HOW TO TEACH ABOUT TEACHING ABOUT SYSTEMATIC REVIEWS

David Nunan, PhD
Research Fellow at the Department of Primary Care Health Sciences and Tutor at Centre for Evidence based medicine
University of Oxford

November 2014
If you had to teach an EBM session on systematic reviews, what would you consider the ‘essentials’?
My aims for this session

Give sample of one of my sessions on SR

Pass on some of my teaching tips

Learn from you
Hands up if the 1\textsuperscript{st} (or 2\textsuperscript{nd}) thing you do when preparing for a teaching session =
November 06, 2014

10 tips for improving your presentations & speeches

In September of this year, I was asked back to the TEDxKyoto stage to give a few words regarding tips from storytelling as they relate to modern presentations. The 15-minute talk can be viewed below. The title of the talk is "10 Ways to Make..."
19/11/08
Already big!

Know the end goal -
but should you go -
Survey -
Face-to-face -
Interactive -
Worth doing it -
27 (60%)

How can we teach an EBM session on GP -
What would work -
Most important -
Talk in 24/31

Objectives:
- Give simple of one of my sessions or site -
- Have some of my teaching tips -
- Learn from you guys

Problem:
If we start small -
Can we then grow -
Teaching session -
Mr Smith is 64 years old and recently diagnosed with atrial fibrillation, a condition associated with a high risk of stroke.

You wish to know if prescribing warfarin will reduce his risk of stroke?

How will you answer this?

Conduct a trial?

Search and appraise a relevant RCT?

Conduct a systematic review?

Search and appraise a relevant SR?
EBM and Systematic Review

**EBM (quick & dirty)**

- **Steps**
  1. Ask Question
  2. Search
  3. Appraise
  4. Apply

- Time: 120 seconds
- < 20 articles
- **This patient survives!**

**Systematic Review**

- **Steps**
  1. Ask Question
  2. Search ++++ x 2
  3. Appraise x 2
  4. Synthesize
  5. Apply

- Time: 6+ months, team
- < 2,000 articles
- **This patient is dead**

Find a systematic review (and appraise it quickly)!
What is a systematic review?

“The application of strategies that limit bias in the assembly, critical appraisal, and synthesis of all relevant studies on a specific topic”

Oxford Centre of Evidence Based Medicine (OCEBM) Levels Table

Ensures that all available evidence is taken into account and minimises “cherry-picking”

Not performing SRs can be dangerous and/or unethical!
How many people died unnecessarily because a systematic review wasn't performed?
What makes a review “Systematic”?

<table>
<thead>
<tr>
<th>Feature</th>
<th>Systematic review</th>
<th>Narrative review</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Delay or not delay?
Practising EBM – the 4 A’s

- Ask a clinical question
- Acquire the best evidence
- Appraise the evidence
- Apply the evidence

Step 1
Step 2
Step 3
Step 4
Step 1 – Framing the question

- Clear, unambiguous, *structured* question
- Questions formulated around:
  - *P* opulations of interest
  - *I* nterventions
  - *C* ontrol
  - *O* utcomes
Unstructured Question

“Is it better to delay knee surgery?”

– For what?
– For whom?
– Compared to what?
– What is meant by “better”? 
Structured Question

Amongst **adults** with **acute ACL injuries**, does

**Intervention**
*early reconstructive surgery* compared with

**Control**
*delayed reconstructive surgery* lead to

**Outcome 1**
*earlier return to former activity* and/or **Outcome 2**
*less risk of recurrent knee injury*?
Practising EBM – the 4 A’s

- **Step 1**: Ask a clinical question
- **Step 2**: Acquire the best evidence
- **Step 3**: Appraise the evidence
- **Step 4**: Apply the evidence
What do you do?
• You do a search
Early versus delayed surgery for anterior cruciate ligament reconstruction: a systematic review and meta-analysis.

Smith TO, Davies L, Hing CB.

