Introduction to Evidence-Based Practice Workbook

5 steps of Evidence-Based Practice Seminar Series

2022

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Empowering people, processes and performance

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INTRODUCTION:

This workbook has been designed to accompany the "Introduction to Evidence-Based Practice Online Seminar Series" and provide you with an opportunity to learn and apply the core skills needed to be an Evidence-Based healthcare professional. The seminar series and workbook will provide you with a guided opportunity to learn how to ask, find, appraise and apply research to inform (or solve) your own real-world clinical problems. Please note that it may take you some time to become familiar and comfortable with all of the content that is covered in the seminar series. This workbook is meant as a resource that you can keep and return to at any time to remind yourself and apply the steps of evidence-based practice.

LEARNING OBJECTIVES

After attending the seminar series, you should be able to:

- Describe what Evidence-Based Practice is and why it is important.
- Identify and apply the 5 steps of Evidence-Based Practice to solve your own clinical problems:
    1. Ask
    2. Acquire
    3. Appraise
    4. Apply
    5. Assess
- Formulate a plan identifying how you will integrate Evidence-Based Practice into your routine clinical practice.

Keep an eye out for these symbols:

Links to further reading

$$ Useful tips

Targeted reading

GLOSSARY

Cohort: a group of people with shared characteristics.

Cohort study: a study design that follows participants over a period of time (sometimes years), otherwise known as a longitudinal study. In a cohort study, participants who meet specific inclusion/exclusion criteria are recruited and followed up over time to describe the course of a condition over time (prognosis) or to determine whether an exposure (risk factor or characteristic) is associated with a specific disease or outcome e.g. death (prognostic factors).

Cross-sectional study: a study design that collects and analyses data that is collected at one point in time, i.e. provides a "snap shot" of a population. Cross sectional studies can answer questions about how common a risk factor or disease is in the population who took part in the study.

Evidence-based practice (EBP): the conscientious, explicit and judicious use of current best evidence in making decisions about the care of the individual patient. It means integrating individual clinical expertise with the best available external clinical evidence from systematic research (Sackett, 1996).

External validity: the extent to which you can generalise the findings of a study to other people, setting and situations.

Incidence: the number of new cases in a particular period. Incidence is expressed as a ratio in which the number of new cases/events is the numerator and the population at risk is the denominator (Harris, 2006).

Intention to treat analysis: an analysis method used in randomised controlled trials where all participants who are randomised are analysed according to the group that they were randomised to, regardless of the treatment they received.

Internal validity: relates to how well a study is conducted and the extent to which the findings represent the truth in the population (i.e. the findings cannot be explained by other factors).

PICO Framework: A framework for asking a well formulated and answerable research question. PICO stands for Population, Intervention, Comparator and Outcome. The relevant elements depend on the type of question you are asking e.g., frequency/prevalence, prognosis or treatment effectiveness etc.

Prevalence: the number of all new and old cases of a disease or occurrences of an event during a particular time period. Prevalence is expressed as a ratio in which the number of events is the numerator and the population at risk is the denominator (Harris, 2006). *See incidence.*

Primary research: the methods used by researchers to collect the data directly, rather than use data that is already available. Examples of primary evidence includes interviews, surveys, cohort study and randomised controlled trials.

Prognosis: course of a condition or disease over time including whether signs and symptoms improve, worsen or remain stable. The term natural history is sometimes used to describe the course of a disease without treatment or intervention, while clinical course is used to describe the course of a condition with treatment.

Meta-analysis: the statistical technique used to combine data from several studies included in a systematic review into a single estimate.

Randomised controlled trial: is a study design (experiment) in which participants are randomly allocated to one of two (or more) treatment groups – one group being the treatment, or intervention, being tested and the other group being the comparison group (control group), which may be usual, no or minimal care. The two groups are then followed up over time to see if there is any difference in the study outcome variable, i.e. identify if one group did better than the other in which case the treatment would be called more effective.

Synthesised evidence: Combining, or synthesising, information from various sources in order to answer a question or construct an argument. Examples of synthesised evidence includes systematic reviews, clinical practice guidelines, and point of care summaries and synopses.

Systematic review: A systematic review is a review of all the available research evidence on a clinical topic. A systematic review aims to answer a clearly formulated question, and uses systematic and reproducible methods to identify, select and critically appraise all relevant research, and to collect and analyse data from the studies that are included in the review.

Introductory questions

1. **What does being an evidence-based healthcare professional mean to you?**

_____
_____
_____
_____

2. **Why is being or becoming an evidence-based healthcare professional important to you?**

_____
_____
_____
_____

3. **How do you currently apply Evidence-Based Practice? I.e. What are the ways you ensure your practice is up to date and you are providing care that considers the most current evidence? Tick all that apply:**

☐ Journal articles	☐ Podcasts	☐ Social media e.g. Twitter
☐ Journal club	☐ Conferences	☐ Grand rounds
☐ Educational seminars, workshops	☐ Professional associations/newsletter	☐ Participate in research activities
☐ Other (please specify):	☐ Other (please specify):	☐ Other (please specify):

NB: Be honest, if you don't currently do any of these activities it is ok as you have lots of options to improve!

SESSION 1:

- **What is Evidence-Based Practice and why is it important?**

Evidence-based practice is defined as **'**the conscientious, explicit and judicious use of current best evidence in making decisions about the care of the individual patient' (Sackett, 1996).

But what is the purpose of evidence-based practice and what is best evidence?

The purpose of evidence-based practice is to assist in clinical decision making (Hoffman, 2017). Whether you realise it or not every time you make a decision (personal or clinical) you identify potential alternatives, collect information for or against each alternative, assess the quality of, and integrate information (evidence) from various sources to eventually make a decision. An evidence-based practice approach recognises that the most robust clinical decisions integrate information, or evidence, from three key sources:

1. Clinical expertise and experience – your knowledge, skills and experience, the context and resources you have available
2. Patients' values, preferences and circumstances – including those of their family and financial considerations
3. Best scientific evidence – published literature/research including systematic reviews, primary research (e.g. randomised controlled trials, cohort studies), clinical practice guidelines

As a healthcare professional, you are the master of your trade and also know how to communicate with your patients to identify their values, preferences and circumstances. However, where many healthcare professionals are not so confident is how to find, appraise and use scientific evidence to inform their clinical decisions. These are the skills we will be covering and practicing in this Seminar Series.

- **Why is Evidence-Based Practice important?**

Evidence-based practice provides us with a framework to approach clinical uncertainty and make robust, up to date, clinical decisions that are more likely to meet the needs of our patients. As you can imagine, if you only collect and indiscriminately use evidence from one source it is likely this information might be biased (deviates from the truth). For example, you probably wouldn't buy a car from a used car salesman based on their (raving) review of the car alone (one source of evidence), you would likely test drive the car yourself (second source of evidence), take it to a trusted mechanic or call on friends/friends who have the expertise to give you an independent assessment (third source of evidence). You would then consider the evidence from all three sources, weigh this up (putting more emphasis on trusted, reliable sources of information e.g. your mechanic), and make a decision. The same rationale can apply to decisions in clinical practice. Relying on only one source of information either from scientific evidence, your own knowledge, skills and experience, or the patients is likely to result in a biased decisions and may not yield the best outcomes for the patient. Table 1 provides some examples of biases that can influence the believability of information obtained from any one source.

Table 1: Example of biases that can influence the believability of information obtained from any one source.

Bias	Description
Confirmation bias	Tendency to search for, interpret, and recall information that supports an individual's ideas, values or beliefs
Confounding	Factor(s) that 'distort' the association between cause and effect
Hawthorne effect	People behave differently when being monitored.
Information bias	Systematic differences in the collection, recall, recording or handling of information
Recall bias	Systematic error due to differences in accuracy or completeness of recall to memory of past events or experiences
Spin bias	The intentional or unintentional distorted interpretation of results unjustifiably suggesting favourable or unfavourable findings that can result in misleading conclusions

Catalogue of biases https://catalogofbias.org/biases/

A strength of using an evidence-based approach is that you are ***not*** making decisions based on only one source of evidence. Rather you are integrating the **best** evidence (most trustworthy, robust, believable or in other words least biased) evidence from three sources. To do this, you need to have an awareness of the potential biases that can influence your decision making and knowledge and skill find the best evidence to inform your decisions. This seminar series provides an introduction on how to find, appraise and apply best scientific evidence, otherwise known as the "5 steps of evidence-based practice".

- **The 5 steps of Evidence-Based Practice**

The 5 steps of evidence-based practice (EBP) provide you a structured approach to help navigate the vast amount of research literature available and to find the best evidence to inform your practice. The 5 steps of evidence-based practice are:

1. Ask - *formulate a well-defined and answerable clinical question*
2. Acquire – *knowledge and skills to find the evidence*
3. Appraise – *determine the trustworthiness (believability) of the evidence*
4. Apply - *interpret the findings and their significance*
5. Assess - *assess your effectiveness and efficiency with steps 1-4*

Over the next 5 weeks we will take a closer look at each step. We will work through an example together and have provided a template for you to tackle your own clinical question.

- **Step 1: Ask – formulate a well-defined and answerable question**

Without a doubt most healthcare professionals on most days will encounter a problem or have a moment of uncertainty where they find themselves saying "*I need to look that up*". This need for trustworthy, reliable, and up to date information is a trigger for evidence-based practice. The first step in applying evidence-based practice is being able to turn your clinical problem into an answerable question.

A good question is one that is well-defined and specific, and therefore is answerable. The **Population, Intervention, Comparator and Outcome (PICO)** framework can help to ensure we have defined all the relevant elements of your clinical problem. The elements of PICO are as follows:

Table 2: PICO elements

Patient, population or problem	Who is the person or population or what is the problem you are interested in? Be specific, and describe this in as much detail as possible e.g. children, adults or older people > 65 years. Is the problem you are interested in an acute or chronic condition?
Intervention (Index test or indicator)	For treatment questions: what is the new treatment or management strategy? For diagnostic test accuracy questions: what is the index test? For risk or prognostic factor questions: what is the indicator of interest?
Comparator	What is the alternative that you are comparing the intervention treatment or index test to?
Outcome	What outcome is most important or of greatest concern to you, your patient or your clinical practice?

Other variants of PICO include PICO-T where the T is timeframe and PICO-TS where the S is the best study design to answer the clinical question.

Remember not all questions need to include all elements of PICO, see Table 3**.** For example, questions about frequency or prevalence of a health condition often only include 'P' and 'O' elements, while questions about the effectiveness of treatments include all elements of PICO i.e. 'P', 'I', 'C' and 'O'.

