Foreword

Students in medical school become involved in research for many reasons. Many are looking for intellectual challenges and want to benefit from the facilities or mentorship available from the school’s faculty. Some may simply have an idea that they would like to pursue as part of the structured research modules within their course. Other students may already have an eye to the future and are considering how to best position themselves for an academic career. Regardless, most student researchers find that the research experience enhances their skill-sets and that the research process of identification of a subject to study, development of methodologies, implementation of their plans, analysis and interpretation of their results, and the subsequent reporting of the findings alters their perspective when encountering clinical problems.

Research by clinicians usually begins with a clinical, or patient-related, question. Thus its objective is usually to improve patient care or the patient experience. For either conducting research studies or interpreting published studies, there are certain basic principles of medical research, which need to be mastered. The objective of this supplement is to de-code the seemingly complex and vast dictionary of medical clinical research terminology, and thus to empower the students of today and the clinicians of tomorrow.

The Graduate Entry Medical School (GEMS) at the University of Limerick was established in 2007 and, since then, medical students from a wide range of backgrounds and with diverse primary degrees have completed research projects. These have included work completed within protected time during semesters but have also involved summer research, research electives and intercalated PhD degrees. Much of this research work has been supervised by principal investigators from the University of Limerick Centre for Interventions in Infection, Inflammation & Immunity (4i), which brings together a multidisciplinary team of researchers focussed on developing studies that directly impact health outcomes. A major interest within 4i is the translation of research findings into improved patient outcomes as well as greater effectiveness, efficiency and economic returns for healthcare provision (www.4i.ie).

To support the GEMS students, and the postgraduate trainees working with our clinical faculty, we developed a number of concise monographs detailing widely used tools, terms and techniques to aid them as they begin their research career. We are delighted to have been invited to share these monographs in the Irish Medical Journal. This supplement makes these available in a single resource, which we hope proves useful to anyone engaging with or teaching medical researchers. In the words of Albert Einstein: “The important thing is not to stop questioning. Curiosity has its own reason for existing.”

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What’s the Difference Between PubMed and MEDLINE? And How Do You Best Search MEDLINE Anyway?

Like most medical doctors, we have searched for information on how to care for patients. As students, you may wish to search to answer a question, or to obtain background information for a project or presentation (and once you are on call, we assure you that you will be searching at 3am for evidence supporting your next option in treating a patient). Most of us with an unanswered question will ask colleagues or local experts but when they are uncertain or differ then it is appropriate to search published research for solutions. MEDLINE is most commonly used, and can be accessed via PubMed (www.pubmed.com).

What is the Difference Between PubMed and MEDLINE? PubMed is a service of the US National Library of Medicine, which provides access to over 15 million MEDLINE citations (dating as far back as the 1950s!) and to additional life science journals (so PubMed is the access point for MEDLINE). MEDLINE is the actual bibliographic database, which is one of the 40 National Library of Medicine MEDLARS databases. MEDLINE is a computerised version of the printed Index Medicus (which took up shelves and shelves of space in the library when we were students but has now been relegated to the basement).

Before we learned how to use PubMed to search MEDLINE we spent a lot of time searching through (often irrelevant!) articles in order to find the research answered our question. Some of us are lucky enough to have received formal training in MEDLINE searching, so we decided to write this tutorial so that others could also know how to get the most from searching. In reading this tutorial, we suggest you also access MEDLINE (via www.PubMed.gov) (www.ncbi.nlm.nih.gov/pubmed/ or www.pubmed.com), and have a clinical query of your own. For the rest of this tutorial, we will refer specifically to PubMed, basically because it provides world-wide free access! (MEDLINE, on the other hand, requires a subscription and the search strategy differs depending on which gateway your institution subscribes to for MEDLINE access). More formalised tutorials are also available on pubmed.gov, or on youtube (see below).

