List 5 critical thinking skills.
- Reasoning
- Evaluating
- Problem solving
- Decision making
- Analysing

How do we identify a “good” healthcare provider?
- Patient Characteristics
- Clinical Expertise
- Current best research evidence

What is clinical expertise?
Clinical expertise is the ability to use skills and past experience to rapidly identify each patient’s unique health state and weigh potential interventions.

What is research evidence?
Research evidence is clinically relevant research into diagnostic tests, prognostic markers and interventions.

What are patient characteristics?
Patient characteristics are the unique preferences, concerns and expectations of each patient which must be integrated into decision-making.

What is the problem with making decisions from a clinical expertise approach?
Clinical expertise is a subjective experience which can result in the expert diagnosing the problem as an illness he/ she has seen in the past without considering the possibility that it is something unusual.

List 4 approaches we don’t use to make clinical decisions.
- Intuition
- Unsystematic clinical experience
- Pathophysiological rationale
- Observation alone

What is evidence based medicine?
Evidence based medicine is informed clinical reasoning.

List 3 reasons why evidence-based medicine is best.
- Traditional sources of information are often invalid. E.g. textbooks, experts, continuing education
- Experience and up-to-date information have an inverse relationship
- Clinicians are busy

Why are traditional sources of information often invalid?
Textbooks are continually being printed in new editions with updated information and you cannot attend every research seminar to keep up.

How do experience and up-to-date information have an inverse relationship?
Experience is built by doing the same thing repeatedly whereas if you are keeping up with up-to-date information, practices are forever changing and your experience is invalid.

List the 5 steps in evidence-based practice.
1. Patient creates need for information
2. The information needed is converted into an answerable question
3. The evidence is consulted
4. The evidence is appraised
5. Clinical performance is evaluated

What was the purpose of Delay et al. (2001) research into current practice and opinions in ACL reconstruction and rehabilitation?
The purpose was to determine current opinion of Orthopaedic Surgeons about ACL techniques and pre-operation and post-operation management.

List 3 findings regarding ACL reconstruction and rehabilitation.
- Immediate weight bearing does not produce excessive loads that permanently deform graft or fixation
- Tends to lower the incident of anterior knee pain.
- 36% of surgeons delay full weight bearing for 1-3 weeks after surgery

Define “evidence”.
Evidence is the results of clinically relevant research, often from the basic sciences of medicine, but especially from patient-centred research.
List 3 research topics for patient-centred research.
- Accuracy and precision of diagnostic testing
- Efficacy of therapeutic regimens
- Power of prognostic markers

List 4 things that evidence is not.
- Continuing education
- Text books
- Class notes
- Expert advice

List 8 barriers to evidence-based medicine.
- It requires a difference mindset
- It requires new skills in searching for and appraising the literature
- Many aspects of medicine have no evidence
- We can’t all agree on the evidence
- New evidence sometimes disproves old evidence
- Protocols stifle innovation
- “It’s really just common sense...” – it’s expected that people are already diagnosing based on evidence
- It creates an illusion that patients fit into discrete categories

List 2 fundamental principles of evidence-based practice.
- Evidence is never enough: Individual patient values, cost/benefit analysis
- Not all evidence is equal: Hierarchy of evidence, dependent upon the type of question being asked

List 4 reasons why we need evidence-based practice.
- Information overload
- Gap between experience and performance
- Variations in Practice-Destiny of Geography
- Gaps between when we know something to be true and when it is implemented (our patients are smarter than we are)

List 2 reasons why information overload is relevant.
- There are too many new publications to keep up with
- There is too much literature that is irrelevant to direct patient care.

List 3 “PUSH” (evidence brought to you) strategies to cope with information overload as a practitioner.
- Subscribe to “table of contents”
- Subscribe to a private review service

List 3 “PULL” (you find the evidence) strategies to cope with information overload as a practitioner.
- Individual searches
- Keep a logbook of your own clinical questions
- Run a case-discussion journal club with your colleagues

What are 3 findings of the review into The Relationship between Clinical Experience and Quality of Health Care?
- Physicians who have been in practice for more years and older physicians possess less factual knowledge, are less likely to adhere to appropriate standards of care and may also have poorer patient outcomes.
- Physicians “toolkits” are created during training and may not be updated regularly.
- Evidence-based medicine is a new approach in medicine and more experienced physicians may have less familiarity with these strategies and may be less accepting of them.

What is the Clinical Practice Truth Table?

<table>
<thead>
<tr>
<th>Treatment is applied</th>
<th>Patient gets better</th>
<th>Patient doesn’t get better</th>
</tr>
</thead>
<tbody>
<tr>
<td>Treatment is not applied</td>
<td>We remember</td>
<td>We forget/ don’t know</td>
</tr>
<tr>
<td>We never know</td>
<td>We never know</td>
<td></td>
</tr>
</tbody>
</table>

What is the problem with induction when considering a treatment?
Studies create statistics to demonstrate the effectiveness of a treatment however the improvement of patients’ condition may not be a direct result of the intervention. You can never know what would have happened if you had done something else. This is why controls and placebo groups are important.