Table 3: Relevant Population, Intervention, Comparator and Outcome (PICO) elements by question type.

Question type	Description Key elements	P	I	C	O
Qualitative	Observation of people understand concepts, thoughts, feelings, opinions or experiences. Key elements: PO	How do healthcare consumers			perceive care delivered via Telehealth?
Frequency, prevalence	How common is the factor that you are interested in (e.g. disease, risk factor, outcome)? Key elements: PO	In adult patients admitted to hospital			how many have a fall during their admission?
Diagnostic test accuracy	How does a new test perform against a 'gold standard'? Key elements: PICO	In patients with diabetes	Is a D-dimer	Or venous ultrasound	More accurate to diagnose a DVT?
Prognosis	What happens over time e.g. it may be who are at risk of developing a condition (risk) or the course of a condition overtime? Key elements: PO	In children under 5 years of age treated for pneumonia			What is the clinical course i.e. what proportion recover/ develop asthma?
Risk/prognostic factors and models	What factors predict the disease or outcome? Key elements: PIO	In patients admitted to the ICU	Is a noisy environment a risk factor		For delirium?
Treatment effectiveness (intervention)	Is a treatment (intervention) more effective compared to a placebo, control or alternative treatment? Key elements: PICO	In adult patients who present to ED with a boxer's fracture (neck of fifth metacarpal fracture)	is buddy taping as effective compared to	A plaster immobilisation	For recovery of function?

Variations of PICO include: PICO-T where T is Timeframe, and PICO-TS where S is the study design.

Introduction to the best primary study design to answer the various types of questions:

As outlined above, when using research evidence to inform our decision making, we need to make sure that we are using the **best** evidence (i.e. most trustworthy, robust, believable or in other words least biased evidence) when applying evidence-based practice. This requires some understanding of the best study designs for each question, see Table 4. By primary study design, we mean the methods used by researchers to collect the data directly, rather than use of data that are already available.

Table 4: Best primary study design(s) to answer the various types of questions

Question type	Description	Best primary study design to answer question
Qualitative	Observation of people understand concepts, thoughts, feelings, opinions or experiences.	• Focus groups • 1:1 interview • Feedback surveys (open responses)
Frequency, prevalence	How common is the factor that you are interested in (e.g. disease, risk factor, outcome)?	• **Cross-sectional study "snap shot"** o Survey a sample of people from the population of interest o Collect information at one point in time o Ask about health behaviour or condition
Diagnostic test accuracy	How does a new test perform against a 'gold standard'?	• **Cross-sectional study** o Aim is to determine test accuracy (i.e. identify those with and without the condition of interest) o Identify consecutive (or random sample) of people who are at risk of the condition of interest o Participants receive two (or more) tests, one being the index test and the other being the gold standard o Compare how the index test performed against the gold standard.
Prognosis	What happens over time e.g. it may be who are at risk of developing a condition (risk) or the course of a condition overtime?	• **Cohort study** o Aim is to identify a group of people with a similar health state and follow them over a period of time and describe the course of their condition, including whether signs and symptoms improve, worsen or remain stable or who develops the condition of interest and who doesn't.
Risk/prognostic factors and models	What factors predict the disease or outcome?	• **Cross-sectional study** o Aim is to predict who are more likely to develop a condition (risk), or who are less/more likely to recover from a condition (prognosis). o Identify a group of people with a similar health state, identify and measure factors at baseline that are though to influence the outcome or disease progression, and follow them over a period of time to identify whether that outcome or condition occurs.
Treatment effectiveness (intervention)	Is a treatment (intervention) more effective compared to a placebo, control or alternative treatment?	• **Randomised controlled trial** o Aim is to estimate what will happen to people who receive one treatment compared to another, to determine which treatment is more "effective". o Identify and recruit people who meet the inclusion/exclusion criteria. o Participants are randomly allocated to one of two (or more) treatment groups – one group being the treatment, or intervention, being tested and the other group being the comparison group (control group), which may be usual, no or minimal care. o The two groups are followed over time to see if there is any difference in the outcome, i.e. identify if one group did better than the other in which case the treatment would be called more effective.

We will return to this concept of identifying the best study design for the question in Session 2, where we will take a closer look at why it is important to understand the type of question you are asking.

- **Activity 1:**

Using the scenario outlined below, identify the key elements of PICO to write a focused question that will help you organise a search of the literature for an answer.

You are discussing evidence-based practice with a colleague and the need to implement only proven interventions. The conversation takes an unexpected turn when you begin talking about the effectiveness of parachutes in reducing death and major injury in adults who jump from an aircraft.

Can you identify the key elements of a PICO question from the unexpected discussion about the effectiveness of parachutes (you may have to be creative)?

Population: _____

Intervention: _____

Comparator: _____

Outcome: _____

Now rephrase the above PICO elements into a question:

_____

_____

- **Template: Now it's your turn**

Take a moment to reflect on your recent clinical practice. Write down one or more questions that have emerged from your practice. *Your question(s) may be related to:*

- *Describing patients/staff experience of a new service (Qualitative question)*
- *Identifying the causes of a disease or outcome (Risk/Prognostic factor question)*
- *How common is a condition or outcome (Frequency/prevalence question)*
- *Describing the people who attend your service (Frequency/prevalence question)*
- *The accuracy of one diagnostic test compared to another (Diagnostic test accuracy question)*
- *What happens to a patient or their condition over a specified period of time (Prognosis question)*
- *Determining if treatment X more effective / less harmful compared to treatment Y (Treatment effectiveness question)*
- *Determine how your care compares to recommended guideline care (Frequency/prevalence question)*

Remember, a question needs to end in a question mark (?) and, depending on the type of question you are asking, may not include all the PICO elements.

Question 1: _____

_____

Question 2: _____

_____

$$ Useful tip:

- Keep a log of your clinical questions! Jot your clinical questions down as soon as possible when you encounter them. At the end of the day it is all too easy to lose track of your clinical questions!

SESSION 2:

- **Step 2: Acquire – Gaining the knowledge and skills to find the evidence**

Not all evidence is equal: Finding the best evidence to answer your clinical question

By definition, evidence-based practice involves the use of 'best evidence' to inform your practice. By best evidence we mean the most trustworthy, robust, believable (or least biased) evidence. In order to find the best evidence, you need to have an understanding of study design, and the study design that will provide you with the best (least biased) information. In session 1, we had a brief look at the best primary study designs to answer the various types of questions. This week, you can see in Table 5 that there are several study designs that can be used to answer the same question (Level I-IV evidence). Ideally, you want to target your search to find articles presenting the findings of research using the study designs that will give you the highest level of evidence (i.e. level I or II evidence) for your specific question type. For example, if your question is one of treatment effectiveness, you would first try and look for a systematic review (of randomised controlled trials). If you are unable to find a relevant systematic review that answers your question, then you would go down the level of evidence hierarchy i.e. search for individual randomised controlled trials etc. This introduces the concept of the evidence hierarchy (Table 5). In Activity 2 you will have the opportunity to identify the type of question being asked and the study design that will provide you with the highest level of evidence.

Table 5: The evidence hierarchy

Best evidence (least biased)

↕

Lower-level evidence (most biased)

Level	Question type*				
	Treatment effectiveness (intervention)	**Diagnostic test accuracy**	**Prognosis**	**Risk/ prognostic factors**	**Frequency/ prevalence**
I†	Systematic review of level II studies	Systematic review of level II studies	Systematic review of level II studies	Systematic review of level II studies	Systematic review of level II studies
II‡	Randomised controlled trial	A study that includes: an independent, blinded comparison with a valid reference standard, among consecutive persons with defined clinical presentation	Prospective inception cohort study	A prospective cohort study	Cross-sectional study of a representative sample
III-1	Quasi/pseudo randomised controlled trial (e.g. alternative allocation)	As per level II with non-consecutive participants	-	-	
III-2	Comparative study with concurrent controls (e.g. non-randomised, cohort, case control, interrupted time series)	A comparison with a reference standard that does not meet the above criteria	Analysis of prognostic factors amongst persons in a single arm of a randomised controlled trial	A retrospective cohort study	
III-3	Comparative study *without* concurrent controls (i.e. historical, two or more single arm study, interrupted time series without a control group)	Diagnostic case-control study	A retrospective cohort study	A case-control study	
IV	Case series	Study of diagnostic yield (no reference standard)	Case series or cohort study where participants are at different stages of the disease/condition	Cross-sectional study or case series	

Based on the National Health and Medical Research Council (NHMRC) levels of evidence and grades for recommendations for developers of guidelines. December 2009.

*See Table 3 or 4 for a description of each question type.
†Level 1 evidence comes from systematic reviews of level II studies (shaded). Systematic reviews synthesise findings from more than one study and consider the results of the included studies with respect to their limitations.
‡Level II evidence and lower is considered primary research i.e. the authors collected and reported there data directly.

- **How and where to begin searching the literature**

Knowing how and where to search the literature are two skills that are critical in finding the best evidence available to answer your clinical question.

Let's take a minute to recap what you now know:

1. You know how to formulate, and have asked, a focussed and answerable question using the PICO framework.
2. You can identify the type of question you have asked and know the study design which will provide you with the highest level of evidence.

Now it is time to search the literature with maximum efficiency. The first step is to select the key search terms from your focussed question. Note that not all elements of the PICO need to be included in the search strategy, see suggested Key search terms column in Table 6. You will also note that the search terms almost always include the population followed by either the intervention and/or the outcome depending on your research question. See Table 6.