Practising EBM – the 4 A’s

Step 1: Ask a clinical question

Step 2: Acquire the best evidence

Step 3: Appraise the evidence

Step 4: Apply the evidence
‘Critical appraisal is the process of carefully and systematically examining research to judge its trustworthiness, and its value and relevance in a particular context.’
“Hang on. Systematic reviews collect, appraise and combine evidence.”

“So why do we need to appraise them?”

Not all systematic reviews are high quality!
“Odds ratios were exaggerated by 41% for inadequately concealed trials and by 30% for unclearly concealed trials (adjusted for other aspects of quality).”
“Go it alone!”
Tools for critical appraisal

CASP: Critical Appraisal Skills Programme Checklists

Critically Appraised Topics: Generic systematic reviews (DARE; ACP Journal club)

SIGN: Scottish Intercollegiate Guidelines Network (based on AMSTAR)

CEBM: Centre for Evidence Based Medicine Appraisal Sheets (www.cebm.net)
### SYSTEMATIC REVIEW: Are the results of the review valid?

**What question (PICO) did the systematic review address?**

<table>
<thead>
<tr>
<th>What is best?</th>
<th>Where do I find the information?</th>
</tr>
</thead>
<tbody>
<tr>
<td>The main question being addressed should be clearly stated. The exposure, such as a therapy or diagnostic test, and the outcome(s) of interest will often be expressed in terms of a simple relationship.</td>
<td>The <strong>Title, Abstract</strong> or final paragraph of the <strong>Introduction</strong> should clearly state the question. If you still cannot ascertain what the focused question is after reading these sections, search for another paper!</td>
</tr>
</tbody>
</table>

**This paper:** Yes □ No □ Unclear □

**Comment:**

**F - Is it unlikely that important, relevant studies were missed?**

<table>
<thead>
<tr>
<th>What is best?</th>
<th>Where do I find the information?</th>
</tr>
</thead>
<tbody>
<tr>
<td>The starting point for comprehensive search for all relevant studies is the major bibliographic databases (e.g., Medline, Cochrane, EMBASE, etc) but should also include a search of reference lists from relevant studies, and contact with experts, particularly to inquire about unpublished studies. The search should not be limited to</td>
<td>The <strong>Methods</strong> section should describe the search strategy, including the terms used, in some detail. The <strong>Results</strong> section will outline the number of titles and abstracts reviewed, the number of full-text studies retrieved, and the number of studies excluded together with the reasons for exclusion. This information may be presented in a figure or</td>
</tr>
</tbody>
</table>
Critical appraisal

- 2 sections to CEBM systematic review appraisal sheet:
  - A: Are the results of the review valid?
  - B: What were the results?

- 6 questions in total

- We are going to work through each section as a group
Early versus delayed surgery for anterior cruciate ligament reconstruction: a systematic review and meta-analysis

Toby O. Smith · Leigh Davies · Caroline B. Bing

Abstract There is no consensus in the literature regarding the optimal timing of surgical reconstruction of the ruptured anterior cruciate ligament (ACL). Previous authors have suggested that early reconstruction may facilitate an early return to work or sport but may increase the incidence of post-operative complications such as arthrofibrosis. This study systematically reviewed the literature to determine whether ACL reconstruction should be performed acutely following rupture. Medline, CINAHL, AMED, EMBASE databases and grey literature were reviewed with a meta-analysis of pooled mean differences where appropriate. Six papers including 370 ACL reconstructions were included. Early ACL reconstructions were considered as those undertaken within a mean of 3 weeks post-injury; delayed ACL reconstructions were those undertaken a minimum of 6 weeks post-injury. We found there was no difference in clinical outcome between patients who underwent early compared to delayed ACL reconstruction. However, this conclusion is based on the current literature which has substantial methodological limitations.