What is practice variation?
Practice variation is the variation between practitioners on how a particular illness is treated. For example, it is common practice to vaccinate in some suburbs than it is in others.
What determines the clinical decision to treat some, but not other, individuals with hypertension?

(a) Level of blood pressure  
(b) Patients age  
(c) Physicians year of graduation from medical school  
(d) The amount of target organ damage

List 4 reasons for Evidence Based practice.

- Daily need to valid information
- Practice variation
- Can you rely on experience?
- Evidence ‘gap’

What is the evidence gap?
The evidence gap is the time between when we know something versus when it is implemented in clinical practice.

Should ultrasound be used to speed the healing time of musculoskeletal conditions?
The theory is that ultrasounds improve blood supply and speed healing of musculoskeletal conditions however there is no evidence to support this therefore ultrasounds should not be used to treat musculoskeletal conditions. This is why evidence based practice is best because it filters out false theories.

What is the evidence based practice goal or end result?
For a specific clinical question, gather and critically appraise evidence, then translate your critical appraisals into direct clinical action, and assess your performance.

What role does clinical expertise have on evidence based practice?
Clinical expertise decides whether the evidence applies to the individual patient and if so, how it is to be integrated into a clinical decision.

LECTURE 2: INTRODUCTION TO RESEARCH METHODOLOGY- DESIGNING CLINICAL RESEARCH

Define variable.
A variable is a characteristic that can be manipulated or observed and that can take on different values, either quantitatively or qualitatively.

What is an independent variable (IV)?
An independent variable is a condition, intervention or characteristic that will predict or cause a given outcome. The independent variable is something that is manipulated by the researcher.

What are the 2 or more levels of an independent variable?
- Groups  
- conditions

Provide an example of an independent variable.
An example of an independent variable is a study comparing the effectiveness of spinal manipulation (SMT) versus a walking program for patients with low back pain (LBP). The independent variables are spinal manipulation and the walking program.

What is a dependent variable?
A dependent variable is a response or effect that is presumed to vary depending on the independent variable(s). The dependent variable is the outcome variable. A dependent variable describes the details related to the method of measurement.

Provide an example of a dependent variable.
An example of a dependent variable is a study comparing the ability to improve low back pain among patients randomised to undergo spinal manipulation or a walking program. The dependent variable is the level of low back pain.

List 3 ways to measure the level of low back pain.
- Pain intensity can be measured on a scale from 0-10, with 10 being the most pain imaginable.  
- Rate pain using words such as ‘minor’, ‘moderate’ and ‘severe’.  
- How pain affected their activities of daily living to measure impact.

What is an operational definition?
An operation definition is the definition of a variable based on how it will be used in a particular study; how a dependent variable will be measured, how an independent variable will be manipulated.
What is a conceptual definition?
A conceptual definition is a dictionary definition which covers a broad base of the term and is widely accepted but may not fit exactly what you are studying.

What is an operational definition?
An operational definition defines a variable according to its unique meaning in the study.

Provide an example of an independent variable operational definition.
Walking program = 10 weeks of daily walking sessions of 60 minutes at a target intensity of 50% HRM, as supervised by an exercise physiologist.

Provide an example of a dependent variable operational definition.
Low back pain = low back pain intensity as measured on the numeric pain rating scale (Smith et al., 2009) as measured at the beginning of each treatment session.

In which section of a research paper are the operational definitions included?
Operational definitions are included in the statement of research objectives.

List 3 components of the statement of research objectives.
- Provide clarification for the objective(s) of the study (Research objectives)
- Specific, concise, delineate what is to be accomplished (purpose statement)(Specific aims)
- Include the variables and population studied.
- Hypothesis is sometimes included.

Provide an example of a statement of research objective.
The purpose of this study was to compare the long-term survival of subjects with heart disease randomised to receive aspirin therapy, aerobic exercise or a placebo.

List the levels of the treatment group for the independent variable.
- Aspirin
- aerobic exercise
- placebo

What is the dependent variable?
The dependent variable is survival.

Provide another example of a statement of research objective.
The purpose of this study was to examine for change in shoulder range of motion before and after 2 weeks of physiotherapy.

List the levels of the treatment group for the independent variable.
- Baseline
- 2 weeks (TIME CAN BE AN INDEPENDENT VARIABLE)

What is the dependent variable?
The dependent variable is the change in shoulder range of motion.

In which section of a research paper is the statement of research objectives included?
The research objectives are stated at the end of the introduction section.

List 4 types of research objectives.
- Comparing for differences
- Exploring for relationships
- Describing phenomenon
- Examining measurement issues

Provide an example of comparing for differences research objective statement.
We will examine for differences in pain intensity among patients with low back pain who will be randomised to receive either spinal manipulation therapy or exercise.

Provide an example of exploring for relationships research objective statement.
We will seek to identify the level of correlation between video game use and body mass index.

Provide an example of a describing phenomenon research objective statement.
We will describe the types of musculoskeletal health complaints often encountered by exercise physiologists practicing in a rural health setting.

Provide an example of an examining measurement issues research objective statement.
We will examine the validity of motion palpation by comparing the manual assessment of joint motion with videofluoscopy.
**What is the aim of examining measurement issues?**
The aim of examining measurement issues is to measure properties such as reliability, validity and responsiveness in research studies.

