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**An exploration of curriculum initiatives to enhance
research skills acquisition by medical students: a
mixed methods study**

Crea Carberry

MB BCh BAO, MMedSc (Clinical Education), FRCGP, DCH, DRCOG

Student number: 94022674

The thesis is submitted to University College Dublin in fulfilment of the requirements for the degree of Doctor of Medicine in the College of Health and Agricultural Sciences.

School of Medicine

Head of School: Prof Michael Keane

Principal Supervisor: Prof Walter Cullen

Doctoral Studies Panel: Prof Walter Cullen, Prof Gerard Bury and Prof Jason Last

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Glossary of abbreviations

AAMC:	The Association of American Medical College
AMEE:	The Association for Medical Education in Europe
BSc:	Bachelor of Science
CRF:	Doris Duke Clinical Research Fellowship Programme (United States)
EBM:	Evidence Based Medicine
ELT:	Experiential learning theory
EPAs:	Entrustable professional activities
GEM:	Graduate entry medicine programme
GMC:	General Medical Council
GP:	General practitioner
LIC:	Longitudinal Integrated Clerkship
MB:	Bachelor of Medicine
MD:	Doctor of Medicine
MEDINE:	Thematic Network on Medical Education in Europe
MSc:	Master of Science
MSRF:	Medical Student Research Fellowship (United States)
NIH:	National Institutes of Health (United States)
PhD:	Doctor of philosophy
PICO:	Population, intervention/exposure, comparison, outcome analysis
PRISMA -SCR:	Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews
RSE:	Research self-efficacy
SCCT:	Social cognitive career theory
SCT:	Social cognitive theory
SLT:	Social learning theory
SSCs:	Special Study Components
SSMs:	Special Study Modules
STARSurg:	The Student Audit and Research in Surgery (STARSurg) collaborative
TBE:	Theory Based Evaluation
WFME:	World Federation for Medical Education

Abstract

Background

There are a decreasing number of physician scientists at a time when there is an increased demand for evidence-based medicine and research. Studies have shown that involving medical students in active research in their undergraduate careers increases the likelihood that they will be research active after graduation. A systematic review in 2020 found there was a lack of consensus on expected research skills of medical students on graduation. Benefits and disadvantages to medical students performing research are discussed in the literature without definite evidence of a net benefit to students and so this study was carried out to explore in more detail participation in 'original research' in pre-registration medical degree programmes and in particular, in General Practice.

Aims

1. To describe educational activity that involves students actively conducting research on pre-registration medical degree programmes.
2. To explore the evidence supporting medical student involvement in research in curricula.
3. To investigate the acceptability and likely effect on student research self-efficacy of one activity – the introduction of a clinical audit as part of a general practice placement.

Methods

A scoping review was undertaken to describe the research options available and to explore the evidence supporting medical student involvement in 'original research' in curricula. A mixed methods investigation was undertaken to investigate the acceptability and likely effect on student research self-efficacy of introducing a clinical audit as part of

a general practice placement. This was underpinned by social cognitive theory as the theoretical framework. Two student questionnaires (before and after the audit initiative), a GP survey after the initiative and semi structured interviews of a purposeful sample of the participating GPs were used in this strand. In addition, the Medicine Subgroup members of the Health Sciences Group of the Universitas 21 (U21) network of universities were consulted to get an international perspective on the findings of the scoping review and to describe the research options available to students in their respective medical schools. The Kirkpatrick approach was used to evaluate outcomes. The data from the scoping review, GP survey / semi-structured interviews, student surveys and U21 medical school survey were compared and triangulated.

Results

Following triangulation of the data, the overall finding was that there was a 'positive sentiment' to medical student participation in research and a deeper understanding of the complexities of medical students doing research in General Practice.

Scoping review

The scoping review described the research opportunities available with elective research projects being the most common described in the selected studies. The studies included in this review reported more positive than negative outcomes in relation to active student research activities but with some issues with the quality of included studies. Positive findings included research output, research self-efficacy and career development. At the same time, cost, mentor availability, student motivations for doing research, potential detrimental effects of time out from clinical studies and quality of medical student publications were reported. A knowledge gap identified by the review was how the effectiveness of the research experiences offered to medical students might be evaluated.

Audit Initiative

The third aim of this thesis was to investigate the acceptability and likely effect on student research self-efficacy of introducing a clinical audit as part of a general practice placement. With regards to research self-efficacy there was a statistically significant difference in the group who completed the audit in their confidence in the knowledge of the audit cycle and the difference between research and audit ($p=0.001$) but no statistically significant difference in other research skills or difference based on demographics / whether they had a postgraduate degree. Parallel to the audit initiative, although 26 (45%) of the respondents had engaged in other research activities over the year, there was a limited increase in research output. Regarding Kirkpatrick's reaction criteria, the students felt they were adequately prepared to do an audit by the academic team in UCD and they felt supported by the GPs in the general practices. Time and workload were the main constraints discussed by students. There were some references to negative GP modelling. There was a relatively large attrition rate from the audit study with ultimately 42 respondents confirming they had taken part (92/104 students had initially signed up to do an audit).

GP perspective-acceptability

The key findings in relation to the participating GPs were that 22 (96%) of the responding GPs said they would be happy for students to do future audits in their practice and importantly 17 (71%) of the GPs felt that the student audits had a positive impact on patient care. There was some discordance in what the GPs reported in the quantitative arm (largely positive) and the qualitative arm (more negative at times). Some barriers to accommodating future student audits and research in general practice were discussed. These included time, workload, student engagement issues, GP confidence in their research skills, personal agency in the research, space / IT access and data protection concerns.

U21 HSG Consultation Survey

All schools had at least one research option described in the scoping review. Overall, there was consensus that mandatory intercalated degrees were ranked as the highest quality research option but were felt to be the least feasible. There was no consensus as to whether research should be mandatory or optional.

Conclusion

With regards to the audit initiative, it was found to be acceptable and useful in helping students learn about audit skills, patient safety and real-world prescribing. Retention was a challenge. The triangulation of data from the scoping review, student, GP and U21 surveys found a positive sentiment towards active participation by medical students in research but identified the lack of empiric data examining effectiveness as an important knowledge gap.

Statement of Original Authorship

I hereby certify that the submitted work is my own work, was completed while registered as a candidate for the degree stated on the Title Page, and I have not obtained a degree elsewhere on the basis of the research presented in this submitted work.

Chapter 1: Introduction

1.1 Background to the research

There are currently a decreasing number of physician scientists at a time when there is an increased demand for evidence-based medicine and research (Sung *et al.*, 2003; Cooke *et al.*, 2006; Jain *et al.*, 2019). Medical schools have a key role to play in this regard, as studies have shown that involving medical students in active research in their undergraduate careers may increase the likelihood that they will be research active after graduation. Indeed, a 2015 systematic review found that medical student participation in research was associated with improved short- and long- term scientific productivity, more informed career choices and improved knowledge about-, interest in- and attitudes towards research (Amgad and Shash, 2015). In 2003, Solomon *et al.* published a review of 25 years of National Institute of Health (NIH) sponsored summer research projects in years one and two, at two medical schools in the United States. Although there was a low response rate (approximately 10% between the two medical schools), long term follow up of 118 former student respondents in one school found that 65% completed further research after their summer research projects and 42% were currently engaged in research (Solomon *et al.*, 2003). A Dutch study found that students who participated in extracurricular research had more publications pre- and post-graduation than their peers who did not (Reinders, Kropmans and Cohen Schotanus, 2005).

Regulators of medical curricula encourage research skills. For example, the Medical Council of Ireland recommends '*research exposure and opportunities*' in the 'Curriculum design and delivery section' of its undergraduate guidelines which are aligned to the standards recommended by the World Federation for Medical Education (The Medical Council, 2013; WFME, 2015). The WFME guidelines and recommendations incorporate international best practice where medical degree programmes are concerned. The

WFME global medical education expert consensus on minimum requirements (basic standards) and standards for quality improvement state:

- **Basic standard:** The medical school must teach, throughout the curriculum, the principles of scientific method, including analytical and critical thinking, medical research methods, and evidence-based medicine.
- **Quality development standard:** The medical school should include elements of original or advanced research in the curriculum. Elements of original or advanced research would include obligatory or elective analytic and experimental studies, thereby fostering the ability to participate in the scientific development of medicine as professionals and colleagues. This current work will focus on this WFME quality development standard.

In 2012, the Association for Medical Education in Europe (AMEE), in their guide '*Developing research skills in medical students*', recommended that every medical student must understand research methods and the benefits that research brings to their profession (Laidlaw *et al.*, 2012). This guide concluded by stating that understanding of research can be greatly enhanced by encouraging the active participation of students in research activities, which correlates with the WFME guidelines. Despite the WFME and AMEE guidelines, a systematic review in 2020 found there was a lack of consensus on expected research skills of medical students on graduation which was, in part, attributed to the diversity of teaching programmes among medical curricula (Lee, Hu and Bilszta, 2020). In fact, worldwide, there are approximately 2600 medical schools (Duvivier *et al.*, 2014).

Here, flexibility in curricula was recommended by The Commission on Education of Health Professionals for the 21st Century in 2010 to adapt to local and community needs (Frenk *et al.*, 2010). Indeed, the WFME guidelines were updated in 2020 to allow a more principles-based approach which allows each agency or institution to make its own version of the basic standards that is contextually appropriate (WFME, 2020).

However, one area that appears to be unstructured and highly variable between medical schools is that of medical student participation in research (Amgad *et al.*, 2015).

A 2015 curriculum review at University College Dublin's School of Medicine indicated that not all medical students were getting the opportunity to be involved in active research. In the United States, 3% of the medical student population undertake structured MD/PhD programmes (Amgad *et al.*, 2015) and many more participate in other research opportunities such as scholarly concentrations (Green *et al.*, 2010). However, despite this, it is difficult to put a figure on the number of students who don't get the opportunity to carry out 'original research'. For the purposes of this study, 'original research' would include activities which allow students to achieve the 'doing research competencies' found in the consensus survey of the Thematic Network on Medical Education in Europe (MEDINE2) in '*Tuning of Research Competencies in Europe*' for the primary medical degree component of the Bologna Cycle (Marz *et al.*, 2013). The following 'doing research' competencies were ranked the most important by survey respondents:

1. Analyse research findings (qualitative or quantitative data).
2. Apply ethical principles and analysis to research, seeking ethical approval where appropriate.
3. Select and carry out appropriate statistical tests and interpret the results.
4. Formulate a research question as a hypothesis and design experiments to test it.
5. Present research results to peers, e.g., in scientific meetings.
6. Contribute effectively to a research team.
7. Choose the appropriate qualitative or quantitative research method.
8. Carry out research on medical practice.

In the first edition of 'Tomorrow's Doctors' in 1993, the UK General Medical Council (GMC) advised; '*As a general guide we would expect approximately a third of the total*

undergraduate programme to be devoted to Special Study Modules [SSMs] ... that at all stages of the course students will be engaged in some work outside the core syllabus...'(GMC., 1993, revised 2003, revised 2009; Riley *et al.*, 2013). Special Study Modules (later Special Study Components) were intended to provide all students with opportunities to select and study areas of particular interest, and predominantly involve project work (Laidlaw *et al.*, 2012). There was variability in how different medical schools incorporated this guidance into their curricula and how many students did 'original research' as part of this (Laidlaw, Guild and Struthers, 2009; Murdoch-Eaton *et al.*, 2010; Riley *et al.*, 2013).

Active involvement in research may be a positive component of undergraduate medical curricula (Jones and Singh, 2013; Amgad *et al.*, 2015), with benefits that may outweigh negative considerations, as described by Simunovic. Simunovic suggested that the majority of medical schools may emphasise student research as an important part of their undergraduate curriculum but added that few attempts to explain the rationale for such an approach have been made (Simunovic, 2008). Pragmatic considerations of research participation include their impact on medical school applications, their effect on the medical curriculum, their costs, the availability of mentors, and their effects on the school's educational culture (Parsonnet *et al.*, 2010). Cheung questioned the benefits of active research to students and some of their motivations behind doing it (Cheung, 2018). He discussed findings by Pathipathi *et al.*, looking at student motivations for doing research (Pathipathi and Taleghani, 2016). They surveyed students in five medical schools in the United States that have highly regarded research programmes. Of the 328 respondents, the most common reasons students take years off for research were found to be: "increase competitiveness for residency application" (32%), "time to pursue other opportunities" (24%), and "academic interest" (23%). Issues also discussed by Cheung in his commentary included relatively low publication rates of students in 'good' journals and the pressure of academic publishing for medical students from a student's perspective. There was no discussion in this article as to what the criteria to decide what

'good journals' are. The benefits of student medical journals such as the Student BMJ were also discussed but so too was a possible compromise in the quality of articles because of the need to accommodate inexperienced researchers.

Given the potential benefits and disadvantages of medical student research, this current study was carried out to examine what options are available to engage medical students in elements of 'original research' and to explore the evidence supporting medical student research in curricula.

1.2 Research question

"What insights arise from a mixed methods exploration of curriculum initiatives aimed at enhancing research skills in medical students?"

1.3 Aims and objectives

Aims

1. To describe educational activity that involves students actively conducting research on pre-registration medical degree programmes.
2. To explore the evidence supporting medical student involvement in research in curricula.
3. To investigate the acceptability and likely effect on student research self-efficacy of one activity – the introduction of a clinical audit as part of a general practice placement.

Objectives:

1. Conduct a scoping review to map the 'original research' options available and to explore the evidence supporting medical student research in curricula.
2. Design and offer an 'original research' option for students (general practice clinical audit) at UCD School of Medicine, to examine uptake and to conduct pre- and post-

clinical audit surveys of participating students to measure changes to research self-efficacy and to examine acceptability issues.

3. Survey and interview participating GPs in the 'original research' option to explore acceptability issues.
4. Consult the medicine subgroup members of the Health Sciences Group of the Universitas 21 network of universities to consider the findings of the scoping review and describe the research options available to students in their respective medical schools.
5. Compare and triangulate the data from the scoping review, GP survey / semi-structured interviews, student surveys, and U21 medical school survey.

1.4 Rationale for using clinical audit

Clinical audit is a quality improvement process that seeks to improve patient care and outcomes through systematic review of care against explicit criteria and the implementation of change. Aspects of the structure, processes, and outcomes of care are selected and systematically evaluated against explicit criteria. Where indicated, changes are implemented at an individual, team, or service level, with further monitoring used to confirm improvement in healthcare delivery (NICE, 2002). Research involves the attempt to extend the available knowledge by means of a systematically defensible process of enquiry (Twycross and Shorten, 2014).

However, although there are definite differences between the two (Hughes, 2005), students involved in clinical audit can learn in a systematic way about 'research skills' such as sampling, data collection and analysis (simple descriptive statistics), dissemination of knowledge, and reflective practice, in addition to audit skills.

It was decided to design and offer a general practice clinical audit rather than other forms of research projects because of the pragmatic availability of general practice placements into which this initiative could be incorporated and because an already full graduate entry curriculum offered no other significant opportunities. Further reasons for focusing on this

area included a literature review that had demonstrated that participation of general practitioners in research projects is mixed, with various barriers being cited (Gray, Woodward and Carter, 2001; Rosemann and Szecsenyi, 2004; Hummers-Pradier *et al.*, 2008; Johnston *et al.*, 2010; Symonds, Trethewey and Beck, 2020) and a lack of published research by students doing research in general practice - see Chapter 2 (literature review of research and audit in general practice). On the other hand, in Ireland, all doctors must do an annual audit as part of their maintenance of professional competency schemes and so GPs have experience of this (The Medical Council Ireland).

It was also noted that it can be a complex process to introduce change in any medical curriculum (Bland *et al.*, 2000), particularly in general practice. Implementing new practices and / or changing existing practices in organisations, services and systems require changes in individual and collective behaviour. Indeed, changing behaviour requires an understanding of the influences on behaviour in the context in which they occur (Atkins *et al.*, 2017). In relation to introducing change to general practice, in 2019, two separate articles outlined the challenges in trying to introduce longitudinal integrated clerkships (LICs) in general practice. The first article outlined the significant workload involved in a pilot study of a 40 weeklong comprehensive LICs in Dundee University School of Medicine in 2016 for seven students (Bartlett *et al.*, 2019), with the second article discussing the evolution and challenges of LICs in general practice (Harding, 2019). The latter described an introductory pilot for four medical students in Cambridge in 1993 to a more recent 2016 typology study by an international collaborative which looked at the processes and outcomes of LICs across 44 medical schools in seven countries (Oswald *et al.*, 1995; Worley *et al.*, 2016; Harding, 2019).

A clinical audit was thus chosen as the 'original research' option to explore in this current study, as it was considered that contextual factors such as GP familiarity with audit and the difficulties associated with curriculum change in GP, made the audit the preferred option.

1.5 The researcher

I have been a lecturer in general practice in University College Dublin since 2010. I have a Masters degree in clinical education and have gained considerable experience in medical education, especially curriculum design and delivery. I was the UCD representative on the (Irish) National Working Group which developed a National Undergraduate Curriculum for Chronic Disease Prevention and Management (Part 2 Self-management Support for Chronic Conditions). This was a collaboration between the Health Service Executive and Higher Educational Institutions in Ireland (Sinclair *et al.*, 2022). I was responsible for overseeing the communication unit of this curriculum. In 2015, a review of the medical degree programme curriculum was overseen by me and Prof. Last in UCD, as part of a university wide curriculum review and enhancement process (Teaching and Learning University College Dublin, 2015). Gaps were identified in the two programme outcomes in relation to research, Outcomes 3 and 5. While Programme Outcome 3 “*critically evaluates information and its sources and apply this appropriately in their decision making*” was satisfactorily achieved in core modules, Programme Outcome 5: ‘*contribute to the creation, dissemination application and translation of new medical knowledge*’ was not achieved in any core medicine modules. A personal learning need I identified from this review was that I was not sure what (if any) changes might benefit the UCD curriculum. This led me to this MD thesis, to explore the options available to engage medical students in elements of ‘original research’ and to review the evidence supporting an emphasis on medical student involvement in ‘original research’ in curricula. From a personal perspective, using Schon’s ‘reflection on action’ (Schon and DeSanctis, 1986), I started this MD thesis mid-career, having up to that point, concentrated more on clinical and teaching commitments. For both clinical practice and medical education, I was very interested in being an ‘evidence-based practitioner’ and ‘using research’. However, upon reflection, was there a slight personal reluctance in not prioritising ‘original research’? Did this stem from an uncertainty about the benefits of being involved in active research? As a practising GP, I am aware of the increasing demands and the changing dynamic of general practice in the last ten years,

which might influence my interpretation of the findings of this study. By exploring the evidence behind options to involve medical students in research, I also hope to gain some personal insights into this. I will also consider how my position as a teacher on this course could influence my assessment of the educational intervention. I will bring my unique experience and perspective to the review process, allowing me to assess the intervention's real-world effectiveness. However, implicit biases in my teaching philosophy and prior experience may influence my evaluation.

1.6 Research Paradigm

Paradigms are overarching frameworks that guide how research is conducted, including the methods used and the interpretation of results.

Bunniss and Kelly (2010) outline four research paradigms in medical education research; Positivism, Post-positivism, Interpretivism and Critical theory and discuss the assumptions about ontology, epistemology, methodology and the related research methods for each of these perspectives (Bunniss and Kelly, 2010).

My ontological position would be on the positivist spectrum (reality is static and fixed, the world is ordered according to an overarching objective truth) but with an epistemological position that objective knowledge of the world is not necessarily fully accessible and thus seeks to establish 'probable' truth which would fit with the post-positivism research paradigm.

Post-positivism is a philosophical stance that evolved from positivism, acknowledging that while objective reality exists, our understanding of it is inherently imperfect and influenced by our perspectives (Guba, 1990). For example, my personal biases in relation to my uncertainty about the benefits of being involved in active research and the role of research, in general practice, may influence my interpretation of findings.

Post-positivism can bridge the gap between the strict objectivity of positivism and the subjective interpretations of constructivism.

The methodology of post-positivism has an emphasis on well-defined concepts and variables, controlled conditions, precise instrumentation and empirical testing (Bunniss and Kelly, 2010). Quantitative and qualitative methods are systematically gathered and analysed from representative samples. It allows for triangulation of data from quantitative and qualitative methods to gain a more comprehensive understanding of the research area.

1.6.1 Application of post-positivism in this research

The research question in this thesis is framed as "What insights arise from a mixed methods exploration of curriculum initiatives aimed at enhancing research skills in medical students?". This is a relatively broad topic area, with potential biases in understanding reality. As such, a positivist research question (typically specific, focused, and aims to uncover objective, measurable facts through empirical data) would not cover the heterogeneous nature of medical student research. The wording of the question reflects, I believe, the complexity and context-dependence of the various curriculum initiatives that endeavour to enhance research skills in medical students, thereby allowing for the incorporation of multiple perspectives.

The mixed methods approach, combining the qualitative and quantitative data, allows for a more robust analysis. Triangulation is used in data analysis to enable a more nuanced interpretation.

1.6.2 Relating Post-Positivism to the Theoretical Framework (Social Cognitive Theory)

Social Cognitive Theory (SCT) is the theoretical framework chosen for this research (see Chapter 2D). Social Cognitive Theory (SCT), developed by Albert Bandura, emphasises the importance of observational learning, imitation, and modelling in behaviour acquisition. It proposes that behaviour is influenced by the dynamic interplay of personal factors, behaviour, and environmental factors—a concept known as reciprocal

determinism. Key components include self-efficacy, which refers to individuals' belief in their ability to succeed in specific situations, and the role of cognitive processes in interpreting and responding to environmental stimuli (Bandura, 1986).

Post-positivism and SCT both stress the importance of context. In SCT, the concept of reciprocal determinism highlights how behaviour is shaped by the environment and personal factors, while post-positivism acknowledges that research findings are influenced by contextual factors and are not universally generalisable.

Post-positivism's acknowledgment of the influence of researchers' perspectives aligns with SCT's focus on how individuals interpret and process information.

1.7 Publications, to date, of this work

1. *Curriculum initiatives to enhance research skills acquisition by medical students: a scoping review*

C Carberry, G McCombe, H Tobin, D Stokes, J Last, G Bury, W Cullen

BMC Medical Education 21 (1), 312

2. *Is it feasible to learn research skills in addition to audit skills through clinical audit? A mixed methods study in general practice*

C Carberry, I Callanan, G McCombe, H Tobin, G Bury, J Last, W Cullen

Irish Journal of Medical Science (1971-), 1-13

1.8 Presentations, to date, of this work

1. *Value of Research in an Undergraduate Curriculum.* Literature review presentation and member of panel discussion on undergraduate research.

Universitas 21 Health Science Group Conference Glasgow 2019

2. *Curriculum initiatives that enhance research activity by medical students: focus on non-intercalated degree options.*

INHED Annual Scientific Meeting Trinity College Dublin February 2020

Chapter 2: Literature review and theoretical framework introduction

This literature review chapter is divided into four subchapters.

As this research involves a curricular innovation, it starts (Chapter 2a) with a brief narrative review on curriculum design and evaluation, with a discussion on clinical curriculum implementation, providing a rationale as to why Kirkpatrick's evaluation model (Kirkpatrick and Kirkpatrick, 2016) was chosen to evaluate outcomes in this thesis.

Chapter 2b outlines a brief narrative review of student research and audit in general practice.

Chapter 2c contains a scoping review mapping the options and evidence available for medical student involvement in research.

Chapter 2d is a subchapter exploring various theoretical frameworks available to evaluate the effectiveness of the audit initiative. It also provides a rationale for the choice of social cognitive theory (SCT) with its theoretical components of self-efficacy and modelling in particular as the theoretical framework for this research (Bandura, 1986).

Choice of Literature Review

A narrative review was chosen for the literature review on curriculum design and student research in general practice (Chapters 2a and 2b) to provide a meaningful synthesis and interpretation on these broad topic areas (Greenhalgh, Thorne and Malterud, 2018). Narrative reviews do not offer an evidence-based synthesis for focused questions but, rather, a readable, relevant synthesis of a diverse literature (Sukhera, 2022). By the nature of the research question to explore the evidence surrounding medical student involvement in research in curricula, a more evidenced based synthesis was required for

this part of the literature review (Chapter 2c). The options available included a systematic review or a scoping review. Systematic reviews can be broadly defined as a type of research synthesis that are conducted by review groups with specialised skills, who set out to identify and retrieve international evidence that is relevant to a particular question or questions and to appraise and synthesise the results of this search to inform practice, policy, and, in some cases, further research (Munn *et al.*, 2018).

In contrast, scoping reviews allow preliminary assessment of potential size and scope of available research literature (Arksey and O'Malley, 2005). A scoping review is defined as “a type of research synthesis that aims to map the literature on a particular topic or research area and provide an opportunity to identify key concepts; gaps in the research; and types and sources of evidence to inform practice, policymaking, and research” (Daudt, Van Mossel and Scott, 2013, p. 8). A scoping review of a body of literature can be of particular use when the topic has not yet been extensively reviewed or is of a complex or heterogeneous nature. Scoping reviews are commonly undertaken to examine the extent, range, and nature of research activity in a topic area; to determine the value and potential scope and cost of undertaking a full systematic review; to summarise and disseminate research findings; and to identify research gaps in the existing literature (Pham *et al.*, 2014). A scoping review was thus chosen because of the heterogeneous nature of the topic and as the research question involved an exploration of the evidence to identify certain characteristics / concepts in medical student research and to map, report and discuss these characteristics / concepts, rather than answer precise questions (Munn *et al.*, 2018).

Chapter 2A: Narrative review on curriculum design and evaluation

The word *curriculum* originated in classical Latin where the original meaning was 'running' or 'racecourse'. In '*Curriculum Development for Medical Education*', Thomas et al. define a curriculum as a 'planned educational experience... which encompasses a breadth of educational experiences from one or more sessions on a particular subject to a yearlong course, from a clinical rotation or clerkship to an entire training programme' (Thomas *et al.*, 2016). The blueprint for modern medical education was laid down in the Flexner report of 1910 (Flexner, 1910), where Flexner's fundamental argument was that medical education should be rooted in the best science of the time and in clinical experiences that train students to meet the pressing health needs of the population (Maeshiro *et al.*, 2010).

Since then, there have been various curriculum models. Prideaux describes two main curriculum models: a prescriptive model, which indicates what curriculum designers 'should do' and 'how to create a curriculum', and a descriptive model, which 'describes what curriculum designers actually do' and 'what a curriculum covers' (Prideaux, 2003).

In medical education, prescriptive curriculum models are more commonly used than descriptive models. One of the most well-known prescriptive models that Prideaux discusses is that of the 'objectives model', which originated in the 1949 work of Ralph Tyler (Tyler, 1949).

Tyler's work was followed by Bloom who developed a taxonomy to categorise the levels of reasoning skills required in classroom situations (Bloom, 1956). They were classified into knowledge, skills and attitudes. In the 1970s, Gagne developed a model of instructional design, a processing model for the mental events that occur when adults are presented with various stimuli. It focuses on learning outcomes and how to arrange specific instructional events to achieve those outcomes (Gagne and Briggs, 1974; Khadjooi, Rostami and Ishaq, 2011).

A more modern prescriptive model is that of 'outcome-based education'. In 1994, in his publication for the American Association of School Administrators, William Spady defined it as follows: "Outcome-based education (OBE) means clearly focusing and organizing everything in an educational system around what is essential for all students to be able to do successfully at the end of their learning experiences" (Spady, 1994, p. 12). In the healthcare education literature, discussions about outcomes first appeared at the end of the 20th century (Myer, 1999; Harden, 1999).

In relation to this thesis, the 2015 WFME standard, in relation to participation in research, would be considered a prescriptive model (WFME, 2015). The updated 2020 WFME guidelines, however, do allow more flexibility for medical schools, in terms of outcomes. In Section 2.1 on Intended Curriculum Outcomes, the 2020 WFME states that, 'The school has defined the learning outcomes that students should have achieved by graduation, as well as the intended learning outcomes for each part of the course'. It goes on to state that outcomes can be set out in any manner that clearly describes what is intended, in terms of values, behaviours, skills, knowledge, and preparedness for being a doctor (WFME, 2020).

In recent times, many graduate medical education programmes have started to consider and adopt entrustable professional activities (EPAs) in their competency frameworks (ten Cate, 2013). There has been some work looking at the option of introducing EPAs into an undergraduate medical curriculum (Chen, van den Broek and ten Cate, 2015). In 2018, ten Cate described the University Medical Center Utrecht's experience of introducing an EPA based undergraduate curriculum (ten Cate *et al.*, 2018). The Utrecht curriculum contains a 'research term' in the final 3 years (Master) of the six-year programme.

How research skills and basic science principles map in entrustable professional activities needs further work, however. The Association of American Medical College, AAMC, in 2009, produced a document which mentions the global competencies that

students should develop during basic undergraduate training in any itinerary of studies in health or life sciences. Among them was Competency E2, *“Demonstrate understanding of the process of scientific inquiry, and explain how scientific knowledge is discovered and validated”*, which is linked to research skills (Association of American Medical Colleges, 2009). In their 2020 work, Fernández et al. developed an EPA-competency matrix to address competency E2, as described by the Association of American Medical Colleges in 2009 (linked with research skills) (Fernández and Costa, 2020).

How clinical curricular activities are implemented varies and it can be difficult to find frameworks to guide implementation. In 2016, Hawkins et al. discussed concerns and challenges to the implementation of Competency Based Medical Education (CBME) frameworks which included increased administrative requirements; the need for faculty development; the lack of models for flexible curricula; and inconsistencies in terms and definitions (Hawkins *et al.*, 2015). They felt dialogue with key stakeholders to be most important. In fact, in their 2018 work discussing the role out and implementation of a five core EPA based clinical curriculum in Utrecht (ten Cate *et al.*, 2018), ten Cate and his co-authors advise that the development of the EPA framework would not have been possible without a continuous dialogue with the clinical teachers involved in coordinating clerkships in the trenches.

With regards to the implementation of research into medical curricula, there is limited data available. In 2016, Maggio et al., in their qualitative study of Evidence Based Medicine (EBM) in 22 US and Canadian medical schools, reported that, although Evidence Based Medicine (EBM) is common in many medical schools, little is known about the challenges medical students face in learning EBM or the educational approaches that medical schools use to overcome these challenges (Maggio *et al.*, 2016). Their article provides medical educators with potential strategies to inform the design of EBM curricula which might be extrapolated to help with the implementation of research into curricula. These include incorporating clinical content into EBM training,

faculty development, spiral curricula to facilitate longitudinal integration of EBM and EBM whole task challenges which would equate with the planning and execution of all the various stages involved in students completing a research project.

Equally, any curricular change needs to be evaluated. Evaluation can be defined as a process of decision making about the object being evaluated and how it compares to some standard of acceptability (Green *et al.*, 1986). Choosing an appropriate model of evaluation depends on several criteria such as the context, the purpose, and the expected outcome of the evaluation (Nouraey *et al.*, 2020). In 2012, Frye and Hemmer produced a comprehensive AMEE Guide on programme evaluation (Frye and Hemmer, 2012). This Guide discusses the theoretical basis around evaluation models and describes four models: experimental/quasi-experimental approach to evaluation; Kirkpatrick's approach; the Logic model; and the Context/Input/Process/Product (CIPP) model. Kirkpatrick's approach is probably one of the best-known evaluation models (Kirkpatrick and Kirkpatrick, 2016). It was created in 1954 by Don Kirkpatrick as part of his PhD dissertation. He described four levels to evaluate programme outcomes (Kirkpatrick, 1996).

- At Level 1, the focus is on the learner's reactions to the programme.
- Kirkpatrick's Level 2 is content evaluation.
- Level 3 measures employees' job performance by determining the extent to which employees (learners) apply their newly acquired knowledge and skills on the job.
- At Level 4, organizations seek business results for their training efforts (Reio *et al.*, 2017).

Potential flaws in relation to Kirkpatrick's model discussed in the literature include that the model is based on three assumptions that may not hold in practice: that each successive level is more informative to the evaluator than the previous one; that each

level is caused by the previous level; and that each succeeding level is correlated with the previous level (Alliger and Janak, 1989; Coldwell and Simkins, 2011).

After consideration of the various curriculum evaluation models, it was decided to opt for the Kirkpatrick approach to evaluate outcomes in this current thesis. The decision was based on several factors:

1. The context - the Kirkpatrick model has been used to evaluate other studies that looked at student research options (Bierer and Chen, 2010; Lee, Hu and Bilszta, 2020).
2. The purpose of this study - with the relatively broad study aims, it was felt that the Kirkpatrick model would allow evaluation of a (relatively) broad range of outcomes.
3. The expected outcome of the evaluation - a preliminary literature review at the initiation stage of the study found that the outcomes were likely to fall within the four Kirkpatrick levels.

Chapter 2B: Narrative review on student research and audit in general practice

In the 2016, the UK Medical Schools Council / Health Education England publication, in relation to promoting general practice careers among medical students, '*Not by chance, by choice*', recommendation 13 states that "All institutions influencing students should collaborate to raise the profile of academic general practice by ensuring all students have access to, and are overtly valued and rewarded, for scholarly activity and visibly supervised by primary care leads" (Wass, Gregory and Petty-Saphon, 2016, p. 10). This study specifically examines one option to engage students in elements of 'original research' in general practice, by getting first year graduate entry medical students to do a clinical audit as part of their general practice placements.

To date, there has been a paucity of published research of students doing research in general practice. There have been some mainly descriptive papers describing initiatives to promote medical student research in primary care / general practice / family medicine (Gonzales, Westfall and Barley, 1998; Ogunyemi *et al.*, 2005; Bonafede, Reed and Pipas, 2009; Burge and Hill, 2014).

In 2014, Mullan *et al.* examined medical student self-perceived research experiences, before and after community research projects, in an integrated research curriculum. They reported a statistically significant improvement in nine out of the ten research areas (Mullan *et al.*, 2014).

Several papers have discussed the possibility of using intercalated degrees to increase interest in research in Primary Care by medical students. Creavin *et al.* described their experience of running a pilot intercalated Masters in Primary Care, an intercalated MPhil (Creavin, Mallen and Hays, 2010), while Jones *et al.* discussed an intercalated BSc in Primary Care from the student and feasibility perspective (Jones, Lloyd and Meakin, 2001; Jones, Singh and Meakin, 2008; Creavin, Mallen and Hays, 2010).

The clinical audit option has been previously reported in general practice (Campion, Stanley and Haddleton, 1992; Morrison and Sullivan, 1993; Morrison and Sullivan, 1997; Wainwright *et al.*, 1999; Gettings *et al.*, 2018), although research skills self-efficacy has not been reported. Chapman *et al.*, in 2015, looked at research self confidence in students pre and post a clinical audit (these audits were done in a surgical setting, not general practice). The authors reported increased confidence in data collection in a clinical setting ($p < 0.001$) and presentation of scientific results ($p < 0.013$). Collaborators also reported an increased appreciation of research, audit, and study design ($p < 0.001$) (Chapman *et al.*, 2015).

Feasibility and acceptability issues of medical students performing a 'research task' (documentation of potential drug interactions with statins) on general practice placements were discussed by Moßhammer *et al.* in 2016 (Moßhammer *et al.*, 2016). They found that the overall assessment of the project by the students was, on average, 'satisfactory' and differed from the assessment by the teaching physicians, which was rated as 'good'. This current study aims to look at student research self-efficacy / self-perceived research and audit experience pre and post the audit initiative, as well as student / GP acceptability issues, and to compare findings to those of Mullan, Chapman, and Moßhammer.