Table 6: Key search terms by question type

Question type	P	I	C	O	Key search terms*
Qualitative	How do healthcare consumer			perceive care delivered via Telehealth?	P AND O Consumers AND perceptions of telehealth
Frequency, prevalence	Patients aged 65 years and older admitted to hospital			how many patients have a fall during their admission?	P AND O Aged AND inpatient AND Accidental fall
Diagnostic test accuracy	In patients presenting to ED with blunt trauma to the neck	Is Canadian c-spine rule or	NEXUS	More accurate to rule out serious cervical spine injury??	I AND C (both tests are unique in their naming but when searching for other tests you may need to add details about the population and/or outcome) Canadian c-spine rule AND NEXUS
Risk/prognostic factors	In patients admitted to the ICU	Is a noisy environmen t a risk factor		For delirium	P AND I AND O AND factor of interest ICU AND noise AND risk factor AND delirium
Prognosis	In children under 5 years of age treated for pneumonia			What is the relative risk of developing asthma	P AND O preschool child AND pneumonia AND Asthma

Treatment effectiveness (intervention)	In adult patients who present to ED with a boxer's fracture (neck of fifth metacarpal fracture)	is buddy taping as effective compared to	A plaster immobilisation	For recovery of function	P AND I Boxers fracture AND Buddy taping You could also search using: fifth metacarpal AND buddy taping If you wanted to do a broader search: fifth metacarpal OR boxers' fracture AND buddy taping

*Search terms entered into PubMed

Depending on how rigorously you want to search, and the number of results retrieved by the database, you may need to add additional terms. You can combine search terms using 'AND' and 'OR'; these terms are called Boolean logical operators. By combining key search terms with an 'AND' you are indicating that each article must include both 'Term 1' AND 'Term 2'. If you combine terms using 'OR' you are indicating you want any of the terms linked by 'OR', these terms are often synonyms of the term you are looking for e.g. 'arthritis' OR 'osteoarthritis', the search will find articles that include the term arthritis or osteoarthritis. Using 'OR' usually increases the number of articles retrieved by the search. See Table 6 for examples of the search terms you could use to search for articles for each question type. Please note that, depending on your question, you may need to add additional search terms to narrow or expand your search.

Where to search:

Which databases or sources you search depends on the purpose of your search. Table 7 below summarises the different approaches that can be used:

Table 7: Where you search depends on your purpose

Purpose	Search	Source	Aim
Browsing	Unsystematic	• Journals/ contents pages • Inbox alerts • Social media	Quell curiosity, remain up to date, kill time
Looking for an answer to a specific question (PICO)	Systematic and focussed	• Database that best suits your question and the study design you are after • CIAP	Find the best evidence that answers your question
Embarking on a research project	Systematic and broad	• Multiple databases, grey literature†, citation tracking	Identify all (substantial amount) relevant literature on a topic

† Grey literature: unpublished research or reports from government, academics, business or industry. Grey literature has not usually been peer reviewed and is not published commercially.

The aim of this workshop is to provide you with the knowledge and skills required to be able to ask and answer your clinical questions. Where and how you search depends on the purpose of your search, the clinical question you are asking and the type of information (including study design) you are looking for. Reported in Table 5 is the evidence hierarchy for the various types of clinical questions. You will note that the highest level of evidence for all clinical questions comes from systematic reviews. Systematic reviews are one type of synthesised information. As the name suggests, synthesised information has identified, sorted and collated (i.e. synthesised) the evidence

for you. Synthesised information is considered a very high level of evidence. This information can assist with translating research into practice and can be used to inform clinician and patient decision-making.

Below is a description of the types of information you may be looking for and where you can direct your search. Please note that this is not an exhaustive list and you may have other databases or sources that you prefer to search.

Clinical Information Access portal (CIAP)

The majority of the databases and resources mentioned below are accessed through CIAP. A link to CIAP is available on the home pages of NNSW LHD and MNC LHD Intranet pages. There is a variety of electronic databases on CIAP including ones on Evidence-Based Practice, Systematic reviews, Point of care summaries and Primary literature searches. CIAP also provides access to journals, books, medication information, guidelines, patient education resources and tools such medication calculators. A keyword search in CIAP will index over 2,000 journals, 400 plus books and the databases UptoDate, BMJ and MIMS. There is a variety of training available on CIAP; workshops, learning modules, user guides and videos.

Systematic reviews

A systematic review is a summary (or synthesis) of all the literature on a particular topic. Systematic reviews aim to answer a clearly formulated question and use systematic and reproducible methods to identify, select and critically appraise relevant primary research, and to collect and analyse data from the studies that are included in the review. Below are a series of resources providing ready access to systematic reviews and other, evidence-based outputs:

- **Campbell collaboration** – is an international social science research network that produces high quality, open and policy-relevant evidence syntheses, plain language summaries and policy briefs. Access via CIAP > Evidence-Based Practice or https://www.campbellcollaboration.org/
- **Cochrane Library**: The Cochrane Database of Systematic Reviews is the leading journal and database for systematic reviews in healthcare. Access via CIAP or https://www.cochranelibrary.com/
- **Joanna Briggs Institute (JBI)** – The JBI's evidence-based practice database contains evidence summaries, recommended practices and best practice information sheets. Access via CIAP
- **TRIP (Translating Research into Practice) database** – PICO search tool with results listed in order of the evidence hierarchy Access via CIAP > Evidence-Based Practice or https://www.tripdatabase.com/

Other sources of synthesised information include point of care summaries and clinical practice guidelines.

Point of care summaries and resources

Point of care summaries and resources are web-based handbooks designed to provide healthcare professionals with comprehensive, up to date and quality assessed evidence at the point of care.

Point of care summaries and resources synthesise evidence from systematic reviews and primary studies and presents this information in a user-friendly way. Examples include:

- **BMJ Best Practice** access via CIAP
- **UpToDate** access via CIAP

Clinical and Best Practice Guidelines databases

Clinical practice guidelines are 'systematically developed statements designed to assist healthcare practitioner and patient decisions about appropriate healthcare for specific clinical circumstances' (Greenhalgh T, 2014). Clinical practice guidelines provide a very high level of synthesised evidence. It is important to acknowledge that recommendations can differ depending on the context and methods used to identify and synthesise the evidence. Trusted sources for clinical practice guidelines include:

- **Therapeutic Guidelines:** > CIAP > Guidelines or https://tgldcdp.tg.org.au.acs.hcn.com.au/etgAccess
- **Agency for Healthcare Research and Quality National Guideline Clearinghouse:** a US government funded database containing international evidence-based clinical practice guidelines, recommendations and related documents https://www.ahrq.gov/gam/index.html
- **National Institute for Health and Care Excellence (NICE):** a UK funded guideline and evidence-based recommendations > CIAP > Guidelines or https://www.nice.org.uk/guidance
- **Northern NSW LHD** Documents https://intranet.nnswlhd.health.nsw.gov.au/doc-lib/
- **Medical Journal of Australia** – Guidelines and statements https://www.mja.com.au/journal/guidelines#

Databases indexing primary literature

Primary literature includes level II evidence and below i.e. any research where the authors collected and reported the data directly. Primary literature can be found in a variety of ways including searching electronic databases, reference lists, table of contents, and on social media. If you are searching an electronic database, most of them include search filters and limits that when selected will target specific types of study designs e.g. randomised controlled trials or years etc. Most databases have help guides to assist you to navigate the site.

- **Medical databases:**
  - **PubMed** (freely accessible): A well-known and easy to search database that comprises more than 33 million citations for biomedical literature including clinical practice guidelines, systematic reviews and primary literature https://pubmed.ncbi.nlm.nih.gov/.
  - PubMed clinical queries is an option within PubMed that uses predefined filters based on best evidence to help you refine clinical or disease specific searches (https://pubmed.ncbi.nlm.nih.gov/clinical/). Enter key words, select appropriate filter based on your question and the scope of your search (broad or narrow).

  - **EMBASE** (Access via CIAP): A large biomedical and pharmacological database.

- **Discipline specific databases**
  - Physiotherapy: Physiotherapy Evidence Database (PEDro) indexes clinical practice guidelines, systematic reviews and randomised controlled trials relevant to physiotherapy. Access via CIAP > Evidence-Based Practice or https://pedro.org.au/
  - Occupational therapy: Occupational Therapy Systematic Evaluation of the Evidence (OTseeker) indexes abstracts of systematic reviews, randomised controlled trials and other resources relevant to occupational therapy interventions. Access via CIAP > Evidence-Based Practice or http://www.otseeker.com/
  - Speech Pathology: SpeechBite indexes clinical practice guidelines, systematic reviews, randomised and non-randomised controlled trials, case series and single-case designs relevant to speech pathology. Access via CIAP > Evidence-Based Practice or https://speechbite.com/
  - Social care and social work: Social Care Online indexes systematic reviews, practice guidelines and grey literature from major journal tiles in social care published in the UK. Access via CIAP > Evidence-Based Practice or https://www.scie-socialcareonline.org.uk/
  - Psychological database: NeuroBite indexes clinical practice guidelines, systematic reviews, randomised and non-randomised controlled trials, case series and single-case designs on cognitive, behavioural and other treatments for psychological problems and issues following an acquired brain impairment. Access via CIAP > Evidence-Based Practice or https://neurorehab-evidence.com/web/cms/content/home

- **Local Health District Library Services:**

The Local Health District Library is another source of information, resources and support to assist you on your evidence-based journey.

Library contact details and location

	Northern NSW LHD	**Mid-North Coast LHD**
Library locations and phone number	• The Tweed Hospital Library* Phone: 07 55067724 • Lismore Hospital Library* Phone: 02 6620 2447 • Grafton Base Hospital Library • Murwillumbah District Hospital Library	• Port Macquarie Hospital Library* Phone: 02 5524 2193 • Coffs Harbour Hospital Library
Email	Tweed: NNSWLHD-TWE-Library@health.nsw.gov.au Lismore: NNSWLHD-LIS-Library@health.nsw.gov.au Grafton: NNSWLHD-GRA-Library@health.nsw.gov.au	mnclhd-pmbh-library@health.nsw.gov.au
Website	https://intranet.nnswlhd.health.nsw.gov.au/library	https://mnclhd.intersearch.com.au

*Librarians onsite

Services provided by the library

Library services include:

- Literature searches
- Access to library catalogue including variety of journals
- Assistance to find specific documents including articles and journals
- Information skills training including training in using specific databases, Endnote
- Document requests
- Access to computers, photocopiers/scanner/printers and quiet study area

$$ Useful tips:

1. **Why don't you just use Google?** Don't get me wrong, there is a time and a place for Google/ web browsers but when it comes to finding the best evidence you want to make sure that: 1) this comes from a reputable source and 2) You can find it again (i.e. you are systematic)! Web browsers are constantly being updated and may make finding a good article impossible, but perhaps more importantly if it is indexed on a database it is more likely to be a reputable article.

2. **Finding full text articles.** Many databases provide links automatically to full text articles if they are open access and therefore freely available. If you are unable to find the article you want, it is worth copying and pasting the title into 'google' as it may find a copy of the article on sites where authors can post their article directly e.g. ResearchGate. The other options are to search the library records and/or put a document request in (please make sure you have searched the library's records first). The other option you can try is to contact the author directly and ask them for a copy of their paper, researchers are all too happy to share their work!

3. **Get help!** If you really don't know where or how to start, you don't need to go it alone and please contact one of our librarians for support – see *Library contact details and location* for website and contact details.

   Otherwise, Google (see there is a time a place) online tutorials for the database you are trying to search. No doubt you will come across YouTube videos and a raft of user guides.

