Junior Medical Officer's Basic Guide to Research

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Acknowledgements:
We would like to thank the librarians at Monash Heath for their assistance with the literature search, Ms Carol Jordon and Ms Marilyn Bullen from PMCV for their assistance in reviewing the guide and support.

Contents:

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We are always trying to improve this guide and welcome any feedback. If you are interested in contributing to the further development of this guide or have any comments regarding the components of the guide, please contact us at: jmoforum.vic@gmail.com.

Chapter 1: Introduction

The importance and pressure to be involved with research is often felt by junior doctors and medical students. Research represents the scientific advancement and the drive for quality improvement in healthcare. Within the world of medicine, research can be found everywhere, and every doctor will inevitably find themselves in one way or another in touch with research.

Despite this, do junior doctors and medical students feel adequately prepared for research and what can be done to offer more support in being involved. Balancing research on top of existing responsibilities of patient care and studies with personal life can often be overwhelming. Therefore, doing research on top of daily duties is no doubt a challenge. Difficulties commonly faced by junior doctors and medical students include time constraints, feeling inexperienced, limited opportunities to find a project or supervisor and poor support.

This guide aims to acknowledge the difficulties in doing research as a junior doctor and medical student. With this in mind, we hope this guide serves as a quick introduction to what is research and tips in getting involved. We hope through reading this guide, you will be able to gain more of an understanding to the basics of research and be encouraged to take a leap forward in your contribution to research. We wish everyone all the very best with their own endeavour of research!

Why is research important?

Research plays a big role in all doctors' life no matter what position or setting they are in. When practicing medicine, a lot of us look up guidelines. Guidelines are a part of evidence-based medicine which is based on research. When the answer we are looking for are not in guidelines we often look up existing research. In order to do this, fundamental aspects of research must be thoroughly understood by the doctor in order to search the correct articles, compare the study's patient group to their own and apply the investigation or management. Understanding research also encourage you to think critically and allows you to even answer these questions yourself.

Doing research also allows you to gain many important skills such as teamwork and leadership as you work towards deadlines. You also are given the opportunity to meet like-minded colleagues and allows you to learn from one another. Due to these desirable skills, a lot of specialty training programs require potential trainees to display evidence of research prior to entry.

Research requirements for colleges

Although research requirements may not be explicitly started by all training colleges, many colleges have research requirements prior and during speciality training. Below is a list of research requirements in some of the training colleges. Please also refer to your interested college website for more information and updates.

TIP: Fulfilling training program application requirements should not be the main motive to be involved with research, however do consider looking at college research requirements and authorship when undertaking a research project.

PHYSICIANS		
Specialty	**Requirements for Training**	**Link**
Cardiology	1 Research Project	https://www.racp.edu.au/trainees/advanced-training/advanced-training-programs/cardiology-adult
Clinical haematology	1 Research Project	https://www.racp.edu.au/trainees/advanced-training/advanced-training-programs/clinical-haematology
Clinical immunology and allergy	1 Research Project and 1 Immunology and Allergy Project (for trainees commencing training in 2019 onwards)	https://www.racp.edu.au/trainees/advanced-training/advanced-training-programs/joint-immunology-and-allergy
Community child Health	1 Research Project	https://www.racp.edu.au/trainees/advanced-training/advanced-training-programs/community-child-health
Dermatology	1 Research Project Recommended that a minimum of 2 research papers be prepared for publication	https://www.racp.edu.au/trainees/advanced-training/advanced-training-programs/dermatology
Endocrinology	1 Research Project and 2 Abstracts of Case Reports	https://www.racp.edu.au/trainees/advanced-training/advanced-training-programs/endocrinology
General and Acute Care Medicine	1 Research Project	https://www.racp.edu.au/trainees/advanced-training/advanced-training-programs/general-and-acute-care-medicine

General Paediatrics	1 Research Project	https://www.racp.edu.au/trainees/advanced-training/advanced-training-programs/general-paediatrics
Geriatric Medicine	1 Research Project	https://www.racp.edu.au/trainees/advanced-training/advanced-training-programs/geriatric-medicine
Infectious Diseases	3 Research Projects	https://www.racp.edu.au/trainees/advanced-training/advanced-training-programs/infectious-diseases
Medical oncology	1 Research Project	https://www.racp.edu.au/trainees/advanced-training/advanced-training-programs/medical-oncology
Neonatal/perinatal medicine	1 Research Project and 1 Neonatal/ Perinatal Medicine project	https://www.racp.edu.au/trainees/advanced-training/advanced-training-programs/neonatal-perinatal-medicine
Nephrology	1 Research Project and 1 Nephrology project	https://www.racp.edu.au/trainees/advanced-training/advanced-training-programs/nephrology
Neurology	1 Research Project	https://www.racp.edu.au/trainees/advanced-training/advanced-training-programs/neurology
Nuclear Medicine	1 Research Project	https://www.racp.edu.au/trainees/advanced-training/advanced-training-programs/nuclear-medicine
Palliative Care	1 Research Project	https://www.racp.edu.au/trainees/advanced-training/advanced-training-programs/palliative-medicine
Respiratory Medicine	1 Research Project	https://www.racp.edu.au/trainees/advanced-training/advanced-training-programs/respiratory-medicine-sleep-medicine
Rheumatology	1 Research Project	https://www.racp.edu.au/trainees/advanced-training/advanced-training-programs/rheumatology
Sleep Medicine	1 Research Project (for trainees who commenced training in 2019 onwards)	https://www.racp.edu.au/trainees/advanced-training/advanced-training-programs/respiratory-medicine-sleep-medicine

OTHER PHYSICIANS		
Addiction medicine	1 Research Project	https://www.racp.edu.au/trainees/advanced-training/advanced-training-programs/addiction-medicine
Sexual Health Medicine	1 Research Project	https://www.racp.edu.au/trainees/advanced-training/advanced-training-programs/sexual-health-medicine
Rehabilitation	1 Research Project	https://www.racp.edu.au/trainees/advanced-training/advanced-training-programs/rehabilitation-medicine-general
Occupational and environmental Medicine	1 Research Project and 1 Ramazzini Presentation	https://www.racp.edu.au/trainees/advanced-training/advanced-training-programs/occupational-and-environmental-medicine
Public Health medicine	1 Research project	https://www.racp.edu.au/trainees/advanced-training/advanced-training-programs/public-health-medicine
SURGERY		
Surgical specialty	**Application requirements**	**Training Requirements / Links**
Cardiothoracic Surgery	- CV out of 36 points - Research must be from the last 5 years - Max. 7 points allocated to publications, 9 points allocated to presentations	Encourages all trainees to undertake up to 12 months of supervised surgical research during training https://www.surgeons.org/become-a-surgeon/how-do-i-become-a-surgeon/set-selection-requirements-process-and-application/specialty-specific-eligibility-criteria-selection-processes/cardiothoracic-surgery https://www.surgeons.org/trainees/surgical-specialties/cardiothoracic-surgery/program/research
General Surgery	- CV out of 28 points - Research must be from the last 5 years - Max. 8 points allocated to publications and presentations	All trainees must complete a mandatory research requirement prior to applying for fellowship in General Surgery https://www.generalsurgeons.com.au/education-and-training/selection https://www.generalsurgeons.com.au/education-and-training/research-requirements

Neurosurgery	- CV out of 15 points - Max. 1 point allocated to presentations, 2 points allocated to publications	Required to take part in a research project, presentation, publication in a peer reviewed scientific journal http://www.nsa.org.au/NSA/Neurosurgical_Training/Application_and_Selection/NSA/Neurosurgical_Training/Application_and_Selection.aspx?hkey=6ec738e7-a7c5-48e2-a871-32b6208d3dc7 http://www.nsa.org.au/NSA/Neurosurgical_Training/Research_Assessment/NSA/Neurosurgical_Training/Research_Assessment.aspx?hkey=8b5c9490-2766-4eb2-a454-96aa0b2e1034
Orthopaedic Surgery	- Required to have presented at an orthopaedic conference - Requirement to a published article in a peer reviewed journal - Max. 2 point allocated to presentations, 4 points allocated to publications	Research mentioned in the AOA curriculum for education and training https://www.surgeons.org/trainees/surgical-specialties/cardiothoracic-surgery/assessment#Research%20report https://www.aoa.org.au/orthopaedic-training/becoming-an-aoa-trainee
Otolaryngology Head and Neck Surgery	- CV out - Research must be from the last 5 years - Max. 3 points allocated to presentations and 5 points allocated to publications	Research must be completed during training: completion of a Masters/PhD in this specialty and/or publication as a first author in a peer reviewed journal https://www.surgeons.org/become-a-surgeon/how-do-i-become-a-surgeon/set-selection-requirements-process-and-application/specialty-specific-eligibility-criteria-selection-processes/otolaryngology-head-and-neck-surgery-australia under 'Selection Eligibility Form' https://www.surgeons.org/trainees/surgical-specialties/otolaryngology-head-and-neck-surgery/program/research
Paediatric Surgery	- CV out of 60 points - Research must be from the last 5 years - Max. 14 points allocated to presentations and publications	Trainees must attend the ANZAPS during various phases of training, in addition to one other research activity (listed on website) https://www.surgeons.org/become-a-surgeon/how-do-i-become-a-surgeon/set-selection-requirements-process-

		and-application/specialty-specific-eligibility-criteria-selection-processes/paediatric-surgery https://www.surgeons.org/trainees/surgical-specialties/paediatric-surgery/program under 'Paediatric Surgery Training Regulations'
Plastics and Reconstructive Surgery	- CV out of 200 points - Max 60 points can be allocated to publications and presentations - More points allocated to articles/case reports published in a P&RS journal	Required to take part in a research project https://plasticsurgery.org.au/about-us/becoming-a-specialist-plastic-surgeon/surgical-education-and-training-set-program/selection-for-training/
Urology	- CV out of 110 points - Research must be from the last 4 years - Max 20 points can be allocated to presentation, 25 points for publications	Required to take part in a research project, presentation, publication and dissertation and 6 months of full-time research. Research must be done prior to fellowship exams. https://www.usanz.org.au/future-trainee/ https://www.usanz.org.au/regulations-and-forms/
Vascular Surgery	- Research must be from the last 4 years - Max 6 points can be allocated to presentation, 6 points for publications	Must complete a minimum of 5 points of research requirements (breakdown of points on the website) https://www.anzsvs.org.au/education-training/selection/ https://www.anzsvs.org.au/education-training/ under 'Training Program Regulations'
OTHER		
Specialty	**Training requirements**	**Link**
General Practice	None	
Radiology	1 research project in first 3 years	https://www.ranzcr.com/documents/603-project-1-ra-instructions/file
Emergency Medicine	Refer to Scholarship and Teaching domain within the ACEM curriculum	https://acem.org.au/Content-Sources/Training/How-the-FACEM-Training-Program-works/Curriculum-Framework-Search
Obstetrics and gynaecology	Trainees must accrue a minimum of 4	https://www.ranzcog.edu.au/RANZCOG_SITE/media/RANZCOG-

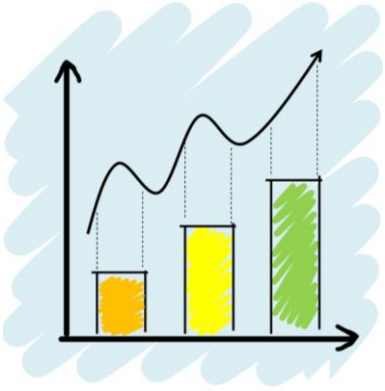
	research points by the end of 52 weeks FTE of time in training in the Advanced Training component of the FRANZCOG Training Program	MEDIA/Training%20and%20Assessment/Specialist%20Training/Curriculum%20and%20Handbook/FRANZCOG-Training-Program-Handbook-2018-(post-2013)v6.pdf

Chapter 2: Types of Research

Research typically involves the acquisition of new knowledge. There are many ways to get involved in research and contribute to the research literature. This can be done through contributing traditional original research such as trials or studies, or by contributing shorter pieces such as case studies, opinion pieces or review articles.

