analyses because they tend to report recurrent instances (Silverman 2016). The themes derived from the analysis were therefore a mix of thematic and content analysis.

The researcher was a novice in the field of qualitative research, and due to the large amounts of data generated by the focus groups it was decided to use computer software to aid in the organisation and analysis of the data. It is acknowledged that computer assisted analysis of qualitative data does not necessarily result in a superior or more rigorous analysis than one conducted manually (Barbour 2014). Coffey et al. (1996) argues that the researcher cannot be pardoned from their conceived account simply by using a computer package to help with the analysis. The importance lies in how systematic and thorough the researcher conducts the analysis process itself. However, the use of a computer package for the analysis stage made the coding process more transparent by storing definitions of various codes, and helping with retrieval by linking segments of the data to particular codes assigned throughout, as this afforded an additional rigour to the methodology.

Ethical requirements

This arm of the study was also covered under the ethical approval granted by the Research Governance and Ethics Committee (RGEC) at BSMS, approval reference 14/015/OKO (Appendix H).

Part of the conditions set out in the approval from the RGEC, stated that because focus groups were being conducted at external institutions, approval had to be sought at the two medical schools in London in addition. The study was granted approval by the King's College London Research Ethics Committee (Appendix I) and St. George's medical school did not require internal ethical approval for the focus groups to be conducted.

All participants of the focus group were sent a participant information sheet during the recruitment stage of the study and signed the associated consent form (Appendices B and C).

Results

Part A – Questionnaire responses

Five medical schools had a policy not to send questionnaires to their medical undergraduate cohort. Two medical schools were listed separately in the questionnaire but their responses were pooled for analysis as their provisions for undergraduate teaching are under the auspices of one organisation.

A total of 1023 medical undergraduates, from 25 UK medical schools responded: comprising 225 year 3 students (22%), 378 year 4 students (37%) and 420 final year students (41%). It was not possible to determine accurately what percentage of the whole medical student population this sample drawn represents as it is unknown how many medical students had access to complete the questionnaire in the first place. The average number of respondents from each medical school was 41 (range 1-122), and only 5 medical schools had fewer than 10 respondents each. The responses from students from these 5 medical schools were pooled for analysis.

The majority (94.3%) of final year medical students reported that there was teaching and learning in practical prescribing on their course (n=396, 95% Confidence Interval [CI] = 92-97%), with 86.8% of fourth years (n=328, CI=83-90%) and 73.8% of third years (n=166, CI=67-80%) reporting the same. 5.7% of final year students (n=24) reported that they did not get taught any practical prescribing on their course or did not know if it would be provided. A comparison of the proportion of students reporting that they received practical prescribing teaching and learning at different medical schools at different stages of their undergraduate medical degree is shown in Figure 3.3.

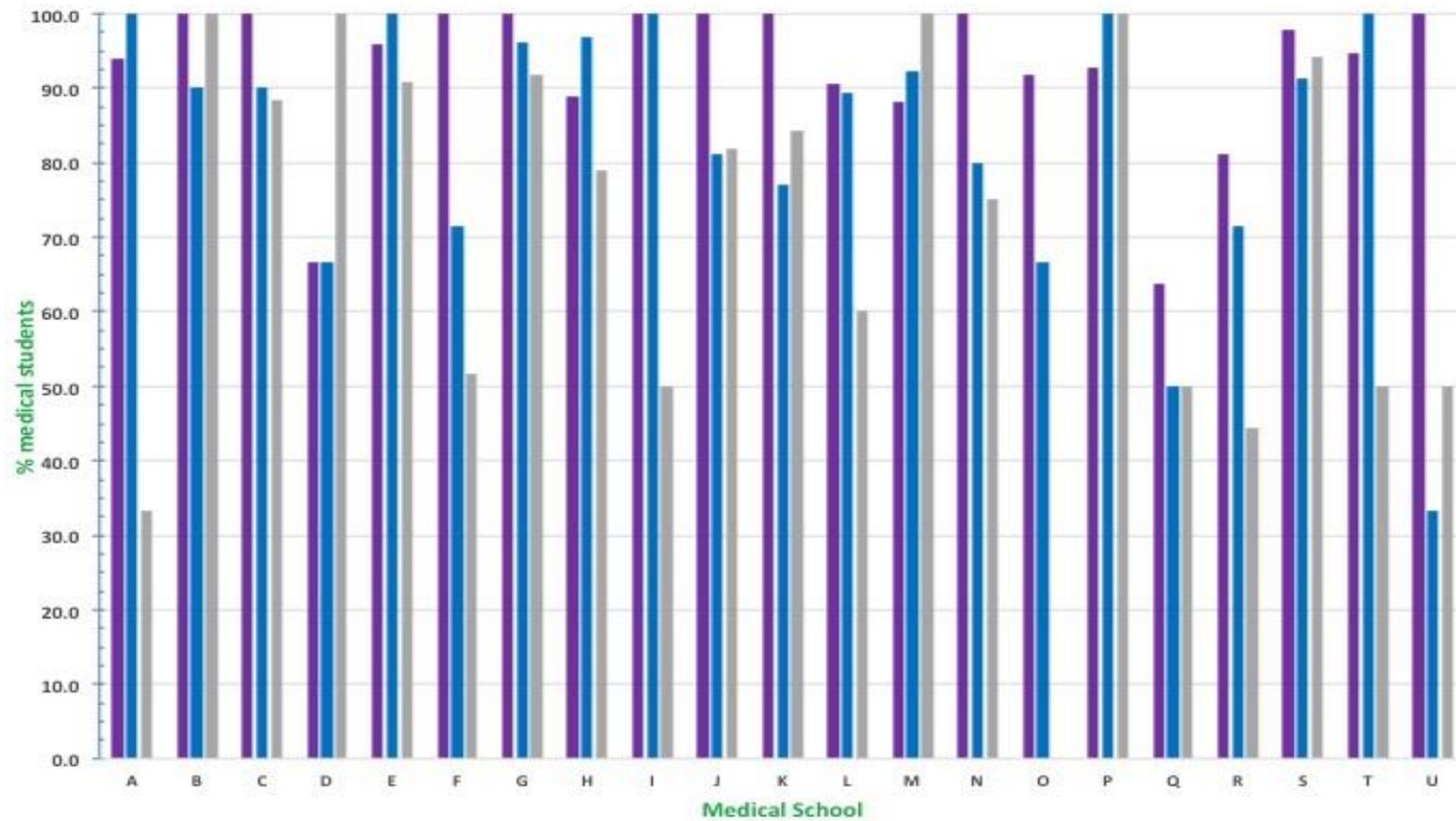


Figure 3.3 : Comparison of student's receiving practical prescribing teaching across UK medical schools

■ Yr 5 ■ Yr 4 ■ Yr 3

What are the teaching and learning methods?

Of the students who reported receiving practical prescribing teaching at their medical school, 65.1% (n=579, CI=61-69%) also reported that this teaching was provided using an integrated approach. Figure 3.4 shows a comparison of the approaches adopted by the various medical schools. This trend was consistent across the year groups with 66.3% of third year (n=110), 66.5% of fourth year (n=218) and 63.4% of final year (n=251) students reporting the use of integration.

Students reported that their medical schools employed a variety of educational methods for delivering practical prescribing teaching and learning. Self-directed learning was the most frequently reported method (n=809, 90.9%), followed by tutorials (n=786, 88.3%), and pre-prescribing seminars (n=725, 81.5%) [Figure 3.5]. At the other end of the scale, provisions by online modules and shadowing clinical pharmacists were scant amongst students with figures of 16.3% (n=145) and 20.2% (n=180) respectively. There was an observed difference with respect to availability across the year groups for some methods e.g. validated pre-prescribing was available to 75% of final years, 52.6% of fourth years and just 37.3% of third years.

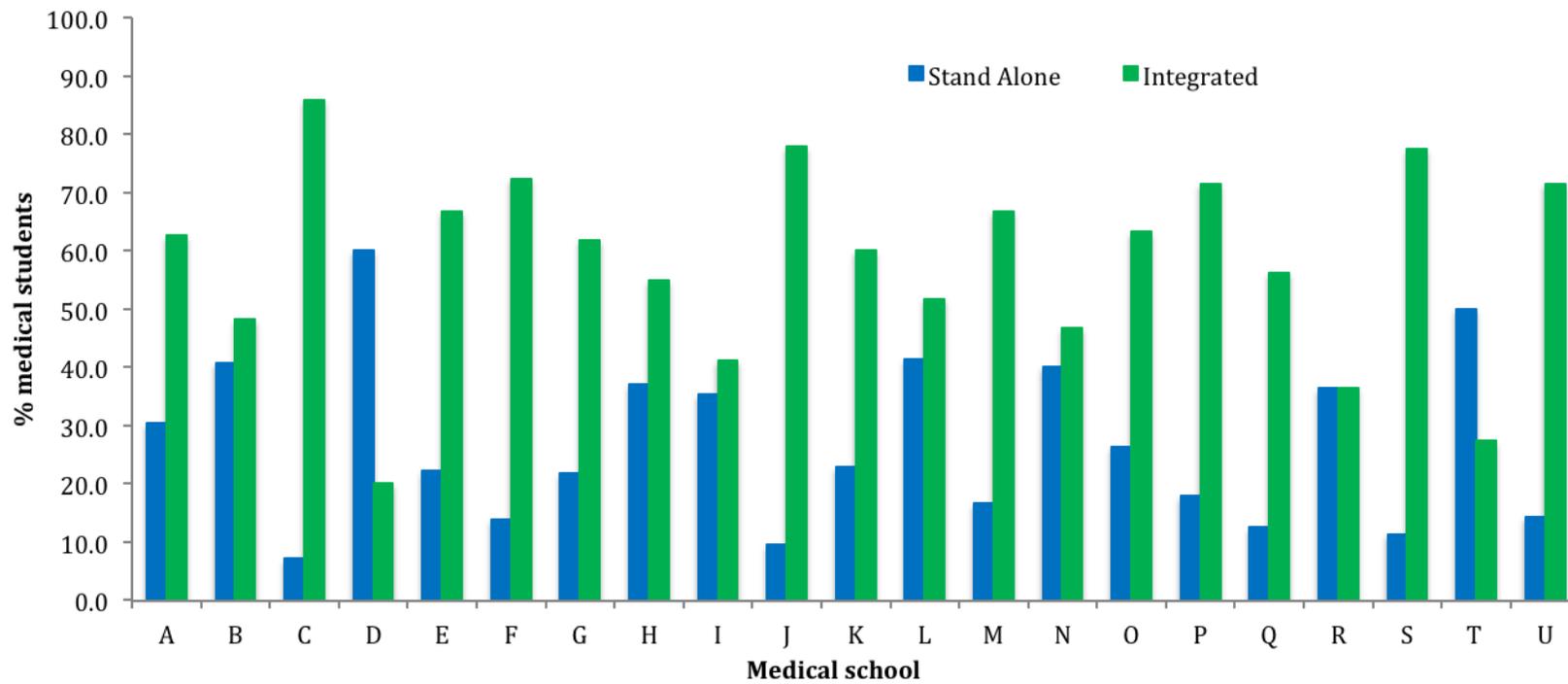


Figure 3.4. Approach adopted by medical schools in teaching practical prescribing

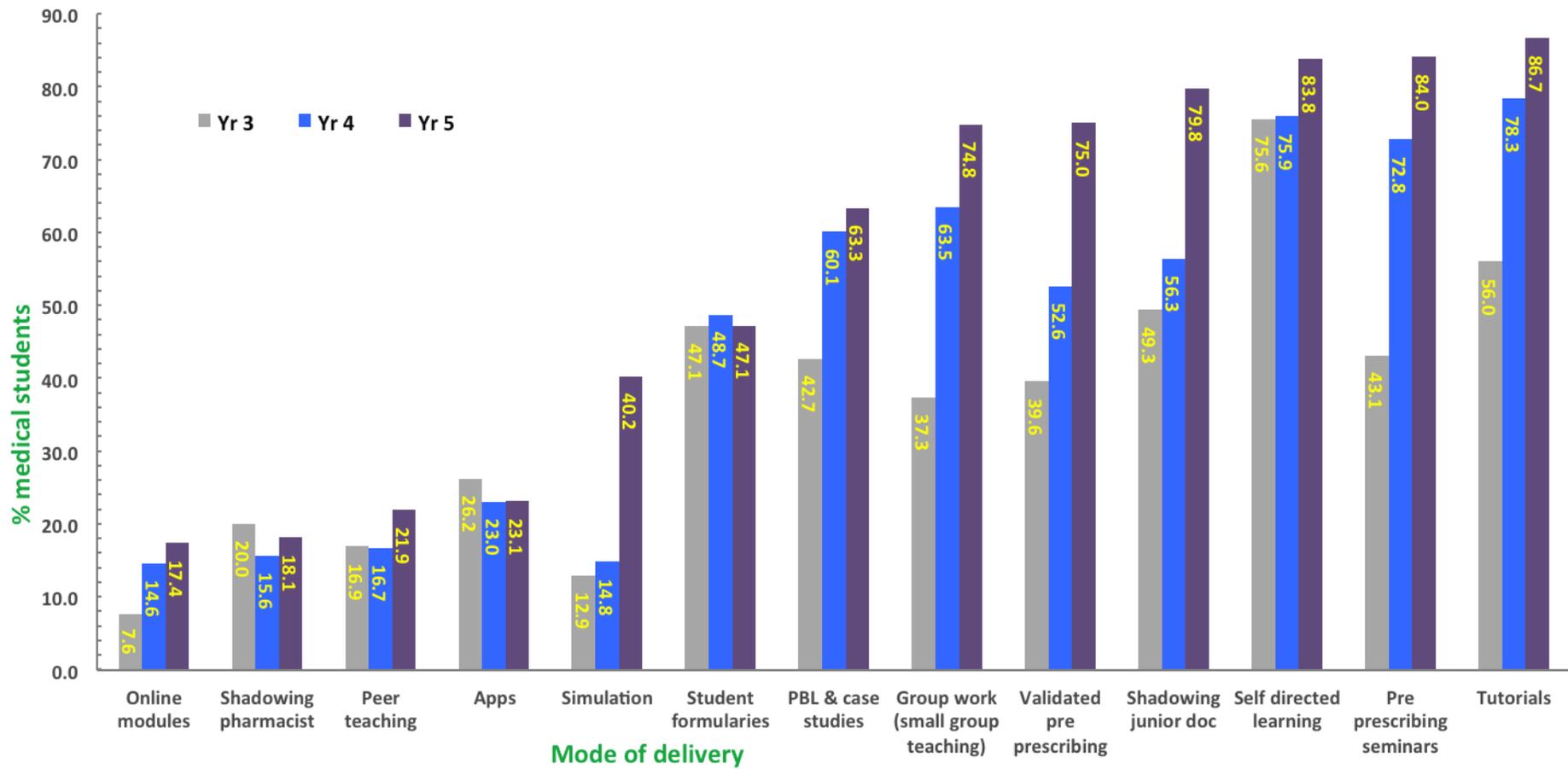


Figure 3.5: Methods employed in the teaching and learning of practical prescribing in UK

Student's perceptions of effectiveness of teaching and learning methods

Students ranked each method in terms of how effective they perceived them to be, a score of 1 being very ineffective and 5 being very effective [Figure 3.6]. Validated pre-prescribing, simulation and pre-prescribing seminars were perceived as the three most effective methods across all three year groups. Self-directed learning or online resources were considered least useful.

Kruskal-Wallis tests were performed to determine if there were significant differences in median scores of perceived effectiveness across the three year groups. Of the three most effective methods, there was no significant difference found between the perceived effectiveness of pre-prescribing seminars $\lambda^2(2, N=725)=3.603, p=0.165$, or simulation $\lambda^2(2, N=254)=1.25, p=0.536$, across the three year groups. There was an observed difference however for validated pre-prescribing $\lambda^2(2, N=603)=10.10, p=0.006$. Further analysis showed that there were differences between its perceived effectiveness for years 3 and 5 ($p=0.003$) and year 4 and 5 ($p=0.04$), with no difference between year 3 and 4 ($p=0.17$).

Of the other methods there were no differences between peers, shadowing a clinical pharmacist, shadowing a junior doctor or use of apps.

Who provides the practical prescribing teaching?

Foundation doctors in their first (F1) and second year (F2) of postgraduate training were the professional group that the majority of final year students reported as being responsible for providing them with practical prescribing teaching ($n=372, 88.6\%$). Students in their fourth (78.8%; $n=298$) and third year (71.1%; $n=160$) of study reported that non-foundation grade doctors (any grade of doctor that is not currently in foundation training i.e. registrar, consultant, GP, etc.) were the professional group responsible for providing this teaching to them most frequently. Patients were responsible for providing this teaching to less than 10% of students across all three years of study [Figure 3.7].

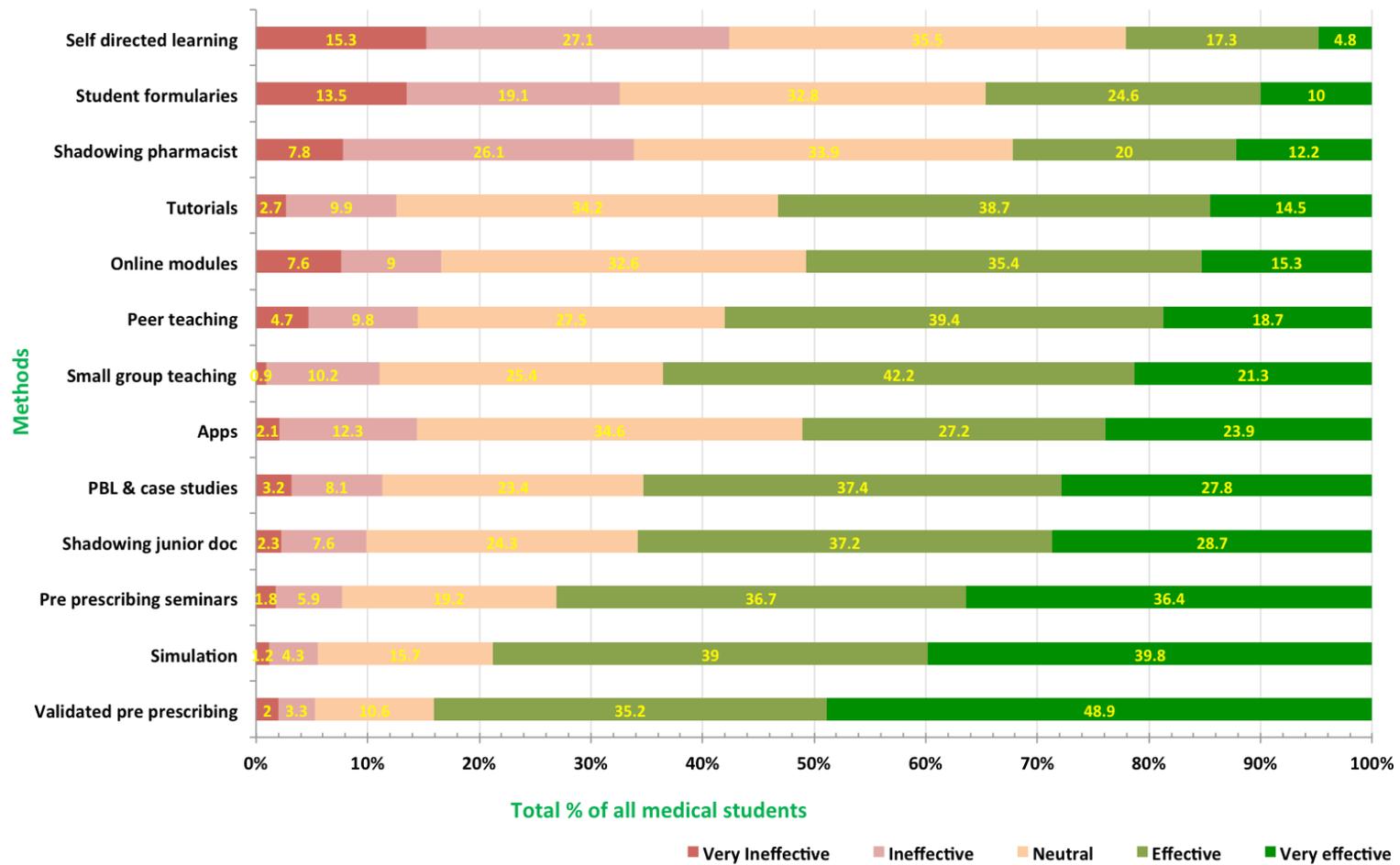


Figure 3.6: Student's perceived effectiveness of methods employed

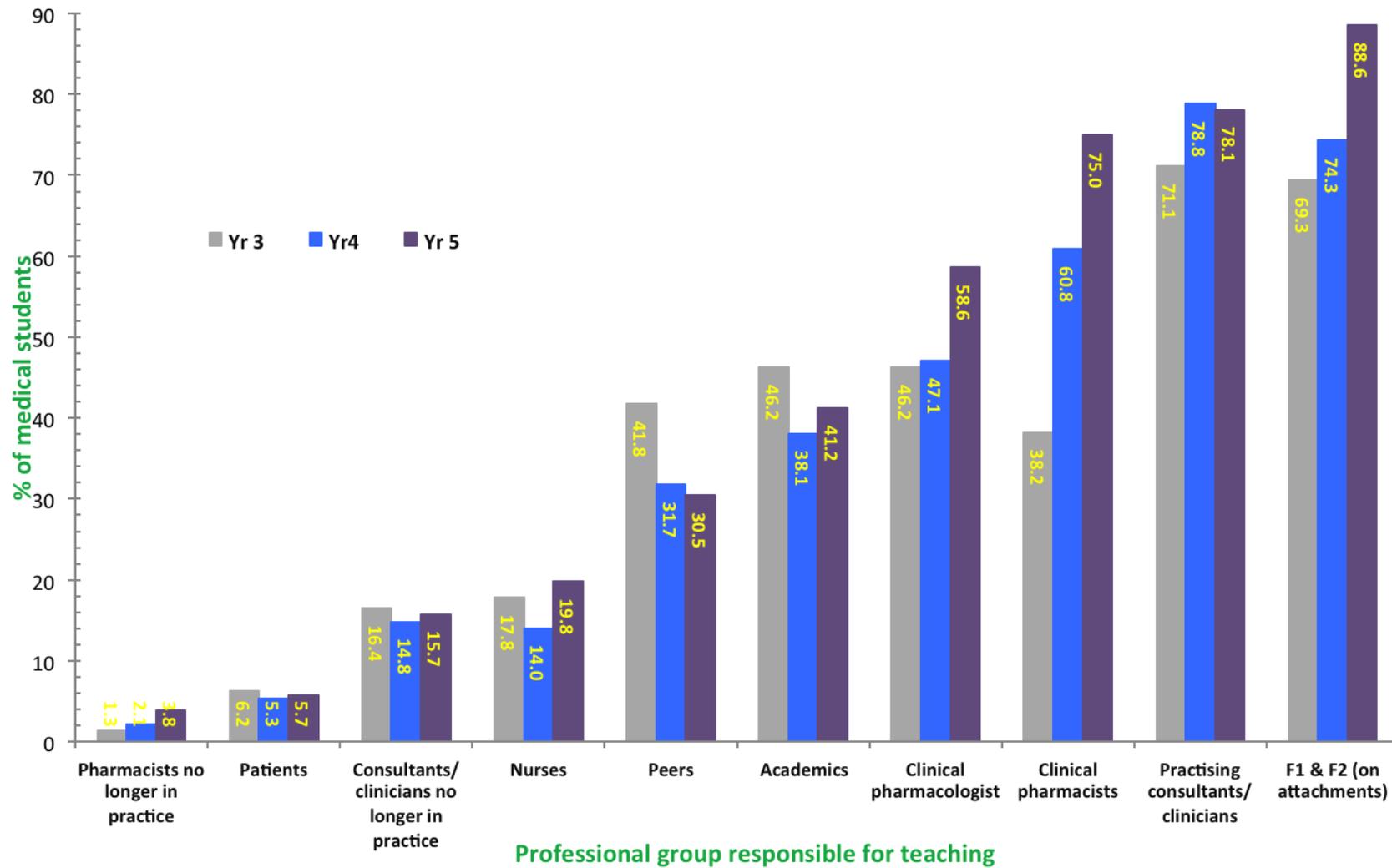


Figure 3.7: Professional groups involved in the teaching of practical prescribing

Effectiveness of the teachers

Clinical pharmacologists were the professional group ranked as “most effective” with the highest percentage of students in their final year (n=102, 39.2%) and fourth year (n=71, 37.4%) while clinical pharmacists had the highest percentage of “most effective” rankings amongst students in their third year (n=29, 28.7%). When considering an overall perceived positive effect (“effective” or “most effective” ranking) little difference was seen between the top four professional groups across the 3 year groups; clinical pharmacologists, clinical pharmacists, practising clinicians that have completed their foundation training including consultants and General Practitioners (GPs), and F1 and F2 doctors [Figure 3.8]. These were the same four professional groups reported by the students in all years as being responsible for providing practical prescribing teaching most often. Patients were considered the least effective group, with 44.1% of students ranking them ineffective.

Preparation for practical prescribing

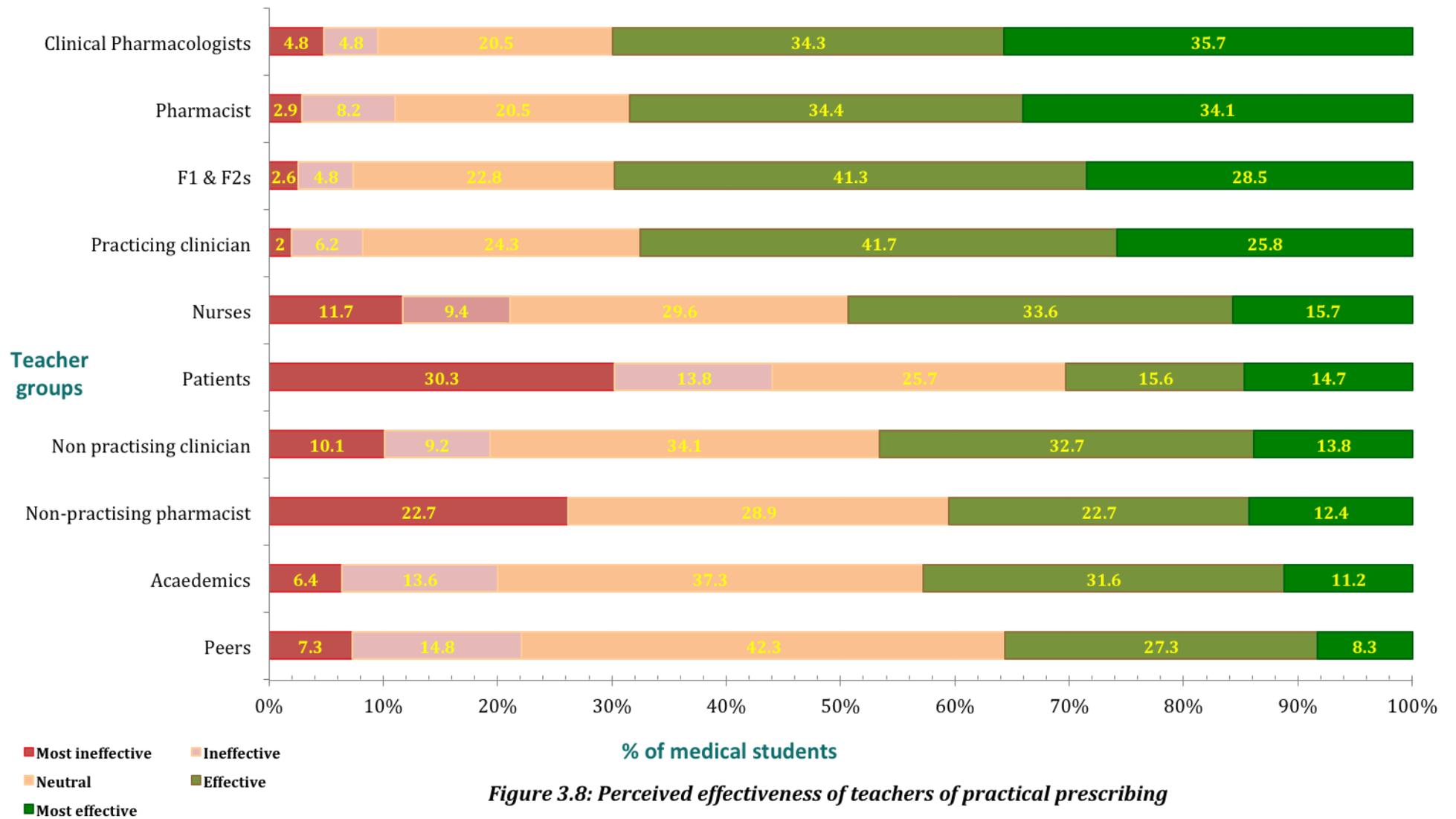
Just 36.4% of all students reported that the medical course in its current format at their medical school adequately prepares them for practical prescribing (n=372, CI=32-41%), with a great deal of variation seen across all the medical schools (Figure 3.9). More final year students reported believing that their course does prepare them for practical prescribing (49%, n=208, CI=43-56%) in comparison to their year 3 (25.8%, n=58, CI=15-37%) and year 4 counterparts (28%, n=106, CI=19-37). This difference was statistically significant $\chi^2(2, N=1023)=53.64, p<.001$.

Students who stated that their course does not prepare them for practical prescribing were asked what aspect(s) should the medical schools focus on to address this. The emerging themes from the thematic analysis of the qualitative responses, with supporting statements, are given in Table 3.2. Placing an emphasis on practical prescribing skill acquisition (including simulation) was the most common theme, followed by the timing that teaching in this area was delivered. Linked with the timing theme, was the issue of the recurrence of teaching sessions, with students believing that one-off sessions were in-effective. There was a perception that learning in the applied/ clinical setting was the most beneficial

approach. The notion of introducing a separate module or course dedicated to prescribing was one of the final themes to emerge during this analysis, with students of the belief that a process as important as prescribing should be more visible throughout the curriculum and have more dedicated teaching.

Overall, the majority of students thought practical prescribing in some format should be introduced earlier into the medical education curriculum (52.6%, $n=538$, CI=48-57%). This message was consistent across all the medical schools (Figure 3.9), and across all three year groups, with 53.3 % of year 3s ($n=120$, CI=44-62%), 57.9% of year 4s ($n=219$, CI=51-64%) and 47.4% of final year students in agreement that it would be beneficial to have some form of practical prescribing in Phase 1 (Years 1 and 2) of the curriculum ($n=199$, CI=50-54%). Again this difference reported between the 3 years was significant $\lambda^2(2, N=1023)=8.95, p=.011$.

There was a perception amongst students that a more consistent approach to practical prescribing teaching and learning might be beneficial: 73.7% of medical students think that the undergraduate teaching of practical prescribing should be more standardised across all medical schools ($n=754$, CI=71-77%), with little difference shown based on respondents' medical school (Figure 3.9) or year of study: 72.6 % of final years ($n=305$, CI=68-78%), 75.1% of year 4 ($n=284$, CI=70-80%) and 73.3% of year 3 ($n=165$, CI=67-80%) students in agreement. This difference was not significant $\lambda^2(2, N=1023)=0.669, p=.716$.



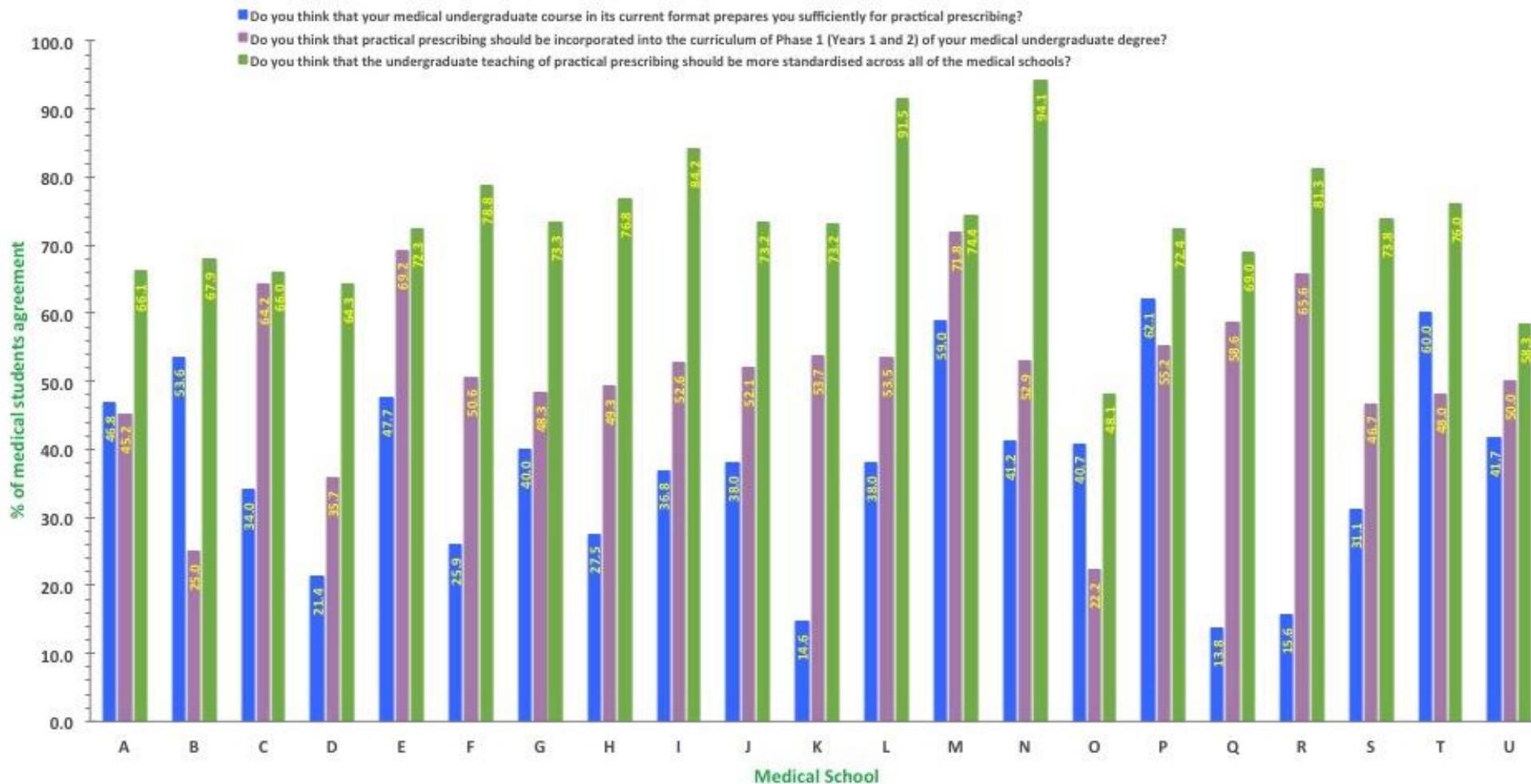


Figure 3.9 : Medical students' positive responses in relation to questions about prep for practice, earlier introduction of practical prescribing teaching, and standardisation of practical prescribing teaching across all medical schools.

Table 3.2: Thematic analysis of student responses regarding how medical schools could improve preparedness for practical prescribing

Theme	Example statement(s)
Practical skill acquisition (including simulation)	<ul style="list-style-type: none"> • “employ greater use of ward simulation scenarios. To give us practice at prescribing promptly but safely in a busy ward environment...” • “more opportunities for hands-on practical prescribing (e.g. in simulation and on the wards” • “Actual technicalities of filling out drug charts correctly, especially for non-standard prescriptions. Prescribing fluids, oxygen, etc”
Time teaching introduced, and its frequency	<ul style="list-style-type: none"> • “anything with practical prescribing incorporated, regular sessions over time, starting earlier in the course and with the opportunity to ask questions” • “It should be started before 5th yr; in yrs 3 & 4 we only do OSCE stations but not a lot of teaching/practising” • “More emphasis on practical prescribing in 2nd year as opposed to theoretical pharmacy” • “More opportunities to practice and more structured teaching sessions (e.g. at least one session / practical per week that should be mandatory to attend)”
Format of the teaching (a more focused approach, less emphasis on self directed learning)	<ul style="list-style-type: none"> • “More lectures from the clinical pharmacologists on actual prescribing in patients. Should be linked in with pharmacology lectures where we are told about the drugs” • “it should be integrated from day one to ensure safety than given in awful bits and bobs its so inefficient and quite frankly infuriating” • “less emphasis on formulary” • “Discontinue the present tutorials/lectures; Reinstate the lunchtime clinical pharmacology teaching; use more ward-based teaching.” • “It would be great to have small group teaching - maybe some cases to do in advance and then go through them
Importance of experiential learning/ learning in clinical context	<ul style="list-style-type: none"> • “More teaching in actual clinical practice - on wards or clinics as this is not a mandatory aspect at the moment and many clinicians will not teach this.” • “I have found that prescribing on the ward and then getting a junior doctor to look it over more beneficial than any lecture / small group session I have ever had” • “More ward experience of prescribing”

Theme (continued)	Supportive statement(s) (continued)
Benefit of having separate prescribing module(s)	<ul style="list-style-type: none"> • “I think a short course on written and computer prescribing would be useful prior to starting FY1” • “...stand alone module which would make it easier to integrate and follow” • “A dedicated prescribing module with an exam at the end (perhaps similar to PSA)”
Teachers	<ul style="list-style-type: none"> • “Clinical pharmacists are usually the best at teaching in seminars/small groups so more of these.” • “...have more opportunities to follow a pharmacist” • “In the later years we have had pharmacists give us scenarios and asked us to prescribe the appropriate drugs on a drug Kardex, which has been useful, but we have had only 2-3 sessions of this... It would be useful to follow a junior doctor and when they need to prescribe something, they should ask the student how they would prescribe it first”

Role of the national Prescribing Safety Assessment (PSA)

Under 90% of all students were aware that they may need to sit a national Prescribing Safety Assessment (PSA) during their final year of medical school (86.5%, n=885, CI 84-89%). Although this figure was consistent across year groups a higher percentage of final year students were aware they were required to sit a PSA (98.3%, n=413, CI=97-100%), in comparison to 84.7% and 68% of their fourth and third year colleagues respectively.