- **Activity 2:**

Back to the unexpected conversation about parachutes:

a) What type of question is this? *Select one response*

☐ Qualitative	☐ Risk/prognostic factors
☐ Frequency, prevalence	☐ Prognosis
☐ Diagnostic test accuracy	☐ Treatment effectiveness (intervention)

b) Based on your answer to question 2a (above), what study design would provide you with the highest level of evidence? *(Use Table 5 to assist you)*

_____

c) Based on your answer to question 2a (above), what study design would provide you with the second highest level of evidence? *(Use Table 5 to assist you)*

_____

d) Using the question below identify the key terms for your search:

For adult aircraft passengers (Population) is a parachute (intervention) effective in reducing death or injury (outcome) immediately after landing (timeframe) compared to an empty backpack (comparator)?

Select the key search terms from the question above:

_____

How would you combine these terms to conduct a search in a database?

_____

e) Which database or resource might you use to search for this evidence? Why?

☐ Database of systematic reviews e.g. Cochrane Library
☐ Point of care summaries and resources
☐ Clinical and Best Practice Guidelines databases
☐ General medical database e.g. PubMed
☐ Discipline specific database
☐ Other: (specify)

Why? _____

- **Template: Now it's your turn**

Return to your clinical question(s) on page 13. For each question, answer the following:

Question 1:

a) What type of question is this? *Select one response*

☐ Qualitative	☐ Risk/prognostic factors
☐ Frequency, prevalence	☐ Prognosis
☐ Diagnostic test accuracy	☐ Treatment effectiveness (intervention)

b) Based on your answer above, what study design would provide you with the highest level of evidence? *(Use Table 5 to assist you)*

_____

c) Based on your answer above, what study design would provide you with the second highest level of evidence? *(Use Table 5 to assist you)*

_____

d) Identifying key words:

Select the key search terms from your question:

_____

How would you combine these terms to conduct a database search?

_____

e) Which database or resource might you use to search for this evidence? Why?

☐ Database of systematic reviews e.g. Cochrane Library
☐ Point of care summaries and resources
☐ Clinical and Best Practice Guidelines databases
☐ General medical database e.g. PubMed
☐ Discipline specific database
☐ Other: (specify)

Why? _____

_____

Question 2:

a) What type of question is this? *Select one response*

- ☐ Qualitative
- ☐ Frequency, prevalence
- ☐ Diagnostic test accuracy
- ☐ Risk/prognostic factors
- ☐ Prognosis
- ☐ Treatment effectiveness (intervention)

b) Based on your answer above, what study design would provide you with the highest level of evidence? *(Use Table 5 to assist you)*

_____

c) Based on your answer above, what study design would provide you with the second highest level of evidence? *(Use Table 5 to assist you)*

_____

d) Identifying key words:

Select the key search terms from your question:

_____

How would you combine these terms to conduct a database search?

_____

e) Which database or resource might you use to search for this evidence? Why?

- ☐ Database of systematic reviews e.g. Cochrane Library
- ☐ Point of care summaries and resources
- ☐ Clinical and Best Practice Guidelines databases
- ☐ General medical database e.g. PubMed
- ☐ Discipline specific database
- ☐ Other: (specify)

Why? _____

_____

SESSION 3:

- **Step 3: Appraise – determine the believability and usefulness of the evidence**

Before we consider how to appraise the literature, let's start by clarifying a few myths:

Myth 1: The article is published so it must be of good quality

Answer: FALSE, just because an article is published it doesn't always mean the paper is of good quality and should be put into practice (implemented) – even if it is published in what is considered a 'good' journal. While it is true that most good scientific journals send papers out for scientific review by their peers in the field (otherwise known as peer review), it doesn't mean all flaws are identified nor does it mean the results will be applicable to your context or setting.

Myth 2: Critical appraisal is the most important component of evidence-based practice

Answer: FALSE, while most people think that appraisal is the be all and end all of evidence-based practice it is no more or less important than the other components and in fact many would argue that Step 1: asking an answerable clinical question using the PICO format is the most critical component as everything stems from a well-designed question (review Sessions 1 and 2).

Myth 3: Critical appraisal is difficult and takes a long time.

Answer: FALSE, critical appraisal need not take a long time if you use targeted reading and know what to look for. Appraisal does however require you to think about papers differently and not go through the motion of reading a paper from start to finish and in its entirety, it also requires you to have an understanding of what things you should consider when thinking about the 'quality' of a paper. In this session, we will provide you with a framework from which to tackle appraisal and recommend you practice these skills for it to become easier.

- **The anatomy of a research paper**

Before jumping into critical appraisal, let's take a moment to recap the anatomy of a research paper. Understanding the 'typical' format of a research article will help you navigate, quickly, to the relevant sections needed when critically appraising the article. This format will apply to mostly quantitative papers and it is worth noting that, while some journals may report qualitative research similarly, these studies may not follow the same convention.

The anatomy of a research paper

Features of the first page:


RESEARCH

Parachute use to prevent death and major trauma when jumping from aircraft: randomized controlled trial

ABSTRACT

WHAT IS ALREADY KNOWN ON THIS TOPIC

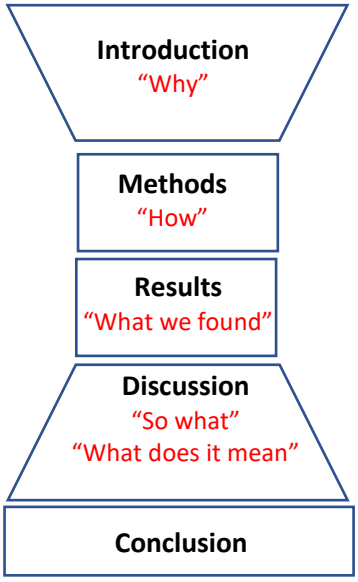
WHAT THIS STUDY ADDS

Title:
Descriptive information that lets the reader search and find the article. Ideally, the title should include the relevant elements of PICO and the study design.

Study authors

Abstract:
A short, clear and concise summary of the paper. The abstract usually has subheadings for the various sections of the paper.

Most journals request authors to report their study and findings using the 'IMRaD' structure i.e. **I**ntroduction, **M**ethods, **R**esults, **a**nd **D**iscussion. Why? Because the IMRaD structure facilitates readers' understanding of the problem, how the authors went about solving the problem, the study findings and what the findings mean in the broader literature on the topic. Let's take a closer look at the IMRaD structure and what it tells us:



Introduction: *Outlines WHY this study is important to do*
The introduction usually outlines in 3 or more paragraphs:

1. What is known about the topic
2. What is unknown
3. How and why it is important to fill this gap.

Methods: *How did the authors do their study*
The methods section often includes subheadings e.g. setting, participants, outcomes, procedures and analysis. The subheadings can facilitate targeted reading

Results: *What the authors found*

Discussion: *Answers the important "so what" question*
The discussion is often structured to include the following:

1. Overview of the main findings
2. Strength/weaknesses of the study
3. Comparison with the body of literature
4. Future research directions

Conclusion: *Key take home message and future direction*

Now that we can navigate our way around a research paper, let's get on to how to critically appraise it to determine its **believability** and **usefulness**.

Why do I need to appraise the quality of a published article?

Each time you pick up a paper you need to assess whether it is fit for *your* purpose and this means assessing whether the results are **believable** (valid, close to the truth, minimises bias) and **useful** (clinical importance and applicable to your patient).

How do I appraise a published article?

As with most things in life there is a gold standard approach and a pragmatic approach and depending on why you are consulting the literature determines which you should use.

- **Gold standard approach**

If you are undertaking a systematic review or just prefer to do things the right way the gold standard approach to critical appraisal involves the use of critical appraisal checklists. A variety of checklists are available and the one you choose will depend on the type of study (study design) you need to appraise and your preferences. Using a critical appraisal checklist can be time consuming but it provides you with an opportunity to learn about the features that makes a study trustworthy (valid). Below is a list of websites where you can access critical appraisal tools for various study designs:

- **CASP** (Critical Appraisal Skills Program): https://casp-uk.net/casp-tools-checklists/
- **JBI** (Joanna Briggs Institute): https://jbi.global/critical-appraisal-tools
- **University of South Australia:** The International Centre for Allied Health Evidence have compiled a comprehensive list of the various critical appraisal tools under the different types of studies https://www.unisa.edu.au/research/allied-health-evidence/resources/cat/

- **Pragmatic approach**

As a busy and time poor healthcare professional, pragmatism and efficiency is critical. We will now go through a framework that you can use to assess an article's validity and usefulness. A key skill required for critical appraisal is *targeted reading* 👀. By targeted reading, we mean purposive reading to identify the key features needed to decide if an article is valid and useful. Why targeted reading? Why indeed, why would you invest your precious time reading something that is methodologically flawed and the results and conclusion misleading (biased) – the answer is you shouldn't read it! When you pick up an article your first pass should be to do a quick critical appraisal to determine if the article is valid and the results believable and whether you should actually invest time in reading the article in its entirety. Using this approach will save you time in the long run as life is too short to read bad research!

Using a pragmatic approach to critical appraisal we are focusing on identification of key methodological flaws related to:

- Selection bias – occurs when the subjects in a study are selected in a way that will influence the results and,
- Measurement/ Detection bias – systematic differences or anomalies that occur in the collection of outcomes between study exposures or groups.

While this pragmatic approach does not consider all the factors a gold standard approach would, the absence of the features listed below can be considered 'red flags' that the study may contain serious design flaws producing biased or misleading findings.

Let us now have a close look at the questions we need to ask to determine if an article is ***believable*** and only then determine if the results are ***useful***.

Where to begin:

Using a pragmatic approach, we are going to review the article to first determine its:

1. ***Believability*** and,
2. ***Usefulness***

To determine if an article is well conducted and the results are ***believable***, we will consider 3 factors that can be summarised as:

- Align
- Design
- Conduct

If you decide that the article is believable only then should you review the results and determine if the results are ***useful***. To decide whether the results are useful we will consider 2 factors related to the:

- Applicability of the findings
- Importance of the findings

Let's now take a closer look at how to critically appraise an article using a pragmatic approach.

1. ALIGN

Just like you started your evidence-based journey, the first question you need to ask is:

Question 1: From the title and abstract of the paper, can you identify the elements of an answerable research question (PICO)?

Target your reading to:

- The title and abstract: can you identify all the relevant elements of a PICO question? Remember not all questions need to include all elements of PICO, see Table 3.