Chapter 2C: Scoping literature review

2.1 Background

There are a declining number of clinician-scientists, which is creating the need for flexible training and research opportunities to ensure their future (Noble *et al.*, 2020). Involving medical students in research may increase the likelihood that they will be research active after graduation (Solomon *et al.*, 2003; Reinders, Kropmans and Cohen Schotanus, 2005; Amgad *et al.*, 2015). Heparin, insulin, the sinoatrial node, and ether anaesthesia are some of the medical discoveries that were made by medical students (Stringer and Ahmadi, 2009). Heparin was first discovered by Jay McLean and William Henry Howell in 1916. McLean was a second-year medical student at Johns Hopkins University who was assisting Howell in the investigation of pro-coagulant preparations (McLean, 1959).

In Chapter 1, the promotion of research by regulators of medical education was discussed. The Medical Council of Ireland recommends '*research exposure and opportunities*' in its undergraduate guidelines based on the standards recommended by the World Federation for Medical Education (WFME, 2015). In the UK, in its *Outcomes for graduates*, the General Medical Council states under the *Clinical research and scholarship outcome* that 'Newly qualified doctors must be able to apply scientific method and approaches to medical research and integrate these with a range of sources of information used to make decisions for care' (General Medical Council, 2018).

In UCD's School of Medicine, a recent review of the medical curriculum was completed as part of a university-wide curriculum review and enhancement process (Teaching and Learning University College Dublin, 2015). Gaps were identified in the two programme outcomes in relation to research, Outcomes 3 and 5. While Programme Outcome 3 (pertaining to the evaluation of source credibility and the application of findings to informed decision-making) was satisfactorily achieved in core modules, Programme Outcome 5 (pertaining to the advancement and dissemination of new medical

knowledge) was not achieved in any core medicine modules. Students can and do take a summer research elective module 'Summer Student Research Awards' (for credit or for audit), in which this outcome can be achieved; however, it is not a core module. UCD also offers an intercalated MSc degree but few students take up this option (School of Medicine University College Dublin, 2024).

Looking at other medical schools in Ireland, three have some mandatory research projects (one at an intermediary stage and two in the final year (School of Medicine University College Cork 2023; School of Medicine University of Limerick, 2024; Royal College of Surgeons in Ireland, 2024). The University of Galway offers summer elective research opportunities, as per UCD (School of Medicine University of Galway, 2024). Trinity College Dublin offers an intercalated MSc but, like UCD, there are small student numbers opting for this (School of Medicine Trinity College Dublin 2023).

In the UK, Special Study Components (SSCs) are offered by medical schools which can involve active research. However, it is unclear if students are aware of the research potential when choosing projects (Murdoch-Eaton *et al.*, 2010). There are also intercalated BSc programmes in many degree programmes but, again, these are not core modules.

Intercalated BSc programmes are also available in Australia, New Zealand, the West Indies, Hong Kong, South Africa, and Canada (Jones and Singh, 2013). Two large programmes in the United States that have sought to engage students in research are the National Institutes of Health (NIH) sponsored Medical Student Research Fellowship Programmes (MSRFs) (Solomon *et al.*, 2003) and the Doris Duke Clinical Research Fellowship (CRF) Programme (Gallin and Blancq, 2005). Examples from Europe include the Norwegian Medical Student Research Programme, which is a Norwegian government led initiative initiated in 2002, in response to a falling number of doctors recruited to conduct medical research in Norway in the 1990s (Hunnskaar *et al.*, 2009). In

the Netherlands, students are required to do full-time individual research projects between years 4 and 6 (Burgoyne, O'Flynn and Boylan, 2010; van Eyk *et al.*, 2010).

In 2012, an AMEE Guide (*'Developing research skills in medical students'*) recommended that every medical student must understand research methods and the benefits that research brings to their profession (Laidlaw *et al.*, 2012). This guide concluded by stating that understanding of research can be greatly enhanced by encouraging the active participation of students in research activities. This correlates with the WFME recommendations.

However, little data has been collated on how medical degree curricula may address this issue. This current scoping review aims to address this knowledge gap by examining options to engage students in elements of 'original research', in terms of 'doing research' rather than 'using research', as discussed by the Thematic Network on Medical Education in Europe (MEDINE2) in *'Tuning of Research Competencies in Europe'* for the primary medical degree component of the Bologna Cycle (Marz *et al.*, 2013).

For this review, both intercalated and non-intercalated degree options were examined because such options are an intrinsic part of some medical degree programmes. Intercalated degree options have been previously reported (Jones and Singh, 2013; Alamri, 2018), but not in the context of what is available or undertaken by students who do not complete an intercalated programme.

Given the potential benefits and disadvantages of medical student research, which were outlined in Chapter 1, a scoping review was carried out to map the options available to promote 'active research', and to examine their distribution and outcomes reported.

2.2 Aims

The primary aim was to describe educational activity that involved students on pre-registration medical degree programmes actively conducting 'original research'. A

secondary aim was to explore the evidence surrounding medical student involvement in research in curricula.

2.3 Methods

The six-stage process developed by Arksey and O'Malley (Arksey and O'Malley, 2005) was utilised to commence a rigorous and methodical search of the current literature. This incorporated their main five-stages and the optional 'consultation' sixth stage which was further developed by Levac et al. in 2010 (Levac, Colquhoun and O'Brien, 2010). A protocol for the process was designed prior to the scoping review.

2.3.1 Stage 1: Identifying the research question

What curriculum initiatives are described in the published literature that involve medical students doing original or advanced research?

2.3.2 The principal focus, context and population

The principal focus of this research was to examine curriculum initiatives that enhance original or advanced research skills acquisition on pre- registration Medical Degree Programmes. For this purpose, Amgad and colleagues' definition of a medical student was adopted, i.e., anyone who is enrolled in the core medical school programme, regardless of programme duration, and whose graduation would guarantee the degree Bachelor of Medicine, Bachelor of Surgery (MBBS) or its equivalent (MD, in the US, for example) (Amgad *et al.*, 2015).

2.3.3 Stage 2: Identifying relevant studies

In the first instance, an initial search of PubMed was conducted, with an analysis of text words contained in the title and abstract, and of the index terms used to describe the article. Search terms were discussed with doctoral panel members and a librarian. This initial search strategy identified 1011 studies, of which 44 were selected to be read in full (see Figure 2- PRISMA -SCR). Then, a second search using all identified keywords and index terms was conducted across all included databases: PubMed, Cumulative Index

to Nursing and Allied Health Literature (CINAHL), PsycINFO, EMBASE, Scopus, Web of Science and ERIC (see Table 1).

Table 1. Refined search terms used

“Active research” OR “original research” OR “research project*” OR “research activit*” OR “research stud*” OR “special study option*” OR “special study component” OR “research elective*” OR “Doing research” OR “research skill*” OR “research competenc*” OR “translational medical research” OR “scholarly activity program*” OR theses OR "Research"[Mesh: NoExp] OR "Translational Medical Research"[Mesh] OR "Academic Dissertations" [Publication Type] OR "Academic Dissertations as Topic"[Mesh]

AND

“Medical student*” OR “student doctor*” OR "Students, Medical"[Mesh]

AND

“concurrent degree*” OR “combined degree*” OR “structured doctoral program*” OR “research degree*” OR “dual degree*” OR “intercalated degree*” OR “intercalated masters” OR “Medical curricul*” OR “Medical Degree Program*” OR “Medical Education” OR “Medical Program*” OR “Medical Degree” OR “MB Program*” OR “MB Degree Program*” OR “Bachelor of Medicine Degree Program*” OR “Bachelor of Medicine Program*” OR “MD Degree Program*” OR “Doctor of Medicine Degree Program*” OR “Doctor of Medicine Program*” OR “Pre-registration Medical Degree Program*” OR “Pre-registration Medical Program*” OR “Bachelor component of Bologna Cycle” OR "Education, Medical"[Mesh:NoExp] OR "Education, Medical, Undergraduate"[Mesh]

2.3.4 Stage 3: Selection of studies

Consistent with the approach adopted by Arksey and O'Malley (Arksey and O'Malley, 2005), initial review of citations in PubMed indicated that the search strategy had identified 967 (1011-44) studies that were subsequently considered not relevant to the research question. As a result, some post hoc criteria were devised, in addition to the original inclusion and exclusion criteria in the protocol, which were then applied to all the

citations to determine their relevance. It was, therefore, an iterative process (see Table 2).

A 'PICO' (population, intervention / exposure, comparison, outcome) analysis was carried out to facilitate identification of studies and to develop the focus and scope of the review.

Dr Carberry reviewed all 342 full text articles deemed eligible for the review. Dr McCombe reviewed 36 of the 342 full text articles. These 36 articles were articles in which Dr Carberry was unsure if they met the inclusion criteria from the protocol. Dr Carberry and Dr McCombe could not reach agreement on whether seven articles should be included in the final review. Clarification was sought from Professor Cullen on these seven articles and agreement on which articles to include in the final review was reached.

Table 2. Inclusion and exclusion criteria

	Inclusion Criteria	Exclusion Criteria
Population	• Medical students • Medical curriculum developers	• Postgraduate and / or non-medical students
Intervention	• Curriculum initiatives that describe elements of original or advanced research as per WFME 2015 definition • Curriculum initiatives that involve data collection by medical students	• Curriculum initiatives that pertain to WFME Basic Standards • Non-MB curriculum initiatives • Student-led Initiatives
Outcomes	• Academic performance • Demonstration of objective active research skills acquisition by the medical students • Feasibility issue discussion • Inspired students to do further research • Objective improvement in students research skills • Output of active research • Report curriculum developers' motivations for active research curriculum initiatives • Report student motivations for doing research • Self-reported active research skills acquisition by the medical students • Sufficient description of the active research initiatives	• Insufficient description of the active research initiatives (i.e., not enough description of the research initiative for it to be reproduced by another medical school)
Study type	• Studies in the published literature in English / French / Spanish	• Studies in other languages apart from English / French / Spanish • Letters / opinion papers

2.3.5 Stage 4: Extracting, mapping and charting the data

After abstract and title screening, 332 papers were selected to be read in full. Having read the articles in full, ten additional articles were selected from reviewing the reference lists of selected studies (“ancestry searching”) (Haig and Dozier, 2003) and a collaborative website listing publications on ‘scholarly concentration programs’ in the United States (Scholarly Concentrations Collaborative, 2015) (342). A total of 222 articles were ultimately excluded after analysis (see Figure 2- PRISMA-SCR). The search process was guided by the PRISMA Extension for Scoping Reviews (PRISMA-SCR) (Tricco *et al.*, 2018). It maps out the number of records identified, included and excluded, and the reasons for exclusions. As this was a scoping review, the literature inclusion was broad. Ultimately, 120 articles were selected for inclusion in this scoping review – 26 were related to intercalated degree options and 94 to non-intercalated degree options (see Figure 1 - PRISMA-SCR).

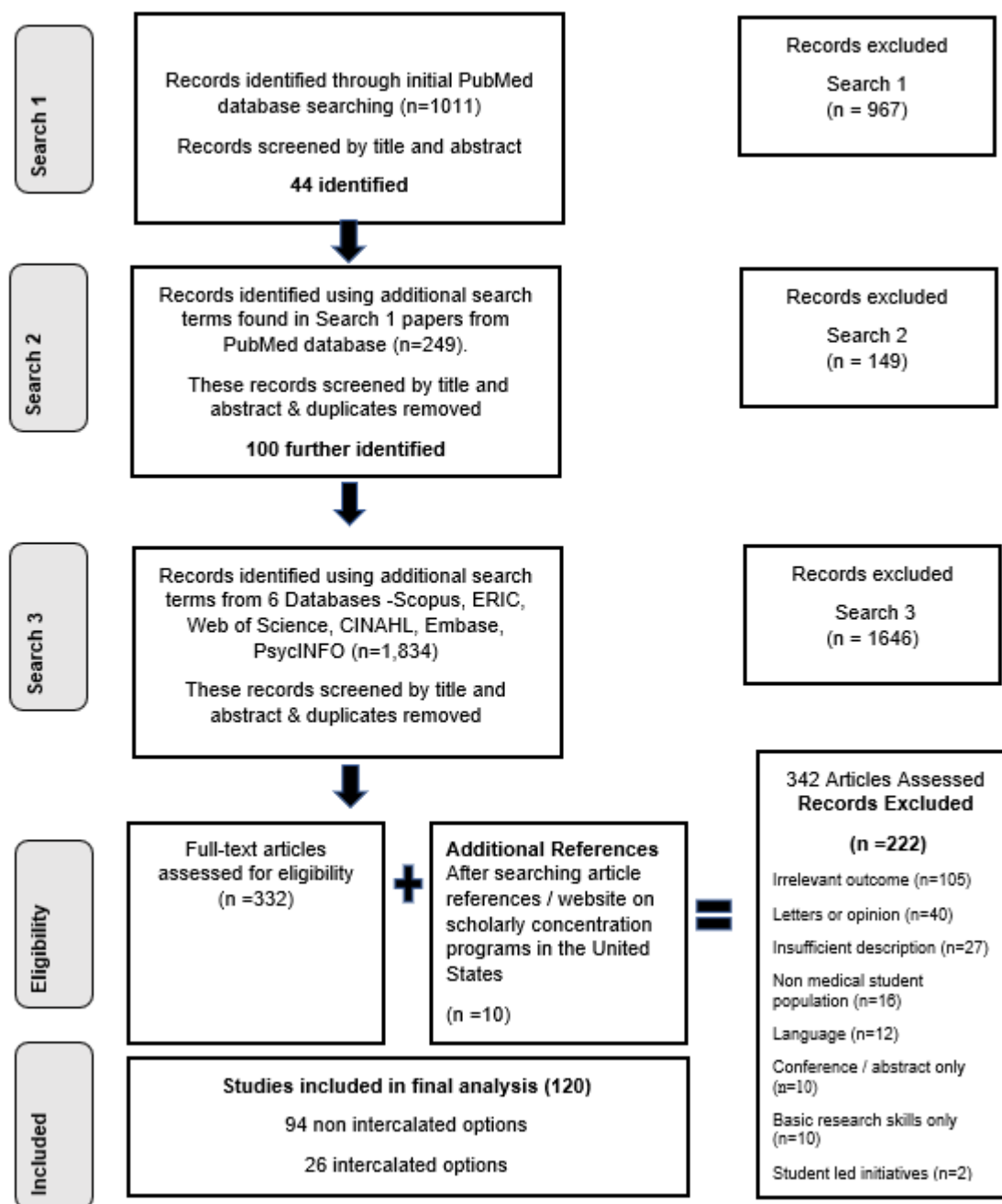


Figure 1. Identification of papers for inclusion in review using 'PRISMA Extension for Scoping Reviews' (PRISMA-SCR)

The data was charted using Microsoft Excel, and a 'descriptive-analytical' method within the narrative tradition was applied. The data extracted from each paper included:

- Author(s), year of publication, types of studies, study location

- Aim(s) of the study
- Main active research option described
- Main outcome measure / other outcomes measures
- Key results

2.3.6 Stage 5: Collating, summarising and reporting the results

After organising studies into 'Intercalated Degree' and 'Non-intercalated Degree' options, 'year of publication', 'study location', aims for doing the study, 'main active research option', and 'main outcome measure' were collated. With regards to study location, the 2020 World Bank definition of countries' incomes was included as a proxy of medical school resources (World Bank, 2020).

As this is a heterogeneous group of studies and outcomes, an attempt to map the results into categories was made. One main outcome was included per study for this review. For studies that reported more than one outcome, the measure chosen was the one that was highlighted by the authors as the main outcome measure.

Thematic analysis was conducted for the key results for both the non-intercalated degree and intercalated options. The initial thematic analysis was completed by Dr Carberry using Braun and Clarke's framework (Braun and Clarke, 2006). Steps 4 and 5 were then undertaken by Dr Carberry, Dr McCombe and Professor Cullen.

2.3.7 Stage 6: Consultation

Healthcare education experts were consulted in relation to the scoping review findings in line with recommendations by Arksey and O'Malley's 'Optional Stage-Consultation' (Arksey and O'Malley, 2005) and Levac et al (Levac, Colquhoun and O'Brien, 2010).

2.4 Results

A total of 120 articles met the inclusion criteria and were selected for inclusion in the review, of which 94 were related to non-intercalated degree options and 26 were related

Table 3. Geographical distribution of non-intercalated study / authors and World Bank definition of countries' incomes as a proxy of medical school resources¹

Country	Frequency Total=94 N (%)	World Bank Income Economy Classification
United States	40 (43%)	High
UK	7 (7%)	High
Australia	5 (5%)	High
The Netherlands / United States	3 (3%)	High
Sweden	3 (3%)	High
Canada	3 (3%)	High
India	3 (3%)	Lower Middle
Germany	3 (3%)	High
Malaysia	3 (3%)	Upper Middle
Türkiye	2 (2%)	Upper Middle
Norway	2 (2%)	High
Argentina	1 (1%)	Upper Middle
Australia / United States	1 (1%)	High
Chile	1 (1%)	High
Croatia	1 (1%)	High
Egypt	1 (1%)	Lower Middle
Germany / Croatia	1 (1%)	High
Greece / UK	1 (1%)	High
Grenada	1 (1%)	Upper Middle
India / Malaysia	1 (1%)	Lower Middle / Upper Middle
Ireland	1 (1%)	High
Ireland / Malaysia	1 (1%)	High / Upper Middle
Japan	1 (1%)	High
New Zealand	1 (1%)	High
Pakistan	1 (1%)	Lower Middle
Portugal	1 (1%)	High
Russia	1 (1%)	Upper Middle
Saudi Arabia	1 (1%)	High
South Africa	1 (1%)	Upper Middle
Spain	1 (1%)	High
UAE	1 (1%)	High

¹ For the 2020 fiscal year, low-income economies are defined as those with a GNI per capita, calculated using the World Bank Atlas method, of \$1,025 or less in 2018; lower middle-income economies are those with a GNI per capita between \$1,026 and \$3,995; upper middle-income economies are those with a GNI per capita between \$3,996 and \$12,375; high-income economies are those with a GNI per capita of \$12,376 or more

Types of studies in selected articles

Most of the included studies were original research articles describing the active research option or the outcome of the active research option. This scoping review identified one randomised control trial in which some students undertook active research in pharmacology and compared various outcomes in this cohort to the other cohort who undertook the traditional pharmacology curriculum (Tamayo, Santibañez and Meana, 2005).

Aims of selected articles

There was heterogeneity in the aims of the selected studies. The top three aims were: to describe the programme experience (36/94; 38%), to assess the impact of the research initiative on students (20/94; 21%), and to describe the research output of the initiative (17/94; 18%).

Main active research option described in selected articles

The most described research option was elective research projects (a mixture of elective summer research projects and elective projects at other times of the year), followed by mandatory research projects at various stages of the medical curriculum. Other options included clinical audits incorporating research skills (see Table 4).

Table 4 Non-intercalated Active Research Options Frequency

Research Option	Frequency (Total=94) N (%)
<i>Mandatory Research Project(s)</i>	40 (43%)
Mandatory research project (Longitudinal)	9 (10%)
Mandatory research project (Various points in curriculum)	11 (12%)
Mandatory research project (Final year)	5 (6%)
Mandatory research project (Year 5)	1 (2%)
Mandatory research project (Year 4)	3 (4%)
Mandatory research project (Year 3)	4 (5%)
Mandatory research project (Year 2)	3 (4%)
Mandatory research project (Year 1)	3 (4%)
Mandatory research project (Four weeks, not stated when in curriculum)	1 (2%)
<i>Elective Research Project(s)</i>	42 (45%)
Elective research project (Summer)	19 (21%)
Elective research projects (Timing unspecified / varies)	18 (20%)
Elective research project (Longitudinal)	3 (4%)
Elective research project (One year)	2 (3%)
<i>Mandatory and elective project(s)</i>	7 (8%)
Mandatory and elective project(s)	7 (8%)
<i>Unclear if mandatory or elective research project</i>	1 (2%)
Unclear if mandatory or elective	1 (2%)
<i>Audit project</i>	3 (4%)
Mandatory audit project	1 (2%)
Elective audit project	2 (3%)
<i>List of options available in the 'research projects section'</i>	1 (2%)
Various options	1 (2%)

Key findings reported of selected non-intercalated research articles

The outcome measure most recorded was output of active research (publication rates, conference presentations) (36/94, 38%). The next area reported was a quality measure of the primary studies which has been labelled as 'sufficient description of the active research method' (26/94, 28%). This was defined as the ability of another medical school to reproduce the research initiative from the description given by the authors (see Figure 3).

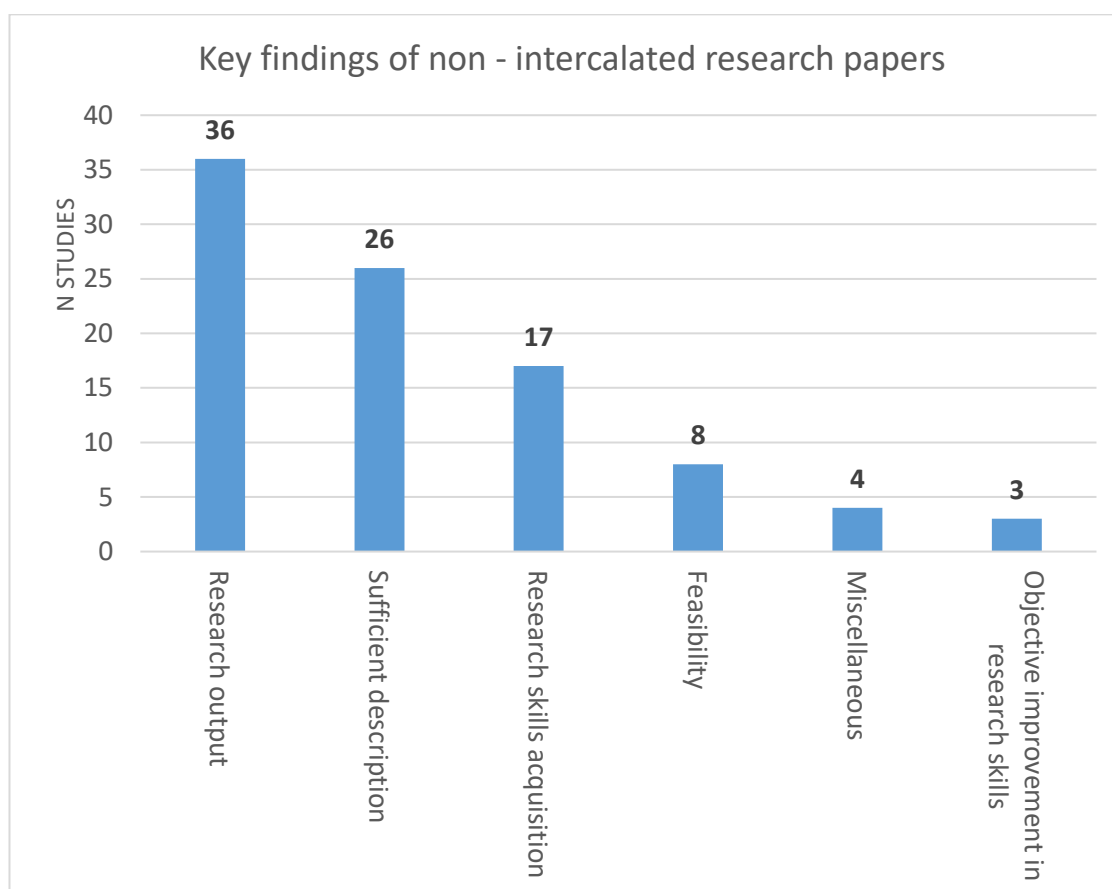


Figure 3. Key findings of selected non-intercalated research papers

Analysis of non-intercalated degree options key findings – outcomes and themes identified

Outcomes: (using Kirkpatrick criteria)

The outcomes of the selected articles were evaluated using the Kirkpatrick evaluation model and they were rated against its four levels of criteria: reaction, learning, behaviour, and results. (Kirkpatrick and Craig, 1970) (See Figure 4).

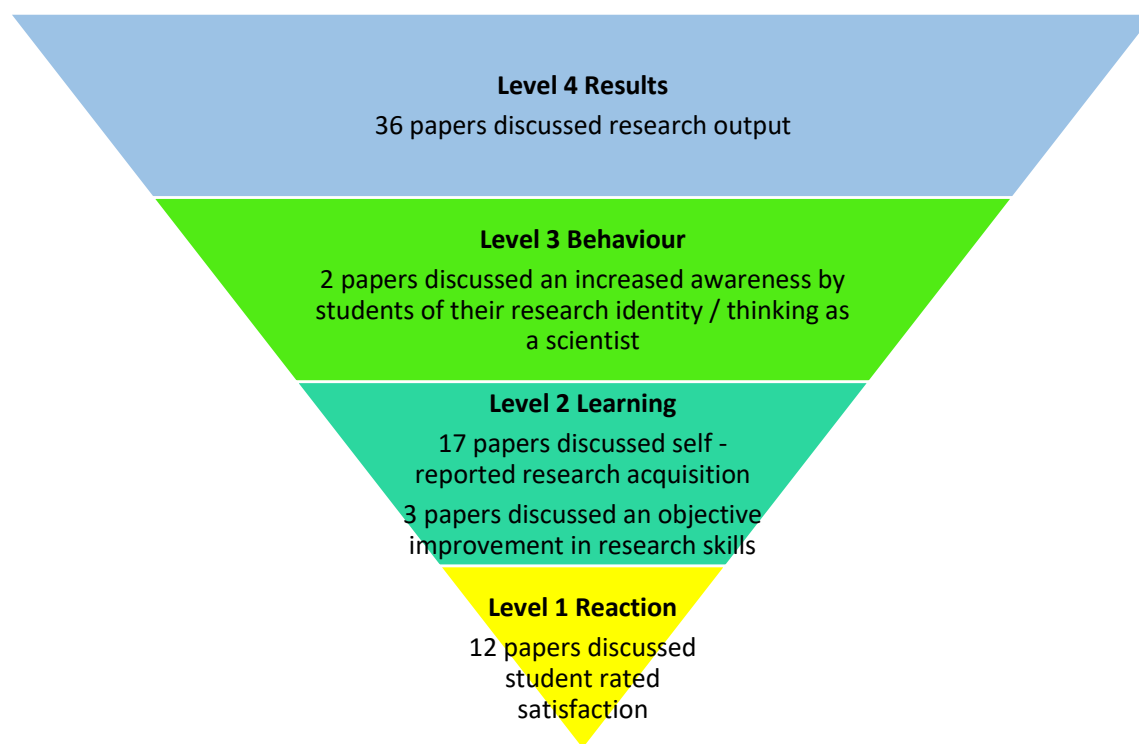


Figure 4. Kirkpatrick evaluation model of outcomes in selected non-intercalated papers

Thirty-six papers reported output of active research options (Kirkpatrick results criteria) of which 17 discussed both student publications and student presentations at conferences, 16 discussed student publications, and three discussed student presentations at conferences.

Seventeen papers described medical students' self-reported skills acquisition (Kirkpatrick learning criteria). In nine of these papers, students reported an increase in their research skills or knowledge, and in two of which students reported an increased awareness of their research identity / thinking as a scientist (Möller, Shoshan and Heikkilä, 2015; Ahmad *et al.*, 2018).

Three studies carried out pre and post tests on the students' research knowledge. There was an objective improvement in students' research skills in all three studies (Kirkpatrick learning criteria). A different instrument was described in each of the three studies (Griswold *et al.*, 1991; Knight, Van Wyk and Mahomed, 2016a; Vereijken *et al.*, 2018a).

Thematic analysis of key findings: Feasibility, mandatory versus elective research, time taken to do research and student research offices

Eight papers discussed feasibility issues or barriers to students doing research. A cross-sectional study in 2016 looked at identifying underlying causes for failure of medical thesis projects and the constantly high drop-out rate in Germany from the supervisors' perspective (response rate to the study was 29%). The authors found that both thesis supervisors and medical students felt ill-prepared for their roles in the process of a medical dissertation (Can *et al.*, 2016). A 2015 mixed-method study across five UK medical schools found that students identified practical difficulties in preparation before the project commenced, including time commitment and applying for ethical committee approval, as potential impediments to choosing a project that might provide research (Murdoch-Eaton *et al.*, 2010).

There was a comparable number of papers reporting on mandatory or elective research projects in the 94 papers that reported on non-intercalated options, and neither approach found to be preferable. In a 2017 qualitative study comparing the impact of elective versus required medical school research experiences on career outcomes, researchers found that, although completion of research at medical school correlated positively with current research involvement, a pre-existing passion for research was the greatest predictor for a career as a physician scientist ($p=0.008$). Their study found that students who were primarily motivated by curricular requirements were less likely to pursue additional research opportunities. They reported that students who recalled positive medical school research experiences were more likely to pursue postgraduate research. However, the response rate to this study was low, at 11.5% (Weaver *et al.*, 2017).

Discussion papers about the issues in relation to mandatory theses in Germany (Diez, Arkenau and Meyer-Wentrup, 2000; Can *et al.*, 2016) discussed issues including their thoughts on time pressures during medical school, how the dissertation was felt to be irrelevant to clinical practice and their perception that many projects were poorly designed.

They discussed evidence from Germany that conducting research can delay graduation and may affect clinical skills because students working on projects attend fewer clinical teaching sessions and may not spend sufficient time preparing for examinations.

Dyrbye and colleagues found that prolonging the break from medical studies to do intercalated degree / research for more than a year can have detrimental effects on student performances in clinical exams (Dyrbye *et al.*, 2007). Indeed, in a second paper they found that shorter experience seemed to yield outcomes similar to longer experiences (Dyrbye, Davidson and Cook, 2008). Several medical schools have developed 'Student research offices' to facilitate participation in extracurricular research (Zier, Friedman and Smith, 2006; Nikkar-Esfahani, Jamjoom and Fitzgerald, 2012). Tuncel *et al.* discussed 'Student research clubs' in a Turkish Medical School (Tuncel and Korpinar, 2015).

2.4.2 Mapping of Intercalated Degree Options (N=26)

The selected studies were published from 1985-2018. More of the selected studies were published in recent years, with two being published in the 1980s, one in the 1990s, seven in the 2000s, and 16 since 2010. There was less geographical variation in the location of the intercalated degrees studies / authors, with most being in the UK followed by the United States. As medical programmes in the United States are graduate entry ('MD'), the included studies from the United States described intercalated masters (two) and PhDs (four) (see Table 5).

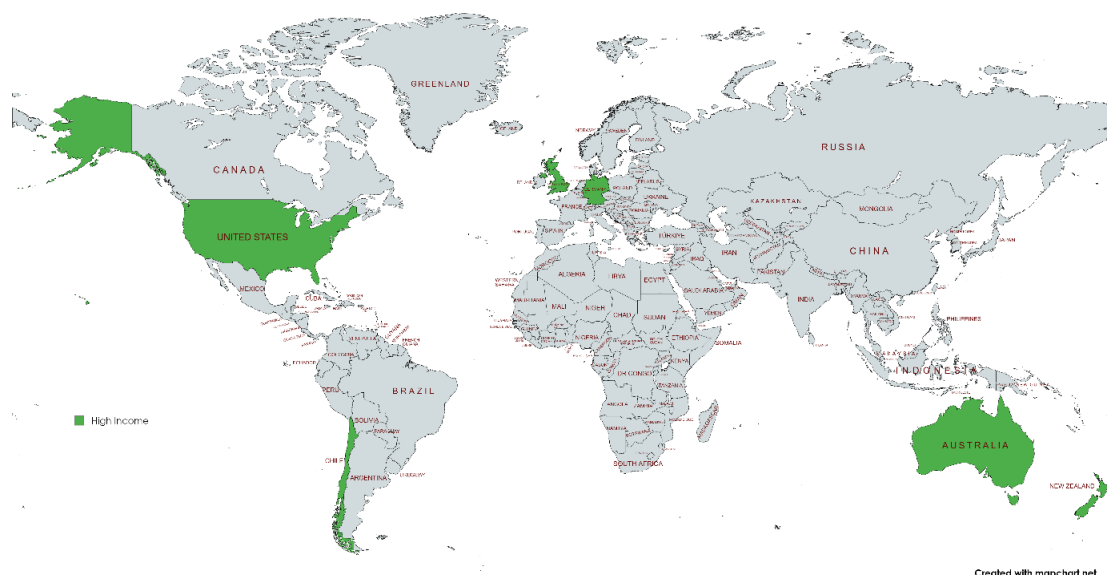


Figure 5. Distribution of selected intercalated articles

Table 5. Geographical distribution of intercalated study / authors and World Bank definition of countries' incomes as a proxy of medical school resources

Country	Frequency Total=26 N (%)	World Bank Income Economy Classification
UK	13 (50%)	High Income
United States	6 (23%)	High Income
New Zealand	3 (12%)	High Income
Australia	2 (7%)	High Income
Chile	1 (4%)	High Income
Germany	1 (4%)	High Income

Main intercalated degree described

The most common intercalated degree described in the studies was an intercalated bachelor's degree (14 papers), with intercalated BSc being most frequently described, followed by an intercalated PhD (six papers) (see Table 6).

Table 6. Intercalated Degree Frequency

Intercalated Degree Type	Frequency (Total=26)
Intercalated Bachelor's degree	14 (54%)
Intercalated PhD	6 (23%)
Intercalated Masters	4 (15%)
Intercalated degrees various	2 (7%)

Key findings reported

Discussions on feasibility and output of the intercalated degrees (publication rates / conference presentations) were most reported (5/26, 19% each) (see Figure 6).

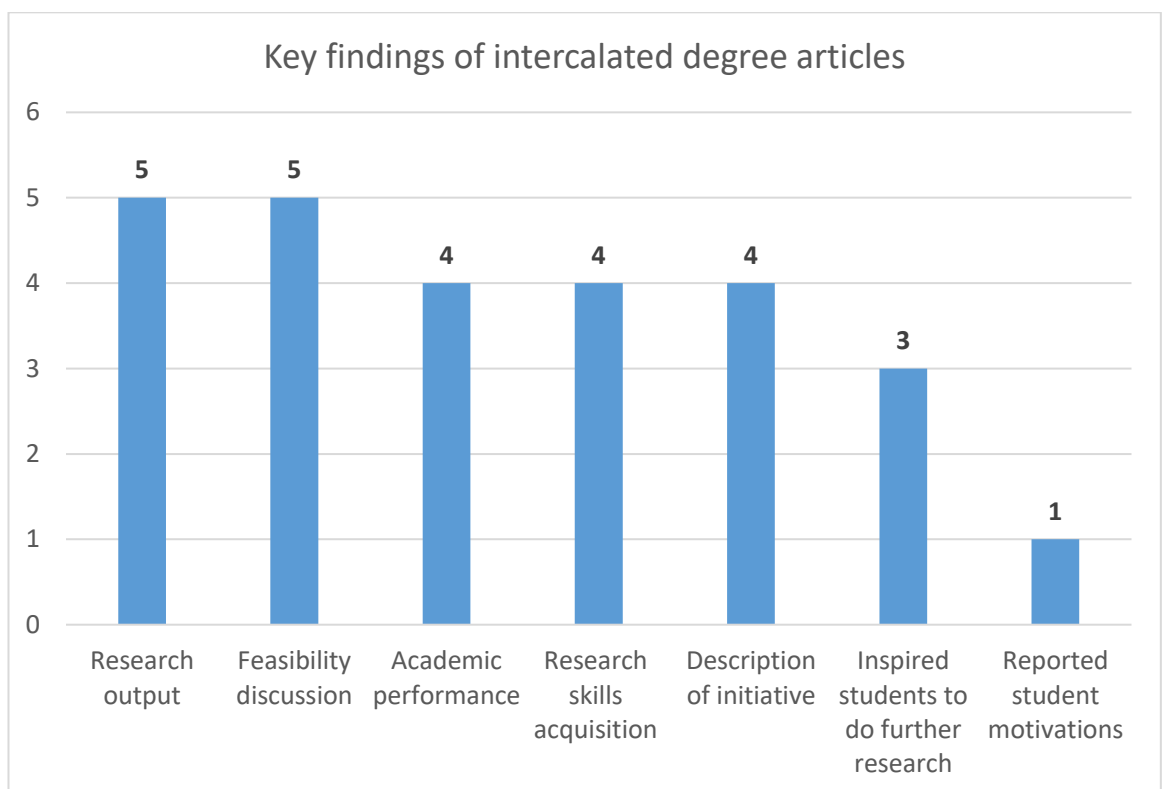


Figure 6. Key findings of selected intercalated research articles

Analysis of key findings of intercalated degree options

As previously discussed by Jones and Amgad in their systematic reviews (Jones and Singh, 2013; Amgad *et al.*, 2015), the effect of doing an intercalated degree on medical student performance and careers was the most featured outcome measure.

