Learning Objectives

• Understand what learning outcomes in a critical appraisal class/workshop are and why they matter
• Work from a framework for teaching critical appraisal concepts
• Identify your own knowledge gaps when it comes to critical appraisal
  o Locate and use resources to help close these knowledge gaps
Agenda

• Introduction
• Pre-assessment
• Why critical appraisal?
• Introduction to therapy
• Introduction to diagnosis
• Introduction to systematic reviews & meta-analyses
• Activity
• Post-assessment
• Questions
Pre-Assessment

https://tinyurl.com/IHSLA2018
tinyurl.com/IHSLADoc
Key Points

• Critical appraisal is an important clinical skill for anyone who will be providing patient care.
• As information professionals, we should also be able to evaluate medical literature for reproducibility, generalizability, and bias.
Why critical appraisal?

- Clinical decision making should be as free from error caused by bias or poor study design as possible.
- Critical appraisal skills help medical professionals evaluate evidence for strengths, weaknesses, and clinical applicability.
Consensus that EBM improves patient care is high (98%), but many physicians lack familiarity with critical appraisal concepts. (Reshma et al, 2017)
Did You Know?

Numerous studies have shown weak or inappropriate study designs, misinterpretation of results, selective reporting, selectively citing literature, and drawing unjustified conclusions. (Inam 2007)
Practicing Evidence-Based Medicine

Best Evidence

Patient Values

Clinical Expertise
Before You Start

1. Formulate your question using PICO format
2. Conduct a systematic, well-constructed search
3. Identify the best evidence to answer your question
Resources

• JAMA Evidence
• EBM Libguide
  http://iupui.campusguides.com/EBM/home
• EBM Toolbox
  https://ebm-tools.knowledgetranslation.net/
• Students 4 Best Evidence
  www.students4bestevidence.net
Therapy

- Study Types
- Minimizing Bias
- Interpreting Results
- Risk vs. Benefit
Therapy: Study Types

Randomized Controlled Trial
Therapy: Minimizing Bias

- Were subjects randomly assigned to groups?
- Were all subjects accounted for at the end of the study?
- Was the study blinded?
- Was treatment allocation concealed?
Sample Methodology

The study was a randomised, controlled, parallel group trial with two arms: paramedics in the active arm administered titrated oxygen treatment and those in the control arm administered conventional high flow oxygen treatment. We invited paramedics from the Tasmanian Ambulance Service to participate in the study and used cluster randomisation to assign them to one of the treatment groups. We used computerised random number generation after stratification by rurality, to reduce differences associated with transportation time between urban and rural areas. This procedure ensured that treatment allocation was concealed before randomisation. Neither paramedics nor the research team were blinded to treatment after randomisation. In situations in which multiple paramedics...
Therapy: Interpreting Results

• Can you apply the results to your patient? Should you?
• Which outcomes were reported? Which weren’t?
• Is it feasible and cost-effective?
• Does it meet patient expectations?
Therapy: Risk vs. Benefit

- Look for absolute numbers in the results
- Absolute risk reduction & numbers needed to treat

Comparisons

- Pre-intervention risk: 80%
- Post-intervention risk: 40%
- Pre-intervention risk: 4%
- Post-intervention risk: 2%
Diagnosis

Study Types

Minimizing Bias

Interpreting Results
Diagnosis: Study Types

• Often you will see an independent, blind comparison to a reference (gold standard) for diagnostic tests.
• Systematic review/MA is still the highest level of evidence.
Diagnosis: Minimizing Bias

• What were inclusion/exclusion criteria for subjects?
• Were all results compared against the standard?
• Are all outcomes clearly reported?
Diagnosis: Interpreting Results

• How were the results presented?
• How precise were the results?
• Does the study population align with my patient?
• Is it likely that new evidence has been found since this study was published?
# Likelihood Ratios

<table>
<thead>
<tr>
<th>Likelihood Ratio</th>
<th>Approximate Change in Probability (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Values between 0 and 1 decrease the probability of disease</td>
<td></td>
</tr>
<tr>
<td>0.1</td>
<td>−45</td>
</tr>
<tr>
<td>0.2</td>
<td>−30</td>
</tr>
<tr>
<td>0.3</td>
<td>−25</td>
</tr>
<tr>
<td>0.4</td>
<td>−20</td>
</tr>
<tr>
<td>0.5</td>
<td>−15</td>
</tr>
<tr>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Values greater than 1 increase the probability of disease</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>+15</td>
</tr>
<tr>
<td>3</td>
<td>+20</td>
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<tr>
<td>4</td>
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<tr>
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<tr>
<td>9</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>+45</td>
</tr>
</tbody>
</table>
LR Example