Did the authors ask a well-defined and answerable research question using the relevant elements of PICO? If your answer to this question is:
Yes → Great the article at least has the makings of a valid paper and one that meets your needs.

No → if you can't find all of the necessary elements of the PICO question in the title or abstract, try and skim read the methods section to identify the missing elements. If you can't find the necessary elements, then this is red flag and you should consider putting this paper down. As discussed above, everything stems from a clearly focused question. If the authors haven't been able to do this well, it is likely the paper is going to have many more flaws and

is <u>not</u> worth reading. Stop reading now and see if you can find a paper that is better suited to your needs.

<u>Question 2:</u> Did the authors use the appropriate study design to answer their research question?

This question is looking at the alignment between what the authors did and what we know about study design and which study design will give the most robust (least biased) results i.e. return to Table 5 and review the evidence hierarchy.

If your answer is:
Yes → Great. The authors have used an appropriate study design, and ideally this is high up in the evidence hierarchy i.e. level 1 or II evidence. Progress to question 3.

No → The paper asked a question and then didn't use a study design in the evidence hierarchy it would be wise to stop reading and to try and find a paper higher up the evidence hierarchy. After undertaking a database search if the best evidence you can find are those which are considered lower levels of evidence, then you will need to read and interpret the findings with respect to its limitations.

2. DESIGN

<u>Question 3:</u> Is the study sample representative of the population?

Target your reading to:

- The inclusion and exclusion criteria. Were participants from a general population, with broad inclusion criteria? Was participation equitable i.e., did people with the condition have equal chance of being included in the study? If so, selection bias is not likely going to be an issue. However, if participants were highly selected, and there were lots of inclusion and exclusion criteria it is likely selection bias will be an issue, meaning that the results are not likely to apply to others with condition.

For example, a study may want to estimate adults' level of physical activity in a city. Consider the following ways of sampling and its impact on the results:

Sampling	Representativeness	Bias
Selecting a random sample of the town's electoral roll	Good, you are likely going to obtain a good estimate as the sample is representative of all the people in the town	Low
Selecting people who are registered with a general practitioner	It would depend on how many people are registered with a GP. What about people who are not registered?	Medium
Selecting people who attend one of the ten gyms in town	Poor, it is unlikely people who go to the gym are representative of all people in the town	High

If your answer is:
Yes → The inclusion/exclusion criteria are not highly selective and therefore the people meeting the criteria are likely to be representative of the population, i.e., your patients and people who present to your service. Progress to question 4.

No → The inclusion/exclusion criteria <u>are</u> highly selective and therefore the people meeting the criteria are <u>not</u> likely to be representative of the population, i.e., your patients and people who present to your service. After undertaking a database search if the best evidence you can find are those which are considered lower levels of evidence, then you will need to read and interpret the findings with respect to this limitation.

<u>Question 4:</u> Were validated outcome measures used? Were data collection methods the same for all participants?

Target your reading to:

- Methods:
  - <u>Outcome measures section:</u> review the outcome measures used. Review each outcome measure in turn and consider its validity (i.e., is the outcome measured using a validated tool or instrument or is it generally accepted as being relevant by subject matter experts in the field) – note, this is something that is explicitly reported i.e., authors will report that "validated outcome" measures were used and/or provide a reference (small number in superscript).
  - <u>Data collection section:</u> Ideally, the same approach should be used to collected data from all participants. If half of the participants were followed up over the telephone and others face to face this could lead to systematic differences in participant responses.

If your answer to these two is:

Yes → Outcomes are measured using validated outcome measures and the same approach was used to collect data from all participants. Fantastic, this means the study finding are likely to reflect changes in the outcome, move onto question 5.

No → if you answered no to these two questions, then the results may be due to factors other than the intervention. If you know of other studies perhaps review those otherwise you would want to see that the authors have interpreted the findings in light of these limitations.

3. CONDUCT

<u>Question 5:</u> Were all participants who entered the study followed up?

Loss to follow up refers to participants who were enrolled in a study but didn't complete the study for one reason or other. Loss to follow up is a concern as you don't know if the person stopped participating because the intervention made them worse or worse yet they died because of it, they moved away or just didn't want to take part any more. Ideally, you want to see a low loss to follow up (i.e., everyone who starts in the study finishes it). A cut off of 20% is often used as the threshold for an acceptable loss to follow up i.e., if the study had less than 20% loss to follow up (in other words 80% follow up). Perhaps more important than the number lost is whether those who were lost to follow up were similar to those who remained.

Target your reading to:

- Participant flow chart (often labelled as Figure 1 in primary research)
- The first paragraph or two of the results.

If your answer is:
Yes → the population in the study is representative of those who you will apply the results and there is <20% loss to follow up, great, selection bias is not likely doing to be a problem. Move onto reading the results and determining if they are applicable and important to your patients!

No → If the sample is highly selected and a significant number of participants were lost to follow up for no explainable reason, the results will likely be misleading. If you know of other studies perhaps review those otherwise you would want to see that the authors have interpreted the findings in light of these limitations.

Now that you have cast a critical eye over how the study was designed and conducted you need to consider whether the results are ***believable*** (enough) to warrant reading, interpreting and applying the results. Doing research well is actually really difficult and time-consuming, and more likely than not all studies have some limitations. It is up to you to assess whether the limitations are severe enough that you no longer believe the results. If you have concerns about the methods used and therefore the believability of the results, stop reading now as the findings of the paper are not going to be useful. On the other hand, if you have spotted some limitations but overall think the authors have done a reasonable job and the results are believable then read on. This next step of critical appraisal involves reviewing the results and determining whether they are ***useful***, and by this we mean ***applicable*** to your patient(s) and ***important***.

Assessing whether the results are useful

To assess the usefulness of the results to YOUR patients and practice you will need to consider:

- Applicability of the findings
- Importance of the findings

<u>Question 1:</u> Does the study and results apply to my patient(s)?

To determine the applicability of the study and results to your patient(s) you will need to consider whether the study PICO aligns to the original PICO question you asked in particular the population, intervention, and outcomes.

If your answer is:

Yes → Great the article is going to be clinically relevant and will provide you with information that applies to your clinical question and population. Progress to question 2.

No → Different population, intervention or irrelevant outcome, then the paper is not likely to give you the answers you are interested in. It is a matter of your own clinical judgment how aligned the study PICO is to your PICO question and therefore requires you to determine how applicable the results are to your patient(s) and setting.

<u>Question 2:</u> Are the results of the study likely going to be clinically important (i.e., meaningful) to me and/or my patient(s)?

Clinical importance, or significance, is referring to the size of the treatment effect and the practical importance or real-world impact of this treatment effect on your patient(s) daily life. Many would argue that the clinical importance is more important than statistical significance (think of the p-value and whether the result was likely to have occurred by chance), these topics will be covered in more detail in the week 4 seminar. To decide whether a result is clinically important, you will need to draw on your clinical experience and prior knowledge of working in the area, patients values and preferences. Alternatively, some studies may provide cut offs from the literature as to how they define clinical importance. Let's look at an example in the field of low back pain. A clinically important effect for pain is often defined as a 2-point reduction in pain on a 0-10 pain scale. Therefore, a study that reports a 1-point difference does not reach the threshold for being clinically important while a study that finds a 4-point reduction in pain would be considered clinically significant. Another factor to consider when determining whether a finding is clinically important is the benefits and harms associated with that particular treatment. The benefit/harm trade of is a factor that you need to discuss with your patient as people have different values and preference as to the risks they would like to assume for any given benefit.

- **Activity 3:**

Using the search terms "adult AND parachute" in PubMed you will likely find the randomised controlled trial below:

> **Parachute** use to prevent death and major trauma when jumping from aircraft: randomized controlled trial.
> Yeh RW, Valsdottir LR, Yeh MW, Shen C, Kramer DB, Strom JB, Secemsky EA, Healy JL, Domeier RM, Kazi DS, Nallamothu BK; PARACHUTE Investigators.
> BMJ. 2018 Dec 13;363:k5094. doi: 10.1136/bmj.k5094.
> PMID: 30545967 Free PMC article. Clinical Trial.

Read the title and what you need to of the abstract.

ABSTRACT

OBJECTIVE To determine if using a parachute prevents death or major traumatic injury when jumping from an aircraft.

DESIGN Randomized controlled trial.

SETTING Private or commercial aircraft between September 2017 and August 2018.

PARTICIPANTS 92 aircraft passengers aged 18 and over were screened for participation. 23 agreed to be enrolled and were randomized.

INTERVENTION Jumping from an aircraft (airplane or helicopter) with a parachute versus an empty backpack (unblinded).

MAIN OUTCOME MEASURES Composite of death or major traumatic injury (defined by an Injury Severity Score over 15) upon impact with the ground measured immediately after landing.

RESULTS Parachute use did not significantly reduce death or major injury (0% for parachute v 0% for control; P>0.9). This finding was consistent across multiple subgroups. Compared with individuals screened but not enrolled, participants included in the study were on aircraft at significantly lower altitude (mean of 0.6 m for participants v mean of 9146 m for nonparticipants; P <0.001) and lower velocity (mean of 0 km/h v mean of 800 km/h; P<0.001).

CONCLUSIONS Parachute use did not reduce death or major traumatic injury when jumping from aircraft in the first randomized evaluation of this intervention. However, the trial was only able to enrol participants on small stationary aircraft on the ground, suggesting cautious extrapolation to high altitude jumps. When beliefs regarding the effectiveness of an intervention exist in the community, randomized trials might selectively enrol individuals with a lower perceived likelihood of benefit, thus diminishing the applicability of the results to clinical practice

ARE THE RESULTS BELIEVABLE:

- **ALIGN**

1. ***From the title and abstract of the paper, can you identify the elements of an answerable research question?***

☐ Yes	*Progress to the next question*
☐ No	*Stop reading now and see if you can find a paper that is better suited to your needs.*

2. ***Did the authors use the appropriate study design to answer their research question?*** Return to the evidence hierarchy Table 4. In activity 2 a/b you identified that this question is asking about the effectiveness of an intervention. No systematic reviews are available so a randomised controlled trial would be considered the best primary evidence.

