“Screening” Head-to-toe PE

- 140 maneuvers for healthy pts
  *(Stillman consortium, '80s)*

- Checklist driven exercise
“What are you thinking?”

“Oh, I haven’t started thinking yet. First I gather all the data and then I think about it.”
“Screening” Head-to-toe PE

- Mechanical thoroughness
- Rote exercise
- Out of context
  ...not linked to pt complaints

(Contrary to Van der V. & Shurwirth (2005) integrated into clinical studies)

- Students not thinking
Csqs during clerkships...

- Difficulty to:
  - **Select** relevant maneuvers/signs
  - Recognize **abnormal findings**
  - **Interpret** what they find

- *Checklist thoroughness is not enough*

Context & thinking
Hypothesis-driven PE

In context of Hx + Diff. Dx

- Anticipate: Discriminating findings
- Elicit signs: Correct maneuvers
- Interpret: Analytical thinking
- Be corrected: Immediate feedback
- Document: Reporting accuracy
Presentation...

1. Rationale for HDPE
2. Case development
3. Student PE assessment
4. Initial validity findings

R&D project in progress...
This project was funded in part by grants from:

The Edward J. Stemmler, MD
Medical Education Research Fund
Of the National Board of Medical Examiners® (NBME®)

This project does not necessarily reflect NBME policy and NBME support provides no official endorsement.

Aid for Scientific Research
Min. of Ed., Culture, Sports & Science & Techno.
Government of Japan, Tokyo, Japan
Rationales
(4 main findings)

- Have a Dx in mind
- Sort out a differential dx
  *(analytical reasoning)*
- Create solid foundation
- Transfer into practice

→ See more findings
→ Looking for discriminating features
→ Less is more *(prototypes)*
→ Mixed practice with feedback

Bordage, 1999
Features are more evident when $Dx$ is also available.

You see what you’re looking for...

Norman, 1996, 2000
Hatala, 1999
Feature identification - an interactive process -

<table>
<thead>
<tr>
<th>Physical signs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Most</td>
</tr>
<tr>
<td>Many</td>
</tr>
<tr>
<td>Fewer</td>
</tr>
<tr>
<td>Least</td>
</tr>
</tbody>
</table>

- If looking **right** Dx
- If looking **something (DDx)**
- **Just looking, thorough:**
- If looking **wrong** Dx
...avoid collecting data simply for its own sake, for being thorough

Have a Dx in mind.
You will see more...
How many Dx initially?

Shoulder pain

All 34 causes in Jacob’s Textbook vs. 4 prototypical causes e.g., tendonitis, capsulitis, rotator cuff, referred pain
How many Dx initially?

\[ r = -0.58 \]

- Number disorders/ syst. course
- Prototype formation in memory (anchor points)

...less is more

Bordage, 1987
Pneumonia & typhoid

"if thoroughly understood by the students, [they] give them a satisfactory foundation on which to build their later experience."

- 1925 -

"... the student tries to learn too much, and we the teachers try to teach too much – neither, perhaps, with great success"

- 1899 -

Wm. Osler
140 PhEx maneuvers

19 chief complaints (23 CC ≈ 80%)

- 3-4 prototypical, competing diagnoses/CC
- Findings for each Dx (Evidence-b.: sensit., spec.)

Devel. Drs. Otaki, Nishogori & Bordage in Japan

~60 Dx as a solid foundation
Shoulder pain

4 diagnoses:
- Bicipital tendonitis
- Adhesive capsulitis
- Rot. cuff tendonitis
- Referred pain

16 maneuvers:
- Point to area
- Flexion
- Int. & external rotation
- Neck flexion & extension
- L & R rotation of neck
- Lateral bending neck
- Palpation: top, lat., ant.
- Shoulder abduction & add
Data gathering

Select new, useful, discrim. info.

Interpret existing data

Data interpretation

Gruppen et al, 1991
Students select / use irrelevant or non-discriminating info to bolster Dx

(Motrin relieves pain...thus RA)

Premature closure

Friedman, 85% M3
Discriminating features

*for example, strep. throat*

- Age
- Nodes
- CA/imm-supp.
- Imp.m. status
- IV drug abuse
- No cough
- Asthma exac.
- Tachyp-cyan.
- Exudate/red th.
- Sex - lung exp.
- Fever
- ...

Wigton, 1986,'87,'89; Tape, 1991; Poses, 1992
Feedback re: discrimin. features

- Outcome feedback (+/-)  No
- Cognitive (optimal vs. S’s cue weights) + use in practice
- Cognitive + Probability ++ Calibration
Integrating 5 basic elements...