Outcomes: Performance and student perspective on intercalated research

As with the non-intercalated degree articles, the outcomes of the selected intercalated degree articles were evaluated using the Kirkpatrick evaluation model and they were rated against its four levels of criteria (See Figure 7).

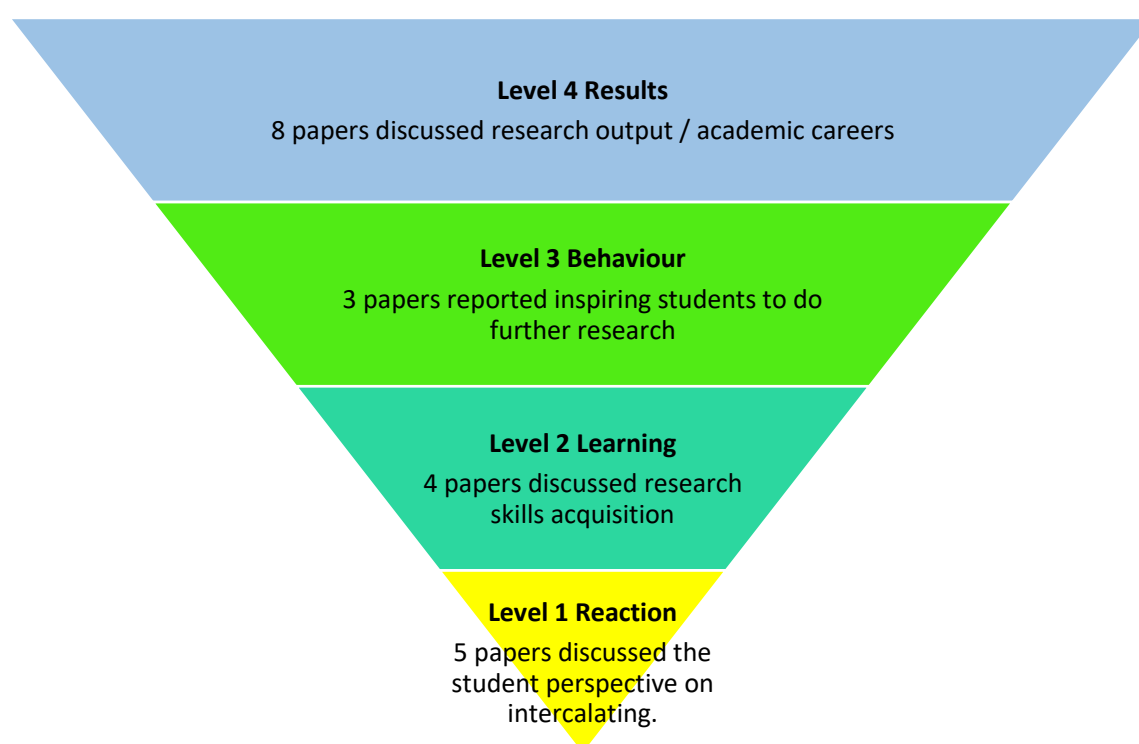


Figure 7. Kirkpatrick evaluation model of outcomes in selected intercalated papers

Eight of the included 26 papers had publication rates, academic performance or careers in academic/research posts as a proxy measurement of the success of their respective intercalated degree programmes (Kirkpatrick results criteria). Five of the included 26 papers discussed the student perspective on doing intercalated degrees (Kirkpatrick

reaction criteria). The two most reported motivations for planning to do intercalated degrees in Agha et al.'s study of 358 second year medical students in London were career prospects and 'a chance to gain publication' (Agha and Howell, 2005). Park et al. found, in their study in New Zealand of graduates who had completed an intercalated BSc from 1972-2005, that an interest in a career in research and academic medicine was the most cited reason for undertaking an intercalated degree (Park *et al.*, 2010). Stubbs et al., in their two-centre cross-sectional study in Bristol and Sheffield Medical Schools, found that participating students valued the intercalated degrees and felt they gained a substantial advantage over their peers, as well as skills helpful for their future careers (Stubbs, Lightman and Mathieson, 2013).

Negative student perspectives on intercalated degrees included Agha et al.'s findings that those who didn't opt to intercalate cited financial (72%) and time costs (44%) and lack of interest in doing research (48%) as the main reasons given (Agha and Howell, 2005). Nicholson et al. reported in their study in Aberdeen that the most common reason students opted not to intercalate was because they did not want to have another year of study (69.6%) or incur more debt (51.9%) (Nicholson *et al.*, 2010).

Park et al. found that 80% of respondents in their study encountered some problems during the intercalated year, with the most common reported being loss of contact with friends in the medical course ((Park *et al.*, 2010). There was a small number involved in this study (30/50 responded).

Thematic Analysis: More 'novel' intercalated degrees than traditional intercalated BSc

In addition to themes already identified, more 'novel' intercalated BSc degrees (Jones, Lloyd and Meakin, 2001; Jones, Singh and Lloyd, 2005) and Masters (Creavin, Mallen and Hays, 2010) in primary care were discussed in the intercalated degree options for medical students. Jones et al. felt that intercalated degrees could be aimed at a broader group of students than those wanting teaching hospital consultant posts or laboratory-based science careers. Elwood et al discussed the community health option of a

mandatory BSc in Nottingham as an alternative to the more traditional BSc (Elwood *et al.*, 1986). Muir *et al.* described a medical education intercalated BMSc in Dundee, in which students enhanced their learning through collaboration and opportunities, thus gaining a better appreciation of the roles and responsibilities of staff roles and academic clinicians (Muir and Law, 2014). Pearson *et al.* described an intercalated BSc which involved students doing field research in foreign, lower income countries (Pearson *et al.*, 2014). Elsewhere, Stellman *et al.* discussed a one-year Masters of Public Health that students took between their third and fourth years in New York (Stellman, Cohen and Rosenfield, 2008), while Menger *et al.* discussed an intercalated MB / PhD programme in Germany in which students perform a PhD thesis on a surgery-related research topic in their 6th year as a culmination of a research programme from the third year (Menger *et al.*, 2012). The aim of this programme is to increase the number of surgeon scientists.

2.5 Discussion

2.5.1 Key findings

This scoping review has mapped the various options available to medical schools to enhance research experiences for medical students, which range from mandatory intercalated degrees to elective research projects. There was heterogeneity in the context and methodologies of the included papers, and few involved experimental design. Most literature described process / activity with limited reproducibility.

The main outcomes reported for the non-intercalated degree options were student research output and self-reported research skills acquisition by medical students. Miscellaneous themes pertained to feasibility issues and whether opportunities to 'do research' should be mandatory or optional for medical students. For the intercalated degree options, the three main areas discussed were descriptions of more 'novel' intercalated degree options than the traditional BSc, student perspectives on intercalating, and the effect of intercalating on medical student performance and careers.

2.5.2 How findings relate to other literature

Any changes to a medical curriculum need to be considered in light of rapidly evolving health system needs, structure and performance (see Chapter 2a - literature review on curriculum design and evaluation). The past number of years have seen a wave of calls for curriculum reform, new accreditation standards, and regulatory requirements (Thomas *et al.*, 2016). As such, the century old paradigm of “2+2” basic science and clinical clerkship and even discipline-based education have been challenged.

Studies, to date, which have synthesised research opportunities for medical students (Jones and Singh, 2013; Amgad *et al.*, 2015), have focused on medical student exam performance and career progression and found an overall positive effect. Amgad *et al.* discussed the fact that students are deterred by practical difficulties, including the lack of opportunities and funding. The concerns of Cheung, Parsonnet and Dyrbye in relation to medical student research were discussed in Chapter 1 and include cost, mentor availability, student motivations for doing research, potential detrimental effects of time out from clinical studies and quality of medical student publications (Dyrbye *et al.*, 2007; Parsonnet *et al.*, 2010; Cheung, 2018). Transferable skills such as communication, teamwork, problem solving, and networking that students can develop when students do research are key to the development of future doctors but are harder to measure (Burgoyne, O'Flynn and Boylan, 2010); however, these are also valuable attributes for further investigation.

In 2010, Bierer and Chen performed a literature review of the impact ‘scholarly concentrations’ had on students using the Kirkpatrick approach to evaluate outcomes. They defined scholarly concentrations (SCs) as “elective or required curricular experiences that give students opportunities to study subjects in-depth beyond the conventional medical curriculum and require them to complete an independent scholarly project” (Bierer and Chen, 2010, p. 438). They found that the diversity of articles and variable results prevented definitive conclusions about the value of scholarly concentrations and recommended increased rigor in evaluation designs to demonstrate

scholarly concentrations' true impact. They found that evaluations of research experiences often rely on trainee satisfaction ratings (Gotterer, O'Day and Miller, 2010; Laskowitz *et al.*, 2010) or trainee-generated publications (Dyrbye, Davidson and Cook, 2008) as proxies of curricular effectiveness (Bierer and Chen, 2010).

Concerns have been raised about the detrimental effects mandatory theses may have on medical students (Diez, Arkenau and Meyer-Wentrup, 2000; Can *et al.*, 2016). An important area to consider regarding flexibility includes the individual medical school's resources. Using the World Bank definitions of countries' incomes, it was noted that there were fewer selected studies from medical schools in lower-middle- and low-income countries, where student involvement in 'original research' may not be the priority to address local healthcare needs in these curricula. Research has shown that African countries collectively spend about 0.5% of their gross domestic products on research and development, significantly lower than the 2.2% global average (Kanmounye *et al.*, 2020; Bah *et al.*, 2021). However, a 2014 study exploring the attitudes, involvement and knowledge of international medical students regarding research found that there appeared to be the same appetite in medical students from high- and lower-income countries to do research (Salloum, Nazha and Zgheib, 2014).

In some higher income countries with more resources, an emphasis has been put on medical student research experience by governments to try and increase the number of physician- scientists. For example, in the US, the National Institutes of Health (NIH) sponsored Medical Student Research Fellowship Programmes (Solomon *et al.*, 2003). An example from Europe is the Norwegian Medical Student Research Programme, which is a Norwegian government led initiative initiated in 2002 in response to a falling number of doctors recruited to medical research in Norway in the 1990s (Hunnskaar *et al.*, 2009). The authors reported that this Medical Student Research Programme had led to an increase in the recruitment of graduated physicians to medical research in Norway.

Equally, the profile of medical student populations (e.g., undergraduate entry versus graduate entry medical students) has a bearing on a medical school's curriculum. Accelerated, graduate-entry medicine courses tend to have particularly full curricula and these students may have prior research experience in a previous degree (Jones *et al.*, 2001). Consideration also has to be taken into account of the effect of time allocated to research and potentially detrimental impact on performance in clinical examinations. As such, mandatory research may therefore not be suitable for all students (Dyrbye *et al.*, 2007). Medical schools can also nurture student involvement in research by supporting student-led initiatives such as student-led research conferences, research clubs, and student medical journals (Funston, 2015).

2.5.3 Methodological considerations

The advantage of using a scoping review was that it provided an exploration of the extent, range, and nature of medical student research opportunities in curricula and identified a gap in the literature. Scoping reviews, however, do have several limitations. Scoping reviews do not formally evaluate the quality of evidence and often gather information from a wide range of study designs and methods (Sucharew and Macaluso, 2019). By design, the number of studies included in this review process was thus sizeable, and the results could not be synthesised into distinct outcomes. Only one main outcome was recorded per study for summarising for this review, which could have introduced bias. As with other scoping reviews, a synthesised result or answer to a specific question was not provided but rather provided an overview of the available literature on 'doing research' options available to medical schools.

Indeed, the heterogeneity of included papers makes it difficult to draw conclusions on the study aim to explore options available to medical schools; though heterogeneity as a review outcome is common to other medical education literature reviews (Prideaux and Bligh, 2002; Reed *et al.*, 2005). The published studies encountered in this scoping review reported more positive than negative outcomes in relation to active student research activities. This may be affected by publication bias, resource availability, and the difficulty

of putting a net value on the overall benefit of active research involvement of medical students, given the heterogeneity of the studies and outcome measures published from research output to students' self-reported research self-efficacy. In addition, Kappa scores were not carried out.

2.5.4 Implications for research, education, practice and policy

Further research is needed to ascertain if 'doing research' options should be more emphasised in medical curricula. By describing the research experiences available, a baseline has been provided for evaluation of the effectiveness of the research experiences offered to medical students. Evaluating the effectiveness of the research options may help shape medical education policy on research and medical workforce planning in the training of physician scientists. Consideration could be given to using Theory Based Evaluation (TBE) to measure 'success' of research initiatives for students (please see chapter 2D-Theoretical framework) (Bierer and Chen, 2010; Bierer, Prayson and Dannefer, 2015). For now, flexibility is probably appropriate depending on a medical school's resources, curriculum, educational culture and population needs. Indeed, the recent COVID-19 pandemic has demonstrated the need for flexibility in medical student research. A study evaluating the impact of the pandemic on medical student research found that undergraduate medical students and staff were forced to adapt and adjust to new strategies for conducting research (Haugh and O'Tuathaigh, 2022). The 17-item online survey was distributed to academic staff across 31 Irish and UK medical schools and over 75% of the 21 respondents reported that the availability of clinical research, lab-based research, summer research programmes, and QI / clinical audit projects was negatively impacted by COVID-19.

2.6 Conclusion

Educational activity that involved actively conducting research ('doing research') was described for students on pre-registration medical degree programmes with elective research projects being the most common described in the selected studies. The studies

included in this review reported more positive than negative outcomes in relation to active student research activities but there were some quality issues (with an awareness of the inherent limitations of the scoping review in relation to evaluating the quality of evidence) (Sucharew and Macaluso, 2019). Positive findings included research output, research self-efficacy and career development. At the same time, cost, mentor availability, student motivations for doing research, potential detrimental effects of time out from clinical studies and quality of medical student publications need to be considered. A gap found in the scoping literature review was how the effectiveness of the research experiences offered to medical students might be evaluated.

Chapter 2D: Theoretical framework

The scoping literature review described educational activity that involves students actively conducting research in undergraduate medical curricula and found that, although there were more positive than negative outcomes reported in the published literature in relation to this, the quality of the evidence was not enough to support a current emphasis on medical student involvement in 'original research' in curricula (with an awareness of the inherent limitations of the scoping review in relation to evaluating the quality of evidence) (Sucharew and Macaluso, 2019). A gap found in the scoping literature review was how the effectiveness of the research experiences offered to medical students might be evaluated. In their literature review on the impact of scholarly concentrations on medical students, Bierer and Chen recommended increased rigor in evaluation designs (Bierer and Chen, 2010), and in 2015 Bierer discussed using Theory Based Evaluation (TBE) to measure the 'success' of a research initiative to students (Bierer, Prayson and Dannefer, 2015).

The third aim of this current thesis is to investigate the acceptability and effect on student research self-efficacy of one of these options in detail - by introducing a clinical audit experience as part of a general practice placement. Self-efficacy is described as a person's perceptions of their capabilities for performance and is a cognitive mechanism underlying behavioural change (Cervone, 2000). Research self-efficacy has been defined as "an individual's belief or confidence in his or her ability to successfully perform tasks associated with conducting research" (Forester, Kahn and Hesson-McInnis, 2004, p. 4).

In their 2012 AMEE Guide on programme evaluation models (discussed in Chapter 2a), Fyre and Hemmer advised that educators can be more confident when choosing an appropriate evaluation model if they first consider the model's theoretical basis against their programme's complexity and their own evaluation needs. In designing this audit initiative, it was essential from a design standpoint to identify a theoretical framework

that encapsulated both the social interactions with the GPs and the development of specific skills, alongside shifts in research self-efficacy.

Various theoretical frameworks were considered to evaluate the effectiveness of the audit initiative. Firstly, experiential learning theory was explored. Experiential learning theory “is constructing knowledge and meaning from real-life experience. In the context of medical education, the term is most applied to experiences which have been included in a curriculum design to bring the learner into contact with others in a particular role and context” (Yardley, Teunissen and Dornan, 2012, p. 161). In the context of the audit initiative, the student experience was the real-life experience of working with general practitioners in GP practices on real patient data. However, experiential learning theory doesn’t provide a framework to analyse self-efficacy, thus other theories were explored.

Experiential learning theory is closely related to sociocultural learning theory, which is a theoretical perspective on how experience and its learning consequences are essentially located in social milieus. Conceptualising learning as a social and cultural concept rather than a purely individual process can be traced back to the Russian scholar, Vygotsky, who is generally regarded as the ‘father’ of sociocultural learning theory (Yardley, Teunissen and Dornan, 2012; Vygotsky, 2012). In the context of the audit initiative, as well as getting experiential learning from real world patient data in GP practices, there was social interaction in their group projects looking up the evidence behind the standard, working in pairs on their audit and with their interactions with the general practitioners. However, as with experiential learning theory, there was no clear framework to evaluate self-efficacy in Vygotsky’s sociocultural learning theory.

Social learning theory (SLT) was introduced in the 1960s by Albert Bandura (Bandura, 1969) and ‘emphasises the importance of observing, modelling, and imitating the behaviours, attitudes, and emotional reactions of others. Social learning theory considers how both environmental and cognitive factors interact to influence human learning and behaviour’ (McLeod, 2016). Bandura’s social learning theory evolved into the social

cognitive theory (SCT) in 1986 when the construct of self-efficacy was added (Bandura, 1986). Social cognitive theory is a psychological model of behaviour that asserts that learning occurs through observation within a social context. According to SCT, people observe the behaviours of others and the resulting consequences and use those observations to inform their own behaviours. The major theoretical components of SCT include modelling, outcome expectations, self-efficacy, goal setting, and self-regulation (Costlow and Bornstein, 2018).

Perceived self-efficacy is defined as a person's belief about their capabilities to produce designated levels of performance that exercise influence over events that affect their lives (Bandura and Wessels, 1994). Individuals with high perceptions of self-efficacy are more likely to persist on a course of action regardless of occasional obstacles or past performance. Self-efficacy then serves as a key predictor of performance and has been recommended as a construct to include in longitudinal evaluations of training programmes (Bierer, Prayson and Dannefer, 2015). A 2021 meta-analysis of studies on research self-efficacy (RSE), in relation to 14 other relevant variables suggested by social cognitive career theory, found that high levels of RSE are associated with having stronger interests in research, more positive attitudes toward research, a stronger identity as a researcher, more positive outcome expectations and stronger trainee intentions to follow a career in research (Livinți, Gunnesch-Luca and Iliescu, 2021). Although based on perceived abilities, self-efficacy beliefs have been found to have weak correlations with objective measures of ability. According to Bandura, people's self-efficacy beliefs are more important than "objective truth" in determining behaviour and motivation (Costlow and Bornstein, 2018).

Limitations reported in the literature to using self-efficacy as a key predictor of performance were that initially tests on self-efficacy were laboratory based with tasks not directly related to individual work performance. Consequently, many findings were not generalisable to individual work performance. In 1997, Harrison et al. in an effort to test the self-efficacy—performance linkage of social cognitive theory, examined the self-

efficacy of 776 American university employees on their computer skills in the workplace using the 'Computer Self-Efficacy Scale'. They found that increased performance with computer-related tasks was found to be significantly related to higher levels of self-efficacy. Decreased performance with computer-related tasks was found to be significantly related to lower levels of self-efficacy, in keeping with Bandura's theory of self-efficacy. A limitation of this study was that there was a low response rate, of 22% (Harrison *et al.*, 1997).

Another key theoretical component of SCT is modelling. SCT is built on the premise that people learn by observing and imitating the behaviours of others in the environment (Costlow and Bornstein, 2018). In Bandura's work with children in the 1960s, he conducted a series of controlled experiments on observational learning, collectively known as the Bobo doll experiments, in which children who were exposed to aggressive behaviour by models were more likely to exhibit aggressive behaviour than children in the nonaggressive and control groups (McLeod, 2016; Costlow and Bornstein, 2018).

Regarding this audit initiative, it was felt that role modelling by general practitioners could influence student experience / outcomes. The following definition of a role model was used for this study: "Role models—people we can identify with, who have qualities we would like to have, and are in positions we would like to reach—have been shown as a way to inculcate professional values, attitudes, and behaviours in students and young doctors" (Paice, Heard and Moss, 2002, p. 707).

Closely aligned to the modelling component of SCT is another of its components, that of reciprocal determinism-human behaviour is shaped by a continuous interaction between personal factors (like thoughts and emotions), behaviour, and the environment. Each influences and is influenced by the others. The success of the initiative was anticipated to depend on the GPs' belief in the audit and their perceived research self-efficacy.

Ultimately, social cognitive theory was selected as the conceptual framework due to existing literature demonstrating its application in assessing research self-efficacy - albeit

through a variant, social cognitive career theory (SCCT) (Bierer, Prayson and Dannefer, 2015) as well as its relevance to modelling, motivation, and reciprocal determinism. Bierer et al. used variables proposed in social cognitive career theory (SCCT) to focus the evaluation of a research curriculum at the Cleveland Clinic Lerner College of Medicine of Case Western Reserve University over a four-year period. They found significant relationships between graduates' perceptions of research self-efficacy and their interest in clinical research careers. Although this audit initiative was evaluated over a short time frame (one year), and the goal of this work was not to measure career development, it was considered that using a similar framework to Bierer et al. would be useful to evaluate findings.

Chapter 3: Methodology

3.1 Overview of methodology

In addition to the literature review undertaken in Chapter 2, a mixed methods investigation was undertaken to:

1. Investigate the acceptability and effect on student research self-efficacy of introducing a clinical audit as part of a general practice placement. This was underpinned by social cognitive theory as the theoretical framework (see Chapter 2d).
2. Survey the Medicine Subgroup members of the Health Sciences Group of the Universitas 21 (U21) network of universities. This was a consultation exercise to consider the findings of the scoping review (Stage 6 of the Arksey and O'Malley scoping review process 'consultation'), to describe the research options available to students in their respective medical schools, and to get a global perspective.
3. Compare and triangulate the data from the scoping review, GP survey / semi-structured interviews, student surveys, and U21 medical school survey.

The Universitas 21 Health Sciences Group is a global university network of Health Sciences staff and students that includes members from 19 universities worldwide, and a collaborative group of Universitas 21. UCD is part of this group.

3.2 Rationale for methodological approach

A mixed methods approach was adopted. Mixed methods approaches are defined as “the collection or analysis of both quantitative and qualitative data in a single study in which the data are collected concurrently or sequentially, given a priority and involve the integration of data at one or more stages in the process of the research” (Creswell, Clark and Garrett, 2003, p. 212). When combined, the strengths of both qualitative and

quantitative methods facilitate a better understanding (Ivankova, Creswell and Stick, 2006). Therefore, mixed methods approaches can deliver more rigorous and methodologically sound research which leads to a more comprehensive analysis of the topic (Creswell, 2007). Researchers can also use the strengths of a second method to compensate for the weaknesses of the other method and vice versa (Johnson and Onwuegbuzie, 2004). The following qualitative and quantitative methods were included in this study:

1. For the student audit initiative in general practice: two student questionnaires (before and after the audit initiative), a GP survey after the initiative, and semi structured interviews of a purposeful sample of the participating GPs. The student questionnaires were largely quantitative (see Student Survey Section 3.3.1 and Appendix A). The GP questionnaire was largely quantitative (see GP Survey Section 3.3.2 and Appendix A).
2. For the U21 Health Science Group Survey: a mixture of quantitative and qualitative questions (see U21 HSG Survey Section 3.5 and Appendix A).
3. Qualitative GP semi structured interviews (see Section 3.4).

3.2.1 Use of questionnaires

It was decided to use questionnaires for the student, GP, and U21 HSG cohorts due to documented advantages of time efficiency, ability to preserve anonymity of the respondents, and to standardise questions (Munn and Drever, 1990). Questionnaires are also useful for showing relationships with data that are easily quantifiable (Birmingham and Wilkinson, 2003). Limitations, however, of using questionnaires include potentially low response rates, eliciting socially desirable responses, and only getting a snapshot of information (Patten, 2016) (see Section 3.31 Questionnaires). Using a mixed methods approach with questionnaires of the students, GPs, U21 HSG, and qualitative analysis of the GP semi-structured interviews allowed multiple complementary perspectives to be explored.

3.3 Student audit in general practice

The GP clinical audit initiative ran over a 15-month period from September 2017-December 2018. Figure 8, below, gives an overview of the steps involved.

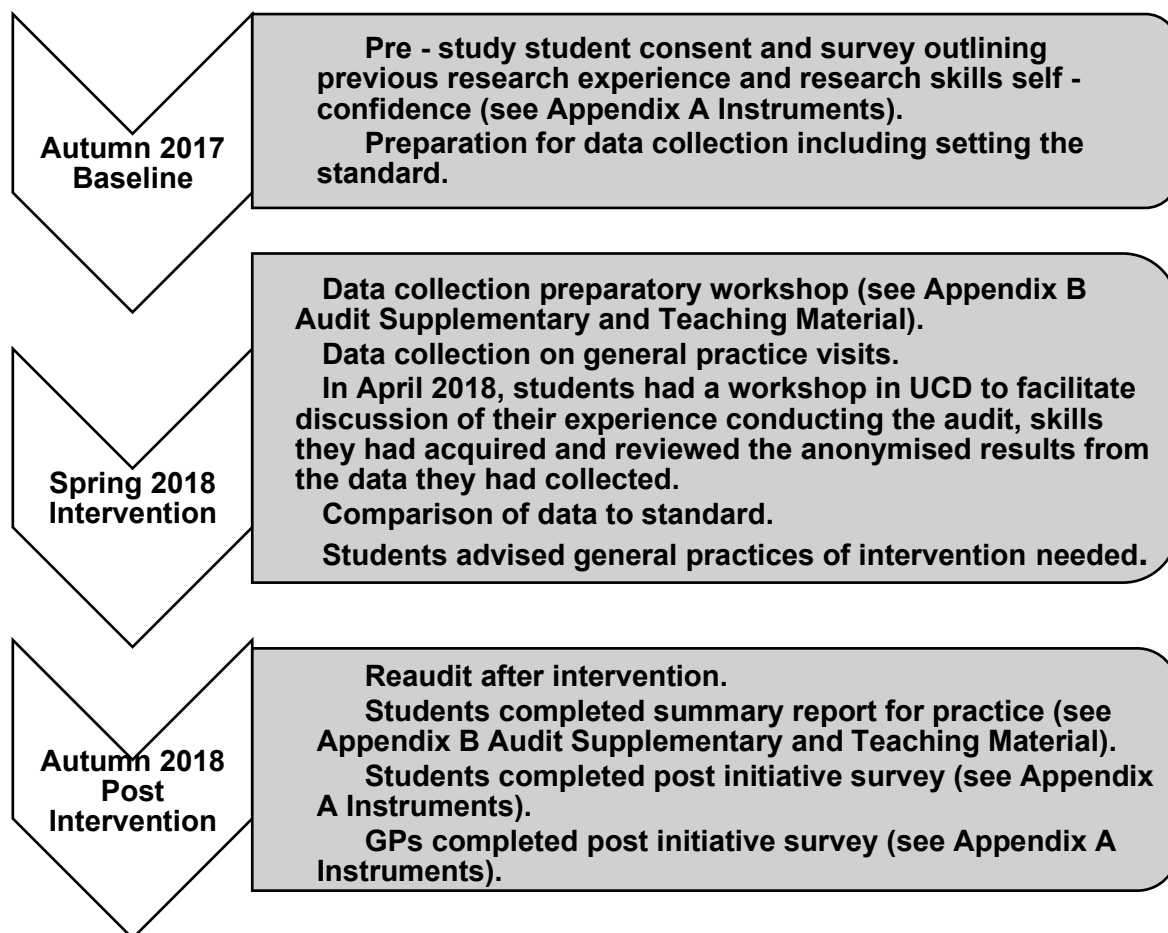


Figure 8. Overview of audit initiative

3.3.1 Recruitment

Students and GPs were invited to take part in the study. Participation in the study was on a voluntary basis, with no additional academic credit for students or financial compensation for GPs. It was effectively 'extra homework' for both GPs and students.

Students: The student cohort invited to participate in this study were the 2017 intake of graduate entry medical students (104 students). An information session outlining the programme and inviting them to participate was held in September 2017.

General Practitioners: General Practitioner tutors on the UCD GP Network were introduced to the initiative at a GP study day, who were then invited by letter to participate.

3.3.2 Context of GEM general practice placements / audit initiative in the curriculum

UCD School of Medicine, founded in 1855, offers two Medicine degree programmes (undergraduate and graduate entry), with approximately 240 graduates per year at the time of the study. The graduate entry programme (GEM) is four years in duration, with an annual intake of 110 students. The School has a modularised system (see Figure 9 below), with an overview of the four-year programme. The modules that this audit initiative was linked to are circled in red:

2019/20 UCD GRADUATE ENTRY MEDICINE PROGRAMME STRUCTURE													
Autumn Trimester					Spring Trimester					Summer Trimester			
SEPT	OCT	NOV	DEC		JAN	FEB	MAR	APR	MAY	JUN			
STAGE 1	CORE				CORE						70 PROGRAMME CREDITS	5	
	Human Form—ANAT20120					Anatomy of the Thorax and Associated Structures—ANAT20070							
	Patient-Centred Practice—GPRS20140					Cardiorespiratory Therapeutics—CLIP30170							
	Principles of Microbiology, Genetic Disease and Neoplasia—MDSA20240					Principles of Infection and its Treatment—MEM30040							
	Cell-Cell Comm and Signalling—PHYS20050					Cardiorespiratory Disease—MDSA30160							
Principles of Biochemistry, Immunology & Pharmacology—PATH20000				Public Health, Psych & Sociology—PHPS20010					Cardiovascular & Respiratory Physiology—PHYS20150				
									SSRA—MDSA30280 *Credit assigned to Stage 2				
STAGE 2	CORE				CORE						75 PROGRAMME CREDITS 5 OPTION CREDITS		
	GI/GU Structure—ANAT20160					Disability—MDSA30090							
	GI/GU Therapeutics—CLIP30230					Neurology in Health and Disease—MDSA30220							
	Endocrine in Health and Disease—PATH30210					Oncology & Immunopathology—PATH30190							
	Haematology/Immunosuppression—PATH30030					Repro, Psych & Child Health Medicine—MDSA40040							
	GI/GU Illness—PATH30200					Otolaryngology/Ophthalmology—MDSA40060							
	GI and Renal Physiology—PHYS30240					Primary Care & Medical Practice—MDSA30320							
	Basic Principles of Trauma—ANAT20050												
	Stem Cells in Medicine—CLIP30240												
	Radiology & Diagnostic Imaging—RDGY30470												
				Option Modules: 5 Credits CHOOSE 1 OF 4 (Note: SSRA in Summer of Stage 1)					Advanced Clinical Skills—MDSA40070				
STAGE 3	CORE				CORE				CORE				PRO- GRAMME CREDITS
	Med 1—MEDN40090		Surgery A—SURGA0080		Med 2—MEDN40100		Surgery B—SURGB0080		Psychiatry—PSYC40150		Medicine in the Comm.—MDSA40140		
	Surgery A—SURGA0080		Med 1—MEDN40090		Surgery B—SURGB0080		Med 2—MEDN40100		Obstetrics & Gynaecology /OBGYN40110		Paediatrics—PAED40120		

- In the autumn semester of the 2017/8 academic year, there was a GP-led early patient contact module ('Patient Centred Practice'), coordinated by Dr Carberry.
- In the spring semester of the 2017/8 academic year, there was a cardio-respiratory therapeutics module ('Cardio-Respiratory Therapeutics'). Students in pairs visited a GP practice in the Dublin area for two visits as part of this module. The audit was done in addition to the requirements of the general practice placements.
- In the autumn semester of the 2018/9 academic year, a gastrointestinal-genitourinary therapeutics module ('GI-GU Therapeutics') was carried out. Students in pairs returned to the same practice as the spring semester of the 2017/8 academic year for two more visits and did the re-audit in addition to the requirements of the general practice placements.

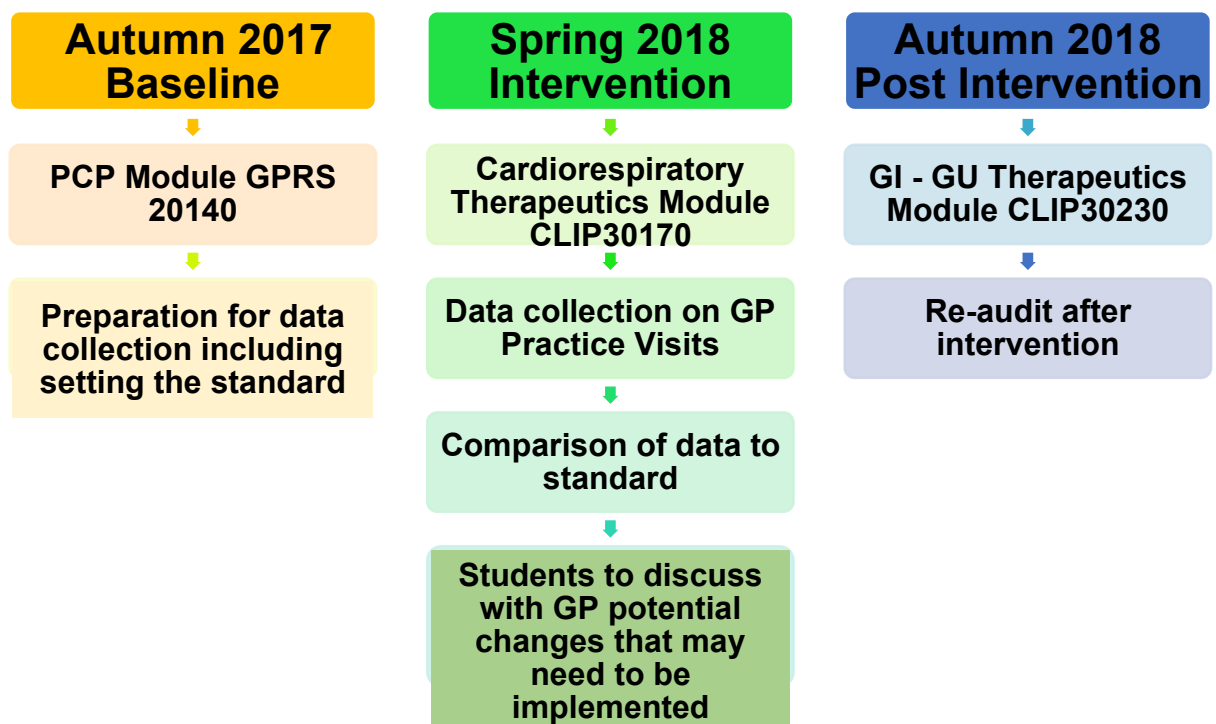


Figure 10. Organisation of activity over three modules

3.3.3 Description of intervention

Autumn semester of the 2017/8 academic year (*Baseline*)

At the outset, a series of lectures was given to students, outlining the purpose of the activity, the theory of clinical audit, data protection, aspects of professionalism (especially confidentiality), and practical requirements and considerations. Students / GPs then decided whether to opt into this extracurricular initiative (see recruitment). All students were assigned to one of four audit topics aligned to the cardiorespiratory module they would be doing in Spring 2018. As they were first year students, it was decided to give students topics aligned to their curriculum, rather than give the students / GPs choice in their audit topic. Constructive alignment implies “that all components in the teaching system - the curriculum and its intended outcomes, the teaching methods used, the assessment tasks - are aligned to each other” (Biggs, 2003, p. 1). Mandating topic choice could potentially affect student / GP interest in the audit. In her 2001 thesis, looking at the effects of topic choice in project-based instruction on undergraduate physical science students' interest, ownership, and motivation, Milner-Bolotin found that, while giving students freedom in the project topic choice was not found to influence student ownership of the project, students' initial interest in the project topic did have a positive impact on their ownership of the project (Milner-Bolotin, 2001).