☐ Yes	*The authors conducted a randomised controlled trial. Progress to the next question.*
☐ No	*Stop reading now and see if you can find a paper that is better suited to your needs.*

- **DESIGN**

3. ***Is the study sample representative of the population?***

☐ Yes	*The inclusion/exclusion criteria and methods used to identify and recruit participants means that the sample is likely to be representative of the population the results will be applied. Progress to the next question.*
☐ No	*A highly selected study population is not sufficient to stop reading the study but the results do need to be interpreted with respect to generalisability of the study findings.*

4. ***Were validated outcome measures used? Were data collection methods the same for all participants?***

☐ Yes	*The authors used a validated outcome measure(s), and the same methods were used to collect data from all participants. Progress to the next question.*
☐ No	*If a study used outcome measures that are not valid, or used different data collection methods for participants*, then the results may be due to factors other than the intervention. If you know of other studies perhaps review those otherwise you would want to see that the authors have interpreted the findings in light of these limitations. Either way this is a flaw that would reduce your belief in the results.

- **CONDUCT**

5. ***Were all the participants who entered the study followed up?***

☐ Yes	*Less than 20% of participants enrolled in the study were lost to follow up and those who dropped out (i.e. were lost) were similar to those who remained. Progress to the next question*
☐ No	*A large loss to follow up (>20%) is not sufficient to stop reading the study but the results do need to be interpreted with respect to the impact this has on the results.*

Overall, is this study designed in a way that the results are likely going to be valid and useful?
If your answer was yes to all or most of these questions than it is likely that the results are believable (or at least provide a good estimate of the true effect). You can go on to review the results and interpret their usefulness (i.e. applicability and importance).

☐ Yes	*While not perfect most of the key features are there and the authors acknowledge and interpret the findings in light of the study limitations.*
☐ No	*Stop reading now and see if you can find a paper that is better suited to your needs.*

USEFULNESS

- **APPLICABILITY AND IMPORTANCE OF THE RESULTS**

1. Does the study and results apply to my patient(s)?
2. Are the results clinically important?

The questions on applicability and importance of results are value-based questions that rely on having awareness of your own clinical knowledge, skills and experience and a working knowledge of your patients values and preferences. It will likely require you to have the conversation with your patient about the benefits and harms of the particular treatment and whether this is an appropriate treatment for them.

- **Template: Now it's your turn**

Return to your clinical question(s) on page 13. For each question use the pragmatic checklist to appraise an article that you have found to answer your question.

ARE THE RESULTS BELIEVABLE:

- **ALIGN**

1. ***From the title and abstract of the paper, can you identify the elements of an answerable research question?***

☐ Yes	*Progress to the next question*
☐ No	*Stop reading now and see if you can find a paper that is better suited to your needs.*

2. ***Did the authors use the appropriate study design to answer their research question?*** Return to the evidence hierarchy in Table 5. In Activity 2, question a/b (page 21) we identified that the question we asked about the effectiveness of parachutes, is a question about 'treatment effectiveness'. No systematic reviews are available so a randomised controlled trial would be considered the best primary evidence.

☐ Yes	*The authors conducted a randomised controlled trial. Progress to the next question*
☐ No	*Stop reading now and see if you can find a paper that is better suited to your needs.*

- **DESIGN**

3. ***Is the study sample representative of the population?***

☐ Yes	*The inclusion/exclusion criteria and methods used to identify and recruit participants means that the sample is likely to be representative of the population the results will be applied. Progress to the next question*
☐ No	*A highly selected study population is not sufficient to stop reading the study but the results do need to be interpreted with respect to generalisability of the study findings.*

4. ***Were validated outcome measures used? Were data collection methods the same for all participants?***

☐ Yes	*The authors used a validated outcome measure(s), and the same methods were used to collect data from all participants. Progress to the next question.*
☐ No	*If a study used outcome measures that are not valid, or used different data collection methods for participants*, then the results may be due to factors other than the intervention. If you know of other studies perhaps review those otherwise you would want to see that the authors have interpreted the findings in light of these limitations. Either way this is a flaw that would reduce your belief in the results.

- **CONDUCT**

5. Were all the participants who entered the study followed up?

☐ Yes	*Less than 20% of participants enrolled in the study were lost to follow up and those who dropped out (i.e. were lost) were similar to those who remained. Progress to the next question*
☐ No	*A large loss to follow up (>20%) is not sufficient to stop reading the study but the results do need to be interpreted with respect to the impact this has on the results.*

Overall, is this study designed in a way that the results are likely going to be valid and useful?

If your answer was yes to all or most of these questions, then it is likely that the results are believable (or at least provide a good estimate of the true effect). You can go on to review the results and interpret their usefulness (i.e. applicability and importance).

☐ Yes	*While not perfect most of the key features are there and the authors acknowledge and interpret the findings in light of the study limitations.*
☐ No	*Stop reading now and see if you can find a paper that is better suited to your needs.*

USEFULNESS

- **APPLICABILITY AND IMPORTANCE OF THE RESULTS**

3. Does the study and results apply to my patient(s)?
4. Are the results clinically important?

SESSION 4:

- **Step 4: Apply – interpret the findings and their significance**

Applying the evidence requires the ability to understand and interpret the findings of the evidence you have systematically searched and appraised. Most often, this will be about interpreting the results of statistical analyses. For the purpose of this seminar, we will focus exclusively on studies assessing the effect of an intervention, treatment or exposure [herein called intervention] on a relevant (health) outcome.

Comparing two group means

When we think about assessing the effect of an intervention, the most common approach takes the form of comparing the study outcome between the treatment and control groups. For example, in a trial assessing a new drug for controlling blood pressure (BP) in hypertensive patients, the interest would be in comparing the mean (average) BP in the new drug group (the intervention group) to the mean (average) BP in the control group (standard/current care group) to see if the new drug has a favourable effect. The main way to do this is by calculating the difference in mean BP between the treatment groups, yielding the estimated effect.

Estimated effect *= difference in mean BP between the treatment groups*

= (mean BP new drug group) – (mean BP standard care group)

Such comparisons are typically done on quantitative data (e.g. height, weight, Visual Analogue Scale pain score). Please see the Figure 1 below for more information on types of data and their examples.

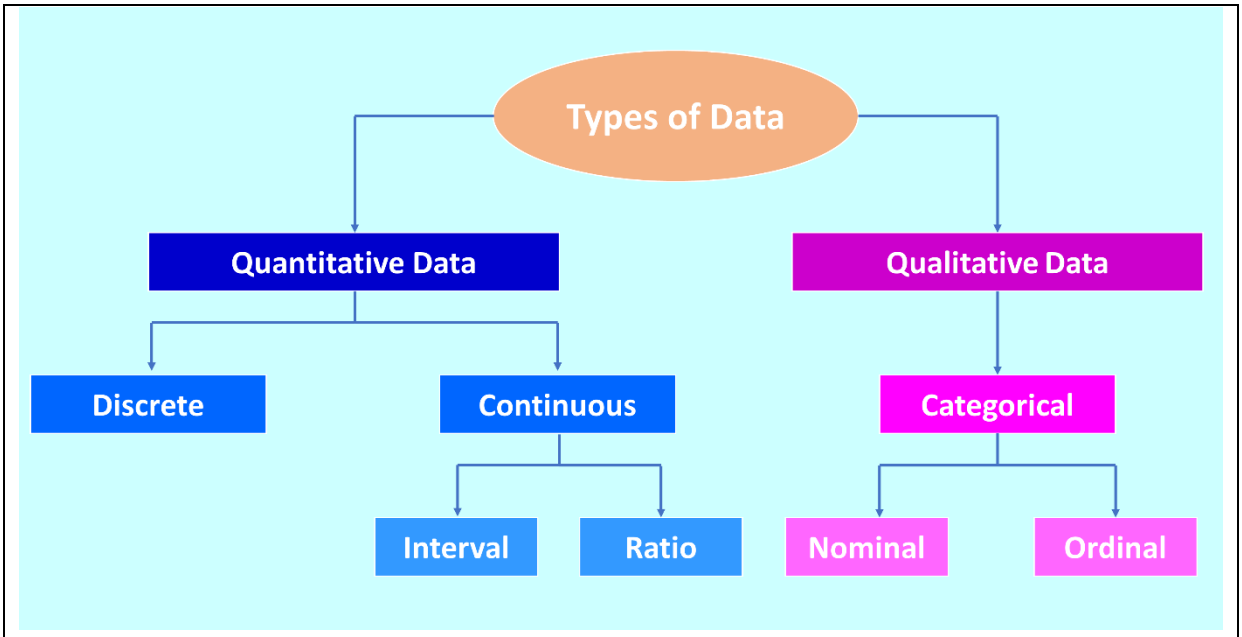


Figure 1: Flow chart of types of data.

You will be pleased to know that there are only two ways to compare data from studies of treatment effectiveness – as a difference or ratio. How you do this depends on the type of data collected and whether the data is:

Quantitative data (numbers) – discrete or continuous

Discrete – data can only take on certain values (e.g. whole numbers, shoe sizes, parity, falls)

Continuous – data can take any value in the scale, either with a true zero (ratio scale; e.g. height in meters, heart rate, blood pressure) or no true zero (interval scale; e.g. temperature in degrees Celsius, pH, IQ score, time)

Qualitative data (categories) – nominal or ordinal

Nominal – categories with no order or direction (e.g. eye colour)

Ordinal – categories with order or direction (e.g. education level)

In research articles, estimated effects for quantitative data outcome variables can take the form of differences in:

- Unadjusted (crude) means
- Adjusted means
- Standardised means

The key, here, is to remember that differences in means are being assessed and we intuitively know that, when the means of the intervention and control groups are the same, the difference in means will be 0 (or very close to it). Another key element to remember, and this is something you may recall from when you did statistics as part of your degrees/training/education, to assist in the interpretation of estimated effects (mean differences in our case), there will typically be some measure of precision. This will be linked to the Standard Error, which is the measure of precision associated with the estimated effect, and is most commonly presented as a confidence interval, typically 95%, around the estimated effect. This confidence interval creates a plausible range of values for the true population parameter. A way to view the 95% confidence interval is that, in a series of 100 identical repeat experiments, 95 of the 100 experiments will include the true population parameter (the true effect) in the 95% confidence intervals. So, based on this statistical property, we probably like our chances that the 95% confidence interval of the estimated effect (we are interpreting) includes the true effect. However, we don't know exactly what value in the range it is. The trick, here, is to look at both the lower and upper limits of the 95% confidence interval and acknowledge that, based on the observed data (that is, the study data), the true effect could be as low as the lower limit or as high as the higher limit.