1. Chief complaint (*clinical context*)
2. Corresponding set of proto. Dx
3. PhEx maneuvers (*Sole focus before!*)
4. Interpreting optimal discrim. findings
5. Documenting findings & interpret.

...learning in context - from rote to dynamic
1. Study guide + practice
2. SP exam with immediate fdbk
3. Debriefing: disclosure without blame
Study guide – homework

Given CCs, prototypical Dx & maneuvers:
- Compare & contrast, sort out findings across pairs of Dx
- Learn maneuvers to make a Dx

Build their own representations
Shoulder pain

4 diagnoses:
- Bicipital tendonitis
- Adhesive capsulitis
- Rot. cuff tendonitis
- Referred pain

16 maneuvers:
- Point to area
- Flexion
- Int. & external rotation
- Neck flexion & extension
- L & R rotation of neck
- Lateral bending neck
- Palpation: top, lat., ant.
- Shoulder abduction & adduction
<table>
<thead>
<tr>
<th></th>
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<tbody>
<tr>
<td>S1</td>
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<tr>
<td>S2</td>
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<td>S3</td>
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<td>S4</td>
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<td>S5</td>
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<td>...</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>S16</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**Discriminating features:**
Positive – negative findings

<table>
<thead>
<tr>
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</thead>
<tbody>
<tr>
<td>S1</td>
<td>Sign +</td>
<td></td>
<td>Sign +</td>
<td></td>
</tr>
<tr>
<td>S2</td>
<td></td>
<td>Sign +</td>
<td></td>
<td></td>
</tr>
<tr>
<td>S3</td>
<td>Sign +</td>
<td></td>
<td>Sign +</td>
<td>Sign +</td>
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<tr>
<td>S4</td>
<td></td>
<td></td>
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<td>Sign +</td>
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<tr>
<td>S5</td>
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<td>Sign +</td>
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</tr>
<tr>
<td>S16</td>
<td></td>
<td></td>
<td>Sign +</td>
<td></td>
</tr>
</tbody>
</table>
Basic, clinical pathophys. mechanisms

- Progressive, chronic inflammation of the internal part of joint (intra artic.)
- Sub-acute inflammation of a tendon (extra artic.) due to overuse
- Referred pain, dermatomes
Study guide + practice

- System-based workshops
- Video demos  (*Novi*)
- Practice with SPs
- Practice on ward & in outpt
- …
Exam procedure

Given brief Hx & DDx:
1. **Anticipate** findings for each Dx
2. **Elicit** physical findings
3. **Interpret** findings... working Dx
4. **SP feedback:** redo if needed
   Revise, **re-interpret** Dx
5. **Document** findings & Dx
Ann, 50 yrs old, sees you because of pain in her right shoulder for the past four weeks, especially when she picks things up that are high as on a top shelf.

You’re thinking of possible rotator cuff tendonitis or adhesive capsulitis. In anticipation of your physical exam of the shoulder, list the positive sign(s) associated with each diagnostic hypothesis.
<table>
<thead>
<tr>
<th>Hearing loss</th>
<th>Otitis media</th>
<th>Sudden viral hearing loss</th>
</tr>
</thead>
<tbody>
<tr>
<td>S31: Auditory acuity</td>
<td>(S) Reduced auditory acuity [McGee 839]</td>
<td>Reduced auditory acuity</td>
</tr>
<tr>
<td>S32: Inspect external ear</td>
<td>No lesions present</td>
<td>Possible vesicles in herpes</td>
</tr>
<tr>
<td>S33: Otoscope: internal ear</td>
<td>(M) Otitis media of right side: Immobile bulging tympanic membrane, dull opaque red color</td>
<td>Normal tympanic appearance without fluid</td>
</tr>
<tr>
<td>S34: Rinne test (air conduction &gt; bone)</td>
<td>(S) Bone conduction longer than air [McGee 839]</td>
<td>Air conduction longer than bone conduction bilaterally</td>
</tr>
<tr>
<td>S35: Weber (apex skull) (toward air conduction; away bone cond.)</td>
<td>(S) Sound better in the right side. (NB) [McGee 839]</td>
<td>Sound better in the left side</td>
</tr>
</tbody>
</table>

www.uptodate.com  v15.2 Evaluation of hearing loss in adults
Data interpretation

Given the results of your physical exam, which diagnosis is most likely?