Broadly speaking, research studies can be divided into the following categories:

Quantitative Research vs. Qualitative Research



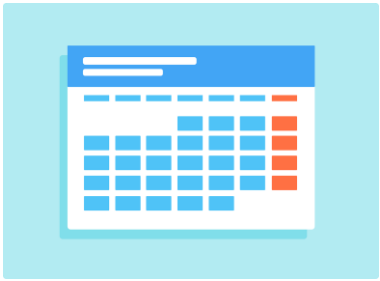
Quantitative research

- An objective study which involves quantifying the research question in such a way that measurable outcomes are generated for further statistical analysis.
- Purpose: To find associations in the study variables and generalisable these results to the population of interest.
- Method: Structured approach. Draw numerical data from survey/questionnaire, observations, review of records.
- Software: SPSS, PSPP

Qualitative research

- A subjective study which involves outcomes that are not easily 'measured' such as opinions, thoughts or beliefs expressed as words or sentences.
- Purpose: To develop an initial understanding to reasons and motivation.
- Method: Unstructured or semi-structured approach. In-depth interview or discussion.
- Software: NVivo.

Prospective vs. Retrospective



Prospective studies

- Timeline: Follows a cohort forward in time
- Example: Prospective cohort studies, randomised control trial.
- Pro: It provides more robust data and is less prone to biases that are inherent to retrospective studies.
- Con: Usually more labour, time and resource intensive than retrospective studies.

Retrospective studies

- Timeline: Identify a cohort and look back in their history to collect research outcomes.
- Examples: Case-control studies, retrospective cohort studies.
- Pro: Easier to perform and logistically can be simpler to execute than prospective studies.

- Con: Privy to research biases and is more vulnerable to missing information should certain outcomes or details be missing from documentation.

Longitudinal vs. cross-sectional studies

Cross sectional studies

- Involve collection of observations at one point in time only, for example the collection of data via a single survey to a group of participants.

Longitudinal studies

- Involve serial testing of a cohort for comparisons in outcomes between two points in time. This would include surveying the same group of participants twice to see how opinions change with or without introducing an intervention of interest or by collecting health data before and after a new drug is introduced.

Observational vs. Experimental Studies

Observational studies

- Do not involve an intervention. The researchers are simply observing and measuring certain outcomes within a sample.
- Examples: Case reports, ecological studies, cross-sectional studies, case control studies, cohort studies.

Experimental studies

- Involve the introduction and allocation of an intervention by the researcher and measurement of its effect on a sample. These studies by nature are usually prospective and longitudinal.
- Examples: Randomized control trial (RCT).

Common study designs

Take note there are many other types or subtypes of study design however we have included some descriptions regarding common study designs that you might encounter.

Hierarchy of evidence

Figure 1: Hierarchy of evidence

Systemic Reviews

A systematic review aims to provide a higher level of evidence base than any single study as it summarises and develops recommendations based on findings from all existing studies that investigate the same topic. Traditionally, systematic reviews are conducted on RCTs and hence are deemed a higher evidence base than a single RCT on its own. However, over time, due to diversity in study designs and the desire to collate information from these studies, modified review systems have been developed. Systematic reviews typically follow the conventions of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. The Cochrane Collaboration aims to provide high level evidence by systematically reviewing many important topics in Medicine.

Meta-analyses

A meta-analysis is similar to a systematic review in that it collates information from all studies investigating the same topic; but pools that data from all these studies to run a separate analysis of the data to find new outcomes. Meta-analyses are considered the highest level of evidence that can be achieved in research. PRISMA guidelines are again used to guide this process.

Randomised Controlled Trials

Randomised controlled trials (RCT) are a prospective experimental study whereby participants are randomly allocated to intervention group or control group (placebo or standard therapy).

Clinical trials often utilise RCTs to assess the efficacy of new treatments as it is recognised as the gold standard study to evaluation cause-effect relationship. All clinical trials must be registered (i.e. Australia clinical trials registry) to ensure all results are made transparent.

Randomisation of participants into intervention and control groups allow the reduction of selection bias of sicker patients into certain groups (Figure 2).

TIP: When being involved with clinical trials or prospective studies consider obtaining a Good Clinical Practice (GCP) certificate which details principles of human research. You can obtain it online or there may be free courses at your hospital/university.

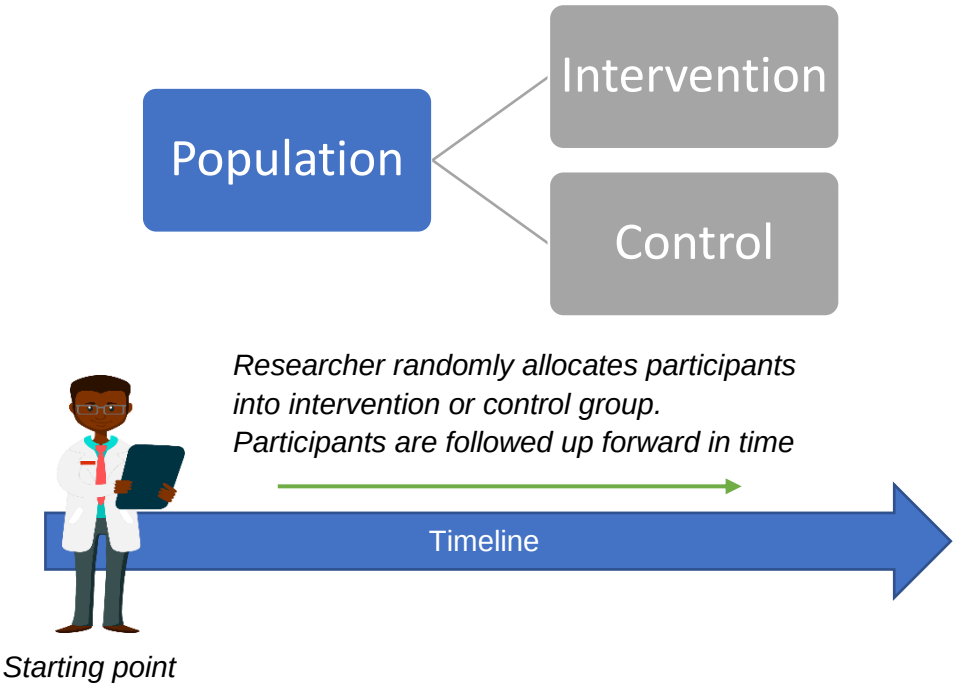
In order to further reduce bias, the trial may be blinded:

- Single blinding: only one party is blinded (i.e. patient only)
- Double blinding: two parties blinded (i.e. patient and investigators)
- Triple blinding: three parties blinded (i.e. patient, investigator, other staff involved or statisticians)

In clinical trials there are four phases:

Phase 1	Assess the safety and dosage of the treatment. Participants: Small number of healthy volunteers. No control group.
Phase 2	Assess therapeutic effects. Participants: Patients with disease. May have a control group.
Phase 3	Compare new treatment against existing standard treatment. Review of therapeutic effect, efficacy and safety profile. Participants: Randomised control trial where patients with disease are randomly allocated into intervention group and control group.
Phase 4	Performed after the new treatment is approved. May look into the longer-term effects or side effects of the new treatment. Participants: Larger RCTs (i.e. more participants or multi-centre)

Figure 2: Outline of randomised control trial



Cohort Studies

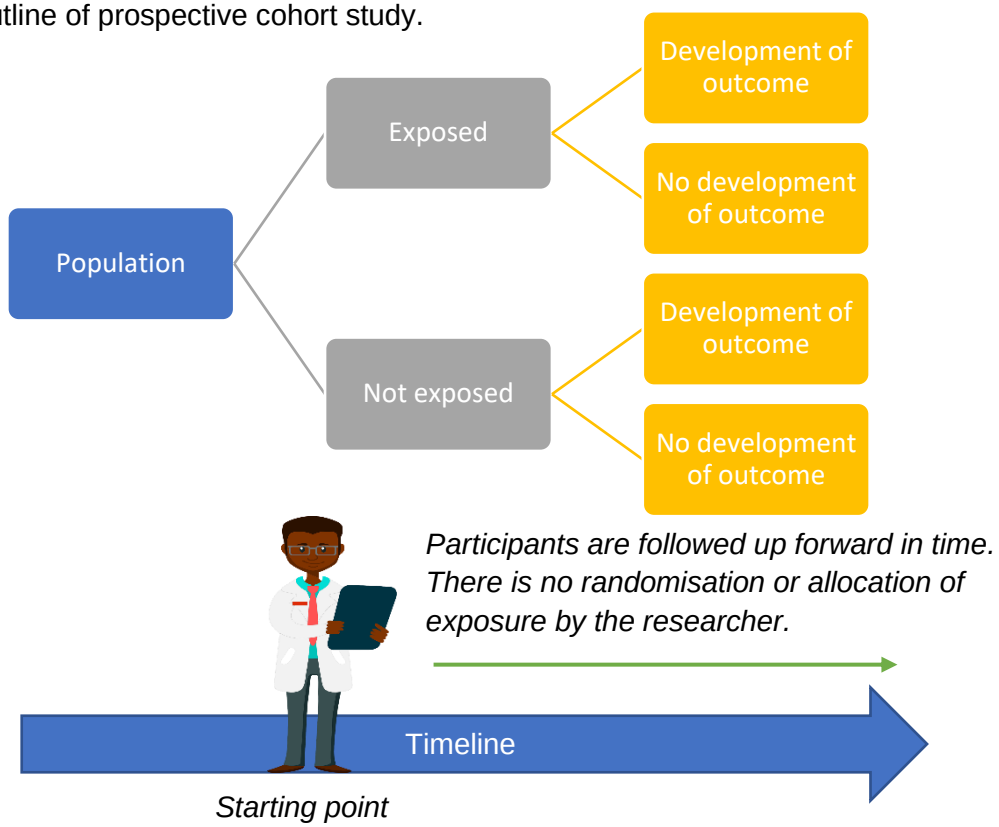
A cohort is a group of people with a shared characteristic i.e. symptom or risk factor.
There are two forms of cohort studies:

- Prospective cohort study
- Retrospective cohort study

<u>Prospective cohort study</u>

Participants are identified before the development of the outcome being studied. The population is then separated into different groups depending on whether they are exposed to the risk factor to the outcome. The groups are then followed up forward in time and the incidence of the developed outcome is compared in each group (Figure 3).

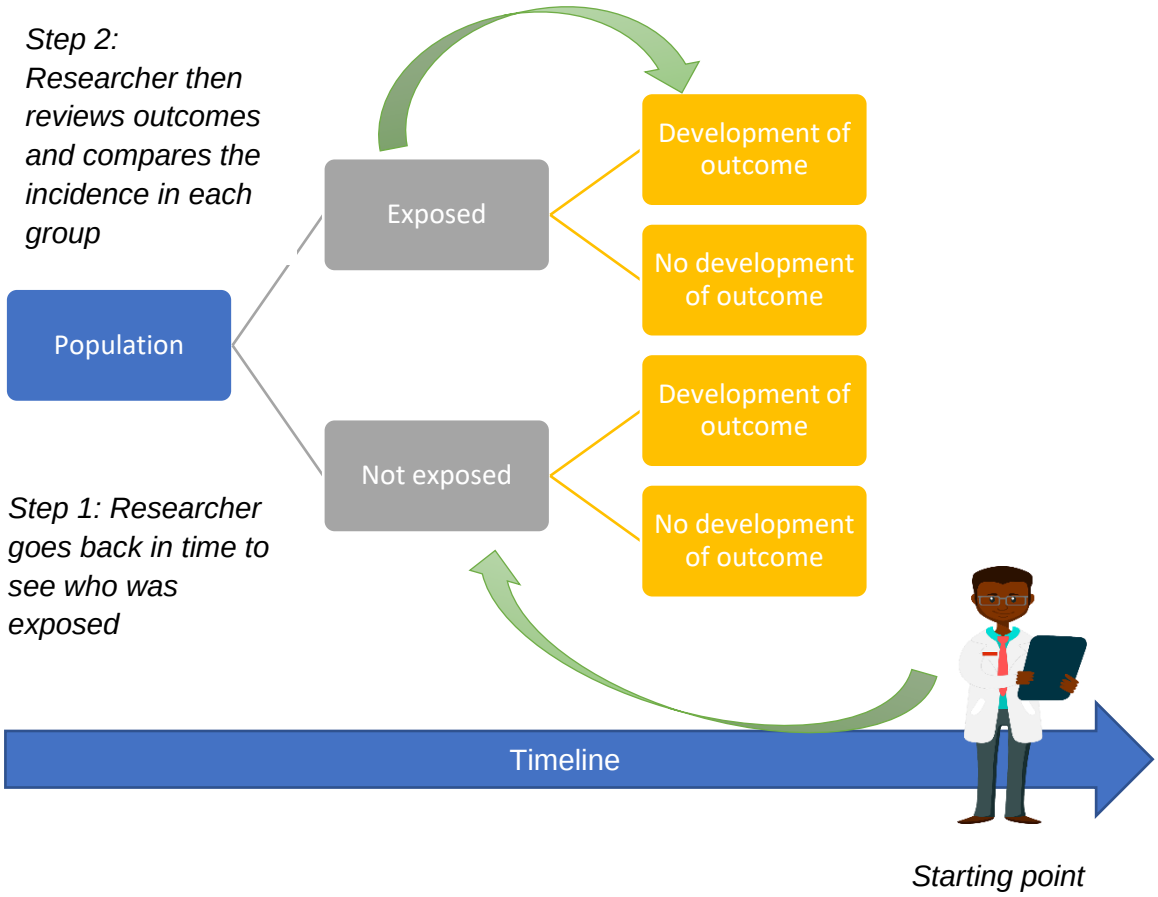
Figure 3: Outline of prospective cohort study.