Keywords Anterior cruciate ligament · Reconstruction · Timing of surgery · Meta-analysis

Introduction

The anterior cruciate ligament (ACL) is the most frequently injured ligament of the knee with an incidence of 8 per 100,000 cases per year [6, 28]. Surgery is the typical treatment for younger athletes or those with physically demanding occupational or sporting pursuits since it restores stability and limits the potential for progressive degeneration and long-term instability of the knee [2, 4, 19]. Surgical techniques of ACL reconstruction have evolved over the past three decades with debate regarding timing of reconstruction [37]. In a national survey by France et al. [12], of 101 consultant orthopaedic surgeons in the UK, 81% reported that they considered the ideal time span from injury to operation to be between 1 and 6 months, although it was acknowledged that only 35% of ACL reconstructions are performed within this timeframe in National Health Service hospitals.

Proponents of early surgical intervention during the initial weeks post-injury have suggested that restoring tibiofemoral stability may minimise the risk of further meniscal and chondral injury which may be associated with degenerative joint changes [3, 9, 35]. Early surgery may also facilitate return to sporting and occupational pursuits with considerable economic consequences. Delayed ACL reconstruction may be associated with an increase in muscle atrophy and reduced strength which may delay early rehabilitation [10, 29]. Conversely, delaying surgical intervention allows optimisation of pre-operative knee range of motion and recovery of surrounding soft tissues from the initial injury potentially reducing the incidence of
1. What question (PICO) did the systematic review address?

- Is question clearly stated early on?
- Treatment/exposure described?
- Comparator/control described?
- Outcome(s) described?

Title, abstract, introduction

post-operative arthrofibrosis and wound complications [17, 31, 37, 38].

There is no consensus in the current literature regarding the optimal time of surgical intervention [29]. The purpose of this study was to assess the effects of duration from injury to surgical intervention for patients undergoing ACL reconstruction by comparing the clinical and radiological outcomes of early to delayed ACL reconstruction following initial injury.
Question 2

2. Is it unlikely that important, relevant studies were missed?

Look for

– Which bibliographic databases were used? More than 1?
– Search terms used (text and MeSH?)
– Search for unpublished as well as published studies?
– Search for non-English studies

Methods
Patients and methods

Data sources and searches

A database search was performed via Ovid of Medline (1950 to June 2009), CINAHL (1982 to June 2009), AMED (1985 to June 2009) and EMBASE (1974 to June 2009) using MeSH terms to identify all English-language randomised and non-randomised clinical trials specifically comparing outcomes of early versus delayed ACL reconstructions. The key word terms and Boolean operators used were “anterior cruciate ligament reconstruction” AND “surgery” AND “timing” OR “delay.” We also searched for unpublished literature using the search term “anterior cruciate ligament” from the databases SIGLE (System for Information on Grey Literature in Europe), the National Technical Information Service, the National Research Register (UK) and Current Controlled Trials databases. We attempted to contact the corresponding authors of each included paper to highlight any omitted citations. Trials
Is finding all published studies enough?

- Negative studies less likely to be published than ‘Positive’ ones
- How does this happen?
- Positive studies SUBMITTED 2.5x more often than negative  (Dickersin, JAMA, 1992)
Publication Bias: solutions (some)

- All trials registered at inception,
  - The National Clinical Trials Registry: Cancer Trials
  - National Institutes of Health Inventory of Clinical Trials and Studies
  - International Registry of Perinatal Trials
- Meta-Registry of trial Registries
  - www.clinicaltrials.gov
  - www.controlled-trials.com
Question 3

3. Were the criteria used to select articles for inclusion appropriate?

*Look for*

- Inclusion/exclusion criteria a priori?
- Are eligibility criteria related to PICO?
- Types of studies?