[ ] Rotator cuff tendonitis
[ ] Adhesive capsulitis (frozen shoulder)
[ ] Neither because the findings are ambiguous or contradictory
[ ] Don’t know; would be guessing
SP feedback

- Immediate: - incorrect *(SP demo)*
  - or
  - omitted maneuvers

- Redo

- Do you wish to *revise* your Dx?
Maximize transfer

“Deliberate mixed practice with feedback”

- Deliberate: planned 19CC-160M-60Dx
- Mixed: Shoulder pain: MS, Cardio, GI
- Practice… *lots*…
- With feedback… cognitive, indiv & gr. “learning from errors”

A. Ericsson, 2003
Hatala et al, 1999
<table>
<thead>
<tr>
<th>Anticipate</th>
<th>Elicit</th>
<th>Interpret</th>
</tr>
</thead>
<tbody>
<tr>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>✓</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>✓</td>
<td>x</td>
<td>✓</td>
</tr>
<tr>
<td>✓</td>
<td>x</td>
<td>✓</td>
</tr>
<tr>
<td>✓</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
<tr>
<td>x</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>x</td>
<td>✓</td>
<td>✓</td>
</tr>
<tr>
<td>x</td>
<td>x</td>
<td>x</td>
</tr>
</tbody>
</table>
## Group profile & feedback

<table>
<thead>
<tr>
<th>Name</th>
<th>Antic. signs-Arter. Oblit.</th>
<th>Antic. signs-Stenosis</th>
<th>Elicit PhEx man.</th>
<th>Interpret: Working Dx</th>
<th>Interpret: Revised Dx</th>
<th>Docum. findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Student-2</td>
<td>86%</td>
<td>100%</td>
<td>71</td>
<td>100</td>
<td>100</td>
<td>40</td>
</tr>
<tr>
<td>Student-3</td>
<td>57</td>
<td>100</td>
<td>71</td>
<td>100</td>
<td>100</td>
<td>100</td>
</tr>
<tr>
<td>Student-4</td>
<td>43</td>
<td>100</td>
<td>71</td>
<td>100</td>
<td>100</td>
<td>80</td>
</tr>
<tr>
<td>Student-5</td>
<td>57</td>
<td>100</td>
<td>86</td>
<td>100</td>
<td>100</td>
<td>50</td>
</tr>
<tr>
<td>Student-6</td>
<td>71</td>
<td>50</td>
<td>71</td>
<td>100</td>
<td>100</td>
<td>80</td>
</tr>
<tr>
<td>Student-9</td>
<td>57</td>
<td>100</td>
<td>86</td>
<td>0</td>
<td>0</td>
<td>20</td>
</tr>
<tr>
<td>Student-10</td>
<td>57</td>
<td>0.0</td>
<td>57</td>
<td>0</td>
<td>0</td>
<td>80</td>
</tr>
<tr>
<td>Student-12</td>
<td>29</td>
<td>50</td>
<td>29</td>
<td>0</td>
<td>0</td>
<td>0.0</td>
</tr>
<tr>
<td>Class aver</td>
<td>56%</td>
<td>75%</td>
<td>68%</td>
<td>63%</td>
<td>63%</td>
<td>54%</td>
</tr>
</tbody>
</table>
Meeting with attending

- Discuss their errors in a non–threatening setting
  "Disclosure without blame"

- Cognitive feedback... to link
  - discrim. features & Dx
  - errors vs. optimal strategy
...in summary: 5 main goals

- See more findings $\Rightarrow$ DDx in mind, early
- Solid foundation $\Rightarrow$ Prototypical Dx
- Sort out DDx $\Rightarrow$ Discriminating features
- Contextualized... maximize transfer
- Cognitive feedback, individual & group

*disclosure without blame*
Validity evidence: 4 studies

- Content validity: Dx, discr. features, refs.
- Performance estim.: Students profiles
- H1: *Discriminating findings provide more reliable measures than entire set of maneuvers* (checklist)
- H2: *Long-term retention enhanced by receiving immediate SP fdbk*
Content validity

- 8 clinicians experienced in teaching PhEx from US, Canada, Europe & Japan

- Reviewed & commented on 19 cases, protot. Dx & corresp. signs & add references (evidence-b.)
Content validation

- Suggestions led to 226 modifications:
  - Maneuvers & signs (65%)
  - Dx (21%)
  - Added references to EBM base