Retrospective cohort study

The outcome and exposure status are retrospectively collected at the beginning of the study. This is often done through look back at medical records or asking the participants. The incidence of outcome is then compared in the exposed and not exposed group (Figure 4).

Figure 4: Outline of retrospective cohort study.



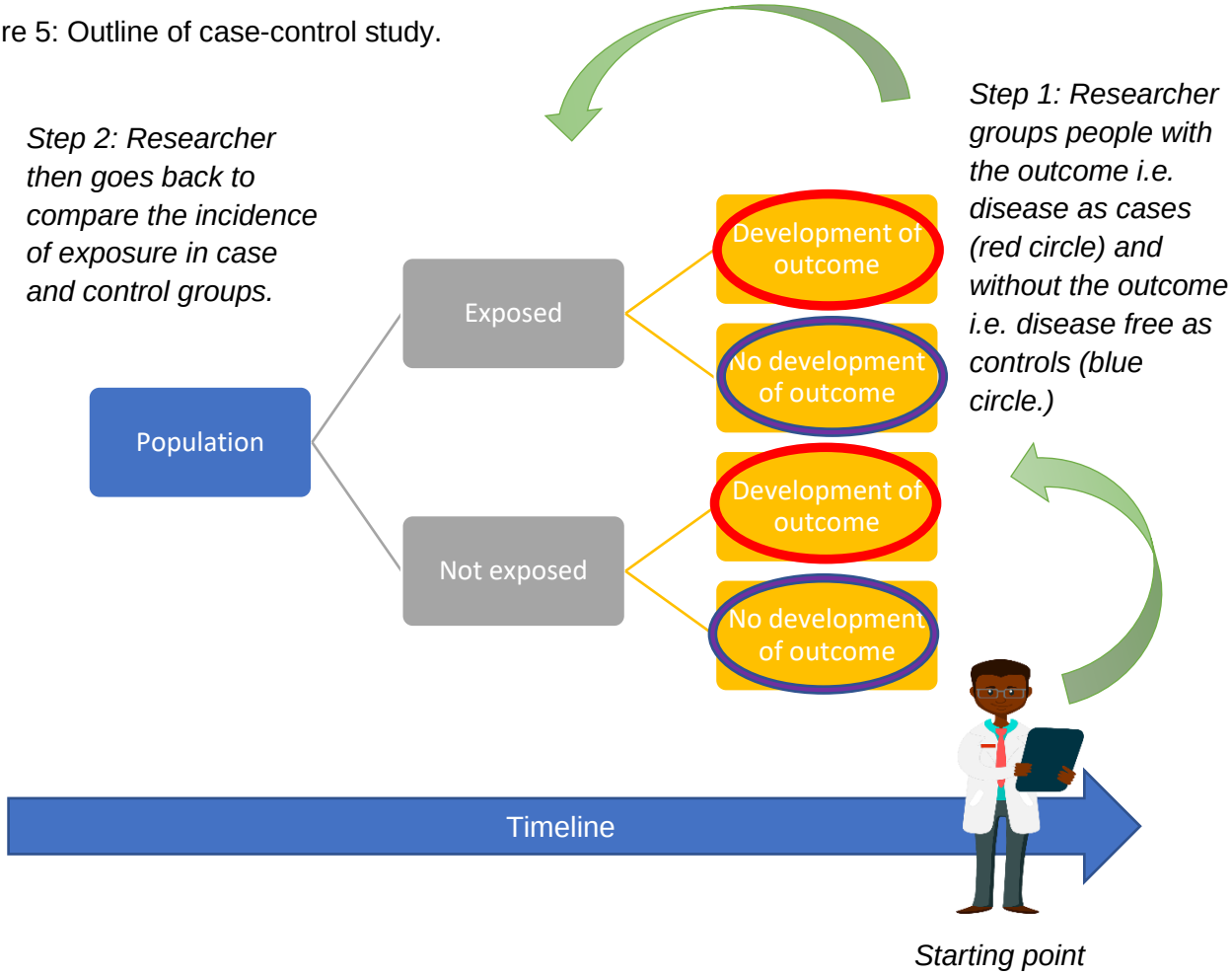
Case-Control Studies

Retrospective study compares the exposure status in cases (people with outcome) and controls (people without the outcome) (Figure 5). The cases and control participants may be matched or unmatched.

Matching allows both the case and control group to be as similar as possible and reduce the chances of any potential confounders. The most common characteristics matched includes age and sex. For example, in your study if you had a 5-year-old male in your case group, you would also include a 5-year-old male in your control group so that both groups are essentially matched. Take not to not overmatch the participants (i.e. matching the actual exposure/risk

factors that predisposes the group to developing the outcome as there will be no difference in your results).

Figure 5: Outline of case-control study.

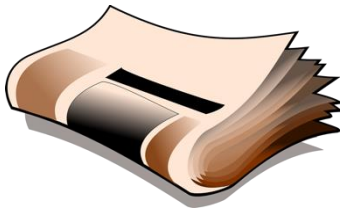


Case Reports/Series

Case reports present an isolated clinical case of interest due to a number of reasons such a diagnosis, response to different treatment or anatomic variation. They are useful ways of communicating isolated interesting or rare cases and conditions discovered in clinical practice. It is considered a low level of evidence but remains a useful way of raising awareness for potential new clinical treatments that may be investigated further with a formal study.

Case series compile a group of cases that share a similar treatment, anomaly or diagnosis. They allow for good discussion for any notable differences between patients in relation to outcome despite the shared clinical factor; and build on the evidence base afforded by a single case report.

Editorials/Expert Opinions



Much like in a newspaper or magazine, the letter to the editor is a means for readership to communicate to the editor and other readers their point of view or opinion on a recently published article. It is a useful means of generating discussion regarding a given research topic and allows for the opportunity for various readers to share their own experience or expertise relating to recently published topics.

TIP: Be alert in clinic or on the wards for interesting cases. Case series and case reports are a good way to be involved with a project short-term.

Other

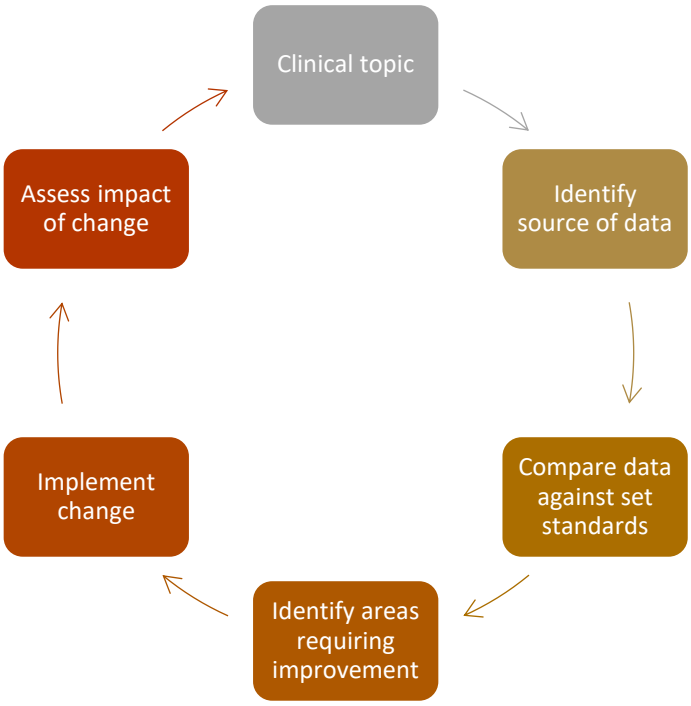
Clinical audits

Clinical audits are a cyclical process which is crucial to the improvement and development of working clinical units. Clinical audits are different to other previously discussed forms of research studies as its purpose is to improve performance rather than answering a hypothesis.

Although some clinical audits are publishable, consider discussing with your supervisor on the suitability of publishing your clinical audit.

The diagram below demonstrates the process and elements of what a clinical audit may look like (Figure 6).

Figure 6: Outline of clinical audit.



Summary of Research Studies

You might consider the level of evidence, pros and cons of each study design before commencing your research project. Of course, your supervisor can give you a hand in deciding which study is best! Have a look at Table 1 for an overview of main study designs.

Table 1: Overview of study designs.

STUDY DESIGN	PURPOSE	PROS	CONS
Systematic Review	To review and summarise information from multiple studies to form an overall	· Low cost · No need for recruitment · High level of evidence	· Time and labour intensive · Specific skills required
Meta-analyses	To statistically summarise results from multiple studies of a particular topic.	· Low cost · No need for recruitment · High level of evidence	· Time and labour intensive · Specific skills required
Randomised Control Trials	To randomly allocate participants to intervention or control and assess effects.	· High level of evidence for cause-effect. · Blinding possible	· Costly · Time and labour intensive · Recruitment can be difficult. Risk of participant drop out.
Prospective Cohort Study	To prospectively follow up on a cohort based on their exposure/risk factors to compare the development of outcome/disease.	· Good evidence of cause-effect · Good for rare exposure.	· Costly · Time and labour intensive · Recruitment can be difficult. Risk of participant drop out.
Retrospective Cohort Study	To retrospectively review exposure/risk factors then compare the incidence of outcome/disease.	· Less costly · Less time and labour intensive · No recruitment and risk of participant drop out. · Good for rare exposure.	· Lower evidence of cause-effect · Prone to bias due to retrospective study.
Case-Control Study	To look at cases (people with outcome/disease) with controls (people without outcome/disease) and	· Less costly · Less time and labour intensive · No recruitment and risk of	· Shows association rather than cause-effect relationship. · Prone to bias due to

	compare their exposure status.	participant drop out · Good for rare outcome/disease.	retrospective study.
Case Report/Series	To report a case or series of cases due to a rare or interesting presentation.	· Quick, easy, no costs · Short term involvement · Often no ethics applications · May be a starting point for larger studies	· Cannot make inferences or generalise results. · May be more difficult to publish – some journals do not accept case reports.
Editorials	To express the author's opinion on a particular topic.	· Low cost · Quick and easy · No recruitment · No ethics or consenting involved	· Lowest level of evidence
Clinical Audits	To review current service/performance and compare with set standards with an aim for quality improvement.	· May be publishable · Even if not publishable, looks good on your CV ·	· May not be publishable

Chapter 3: Getting started

Finding opportunities

You might find yourself asking - Well, I would love to be involved with research, but I just don't know where to start and how to I get on a project?

TIP: Case reports or case series are a quick and easy way to publish. Keep an eye out for interesting cases and let your consultants know you are keen to write any interesting cases and to let you know if they are aware of any.

The good news is, there is always research happening in almost all places and time and there are many ways to be involved. Sometimes it might be a bit of a draw of luck whether a research opportunity is presented right in front of you or requires you to do a bit of searching.

Depending on your field of interest, you may consider approaching your hospital's director of research, head of unit or consultants to seek research projects. These people are likely to know the research that is available in the unit or can point you to the right people to speak with. If there is no research happening, you can create opportunities for yourself by looking at potential research topics that can be done and looking for a supervisor to support your idea.

For more information regarding contacts for research, please refer to the Appendix 1: Research Contacts List.

Learning more about research

There are many ways to learn more about research depending on your availability, preferred method of learning and preparedness for out of pocket costs.

As the quote from ancient Greek philosopher Aristotle, "For the things we have to learn before we can do them, we learn by doing them". You can learn more about research by concurrently being involved with research projects and through experience.