*Methods*
Patients and methods

Data sources and searches

A database search was performed via Ovid of Medline (1950 to June 2009), CINAHL (1982 to June 2009), AMED (1985 to June 2009) and EMBASE (1974 to June 2009) using MeSH terms to identify randomised and non-randomised comparing outcomes of early versus delayed ACL reconstruction. Studies were included irrespective of whether the surgery was open or arthroscopic, the type of graft, gender or post-operative rehabilitation. The reference lists of review papers were scrutinised for relevant publications not identified by the initial search strategy. Single case reports, comments, letters, editorials, protocols, guidelines and review papers were excluded. We also excluded studies evaluating cases under the age of 16; studies of revision ACL reconstruction; studies presenting result of ACL repair rather than reconstruction; and papers which did not specifically detail the range of time between injury and surgery for their acute and delayed groups. Two investigators (TS, LD) independently selected articles meeting the inclusion criteria.
Is it worth continuing?
Question 4

4. Were the included studies sufficiently valid for the type of question?

Look for

- Criteria for quality assessment defined?
- Appropriate for the question?
- Were the assessment results provided?

Methods, Results
Data extraction and quality assessment

Two investigators (TS, LD), blinded to the source, publication date, authors and affiliations for each paper, used a standardised extraction form. All papers were then evaluated against the eleven-item PEDro scoring system by TS and LD independently. The PEDro appraisal tool has demonstrated reliability and validity in the assessment of
Appropriate for the question?

**PEDro scale**

1. eligibility criteria were specified  
   no □ yes □ where:

2. subjects were randomly allocated to groups (in a crossover study, subjects were randomly allocated an order in which treatments were received)  
   no □ yes □ where:

3. allocation was concealed  
   no □ yes □ where:

4. the groups were similar at baseline regarding the most important prognostic indicators  
   no □ yes □ where:

5. there was blinding of all subjects  
   no □ yes □ where:

6. there was blinding of all therapists who administered the therapy  
   no □ yes □ where:

7. there was blinding of all assessors who measured at least one key outcome  
   no □ yes □ where:

8. measures of at least one key outcome were obtained from more than 85% of the subjects initially allocated to groups  
   no □ yes □ where:

9. all subjects for whom outcome measures were available received the treatment or control condition as allocated or, where this was not the case, data for at least one key outcome was analysed by “intention to treat”  
   no □ yes □ where:

10. the results of between-group statistical comparisons are reported for at least one key outcome  
    no □ yes □ where:

11. the study provides both point measures and measures of variability for at

Highest (best) score = 11

Lowest (worst) score = 0

Validated for RCTs
Were quality assessment results provided?

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Eligibility criteria</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Random allocation</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Concealed allocation</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Baseline comparability</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Blind subject</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Blind clinician</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Blind assessor</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Adequate follow-up</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Intention-to treat analysis</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Between-group analysis</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Point estimates and variability</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Total score</td>
<td><strong>7</strong></td>
<td><strong>2</strong></td>
<td><strong>6</strong></td>
<td><strong>2</strong></td>
<td><strong>4</strong></td>
<td><strong>3</strong></td>
</tr>
</tbody>
</table>

1 one point, 0 no point
5. Were the results similar from study to study?

*Consider whether*

- The results of all the included studies are clearly displayed
- The results are combined (meta-analysis)
  - Results of different studies are sufficiently similar
- The reasons for any variations in results are discussed
Meta-analysis

= calculated “best guess” of the true effect size

• The statistical combination of the results gives a pooled, weighted average of the primary results

• It weighs the effect size (result) of each study in relation to sample size of the study

• Optional part of SR
Overall effect
Confidence interval
Line of no effect
trials
FOREST Plots
OR = 0.50
Overall effect
A. Which is the smallest study?
B. Which is the largest study?
C. How many are statistically significant?
Should I give streptokinase following MI?

A. Which is the smallest study?

B. Which is the largest study?

C. How many are statistically significant?
Effect size = 
1 - 0.66 = 0.34 (0.44 - 0.22) 
0.34 x 100 = 34% (44% - 22%) 

There is a 34% reduced risk of mortality in the treatment compared to the control group.
How many people died unnecessarily because a systematic review wasn’t performed?
Heterogeneity

- **Clinical heterogeneity**
  Variability in the participants, interventions and/or outcomes studied

- **Methodological heterogeneity**
  Variable in study design and risk of bias

- **Statistical heterogeneity**
  The observed intervention effects being more different from each other than we would expect due to random error (chance) alone
Too much heterogeneity = inappropriate to pool data
Are the results similar across studies?