Search Question

The first and most important step in any search is to be definite about what you are searching for. For example, when talking about steroids for preterm delivery: are you looking at threatened preterm labour or for early pre-eclampsia? Is your outcome of interest just perinatal mortality or are you also looking at respiratory distress syndrome, intraventricular haemorrhage and necrotising enterocolitis? One of the easiest ways to define a question is to use a PICOT framework. This divides your question into separate components and formalises your thinking.
Take preterm labour; your general question may be: Does tocolysis (medication to stop labour) work? The formalised question now becomes: In patients with threatened preterm labour between 24 and 34 weeks gestation (participants) does atosiban (intervention) versus no tocolysis (or ritodrine, or whatever comparison you are interested in) reduce preterm labour (outcome) within one week of administration? (time).

**Search Terms**

Having defined your question, you are now ready to start searching for studies. Take a blank piece of paper and divide it into four sections, headed by participants, intervention, comparison and outcome (and a fifth section for timing, if you are including this in your question). Under each heading write the relevant terms and synonyms for this search. In this example, the participant section would have the term “women with threatened preterm labour” substituted (e.g., labor rather than labour, epinephrine rather than adrenaline, cesarean rather than caesarean). If you are having difficulty coming up with synonyms then ask your colleagues, or your consultant. Alternatively pull some recent articles and jot down the keywords from these: these are words that the articles were “filed” under, and it is reasonable to expect that other articles would be filed using these same key words.

**Steps to finding MeSH terms**

There are two rectangular boxes at the top of the screen on MEDLINE (via PubMed). The first says “search” and the second says “for”. The search box has options for places where one can search. Most people use just PubMed, but scroll down and you will find the “MeSH” option. Type in your free text term in the search box and then press go.

You should then see a screen that gives you the various MeSH options. Click on those you wish to select, then click on the “Send to” and pick the option “search box with and”. You will be sent to another screen where your MeSH term(s) are in a “search box”. Click on the “Search PubMed” box and the articles with these MeSH terms will be retrieved.

**MeSH TERMS**

MEDLINE files articles under particular key words called MeSH terms. If you searched for articles on cardiac failure, you may miss the articles which were filed under the MeSH term “Heart Failure, Congestive”. Therefore, if you are looking for articles relating to CCF, it is best to search under your own words (called “free text”) including cardiac failure, pulmonary oedema, pulmonary edema and then the MeSH term “Heart Failure, Congestive Edema, Cardiac” or “Cardiac Output, Low” (see Figure 1, steps to finding MeSH terms). You should now have a page of search terms, with a mixture of both free text and MeSH terms. The amount of time it takes to compile these terms will depend on your needs: if you are doing a formal Systematic Review then defining your search terms may take several full time days (if not weeks), whereas a simple question for a lunch time meeting will only take a few minutes. (Next time you are reading a systematic review, check out their search strategy and see if you could do better!)

**Boolean Operators: AND, OR, NOT**

Boolean operators are terms that are used to define your search. Their use seems obvious: combining “cesarean section OR cesarean section” should result in European and North American studies looking at caesarean sections. It is good to start by combining each of your categories with “OR”. For example, if you are looking at preterm labour, for participants you combine “preterm labour” OR “preterm labor” OR “preterm contractions” OR “Obstetric Labor, Premature”[MeSH]. This should then result in all the studies relating to your participants. Resist the urge to start looking through the results for the moment, and repeat this search using your terms for your intervention, comparison and outcome. Now you need to start combining the groups. Underneath the search box is another series of boxes labelled limits, preview, history, etc. By clicking on “history” you will find a record of all the searches that you have performed each labelled by a number. The next step is to do a very specific search by combining your four groups by the term “AND” (Figure 2); in this particular example, this resulted in 110 articles (search performed on 19th July 2012). This is a very specific search resulting in articles with all the groups mentioned.