For those of you who prefer some formal teachings, consider one of the following options.

TIP: Consider speaking to your supervisor regarding your interest for further research learning. They may be aware of suitable research courses for your interested speciality.

COURSE	**DESCRIPTION**
Undergraduate courses	Research activities which are often offered during undergraduate/postgraduate medical training. It is a good way to be formally involved with research as a medical student. Examples include: Bachelor of Medical Science
Masterclasses	Research masterclasses often run over a few sessions and aim to provide a good overview on basic research knowledge and skills. It is good for people who have limited time. Examples include: Intensive course: Surgical Research Essentials (SuRE), MedCube Research Masterclass.
Short courses/ Graduate certificate/ Diploma	These include formal courses that often run over a few months or up to a year. It provides formal learning and assessments of research knowledge and can lead to higher studies such as Master's degree. Examples include: Emergency Medicine Research Course, Graduate Diploma in Clinical Research.
Masters	There are various Master courses available depending on your interests while incorporating formal research courses. It often takes around two years full time to complete but can often be completed part-time to accommodate for people who have other commitments. Many different universities offer similar courses, be sure to look through each universities' handbook to see which ones suit you best. Examples include: Master of Public Health, Master of Clinical Research, Postgraduate diplomas/Masters in Clinical Education often incorporate a research unit/project.
PhD	Doctoral degrees are the highest form of research degree. Often completed over a number of years. It allows the individual to carry out in depth study and creation of a thesis on a particular topic of interest.

Choosing a supervisor

A supervisor is someone who will guide you through your project from the start to the end of the project. They are the first person you seek for advice when troubleshooting any issues. Therefore, choosing the right supervisor is very important. It is important to note that a supervisor who has agreed to be involved or provide you with a project is very different to someone who is willing to take the time and sit down with you to plan a project that suits your requirements.

TIP: Consider looking at your supervisor's and their student's publication history. A successful track record may provide insight to your publication success chance with that particular supervisor.

Consider some of the following things when choosing a supervisor:

- Does their research interest match yours?
    - Consider looking at your supervisor's research publications and presentation to see what areas and type of research they are involved with and whether that matches up with yours.

- Can they offer what you are looking for?
    - Looking for a supervisor to help you with a case report is very different to a supervisor for a masters or PhD as an example. Establish what sort of support and commitment your supervisor is able to offer and ensure they are aware of your goals.

- Are they easily contactable and approachable?
    - Questions and problems are likely to arise in research projects. Having a supervisor who you can easily ask questions and responds to your emails quickly is ideal in moving the project along.

- Do they have previous experience working with students or junior doctors?
    - A supervisor who has previously worked with other students and junior doctors will likely to understand the common difficulties that often arises. They will also understand how to guide you along your project and explain any difficult concepts/procedures that you may not be familiar with.

TIP: When approaching supervisors, you may feel nervous and concerned you have not been involved with research or publications. However, remember everyone starts from somewhere and supervisors are aware of this. Showing enthusiasm and how you can be a valuable team member is the key.

The next step after you have identified a potential supervisor is to approach them!

Although there are no hard and fast rules to how to approach a potential supervisor, consider the following questions which your supervisor may be interested in.

- What is your career interest? How is your career interest related to the research that you would like to be involved?
- What particular topic or area are you interested in? And why?
- Why have you chosen to approach this particular supervisor? How do you think you are able to assist in their research project? Why do you think this particular supervisor will be able to achieve your goals?
- What are your goals? Is it to learn more about research? Is it to publish? Is it part of your curriculum or coursework?
- Do you have a project idea in mind? If yes, how would you suggest executing this idea? Have you done a literature search on your project idea?
- What is your previous research experience? What other projects are you doing?
- What is your time commitment and availability? What do you expect to achieve during this timeframe? Is it feasible for you to commit to this project (i.e. even if you were to move rotations)?

If your supervisor has a project in mind, it is often a good idea to establish what responsibilities you are required, what role you play, who else is involved, will you likely to be first author or co-author and so on.

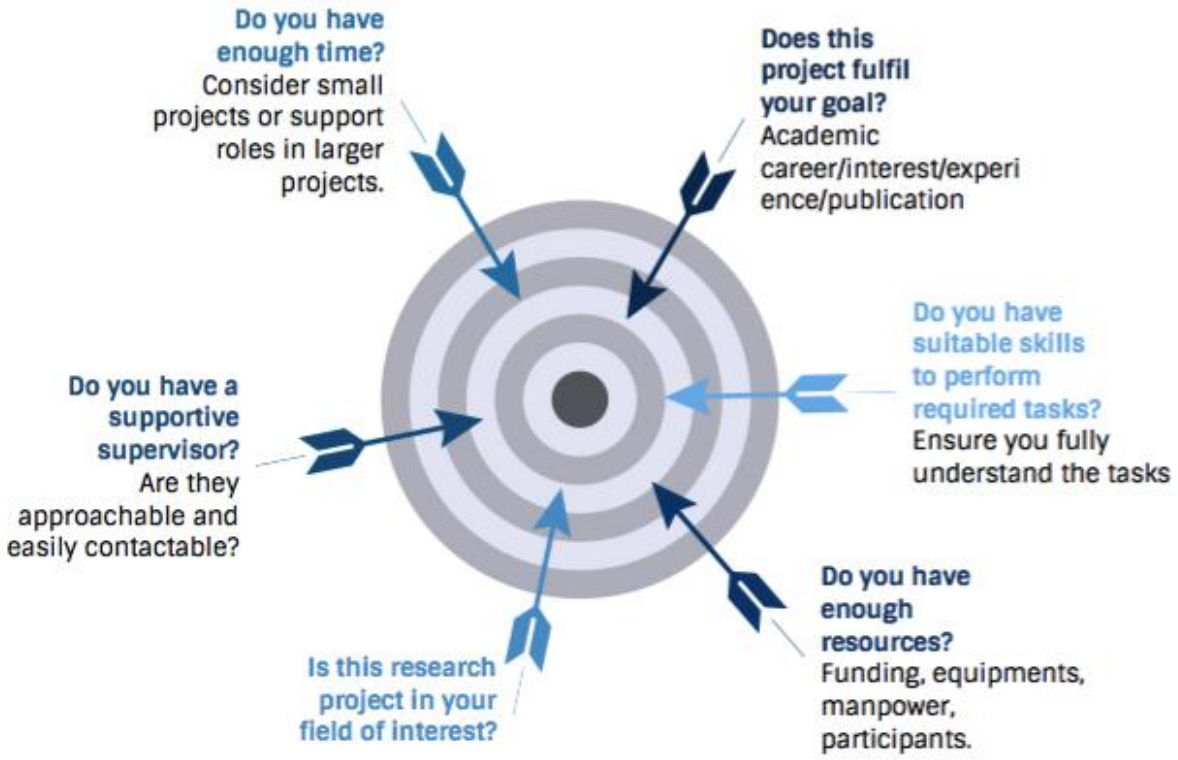
Set up a timeframe and jobs to follow up so both you and your supervisor are clear on what to expect and know when you are expected to catch up again.

Choosing a project

Finally, ensure you choose a project that is well-suited for you. Below are some of the key factors that might be important to consider when choosing a research project (Figure 1).

TIP: Think carefully if you have enough time and support to undertake your research project. Ensure it does not negatively affect your clinical work. Consider doing BMedSci, Honours, Masters or PhD if you would like formal dedicated research time.

Figure 1: Key factors when choosing a research project.



Chapter 4: Carrying out the Project

Planning out your project is probably one of the most important steps. A well-planned project will ensure that various aspect of your project has been well thought out and potential problems can be addressed early in the project. Below is a basic flowchart of how you may approach your research project and the things to consider ahead when planning your project (Fig 1.).

Figure 1:

Formulating a Research Question

Your research question will be developed in conjunction with consideration for what type of research you will be conducting (qualitative, quantitative or mixed methods). It is perhaps the most important foundation for your study in order to keep your aims and objectives grounded and focused. In general, research questions aim to be concise and specific to clearly define what it is you want to study. You will find you repeatedly return to your research question to determine whether particular aspects of your study should be included as it helps to determine the scope of your study.

Quantitative research questions tend to be much more concrete, and oftentimes may involve a single research question and formal hypothesis which is aimed to be proven or disproven.

Example: In a study that aims to determine what factors may influence of gender on mortality and morbidity in very low birth weight premature babies

- *Null hypothesis: there is no gender difference in the mortality, morbidity and neurodevelopmental outcome of babies admitted to tertiary perinatal centres*

Qualitative research tends to be much more exploratory, so a range of research questions may be used to identify major ideas that are intended to be explored.

Example: In a qualitative study that aims to explore what factors influence women's epidural preference in labour, a range of research questions may include:

1. *What are the environmental and social influences impacting on epidural uptake?*
2. *What patient factors (age, obstetric, medical, psychological etc.) are impacting on epidural uptake?*
3. *How efficacious is the knowledge being sourced by pregnant women about epidural analgesia? What sources are these and what sources should be used?*
4. *What proportion of women who intend to have an epidural will actually receive one?*

Managing your data

This will be an important consideration from an Ethics point of view. Maintaining patient confidentiality is of utmost importance. Some helpful tips are as follows:

- Code and label your data in a way that makes sense to you but does not divulge the identity of the subject it entails
- Store your information on password protected computers or hard-drives

- Keep in mind you will need to store your data in a safe and secure location for a period of time after your project has been concluded before it can be destroyed
- Stay organised! Make sure one person has a complete compilation of all the data stored in a systematic way so that it is easily accessible - this will aid transference of the data between people to help with analysis

TIP: It is often a good idea to password protect your data which is often a requirement when submitting your ethics application.

Literature Search

Literature search is important in the everyday life of a doctor in searching evidence-based practice as well as for research purposes. Therefore, it is important to understand how to effectively and efficiently perform a literature search.

Here are some tips and tricks on how to do a literature search.

You may also decide to see your librarian who may assist you in accessing search engines, how to navigate the search engines. finding an article and refining your search strategies.

Here are some of the search engines you may consider using. See table 1 for further details:

- Pubmed
- Medline
- Embase
- Cochrane Library
- Ovid
- Google Scholar

Table 1: Comparison of major databases

	OVID DATABASES			
	PUBMED	**MEDLINE**	**EMBASE**	**COCHRANE**
Availability	Freely available	Requires institutional login	Requires institutional login	Freely available
Coverage	Coverage to 1966 including medical, biomedical and life sciences texts.	Coverage of mostly US based journals to 1946	Comprehensive coverage to 1947 from at least 90 countries	High level evidence (RCT and systematic reviews) to 1993

Search features	Automatic mapping to MeSH terms Limit results to full text available	MeSH terms incorporated in advanced search "Explode" and "Focus" options allow more targeted searches Combine search functions Subheadings function	MeSH terms incorporated in advanced search "Explode" and "Focus" options allow more targeted searches Combine search functions Extensive limiting functions for targeted searching Subheadings functions	Many filtering options in Basic search. Advanced search allows incorporation of Boolean phrases, MeSH terms, combining multiple phrases and limits
Other features	'Related citations' function Export to Endnote/citation manager Register to save searches	'Find similar' and 'Find Citing articles' Export to Endnote/citation manager Register to save searches	'Find similar' and 'Find Citing articles' Export to Endnote/citation manager Register to save searches	Cochrane Clinical Answers – succinct answers to clinical questions, searchable by topic/field of medicine Register to save searches Export to Endnote/citation manager
When to use	If unable to access subscription services For easy keyword searches Expand your search beyond medical topics only	Guided MeSH subject searching, more limiting options than PubMed Extensive medical subheadings Independent, less sponsored content than PubMed	Useful for drug/pharmacological searches Recent articles and conference papers Extensive search limiting options	Looking for high level evidence (not as useful for low level evidence or emerging)
Online guide to use	https://www.youtube.com/watch?v=NNBHFjArneU https://www.ciap.health.nsw.gov.au/training/ebp-learning-modules/module3/broadening-and-		https://guides.library.utoronto.ca/comprehensivesearching/cochrane	

	narrowing-search-terms-on-ovid-database-explode-and-focus.html	

Structured Searching using the PICO process:

Step 1: Formulate your search sentence or question

Step 2: Identify keywords for each PICO element
- P = Population/Patient
- I = Intervention
- C = Comparison
- O = Outcome

Step 3: Plan your search strategy:
- Determine which database you will use to search the literature
- Identify any synonyms for your search keywords in 'Step 2'
- Use Boolean operators (See below for further information).
- Consider the use of truncation and wildcard

Truncation	Wildcard
Infect* will retrieve • Infect • Infected • Infection • Infections • Infectious • Infecting	Isch?emia will retrieve Ischaemia Ischemia

- Be care not to be too broad or too narrow in your search
- Consider the use of subject headings or subheadings and is exploding the headings are necessary.

