Critical Appraisal of Topics (CAT) for RDs

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Think of Literature as a “Shortcut”
But, use the Strongest Evidence

- Systematic Reviews and Meta-Analyses
- Randomized Controlled Trials
- Cohort Studies
- Case-Control Studies
- Case Series, Case Reports
- Editorials, Expert Opinion
And, a Critical Eye

Random Error: Due to Chance

Systematic Error: Due to Human Influence (Bias)
Research Studies

Observational
“watch & describe”

Experimental
“intervene & compare”
Observational

Cross-sectional

Cohort

Case-control

Case report/series
Randomized Controlled Trial

Before & After Study

Experimental
Data Collection by Study Type

<table>
<thead>
<tr>
<th>Past</th>
<th>Present</th>
<th>Future</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cross-sectional study</td>
<td>Prospective cohort</td>
<td>- Data collection forms</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Study protocols</td>
</tr>
<tr>
<td>Retrospective cohort</td>
<td></td>
<td>- Chart audits</td>
</tr>
<tr>
<td>Case-control study</td>
<td>RCT</td>
<td>- Self-report questionnaires</td>
</tr>
<tr>
<td>Before-after study</td>
<td></td>
<td>- Data collection forms</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Study protocols</td>
</tr>
</tbody>
</table>
Organize: CAT Format

- Provides a structure for analyzing a body of literature
- Helps to targeting similarities and differences
  - Methods
  - Populations
  - Outcomes
- Facilitates decision-making
Organize: CAT Format

Critically Appraised Topic (CAT)

Title:
CAT Author:
CAT Date:

Background/Clinical Scenario:

Section I: Identify the PICO question

<table>
<thead>
<tr>
<th>Population (patient or problem)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Intervention (or therapy being evaluated)</td>
<td></td>
</tr>
<tr>
<td>Comparison (or control group)</td>
<td></td>
</tr>
<tr>
<td>Outcome (specific, measurable effect)</td>
<td></td>
</tr>
</tbody>
</table>

Section II: Search Strategy and Results

Databases searched:

Search strategies: [list strategy for each database]

Filters/limits (publication date, age, etc.):

Study selection process:
Evaluating Healthcare Research

Are the results valid?

Are the results important?
EXPERIMENTAL STUDIES
CAT Format – RCT

Section III: Are the results valid?

Article 1: TITLE (Author, Year)

P:
I:
C:
O:

Randomized Controlled Trial (RCT):

<table>
<thead>
<tr>
<th>Are the results of this RCT valid?</th>
<th>Yes/No/NA</th>
<th>Comments:</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Was the allocation of patients randomized?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Was randomization blinded (if possible)?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Were groups similar at the start of the trial?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Was follow-up sufficiently long and complete?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Were all patients analyzed with their assigned group?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Were patients, clinicians, &amp; study personnel blinded?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Were patients treated equally (except intervention)?</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Overall</td>
<td></td>
</tr>
</tbody>
</table>

Outcome(s) of interest:
Include statistics (i.e., effect size, 95% confidence interval, p-value)
Selection bias
Performance bias
Detection bias
Attrition bias
Selection Bias

- Sample size
- Randomization
- Allocation concealment
  - Person randomizing subjects unaware of group assignment
- Goal = similarity of subjects in each group

This study was designed as a randomized controlled clinical trial. Participants were randomized, using a computer-generated 1:1 process, to the intervention or standard of care control arm and followed for 12 weeks.
Blinding

• **Performance Bias**
  • Subjects = decreases differences in behavior or response
  • Researchers and/or clinical staff = ensures similar treatment of both groups

• **Detection Bias**
  • Evaluators = ensures neutral assessment of outcomes
Attrition Bias

- Loss to follow-up
  - < 5% = little bias
  - > 20% = serious threat
- Intent-to-treat analysis
- Length of follow-up
**Section III:** Are the results valid?

**Article 2: TITLE (Author, Year)**

P:
I:
C:
O:

**Observational (Cohort, Case-Control):**

<table>
<thead>
<tr>
<th>Are the results of this observational study valid?</th>
<th>Yes/No/NA</th>
<th>Comments:</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Was a defined, representative sample of patients enrolled at a common point (in time or in disease progression)?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Was patient follow-up sufficiently long and complete?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Were outcome criteria objective (using an explicit definition) or applied in a “blind” fashion?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Were potential confounding factors comparable between groups and/or accounted for using statistical analysis?</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Overall</strong></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Outcome(s) of interest:**
Include statistics (i.e., effect size, 95% confidence interval, p-value)
Selection bias
Information bias
Attrition bias
Selection Bias

- Sample size
- Voluntary participation (prospective)
- Representative sample
  - Demographics
  - Point in disease course
Information Bias

- Self-report (Recall)
  - Distant past
  - Emotional connection
- Interviewer
- Outcome criteria
  - Clearly defined, measurable changes
Confounders

- Factors that directly impact the relationship between exposure and outcome
- Competes with exposure in explaining an outcome
Attrition Bias

