Evidence-Based Practice: Prognosis

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Prognosis

What are my chances of ever walking again without help?

What is Prognosis?

- prog-no-sis
- Pronunciation: ‘präg-nô-sës\"
- Function: noun
- Inflected Form(s): plural prog·no·ses\-sēz\"
- 1: the act or art of foretelling the course of a disease
- 2: the prospect of survival and recovery from a disease as anticipated from the usual course of that disease or indicated by special features of the case —the prognosis is poor because of the accompanying cardiovascular disease—P. A. Mead et al

http://www.merriam-webster.com/medlineplus/prognosis
What is Prognosis?

- Medical Prognosis:
  - How long will I live?
  - What if I choose not to start chemotherapy?

- Physical Therapy Prognosis (related to goals)
  - What are my odds of returning to basketball this season?
  - Can I expect my back pain to simply go away over time?
  - What prognostic factors predict successful treatment?


Two Quotes from Jules Rothstein
Former Editor of Physical Therapy

- "As physical therapists, not only do we need to know our literature on prognosis, but we need to acquire additional evidence, particularly when we want to change prognoses through the use of preventive intervention."

- "The dictionary fails to note that prognosis also is often what establishes (and enhances) a health care professional's credibility. As a young physical therapist, thanks to my ignorance and the lack of a body of published data, I usually would offer a two-word prognosis: "It depends." If a patient asked when to expect full range of motion, I might say, "It depends." If a persistent patient asked what it depended on, again I might deliver sage wisdom: "It depends on a lot of things." Only the patient's persistence determined how long I was allowed to sputter ambiguously."


EBP Approach to Prognosis

- Define the question clearly (foreground question)
- Get the best available evidence
- Assess the quality/validity of the evidence
- Determine expected prognosis (probability of outcome)
- Determine modifying prognostic factors
- Decide whether the evidence applies to my patient
- If appropriate, provide evidence-based prognosis to my patient
- Post-treatment, determine whether patient outcome was consistent with prognosis
The Foreground Question

- Takes the familiar 3-part structure: P - E - O
  - Patient (or population)
  - Exposure (prognostic risk)
  - Outcome of interest
- Example:
  - “For a 25 year old male basketball player with a first-time shoulder dislocation, what is the likelihood of subsequent dislocation(s) with non-surgical management?”

Prognosis: Where to Look for Evidence

- Note that you will generally find prognostic evidence in cohort studies or case-control studies
- However, randomized controlled trials for therapy provide some prognostic information
  - Experimental treatment group provides information about prognosis if treatment received
  - Control group provides information about prognosis if treatment not received

4 Basic Types of Clinical Questions -- and where to look for evidence

- **Diagnosis**
  - PubMed Clinical Queries (Diagnosis, Systematic Reviews, & Clinical Prediction Guides)
  - Cochrane CDSR
  - National Guideline Clearinghouse (NGC)
- **Prognosis**
  - PubMed Clinical Queries (Prognosis, Systematic Reviews, & Clinical Prediction Guides)
  - Cochrane CDSR
  - National Guideline Clearinghouse (NGC)
- **Intervention**
  - PubMed Clinical Queries (Therapy & Systematic Reviews)
  - Cochrane CDSR
  - PEDro
  - OT Seeker
  - APTA’s Hooked on Evidence
  - National Guideline Clearinghouse (NGC)
- **Harm**
  - PubMed Clinical Queries (Etiology & Systematic Reviews)
  - Cochrane CDSR
  - National Guideline Clearinghouse (NGC)
PubMed Clinical Queries
Filter Hedges for Prognosis

**sensitive/broad**


Yields more results, including some lower down on the hierarchy for levels of evidence

**specific/narrow**

- (prognos*[Title/Abstract] OR (first*[Title/Abstract] AND episode*[Title/Abstract]) OR cohort*[Title/Abstract])

Yields fewer results, eliminating some lower down on the hierarchy for levels of evidence

Prognosis:
What evidence are we looking for?