<table>
<thead>
<tr>
<th>Study</th>
<th>Treatment n/M</th>
<th>Control n/M</th>
<th>OR (95%CI Fixed)</th>
<th>Weight %</th>
<th>OR (95%CI Fixed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brown 1988</td>
<td>24 / 472</td>
<td>35 / 499</td>
<td></td>
<td></td>
<td>9.6 [0.42, 1.21]</td>
</tr>
<tr>
<td>Geoffrey 1997</td>
<td>120 / 2850</td>
<td>182 / 2833</td>
<td></td>
<td></td>
<td>51.8 [0.51, 0.81]</td>
</tr>
<tr>
<td>Mason 1996</td>
<td>58 / 2051</td>
<td>84 / 2030</td>
<td></td>
<td></td>
<td>24.4 [0.46, 0.92]</td>
</tr>
<tr>
<td>Peters 2000</td>
<td>5 / 81</td>
<td>4 / 78</td>
<td></td>
<td></td>
<td>1.1 [0.31, 4.71]</td>
</tr>
<tr>
<td>Scott 1995</td>
<td>31 / 768</td>
<td>46 / 792</td>
<td></td>
<td></td>
<td>13.1 [0.42, 1.06]</td>
</tr>
<tr>
<td>Total (95%CI)</td>
<td>236 / 6242</td>
<td>351 / 6237</td>
<td></td>
<td>100.0</td>
<td>0.66 [0.56, 0.78]</td>
</tr>
</tbody>
</table>

Test for heterogeneity chi-square = 0.92 df = 4 p = 0.92
Test for overall effect Z = 1.92 p = 0.05001

3 tests
1. ‘Eyeball’ test – do they look the same?
2. Formal tests
   a) Test of ‘Null hypothesis’ of no variation (Chi square, p-value)
   b) Proportion of variation not due to chance ($I^2$)
      - 0% to 40%: might not be important;
      - 30% to 60%: may represent moderate heterogeneity;
      - 50% to 90%: may represent substantial heterogeneity;
      - 75% to 100%: considerable heterogeneity
Fig 3: Incidence of antibiotic-associated diarrhea — intention-to-treat analysis. The analysis showed a nonsignificant difference between probiotics and placebo (z score) and statisti-
Were studies similar?