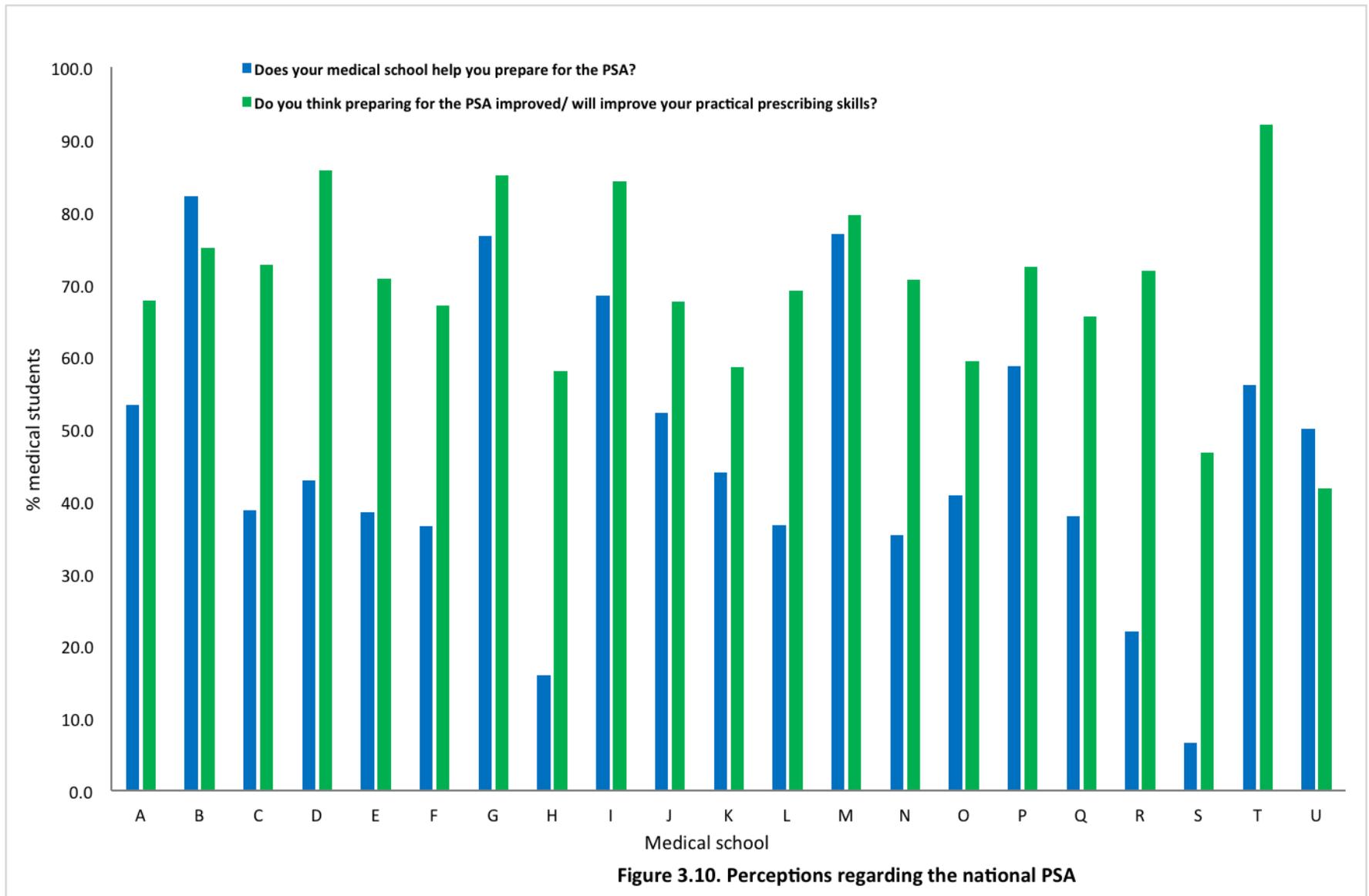
Over half of final year students reported that their medical school helped them to prepare for the PSA (54%, n=227, CI=48-60%). The majority of students in their fourth year of study did not know if any specific teaching was provided in preparation for the PSA (56.3%, n=213, CI=31-47%), while the corresponding figure for the third year cohort was almost three quarters (72.4%, n=163, CI=8-32%). This difference was significant $\chi^2 (2, N=1023)=0.72.31, p<.001$. There appeared to be some variation with respect to this when comparisons were made between student responses from different medical schools (Figure 3.10).

Overall, there appeared to be a perception amongst students that preparing for the PSA will or had improved their practical prescribing skills (67.4%, n=690, CI=64-71%). This was reported by a higher percentage of final year students (72.1%, n=303) in comparison to their counterparts in third year (59.6%, n=134) or fourth year (66.9%, n=253). The difference was significant $\chi^2(2, N=1023)=10.646, p=.0005$ but there was less variation when comparisons were made across the medical schools (Figure 3.10).

Students were asked about their perceptions of how preparation for the PSA impacted on practical prescribing skill acquisition. Responses were divided into 2 groups initially, based on whether the respondents had the perception that the PSA had a positive impact on practical prescribing skills or not. Subsequent thematic analysis was conducted on the qualitative data (Figure 3.11).

Of students who believed that the PSA does positively impact on prescribing skills the most commonly occurring theme was that the skills required to pass the PSA were directly transferable for their future careers as junior doctors. They felt that by passing the PSA or even preparing for it, performance as a junior doctor might be improved. Students also had a strong belief that the PSA made them focus on specific aspects of prescribing that they otherwise would not have focused on in as much detail. Examples include calculations, side effects, or becoming familiar with sources of information. Of those who did not think that the PSA impacted on prescribing skills the most common theme was that there was a discord between the PSA examination process and real life, and that scenarios were not necessarily true to life (Table 3.3).

In addition to the findings in Table 3.3, there was a final theme arising from the respondents who thought the PSA had a positive influence (primarily in years 3 and 4): an expectation that their medical school would provide targeted teaching later in the medical undergraduate course in preparation for the PSA.



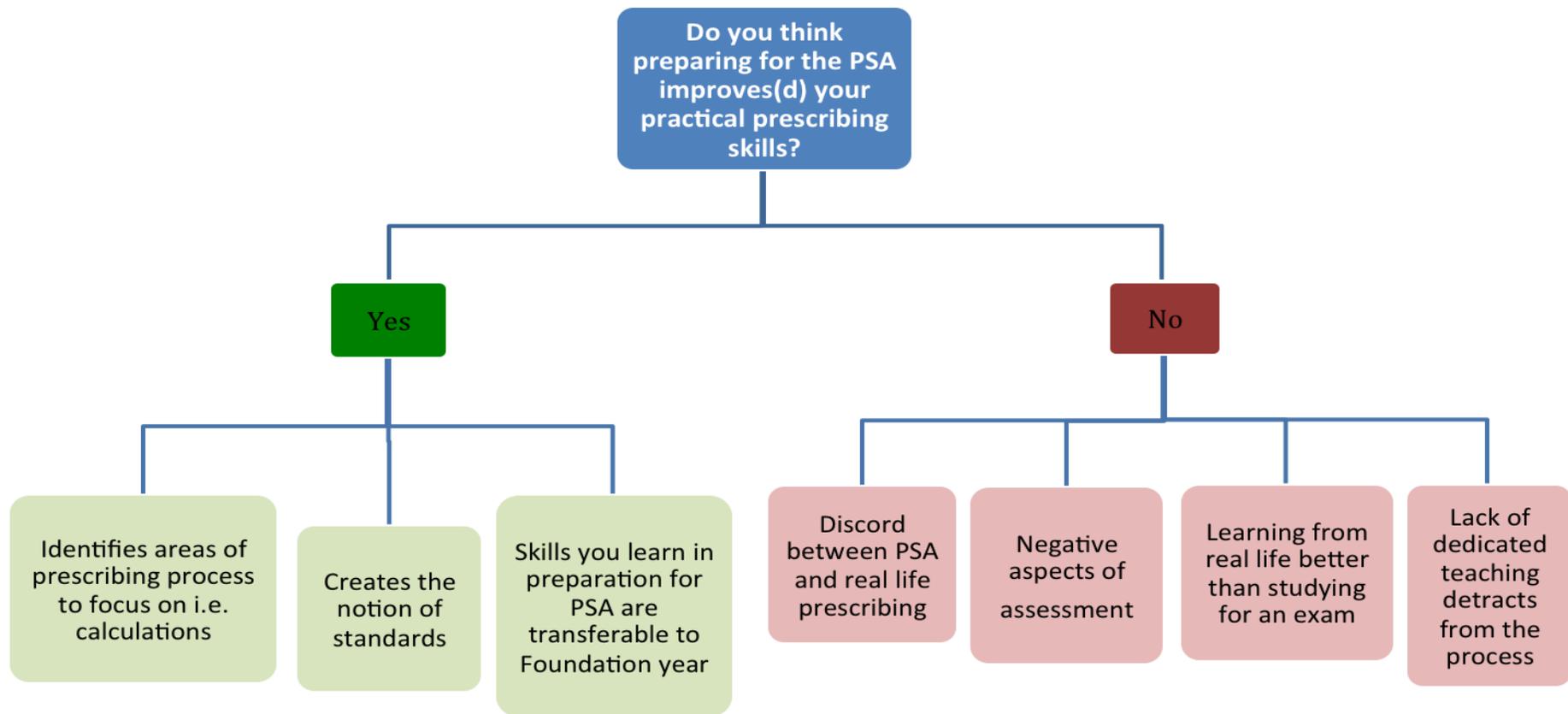


Figure 3.11. Derivation of themes regarding perceptions of the influence of the PSA on practical prescribing

Table 3.3: Thematic analysis of medical students' views regarding the national PSA

Themes arising	Supportive quotes
<i>Those who believed the PSA has or will improve practical skills</i>	
<p>Skills learned for PSA transferable for F1</p>	<ul style="list-style-type: none"> • "...preparation for my PSA has increased my confidence in prescribing and has made me more familiar with the different sources of information that will be available to me as an FY1" • "It would aid learning and help students understand what is expected of them once graduated" • "It kind of 'primes' medical students to the real world of prescribing."
<p>Forces you to focus on particular aspects of prescribing process i.e. calculations, use of information sources, awareness of side effects</p>	<ul style="list-style-type: none"> • "Preparing for PSA actually makes me revise prescribing, drug doses, interactions and calculations. It will only improve my knowledge the more I prepare for PSA" • "It will get me more used to using the BNF and filling in drug charts." • "It forces me to practice actually writing out the prescription, and discover the pitfalls and errors that I should avoid"
<p>Highlights individual learning needs</p>	<ul style="list-style-type: none"> • "It'll identify areas of weaknesses prior to starting work, that we may be able to work and improve on during our final year placements." • "give me a chance to consolidate skills and fill knowledge gaps" • "Exam revision may ensure that areas of uncertainty with regards to prescribing are addressed"
<p>Introduces the notion of standards</p>	<ul style="list-style-type: none"> • "I do think the PSA is useful in ensuring that i do reach the standard that will be required of me as an FY1 next year and doing well in the PSA will be reassuring that i am ready for this step up, whilst a poor result will identify any issues i may not be aware about" • "Yes as it means everyone has to maintain a certain understanding and knowledge of appropriate prescribing" • "It forces you to ensure you are competent - it's just sad that we are not encouraged and guided to do so from the beginning of our medical training. It gives us a standard to aim for."

Themes arising (continued....)	Supportive quotes (continued....)
<i>Those who believed the PSA did not/ will not improve practical skills</i>	
Discord between exam process and real life	<ul style="list-style-type: none"> • “PSA is just full of random drug questions none of which actually test whether what I prescribe is safe” • “It is an online exam, and I cannot translate a computer screen with clicking and typing to real life pen and paperwork.” • “tests exam skill and general medical knowledge, and not practical prescribing. students good at this do well, students with poorer knowledge do poorly but prescribing skills do not improve” • “not comparable to real life situations, a lot of aspects in practice questions are not realistic of what a junior doctor will actually be doing”
Lack of formal education detracts from the value of the assessment	<ul style="list-style-type: none"> • “I do not see value in the exam when actual education is poor” • “.....We can only remember safe prescribing if it is taught as a key component throughout medical school, not as a last minute thought in final year”
Experiential learning better than studying for an exam	<ul style="list-style-type: none"> • “I think working in real life is the only thing that will improve my practical prescribing skills.” • “I am learning prescribing to become a doctor, not for any exam.”
Negative aspects of assessment	<ul style="list-style-type: none"> • “It may, in fact, have the opposite effect, breeding complacency - "I passed the PSA - I'm a safe prescriber” • “Having a timed prescribing test (less than 2 minutes per question) does not instil confidence in prescribing abilities, rather it can actually be detrimental. In a time when we are nervous about prescribing and being told to take our time to learn and make sure we make no mistakes, then giving us an assessment where marks count gives contradicting viewpoints from the medical schools/NHS”

Part B – Focus group data

A total of twenty-two students attended five focus groups at two UK medical schools; eight students in year 5, ten student in year 4 and four students in year 3 between February and October 2015. Twelve of the participants were female and ten were male, no demographic data was captured. All focus group sessions lasted 60 to 90 minutes. An additional four focus groups were organised at the two London based medical schools during November and December 2015 but no participants turned up to these groups on the scheduled days. The composition of individual focus groups conducted in summarised in Table 3.4.

Table 3.4: Breakdown of individual focus group details

Medical school	YEAR OF STUDY	Date of focus group	Number of participants
A	3	04/03/15	4 (2 male, 2 female)
A	4	05/03/15	6 (1 male, 5 female)
A	5	28/02/15	5 (2 male, 3 female)
B	4	23/10/15	4 (3 male, 1 female)
B	5	10/06/15	3 (2 male; 1 female)

Two hundred and ninety two codes were identified in the transcripts by the researcher (Appendix O). These were then grouped into themes independently by the researcher and another PhD student with experience of qualitative analysis techniques. Table 3.5 summarises the results of these individual theme derivations. The findings from both analyses were discussed and the final themes decided upon by the researcher. These nine themes are discussed individually below with a description of each and illustrative quotes from the students provided throughout.

Table 3.5: Comparison of initial themes derived from codes by individual researchers

THEMES IDENTIFIED BY RESEARCHER	THEMES IDENTIFIED BY VERIFIER
Practical prescribing bridging the gap	The role/value of experience/ practical training – students want more practical training
Clarity – knowing what is expected at each stage	The importance of being aware of expectations (what do they need to know) and linking those with assessments
Timing and repetition (frequency)	The importance of timing
Effective supervision	Importance of good guidance and supervision
Multidisciplinary teaching important	Multidisciplinary and multimodal teaching is important with access to appropriate resources
Quality and availability of learning materials	Insufficient training/ knowledge can cause harm, learning how to prevent harm by safe prescribing is important
Links to rotations is crucial (tasks, assessment, cases)	Better integration of prescribing to the curriculum would be beneficial/valued
Cases/ scenarios of real patients important source of learning	Case-based and focused teaching is valued
Variability of teaching experiences within and amongst medical schools & NHS Trusts	Current problems with prescribing training – disjointed, lack of resources, not linked into practice
Nature of the teaching	Importance of knowing the basics
Importance of compulsory aspects	Life-long learning
The role of assessment with proper feedback	
Learning in context	

Final themes

- 1) Bridging the gap – this theme refers to student recognition of the importance of experience and practical prescribing training as an effective way to help them bridge the gap between the underlying theory and putting this knowledge into practice in the applied setting. The use of prescribing scenarios in addition to practical training in the context of real patients was discussed in every focus group conducted, with the consensus that learning about drugs and prescribing in context was very effective in helping to consolidate learning. Ward-based teaching was seen as far superior to a didactic lecture based format where prescribing was concerned. Problem based learning was suggested as a useful approach to developing a holistic approach to patient care. Students felt that it was important to know the basics but didn't believe that in-depth knowledge was the most important aspect but rather seeing drugs in action made for more memorable learning experiences.
- 2) Inconsistency – this theme refers to the disparity of many aspects of the undergraduate curriculum in relation to practical prescribing teaching and how these can hamper learning. In each focus group, students discussed the variation in practical prescribing provisions between different medical schools, but were more frustrated by the apparent inconsistency with regard to prescribing teaching during various rotations, and at different placement sites within their own institutions. The quality and accessibility of certain learning materials was highlighted as problematic, particularly for sessions delivered at external sites for experiential learning. Most students agreed that the medical school could and should have more control over teaching at these external sites, by either providing more guidance to the consultants overseeing their training or standardising the learning materials used for teaching their students ensuring less variation in student experience. Controlling this would also mean that accessibility to high quality learning materials would be improved, and students would be less disadvantaged by virtue of the location of particular placements.

- 3) Effective guidance and supervision – students highlighted the importance of adequate support and supervision, particularly while practicing prescribing tasks on placement. Some students felt they learned more from tasks such as clerking patients with more autonomy than simply transcribing a drug chart for a patient they knew little about, but this appeared to be largely personal preference. This theme also encompasses the need to be knowledgeable about support available in written or online formats such as local or national prescribing guidelines and other references resources such as the BNF. Once more the variability of the student experience in this regard surfaced, with clinical teaching fellows being highlighted at one medical school as having an active interest in medical student development.
- 4) Multidisciplinary and multimodal teaching – this refers to the value that the students place in the awareness of the expertise of other healthcare professionals when it comes to learning about prescribing, particularly that of pharmacists. Students did acknowledge that due to limited resources such as staffing levels, timing and finances it is not always possible for a medical school to deliver the types of teaching from qualified professionals as much as students would like.
- 5) Improved integration – there was a feeling amongst students that the practical prescribing teaching that they receive is very disjointed and as a result, of limited benefit. Often it was the time intervals between sessions that were the issue, with students finding it difficult to piece the different bits of information together and how these related to the bigger prescribing picture. They favoured revisiting and reinforcing key topics rather than having one off sessions. There was also a feeling that integrating focused teaching at appropriate timings in relation to specific clinical rotations would further help to consolidate learning about the use of medicines
- 6) Role of assessments– the old adage that assessment drives learning emerged from every focus group. Students appear to greatly value exercises that would force them to learn and highlight gaps in knowledge.

The use of more frequent formative assessments akin to the national PSA was mentioned in many groups, particularly focused in final year would be beneficial. Students would also appreciate more online quizzes specific for particular rotations or groups of drugs to help focus learning.

- 7) Focus – this theme covers several aspects within the curriculum. Firstly, the need for medical schools to make clearer what the expectations of students are with respect to knowledge of medicines and their use in practice, and provide more focused sessions and learning materials to help students achieve this. Students discussed that the focus on prescribing skills was typically left until final year, yet the issue surrounding its' earlier introduction proved divisive within the groups – the more senior years thinking it was less valuable to do so than their more junior colleagues. Adapting a focus on certain medicines (those classed as high-risk, commonly prescribed, or those appearing on the national PSA) is the approach currently in use at both medical schools, however students had mixed views on the efficacy of this approach. Where a paper based formulary was used in isolation students did not find this a useful learning exercise, and many felt it was a token “copy and paste” exercise from the BNF.

- 8) The role of compulsory elements – linked to the assessment theme students reported that they were less likely to engage in optional sessions provided even if it was known they would be beneficial. Students discussed the pros and cons of having compulsory sign off for certain prescribing tasks while on placements. Many felt it would push the students to be more proactive in seeking out tasks, but conversely some felt that it often turns into a signature chasing exercise without much attention paid to the actual task at hand or the intended learning outcomes.

- 9) Effective feedback – this theme transcends many of the above themes. Students acknowledge that almost all learning experiences such as log book style sign offs, student formularies, assessments, and prescribing tasks either on the ward or at university, are only as useful as the feedback they receive on their performance. Students reported great variation in

feedback provisions across the board; even for standardised tasks given at university with academic tutors being responsible for checking progression – which had an impact on overall learning and perceptions of how important tasks were. Students unanimously agreed that without meaningful feedback on performance, experiential learning is often not as effective as it could be.

Discussion

This study, for the first time, has explored the provisions for the teaching and learning of practical prescribing, and the perceived effectiveness of these provisions by medical students in UK medical schools. Previous studies have tended to focus either on the provisions of CPT, or on effectiveness of individual educational interventions introduced to improve prescribing. The importance of utilising student feedback as one aspect for quality assurance in the higher education setting is well established (Leckey & Neill, 2001), and its use is now widespread. If curricula can encompass methods highly valued by students, this may lead to better engagement, the benefits of which have been discussed above.

The majority of final year medical students (94.3%) reported that there was teaching and learning in practical prescribing at their institution. Furthermore, only 9 medical schools represented in this study had all final year student respondents reporting that they received this teaching. However it is worth highlighting that some students have reported that this is not the case at their medical schools. It is perturbing to note that any students at this stage of their medical degree report they do not receive teaching in this skill that is so fundamental for junior doctors. It is not clear from this study whether it is because some final year students are not exposed to practical prescribing teaching at all or whether, in fact, the prescribing teaching is integrated into the curriculum in a form that does not make it readily identifiable by the students. Interestingly, a lower proportion (75%) of third year medical students reported that there was teaching and learning in practical prescribing, which suggests that medical schools might be delaying introduction of this until later in the course. Timing and frequency of practical prescribing sessions was discussed in many of the focus groups. The consensus amongst the third and fourth year

students was that earlier introductions may be beneficial, however the fifth years thought introducing such teaching too early on would have the opposite effect. However, there is no evidence to indicate the optimal time of introduction of various educational interventions around the teaching and learning of practical prescribing into the curriculum. As a result, the impact of earlier introduction of such interventions on the preparedness to prescribe as a newly qualified doctor remains to be demonstrated.

Results from this study highlight that an integrated approach for the delivery of practical prescribing teaching at medical schools is predominant over stand-alone modules/ courses. There is a paucity of evidence for the superiority of either approach but it is not surprising that medical schools veer towards an integrated approach as this is in line with GMC guidance (General Medical Council, 2016). However, with an integrated curriculum, aspects relating to the safe use of medicines should still be clearly identifiable (Maxwell & Walley 2003, Ross & Maxwell 2012). Integration was one of the themes that emerged from the focus groups, with students across both medical schools raising the issue of improved integration of prescribing teaching within the curriculum at focused or clinically relevant times:

Students reported that they were exposed to a variety of teaching and learning methods. The availability of methods such as peer teaching, student formularies, shadowing a clinical pharmacist and use of mobile apps was similar across all years of study. However, it was noted that their use was not consistent across all medical schools. Conversely, there was disparity with respect to the apparent availability of methods such as simulation, pre-prescribing on actual drug charts/ e-prescribing systems (both validated i.e. prescriptions written by students are checked by an appropriate professional for accuracy, and un-validated i.e. prescriptions written are not checked for accuracy), and shadowing of junior doctors. This was particularly prominent in year 3 and suggests that there might be a delay in their introduction and suboptimal use. Medical schools may wish to review the provision of such methods more closely as these were also the ones perceived to be most effective by the students themselves, with students placing particular value in the methods that bridge the gap between theory and clinical application. Although in the current study

we determined perceived benefit of the above methods of delivery, their practical value has been proven elsewhere (Smith et al., 2012, Conroy-Smith et al., 2011, Tittle et al., 2014).

The four professional groups ranked most effective in delivery of teaching, were the same four groups the students stated were responsible for the delivery of most of the safe prescribing teaching. One explanation for these findings may be that students benefit most from teaching, which is delivered by individuals in active clinical service. However, there are currently no data available to corroborate this. The qualitative findings indicate that students value teaching about prescribing from many healthcare professionals, particularly clinical teaching fellows and pharmacists – however students showed insight into the impact of limited resources on their availability within the curriculum

The importance of the professional group responsible for delivery of the teaching is unclear from the data obtained, but the emphasis should be on having teachers that possess the appropriate knowledge and experience (Maxwell and Walley 2003). A pragmatic approach is for individual medical schools to decide who is best suited to perform this role locally. One important aspect to be taken from these data is the importance of ensuring that those providing practical prescribing teaching are confident and competent enough to do so. The junior doctors (foundation doctors), who were widely reported to be currently involved in this role, should receive specific training to allow them to fulfil this role, as should be the case with any healthcare professional responsible for this.

This study has for the first time gathered the perceptions of UK medical students regarding the acquisition of practical prescribing skills. Although the data presented represents the views of students, which is not necessarily a comprehensive measure of efficacy or actual provisions, the role of student feedback in higher education is well documented (Lecky & Neill 2001). The importance of face validity with respect to curriculum review and student engagement has been discussed already.

It is concerning that so few medical students reported that their undergraduate course currently prepares them to undertake the task of practical prescribing. Although this supports the findings of previous reports of a similar nature (Geoghegan et al., 2017, Heaton et al., 2009, Iling et al., 2008), it is worth highlighting that there was a less positive attitude amongst the medical students in year 3 and 4, who may not have had the opportunity to experience the real world demands of prescribing or done some shadowing on the wards. However the final year students are a more credible source, as they would likely have experienced these in practice and could provide a more informed critique.

Heaton et al. (2008) highlighted perceived insufficiencies in prescribing assessment, and in a manner paving the way for the development of the PSA. However, these current findings act as a reminder that despite changes to undergraduate curricula, students still perceive there are issues in terms of acquiring practical prescribing skills. Without another in depth prescribing error study it remains to be seen what impact (if any) the various education interventions introduced have had on actual prescribing errors in practices or longitudinal study design assessing changes in attitude. Assessing the impact of the PSA would similarly be very difficult to assess.

It has been said that to achieve quality in higher education teaching one must chiefly satisfy the primary user of the service, i.e. the students (Ellis et al. 1993). The study results suggest that in relation to the teaching and learning of practical prescribing, the country as a whole might be falling short of “quality”. It is not clear from this study if the teaching provisions as reported by the students reflect accurately the purported content of individual medical schools, however medical schools must look at why this discord may be present.

There is an apparent variation in students’ perception of how their medical undergraduate course prepares them for practical prescribing. The determination of the efficacy of the method of teaching and learning used in various medical schools might enable the sharing of best practice. However, due to confounding factors it would be deeply challenging to ascertain their relative efficacy.

Students support the notion of a standardised approach to the teaching and learning of practical prescribing across all medical schools, and on the whole agree that earlier introduction in medical undergraduate curricula could also be a beneficial approach. There are no data available to suggest what the optimal time to introduce such teaching would be, but other core skills are commonly introduced from very early in curricula. We would argue that for a skill as complex as prescribing, and one that is so fundamental for junior doctors, the same should hold true, and its presence throughout the course is made more prominent. Further evidence of this is from the thematic analysis of qualitative data with students calling for more teaching, earlier in the course with key topics being revisited frequently throughout the course rather than one-off sessions (Table 3.1). Junior doctors are expected to perform this complex task, with minimal supervision from day one of their foundation training. Should full registration move to the point of graduation as proposed, this highlights the need for students to achieve minimum standards in practical prescribing, hence the teaching and learning of this vital skill at the undergraduate phase will become of even greater importance.

It is not surprising that final year medical students appeared to have a heightened awareness of the PSA, or indeed an awareness of support offered to students by their medical schools. This might be because the PSA is taken in the final year of study at medical school, but the cause for concern is the apparent variation in preparation of students by medical schools for the assessment. Considering that the PSA is a standard examination implemented nationwide, there should perhaps be more formal guidance to aid medical schools in providing the appropriate support for its students, or at the least clarify what is expected of students: qualitative data suggest this is something students currently find challenging. Unsurprisingly the student attitudes appear to support the old adage that “assessment drives learning”. Despite the lack of preparation or support that students perceive, they see the PSA as a useful learning tool that will aid their practical skill acquisition regardless. It remains to be seen what impact, if any, the PSA will have on actual prescribing error rates amongst newly qualified doctors. The development of the PSA is some proof of how important an issue the task of teaching and learning of prescribing must be taken, as efforts are being made on a national level to address the issue.

Having the PSA in place highlights the potential value of setting standards that all medical schools could use to guide the teaching and learning of practical prescribing, not just to help in preparation for the PSA but for life afterwards as a junior doctor. It might also be useful to determine whether there is a correlation between prescribing assessments undertaken by foundation doctors in individual NHS Trust and the PSA. Such information might enable the prediction of candidates who require additional training in safe prescribing during their F1 year. To date no such study has been completed.

Limitations

This study is not without its limitations. It was not possible to determine an accurate response rate for the questionnaire as some medical schools had a total ban on disseminating questionnaires to their students. Although it is difficult to extrapolate and generalise the results, there is no reason to believe that the medical schools not represented in this study are likely to be so different. However it is impossible to say for certain. What this study does provide are the views of over 1000 medical students from 25 medical schools giving an overview of the current state of affairs in the UK.

Similarly, the qualitative data was obtained from just 5 focus groups at two medical schools, and although the aim was to obtain the views of a small cross section of the overall study population, a larger number of focus groups could potentially increase the generalisability of these data. However, it is reassuring that the messages coming from the focus group data does triangulate the quantitative data from the questionnaire, so perhaps is an indication of the picture in the UK.

The effectiveness of modes of delivery and personnel, were perceived by the students, and not measurable as a hard outcome. However, in terms of curriculum design and improvement, the importance of student feedback is recognised.

It must also be acknowledged that there may be selection bias as the more motivated students or those wanting to voice frustrations about the curriculum may be more likely to respond to these types of questionnaires, or attend focus groups.

The questionnaire and focus groups did not collect demographic data on respondents, so it was not possible to determine with any certainty if a representative sample was actually achieved.

Conclusion

This study highlights the current picture of teaching and learning practices in practical prescribing in UK medical schools, highlighting the methods the medical students perceive to be most effective and certain areas that could be targets for improvement. Students are exposed to numerous methods, at different stages of their undergraduate course and in the absence of individual error studies it remains difficult to assess the actual efficacy of these methods on a long-term basis.

This study also highlights a perceived disparity in the medical schools' approach to preparation of their students for practical prescribing, which includes preparation for the PSA. All junior doctors are required to prescribe safely and effectively and in order to do so their undergraduate curriculum must be optimised.

It is not possible to make individual recommendations on the data generated by this study alone, because this tells the story from one side of the interface. It is therefore not clear from this study if the teaching provisions as reported by the students reflect accurately the purported content of individual medical schools. The next stage of the research will study these provisions from the medical schools' viewpoint, and highlight any discrepancies between the two view-points. Any discord identified must be further explored in an attempt to identify why it may be present.

Chapter 4 – Practical prescribing teaching provisions in UK medical schools, undergraduate curriculum lead perspective

Introduction

Undergraduate medical education in the UK has undergone many changes over the years, rendering disciplines such as clinical pharmacology and therapeutics (CPT) less visible in curricula, in favour of an integrated approach (GMC 1993, GMC 2002, GMC 2009). This approach was appropriate to lessen factual burden on students, but it has been suggested that such changes may have inadvertently affected the practicality of consolidating the fundamentals of CPT necessary to safely prescribe (Maxwell & Walley, 2003). It remains to be proven how this new way of teaching has affected learning outcomes, or indeed prescribing error rates. A comprehensive review of error rates in the UK has not been undertaken since the EQUIP study, so it is not known if error rates have fallen over time. However with respect to high fidelity, and fundamental tasks, particularly those of prescribing, medical students and recent graduates have raised concerns about knowledge deficiencies with respect to CPT (Heaton et al. 2008, Illing et al. 2008, Brinkman et al. 2014). Prescribing error rates attributed to newly qualified junior doctors in particular have reinforced these concerns (Dornan et al 2009). Hence it appears that more needs to be done to ensure students can develop appropriate practical prescribing skills.

Traditionally students relied on learning opportunities arising throughout final year placements to practice skills such as prescribing (Monrouxe 2014). However, with an ever-increasing reliance on electronic prescribing systems throughout many NHS hospitals, the potential for such learning opportunities may be limited, and where they do exist, have been found to be of questionable value or quality (Heaton et al. 2008). Medical schools therefore have a duty to address this barrier to prescribing skill acquisition within the curriculum. One solution to this may lie in providing more targeted teaching for practical prescribing at the undergraduate level, which could lead to an improvement in patient safety and fewer prescribing errors in the future.

Undergraduate teaching and learning of CPT

The diversity of the teaching of CPT in UK medical schools, and apparent lack of emphasis on prescribing has been commented on previously (O'Shaughnessy et al., 2010). More recent findings indicate that the teaching of CPT across and within countries in Europe is inadequate and may be an underlying factor in poor prescribing competency attainment amongst final year medical students (Brinkman et al., 2016, Brinkman et al., 2017). Deficiencies have also been highlighted with respect to teaching and learning provisions for practical prescribing in postgraduate settings in the UK (Kennedy et al., 2016).

However, to date, the provisions for the teaching and learning of practical prescribing at the undergraduate level specifically have not been studied. Practical prescribing encompasses processes that lead to the writing of a clear, safe and legal prescription and the teaching and learning of this helps bridge the gap between theory and clinical practice (Ross & Maxwell 2012). Dornan stressed the importance of education in addressing the issue of prescribing errors (Dornan et al., 2009) and although many educational interventions have been developed, the long-term efficacy of these remains to be proven.

The national Prescribing Safety Assessment (PSA)

Although there is no consistent programme across all UK medical schools for the teaching of prescribing skills, there is now a consistent approach to the assessment of prescribing skills. All newly qualified doctors are required to now sit the national PSA prior to commencing their first year of postgraduate medical training (F1) (Maxwell et al., 2017). The PSA, first piloted in 2013, is the result of a collaboration between the BPS and the MSC, in an attempt to determine if final year medical students possess the necessary skills, judgement and underpinning knowledge to prescribe medication safely and effectively (Maxwell et al., 2017). The importance of the PSA may become greater in future if full registration were to move to the point of graduation, as proposed by the GMC (Greenway et al., 2013). To date there is no literature relating to the effect of the PSA on actual prescription error rates, however such studies would be difficult to conduct due to the

numerous confounding factors. Likewise there is no data available regarding the PSA's perceived role in practical prescribing skill acquisition.

Prescribing curricula

The first attempt to address the lack of clear guidance with respect to CPT and prescribing came with the proposal of "the key elements of a core curriculum in prescribing and therapeutics" (Maxwell & Walley 2003). It was suggested that learning should be focused around a core list of commonly prescribed drugs, and expanded on those essential elements of core knowledge, understanding, skills and attitudes. There was little focus however on practical prescribing skill acquisition.

Building on these foundations, the BPS's prescribing initiative further formalised the learning outcomes for an undergraduate prescribing curriculum (Ross & Loke 2010). The 50 learning outcomes, sanctioned by a Delphi panel, was more focused on prescribing than its 2003 predecessor, and placed an emphasis on medication review, communication and documentation of prescribing decisions.

The overall aim of this iteration was to produce a curriculum that would set out clearly defined criteria against which to assess students' performance, which was proving difficult with the lack of specific guidance (Ross & Locke 2010). It is not possible to say if this was used in medical undergraduate education

Latest BPS curriculum

The latest update to the BPS's core curriculum was the most detailed (Ross & Maxwell, 2012). Intended learning outcomes were set out into 4 key topics: principles of pharmacology, essential drugs, essential therapeutic problems and prescribing skills. The primary purpose of these was to help in the design of and subsequent mapping of undergraduate curricula to drive improvements, and suggest the core learning required to satisfy the outcomes of Tomorrow's Doctors (GMC 2009). However, there was less attention paid to the practical acquisition of the skill of prescribing itself in favour of the underlying knowledge required to safely do so (Ross & Maxwell 2012). The prescribing and related skills umbrella, covers topics such as taking a medication history, prescribing a new medication, and subsequent

prescription review, calculating drug doses, prescription writing, communication and adverse drug reactions. The curriculum does not specify the core content and learning outcomes required specifically for an undergraduate to safely and practically prescribe a medicine.

Despite their development, it is not known to what extent, if at all, medical schools have adapted these curricula, and indeed as Ross and Maxwell (2012) acknowledge in the last iteration, the universal uptake would not be likely.

In order to develop strategies to address the inadequacies highlighted in the literature, it is essential to understand current levels of teaching and learning for prescribing. The previous chapter focused on student perceptions regarding the provisions of practical prescribing teaching. To balance these views, the data presented in this chapter presents the medical schools' perspective about the same provisions.

Aim

This study set out to determine the teaching provisions in practical prescribing as set out in UK medical schools curricula, by seeking views from those responsible for the undergraduate curriculum (prescribing lead where such posts exist) at each UK medical school.

The main objectives of this study include:

- To determine whether each UK medical school offers specific teaching in safe prescribing to its medical undergraduates
- To determine if differences exist between the provision of practical prescribing in UK medical schools
- To determine who is responsible for delivering practical prescribing training, and to determine the dominant mode of delivery, i.e. face-to-face, practical prescribing sessions, pre-prescribing, etc.

- To determine what impact, if any, the Leads for the undergraduate medical programmes think that the Prescribing Safely Assessment (PSA) has on practical skill acquisition amongst medical undergraduates
- To determine if there is a belief that medical education should be more standardised across all medical schools in the UK

Methods

Design

A questionnaire was designed to elicit information regarding the teaching and learning provisions for practical prescribing from the perspective of the medical schools throughout the UK in 2014. This study was conducted alongside the undergraduate questionnaire described in the preceding chapter. This was in an attempt to ascertain a full picture of the methods used to teach practical prescribing, the number of hours dedicated to each, and identify who was responsible for the teaching. In addition the questionnaire explored views regarding preparedness for practice, value of standardising content of undergraduate curricula, and the PSA.

The questionnaire, which contained a mix of open and closed questions types, was designed and delivered using the Bristol Online Surveys software, described in the previous chapter. Respondents could request paper copies of the questionnaire if required.

Respondents and setting

Respondents had to be the Lead for undergraduate medical education in a UK medical school, or their nominee. To facilitate the nationwide approach, the researcher contacted the Medical Schools Council (MSC), who provided a contact from each medical school, who was a named representative in the MSC's Assessment Alliance group.

Questionnaire design

The questionnaire (Appendix B) contained 26 questions, separated into 4 sections exploring the provisions of practical prescribing teaching, preparation for prescribing and the national PSA (Table 4.1). The questionnaire followed the same format as the undergraduate questionnaire described in Chapter 3. A questionnaire examining CPT provisions throughout the UK, and one used to determine the training provisions in prescribing for Foundation doctors were used as guides in questionnaire development (O'Shaughnessy et al 2009, Kennedy et al. 2016).

Once the final questionnaire was drafted, it was piloted amongst members of the DME at BSMS not directly involved in the research project, thus providing a degree of content and internal validity.

Table 4.1 Breakdown of the questionnaire into sections

Section	No. of questions	Questions sought to elicit information regarding
About you	2	Information regarding the medical school
Teaching of practical prescribing	18	What teaching and learning takes place at the medical school to prepare undergraduates for the practical prescribing required as foundation doctors
Preparation for practice	3	How medical students prepare for the responsibilities of undertaking safe prescribing as a foundation doctor
Prescribing safety assessment	3	Views regarding the prescribing leads' perceptions of any impact that the PSA has on practical skill acquisition amongst the undergraduates

Distribution procedure

As agreed by the MSC Executive Director and researchers, all potential respondents received a written summary of the purpose of the study at an MSC

Assessment Alliance (MSCAA) meeting in October 2014, which was disseminated by the Assessment Leads from BSMS on behalf of the research team.