- Overall prognosis
  - With some indication of precision (95%CI)
- Modifying prognostic factors
  - With some indication of precision (95%CIs)

Overall Prognosis

- How likely is the outcome?
- Usually expressed as a percent with a 95% confidence interval
- This is the overall probability of the outcome

Prognostic Factors

- Attributes that modify the overall prognosis
  - Making the outcome more or less likely
- Demographic (age, gender, socioeconomic factors)
- Individual Patient Behaviors (Fear-avoidance, copers)
- Condition Specific (severity of disorder, degree of test abnormality)
- Comorbid (presence or absence of other conditions)

- Usually quantified by magnitudes of odds ratios (ORs) or risk ratios (RRs) – with 95% CIs
**Hierarchy and Levels of Evidence for Prognosis -- from www.CEBM.net**

<table>
<thead>
<tr>
<th>Level</th>
<th>Prognosis</th>
</tr>
</thead>
<tbody>
<tr>
<td>1a</td>
<td>SR (with homogeneity*) of inception cohort studies; CDR† validated in different populations</td>
</tr>
<tr>
<td>1b</td>
<td>Individual inception cohort study with &gt; 80% follow-up; CDR† validated in a single population</td>
</tr>
<tr>
<td>1c</td>
<td>All or none case-series</td>
</tr>
<tr>
<td>2a</td>
<td>SR (with homogeneity*) of either retrospective cohort studies or untreated control groups in RCTs</td>
</tr>
<tr>
<td>2b</td>
<td>Retrospective cohort study or follow-up of untreated control patients in an RCT; Derivation of CDR† or validated on split-sample§§ only</td>
</tr>
<tr>
<td>2c</td>
<td>&quot;Outcomes&quot; Research</td>
</tr>
<tr>
<td>4</td>
<td>Case-series (and poor quality prognostic cohort studies***)</td>
</tr>
<tr>
<td>5</td>
<td>Expert opinion without explicit critical appraisal, or based on physiology, bench research or &quot;first principles&quot;</td>
</tr>
</tbody>
</table>

See: http://www.cebm.net/index.aspx?o=1025

**Prognosis: Critical Appraisal**

- Are the results valid?
- What are the results?
- How can I apply the results to patient care?
Are the Results Valid?

1. Was the sample of patients sufficiently representative?
   - Sample must represent population
     - Otherwise, study patients may have a prognosis better or worse than population of interest
   - Beware studies where patients are highly filtered
     - Such as tertiary care center patients: will likely have greater severity of disorders compared to entire population (different prognosis due to referral bias)

2. Did all study patients have reasonably similar prognostic risk?
   - Beware studies with great heterogeneity
     - One overall prognosis may overestimate or underestimate prognoses for subgroups
   - Look for adjusted estimates for prognostic factors
     - Unadjusted ORs (univariate analyses) don’t account for correlations among factors
     - Adjusted ORs (multivariate analyses) provide robust estimates of effects taking other factors into account

3. Was there sufficiently complete follow-up?

4. Did the authors apply objective & unbiased outcome criteria?
Are the Results Valid (#3)?

3. Was there sufficiently complete follow-up?
   ■ Ideally we’d like to know outcomes for all enrolled subjects.
   ■ Study dropouts pose a greater validity threat in studies with low incidence rates.
   ■ The validity threat is more severe if there is reason to believe that those lost to follow-up had a worse prognosis than those completing the study (often the case).

Are the Results Valid (#4)?

4. Did the authors apply objective & unbiased outcome criteria?
   ■ We use our clinical judgment here.
   ■ Outcomes that are completely subjective may pose a significant validity threat.

What are the results?

■ How likely is the outcome of interest?
  □ Overall prognosis

■ How precise is the estimate of overall prognosis?
  □ Width of 95%CI

■ What are the modifying prognostic factors?
  □ Look for independent factors with associated ORs

■ How precise are estimates of influence for prognostic factors?
  □ Widths of 95%CIs around ORs (or RRs)
Computing Overall Prognosis

- Often authors will fail to provide confidence intervals around point estimates for incidence rates (overall prognosis or probability).
- The PEDro Confidence Interval Calculator provides a worksheet for making these computations.