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Papers</th>
<th>Relative risk (95% CI)</th>
<th>Overall effect (P value)</th>
<th>Heterogeneity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lysholm Score</td>
<td>[4, 34, 35]</td>
<td>0.07 (−9.93, 10.08)*</td>
<td>0.99</td>
<td>0.02 81</td>
</tr>
<tr>
<td>Lysholm Score (Good/excellent)</td>
<td>[26]</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tegner Score</td>
<td>[4, 34, 35]</td>
<td>−0.07 (−0.42, 0.29)*</td>
<td>0.71</td>
<td>0.60 0</td>
</tr>
<tr>
<td>KT-1000 Arthrometer</td>
<td>[4, 34, 35]</td>
<td>0.05 (−0.52, 0.63)*</td>
<td>0.85</td>
<td>0.19 42</td>
</tr>
<tr>
<td>Tibiofemoral Displacement &gt; 3 mm</td>
<td>[25, 35]</td>
<td>0.59 (0.25, 1.43)</td>
<td>0.24</td>
<td>0.19 43</td>
</tr>
<tr>
<td>Positive Lachman</td>
<td>[26, 34, 35]</td>
<td>0.64 (0.27, 1.51)</td>
<td>0.31</td>
<td>0.02 73</td>
</tr>
<tr>
<td>Positive pivot shift</td>
<td>[26, 34, 35]</td>
<td>0.69 (0.43, 1.11)</td>
<td>0.13</td>
<td>0.52 0</td>
</tr>
<tr>
<td>Extension deficit</td>
<td>[4, 35]</td>
<td>−0.90 (−2.39, 0.59)*</td>
<td>0.24</td>
<td>N/E N/E</td>
</tr>
<tr>
<td>Flexion deficit</td>
<td>[4, 35]</td>
<td>−0.50 (−2.55, 1.55)*</td>
<td>0.63</td>
<td>N/E N/E</td>
</tr>
<tr>
<td>Extension deficit &gt; 10°</td>
<td>[4, 26, 34]</td>
<td>0.96 (0.21, 4.37)</td>
<td>0.96</td>
<td>0.21 36</td>
</tr>
<tr>
<td>Incidence of arthrofibrosis</td>
<td>[28, 34, 35, 42]</td>
<td>1.83 (0.81, 4.14)</td>
<td>0.15</td>
<td>0.76 0</td>
</tr>
<tr>
<td>Incidence of meniscal injury</td>
<td>[4, 26, 28, 34, 42]</td>
<td>0.92 (0.71, 1.19)</td>
<td>0.53</td>
<td>&lt;0.01 74</td>
</tr>
<tr>
<td>Incidence of chondral injury</td>
<td>[4, 26, 34, 42]</td>
<td>0.77 (0.44, 1.37)</td>
<td>0.38</td>
<td>0.26 25</td>
</tr>
<tr>
<td>Frequency of revision surgery</td>
<td>[26, 28, 34, 35, 42]</td>
<td>0.81 (0.42, 1.58)</td>
<td>0.54</td>
<td>0.30 17</td>
</tr>
<tr>
<td>Incidence of patellofemoral pain</td>
<td>[35, 42]</td>
<td>2.05 (0.86, 4.89)</td>
<td>0.11</td>
<td>0.58 0</td>
</tr>
<tr>
<td>Incidence of thromboembolic complication</td>
<td>[28, 35]</td>
<td>1.79 (0.21, 27.29)</td>
<td>0.68</td>
<td>0.21 37</td>
</tr>
</tbody>
</table>

*Mean difference (95% confidence intervals), ° degrees, CI confidence intervals, mm millimetres, N/E not estimated.
Question 6

6. What were the results? How are they presented?

Consider