Step 4: Execute your search

Step 5: Refine your results
- You have many ways to limits your search to relevant articles of your wish. You may want to limit your search results to certain publish dates, types of study, peer reviewed articles only, etc.

Step 6: Review the literatures
- Review your search results after applying your limitations and select articles that are relevant.

Boolean phrases explained
One way to increase the power of your basic search is to use Boolean phrases. These are phrases used across all search engines called operators, that instruct the engine to find things in a certain way.

Common Boolean phrases include:

- **AND**: placing AND between words instructs the search engine to find only articles containing both words. Eg Neonatal **AND** Sepsis
- **OR**: placing OR between words instructs the search engine to find articles containing at least one of the words used. Eg Neonatal **OR** Newborn
- **NOT**: placing NOT between words instructs the search engine to find articles containing one word but not another. Eg Aids **NOT** hearing (to exclude articles about 'hearing aids' from coming up

Another great option is using truncation as explained above to improve your searches. This involves using a word root and inserting an asterisk somewhere within it, to search for all words containing that word root. This is helpful for words with alternate spellings (British vs US), or where you want to broaden your search to pluralised words. For example, searching for "**Neonat***" will return results for **neonat**e, **neonat**al and **neonat**ology (the word root is in bold). Searching for "**Leuk*mia**" will return results for **leuk**ae**mia** and **leuk**e**mia**.

For more information, please follow the link here: http://lib.dmu.edu/db/cochrane/help

Here are some further links if you would like to read more about literature search:

- MESH heading: https://www.nlm.nih.gov/mesh/
- Grey literature: http://monashhealth.libguides.com/grey_literature

Preparing your project

There are several key things to consider when planning your project - they are mainly resource and time based. Assuming you are the Principal Researcher, some key things to consider are:

- How much time do you have?
- How much funding and manpower do you have?

How much time do you have?
This is an important consideration before you start planning or asking to be a part of a project. A good idea is to be honest and **realistic** about your availability to avoid awkward situations down the line with a supervisor!

If you are planning your own project from scratch, the benefit is you can decide how big or small your project will be (and as a result, how much time it will require). Of course, there are different situations you may find yourself in that will shape how much time you can dedicate to your project such as:

- Are you doing a dedicated full time research year(s)?
- Are you overloading a project on top of full-time work?

Things you will need to consider when planning your project are:

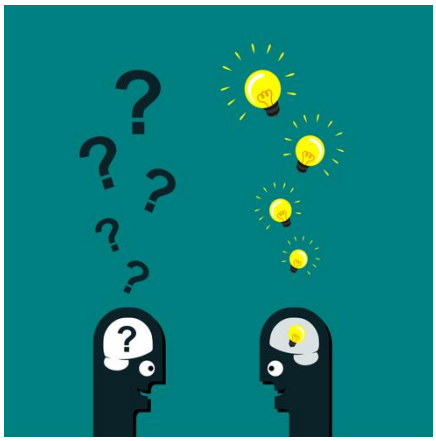
- Finding a supervisor and discussing the project details to develop your proposal
    - Developing a research question (see below)
    - Consider various aspects of project design - pros and cons and what is suitable or feasible for you (discussed briefly above). You may find you need to compromise on design to achieve particular timeline or resource restraints (which can be acceptable, provided you acknowledge these in your write-up)
- Submitting an application for Ethics approval
- Submitting an application for Governance approval
- Commencing data collection
- Commencing data analysis
- Final write-up of our project for distribution

Determining how much time exactly you will need is a tough question to answer - it is best to discuss in detail with a supervisor to get a rough guide on how long you should be aiming for based on the details of your project. For example, a retrospective study reviewing past imaging and records could be approved and have data collected in a matter of months; whereas a prospective study could span a year or more depending on the observational interval.

Once you have a rough idea of how your project will pan out, set yourself a strict project timeline and try your best to stick to it! This will help keep you and your research team on track as lengthy projects and deadlines in the distant future are easy to lose track of! A good rule of thumb is also to plan for setbacks such as prolonged Ethics and Governance process or researchers being unavailable due to other commitments (such is life). Allow generous leeway to avoid disappointment and stress!

Some helpful tips:

1. As stated above, prospective studies will always be more time consuming than retrospective studies.
2. Talk in detail with your supervisors to get their advice and experience on what will be feasible for you
3. Schedule regular meetings with your supervisor (e.g. monthly) within your timeline and agree on this before starting to keep your team organised and on the same page



What kind of resources do you have?

Another important part of project planning is realistically considering how you can physically carry the project out. Make sure you are budgeting well to ensure successful completion of your project.

Some potential costs to consider:

- Printing surveys/advertisement posters/conference posters
- Mailing surveys/follow up documents
- Providing refreshments if interviews are involved
- Hiring venues to carry out research if required (e.g. interviews)
- Purchasing particular tools required to carry out the investigation
- Hiring researchers to help with data collection
- Hiring typists/analysts to help with data organisation
- Conference attendance

TIP: It is a good idea to calculate the approximate sample size required for significant results prior as part of planning for your study. If you are unable to achieve the targeted sample size, you can consider the study as a pilot study.

So, where can you get the help from?

- Research grants
    - There are multiple sources you could apply to gain access to funds to help carry out your project - the key is to know where to look (hopefully with the help of your supervisor!)
    - This is where a solid project proposal comes in very handy
- Volunteers
    - Medical students / other junior doctors may be able to donate some time to your project whether it be with data collection, analysis or write-up
    - Experts are also often keen to lend a helping hand to keen budding researchers - just ask around! This may get you access to a biostatistician who can help you run some numbers or even teach you how to run them yourself!
        - These can be found usually via talking to Research Departments belonging to Universities or Hospitals

- Your supervisor may also be a good reference for people they have worked with in the past

Ethics application

In most health network there should be an Ethics and Research Governance committee who you may refer to for assistance with anything related to ethics for your research.

It is a good idea to look at your hospital Ethics and Research Governance website which is often filled with many useful information.

The below information serves to be a general guide, for any queries it would be best to consult your respective ethics officer.

Case reports

Case reports do not need an ethics application however a consent form should be completed prior to starting your case report. You may find your health network to have an already available template. You might also consider thinking about the which journal you will be publishing as an additional consent form specific to that journal may be required. If images of patients are included in your article remember to obtain specific consent to publish these photos as well.

Low risk projects

Ensure your project satisfies the low risk project check. If you are uncertain, consult your ethics officer.

Greater than low risk projects

Your application may vary depending on specific details of your project. A tip of advice would be to ensure you have included all details and making sure the information you provide is clear.

TIP: Ensure you have a local supervisor who you can easily approach to ask questions and can guide you with the ethics submission which can be a tricky process.

Roles in an ethics application

There are variable roles which reflect your duties in the research project.

Principal investigator:

This is the primary individual responsible for the preparation and conduct of the project. They are also responsible to ensure all other investigators of the project adhere to the approved project protocol. This role is often your supervisor who is allocated as the principal investigator. If you are allocated as the principal supervisor, ensure this is done under the supervision of your supervisors and that you got the support to do so as this is a big role.

Coordinating Principal Investigator:

This role may be more appropriate in multi-centre studies where there is a coordinating principal investigator who liaise with the principal investigators at each site participating in the research study.

Co-investigator/Associated investigator:

More of the case, this will be your allocated role in an ethics application. A co-investigator or associate investigators are crucial members of the research project who will assist in carrying out activities required but are not responsible for the overall conduct of the project.

Chapter 5: Basic epidemiology and biostatistics

Epidemiology and biostatistics often contain concepts which can be quite difficult to understand and grasp. Below is some of the common terminology and ideas in understanding the basic concept of epidemiology and biostatistics. It is good to have a basic understanding as it will help you understand the purpose of your study and how you are carrying out your methodology. If you are interested in learning more there are formal epidemiology or biostatistics courses. For statistical analysis of your study, you may need a professional statistician to assist you in analysing the data.

Common Epidemiological Terms

Term	Definition & Calculation	Example
Prevalence	The proportion of the population to have the interested outcome at a point of time. $Prevalence = \frac{Number\ of\ cases}{Population}$	In a study reviewing women in Town X from ages 18 to 75, what is the prevalence of cervical cancer in 2012? There are 25,000 women from ages 18 to 75 in Town X and at the start 2012, 125 women have cervical cancer. $Prevalence = \frac{125}{25{,}000} = 0.5\%$
Incidence	The number of new cases who have developed the interested outcome. $Incidence = \frac{Number\ of\ new\ cases}{Population\ at\ risk}$	In a study reviewing women in Town X from ages 18 to 75, what is the prevalence of cervical cancer in 2012? There are 25,000 women from ages 18 to 75 in Town X and at the start 2012, 125 women have cervical cancer. In 2013, an additional 16 women developed cervical cancer. What is the Incidence of cervical cancer in 2013?

<table>
<tr><td></td><td></td><td>$$Incidence = \frac{16}{24{,}875}$$
$$= 0.6\ per\ 1000\ women\ per\ year$$</td></tr>
<tr><td>Absolute risk (AR)</td><td>The baseline risk or the probability of an outcome. It has no suggestion of any association between the outcome and exposure.

$$AR = \frac{Number\ cases}{Population}$$</td><td>In Town X, in every 100 men, 12 develop lung cancer. What is the absolute risk of a man living in Town X developing lung cancer in his lifetime?

$$AR = \frac{12}{100} = 12\%$$</td></tr>
<tr><td>Relative risk (RR)</td><td>The risk or the probability of developing the outcome in the exposed group compared to the non-exposure group. It compares the absolute risk in each group.

It is used in studies such as RCT, Cohort studies, Cross-sectional studies.

RR equal to 1 shows no difference between the groups, RR greater than 1 means the exposure is a risk factor, RR less than 1 means the exposure is a protective factor.

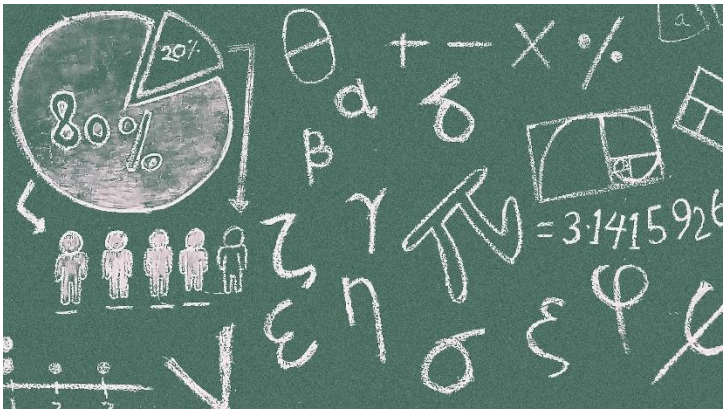
<table><tr><td></td><td>Disease present</td><td>Disease absent</td><td></td></tr><tr><td>Exposure present</td><td>a</td><td>b</td><td>a+b</td></tr><tr><td>Exposure absent</td><td>c</td><td>d</td><td>c+d</td></tr><tr><td></td><td>a+c</td><td>b+d</td><td></td></tr></table>
$$RR = \frac{Risk\ in\ exposed}{Risk\ in\ unexposed}$$
$$= \frac{a}{a+b} \div \frac{c}{c+d}$$</td><td>A researcher in Town X is studying whether exposure to smoking increases the risk of developing lung cancer. The researcher looks at the risk of developing lung cancer in a group of men.