Computing Overall Prognosis
PEDro CI Spreadsheet

- Use worksheet: “a proportion or odds”


Interpretation of Overall Prognosis
PEDro CI Spreadsheet

- If 12 of 57 subjects in a study had the outcome of interest:
  - The proportion of subjects in the sample was 12/57 = .2105 = 21.1% (point estimate for overall prognosis for outcome).
  - The best estimate of what the proportion will be in the target population is that same proportion from the sample: 21.1%.
  - However, at a 95% level of confidence we can only say that the true overall prognosis for that outcome in the population will be somewhere between 12.5% (lower limit of 95% CI) and 33.3% (upper limit of 95% CI).
Prognostic Factors: Interpreting the Risk Ratio (Relative Risk) < 1.0

- The RR is the ratio of risk (incidence of outcome) in those with the prognostic factor divided by the risk (incidence of outcome) in those without the prognostic factor.
  - If only 20 out of 100 with the attribute have the outcome but 50 out of 100 without the attribute have the outcome, the RR is 20/50 = .40.
  - If the RR is .40, we would say that those with the prognostic factor are only about 40% as likely to have the outcome as those without that attribute.

Computing the Risk Ratio (Relative Risk) < 1.0

<table>
<thead>
<tr>
<th></th>
<th>Outcome Present</th>
<th>Outcome Absent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Risk Factor Present</td>
<td>20 (a)</td>
<td>80 (b)</td>
</tr>
<tr>
<td>Risk Factor Absent</td>
<td>50 (c)</td>
<td>50 (d)</td>
</tr>
</tbody>
</table>

- $\text{RR} = \frac{a}{a+b} = \frac{20}{20+80} = \frac{20}{100} = .2$
- $\text{RR} = \frac{c}{c+d} = \frac{50}{50+50} = \frac{50}{100} = .5$

- RR = .40


Prognostic Factors: Interpreting the Risk Ratio (Relative Risk) >1.0

- Often, presence of the prognostic factor makes it more likely to have the outcome.
  - If 20 out of 100 with the attribute have the outcome but only 10 out of 100 without the attribute have the outcome, the RR is 20/10 = 2.0.
  - If the RR is 2.0, we would say that those with the prognostic factor are about twice as likely to have the outcome as those without that attribute.
Computing the Risk Ratio (Relative Risk) < 1.0

<table>
<thead>
<tr>
<th>Outcome</th>
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<tr>
<td>Risk Factor Present</td>
<td>20 (a)</td>
<td>80 (b)</td>
</tr>
<tr>
<td>Risk Factor Absent</td>
<td>10 (c)</td>
<td>90 (d)</td>
</tr>
</tbody>
</table>

- \[ RR = \frac{a}{a + b} = \frac{20}{20 + 80} = \frac{20}{100} = .20 \]
- \[ c/(c + d) = \frac{10}{10 + 90} = \frac{10}{100} = .10 \]
- \[ RR = 2.0 \]


Prognostic Factors: Interpreting the Odds Ratio

- The OR is the ratio of odds (proportion of those with/without the outcome) in those with the prognostic factor divided by the odds (proportion of those with/without the outcome) in those without the prognostic factor.
  - If only 20 out of 100 with the attribute have the outcome but 50 out of 100 without the attribute have the outcome, the OR is \((20/80)/(50/50) = .25\).
  - If the OR is .25, we would say that the odds for having the outcome among those with the prognostic factor are only about 25% as high as the odds for having the outcome among those without that attribute.

Computing the Odds Ratio

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Outcome Present</th>
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<td>Risk Factor Absent</td>
<td>50 (c)</td>
<td>50 (d)</td>
</tr>
</tbody>
</table>

- \[ OR = \frac{a}{b} = \frac{20}{80} = .25 \]
- \[ c/d = \frac{50}{50} = 1 \]
- \[ OR = .25 \]

Computing RR & OR for Prognostic Factors
PEDro CI Calculator Spreadsheet

- Use worksheet: "compare 2 proportions or odds"
- Provides univariate results (unadjusted for other prognostic factors)
- Place information for those without the prognostic factor under "control group" & information for those with the factor under "experimental group"


Equivalence (or non-equivalence) of interpretations: RR vs. OR

- If incidence rates are rather high, the OR can be quite different from the RR
  - See previous slides where 20 out of 100 with the attribute have the outcome but 50 out of 100 without the attribute have the outcome: \( \text{RR} = 0.40 \) but \( \text{OR} = 0.25 \).

- However, if incidence rates are quite small, the OR can be interpreted about the same as the RR.
  - If only 2 out of 100 with the attribute have the outcome but 5 out of 100 without the attribute have the outcome:
    - the RR is \( \frac{2/100}{5/100} = 0.40 \)
    - the OR is about the same: \( \frac{2/98}{5/95} \approx 0.39 \)
    - Here, the OR and the RR can be interpreted in a similar way: "Those with the prognostic factor are only about 40% as likely to have the outcome as those without the prognostic factor.”