In small groups, students had to review the evidence behind the standard which was at the core of the clinical audit and they carried out group presentations about their findings in their first semester as part of the 'Patient Centred Practice' module.

Table 7. Autumn semester of the 2017/8 academic year formal teaching UCD

Lectures:

- Introduction to clinical audit
- Professionalism
- Data protection
- Coding of clinical data

Seminar:

Library searches / Use of EndNote ® / Introduction group projects / Information re the evaluation of the clinical audit exercise.

Audit topics assigned to students:

1. *'All patients should have a renal blood test prior to starting an ACE inhibitor. This should be repeated between 1-2 weeks after starting the ACE inhibitor and after each dose increase.'*

The standard was the NICE CKD Guidelines (National Institute for Health and Clinical Excellence, 2008).

2. *'All children on oral corticosteroid inhalers should have their growth (height and weight centile) monitored at least annually.'*

The standard was the 2016 BTS / SIGN Guidelines on Management of Asthma (Health improvement Scotland, 2016).

3. *'All patients with asthma should be given specific training and assessment in inhaler technique before starting any new inhaler treatment and patients with asthma should receive a structured review at least annually. Review includes checking inhaler technique.'*

The standard was the NICE Quality Standard on Asthma 2013 (National Institute for Clinical Excellence, 2013).

4. *'All patients should have their liver enzyme tests checked before starting statin therapy and as clinically indicated thereafter.'*

The standard was the FDA Guidelines 2012 (U.S. Food & Drug Administration, 2016).

Spring semester of the 2017/8 academic year

In January 2018, students had a preparatory workshop in a Computer Assisted Lab, in which they practised reviewing dummy patient notes and extracting data using one of the GP record keeping software programmes (Socrates®). A handbook was provided for the GPs and students in preparation (see Appendix B Audit Supplementary and Teaching Material for the workshop notes and handbook).

Table 8. Spring semester of the 2017/8 academic year formal teaching UCD

Seminars • Workshop on GP IT software for data collection prior to attending practices (see Appendix B). • UCD campus GP tutor facilitated seminar on discussion on data collection findings, comparing findings to the standard and student group in order to decide on intervention needed to improve clinical care.
--

Intervention

The students then undertook data collection for the first round of the audit cycle in the spring semester of the 2017/8 academic year (see Figure 11 - sample data collection form).

Audit 1 Ace inhibitors and renal function

'All patients should have a renal blood test prior to starting an ACE inhibitor. This should be repeated between 1-2 weeks after starting the Ace inhibitor and after each dose increase.'

STANDARD =NICE CKD Guidelines (National Institute for Health and Clinical Excellence, 2008)

(GPs, please provide students with a list of 10 patients ≥ 18 from your practice that have been prescribed an ace inhibitor in the past year.

- Students, please check the patients' clinical notes to see if they had their renal function checked:
 - 1) Prior to initiation of therapy –if started elsewhere (e.g., hospital) write 'started elsewhere' in this column
 - 2) Repeated within 1-2 weeks of starting the ace inhibitor
 - 3) Repeated 1-2 weeks after any dose increase
 - 4) After you have collected your data, compare your data with the standard and discuss with your supervising GP any potential changes that may need to be implemented.
 - 5) You will then re-audit this data in autumn 2018 on a return practice visit.

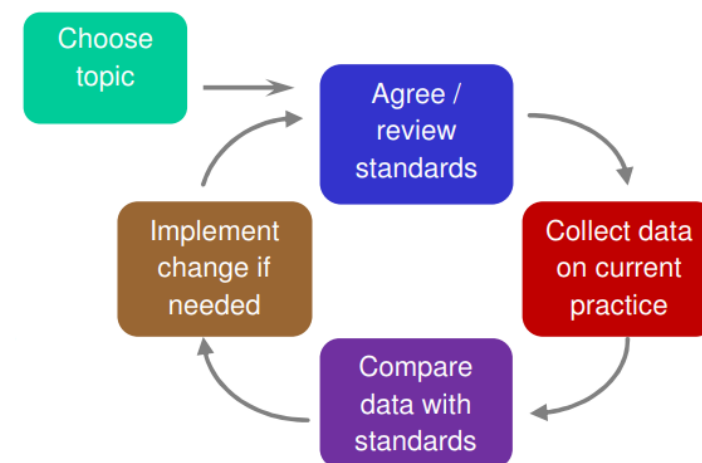


Figure 1. NHS Bristol. What is Clinical Audit? 2009

Patient	Renal function prior to starting Yes / No / Started Elsewhere	1-2 week repeat after starting Yes / No / Started Elsewhere	Repeated 1-2 weeks if dose increase Yes / No / Not Applicable
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

Figure 11. Sample data collection form

They then had a review session with the academic team in April 2018 in which they discussed, their experience conducting the audit, and skills they had acquired, before reviewing anonymised results from the data they had collected. After the review session with UCD academic staff, they contacted their assigned general practices to discuss their findings and any suggested interventions.

Autumn semester of the 2018/9 academic year

The students completed the re-audit in Autumn 2018 in their assigned practices and were advised to produce a confidential, anonymised report for the GP practice (see Appendix B Audit Supplementary and Teaching Material). Academic staff at UCD did not have access to these reports. A review session was held with the academic staff in November 2018 and students completed the follow up student surveys.

3.3.4. Student surveys

Sample size calculation

Using G* Power statistical power analysis software, a minimum target sample size of 20 was deemed to be sufficient on the basis that a two-tailed pre and post Wilcoxon Signed Rank test should be used with an effect size of 0.8, an $\alpha = 0.05$, and 90% power. This strategy was coupled with convenience sampling to target as many participants as possible to acquire maximum statistical power.

Instrument development

A pre- and post-study questionnaire was developed which contained different sections and question types. Woodward's 1988 '*Questionnaire construction and question writing for research in medical education*' was consulted to help with question design and type

(Woodward, 1988). Bee and Murdoch-Eaton's previously published guidelines on questionnaire development were also consulted (Bee and Murdoch-Eaton, 2016).

Instrument content

A pre- and post-study questionnaire was adapted with permission from the STARSurg 2015 initiative / Medine 2 consensus survey of research competencies ((Chapman *et al.*, 2015; Drake *et al.*, 2018). The STARSurg initiative was chosen because it was used in undergraduate medical students and had questions relating to clinical audit. The STARSurg surveys used were considered sufficiently validated for the purposes of this study but it is acknowledged that it is not fully validated. Validation in relation to surveys refers to the process of ensuring that the survey effectively measures what it is intended to measure. In their paper, the authors advised that their surveys were piloted on senior medical students and junior doctors to ensure content and face validity. Written feedback was received and used to iteratively refine the question items to improve clarity and understanding (Chapman *et al.*, 2015).

The Medical Education in Europe (MEDINE) Thematic Network had previously undertaken a pan-European consensus survey to generate a set of research competencies and core learning outcomes for medical curricula in Europe across all three Bologna cycles (Bachelor, Master and Doctor). These research-specific learning competencies can be broadly considered in three groups: 'generic' competences, those related to 'using research', and those related to 'doing research'. The MEDINE network conducted a Delphi exercise, attempting to identify key research skills to include in curricula, known as the MEDINE2 survey (Marz *et al.*, 2013). For this survey, the 'doing research' options, as outlined by MEDINE, were looked at, which would correlate with the World Federation for Medical Education's 2015 quality improvement standard (WFME, 2015) in relation to research.

The surveys contained questions pertaining to the students' prior research experience and paired research self-efficacy before and after the initiative (whether they had done an audit or not). This was included because the students may have gained other research experience over the year which may have affected their research self-efficacy. The self-efficacy component of social cognitive theory was used as a framework here (see 'Considerations of using Likert scale to measure research self-efficacy' section below). Ethical approval was granted to include the last four digits of students' numbers on the pre and post student surveys so that students could be matched to check for change in their research self-efficacy over the year. These four numbers were then changed to a different number - 'student 1', 'student 2' etc. The post survey also contained questions on their experience of the initiative if they had taken part, with feasibility questions for those who had not taken part / withdrew from the initiative. All students were also asked to document any other research initiatives they had participated in over the year (see Appendix A Instruments for the student surveys).

Pre-study questionnaire layout and question types

- Section 1: demographics, with ordered closed ended questions
- Section 2: prior research / audit experience, with a numerical range from 0 to 5+
- Section 3: baseline research self-efficacy questions using a Likert scale (see below)
- Section 4: free text comments area, with an open question for students to comment on prior research or audit experience.

Post-study questionnaire layout and question types

- Section 1: research / audit experience, with a numerical range from 0 to 5+ after one year
- Section 2: follow up research self-efficacy questions using a Likert scale (see below)
- Section 3: closed questions related to audit experience, educational impact, and support, with yes / no answer option and free text boxes to expand on

each of the closed questions (for those students who had done the clinical audit)

Section 4: open question to those students who did not take part / or dropped out as to why did not participate

Section 5: closed question asking about other research experience, with yes / no answer option and free text box to describe the research experience.

Differences in research self-efficacy questions

The instrument was piloted by faculty and adapted for use in this cohort. The following research self-efficacy questions in the STARSurg survey were not included in the student questionnaire, as, from faculty experience of working with previous first year GEM students, this cohort were unlikely to have had experience of contacting hospital clinical audit departments or filling out audit registration forms. The academic team in UCD approached the GPs on their behalf.

1. How to contact your hospital's clinical audit department.
2. How to fill out an audit registration form.
3. Approaching clinical staff to help you formulate an audit / research protocol.
4. Approaching clinical staff to form a team to help you an audit / research protocol.

The wording of '*present results in a scientific meeting*' in the STARSurg survey was changed to '*present results to peers*', which was the wording in the MEDINE2 survey (Marz *et al.*, 2013).

An additional question relating to confidence looking up the evidence behind the recommendation was added which would relate most closely to "*Critically appraise published medical literature including observational, interventional, and meta-analysis using established critical appraisal guideline*" from the MEDINE2 survey. All students

completed group projects examining the evidence behind the audit standards in preparation for the audit.

Considerations of using Likert scale to measure research self-efficacy

Perceived self-efficacy is concerned with people's beliefs in their capabilities to achieve given attainments and should be distinguished from other constructs such as self-esteem, locus of control, and outcome expectancies. Perceived efficacy is a judgment of capability; self-esteem is a judgment of self-worth (Bandura, 2006). As discussed in Chapter 2, Research Self Efficacy has been defined as “an individual's belief or confidence in his or her ability to successfully perform tasks associated with conducting research” (Forester, Kahn and Hesson-McInnis, 2004, p. 4).

A Likert scale was used in the survey to measure student research self-efficacy. A Likert scale is an ordinal psychometric measurement used to measure attitudes, beliefs, and opinions. In 1932, Likert developed the scales to be composed of five equal appearing intervals with a neutral midpoint, such as strongly disagree, disagree, neither agree nor disagree, agree, strongly agree (Likert, 1932). With respect to scaling the items in a survey, Hinkin advises that it is important that the scale used generate sufficient variance among respondents for subsequent statistical analyses (Hinkin, 1998). It is suggested that items be scaled using 5-point Likert scales. Coefficient alpha reliability with Likert scales has been shown to increase up to the use of five points, before it levels off (Lissitz and Green, 1975).

The 5-point Likert scale used to measure students' research self-efficacy was: lacking any confidence, lacking confidence, neutral, confident, and very confident. A limitation to using this scale might be that some participants may avoid selecting the extreme measures 'lacking any confidence' and 'very confident' and prefer to choose the middle measures (Theofanidis and Fountouki, 2018). Bandura advised that including too few steps may lose differentiating information because people who use the same response

category may differ if intermediate steps were included and so he recommended an efficacy scale with the 0-100 response format as a stronger predictor of performance than one with a 5-interval scale (Bandura, 2006). Maurer and Pierce found in their study comparing Likert scales and traditional measures of self-efficacy, that Likert-type and traditional measures of self-efficacy have similar reliability–error variance, provide equivalent levels of prediction, and have similar factor structure and similar discriminability (Maurer and Pierce, 1998). As the research self-efficacy questions were adapted from the STARSurg 2015 initiative (Chapman *et al.*, 2015) which used a 5-point Likert scale, a 5-point Likert scale was opted for in this study.

Of note, the 5-point scale used in this study differed from that used in the 2015 STARSurg Study in that 'lacking any confidence' and 'lacking confidence' were used in lieu of 'very unconfident' and 'unconfident' respectively. The wording was changed to have a more 'closer to 0' scale as suggested by Bandura with similar wording noted in an educational self-efficacy survey designed by the Centre for Higher Educational Research and Scholarship at Imperial College London who used 'not at all confident' as the first point in their scale (Centre for Higher Education and Scholarship Imperial College London). This change in the wording (compared to the STARSurg survey) had the potential to affect the validity and reliability of the results.

3.3.5. GP surveys

Instrument design

A validated suitable questionnaire was not found in the literature and so the content of the GP survey contained a demographics section based on categories used in a national survey of general practice in Ireland (O'Dowd, O'Kelly and O'Kelly, 2016), a section on UCD medical student placements in a similar format to previous surveys from the academic team so the GPs were familiar with the format and some satisfaction questions.

GP Survey layout and question types

- Section 1: demographics and student placement history, with ordered closed ended questions
- Section 2: satisfaction with audit initiative, with five Likert scale questions and free text boxes to expand of these questions
- Section 3: open question on any other comments / feedback the GPs would like to make.

Likert scale

In this survey, a 4-point scale was used (strongly disagree, disagree, agree, strongly agree). Using a 4-point scale, rather than a 5-point scale, may have affected reliability but in their 1975 study, Lissitz and Green found that, with a covariance of .8, the average alpha coefficients for tests with 2 and 5 scale points per item were .77 and .84, respectively. They discussed that although this gain appeared sizable, the standard deviations of .05 for a 2-point scale and .03 for a 5-point scale indicated the possibility that for any group of empirical studies, the gain in reliability may not come to light (Lissitz and Green, 1975) (see Appendix A Instruments for GP Survey).

Type of surveys

Paper surveys were distributed to both the participating GPs and students using 'Sphinx Survey' ® compatible hard copy surveys and then converted to Excel files using Sphinx software. It was decided to use hard copy surveys rather than electronic surveys because previous experience had found in general an increased response rates for surveys with paper-based surveys (Nulty, 2008; Shih and Fan, 2009). It is recognised that one of the disadvantages to using questionnaires in research is a low response rate (Patten, 2016). To increase response rates, a self-addressed envelope was sent to the participating GPs, with an easily accessible drop-off box made available to the students for their responses; with two reminders sent (Birmingham and Wilkinson, 2003).

3.4 GP semi-structured interviews

Telephone semi-structured interviews were conducted. It had been planned to conduct a focus group for the qualitative work with GPs but, due to restrictions as a result of the COVID-19 pandemic, this was cancelled. In notifying GPs of this, they were asked if they would be willing to participate in a telephone interview instead. Those who indicated they would, were sent the written information in advance, signed the consent form and the telephone interview was conducted at a time that was convenient for them. The interviews were conducted by Dr Geoff McCombe who is an experienced qualitative researcher and had not been involved in programme delivery.

The GPs were sent a summary of the findings of the qualitative survey prior to the interviews (see Appendix A Instruments with the interview schedule). The telephone interviews were audio recorded, transcribed and thematic analysis was used to analyse the transcripts (Braun and Clarke, 2006) (see 3.6.2. Thematic analysis of GP semi structured interviews).

3.5 Universitas 21 Health Science Group survey

For the Universitas 21 Health Science Group (U21 HSG) survey, a forum on undergraduate research with international experts in health professionals' education was held at the U21 HSG, Annual Meeting, University of Glasgow 2019. The findings of the scoping review were presented at this forum and discussion points raised at this led to the formation of a draft electronic survey. Dr Carberry introduced the draft survey to a teleconference of representatives of the U21 Health Science Group in December 2019. Following feedback from this teleconference about the use of jargon and the importance of using plain English for those who did not have English as a first language, the final version of the survey was adapted and sent out to group members in January 2020 (see Appendix A Instruments). The electronic 'Google form' survey was initially sent to 13 members of the medicine subgroup of the HSG including UCD Medical School which is

a member of this group. As there was already data on the research options available in UCD (see Chapter 2), it was decided not to include UCD.

3.6 Data analysis

3.6.1. Survey analysis

Preparation for analysis

Advice on statistical analysis of the data was provided in advance by a biostatistician in CSTAR UCD (Centre for Support and Training in Analysis and Research).

1. The student, GP and U21 HSG surveys were converted from Excel ® files to SPSS Version 24.0 ®. Prior to the conversion, the excel files were checked for missing data so that there were no blank cells and every variable in the dataset was coded. Missing data was not included in the analysis.
2. The variables were then coded correctly in SPSS as Type, Measure, Values.
3. Four new variables in the student data were created to be able to compare groups:
 - pre and post scores in ‘matched’ students (labelled ‘change’ variables). ‘Matched’ refers to matched respondents (‘paired respondents’) whose pre- and post-surveys were matched up using the last four digits of their student number.
 - whether research self-efficacy increased depending on whether students had participated in audit and another research project, participated in audit but no additional research project or no research / audit activity over the year (labelled ‘audit and project’ variable)
 - whether research self-efficacy increased depending on whether students had participated in any or no research activity / audit over the year (labelled ‘any research experience’ variable)
 - whether having a postgraduate degree made a difference to research self-efficacy (labelled ‘degree level’).

a) 'Change' variables

One new variable was created for every question of interest that represented the "change" for each response, e.g., **How confident do you feel in writing an audit or research protocol? (pre)** one respondent answered 1 = Very unconfident and in the same question (post) the response is 3 = Neutral; thus, for the new variable **How confident do you feel in writing an audit or research protocol? (difference)** the value is $3 - 1 = 2$. These variables were no longer categorical but continuous, i.e., the 2 did not translate to say 'confident'.

b) 'Audit and project' variable

This variable had three categories: 1 = those that said 'Yes' to both having done the audit and to having extra projects, 2 = those that said 'Yes' at having done the audit and 'No' to the extra project, and 3 = All the rest.

c) 'Any research experience' variable

This variable had 3 categories: 1 = no audit / project, 2 = either of the two and 3 = all other.

d) 'Degree level' variable

This variable had 2 categories: 1 = those that have a primary degree, 2 = those that have postgraduate degree.

Survey analysis

The number and valid percentage was calculated for all categorical variables and the number and median for all the ordinal variables.

To answer the following questions in relation to the student surveys, the following statistical tests were used:

1. Was there a statistically significant increase in student research self-efficacy after doing the audit component?

Wilcoxon signed-rank test was used as the same groups were compared before and after (Whitley and Ball, 2002). For the whole group (both those who did the audit versus those who did not) - only those that were 'matched' i.e., which we had pre and post survey responses for, were kept for analysis. Therefore, the data was split by the variable 'matched', before performing the analysis.

2. Was there any statistically significant difference in student research self-efficacy between the groups?

- a) those who did the audit versus those who did not
- b) those who did other projects versus those who did not
- c) those that did the audit and an additional project versus those that just did the audit
- d) those who did not do any additional project or audit to those that did either an additional project or audit.

As these groups were not related to each other but were independent, the non-parametric test for independent groups, Mann-Whitney U was used for two categories and Kruskal Wallis for more than two categories to find whether there was a significant difference in the responses (Whitley and Ball, 2002).

3. Was there any difference in student research self-efficacy based on the student's primary degree type?

For this, as the response of each question was compared across three groups (primary degree variable), independent samples again but three categories, the relevant test used was Kruskal Wallis.

a) Was there any difference in student research self-efficacy in those with postgraduate degrees (masters / PhD) versus those that had primary degrees only?

Mann U Whitney was used here, as there were two categories - the grouping variable was 'degree level' (primary / postgraduate).

b) Any statistical significance in student research self-efficacy based on age / sex / nationality?

As before, two categories were analysed with Mann-Whitney, more than two with Kruskal Wallis.

GP survey data analysis

As the categories age / sex / years in practice / single handed versus group practice, post graduate training practice versus non post graduate training practice / numbers of students they supervised audits were independent (i.e., someone was not in more than one category) the tests used were Mann-Whitney when two categories were analysed and Kruskal Wallis when more than two. The above categories were the grouping variables and the test variables were the questions of interest.

3.6.2. Thematic analysis of semi-structured interviews

Thematic analysis was used to analyse the transcripts using Braun and Clarke's six step approach (Braun and Clarke, 2006). Consideration was given to using Interpretative

Phenomenological Analysis (IPA), in lieu of thematic analysis. The primary goal of IPA is to investigate how individuals make sense of their experiences (Pietkiewicz and Smith, 2014) and has a theoretically informed framework (phenomenology). However, as phenomenology was not the theoretical framework selected, thematic analysis was opted for with its inherent flexibility.

According to Social Cognitive Theory, people observe the behaviours of others and the resulting consequences and use those observations to inform their own behaviours (Costlow and Bornstein, 2018). In the context of the thematic analysis of the GP interviews, SCT helped identify themes related to social influences on behaviour and learning processes. Self-efficacy, or one's belief in their ability to succeed in specific situations or accomplish a task, is also a key concept in social cognitive theory and this was used to guide the generation of this theme in relation to general practice research (See Chapter 4 -thematic analysis of GP interviews).

The initial thematic analysis (familiarisation, coding and generating themes) was completed by Dr Carberry using Braun and Clarke's framework. Vaismoradi et al.'s work on theme development in qualitative content analysis and thematic analysis was consulted to assist in theme construction. (Vaismoradi *et al.*, 2016). Steps 4 (reviewing themes) and 5 (defining and naming themes) of the framework were then undertaken by Dr Carberry and Dr McCombe following Dr Carberry's initial coding and theme generation. Dr McCombe had interviewed the GPs and had designed the questions for the semi-structured interviews with Dr Carberry. Initially themes were extracted by hand, however, to improve rigor, it was decided to use the qualitative data analysis software programme NVivo 12 Plus © (Hilal and Alabri, 2013). Throughout the process, attempts were made to be reflexive and to be aware of personal perspectives. Moreover, participating GPs were then sent the collective findings of the thematic analysis for respondent validation (Barbour, 2001).

3.7 Triangulation of data

In the triangulation of data, careful attention was paid to both the alignment of different data sources and methods (convergence) and their discrepancies (divergence), to enrich the understanding of the complexities inherent in the findings. Throughout the triangulation process, I engaged in reflexive practice to consider how my own biases might influence the data interpretation.

3.8 Ethical considerations

Ethical approval for this study was granted by the UCD Human Research Ethics Committee (HREC) (see Appendix C - Ethics for consent forms and correspondence from HREC).

The following issues were considered:

Beneficence

This study was undertaken to explore options to involve medical students in research, with the aim of benefitting medical students, science, medicine and society.

Non-maleficence

There were three potential ethical issues that could have arisen in the course of the study. These were addressed as follows:

1. Minimising conflict of interest

Some of the researchers involved in the study were also involved in the teaching of the students. Students were given the option of doing the clinical audit component and completing the pre-and post-evaluation surveys of same. The advantages and disadvantages of taking part in the audit component of the study were presented by a member of the team who was not teaching the students in any of the modules the audit component was linked to. It was made clear to the students that their participation in the

study was entirely voluntary and it would not affect the assessment of their performance in any of the modules should they opt out of taking part in the study.

2. Potential effect on GP placements

Some GP tutors may have felt pressured to allow students to do an audit in their practice as they may have felt future student placements depended on it. An information evening in January 2018 was held to go through the advantages and disadvantages of taking part in the study and as per the students, the GP tutors were advised that their participation in the study was voluntary. Students / GPs who chose not to take part in the audit study were paired up for GP placements.

3. Content of surveys / qualitative questions: non-sensitive information

The questions in the surveys and focus groups were not deemed to be of a sensitive nature.

Data Protection

- a) One area that was very important was to ensure that all students were very clear on data protection when reviewing patients' medical notes in general practices. They had a lecture on data protection and another on professionalism (with an emphasis on confidentiality) in Autumn 2017. Only de-identified, aggregated data left the practice. This was achieved by students being given a template to fill in and this was the only data that left the practice with the students - the template did not have any identifiable patient data on it (see Appendix B - Audit Supplementary and Teaching material).
- b) In order to match students' pre and post data, ethical permission was given to ask students for the last four digits of their student numbers on the pre and post student

surveys. These four numbers were then changed to a different number- 'student 1', 'student 2' etc.

- c) The clinical data obtained by students was not used by the academic team in UCD.

Amendments to the research programme as a result of the COVID-19 Pandemic

It had been planned to run a focus group for the qualitative work with GPs but due to restrictions as a result of the COVID-19 pandemic, semi structured interviews by telephone were carried out instead. Permission for this change was granted by UCD HREC in March 2020.

Chapter 4: Results

4.1 Overview of chapter

The third aim of this thesis was to investigate the acceptability and effect on student research self-efficacy of introducing a clinical audit as part of a general practice placement. In Chapter 3, the mixed methods used to explore this aim were outlined, i.e., a (pre / post) survey of students who participated in the audit initiative, a survey of the GPs who participated in the initiative (with in-depth semi-structured interviews of five of these GPs). In this chapter, the findings of the survey of Medicine Subgroup members of the Health Sciences Group of the Universitas 21 network of universities are also presented. This was a consultation exercise which considered the findings of the scoping review and outlined the research options available to students in their respective medical schools. Finally, the results of the student / GP / U21 HSG surveys and findings of the thematic analysis of the semi-structured interviews are triangulated (see Figure 14).

4.2 Student surveys

Participation-student numbers opting into audit initiative:

Students were invited to participate and to 'opt in' to the audit component while on their GP placements. In September 2017, 92/104 students opted in for this component (see Figure 12, which outlines student participation and survey response rate).

In January 2018, prior to training delivery and data collection, 14 students withdrew from the initiative, with heavy workload the reason most commonly provided for withdrawal. In addition, one student had withdrawn from the degree programme and two had been unwell and so had not participated. In May 2018, one student withdrew, stating their partner had withdrawn from the programme and cited difficulty contacting their assigned

GP to complete the placement. Therefore, 74 (i.e., 92 minus 18) students commenced audits in general practice.

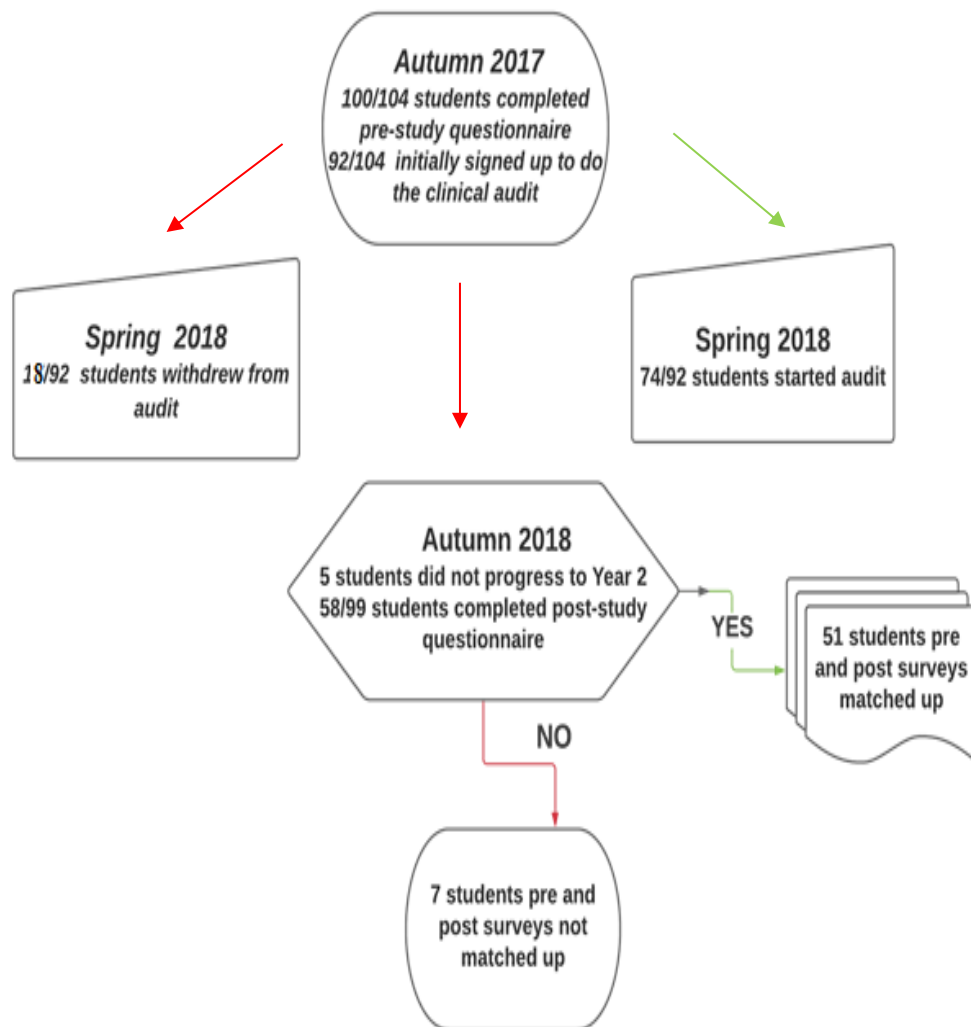


Figure 12. Flowchart outlining student recruitment and participation

Research experience and confidence questionnaire

Of 104 students who ‘opted in’, 100 (96%) completed a self-administered questionnaire examining their previous research / audit experience, research skills, and confidence. The students completed this survey within two weeks of being invited to participate. Of

these 104 students, five students did not progress to the next year for various reasons. At follow up, of the remaining 99 students, 58 (59%) completed the questionnaire.

Missing Data

The 100 responses to the initial survey in Autumn 2017 were analysed. In Autumn 2018, 58 post study surveys were analysed. There were 51 matched respondents ('paired respondents') whose pre- and post-surveys were matched up using the last four digits of their student number. Seven students failed to complete both pre-and post-questionnaires, resulting in incomplete pairs of data. These seven student post surveys were analysed but no change in research self-efficacy was identified for these.

Table 9. Demographic characteristics of sample participating in pre-study survey (n=100)

Sex	Female	58 (58%)
	Male	42 (42%)
	<25 years	82 (82%)
	26-30 years	15 (15%)
	>30 years	3 (3%)
Nationality	Irish	60 (60%)
	North American	24 (24%)
	Other EU (including UK)	12 (12%)
	Other nationality	4 (4%).
Primary degree	Primary degree in health science	56 (56%)
	Other (non-health science) science degree	29 (29%)
	Non-science related primary degree	15 (15%)
Postgraduate degree	No postgraduate degree	79 (79%)
	Masters degree	19 (9%)
	PhD	1 (1%)
	Other	1 (1%)

After the follow-up survey, we compared the demographics of the respondents who participated (39 out of 51) with those who did not (12 out of 51). More female students

participated in the audit than male students (29 out of 39). Additionally, 13 students with a postgraduate degree participated, while none of the non-participants had a postgraduate degree.

Outcome variables

In the student quantitative survey, the main outcomes we wanted to measure were:

1. Research self-confidence / efficacy pre and post intervention (see Table 10).
2. Change in research self-confidence / efficacy in 'matched' students pre and post intervention (see Table 11).
3. Change in research self-confidence / efficacy in matched students based on age, sex, nationality, primary degree subtype and postgraduate degree attainment (Tables 12-17)
4. The research experience of the students pre and post intervention.
5. Student perspectives on feasibility and acceptability (Educational impact).

1. Research self-confidence / efficacy (Kirkpatrick learning criteria)

Students self-rated their research confidence in various research tasks using a five-point Likert scale; (1= lacking any confidence, 2= lacking confidence, 3= neutral, 4=confident, 5= very confident). Table 10 outlines the median / mean self-reported research confidence and self-efficacy scores at baseline and follow up. The discrepancy in the denominators between the two groups (100 versus 58) due to student attrition means that their research confidence self-ratings cannot be directly compared.

Table 10. Research self-efficacy at baseline and follow up (not paired)

	Median score at baseline (mean, standard deviation) n=100		Median score at follow up (mean, standard deviation) n=58
How confident do you feel in your knowledge of the clinical audit cycle?	3 (2.64, +/- 1.035)		3 (2.86, +/- 1.076)
How confident do you feel describing the differences between clinical audit and research?	2.5 (2.49, +/- 0.870)		3 (3.26, +/- 0.890)
How confident do you feel in looking up the evidence behind a clinical recommendation?	3 (2.98, +/- 0.985)		4 (3.62, +/- 0.799)
How confident do you feel in writing an audit proposal or research protocol?	4 (3.61, +/- 0.942)		4 (3.74, +/- 0.785)
How confident do you feel collecting data in a clinical setting	3 (3.32, +/- 0.942)		4 (3.64, +/- 0.724)
How confident do you feel in the use of simple descriptive statistics?	4 (3.56, +/- 0.967)		4 (3.58, +/- 1.017)
How confident do you feel presenting results to peers?	4 (3.37, +/- 0.996)		3 (3.21, +/- 1.091)

2. Change in research self-efficacy after one year (matched 51 respondents only)

In the follow-up survey, 51 matched pre- and post-student surveys were compared to see if their research / audit self-efficacy had changed between baseline and follow up.

