Diagnostic errors related to flaws in clinical reasoning: mechanisms and prevention in practice

Mathieu Nendaz
Service de Médecine Interne Générale, Hôpitaux Universitaires
UDREM, Faculté de Médecine
Geneva, Switzerland

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Plan:
Processes of reasoning and of decision
Pitfalls related to the processes
Can we do something against pitfalls
Diagnostic error: frequency

- Chart analyses of patients having suffered from an incident
  - 7-20% of events are due to diagnostic errors
- Observation of clinical practice (non-visual disciplines)
  - Up to 15% of patients had diagnostic errors
    - Cancer
    - Post-trauma lesions, surgical problems
    - Infections
    - Myocardial infarction
    - Thrombo-embolic disease

Blendon. NEJM 2002;347:1933-40
Schiff G. Arch Intern Med 2009;169:1881-7

Causes of diagnostic errors

- Cognitive factors = how doctors think!
  - 46%
- Context system
  - 19%
- No-fault error
  - 7%

Arch Intern Med. 2005;165:1493-1499
http://www.webmm.ahrq.gov/media/cases/images/cheese.jpg
Understanding the reasoning process is key...

Some elements


One clinical case

- M. P. 72 year-old
- Previous history
  - Arterial Hypertension, stable for years under ACE Inhibitor + thiazidic diuretic
- New appointment
  - For 3-4 weeks: new dyspnea, leg edema
- Physical examination
  - BP: 185/100 mmHg
  - Pitting leg edema
  - Lung rales
  - Left flank with arterial bruit
- Laboratory
  - Serum creatinine 320mol/L
- Dx hypothesis
  - Renal artery stenosis
- Decision
  - Angio-Magnetic Resonance Imaging
Ideal process to a decision

Patient problem
Clinical reasoning
Reflexion

Biases – heuristics
external factors

WORKING HYPOTHESIS

Decision analysis
EBM

DECISION: test, ttt, triage, …

Known hypertension, cardiac failure, worsening GFR under ACEI, flank murmur
Renal artery stenosis
Angio-Magnetic Resonance Imaging

Nendaz M. Rev Med Int 2011;32:435-42

Hypothetico-deductive Process

Patient information

Hypothesis(es) generation

Data interpretation

Hypothesis(es) verification

Final hypothesis(es)

It's been hard to breathe for 3 weeks, particularly when I'm lying
Heart failure?
Lung problem?
Orthopnea not discriminative
Heart failure remains plausible, lung problem not excluded
HEART FAILURE
What is your diagnosis?

Non-analytic, immediate process

Memorization of instances
holistic: even the patient’s context (e.g. banker)

Norman GR. Med Ed 2007; 41:1140-5
Recognition of clinical picture depends on the clinical information collected or valorized by the physician !!!

**problem representation**

- Known hypertension, dyspnoea, leg edema, worsening GFR
- Hypertensive cardiac insufficiency, nephroangiosclerosis
- Renal artery stenosis
- Known hypertension, dyspnoea, leg edema, worsening GFR, under ACEI, flank murmur
Data collection from the patient

Knowing which clinical data to collect from the patient and why

History: A 20-y.o. man feels generalized muscle weakness.

Key features of the case detected on a picture

Conclusions of this study

- Recognition and interpretation of clinical data go with the quality of diagnostic hypothesis to test
- Mechanical data collection is not a guarantee of diagnostic success...

One only finds what we are looking for...
- Cf cardiac auscultation of pericardial rub or mitral murmur after reading the echo report...

Brooks L et al. Psychol Sci 2000; 11:112-17
Flaws in clinical reasoning: %

- Knowledge
- Data collection
- Data integration
- Data verification

Graber M. Arch Intern Med. 2005;165:1493-1499

Flaws in decision process: heuristics

Decision analysis EBM

DECISION: test, ttt, triage, ...
Dr Missouri

- Trained in the US in an area with a very high prevalence of histoplasmosis
- Moves to Basel, Switzerland (no histoplasmosis)
- Pulmonary infiltrate:
  - Continues to evoke histoplasmosis systematically despite very low prevalence

→ **Representativeness bias**

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**Some other heuristics and biases**

- **Availability**
  - One remembers a recent/striking fact: considered as frequent
- **Anchoring**
  - Cannot give up the first hypothesis despite lack of evidence
- **Confirmatory**
  - One only values data confirming own hypothesis
- **Overconfidence, inability to suspect own flaw in**

**Consequences:**
- Premature diagnostic closure
- No verification of initial hypotheses

**Inappropriate Decision**

_Elstein A. Acad Med 1999;74:791_  
_Am J Med 2008;121:S2–S23_
Decision modulators...