Three weeks after this meeting an invitation message was e-mailed directly to the undergraduate lead at each of the medical schools (33 in total as listed on the MSC website providing undergraduate medical education). This e-mail contained a participant information sheet regarding the study and a link to the online questionnaire. Reminder e-mails were initially sent at fortnightly intervals to non-responders throughout November and December 2014, and subsequently reminders sent at monthly intervals for the remainder of the study. The questionnaire was available for completion from November 2014 until April 2015.

Data analysis

Completed responses were stored in a password protected BoS account; data were subsequently transferred to Microsoft Excel 2011 to facilitate the completion of further descriptive statistics on the quantitative data. The content of open-ended questions within the questionnaire were analysed manually for themes, to allow comparison of opinions amongst respondents. The thematic analysis followed the six stages described by Braun and Clarke (2006), which has been discussed in detail in Chapter 2.

Ethics and method for obtaining consent

The Research Governance and Ethics Committee at Brighton and Sussex Medical School reviewed and subsequently granted ethical approval for the study (reference 14/015/OKO). The MSC Executive Director also considered the study and permission was granted to disseminate study material at an MSCAA meeting as described above.

There was no special procedure in place to obtain informed consent from participants, so completion and submission of a response was taken as consent to participation.

Results

Twenty-four prescribing leads responded, representing medical schools in England (n=17, 70.83%), Scotland (n=5, 20.83%), Northern Ireland (n=1, 4.17%) and Wales (n=1, 4.17%).

Of the non-responders: one medical school did not submit a response but the clinical teaching that medical students receive are provided under the auspices of an umbrella organisation made of up of two individual medicals schools. The medical school that submitted a response, therefore represented the teaching provided by the umbrella group, and so was treated as such as the request of the respondent. A total of 8 medical schools were therefore not represented, 7 based in England and 1 based in Wales. This left the overall response rate of the prescribing lead questionnaire at 72.7% nationally (n=24).

One hundred per cent of the medical schools that responded, reported that their course incorporates teaching on practical prescribing (n=24). The majority of medical schools reported this teaching is done in an integrated fashion (n=13, 54.17%), with a third reporting teaching being provided as stand alone module(s) (n=8, 33.33%). The remaining 3 medical schools use a combination of the two (12.5%).

Methods employed in teaching practical prescribing

All but one medical school reported the use of tutorials in the teaching of practical prescribing (n=23, 95.83%). Problem based learning (PBL) was reported as the second most commonly employed method in the teaching of practical prescribing (n=22, 91.67%), followed by small group teaching (n=21, 87.5%). Peer teaching was the method reported as being used by the fewest number of medical schools (n=7, 29.17%). Figure 4.1 highlights, which methods medical schools report are used to teach practical prescribing in general across the UK as a whole.

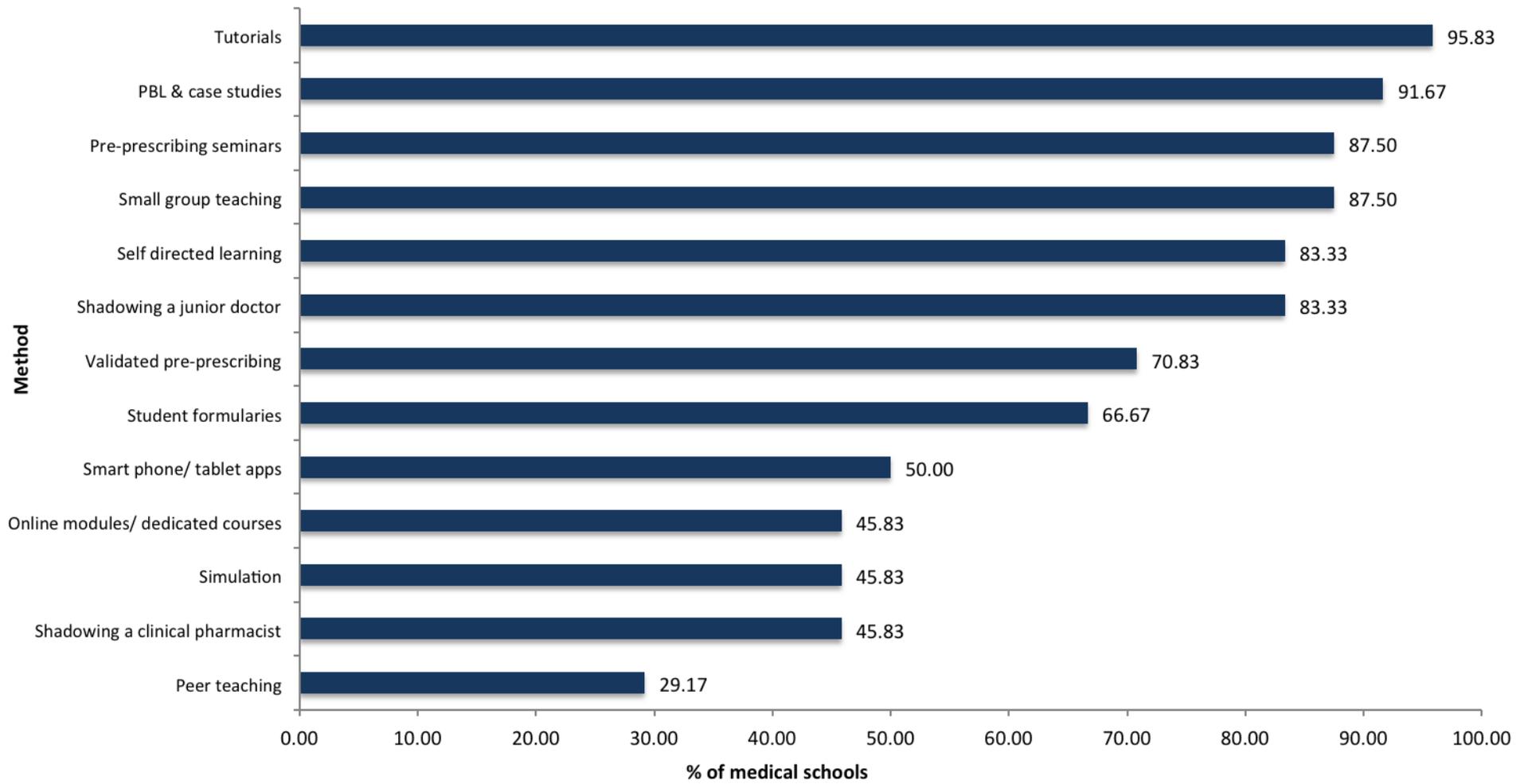


Figure 4.1: Methods used in UK medical schools for teaching and learning practical prescribing

Twelve and a half per cent of medical schools reported that their students do not get to practice prescribing on actual drug charts/ electronic prescribing systems informally while at university i.e. pre-prescribing seminars (n=3, 12.5%). In addition to prescribing informally as described, the questionnaire asked about exposure to prescribing in a more formal manner. Such prescribing exercises, which an appropriate professional validates, were not available to students at seven medical schools (29.17%). Simulation i.e. prescribing in a simulated busy work environment to mimic real life stresses encountered on the ward, is used in less than half of medical schools responding (n=11, 45.83%). Figure 4.2 shows how the provisions of the various methods vary by geographic location across the UK, in England, Scotland, Northern Ireland, and Welsh medical schools who responded (n=11, 45.83%). Values are reported as percentages of the total number responding to the questionnaire for that specific region.

Compulsoriness of methods

Medical schools were asked in addition, to indicate if the various methods, where used, were mandatory for students to attend or not (Figure 4.3). No method was reported as being compulsory by all medical schools. Just three methods were reported as being compulsory components in curricula by over 90% of medical schools that use them: small group teaching (n=20, 95.24%), tutorials (n=21, 91.3%) and problem based learning (PBL) and case studies (n=20, 90.91%). Self-directed learning, although reported as being a commonly used method (Figure 4.1), was only compulsory at half the schools it is employed in (n=10, 50%). The methods that bridge the gap between theory and practice where used, were mandatory in the majority of medical schools: pre-prescribing seminars (n=18, 85.71%), validated pre-prescribing (n=14, 82.35%) and simulation (n=8, 72.73%)

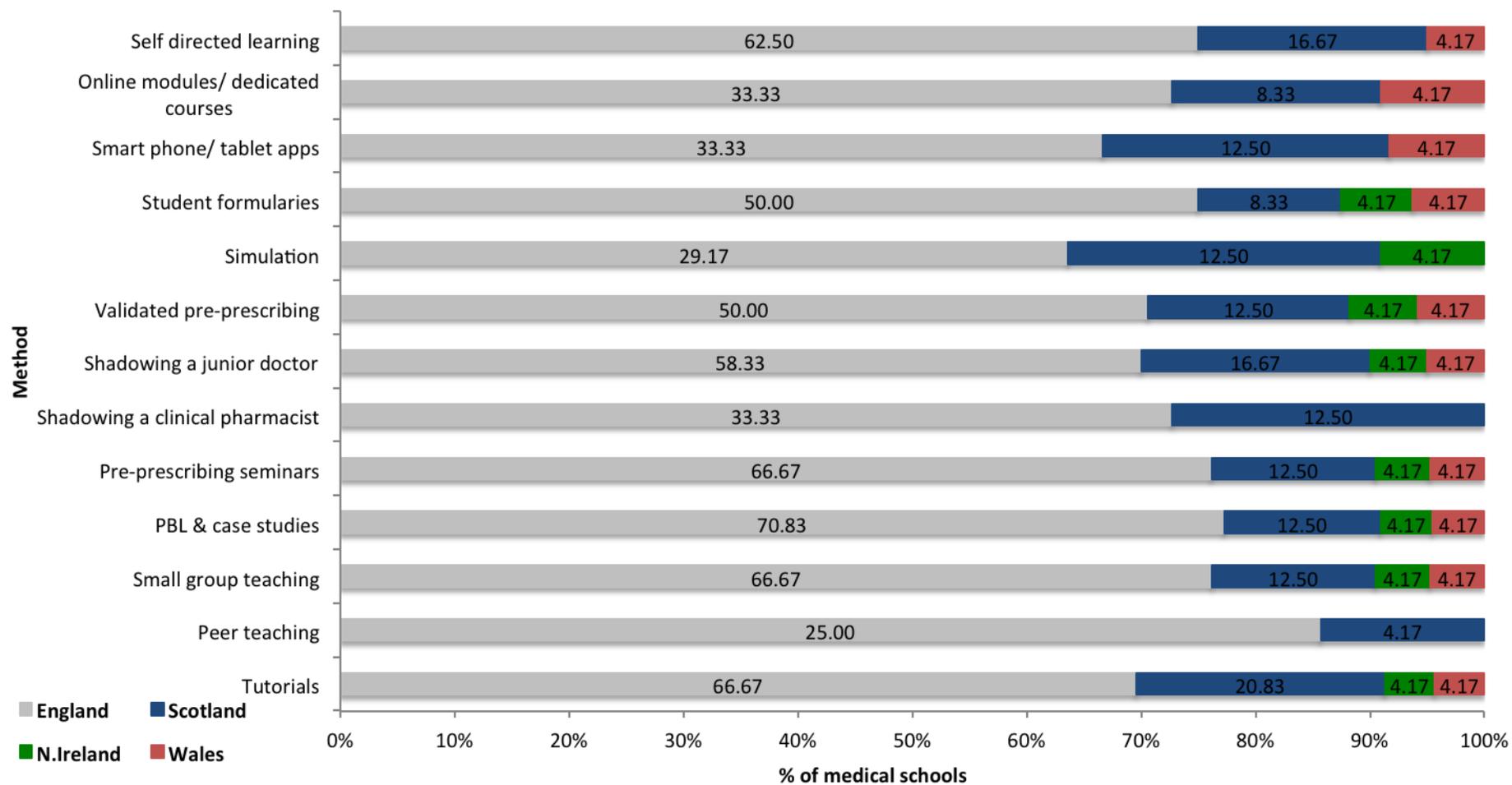


Figure 4.2: Methods used for teaching and learning practical prescribing according to geographic location in UK

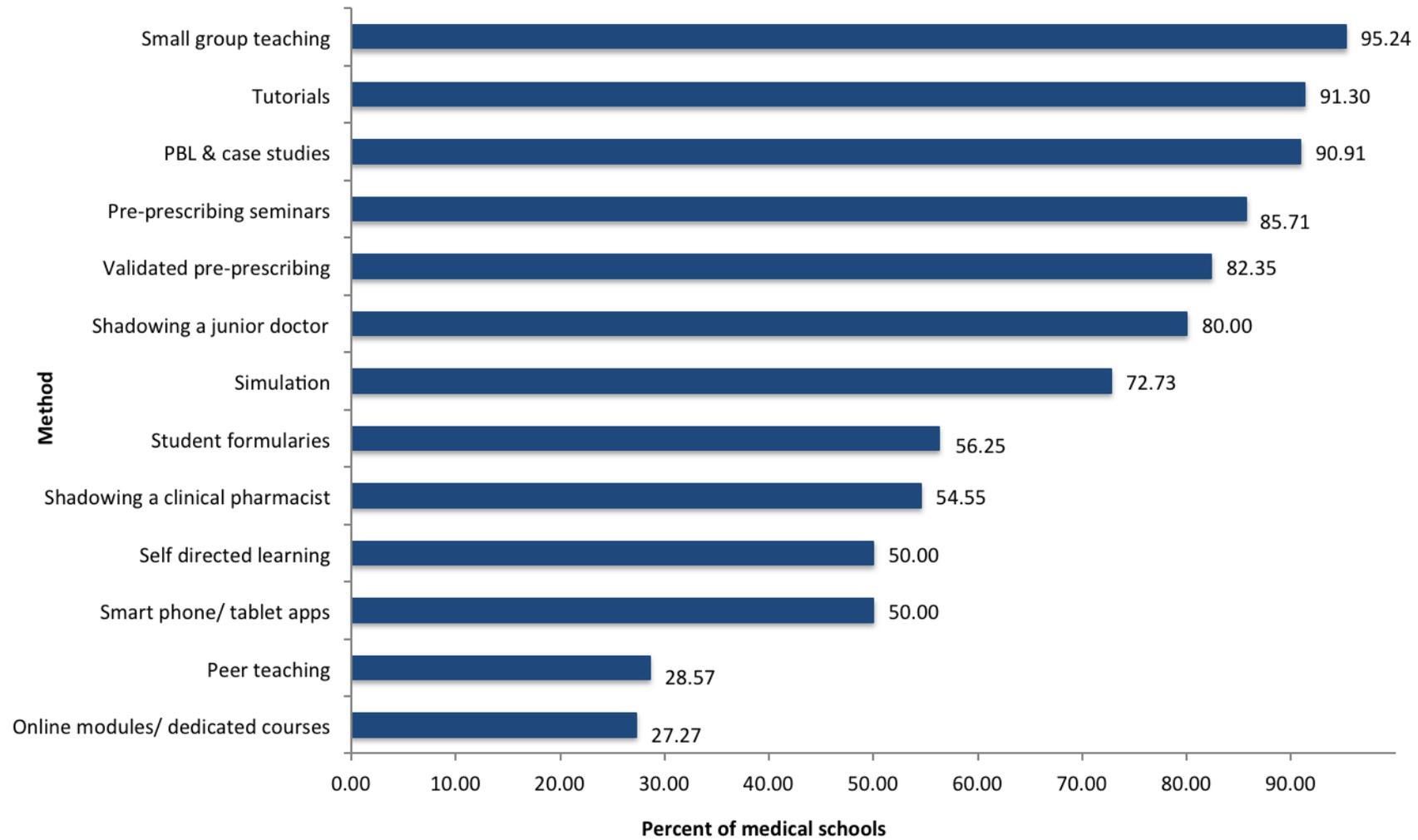


Figure 4.3: Mandatory status of methods used in teaching and learning of practical prescribing

Time spent per method

With respect to characterising the number of hours dedicated to each method in relation to practical prescribing teaching over the course of the full medical degree, respondents found it difficult to state with certainty how many hours were dedicated to many of the methods suggested (Figure 4.4). The methods too difficult to define (TDTS, dark blue bar) tended to be those that are provided in a less formal setting within the curriculum i.e. self-directed learning, online modules, smart phone or tablet apps, and student formularies (Figure 4.4). No medical school reported that fewer than three methods were used in the teaching of practical prescribing at their medical school.

Only nine medical schools assess which methods students most benefit from (37.5%): eight English and one Scottish medical school. Where this was assessed, medical schools rely on direct student feedback, assessment/ progression data (including PSA data), in addition to GMC feedback.

Who teaches practical prescribing?

All 24 medical schools reported that consultants/ clinicians currently in practice are involved in the teaching of practical prescribing to undergraduates. This was the only professional group that 100% of medical school reported as being responsible for this role. Foundation year doctors in their first and second year of post-graduate training (F1 and F2 respectively) were the second most commonly reported group responsible for this teaching at 22 medical schools (91.67%). Clinicians no longer in practice, peers and patients were all used in less than 10 medical schools (Figure 4.5).

Figure 4.6 shows who provides the practical prescribing teaching according to geographic location of medical school. Patients and pharmacists no longer in practice are only used in medical schools in England, and consultants/ clinicians no longer in practice used in England and Wales only. Consultants and practicing clinicians, junior doctors and pharmacists are widely used in medical schools across all four geographic regions.

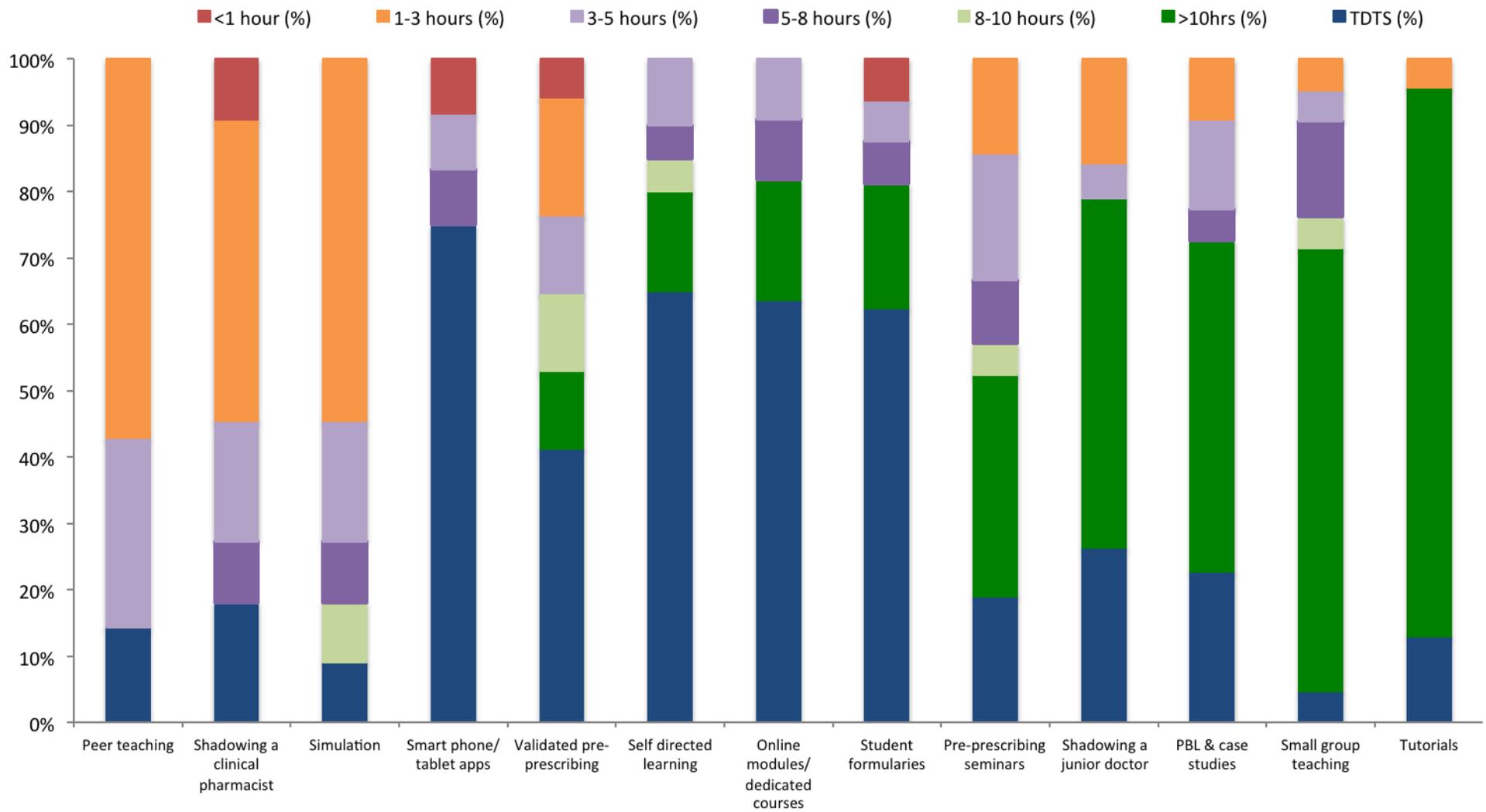


Figure 4.4: Number of hours dedicated to various teaching and learning practical prescribing methods

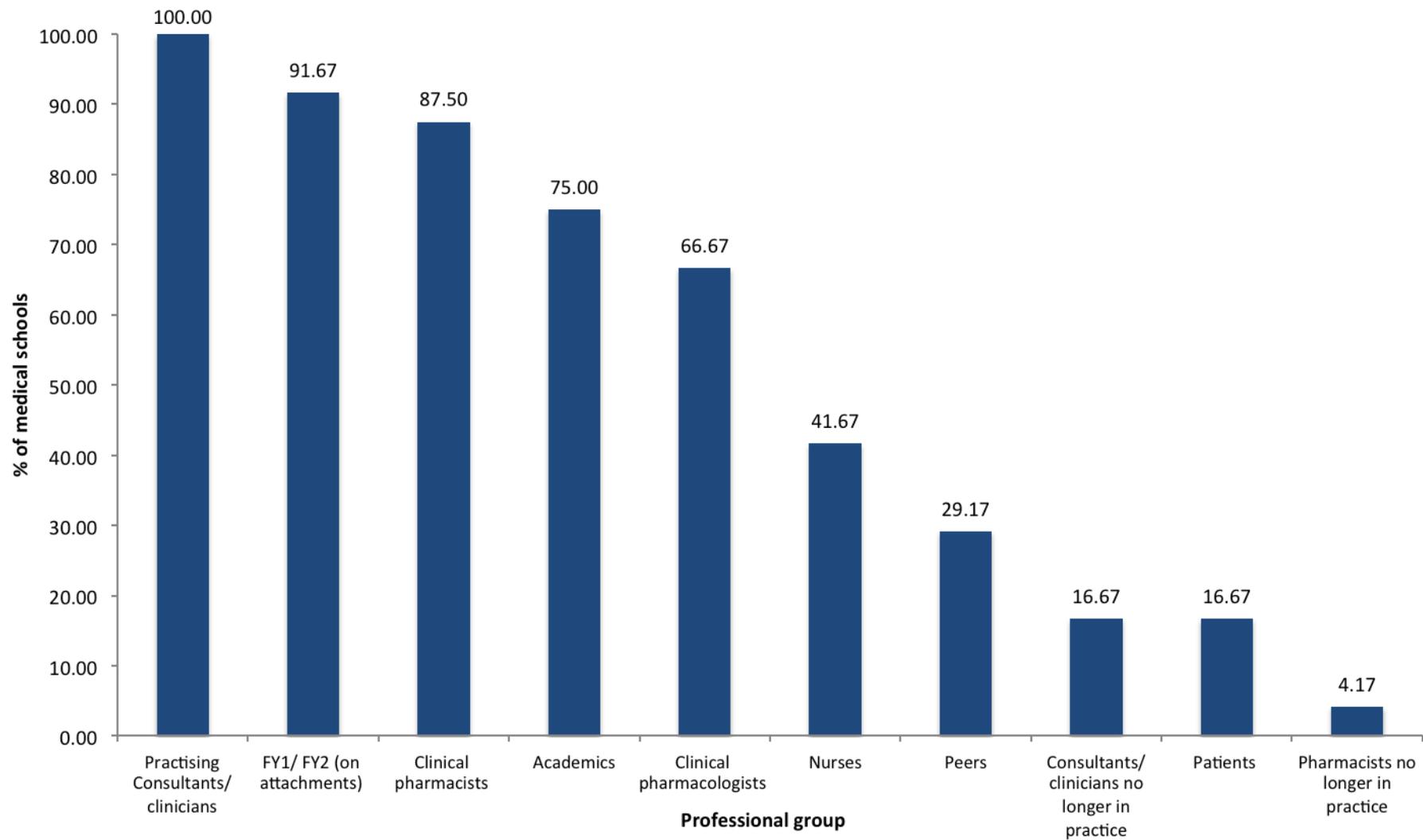


Figure 4.5: Professional groups responsible for teaching practical prescribing in UK medical schools

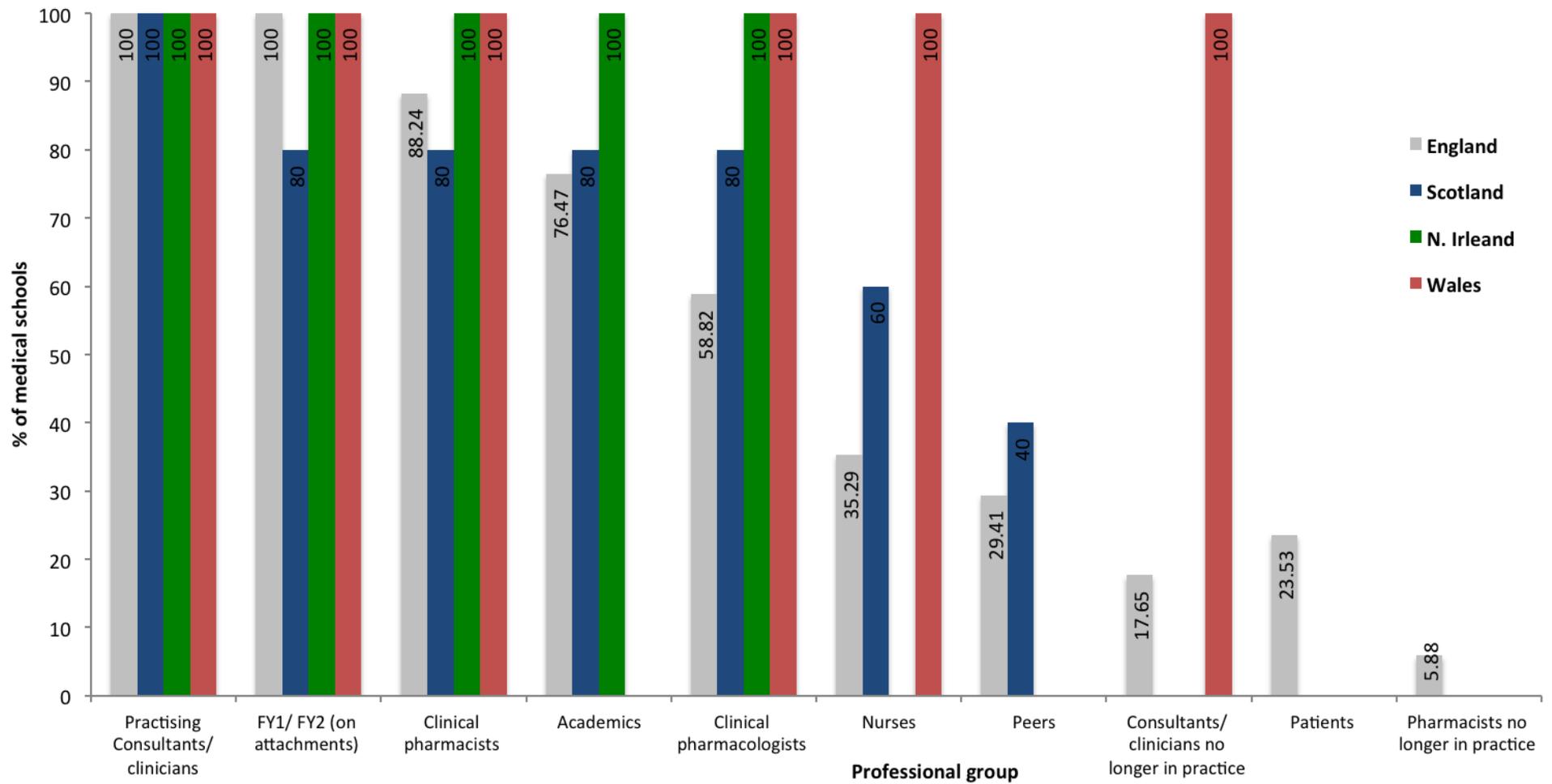


Figure 4.6: Professional groups responsible for teaching practical prescribing by geographic location

Preparedness to practice

The majority of respondents thought that the medical undergraduate degree at their respective medical school sufficiently prepares their undergraduates to undertake the practical prescribing in foundation year 1 (n=18, 75%). Less than a fifth disagreed with this statement (n=4, 16.67%) and just 2 didn't know (8.33%).

A total of 15 medical schools (62.5%) reported seeking feedback from final year medical students to determine how prepared they feel to undertake the task of prescribing once graduated. A quarter reported that they do not (n=6, 25%) and one medical school's respondent reported that they did not see the value in seeking such feedback (4.2%). Geographically, medical schools in England seek this feedback less (n=9, 52.94%) in comparison to Scottish, (n=4, 80%) and Welsh and Northern Irish counterparts (n=1, 100%) (Figure 4.7).

Responses to the question "Do you feel that there should be a practical prescribing component (in any format) in the curriculum of Phase 1 (Years 1 and 2) of the medical undergraduate degree?" yielded more variable results: 7 medical school respondents thought there definitely should be (29.17%), with a further 9 respondents selecting maybe (37.5%). A third of respondents thought practical prescribing should not be incorporated into phase 1 (33.33%).

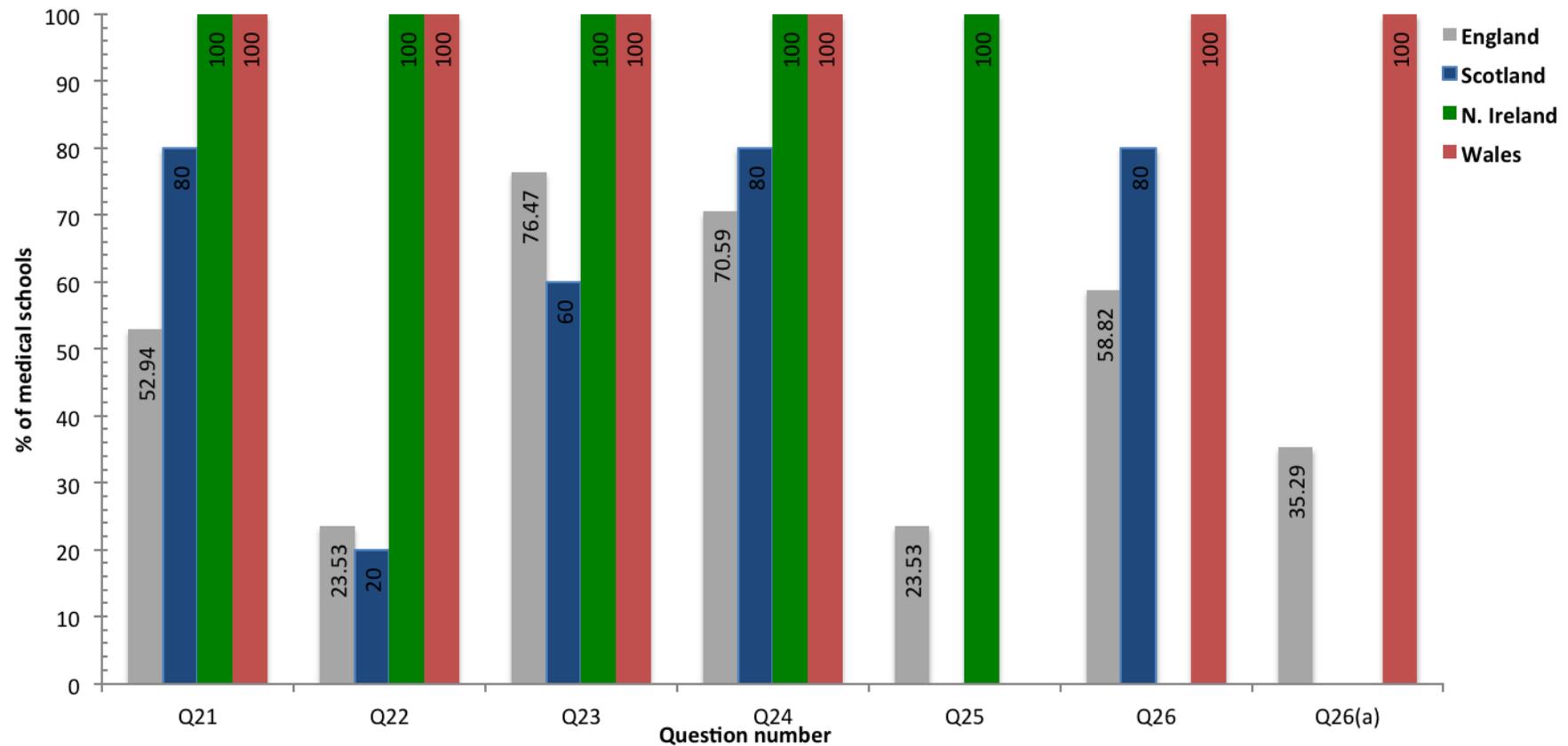


Figure 4.7: Agreement to Q21 to 26a based on geographic location of medical school

Key for Figure 4.7: Q21 Seeking feedback form final year students regarding preparedness for practice? Q22 Should practical prescribing be incorporated into Phase1? Q23 Course in its current format prepares for practical prescribing? Q24 PSA improving practical prescribing skills? Q25 Standardise teaching of practical prescribing? Q26 Awareness of the SCF? Q26 (a) Course review since SCF published?

Those responding that they did not believe the course in its current format sufficiently prepares students for practice were asked what area(s) of the curriculum need revision in order to achieve preparedness for practice. Of the four responses, 1 medical school introduces prescribing for year 3 students who then later go to a clinical partner school where the competencies required of a foundation trainee are addressed. Another reported that improvements have been made at their medical school (practical sessions before placements in phase 3), which have helped, but further reviews of the curriculum are on going with prescribing being a prominent theme: “perhaps not fully - but it is getting there...and the Curriculum is undergoing extensive review with prescribing being a key theme, in the meantime a prescribing theme lead also being appointed for phase 4”. One respondent felt that more focused efforts could be made in the final stages of the course “More formal prescribing training in LATER years of the course“. Another respondent felt that their medical school could introduce practical prescribing to all clinical attachments from half way through year 3, and incorporate shadowing a clinical pharmacist in year 4, “At the moment, we only introduce practical prescribing in the final year of our course (except the insulin package which is completed in year 4) “.

Prescribing Safety Assessment

Just 2 medical schools reported that their school does not run the PSA (one in England and one in Scotland). Three quarters of medical schools representatives reported believing that preparing for the PSA improves actual practical prescribing skills amongst undergraduates (n=18): including 80% of medical schools in Scotland (n=4), 70.59% in English medical schools (n=12) and both the medical schools in Northern Ireland and Wales (n=2, 100%). Reasons for this belief reported by respondents include:

1. The PSA focusing student’s learning and the teaching provided by medical schools
2. The PSA raising the profile of prescribing within the curriculum
3. Domains of the PSA are more relatable to real life so better prepare students to undertake the tasks
4. Assessment always drives learning

Standardisation of practical prescribing teaching

A fifth of respondents were of the belief that the undergraduate teaching of practical prescribing should be more standardised across all of medical schools (n=5, 20.83%): 4 in England and 1 in Northern Ireland. A fifth of respondents were also against the notion of standardisation of teaching across medical schools (n=5, 20.83%), including 4 in England and 1 in Wales.

The majority of respondents were undecided (neither for or against) standardisation of practical prescribing teaching across UK medical schools (n=14, 58.33%). The reasons respondents gave to justify their answer is summarised in Table 4.2.

Table 4.2 Summary of qualitative responses to Q25(a)

Pro standardisation	Undecided	Anti standardisation
Would allow doctors to practice anywhere throughout the UK	Standardisation is not always positive	Limits innovation and could decrease overall standards
Students should have access to same resources throughout UK	Medical schools should have autonomy and flexibility as this is part of their identity	Allowing schools to experiment facilitates the emergence of the best methods
Should be a national curriculum to prepare for the national PSA	Difficult to find a one size fits all	Allows more flexibility to teach in the scheme of local prescribing practice
Share best practices from all medical schools	Prescribing practices vary on a local level	

Discussion

This study presents the provisions of practical prescribing teaching from the perspective of the medical schools. Although valid in their own right, when read in conjunction with the data presented in the previous chapter, these data give a fuller picture of the current teaching and learning practices for practical prescribing throughout the UK.

Practical prescribing teaching within medical undergraduate curricula

The literature has demonstrated that there are marked differences not only in the UK, but throughout and within Europe in terms of quality and quantity of prescribing teaching at the undergraduate phase of medical education, as discussed above (Brinkman et al. 2016, Brinkman et al. 2017). The apparent lack of emphasis on prescribing reported back in 2009 in the UK (O'Shaughnessy et al. 2010) appears to have been somewhat addressed according to the findings of the current study. All 24 medical schools represented in this study reported that their course now incorporates teaching on this fundamental skill. Despite changes to curricula throughout the country, some respondents additionally reported that their courses do not fully prepare graduates for practical prescribing (16.7%), which seems understandable considering some medical schools reported that their students do not actually get to practice prescribing on drug charts/ electronic prescribing systems informally whilst at university. Clearly further optimisation of the curriculum is required to address the lack of preparedness.

The majority of medical schools deliver prescribing teaching in an integrated fashion (54.2%). CPT is arguably the most integrated and important of the clinical disciplines, whose core principles are widely applicable across almost all areas of practice (Maxwell & Walley 2003). In the absence of evidence for the superiority of either approach, it is not concerning that the stand alone module/ course approach also appear to be commonly employed in many medical schools (33.3%). Although revisions of the GMC guidance documents place greater emphasis and prominence of prescribing skills, they do not support the re-emergence of CPT as a distinct discipline within medical undergraduate curricula

(Tomorrow's Doctors 2002). However it is essential that relevant teaching, wherever it is provided, be identifiable vertically throughout the undergraduate degree, integrating within the relevant horizontal modules (Maxwell & Walley 2003, Ross & Loke 2009).

Methods for teaching practical prescribing

A variety of methods were reportedly used by the medical schools in the teaching of practical prescribing, across the UK, similar to other studies examining the teaching of CPT (Brinkman et al. 2017, O' Shaughnessy et al. 2010).