Table 11. Change in research self-efficacy in 51 matched pre- and post- surveys

Research skill	Pre-test median score (1-5)	Post-test median score (1-5)	Wilcoxon Signed Ranks Test
Writing a research proposal	2	3	Asymp Sig = 0.048 Z = -1.980
Knowledge of audit cycle	3	4	Asymp Sig = 0.000 Z = -4.087
Describing the differences between clinical audit and clinical research	3	4	Asymp Sig = 0.000 Z = -3.568
Looking up the evidence behind a clinical recommendation	4	4	Asymp Sig = 0.450 Z = -0.755
Collecting data in a clinical setting	4	4	Asymp Sig = 0.211 Z = -1.250
Using simple descriptive statistics	4	4	Asymp Sig = 0.925 Z = -0.094
Presenting audit / research results to audience of your peers	4	4	Asymp Sig = 0.118 Z = -1.563

There was a statistically significant difference in students' self-efficacy in writing a research proposal, knowledge of the audit cycle, and differences between audit and research in the 51 matched students. Further Wilcoxon signed-rank tests were then completed to investigate if there was a change in the research self-efficacy of those

matched respondents who completed the audit (39/51) versus those that did not (12/51). For the group who completed the audit, there was increased student self-efficacy in the knowledge of the audit cycle and the difference between research and audit ($p = 0.001$ = Asymptotic Significance for both items). For the group who did not complete the audit, there was increased student self-efficacy in the knowledge of the audit cycle only ($p = 0.013$ = Asymptotic Significance).

3. Comparison of student demographics

Among students with a primary health science degree, there was a statistically significant difference in self-efficacy in writing a research proposal (Sig.= $p=0.047$ using Kruskal - Wallis test). Student factors that were not associated with a change in research self-efficacy were: age, sex, nationality and having completed a previous postgraduate degree. See Tables 12-17.

Table 12. Mann- Whitney U Test change in research self-efficacy based on sex

Hypothesis Test Summary				
	Null Hypothesis	Test	Sig.	Decision
1	The distribution of Change_Proposal_Confidence is the same across categories of Before_Sex.	Independent-Samples Mann-Whitney U Test	.107	Retain the null hypothesis.
2	The distribution of Change_Audit_Cycle is the same across categories of Before_Sex.	Independent-Samples Mann-Whitney U Test	.288	Retain the null hypothesis.
3	The distribution of Change_Audit_vs_research is the same across categories of Before_Sex.	Independent-Samples Mann-Whitney U Test	.155	Retain the null hypothesis.
4	The distribution of Change_Evidence_search is the same across categories of Before_Sex.	Independent-Samples Mann-Whitney U Test	.910	Retain the null hypothesis.
5	The distribution of Change_Clinical_data is the same across categories of Before_Sex.	Independent-Samples Mann-Whitney U Test	.438	Retain the null hypothesis.
6	The distribution of Change_Statistics is the same across categories of Before_Sex.	Independent-Samples Mann-Whitney U Test	.314	Retain the null hypothesis.
7	The distribution of Change_Present_Peers is the same across categories of Before_Sex.	Independent-Samples Mann-Whitney U Test	.982	Retain the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

Table 13. Kruskal-Wallis change in research self-efficacy based on age

Hypothesis Test Summary				
	Null Hypothesis	Test	Sig.	Decision
1	The distribution of Change_Proposal_Confidence is the same across categories of Before_Age.	Independent-Samples Kruskal-Wallis Test	.827	Retain the null hypothesis.
2	The distribution of Change_Audit_Cycle is the same across categories of Before_Age.	Independent-Samples Kruskal-Wallis Test	.053	Retain the null hypothesis.
3	The distribution of Change_Audit_vs_research is the same across categories of Before_Age.	Independent-Samples Kruskal-Wallis Test	.213	Retain the null hypothesis.
4	The distribution of Change_Evidence_search is the same across categories of Before_Age.	Independent-Samples Kruskal-Wallis Test	.301	Retain the null hypothesis.
5	The distribution of Change_Clinical_data is the same across categories of Before_Age.	Independent-Samples Kruskal-Wallis Test	.964	Retain the null hypothesis.
6	The distribution of Change_Statistics is the same across categories of Before_Age.	Independent-Samples Kruskal-Wallis Test	.850	Retain the null hypothesis.
7	The distribution of Change_Present_Peers is the same across categories of Before_Age.	Independent-Samples Kruskal-Wallis Test	.857	Retain the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

Table 14. Kruskal-Wallis change in research self-efficacy based on nationality

Hypothesis Test Summary				
	Null Hypothesis	Test	Sig.	Decision
1	The distribution of Change_Proposal_Confidence is the same across categories of Before_Nationality.	Independent-Samples Kruskal-Wallis Test	.247	Retain the null hypothesis.
2	The distribution of Change_Audit_Cycle is the same across categories of Before_Nationality.	Independent-Samples Kruskal-Wallis Test	.518	Retain the null hypothesis.
3	The distribution of Change_Audit_vs_research is the same across categories of Before_Nationality.	Independent-Samples Kruskal-Wallis Test	.728	Retain the null hypothesis.
4	The distribution of Change_Evidence_search is the same across categories of Before_Nationality.	Independent-Samples Kruskal-Wallis Test	.069	Retain the null hypothesis.
5	The distribution of Change_Clinical_data is the same across categories of Before_Nationality.	Independent-Samples Kruskal-Wallis Test	.331	Retain the null hypothesis.
6	The distribution of Change_Statistics is the same across categories of Before_Nationality.	Independent-Samples Kruskal-Wallis Test	.167	Retain the null hypothesis.
7	The distribution of Change_Present_Peers is the same across categories of Before_Nationality.	Independent-Samples Kruskal-Wallis Test	.878	Retain the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

Table 15. Kruskal-Wallis change in research self-efficacy based on primary degree subtype

Hypothesis Test Summary				
	Null Hypothesis	Test	Sig.	Decision
1	The distribution of Change_Proposal_Confidence is the same across categories of Before_Primary_degree.	Independent-Samples Kruskal-Wallis Test	.047	Reject the null hypothesis.
2	The distribution of Change_Audit_Cycle is the same across categories of Before_Primary_degree.	Independent-Samples Kruskal-Wallis Test	.236	Retain the null hypothesis.
3	The distribution of Change_Audit_vs_research is the same across categories of Before_Primary_degree.	Independent-Samples Kruskal-Wallis Test	.108	Retain the null hypothesis.
4	The distribution of Change_Evidence_search is the same across categories of Before_Primary_degree.	Independent-Samples Kruskal-Wallis Test	.958	Retain the null hypothesis.
5	The distribution of Change_Clinical_data is the same across categories of Before_Primary_degree.	Independent-Samples Kruskal-Wallis Test	.909	Retain the null hypothesis.
6	The distribution of Change_Statistics is the same across categories of Before_Primary_degree.	Independent-Samples Kruskal-Wallis Test	.739	Retain the null hypothesis.
7	The distribution of Change_Present_Peers is the same across categories of Before_Primary_degree.	Independent-Samples Kruskal-Wallis Test	.990	Retain the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

Table 16. Change in research self-efficacy based on postgraduate degree status

Hypothesis Test Summary				
	Null Hypothesis	Test	Sig.	Decision
1	The distribution of Change_Proposal_Confidence is the same across categories of Degree_level.	Independent-Samples Mann-Whitney U Test	.617 ¹	Retain the null hypothesis.
2	The distribution of Change_Audit_Cycle is the same across categories of Degree_level	Independent-Samples Mann-Whitney U Test	.447	Retain the null hypothesis.
3	The distribution of Change_Audit_vs_research is the same across categories of Degree_level.	Independent-Samples Mann-Whitney U Test	.535	Retain the null hypothesis.
4	The distribution of Change_Evidence_search is the same across categories of Degree_level.	Independent-Samples Mann-Whitney U Test	.067	Retain the null hypothesis.
5	The distribution of Change_Clinical_data is the same across categories of Degree_level	Independent-Samples Mann-Whitney U Test	.446	Retain the null hypothesis.
6	The distribution of Change_Statistics is the same across categories of Degree_level	Independent-Samples Mann-Whitney U Test	.968	Retain the null hypothesis.
7	The distribution of Change_Present_Peers is the same across categories of Degree_level.	Independent-Samples Mann-Whitney U Test	.892 ¹	Retain the null hypothesis.

Asymptotic significances are displayed. The significance level is .05.

¹Exact significance is displayed for this test.

Reliability of scale used to measure research self-efficacy

Cronbach's alpha was calculated in SPSS ® for the seven questions measuring research self-efficacy in the pre- and post-clinical audit surveys and was deemed acceptable (acceptable alpha score considered to be between 0.70 to 0.95 (Tavakol and Dennick, 2011)). The pre-audit survey had a Cronbach's alpha of 0.776, while the post-audit survey had a Cronbach's alpha of 0.736.

Assessment for floor / ceiling effects

The ceiling and floor effects were calculated by percentage frequency of lowest or highest possible score achieved by respondents. Floor or ceiling effects are considered to be present if more than 15% of respondents achieved the lowest or highest possible score, respectively (Terwee *et al.*, 2007).

Table 17. Distribution of low and high research self-efficacy scores to assess for floor and ceiling effects with 1 = 'lacking any confidence' and 5 = 'very confident'

	Pre-study (100/104 students)	Post-study (58/99 students)
How confident do you feel in your knowledge of the clinical audit cycle?	Scored 1 N=13 (13%) Scored 5 N=0 (0%)	Scored 1 N=2 (3%) Scored 5 N=1 (2%)
How confident do you feel describing the differences between clinical audit and research?	Scored 1 N=6 (6%) Scored 5 N=3 (3%)	Scored 1 N=1 (2%) Scored 5 N=4 (7%)
How confident do you feel in looking up the evidence behind a clinical recommendation?	Scored 1 N=4 (4%) Scored 5 N=12 (12%)	Scored 1 N=1 (2%) Scored 5 N=5 (9%)
How confident do you feel in writing an audit proposal or research protocol?	Scored 1 N=15 (15%) Scored 5 N=1 (1%)	Scored 1 N=6 (10%) Scored 5 N=3 (5%)
How confident do you feel collecting data in a clinical setting	Scored 1 N=3 (3%) Scored 5 N=7 (7%)	Scored 1 N=0 (0%) Scored 5 N=2 (3%)
How confident do you feel in the use of simple descriptive statistics?	Scored 1 N=3 (3%) Scored 5 N =11(11%)	Scored 1 N=1 (2%) Scored 5 N=10 (17%)
How confident do you feel presenting results to peers?	Scored 1 N=2 (2%) Scored 5 N=1 (1%)	Scored 1 N=1 (2%) Scored 5 N=10 (17%)

4. Research Experience

Most students had limited research experience upon entry to the programme (see Table 18).

Table 18. Research experience on entry to the programme

	Pre-study survey (100 responses)
Audit	3 (3%) had completed a prior clinical audit.
General Project	81 (81%) had done a prior general project with the majority having done 1 project (40%). 4 students had completed five or more general research projects.
Clinical Projects	26 (26%) had completed a clinical project, with 3 students having completed three or more.
Abstract Submission	22 (22%) had submitted an abstract to a national or international conference. 1 student had submitted to five or more conferences.
Poster Presentation	20 (20%) had a poster presentation at a national or international conference. 2 students had five or more poster presentations at national or international conferences.
Oral Presentation	10 (10%) had done an oral presentation at a national or international conference. 2 students had done two or more oral presentations.
Peer Review Publication	21 (21%) had peer reviewed publications, with 1 student having three or more peer reviewed publications.
No Research Experience	19 (19%) had no research experience (i.e., none of the above).

Research experience after 1 year (in addition to the audit)

Due to the attrition rate, it was not possible to directly compare the pre and post intervention research experience of the students. One area where there was a definite increase was in the number of students who had now completed a clinical audit (three students had completed a clinical audit prior to commencing their medicine degree at UCD while 43 students reported having completed a clinical audit on the post-study survey). Of the 58 post-study respondents, 26 had completed other research over the year (for example summer student research projects).

5. Student perspectives on feasibility and acceptability (Kirkpatrick reaction criteria)

Twenty-one participants (55%) reported the initiative had a positive educational impact, with 28 reporting (72%) that it increased their understanding of the audit cycle and 30 (77%) reported it improved their understanding of real-world prescribing. Eleven students (29%) reported it increased their research exposure or research skills. Overall, they felt they were adequately prepared to do an audit by the programme and 32 (80%) felt supported by the GPs in the general practices.

There was a relatively large attrition rate from the study. Initially, 92/104 students agreed to partake in the audit study but there are only 42 responses confirming they had taken part (39 matched students + three non-matched students). There were several feasibility issues mentioned; lack of time / workload, no academic credit, issues to do with GP / role modelling, issues with assigned student partner and issues with the assigned topic (see Table 20). These issues are discussed further in Section 4.6 (comparison and triangulation of findings).

Table 19. Kirkpatrick reaction criteria for students-themes from survey open questions

Lack of time / workload	<i>'Limited time during the school year.'</i> <i>"Busy lifestyle. Hard to find time.'</i> <i>'Was concerned it would take up too much time.'</i>
No academic credit	<i>'Prioritisation of aspects of the course carrying credits.'</i> <i>'There was no grade for the audit and so I did not want to do extra work.'</i>
Issues to do with GP / role modelling	<i>'The GP felt that the audit was a waste of time. They said that they were aware of guidelines but did not have time to implement them. They were not very receptive to making changes and as a result we did not re-audit.'</i> <i>'Our GP was not too enthusiastic in the audit first round, like did not continue due to our own time constraints.'</i>
Issues with assigned student partner	<i>'My partner in the audit didn't return after the summer so the initial data collection was not sufficient (I didn't realise he wasn't coming back.)'</i> <i>'Partner dropped out first.'</i>
Issues with assigned topic	<i>'I also thought the topic of my audit (LFTS with statins) had been demonstrated in the literature to be evidence based. I would have liked to have had a choice of topic before having to do the intervention.'</i> <i>'My audit topic was checking inhaler technique; however, the GP informed us that they never record this.'</i>
Previous research experience	<i>'Had previous research experience, didn't feel necessary.'</i>
Regrets about not opting in	<i>'Did not realise the importance of audit in continuing development and CV building. Would have done it with understanding I have now.'</i>

4.3 GP survey

Twenty-five GPs in the Dublin area agreed to participate. There was a 96% (N=24) response rate from participating GPs.

Demographics of participating GPs

In relation to participating GPs, 13 (54%) were male and 11 (48%) were female. Ten (42%) GPs were aged 50-64 years, with three GPs aged less than 39 and two GPs aged over 65. Twenty-two (92%) of GPs worked in group practices. Sixteen (67%) worked in practices that had between 2000 and 6000 patients. Seven (29%) worked in practices that were postgraduate training practices.

Eighteen (75%) practices had been taking UCD medical students for more than 5 years, with four (17%) having UCD medical students for more than 20 years. The average range of students on placement in the previous year per practice was 3-4.

Table 20. GP feasibility and acceptability (Kirkpatrick reaction criteria)

	Response rate / 25	Median of 4-point Likert scale
I felt prepared to supervise the GEM students doing an audit	24 (0 missing)	3
I felt supported by UCD Academic General Practice with this audit study	23 (1 missing)	3
The time spent supervising the student audit was as expected	23 (1 missing)	3
The student audit(s) impacted positively on patient care / safety	21 (3 missing)	3
I would be happy for UCD medical students to do audits in my practice in future	22 (2 missing)	3

Reliability of scale used in GP survey

Cronbach's alpha was calculated in SPSS ® for the five feasibility and acceptability questions outlined in Table 21 and was deemed acceptable, with an alpha score of 0.924.

GP feasibility issues identified in survey

The main difficulty that GPs identified with the initiative was the time allocated - GPs felt more time was needed to be given to the activity. In addition, there was a discrepancy in the topics the GPs wanted audited and the topics that had been assigned.

Table 21. Asymptotic Significance comparing GP demographics and satisfaction

	Age	Male	No. of students doing audit	No. of patients in practice	Urban or rural practice	Training practice or non-training	Group or single practice	Years in practice
Preparedness to supervise students	.120	.228	.885	.220	.197	.042	.026	.248
Support from UCD General Practice	.195	.110	.348	.188	1.000	.009	1.000	.082
Workload as expected	.291	.814	.311	.117	.741	.560	.741	.041
Positive impact on patient care	.287	.054	.903	.308	.207	.640	.026	.300
Facilitate future student audits	.595	.044	.545	.455	.483	.587	.122	.309

Statistically significant results from GP Survey

With regards to sex, male GPs were more likely to have GEM students do audits in their practice in the future than female GPs ($p = 0.044$ = Asymptotic Significance, $Z = -2.015$, Mann Whitney U test). With regards to years in practice, those in practice for 10-20 years disagreed that the workload was as expected ($p = 0.041$ = Asymptotic Significance, Kruskal Wallis test). With regards to whether the practice was a post graduate training practice, those from non-training practices did not feel as supported by UCD ($p = 0.009$ = Asymptotic Significance, $Z = -2.600$, Mann Whitney U test). With regards to practice type, those from single handed practices felt more prepared to supervise student audits ($p = 0.026$ = Asymptotic Significance., $Z = -2.231$, Mann Whitney U test) and that the initiative had a positive impact on patient care ($p = 0.026$ = Asymptotic Significance, $Z = -2.225$, Mann Whitney U test).

4.4 GP semi-structured interviews

The themes were reviewed, as per Braun and Clarke's six step approach, with Social Cognitive Theory helping to identify themes related to social influences on behaviour and research self-efficacy.

Five overarching themes were identified:

1. Barriers to facilitating student research placements
2. Research in general practice
3. GP role and modelling – mentoring
4. Student engagement
5. Personal agency in the research

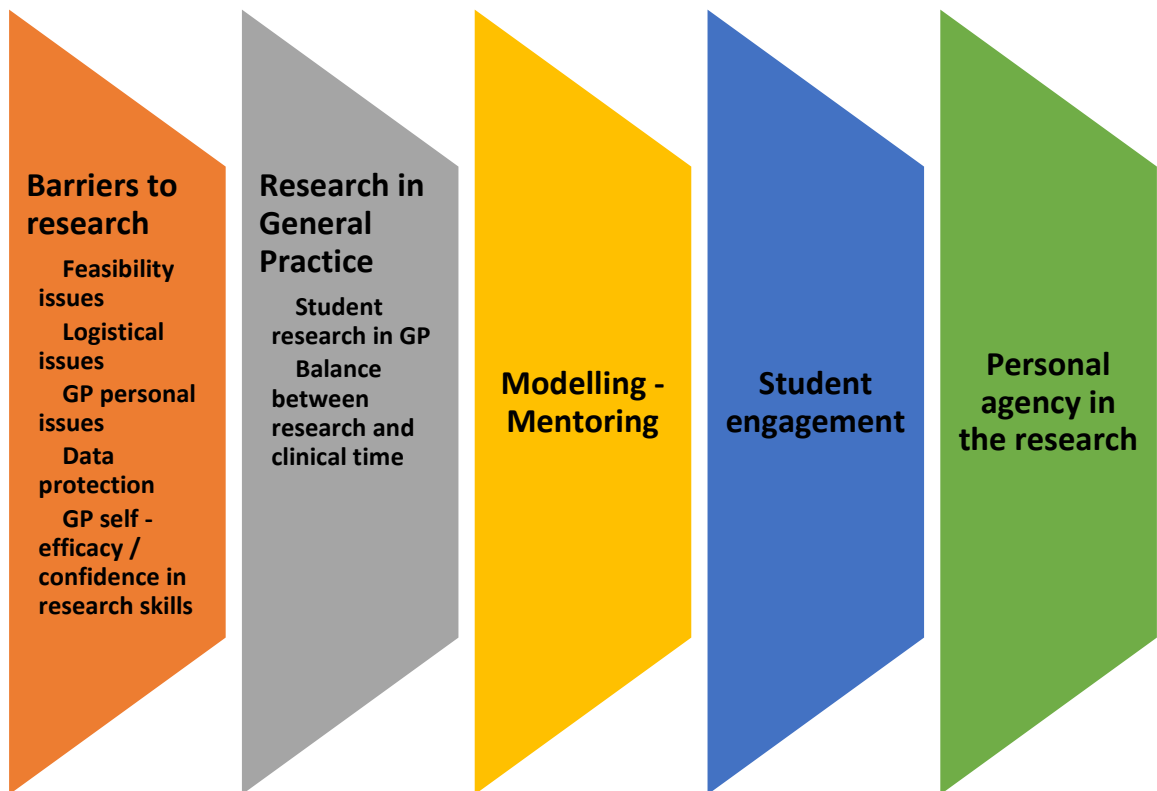


Figure 13. Themes identified from GP Semi Structured Interviews

4.4.1 Theme 1 - Barriers to facilitating student research placements

Time

One of the barriers identified by GPs was lack of time, which was mentioned by four out of the five GPs interviewed, with one GP mentioning 'time' 18 times in their interview.

'I think really for them to learn about audit; and I think that is the problem, if they come out to us without any idea of what audit is, we don't really have the time to spend explaining it all to them because it actually takes time away from patients.' (GP 1)

Logistical issues

Logistical issues such as room and computer availability were mentioned as issues by two of the GPs. Linked to computer availability, one GP mentioned an issue with the IT software they used when auditing.

'I think probably rooms and computers, so from a resource perspective that you would have a spare room for a student to be able to sit at the computer and carry out some research.' (GP 1)

Data protection and GDPR

GPs 1 and 4 were concerned about data protection and GDPR.

'The problem is that being students, we couldn't have them working remotely with the patient data. I want everything to stay on site and they walk home with nothing.' (GP 4)

'I suppose finding the barrier of GDPR. I suppose I am not sure of that. I am not fully sure that I would understand the extent of GDPR and students and audit, and how the three interact.' (GP 1)

Workload in the context of COVID-19

One GP mentioned the impact of the COVID-19 pandemic. For context, these interviews were conducted in March 2020 at the start of the COVID-19 pandemic when there was a lot of uncertainty and Ireland was under 'lockdown'.

'I know, personally, for me, it is me who has to do everything because I am the boss. So, with COVID-19 it is me who does absolutely every single thing for all my staff, all the time. Nobody else does it. If I had students come in and I would

have to talk to them all about audits, I am saying, “Oh, my God, another thing that I have to do”.’ (GP 2)

*‘We are finding it very difficult to do our own audits, especially now with COVID-19, I can’t imagine that any GPs are going to have their audit done this year.’
(GP 2)*

GP confidence / self-efficacy in research skills

One GP discussed their lack of confidence in their research skills, and another mentioned that GPs might need more training in the audit cycle.

‘Perhaps the GPs might need some tuition on the audit cycle as well as the students. Perhaps it is assumed that GPs understand audit but that might not be the case. I am just speculating there; I don’t know that.’ (GP 1)

‘But I think, from a GP’s perspective, we certainly don’t have any significant expertise in either doing research or...’ (GP 5)

‘So yeah, I think they have somewhat more experience than me in doing audits per se. It is only something that we have been doing in latter years since the Irish Medical Council would have mandated it in the College. I think one of the traits of GPs is that they maybe steer clear of research and audit because it wasn’t part of our post graduate training. Certainly, when I was qualifying in YYYY, we went the hospital route and a requirement to do audits and some research wasn’t a requirement at our time.’ (GP 5)

4.4.2 Theme 2 - Research in General Practice

This theme is linked to the 'GP confidence in research subtheme', which was discussed above. GP 5 was, in particular, unsure of their ability to conduct research in primary care but at the same time wanted to facilitate the students.

'I don't have enough experience around doing actual primary care research.'
(GP 5)

'Undoubtedly, the opportunity is there as the material is all there. It will improve as we get better at coding.' (GP 5)

With regards to students doing research in general practice, GPs 1 and 4 were unsure

'I suppose the first consideration is whether or not it is mandatory for students to perform research and if so, does it have to be in general practice?' (GP 1)

'To be very blunt about this, I think research is great for people who want to do research. I think we almost over-fetishize it for all medical graduates and trainees.... I think by forcing the whole research issue for a lot of people, you just end up possibly discriminating against the people who may have strengths on other sides. Because it is very easy to have research on a CV while it is not easy to have general aptitude or cop on, as their interests in their CV.' (GP 4)

GP 3 had a lot of positive sentiment towards students and the student audit initiative.

'I would be open to it. I always think it is great to do an audit and just review what you are doing and see can you do better..... We would certainly support it.' (GP 3)

4.4.3 Theme 3 - Modelling-mentoring

Two GPs discussed social influences on behaviour and learning processes. Modelling was identified, with GPs discussing their role as a mentor to students.

'Let's say if a student and a GP mentor are having a bit of a brain freeze as to what they consider doing, the student is more than welcome to contact their UCD tutor to help them in creating that decision making....so, they would certainly need our guidance because obviously being in practice, we would have an idea or a good sense of what would be correct in an interpretation.' (GP 5)

Another GP outlined the importance of the GP-student relationship *'I think you can have one-to-one relationships with students in general practice.'* (GP 1).

4.4.4 Theme 4 - Student engagement

All of the GPs discussed this theme and there were mixed views on student engagement. One GP did not rate the student engagement with the audit project:

'I suppose the interest levels were highest at the start and waned. Which I think would be typical of most research projects, but it seemed to happen quite quickly with the students. I suppose the two things that struck me was number one, was that it was optional, so I think they were very interested at the start. I think when they thought it might boost their CV but when they realised that they didn't need it for their core curriculum, they were inclined to put that to the bottom of the pile and lost interest.... I think when it became evident to them that doing an intervention in an audit cycle would be a lot of work, they kind of elected to do fairly minimal interventions and then kind of had little enough interest in and it hasn't changed because there wouldn't really be much change.' (GP 1).

Another GP reported concerns as to what students were likely to be gaining from the

exercise: *'I guess I actually haven't seen any of the results of the audits that they have done. So, that would probably tell a tale itself as to how much they are actually getting out of it.'* (GP 2)

Other GPs reported a more positive experience in respect of student engagement:

'Ah, they are brilliant, absolutely.' (GP 3)

'We had a student in November and what we were doing is we were looking at polypharmacy in a nursing home. He was actually fantastic at that job.' (GP 4)

'I think they are good, yes. If they have an audit idea that is doable and achievable, in general, they can do it and I find they can do it from beginning to end.' (GP 5)

4.4.5 Theme 5 – Personal agency in the research

This theme was brought up by GP 1 who felt that the inability to choose the audit topic may have affected student engagement with the project.

'So, I think a bit more autonomy in the project's outline would be my first suggestion... more maybe to create their own ideas from. I think the student I met had an audit title and it might have been useful to have that as a basis to maybe come up with their own audit that we both would find interesting... 'But I suppose I am wondering would there be a richer output of research if the students had a choice or who they wanted to pair up with to do their research.'
(GP 1)

4.5 Summary of findings from the Universitas 21 Health Science Group survey

Eight out of the 12 invited medical schools responded to the survey. Four of these medical schools were in Europe, two were in Australia, one was in North America, and one was in South America. The number of graduates per year per school ranged from 130 to 400. Three medical schools offered undergraduate entry only programmes, one school offered a graduate entry programme only and four offered both undergraduate and graduate entry programmes. Four of the medical schools who responded indicated they had a designated faculty member responsible for student research while the other four did not. When asked about the provision of student research options, one respondent indicated that it is curriculum dependent and should not be prescriptive, three said that there should be some basic mandatory research for all but with an option for additional opportunities for those students who might be interested. Two respondents supported mandatory research for all. All responding medical schools reported having at least one research option in their curriculum for their medical students. These options ranged from mandatory intercalated degrees (two schools), optional intercalated degrees (four schools), mandatory research projects (other than projects associated with an intercalated degree, four schools), and optional research projects (four schools) to clinical audits (one school reported an obligatory audit for all students while two provide the option of doing clinical audit). Obligatory intercalated research degrees and obligatory clinical audit were rated as being of the highest quality of the research options available with a median Likert score of 5 for both these options (the Likert scale ranged from 1 'poor quality' to 5 'very high quality' for this question). While obligatory intercalated degrees were rated as being of the highest quality of the research options available, they were also rated as being the least feasible scoring a median Likert score of 1.5 (the Likert scale ranged from 1 'not at all feasible' to 5 'very feasible' for this question).

Table 22. Feasibility of research options ‘Please rate the feasibility of the below research options for your medical school from 1-5.’

Research Option	Median 5-Point Likert Score
Obligatory intercalated research degree for all medical students	1.5
Optional intercalated research degree for interested medical students	4.5
Optional elective research project for interested medical students	4
Obligatory clinical audit incorporating research skills for all students	4
Optional elective clinical audit incorporating research skills for interested students	3.5
No research or audit opportunities.	3

Five (of eight) respondents felt there was enough time dedicated to research in their curriculum, two were not sure, and one felt that not enough time was dedicated to research.

Five (of eight) respondents felt there were adequate resources for research in their medical school, one was not sure, and two felt there were not enough resources.

Seven (of eight) respondents answered that there was a structured process for student research ethics review. There were mixed views on respondent satisfaction with the research output of the students at their medical school, with four (of eight) saying they were happy, three not, and one not sure. Half of respondents felt that undergraduate research is necessary for career progression, three felt that it was not necessary, and one respondent was not sure. Seven (of eight) respondents supported the WFME research standards, while the other respondent left this question blank.

4.6 Comparison and triangulation of findings

Triangulation of results

Triangulation is defined as “the combination of methodologies in the study of the same phenomenon” (Denzin, 1978, p. 291) and aims to achieve a rounded multi-layered understanding of the research topic (Yardley, 2000). Findings from the scoping review were triangulated with the surveys and semi-structured interviews to explore the evidence supporting medical student involvement in research in curricula (see Figure 14).

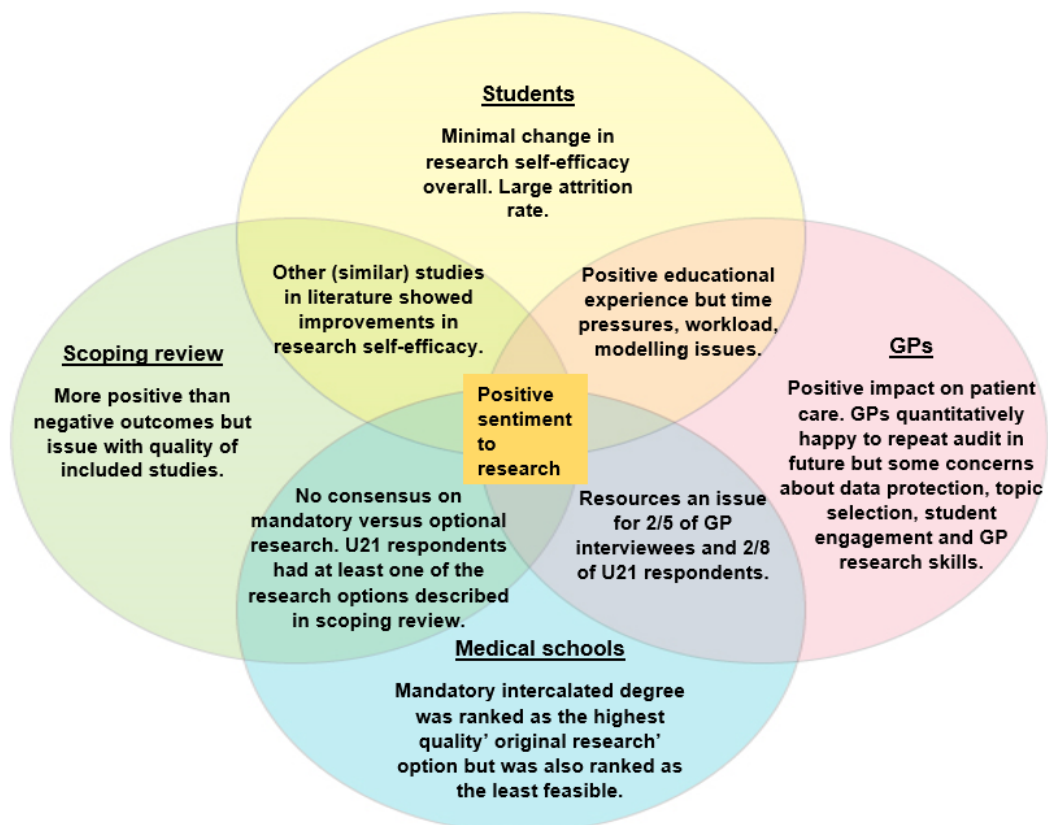


Figure 14. Venn diagram illustrating data triangulation.

After triangulation of the data, the overall main finding was that there was a 'positive sentiment' towards encouraging medical student research. There were some definite caveats to the 'positive sentiment.' These included the evidence from the scoping review

which found that although there were more positive than negative outcomes reported, there was an issue with the quality of the included studies. With regards to the audit initiative, students and GPs found it overall a positive educational experience but concerns raised included time pressures, workload and modelling issues. Resources for research were an issue for two (out of the five) GP interviewees and two (of the eight) Universitas 21 survey respondents. There was no consensus in the literature review or from the consultation exercise with the U21 Health Science Group respondents about whether medical student research should be optional or mandatory. Different strands of the project produced different key findings.

For instance, the scoping review mapped the various options available to medical schools to enhance research experiences for medical students. The Kirkpatrick approach was chosen to evaluate the outcomes of the research options. Kirkpatrick's results criteria (output of research) was the most common outcome reported for both intercalated and non- intercalated research options (41/120 studies). The scoping review highlighted quality issues with those studies that had been identified.

With regards to student data, the participation in the audit was significantly associated with improved confidence in 'knowledge of the audit cycle' and the 'difference between research and audit' ($p=0.001$) but no statistically significant difference in other research skills or difference based on student characteristics. Two similar studies found in the literature review (Chapman *et al.*, 2015; Mullan *et al.*, 2014) reported an improvement in research self-efficacy and this is discussed further in Chapter 5 (Discussion).

While students felt, overall, that conducting the audit was a positive educational experience, there was a large attrition rate of 54% from the audit study. There was a definite fall off from the initial number of students who agreed to participate in the audit at entry to the Medicine degree programme in September 2017 ($N=92$) and those who started data collection in Spring 2018 ($N=72$). Lack of time was mentioned as the largest

barrier by students, and the most common reason cited by students for dropping out of the audit study. Workload was cited as the most common reason to drop out of the initiative. Time was also the biggest feasibility issue that arose in the GP quantitative and qualitative data.

With regards to modelling-mentoring, this featured also in the GP interviews (see below and section 4.4) and is a component of SCT. The modelling that two groups of students reported however was negative and affected their participation in the audit initiative.

‘The GP felt that the audit was a waste of time. They said that they were aware of guidelines but did not have time to implement them. They were not very receptive to making changes and as a result we did not re-audit.’

‘Our GP was not too enthusiastic in the audit first round, like did not continue due to our own time constraints.’

With regards to GP quantitative data, there was a high response rate, with responses from 24/25 of the participating GPs. 71% (N=17) of the GPs felt that the student audits had a positive impact on patient care.

While 23 out of 24 survey respondents supported future student audits, qualitative interviews revealed more mixed feelings

With regard to *GP qualitative data*, time, workload, student engagement issues, GP confidence in research skills, and personal agency in topic choice were among the barriers discussed. While GPs raised concerns about space / access to practice management systems / data protection, these concerns were not identified by students. Feasibility issues were a key finding of the scoping review. There were some qualitative comments from both GPs and students about ambivalence towards participating in the audit.

Finally, the ability to form one-to-one relationships with students in general practice was discussed in the qualitative interviews. One GP discussed their role as a mentor to students. Negative aspects of modelling were discussed by two students (please see Table 15).

With regards to the Universitas 21 Consultation, of the eight Schools that responded, all indicated they offered at least one of the research options that were described in the scoping review to their students. While a mandatory intercalated degree was ranked as the highest quality 'original research' option by respondents, it was also ranked as the least feasible. There was no consensus on the question of mandatory or optional research and the research outputs of the medical students at their respective medical schools. There was an even mix between mandatory and elective research projects in the 92 non-intercalated studies in the selected studies from the scoping review and no study found one to be preferable to the other. Two of the eight respondents stated they had concerns about resources in their respective medical schools, as did two of the five GPs interviewed.