- **Loss to follow-up**
  - < 5% = little bias
  - > 20% = serious threat
- **Length of follow-up**
  - Long enough after exposure (prospective)
  - Far enough back (retrospective)
Types of Review Articles

- Meta-analyses
- Systematic reviews
- Individual patient data (IPD) meta-analyses
- Reviews that are not systematic (traditional, narrative reviews)

All reviews (also called overviews)

CAT Format – Systematic Review

**Section III:** Are the results valid?

**Article 3:** TITLE (Author, Year)

P:
I:
C:
O:

*Systematic review/Meta-analysis:*

<table>
<thead>
<tr>
<th>Are the results of this systematic review valid?</th>
<th>Yes/No/NA</th>
<th>Comments:</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Is this a systematic review of randomized trials?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Is a comprehensive/detailed search described?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Were individual studies assessed for validity?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Were individual patient or aggregate data used in the analysis?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Are results consistent across studies?</td>
<td></td>
<td></td>
</tr>
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</table>

**Outcome(s) of interest:**
Include statistics (i.e., effect size, 95% confidence interval, p-value)
Purpose of Systematic Review

• Summarize results of multiple, well-designed studies

• Provide high-level evidence for decision making

• If studies are similar enough, then results can be combined to draw stronger conclusions (meta-analysis)
Systematic Review Process

• Methodical
  • Focused clinical question
• Objective
  • Exhaustive and detailed search
  • Detailed inclusion criteria
  • Independent review by multiple authors
Bias in Systematic Reviews

- Quality of studies
  - Publication bias (funnel plot)
  - Quality assessment
    - Cochrane
    - Ottawa-Newcastle scale
Evaluating Healthcare Research

- Are the results valid?

- Are the results important?
P-value

How mathematically significant are the differences?

“factors that raise your chance of divorce include living in a red state, having twins, and contracting cervical or testicular cancer…”

differences between groups

relationships between things

p < 0.05
<table>
<thead>
<tr>
<th>Statistically significant AND clinically important</th>
<th>Not statistically significant BUT clinically important</th>
<th>Statistically significant BUT NOT clinically important</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Important and meaningful difference between groups</td>
<td>• Noticeable effect for patients with no mathematical differences noted</td>
<td>• Differences can be mathematically significant but clinically negligible (i.e., small effect size)</td>
</tr>
<tr>
<td>• Noticeable effect for patients supported by mathematical differences in outcomes</td>
<td>• Can occur when sample sizes are small or cases are rare</td>
<td>• Large sample size can lead to more mathematical differences between groups</td>
</tr>
<tr>
<td></td>
<td>• Includes decisions driven by case series and/or case reports</td>
<td></td>
</tr>
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Results of Systematic Review

Qualitative synthesis
- Study findings are systematically compared using a series of expert judgements

Quantitative synthesis
- Numerical data about effects of the treatment are pooled and analyzed together (meta-analysis)
Meta-Analysis: Heterogeneity

How different are the studies in a Systematic Review?

- Study Design
  - Participants
  - Interventions
- If similar enough, then meta-analysis is possible
- Outcomes
  - I² statistic (goal = 0%)
Meta-Analysis: Forest Plots

What is the outcome when all results are combined?

<table>
<thead>
<tr>
<th>Study</th>
<th>Dexamethasone group</th>
<th>Placebo group</th>
<th>Relative risk (fixed) (95% CI)</th>
<th>Weight (%)</th>
<th>Relative risk (fixed) (95% CI)</th>
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<tbody>
<tr>
<td>Innes 1999</td>
<td>9/49</td>
<td>22/49</td>
<td>0.41 (0.21 to 0.80)</td>
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<tr>
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<td></td>
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<tr>
<td>Total (95% CI)</td>
<td>385</td>
<td>353</td>
<td></td>
<td>100.00</td>
<td>0.74 (0.60 to 0.90)</td>
</tr>
</tbody>
</table>

Test for heterogeneity: $\chi^2 = 6.21, df = 6, P = 0.40, I^2 = 3.4\%$

Test for overall effect: $z = 3.01, P = 0.003$

Overall effect (pooled)
Meta-Analysis: Forest Plots

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Total (95% CI): 385/353
Test for heterogeneity: \( \chi^2 = 6.21, df = 6, P = 0.40, I^2 = 3.4\% \)
Test for overall effect: \( z = 3.01, P = 0.003 \)
Section IV: Are the valid results of this treatment important? (magnitude of the effect, precision of measurements)

<table>
<thead>
<tr>
<th>Is the valid, important evidence applicable to our patient?</th>
<th>Yes/No/NA</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Is our patient so different from those in the study that results cannot be applied?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Is the treatment feasible in our setting?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• What are the potential benefits and harms from the treatment?</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Do our patient’s values support using the therapy?</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

| Overall | | |

Clinical Bottom Line:
"Statistics are like bikinis. What they reveal is suggestive, but what they conceal is vital."

AARON LEVENSTEIN