- If you are clear about the review’s ‘bottom line’ results
- What these are (numerically if appropriate)
- How were the results expressed (risk ratio, odds ratio etc)
What’s missing? What are we interested in?

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Papers</th>
<th>Relative risk (95% CI)</th>
<th>Overall effect (P value)</th>
<th>Heterogeneity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lysholm Score</td>
<td>[4, 34, 35]</td>
<td>0.07 (−9.93, 10.08)*</td>
<td>0.99</td>
<td>0.02</td>
</tr>
<tr>
<td>Lysholm Score (Good/excellent)</td>
<td>[26]</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tegner Score</td>
<td>[4, 34, 35]</td>
<td>−0.07 (−0.42, 0.29)*</td>
<td>0.71</td>
<td>0.60</td>
</tr>
<tr>
<td>KT-1000 Arthrometer</td>
<td>[4, 34, 35]</td>
<td>0.05 (−0.52, 0.63)*</td>
<td>0.85</td>
<td>0.19</td>
</tr>
<tr>
<td>Tibiofemoral Displacement &gt; 3 mm</td>
<td>[25, 35]</td>
<td>0.59 (0.25, 1.43)</td>
<td>0.24</td>
<td>0.19</td>
</tr>
<tr>
<td>Positive Lachman</td>
<td>[26, 34, 35]</td>
<td>0.64 (0.27, 1.51)</td>
<td>0.31</td>
<td>0.02</td>
</tr>
<tr>
<td>Positive pivot shift</td>
<td>[26, 34, 35]</td>
<td>0.69 (0.43, 1.11)</td>
<td>0.13</td>
<td>0.52</td>
</tr>
<tr>
<td>Extension deficit</td>
<td>[4, 35]</td>
<td>−0.90 (−2.39, 0.59)*</td>
<td>0.24</td>
<td>N/E</td>
</tr>
<tr>
<td>Flexion deficit</td>
<td>[4, 35]</td>
<td>−0.50 (−2.55, 1.55)*</td>
<td>0.63</td>
<td>N/E</td>
</tr>
<tr>
<td>Extension deficit &gt; 10°</td>
<td>[4, 26, 34]</td>
<td>0.96 (0.21, 4.37)</td>
<td>0.96</td>
<td>0.21</td>
</tr>
<tr>
<td>Incidence of arthrofibrosis</td>
<td>[28, 34, 35, 42]</td>
<td>1.83 (0.81, 4.14)</td>
<td>0.15</td>
<td>0.76</td>
</tr>
<tr>
<td>Incidence of meniscal injury</td>
<td>[4, 26, 28, 34, 42]</td>
<td>0.92 (0.71, 1.19)</td>
<td>0.53</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Incidence of chondral injury</td>
<td>[4, 26, 34, 42]</td>
<td>0.77 (0.44, 1.37)</td>
<td>0.38</td>
<td>0.26</td>
</tr>
<tr>
<td>Frequency of revision surgery</td>
<td>[26, 28, 34, 35, 42]</td>
<td>0.81 (0.42, 1.58)</td>
<td>0.54</td>
<td>0.30</td>
</tr>
<tr>
<td>Incidence of patellofemoral pain</td>
<td>[35, 42]</td>
<td>2.05 (0.86, 4.89)</td>
<td>0.11</td>
<td>0.58</td>
</tr>
<tr>
<td>Incidence of thromboembolic complica</td>
<td>[28, 35]</td>
<td>1.79 (0.21, 27.29)</td>
<td>0.68</td>
<td>0.21</td>
</tr>
</tbody>
</table>