• Among patients with abdominal distension who undergo ultrasonography, the physical sign “bulging flanks” is present in **80% of patients with confirmed ascites** and in **40% without ascites** (i.e., the distension is from fat or gas). Similarly, the finding of “flank tympany” is present in **10% of patients with ascites** but in **30% with distension from other causes**.

\[
LR = \frac{\text{probability of finding in patients with disease}}{\text{probability of same finding in patients without disease}}
\]
Systematic Reviews and Meta-Analyses

- Bias
- Methodology
- Combining the Studies
- Interpreting the Results
SR and MA: Bias

- Bias in the original studies
  - Randomization
  - Allocation concealment
  - ITT
  - Conflict of interest
  - Sample selection/size

- Scope of the evidence
  - Publication bias
  - Selective outcome reporting bias
SR and MA: Methodology

- Could you do the search exactly as described in the methodology?
- Can you tell how the studies were selected for inclusion or exclusion?
- Were studies homogenous enough to combine?
Methodology Example #1

This produced the following basic search strategy:

(1) migraine
(2) magnesium
(3) 1 AND 2.

The search was refined, expanded and used on the electronically indexed databases, including the Medline, EMBASE and CINAHL, through the NHS Evidence healthcare databases interface. The Cochrane Central Register of Controlled Trials was searched using the terms ‘migraine’, ‘headache’ and ‘magnesium’. Other sources used
APPENDIX: SEARCH STRATEGIES ON MEDLINE

1. acute lung injury; ti, ab, kw.
2. ALI; ti, ab, kw.
3. acute respiratory distress syndrome; ti, ab, kw.
4. ARDS; ti, ab, kw.
5. 1 or 2 or 3 or 4
6. open lung; ti, ab, kw.
7. lung recruitment; ti, ab, kw.
8. recruitment maneuvers; ti, ab, kw.
9. alveolar recruitment; ti, ab, kw.
10. positive end-expiratory pressure; ti, ab, kw.
11. PEEP; ti, ab, kw.
12. 6 or 7 or 8 or 9 or 10 or 11
13. randomized controlled trial; pt.
14. controlled clinical trial; pt.
15. randomized; ti, ab.
16. placebo; ti, ab.
17. randomly; ti, ab.
18. trial; ti.
19. 13 or 14 or 15 or 16 or 17 or 18
20. 5 and 12 and 19
Methodology Example #3

Studies were considered eligible for the meta-analysis if they were double-blind, RCTs of intravenous magnesium given for acute migraine attacks in adults. We included trials only if they were conducted in a setting that indicated headache as an acute episode – emergency department or headache clinic.

Two independent reviewers identified studies for eligibility. Papers considered potentially relevant were selected and the full manuscripts were reviewed for inclusion. Two independent reviewers abstracted information on patients, study design, primary and secondary outcomes, key results and study weaknesses onto specially designed, pretested forms. Disagreements were resolved by consensus.
Methodology Example #4

458 Published articles searched in Pubmed, Embase, Web of Science and Cochrane Database

- 62 Duplicate studies excluded
- 396 Articles screened based on titles and abstracts

- 330 Excluded (not relevant, reviews and meta-analyses, not RCTs, studied other treatment, inappropriate study population)

- 66 full-text articles identified for full review

- 51 Excluded
  - 18 Inappropriate study design
  - 12 Not relevant intervention
  - 11 Had an inappropriate study patients
  - 9 No outcomes of interest to review
  - 1 Overlapping data

- 15 RCTs studies included in the analysis
Do you have to include a meta-analysis in your systematic review?
Should You Perform a MA?

- Variety of comparators
- Variety of interventions
- Variety of outcome measures
- Variety of study participants
- Primary outcome endpoints
- Statistical measures of heterogeneity
SR and MA: Interpreting the Results

Risk difference meta-analysis plot (random effects)

Frank et al. [15] -0.05 (-0.30 to 0.21)
Cete et al. [16] 0.21 (-0.02 to 0.41)
Ginder et al. [17] -0.34 (-0.60 to -0.05)
Corbo et al. [18] -0.24 (-0.47 to -0.03)
Bigal et al. [19] 0.00 (-0.14 to 0.14)
Combined (random) -0.07 (-0.23 to 0.09)
Activity!

• In pairs, we’re going to do a role playing activity.
• Give a short (60-90 second) elevator speech to a stakeholder in EBM at your organization.
• Convince them to support a class or workshop on critical appraisal.
Post-Assessment

https://tinyurl.com/IHSLAPost
References

- Inam, SN. Experience of teaching critical appraisal of scientific literature to undergraduate and postgraduate students at the Ziauddin Medical University, Karachi, Pakistan. Int J Health Sci 2007. 1(1) 119-124.
Questions?

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