Tutorials (in either large and small group sessions), Problem Based Learning (PBL)/ case studies and small group teaching were reportedly widely used, and furthermore were mandatory in almost all medical schools employing them. With regard to solving clinical problems, the importance of contextualisation with a patient has been demonstrated (Nazar et al. 2015). The overall process involves integration of the underpinning CPT knowledge, high level cognitive processes, as well as the skills of accurately writing the prescription itself (Maxwell & Walley 2003, McLellan et al. 2012). Such complex scenarios, where inquisitive learning is required, lends itself well to PBL and the use of case studies (Nazar et al 2015). It is encouraging to see their use in undergraduate medical curriculum, as it appears that students taught within traditional learning curricula have inferior prescribing skills and knowledge versus those taught in problem based curricula (Brinkman et al. 2016).

The use of pre-prescribing and simulation across the UK was variable. Such methods, demonstrated as being effective in their own right (Tittle et al 2014, Conroy-Smith et al. 2011, Smith et al. 2012), have the added benefit of being acceptable and preferred by students, see Chapter 3. One possible explanation for their apparent popularity amongst undergraduates learning to prescribe is that they appear to be effective in bridging the gap between theory and clinical practice by facilitating learning on the steepest part of the learning curve in more favourable less dynamic conditions (Ross & Maxwell 2012).

Student formularies were first proposed in 2002 as the basis of the CPT curriculum to meet the learning outcomes of the GMC guidance (Tomorrow's doctors), however it appears that just two thirds of medical schools use them currently. They are a mandatory component in just half of those schools where they are used. Student formularies were proposed to help focus the learning of students who often became overwhelmed by the number of medicines available (Maxwell and Walley 2003, Baker et al. 2011). This notion is still present in the latest iteration of the BPS curriculum, as "essential drugs", so it appears that not all medical schools have adapted their curricula to be completely in line with this (Ross & Maxwell 2012).

Time dedicated to methods

Although the methods used throughout the UK were well characterised, it was more difficult for respondents to definitively state how many hours are dedicated to each within the curricula. Some methods, where discrete sessions are provided or need timetabling were better characterised, such as simulation sessions, tutorials, small group teaching, and prescribing seminars. Methods that the majority of respondents found this too difficult to determine were those which are largely self-directed in nature i.e. online modules, smart phone applications and student formularies, as was acknowledged by some of the respondents.

These findings indicate that where there is a reliance placed on student led methods, medical schools find it too difficult to express how many hours are spent on individual methods. In hindsight it may not have been reasonable to expect the undergraduate leads to respond to this question. However a minimum amount of time that would be expected of students for each of these should be outlined in module handbooks as a guide for students. Furthermore the 2012 version of the BPS curriculum discusses the need for effective leadership in ensuring there is adequate time dedicated to and visibility of CPT, of which practical prescribing is a crucial element, within the curriculum (Ross & Maxwell 2012).

Teachers

It is not surprising that a variety of teachers were reportedly used in the teaching of practical prescribing. There is no evidence in the literature or suggestion as to which professional group is best placed to provide teaching in this fundamental skill, it is however acknowledged that a background in clinical pharmacology would perhaps be beneficial (Maxwell & Walley 2003). Nonetheless, others who can enthusiastically and effectively highlight the generic prescription principles beyond an individual organ system, would also be suitable (Maxwell & Walley 2003). Medical schools seem keen to involve pharmacists and nurses in the teaching as both groups of professions are readily available and possess additional skills and attributes in prescription review and medicines administration (Brinkman et al. 2017, Ross & Maxwell 2012). UK medical schools appear to involve junior doctors in teaching to medical students more than their European counterparts (Brinkman et al., 2017).

The national Prescribing Safety Assessment (PSA)

The UK now has a national PSA, that all newly qualified doctors are required to sit prior to commencing their first year of postgraduate medical training (F1) (Maxwell et al., 2017). All but 2 medical schools in this study indicated that the PSA is currently utilised within the undergraduate curriculum. It is not possible to comment on its perceived value amongst educationalists, they may want to prepare students for the PSA but not value its use generally. However there is a belief amongst the respondents of this study that the assessment not only raises the profile of prescribing overall within the curriculum, but may help to prepare students to undertake the complex task due to its multifaceted nature. Whether or not this translates to a reduction in prescribing error rates in practice remains to be proven.

Standardisation of teaching

The issue of standardising the teaching of practical prescribing across the UK did not achieve consensus: with an equal number of respondents being definitively pro and anti-standardisation, while the majority were undecided (58.3%). The lack of standardisation, in addition to other factors, has been suggested as one contributing factor for poor prescribing (Ross & Loke 2009). In addition the lack of

standardisation with respect to assessment styles used across medical schools in the UK was highlighted (McDougall 2015). This study concluded that existing concerns regarding medical students achieving a common standard were valid. Should the teaching of practical prescribing become more standardised it could potentially support the movement of doctors throughout the UK and result in the best practices from various medical schools being shared as proposed by the respondents. Standard teaching in combination with a standard assessment (the PSA) could help to alleviate concerns about students not reaching the required benchmark to practice as a doctor. There was however a feeling amongst some respondents that achieving such a feat would come at a cost: the dilution or loss of individuality at the various medical schools. Allowing medical schools to retain their identity and autonomy is crucial, as these were the main reason respondents gave for being against standardisation, and may be the reason for some students selecting where to study medicine in the first place.

The success of the national PSA highlights further the potential value of setting standards that all medical schools could use to guide the teaching and learning of practical prescribing, not just to prepare for the PSA, but life afterwards as a junior doctor.

One approach that may be acceptable to those wishing to retain their institutional identity, would be standardisation of the content of the teaching, rather than the actual methods used themselves, as suggested by one respondent:

“I think that some central resources - online materials, online tasks etc could be centralised - because all doctors need to be trained to the same level, so the learning outcomes will be the same. Also, I can see some lovely online resource already and it seems quite a waste of effort for us to develop our own parallel resources here when there are open access ones out there...but I think an overarching centralised approach has benefit.”

In essence this would result in medical schools sharing electronic learning resources (such as mobile applications or online modules), increasing availability

and accessibility of relevant information to help develop and nurture practical prescribing skills to students regardless of location (Brinkman 2017, Holmes & Gardner 2006, Ross & Loke 2009). This may well be more acceptable than a blanket standardisation, and is a method supported by the EACPT (Brinkman et al. 2017). This approach is at the heart of the Prescribe; an e-learning resource, that underpins safe prescribing, developed by the BPS and Health Education England (HEE) (BPS online).

Limitations

This study sought to determine the teaching provisions in practical prescribing within UK medical school curricula from those responsible for delivering the undergraduate curriculum. These data from the current study highlight variation across the UK, and the belief at some medical schools that undergraduate curricula still do not adequately prepare students to undertake prescribing in practice.

This study did not look specifically at the various CPT topics covered in medical school curricula, but focused instead on the methods employed in practical skill acquisition. It is therefore not possible to determine to what extent the current BPS core curriculum is currently utilised across the UK. Perhaps gaining a better understanding of the breadth of topics that are covered at various stages of the curriculum may have highlighted gaps and provided more insight into how the curriculum could be enhanced.

It was not possible to determine from these data what proportion of the teaching time is dedicated to prescribing

Conclusions

It appears that the lack of emphasis UK medical schools places on prescribing in the past, has to a large extent, been addressed, with a variety of methods and approaches reportedly being used. Despite changes, preparedness to practice is still perceived as an issue. It is concerning that some medical schools do not offer students the chance to practice prescribing skills on drug charts while at university, and furthermore that the availability of methods that help bridge the gap between

theory and clinical practice remain so variable. Medical undergraduates and newly qualified junior doctors have voiced their concerns about the fitness of the curricula in their current formats to adequately prepare for practice.

The issue of standardising the teaching and learning of practical prescribing was less clear-cut, with arguments being made for and against this proposal. However there may be value in ensuring all medical graduates, regardless of place of study, have access to the same high quality learning materials. All junior doctors must now sit the PSA prior to commencing their foundation training. The undergraduate curriculum must therefore be optimised to ensure graduates are equipped with the necessary knowledge and skills to prescribe effectively and safely.

Chapter 5 – Post-graduate training in safe and effective practical prescribing: focus on foundation doctors

Introduction:

It is well recognised that doctors in both primary and secondary care continue to make prescribing errors, which not only causes patient safety to be compromised, but also are a huge financial burden to an already overstretched NHS, as discussed in Chapter one.

The EQUIP study, highlighted the prevalence and nature of prescribing errors by foundation doctors in the UK, and found a mean error rate of 8.9% across all grade of doctors (Dornan et al. 2009). However it was the doctors in their second year of postgraduate training (F2s) who were found to have the highest error rate of 10.3%, followed by doctors in their first year of training (F1s) at 8.4%. The reasons for this have yet to be explored but what is currently known is that graduates do not adequately feel prepared to undertake the complex task of prescribing (Illing et al. 2008, Heaton et al. 2009). The GMC and BPS have developed guidelines, which underpin the teaching and learning of safe prescribing at undergraduate level, but, there are no regional or nationally agreed standards for the training of foundation trainees in safe prescribing. Although UK Foundation Programme Curriculum 2016 specifies a list of competencies that must be achieved, autonomy is afforded each NHS trust as to how to ensure that their trainees meet the learning outcomes and demonstrate themselves to be proficient practitioners.

The EQUIP study concluded that the paucity of training in practical prescribing coupled with doctor's unfamiliarity with drug charts are both contributing factors that can bring about prescribing errors. This justified a recommendation that training in practical prescribing be offered to all foundation year one trainees, and practice related to prescribing should be provided during induction (Dornan et al. 2009). This would be seen to tackle the apparent failure to address the association between theory and practice. One shortcoming of this however is that the recommendation was made for F1 training only, despite F2s having the highest prescribing error rate (Dornan et al. 2009). Although there is evidence to suggest that foundation doctors' confidence increases with greater exposure, familiarity and knowledge (Rothwell et

al 2012, Tobaiqy et al. 2007), this does not eliminate error completely and conversely may result in an ill placed sense of confidence amongst more experienced F2s. Ryan et al. (2014) advised exercising caution when using confidence as a predictor to competence, as these have been poorly demonstrated in the past (Brinkman et al. 2015).

Aim

This study set out to determine the training provisions in safe prescribing available to Foundation Programme doctors (F1 and F2) in NHS hospitals located in the South Thames Foundation School (STFS).

The main objectives of this study include:

- To determine whether NHS Trusts offer specific training in the safe and rational use of medicines to foundation doctors (F1 and F2s)
- To determine who is responsible for delivering safe prescribing training, and the mode of delivery, i.e. face to face, practical prescribing sessions, e-learning, etc.
- To determine whether there are differences in training methods for trainees at different stages of their Foundation Programme training
- To determine the assessment methods employed by NHS Trusts to indicate whether the trainee is a safe prescriber, and who is responsible for the delivery of this
- To determine what action, if any, is taken to support any trainees that have been identified as requiring additional training in safe prescribing after the assessment
- To determine the views of the foundation doctors on what they perceive the most effective methods of training in safe prescribing to be

Methods:

An e-questionnaire was utilised to elicit information regarding safe and practical prescribing training provisions during the period of August 2013 and July 2014, with

the induction period and the remainder of the foundation-training year scrutinised. Paper copies were available if requested.

The relative merits of using questionnaires have been discussed in detail in chapter 2.

Overall study design

The study comprised of two questionnaires (Appendices C and D): one directed at the foundation doctors themselves and one directed at the lead for prescribing at each NHS Trust (or their nominee). This was in an attempt to ascertain a full picture of the training provided, assessment structure, and which aspects, if any, were mandatory. In addition, information was obtained on which sessions the foundation doctors perceived to be most useful.

The questionnaires were designed using the Bristol Online Surveys software package, (Chapter 2). Both questionnaires contained closed and open questions regarding the training provision of safe and practical prescribing both at induction and during the remainder of the foundation-training year.

Respondents and setting

All respondents had to be involved in providing (trainers) or receiving (trainees) training in the foundation years of postgraduate training at NHS Trusts within the South Thames Foundation School (STFS) region between August 2013 and July 2014.

The STFS covers a large geographical region in the South East of England, including all hospital NHS Trusts in South London, Kent, Surrey and Sussex. STFS, which oversees the training of approximately 1700 F1 and F2 foundation doctors annually, and comprises of three medical Schools, and two Health Education bodies (STFS online).

There were no specified exclusion criteria. Participants were identified via Health Education England and the South Thames Foundation School.

Questionnaire design

Prescribing Lead questionnaire (Appendix D)

The questionnaire was composed of 19 questions in total:

- Three questions collected demographic data (name, NHS Trust, and current role within the Trust)
- Seven questions related to the training provided to the foundation doctors during the induction and the remainder of the training period in 2013-2014
- Eight questions related to local prescribing assessment arrangements
- One open ended question was included at the end offering the opportunity for respondents to make additional comments about the safe prescribing training provided for foundation trainees (capturing data not covered elsewhere throughout the questionnaire)

Questions were primarily single best answer in nature; with spaces provided for additional comments throughout the questionnaire.

No validated questionnaire for this study existed. A study investigating the teaching and learning of clinical pharmacology in UK medical schools in 2009 used a questionnaire as the data collection tool (O'Shaughnessey et al. 2009). This was used as a template in the development of the questionnaire for the current study in terms of content and structure. The aspects of the prescribing process used in question 6 were based on a review of the literature (De Veries et al, Maxwell et al bps).

Foundation doctor questionnaire (Appendix C)

The questionnaire contained 14 questions, 13 of which were mandatory. Questions explored demographics, details concerning the training relating to safe prescribing during induction and throughout the remainder of the foundation training year: to ascertain which aspects were mandatory and which sessions the respondents perceived to be useful.

Questions were mainly in the single-best answer format, but some contained free text boxes for more detailed responses. The qualitative data resulted from such optional free text comments, and one dedicated question at the end of the questionnaire inviting participants to comment further on any/all aspects of the training in safe prescribing they had received.

This questionnaire followed a similar structure to the Prescribing Lead questionnaire. Furthermore, the tasks associated with writing a safe prescription i.e. dedicated training sessions, as listed in questions were the same in both questionnaires. These were based on the available literature (de Vries et al.1994, Ross & Maxwell 2012).

Distribution procedure

Due to data protection laws it was not possible to obtain a list of the foundation doctors directly from the Foundation School or their respective NHS Trusts. A link to the questionnaire was therefore sent out in online bulletins both from the STFS and at some Trusts that utilise e-communications on behalf on the research team. In addition, each NHS Trust's postgraduate medical centre was contacted directly and asked to forward a link to the survey via e-mail to their foundation doctors. The foundation school and the postgraduate medical centres on behalf of the research team sent out reminder e-mails, at 2 weekly and monthly intervals.

A list of prescribing leads was provided by the Health Education Kent Surrey and Sussex (HEKSS). The prescribing leads were all part of a local safe prescribing group. The researcher was invited to attend a meeting of this group in February 2014, to explain the purpose and scope of the current study. All prescribing leads verbally provided informal consent at this meeting to be contacted once the study went live. The Prescribing Lead at HEKSS sent out the initial invitational e-mail on behalf of the researcher in April 2014. The researcher sent all follow up e-mails directly. The questionnaire was also available for completion from April to July 2014.

Data management and analysis

Completed responses to the questionnaire were stored electronically by Bristol Online Surveys, in a password-protected account. The results were transferred to Microsoft Excel (2011) and Statsdirect to perform descriptive statistics and the Chi squared test for association respectively on the quantitative data. The qualitative data was analysed manually using a content analysis approach, and was completed independently by two members of the research team, who then discussed findings and agreed on the final themes. Thematic analysis is discussed in detail in chapter 2.

Foundation doctors were asked how effective they perceived individual training sessions and the variety of trainers. The intention was that each trainee would assign each of the 12 proposed sessions (including the “other” option) a score from 1 to 12 (1 being most useful, 12 being least useful), to determine which session(s) the foundation doctors perceived to be most useful i.e. they would assign a score of 1 just once for the most effective, 2 for second most effective, etc. This was also the case for the trainers (scoring options from 1 to 9 were available). However from the data obtained it appeared that the trainees mis-interpreted the scales as Likert-like and so used each score multiple times within a given question. With this in mind for training sessions, scores from 1-4, 5-8 and 9-12 were pooled to represent most effective, neutral and least effective groups respectively in terms of how useful trainee doctors perceived them to be. With respect to analysis of the ranking of usefulness of the teachers, a score of 1-3 was assigned as being more effective; 4-6 was neutral and 7-9 representing less effective. Average scores of the rankings were calculated to give an indication of which sessions and teachers overall the students perceived to be most effective in helping them to become safer prescribers.

Ethics and method for obtaining consent

The Research Governance and Ethics Committee at Brighton and Sussex Medical School reviewed and subsequently granted ethical approval for the study (reference 14/015/OKO) on 23/3/2014 (Appendix G). Completion and submission of a response was assumed as consent to participation.

Results

Prescribing Lead questionnaire:

There were a total of 11 respondents representing 10 out of 15 NHS Trusts (66%). There were two responses from one NHS Trust, of which one was excluded on the basis that the participant's role with regard to prescribing training within the Trust was unclear, and this was therefore classified as an unreliable source. This left 10 responses representing 10 NHS Trusts.

Trust Induction

Of the 10 NHS Trusts, 9 reported that their F1 doctors received induction a week prior to the official start date of their job. Six of these Trusts delivered this in the format of a mandatory shadow week. One Trust offered induction within the first four weeks of the F1s joining the Trust. Attendance at the F1 induction was reported as being mandatory in 9 NHS Trusts.

With regard to F2 induction, 8 of the NHS Trusts offered this within the trainees' first week, one Trust offered this within the first four weeks, and one Trust did not know when it was delivered in relation to their start date with the Trust. All 10 Trusts reported that F2 attendance was compulsory at induction. Table 5.1 shows a comparison of the number of dedicated hours provided to F1 and F2 trainees during the induction.

Table 5.1: Hours of training provided to F1 and F2 trainees during induction

NHS Trust	Total F1 induction	Total F2 induction	F1 face-to-face training	F2 face-to-face training	F1 online & self-directed study	F2 online & self-directed study
A	>20 hours	15-20 hours	10-15 hours	10-15 hours	Don't know	Don't know
B	>20 hours	3-4 hours	4-5 hours	3-4 hours	Don't know	Don't know
C	>20 hours	5-10 hours	10-15 hours	5-10 hours	0 hours	0 hours
D	4-5 hours	0-1 hours	2-3 hours	0-1 hours	1-2 hours	0-1 hours
E	>20 hours	5-10 hours	>20 hours	5-10 hours	Don't know	Don't know
F	>20 hours	5-10 hours	15-20 hours	5-10 hours	1-2 hours	0-1 hours
G	2-3 hours	1-2 hours	2-3 hours	1-2 hours	Don't know	Don't know
H	>20 hours	5-10 hours	>20 hours	5-10 hours	Don't know	Don't know
I	>20 hours	5-10 hours	15-20 hours	4-5 hours	2-3 hours	2-3 hours
J	Don't know	Don't know	Don't know	Don't know	Don't know	Don't know

9 NHS Trusts had a separate induction programme for F1 and F2 trainees and this included specific prescribing training. However only 5 NHS Trusts included a practical prescribing session where trainees got to practice using the drug chart/ e-prescribing system before being required to do so on the wards.

Additional support for foundation doctors during induction

In terms of additional support to aid safe prescribing during the induction, none of the NHS trusts offered the opportunity for foundation doctors to shadow consultants or specialist registrars. Shadowing foundation doctors was available in 7 Trusts, and this was compulsory in just 4. Support in an online format was available at 4

Trusts, but mandatory in just 2. Support in written formats was available in 6 Trusts, but was mandatory in just 4 of these. Group interactive sessions were available in 3 Trusts but compulsory in 2, and shadowing clinical pharmacists was available in one Trust and was a mandatory component of the induction at this Trust.

Training on specific aspects of the prescribing process

The prescribing process in accordance with current literature was divided into 11 distinct steps (Ross and Maxwell 2012). NHS Trusts indicated if dedicated training was provided for each aspect and if so when during the foundation training period it was provided i.e. during induction specifically and/or after induction. Figures 5.1a and b show which sessions were reported as being provided at induction in comparison to throughout the rest of the foundation year i.e. after the induction period, and if attendance at the sessions were mandatory.

One NHS Trust (C) provided training at both stages on the topic of safety issues, Trust F did the same on the topic of pharmaceutical calculations, and one further Trust (D) provided sessions at both stages for all of the following aspects:

1. Practical prescription writing
2. Pharmaceutical calculations
3. Monitoring drug effects including prescription review
4. Signposting to other sources of information
5. Safety issues such as reporting suspected or actual adverse drug reactions

All of the other NHS Trusts provided the dedicated sessions for the various aspects of the prescribing process either during the induction or afterwards throughout the foundation year training, not both.

By the end of the Foundation training year (including the induction phase) 8 NHS Trusts had provided dedicated session(s) on taking an accurate drug history to F1s, compared with 3 Trusts for F2s. These 3 Trusts also provided this training to their F1s. The data collected did not permit a comparison of which sessions were provided to F1 and F2 doctors at induction specifically hence the data are reported cumulatively for the whole training period.

The same figures were reported for pharmaceutical calculations (8 NHS Trusts for F1 and 3 Trusts for F2 doctors). Practical prescription writing and safety related topics were another 2 areas where Trusts reported a notable difference in training for F1 and F2 doctors: 6 Trusts provided a dedicated practical prescribing session to F1s while 2 Trusts provided this to their F2 cohort, and F1s at 7 Trusts received dedicated training on other aspects of safety but F2s at only 3 Trusts received the same (Figure 5.2).

No NHS Trusts reported that they provided a dedicated prescribing session for the F2 doctors only: sessions were either provided to both cohorts, and just the F1 doctors only.

Who provides the training?

A variety of healthcare professionals were reportedly responsible for providing safe prescribing training for foundation trainees. No NHS Trust reported that any single professional group provided training exclusively to F2 doctors, in comparison clinical pharmacists and peers were reported by 3 Trusts as providing training to F1 doctors only, and one further Trust reported nurses provide training for the same cohort (Table 5.2)

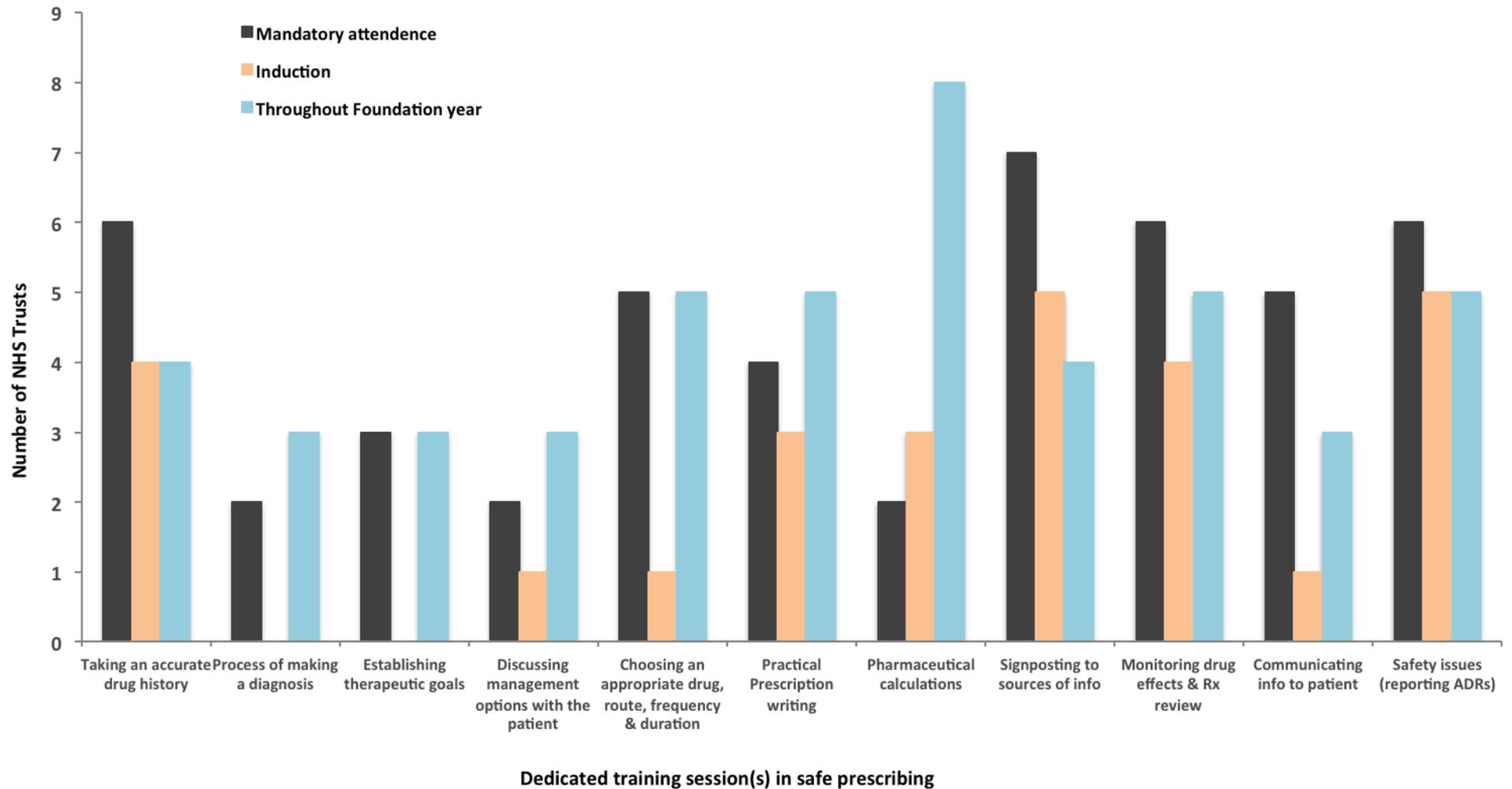


Figure 5.1: Provision of dedicated sessions for aspects of the prescribing process for foundation doctors in the 2013 - 2014 training year according to NHS Hospital Trusts

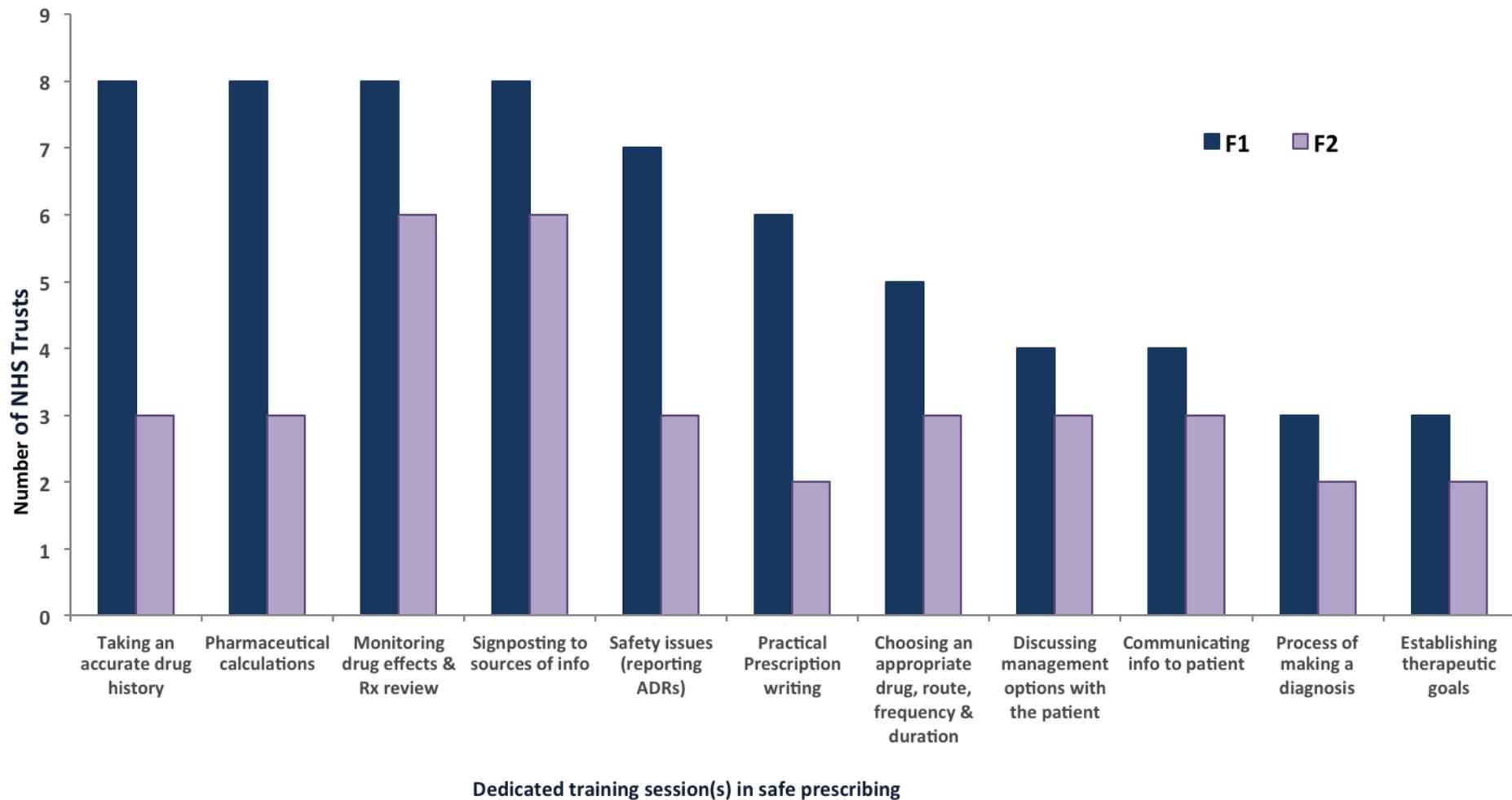


Figure 5.2: NHS Trusts' training provisions to aid safe prescribing for F1 and F2 doctors 2013-2014

Table 5.2 Professionals responsible for prescribing training for foundation trainees

Professional group	Training to both F1 and F2s
Clinical pharmacist	7
Online learning	6
Consultants	5
Specialist registrar	4
Nurses	4
Clinical pharmacologist	1
Peers	1
Inter-professional education	1

The reporting of the number of hours each professional group was responsible for providing training to foundation doctors in safe prescribing was low. All responses relating to clinical pharmacologists and IPE training yielded either 0 hours or “I don’t know”.

An attempt to ascertain how many hours of prescribing training that each of the above professional groups provided did not yield useful results with the majority of respondents selecting the “*I don’t know*” option when completing this section of the questionnaire. These data are therefore not reported here.

Regional Prescribing Assessment (RPA)

Nine respondents reported that their NHS Trust ran a prescribing assessment: 3 Trusts deliver this assessment the same day as the foundation doctor’s induction, 2 Trusts deliver it the same week, 2 Trusts deliver it the same month, and 2 Trusts deliver it more than 2 months after (1 of these reported it was delivered 3-6 months later). One respondent could not remember when it was delivered at their Trust. A clinical pharmacist was responsible for overseeing the assessment at 9 NHS Trusts.

Three NHS Trusts delivered the prescribing assessment to F1 and F2 doctors, and a further 6 Trusts delivered it to the F1 cohort only. Non-foundation grade doctors at 3 NHS Trusts were also expected to sit the prescribing assessment i.e. doctors employed directly by the Trust who may have undertaken a similar role to the foundation doctors.

NHS Trusts were asked to indicate when, in relation to the day the prescribing assessment was sat by the foundation doctors that feedback on their performance was provided to trainees. Feedback regarding the assessment was provided on same day at just 1 NHS Trust. Trainees were provided with feedback within 1 to 3 days at 3 Trusts, and 1 week after the assessment at 1 Trust. Two NHS Trusts provided this feedback after 1 to 2 weeks, and 3 to 4 weeks of sitting the assessment, and 1 Trust reported the timing of the feedback was unknown.

The feedback was primarily done either face-to-face (5 NHS Trusts) or electronically via e-mail (3 NHS Trusts) with 1 Trust sending written feedback via internal mail.

Prescribing restrictions (on those who did not pass the prescribing assessment) at ward level were only imposed at 3 NHS Trusts, with the remaining 7 responding that there were no restrictions or impositions. Of the 3 NHS Trusts that reported restrictions on practice were imposed; all reported that feedback was given either the same day as, or within 3 days of the assessment being delivered.

Foundation doctor questionnaire

A total of 124 foundation doctors (7.3%) completed the online questionnaire from 16 NHS Hospital Trusts and included 69 F1s (55.6%) and 55 F2s (44.6%). The average number of respondents from each NHS Trust was 8 (range 1-32).

Induction and safe prescribing support

All F2s (n=55, 100%) and almost all F1s (n=63, 91.3%) reported their induction was within one week of their official start date at the NHS Trust; the remaining 8.7% of F1s had theirs within 2 weeks (n=6). Attendance was reported as being mandatory by 95.7% of F1s (n=66,) and 94.5% of F2s (n=52); the remaining trainees did not know if attendance was mandatory or not.

Practical prescribing training

The majority of F1s reported that they received dedicated training in safe prescribing at their NHS Trust induction (87%, n=60, CI=79-95%) in comparison to 49% of F2 doctors (n=27, CI=30-68%). This difference was significant, $\lambda^2 (1, N = 124) = 34.23$, $p < 0.0001$.

Eighty percent of F1s had a practical prescribing session (with a pharmacist or other clinician) during induction (n=55, CI=69-91%), while the corresponding figure for the F2s was 29% (n=16, CI=7-51%). This difference was also significant, $\lambda^2 (1, N = 124) = 32.37$, $p < 0.0001$. The remaining respondents reported that they either did not receive training or could not remember if they did or not.

In addition to specific training sessions, during the induction, the foundation doctors reported that online support and other forms of written support were most frequently employed by NHS Trusts to aid safe prescribing (Table 5.3). No trainees reported that they had the opportunity to shadow a clinical pharmacist.

Table 5.3 Support provided to aid safe prescribing during induction – as reported by foundation doctors

Support given to aid safe prescribing	F1 cohort	F2 cohort
Shadow senior colleagues	23 (33.3%)	5 (9.1%)
Group interactive sessions	28 (40.6%)	7 (12.7%)
Online support i.e. use of online prescribing modules, signposting to online resources such as the BNF, Trust prescribing guidelines, etc.	45 (65.2%)	25 (45.5%)
Other support in the form of written information (booklets, hardcopy of BNF, etc.)	32 (46.4%)	23 (41.8%)

A breakdown of the dedicated safe prescribing training sessions provided to F1 and F2s during induction and for the total training period up until July 2014 is shown in

Figure 5.3. The figures quoted for the total training period are inclusive of the training provided during the induction period itself and throughout the remainder of the training period. The session topics have been classified to represent the various stages involved in the prescribing process (de Vries et al 1994, Ross and Maxwell 2012).

By the end of the one-year training period, which included induction, 94% of F1s (n=65, CI=88-100%) and 56% of F2s (n=31, CI=39-73%) had received a dedicated training session in practical prescription writing (including drug chart workshops). This difference was also significant, $\lambda^2 (1, N = 124) = 25.07, p < 0.0001$.

Generally, foundation doctors (both F1 and F2) did not know if attendance at specific prescribing training sessions, where provided, was mandatory or not. Over half of all trainees were unsure about attendance requirements at the following sessions: taking a drug history (n=71, 57.26%, CI=46-69%), making a diagnosis (n=69, 55.65%, CI=44-67%), establishing therapeutic goals (n=67, 54.03%, CI=42-66%), discussing management options with a patient/ carer (n=72, 58.06%, CI=47-69%) communication (n=73, 58.87%, CI=48-70%), safety issues (n=65, 52.42%, CI=40-65%) and monitoring drug effects and prescription review (n=63, 50.81%, CI=38-63%). Table 5.4 highlights the proportion of foundation trainees reporting mandatory attendance at the specific sessions.

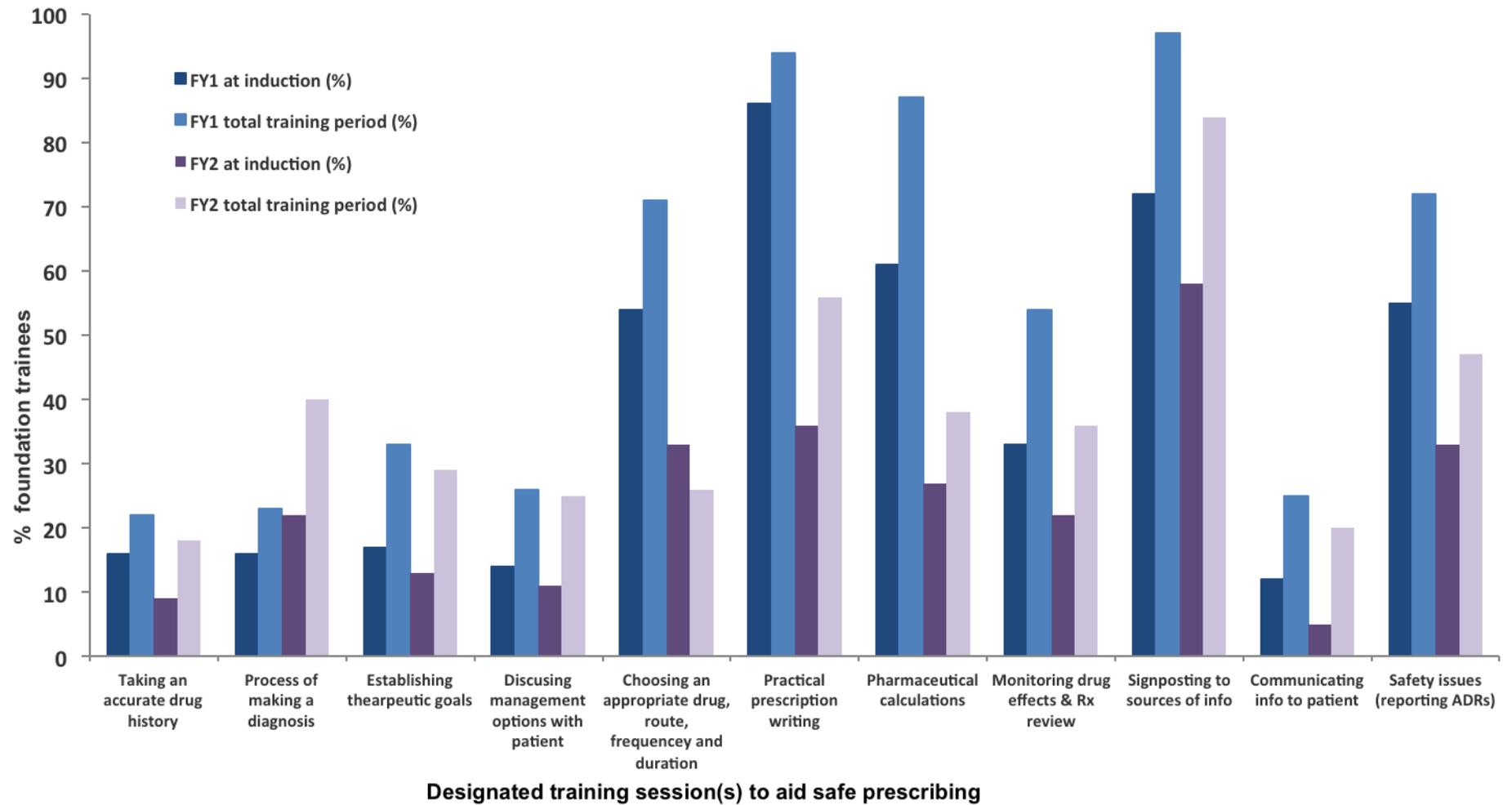


Figure 5.3: Provision of dedicated training sessions in safe prescribing to foundation doctors during 2013-2014 training period in STFS region according to trainees

Table 5.4. Comparison of dedicated sessions to aid safe prescribing reported as being mandatory by foundation doctors

Dedicated prescribing session	F1 cohort		F2 cohort		Total	
	(n)	(%)	(n)	(%)	(n)	(%)
Taking an accurate drug history	12	17.4	4	7.3	16	12.9
Process of making a diagnosis	11	15.9	8	14.5	19	15.3
Establishing therapeutic goal(s)	13	18.8	7	12.7	20	16.1
Discussing management options with the patient	10	14.5	5	9.1	15	12.1
Choosing an appropriate drug, route, frequency & duration	25	36.2	15	27.3	40	32.3
Practical prescription writing (including drug chart workshops)	45	65.2	12	21.8	57	46.0
Pharmaceutical calculations	38	55.1	12	21.8	50	40.3
Signposting to sources of information (local/ national guidelines)	37	53.6	14	25.5	51	41.1
Monitoring drug effects and prescription review	20	29.0	9	16.4	29	23.4
Communicating information to the patient/ carers	11	15.9	5	9.1	16	12.9
Safety issues i.e. how to report suspected or actual (ADRs)	29	42.0	10	18.2	39	31.5

Effectiveness of dedicated sessions

Overall the dedicated session that both cohorts of foundation doctors perceived most effective in helping them to become safer prescribers was practical prescription writing (including drug chart workshops): 68.3 % of F1s (n=41) and 58.7% of F2s (n=27) gave a rank of 1 to 4. The average rank for this session from all trainees was 4.1 (median 2, mode 1).