Equivalence of interpretations: RR vs. OR (when incidence is low)

- Example with low incidence rates
- Can interpret OR and RR about the same
Independence of Prognostic Factors

- Any given prognostic factor is considered “independent” of other prognostic factors if two conditions are met:
  1. The OR must be statistically significant
     - That is, the 95% CI must exclude the null value of 1.0
  2. The prognostic factor must be retained in a multivariate analysis
     - Typically logistic regression or Cox-model regression
     - Yields an “adjusted” odds ratio for that prognostic factor

Prognostic Studies: What Are the Results?

[Table and graph with data]


### Prognostic Studies: What Are the Results?

<table>
<thead>
<tr>
<th>Prognostic Factor</th>
<th>Outcome</th>
<th>Odds Ratio</th>
<th>Confidence Interval</th>
<th>Independent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical Therapy</td>
<td>Yes</td>
<td>3.54</td>
<td>1.42 - 8.88</td>
<td>yes</td>
</tr>
<tr>
<td>Age less than 54 years</td>
<td>Yes</td>
<td>4.5</td>
<td>1.3 - 15.7</td>
<td>yes</td>
</tr>
<tr>
<td>Dominant arm is not affected</td>
<td>Yes</td>
<td>6.1</td>
<td>1.5 - 24.3</td>
<td>yes</td>
</tr>
<tr>
<td>Lower arm does not worsen symptoms</td>
<td>Yes</td>
<td>3.3</td>
<td>1.1 - 10</td>
<td>yes</td>
</tr>
</tbody>
</table>

*Note: these factors are statistically significant because all CIs exclude a null value of 1.0.*


### Prognostic Studies: What Are the Results?

<table>
<thead>
<tr>
<th>Prognostic Factor</th>
<th>Outcome</th>
<th>Odds Ratio</th>
<th>Confidence Interval</th>
<th>Independent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male gender</td>
<td>Yes</td>
<td>1.44</td>
<td>1.01 - 1.93</td>
<td>no</td>
</tr>
<tr>
<td>Good balance (SKDB)</td>
<td>Yes</td>
<td>1.59</td>
<td>1.20 - 2.10</td>
<td>no</td>
</tr>
<tr>
<td>Severe sports</td>
<td>Yes</td>
<td>1.48</td>
<td>1.30 - 1.60</td>
<td>no</td>
</tr>
</tbody>
</table>

*Note: these factors are not statistically significant because the CIs include a null value of 1.0.*

### Prognostic Studies: What Are the Results?

- Survival analyses (Kaplan-Meier graphs)
- Cox-model regression (accounts for time-dependent variables)
- Logistic regression

- Odds ratio
- Likelihood ratio (PLR & NLR)
- Risk ratio (relative risk)
- Hazard ratio
- Confidence intervals
Applying Results to Patient Care

- Were study patients similar to my patients?
- Was the management of patients similar to my practice?
- Was there adequate follow-up?
- Can I use these results to manage my patients?

Prognosis in Physical Therapy: Example #1

"How likely is it that our 16-year old son with his recent traumatic brain injury will be able to walk by himself upon discharge from your residential rehabilitation facility?"

-- The parents

Formulating an Answerable Clinical Question

- P: For a 16-year old male
- E: with a recent traumatic brain injury,
- O: what is the probability of independent ambulation without an assistive device upon discharge from an inpatient rehabilitation facility?
Searching for Evidence
- Entered following search string into PubMed Clinical Queries using narrow, specific search for prognosis: traumatic brain injury AND ambulation AND adolescents
- Yielded 9 hits; Dumas et al. article was #3

PubMed Clinical Queries

Prognosis in Physical Therapy: Example #1 - Dumas et al. (2004)
- Are the Results Valid?
  - Was the sample of patients representative?
    - 95 consecutive children & adolescents with TBI (2-18 years) admitted for inpatient rehabilitation
    - 2/3 male; 1/3 female
    - 61% white, 19% Hispanic, 9% black, 6% other

Prognosis in Physical Therapy: Example #1 - Dumas et al. (2004) - continued
- Were patients sufficiently homogenous re: prognostic risk?
  - Average time from injury to admission
    - 30 ± 57 days (range 4-407 days)
  - 45% struck by MV; 39% driver/passenger in MVA, 7% falls, 6% other
  - Length of inpatient rehabilitation stay 73 ± 91 days (range 3-664 days)
Prognosis in Physical Therapy: an Example  
- Dumas et al. (2004) - continued

Was follow-up sufficiently complete?
- All enrolled subjects were evaluated for outcome

Were objective and unbiased outcomes used?
- ambulation without the assistance of a device or person for 50 ft. on a flat, level surface at D/C from inpatient rehab

Prognosis in Physical Therapy: an Example  
Dumas et al. (2004) - continued

What are the Results?