<table><tr><td></td><td>Yes lung cancer</td><td>No lung cancer</td><td></td></tr><tr><td>Yes smoking</td><td>80</td><td>20</td><td>100</td></tr><tr><td>No smoking</td><td>50</td><td>50</td><td>100</td></tr><tr><td></td><td>55</td><td>200</td><td></td></tr></table>
$$RR = \frac{80}{100} \div \frac{50}{100} = 1.6$$

The researcher concludes that smoking increases the risk of lung cancer by 60%.</td></tr>
<tr><td>Odds ratio (OR)</td><td>The odds or probability of the disease in the exposed group compared to non-exposed group.</td><td>The researcher in Town X is now interested in a rare disease called Disease Y and whether is associated with smoking. The researcher finds in the group of 20</td></tr>
</table>

	It is used in studies with rare outcomes such as Case-control studies. OR equal to 1 shows no difference between the groups, OR greater than 1 means the exposure is a risk factor, OR less than 1 means the exposure is a protective factor. 		Disease present	Disease absent
---	---	---
Exposure present	a	b
Exposure absent	c	d | $$OR = \frac{ad}{bc}$$	participants, half are exposed smoking and half are not. In the exposed group, 6 have Disease Y and in the non-exposed group, 2 have Disease Y. |	Disease present	Disease absent
---	---	---
Exposure present	3	7
Exposure absent	2	8 | $$OR = \frac{3x8}{7x2} = 1.7$$ The researcher concludes that the exposed group is 70% more likely to have Disease Y.

Basic Biostatistical Concept

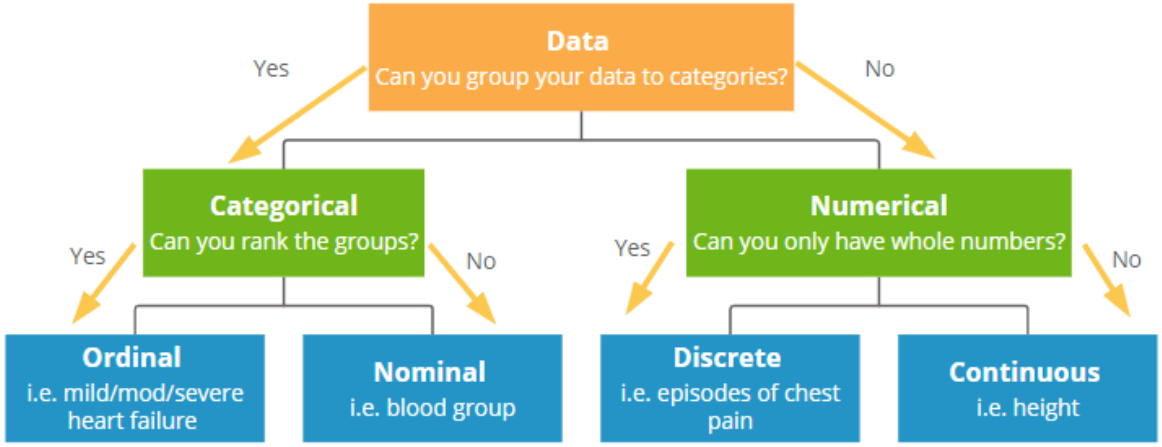


Types of data

A variable is an observation that is different in the study subjects. Examples of a variable may be patient age, gender, blood pressure. There are different types of variable depending whether you are able to categorise them and what values they contain (Figure 1).

TIP: Ensure when you are collecting data that it is clear and accurate so that others can understand it. If you have an idea of how the data will be analysed prior to data collection, this will help you plan on your method of data collection.

Figure 1: Types of data



Basic summary statistics

Categorical data can easily be described with percentages or graphically with pie or chart graphs.

Numerical data is often described with central tendencies and measure of dispersion as discussed below. Graphically, numerical data can be demonstrated on a box-plot or histogram.

<u>Central tendency</u>

- Mean: an average of all values calculated by obtaining the sum of all values divide by the number of values. It is often influenced by extreme outlier values.
- Median: the value which divide the data into half. It is less likely to be influenced by extreme outlier values.
- Mode: the most commonly occurring value.
- Percentiles (Quartiles):
    - 25^{th} percentile/first quartile is the median value in the lower half set of data below the median.
    - 50^{th} percentile/second quartile is the median value.
    - 75^{th} percentile/third quartile is the median value in the upper half set of data above the median.

<u>Measure of dispersion</u>

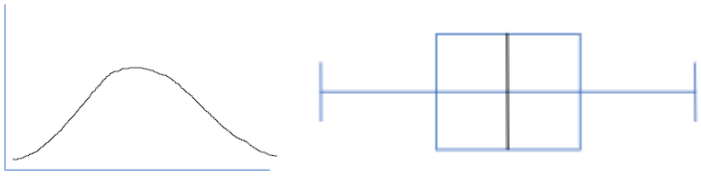
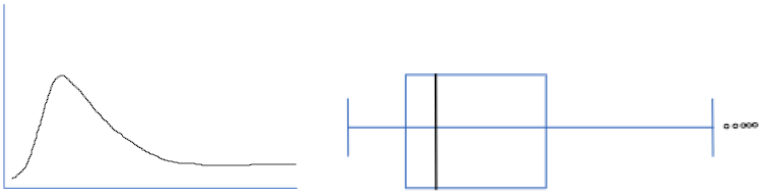
- Range: the difference between the lowest and highest value. It is often influenced by extreme outlier values.
- Inter-quartile range (IQR): the difference between first quartile and third quartile. It shows the spread of data in the middle 50% of the observation and therefore is less likely to be influenced by extreme outlier values.
- Standard deviation (SD): reflects the average distance of the observation from the mean.

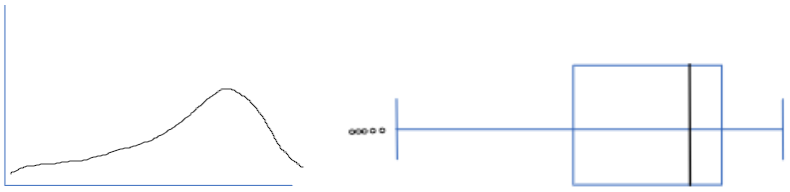
Further discussions about data symmetry and skewness is discussed below. In general, for symmetrical data you would prefer to use summary statistics such as mean and standard deviation and for asymmetrical data you would use values less likely to be affected by extreme outliers such as median and percentiles.

Data symmetry/skewness

Before further analysis of your data, you will need to find out if your data is normally distributed or skewed. You can do this by closely by observing the histogram/box-plot (Fig 2) or doing statistical tests such as Q-Q plot or Shapiro-Wilk Test.

Figure 2. Distribution of data

Distribution	
Normally distributed	 The left-hand graph shows the overall shape of the histogram is symmetrical. As there is a peak in the middle of the graph, we can infer that mean = median = mode. The right-hand graph shows a box-plot with the median (black line) in the middle of the graph and graph is evenly distributed both sides.
Right-skewed (positive skew)	 The left-hand graph shows the overall shape of the histogram is asymmetrical and positively skewed as its long tail is pointing to the positive/right direction. In positively skewed data, it is often the case that mean ≥ median ≥ mode. The right-hand graph shows a box-plot with the median (black line) in the lower half of the box plot with outliers (small dots) extending to the right side of the graph.

Left-skewed (negative skew)	 The left-hand graph shows the overall shape of the histogram is asymmetrical and negatively skewed as its long tail is pointing to the negative/left direction. In negatively skewed data, it is often the case that mean ≤ median ≤ mode. The right-hand graph shows a box-plot with the median (block line) in the upper half of the box plot with outliers (small dots) extending to the left side of the graph.

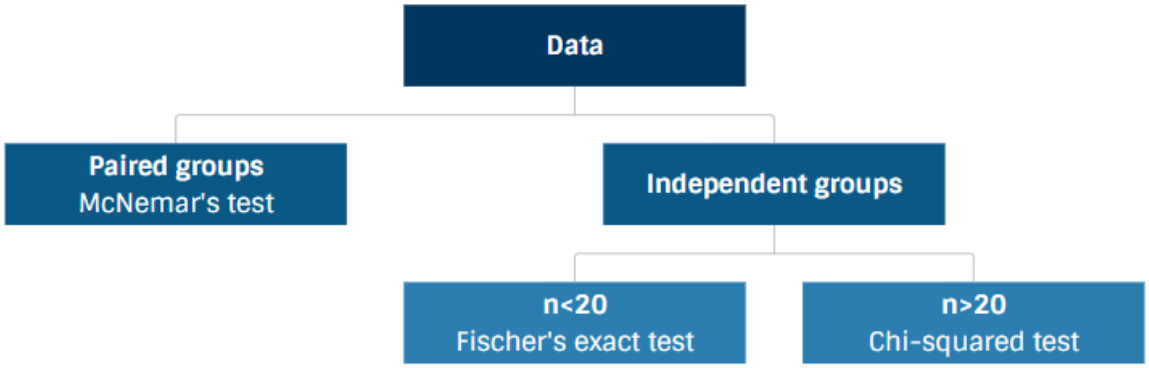
Statistical analysis

There are many different statistical software available to analyse data such as Excel, SPSS, SAS. Selecting which program depends on the complexity your data is, skills required and the availability of the program.

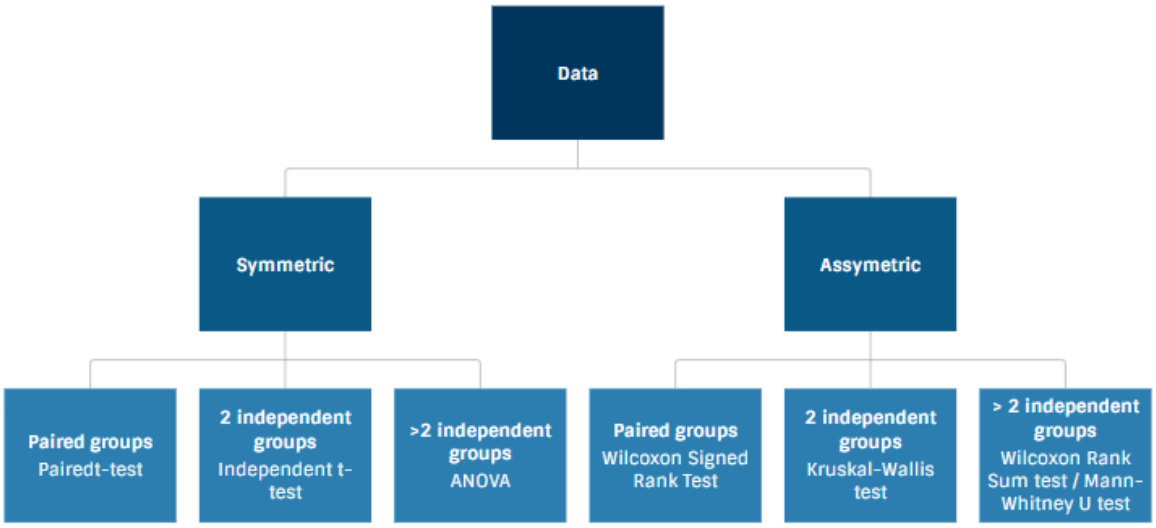
TIP: Before analysis, it may be a good idea to check through your data to ensure there is no missing data, no incorrect data, no unexpected outliers.

Below is a brief mention of some common statistical tests you may encounter. If you are interested in learning more and how to complete these tests yourself, you may consider taking formal statistical courses.

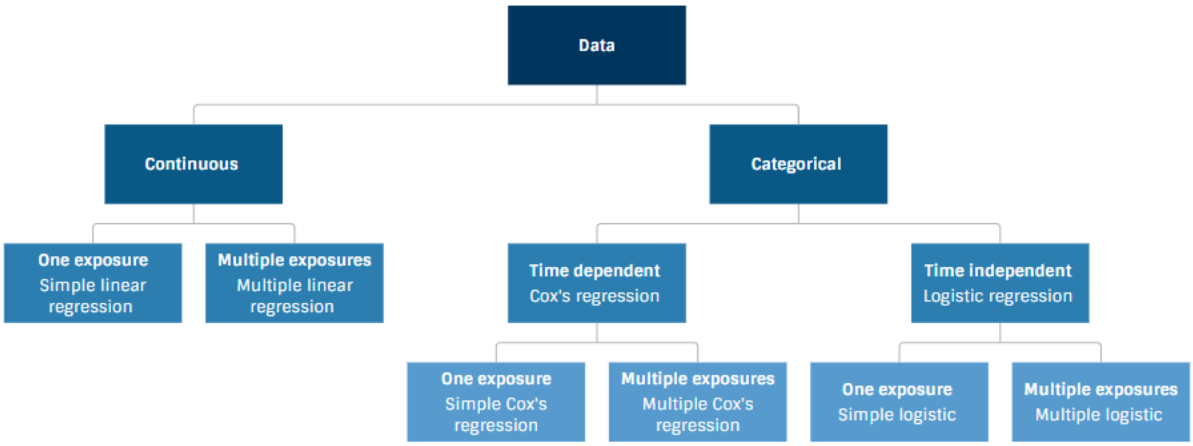
<u>Comparing difference between groups with categorical outcome</u>



Comparing means between groups with numerical outcome



Analysing the relationship between outcome and exposure



Statistical outcome

p-value refers to the probability the null hypothesis is true.

