

## **How is Prescribing Taught in Health Professions Education? A Scoping Review.**

### Review Group Members:

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2. Dr Patricia Wade MB BAO BCH MRCPI, Clinical Lecturer, Department of Medicine, RCSI University of Medicine and Health Sciences, Dublin. Dr Wade is a medical practitioner and clinical lecturer in medicine with experience in undergraduate medical education, including the teaching and assessment of prescribing.
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4. Dr Shane Cullinan BPharm PGDipHPE PhD, Lecturer in Pharmacy Practice, School of Pharmacy, RCSI University of Medicine and Health Sciences, Dublin. Dr Cullinan is a pharmacist with experience in both community and hospital pharmacy settings, and completed his PhD investigating inappropriate prescribing in older patients and worked on two European clinical trials (FP7 and Horizon2020 funded), both of which are currently investigating the use of custom designed software packages incorporating computerised decision support systems to optimise prescribing in older patients.
5. Prof David Williams, BSc (Pharmacy) MB BCH BaO DME MRCPI FRCPI PhD, Consultant Clinical Pharmacologist and Stroke Physician, Associate Professor, Department of Geriatric Medicine, RCSI University of Medicine and Health Sciences, Dublin. Prof Williams was awarded a PhD in 2002 for his work on pharmacoepidemiology. Following completion of higher medical training at St James Hospital, Dublin, he was appointed as consultant Clinical Pharmacologist and Stroke Physician in Aberdeen in 2002. He served as Clinical Vice-President of the British Pharmacological Society from 2007 to 2010. He is currently the managing editor of the European journal of Clinical Pharmacology. In 2009, he was appointed as the Associate Professor in Geriatric Medicine at the Royal College of Surgeons in Ireland/Beaumont Hospital, where he has helped develop the Acute Stroke Service and undergraduate teaching curriculum in Geriatric Medicine. He is currently the National Speciality Director of training for Clinical Pharmacology and Therapeutics.
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7. Mr Paul Murphy, MLIS, is an information specialist with the Library, RCSI University of Medicine and Health Sciences, Dublin. He was previously medical librarian of University College Dublin. He is a member of the European Association for Health Information and Libraries. Paul has extensive expertise in literature searching for clinical systematic reviews, clinical guidelines, Best Evidence Medical Education (BEME) reviews, and evidence summaries.

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**Abstract:**

**Background:** Prescribing is a complex task, requiring knowledge, judgement and skills to complete. Doctors are expected to be able to prescribe safely and effectively from the beginning of their careers. However, prescribing errors remain a frequent occurrence, particularly in newly qualified and junior doctors, with associated negative outcomes for patient morbidity and mortality. Many newly qualified doctors also lack confidence in their prescribing ability. Only 28% of respondents in one survey agreed that their undergraduate education prepared them for prescribing. A wide variety of methods are used to teach prescribing; given the challenges, however it is still unclear how to select an approach to support students' learning.

**Aim:** To conduct a scoping review of the literature concerning approaches to teaching prescribing in health professions' education.

**Methods:** The following databases will be searched: Pubmed, Embase, PsycINFO, Web of Science and CINAHL. Screening, selection and data extraction will be performed by two independent reviewers using a consensus approach, consulting a third reviewer to resolve disagreements.

**Discussion:** Based on this review, the major methods of teaching prescribing in health professions education will be identified, and effective approaches for teaching and learning mapped, enabling the definition of areas of contemporary educational activity, in order to inform future educational development.

## 1. Background to the topic:

Prescribing is a necessary skill for all doctors; newly qualified doctors are expected to be able to prescribe effectively and safely from the very beginning of their professional careers. In addition, the number of independent and supplementary prescribers outside of medical doctors, dentists and veterinarians has continued to grow worldwide in recent years. Prescribers in many health systems now include pharmacists, physician assistants, nurses, nurse practitioners and advanced practice nurses

Prescribing is not simply the act of writing a drug order on a chart or prescription; it is a complex task which requires a combination of competencies involving a mix of knowledge, judgement and skills to complete. For the purposes of this review, a holistic approach to defining the competencies required to prescribe is taken. This includes a number of elements; basic and clinical pharmacology, therapeutics and appropriate selection of medications in relation to specific diagnoses, the practical and technical skills of writing prescriptions, as well as the relevant regulatory knowledge required to prescribe.