The session perceived to be the next most useful was the session covering appropriate drug selection, with 58.6% of all trainees ranking it 1 to 4 (n=58). Figure 5.4 shows overall how useful the foundation doctors perceived each of the dedicated session to be, and Table 5.5 shows a comparison of the perceived effectiveness as reported by the F1 and F2 doctors. The methods perceived by foundation doctors as being less useful included discussing management options with patients and/ or carers (44.4%) and communicating information to the patient/ carer (39.7%) with trainees ranking their usefulness as 9-12.

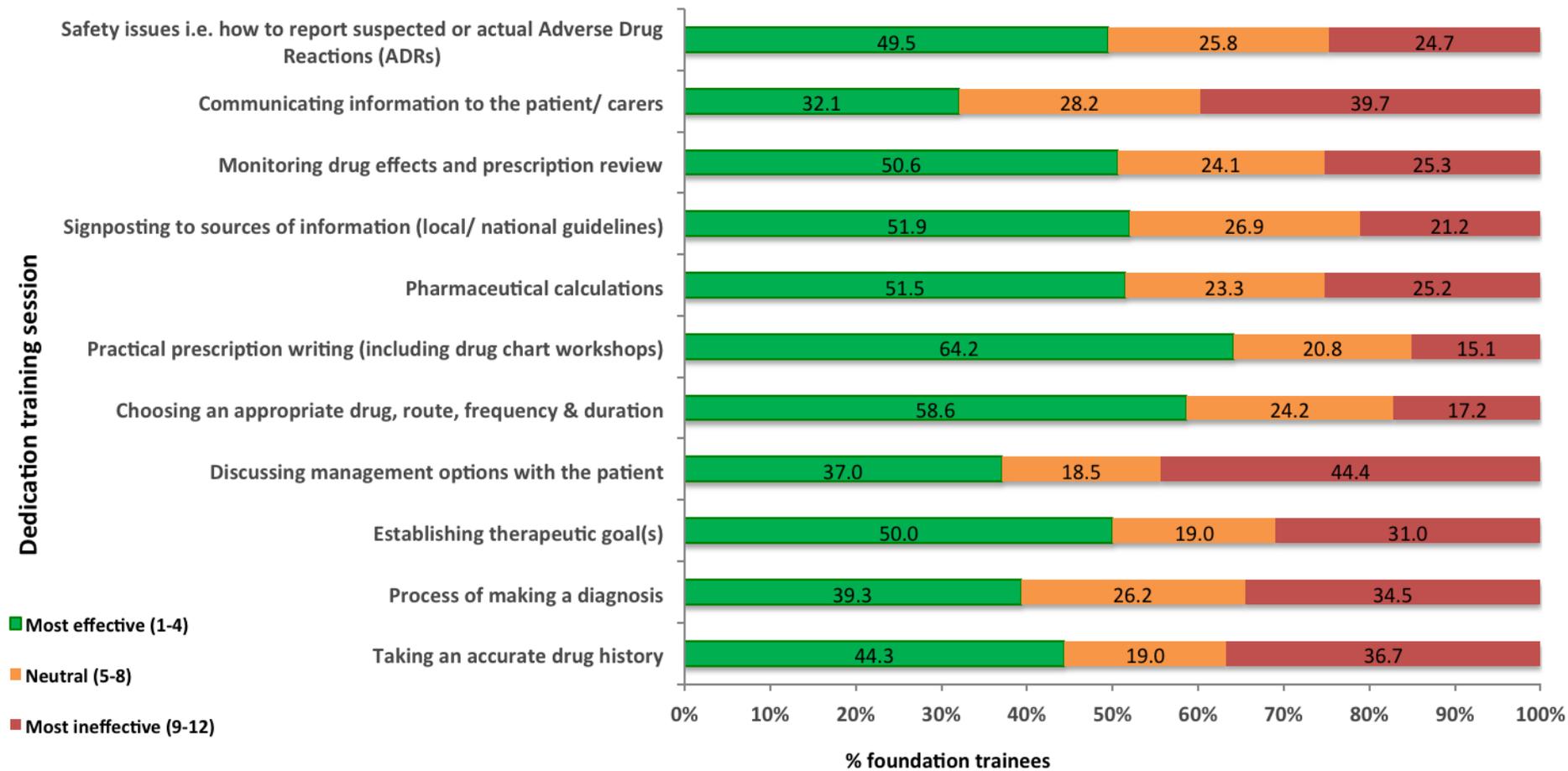


Figure 5.4: Perceived effectiveness of training sessions on foundation doctors becoming safe prescribers

Table 5.5 Comparison of F1 and F2 ranking of perceived effectiveness for dedicated prescribing training sessions provided during Foundation training period 2013-2014

Dedicated prescribing session	Most useful		Neutral		Most ineffective	
	F1	F2	F1	F2	F1	F2
Practical prescription writing (including drug chart workshops)	68.3	58.7	18.3	23.9	13.3	17.4
Choosing an appropriate drug, route, frequency & duration	58.5	58.7	26.4	21.7	15.1	19.6
Pharmaceutical calculations	52.6	50.0	19.3	28.3	28.1	21.7
Signposting to sources of information (local/ national guidelines)	52.6	51.1	21.1	34.0	26.3	14.9
Monitoring drug effects and prescription review	51.1	50.0	26.7	21.4	22.2	28.6
Establishing therapeutic goal(s)	48.8	51.2	20.9	17.1	30.2	31.7
Safety issues i.e. how to report suspected or actual Adverse Drug Reactions (ADRs)	43.1	56.5	33.3	17.4	23.5	26.1
Taking an accurate drug history	41.5	47.4	22.0	15.8	36.6	36.8
Process of making a diagnosis	37.5	40.9	27.5	25.0	35.0	34.1
Discussing management options with the patient	32.5	41.5	20.0	17.1	47.5	41.5
Communicating information to the patient/ carers	23.1	41.0	38.5	17.9	38.5	41.0

Who provides the training?

Eighty per cent of trainees (n=99, CI=72-88%) reported dedicated teaching on safe prescribing by a clinical pharmacist. Over half of respondents had to complete online training relating to safe prescribing (n=68, 55% CI=43-67%). Clinical pharmacologists provided dedicated session to just 11% of trainees (n=14), but received the highest proportion of respondents who found their session(s) very effective 79% (n=11). Table 5.6 shows the breakdown of who was responsible for providing safe prescribing training sessions, and the associated rank of

effectiveness assigned to each by the foundation doctors is illustrated in Figure 5.5. The foundation trainees did not report that any other professional groups, in addition to those proposed in the questionnaire, were responsible for providing dedicated training in safe prescribing.

Table 5.6: Professional groups reported as being providing prescribing training to foundation doctors

Sessions delivered by:	Trainees		
	F1	F2	Total cohort
Consultant	25 (36.4%)	20 (36.4%)	45 (36.3%)
Specialist Registrar (SpR)	21 (30.4%)	19 (34.5%)	40 (32.3%)
Clinical pharmacist	66 (95.7%)	33 (60.0%)	99 (79.8%)
Clinical pharmacologist	11 (14.5%)	3 (5.5%)	14 (11.3%)
Nurse	12 (17.4)	7 (12.7%)	19 (15.3%)
Peers	15 (21.7%)	13 (23.6%)	28 (22.6%)
Inter-Professional Learning	10 (14.5%)	10 (18.2%)	20 (16.1%)
Online sessions	40 (58%)	28 (50.9%)	68 (54.8%)

Impact of training:

Over two thirds of F1s reported that the training they received had an impact on their ability to safely prescribe on the ward on a daily basis (n=48, 69.57%, CI=57-83%), in comparison to 58.18% of F2s (n=48, CI=44-73%). Of the 80 comments further explaining the nature of this impact, 69 related to a positive impact on trainees (86.25%). Only 3 comments were negative and comments focused on a need for more formalised training provisions.

Ninety per cent (n=63, CI=83-91%) of F1 doctors reported confidence had improved to some degree by the end of the training period, compared to 65% of F2 doctors (n=36, CI=49-81%). Only one respondent reported a negative change in prescribing confidence by the end of the training period, this was an F2 doctor. The remaining respondents either reported no change in confidence or that any change would be situation dependent.

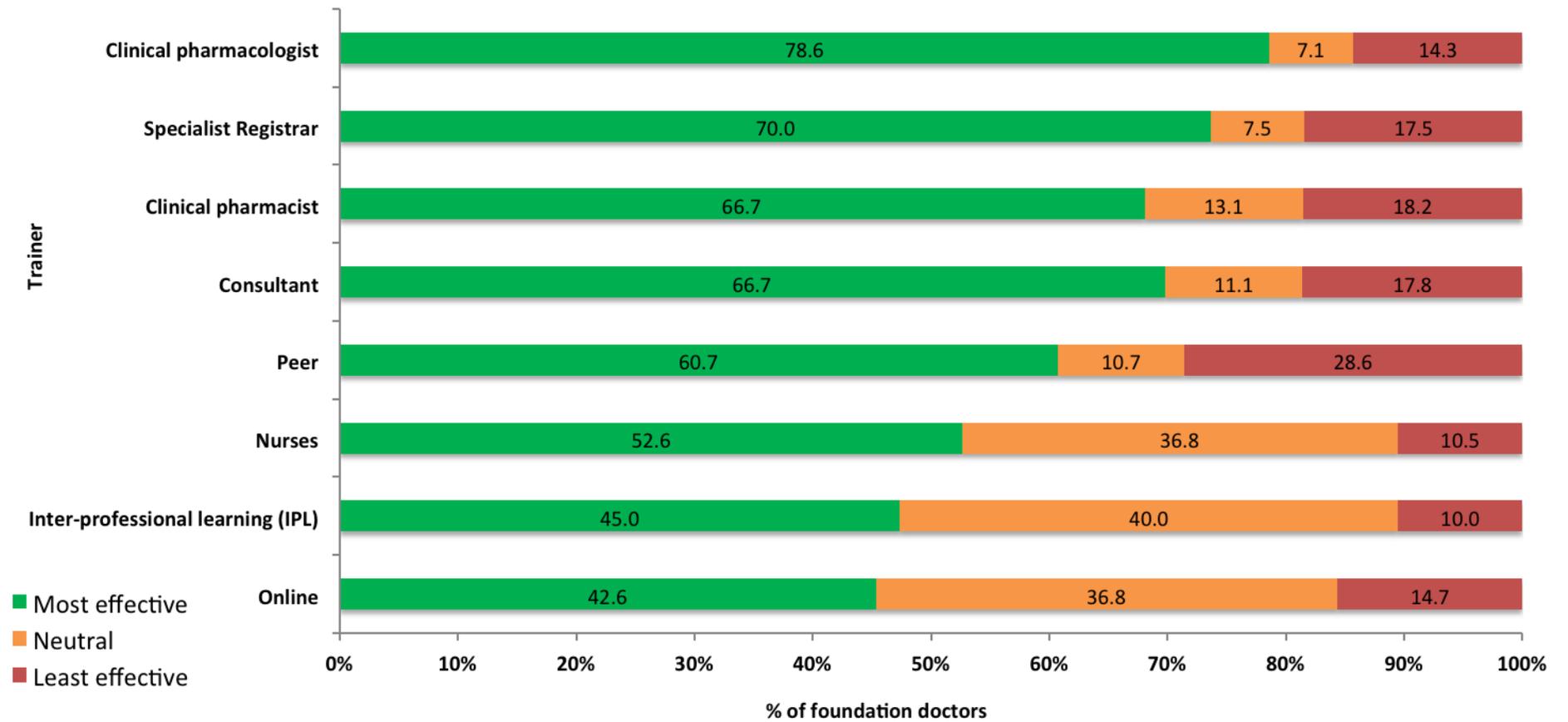


Figure 5.5: Foundation doctors' perceived effectiveness of trainers in safe prescribing

Regional prescribing assessment

Over half of foundation doctors reported that their NHS Trust ran a prescribing assessment (n=71, 57.25%, CI=46-69%). However, the proportion of F1 doctors reporting this was far greater than their F2 counterparts; 57 F1 (82.61%, CI=73-92%) and 14 F2 doctors (25.45%, CI=3-48%) respectively.

Of the 71 foundation doctors who reported that their NHS Trust ran a prescribing assessment, 7.46% reported that they received feedback from the prescribing assessment immediately i.e. the same day as the assessment was sat (n=5, CI=16-30%), 31.34% reported feedback was given within a week of the assessment (n=21, CI=11-51%) and 41.79% reported the feedback was given within one month (n=28, CI=24-60%). Over 10% of trainees reported that no feedback was given at all (n=7, 10.45%, CI=1-30%).

Qualitative data:

There was one open ended question at the end of the questionnaire where trainees were asked if they would like to make additional comments about the safe prescribing training they received as part of the foundation programme. Thirty two foundation doctors responded to this question and a thematic analysis of its' content highlighted four emerging themes:

1. Importance of medical education as a continuum. 7 out of the 32 responses commented about the continuum from undergraduate to postgraduate phases, but also on the importance of building on the training received during induction throughout the foundation programme and the need for more training on the whole.
2. Awareness of importance of safe use of high-risk drugs. 7 of the 32 respondents made reference to drugs which may be associated with high risk: opioids, antibiotics, anticoagulants, or patient groups who may be more vulnerable to effects of drugs: renal, paediatric, oncology.

3. Working relationship between pharmacists/ pharmacy staff and foundation doctors. This was mentioned by 6 of the 32 participants, and referred to the positive aspects of pharmacists being knowledgeable, accessible and approachable, as well as how patient safety can be affected when these relationships break down.
4. Neglect of F2 doctors in safe prescribing training was mentioned by 4 of the trainees. All spoke about a lack of dedicated training sessions relating to safe prescribing, and how there are often incorrect assumptions made about F2 knowledge or experience.

Table 5.7 gives examples of the junior doctor's opinions relating to each theme.

Table 5.7 Thematic analysis results and supporting comments from foundation doctors

Theme	Quotes from foundation doctors
Importance of medical education as a continuum.	“I feel prescribing training should be provided both in medical school and foundation training. During foundation training it should be regular and not just consigned to induction - some of us don't work on the ward for our first job.”
	“I think the initial prescribing teaching was good in the induction week however I feel this would be more useful again later on once we were on the wards and prescribing.”
Awareness of importance of safe use of high-risk drugs	“At the end of F1 may be useful to do a session on prescribing in emergencies, small group work so we can relate it to clinical experience.”
	“...I use it to check doses and antibiotic guidelines. The pain section is especially useful.”
	“The new NICE IV fluids guidelines have not been disseminated to us as juniors and I continue to prescribe IV fluids in a relatively arbitrary fashion.... I would also like teaching on analgesia and A&E and on assessing drug charts with polypharmacy”
Working relationship between pharmacists/ pharmacy staff and foundation doctors	“I would love to have practical, relevant teaching on this from a pharmacist - not an anaesthetist, who would view it from a very academic perspective, but from someone with a more practical medicine focus.”
	“In certain posts at Trust X ward rounds are conducted with a pharmacist, which is very useful for specialist prescribing in renal/oncology etc where we are less familiar. We also have an excellent intranet source of guidance for local deviations from the norm and excellent pharmacists.”
Neglect of F2 doctors in safe prescribing training	“We did not have any formal pharmacy or prescribing induction. This would have been very useful. I think it is presumed that FY2s know this already. This is not always the case. “
	“Ward pharmacists are excellent and should have more dedicated teaching slots for F1s but also F2s as this has been entirely neglected since I became an FY2...”

Discussion

This study, for the first time, highlights the difference in safe prescribing training provisions between F1 and F2 doctors in NHS Trusts across the South East of England. Medical graduates report that they feel ill prepared to safely and competently prescribe medicines (Heaton et al. 2008, Tallentire et al. 2011, Illing et al. 2008). Coupled with findings which indicate higher errors rates in foundation doctors (Dornan et al. 2009), it is not surprising to see that NHS Trusts attempt to address this unpreparedness and transition by offering prescribing training to their F1 doctors. However, due to a lack of agreed national or regional standards for the training of junior doctors in safe prescribing, there is little consistency in how various NHS Trusts ensure competencies are achieved (NPC 2012, superseded by RPS 2016).

The absence of a standardised programme of the induction provided by NHS Trusts within the region to foundation doctors is concerning, and perhaps more so the fact that one Trust reported that attendance at such a programme was not mandatory. More needs to be done to minimise the stress and anxiety in foundation doctors that has been reported during this transition phase (Illing et al. 2008, Tallentire et al. 2011). A well-structured induction programme with essential components such as safe practical prescribing training might address this obvious gap. It is not possible to say for certain if the induction programmes are in reality so poorly defined, because respondents may have had difficulty breaking down distinct sessions to marry up with the options as they were presented or in the questionnaire. It is a cause for concern however that those responsible for the prescribing training at the NHS Trusts could not answer more definitively some of the questions about provision of training, at induction in particular. The teaching provisions at undergraduate level are more descriptive with module descriptors detailing how many face to face hours are provided and how many hours of self-directed learning (be it online or otherwise) are expected. The same should be the case for a postgraduate training programme, and the person(s) responsible for overseeing the training should know who provides what training and to which cohort.

Results from this study also indicate that a minority of NHS hospital trusts appear

to provide dedicated training in making a diagnosis, establishing therapeutic goals, communication, and discussing management options with patients. All processes recognised as being important aspects of the prescribing process (Ross and Maxwell 2012, De Vries et al. 1994). However it was noted that the junior doctors themselves indicated that they were well versed in such topics as a result of effective teaching and learning during their undergraduate course. These data corroborate the existing literature that indicates that such tasks were not associated with a feeling of unpreparedness (Illing et al. 2008). Arguably, in the light of damaging reports about poor standards of care within the NHS, all tasks associated with the prescribing process should be included in a more formal and visible way in any safe prescribing training programmes irrespective of NHS Trust, i.e. a more standardised content of training. The idea that competency frameworks such as the WHO or BPS guidelines could be used to identify educational interventions for each competency domain has been highlighted (Kamarudin et al. 2013), and appears to be a logical approach.

Literature documenting the post-graduate teaching and learning of safe prescribing is sparse but there is evidence that learning in the applied setting has been shown to boost prescribing confidence (Rothwell et al. 2012). However, as the association between confidence and competence has not been well established (Ryan et al. 2014, Brinkman et al. 2015), complacency in this area of research is not an option.

It is gratifying to note, from results of this study, that by the end of the training year almost all F1s have had some dedicated training in practical prescribing (94 %) and pharmaceutical calculations (87 %) which are both important aspects of the prescribing process especially at the extremities of age and with impaired physiological function. In comparison, just over a third of F2s receive a dedicated session in these areas by the end of their training year. The timing of the training is also an issue for F2s, in particular, with 36 and 27 % receiving the training at induction for the practical prescription writing and pharmaceutical calculations respectively (Figure 5.3). The training provided is more purposeful if it occurs earlier during the training year, to support the transition; a period that has been well documented as being an area of concern (Tallentire et al 2011, Illing et al.

2008).

Although the transition in medical education from undergraduate to postgraduate is better understood, there is a paucity of data relating to the transition from F1 to F2. There remains uncertainty as to why NHS Trusts do not routinely offer safe prescribing training for F2 doctors, or indeed why the error rate is greatest amongst this cohort. What is clear from this study is that we might be failing to support F2 doctors, who feel that NHS Trusts often make incorrect assumptions about their capabilities: "I think it is presumed that F2s know this already. This is not always the case" (Table 5.7). Potential neglect of the F2 trainees is highlighted in this study.

It has been recommended that sources of drug information are clearly outlined and readily available in clinical workplaces (Dornan et al. 2009). In order for trainees to have an awareness of such sources of information, appropriate signposting sessions need to be optimised for all trainees. Considering it is not possible to determine how much education is enough, due to variability in how and when people learn, equipping foundation doctors with knowledge of the sources of information early in their training is vital. Ideally, such training should be delivered during induction to raise awareness amongst F1 and F2s, before they are required to depend on these sources on the wards, and a more robust and mandatory induction could further support the trainees at the point of transition. The F2s in this study felt that unrealistic assumptions are often made about their knowledge or prescribing experience and therefore they do not receive enough dedicated training in this area of practice. The optimal amount of training in practical prescribing for the F2 cohort of doctors is currently unknown but considering that these doctors have highest prescribing error rate, perhaps more should be done (Dornan et al. 2009).

A number of professionals were involved in the training of foundation doctors in safe and effective practical prescribing. Consultants, specialist registrars, clinical pharmacists and clinical pharmacologists were all perceived to be effective by both F1 and F2s. Pharmacists were generally considered as knowledgeable, accessible and important sources of information on safe and effective prescribing by many

foundation doctors. The relationship with colleagues from pharmacy also emerged as an important theme, with both positive and negative comments being made. In view of the predominant role of pharmacists in this training process (and assessment process locally) and their availability in the clinical setting to further consolidate learning, maintaining the positive aspects of this relationship might be important to nurture prescribing knowledge, attitude and skills.

Although training by clinical pharmacologists was reportedly not widely available, foundation doctors appear to place great value on the expertise provided by this group of practitioners where it was available. The impact of clinical pharmacologists and the significant contributions that CPT has on the NHS has been recently highlighted by the BPS (Pirmohamed et al. 2016). Looking forward, if there is a shift in the workforce and more clinical pharmacologists are employed then they may have a greater role to play in the education and training domain, particularly where the foundation trainees are concerned (Pirmohamed et al. 2016).

Despite online learning resources being offered in many Trusts to a significant number of trainees, its perceived effectiveness in this study was unclear. Further investigations as to the reasons for this are required. The benefits of using e-learning in the undergraduate domain have been discussed elsewhere (Kamarudin et al 2013, Maxwell & Mucklow 2012), but perhaps its use in the context of postgraduate education is not being optimised. This questionnaire did not seek to determine the appropriateness of the e-learning tools being made available to trainees, so its perceived lack of effectiveness amongst trainees may be to do with the nature of the resources available.

It also remains unclear if the professional background of the trainer is as an important factor as the content and nature of the actual training sessions, i.e. the “what” and “how” versus the “who”. It is likely that the foundation doctors benefit from training from clinicians in active clinical service who possess the appropriate knowledge, experience and willingness to do to so, however further studies would be required to explore and corroborate this.

Valid and reliable assessments are important for both trainees and trainers. They drive learning, measure the success of training programmes and act as a diagnostic tool to highlight when additional support is required by the learner, or indeed gaps in training provisions (Mucklow et al 2013, Allen et al. 2013). It is reassuring for patients that a skill as crucial as prescribing appears to be an assessment priority at the majority of NHS Trusts where newly qualified F1 doctors are concerned, (90% of NHS Trusts). However prescribing skills amongst the F2 doctors are only routinely assessed at 30% of these hospitals. This is surprising considering the F2s demonstrated the highest prescribing error rates (Dornan et al. 2009), so perhaps more of an emphasis should be placed on assessment of this cohort.

The regional prescribing assessment is used primarily to identify foundation trainees that may require additional support (Allen et al. 2013). If feedback is provided in a timely manner, this might facilitate remediation in the form of educational interventions. However it appears that feedback needs to be provided more promptly to have the desired effect: less than 10% of trainees reporting immediate feedback. This may lead to delays in doctors identifying gaps in their knowledge and the additional support that may be required. This is particularly imperative in those NHS Trusts where no prescribing restrictions are imposed on those who perform poorly in the assessment.

Limitations

This study sought to identify the training provisions for safe and effective practical prescribing within the STFS region and not their efficacy. Whilst our data suggest gaps in the provision of safe and effective prescribing training, we have not considered why these gaps are present or how they might affect patient safety. Although there appears to be a positive impact of the training on confidence in prescribing, it would be necessary to establish a link between training provisions and prescribing errors to determine their true value. However there are confounding factors that might make the evaluation of the effectiveness of this process very challenging.

The low response rate for the trainees' questionnaire is acknowledged, and as a result the sample size of the study is a limitation in terms of its generalisability. A study sampling a greater number of trainees might produce data that highlight the situation nationally. It is worthy of note however, that the majority of NHS Trusts in the region were represented. Furthermore, the fact that the data from both groups (foundation doctors and prescribing leads) gives a consistent insight provides some reassurance that results might reflect the prevailing situation. However, further studies are indicated in order to ensure validity.

Conclusion

The variation in the teaching and learning of pharmacology and therapeutics in UK medical schools, and an associated lack of emphasis on practical prescribing within the UK is well recognised (O'Shaughnessy et al 2010). The current study suggests that a similar trend can be seen in the postgraduate domain.

Despite on-going research in an attempt to reduce prescribing errors it remains a significant problem. One of the fundamentals of therapeutics is the ability to write a clear, legible and safe prescription and most NHS Hospital Trusts do provide some training in safe and effective practical prescribing to their foundation trainees, but perhaps a review of the training might optimise the approach and content. NHS Trusts must assume responsibility to ensure that all foundation doctors feel prepared to undertake this complex task. A more consistent approach across regions in terms of safe prescribing training provisions, with a greater emphasis on the induction period and on F2 doctors might be beneficial.

In spite of the limitations of this study, the results might prompt NHS Hospital Trusts to review their training in safe and effective practical prescribing in early postgraduate medical training. The development of minimum standards for the teaching and learning of safe prescribing during the foundation years of training should be explored. It is proposed that all NHS Trusts provide training, which includes a practical prescribing session, at induction. In addition, as F1 and F2 needs are slightly different there should be a separate induction process placing emphasis on the more important aspects for each group.

Chapter 6 – Seeking consensus on a practical prescribing programme for UK medical undergraduates

Introduction

The findings of the EQUIP and PRACTICE studies highlighted the prescribing error rates of UK doctors across primary and secondary care to be 8.9% and 4.9% respectively (Dornan et al., 2009, Avery et al., 2012). Although the patient safety and economic ramifications of poor prescribing practices is evident, and has been discussed in Chapter 1, complacency regarding these findings is not an option. Newly qualified junior doctors are typically responsible for the majority of prescribing in NHS hospitals (Gordon et al. 2013). However, they are the most inexperienced doctors and have the highest prescribing error rates (Dornan et al., 2009).

This highlights the fact that support must be given to prescribers at all stages of their career, and that medical schools need to emphasise the importance of lifelong/ self-regulated learning to their undergraduates so that they will be receptive to educational interventions to ensure prescribing practices are kept up to date throughout their careers (White & Gruppen in Swanick 2010). To date there is little evidence to suggest that this has been embedded in undergraduate curricula in any meaningful way.

At the point of graduation in the UK, medical students are supposed to have achieved the outcomes set out by the GMC in Outcomes for Graduates 2015 (initially published in Tomorrow's Doctors 2009), and have proven themselves to be a scholar, scientist, practitioner and professional. The overarching outcome relating to safe prescribing states that graduates should "prescribe drugs safely, effectively and economically" (outcome 17, GMC 2015, originally Tomorrow's Doctors 2009). It is the responsibility of each medical school to ensure that their students are provided with the necessary background knowledge, skills, learning environments and opportunities to achieve and demonstrate proficiency in the above competencies. To date there is no literature on how medical schools differ in their approaches to achieving this.

There appears to be discord between what the GMC state a graduate should be competent in and what graduates perceive their level of proficiency to be: the literature is rich of accounts of final year medical students and newly qualified junior doctors expressing concerns about the education they received in relation to crucial and complex skills such as prescribing, not just in the UK (Heaton et al., 2008, Illing et al., 2008, Rothwell, 2012). The link between theory and practice is one area that appears to be particularly problematic (Baker et al., 2011). Results reported in Chapter 3 corroborate this assertion. The issue may not always be due to knowledge deficits but the practical acquisition of the process itself i.e. outing the skills into practice.

The provisions of CPT in the UK was found to be disparate (O'Shaughnessy et al., 2010), with fewer hours being dedicated to practical prescribing workshops than any other aspect of CPT in medical schools where they were delivered at all.

Prescribing curricula developed in past

Previous undergraduate curricula tended to focus on the intended learning outcomes that graduates should have achieved prior to graduation, as specified by the GMC. However there was little emphasis on the methodologies, as this was historically left to individual medical schools.

However successful curricula depend on alignment of three key areas: intended learning outcomes, teaching and learning activities, and subsequent assessment (Biggs 2003). Assessment has been addressed with the development of the national PSA by the BPS and MSC, which newly qualified junior doctors sit before their foundation year 1 (Maxwell et al., 2017). This study will focus on the first two areas: learning outcomes and teaching activities.

The preceding chapters have provided an insight into the current teaching and learning provisions for practical prescribing in the undergraduate and postgraduate phases of the medical educational continuum in the UK, and locally in South East

of England. Considering the lack of guidance on how prescribing should be taught, the diversity in provisions is hardly surprising.

This current study will seek consensus on learning outcomes for practical prescribing from a group of experts in the field, and furthermore outline their views on possible teaching and learning methodologies. When used in conjunction with the national PSA, all aspects of Biggs model have been addressed, which may inform on the teaching practices for practical prescribing in the UK.

Aim of study

The aim of this study was to:

- To form a group of knowledgeable individuals or “experts” in prescribing teaching and learning, as defined by pre-determined criteria (see below).
- Conduct a Delphi study with a minimum of 2 rounds to achieve consensus amongst the panel regarding the content of a dedicated programme of study for practical prescribing for medical undergraduates in UK medical schools.

Methodology

Sampling technique

Purposive sampling was used because all participants needed to have experience and knowledge of teaching and learning in safe prescribing and in undergraduate medical education. Snowballing was encouraged, in that panel members could forward the survey to colleagues they felt could make a worthwhile contribution to the process, had expertise in some aspect of the teaching and learning of prescribing, and met the inclusion criteria.

A “quasi-anonymised” approach was used in the study. The identity of those invited to join the panel was not revealed to other participants, but known only to the research team. This was not the case where snowball recruitment occurred.

Inclusion criteria of panel members

All participants were required to be adults over the age of 18 years of age, with an e-mail address and a working internet connection to facilitate completion of the questionnaires. They also needed to be able to read and write in English and possess good written communication skills.

To qualify as an “expert”, all participants would need to meet at least two of the criteria from points 1-4, and all had to meet criteria points 5-6:

1. Performing a current role in the teaching and learning of prescribing and is involved in undergraduate or postgraduate curriculum development i.e. at a UK Medical School, Foundation School, Medical Schools Council, etc.
2. Has a minimum of 2 publications in a peer reviewed journal relating to teaching and learning of prescribing or curriculum development.
3. Has a minimum of 3 years post-qualification experience in his or her clinical area/ speciality related to safe prescribing (unless a junior doctor).
4. Is involved in the delivery of Independent Prescribing (IP) training to Allied Health Professionals under the Single Competency Framework.
5. Currently employed in one of the following roles: consultant, GP, junior doctor, clinical pharmacologist, clinical pharmacist, clinical psychologist, nurse IP or nurse with specialist in safe prescribing, pharmacist IP.
6. Able to dedicate the time required completing the multiple rounds (minimum of 2, at estimated 20 minutes each).

Panel selection and recruitment

The researcher and a member of the supervisory team drafted a shortlist of “experts” independently. Initially 87 individuals were put forward, but 30 were excluded at this panel selection stage. These exclusions were made on the basis that these individuals were no longer in active roles relating to teaching and learning of safe prescribing, so their knowledge of current practices could not be guaranteed.

A final list of 57 experts was agreed upon after a discussion regarding their suitability. Decisions were based on the individual's professional background and contribution to the field of prescribing teaching/ medical education in relation to the inclusion criteria.

The experts were initially identified (according to the inclusion criteria) through a variety of sources:

- Leading authors in the UK involved in the teaching and learning of safe prescribing, identified during reviewing the literature
- Members of the PSA Executive Board
- Recommendations from the research project team members

An invitational e-mail, outlining the purpose of the study, was sent to each of the 57 experts included on the final panel list. A participant information sheet was also included (Appendix P).

Three members of the panel were excluded at the initial recruitment stage, due to the researcher not being able to establish contact, or not being able to obtain an accurate or up-to-date e-mail address. A further 7 experts declined to take up the invitation to participate at this stage, which reduced the panel of experts to 47.

Piloting of questionnaires

Once devised, the questionnaire for Round 1 (Appendix E) was pre-tested by the research supervisors and members of the Division of Medical Education (DME) at BSMS not directly involved in the project. This helped to ensure content and face validity, the importance of which has been discussed in the context of nursing and health research (Keeney et al., 2010, Hasson & Keeney 2011).

The questionnaire for Round 2 (Appendix F) was identical in structure to round 1, therefore only the research supervisors checked the content of the questionnaire prior to dissemination.

Data analysis

The primary analysis involved both qualitative and quantitative methods. The main quantitative statistics used were those measuring central tendency i.e. mean, mode and median. Standard deviation and interquartile ranges (levels of dispersion) were also calculated. This analysis was completed in Microsoft Excel 2011. The content of the free-text boxes was studied manually and independently by two members of the research team (MK & MO), to decide what items would be taken forward to the next round. It was decided to ignore modifications that related purely to syntax. Duplicated or similar items were reviewed and where appropriate, amalgamated to avoid duplication.

At the end of Round 1 a summary of findings was drafted (Appendix Q). This was sent to panel members for their perusal prior to completing Round 2.

Delphi Endpoints

A Delphi by its very nature seeks to reach consensus. However what defines consensus in the literature varies as greatly as the process of conducting a Delphi. Some studies take this to mean as little as 51% of the panel being in agreement (Loughlin and Moore 1979). It is recognised that achieving 100% agreement on every issue under scrutiny would be a very difficult task, so such a level would only tend to be used in high stakes scenarios i.e. life and death issues (Keeney et al. 2006).

This study defined consensus as achieving a minimum of 75% expert panel agreement in line with previous studies (Keeney et al. 2001, Hasson et al. 2000). However, as is the case with methodology of the Delphi no formally agreed figure is “standard”, so there is no scientific rationale available for any selected figure: hence 75% has been suggested as the minimum that researchers should accept (Keeney et al. 2006).

A 4-point likert scale was used in this study, (where 1 = strongly disagree, 2= disagree, 3 = agree and 4 = strongly agree) and consensus was taken where a

mean of 3 or more (with a standard deviation of less than 1) was achieved, or 75% of experts score 3 or 4, i.e. 75% panel agreement.

The Delphi Questionnaires

Round 1

Round 1 of the Delphi process was split into 2 parts, A and B. Part A contained the Delphi itself relating to the core content and learning outcomes for the programme of study and Part B contained a questionnaire on possible teaching and learning methods that could be employed by medical schools.

The questions relating to methodology appeared in Round 1 only as, strictly speaking, a Delphi study in relation to curriculum design would focus on core content and or learning outcomes (Smith et al. 2016).

Round 1: Part A

Question 1 referred to the core content and related to discrete aspects of the prescribing process. The 17 items included were derived primarily from the literature – previous CPT curricula (Maxwell and Walley 2003, Ross and Loke 2009, Ross & Maxwell 2012). Additionally suggestions made by the students in previous studies forming part of this doctoral thesis (outlined in Chapter 3) were included where relevant. Panel members were asked to what extent they thought these aspects ought to be included in a dedicated programme of study for practical prescribing, rather than taught elsewhere in the undergraduate curriculum. A 4-point Likert scale was used to determine agreement, 1 being strongly disagree and 4 being strongly agree. An optional open-ended question followed availing panel members the opportunity to propose additional items (Question 2).

Question 3 related to the learning outcomes for the proposed programme of study for practical prescribing. There were 25 learning outcomes proposed, based on the literature and linked to the proposed items in question 1. Panel members were asked to decide which should be included. They could choose to accept, reject or

modify each item. If the latter option was selected a free text box was available for the expert to propose a suitable modification. Again, an optional open-ended question followed as a sub-question allowing panel members to suggest an additional 3 learning outcomes. This approach had been successfully used in another area of curriculum review for anatomy in the UK (Smith et al. 2016), and so was adapted for use in this study.

Round 1: Part B

Part B concerned the methods used in the teaching and learning of practical prescribing. Panel members were presented with a list of methods (the same used in previous studies – see Chapters 3 and 4) and were asked to state their agreement that it would be useful to utilise the particular method in a dedicated programme of study for practical prescribing. A four-point Likert scale was utilised (1 being strongly disagree and 4 being strongly agree). In addition, members were asked at what stage of the curriculum such methods would be best introduced or used. Panel members also had the opportunity to propose any additional methods.