**Define hypothesis.**
A hypothesis is a statement of the expected relationship between variables.

**What is a research hypothesis?**
A research hypothesis states the researcher’s expectation of results. The hypothesis is either directional or non-directional meaning it does or does not predict the direction of change. Research hypothesis is also known as alternative hypothesis.

**What is a non-directional hypothesis?**
A non-directional hypothesis is a research hypothesis (or alternative hypothesis) that does not indicate the expected direction of the relationship between variables.

**What is a directional hypothesis?**
A directional hypothesis describes the relationship between variables in terms of a difference and assigns a direction to that difference.

**What is a simple hypothesis?**
A simple hypothesis includes one independent variable and one dependent variable.

**What is a complex hypothesis?**
A complex hypothesis contains more than one independent or dependent variable. Complex hypotheses are non-directional because of the potential difficulty in clarifying multiple relationships. They are efficient for expressing expected research outcomes in a research report, but they cannot be tested. For analysis purposes, they must be broken down into several simple hypotheses. Several hypotheses can be addressed in a single study.

**Provide an example of a non-directional research hypothesis.**
There will be a difference in perceived learning between students enrolled in online or on-campus courses.

**Provide an example of a directional research hypothesis.**
Student enrolled in on-campus courses will exhibit higher levels of perceived learning as compared to students enrolled in online courses.

**What is a statistical hypothesis?**
A statistical hypothesis, also known as a null hypothesis, is interested in finding empirical statistics. It is a statement of no difference or no relationship between variables.

**Provide an example of a statistical hypothesis.**
There will be no difference in perceived learning between students enrolled in online classes and those enrolled in on-campus courses.

**How are study participants selected?**
The researcher seeks to identify a sample of individuals who resemble the population of interest.

**Define population.**
Population refers to persons, objects or events that meet a specific set of criteria. Population is the entire set of individuals or units to which data will be generalised.

**Define target population.**
Target population is the larger population to which results of a study will be generalised to.

**Define accessible population.**
Accessible population is the actual population of subjects available to be chosen for a study. This group is usually a non-random subset of the target population.

**Define sample.**
A sample is a subgroup of the population of interest which allows the results of research to be generalised to the population.

**Who is the target population for a study of sports scientists’ attitudes about rehabilitation following hamstring injury?**
The target population is sports scientists practicing in Australia.
Who is the accessible population for a study of sports scientists’ attitudes about rehabilitation following hamstring injury?
The accessible population is active members of Exercise and Sports Science Australia (ESSA).

Who is sample for a study of sports scientists’ attitudes about rehabilitation following hamstring injury?
The sample is sports scientists chosen at random who answer a survey.

Define sampling bias.
Sampling bias is when individuals in a sample do not represent the attributes of the population. Bias is a form of error and leads the results away from the truth.

Define conscious sampling bias.
Conscious sampling bias is when a sample is purposely selected.

Define unconscious sampling bias.
Unconscious sampling bias is when the researcher’s own bias affects recruitment of subjects.

Define sampling error.
Sampling error is the difference between sample statistics and population parameters.

Define probability sampling.
Probability sampling is a process of random selection in which each individual in a population has an equal chance of being selected. Probability sampling uses randomised methods. Probability sampling helps to eliminate bias and is results where the sample is considered to represent the population. Probability sampling is also known as random sampling.

Define non-probability sampling.
Non-probability sampling is when selection of participants is by non-random methods. There may be biased regarding age, severity of the condition, socioeconomic status etc. In non-probability sampling, the sample is not considered to represent the population.

Define random assignment.
Random assignment is what we do with people once they are part of the sample in the study. Random assignment is the assignment of subjects to groups using probability methods, where every subject has an equal chance of being assigned to each group. Random assignment is also known as randomisation.

Define simple random sampling.
Simple random sampling, also known as random selection, draws on random sample from an accessible population. Simple random sampling is often accomplished with a table of random numbers, or computer generated list of numbers. Everyone has equal chance of getting into the study.

Define convenience sampling.
Convenience sampling is the most common non-probability sampling technique as it is extremely efficient and convenient. In convenience sampling, subjects are chosen based on their availability.

List 4 things to consider when evaluating resources found when researching.
- Relevance | Is the resource relevant to your topic?
- Currency | Is the resource up-to-date? Does it consider the latest research in your field?
- Reliability | Is the resource from a reliable source? Can you find out who the author is, what their qualifications are and with whom they are affiliated? Is it a reputable, peer-reviewed article?
- Accuracy | Is the resource accurate and precise? Is the information contained therein properly referenced? If it is original research, is there evidence that the research actually took place?

What are the 5 search steps?
1. Define (understand) your topic | Use a dictionary or encyclopaedia
2. Find background information | Look for books in the library catalogue
3. Find detailed information | Search the journal literature
4. Find original research | Keep good records and learn about citation styles
5. Organise and manage your information | Write assignment

What are assumptions?
Assumptions are concepts or principles that are assumed to be true, based on documented evidence of accepted theoretical premises.