- 56% achieved independent ambulation at discharge
- Logistic regression yielded 3 predictors: no LE hypertonicity, no LE injury, low injury severity
  - 78% overall accuracy of prediction using model
  - 77% of those predicted by model did ambulate (PPV)

How precise are the estimates of likelihood?
- 56% ambulators (95% CI 46%-65% [authors didn’t report*])
- Nagelkerke $R^2 = 0.44$ for logistic regression model
  - no LE hypertonicity OR = 8.6 (95% CI 2.1–34.6)
  - no LE injury OR = 5.3 (95% CI 1.7–16.8)
  - low injury severity OR = 4.8 (95% CI 1.3–18.0)

*computed with PEDro Confidence Interval Calculator spreadsheet

Prognostic Studies: What Are the Results?

Overall Prognosis

Note these prognostic factors are not statistically significant because CI includes null value of 1.0

Note these prognostic factors are statistically significant because CI excludes null value of 1.0

\textbf{Prognosis in Physical Therapy: Example #1}  
\textbf{Dumas et al. (2004) - continued}

- \textbf{How can I apply the results to patient care?}
- \textbf{Best Research Evidence*} – my interpretation:
  - We can say in general that there is some limited evidence to suggest about a 50\% probability of independent ambulation at discharge for children and adolescents admitted for inpatient rehabilitation of traumatic brain injuries. With less confidence, we can speculate that those with no lower extremity hypertonicity, no lower extremity injuries, and/or low injury severity (loss of consciousness < 24 hours) may have a higher probability of independent ambulation, perhaps as high as 75%.

\textit{Note: This evidence derived from a single study only (for illustration of method); other evidence exists that should also be considered.}

\textbf{Integrating Evidence into EBP: Scenario A}

- \textbf{Patient Values & Expectations:}
  - Mr. & Mrs. Smith are frightened parents. They both have limited education and seem overwhelmed by what has happened to their son. They have shown a tendency to hang on every word from health care providers; they place these providers on a pedestal.

- \textbf{My clinical expertise:}
  - I do not believe I have the ability to explain the subtleties of this evidence to these parents without creating unrealistic expectations.

- \textbf{My answer to the parents’ question:}
  - "The truth is that we don’t know with certainty how likely it is that your son will be able to walk by himself. The research suggests that about half of young people can walk independently at the time of discharge. I promise that I’ll work as hard as I can to help your son walk again, but there can be no guarantee."
Integrating Evidence into EBP: Scenario B

- Patient Values & Expectations:
  - Mr. & Mrs. Jones are concerned and perceptive parents. Dad is a nurse; Mom is an epidemiologist with a Ph.D. Both show the ability to understand nuances of clinical evidence.
- My clinical expertise:
  - I believe I can explain the subtleties of this evidence to these parents such that they can place it in proper perspective.
- My answer to the parents’ question:
  - “There is some limited evidence to help us give a prognosis for independent ambulation. One recent peer-reviewed article suggests that although the overall probability for walking at discharge is about 50%, those adolescents like your son may have a better prognosis: perhaps somewhere around a 75% probability. However, this evidence was from a retrospective study, it has not been validated, and the confidence intervals were quite wide. Therefore, this evidence isn’t very strong. I’ll give you a copy of the article from the Physical Therapy journal.”

Integration of:
1. best research evidence
2. clinical expertise
3. patient values

Prognosis in Physical Therapy: Example #2

- “How likely is it that my 68-year old mother with her recent stroke will be able to walk by herself after this is all over?”