One question sought to identify who panel members thought should be best placed to lead on a programme of study for practical prescribing in medical schools.

The final 4 questions were designed to collect demographic data such as profession and level of experience. These questions were included in both rounds.

The panel was initially given a 3 week window in which to complete Round 1. However this deadline was extended by an additional 2 weeks to accommodate some panel members who were unavailable for the original deadline. Reminder emails were sent every 2 weeks. Round one was available to complete from May to June 2016.

Round 2:

Round 2 of the Delphi contained questions concerning the content and learning outcomes for the practical prescribing programme of study only (corresponding to Part A of round 1). The teaching and learning methods were not considered in Round 2. The layout and format of the questionnaire used in Round 1 was replicated for the second round.

Question 1 focused on the core content. As consensus had been achieved on all aspects initially put forward in round 1, the additional 25 aspects of the prescribing process proposed by panel members were included in this round. A 4-point Likert scale was used to determine agreement on inclusion or exclusion. There was no option in Round 2 for members to propose additional items, in order to avoid sample fatigue and subsequent rounds.

Question 2 focused on learning outcomes. Three of the 25 items initially put forward in round 1 were not accepted so were taken forward, with the associated modifications suggested by the panel. The additional items proposed by the panel were also taken forward for consideration resulting in 16 items being included in this round. Panel members could either accept or reject these 16 items. The demographic questions from round 1 were also taken forward to round 2 in addition to the above 2 questions.

Round 2 was launched the first week of July 2016. Panellists were initially given 2 weeks to respond, after which point a reminder e-mail was sent. As round 2 coincided with summer holidays and numerous panellists were away the questionnaire remained open until the end of August 2016, with the final reminder e-mail was sent one week before.

Ethical approval and procedure for consent

The ethics application for this Delphi study was considered and subsequently granted approval by the Research Governance and Ethics Committee (RGEC) at Brighton and Sussex Medical School, reference 16/011/OKO on 24th February 2016 (Appendix I).

There was no special procedure in place to obtain consent from panel members prior to completion of the questionnaires. The invitational e-mail stated that completion and submission of a response was the mechanism in place for obtaining consent. A copy of the participant information sheet was attached to the initial invitational e-mail.

Results:

Round One

Forty-seven experts were sent the initial questionnaire for Round 1, of whom 34 responded (72.34%). The proportion of male and female respondents was equal, (50%, n=17). Thirteen of the respondents were clinical pharmacologists (38.2%), 7 were consultants (20.6%), 6 were clinical pharmacists (17.6%), 5 were academics (14.7%), and there was one each of a junior doctor, nurse and a GP (8.7%). Over 70% of the respondents had more than 15 years of post-qualification experience (73.5%, n=25), 17.6% of respondents had 10-15 years of experience, of the remaining 3 respondents just one had less than 3 years' experience, the junior doctor (2.9%).

Core content/ aspects of the prescribing process

Consensus for acceptance was achieved where >75% of the panel scored 3 or 4 per item on the 4-point Likert scale i.e. agree (3) or strongly agree (4). Likewise consensus for rejection was achieved where >75% of the panel scored 1 or 2 per item on the same scale, i.e. strongly disagree (1) or disagree (2).

All 17 proposed core content items achieved consensus for acceptance after round 1. Four core content items achieved 100% agreement, 9 achieved 97% agreement, 3 items achieved 94% agreement. The only item to score below 90% panel agreement was "knowledge of basic pharmacology and therapeutics", (76.5%). Central tendency scores for these data are presented in Table 6.1, along with the percentage panel agreement for each proposed core content item.

Table 6.1. Respondent central tendency scores for proposed core content items from round 1

<i>It would be useful to include these various aspects of the prescribing process in a dedicated programme of study for practical prescribing.</i>	<i>% Agreement</i>	<i>Mode</i>	<i>Median</i>	<i>IQR</i>
ITEMS achieving consensus (>75% panel agreement)				
Prescribing high risk drugs	100	4	4	0.75
Appropriate drug selection including dose, frequency, formulation, route, and duration	100	4	4	0
Pharmaceutical and dosage calculations	100	4	4	0.75
Providing information, instruction on use and cautionary/ warning advice to patients or carers	100	4	4	0
Establishing therapeutic goals - how is patient likely to benefit from medication	97.1	4	4	0
Obtaining an accurate drug history from the patient (including detailed allergy history)	97.1	4	4	0
Patient specific and physiological factors that may impact drug choice i.e. kidney or hepatic function, etc.	97.1	4	4	0
Prescribing at the extremes of age (paediatric and geriatric)	97.1	4	4	1
Prescribing in common acute emergencies and illnesses	97.1	4	4	1
Monitoring for benefit and adverse effects of medication	97.1	4	4	0
Recognising actual or suspected adverse drug reactions and how to report these	97.1	4	4	1
Documentation of rationale for prescribing medication or stopping treatment if applicable	97.1	4	4	1
Drug information resources such as BNF	97.1	4	4	0
Reasoning behind the need to prescribe a drug i.e. establish a (working) diagnosis	94.1	4	4	1
Prescribing in pregnancy and lactation	94.1	4	4	1
Signposting to local or national prescribing guidelines as clinically appropriate	94.1	4	4	1
Knowledge of basic Pharmacology and therapeutics	76.5	4	4	1

In addition to accepting the 17 proposed items, the panel proposed an additional 47 items (Appendix Q), of which 25 were taken forward to round 2 for consideration. Duplicated items in the suggestions were amalgamated to form one core content item, items relating to syntax were not considered.

Learning outcomes

Consensus was achieved when >75% panel agreement was reached, i.e. > 75% accepting or rejecting the proposed learning outcomes. If panel members did not want to reject or accept a proposed learning outcome outright they had an opportunity to suggest a modification.

Of the proposed 25 learning outcomes, 22 achieved consensus for acceptance after round 1 (Table 6.2, highlighted in green). Eleven of these achieved consensus at >90%, just one achieving consensus at 100% - "Know that various formulations of certain drugs differ in bioavailability and need to be prescribed by brand rather than generically".

No learning outcomes achieved consensus for rejection by the panel. The 3 learning outcomes that did not achieve consensus for acceptance are listed at the bottom of Table 6.2, highlighted in red. The proposed modifications (Appendix O) suggested by the panel indicated that these items required further differentiation, for example the panel seemed unsure if "classes of drugs" referred to the therapeutic classification or legal classification. Similarly the panel felt that "high-risk" drugs ought to be defined further for clarity. With respect to item regarding familiarity with local drug charts of prescribing systems, the modifications put forward by the panel indicated that the use of generic forms for teaching purposes would be more appropriate.

Two members of the research team examined all 83 proposed modifications and suggestions of 6 additional learning outcomes independently. Of the items proposed, 24 were rejected automatically as they referred to the syntax or were a

comment on the learning outcome without a modification actually being suggested.
An additional 16 items were taken forward for consideration to round 2.

Table 6.2. Respondents' acceptance or rejection of proposed learning outcomes in round 1

At the end of completing the programme for practical prescribing the medical students should:	Accept LO	Reject LO	Modify LO
ITEMS achieving consensus (>75% panel agreement)			
Know that various formulations of certain drugs differ in bioavailability and need to be prescribed by brand rather than generically	100.00	0.00	0.00
Be able to write a clear, legible, unambiguous prescription (including fulfilling prescription requirements for Controlled Drugs on TTO/ FP10 prescription forms)	97.06	2.94	0.00
Be able to predict and manage common potential drug interactions including those caused by non-prescribed, herbal or complementary medication	97.06	2.94	0.00
Be competent and confident in performing pharmaceutical and dosage calculations	97.06	2.94	0.00
Have a working knowledge of various sources of drug information (dosage, interactions, etc.) for example the BNF, local prescribing guidelines, summary of product characteristics, etc.	97.06	2.94	0.00
Know the considerations that need to be made when prescribing for patients with renal or hepatic dysfunction	94.12	5.88	0.00
Be able to explain the need for performing therapeutic drug monitoring (TDM)	94.12	5.88	0.00
Know the commonly prescribed medicines that require TDM (e.g. lithium & gentamicin)	94.12	2.94	2.94
Be able to identify suspected or actual adverse drug reactions	94.12	5.88	0.00
Be able to prescribe drugs commonly used to manage acute emergencies	94.12	2.94	2.94
Be able to tell the difference between a drug allergy and a drug intolerance	91.18	5.88	2.94
Be able to appropriately use the different sections on the drug chart i.e. "once only" dosing, regular, as required, IV fluids, and blood products	88.24	8.82	2.94
Know the considerations that need to be made when prescribing for pregnant or breast-feeding women	88.24	8.82	2.94
Know the considerations that need to be made when prescribing for geriatric and paediatric patients	88.24	11.76	0.00
Be able to counsel patients on commonly prescribed drugs	88.24	5.88	5.88
Be able to identify possible causes of non-adherence	88.24	5.88	5.88

At the end of completing the programme for practical prescribing the medical students should (continued):	Accept LO	Reject LO	Modify LO
ITEMS achieving consensus (>75% panel agreement) continued			
Know about the existence of the yellow card reporting systems for reporting actual or suspected adverse drug effects	88.24	5.88	5.88
Be able to recognise and manage a medication error	88.24	11.76	0.00
Have knowledge of, and be able to apply basic pharmacokinetic and pharmacodynamic principles	85.29	8.82	5.88
Know about the drug management of common illnesses	85.29	5.88	8.82
Know the common inducers and inhibitors of CYP450 liver enzymes (including those of herbal or complementary origin)	82.35	11.76	5.88
Have a basic understanding of how drugs work: their mechanisms of action to produce not only therapeutic effects but also adverse effects	82.35	8.82	8.82
ITEMS NOT achieving consensus (<75% panel agreement)			
Be able to prescribe high-risk drugs	73.53	20.59	5.88
Be familiar with local drug charts/ prescription forms/ electronic prescribing systems	73.53	20.59	5.88
Know the different classes of drugs (including unlicensed or off label prescribing)	64.71	26.47	8.82

Practical prescribing teaching and learning methods

There was 100% panel agreement that it would be useful to include the following 5 proposed methods in a dedicated programme of study for practical prescribing i.e. a score of 3 (agree) or 4 (strongly agree) from the Likert scale data:

1. Validated pre-prescribing i.e. having prescribing validated by a qualified clinician
2. Small group teaching
3. Shadowing a clinical pharmacist
4. Problem based learning (PBL) and case studies
5. Awareness of safe prescribing resources

Peer teaching, where students are responsible for teaching fellow students, was the only method that caused significant variability in responses with <60% of the panel agreeing it would be useful to include in a dedicated programme of study for practical prescribing (58.8%). Greater than 80% of the panel agreed it would be useful to use the remaining 9 methods (Figure 6.1).

Experts were asked at what stage of the curriculum various methods would best be introduced: final year only, years 1 to 2, years 3-5, continuous through the course or whether they should not be used at all. Over two thirds of the panel believed that tutorials (70.59%, n=24), awareness of safe prescribing resources, self-directed learning and apps (all 67.65%, n=23) should be used continuously throughout the course Figure 6.2.

Experts indicated that certain methods would be best used during years 3-5 or in final year only (traditionally the clinical years of the undergraduate medicine degree): shadowing a junior doctor, shadowing a clinical pharmacist, validated pre-prescribing and pre-prescribing seminars (Figure 6.2)

No expert indicated that the use of 4 of the methods would be unsuitable to use in a dedicated programme of study for practical prescribing: awareness of safe prescribing resources, PBL/ case studies, small group teaching and shadowing a clinical pharmacist. For all other methods at least one expert indicated they thought it would not be useful to use (Figure 6.2).

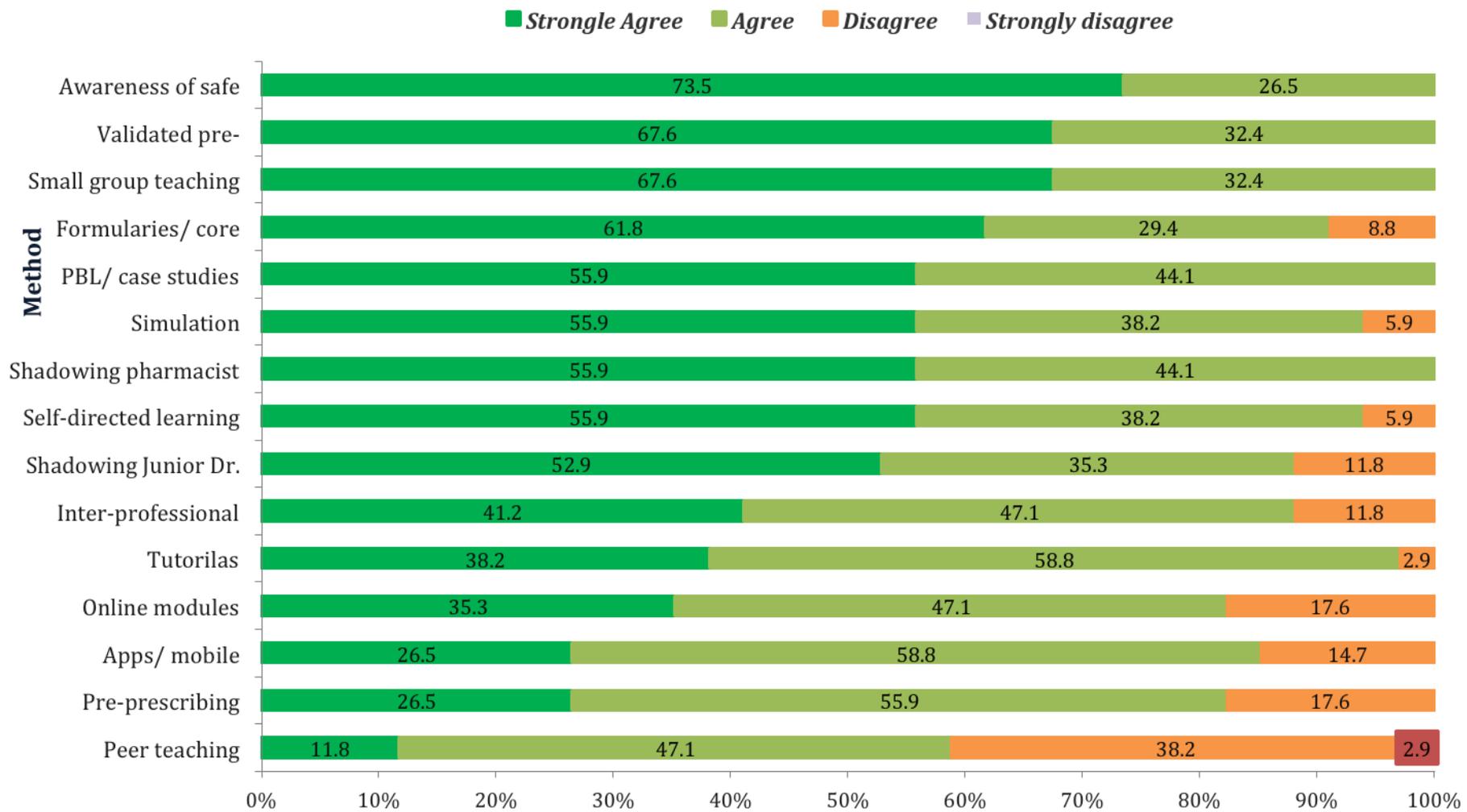


Figure 6.1. Delphi panel's perception of methods that would be useful in teaching practical prescribing

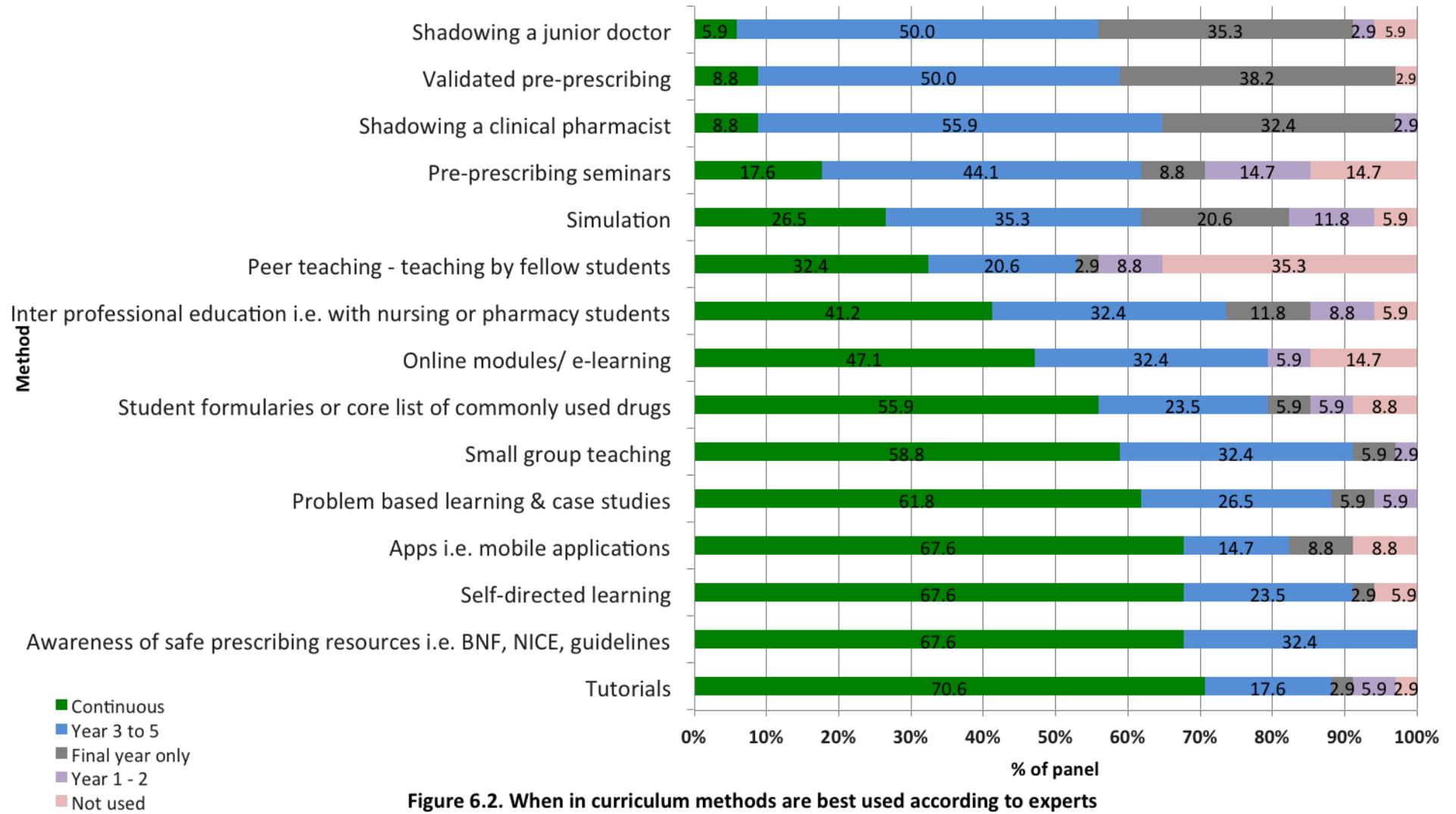


Figure 6.2. When in curriculum methods are best used according to experts

Round 2

Of the panel of 34 experts who responded in round 1, 28 responded in round 2 (82.4% retention rate). The gender distribution was as follows: male (57.14, n=16), female (39.29% n=11) and one panel member did not wish to disclose their gender (3.57%, n=1).

Core content

The same levels of consensus for acceptance from round 1 were used (>75%). Of the proposed 25 core content items, 17 reached consensus for acceptance after round 2 (Table 6.3, highlighted in green). One item achieved 100% panel agreement: “the practicalities of good prescription writing practice, inc. appropriate abbreviations, non-proprietary vs brand-name prescribing”. Eight achieved consensus for agreement >90%, 7 achieved consensus 80-90% and just one achieved consensus <80%. Eight of the proposed core content items were not accepted by the panel (Table 6.3, highlighted in red), and related to items such as biologics, drugs of animal origin for religious groups, NHS drug tariff and ethics/dilemmas.

Table 6.3. Respondent central tendency scores for additional 25 proposed core content items from round 2

It would be useful to include these various aspects of the prescribing process in a dedicated programme of study for practical prescribing.	% Agreement	Mode	Median	IQR
ITEMS achieving consensus (>75% panel agreement)				
The practicalities of good prescription writing practice, inc. acceptable abbreviations, non-proprietary vs brand-name prescribing	100.00	4	4	0.25
How to prescribe controlled drugs	96.43	4	4	1
Common errors or pitfalls with prescribing and how to avoid them	96.43	4	4	0
Practical training in filling out a sample drug chart and a sample electronic prescription (including awareness how to navigate and use these, and awareness of other systems available)	92.86	4	4	0
Dosing and monitoring of drugs that require individualised dosing e.g. gentamicin and vancomycin	92.86	4	3	1
Selection of actual drug/ drug class before considering dose, frequency, etc.	92.86	4	4	1
Managing polypharmacy	92.86	4	4	1
Preventing and dealing with prescribing errors – including reporting	92.86	4	4	1
Clarity of documentation	92.86	4	3	1
Recognising common and significant interactions, inc. drug-drug, & those linked to kinetics and dynamics	89.29	4	3.04	1
Understanding pharmacy and medicines information support	85.71	3	4	1
Communicating instructions to other members of staff involved in administration or monitoring of medicines	85.71	4	4	1
Consideration of formulations and practicalities e.g. administration via nasogastric tube	85.71	3	4	1
Antimicrobial stewardship	85.71	4	3	1
Critically reviewing prescription charts	82.14	4	4	1
Safe evidence based stopping of medicines i.e. in elderly patients	82.14	4	4	1
Prescribing outside licensed indications	78.57	3	2.3	0.5
ITEMS NOT achieving consensus (<75% panel agreement)				
Prescribing in a team environment	75.00	3	3	1.25
Ethics and dilemmas	71.43	3	4	1
Law pertaining to medicines and adherence and concordant relationship	71.43	2	3	1.5
Special problems with biologics	64.29	2	3	1
Communication throughout the consultation process	64.29	3	3	1
Drugs of animal origin for religious groups	60.71	2	3	1
Harm from substances of recreation	50.00	2	3	1
Use of the NHS drug tariff	39.29	2	3	1

Learning outcomes

All 16 additional learning outcomes proposed by the panel achieved consensus for acceptance: the level was the same as that set in round 1 i.e. >75%. Five of these were accepted at the 100% consensus level, and related to prescribing high risk drugs, sources of information, knowing when not to prescribe but ask for help and how to report ADEs. Seven of the learning outcomes were accepted by >90% consensus and the remaining 4 were accepted with 80-90% consensus (Table 6.4).

Table 6.4. Respondents' acceptance/ rejection of additional 16 proposed learning outcomes from round 2

At the end of completing the programme for practical prescribing the medical students should:	Accept LO	Reject LO
ITEMS achieving consensus (>75% panel agreement)		
Know which drugs are high risk, and what particular measures are needed to prescribe them safely	100.0	0.0
Know the sources to look for information on drug interactions including herbal medicines	100.0	0.0
Be able to access and use the electronic and paper-based BNF, in addition to other safe prescribing resources	100.0	0.0
Know how to report adverse drug events using the yellow card system (paper and electronic)	100.0	0.0
Have an awareness of when it is appropriate not to prescribe but ask for help	100.0	0.0
Be aware of the existence of the different legal classes of medications (e.g. P, POM, GSL, CD)	96.4	3.6
Demonstrate the ability to interpret data from TDM of commonly prescribed medicines (e.g. lithium, gentamicin, vancomycin) and perform basic dose adjustments as appropriate	96.4	3.6
Be able to use of a range of generic prescription forms/ drug charts/ electronic prescribing systems	92.9	7.1
Have an awareness of the limitations on prescribing of high risk drugs by F1 and F2 doctors	92.9	7.1
Understand the role of other prescribers and team members e.g. pharmacist and nurse practitioners	92.9	7.1
Demonstrate an understanding of patient differences and beliefs and how this may impact on choices of therapy	92.9	7.1
Be able to explain the importance and role of anti-microbial stewardship	92.9	7.1
Know that it may be appropriate to prescribe medicines outside the terms of their license, and what additional considerations this involves (including providing information to the patient)	89.3	10.7
Demonstrate the ability to apply pharmacokinetic and pharmacodynamic principles	89.3	10.7
Understand that the patient is the centre not the drug or the drug chart	89.3	10.7
Be aware of drug use pre-conception i.e. drugs that may affect conception	82.1	17.9

Discussion

Ineffective teaching of the safe and rational use of medicines, particularly at undergraduate level can lead to prescribing errors downstream, which jeopardise patient safety and cost an already overstretched NHS millions of pounds each year.

This current study focuses on practical prescribing skill acquisition. Consisting of a two round Delphi, it achieved consensus on 34 core content items and 38 learning outcomes by a panel of experts in the field of safe prescribing within a period of 4 months. These core content items and learning outcomes form the basis of a dedicated programme of study focused on the principles of writing a prescription, addressing the apparent lack of emphasis placed on application or practical skills in favour of knowledge acquisition within undergraduate curricula (EMERGE group 2009, Brinkman et al., 2017).

A traditional Delphi study would begin with an exploratory first round (Hsu & Sandford 2007a&b), and gather opinions from the expert panel, which would then be analysed and form the basis of the subsequent questionnaires. However due to the fact that a lot of work has been done with respect to the teaching and learning of CPT within medical education in the UK (Maxwell & Walley 2003, Ross & Loke 2010, Ross & Maxwell 2012), it was decided to use this as the basis for the questionnaire for round 1. This approach has been successfully used in the development of an anatomical syllabus for medical undergraduates in the UK (Smith et al., 2016), and indeed for an iteration of the BPS core curriculum (Ross & Locke 2010), so was not thought to have detracted from the results.

Dornan et al. (2009) mentions five areas that could potentially be targets to minimise prescribing errors: of these four relate to education. Much of the undergraduate curriculum is concerned with knowledge acquisition (EMERGE group, 2009). Previous curricula in this area have been more general and cover most aspects of CPT: where the focus was on knowledge, skills and attitudes that medical students should demonstrate prior to graduation (Maxwell & Walley, 2003, Ross & Loke, 2010, Ross & Maxwell 2012). However it is not known to what extent UK medical schools use such curricula, and a previous study forming part

of this PhD project were unable to determine this also. It is not intended as a stand-alone curriculum but should be used in conjunction with current CPT teaching and learning practices to aid the delivery of teaching provisions to support the acquisition of practical prescribing skills.

Core content

All core content items achieved consensus in round 1. Just one proposed item “Knowledge of basic pharmacology and therapeutics” achieved <90% consensus. It is probably not the case that the experts do not consider this fundamental for prescribing, but they were asked specifically for agreement on items to include in a programme of study to support the development of practical prescribing skills. Some members of the expert panel, suggested that the students ought to be taught the basics of how drugs work and knowledge of pharmacokinetic/ pharmacodynamics before starting a programme of study for practical prescribing. This would make sense that the basics of CPT are taught within the pharmacology lectures with this programme of study supporting the students learning the application of these in clinical practice. The overall impetus of the development of this programme of study was to produce a set of learning outcomes and core content to help with the acquisition of practical prescribing skills, and bridge the gap between theory and its application in clinical practice, which Baker et al. (2011) have cited as being a particularly problematic area.

The additional item proposed by the panel further clarified some of the items proposed in Round 1, and included more descriptive tasks such as practicalities of filling out a drug chart/ prescription form. Other proposals included prescribing about particular groups of medicines i.e. controlled drugs, those requiring special monitoring i.e. drugs that would be deemed “high risk” and have been associated with errors in the past (Ross et al., 2009, Baker et al., 2010).

The topics of content that did not achieve consensus for acceptance included the drug tariff, substances of recreation, biologics, and ethical dilemmas. Some of these topics are highly specialist (biologics), or more relevant to the pharmacy

profession (drug tariff), and so it is perfectly reasonable that they did not achieve consensus for inclusion and will not appear in the programme of study.

Learning outcomes

It was interesting to see at the end of round 1 that the learning outcome 'being able to prescribe high risk drugs' did not achieve consensus for acceptance, despite being top of the list of core content items. This is most certainly due to the vagueness of the initial statement, because clarification of this to "Know which drugs are high risk, and what particular measures are needed to prescribe them safely" as per the modifications proposed by the expert panel, resulted in this being accepted with 100% consensus.

Another important suggestion proposed by one the experts was the learning outcome of having an awareness of when it is appropriate not to prescribe but rather to ask for help. This achieved consensus at 100% in round 2. Junior doctors, despite prescribing most often, can lack the expertise and knowledge to do so effectively, but seem reluctant to ask or clarify instruction if in doubt due to the well renowned and documented hierarchical configuration and etiquette associated with medicine (Ross et al., 2012, Lewis & Tully 2009). This hierarchy is a barrier to patient safety as juniors are often reluctant to question the decision of their senior colleagues, so are not always as critical in their review of prescriptions as they should or could be (Dean et al., 2002), despite remaining legally accountable for any errors that may arise. Conversely senior doctors may rely on the juniors to prescribe medication appropriately based on general instruction especially if it outside their own scope of practice (Ross et al., 2012). Hence, the inclusion of this particular learning outcome of knowing when it is best not to prescribe but ask for help, although is particularly relevant for newly qualified doctors, remains pertinent throughout a medics career.

Methodologies

The experts have advised on the possible methodologies, which is one of the three components of Biggs alignment (2003). Five methods that all experts agreed would be useful in teaching practical prescribing were awareness of safe

prescribing resources, practical prescribing sessions that were validated by an appropriate professional/ clinician, small group teaching, PBL and shadowing a pharmacist.

The methods that the students themselves reported in Chapter 3 as being effective in developing prescribing skills were those where they got to practice writing prescriptions, or shadowing junior doctors (where presumably they would see the skill being carried out in the clinical setting). Interestingly the expert panel generally felt that these methods would best be used in the latter phases of the undergraduate course, rather than used continually throughout. This is in opposition to what another expert panel recommended back in 2002 that the earlier the introduction to clinical skills such as prescribing the better (the EMERGE group, 2002).

The only method that appeared not to be preferred method was peer teaching. Considering the clinical judgement and underlying knowledge required to safely prescribe it is perhaps not surprising that the experts think teaching of this important skill is best left to professional groups rather than fellow students, who according to previous studies in the UK and Ireland, have reported they themselves feel unprepared to undertake this task (Illing et al., 2008, Heaton et al., 2008, Geoghegan et al., 2017).

Junior doctors as teachers

The majority of the panel were in favour of using shadowing junior doctors as a methodology from year 3 through to final year. Additionally, students reported that they thought shadowing junior doctors was an effective method, and furthermore that F1 and F2 doctors were one of the 4 professional groups that students perceived to be most effective amongst all staff teaching groups (Chapter 3). A study in Scotland investigated the effectiveness of a programme of prescribing tutorials led by junior doctors i.e. near peers (Gibson et al., 2014). The junior doctors underwent dedicated tutor training prior to facilitating the tutorials to the final year medical students. The study demonstrated that prescribing confidence (albeit self-reported), knowledge and skills increased amongst students after the

tutorial, and performance in end of year assessment tended to improve in those attending more than one tutorial. Almost all student participants expressed a preference of junior doctors providing prescribing training over more senior and clinically experienced colleagues.

Limitations

This study is not without its limitations. Due to the time constraints the time afforded to the expert panel was less than that typically seen in Delphi studies, however that said, the response rate achieved, and subsequent retention rate achieved was quite good for external surveys. The questionnaires were purposely designed to be as easy and quick to complete as possible to facilitate completion by the busy expert panel. The response rates highlight the importance of the issue of safe prescribing and the recognition of the importance of education in any attempts to try improve or address suboptimal prescribing practices.

Due to the limited time available to complete the study within the context of the overall research process, the decision was taken in the final round to force a decision from the experts one way or another to accept or reject the proposed learning outcomes. It is possible that further learning outcomes or core content items could have emerged had the second round afforded an option for the experts to modify or propose items. Furthermore the use of a modified approach meant that the traditional open-ended Round 1 of the Delphi was not used to generate the initial learning outcomes and core content items.

It is not possible to say with certainty that this panel of experts consisted of every single individual that would be deemed an “expert on safe prescribing”. Although ever effort was made to include all of the relevant individuals from the field it is possible some were missed out. The individuals that did participate were UK based, and perhaps had experts from outside the UK been included a different output may have been achieved. However considering the programme of study derived was for use within UK medical schools it made sense to include UK experts who would have more in depth knowledge of UK medical education.

As mentioned above one of the difficulties with a Delphi is deciding on an appropriate consensus level. It was decided to take 75% for the current study, which was below that used in the development of the anatomical syllabus (Smith et al., 2016), but in line with any other form the literature. However it should be noted that many of the proposed items achieved consensus at a much higher level than the lower limit set. Medical schools could choose to focus on the items that achieved the highest consensus as a matter of priority, and once integrated into their courses appropriately, could then look at the items further down the list.

Chapter 7 – Overall discussion

Overview of chapter

In the final chapter of this doctoral thesis, the study aims will be re-visited to determine if these have been met and if not, reasons for this will be discussed. This chapter will also bring together the results of the individual studies that make up the thesis, and key findings from each will be highlighted in relation the current literature to identify the contributions of this thesis to the field.

Study aims and key findings

The student perspective of the teaching provisions of practical prescribing was obtained using a mixed methods approach: results from a questionnaire achieving 1024 responses representing 24 UK medical schools, followed by focus group discussion involving 22 students from 2 medical schools have been presented (Chapter 3). It was felt that as primary users of the medical undergraduate curricula they would be best placed to provide an overview of the “experienced curriculum” which often differs from that planned by the academics and teachers (Prideaux, 2003).

Some form of prescribing teaching is provided at all medical schools. Those methods that help to bridge the gap between theory of CPT and prescribing in practice were valued and rated highly by the students. This is perhaps not surprising because although students may be conversant with the underlying principles, applying these in practice is a more complex task, and one that students may struggle with. Having the opportunity to mimic writing prescriptions for patients in a less threatening or dynamic environment (such as at university) may well alleviate some of the stress previously reported by those transitioning from undergraduate students to postgraduate practitioners, but there is currently no data to corroborate this. However the availability of some of the newer methods (simulation) was reportedly variable between some medical schools, highlighting potential areas that could be targets for improvement.

The professional background of the staff delivering such teaching appeared less important to the students. There is no data available to support the superiority of any professional group in teaching prescribing to medical undergraduates. This thesis recognises that different professional groups have different perspectives on the safe and effective use of medicines, and exposure to a variety of these throughout their undergraduate studies could give the students a better-rounded experience. All teachers should however possess the appropriate knowledge and skills required to adequately train undergraduates about the safe and effective use of medicines.

Students reported that the preparation for the national PSA was variable, but recognised that preparing for the assessment focused attention on certain aspects of the prescribing process and so was a useful learning resource in its own right.

The Undergraduate Curriculum Lead at 24 UK medical schools provided an outline of the teaching and learning methods employed in their planned curricula: these data were presented in Chapter 4. Despite all stating that practical prescribing teaching is provided, some still reported that students do not have the opportunity to practice prescribing skills on dummy charts/ an electronic prescribing system while at university. Additionally no single method was a compulsory curriculum component at all the medical schools. These findings are worrying considering how fundamental prescribing is for junior doctors, and more so because they are required to perform this task under minimal supervision from day one of their foundation training. The teaching provisions need to be improved and methods that help bridge the gap should be mandatory at each medical school.

An attempt to characterise the time given to various methods within the curriculum proved difficult; perhaps due to the increasingly integrated approach to medical school curricula.

In the South East of England, a discrepancy between training provisions for F1 and F2 doctors within the STFS was identified. Not only were differences seen during the induction period but throughout the remainder of the foundation training

year (Kennedy et al. 2016). Although this might not be representative of the situation in other parts of the UK these results should at least prompt a review of the prescribing support provided to foundation doctors. The Royal College of Physicians recently published a guide to supporting prescribing skills in junior doctors (RCP 2017); in this, the recommendations of this thesis are echoed, particularly a focused induction for practical prescribing skills and appropriate signposting to other forms of support to orientate them to the prescribing systems within which they will be required to work (RCP, 2017).

Another important area that the RCP focus its attention on, is prescribing error feedback provisions to junior doctors. Although the thesis did not look at prescribing error feedback provisions at either the undergraduate or postgraduate phase, the researcher acknowledges the importance of this in the context of prescribing education. Often prescribers are unaware of the fact they have made a prescribing error (Ryan et al. 2014). This could deprive them of the subsequent opportunity to learn and reflect on that error, and improve their knowledge or technical skills, which is a priority in the NHS Five Year Forward View (2014 & 2017). Although work has begun to address this, more needs to be done nationally to improve the reporting of prescribing errors, to help identify targets for quality improvement and further education and development. This thesis focuses primarily on the teaching and learning at the undergraduate level, but more work is required at postgraduate level in order to increase the visibility and prominence of prescribing in the medical education continuum.

A two round Delphi resulted in consensus being achieved on 38 learning outcomes and 34 core content items for a focused programme of study for practical prescribing. Achieving consensus in two rounds was necessary due to time constraints available, and the researcher felt that the response and retention rates would decline with subsequent rounds.

In addition, the panel indicated what would be the most appropriate stage of the undergraduate curriculum to introduce the various methodologies that were reportedly used in UK medical schools.

The planned and experienced curricula

This thesis highlights the role of teaching and learning in safe and effective prescribing and the associated perceptions of the two main stakeholders i.e. the learners and teachers at two phases (undergraduate and postgraduate) of the medical education continuum. It was important to obtain perspectives on prescribing teaching provisions from these stakeholders to obtain a more holistic picture of current practices at the medical schools and NHS Trusts in the UK, which has largely been achieved. Previous studies have focused typically on the CPT content from the teachers' perspective (O'Shaughnessy et al., 2010, Brinkman et al., 2017) and this is the first study to explore the perceptions of both the medical students and the educators.

As mentioned above, there is often discrepancy between the curriculum as experienced by the students and that proposed by the teachers (Prideaux, 2003). There could be many reasons why students reported certain aspects of prescribing teaching were lacking. This could be due to poor visibility within the curriculum, because of integration or distinct one-off learning events being forgotten by students, or also because they didn't actually happen. Teachers reinforcing or revisiting the learning later in the curriculum could address this in future. Results from both stakeholders however highlight that improvements can be made in respect to the current curriculum, and furthermore highlight potential targets for such improvement.

A programme of study for practical prescribing

This thesis has produced a structured programme for the teaching and learning of practical prescribing incorporating modern educational approaches. It should be noted that this programme of study for practical prescribing is not intended to replace current curricula, such as that proposed by the BPS (2012). Furthermore, it is not intended as a stand-alone curriculum, but as a guide for medical schools to embed the teaching and learning of practical prescribing in their existing curriculum. This programme of study should be complimentary to the acquisition of underpinning CPT knowledge covered in other aspects of the undergraduate curriculum.