**Sensitive Search**

A second way of combining your groups is to use the term “OR”. This will result in many more articles relating to the question, but will include articles where the search term relating to, for example, the intervention, was not included. A good idea is to start with a very sensitive search: if this results in very few articles then you could proceed with a sensitive search. However, if your very specific search results in hundreds of articles then this is an area that has been extensively researched. You may then choose to expand the search further, but this will depend on whether you are doing a very thorough review or searching for one easily found article.

**Limits**

The “limits” button will lead you to a page which allows you to limit your search based on article type, year of publication and language amongst other options. A quick search is certainly easier if the results are limited to those in English (for example, as it is the language we are using for this tutorial). However, if you are searching for a systematic review, then it is considered a source of bias to search in only one language.

**Clinical Queries**

“Clinical queries” is a search option that allows you to search based on diagnosis, treatment and aetiology amongst other options. This also allows you to search for systematic reviews specifically. The design of “clinical queries” include search filters which aim to improve the yield of searches for clinically-relevant studies and reduce the number of “false drops”.
My NCBI
Under the clinical queries is another option called “My NCBI”, for which you need to register and provide a password and ID (which is free). This is a very useful option as it allows you to save your searches, and then access them at another time. My NCBI will also automatically update your search as newer studies are added to the database and can even e-mail you to tell you that the search has been updated. This is especially thrilling when you have published your research, and NCBI emails you your own article!

Where to Learn More
PubMed has an online tutorial on how to search MEDLINE, which is very useful. There are also other published articles and books on how to get the most of your medline search. NCBI have uploaded tutorials on YouTube on how to use search Medline (http://www.youtube.com/user/NCBINLM). Things have come a long way since looking up Index Medicus in the library on a wet Wednesday night in November!

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References

SUGGESTED FURTHER READING.


Research Confuses Me: What is the Difference Between Case-Control and Cohort Studies in Quantitative Research?
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What is the difference between a cohort and a case-control trial? And why is it important? As a student, it is sometimes difficult to appreciate the difference between these two study methods, and why should it matter to us anyway? After all, we study medicine to treat patients, not statistics. Study methodologies were for the scientists; we are clinicians. Fast forward to clinical practice, and the importance of research design becomes apparent. As medical doctors we treat patients, but we also look at the bigger picture: why is this happening to this patient? Why is this patient more likely to be affected than another? In order to truly care for patients it is necessary to search and query and that means doing, or being able to properly interpret, research.

The most fundamental point of both cohort and case-control trials is that they are observational trials. Unlike randomised controlled trials (RCTs), where the researchers actively divide participants into control and comparison groups, observational trials are more passive: here the researchers literally observe participants. The major drawback is the potential for bias: apparent differences may be due to known or unknown confounders. However, in emotive or ethically difficult areas (e.g., obstetrics or paediatrics) or in situations where blinded randomisation is not possible (e.g., surgical procedures) they may be the best quality evidence available.

To illustrate the differences between the two study types, a good example is the history of research into lung cancer. We all know that smokers are more likely to develop lung cancer, but where did that knowledge come from? And what if you look at this from the other direction: How many persons with lung cancer were smokers? These two ways of looking at a question illustrate the differences between a cohort and a case-control trial perfectly. In fact, over fifty years ago in the UK a young doctor and a statistician asked just that same question and decided to use these two methods to find an answer.

Case-Control
How many people with lung cancer were smokers? Sir Richard Doll (an epidemiologist) and Sir Austin Bradford Hill (a statistician) started off by looking at patients with lung cancer; the “cases”. They then picked a group of controls, patients without lung cancer but in hospital for another reason. Looking back in time (retrospectively) they tried to ascertain what the cases had been exposed to that made them more likely to develop lung cancer than the controls. The cases were divided into those exposed to smoking and those unexposed. A similar group (in this case, other hospital patients) were similarly divided into exposed and unexposed groups (Figure 1). Due to the risk of confounding (see below) the researcher then assumes (and hope!) that the cases and controls come from the same population. So the key features to a case-control trial are retrospective and comparison.

![Figure 1 Case Control Trial](https://example.com/case-control.png)