Despite the expectation of competency in prescribing for those carrying out this task, prescribing error remains a frequent occurrence, with associated negative outcomes in terms of patient morbidity and mortality<sup>1</sup>. The Harvard Medical Practice study found that adverse events, which affect at least 3.7% of hospital admissions, were predominantly due to medication<sup>2</sup>. A systematic review of the prevalence, incidence, and nature of prescribing errors in hospital inpatients internationally found that prescribing error affected 7% of medication orders, 2% of patient days and 50% of hospital admissions<sup>3</sup>.

The incidence of prescribing error is higher in newly qualified and more junior doctors, with two recent studies describing prescribing error rates of between 7.4% and 10.3% in doctors within their first two years of practice, in comparison to rates of 5.9% to 6.3% in senior physicians<sup>4,5</sup>. Newly qualified doctors also carry out a higher proportion of prescribing than more senior physicians<sup>5</sup>. Additionally, many newly qualified doctors lack confidence in their ability to safely and competently prescribe. Only 28% of respondents in one survey of newly qualified doctors agreed that their undergraduate medical education had prepared them for prescribing<sup>6</sup>.

The causes of error in prescribing by more junior doctors are complex and multifactorial, with aspects of the prescribing environment, the individual, the team and other supports, organizational or system issues, patient and task related factors all contributing.

Potentially avoidable adverse drug reactions and drug interactions were reported by 60–75% of newly qualified doctors. Many highlighted these errors as avoidable with increased undergraduate training in this area<sup>7</sup>. This group also felt that they would benefit from focused undergraduate teaching on the avoidance of adverse drug reactions and drug–drug interactions, in addition to a greater emphasis on clinical pharmacology and therapeutics as part of their postgraduate training. Education in the practical aspects of prescribing, (i.e. the skills of prescription writing itself including medication selection, knowledge of drug interactions, duration of treatment and routes of administration, as opposed to basic pharmacological principles), during the first year of practice was valued by trainees and they felt they would benefit from greater emphasis on this<sup>4</sup>.

One review into prescribing error and practices outlined that a lack of training in practical prescribing had a significant contribution to the incidence of prescribing errors, including failure to link theory with practice, and emphasis on domain-specific knowledge and skills rather than generic skills, such as seeking help and knowing how to do so. Feedback to students regarding their prescribing skills and knowledge was also found to be lacking<sup>4</sup>. Newly qualified doctors also reported deficiencies in their education in prescribing skills and error prevention, and felt that there could have been greater emphasis on linking theory with practice as part of their undergraduate education, with enhanced focus on making connections between theory and practice to prepare for the complexities of clinical practice. On foot of these findings, it was highlighted that prescribing teaching should be prioritised at undergraduate level in terms of education and summative assessment<sup>4</sup>. The World Health Organisation also focuses on the education and training of health care professionals as part of its global patient safety challenge, focused on the reduction of harm consequent to medication<sup>8</sup>.

Work to date does suggest that a number of interventions targeting different parts of the prescribing process may be required to support newly qualified doctors to prescribe safely, to reduce the risk of error<sup>9</sup>. Multiple studies have examined various educational methods of teaching prescribing – inter-professional education, near peer teaching, problem based learning, e-learning and simulation to name a few. While many interventions have been shown to improve prescribing ability and confidence<sup>10</sup>, it is still not clear how to support students' learning of the practical aspects of prescribing, and further work is needed in this area<sup>11</sup>: the proposed scoping review aims to map underpinning evidence. This will enable an accurate description of the up to date landscape in this area, allowing us to define contemporary educational activity and outcomes in terms of future educational development in supporting prescribing skills in health professions education. This review will be carried out according to the Joanna Briggs Institute (JBI) scoping methodology<sup>12,13</sup>.