The core curriculum for medical undergraduates covers an extensive range of clinical pharmacology and therapeutics subject areas and comprehensively covers the underlying knowledge required to safely prescribe. It is not certain if medical schools have used this curriculum in their courses and not capturing these data was an oversight of the researcher.

Another challenge for the educators is identifying the most appropriate time to introduce various aspects of the prescribing process or methodologies to medical students. This thesis presents the views of the students, teachers, and also those of the expert panel and provides a useful insight for medical schools, who should individually look at practices locally and make such decisions in regard to what would fit within their own curriculum.

Lifelong learning and prescribing

In medicine, as is the case with many professionals it is no longer acceptable to pass an exam, join the associated professional body and not commit to lifelong learning to ensure your knowledge and skills are being constantly updated to meet the ever-changing demands of the patients. For example; pharmacists are not only required by their governing body, the General Pharmaceutical Council (GPhC), to engage in Continued Professional Development (CPD), but must also demonstrate evidence to this effect when called upon periodically.

Considering the number of medicines at a prescriber's disposal is ever increasing, with complex pharmacology, and the issues of multi-morbidity and polypharmacy discussed in Chapter 1, on-going prescribing competence cannot be assumed.

One aspect of being a professional involves taking responsibility for your own learning practices. Once qualified as a non-medical prescriber (NMP), practitioners take personal responsibility for and demonstrate their continued competence to prescribe in their specified area. However there is no formal requirement for doctors to do so in relation to their prescribing. Although a formal process of validating this competence has not been developed it has been suggested that practitioners keep a portfolio of evidence (Caddy & St-Clair

Jones, 2015). The proposed approach for NMPs to use pre-existing validated tools, which have been used successfully elsewhere in educational programmes for postgraduate pharmacist and doctors, seems plausible and would save the need to develop novel performance assessment tools.

There is also a need for a similar re-validation system within medicine, in order to provide some reassurance to the patient, public and employer. Mucklow et al. (2012) comment on the lack of a “validated, reliable and widely accepted measure of prescribing performance” available in the UK. Perhaps in the absence of such a tool, one must look back to the concept of doctors taking personal responsibility for their own prescribing. There is evidence to link continued medical education and the quality of healthcare, hence the need for clinicians to engage in self-regulated learning (SRL) (White & Gruppen in Swanick 2010). SRL is crucial for continued professional development, and although medical education aims to demonstrate a commitment to lifelong learning, there is little evidence in the literature to suggest that medical schools or postgraduate centres have succeeded in integrating this into their programmes in any meaningful manner. This thesis did not study this aspect of education, but it is evident that more effort should be made to improve this current situation.

The practical prescribing programme and NHS priorities

The NHS initially set out a 5 year forward view in 2014 of its plan to uphold the positive treatment outcomes and patient satisfaction for a growing and ageing population (NHS, 2014). This is despite the many challenges (i.e. financial and patient pressures), it faces. Amongst its priorities are strengthening the workforce and patient safety, both of which this doctoral thesis supports. Locally derived improvement programmes have already been created across the UK to promote safer working systems to reduce medication errors and reduce avoidable harm. However, moving forward a key priority for the NHS for the next 2 years, and additionally for the WHO, is a total reduction in medication errors (NHS, 2014, & 2017, WHO, 2016). If incorporated to medical undergraduate degrees, this programme of study could potentially impact on prescribing error rates in practice. Improved teaching at the crucial undergraduate phase would need to be

consolidated with further training in the postgraduate phase during foundation training and beyond to try improve prescribing practices amongst all doctors in general.

This structured programme of study, in its current format, is best suited to but not exclusively intended for medical undergraduate course development. This is with the aspiration that the programme of study presented in Chapter 5 could be modified to suit the curriculum of other professions e.g. the 650 Physician Associates (PAs) currently in training (NHS, 2017). Although PAs do not currently have prescribing rights, there is no reason to think that this may not change in the future especially as by 2020 HEE is expected to have supported the training of 3000 PAs. These will aid frontline staff in primary and secondary settings, who are under increasing pressures (NHS, 2014, & 2017). Training PAs to prescribe in the future may be one way to help alleviate some of the burden of other prescribers including the junior doctors, who are responsible for the majority of prescribing in NHS hospitals in the UK. Introduction of this prescribing programme could be a key resource in addition to the competency framework for all prescribers proposed by the Royal Pharmaceutical Society (2015).

In addition to the NHS Five Year Forward View, the structured programme aligns with UK medicines optimisation strategy, which details the safe and effective use of medicines for patients who are being considered for medication or have had medication prescribed (NICE Quality Standard 2016). Medicines optimisation requires clinicians to work together to adopt a patient centered approach, ensuring evidenced based regimens are prescribed and taken correctly over time (RPS Medicines Optimisation, 2013)

Investigating the postgraduate training in practical prescribing formed a minor part of this PhD thesis, and more work is required in this area. This study importantly highlighted short-comings in the STFS region, in supporting junior doctors to safely prescribe. However, considering the continual developing nature of a medics career, support should be extended to include all grades of prescribers in all settings, in an effort to improve prescribing errors, and eradicate avoidable

medication harm in both primary and secondary care, in line with the NHS 5 Year Forwards View (NHS, 2014, & 2017).

Limitations of the research

It should be noted that the views of the students presented in this research, may be inherently biased as typically more motivated students tend to participate in survey style research. Similarly this study has provided a platform for disgruntled students to voice concerns.

The need to improve prescribing practices in the UK was highlighted in the wake of the publication of the GMC's EQUIP study (Dornan et al., 2009). The difficulty was in identifying how this could actually be achieved, considering the many system, environmental and individual factors that are associated with prescribing errors. The focus on educational interventions seemed an obvious approach in response to Dornan et al.'s recommendations to reduce the prescribing error rates in the UK, where 4 out of the 5 recommendations (Figure 1.2) related to education (Dornan et al., 2009). As discussed throughout this thesis, various educational interventions have been developed and trialled at the undergraduate and postgraduate phases, however their consistency of use and effectiveness in reducing prescribing errors in clinical practice remains uncertain. Interventions were often tried in isolation and tended to adopt a uni-modal focus e.g. knowledge deficits or the technicalities of writing a prescription (Kirkham et al, 2015). It is not known if this is an effective strategy and if one off educational interventions are effective.

Dedicated programmes of study have proved useful in improving prescribing assessment scores amongst medical students, but did not completely eradicate error (Sandilands et al., 2011). It is not known if this was because the programme of study ran for such a short time or because the errors that did persist were due to the environmental or psychological causes of prescribing errors that are harder to control for.

The questionnaire to the undergraduate curriculum lead failed to address the content of sessions in terms of which aspects of the prescribing process had distinct teaching delivered on. Because of this it was not possible to comment on the extent to which (if at all) the BPS core curriculum (Ross and Maxwell 2012) is utilised in undergraduate courses in the UK.

The qualitative arm of the undergraduate study was weakened in that the desired number for focus groups was not reached. Although this was due to factors outside the researcher's control, it is not possible to say whether the point of saturation was reached from the 5 sessions conducted. Reassuringly, all groups produced similar messages. It is not possible to say if focus groups were conducted within medical schools outside of the STFS regions, whether the emerging themes would have been any different.

It is difficult to say what the optimum teaching provisions for practical prescribing at the undergraduate level in the UK would be. There have already been attempts to develop curricula in clinical pharmacology and therapeutics (BPS, 2012), and it is not clear to what extent they have been incorporated to undergraduate curricula in UK medical schools. This information was not captured in the questionnaire detailed in chapter 4. It is possible that a questionnaire was not the most effective data collection method for this aspect of the research study. An interview (either in person or on the telephone) with the Lead for the undergraduate curriculum at each medical school might have allowed for more probing questions to be asked and responses clarified. However due to the time required and schedules of such individuals, this approach might have yielded a lower response rate.

The programme of study derived from the Delphi expert panel was not designed as a replacement or direct competition for the BPS curriculum, but is more focused on the practical skill acquisition. The BPS core curriculum covers in detail the underpinning knowledge required to safely prescribe. However it has been commented on previously that there is often too much focus on the knowledge and not enough focus on the application of skills in practice (the EMERGE group, 2009).

Experts in the field previously indicated that students should be encouraged to practice clinical skills as early in the curriculum as possible (the EMERGE group, 2009). This programme of study, if used at appropriate times throughout the undergraduate curriculum, could encourage students to practice various aspects of the prescribing process earlier in their degree and place an emphasis on the acquisition of practical prescribing skills. However this thesis does not provide evidence to suggest what the optimal time of introduction of the various stages of practical prescribing would be. This was somewhat a divisive issue amongst students and leads for undergraduate curricula in the UK. Therefore there remains a lack of clarity on this issue.

Future work

The landmark EQUIP study, first highlighted the scale of prescribing errors in practice in the UK in 2009, and has led to much work to try address the apparent gaps in the underpinning knowledge and practical skill acquisition for prescribing discussed throughout this doctoral thesis. It is unclear what impact any single educational intervention or prescribing assessment that has been introduced (be it local or national) has had on actual prescribing error rates in NHS hospitals in the UK. It would seem prudent to try to establish the current prescribing error rates across the UK as a whole in order to determine if interventions introduced since the publication of the EQUIP have had an impact on error rates in practice, and if this could potentially give some insight into how error rates have evolved over time. There would be certain confounding factors that could make direct comparisons difficult, however such a study may indicate if there is a trend towards improvement or not. If a reduced error rate is observed nationally, it would be easier to make a case for sustained use of targeted education on medical students and prescribers, as education will probably be partly responsible.

Although the provisions of practical prescribing teaching in the UK have been identified, it is still unclear what proportion of the undergraduate curriculum is dedicated to developing this fundamental skill amongst undergraduates. This thesis provides a better understanding of the methods currently employed in the UK, but did not focus on the content of teaching sessions, nor on the relative

proportions spent on teaching about the various stages of the prescribing process itself. This could be difficult to determine due to the increasingly integrated nature of medical school curricula. However if the content could be better described or characterised it may be possible to determine to what extent the BPS core curriculum has been embedded into undergraduate medical curricula, and identify possible targets for improvement or development.

To date there is a lack of data exploring how attitudes towards prescribing skill acquisition changes as medical students progress from year 3 right the way through to F2 doctors. Previous studies of preparedness to practice have tended to focus on final year medical students or recently qualified junior doctors, however by including the more potentially practice naïve year 3 students and those doctors at the end of the foundation programme training in a large scale qualitative or mixed methods a better understanding about practical skill acquisition could be obtained. This study could incorporate an investigation of how feedback on prescribing errors supports the learning process.

Conclusions

It is not uncommon for doctors to work in a different region from the one in which they completed their undergraduate education, when completing their foundation or subsequent training. It does not seem rational therefore that different methods are used in the teaching of practical prescribing across the UK.

There is no definitive answer as to how the problem of prescribing error can be eradicated completely, nor does this thesis claim to hold the answer. Education has been central to many of the interventions used to try address this problem in the past, and will be likely continue be a key component of any approach aimed to improving the situation in the long term. It should be said that although technology is increasingly being used to help reduce prescribing errors in practice in NHS hospitals, it is unlikely to eliminate them completely, and may instead introduce new types of error. Human error cannot fully be corrected for by e-prescribing systems i.e. incorrect selection of a drug from an alphabetical list. Hence

education must therefore remain a central target for interventions aimed at reducing error.

Efforts have been made nationally in the UK and internationally within Europe to develop curricula in CPT to help ensure visibility of this crucial discipline within increasingly integrated undergraduate medical courses. This thesis has presented current teaching provisions for practical prescribing in the UK, and furthermore proposed a programme of study, consisting of 34 core content items and 38 learning outcomes. If introduced alongside the current undergraduate curricula, this may help orientate the focus on practical prescribing skill acquisition. The author acknowledges that more needs to be done in terms of postgraduate medical education, where the approach may need to include a combination of education, technology, and feedback on performance and prescribing errors. The programme of study proposed is a starting point.

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Appendices

Appendix A - Medical student questionnaire

This questionnaire is designed to elicit the teaching and learning that takes place in preparation for practical prescribing as a doctor. The main focus is to obtain your perspective of teaching and learning approaches that are most beneficial in making you a competent and confident prescriber on your first day as a doctor.

- Which UK medical school do you study at?
- At which stage of your undergraduate medical degree are you currently?
- Do you get taught practical safe prescribing on your course?
 - If yes is it taught as a stand alone module, integrated in a systems based approach, or are you unsure?
- Is/ are [*insert method here*] employed in the teaching of practical prescribing at your medical school?
 - If yes please rank how effective you think this method is (a rank of 1 represents very ineffective and 5 represents very effective)
 - Is this a mandatory component
- Are any other methods employed in the teaching of practical prescribing at your medical school? Please give details.
- If none/ not many (<3) of the methods listed (Q4-17 inclusive) are employed in the teaching of practical prescribing at your medical school, do you rely on training provided by the NHS Trust during the Foundation Programme to acquire this skill?
- Please indicate which of these groups you have received teaching in practical safe prescribing from at your medical school?
 - For each group indicate if they provide teaching or not, then please rank their effectiveness as teachers from 1 to 5 (where 1 is very ineffective and 5 is very effective). Select 0 if the group does not provide teaching.
- Have you attempted to gain an insight from students in higher years of their medical undergraduate course to determine how prepared they feel to undertake the task of safe prescribing and rational use of medicines once they graduate?
- Do you seek feedback from junior doctors to determine in retrospect how they might have approached learning safe practical prescribing and rational use of medicines when they were students?

- Do you try to gain insight from junior doctors to determine the expectations of newly qualified doctors in relation to safe prescribing?
- Do you think that practical prescribing should be incorporated into the curriculum of Phase 1 (Years 1 and 2) of your medical undergraduate degree?
- Do you think that your medical undergraduate course in its current format prepares you sufficiently for practical prescribing?
 - If no what do you think should be the focus of the medical school to address this?
- Are you aware you may need to sit a Prescribing Safety Assessment (PSA) during your final year of medical school?
- Does your medical school help you prepare for the PSA?
- Do you think preparing for the PSA improved/ will improve your practical prescribing skills? Please provide a reason.
- Do you think the undergraduate teaching of practical prescribing should be more standardised across all medical schools? Please provide a reason.

Appendix B – Undergraduate lead questionnaire

- Which UK medical School do you work at?
- How many medical undergraduates are enrolled at your medical school?
- Does your undergraduate medical course incorporate teaching and learning in practical safe prescribing?
 - If yes, is it this teaching provided as stand-alone module or integrated in a system-based approach?
- Is/ Are [*insert method here*] employed in the teaching of practical prescribing at your medical school?
 - Is this a mandatory component?
 - How many hours are dedicated to this in relation to practical prescribing teaching (over the full course of the medical degree you offer)
- Are there any other methods employed in the teaching of practical prescribing at your medical school? Please give details.
- If none/ not many (<3) of the methods (Q4-17 inclusive) are employed in the teaching of practical prescribing at your medical school do you rely on the training provided by the NHS Trust during the Foundation Programme for your students to acquire this skill?
- Do you assess which methods students benefit from most?
 - If yes please explain.
- Please indicate which of these groups are utilised for the teaching of practical safe prescribing at your medical school?
- Do you seek feedback from your final year medical students to determine how prepared they feel to undertake the task of safe prescribing and rational use of medication once they graduate?
- Do you feel that there should be a practical prescribing component (in any format) in the curriculum of Phase 1 (Years 1 and 2) of the medical undergraduate degree course?
- Do you think that your medical undergraduate course in its current format prepares your students sufficiently for practical prescribing in Foundation Year One?
 - If no, what areas of the curriculum do you think need to be revised in order to achieve this?

- Do you think preparing for the Prescribing Safety Assessment drives learning and improves practical prescribing skills amongst your students? Please provide a reason.
- Do you think the undergraduate teaching of practical prescribing should be more standardised across all medical schools? Please provide a reason.
- Are you aware of the existence of the Single Competency Framework for all prescribers?
- Has your course been updated since its publication?

Appendix C – Foundation trainee questionnaire

- What is the name of the NHS Trust that you currently work for?
- At what stage of training in the foundation programme are you currently?
- When was your Trust induction programme delivered in relation to your start date?
- Is it compulsory for all foundation trainees to attend?
- Did you receive a specific prescribing training session as part of your Trust/ departmental induction programme?
 - Did this include a practical prescribing session with a pharmacist i.e. did you get to practice using the drug chart/ e-prescribing system before doing so on the wards?
- What support if any, to aid you in safe practical prescribing was provided by your Trust during the induction?
- Please indicate which of the following tasks have dedicated sessions in your induction throughout the foundation training year? For all those that apply please rank how effective these methods were to you becoming a safer prescriber, with 1 being the most useful and 12 being the least useful. Also indicate if attendance at these sessions is mandatory or not.
- Who provides the training to you and indicate by order of ranking which you found most effective, with 1 being most useful and 9 being least useful.
- Was there any additional support in relation to safe prescribing during the remainder of the foundation training period? Please give details.
- Overall do you feel that the training you received had an impact on your ability to safely prescribe on the ward on a daily basis?
 - Please further describe any impact that occurred i.e. generally positive, negative and to what extent?
- How has your training period affected your confidence in prescribing safely? “training period” in this sense refers to the time and training received since starting your current role as an FY1 or FY2 to the present time.
- Does your NHS Trust run a prescribing assessment?
 - When was this assessment delivered in relation to your induction?

- How soon after the assessment was the feedback provided?
- What feedback mechanism(s) was employed?
- Were you given access to any safe prescribing resources online – for example online prescribing modules, SCRIPT, links to prescribing guidelines, online access to the BNF, etc.? Please give details.
- The space below is left blank if you would like to make any additional comments about the safe prescribing training that you have received as part of your Foundation Programme.

Appendix D – Prescribing lead questionnaire

- What is the name of the NHS Trust that you currently work for?
- When is your Trust induction programme delivered in relation to the trainees start date?
- Concerning your Trust's induction programme, how much time (in hours) is dedicated to/ expected of your foundation trainees for the following aspects: total duration, face to face teaching sessions, online/ self directed learning.
- Does your Trust have a separate induction programme for new FY1 and FY2 doctors joining the Trust?
 - Does your induction include specific prescription training session(s)?
 - Does this include a practical prescribing session with a pharmacist i.e. do trainees get to practice using the drug chart/ e-prescribing system before doing so on the wards?
- If your induction does not include any practical prescribing sessions how do you provide support to aid safe prescribing amongst your foundation doctors during their induction?
- Please indicate which of the following tasks have dedicated sessions either in your induction or throughout the foundation training year. For all that apply please indicate how many hours are dedicated to each group of trainees and indicate if this is provided at induction, after induction or not all.
- Who provides this training? Please indicate how many hours each professional provides to each group of trainees.
- Are there any additional support relating to safe prescribing provided during the remainder of the foundation training period? Please give details.
- Does your Trust run a prescribing assessment?
- When was the assessment delivered in relation to your induction?
- How soon after the assessment was the feedback provided to your trainees?
- What feedback mechanism was employed?
- Is the assessment delivered to the FY1s only, FY2s only, or both groups?

- Are other doctors in the Trust expected to sit the assessment (i.e. those employed directly by the Trust who may undertake a similar role to the junior doctors)?
- Who is responsible for conducting the assessment – please specify role rather than individual?
- Are trainees that did not pass the assessment restricted from prescribing on the ward?
- What action is taken to support those identified as trainees that require additional assistance in safe prescribing – i.e. those that raised a cause for concerns or did not pass the assessment?
- Are trainees given access to any safe prescribing resources online – for example online prescribing modules, SCRIPT, links to prescribing guidelines, online access to the BNF, etc.? Please give details.
- Please provide any additional comments you wish below.

Appendix E – Delphi Round 1

Part A: The Delphi

What is taught - principles of writing a prescription

The following are reported in the literature as being important *aspects* of the *prescribing process*. Please indicate those you think *should be included* as **core content** in a dedicated programme of study for practical prescribing, rather than being taught *elsewhere* in the undergraduate curriculum.

Q1. It would be useful to include these various aspects of the prescribing process in a **dedicated programme** of study for **practical prescribing**. Use a scale of 1 to 4 (1 is **strongly disagree**, and 4 is **strongly agree**).

Knowledge of basic pharmacology and therapeutics
Reasoning behind the need to prescribe a drug i.e. establish a (working) diagnosis
Establishing therapeutic goals - how is patient likely to benefit from medication
Obtaining an accurate drug history from the patient (including detailed allergy history)
Patient specific and physiological factors that may impact drug choice i.e. kidney or hepatic function, etc.
Prescribing in pregnancy and lactation
Prescribing at the extremes of age (paediatric and geriatric)
Prescribing in common acute emergencies and illnesses
Prescribing high risk drugs
Appropriate drug selection including dose, frequency, formulation, route, and duration
Pharmaceutical and dosage calculations
Providing information, instruction on use and cautionary/ warning advice to patients or carers
Monitoring for benefit and adverse effects of medication
Recognising actual or suspected adverse drug reactions and how to report these
Documentation of rationale for prescribing medication or stopping treatment if applicable
Signposting to local or national prescribing guidelines as clinically appropriate
Drug information resources such as BNF

Q2 If you think there are any *other* aspect(s) of the prescribing process that have been *omitted*, but you feel would be useful to include in a dedicated programme of study for practical prescribing please specify this/ these below

Learning outcomes of dedicated programme of study

The learning outcomes below have been adapted from those in the literature and from national guidance. Please think about these, and select whether you think they are *appropriate for inclusion as they stand*, **require modification** or

would **not be suitable** at all.

Q3. At the end of completing the programme for practical prescribing the medical students should:

Be familiar with local drug charts/ prescription forms/ electronic prescribing systems
Be able to appropriately use the different sections on the drug chart i.e. "once only" dosing, regular, as required, IV fluids, and blood products
Be able to write a clear, legible, unambiguous prescription (including fulfilling prescription requirements for Controlled Drugs on TTO/ FP10 prescription forms)
Know the different classes of drugs (including unlicensed or off label prescribing)
Know the considerations that need to be made when prescribing for pregnant or breast-feeding women
Know the considerations that need to be made when prescribing for geriatric and paediatric patients
Know the considerations that need to be made when prescribing for patients with renal or hepatic dysfunction
Be able to predict and manage common potential drug interactions including those caused by non-prescribed, herbal or complementary medication
Know the common inducers and inhibitors of CYP450 liver enzymes (including those of herbal or complementary origin)
Have knowledge of, and be able to apply basic pharmacokinetic and pharmacodynamic principles
Have a basic understanding of how drugs work: their mechanisms of action to produce not only therapeutic effects but also adverse effects
Be competent and confident in performing pharmaceutical and dosage calculations
Be able to explain the need for performing therapeutic drug monitoring (TDM)
Know the commonly prescribed medicines that require TDM (e.g. lithium & gentamicin)
Know that various formulations of certain drugs differ in bioavailability and need to be prescribed by brand rather than generically
Be able to identify suspected or actual adverse drug reactions
Be able to tell the difference between a drug allergy and a drug intolerance
Be able to counsel patients on commonly prescribed drugs
Be able to identify possible causes of non-adherence
Know about the existence of the yellow card reporting systems for reporting actual or suspected adverse drug effects
Be able to prescribe drugs commonly used to manage acute emergencies
Be able to prescribe high-risk drugs
Know about the drug management of common illnesses
Have a working knowledge of various sources of drug information (dosage, interactions, etc.) for example the BNF, local prescribing guidelines, summary of product characteristics, etc.
Be able to recognise and manage a medication error

Q3.a If you think that any learning outcomes have been omitted from the above table, please list up to a maximum of 3 additional learning outcomes for a practical prescribing programme.

Part B: Methods used in practical prescribing teaching and learning

Although this is strictly *not* part of the Delphi, we felt it would be useful to obtain your views about **possible methodologies** for delivering the practical prescribing programme of study.

Q4. It would be **useful** to utilise this **method** in a **dedicated programme** of study for **practical prescribing**. Please indicate to what extent you agree/ disagree with the above statement, using a scale of **1 to 4** (**1 is strongly disagree**, and **4 is strongly agree**). Also please indicate at **what stage** of the medical course this method would be best utilised by selecting from the **drop down menu** on the *right hand side*.

Small group teaching
Self-directed learning
Validated pre-prescribing (practicing prescribing on drug charts with individual feedback given by qualified professionals, can be done in the clinical setting, or in small groups)
Pre-prescribing seminars (typically with larger groups no individual feedback given, generic ideal prescriptions may be presented)
Online modules/ e-learning
Shadowing a junior doctor
Shadowing a clinical pharmacist
Simulation
Problem based learning & case studies
Student formularies or core list of commonly used drugs
Tutorials
Peer teaching - teaching by fellow students
Apps i.e. mobile applications
Inter professional education i.e. with nursing or pharmacy students
Awareness of safe prescribing resources i.e. BNF, NICE guidelines

Q5. If you are aware of any **novel** methods that are utilised in the teaching and learning of practical prescribing but *not* included above, and would be useful to include in a dedicated programme of study in this area, please list them in the space provided below.

Q6. In an ideal situation, who do you think would be the best person to lead a programme of practical prescribing in a medical school?

Demographic questions

Q7. What is your name

Q8 What is your gender

Q8a(i) What is your professional background

Q8a(ii) How many years of post qualification experience do you have?.

Appendix F – Delphi Round 2

Delphi process - Round 2: Core content and learning outcomes

What is taught - principles of writing a prescription

Regarding core content, consensus (taken as >75% panel agreement) was achieved on the 17 items originally suggested in Round 1 of the Delphi. Below are those additional aspects of the prescribing process that members of the panel have put forward for consideration.

Please indicate those you think *should be included as **core content*** in a dedicated programme of study for practical prescribing, rather than being taught *elsewhere* in the undergraduate curriculum.

Q1. It would be useful to include these various aspects of the prescribing process in a **dedicated programme** of study for **practical prescribing**. Use a scale of 1 to 4 (1 is **strongly disagree**, and 4 is **strongly agree**).

Practical training in filling out a sample drug chart and a sample electronic prescription (including awareness how to navigate and use these, and awareness of other systems available)
How to prescribe controlled drugs
The practicalities of good prescription writing practice, inc. acceptable abbreviations, non-proprietary vs brand-name prescribing
Dosing and monitoring of drugs that require individualised dosing e.g. gentamicin and vancomycin
Consideration of formulations and practicalities e.g. administration via nasogastric tube
Selection of actual drug/ drug class before considering dose, frequency, etc.
Recognising common and significant interactions, inc. drug-drug, & those linked to kinetics and dynamics
Prescribing in a team environment
Understanding pharmacy and medicines information support
Common errors or pitfalls with prescribing and how to avoid them
Critically reviewing prescription charts
Safe evidence based stopping of medicines i.e. in elderly patients
Managing polypharmacy
Preventing and dealing with prescribing errors – including reporting
Antimicrobial stewardship
Ethics and dilemmas
Communicating instructions to other members of staff involved in administration or monitoring of medicines
Clarity of documentation
Law pertaining to medicines and adherence and concordant relationship
Harm from substances of recreation
Drugs of animal origin for religious groups
Special problems with biologics
Prescribing outside licensed indications
Use of the NHS drug tariff
Communication throughout the consultation process

Learning outcomes of dedicated programme of study

Regarding the learning outcomes, 22 of the 25 proposed in Round 1 were accepted (with >75% panel agreement). The learning outcomes listed below were proposed by the panel members, and includes modifications to the 3 that were not accepted from Round 1.

Please think about these, and select whether you think they are *appropriate for inclusion or not*.

Q2. At the end of completing the programme for practical prescribing the medical students should:

Be able to use of a range of generic prescription forms/ drug charts/ electronic prescribing systems
Be aware of the existence of the different legal classes of medications (e.g, P, POM, GSL, CD)
Know that it may be appropriate to prescribe medicines outside the terms of their license, and what additional considerations this involves
Know which drugs are high risk, and what particular measures are needed to prescribe them safely
Have an awareness of the limitations on prescribing of high risk drugs by F1 and F2 doctors
Be aware of drug use pre-conception i.e. drugs that may affect conception
Know the sources to look for information on drug interactions including herbal medicines
Demonstrate the ability to apply PK and PD principles
Demonstrate the ability to interpret data from TDM of commonly prescribed medicines (e.g. lithium, gentamicin, vancomycin) and perform basic dose adjustments as appropriate
Understand the role of other prescribers and team members e.g. pharmacist and nurse practitioners
Be able to access and use the electronic and paper-based BNF, in addition to other safe prescribing resources
Demonstrate an understanding of patient differences and beliefs and how this may impact on choices of therapy
Know how to report adverse drug events using the yellow card system (paper and electronic)
Have an awareness of when it is appropriate not to prescribe but ask for help
Understand that the patient is the centre not the drug or the drug chart
Be able to explain the importance and role of anti-microbial stewardship

Demographic questions

Q3. What is your name

Q4. What is your gender

Q5. What is your professional background

Q6. How many years of post qualification experience do you have?.

Appendix G – RGEC Approval post graduate study

BSMS Research Governance & Ethics Committee
(RGEC)

20/03/2014

Brighton and Sussex Medical School
Medical Teaching Building
University of Sussex
Falmer
Brighton
BN1 9PX

Dr Michael Okorie
Division of Medical Education
Mayfield House
University of Brighton
Falmer
Brighton
BN1 9PH

Dear Dr Okorie

Full Study Title: **Improving prescribing competence in foundation doctors:
the development of a structured approach to undergraduate
teaching of prescribing and therapeutics in UK medical
schools**

R&D Ref No. : **14/015/OKO**

I am writing to inform you that the Brighton and Sussex Medical School Research Governance and Ethics Committee (RGEC) which met on Thursday 13th March 2014 has now assessed your application and granted Research Governance Approval to proceed with the above named project.

This letter acknowledges that you have the necessary internal regulatory approvals. However, as this study is NHS staff research it will now require NHS management permission (also referred to as R&D Approval) for each NHS research site, please see:

<http://www.hra.nhs.uk/research-community/before-you-apply/determine-which-review-body-approvals-are-required/>

Conditions of Approval

The approval covers the period stated in the Research Governance and Ethics Committee (RGEC) application and will be extended in line with any amendments agreed by the RGEC. Research must commence within 12 months of the issue date of this letter. Any delay beyond this may require a new review of the project resources.

Amendments

Project amendment details dated after the issue of this approval letter should be emailed to RGEC for formal approval.

Monitoring

The Medical School has a duty to ensure that all research is conducted in accordance with the Research Governance Framework. In order to ensure compliance the department undertakes random audits. If your project is selected for audit you will be given 4 weeks' notice to prepare all documentation for inspection.

It is your responsibility to inform me in the event of early termination of the project or if you fail to complete the work.

I wish you luck with your project.

Yours sincerely

A handwritten signature in black ink, appearing to read 'Bobbie Farsides', with a stylized flourish at the end.

Professor Bobbie Farsides
Deputy Chair of the BSMS Research Governance and Ethics Committee

Appendix H – RGEC approval undergraduate study

BSMS Research Governance & Ethics Committee
(RGEC)

29/07/2014

Dr Michael Okorie
Division of Medical Education
Mayfield House
University of Brighton
Falmer
Brighton
BN1 9PH

Brighton and Sussex Medical School
Medical Teaching Building
University of Sussex
Falmer
Brighton
BN1 9PX

Dear Dr Okorie

Full Study Title: Improving prescribing competence in foundation doctors: the development of a structured approach to undergraduate teaching of prescribing and therapeutics in UK medical schools

R&D Ref No. : 14/015/OKO

Amendment No. : 1

I am writing to inform you that you have BSMS Research Governance and Ethics Committee (RGEC) approval to proceed with the above named project. This letter acknowledges that you have submitted evidence of all the necessary internal and external regulatory approvals in relation to this amendment. This approval also acknowledges all previous amendments.

Approval was granted on the basis of an undertaking by the researchers to obtain research governance approval (or its equivalent) from each of the respective medical schools included in the study to cover the project as a whole, distribution of the online questionnaire and the running of focus groups.

The documents reviewed for this approval were:

Document	Version	Date
Request for an Amendment Form – request for the following: Amendment to the initial application is being sought to widen the breath of the research. This study is an extension of the first study and aims to gain an understanding of the current teaching and learning of practical prescribing in UK medical schools i.e. the	N/A	19 th May 2014
Response to the Committee letter (following unfavourable decision - 19 th May	N/A	16 th July 2014
Application Form	Unknown	Unknown
Consent Form	V1.0	2 nd April 2014
Participant Information Sheet	V1.0	3 rd July 2014
Questionnaire	V1.0	July 2014

Conditions of Approval

The approval covers the period stated in the Research Governance and Ethics Committee (RGEC) application and will be extended in line with any amendments agreed by the RGEC. Research must commence within 12 months of the issue date of this letter. Any delay beyond this may require a new review of the project resources.

Amendments

Further project amendment details dated after the issue of this approval letter should be emailed to the Research Governance and Ethics Committee (RGEC) for formal approval.

Monitoring

The Medical School has a duty to ensure that all research is conducted in accordance with the University's Research Governance Code of Practice. In order to ensure compliance the department undertakes random audits. If your project is selected for audit you will be given 4 weeks notice to prepare all documentation for inspection.

It is your responsibility to inform me in the event of early termination of the project or if you fail to complete the work.

I wish you luck with
your project. Yours
sincerely

A handwritten signature in black ink, appearing to read 'Kevin Davies', with a long horizontal stroke extending to the right.

Professor Kevin Davies
Chair of the BSMS Research Governance and Ethics
Committee

Appendix I – RGEC approval Delphi study

BSMS Research Governance & Ethics Committee (RGEC)

Chair: Professor Kevin Davies

Deputy Chair: Professor Bobbie

Farsides Secretary: Miss Caroline

Brooks

Tel: 01273 872855 c.e.brooks@bsms.ac.uk

Applications and general enquiries:

rgec@bsms.ac.uk

Brighton and Sussex Medical School
Medical Teaching Building
University of Sussex
Falmer Brighton BN1 9PX

21/03/2016

Dr Michael Okorie
Brighton and Sussex Medical School Division
of Medical Education

Dear Dr Okorie

Full Study Title: Expert consensus on a structured approach to the undergraduate teaching of practical prescribing in UK medical schools: a Delphi study

R&D Ref No. : 16/011/OKO

I am writing to inform you that the Brighton and Sussex Medical School Research Governance and Ethics Committee (RGEC) Sub-Panel which met on Wednesday 24th February 2016 has now assessed your application and granted Research Governance Approval to proceed with the above named project. (The Sub-Panel assumes the student has built in adequate time to write up her PhD dissertation).

This letter acknowledges that you have the necessary internal regulatory approvals.

Conditions of Approval

The approval covers the period stated in the Research Governance & Ethics Committee (RGEC) application and will be extended in line with any amendments agreed by the RGEC. Research must commence within 12 months of the issue date of this letter. Any delay beyond this may require a new review of the project resources.

Amendments

Project amendment details dated after the issue of this approval letter should be submitted to RGEC for review and formal approval. Please submit your application for an amendment to the Committee (via rgec@bsms.ac.uk) using the 'Request for an Amendment Form'.

Monitoring

The Medical School has a duty to ensure that all research is conducted in accordance with the University's Research Governance Code of Practice. In order to ensure compliance the department undertakes random audits. If your project is selected for audit you will be given 4 weeks notice to

prepare all documentation for inspection.

It is your responsibility to inform me in the event of early termination of the project or if you fail to complete the work.

**I wish you luck with your project. Yours
sincerely**

A handwritten signature in black ink, appearing to read 'Kevin Davies', with a long horizontal flourish extending to the right.

**Professor Kevin Davies
Chair of the BSMS Research Governance and Ethics Committee**

Appendix J – Ethics approval letter form KCL

Maria Kennedy
Division of Medical Education
Brighton and Sussex Medical School
Mayfield House
Falmer
BN1 9PH

19 August 2014

Dear Maria,

RE: ‘A study to develop an understanding of the teaching and learning of practical prescribing in UK medical schools’. – King’s College London external research request permission

I am writing with regard to your recent application for permission from the King’s College London Research Ethics Office to undertake the above research study, as per our external research request procedure.

I can confirm that your application for permission has been accepted and that you now have permission to undertake external research using King’s College London staff or students. Your permission has been granted by the Chair of the College Research Ethics Committee, with the following proviso:

Please ensure you obtain the relevant head of Departments approval to conduct your research, as outlined in point 7 of the King’s College London external research criteria.

Please note that the external research request procedure does not constitute ethical review, rather it is a permission procedure put in place to ensure that only ethically acceptable studies are carried out by King’s College London staff/students and premises.

Please do not hesitate to contact the Research Ethics Office should you have any queries regarding the above.

Kind regards,

Annah Whyton
Research Support Assistant
King’s College London

Appendix K -Participant information sheet

Dear Participant

A study to develop an understanding of the teaching and learning of practical prescribing in UK medical schools.

I would like to invite you to take part in my research study. Before you decide I would like you to understand why the research is being carried out and what it would involve for you if you took part. I will go through the information with you and answer any questions you may have. This should take about 10 minutes.

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

What is the purpose of the study?

This study will form part of my PhD which chiefly aims is to investigate the current teaching, learning and assessments used for doctors during their undergraduate and postgraduate training, to inform development of a future curriculum that would make doctors safer prescribers and reduce error rates.

As part of this project I am looking to obtain the views of medical students about the provision of practical prescribing teaching during their medical undergraduate degrees, and the value they place on this.

This study will examine your experiences of practical prescribing teaching in any format during your medical undergraduate degree, and create a broader discussion as to what you think are areas where the curriculum could be improved around safe practical prescribing.

Who is organising and funding the research?

This PhD research project is funded by Brighton & Sussex Medical School.

Why have I been invited?

You have been chosen as you are currently a medical undergraduate in your third, fourth or final year in a medical school in the South Thames Foundation School region, and your views about practical prescribing are being sought.

Do I have to take part?

Participation is completely on a voluntary basis. It is up to you to decide if you would like to take part or not, you will not be forced or pressurised to participate in any way. You will be given information in addition to that on this information sheet and if you then do wish to participate you will be required to sign a consent form.

You will still be able to withdraw from the study at any point without giving reasons for your choice to do so.

What will happen to me if I take part?

If you do choose to take part I will arrange a mutually convenient location (probably at your university), date and time for the focus group. A room will be available in which the focus group will be conducted in private for approximately 30-40 minutes. With your permission the focus group will be audio recorded and transcribed.

What will I have to do?