Physician’s personality

- Gender
- Age
- Specialisation
- Emotional implication
- Stress management
- Risk prone or risk adverse
Perceptions and representations about patient (a priori)

- Socio-economic level
- Age
  - Underuse of some medication or procedures
- Gender, race
- Addiction (OH, illicit drugs...), risky behaviors (tobacco, obesity...)
  - Negative feeling leading to diminished patient-doctor communication and decision quality

External constraints

- Health care policies
  - TARMED
  - Fin de l’obligation de contracter
    - (Vernehmlassung über Aufhebung des Kontrahierungszwanges)
  - Clause du besoin
    - (Ärztestopp)
  - Complementary medicine
  - Glasses
  - Etc..
  - \( \rightarrow \) impact on reasoning and decisions?
Summary: putting all together...
Flaws in reasoning and decision processes

Patient problem
Clinical reasoning
Reflexion

Lack of knowledge and experience
Overconfidence

Inappropriate reasoning shortcuts
Faulty immediate recognition
Anchor and confirmation biases

Flaws in patient data collection and integration

Premature diagnostic closure

Absence of self-evaluation
Incapacity to recognize own weaknesses

Erroneous decision

Can we do something about these flaws?
3 levels of action

Acting on action
Training
System

*Berner E. Am J Med 2008;121:S2-23*
Reflective physician: Self-awareness about own processes


Self-awareness about own work

- Tools to foster physician’s self-assessment
  - Meta-cognition (*situational awareness*)
    - Knowing reasoning and decision processes and their potential biases
    - = today’s presentation !!!
    - Being able to recognize these biases in ourselves while working…
  - Criticizing own diagnosis or decision (*prospective hindsight*)
    - What are the consequences of this diagnosis?
    - What diagnosis should I not miss?
    - What is the differential diagnosis?
    - If it is not what I think, what else could it be?
  - Reflective, deliberate practice
    - Metacognition + self-assessment according to a specific method
Training (future) physicians: prescriptions

Image: http://www.niquenyafulbright.com/become_a_coach.htm

Rp. #1. Reasoning process

- Case specificity: Learning process without content is not transferable to any case!
- Use mixed approach (dual processing: analytic + non-analytic): more efficient!

- Generation of diagnostic hypotheses
- Verification, integration of clinical information
- Search for additional information

- Working hypothesis: decision about tests, management, triage
Rp. #2. Practice, practice, practice…

- Practice in real world of clinical context, see many cases…
- Yes… but with feed-back!

Impact of clinical context on learning

- Increased relevance of collected information from patient (Hx and PE)
- Increased reasoning quality in charts

Nendaz et al. SSMI and AMEE 2009

Rp. #3. Train content and process

- Training of clinical reasoning should also give insight into own process of clinical reasoning: has a positive impact

<table>
<thead>
<tr>
<th>Correct diagnosis mentioned in the differential of the chart</th>
<th>Control</th>
<th>Intervention</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>75% (57-87)</td>
<td>97% (83-99)</td>
<td>0.02</td>
<td></td>
</tr>
</tbody>
</table>

This case-based clinical reasoning seminar intervention designed to bring students insight into cognitive features of their reasoning improved the quality of the differential diagnosis at the time of case synthesis in the medical chart
Rp. #4. Train the trainers...

- Train your clinician-teachers in pedagogy: they will provide more efficient teaching
  - Steinert Y et al. Med Teach 2006;28:497–526

- Teaching often based on personal opinions while evidence exist on methods
- Importance of faculty development in pedagogical skills!

Impact

- Metacognition « encouraging »
  - Limited studies
  - Some effect demonstrated in some fields (e.g. obstetrics)

- Reflective practice: positive effect
  - Particularly on difficult cases
    - Mamede S. Acad Med 2008;83:1210–6

- Limitations
  - Physician compliance and adhesion to such approaches
  - Additional intervention should try, not only to prevent flaws, but to detect and immediately correct them while working
    - Dror I. Med Teach 2010;33:34-8
Environment adaptation to prevent errors

Lack of knowledge
Lack of supervision, of communication, of teamwork
Environment, work overload
Cognitive biases (heuristics)
Incorrect decision

Inspired from
http://www.webmm.ahrq.gov/media/cases/images/cheese.jpg

Examples of external help

- Diagnostic support systems
- Alerts
- Electronic chart
- Verifications and feed-back
- Coaching
- Political стратегические decisions
  - Resources (human and $)
  - Work load
  - Working duration, schedules

→ Impact on decision flaws?
Conclusions

- Diagnostic processes are well studied
- Reasoning process includes flaws
  - Mainly cognitive in nature
- The mechanisms of those flaws have been well described
- Ways to prevent these flaws are under study but some evidence already exists

- Physicians should be interested in their ways of making decisions
- Training clinical reasoning and helping physicians detect and correct flaws should be valorized in institutions and medical societies (pre-, post-graduate and continuous education)
Thank you!

Clinical-reasoning-learning seminars with enhancement of reflective practice on selected features related to diagnostic competence

**STUDENTS**
- Raise initial hypotheses
- Establish strategy
- Ask the preceptor for additional information
- Raise, compare, contrast diagnostic hypotheses
- Final diagnosis and patient management

**PRECEPTOR INTERVENTION**
- Presentation of the chief complaint
- Before providing the requested information:
  - Asks students to justify their requests
- Makes students prioritize and verify the hypotheses elaborated

**FEATURES TO REINFORCE EXPLICITLY**
- Non-analytic diagnostic impression
- Directed and relevant data acquisition
- Characterization of chief complaint
- Pbl representation
- Early elaboration of dx hypotheses
- Early collection of key information
- Elaboration of prototypical dx hyp to frame data collection

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Training content and reasoning: 5 Rp.

1. Case specificity: Learning process without content is not transferable to any case!

2. Reasoning process: Mixed approach (analytic+non-analytic) more efficient
   ▶ Ark TK et al. Acad Med 2006;81:405-9

3. Practice in real world, see cases… with feedback
   ▶ Kassirer JP. Acad Med. 2010;85:1118-24

4. Reasoning seminars giving insight into own process of clinical reasoning has a positive impact
   ▶ Nendaz M. Educ for Health 2011;in press

5. Clinicians with training in pedagogy provide more efficient teaching