* Mean difference (95% confidence intervals), ° degrees, CI confidence intervals, mm millimetres, N/E not estimated
There was no statistically significant difference between the early and delayed ACL reconstruction groups for the Lysholm score or Tegner score (Table 2). There was no significant difference between the groups for International Knee Documentation Committee rating score [not significant (n.s.)] [26], IKDC perceived stability rating (n.s.) [26], or the Hospital for Special Surgery score system (n.s.) [35]. There was no reported significant difference in patient satisfaction ($P = 0.19$) [35]. The frequency that patients returned to the same level of sporting participation was assessed in Marcacci et al.’s [26] paper. This reported that there was no statistically significant difference in return rates between the two groups (n.s.) [26].
# Table 2 Results of meta-analysis

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Papers</th>
<th>Relative risk (95% CI)</th>
<th>Overall effect (P value)</th>
<th>Heterogeneity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lysholm Score</td>
<td>[4, 34, 35]</td>
<td>0.07 (−9.93, 10.08)*</td>
<td>0.99</td>
<td>0.02, 81</td>
</tr>
<tr>
<td>Lysholm Score (Good/excellent)</td>
<td>[26]</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tegner Score</td>
<td>[4, 34, 35]</td>
<td>−0.07 (−0.42, 0.29)*</td>
<td>0.71</td>
<td>0.60, 0</td>
</tr>
<tr>
<td>KT-1000 Arthrometer</td>
<td>[4, 34, 35]</td>
<td>0.05 (−0.52, 0.63)*</td>
<td>0.85</td>
<td>0.19, 42</td>
</tr>
<tr>
<td>Tibiofemoral Displacement &gt; 3 mm</td>
<td>[25, 35]</td>
<td>0.59 (0.25, 1.43)</td>
<td>0.24</td>
<td>0.19, 43</td>
</tr>
<tr>
<td>Positive Lachman</td>
<td>[26, 34, 35]</td>
<td>0.64 (0.27, 1.51)</td>
<td>0.31</td>
<td>0.02, 73</td>
</tr>
<tr>
<td>Positive pivot shift</td>
<td>[26, 34, 35]</td>
<td>0.69 (0.43, 1.11)</td>
<td>0.13</td>
<td>0.52, 0</td>
</tr>
<tr>
<td>Extension deficit</td>
<td>[4, 35]</td>
<td>−0.90 (−2.39, 0.59)*</td>
<td>0.24</td>
<td>N/E, N/E</td>
</tr>
<tr>
<td>Flexion deficit</td>
<td>[4, 35]</td>
<td>−0.50 (−2.55, 1.55)*</td>
<td>0.63</td>
<td>N/E, N/E</td>
</tr>
<tr>
<td>Extension deficit &gt; 10°</td>
<td>[4, 26, 34]</td>
<td>0.96 (0.21, 4.37)</td>
<td>0.96</td>
<td>0.21, 36</td>
</tr>
<tr>
<td>Incidence of arthrofibrosis</td>
<td>[28, 34, 35, 42]</td>
<td>1.83 (0.81, 4.14)</td>
<td>0.15</td>
<td>0.76, 0</td>
</tr>
<tr>
<td>Incidence of meniscal injury</td>
<td>[4, 26, 28, 34, 42]</td>
<td>0.92 (0.71, 1.19)</td>
<td>0.53</td>
<td>&lt;0.01, 74</td>
</tr>
<tr>
<td>Incidence of chondral injury</td>
<td>[4, 26, 34, 42]</td>
<td>0.77 (0.44, 1.37)</td>
<td>0.38</td>
<td>0.26, 25</td>
</tr>
<tr>
<td>Frequency of revision surgery</td>
<td>[26, 28, 34, 35, 42]</td>
<td>0.81 (0.42, 1.58)</td>
<td>0.54</td>
<td>0.30, 17</td>
</tr>
<tr>
<td>Incidence of patellofemoral pain</td>
<td>[35, 42]</td>
<td>2.05 (0.86, 4.89)</td>
<td>0.11</td>
<td>0.58, 0</td>
</tr>
<tr>
<td>Incidence of thromboembolic complication</td>
<td>[28, 35]</td>
<td>1.79 (0.21, 27.29)</td>
<td>0.68</td>
<td>0.21, 37</td>
</tr>
</tbody>
</table>

* Mean difference (95% confidence intervals), ° degrees, CI confidence intervals, mm millimetres, N/E not estimated
Conclusions

The findings of this study suggested that there was no statistically significant difference in outcomes between those patients who underwent earlier compared to delayed ACL reconstruction. The present evidence-base presented with substantial methodological limitations. A sufficiently powerful, well-design randomised controlled trial is required to determine whether of duration from injury to surgical intervention is an important prognostic indicator for patients who undergo an ACL reconstruction.
Practising EBM – the 4 A’s

Step 1
Ask a clinical question

Step 2
Acquire the best evidence

Step 3
Appraise the evidence

Step 4
Apply the evidence
Can I apply these results to my case?

- Is my patient so different to those in the study that the results cannot apply?

Early procedures were compared to 209 delayed procedures. The mean age was 25.6 years in the early group [Standard deviation (SD) = 2.3] compared to 26.2 years (SD = 1.1) in the delayed group (Table 1).
Delay or not delay?
Preferred Reporting Items for Systematic Reviews and Meta-Analyses

- Consists of a 27-item checklist and four phase flow diagram
- Evidence-based minimum set of items for reporting in systematic reviews and meta-analyses
- Can be used for critical appraisal but not designed for it

http://www.prisma-statement.org/
‘Clinical pearls’

• Look for ‘key’ references: AMSTAR, PRISMA, Cochrane Risk of Bias
  – If absent, may be an indication of a poor quality review

• $I^2 > 50\%$: adequate statistical heterogeneity to suggest looking deeper into clinical, methodological heterogeneity reported

• Would your patient meet the inclusion criteria of trials/studies in the review?
30 minutes!

\[
\text{\( \frac{1}{4} \text{hr} = 2 \text{Kcal/min}^{-1} \)}
\]

28 mins = 56 kcal =
34 mins = 68 kcal =
43 mins = 86 kcal =
Teach only what the needs of the audience dictates

Have a hook

Keep it simple