Should you consent to participate you will be required to attend a focus group, which will last approximately 30-40 minutes. During this time I will ask you and a small group (no more than 8 students per group) a set of pre-defined questions to elicit opinions/ experiences of practical prescribing teaching. Depending on the

answers that the group give, the conversation may deviate from the question list slightly to explore further themes that may arise or comments made during the group discussion.

There are no other special requirements needed should you choose to participate.

What are the possible benefits of taking part?

Although this research may have no immediate benefit to you, its' results may be used to inform the future teaching, learning and assessment of safe and rational prescribing at both the undergraduate level and continuing into the foundation training years

Are there any possible disadvantages or risks of taking part?

Attending the interview will take time out of your day, but every effort will be made to minimise the inconvenience and ensure your comfort in the group discussion process. It will be possible to take a break or stop at any point if necessary.

If at the end you wish to discuss any issues that emerged further, it will be possible to refer you to a more expert source of help

What about confidentiality?

All the information about your having taken part in this study and all information collected during the course of the research will be kept strictly confidential. (If applicable: Any information about you which leaves the hospital or university will have your name and address removed so you cannot be recognised from it). All data will be stored securely.

Transcribing of the audio recording of the focus group will be done immediately after the focus group by the researcher and original recordings deleted once this is completed. Direct quotations from the interview may be used but will be anonymised completely, so will not be identifiable to you.

Your comments will not be made available to your lecturers at the university, so you can freely discuss your views about the curriculum at your medical school.

What will happen if I don't want to carry on with the study?

You are free to withdraw from this study at any time and without giving a reason.

If you decide to withdraw or not join the study, this will not affect the standard of education you receive. We will also be happy to discuss with you what will happen to any data that has been collected up to the point of your withdrawal from the study.

What if there is a problem?

If you have any concerns about any aspect of this study, how it is being conducted or complaints about the way in which you have been treated during the study or possible harm you might suffer, you should ask to speak with the researcher who will do their best to answer your questions. The researchers contact details are provided at the end of this Sheet. However it is not expected that any problems will occur.

Harm

The Universities of Brighton and Sussex have insurance in place to cover their legal liabilities in the unlikely event harm should arise from this study.

What will happen to the results of the research study?

The results of the study will be written up and form the basis of my PhD thesis. I will aim to publish parts of the study in scientific journals, or present findings at national or international conferences. In addition, a short report of the research findings will be provided for distribution to participants if requested.

Who has approved this study?

This study has received ethical approval from *the Brighton and Sussex Medical School Research Governance and Ethics Committee (BSMS RGEC)*.

Thank you for taking the time to read this information sheet.

Contact Details:

Primary Investigator:

Maria Kennedy, PhD Student Researcher,
Division of Medical Education, Brighton & Sussex Medical School,
Room 344a Mayfield House, University of Brighton campus,
Falmer.

Email: m.kennedy@bsms.ac.uk

PhD Supervisor

Dr. Michael Okorie,
Senior Lecturer in Medicine and Medical Education, Division of Medical
Education,
Brighton & Sussex Medical School, Room 344a Mayfield House,
University of Brighton campus, Falmer.

Tel: 01273 644577

Email: m.okorie@bsms.ac.uk

Appendix L – Consent form

Title of Project: A study to develop an understanding of the teaching and learning of practical prescribing in UK medical schools.

Name of Researcher: Maria Kennedy

Please initial box

I confirm that I have read and understood the information sheet dated **July 3rd 2014 (Version number 1.0)** for the study **A study to develop an understanding of the teaching and learning of practical prescribing in UK medical schools.**

I have had the chance to read the information and ask questions about the study and am satisfied with the answers I have been given.

I understand that my participation in this study is voluntary and that I am free to stop at any time, and I do not have to give a reason for doing so. I understand that if I ask to stop the study my medical care and legal rights will not be affected in any way.

Occasionally an external regulator or funding body may ask to look at the data for this study to check that it is being run correctly.

I understand that relevant sections data collected during the study, may be looked at as part of the research. I give permission for my data to be used for this purpose.

I understand that my interview will be recorded.

I agree to take part in the above study.

Name of Participant

Date

Signature

Researcher to complete:

- I have explained the information in this document and encouraged the participant to ask questions and provided adequate time to answer them.

Maria Kennedy

Date

Signature

When completed: 1 copy for the participant; 1 copy for the researcher site file;

Appendix M - Emerging themes from midpoint data of questionnaire

DOES MEDICAL UNDERGRADUATE COURSE IN ITS CURRENT FORMAT PREPARE SUFFICIENTLY FOR PRACTICAL PRESCRIBING?

- Less self-directed learning/ more guidance in practical prescribing tasks rather than teaching each other
- More PBL/CBD- PBL calmer environment to help familiarise with prescribing vs Practice under pressure e.g. OSCE/wards
- More prescribing teaching in the wards/clinic/ practice simulated scenarios/ pre-prescribing
- Becoming accustomed with real drug charts and prescribing oxygen/fluid/infusions/blood products/cream and sprays/analgesia and learning drug dosages. Side/effects and drug interactions
- Teach how to correctly prescribe drugs in patients with different clinical states
- Observe/shadow how junior doctors/doctors/pharmacists prescribe drugs
- More regular- once-twice a term/once every fortnight and longer sessions
- Learn about common drugs prescribed by FY1/2 and learn common S/Es and interactions
- Implement teaching at earlier stage to year 1 and 2
- Teaching by pharmacists/ CT doctors/FY1 and 2/nurses
- More tutorials/small group sessions/role play rather than lectures or large group sessions as they are less intimidating and easier to ask questions
- E-modules on practical prescribing with clinical cases, online quiz with feedback
- Formative assessments from Year 1
- Teaching of common drugs their s/e and interactions prior to rotation
- Separate practical prescribing module
- Teaching on how to prescribe drugs in complicated scenarios
- More pharmacology based teaching of commonly used drugs
- Categories teaching according to disease type
- Clinical pharmacists better at delivery of small group teaching
- Compulsory/mandatory sessions
- More pharmacology teaching/lectures/ learning about drugs and their dosages in early years
- Early exposure to prescribing
- Teaching how to use the BNF
- Validated prescribing/ drug charts checked by doctors
- Prescribing tasks with pharmacy students
- Introduce list of drugs appropriate to the year group and apply it in a pre-prescribing system
- Less focus on psychosocial aspect and leadership skills and more teaching on prescribing.

WHEN

- More regular sessions throughout the curriculum- once-twice a term/once every fortnight and longer sessions- workshops often felt rushed and less time for individual feedback
- Implement more pharmacology teaching and prescribing exposure in preclinical years 1 and 2
- More pharmacology teaching/lectures/ learning about drugs and their dosages in early years

WHERE

- Wards/clinic/small group seminars/tutorials rather than lecture theatres, less confrontational and easier to ask questions

TAUGHT BY WHO

- Clinical pharmacists/junior doctors rather than senior doctors as they are too busy
- Teaching by pharmacists/ CT doctors/FY1 and 2/nurses
- Clinical pharmacists better at delivery of small group teaching

HOW SHOULD IT BE DELIVERED

- more guidance in practical prescribing tasks rather than teaching each other
- More PBL/CBD- PBL calmer environment to help familiarise with prescribing vs Practice under pressure e.g. OSCE/wards
- Observe/shadow how junior doctors/doctors/pharmacists prescribe drugs
- More tutorials/small group sessions/role play rather than lectures or large group sessions as they are less intimidating and easier to ask questions
- E-modules on practical prescribing with clinical cases, online quiz with feedback
- Formative assessments from Year 1
- Separate practical prescribing module
- Categories teaching according to disease type
- Compulsory/mandatory sessions
- Validated prescribing/ drug charts checked by doctors
- Prescribing tasks with pharmacy students

WHAT SHOULD IT FOCUSED ON

- Becoming accustomed with real drug charts and prescribing oxygen/fluid/infusions/blood products/cream and sprays/analgesia and learning drug dosages.side/effects and drug interactions
- Teach how to correctly prescribe drugs in patients with different clinical states
- Learn about common drugs prescribed by FY1/2 and learn common S/Es and interactions
- Teaching on how to prescribe drugs in complicated scenarios
- Teach how to use BNF
- Teaching of common drugs their s/e and interactions prior to rotation

- More pharmacology based teaching of commonly used drugs
- Introduce list of drugs appropriate to the year group and apply it in a pre-prescribing system

- Less focus on psychosocial aspect and leadership skills and more teaching on prescribing.

SHOULD U/G TEACHING BE MORE STANDARDISED?

YES

- Same knowledge/ similar abilities/ levels of consistency to ensure that all students will be safe prescribers
- Equal access to the best learning opportunities
- All junior doctors should have the similar standards/ To set an equal or minimal standard of prescribing skills prior to graduation
- To set a standard of core prescribing skills for everyone which can be applied in multiple trusts
- To ensure a gold standard
- As an incentive for more and better prescribing teaching in some medical schools
- Equal preparation/fair for PSA which is standardised so it offers adequate teaching to students who haven't received much teaching on this.
- To minimise patients' morbidity and mortality
- To satisfy the expectations of senior colleagues regardless of where you will end up working
- To improve patient safety and limit prescribing errors

NO

- Difficult to apply as different medical schools have different sized cohorts with different resources/ different curriculums
- Different guidelines/appearance of drug chart apply to different trusts
- Depends if the course is based on PBL or traditional teaching
- Different clinical experiences across medical schools
- Students learn in different ways
- A large amount will be learnt in the workplace
- Different medical schools should have the freedom to teach differently. Nonetheless these different curriculums should be for a purpose
- Standardised curriculum will be quite restrictive and would not drive up standards/ fail to encourage diversity in the skills and knowledge of qualifying doctors.
- Difficult to arrange based on the difference in resources and curricula across medical schools

I DON'T KNOW

- Medical schools have different approaches
- Don't know how standardised the current system is
- Don't know how other medical schools perform
- Haven't received any form of teaching
- Although a standardised curriculum on core knowledge that is expected once graduated would be useful, teaching styles and resources to achieve this vary from one med school to another

Appendix N - Question schedule for focus groups

- 1) Students have expressed concern that there should be more of an emphasis on increased knowledge of pharmacology and therapeutics and of drugs. How important do you think this is in relation to prescribing?
 - What does prescribing mean to you and what processes are involved?
 - What worries you most?
- 2) With respect to medical schools preparing their students to become safer prescribers, what do you as a medical undergraduate expect from your medical school?
 - Do you think that simulation of prescribing in some form should be utilised?
 - If so, simulate prescribing in calm environment and build up to more realistic dynamic environment?
 - Do you think there would be any benefit in introducing exposure to prescribing earlier in the curriculum and in particular in Phase 1 (Year 1&2)?
 - Where do you think assessment fits into this?
- 3) Medical undergraduates across the county have indicated that medical schools need to provide more training in prescribing more often, what do you think would be a reasonable and realistic?
 - How much teaching do you think should be provided?
 - How often should these be provided?
 - What format would be best?
 - Fewer cases but in more depth?
- 4) Thinking about all of the teaching you have had in terms of safe and practical prescribing, which methods do you feel have been most beneficial to you?
 - Have you had experience of prescribing on ward, transcribing?
 - How much guidance and from who?
 - What is the value of the practical aspects?
 - Who, what, where, and what formats?
 - What worked particularly well or not?
- 5) Students have suggested that as undergraduates, more of an emphasis should be placed on commonly prescribed drugs, or those associated with higher risk (oxygen, fluids, analgesia, etc). Do you think this would be a beneficial approach?
 - Are you aware of a list of core drugs you have to learn about?
 - Has anyone used/ referred to this list?
 - How useful is it in the current format, any comments on content?
 - Could you suggest how this could be improved?
- 6) Do you think that preparation at undergraduate level is more important than NHS Trusts offering support at the point of transition when you become junior doctors?
 - Whose responsibility is it to ensure prescribing skills are up to speed?

Appendix O – Codes identified from focus groups

QUESTION 1	QUESTION 2 expectations with respect to (wrt) prep for becoming safer prescribers	QUESTION 3 - realistic reasonable wrt teaching provisions for prescribing within the curriculum	QUESTION 4 - what has worked well or not wrt practical prescribing experiences	QUESTION 5 - emphasis on high risk / commonly prescribed drugs	QUESTION 6 - role of under grad versus post grad wrt preparation for practice/ transition
why drugs are prescribed or not	reinforce key topics	ward round with pharmacists	sign off in logbook	approach in use (top 100)	ward round with pharmacist
drug selection in general	effective teaching	didactic versus interactive	experience real life situations i.e. wrt to timing to clerk a patient	focused learning - good	teaching on the job
basics important	feeling supported throughout	more clinical context in sessions	actually prescribing with feedback	information needs to be in manageable format	fundamentals covered at university
broad overview important	supervision on wards	large group session versus ward round	repetition of tasks to reinforce	student led encouraged	guided training
knowledge differentiates between dr and other hcp	quality of teaching	resources are an issue - staffing/ timing	learning from other HCPs	need proper guidance	lifelong learning
knowledge not be all and end all	relevance of learning material content	link to logbook sign off	rotation specific tasks/ sessions	practical points that wouldn't be covered in lectures i.e. counselling points	prescribing situational

know how to use resources such as bnf	clarify learning outcomes at each stage	compulsory aspect of course	lectures not best to learn prescribing skills	highlight high risk drugs	self awareness
awareness of local/national guidelines	link to clinical practice	focus on medication not disease i.e.	teachers need to be suited to the activity	not routinely prescribed by junior doc	prescribing norms in different rotations
timing key factor	check progress regularly	poor organisation	poor organisation	accuracy of info/ learning materials	uncertainty what future training provisions will be
teaching too disjointed to be useful	spiral lacking i.e. reinforcement	ward versus didactic teaching	aspects compulsory to ensure students attend	keep info/ learning materials up to date	supervision from seniors
delivery of sessions hampers acquisition	curricular mapping	cover basics first and more focused learning in clinical years	ward based tasks interactive lectures	relevance of learning materials	should be taught to national not regional standard i.e. guideline wise
knowing what you need to know	link to assessment	clinically relevant cases	technology as a barrier	awareness of other useful resources	sign off
experience is more important for practice	tasks linked to rotations	pre clinical/ clinical split	peer teaching	resources needed to cover voids wrt some learning materials (formulary)	is help available
learning is life long	sign offs/ compulsory tasks	learning in context more memorable	teachers suited but have time	focus on drugs with potential to kill	focus on getting through course not on end goal
seeing drugs in action in practice key	drug charts/ prescription type - familiarity with	assessment focuses learning	clinical cases based on students	focus on drugs on the PSA	guides to guidelines

contextualise with patients helps consolidate	knowing basics of pharmacology	logbook/ signoffs	Prescribing review i.e. spot the error/ difference	approach in use - how med schools teach	dynamic field always evolving
know what fits where	know when not to prescribe i.e. limits	formulary (core drugs list) not helpful in some format	prescription review	already focus on common/ high risk/ top 100	self responsibility support from others
disjointed sessions	focus on certain drugs	more clinically relevant	junior docs lack time	not just about high risk	
sessions to bring basics together	practical prescribing sessions	logbook results in learning about drugs in isolation	resources in clinical setting can be limited	high impact - i.e. patient experience	
translation of knowledge to practice	clarity of learning outcomes	MDT working at undergrad level	variability of learning	focus year 3 vs final year	
caveats need to be covered better	progression checked	limited benefit introducing Rxing too early	if no time info to contextualise can be skipped i.e. barrier to learning in applied setting	timing is big issue	
difficult to teach ward based situations	reinforce key points	need basics first	practical prescribing sessions	focused learning - good	
know what you know vs what you don't	meaningful feedback	more relevant learning in senior years (clinical)	seeing different charts in practice - different prescription types	accessibility of learning materials	
taught in bits difficult to piece together	awareness of limitations wrt resources, time,	timing/ frequency	learning from different HCP	nature of learning materials (cased based vs	

	teaching, money			box filing exercise)
deficit of knowledge could kill	counteract variations in teaching	soot the difference/ mistake exercises	sign offs and if not don't pay much attention	integration
pressurised environment calcs performed in	how to discuss medication with patients	prescription review	Inter-professional education not helpful in current format	nature of assessments
adverse drug reactions	better integration between med school and nhs trusts	practical sessions	pharmacists as teachers are effective	nature of learning materials (cased based vs box filing exercise)
most important action of a doctor	familiarity with drug charts	assessment link	Quality of learning materials in general inc. content of lectures and slides	log book i.e. compulsory aspect
prescribing = toolkit, knowledge being the tools	link to clinical practice	organisation of sessions	small group teaching on cases	timing is crucial
prescribing as a process	support and supervision	compulsory sessions or exercises	case based discussions	focused on learning materials
learning for exam vs learning for real life	sign offs/ compulsory tasks	clinical relevance of sessions	cases on patients	both important focuses
pen to paper minor	effective and meaningful feedback	common pitfalls	student lead to a degree	potential to harm important to know
feedback from activities on ward	practical prescribing sessions	various HCP providing the teaching	quality of teachers	formulary not useful
dangerous process with potential to	clarify learning outcomes expected	limited resources	teachers nee dto be suited to the activity	timing most important aspect

cause harm				
dosing errors, calculations, drug reactions, interactions	prescribing etiquette	introduce earlier in course/ year	lectures not always best	basic info covered yrs 1 & 2
concern knowledge deficit leading to harm	practical prescribing / simulation	assessment is key	know the basics	build/ integrate clinical info into phase 2
building block of pharmacology	assessment important (formative)	management versus prescribing	know what is safe vs what is not	timing is important
basics not easily translatable to clinical practice	not become complacent	link theory to practice	ward work nb to consolidate	repetition and frequency
knowing what you need to know	timing important	themed sessions	patient scenarios force you to think and engage more	linked to rotations
knowing what level need to be at at various stages	progression checked	lack of standards is problematic	disparity of teaching regular	integrate into rotations better
not clear what you need to learn - too broad	feedback	interactive sessions	frequency of sessions akin to PSA	link with assessment
evidence should only guide decisions	quality of teaching	will only learn if relevant at that point in time	Clinical teaching fellows effective actively encourage med students to participate in ward	formative assessments useful tool

			round	
clinical experience can lead to deviations from guidelines	learning materials and resources	learning curve	practically prescribe on ward round	quizzes i.e. nature of assessment good
choices shaped by experience if little between therapies wrt to evidence	link to clinical practice	basic framework early - to be built on later	curriculum for student placements	isolation of top 100
logistics of sessions can influence learning	difference between graduate and regular entry - timing introduced	end of rotation formative assessment	standardise what's covered on placement	contextualise with patients
more of an art than a science - guided by experience	dose calculations	link PBL with assessment or quizzes	block sessions of preparation before placements	know what/ when to flag up re high risk
knowledge of resources to support prescribing decisions	assessment fit for purpose	formal formative PSA early in final year	access to learning materials from DGH too variable	management is less crucial
costs associated with prescribing	timing prescribing introduced	compulsory sessions for CPT	lectures slides from placements (worksheets) availability	
underlying problems need to be understood to treat effectively	practical prescribing	intervals more important i.e. weekly	formal assessments	
	link to clinical practice	practical prescribing sessions	timing of sessions within rotations	

dedicated contact time	access to learning materials (outline)	themes sessions linked with rotations
reinforce key topics i.e. revisit topics not just one off sessions	work based assessment	prescribing scenarios
compulsory attendance	better quality of learning materials	online resources i.e. accessibility
appropriate coverage throughout curriculum	tick box exercise versus helpful learning	bridge gap between theory and practice
assessments - more and earlier	logistically problematic	writing up drug charts / practice in applied setting
relevance of learning material content	variability of learning materials	variability of learning environments wards etc
meaningful feedback	better together	lack of autonomy wrt to rxing transcribing not challenging vs clerking in patients from admission
		delegation of tasks to medical students on ward round
		junior docs, consultants, pharmacists as teachers
		utilising the multi-disc

	team to learn either informal or formal on ward round
	prescribing in context knowing patient vs transcribing
	lack of feedback on wards
	prescribing assignments in log book (compulsory)
	timing as an issue- end of year signoff signature chasing
	basic info covered in early years not useful for everyday prescribing

Appendix P – Focus group participant information sheet

A study to develop an understanding of the teaching and learning of practical prescribing in UK medical schools.

Version 1.0 July 03, 2014

Dear Participant

A study to develop an understanding of the teaching and learning of practical prescribing in UK medical schools.

I would like to invite you to take part in my research study. Before you decide I would like you to understand why the research is being carried out and what it would involve for you if you took part. I will go through the information with you and answer any questions you may have. This should take about 10 minutes.

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

1. What is the purpose of the study?

This study will form part of my PhD which chiefly aims is to investigate the current teaching, learning and assessments used for doctors during their undergraduate and postgraduate training, to inform development of a future curriculum that would make doctors safer prescribers and reduce error rates.

As part of this project I am looking to obtain the views of medical students about the provision of practical prescribing teaching during their medical undergraduate degrees, and the value they place on this.

This study will examine your experiences of practical prescribing teaching in any format during your medical undergraduate degree, and create a broader discussion as to what you think are areas where the curriculum could be improved around safe practical prescribing.

2. Who is organising and funding the research?

This PhD research project is funded by Brighton & Sussex Medical School.

3. Why have I been invited?

You have been chosen as you are currently a medical undergraduate in your third, fourth or final year in a medical school in the South Thames Foundation School region, and your views about practical prescribing are being sought.

4. Do I have to take part?

Participation is completely on a voluntary basis. It is up to you to decide if you would like to take part or not, you will not be forced or pressurised to participate in any way. You will be given information in addition to that on this information sheet and if you then do wish to participate you will be required to sign a consent form. You will still be able to withdraw from the study at any point without giving reasons for your choice to do so.

5. What will happen to me if I take part?

If you do choose to take part I will arrange a mutually convenient location (probably at your university), date and time for the focus group. A room will be available in which the focus group will be conducted in private for approximately 30-40 minutes. With your permission the focus group will be audio recorded and transcribed.

6. What will I have to do?

Should you consent to participate you will be required to attend a focus group, which will last approximately 30-40 minutes. During this time I will ask you and a small group (no more than 8 students per group) a set of pre-defined questions to elicit opinions/experiences of practical prescribing teaching. Depending on the answers that the group give, the conversation may deviate from the question list slightly to explore further themes that may arise or comments made during the group discussion.

There are no other special requirements needed should you choose to participate.

7. What are the possible benefits of taking part?

Although this research may have no immediate benefit to you, its' results may be used to inform the future teaching, learning and assessment of safe and rational prescribing at both the undergraduate level and continuing into the foundation training years

8. Are there any possible disadvantages or risks of taking part?

Attending the interview will take time out of your day, but every effort will be made to minimise the inconvenience and ensure your comfort in the group discussion process. It will be possible to take a break or stop at any point if necessary.

If at the end you wish to discuss any issues that emerged further, it will be possible to refer you to a more expert source of help

9. What about confidentiality?

All the information about your having taken part in this study and all information collected during the course of the research will be kept strictly confidential. (If applicable: Any information about you which leaves the hospital or university will have your name and address removed so you cannot be recognised from it). All data will be stored securely.

Transcribing of the audio recording of the focus group will be done immediately after the focus group by the researcher and original recordings deleted once this is completed. Direct quotations from the interview may be used but will be anonymised completely, so will not be identifiable to you.

Your comments will not be made available to your lecturers at the university, so you can freely discuss your views about the curriculum at your medical school.

10. What will happen if I don't want to carry on with the study?

You are free to withdraw from this study at any time and without giving a reason. If you decide to withdraw or not join the study, this will not affect the standard of education you receive. We will also be happy to discuss with you what will happen to any data that has been collected up to the point of your withdrawal from the study.

11. What if there is a problem?

If you have any concerns about any aspect of this study, how it is being conducted or complaints about the way in which you have been treated during the study or possible harm you might suffer, you should ask to speak with the researcher who will do their best

to answer your questions. The researchers contact details are provided at the end of this Sheet. However it is not expected that any problems will occur.

12. Harm

The Universities of Brighton and Sussex have insurance in place to cover their legal liabilities in the unlikely event harm should arise from this study.

13. What will happen to the results of the research study?

The results of the study will be written and up and form the basis of my PhD thesis. I will aim to publish parts of the study in scientific journals, or present findings at national or international conferences. In addition, a short report of the research findings will be provided for distribution to participants if requested.

14. Who has approved this study?

This study has received ethical approval from *the Brighton and Sussex Medical School Research Governance and Ethics Committee (BSMS RGEC)*.

Thank you for taking the time to read this information sheet.

Contact Details:

Primary Investigator: Maria Kennedy
PhD Student Researcher,
Division of Medical Education,
Brighton & Sussex Medical School,
Room 344a Mayfield House, University of Brighton campus, Falmer.

Email: m.kennedy@bsms.ac.uk

Appendix Q - Results summary from the Delphi study - Round 1

Q2. It would be useful to include these various aspects of the prescribing process in a dedicated programme of study for practical prescribing.

Consensus, taken as >75% panel agreement, was achieved on all aspects listed in round 1. These are listed below for your records.
(Additional items, suggested by the panel members, form the basis of round 2)

Knowledge of basic P&T	Appropriate drug selection including dose, frequency, formulation, route, and duration
Reasoning behind the need to prescribe a drug i.e. establish a (working) diagnosis	Pharmaceutical and dosage calculations
Establishing therapeutic goals - how is patient likely to benefit from medication	Providing information, instruction on use and cautionary/ warning advice to patients or carers
Obtaining an accurate drug history from the patient (including detailed allergy history)	Monitoring for benefit and adverse effects of medication
Patient specific and physiological factors that may impact drug choice i.e. kidney or hepatic function, etc.	Recognising actual or suspected adverse drug reactions and how to report these
Prescribing in pregnancy and lactation	Documentation of rationale for prescribing medication or stopping treatment if applicable
Prescribing at the extremes of age (paediatric and geriatric)	Signposting to local or national prescribing guidelines as clinically appropriate
Prescribing in common acute emergencies and illnesses	Drug information resources such as BNF
Prescribing high risk drugs	

Q3. At the end of completing the programme for practical prescribing the medical students should:

The learning outcomes listed below have been accepted as consensus, taken as >75% panel agreement, was achieved in Round 1.

(The panel did not reject any of the learning outcomes put forward in Round 1, so items not achieving consensus have been taken forward to Round 2 with modifications, along with those additional learning outcomes suggested by the panel)

Be able to appropriately use the different sections on the drug chart i.e. "once only" dosing, regular, as required, IV fluids, and blood products

Be able to write a clear, legible, unambiguous prescription (including fulfilling prescription requirements for Controlled Drugs on TTO/ FP10 prescription forms)

Know the considerations that need to be made when prescribing for pregnant or breast-feeding women

Know the considerations that need to be made when prescribing for geriatric and paediatric patients

Know the considerations that need to be made when prescribing for patients with renal or hepatic dysfunction

Be able to predict and manage common potential drug interactions including those caused by non-prescribed, herbal or complementary medication

Know the common inducers and inhibitors of CYP450 liver enzymes (including those of herbal or complementary origin)

Have knowledge of, and be able to apply basic pharmacokinetic and pharmacodynamic principles

Have a basic understanding of how drugs work: their mechanisms of action to produce not only therapeutic effects but also adverse effects

Be competent and confident in performing pharmaceutical and dosage calculations

Be able to explain the need for performing therapeutic drug monitoring (TDM)

Know the commonly prescribed medicines that require TDM (e.g. lithium & gentamicin)

Know that various formulations of certain drugs differ in bioavailability and need to be prescribed by brand rather than generically

Be able to identify suspected or actual adverse drug reactions

Be able to tell the difference between a drug allergy and a drug intolerance

Be able to counsel patients on commonly prescribed drugs

Be able to identify possible causes of non-adherence

Know about the existence of the yellow card reporting systems for reporting actual or suspected adverse drug effects

Be able to prescribe drugs commonly used to manage acute emergencies

Know about the drug management of common illnesses

Have a working knowledge of various sources of drug information (dosage, interactions, etc.) for example the BNF, local prescribing guidelines, summary of product characteristics, etc.

Be able to recognise and manage a medication error

Appendix R – Expert panel’s proposed modifications to learning outcomes and suggested core content

What is taught (core content) - principles of writing a prescription – Panel’s suggestions

2. If you think there are any other aspect(s) of the prescribing process that have been omitted, but you feel would be useful to include in a dedicated programme of study for practical prescribing please specify this/ these below.

Practical training in at least one "on paper" and one ePrescribing process
(1) How to prescribe controlled drugs ; (2) how to actually fill out a sample paper drug chart and a sample electronic prescription (3) dosing and monitoring of drugs that require individualised dosing eg gentamicin, vancomycin, (4) consideration of formulations and practicalities eg when administering via nasogastric tube

understanding drug charts - familiarisation of paperwork

selection of actual drug/drug class before considering dose, frequency, etc
recognising common drug-drug interactions

preventing and dealing with prescribing errors. Drug interactions

No

Prescribing in a team environment, pharmacy and MI support, clear communication

Antimicrobial stewardship; special problems with "biologics"; harms from substances of recreation

I think your list is fairly exhaustive and chimes with our own curriculum
common errors in prescribing, reviewing prescription charts / drug history for contraindications / adverse interactions, communicating information / instructions to other staff involved in administration or monitoring

The practicalities of actually writing prescriptions, including drug names (non-proprietary vs brand-name prescribing), acceptable abbreviations, clarity of documentation, and how to navigate and use drug charts (and their electronic equivalents)

understanding key roles of all healthcare professionals; communication in the consultation; common errors and how to avoid them; ethics and dilemmas; drug interactions linked to kinetics and dynamics; how to deal with Controlled drugs; the law pertaining to medicines and adherence and the concordant relationship. Perhaps something about drugs of animal origin for religious groups

Awareness of the variety of prescribing systems available and common pitfalls.

Use of resources- the bnf. Also it is unclear if you intend any of your selections to actually include practical teaching and skills sessions on writing a prescription, including legal aspects of a valid prescription.

Prescribing controlled drugs.

Awareness of common and significant drug interactions
specific time is required to teach students to critically review prescriptions
managing polypharmacy; adherence
Good prescription writing practice, including acceptable abbreviations and
their meanings, NHS drug tariff, prescribing outside licensed indications,

Learning outcomes panel members' suggested modifications for each LO

3.1.a. Be familiar with local drug charts/ prescription forms/ electronic prescribing systems - Suggested modification:

be familiar with generic forms/electronic systems

Difficult because of lack of uniformity in UK

Be confident in completing local...

local is too broad for medical schools where there may be 20 NHS trusts involved in education that have bespoke dx charts. also need for different forms of scripts for primary care and OPDs

Demonstrate use of local drug charts/ prescription forms/ electronic prescribing systems

Be familiar with a range of drug charts/prescription forms/electronic prescribing systems (this is because most will not be based locally for F1 training)

That should be the requirement of the foundation trust however they should have an awareness of the variety of prescribing systems available and common pitfalls.

Be familiar with 'a' drug chart. Doesn't need to be 'local'

3.2.a. Be able to appropriately use the different sections on the drug chart i.e. "once only" dosing, regular, as required, IV fluids, and blood products - Suggested modification:

iv fluids and blood should be covered separately

Be able to use the different sections on the drug chart appropriately i.e. "once only" dosing, regular, as required, IV fluids, and blood products

Prescribing insulin, anticoagulants

.. to use appropriately..

3.3.a. Be able to write a clear, legible, unambiguous prescription (including fulfilling prescription requirements for Controlled Drugs on TTO/ FP10 prescription forms) - - Suggested modification:

Not convinced by this one - the first part only applies to handwritten prescriptions as legibility is not an issue with electronic prescribing. It mixes 2 objectives - it would be better to have a separate objective for controlled drugs - also define abbreviations

3.4.b. Know the different classes of drugs (including unlicensed or off label prescribing) - Suggested modification:

Rather ambiguous as to what this means - different legal categories? Therapeutic categories?

this is vague- is this about schedules, GSL , P and POM?

Unlicensed prescribing very difficult because of its scope

Be aware of the difference classes of drugs (including unlicensed or off label prescribing)

This is open ended and totally ambiguous - there are many classes - do they need to know them all and what level is this set at. Also drug classes are a different objective from unlicensed and off labelled prescribing At St George's our objectives define the drugs we expect our students to be able to prescribe independently at each stage of the course and at graduation to foundation doctor

This just seems to be a very open-ended / poorly defined outcome.

This is too non-specific, and probably too wide an aim for a prescribing course (as opposed to a pharmacology & therapeutics curriculum). It could be modified to focus on unlicensed and off-label prescribing specifically - e.g. 'Know when it is appropriate to prescribe medicines outside the terms of their license, and what additional considerations this involves'

Off label prescribing not necessary

Its hard enough to get them to understanding the licensed indications! Need to know that drugs can be prescribed off label in some instances but perhaps not specific examples

3.5.b. Know the considerations that need to be made when prescribing for pregnant or breast-feeding women - Suggested modification:

Superficially as this is a specialist area

Feels vague and wishy washy We have defined this more specifically - I will send our staged objectives over

know the requirement to and how to access the considerations that need to be made when prescribing for pregnant or breast-feeding women

also need to think about pre-conception (e.g. drugs that affect conception)

3.6.b. Know the considerations that need to be made when prescribing for geriatric and paediatric patients - Suggested modification:

2 separate outcomes for geriatrics and paediatrics

Feels vague and wishy washy We have defined this more specifically - I will send our staged objectives over

know the requirement to and how to access the considerations that need to be made when prescribing for geriatric and paediatric patients

particularly neonates

older people?

3.7.b. Know the considerations that need to be made when prescribing for patients with renal or hepatic dysfunction - Suggested modification:

Feels vague and wishy washy We have defined this more specifically - I will send our staged objectives over

know the requirement to and how to access the considerations that need to be made when prescribing for patients with renal or hepatic dysfunction

3.8.b. Be able to predict and manage common potential drug interactions including those caused by non-prescribed, herbal or complementary medication - Suggested modification:

Be able to predict and manage common potential drug interactions including those

relating to non-prescribed, herbal or complementary medication One drug doesn't cause an interaction! Again we have defined common interactions in our teaching material as how do students set this level

3.9.b. Know the common inducers and inhibitors of CYP450 liver enzymes (including those of herbal or complementary origin) - Suggested modification:

the importance of always checking for interaction using appropriate resources eg BNF the other part of this is knowing about when prescription of these might cause clinically important drug interactions

I think it is impossible for a medical student to know this especially around herbal - however they should have an awareness and know how methods to investigate it if it occurred in practice.

Principles more important than examples

Covered above

3.10.b. Have knowledge of, and be able to apply basic pharmacokinetic and pharmacodynamic principles - Suggested modification:

Again too vague as a learning outcome

When starting the practical prescribing programme should have knowledge of basic pharmacokinetic and pharmacodynamic principles. During the practice prescribing programme learn how to apply these

A potentially wide-ranging objective that has not been specified sufficiently clearly here. I would also question whether it is part of the core prescribing programme, as opposed to other parts of the medical curriculum.

3.11.b. Have a basic understanding of how drugs work: their mechanisms of action to produce not only therapeutic effects but also adverse effects - Suggested modification:

I wonder if this is best taught in pharmacology lectures and that the learning objective here should be about applying this knowledge in practice

Mechanism of adverse effects often unknown

Okay, but need to give some indication of what drugs (will there be a core drugs list?)

why use the word basic?

Not within prescribing module - this is a prerequisite - background pharmacology

3.12.b. Be competent and confident in performing pharmaceutical and dosage calculations - Suggested modification:

depending on where this is - we teach in year 5 skills day also

Yes but which ones

3.13.b. Be able to explain the need for performing therapeutic drug monitoring (TDM) - Suggested modification:

More than just the need for - perhaps indications for

Suggest clarify whether you intend this to mean drug concentration monitoring, or monitoring drug therapy more generally. If the former, there should be an objective around the other more general (arguably more important) monitoring considerations.

3.14.b. Know the commonly prescribed medicines that require TDM (e.g. lithium & gentamicin) - Suggested modification:

More than knowing which - should they be able to interpret data and perform basic dose adjustments

3.15.b. Know that various formulations of certain drugs differ in bioavailability and need to be prescribed by brand rather than generically - Suggested modification:

Fundamentals - knowledge of High risk medications and references to go to in practice.

3.16.b. Be able to identify suspected or actual adverse drug reactions - Suggested modification:

... And report them appropriately?
and appropriate action

3.17.b. Be able to tell the difference between a drug allergy and a drug intolerance - Suggested modification:

Also need to know what to do if a patient is given a drug that they have a reported allergy to and has no reaction i.e. refer to allergy clinic for further investigation, rather than remove the allergy status from the patient's record.
and appropriate action

3.18.b. Be able to counsel patients on commonly prescribed drugs - Suggested modification:

"Educate" rather than "counsel"?

Should be able to counsel on any drug you are prescribing

Again how do you define commonly prescribed - this is potentially open ended without the 'top 100' (or whatever)

They should use the Medicines Related Consultation Framework as pharmacists use to ensure correct consultation skills for medications.

3.19.b. Be able to identify possible causes of non-adherence - Suggested modification:

Does this mean has knowledge of them or can communicate well enough with the patient to know for that patient what their personal issues are

synthesise and collate causes of drug non adherence

They should use the Medicines Related Consultation Framework as pharmacists use to ensure correct consultation skills for medications.

3.20.b. Know about the existence of the yellow card reporting systems for reporting actual or suspected adverse drug effects - Suggested modification:

should be able to sue them and know the patient can also self report as can some other HCP

Is that the limit of our ambitions - our objective is 'Report adverse events appropriately using the yellow card system'

mention MHRA and online service

3.21.b. Be able to prescribe drugs commonly used to manage acute emergencies -

Suggested modification:

Again how are these defined

3.22.b. Be able to prescribe high-risk drugs - Suggested modification:

Real high risk drugs should not be prescribable by F1s

Such as....

not necessarily prescribe them but identify drugs that policies limit the prescription of know which drugs are high-risk and why as well as what particular measures are needed to prescribe them safely

Great majority will not be prescribed by junior doctors

what is definition of high risk?

Badly/safely/ appropriately?

Be aware of the issues relating to the prescription of high-risk drugs (In STFS we do not allow foundation doctors to prescribe eg cytotoxics)

Do you mean anticoagulants, insulin, opiates, certain antibiotics? Should you specify the high risk drugs?

3.23.b. Know about the drug management of common illnesses - Suggested modification:

What aspects of drug management and which common illnesses

I don't think that this would be part of this programme but rather that students would come with this knowledge

Too vague to be helpful

3.24.b. Have a working knowledge of various sources of drug information (dosage, interactions, etc.) for example the BNF, local prescribing guidelines, summary of product characteristics, etc. - Suggested modification:

Be able to access drug information appropriately using

medicines.org.uk and medicines information units

3.25.b. Be able to recognise and manage a medication error - Suggested modification:

And report...?

Recognise but not necessarily manage

END