-- The daughter

Formulating an Answerable Clinical Question

- P: For a 68-year old female
- E: with a recent first-ever ischemic stroke,
- O: what is the probability of independent ambulation within 6 months post-stroke?
Searching for Evidence

- Entered following search string into PubMed Clinical Queries using narrow, specific search for prognosis: stroke AND independent ambulation
- Yielded 50 hits; Veerbeek et al. article was #5

Prognosis in Physical Therapy: Example #2
- Veerbeek et al. (2011)

Are the Results Valid?

✔ Was the sample of patients representative?
  - 154 subjects completed study:
    - Mean age 67.54 yrs all assessed within 72 hours of CVA
    - 61 males/93 females
    - Mean BMI 25.87
    - Co-morbidities 129 yes & 25 no
    - Hemisphere of stroke R=87 & L=67
    - Received tPA 44 yes & 110 no
    - Conscious at onset 28 no & 126 yes


Prognosis in Physical Therapy: Example #2
- Veerbeek et al. (2011) - continued

✔ Were patients sufficiently homogenous re: prognostic risk?
  - Mean time between stroke onset & 1st assessment = 2.24 ± 1.32 days
  - All suffered an ischemic first-ever anterior circulation stroke
  - All had hemiparesis within 72 hours poststroke
  - All unable to walk independently at baseline
  - None with disabling medical history
  - None with severe deficits of communication, memory, or understanding

Prognosis in Physical Therapy: Example #2 - Veerbeek et al. (2011) - continued

Was follow-up sufficiently complete?
- 221 patients recruited; 32 excluded because they spontaneously recovered gait within 72 hours
- 35/189 (18.5%) lost to follow-up

Were objective and unbiased outcomes used?
- Independent gait operationalized as a score of 4 or 5 on the Functional Ambulation Categories scale (0-5).
  - FAC 4: Independent, Level Surfaces Only
  - FAC 5: Independent, Level and Non-Level Surfaces


What are the Results?
- How likely are the outcomes over time?
  - 122 of 154 (79%) walked independently at 6 mo. s/p CVA
  - Logistic regression yielded 2 predictors: independent sitting for 30 sec; Motoricity Index leg score of ≥25
    - 98% walked independently at 6 mo. if both prognostic factors present within 72 hours poststroke.
    - 27% walked independently at 6 mo. if neither prognostic factor present within 72 hours poststroke
- How precise are the estimates of likelihood?
  - 79% ambulators (95% CI 72%-85% [authors didn't report*])
  - Nagelkerke $R^2 = 0.44$ for logistic regression model
    - Indep. sitting 30 sec OR = 33.3 (95% CI 10.6 to 105.1)
    - MI leg score ≥25 OR = 20.8 (95% CI 7.6 to 56.9)

*computed with PEDro Confidence Interval Calculator spreadsheet

Prognostic Studies: What Are the Results?

The Evidence

<table>
<thead>
<tr>
<th>Prognostic Factor</th>
<th>Outcome</th>
<th>Result Measure</th>
<th>Confidence Interval</th>
<th>Independent*</th>
</tr>
</thead>
<tbody>
<tr>
<td>W/C (true negative control)</td>
<td>Independent</td>
<td>Ambulation within 6 months</td>
<td>79%</td>
<td>72%-85%</td>
</tr>
</tbody>
</table>

*computed with PEDro Confidence Interval Calculator spreadsheet

Prognosis in Physical Therapy: Example #2
- Veerbeek et al. (2011) - continued

- How can I apply the results to patient care?
  ✓ Were the study patients and their management similar to my practice?
  ✓ Is the study outcome what my patient & parents are asking about?
  ✓ Can I use the results in the management of patients in my practice?
    □ Prospective cohort study (>80% F/U): 1b level of evidence
    □ CPR derived but not yet validated: 2b level of evidence


Prognosis in Physical Therapy: Example #2
- Veerbeek et al. (2011) - continued

- How can I apply the results to patient care?
  - Best Research Evidence* – my interpretation:
    □ There is some fairly good evidence to suggest about an 80% probability of independent ambulation at 6 months poststroke for patients with first-ever ischemic strokes of anterior circulation. With less confidence, we can speculate that: 1) those who can sit independently for 30 seconds within the 1st 72 hours poststroke, and who have a score of at least 25 on the MI leg scale within the 1st 72 hours poststroke may have a higher probability of independent ambulation: perhaps as high as 98%; 2) those with neither factor present @72 hrs have perhaps only 27% probability for independent ambulation.