Glossary of terms used:

**Scoping review:** A scoping review is a type of systematic review which can be used to map or explore the literature and summarise evidence relating to a specific topic, e.g. to map the key concepts underpinning research or to inform future research, to clarify working definitions of a topic, or to define the conceptual boundaries of a topic<sup>14</sup>.

**Prescribing:** For the purpose of this review, prescribing is defined as the act of advising, influencing or authorising use of a medication, and encompasses all elements required to inform and assist prescribing, including basic and clinical pharmacology, therapeutics, appropriate selection of medications in relation to specific diagnoses, knowledge of medications, the practical and technical skills of writing prescriptions, as well as the relevant regulatory information required to prescribe.

**Teaching methods/educational interventions/methods of supporting learning:** In the context of this review, this refers to the different methods of and principles used by educators to enable or facilitate student learning.

**Transferable learning:** Learning that occurs in one context or situation which has potential to be applied in other in another context or situation, with or without being refined or amended<sup>15</sup>.

## **2. Review question(s), objectives and key words**

**Aim:** To adopt a scoping review approach to the evidence relating to educational interventions in prescribing for health professionals

**Objective:** We aim to explore and review the literature relating to teaching and supporting learning of prescribing in health professions education, to describe the major educational methods used to inform future development of novel educational interventions in prescribing.

**Primary scoping review question:** How is prescribing taught in health professions education?

**Detailed review questions:**

We will also include the following questions to inform our search strategy and scoping:

1. How is prescribing education delivered to health professionals as part of undergraduate and postgraduate training?
2. What methods are used to support learners while they are being taught how to prescribe?
3. What are the opportunities for transferable learning between professions?

We will report the evidence from this scoping review using the Framework for Evaluating Competency based programmes.<sup>16</sup>

**Keywords:** Health professions education, prescribing, teaching, learning, clinical competence – see full proposed search strategy in search sources and strategies section below for details.

## **3. Scoping search**

With the support of the information specialist with expertise in health professions education (PM) to ensure appropriate construction of our search strategy, an initial limited pilot search of PubMed and Embase was carried out according to JBI guidelines. This was followed by an analysis of the text words in the titles and abstracts of identified papers, along with index terms used to describe these in order to refine search terms used and ensure alignment with the research question and objectives for the scoping review, and to further identify keywords and index terms that could be utilised as part of the full database search.

A number of reviews looking at specific methods of teaching prescribing were identified following the initial pilot screening of studies, but we have not to date identified any reviews looking broadly at what methods are used to teach prescribing across health professions education.

## **4. Search sources and strategies**

Following review team discussion and refinement of the search terms based on the pilot search, and working in conjunction with the information specialist, our search strategy will target the following literature databases: Pubmed, Embase, PsycINFO, Web of Science and CINAHL. Following JBI guidelines, the search will be carried out using all identified key words and index terms, combining controlled vocabulary (MeSH, Emtree etc.), text words and Boolean combinations of these for each database searched.

## BEME Protocol: How is Prescribing Taught in Health Professions Education? A Scoping Review.

The reference lists of identified articles which are selected for full-text review will be scrutinised to identify any other relevant literature that may not have been captured by the original search. If relevant, authors of primary studies or reviews will be contacted for further information. Citation searching will be carried out with the support of the information specialist if applicable. Any relevant grey literature will also be followed up.