Chapter 5: Discussion

5.1 Key findings

A summary of the major findings is presented below, framed in relation to the three main study arms. By employing mixed methods, I was able to gain deeper insights into the context and better comprehend the outcomes of the audit initiative through the lens of Social Cognitive Theory (see Section 5.3 Interpretation of findings).

1. **Scoping Review** – Most studies assume medical student research is beneficial; however, none explicitly explore the specific role of research. The emphasis is largely on outcomes, with a notable evidence gap in terms of feasibility and effectiveness.
2. **Audit Initiative** – First, the study experienced an attrition rate of 54%, reflecting a notable dropout over the course of the intervention. Second, only minimal changes were observed in relation to RSE outcomes. Third, a disparity emerged between the qualitative accounts and the quantitative data provided by GPs.
3. **U21** – The internationally focussed Universitas 21 survey found that no single option stands out as the best among a range of possibilities, as choices are largely context-dependent—particularly in terms of time and resource availability.

5.2 Methodological considerations

Strengths

The strengths of this study are that the mixed methods used provided a more comprehensive understanding of the research problem. The dual approach allowed me to capture the breadth and depth of the subject which aligned with my post positivist epistemological position allowing me to incorporate the objective findings of the quantitative surveys and my perspectives on the interpretation of the qualitative data through the SCT lens. The scoping literature review was extensive, encompassing a broad range of relevant papers that aligned with the study's objectives. The findings were systematically presented in adherence to the PRISMA Extension for Scoping Reviews (PRISMA-ScR) guidelines (Tricco et al., 2018). The triangulation of data enhanced the validity and reliability of my findings. Ethical guidelines were strictly followed which ensured the integrity and ethical soundness of my research.

Limitations

There are several limitations to consider in this study; the limitations of the scoping review, the mixed methods approach with the potential difficulty of aligning data from two different methods (cf. GP quantitative and qualitative data findings), the use of questionnaires (issues with using Likert scales, self-report surveys, floor and ceiling effects, the omission of missing data), considerations re the statistical analysis used and the need to make a late change from the original plan of doing a face to face focus group with the GPs to telephone semi structured interviews due the outbreak of COVID-19 in March 2020.

Scoping Review Limitations

The scoping review approach has several limitations (no formal evaluation of the quality of the evidence, heterogeneity and difficulty synthesising results into distinct outcomes (Sucharew and Macaluso, 2019)). No universal agreement exists on terminology, definition, or methodological steps in scoping reviews. In 2010, Levac et al. proposed

recommendations, building on each stage of the scoping study framework, highlighting considerations for advancement, application and relevance of scoping studies in health research which were implemented in this scoping review (Levac, Colquhoun and O'Brien, 2010; O'Brien *et al.*, 2016). Like other studies, scoping reviews are at risk for bias from different sources. For example, selection bias may have occurred if the scoping review did not identify all available data on this topic, reducing the validity of its findings. However, a robust search methodology was followed to reduce this risk. Only one main outcome was recorded per study for summarising for the scoping review write up, which could have introduced bias (the other study outcomes were recorded in an excel file). Kappa scores were not carried out.

Synthesising data from two different methods

In addition, the use of a mixed methods approach facilitated data triangulation—particularly in identifying dissonance within the GP findings—a tension emerged between the narrative conveyed by the quantitative data (suggesting GPs responded positively and would engage again, potentially reflecting socially desirable responses) and that of the qualitative data, which revealed deeper insights into their own research self-efficacy, motivation, and role modelling. This discordance may also reflect a methodological issue—specifically, the challenges involved in integrating qualitative and quantitative data within a mixed methods approach. Indeed, Harris and Brown report that, although questionnaire and interview data are frequently reported together, studies within educational contexts seldom examine the level of similarity between people's questionnaire and interview responses to determine when and if comparisons between these data sets are appropriate (Harris and Brown, 2019). They comment on work by Oei and Zwart who suggest that participants respond differently to questionnaire and interview prompts, with interviews triggering perhaps strong affective responses, while questionnaires permit a wide range of responses, of, perhaps, a more cognitively

dispassionate nature (Oei and Zwart, 1986). This aspect may be relevant when interpreting the inconsistency observed between GPs' qualitative and quantitative responses. To help align the two methods, they make several suggestions, the two most relevant to this current study being, firstly, to ensure that interview prompts and questionnaire items are structured and highly similar and, secondly, to separate data collection by only a short period of time. Thus, although there were attempts made to align the content of the GP survey and semi structured interviews, there was a time lag between the data collection of both (one year), which may have contributed to the discordance. However, despite this potential methodological flaw, I would argue that the dissonance may be real when interpreted through the lens of SCT and the medical myth (see Section 5.3 Interpretation of findings).

Limitations to the use of questionnaires

Elsewhere, although validated questionnaires were not found for the surveys, modified versions of previous questionnaires were found, which enabled a comparison to be made to previous studies (Chapman *et al.*, 2015; Drake *et al.*, 2018). The modifications and omissions to the questionnaires are discussed in Chapter 3, as are limitations to the use of questionnaires (potentially low response rates, eliciting socially desirable responses and only getting a snapshot of information (Patten, 2016).

'Closer to 0' Likert scale

Furthermore, a Likert scale was used to measure research self-efficacy. Considerations of using Likert scales in the measurement of research self-efficacy are discussed in Chapter 3, as is the rationale for modifying the wording of the Likert scale from the STARSurg survey to encompass a more 'closer to 0' scale as suggested by Bandura in social cognitive theory. This could have affected the validity and reliability of the results. The GP survey contained a 4-point, rather than a 5-point Likert scale, which may have

affected reliability. However, the standard deviations of .05 for a 2-point scale and .03 for a 5-point scale in a previous study indicates the possibility that, for any particular group of empirical studies, the gain in reliability may not come to light (Lissitz and Green, 1975). Cronbach's alpha scores for the Likert scales used in the pre- and post-clinical audit surveys and GP survey were deemed reliable (0.776, 0.736 and 0.924, respectively).

Potential for the 'cognitive miser' in Likert scale responses

A "cognitive miser" in the context of Likert scale responses refers to individuals who tend to conserve their cognitive resources by opting for simpler, less effortful responses. This behaviour often manifests as selecting the neutral or middle option on a Likert scale, rather than carefully considering each statement and providing a more nuanced response. This can lead to less accurate data, as the responses may not fully reflect the individual's true opinions or attitudes (Kankaraš and Capecchi, 2024). In the student survey assessing self-efficacy related to research tasks, most respondents selected the neutral point (3) on the Likert scale in both the pre- and post-surveys, potentially impacting the results. Utilising a semantic differential scale might have mitigated this issue although no scale is immune to this.

Potential ceiling / floor effects

Surveys with scales have the potential to have ceiling / floor effects. Ceiling and floor effects occur when a considerable proportion of subjects score the best / maximum or worst / minimum score, rendering the measure unable to discriminate between subjects at either extreme of the scale (Lim *et al.*, 2015). Floor or ceiling effects are present if more than 15% of respondents achieved the lowest or highest possible score, respectively (Terwee *et al.*, 2007). In the student post-clinical audit survey, there was a possible ceiling effect with two of the seven research self-efficacy questions; 'How

confident do you feel in the use of simple descriptive statistics?’ and ‘How confident do you feel presenting results to peers?’ with both questions having 17% of respondents (N=10) selecting the highest score ‘very confident’ =5 (see table 12 in Chapter 4).

Missing data

Missing data was not included in the analysis. There is the potential of introducing bias or influencing the reliability of data collection if significant amounts of data are missing from some variables as the participants who provide those data might significantly differ from those who don’t. In relation to the three surveys, firstly in the pre- study student survey, there were six questions missed altogether by thirteen separate students: *‘How many clinical research projects have you completed?’* (one student), *‘How confident would you feel in presenting to an audience of your peers?’* (one student), *‘How confident do you feel in writing an audit proposal?’* (one student), *‘How confident do you feel about looking up the evidence behind a clinical recommendation?’* (three students), *‘Do you have a postgraduate degree?’* (three students) and *‘What is your nationality?’* (four students) so it is unlikely that there was much bias in the student survey.

Moreover, in the GP survey, there were four questions missed altogether by six GPs: *‘I felt supported by UCD Academic General Practice with this audit study?’* (one GP), *‘The time spent supervising the student audit was as expected?’* (one GP), *‘I would be happy for UCD medical students to do audits in my practice in future’* (two GPs) and *‘The student audit(s) impacted positively on patient safety?’* (three GPs). As three (out of twenty-four) GPs missed that question, there is a possibility that there could be some bias for that question. In the U21 survey, one respondent missed three questions and another respondent two questions, which may have introduced bias for those questions.

Self-report surveys

Student self-report surveys also have the potential risk of eliciting socially desired responses (SDR) (Van de Mortel, 2008), incurring response bias and may lack flexibility for students to respond to fixed choice questions) (Demetriou, Ozer and Essau, 2015). An alternative option to using self-report surveys would have been to consider formative validated questionnaires to assess before and after knowledge and skills in some of the research domains-for example the Berlin questionnaire developed by Fritsche, Greenhalgh and colleagues which looks at knowledge and skills in evidence-based medicine (Fritsche *et al.*, 2002). Although they used it on postgraduate students, it was piloted on undergraduate students and the student cohort in this study were graduate entry students. It was difficult to find other validated research skills questionnaires; the scoping review found three studies which carried out pre and post tests on the students' research knowledge. There was an objective improvement in students' research skills in all three studies, but a different instrument was described in each of the three studies and none of the instruments were validated (Griswold *et al.*, 1991; Knight, Van Wyk and Mahomed, 2016b; Vereijken *et al.*, 2018b).

Alternative research self-efficacy tool

Consideration was also given to using an alternative research self-efficacy tool, the Clinical Research Appraisal Inventory (CRAI), which was developed by Mullikin et al and is an 88-item inventory developed to measure clinical research self-efficacy (Mullikin, Bakken and Betz, 2007). The authors reported that it reliably measures eight dimensions of research self-efficacy according to competencies previously deemed important for a clinical research career. Bierer et al. used a shorter version of this inventory (the Clinical Research Appraisal Inventory-Short Form (CRAI-SF)), which contains 46 items in their study on research self-efficacy from 2009-2013 (Bierer, Prayson and Dannefer, 2015). They both used a '0-10' scale, ranging from 'no confidence' to 'extremely confident'. Both the original and shorter inventories were consulted but deemed not suitable for the

current audit study, as they required longer, substantive research project involvement by the students.

Use of single variable comparisons

In the statistical analysis presented in Chapter 4, single-variable comparisons were conducted. Had multiple variables demonstrated statistical significance, the intention was to proceed with a multivariate regression analysis. However, as only one variable reached statistical significance, no further analysis was deemed necessary.

Wilcoxon signed-rank test

The Wilcoxon signed-rank test was used because this test could compare scores from the pre and post intervention periods and, as a non-parametric test, it is better suited than the dependent t-test for comparing pre and post scores using smaller datasets which may be subject to the influence of outliers.

Asymp. Sig. (2-tailed) was used to determine statistical significance as this is the p-value generated by the statistical software SPSS ® used for Wilcoxon signed-rank test. Limitations of the Asymp. Sig. (2-tailed) p-value in this context are that it is a non-directional value and that it is not well suited to datasets with small samples. However, an established rule of thumb based on the Central Limit Theorem indicates that Wilcoxon signed-rank test Asymp. Sig. (2-tailed) values are likely to approximate normal distributions and therefore be reliable when applied to sample sizes greater than or equal to 25 (Conover, 1999, Sheskin, 2003).

Need to switch to telephone semi structured interviews

Finally, we had planned to run a focus group for the qualitative work with GPs but due to restrictions as a result of the COVID pandemic, the focus group was cancelled and semi-

structured interviews by telephone were carried out instead. The interviews were conducted by a member of the research team, Dr Geoff McCombe, who is an experienced qualitative researcher and had not been involved in programme delivery. The advantages of this approach were health and safety, convenience, and allowing GPs to participate, all while including an interviewer who had not been involved in the programme delivery with the disadvantages being that interaction with the researcher / other GPs was not possible.

5.3 Interpretation of findings

The finding of a broadly positive sentiment to medical student research in the quantitative work is tempered with some novel findings in the qualitative study and can be considered through four of SCT's core elements: motivation, modelling, reciprocal determinism and self-efficacy.

Motivation

Students' perceptions of research can influence their interest in pursuing a research career. Ommering et al. used grounded theory to explore the student perspective on this matter, to see if 'evidence-based strategies to stimulate positive perceptions of and motivation for research among students could help to enhance research engagement' (Ommering *et al.*, 2020, p. 1). They interviewed thirteen purposively selected first year Dutch medical students, with the aim of identifying conditions under which students develop positive perceptions of, and motivation for, research. They found that first year students could identify many aspects of research and that there was a relationship between perceptions of, and motivation for, research.

In relation to graduate entry medical students, a 2004 US study of 71 first year graduate entry medical students found that there was a significant increase in the number of

students expressing an interest in pursuing a research career following a mandatory eight week 'critical enquiry' course (Houlden *et al.*, 2004). Most of this cohort reported research experience prior to medical school. Interestingly, over half the class found the critical enquiry course useful in making their decision; however, many students had already formed their decision about a research career before the course. However, findings from this current thesis (from the student audit initiative and the scoping literature review) show that there are other factors at play.

As noted, enthusiasm and early research exposure does not always correlate with an interest in research or the production of more physician scientists. The UCD first year graduate entry students differed from the students in Houlden *et al.*'s study in that regard, in that they had limited research experience at baseline, with considerably less active research exposure in the audit initiative, compared to the eight week 'critical enquiry course' (linked also to SCT's personal and environment factors). Nonetheless, the UCD students were certainly enthusiastic about the audit project at baseline, with 92/104 signing up.

Ultimately, however, only 42 students confirmed they had taken part.

So, what happened in a year to curb this enthusiasm? The students mentioned lack of time, excess workload, no academic credit, issues to do with GP / role modelling, issues with assigned student partner, and issues with the assigned topic as reasons. This is consistent with findings from the scoping review. Demotivators for student participation in research identified in the scoping review included cost, mentor availability, student motivations for doing research, potential detrimental effects of time out from clinical studies, and quality of medical student publications. This then leads on to discuss two other key areas of SCT, modelling and reciprocal determinism.

Role modelling

The GP tutors were role models to the students. Some negative GP role modelling was reported by the students in this study. For the audit initiative to work, it needed GPs who were invested and believed in it. A 2020 literature review examined the influence that teachers can have as role models on the development and career choices of medical students and whether GPs who teach medical students might benefit from assistance in developing positive attributes (White, 2020). The author found that there was evidence of association between a student having an influential role model as a teacher and choosing specialty training in that area. A recurring theme was the recommendation that teachers should be aware of the influence they can have as role models, both positive and negative.

Reciprocal determinism

Closely related to modelling, reciprocal determinism elucidates how behaviour is influenced by the interplay of environmental and personal factors. The personal factors identified by the students, along with the issues related to the clinical placement learning environment and the consequences of (negative) role modelling, likely impacted student participation. This bidirectional dynamic was evident in the qualitative findings, where motivational factors and research self-efficacy among both GPs and students were shown to influence audit participation. During the audit, one GP appeared dissatisfied with the level of engagement shown by their assigned students, which in turn influenced the extent of the GP's own involvement.

The qualitative interviews with GPs revealed that some harboured doubts about their own research self-efficacy, along with ambivalent attitudes toward research—particularly within the context of General Practice. These findings align with patterns observed in the broader literature (see below) and likely shaped medical students' perceptions, as detailed in Table 20.

In relation to GP participation in research, a recent study, with 3,556 fully completed questionnaires from German GPs (response rate of 27%), found that GPs were unsure as to how far primary care would stand to benefit from clinical research, with respondents also divided on the willingness to participate in research (Wangler and Jansky, 2024). These findings were similar to an earlier 2008 German mixed methods study which explored the motives for non-participation in, and subjective barriers to, general practice research, by a cohort of German GPs who had declined to take part in a study which involving allowing researchers access to their patients' Electronic Patient Records (EPRs) (Hummers-Pradier *et al.*, 2008). They found that GPs' reservations towards participating in research were, however, not merely a matter of time and workload (although time constraints were listed as the dominant reason for non-participation). Instead, nearly half of respondents (47/96) were opposed to having data extracted from their EPRs due to concern about potential misuse of data. Interestingly, nearly all respondents (88/96) in this study considered general practice research to be important, but 58% had not previously participated in research projects and 56% would not do so in the future. This is a similar figure to a UK study published in 2000 in the West Midlands Region, in which 2,770 GPs were surveyed to quantify their research involvement and to explore determinants of this. The response rate was 49%, with 41% of responders reporting no interest in research (Jowett *et al.*, 2000).

Concerns about data protection, topic selection, student engagement, and GP research skills were reported in the GP interviews. Time and workload were found to be the largest barriers to GPs facilitating the student audit projects in this study. The feasibility issues raised by the GPs were similar to findings of other research initiatives in general practice. Workload was found as the main barrier for participation in a 2004 study assessing the willingness of German General Practitioners involved in medical student teaching to participate in primary care research (Rosemann and Szecsenyi, 2004). A 2001 qualitative study in the UK explored the difficulties from a general practice perspective of

participating in external collaborative projects. They found the GPs' main concerns were time constraints; team motivation; the perception that external researchers have unrealistic expectations; the need for good communications throughout and, specifically, for good feedback from these researchers (Gray, Woodward and Carter, 2001).

Research self-efficacy

The fourth critical component of Social Cognitive Theory (SCT) to guide the findings is the evaluation of its impact on student research self-efficacy. The audit study revealed minimal change in overall student research self-efficacy, demonstrating an increased awareness of the distinction between research and audit but not affecting other parameters. This outcome was unexpected, as a prior comparative extracurricular study, the STARSurg Study, which involved a similar student demographic, reported a significant increase in confidence regarding data collection in a clinical setting ($p < 0.001$) and the presentation of scientific results ($p < 0.013$), findings that were not observed in the current study (Chapman et al., 2015). Although these audits were conducted in a hospital setting, the research involved a comparable sample size.

There are several potential explanations for the minimal change in RSE:

1. A potential methodological limitation includes the lack of validation of the instrument used. Additionally, the high baseline levels of student self-efficacy raise questions about the suitability of self-efficacy as an appropriate measure. It may be worth considering whether effectiveness would serve as a more suitable indicator.
2. There was no change in their RSE.
3. The qualitative component adds an additional dimension by applying the lens of SCT revealing several factors that may explain why the initiative was less effective—particularly issues related to role modelling and reciprocal

determinism. Environmental factors potentially influencing these results included the brief duration of placements, which may have imposed excessive demands on the students. Additionally, the general practice placements and the time dedicated to audits coincided with a period in the academic year when there was no direct face-to-face teaching by general practice academic staff, which may have impacted task performance.

Other studies that looked at student research self-efficacy changes after completing research projects had mixed results. In 2014, Mullan *et al.* reported an improvement on medical student self-perceived research experiences pre and post community research projects in an integrated research curriculum. In their study, they had a higher response rate in the follow up test, and, although measuring some different research skills, they reported statistically significant improvements in nine (out of the ten) areas. In their study, students did a research project as part of a much longer community placement (12 months) and so differed from the audit study and that of Chapman *et al.*, in which participation was voluntary (Mullan *et al.*, 2014).

A 2021 prospective study used a baseline measure and comparable control group to examine the effects of an extracurricular research programme in the Netherlands on academic achievement, intrinsic motivation for research, and research self-efficacy beliefs (Ommering, van Blankenstein and Dekker, 2021). They defined research self-efficacy as students' beliefs about their own abilities to conduct research, subsequently developing their own scale which consisted of three items (e.g., 'I feel I am competent enough to do research'); inspired by the Dutch General Self- Efficacy Scale and the Academic Efficacy Scale (Schwarzer R, 1995; Midgley *et al.*, 2000). They found that participation in their extracurricular research programme was related to higher odds of obtaining a bachelor's degree in the appointed amount of time, whereby starting the programme resulted in higher levels of intrinsic motivation for research. However, no

effect was found on perceptions of research self-efficacy. This brings this discussion to that of measuring the effectiveness of curricular interventions rather than RSE as RSE might not be the best outcome measure.

Measuring effectiveness rather than RSE

The scoping review identified the lack of empiric data examining effectiveness as an important knowledge gap. Cook advocates reframing the medical education position to focus more on effectiveness, as is the norm in clinical medicine, having theory-guided and theory-building studies comparing active interventions and robust evaluations that provide practical guidance for subsequent implementations (Cook, 2012). Another way of looking at the effectiveness of medical student research is to look at its usefulness. Earlier in the thesis, I discussed the important discoveries made by medical students (Stringer and Ahmadi, 2009). A recent mixed methods study explored key features identified by hospital physicians, medical educators, and medical students as central to clinical usefulness in an undergraduate medical research context and reviewed a sample of undergraduate medical research projects based on usefulness criteria described by Ioannidis (Ioannidis, 2016; Burke *et al.*, 2024). They found the highest scoring categories in relation to clinical usefulness were feasibility, transparency, and problem base. Importantly, the sample of research projects carried out by medical students did contain many aspects of what is considered “useful” clinical research. Therefore, they recommended that undergraduate courses designed to enhance the research skills of undergraduate medical students should incorporate consideration of criteria for clinical usefulness during research project conceptualisation and development. In relation to this study, the clinical relevance of the GP audit initiative was supported by the finding that 71% of GPs perceived the student audits as having a positive impact on patient care.

Medical myth lens

Finally, the conversation around stakeholders' positive sentiment toward medical student research may warrant re-examination from a new angle. Could the positive sentiment to research and the encouragement of same in medical curricula be a 'medical myth'? As previously discussed, interpreting the findings through the lens of reciprocal determinism—a core component of SCT—suggests that while the environment appears to endorse the importance of research, the qualitative data from GPs and students reveal a contrasting narrative, pointing to the encouragement of medical student participation in research as a potential medical myth.

The term “myth” stems directly from the Greek word *mythos* and from the modern Latin *mythus*. It connotes a traditional story, legend, piece of folklore or tale that provides an explanation, aetiology or justification for social or natural phenomena. It also refers to an untrue or erroneous belief, a widely held misconception, a misrepresentation of the truth, or something fictitious (Oxford English Dictionary, 2023). Certainly, within the 'culture' of medical training, research is given high regard. Three different ethnographic studies of 'the culture of medical training' explore cultural and institutional issues in medical training from different angles. Firstly, Anne Marie Moll in her seminal work examining the multiple enactments of atherosclerosis in *'The Body Multiple: Ontology in Medical Practice'* wearing her dual hat as 'both insider and outsider' (as she had received basic training in medical school as well as extensive training in philosophy) presents philosophical reflections on the body and medical practice (and culture) through vivid storytelling (Mol, 2002). Indeed, in the opening chapter, she notes that when she approached the professors of “a university hospital in a medium-sized town in the centre of the Netherlands, Hospital Z' about doing her research in their departments, they all responded favourably as 'they all emphasized that academic hospitals must encourage research'”.

The second ethnographic study of medical training culture examined the group and individual perspectives on the medical student culture in the University of Kansas Medical School starting in 1956 (Becker, 1961). At the time, the medical school had a full-time faculty of 118 and 62 students (the 'boys in white', as there were 57 male students and only five female students). Becker summarised the sizeable majority of the student body as "young, white, male, Protestant, small town native Kansans who are married." In his book review, Lacquer reports on the students' slow assimilation of medical values through peer pressure and example and their learning how to negotiate a hospital or clinic in all its complexity (Laqueur, 2002). Although dated now, not least in the comparison to the demographics of today's medical students and the (more) external regulation there is of the profession, some medical culture norms still ring true. Is medical student research one of these? Importantly, there was a discordance between observation and interview findings in the Becker study. He wrote a paper addressing the issues of inference and proof in participant observation in this study (Becker, 1958). Becker reported that they "made relatively little use of the interview materials in their later analyses" despite having hours of interview transcripts (Becker, 1961, p.29). He reported that the primary reason was the interview method's inadequacy in capturing the issues they encountered during their observations. They believed their observations provided a more accurate depiction of the 'medical culture.'

The last, more recent ethnographic study, looking at the basic medical training (and its associated culture) in a London teaching hospital in 1993 / 1994 (also by an 'insider' like Ann Marie Moll as the author trained as a doctor and as an anthropologist), provides an account of basic medical training and the social and psychological construction of doctors in terms of the formation of the basic medical habitus and incorporating an "exclusive professional identity" (Sinclair, 1997, p. 321). Sinclair compares his work to that of American sociologist Everett Hughes' 'passing through the mirror' ("One might say that the learning of the medical role consists of a separation, almost an alienation,

of the student from the lay medical world; a passing through the mirror so that one looks out on the world from behind it, and sees things in mirror writing” (Hughes, 1956, p. 22). Indeed, a suggestion by one of my thesis examiners is that the three ethnographic studies discussed here highlight the ‘passing through the mirror’ effect, in which doctors tend to retreat into their own world, the ‘medical world’, where potentially they can never again be totally truthful about matters, which can then lead to an inability to perceive reality properly. This has the potential consequence of the perpetuation of medical myths, in this case, the superficial positivity to research in medical education.

In their 2020 ‘myth busting’ work, Martimianakis *et al.* used a critical narrative approach to search the medical education literature for orientations to myths and myth busting in order to address the myth that ‘all myths in medical education deserve to be busted’ (Martimianakis *et al.*, 2020). Their analysis revealed the important function of myths in the social practice of medical education and practice. A deconstruction of five salient examples of the contemporary myth in medical education (the myth of the “ideal candidate”, the myth of “cut-throats”, the myth of “cadaver stories”, the myth of “learning styles”, and the myth of “patient information leaflets”) demonstrates that myths continue to have material effects, even after they have been busted. They concluded by arguing that myths play an important part in the social practice of medical education and practice. Brown *et al.*, in their commentary on this work, advocate going beyond the call to tolerate myths as an ‘unbearable necessity’ to celebrate them as valuable social tools to use, critique and modify for purposeful social ends (Brown and Nestel, 2020). Therefore, regardless of the evidence for undergraduate medical research and, even if the positive sentiment to research is a myth, there is an argument to retain its status in curricula.

Chapter 6: Conclusions

6.1 Implications for research, education, practice policy

The study set out to describe educational activity that involves students actively conducting research on pre-registration medical degree programmes and to explore the evidence supporting medical student involvement in research in curricula. The triangulation of data from the scoping review, student, GP, and U21 surveys found a positive sentiment towards active participation by medical students in research but with a recognition that there are complexities to this, particularly in General Practice. The scoping review highlighted a lack of clarity around how to evaluate the effectiveness of research curriculum initiatives.

The third aim of the study was to investigate the acceptability and likely effect on student research self-efficacy following the introduction of a clinical audit as part of a general practice placement. There was a large attrition rate by students but, despite this, it was deemed largely acceptable by participating students and GPs alike. There was minimal change in research self-efficacy which was an unexpected result. A notable finding was the discrepancy between the qualitative and quantitative data provided by GPs, with the latter potentially reflecting socially desirable responses, while the qualitative interviews offered more candid insights into their research self-efficacy and underlying motivations.

There was a positive sentiment to research among GPs and students. While recruitment was high, retention was a challenge. Student factors, curriculum factors and GP factors are likely to explain this. This may be best understood through the lens of Social Cognitive Theory, wherein retention can be viewed not merely as a process but as an outcome in its own right, influenced by core SCT elements such as motivation, role modelling, and environmental factors. There were a few examples of negative role

modelling by GPs in this study which might possibly reflect the 'hidden curriculum' in relation to the ambivalence to research in primary care by some GPs. Several possible reasons for this were discussed in this thesis; time constraints; team motivation; the perception that external researchers have unrealistic expectations; the need for good communication / feedback and data protection concerns, though I am not sure if that covers it all. Is there something more tacit? This constitutes a prospective field for future research. As an initial step, it may be valuable to explore prevailing attitudes toward research within general practice in the Irish context, particularly in relation to GPs' self-efficacy in conducting research. Should this initiative be revisited, the participation of GPs who demonstrate a strong belief in its value and possess high research self-efficacy would likely be pivotal to its success.

From a personal perspective, on reflection, prior to this thesis, I would have considered myself to be 'an average GP' regarding my relationship with research. Indeed, while I was very happy to practice and teach evidence-based medicine and to support general practice research projects that came my way, I never fully embraced the idea of being a bona fide primary care / medical education researcher. This thesis has certainly been a learning journey for me in this regard and has changed my perspective, as I now have a much greater appreciation of the multifaceted dimensions to research. I take pride in the fact that, despite general practitioners' ambivalence to research, as reported in the literature, 22 (96%) of participating GPs reported that they would be happy for medical students to do clinical audits in their practice again.

From a medical education perspective, Cook et al. advocate more studies which ask: '*How and why does it work?*' (Cook, Bordage and Schmidt, 2008). In order to evaluate the effectiveness of the research options, Cook argues that medical education needs to have more comparative effectiveness research but warns of the need to be aware of two important pitfalls; firstly, that studies which compare two active interventions will require

much larger sample sizes than studies making comparison with no intervention, because the expected effect size will be smaller and secondly to be aware of the risk of confounded research. To aid future medical education work into the 'value and effectiveness of medical student research, standardisation of methods to record research output, pre- and post-research experience and research self-efficacy tools would be helpful. In addition, having more prospective studies, with a baseline measure and comparable control group to measure research self-efficacy to compare to the findings of Ommering and colleagues (Ommering, van Blankenstein and Dekker, 2021), would be welcomed.

It is, of course, harder to measure transferable skills such as communication, teamwork, problem solving and networking that students can develop when they do research (Burgoyne, O'Flynn and Boylan, 2010); however, these are also valuable attributes for further investigation.

Based on the findings of this research, the positive sentiment to medical student research, be it a 'medical myth' or not, warrants further investigation. Conducting comparative studies could provide an initial framework in evaluating the effectiveness of student research initiatives. Further inquiry into GPs' engagement with research and their perceived research self-efficacy appears justified. The latest WFME recommendations (WFME, 2020) appropriately underscore the value of curricular flexibility in facilitating medical student research.

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Appendices

Appendix A – Instruments

- A1. Pre-audit initiative student survey
- A2. Post-audit initiative student survey
- A3. GP survey
- A4. Interview schedule for GP semi-structured interviews
- A5. Universitas 21 Health Science Group survey

A1: Pre-audit initiative student survey



We are conducting research on graduate entry medical students' clinical research skills and are exploring how those skills develop during the programme. You are invited to complete this questionnaire on your experience and confidence in research and clinical audit at the start of the Medicine programme and again in Autumn 2018. Your participation is entirely voluntary and there are no repercussions of any kind if you decide not to participate. To match up your pre and post questionnaire data, we ask that you supply the last 4 digits of your student number. Once the data is matched, these numbers will be changed to a coded number. Thank you for completing this survey.



Please enter the last 4 digits of your student number here

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I understand the information and consent to participate in this study ☐ Yes

A little about your background - please tick the appropriate box

Sex

☐ Male ☐ Female

Age

☐ 25 yrs or younger ☐ 26-30 yrs old ☐ Over 30 yrs

Nationality

☐ Irish ☐ North American
☐ Other EU ☐ Other

Primary degree

☐ Mainly health science related ☐ Mainly non-science based
☐ Mainly other science related

Postgraduate degree

☐ None ☐ PhD
☐ Masters ☐ Other

Prior research / audit experience

We are seeking a measure of prior audit and research experience that you may have, but there are no expectations that you may have carried out any of these activities prior to entry to UCD School of Medicine

	0	1	2	3	4	5 or more
How many clinical audits have you carried out or actively participated in?	☐	☐	☐	☐	☐	☐
How many research (general) projects have you been actively involved in?	☐	☐	☐	☐	☐	☐
How many research (clinical) projects have you been actively involved in?	☐	☐	☐	☐	☐	☐
How many abstracts have you submitted to national or international conferences (total accepted and rejected)	☐	☐	☐	☐	☐	☐
How many poster presentations have you given to national or international conferences?	☐	☐	☐	☐	☐	☐
How many oral presentations have you given to national or international conferences?	☐	☐	☐	☐	☐	☐
How many peer-reviewed publications do you have? (original research and reviews / case reports but excluding letters, comments, editorials etc)	☐	☐	☐	☐	☐	☐

Baseline confidence measures

Please rate yourself on the following topics

	Lacking any confidence	Lacking confidence	Neutral	Confident	Very Confident
How confident do you feel in writing an audit proposal or a research protocol?	☐	☐	☐	☐	☐
How confident do you feel in your knowledge of the clinical audit cycle?	☐	☐	☐	☐	☐
How confident do you feel in describing the differences between clinical audit and clinical research?	☐	☐	☐	☐	☐
How confident do you feel about looking up the evidence behind a clinical recommendation?	☐	☐	☐	☐	☐
How confident do you feel about collecting data in the clinical setting?	☐	☐	☐	☐	☐
How confident do you feel in the use of simple descriptive statistics?	☐	☐	☐	☐	☐
How confident would you feel in presenting your clinical audit or clinical research results to an audience of your peers?	☐	☐	☐	☐	☐

Do you have any other comments or observations on your prior research / audit experience that you would like to include in this research study?

Thank you for completing the questionnaire

If you have any further questions please contact Dr Crea Carberry at
 crea.carberry@ucd.ie
 UCD Academic Practice C109 HealthSciences Building 01 7166666

A2. Post-audit initiative student survey



This is a follow up survey to the survey you completed in Autumn 2017 in which we explored the experience and confidence in research and clinical audit of UCD graduate entry medical students. We want to see if there has been a change since the initial survey. To match up your pre and post questionnaire data, we ask that you supply the last 4 digits of your student number. Once the data is matched, these numbers will be changed to a coded number. Thank you for completing this survey.



Please enter the last 4 digits of your student number here

I understand the information and consent to participate in this study ☐ Yes

--	--	--	--

Research / audit experience

This section is included so that we can measure the range of audit / research experience since the initial survey in 2017. There is no expectation to have carried out these components over the past year.

	0	1	2	3	4	5 or more
How many clinical audits have you carried out or actively participated in?	☐	☐	☐	☐	☐	☐
How many research (general) projects have you been actively involved in?	☐	☐	☐	☐	☐	☐
How many research (clinical) projects have you been actively involved in?	☐	☐	☐	☐	☐	☐
How many abstracts have you submitted to national or international conferences (total accepted and rejected)?	☐	☐	☐	☐	☐	☐
How many poster presentations have you given to national or international conferences?	☐	☐	☐	☐	☐	☐
How many oral presentations have you given to national or international conferences?	☐	☐	☐	☐	☐	☐
How many peer-reviewed publications do you have? (original research and reviews / case reports but excluding letters, comments, editorials etc)	☐	☐	☐	☐	☐	☐

Confidence measures

Please rate yourself on the following topics

	Lacking any confidence	Lacking confidence	Neutral	Confident	Very Confident
How confident do you feel in writing an audit proposal or a research protocol?	☐	☐	☐	☐	☐
How confident do you feel in your knowledge of the clinical audit cycle?	☐	☐	☐	☐	☐
How confident do you feel in describing the differences between clinical audit and clinical research?	☐	☐	☐	☐	☐
How confident do you feel about looking up the evidence behind a clinical recommendation?	☐	☐	☐	☐	☐
How confident do you feel about collecting data in the clinical setting?	☐	☐	☐	☐	☐
How confident do you feel in the use of simple descriptive statistics?	☐	☐	☐	☐	☐
How confident would you feel in presenting your clinical audit or clinical research results to an audience of your peers?	☐	☐	☐	☐	☐

☐ Yes ☐ No

Do you feel that doing a clinical audit enhanced your exposure to clinical research?