- Went from **anatomical** organization to **Dx reasoning** organization

  *Ex.: Chest: lungs only to lungs + JVD + pedal edema*
<table>
<thead>
<tr>
<th></th>
<th>Case-1</th>
<th>Case-2</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Anticip. signs:</td>
<td>Dx-1 29 (57)</td>
<td>Dx-2 50 (75)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Elicit PhEx man.</td>
<td>29 (71)</td>
<td>60 (80)</td>
</tr>
<tr>
<td>3. Interpret: Work. Dx</td>
<td>0 (53)</td>
<td>0 (73)</td>
</tr>
<tr>
<td>4. Interpret: Rev. Dx</td>
<td>0 (60)</td>
<td>100 (87)</td>
</tr>
<tr>
<td>5. Documentation</td>
<td>0 (54)</td>
<td>60 (66)</td>
</tr>
</tbody>
</table>
## Student-A profile

<table>
<thead>
<tr>
<th></th>
<th>Correct</th>
<th>Inc, incomplete</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anticipation</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Maneuvers</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Interpretation: unprompted</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Interpretation: prompted</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

44
# Student-B profile

<table>
<thead>
<tr>
<th></th>
<th>Correct</th>
<th>Inc, incomplete</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anticipation</td>
<td>X</td>
<td></td>
</tr>
<tr>
<td>Maneuvers</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Interpretation:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>unprompted</td>
<td></td>
<td>X</td>
</tr>
<tr>
<td>Interpretation:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>prompted</td>
<td>X</td>
<td></td>
</tr>
</tbody>
</table>

45
## Student Profiles (8)

<table>
<thead>
<tr>
<th>Anticipate</th>
<th>Elicit</th>
<th>Interpret</th>
</tr>
</thead>
<tbody>
<tr>
<td>✔</td>
<td>✔</td>
<td>✔</td>
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<tr>
<td>✔</td>
<td>✔</td>
<td>✗</td>
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<td>✔</td>
</tr>
<tr>
<td>✗</td>
<td>✔</td>
<td>✗</td>
</tr>
</tbody>
</table>

The percentage for each category is as follows:
- Anticipate: 6%
- Elicit: 2%
- Interpret: 5%
How many cases for reliable assessment?
Generalisability study: \( \varphi \) coefficient

<table>
<thead>
<tr>
<th>Total list</th>
<th>Discrim. signs</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>M3s</strong></td>
<td></td>
</tr>
<tr>
<td>3 cases</td>
<td>.35</td>
</tr>
<tr>
<td><strong>D-study</strong></td>
<td></td>
</tr>
<tr>
<td>6 cases</td>
<td>.56</td>
</tr>
<tr>
<td>12 cases</td>
<td>.68</td>
</tr>
<tr>
<td>22 cases</td>
<td>.80</td>
</tr>
</tbody>
</table>
Impact of prior experiences (M3) on retention (M4)

66 M3s IM clerkship → 125 M4 exam

- Student cohorts prep. 6 of 18 complaints using study guide
- Assessed on 3 of 6 complaints

- Assessed on 3 of 6 complaints
- Some students:
  - not seen/studied c.
  - studied, not tested
  - tested on same complaint / w SP fdbk

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Impact of prior experiences (M3) on retention (M4)

Dx accuracy

- Not studied or seen: 68
- Studied but not tested: 73 (NS)
- Seen with SP feedback: 85 (p<.05)
Study guide alone did not have an effect

Dx problems tested with an SP with feedback enhanced long-term retention
Anticipate, elicit & interpret findings in context & thinking

- Key role of **discriminating findings (+/-)** for analytical reasoning
- **Detailed profiles** to focus feedback & instruction
- **Disclosure without blame**
- **Reliable & feasible** *(12 complaints)*

- **Better long-term retention with immediate feedback from SP**
Future plans... development

- Replace HTT with HDPhEx in M2 year, integrated with clinical pathology
- Add Hx component; anal. & non-anal.
  
  Eva, 2006; Ark et al, 2006

- Introduce HDPhEx in M3 yr, reinforcement

- Use discriminating items to build cklists: library of key-feature items linked to Dx
Future plans... research

- HDPhEx - As initial method (M1-2) to learn PhEx
  - Reinforcement in M3-4 yrs
- Validity data from other sites
- Differentiate SP from SP+Fdbk effect
THANK YOU
Questions
Beyond checklist to context & meaning
Hypothesis-driven Ph Exam

Hx + Diff. Dx : in context

- Anticipate : discriminating findings
- Elicit signs : correct maneuvers
- Interpret : analytical thinking
- Be corrected : immediate feedback
- Document : reporting accuracy
Norman, NEJM, 2006;355:2251-52
Eva, Med. Ed., 2005
Ark et al, Med Ed., 2007;41:281-87
Van der V. & Schuwirth, Med Educ 2005, 39, 309-317
Ericsson et al. Psychol Rev. 1993; 100:363-406.