For a sample of a proposed search strategy, please see below:

Prescribing	Prescribing[Title/Abstract] OR prescriptions" OR Medication Errors"[Mesh]
Setting	medical[Title/Abstract] OR medicine[Title/Abstract] OR nursing[Title/Abstract] OR midwifery[Title/Abstract] OR midwives[Title/Abstract] OR pharmacy[Title/Abstract] OR pharmacist[Title/Abstract] OR physiotherapist[Title/Abstract] OR physiotherapists[Title/Abstract] OR veterinary [Title/Abstract] OR veterinarian [Title/Abstract] OR dental[Title/Abstract] OR dentist [Title/Abstract] OR dentists [Title/Abstract] OR dentistry [Title/Abstract]
Students / population	AND student[Title/Abstract] OR students[Title/Abstract] OR "Students, Premedical"[Mesh] OR "Students, Pharmacy"[Mesh] OR "Students, Nursing"[Mesh] OR "Students, Medical"[Mesh] OR "Students, Health Occupations"[Mesh] OR "physician associate"[All Fields] OR "physician associates"[All Fields] OR "physician assistant"[All Fields] OR "physician assistants"[All Fields]
Education	education[Title/Abstract] OR educational[Title/Abstract] OR learning[Title/Abstract] OR "Learning"[Mesh] OR "Education, Pharmacy, Graduate"[Mesh] OR "Education, Pharmacy"[Mesh] OR "Education, Nursing, Graduate"[Mesh] OR "Education, Nursing, Diploma Programs"[Mesh] OR "Education, Nursing, Continuing"[Mesh] OR "Education, Nursing, Baccalaureate"[Mesh] OR "Education, Nursing, Associate"[Mesh] OR "Education, Nursing"[Mesh] OR "Education, Medical, Undergraduate"[Mesh] OR "Education, Medical, Graduate"[Mesh] OR "Education, Medical, Continuing"[Mesh] OR "Education, Medical"[Mesh] OR "Educational Measurement"[Mesh] OR "Teaching"[Mesh] OR teaching[Title/Abstract] OR teaching[Title/Abstract] OR "clinical competence" [Mesh]

Initial scoping searches for literature yielded 3115 records before de-duplication, as follows:

- PubMed – 734
- Embase – 1303
- Web of Science: 810
- Cinahl: 192
- PsycINFO: 76

A total of 581 duplicate studies were identified, bringing the final de-duplicated total of studies to be screened to 2534.

## 5. Study selection criteria

Concept:

The core concept we aim to explore with this review is the identification of educational interventions or other methods utilised to support learning in the area of prescribing. All literature that provides a description of the above, which can be enacted, will be included.

Types of studies:

Following on from the above, for the purposes of this review, we will focus on peer-reviewed publications. Conference abstracts and book chapters will be included. Quantitative, qualitative and mixed methods studies will all be included, in addition to reviews (e.g. systematic reviews). Letters, editorials and theses will be excluded, on the expectation that relevant literature in these categories will be uncovered by secondary searching (See information specialist note in appendix).

Context/types of participants:

A broad range of health professions will be included in this review, in order to capture methods of supporting prescribing and prescribing education that exist across multiple disciplines in health professions education, rather than limiting this to medical prescribers only. In view of the fact that involvement of the professions differs between countries, and also because the terminology for the different prescribing professions also differs, we will include the following search terms and in consultation with our information specialist, will test the output of search strings to ensure inclusivity of all of these groups. These will comprise the following:

- Medicine
- Nursing
- Veterinary medicine
- Dentistry
- Pharmacy
- Physiotherapy
- Physician associates/physician assistants

We identified these health professions educators involved in prescribing from our pilot search, however if other professions have studies emerging from our full search they will be included. In order to be maximally inclusive no time limits have been set for database searches.

The review team will look for opportunities for transferable learning across professions. Both undergraduate and postgraduate learning within these professions will be included. The decision to include both was taken in the context of the life-long continuum of learning which takes place in health professions beyond undergraduate level, as it was felt that limiting the boundaries of the review to undergraduate only would possible exclude potentially valuable literature relating to postgraduate education in prescribing which could be transferable.

The references identified by this search strategy will be de-duplicated, and the inclusion and exclusion criteria outlined will be applied by two reviewers (HG and PW), to perform title and abstract screening of all potentially relevant articles, according to JBI methodology.

Given the often iterative nature of scoping reviews, it is recognised that additional inclusion/exclusion criteria may be identified during the screening process. In this event, these will be added to further inform inclusion/exclusion as relevant, following discussion with all three reviewers.