*Note: This evidence derived from a single study only (for illustration of method); other evidence exists that should also be considered.

Prognosis in Physical Therapy: Example #3

- “How likely is it that my 2-year old daughter with cerebral palsy (who is not walking now) will be able to walk by herself when she reaches school age?”

  -- The mother
Formulating an Answerable Clinical Question

- **P:** For a 2-year-old female
- **E:** with cerebral palsy who is not currently able to walk,
- **O:** what is the probability of independent ambulation by age 6?

Searching for Evidence

- Entered following search string into PubMed Clinical Queries using narrow, specific search for prognosis: cerebral palsy AND independent ambulation
- Yielded 9 hits; Wu et al. article was #3

Prognosis in Physical Therapy: Example #3  - Wu et al. (2004)

- **Are the Results Valid?**
  - Was the sample of patients representative?
    - 5366 subjects enrolled in study:
      - All age 2 at enrollment
      - 56% Male & 44% Female
      - 34% White; 36% Hispanic; 10% Black; 5% Asian; 15% other or unspecified ethnicity
Prognosis in Physical Therapy: Example #3
- Wu et al. (2004) - continued

Were patients sufficiently homogenous re: prognostic risk?
- 62% spastic; 2% ataxic; 2% dyskinetic; 17% hypotonic; 17% other (including mixed type CP)
- 70% quadriplegic; 12% diplegic; 6% hemiplegic; 2% monoplegic; 1% triplegic; 10% other

Was follow-up sufficiently complete?
- Follow-up from age 2 to age 6
- only 2295 (43%) completed study at age 6

Were objective and unbiased outcomes used?
- Independent gait operationalized as walking alone > 20 ft. without assistive devices.

What are the Results?
- How likely are the outcomes over time?
  - 195 of 2295 (8.5%) walked independently at age 6
  - Logistic regression yielded 5 predictors: 3 motor milestones such as the ability to sit or pull to standing, absence of spastic quadriplegia, and absence of blindness
  - How precise are the estimates of likelihood?
    - 8.5% overall (95% CI 7.8%-9.3% [authors didn't report*])
    - Rolls without sitting OR = 4.6 (95% CI 2.2 to 9.6)
    - Sits without standing OR = 12.5 (95% CI 5.8 to 27.2)
    - Pulls to standing OR = 28.5 (95% CI 13.4 to 60.4)
    - No spastic quadriplegia OR = 2.2 (95% CI 1.5 to 3.1)
    - No blindness OR = 2.4 (95% CI 1.1 to 5.4)

*computed with PEDro Confidence Interval Calculator spreadsheet
Prognostic Studies: What Are the Results?

<table>
<thead>
<tr>
<th>Prognostic Factor</th>
<th>Outcome*</th>
<th>Result Measure</th>
<th>Confidence Interval</th>
<th>Independent*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cerebral palsy</td>
<td>independent ambulation by age 6</td>
<td>0.9%</td>
<td>0.9%</td>
<td>no</td>
</tr>
<tr>
<td>Rolls over but does not without support**</td>
<td>independent ambulation by age 6</td>
<td>4.6 odds ratio</td>
<td>3.9-6.6</td>
<td>yes</td>
</tr>
<tr>
<td>Sit without support, does not stand***</td>
<td>independent ambulation by age 6</td>
<td>32.5 odds ratio</td>
<td>18.5-57.2</td>
<td>yes</td>
</tr>
<tr>
<td>Falls to stand**</td>
<td>independent ambulation by age 6</td>
<td>35.5 odds ratio</td>
<td>13.4-101.4</td>
<td>yes</td>
</tr>
<tr>
<td>No Spastic Quadriplegia independent ambulation by age 6</td>
<td>2.2 odds ratio</td>
<td>1.5-3.1</td>
<td>yes</td>
<td></td>
</tr>
<tr>
<td>No Blindness independent ambulation by age 6</td>
<td>2.4 odds ratio</td>
<td>1.1-5.4</td>
<td>yes</td>
<td></td>
</tr>
</tbody>
</table>

*Note: These prognostic factors are all statistically significant because CIs exclude null value of 1.0

**Relates to children who could not roll at age 2

Prognosis in Physical Therapy: Example #3
- Wu et al. (2004) - continued

How can I apply the results to patient care?

- Were the study patients and their management similar to my practice?
- Is the study outcome what my patient & parents are asking about?
- Can I use the results in the management of patients in my practice?