Interpreting the confidence interval through example

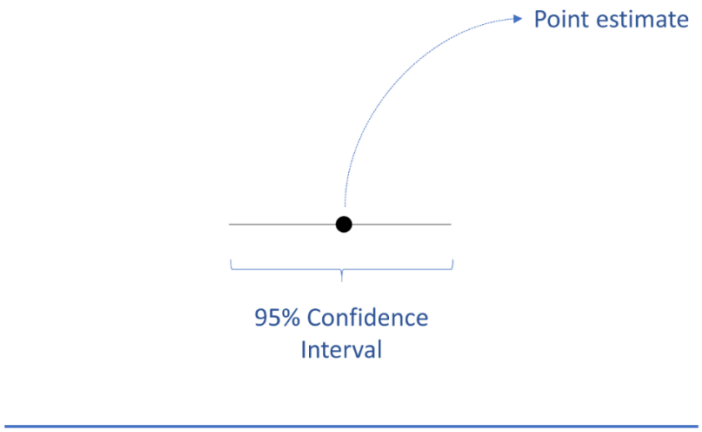


Figure 2: Error bar plot displaying the point estimate and associated 95% confidence interval of an estimated mean difference.

Link between p-values and the 95% confidence interval

Up to this point, we have not mentioned the p-value, which is the likelihood of obtaining results by chance when, in fact, there is no difference between the groups being compared. Luckily, there is a direct link between the confidence interval and the p-value in that the p-value will be below the most commonly applied threshold of 0.05 when the 95% confidence interval **does not include the null value**, which is the value of no difference. When comparing means, this null value is 0. We can look at this graphically in Figure 3:

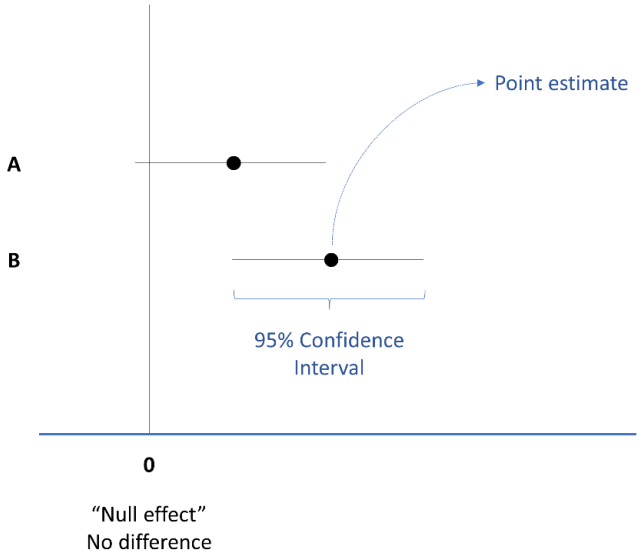


Figure 3: Error bar plot of point estimates and associated 95% confidence intervals of mean differences placed in the context of the null value (no difference between means).

For the comparison in A, we can see that the 95% confidence interval includes 0, the null value representing no difference, which suggests the true population parameter (or the true difference in means between the two groups) could be zero (remembering back to our definition of the 95% confidence interval). In this case, p-value > 0.05. For the comparison in B, we see that the 95% confidence interval does not include 0 and given that we like our chances that the interval includes the true population parameter, we can conclude that the mean difference is significantly greater than zero. In this case, p-value < 0.05.

Interpreting the 95% confidence interval in the context of clinically significant differences

We can extend the concept of confidence intervals to include clinically important/significant differences. For example, a difference between the means of two groups can be statistically significant, but this doesn't necessarily specify the difference would be clinically relevant. This is where the concept of minimally or clinically important differences becomes applicable. Much like the null value, the 95% confidence interval can be placed in the context of a clinically important difference, based on your knowledge of the area, patient values or preferences, or the existing literature, as shown in Figure 4 below:

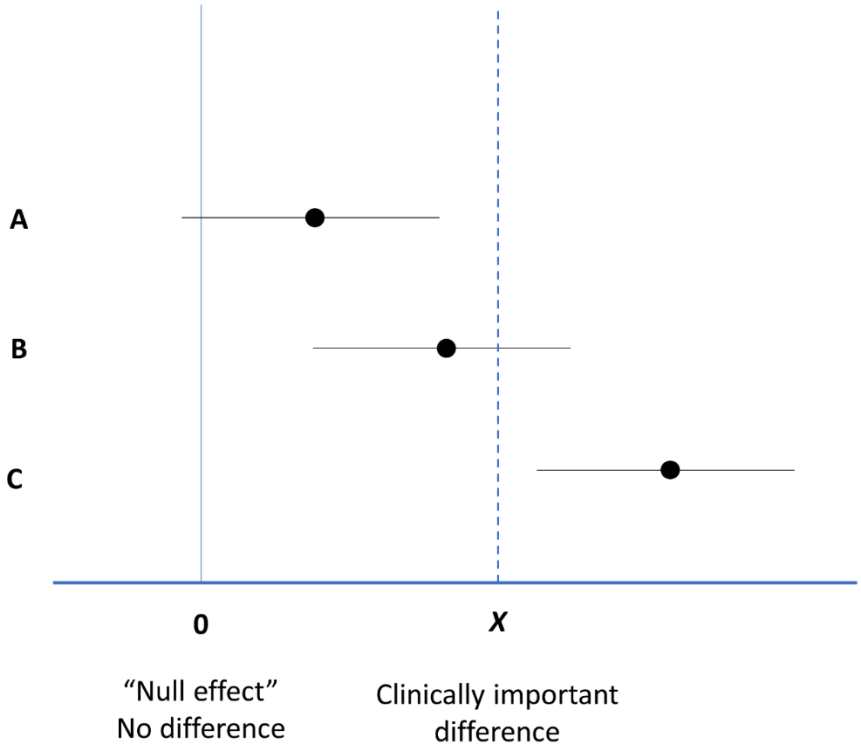


Figure 4: Error bar plot of point estimates and associated 95% confidence intervals of mean differences placed in the context of the null value (no difference between means) and the clinically important difference (dashed line, *X*).

In this hypothetical example, three different point estimates and associated 95% confidence intervals of mean differences (A, B and C) are depicted in the context of the null effect (no difference) and a dashed line indicating the point, *X*, at which differences reach clinical relevance.

- **For A**, the 95% confidence interval includes the null value, indicating the difference in means is not statistically significant (i.e. there is insufficient evidence from the study data to indicate the true population parameter is different to 0). The mean difference and 95% confidence interval also falls below the line of clinical relevance, so we would conclude that the difference in means is not clinically relevant.
- **For B**, there is sufficient evidence to suggest the true difference between the means being compared is greater than 0 (statistically significant). It also shows the true mean difference has the potential to be clinically relevant as the confidence interval includes *X*. However, while we like our chances that the true population parameter falls within the confidence interval, we don't know where, and it could be below the clinically important difference or above it, that's why we judge this hypothetical example to have the *potential* to be clinically relevant.
- **For C**, the lower limit of the 95% confidence interval exceeds both the null effect and the clinically important difference, and we conclude that the difference in means is statistically significant and clinically relevant.

Comparisons between groups using ratios

So far, we have focused on the comparison of group means by understanding how to interpret estimated mean differences and their associated 95% confidence intervals, which is useful when the study outcome variable is measured on a continuous scale. However, you may be aware that this is not the only way estimated effects can be assessed and this is usually the case when study outcome variables are in the form of events, rates or categories (e.g. binary or other). As examples, consider falls in hospital, which can be analysed numerous ways, as follows: in-hospital falls (event; yes/no); number of in-hospital falls per 1,000 patients (rate); and in-hospital fall groupings reflecting different numbers of falls (categories; e.g. those who didn't fall, those who fell once and those who fell multiple times while in hospital). In these cases, the most common form of analysis applied is categorical data analysis and typical measures of effect are:

- Risk ratios
- Odds ratios
- Rate ratios and
- Hazard ratios.

The key, here, is that they are ratios!

Luckily, the estimated effects are interpreted in much the same way as estimated mean differences; there is a point estimate and an associated 95% confidence interval. The only main difference is that the value of the **null effect (the reference group) is 1**.

Hypothetical example of odds ratio error bar plot

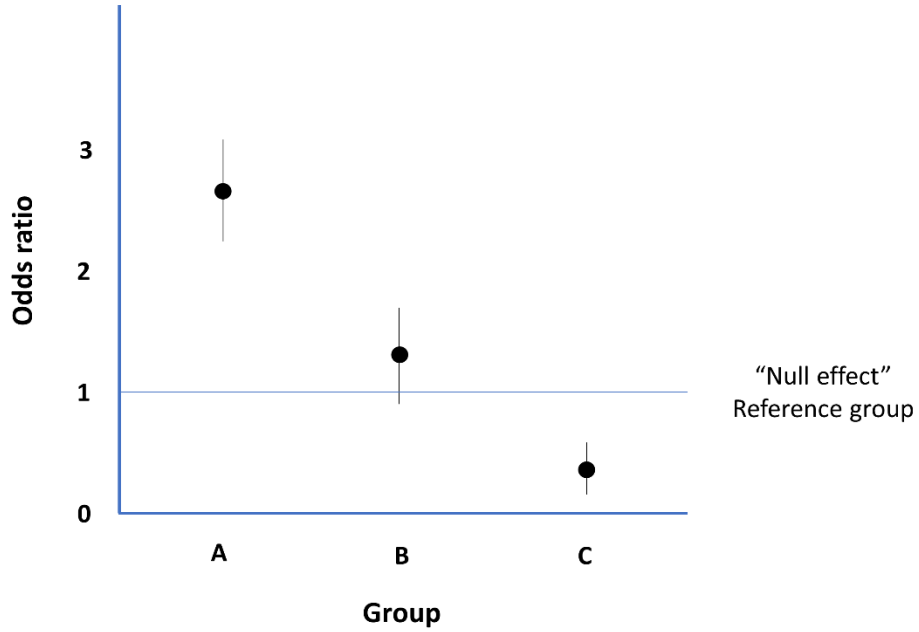


Figure 5: Error bar plot of odds ratio point estimates and 95% confidence intervals.

In this example (Figure 5), compared to the reference group, A has a higher odds of the outcome (the 95% confidence interval does not include the null value indicating the difference in outcomes between groups is statistically significant), B has odds of the outcome that is not significantly different to the reference group (95% confidence interval includes the null value, 1) and C has significantly lower odds of the outcome (again indicating that the outcomes between groups is statistically significant).

Summary – assessing the effect of an intervention

- We covered the two main ways of assessing intervention effects in the form of study group **mean differences** and **ratios** in study outcome variables (the estimated effects as point estimates).
- We noted that point estimates are typically reported with measures of precision in the form of 95% confidence intervals, which provides a plausible range of values for the true population effect (parameter).
- We explored the connection between 95% confidence intervals and p-values in that a 95% confidence interval that does not include the null value of no difference will have a p-value < 0.05 (and vice versa).
- We covered the concepts of statistical significance and clinical significance and that both need to be considered when interpreting and applying the evidence.