Inclusion criteria:

Peer reviewed research articles, of all methodologies, in addition to conference abstracts and book chapters, which include:

1. Description of educational intervention(s) or other method(s) of supporting learning in prescribing in health professions education
2. Undergraduate and postgraduate health professions education
3. Description on how prescribing is taught i.e. reproducible in practice

Exclusion criteria:

1. Studies that do not describe a specific educational intervention focused on prescribing
2. Non-English language studies (due to logistics , this review is unfunded)
3. Theses, editorials, letters
4. Alternative or non-pharmacological prescribing e.g. traditional medicine, homeopathy, exercise prescribing etc.
5. Studies focusing exclusively on assessment of prescribing without the provision of feedback
6. Self-prescribing or self-medication
7. Administration of medication where the individuals concerned are not choosing or influencing the selection of medications being administered e.g. nurses administering, rather than prescribing medication.

## **6. Procedure for extracting data**

Following completion of searches by the information specialist, the results will be compiled in EndNote and removal of duplicate records carried out.

Two reviewers (HG and PW) will perform title and abstract review independently of and blinded to the other reviewer. Consensus discussions with an arbitrator (TP) will take place in the event of any arising disagreements in order to resolve these.

Following title/abstract review, papers identified as meeting inclusion criteria will move to a further stage of the screening process. Full texts of these articles will be sourced and screened, utilising the same criteria, and moving on to data extraction.

A data extraction form will be developed and utilised to chart relevant information by highlighting and coding relevant text. It is anticipated that the following information will be included on the data extraction form:

- Author(s)
- Year of publication
- Journal name

- Country of origin
- Aims/purpose
- Study population e.g. medical students, nursing, pharmacy, undergraduate/postgraduate etc.
- Methodology/methods
- Specific competencies addressed<sup>16</sup>
- Assessment practices<sup>16</sup>
- Instructional methods<sup>16</sup>
- Learning experiences<sup>16</sup>
- Overall goals<sup>16</sup>
- Theoretical roots/pedagogical underpinning<sup>16</sup>
- Outcome measures with reference to Kirkpatrick's levels<sup>17,18</sup>
- Transferable learning between professions will be highlighted
- Other key findings relating to the scoping review question

The extraction form will be piloted initially by two members of the review team (HG, PW), on a small number of diverse studies, in discussion with the third experienced team member (TP), to ensure that all relevant data is captured. It is expected that this process will be iterative and that updates may be made to the form during the data extraction. Any amendments will be recorded. The degree of agreement reached by independent coders will be reported in terms of Cohen's Kappa value.

Once extracted, findings will be reported in terms of study characteristics, organised in tables mapping the particulars of studies identified, with specific emphasis on teaching methods and learning supports utilised, together with transferable learning. This will allow categorisation of the various approaches to teaching and learning, to facilitate the narrative discussion of the body of literature explored. Inconsistencies or disagreements in coding between the reviewers (HG, PW) will be discussed with a third experienced reviewer (TP) until a consensus agreement is reached. 10% of randomly selected coded papers will be reviewed at initiation by a moderator (TP) to ensure accuracy and support inter-rater reliability, and adjustments to the extraction and coding process will be made if required based on this review.

## **7. Synthesis of extracted evidence:**

Following extraction of data as above, the findings will be reported according to Arksey and O'Malley's reporting framework for scoping reviews<sup>14</sup>. In alignment with guidance for scoping review procedures, appraisal of study quality is not routinely performed and thus will not be conducted as part of this review<sup>12</sup>.