- Retrospective cohort study: 2b level of evidence


Prognosis in Physical Therapy: Example #3
- Wu et al. (2004) - continued

How can I apply the results to patient care?

- Best Research Evidence* – my interpretation:
  - There is moderate evidence with some validity threats to suggest that only 8 or 9% of children with CP who cannot walk at age 2 will be able to walk independently at age 6. The prognosis appears to be worse for children at age 2 who cannot roll, who are blind, or who have spastic quadriplegia.

*Note: This evidence derived from a single study only (for illustration of method); other evidence exists that should also be considered.
**Prognosis in Physical Therapy: Example #4**

- "What are my chances of returning to competitive soccer within a year after this reconstructive surgery of my anterior cruciate ligament?"

  -- A 23-year old male

---

**Formulating an Answerable Clinical Question**

- **P:** For a 25-year old male who plays collegiate-level soccer
- **E:** who has just had reconstructive surgery for his torn anterior cruciate ligament,
- **O:** what is the probability of returning to competitive sport within 12 months post-surgery?

---

**Searching for Evidence**

- Entered following search string into PubMed Clinical Queries using narrow, specific search for prognosis: competitive sport after anterior cruciate ligament reconstruction

- Yielded one original article and one systematic review

---
Are the Results Valid?

Were the sample of patients representative?
- Case series of 1201 patients who received ACL repairs
- 1062 (88%) returned for routine surgical review at 12 months
- Of these, 503 were in competitive sports pre-injury (20% soccer)
  - 340 men (68%); 163 women (32%)
  - Age 27 ± 8 years
  - 86% injured in league play
  - 12% injured in recreational sport
  - 2% non-sport injuries

Were patients sufficiently homogenous re: prognostic risk?
- All had primary autologous hamstring ACL reconstructions (2003 to 2008)
- All surgeries by same surgeon
- All had same/similar post-operative rehabilitation
- All cleared for competitive sport post-op (most @ 9mo)
- 197 (39%) Australian rules football players
- 102 (20%) soccer players
- 85 (17%) basketball players
- 119 (24%) netball players

Was follow-up sufficiently complete?
- 139/1201 (12%) lost to follow-up; surely some were competitive sports players
- If all 139 dropouts were competitive, this would be 139/642 = 22% dropout rate among competitive players

Were objective and unbiased outcomes used?
- Subjective: Patients answered item on questionnaire:
  - “Have you returned to sports participation following your ACL reconstruction surgery?”
- Responses were coded as not at all, training and/or modified competition, and full competition.
**Prognosis in Physical Therapy: Example #4 - Ardern et al. (2011) - continued**

- **What are the Results?**
  - How likely are the outcomes over time?
    - 168 of 503 (33%) attempted full competition at 12 mo.
    - Univariate (unadjusted) Risk Ratios computed for gender, good vs. poor knee function, & seasonal vs. year-round sports
  - How precise are the estimates of likelihood?
    - Overall, 33% full competitors (95% CI 29%-38%)
    - For soccer, 29% full competitors (95% CI 21%-38%)
    - Overall:
      - Male gender: RR = 1.44 (95% CI 1.01 to 1.90) not significant
      - Good function (IKDC): RR = 1.50 (95% CI 0.86 to 2.50) not significant
      - Good function (hop test): RR = 2.50 (95% CI 1.40 to 4.40) not significant
      - Seasonal sports: RR = 1.40 (95% CI 1.10 to 1.80)

- **How can I apply the results to patient care?**
  - Were the study patients and their management similar to my practice?
  - Is the study outcome what my patient is asking about?
  - Can I use the results in the management of patients in my practice?
    - Case series with (possibly) <80% F/U rate: Level 4
    - Only 20% were soccer players
    - RRs were determined only for entire group (also: not adjusted; not independent)

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Prognosis in Physical Therapy: Example #4

- Ardern et al. (2011) - continued

- How can I apply the results to patient care?

- Best Research Evidence* – my interpretation:
  - There is some fairly weak evidence to suggest that about a third of those who played competitive sports prior to ACL reconstructive surgery will have attempted a return to competitive sports by 1 year post-surgery.
  - For soccer players, this evidence suggests that the true return attempt rate may be anywhere from 21% to 38%.

Journal Article References


Journal Article References (continued)

Book References


Questions