Although the requirements of the p-value vary from study to study and depending on the journal requirements, it is often quoted as 0.05. The smaller the p-value the stronger the evidence is.

- p-value ≤ 0.05 – reject the null hypothesis and accept the alternative hypothesis. The test result is significant.
- p-value > 0.05 – retain the null hypothesis and the test result is insignificant.

For example:

Null hypothesis: Swimming is not associated with ear infections.
Alternative hypothesis: Swimming is associated with ear infections.

After running your statistical tests, the p-value is 0.003. This means there is less than 3 out of 1000 chance that the results obtained in the study is due to chance.

Study pitfalls

Errors in hypothesis test

	The null hypothesis is actually true	The null hypothesis is actually false
You retain the null hypothesis		Type II error -To reduce the chance of making this error ensure your test has enough power i.e. increasing sample size.
You reject the null hypothesis	Type I error -To reduce the chance of making this error lower the p-value.	

Bias

Bias refers to the any deviation (such as over or under-estimation) from the true value. Bias can be a result of the study design and therefore can affect the accuracy of your results. In order to reduce the effects of bias on you study it is important that you are able to identify it and adjust for it.

Below are some of the common biases:

- Selection bias:
  - Subjects are not randomly selected and therefore subjects selected have different characteristics to subjects not selected.
  - For example: you conduct a survey to the general population to see the prevalence of diabetes and its comorbidities. People who respond to the survey may be more health aware than people who do not respond.
- Recall bias:
  - Subjects with the interested outcome may have a different selective memory when recalling the past.
  - For example: someone with lung cancer may recall specific exposures that someone who does not have lung cancer may experience however do not recall.
- Observer bias:
  - Due to knowledge of the study or participants, researchers may subconsciously interview in such a way that produces certain answers

(interviewer bias), prejudiced in their interpretation of the data (interpretation bias) or selectively publish certain results (publication bias).

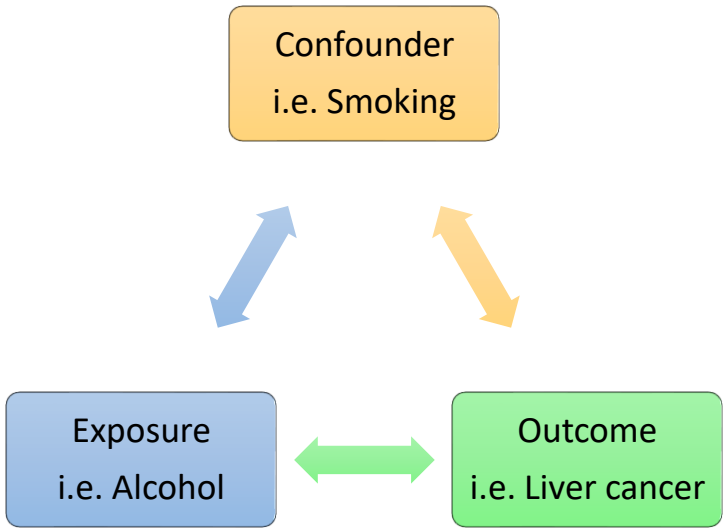
Confounders

Confounders is a third factor if present can influence the results of the interested outcome and therefore can influence on the accuracy of your study (Fig 3). Confounders can be accounted for by identifying them in your study and applying strategies such as matching of stratification to ensure there are equal numbers of confounders in your case/study and control groups.

There are three criteria of a confounder:

1. Associated with the exposure
2. Associated and provides an independent causative link to the interested outcome
3. Cannot be an extension of the exposure pathway to interested outcome

Figure 3: Example of confounders



Smoking is a confounder:

1. *People who smoke are more likely to drink alcohol*
2. *It can increase the risk of liver cancer*
3. *It is not an extension of the exposure pathway to interested outcome.*

Chapter 6: Presentation and Publications

Writing

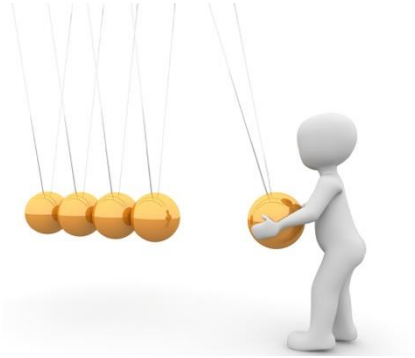
Start with an outline and think of the following questions to guide your outline:

- What is my topic?
- Why is it important?
- What is my hypothesis?
- What are my major results?
- What are my major findings?

TIP: Writing up your project can be hard and starting out might be the most difficult part. Set writing times in your schedule or you can start with easy sections first.

In your outline, include the visuals (any figures, tables or images that you may want to use).

- More often than not, the methods and materials is the section that is the least problematic to write as you should know your experimental design and procedures well
- The results section is often the second section that is written up
- The discussion must combine what is known about the topic and how your results compare/what they add to the literature
- If you feel you are stagnating while writing one section, change to another section
- Save your work at least every 10 minutes while writing



Reviewing

Now that you have written a first draft, you must revise it.

Often the first draft will seem messy and disorganised. Start by reviewing the major structure/ideas first, followed by details such as spelling. If you have presented the results in a specific order, ensure this is reflected in your materials and methods, and discussion. This will help the paper flow better. You can always go back to your original outline and see whether the ideas in your paper are coherently structured, are the results logical and does the discussion answer the research questions your presented in the introduction.

Once you are happy with the content, revise words, sentence structure, grammar and punctuations. When you are done reviewing, try and get as much feedback from colleagues/friends as you can and revise again!

Other helpful tips:

- Take a bird's eye view on the paper – does the order make sense?
- Work on small sections at a time (roughly 4-5 pages)
- Some people find it helpful to read the paper aloud
- Expect to have roughly 5 – 7 drafts of the paper
- Set a deadline on when you should complete the revisions if you find you are spending too much time revising

Common structuring points

Once you have developed an outline, you need to add context and a structure to your manuscript. This is where you group all your ideas into sections: Abstract, Introduction, Methods, Results, Discussion, Conclusion. Every journal article will have their own requirements with what to include within each section and it is important to strictly follow these guidelines


TIP: The title should be roughly about 15 words and should attract the most diverse readership.

Abstract

This section is a mini summary of the main sections in your paper. This section is very short and to the point. Most journal articles ask for the abstract to be between 240-260 words. Here are some tips on how to write it:

- Must be written in past tense at it describes work done
- Never include information not present in the paper
- You don't need to put citations in the abstract
- Some authors will write the abstract after writing the manuscript

Introduction

In this section make the rationale of your study clear and include references that provide the most relevant background to your study. Don't forget to briefly state the methods of your investigations and results at the end of your introduction. Any specialised terms can also be defined here.

Methods and Materials

In this section provide every detail you can about the methods and materials that you used. There should be enough information so that another researcher can repeat your study. Here are some other tips:

- It is appropriate to use subheadings here
- If you used humans as your subjects include a statement regarding 'informed consent' if applicable
- Outline your methods in a chronological order
- Do not include any results here

Results

This will often be the shortest section in your manuscript if your methods/materials section is well written. Here you need to state the results without repeating any of the experimental details. Refer to your tables and figures here and don't repeat what it in them

TIP: Don't be verbose in your writing and use words such as 'very'.

Discussion

This will be hardest section to write! But the general outline of this section will be:

- Summarize your results at the start without just recapitulating them.
- Show how your interpretation of the results compare to what is known
- Discuss the implications of your findings
- Describe the limitations

Conclusion

In your conclusion as yourself whether you answered the question that you posed in your introduction? Briefly state what future work might look like as well.

References

Ensure to check what style and if there is a limited number of references for your particular article and journal. You may consider using Endnote to organise your references. To learn more about how to access or use Endnote, consider approaching your local health network librarian. You can also find a guide to how to use Endnote here: https://guides.lib.monash.edu/endnote.

Acknowledgments

- Acknowledge the technical help that you received and be courteous

How to stay organized

- You will start to have a lot of word documents with the manuscript, others for the tables/graphs and anything else you're including in your paper
- You'll find these word documents all over the place in your computer! In the Downloads folder, in Documents folder, in the Trash folder, on your desk top etc. The key here is to be organized!
- Do this by creating folders early on and name each word document according to the approximate month that you finalized the draft! This helps you stay on track
- Keep all your drafts until you have published
- Makes sure to have a backup drive for all your work! It would be a shame that your computer encounters a problem and you lose all your hard work!

Submission

Now comes the exciting part!

Pick the appropriate journal to submit to with the assistance of your supervisor. Each journal will have specific requirements for submission and you must follow these strictly! Common requirements include having the information of every author involved such as full name, qualifications, email address, affiliations. Make sure to save this information somewhere. Some journals will ask you to separate your manuscript from your tables and figures into separate documents so make sure to have that ready

TIP: It may be a good idea to establish with your supervisor regarding the order of authors early on.

Revisions

Now your paper has been submitted and you get asked to do a revision. While this might be frustrating as you have already put in countless hours into this one paper, peer critique is an important part of research. It ensures that your research paper is clear and that there is no confusion. You will likely have more than one reader critiquing your work and you will find that there are often shared themes across the suggested revisions.

You should approach this part of the publishing process as a way to make your paper better and easier to understand for readers. Remember, the best journal articles are the ones that are easy to comprehend even in the most complex and challenging fields of research which means that more people will enjoy reading your paper. Rather than thinking of the critiques as negative, try to determine why they made these comments.

The best way to approach the revisions is to make a list of all the critiques in point form. This will make you realise that some of the revision requests are actually very similar. For example, you may notice that a lot of the critiques are on your interpretation. Your revision should therefore be aimed at clarifying this section in particular.

Secondly, start each response by quoting the reviewers comment before answering. In your response, describe what changes you have made or any additional work you may have done. Sometimes you may not agree with the suggestions. Rather than ignoring the suggestion, respond with an objective answer.

In summary, getting a revision request can be frustrating however if you view these as a positive opportunity, you can impact the editor’s opinion of your work and increase your chances of being accepted for publication

“It’s taking me longer than expected to publish my work in a paper… where else can I present my hard work?”

There are plenty of other places where you can show your work! Almost all health services have a research week. This is a great opportunity to present your work and receive feedback from colleagues. You can also consider presenting your project at conferences! Translating your work into a poster or a presentation can be a great way to take a bird’s eye view on your work!

Chapter 7: Critical appraisal

A critical appraisal is a systematic and organized process used to identify the strengths and weaknesses of a research article in order to assess the worth and validity of its research findings. The most important components of a critical appraisal is an evaluation of the appropriateness of the study design for the research question and a careful assessment of the key methodological features of this design.

Depending on the type of research that was undertaken (RCT, retrospective cohort study etc.) there will be specific elements of the article that need to be analysed. However here are some general tips and tricks on how to start analysis and research paper.

Abstract

- Is the aim of the study clearly stated?
- Is the study design well explained?
- Are the key measurements along with their statistical analysis and significance highlighted?
- Does the conclusion clearly answer the question?

TIP: Think about what is the purpose of the study? Why is this study necessary?

Introduction

- A good introduction will include and summarize very well what is already known about the topic
- They will also highlight what is lacking in our current knowledge of the topic based on previous research

Methods and Materials

- Is the information on how they actually carried out the study clear?
- Do they include the design, population, sample size and interventions presented if relevant?
- If you were to personally undertake this same research project would you be able to with all the information that they provide you with?

Results

- This section must highlight in details all their results along with the statistical analysis
- Are the tables, diagrams and graphs clear to understand? Do they add any value to the text?

Discussion

- Does the study summarize the main findings?
- Is the interpretation consistent with the results of the current study and previous work in that same topic?
- Can the results be generalized?
- Does it mentioning how the results can be used clinically? How are they applicable?
- Does it mention any limitations?

TIP: Ensure that you identify any ethical issues and whether ethics approval was gained.

References

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Albury Wodonga Health

General Information

- Partners with University of Melbourne, Charles Sturt University, LaTrobe University, University of NSW.
- Annual Medical Research Symposium.