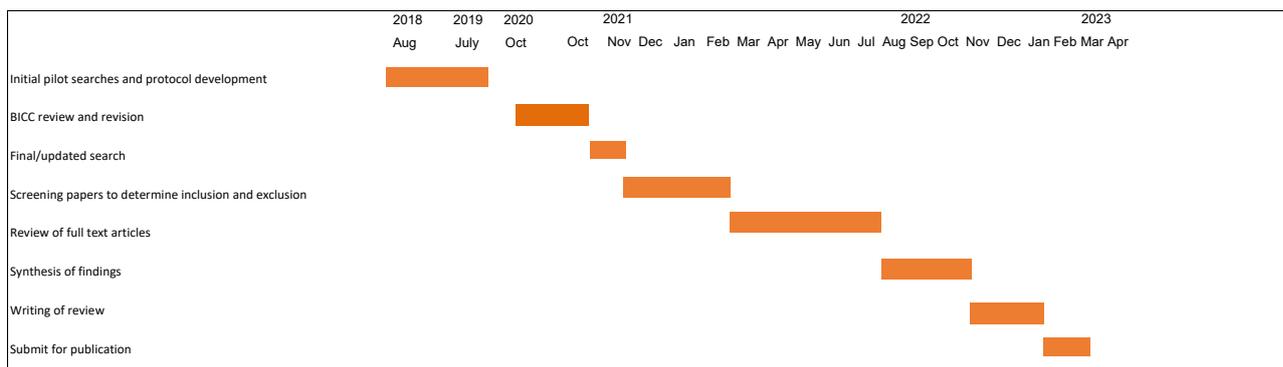
It is envisaged that studies will be grouped thematically according to the types of educational intervention described. Study findings will be tabulated, mapping the characteristics of the interventions according to characteristics including population, setting, methods and outcomes. The exact format will be determined by the core of references, so that ease of reference and utility can be maximised for educators in the field. Given that prescribing competence is an issue, the core components of the interventions will be reported (as far as we are able from the studies included) according to the reform characterisation of competency based medical education, outlined as part of the development of a framework for evaluating implementation of competency based health

professions education<sup>16</sup>. This will include competencies, instructional methods, learning experiences, overall goals and theoretical roots. In addition, it is anticipated that the Kirkpatrick's hierarchy of training evaluation will be utilised as a means to report the outcomes in terms of teaching effectiveness.<sup>16</sup> We anticipate that educational outcomes will be identified and classified iteratively and added to the coding sheet. We will commence by considering a maximally variant sample of studies to inform our views of potential educational outcomes and map them to the modified Kirkpatrick framework. The level of the impact will be extracted and coded and the outcomes of the intervention will be summarised<sup>17,18</sup>. The review process and results will be summarised and displayed in a standard PRISMA diagram, along with a narrative summary and conclusions.

#### **8. Translation into practice:**

Through the development of this BEME scoping review, we aim to identify the major methods of teaching prescribing in health professions education. The incidence of prescribing error and the predominance of this among junior and newly qualified doctors, suggests that their prescribing competency is not sufficiently addressed by their undergraduate medical education- the results of this review aim to provide an evidence base on which to build decisions for educationalists. Current recommendations suggest that there are gaps and deficiencies in prescribing education at undergraduate level, and that there is benefit to continued focused instruction and learning support in prescribing at postgraduate level<sup>4</sup>. This review will allow effective approaches for teaching and learning globally to be mapped, in alignment with a competency-based framework, in order to define the areas of contemporary educational activity and outcomes in this area. Examples of innovative practice that can provide transferable learning will be highlighted. In performing this review it is also envisaged that gaps in the evidence will be identified that may inform future educational research in the field. It is hoped that this study will inform health care educators, health care policy makers, those involved in future curriculum planning, enhancement of educational programmes and novel educational development in the area of prescribing, at undergraduate and postgraduate training levels.

### 9. Project timetable:



### 10. Conflict of interest statement

There are no conflicts of interest to declare, academic, institutional, political, financial, personal or otherwise.

### 11. Plans for updating the review

Future updates may be undertaken on a ten yearly basis as required.

### 12. Changes to the protocol

If changes to the protocol are required, e.g. adjustments to inclusion/exclusion criteria these will be carefully recorded and reasons for the changes documented, including recording of the reasoning and the date upon which these changes took place. Such changes to the protocol would be submitted to BEME for approval.

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