☐ Yes ☐ No

Do you feel that doing a clinical audit enhanced your research skills?

☐ Yes ☐ No

Do you feel that doing the clinical audit had a positive educational impact?

☐ Yes ☐ No

Do you feel that doing a clinical audit enhanced your understanding of clinical audit, quality and patient safety in practice?

☐ Yes ☐ No

Do you feel that doing a clinical audit demonstrated real world challenges in evidence based prescribing?

☐ Yes ☐ No

Do you feel that the preparatory session in UCD adequately prepared you for doing an audit in your assigned GP practice ?

☐ Yes ☐ No

Did you feel supported doing the clinical audit at your assigned GP practice?

☐ Yes ☐ No

As this is a feasibility study, we would appreciate if you could briefly outline why you did not participate in the clinical audit component

--

Did you gain other research experience, which benefitted your research skills?

☐ Yes ☐ No

Thank you for completing the questionnaire. Please place the completed surveys in the **box in the lecture theatre** or **drop box #81** outside Rm. C209 on the 2nd floor as per last year. If you have any further questions please contact Dr Crea Carberry at: crea.carberry@ucd.ie UCD Academic Practice C109 HealthSciences Building 01 71666666

How many GEM medical students does your practice take on average per year? ☐ 0-2 ☐ 2-4 ☐ 4-6 ☐ >6	
Does your practice take medical students from other Medical Schools? ☐ Yes ☐ No	
I felt prepared to supervise the GEM students doing an audit ☐ Strongly disagree ☐ Disagree ☐ Agree ☐ Strongly agree	
Is there anything else that would have helped you be more prepared 	
I felt supported by UCD Academic General Practice with this audit study ☐ Strongly disagree ☐ Disagree ☐ Agree ☐ Strongly agree	
Are there additional supports that UCD could have offered you? 	
The time spent supervising the student audit was as expected ☐ Strongly disagree ☐ Disagree ☐ Agree ☐ Strongly agree	
If you disagreed, please let us know why? 	
Any other factors that affected the workload? 	
The student audit(s) impacted positively on patient care / safety ☐ Strongly disagree ☐ Disagree ☐ Agree ☐ Strongly agree	
How did the audits impact on patient care? 	
I would be happy for UCD medical students to do audits in my practice in the future ☐ Strongly disagree ☐ Disagree ☐ Agree ☐ Strongly agree	
25. Why / why not? 	
Any other comments / observations you would like to make 	

A4: Interview schedule for GP semi-structured interviews

Areas for discussion in semi-structured interview:
1. What are your views on introducing more student research opportunities in general practice? 2. What do you think are the barriers to introducing more student research opportunities in general practice? 3. What do you think UCD School of Medicine and general practice could do to facilitate introducing more student research opportunities in general practice? 4. Could you tell me about your experience of facilitating a student research placement in your practice? 5. Did it meet your expectations? 6. How do you feel about students carrying out a clinical audit in your practice? 7. Do you feel that student audits have a positive impact on patient care? 8. What do you think are appropriate topics for a student carrying out an audit? 9. Should more time be allocated for student research placements in general practice? 10. Do you think you should receive more support from the UCD Primary Care Academic team? 11. What are your thoughts on the balance between a student's clinical exposure/engagement with patients and carrying out clinical audit? 12. Any other comments Thank you very much for answering these questions. Is there anything else you would like to add?

A5: Universitas 21 Health Science Group survey



Information and Consent U21 Health Science Group Survey

This study is looking at current 'doing research' opportunities available to medical students in pre-registration medical curricula of the U21 Health Science Group to get an overview of the scope of research opportunities in the group. We consider 'doing research' opportunities to be those in which medical students get to do data collection. Only aggregated research data will be disseminated. We estimate that this survey may take 10-15 minutes to complete. If you have any queries about this survey, please contact Dr Crea Carberry (crea.carberry@ucd.ie).

* Required

1. I understand the above information, and consent to participate in this study *

Mark only one oval.

Yes ☐ No ☐

Survey

Part 1 Information about your medical school

2. Continent

Mark only one oval.

- ☐ Africa
- ☐ Asia
- ☐ Australia
- ☐ Europe
- ☐ North America
- ☐ South America

3. Total number of medical students in your medical school (approx.)

4. Medicine Programmes offered (tick which best describes)

Mark only one oval.

- ☐ Undergraduate Entry Programme
☐ Only Graduate Entry Programme
☐ Both Undergraduate and Graduate Entry Programmes

5. Is there a faculty member with a designated overall responsibility for student research in your medical school?

Mark only one oval.

Yes ☐ No ☐ I am not sure ☐

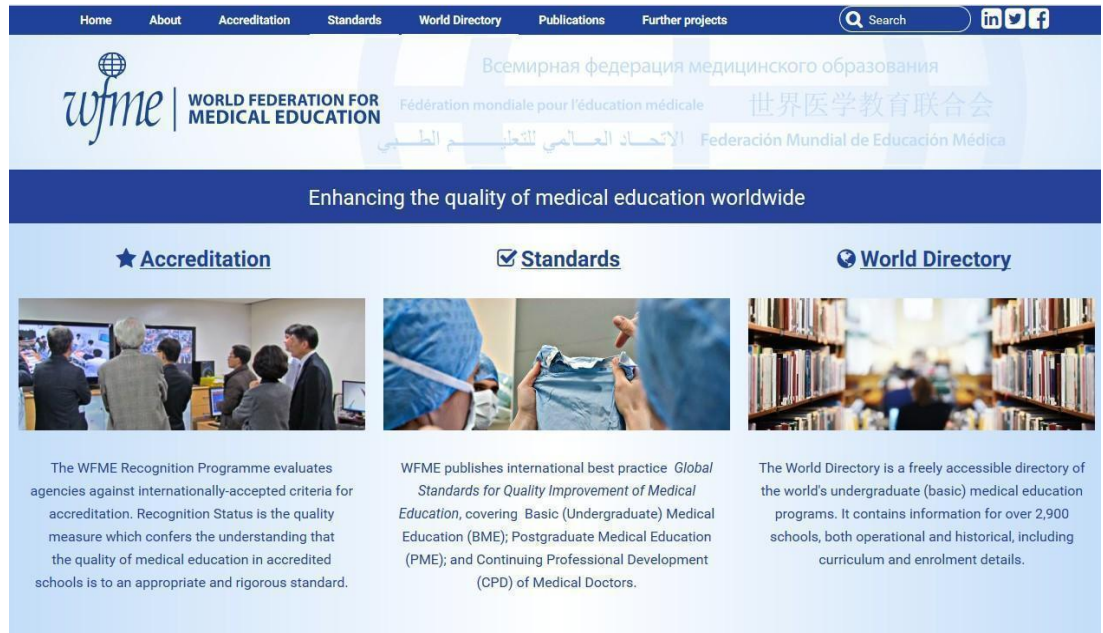
Part 2 Your thoughts on the 2015 WFME Guidelines in relation to medical student research

In its Global Standards for Quality Improvement, the World Federation of Medical Education (WFME) advise the following in a medical curriculum in relation to research:

Basic standards: *The medical school must throughout the curriculum teach the principles of scientific method, including analytical and critical thinking, medical research methods and evidence-based medicine.*

Quality development standard: *The medical school should in the curriculum include elements of original or advanced research. Elements of original or advanced research would include obligatory or elective analytic and experimental studies, thereby fostering the ability to participate in the scientific development of medicine as professionals and colleagues.*

For more information on these standards please see this link:
<https://wfme.org/standards/bme/>



6. What are your thoughts on these research standards? *

7. What are your thoughts on obligatory (mandatory) versus elective (optional) research options in a medical curriculum? *

Part 3 Overview of research opportunities at your medical school

8. Does your programme have an obligatory (mandatory) intercalated research degree for all medical students? An intercalated degree is when a student pursues a separate but related research degree (BSc / MSc or equivalent) and then returns to the main medical degree.

Mark only one oval.

Yes ☐ No ☐ I am not sure ☐

9. If your programme does not have an obligatory intercalated research degree (intercalated BSc, MSc or equivalent), is there an option for some medical students to do this?

Mark only one oval.

Yes ☐ No ☐ I am not sure ☐

10. If yes, what percentage of medical students in your medical school opt to do an intercalated BSc, MSc or equivalent per year?

11. Is a research project (other than that associated with an intercalated degree) an obligatory component of the medical curriculum at your medical school? Research projects are scholarly projects / activities designed to develop analytical skills, self-directed-learning and communication skills that students undertake at some point in the medical curriculum.

Mark only one oval.

Yes ☐ No ☐ I am not sure ☐

12. Is a research project (other than that associated with an intercalated degree) an optional (elective) component of the medical curriculum at your medical school?

Mark only one oval.

Yes ☐ No ☐ I am not sure ☐

13. If yes, what percentage of medical students in your medical school opt to do a research project per year?

14. Does your programme have an obligatory clinical audit for all medical students? Clinical audit is defined as the systematic review and evaluation of current practice against research-based standards with a view to improving clinical care for patients.

Mark only one oval.

Yes ☐ No ☐ I am not sure ☐

15. If your programme does not have an obligatory clinical audit, is there an option for some medical students to do this at your medical school?

Mark only one oval.

Yes ☐ No ☐ I am not sure ☐

16. If yes, what percentage of medical students in your medical school opt to do a clinical audit per year?

17. Are there other active research opportunities available in your medical school?

Mark only one oval.

Yes ☐

No ☐

I am not sure ☐

18. If yes, please briefly describe these research opportunities

Part 4 Options from the literature

The research literature has identified the following 'doing research' options in a preregistration medical curriculum.

- ❖ Obligatory intercalated research degree for all medical students
- ❖ Optional intercalated research degree for interested medical students
- ❖ Obligatory research project for all medical students
- ❖ Optional elective research project for interested medical students
- ❖ Obligatory clinical audit incorporating research skills for all students
- ❖ Optional elective clinical audit incorporating research skills for interested students

- ❖ No research or audit opportunities.

19. Please RATE the FEASIBILITY of the below research options for your medical school from 1-5. You can give several options the same feasibility rating

Mark only one oval per row.

Research Option	1=Totally unfeasible	2=unfeasible	3=Neither feasible nor unfeasible	4=feasible	5=very feasible
Obligatory intercalated research degree	☐	☐	☐	☐	☐
Optional intercalated research degree	☐	☐	☐	☐	☐
Obligatory research project	☐	☐	☐	☐	☐
Optional elective research project	☐	☐	☐	☐	☐
Obligatory clinical audit	☐	☐	☐	☐	☐
Optional elective clinical audit	☐	☐	☐	☐	☐
No research or audit opportunities	☐	☐	☐	☐	☐

20. Please RATE the QUALITY of the below research options from 1-5. You can give several options the same quality rating

Mark only one oval per row.

Research Option	1=Very poor quality	2=Poor quality	3=Average quality	4=Good quality	5=Very high quality
Obligatory intercalated research degree	☐	☐	☐	☐	☐
Optional intercalated research degree	☐	☐	☐	☐	☐
Obligatory research project	☐	☐	☐	☐	☐
Optional elective research project	☐	☐	☐	☐	☐
Obligatory clinical audit	☐	☐	☐	☐	☐
Optional elective clinical audit	☐	☐	☐	☐	☐
No research or audit opportunities	☐	☐	☐	☐	☐

21. Please comment on your choice

22. There are adequate resources in my medical school to support medical student research projects and research skills acquisition

Mark only one oval.

Yes ☐ No ☐ I am not sure ☐

23. Please comment on your choice

24. There is a structured system in place for reviewing undergraduate research ethics applications in my medical school

Mark only one oval.

Yes ☐ No ☐ I am not sure ☐

25. Please comment on your choice

26. I am satisfied with the research output of medical students in my medical school

Mark only one oval.

Yes ☐

No ☐

I am not sure ☐

27. Please comment on your choice

28. Undergraduate research is necessary for career progression

Mark only one oval.

Yes ☐

No ☐

I am not sure ☐

29. Please comment on your choice

Final comments

30. Any other comments / observations you would like to make on integrating research within undergraduate medical curricula:

Appendix B - Audit supplementary and teaching material

B1. Student and GP tutor handbook which includes audit topics

B2. Workshop notes

B3. Audit summary report for practices

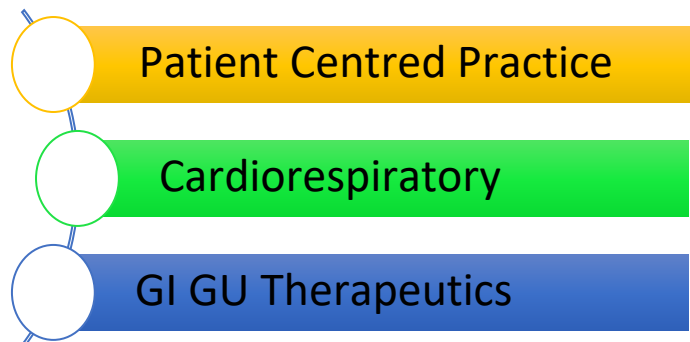
B1: Student and GP tutor handbook which includes audit topics



UCD Academic General Practice

Clinical Audit in General Practice

Student / GP tutor Handbook (2017-18)



Contents

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OVERVIEW

WHAT IS CLINICAL AUDIT?

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AIMS AND OBJECTIVES

HOW THE ACTIVITY WILL BE ORGANISED

GP PRACTICE VISITS

FORMAL TEACHING AT UCD

EVALUATION

Academic Team / Contact Details:

Dr Crea Carberry	crea.carberry@ucd.ie
Professor Walter Cullen	walter.cullen@ucd.ie
Professor Gerard Bury	gerard.bury@ucd.ie
Associate Professor Helen Gallagher	helen.gallagher@ucd.ie
Dr Mark Coyne	mark.coyne@ucd.ie
Dr Ian Callanan	i.callanan@st-vincent's.ie
Ms Helen Tobin	gp.admin@ucd.ie

Address: Academic General Practice, C110 Health Sciences Centre, Belfield,
Dublin 4.

Telephone: +353-1-7166696

Introduction

Overview

As part of the Stage 1 Graduate-Entry Medicine curriculum, students are invited to conduct a clinical audit of topics related to material from the 'Cardio-Respiratory Therapeutics' module (CLIP30170)

The audit will be conducted during the GP placements in Spring 2018, with follow up in Autumn 2018 and will be facilitated by GP Tutors who will assist students by identifying a sample of patients with the required conditions and assisting the student to collect anonymised data on their assigned topic.

Both student and tutor will be involved in the exercise and thus, GP Tutors may use the exercise towards their competence assurance requirements. Meanwhile, students will learn in a systematic way about key research skills and competencies such as: evidence-based practice, data protection, data collection, data analysis, presentation / dissemination and reflecting on practice.

What is Clinical Audit?

Clinical audit is defined as: "Clinical audit is a quality improvement process that seeks to improve patient care and outcomes through systematic review of care against explicit criteria and the review of change. Aspects of the structure, process and outcome of care are selected and systematically evaluated against explicit criteria.' (NICE 2012)

Rationale

This initiative is being introduced:

- To enhance students' exposure to research skills
- To help students appreciate the importance of clinical audit, quality & patient safety in practice
- To demonstrate the real-world challenges involved in evidence-based prescribing

Garda Clearance

It is crucial that students apply for Garda clearance as early as possible in Semester 1 as they will not be able to partake in the visits / audit if they do not have police clearance.

Aims and objectives

Students will use clinical audit to learn in a systematic way about key research areas such as sampling, data collection / analysis (simple descriptive statistics), dissemination of knowledge and reflective practice.

A secondary objective is for students to develop transferable skills in communication, teamwork, management, problem solving and networking.

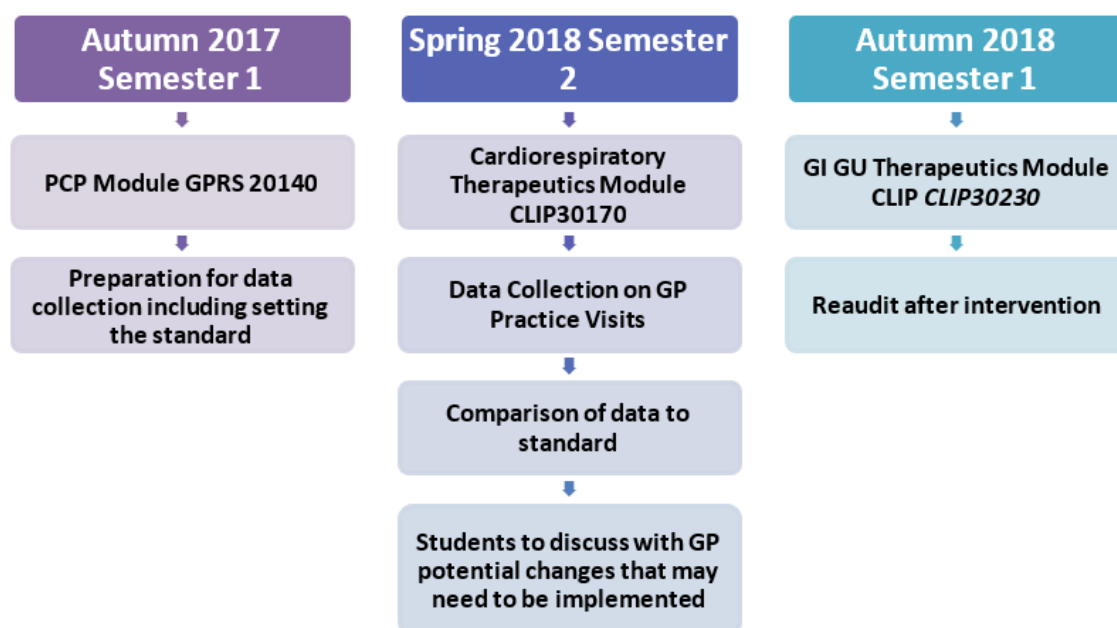
In parallel, the impact of this initiative on students' learning and on care delivery in practice will be evaluated.

How the activity will be organised

At the outset, a series of lectures will help students to appreciate the purpose of this activity, the theory of clinical audit, what is required of them and how this relates to the 'Cardio-Respiratory Therapeutics' and 'GI/GU Therapeutics' modules. In Spring 2018, they will undertake a clinical audit while on clinical placement in General Practice. This exercise will be used as the basis for small group tutorials during which they will reflect on their experience and consider ways in which care might be enhanced. The clinical audit will be repeated again in Autumn 2018.

(see Figure 1)

Figure 1. Organisation of activity over three modules.



GP Practice Visits

GEM students typically have two practice visits in Semester 2 of their first year and two practice visits in Semester 1 of year 2, which involve observing GP consultations. In addition, students would be required to spend two hours reviewing the clinical records of a sample of patients provided by the GP with specific conditions¹ at a time that is mutually convenient for them and the practice. The students will have a proforma to fill out-please see audit topics at the end of this handbook with the 4 audit topics for 2018.

¹ Advised each year by the Academic Lead for the Audit.

Formal Teaching at UCD

Semester 1 2017 Patient Centred Practice GPRS20140

Lectures:

- Introduction to clinical audit
- Professionalism
- Data protection
- Coding of clinical data

Seminars

- Library Searches / Use of Endnote / Introduction Group Projects /
Information re the evaluation of the clinical audit exercise

Semester 2 2018 Cardiorespiratory Therapeutics CLIP30170

Seminars

- Tutorial on GP IT software for data collection prior to attending practices
- Belfield GP tutor facilitated seminar on discussion on data collection
findings, comparing findings to the standard and student group to decide
on intervention needed to improve clinical care

Semester 1 2018 GI GU Therapeutics CLIP30230

Seminars

- Belfield GP tutor facilitated seminar on discussion on re audit findings
and students to present in groups completed audit

Evaluation

Led by Dr Carberry, the educational impact of this initiative is being evaluated by the academic team responsible for its delivery.

Students will be asked to complete a brief survey (focusing clinical audit / research related knowledge / skills) in Autumn 2017. In Autumn 2018, they will be asked to complete this survey again and also to report their experience of the initiative.

GPs / practices will also be asked to complete a brief survey on their experience of the initiative and if / how it has impacted on their practice.

Audit topics and data collection sheets 2018

Audit 1 Ace inhibitors and renal function

'All patients should have a renal blood test prior to starting an ACE inhibitor. This should be repeated between 1-2 weeks after starting the Ace inhibitor and after each dose increase.'

STANDARD =NICE CKD Guidelines (National Institute for Health and Clinical Excellence, 2008)

- GPs, please provide students with a list of 10 patients ≥ 18 from your practice that have been prescribed an ace inhibitor in the past year.
- Students, please check the patients' clinical notes to see if they had their renal function checked:
- 6) Prior to initiation of therapy –if started elsewhere (e.g., hospital) write 'started elsewhere' in this column
- 7) Repeated within 1-2 weeks of starting the ace inhibitor
- 8) Repeated 1-2 weeks after any dose increase
- 9) After you have collected your data, compare your data with the standard and discuss with your supervising GP any potential changes that may need to be implemented.
- 10) You will then re-audit this data in autumn 2018 on a return visit to the practice

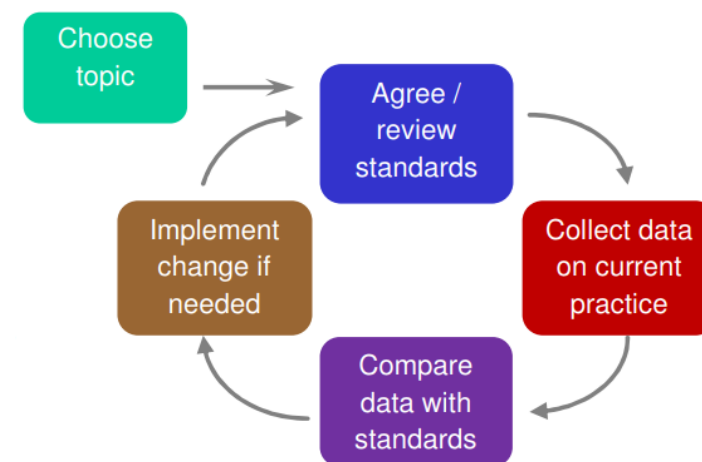


Figure 1. NHS Bristol. What is Clinical Audit? 2009

Patient	Renal function prior to starting Yes / No / Started Elsewhere	1-2 Week repeat after starting Yes / No / Started Elsewhere	Repeated 1-2 Weeks if dose increase Yes / No / Not Applicable
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

Audit 2 Corticosteroid inhaler use in children

'All children on oral corticosteroid inhalers should have their growth (height and weight centile) monitored at least annually.'

STANDARD =2016 BTS / SIGN Guidelines on Management of Asthma
(Health improvement Scotland, 2016)

- GPs, please provide students with a list of 10 children from your practice ≥ 2 years old prescribed inhaled corticosteroid inhalers in the past year
- Students, please check the patients' clinical notes to see if they had their height and weight recorded:
 - 1) At initiation of therapy- if started elsewhere (e.g., hospital) write 'started elsewhere' in this column
 - 2) If they have had their height and weight checked in the last 12 months
 - 3) After you have collected your data, compare your data with the standard and discuss with your supervising GP any potential changes that may need to be implemented
 - 4) You will then re-audit this data in autumn 2018 on a return visit to the practice

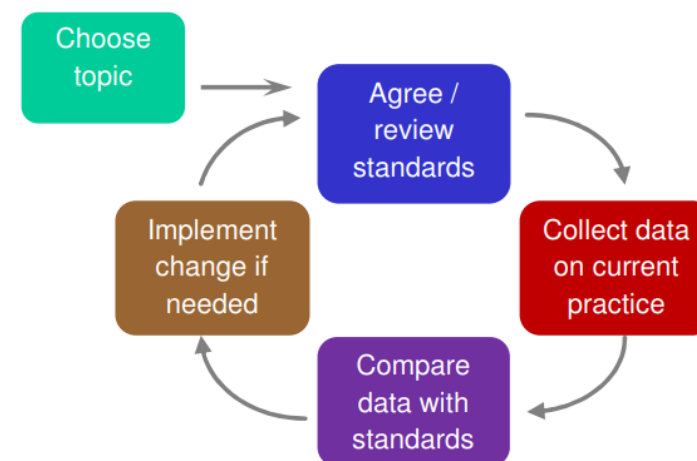


Figure 1. NHS Bristol. What is Clinical Audit? 2009

Patient	Height / weight start	Height / weight last 12 months
	Yes / No / Started Elsewhere	Yes / No
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		

Audit 3 Monitoring inhaler technique

'All patients with asthma should be given specific training and assessment in inhaler technique before starting any new inhaler treatment and patients with asthma should receive a structured review at least annually. Review includes checking inhaler technique.'

STANDARD= NICE Quality Standard on Asthma 2013 (National Institute for Clinical Excellence, 2013)

- GPs, please provide students with a list of 10 patients from your practice ≤ 35 years old prescribed a salbutamol inhaler on a repeat basis in the past year
- Students, please check the patients' clinical notes to see if they had specific inhaler training:
 - 1) At initiation of the new inhaler-- if started elsewhere (e.g., hospital) write 'started elsewhere' in this column
 - 2) A review / review of any inhaler technique in the last 12 months
 - 3) After you have collected your data, compare your data with the standard and discuss with your supervising GP any potential changes that may need to be implemented
 - 4) You will then re-audit this data in autumn 2018 on a return visit to the practice

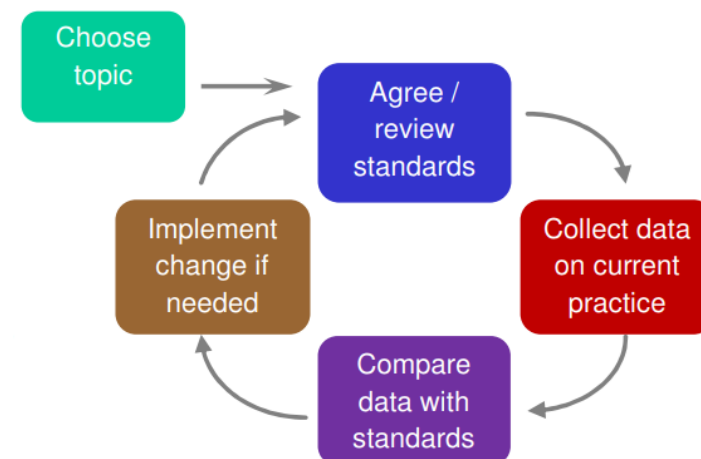


Figure 1. NHS Bristol. What is Clinical Audit? 2009

Patient	Inhaler training start	Inhaler review last 12 months
	Yes / No / Started Elsewhere	Yes / No
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		

Audit 4 LFTs and statins



'All patients should have their liver enzyme tests checked before starting statin therapy and as clinically indicated thereafter.' STANDARD= FDA Guidelines 2012 (U.S. Food & Drug Administration, 2016)

- GPs, please provide students with a list of 10 patients ≥ 18 from your practice that have been prescribed a statin in the past year.
- Students, please check the patients' clinical notes to see if they had their liver enzymes checked:
 - 1) Prior to initiation of therapy if started elsewhere (e.g., hospital) write 'started elsewhere' in this column
 - 2) Rechecked if clinically indicated (abnormal liver function tests prior to initiation, onset of jaundice ...)
 - 3) After you have collected your data, compare your data with the standard and discuss with your supervising GP any potential changes that may need to be implemented
 - 4) You will then re-audit this data in autumn 2018 on a return visit to the practice

Patient	Liver enzyme check prior to statin	Rechecked if clinically indicated
	Yes / No / Started Elsewhere	Yes / No / Not indicated
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		

B2: Audit preparatory workshop in CAL lab content

AUDIT PROJECTS 1 & 4 (ACE INHIBITOR AND STATIN) PREPARATORY WORKSHOP

Aim of workshop:

The aim of this audit workshop is for students to get the opportunity to practice reviewing patient notes and extracting data using one of the GP record keeping software programmes, Socrates. This may not be the software package that is used in your assigned GP practice but we hope the workshop today will prepare you for the process of extracting data from patients' medical notes. Other common GP record keeping software programmes used in Ireland include Health One and Helix Practice Manager

Patient confidentiality:

The patients in the workshop versions of Socrates are dummy patients. Your GP will assign you ten patients from the practice's list of patients who satisfy the audit criteria. Please ensure that no identifying information in relation to these patients leaves the practice. Your GP may keep a list of the names but this is to remain in the practice. In the worksheet here we have included three dummy patients but you will see that in the audit data extraction form in the appendix of the audit handbook, no identifying information is asked for-patients are numbered 1 to 10.

Plan for workshop:

- Run through with tutors how to review a patient's medical notes in Socrates and extract relevant data
- Extract data in your pairs on two dummy patients using the relevant audit proforma (end of this document)

Logging into Socrates from CAL lab

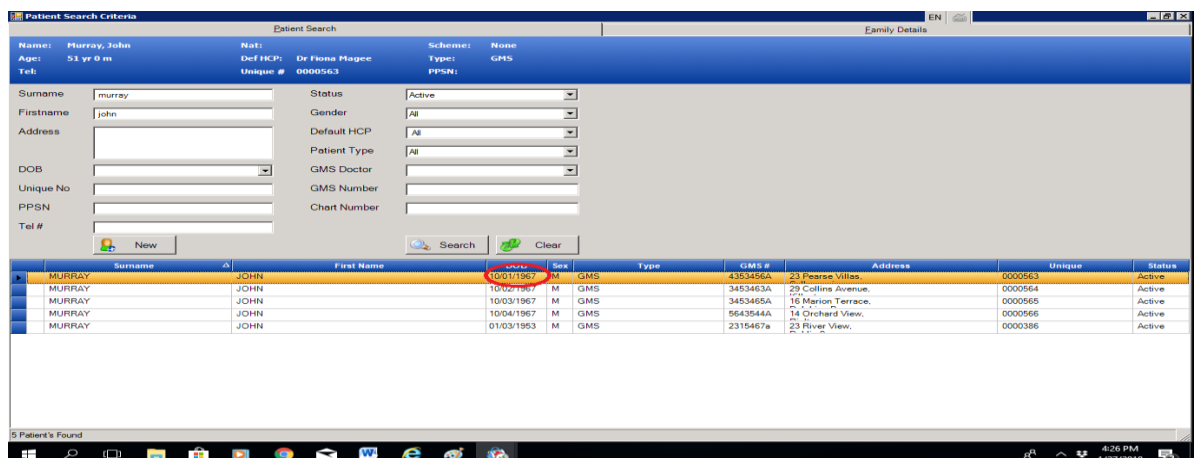
- Log on to the PC using your UCD Connect details as usual
- Click the Windows icon
- Click on each of the following: Teaching and learning > Specialist Applications > Life Science > Socrates.
- Your username and password are on your sticker e.g., username 'group1', password 'group1'

To look at a patient's notes in Socrates for audit

- Click the 'consultation tab' on the left-hand side



- We are going to search for a dummy patient called John Murray 10/01/1967
- Type in Murray for surname.
- Double-click on *John Murray 10/01/1967* -this will open the patient's notes.



This will bring you to the summary section of John's electronic notes-you will see that on the left-hand side there is a tab called prescriptions which is circled in red.

Socrates (1.8.2.0) - Dr Crea Carberry Logged On - UCD School of Medicine

File Edit Accounts Consultation Custom Forms Window Help

EN

2 Notifications

Consultation

Consultation Details

Find Patient...

Patient Summary...

Begin Consultation

Edit Consultation

Finish Consultation

Open Consultation...

Notes

Immunisations

Prescriptions

Investigations

Documents

Care Protocols

Appointments

Waiting Room

Patient Maintenance

Consultation

Reports

Communication

My Control Panel

Murray, John

23 Pearse Villas, Sallynoggin, Co Dublin

10/01/1967 (51 yr 0 m) Male GMS(4353456A) P:€0.00 F:€0.00

Editing: 27/09/2017 16:47 by Dr Crea Carberry 0000563

POMR Category: [ALL] Assign...