Research areas of interest

- No particular areas of interest disclosed

First point of contact

- Anna Moran (Research Coordinator)
- She acts as a broker between health service students, junior doctors and external stakeholders (universities, health network, GP, specialist services). She has a list of active projects for junior doctors.
- Junior doctors to approach her directly at orientation or email: Anna.moran@awh.org.au

Alfred Health

General Information

- Research available at all 14 of their state-wide services including health and lung transplant services, trauma medicine, melanoma service
- Project grants available for junior doctors which happens twice per year
- Yearly Research Week at Alfred Health and Caufield Hospital

Research areas of interest

- https://www.alfredhealth.org.au/research/research-areas

First point of contact

- Research coordinator for the Department of interest https://www.alfredhealth.org.au/research/research-areas
- Small project coordinator: Rebecca Erlich
  - Email: r.erlich@alfred.org.au
  - Phone: +61 3 8532 1772
- URL: https://www.alfredhealth.org.au/research

Austin Health

General Information

- Affiliated with multiple institutions: Florey Institute, ONJCRI, IBAS, spinal research institute, Mercy Hospital for Women
- DARE Centre is co-funded by Austin Health and The University of Melbourne, opened in 2018 to analyze and interpret complex clinical data
- Yearly research week

Research areas of interest

- https://www.austin.org.au/resarch/

First point of contact

- Dr Sianna Panagiotopoulos
- Phone: +61 3 9496 5088
- Email: research@austin.org.au
- URL: http://www.austin.org.au/research/

Ballarat Health

General Information

- Affiliated with University of Melbourne and Deakin University
- Yearly Research Symposium

Research areas of interest

- Primarily involved in clinical trials in medical oncology, gastroenterology, geriatrics, and cardiology

First point of contact

- Phone: +61 3 5320 4735
- Email: ResearchEthics@bhs.org.au
- URL: https://www.bhs.org.au/node/139

Barwon Health

General Information

- Affiliated with Deakin University
- Annual Barwon Health and Deakin University Research Week

Research areas of interest

- https://www.barwonhealth.org.au/research/research-areas

First point of contact

- Barwon Health does not have a central body that facilitates research opportunities for students or junior doctors.
- To contact head of department or research director within the department to ascertain research scope

Bendigo Health

General Information

- Involved in conducting research conducting research and projects within a regional health context.
- Yearly research week and symposium
- Some departments have a research coordinator but not all

Research areas of interest

- Mainly focused on regional health medicine

First point of contact

- Research and Innovation unit
- Phone: +61 3 5454 6397
- Email: RandD@bendigohealth.org.au
- Research coordinator for the Department of interest (available for most departments)

Eastern Health

General Information

- Office of Research and Ethics provides training and support regarding methodology and ethics and governance requirements
- Yearly Eastern Health Research Forum
- Department of Medicine also has a dinner during which work is presented.

Research areas of interest

- Medical disciplines, mental health, drug and alcohol

First point of contact

- Phone: +61 3 9985 3398
- Email: research@easternhealth.org.au
- URL: https://www.easternhealth.org.au/research-ethics
- Planning an upgrade to the internet which it is hoped that will provide a pathway. Until then junior doctors/trainees approach their supervisors or investigators they come into contact with.

easternhealth

Gippsland Rural Intern Training

General Information

- Senior lecturer who supports JMO's with research projects
- Yearly Research Development Day providing support on how to do research, types of research, etc.
- During each Human Resources and Ethics Committee meeting a research project is presented to the group

Research areas of interest

- No particular areas of interest disclosed

First point of contact

- Anita Raymond, General Manager in education, research and training
- Email: araymond@lrh.com.au
- Phone: +61 3 5173 8483
- URL: http://www.lrh.com.au/important-info/lrh-information/research

LRH
Latrobe Regional Hospital

Goulburn Valley Health

General Information

- Affiliated with Deakin University
- Annual Goulburn Valley Health Research Fair

Research areas of interest

- No particular areas of interest disclosed

First point of contact

- Director of Research: Dr Md Rafiqul Islam
- Phone +61 3 5831 0035
- Email mdrafiqul.islam@gvhealth.org.au

GVHealth

Grampians Rural Community Intern Program

General Information

- A partner of Western Alliance. Works alongside Maryborough District Health Service and SJOG Ballarat Hospital.
- No specific framework exists but they are happy to support research interests on a case-by-case basis

Research areas of interest

- No particular areas of interest disclosed

First point of contact

- Sarah Woodburn (in charge of Medical Training)
- Phone: +61 3 5352 9437
- Email sarah.woodburn@eghs.net.au.

East Grampians Health Service

Hudson Institute of Medical Research

General information

- Partnerships with Monash Health and Monash University.

Research areas of interest

- Five research specialist centres - Cancer, Endocrinology and Metabolism, Innate immunity and Infectious Disease, Reproductive Health, Obstetrics and Gynaecology.

First point of contact

- Contact individual researchers directly.
- URL: http://hudson.org.au/research-centres

HUDSON
INSTITUTE OF MEDICAL RESEARCH

Melbourne Health

General Information

- Partners with Doherty Institute, Melbourne Brain Centre, The University of Melbourne, Victorian Comprehensive Cancer Centre, Walter and Eliza Hall Institute of Medical Research.
- Annual Research Week

Research areas of interest

- No particular areas of interest disclosed

First point of contact

- Angela Niguira, Office for Research: +61 3 9342 8530
- Research office can be approached and they are directed to a senior staff member with whom they work to discuss existing projects OR they can link in with details for key research leaders in particular areas of research.

The Royal
Melbourne Hospital

Mercy Hospital for Women

General Information

- Mercy Health Services Academic Research & Development Committee manages a Small Grant process financial every year. The grants are for research projects initiated by Mercy Health Services staff and do not have substantial funding from external sources. The purpose of the grants is to encourage Mercy investigator initiated studies.
- Affiliated with the University of Melbourne, University of Notre Dame, Mercy Perinatal and MACH.

Research areas of interest

- Obstetrics, gynaecology, mental health, paediatrics, reproductive medicine, aged care, midwifery and palliative care.

First point of contact

- Natasha Rooney
- Administrative Officer, Human Research Ethics Committee
- Phone: +613 9929 8348 | Fax: +613 9663 7203
- Email: nrooney@mercy.com.au.

Mercy Health

Monash Health

General Information

- Monash Health Translation Precinct is a partnership between Monash Health, Monash University and the Hudson Research Institute. A part of Monash Partners, Victorian Cancer Biobank, Biogrid Australia and also collaborates with Deakin University.
- Research is driven at a unit/departmental level and through Monash University Clinical school.
- Also offers an Emerging Researcher Fellowship program for staff wanting to engage in research.

Research areas of interest

- www.monashhealth.org/research

First point of contact

- Ms Deborah Dell
- Manager, Human Research Ethics Committee & Research Support Services,
- Phone: +61 3 9594 4605| Fax: +61 3 9594 6306
- Email: deborah.dell@monashhealth.org

MonashHealth

Monash Children's Hospital

General information

- Closely linked to Ritchie Centre at Hudson and Monash Health/ Monash University

Research areas of interest

- Sleep disorders in children, Vaccine safety, Newborn lung disorders, Early childhood infections, Newborn immune systems, Cerebral palsy and neuro-rehabilitation, Cystic Fibrosis, Children's Cancer

First point of contact

- Junior doctors have opportunities to conduct research within their departments/units and should approach their Head of Unit or Clinical Director for opportunities available.

Monash Alfred Psychiatry Research Centre

General information

- Partnerships with Alfred Health and Monash University.

Research areas of interest

- Women's mental health and clinical research developing new and innovative treatments for mental illnesses including schizophrenia, depression, etc. Trials in psycho-neuroendocrinology and women's health - oestrogen and other hormones as adjunctive treatment.

First point of contact

- Anthony De Castella, Research Manager
- Tel: +613 9076 6554| Fax: 9076 8545
- Email: anthony.decastella@monash.edu

Murdoch Children's Research Institute/ Royal Children's Hospital

General Information

- MCRI is active with programs to support PhD clinician researchers, with protected paid time in place through a Clinician Scientist Fellowship scheme.
- MCRI researchers have numerous collaborations – key ones are Broad Institute of MIT/Harvard, Institute of Child Health/Great Ormond Street UK, USCF and University of Melbourne.

Research areas of interest

- https://www.mcri.edu.au/research/projects

First point of contact

- Junior doctors have opportunities to conduct research within their departments/units and should approach their Head of Unit or Clinical Director for opportunities available.

murdoch children's research institute

Northeast Health (Wangaratta)

General Information

- Rural Health Academic Network coordinates research in the area.

Research areas of interest

- Aged Care, Allied Health, Anaesthesia, Antimicrobial Stewardship, Advanced Care Planning, Cancer Care, Palliative Care, Emergency Care, Maternity Care, Surgery

First point of contact

- Education and Research Unit. Speak with Research Development and Governance Officer (Anita.star@nhw.org.au) and/or the University of Melbourne Rural Health Academic Network research Coordinator (hhaines@unimelb.edu.au).
- Check the NHW website for current research activity: https://www.northeasthealth.org.au/clinical-research/

NORTHEAST HEALTH WANGARATTA

Appendix 1: Research Contact List

Northern Health

General Information

- Partners with the University of Melbourne and LaTrobe University.
- Research is organised by multidisciplinary division with Research Leads managing a team of research staff, admin etc may help provide small research grants.
- Also has a 'Stepping into Research' program (12 weeks, bring your own idea and mentor).

Research areas of interest

- No particular areas of interest disclosed

First point of contact

- Can initially email: nh.research@nh.org.au
- The senior advisor in education and research advised that there are research leads from within the divisions that junior staff can go to seek advice from.
- Also consultants and department heads are good first contacts.

Northern Health

Peninsula Health

General Information

- Part of Monash Partners and collaborates with Monash University and Biomed Vic
- Rural Health Academic Network coordinates research in the area.
- Yearly research week
- Multiple resources provided by librarian

Research areas of interest

- https://www.peninsulahealth.org.au/research/our-research/

First point of contact

- Office for Research
- Email: researchethics@phcn.vic.gov.au
  or
- Kim Sherry , Office Coordinator,
- Email: KimSherry@phcn.vic.gov.au.

Peninsula Health

Peter Mac

General information

- Affiliated with Melbourne Health and Melbourne University
- Research Education Program available

Research areas of interest

- https://www.petermac.org/research

First point of contact

- To contact individual researchers directly.
- https://www.petermac.org/contact

Peter Mac
Peter MacCallum Cancer Foundation

Royal Women's Hospital

General information

- Annual Research week

Research areas of interest

- Newborn, infectious diseases, gynaecology, cancer, pregnancy, mental health, midwifery and maternity services, allied health, anaesthetics and family violence prevention

First point of contact

- Junior doctors have opportunities to conduct research within their departments/units and should approach their Head of Unit or Clinical Director for opportunities available.

the women's
the royal women's hospital
victoria australia

Southwest Health (Warrnambool)

General Information

- Affiliated with Deakin University.
- Research Working Lunch

Research areas of interest

- No particular areas of interest disclosed

First point of contact

- Barbara Moll
- Manager Education, Research and Workforce development
- Email: ethics@swh.net.au
- https://swarh2.com.au/swh/content/create-research.aspx

St Vincent's Health

General information

- Affiliated with University of Melbourne
- Yearly Research Week
- Research endowment fund distributed ~$1M each year

Research areas of interest

- No particular areas of interest disclosed

First point of contact

- Executive Officer of Research
- Phone: +61 3 9231 3930 | Fax:+61 3 9231 3949
- E-mail: Tam.Nguyen@svha.org.au

The Royal Victorian Ear and Eye hospital

General information

- Part of Alfred Hospital and Monash University

Research areas of interest

- Ophthalmology and Otolaryngology, Audiology and Speech Pathology

First point of contact

- Dr Andrea Johannessen
- Research Manager
- T +613 9929 8348 | F +613 9663 7203
- Email: Andrea.Johannessen@eyeandear.org.au

Western Health

General information

- Yearly Research Week
- Research Office: Level 3 Western Centre for Health, Research & Education Sunshine Hospital Furlong Rd, St Albans VIC 3021.

Research areas of interest

- No particular areas of interest disclosed

First point of contact

- Professor Edward Janus
- Director of Research, Western Health
- Phone: +613 839 58150 | Fax: +61 3 8345 6264
- Email: edwarddj@unimelb.edu.au