- **Activity 4:**

Using the article below please target your reading to the methods and results section to answer the following questions:
Yeh RW, Valsdottir LR, Yeh MW, Shen C, Kramer DB, Strom JB, Secemsky EA, Healy JL, Domeier RM, Kazi DS, Nallamothu BK; PARACHUTE Investigators. Parachute use to prevent death and major trauma when jumping from aircraft: randomized controlled trial. BMJ. 2018 Dec 13;363:k5094. doi: 10.1136/bmj.k5094.

1. For each outcome measure listed below answer the following questions:
   a) How are the data collected and reported?
   b) What is the measure of treatment effect and what is the point of no effect?
   c) What is the result?

Primary outcome: Composite of death (Yes/No) and major traumatic injury (score > 15, Yes/No)

a) What are the outcomes, and how are the data collected and reported?
- ☐ Quantitative data (data that is in the form of numbers)
- ☐ Qualitative data (data in the form of categories)

b) For the type of data identified what is the measure of treatment effect and the point of no difference?
- ☐ Difference. Point of no effect = 0
- ☐ Ratio. Point of no effect = 1

c) What is the result for this outcome?

"no significant difference in the rate of death or major traumatic injury between the treatment and control arms within five minutes of ground impact (0% for parachute v 0% for control; P>0.9) or at 30 days after impact (0% for parachute v 0% for control; P>0.9)."

d) Interpret the result for this outcome?

_____

Secondary outcome: Mean short form Health Survey score

a) What are the outcomes, and how are the data collected and reported?
- ☐ Quantitative data (data that is in the form of numbers)
- ☐ Qualitative data (data in the form of categories)

b) For the type of data identified what is the measure of treatment effect and the point of no difference?
- ☐ Difference. Point of no effect = 0
- ☐ Ratio. Point of no effect = 1

c) What is the result for this outcome?

*"*Health status as measured by the Short Form Health Survey was similar between groups (43.9, SD 1.8 for parachute *v* 44.0, SD 2.4 for control; P=0.9; mean difference of 0.1, 95% confidence interval −2.0 to 2.2)."

d) Identify the point estimate and 95% confidence interval. Interpret the result for this outcome?

_____

- **Template: Now it is your turn**

For the article you have identified:

1. **What is the primary and a secondary outcome measure. For each outcome identify:**
2. **How are the data is collected and reported** (*is it quantitative or qualitative data*)**?**
3. **What is the measure of treatment effect and what is the point of no effect?**
4. **What is the result?**

Primary outcome: _____

a) For this outcome, how is the data collected and reported?

☐ Quantitative data (data that is in the form of numbers)
☐ Qualitative data (data in the form of categories)

b) For the type of data identified what is the measure of treatment effect and the point of no difference?

☐ Difference. Point of no effect = 0
☐ Ratio. Point of no effect = 1

c) *What is the result for this outcome? Identify the point estimate and 95% confidence interval.*

_____

d) Interpret the result for this outcome?

_____

IN PREPARATION for Session 5 - Becoming an evidence-based practitioner

Ideally, evidence-based practice is a process that is incorporated into your everyday clinical practice. Take a moment to reflect on the information that has been covered in this seminar series. In preparation for Session 5 (the last session), jot down your thoughts to the following 3 questions. In Session 5, we will bring it all together and revisit and discuss your learnings, thoughts and experiences of evidence-based practice, identify facilitators and tackle the barriers to evidence-based practice and overall help you to develop your own strategy to becoming an evidence-based practitioner.

1. **In applying what I've learnt…** the main challenges for integrating evidence into practice will be:

   _____
   _____
   _____
   _____

2. **In applying EBP and the things I've learnt in this course …** the strategies that work well are:

_____
_____
_____
_____

3. **Going forward, the things I/we need to focus on to support evidence-based practice are…** please list the actions, steps or concepts that you may need to invest more time in understanding, sharing or uniting your team on to support evidence-based practice in your work:

_____
_____
_____
_____

SESSION 5:

- **Step 5: Assess – Becoming an evidence-based practitioner**

The final step of evidence-based practice is to assess your own effectiveness and efficiency with steps 1-4 of the evidence-based practice process. After you have completed the previous 4 steps, take a moment to ask yourself the following questions to identify what you did well, and areas you may need to improve. (Hoffman, 2017)

- Is my question well-formulated (i.e. does it include the relevant elements of PICO, Population, Intervention, Comparator and Outcome), and is it clinically relevant?
- What type of question am I asking, and what is the best evidence or study design to answer my clinical problem or question?
- Does my search target the highest level of evidence that can be used to answer my clinical question?
- Did you use targeted reading to appraise the believability (validity) and usefulness of the evidence before reading the article in its entirety?
- Was I able to interpret the results and its clinical importance?
- Am I able to communicate the findings of the evidence to my colleagues or a patient?
- Am I proactively monitoring for newly emerging evidence in my field of practice?

$$ Useful tips: Evidence in healthcare rapidly changes. Here some strategies that might help make the steps of evidence-based practice more routine and support you to 'stay up to-date' with evidence.

1. Keep a log of your clinical questions. It can be useful to reflect on how you ask clinical questions and how your knowledge of the evidence evolves.
2. Treat yourself - Get cosy with a cuppa and a research paper. Set time aside each week to read one research paper. Why? Let me count the ways… it will help you apply your new found skills in evidence-based practice, you will become faster at reading and interpreting the findings (remember targeted reading), your clinical practice will become more evidence-based, you will start to question more, it counts towards your continuing professional development required for registration…. I can continue but I won't. You may not understand everything about the paper but take the opportunity to talk to your colleagues or someone who may be more familiar with interpreting research.
3. Share it with others - Start your own journal club. Why get cosy with a cuppa on your own, invite your friends and colleagues to read the same paper and then take the opportunity to discuss the results. BAM you have started your own journal club.
4. Get alerts - sign up to email alerts. Many databases can be set up in a way to bring relevant research literature to you via a periodic email notification. Alternatively, you can sign up to receive the 'table of contents' from journals in your area.
5. Commit to continued improvement - Are the policies and procedures for your ward/place of work based on current evidence? Do you have all of the answers? Does your team strive to do better? Committing to continually improving our professional practice allows marginal shifts in performance overtime and is easier to than overhauling practice. Integrating the perspective and habits to routine scope and make change in health care can be challenging at first, but many professionals find higher satisfaction at work when they are being to innovate and apply new approaches routinely.

5 STEPS OF EVIDENCE-BASED PRACTICE SUMMARY

STEP 1: Ask – The components of a well-defined and answerable question, page 9

PICO framework:

- Patient, population or problem
- Intervention (Index test or indicator)
- Comparator
- Outcome

STEP 2: Acquiring the literature, page 14

- The evidence hierarchy – identifying the best (least biased) evidence to answer your question
- **Where to search:**
  - Systematic reviews: Campbell collaboration, Cochrane Library, Joanna Briggs Institute, TRIP database, EBM Reviews
  - Point of care summaries and resources: BMJ Best Practice, UpToDate
  - Clinical and Best Practice Guidelines databases: Australian Therapeutic Guidelines, Agency for Healthcare Research and Quality National Guideline Clearinghouse, National Institute for Health and Care Excellence (NICE), Northern NSW LHD Documents, Medical Journal of Australia
  - Medical databases: PubMed, EMBASE
  - Discipline specific databases:
    - Physiotherapy: PEDro
    - Occupational therapy: OTseeker
    - Speech Pathology: SpeechBite
    - Social care and social work: Social Care Online
    - Psychological database: NeuroBite
  - Local Health District Library services and support
    - CIAP

STEP 3: Appraise, page 24

- Gold standard vs pragmatic approach to critical appraisal
- **Pragmatic approach**

1. **Are the results BELIEVABLE?**
   - **ALIGN**

   Question 1: From the title and abstract of the paper, can you identify the elements of an answerable research question?

   Question 2: Did the authors use the appropriate study design to answer their research question?

   - **DESIGN**

   Question 3: Is the study sample representative of the population?

Question 4: Were validated outcome measures used? Were data collection methods the same for all participants?

- **CONDUCT**

Question 5: Were all participants who entered the study followed up?

2. **Are the results USEFUL?**

Question 1: Does the study and results apply to my patient(s)?

Question 2: Are the results of the study likely going to be clinically important (i.e., meaningful) to me and/or my patient(s)?

STEP 4: Apply – how to interpret the findings, page 37

- Two ways of assessing intervention effects:
    - Quantitative data: mean differences; point of no difference = 0
    - Qualitative data: ratios; point of no difference = 1
- Results are reported as:
    - Point estimate = mean treatment effect
    - 95% Confidence interval = range between which the true population effect lies
- Interpreting 95% confidence intervals = 95% confidence interval that does not include the null value of no difference indicates a significant finding (p-value < 0.05).
- Clinical significance = the size of the treatment effect and the practical importance or real-world impact of this treatment effect on your patient(s) daily life. Needs to be considered when interpreting and applying the evidence.

STEP 5: Assess, page 46

- The final step of evidence-based practice is to assess your own effectiveness and efficiency with steps 1-4 evidence-based practice process.

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Resources:

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Hoffman T, Bennett S and Del Mar CB. Evidence-Based Practice Across the Health Professions 3rd Edition – 25 May, 2017

National Health and Medical Research Council (NHMRC) levels of evidence and grades for recommendations for developers of guidelines. December 2009. https://www.nhmrc.gov.au/sites/default/files/images/NHMRC%20Levels%20and%20Grades%20(2009).pdf Accessed 11 April 2022.

Greenhalgh T. How to Read a Paper: The Basics of Evidence-Based Medicine. 5th Edition – 28 March 2014

Sackett, D., Rosenberg, W., Gray, J., et al. (1996). Evidence based medicine: what it is and what it isn't: it's about integrating individual clinical expertise and the best external evidence. *BMJ*, 312, 71-72. doi: http://dx.doi.org/10.1136/bmj.312.7023.71

Centre of Evidence Based Medicine (CEBM). Catalogue of bias: https://catalogofbias.org/

APPENDIX: Yeh et al article

Yeh et al Parachute use to prevent death and major trauma when jumping from aircraft: randomized controlled trial. BMJ. 2018 Dec 13;363:k5094. doi: 10.1136/bmj.k5094.

Please click on the “attachments” icon on the left side bar in Adobe Acrobat Reader (as per screen grab below) to access the article.