Tasks (0) SMS (0) Reminders (0)

Date	BP	Chol	Ht	Wt	BMI	Cig	Alc	Wst
27/01/2018	100 / 70		180.00	0.00	0.00	Y (20)	Y (30)	
04/12/2016	170 / 90		180.00	0.00	0.00	Y (20)	Y (30)	
04/12/2016	160 / 95		180.00	0.00	0.00	Y (20)	Y (30)	
04/06/2016	144 / 92		180.00	105.00	32.41	Y (20)	Y (30)	

Current Medications

Active Diagnosis

Date	Diagnosis
27/01/2018	D97-LIVER DISEASE NOS: Liver failure
08/06/2017	T92-GOUT:
04/06/2016	T99-ENDOCRINE/METABOLIC/NUTRITIONAL DISEASE OTHER: impaired fasting glucos...
04/06/2016	K86-HYPERTENSION UNCOMPLICATED: on meds since 2013
04/06/2016	L91-OSTEOARTHRITIS OTHER: lumbar spine

Social & Past Medical History

History	Social	Personal	Family
Electrician, married with 2 children.			
H82-VERTIGINOUS SYNDROME: last episode 2011			
K74-ISCHAEMIC HEART DISEASE WITH ANGINA: father died MI age 52			

Prescriptions

Date	HCP	Type
27/01/2018 16:41	Dr Crea Carberry	General
ICPC2	D13: JAUNDICE	
ICPC2	D97: LIVER DISEASE NOS	
ICPC2	D97: LIVER DISEASE NOS	
27/09/2017 16:47	Dr Crea Carberry	General
ICPC2	A50: Medication/prescription/renewal/injection	
Prescription	RAMIPRIL	
Prescription	RAMIPRIL	
Prescription	ATORVASTATIN ACTAVIS 20 MG TABLETS	
Prescription	ATORVASTATIN ACTAVIS 20 MG TABLETS	
08/06/2017 16:15	Dr Fiona Magee	General
ICPC2	T92: GOUT	
08/06/2017 14:33	group1 group1	General
Note	Pain in hallux, right foot	
Note	Q-risk 2 score: 50.5%; statin advised	
Prescription	COLCHICINE TABS 500MCG	
Prescription	PARACETAMOL TABS 500MG	
Prescription	TRITACE CAPS 5MG	
Prescription	ATORVASTATIN ACTAVIS 20 MG TABLETS	
Prescription	RAMIPRIL	

Windows taskbar: 4:53 PM 1/27/2018

Click once on the prescriptions tab

Here you can check verify that your patient is on a statin / ace inhibitor (depending on which audit you are doing)-see red circles for Atorvastatin / Ramipril

Socrates (1.8.2.0) - Dr Crea Carberry Logged On - UCD School of Medicine

File Edit Accounts Consultation Custom Forms Window Help

Consultation - John Murray

Murray, John
23 Pearse Villas, Sallynoggin, Co Dublin
10/01/1967 (51 yr 0 m) Male GMS(4353456A) P:€0.00 F:€0.00

27/09/2017 16:47 by Dr Crea Carberry 0000563

To Print (7) Current Printed (16) Completed (5) Cancelled (5) Audit

QT	Drug	Status	Next Issue	Started	Type	Dur	Rem	Issued Until	Added By
28	RAMIPRIL 5MG	Active	20/12/2017	27/01/2018	Repeat	28	3	20/12/2017	Dr Crea Carberry
28	ATORVASTATIN ACTAVIS 20 MG TABLETS - ATORVASTATIN 20MG	Active	20/12/2017	27/01/2018	Repeat	28	3	20/12/2017	Dr Crea Carberry
1	NEEDLE SAMPLES FOR ORAL SUSPENSION 10 MG SACHETS - ESOMEPRAZOLE 10MG	Active	08/06/2017	08/06/2017	Acute	1	1		group1 group1
84	BETAHISTINE HYDROCHLORIDE 8MG	Active	04/06/2016	04/06/2016	Repeat	28	6		Dr Fiona Magee
84	PARACETAMOL 500MG	Active	04/06/2016	04/06/2016	Repeat	28	6		Dr Fiona Magee
28	BISOPROLOL FUMARATE 5MG	Active	04/06/2016	04/06/2016	Repeat	28	6		Dr Fiona Magee
28	ASPIRIN 75MG	Active	04/06/2016	04/06/2016	Repeat	28	6		Dr Fiona Magee

Add Print Re-Print Re-Issue Edit Complete Cancel

Date Allergy Note HCP

No Known Allergies

Add Allergy Add Drug Allergy Remove NKA Flag Active In-Active

5:04 PM 1/27/2018

To see the date the medication was first issued in the practice, click on the printed icon above the medications

Socrates (1.8.2.0) - Dr Crea Carberry Logged On - UCD School of Medicine

File Edit Accounts Consultation Custom Forms Window Help

Consultation - John Murray

Murray, John
23 Pearse Villas, Sallynoggin, Co Dublin
10/01/1967 (51 yr 0 m) Male GMS(4353456A) P:€0.00 F:€0.00

27/09/2017 16:47 by Dr Crea Carberry 0000563

To Print (7) Current Printed (16) Completed (5) Cancelled (5) Audit

Printed by Date Printed By Drug

QT	Drug	Status	Last Issue	Type	Dur	Issues
Today: 3 Prescriptions						
28	RAMIPRIL 5MG	Printed	23/04/2017	Repeat	28	6
28	RAMIPRIL 5MG	Printed	22/11/2017	Repeat	28	3
28	ATORVASTATIN ACTAVIS 20 MG TABLETS - ATORVASTATIN 20MG	Printed	22/11/2017	Repeat	28	3
08/06/2017: 4 Prescriptions						
3	COLCHICINE TABS 500MCG - COLCHICINE 500 MCG 500MCG	Printed	08/06/2017	Acute	7	1
8	PARACETAMOL TABS 500MG - PARACETAMOL 500MG	Printed	08/06/2017	Acute	7	1
1	TRITACE CAPS 5MG - RAMIPRIL 5MG 5MG	Printed	08/06/2017	Acute	7	1
28	ATORVASTATIN ACTAVIS 20 MG TABLETS - ATORVASTATIN 20MG	Printed	08/06/2017	Repeat	28	1

Add Print Re-Print Re-Issue Re-Prescribe Complete Cancel

Date Allergy Note HCP

No Known Allergies

Add Allergy Add Drug Allergy Remove NKA Flag Active In-Active

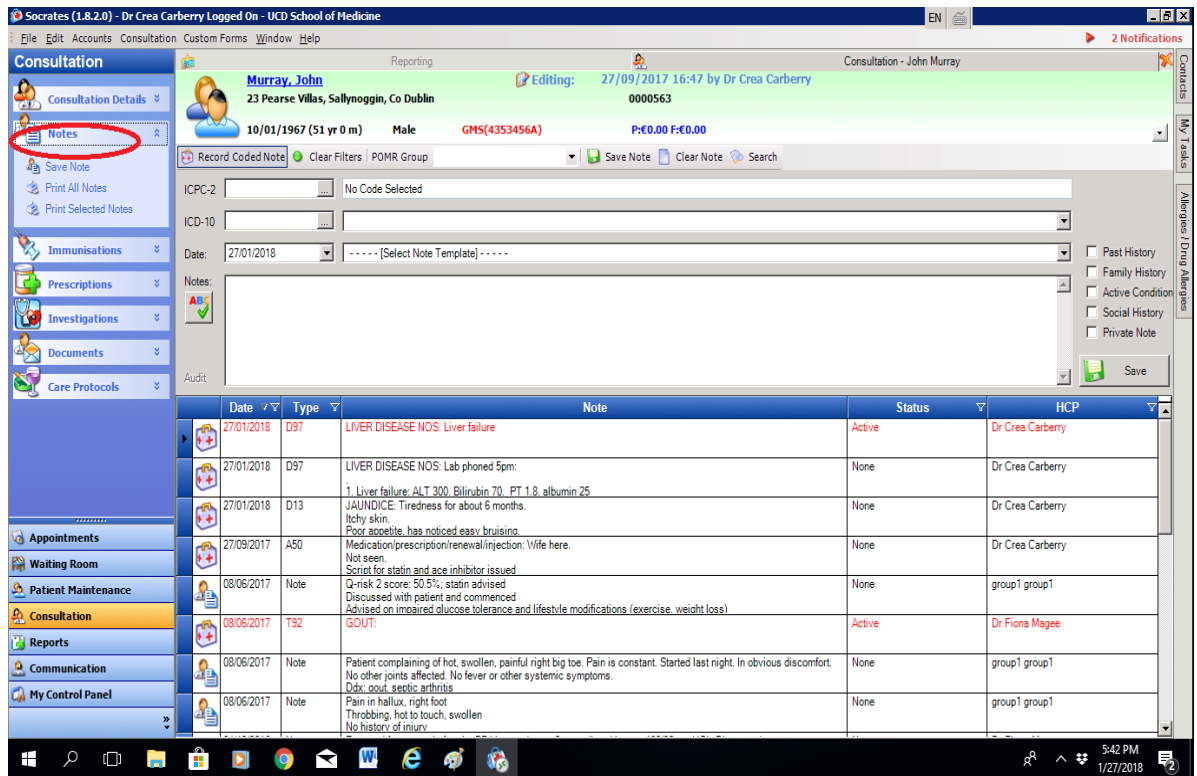
5:30 PM 1/27/2018

You will see that Ramipril and Atorvastatin were first issued on 08/06/2017*.

*This is the first time issued by the practice-remember the patient may have been on medications in a previous GP practice.

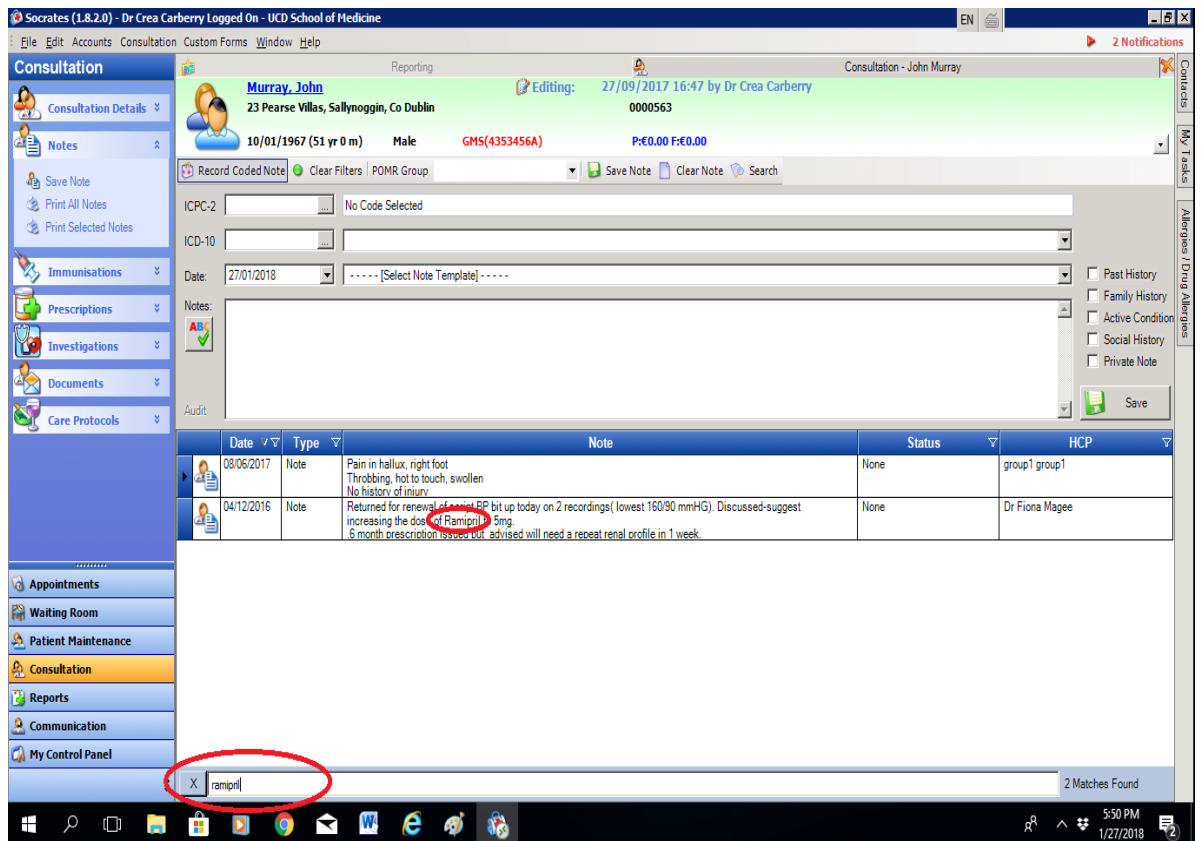
Another option of checking for when medication may have been started in the practice is to check the free text in the notes tab which is on the left.

- Click on the notes tab on the left



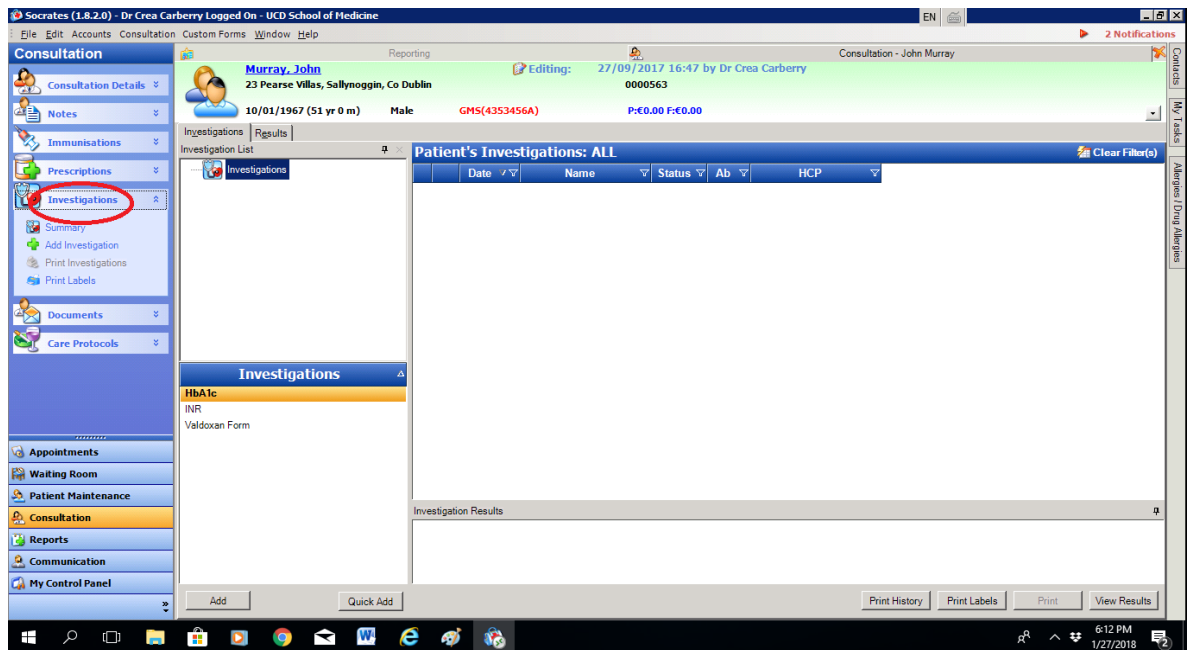
You can then do use a shortcut 'control and D' keys together to look for specific text in the notes section – after pressing 'control' and 'D' keys you can then look for specific text depending on your audit e.g., *ramipril/statin/ace inhibitor/renal blood tests / 'lfts'/ liver functions tests*. This is particularly useful for patients who have a lot of consultation notes

On the next image, you will see what a screenshot of what will appear after hitting the 'control and D' keys together and typing in a search term, in this example *ramipril* is typed in the search box that appears at the bottom



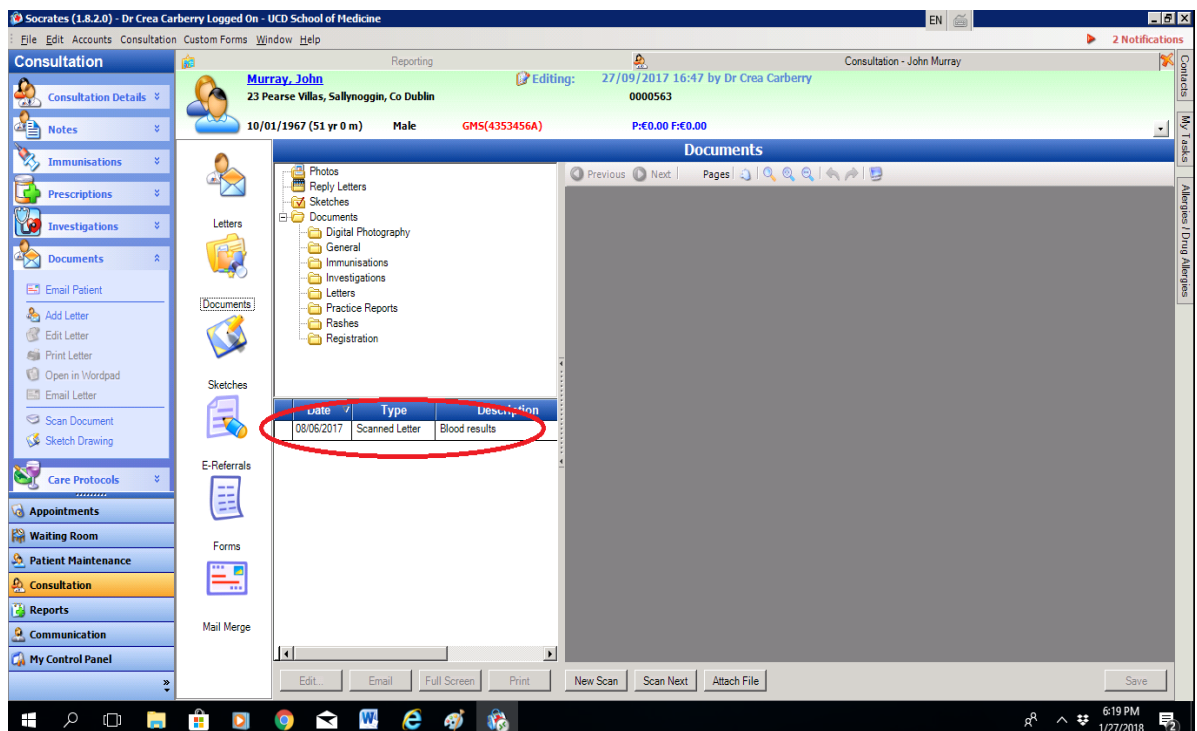
This is the search box that will appear after hitting the control and D keys together

Investigations such as renal or liver blood tests are ordinarily found by clicking the Investigations tab on the left and you can check what dates they were done on



As we are using a dummy patient, there are no investigations here

It is important to check if there have been any hospital letters documenting starting medication or blood tests that may have been done there - to do this click on the *Documents* Tab on the left.



- As you can there are blood results here from 18/06/2017-click on these to open them

Audit 1 Ace inhibitor and renal function practice worksheet

'All patients should have a renal blood test prior to starting an ACE inhibitor. This should be repeated between 1-2 weeks after starting the Ace inhibitor and after each dose increase.

STANDARD =NICE CKD Guidelines (National Institute for Health and Clinical Excellence, 2008)

- GPs, please provide students with a list of 10 patients ≥ 18 from your practice that have been prescribed an ace inhibitor in the past year.
- Students, please check the patients' clinical notes to see if they had their renal function checked:
 - 1) Prior to initiation of therapy –if started elsewhere (e.g., hospital) write 'started elsewhere' in this column
 - 2) Repeated within 1-2 weeks of starting the ace inhibitor
 - 3) Repeated 1-2 weeks after any dose increase
 - 4) After you have collected your data, compare your data with the standard and discuss with your supervising GP any potential changes that may need to be implemented.
 - 5) You will then re-audit this data in autumn 2018 on a return visit to the practice

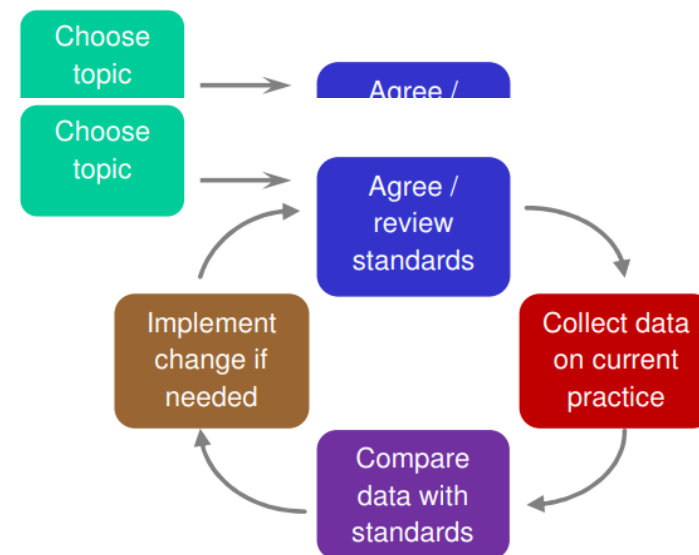


Figure 1. NHS Bristol. What is Clinical Audit? 2009

Date of audit	Patient	Renal function prior to starting Yes / No / Started Elsewhere	1-2 week repeat after starting Yes / No / Started Elsewhere	Repeated 1-2 Weeks If dose increase Yes / No / Not Applicable
30/01/2018	J Murray 10/01/1961	Started previous GP	Started elsewhere	No (increased to 5mg 8/6/17 and did not come for repeat 1 week later
30/01/2018	K Clarke 11/03/1956			
30/01/2018	R Owens 30/05/1950			
	4			
	5			

Audit 4 LFTs and statins practice worksheet

'All patients should have their liver enzyme tests checked before starting statin therapy and as clinically indicated thereafter.'

STANDARD= FDA Guidelines 2012 (U.S. Food & Drug Administration, 2016)

- GPs, please provide students with a list of 10 patients ≥ 18 from your practice that have been prescribed a statin in the past year.
- Students, please check the patients' clinical notes to see if they had their liver enzymes checked:
 - 1) Prior to initiation of therapy-- if started elsewhere (e.g., hospital) write 'started elsewhere' in this column
 - 2) Rechecked if clinically indicated (abnormal liver function tests prior to initiation, onset of jaundice ...)
 - 3) After you have collected your data, compare your data with the standard and discuss with your supervising GP any potential changes that may need to be implemented
 - 4) You will then re-audit this data in autumn 2018 on a return visit to the practice

Date of audit	Patient	Liver enzyme check prior to statin	Rechecked if clinically indicated
		Yes / No / Started Elsewhere	Yes / No / Not indicated
30/01/2018	J Murray 10/01/1961	No	Yes, when presented with jaundice on 27/01/2018
30/01/2018	K Clarke 11/03/1956		
30/01/2018	R Owens 30/05/1950		
	4		
	5		

B3: Audit Summary Report

UCD GEM STUDENT GP PRACTICE AUDIT REPORT TEMPLATE



CONFIDENTIAL REPORT FOR PRACTICE AND PARTICIPATING STUDENTS

Title of audit:	
Student(s)	
Initials of supervising GP	
Date of report:	
Original audit date:	
Re-audit date:	

Background & Aim:	<i>Put a <u>very short</u> summary of the findings of your group project / rationale for audit</i>
Standard / Criteria	<i>Select the appropriate standard for your assigned audit and delete the other audit standards</i> <i>Audit 1: 'All patients should have a renal blood test prior to starting an ACE inhibitor. This should be repeated between 1-2 weeks after starting the Ace inhibitor <u>and</u> after each dose increase.'</i> <i>STANDARD =NICE CKD Guidelines (2008)</i> <i>Audit 2: 'All children on oral corticosteroid inhalers should have their growth (height and weight centile) monitored at least annually.'</i> <i>STANDARD =2016 BTS / SIGN Guidelines on Management of Asthma</i> <i>Audit 3: 'All patients with asthma should be given specific training and assessment in inhaler technique before starting any new inhaler treatment and patients</i>

	<i>with asthma should receive a structured review at least annually. Review includes checking inhaler technique.'</i> <i>STANDARD= NICE Quality Standard on Asthma 2013</i> Audit 4: <i>'All patients should have their liver enzyme tests checked before starting statin therapy and as clinically indicated thereafter. '</i> <i>STANDARD= FDA Guidelines 2012</i>
Methodology: • Chosen population • How sample selected • Identify tool used	<i>Patients of Practice X (no need to identify practice in student report, practice can keep record)</i> <i>10 patients on medication Z notes were reviewed</i> <i>Practice Software (e.g., Socrates, HealthOne etc)</i>
Results of first round: State the results. Start with the total number (n =). Data may be presented graphically.	
Recommendations after first round:	
Results of re-audit	
Conclusion and future recommendations	

Appendix C - Ethics

C1. HREC UCD ethical approval letter

C2. Student / GP consent and information leaflets

C3. COVID - 19 amendment permission to switch from GP focus groups to semi-structured interviews

C1: Ethical approval letter HREC UCD



UCD Office of Research Ethics

Roebuck Castle
University College Dublin
Belfield, Dublin 4, Ireland

T +353 1 716 8767

An Oifig Éitice Thaighde UCD

Caisleán an Rusbhoilc
An Coláiste Ollscoile, Baile Átha Cliath
Belfield, Baile Átha Cliath 4, Éire

hrec@ucd.ie
www.ucd.ie/researchethics

September 18th, 2017

Dr Crea Carberry
UCD School of Medicine
Health Sciences Centre
Belfield
Dublin 4

Re: **LS-17-76-Carberry: Enhancing practical research skills amongst medical students-a mixed methods study**

Dear Dr Carberry

Thank you for your response to the Human Research Ethics Committee – Sciences (18/09/17). The Decision of the Committee is that **approval is granted** for this application which is subject to the conditions set out below.

Please note that public liability insurance for this study has been confirmed in accordance with our guidelines.^[1]

Please note that approval is for the work and the time period specified in the above protocol and is subject to the following:

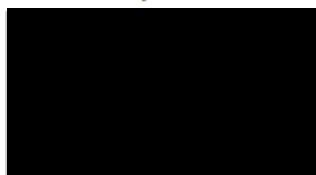
- Any amendments or requests to extend the original approved study will need to be approved by the Committee. Therefore you will need to submit by email the *Request to Amend/Extend Form*;
- Any unexpected adverse events that occur during the conduct of your research should be notified to the Committee. Therefore you will need to Submit, by email, an *Unexpected Adverse Events Report*;
- You or your supervisor (if applicable) are required to submit a signed *End of Study Report Form* to the Committee upon the completion of your study;
- This approval is granted on condition that you ensure that, in compliance with the Data Protection Acts 1988 and 2003, all data will be managed in accordance with your application and that you will confirm this in your *End of Study Report*;
- Please note that further new submissions from you may not be reviewed until any *End of Study Reports* due have been submitted to the Office of Research Ethics. That is, any earlier study that you received ethical approval for from the UCD HRECs;

.../.

- You may require copies of submitted documentation relating to this approved application and therefore we advise that you retain copies for your own records;
- Please note that the granting of this ethical approval is premised on the assumption that the research will be carried out within the limits of the law;
- Please also note that approved applications and any subsequent amendments are subject to a Research Ethics Compliance Review.

The Committee wishes you well with your research and look forward to receiving your End of Study Report. All forms are available on the website www.ucd.ie/researchethics please ensure that you submit the latest version of the relevant form. If you have any queries regarding the above please contact the Office of Research Ethics and please quote your reference in all correspondence.

Yours sincerely,



Mr T. John O'Dowd
Chairman, Human Research Ethics Committee - Sciences

^[i] http://www.ucd.ie/researchethics/information_for_researchers/insurance/



GEM Student Information Sheet and Consent Form

AN COLÁISTE OLLSCOILE | University College Dublin School of Medicine

'Enhancing practical research skills amongst medical students-a mixed methods study'

Researchers

Dr Crea Carberry UCD
Professor Walter Cullen UCD
Professor Gerard Bury UCD

Professor Jason Last UCD
Dr Geoff McCombe UCD
Dr Ian Callanan UCD / SVUH

Dear GEM Student,

We are conducting research on graduate entry medical students' clinical research skills and how those skills develop during the programme. Some funding for this research has been received from the *Learning Through Research Seed Funding Scheme* from UCD Teaching and Learning.

Why are we doing this research?

A recent UCD School of Medicine graduate survey and curriculum review identified a gap where research skills are concerned. Students can and do take a summer research elective module 'SSRA' in which this outcome can be achieved but it is not core for all medical students. UCD also offers an Intercolated MSc, but only a small number of students take up this option.

What is this research about?

This study looks to specifically look at how we might best support students to develop their research skills. There is an overlap in the skill set and knowledge required in the completion of a clinical audit and of a research project, therefore we plan to evaluate the impact of doing a clinical audit on General Practice placements has on the research skills of participants.

Why am I being asked to take part in the study?

As a graduate entry medical student with a previous degree, we feel you have the necessary skills to evaluate this educational intervention.

What will happen if you decide to take part in this research study?

If you decide to take part in this study, there will be 2 parts you will be invited to take part in:

Part 1 - Survey on research experience and research skills confidence

You will be asked to fill in a brief questionnaire on your research experience and confidence in completing research in Autumn 2017 and then asked to fill in a follow up

questionnaire in Autumn 2018 related to your research experience and confidence in research skills whether or not you opted to do a clinical audit as outlined in Part 2 below.

Part 2 - Opt to do an optional clinical audit on GP Placements in 2018 You are invited to do a clinical audit as an extra exercise as part of your GP placements in 2018. This would involve an extra workload -please see student handbook outlining what is involved.

What are the benefits of taking part in this research study?

The development of research skills has been identified as a core component of medical education. The evaluation of a structured support to the development of these skills will inform future practice and ongoing development of this component of the curriculum.

Doing a clinical audit has the potential to help students to develop research skills such as sampling, data collection / analysis (simple descriptive statistics), dissemination of knowledge and reflective practice. We want to evaluate if doing a clinical audit helps develop your research self-efficacy.

It is currently a legal requirement for practising doctors in Ireland to complete a clinical audit so participating students would gain experience doing this as an undergraduate.

What are the risks of taking part in this research study?

There are no obvious risks and you will not be required to answer any question you do not wish to. In order to match up pre and post audit questionnaires, we would like you to put the last 4 digits of your student number on both surveys. When the responses from the 2 surveys are matched up, each 4-digit student number will be converted to a coded number. There is a very small risk of breach of confidentiality. However, this is very unlikely given your survey responses will be de-identified.

How will your privacy be protected?

Any information that is obtained during this study will be kept confidential. Only the researchers will have access to the data and data will be stored on password protected computers / locked cupboard. We will not be creating a data analysis whereby any individual will be identified.

Can you change your mind at any stage and withdraw from the study?

Participation in this study is strictly voluntary, and if agreement to participation is given, it can be withdrawn at any time.

How will you find out what happens with this project?

A copy of the research results will be available at the conclusion of the study from Dr Crea Carberry. Empiric work will form part of the MD thesis being undertaken by Dr Carberry.

Contact details for further information

It is understood that should any questions or comments arise regarding this study, the Principal Investigator, Dr. Crea Carberry (email: crea.carberry@ucd.ie, phone: (01) 4730893) should be contacted.

Statement of Consent

I have read the information provided above. I have been given the opportunity to ask questions and have had enough time to consider the information. I understand that my participation is voluntary and that I am free to withdraw, without giving any reason, without my legal rights being affected .

Please tick (✓)

I agree to take part in the pre and post research experience and confidence surveys **Yes** ☐

No ☐

I opt in to do a clinical audit and its related teaching / preparation as an extra exercise **Yes** ☐

No ☐

Signature:

Date:

Telephone Semi Structured Interview Information Sheet and Consent Form for GPs

AN COLÁISTE OLLSCOILE | University College Dublin School of Medicine

‘Enhancing research skills amongst medical students-a mixed methods study’

Researchers



Dr Crea Carberry UCD
Professor Walter Cullen UCD
Professor Gerard Bury UCD

Professor Jason Last UCD
Dr Geoff McCombe UCD
Dr Ian Callanan UCD / SVUH

Dear UCD Network GP,

We are conducting research on medical students' clinical research skills and how those skills can develop during the programme.

Why are we doing this research?

A recent UCD School of Medicine graduate survey and curriculum review identified a gap where research skills are concerned. Students can and do take a summer research elective module 'SSRA' in which this outcome can be achieved but it is not core for all medical students. UCD also offers an Intercolated MSc, but only a small number of students take up this option. A key recommendation of the curriculum review team was that options be explored to increase active research opportunities for medical students in UCD School of Medicine and this correlates with both a Best Evidence in Medical Education (BEME) review by Laidlow and colleagues in 2012 *'Developing Research Skills in Medical Students'* and WFME (World Federation of Medical Education) recommendations in 2015.

What is this research about?

This study looks to specifically look at how we might best support students to develop their research skills. We are looking at your experience and the feasibility of students doing clinical audits (and other research) on General Practice placements.

Why am I being asked to take part in the study?

As a GP actively involved in the education of our medical students, we would value your opinion on the merits of the various potential research options and the barriers / facilitators to introducing more student research opportunities in General Practice.

What will happen if you decide to take part in this research study?

If you decide to take part in this study, you will be contacted for a Skype telephone interview by Dr Geoff McCombe, Research Scientist in the Primary Care Research Group at UCD School of Medicine.

What are the benefits of taking part in this research study?

The development of research skills has been identified as a core component of medical education. The evaluation of options will inform future practice and ongoing development of this component of the curriculum.

What are the risks of taking part in this research study?

You will not be required to answer any question you do not wish to. The potential risks of participating in this study are a breach of confidentiality. However, this is very unlikely. We will not be creating a data analysis whereby any individual will be identified

How will your privacy be protected?

The telephone interview will be recorded and shall be transferred as an audio file to a password protected computer and encrypted. The audio file will then be transcribed. All participants are to be assured that there will be no identifying features in the transcript and they will be referred to as 'participant 1' and so forth. Any information that is obtained during this study will be kept confidential. Only the researchers will have access to the data and data will be stored on password protected computers.

Can you change your mind at any stage and withdraw from the study?

Participation in this study is strictly voluntary, and if agreement to participation is given, it can be withdrawn at any time.

How will you find out what happens with this project?

A copy of the research results will be available at the conclusion of the study from Dr Crea Carberry. Empiric work will form part of the MD thesis being undertaken by Dr Carberry.

Contact details for further information

It is understood that should any questions or comments arise regarding this study, the Principal Investigator, Dr. Crea Carberry (email: crea.carberry@ucd.ie, phone: 0867299911) should be contacted.

Statement of Consent

I have read the information provided above. I have been given the opportunity to ask questions and have had enough time to consider the information. I understand that my participation is voluntary and that I am free to withdraw at any time, without giving any reason, without my legal rights being affected.

I understand this information and agree to participate fully.

Signature:

Date:

C3: COVID-19 amendment (permission to change to GP semi-structured interviews)

SECTION A: GENERAL INFORMATION		
1) Research Ethics Reference Number:		LS-17-76-Carberry
2) Title of study:	Enhancing practical research skills amongst medical students-a mixed methods study	
3) Name (s) of Principal Investigator/ Applicant:		Dr Crea Carberry
4) Name of UCD Supervisor (if applicable)		Professor Walter Cullen
5) UCD School/Department:		School of Medicine
6) Date UCD Ethics Approval Granted:		18.09.2017
7) Date of Study Completion		08.05.20
8) Academic Qualification Granted/to be granted (if applicable)		MD
9) Have you requested any amendments or extensions before from UCD HREC?		Yes ☒ No ☐ <i>If yes, please provide details below</i>
a)	<i>Please confirm how many amendments and extensions you have requested</i>	An extension was granted until 08.05.20
b)	<i>Please provide the dates of each amendment and/or extension approval you have received</i>	
10) What is this request for?		Amendment? Yes ☒ No ☐ <i>If yes, please complete Section B below</i>
		Extension? Yes ☐ No ☒ <i>If yes, please complete Section C below</i>

HUMAN RESEARCH ETHICS COMMITTEE
AMENDMENT/EXTENSION REQUEST FORM

If you wish to make an amendment or request an extension for an approved study, you will need to complete this form and submit to the Chair of relevant Human Research Ethics Committee

SECTION B: PROPOSED AMENDMENT		
1)	Please provide details of the amendment you wish to make	
	We were due to run a focus group of GPs on 19.3.20 but due to the Coronavirus outbreak this has been cancelled. We plan to run short telephone interviews of the GPs instead (5) over the coming weeks. We hope to do this soon as analysis needs to be done prior to thesis submission on 8.5.20. We have updated the consent form-please see attached.	
2)	Does this amendment alter the original approved study?	Yes ☐ No ☒ <i>If yes, please provide details below</i>
	No, same questions shall be asked	
3)	Were there any unexpected adverse events during your study? Please provide brief details but note you will need to submit an Unexpected-Adverse Events Report (HR5) with this form.	Yes ☐ No ☒ <i>If yes, please provide details below</i>

SECTION D: SIGNATURES (DIGITAL FORMAT ONLY)		
Signature of Applicant/P I		Date 18.03.20
Signature of Supervisor (if applicable)		Date 20.03.20
Signature of Head of School (or designate)		Date

LS-17-76-Carberry permission to amend email



<u>hrec@ucd.ie</u>		Mon, 23 Mar, 12:32	
to me, Walter			

RE: LS-17-76-Carberry

Dear Crea,

Thank you for your request to amend (20/03/20) which has been **granted approval**. This is for the work and time period specified in your submission and is subject to the conditions below:

Requests to amend and extend are limited to five requests within two years of the first approval date. The details of your approval to date are as follows:

Amendment: granted 23-Mar-20

This approval is granted on condition that you ensure that, in compliance with the Data Protection Acts 1988 and 2003, all data will be managed in accordance with your application and that you will confirm this in your End of Study Report (HR6);

You may require copies of submitted documentation relating to this approved application and therefore we advise that you retain copies for your own records;

Please note that the granting of this ethical approval is premised on the assumption that the research will be carried out within the limits of the law;

Please also note that approved applications and any subsequent amendments are subject to a Research Ethics Compliance Review.

If you have any queries regarding the above, please contact the Office of Research Ethics and please quote your reference in all correspondence.

Regards,
Tom

Tom Seaver
Office of Research Ethics
Roebuck Castle
Belfield
Dublin 4

t: 01 716 8767
w: www.ucd.ie/researchethics