Pitfalls in medicine

How do internists reason and why does it matter?

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Geneva University Hospitals and Faculty of Medicine

Winter School

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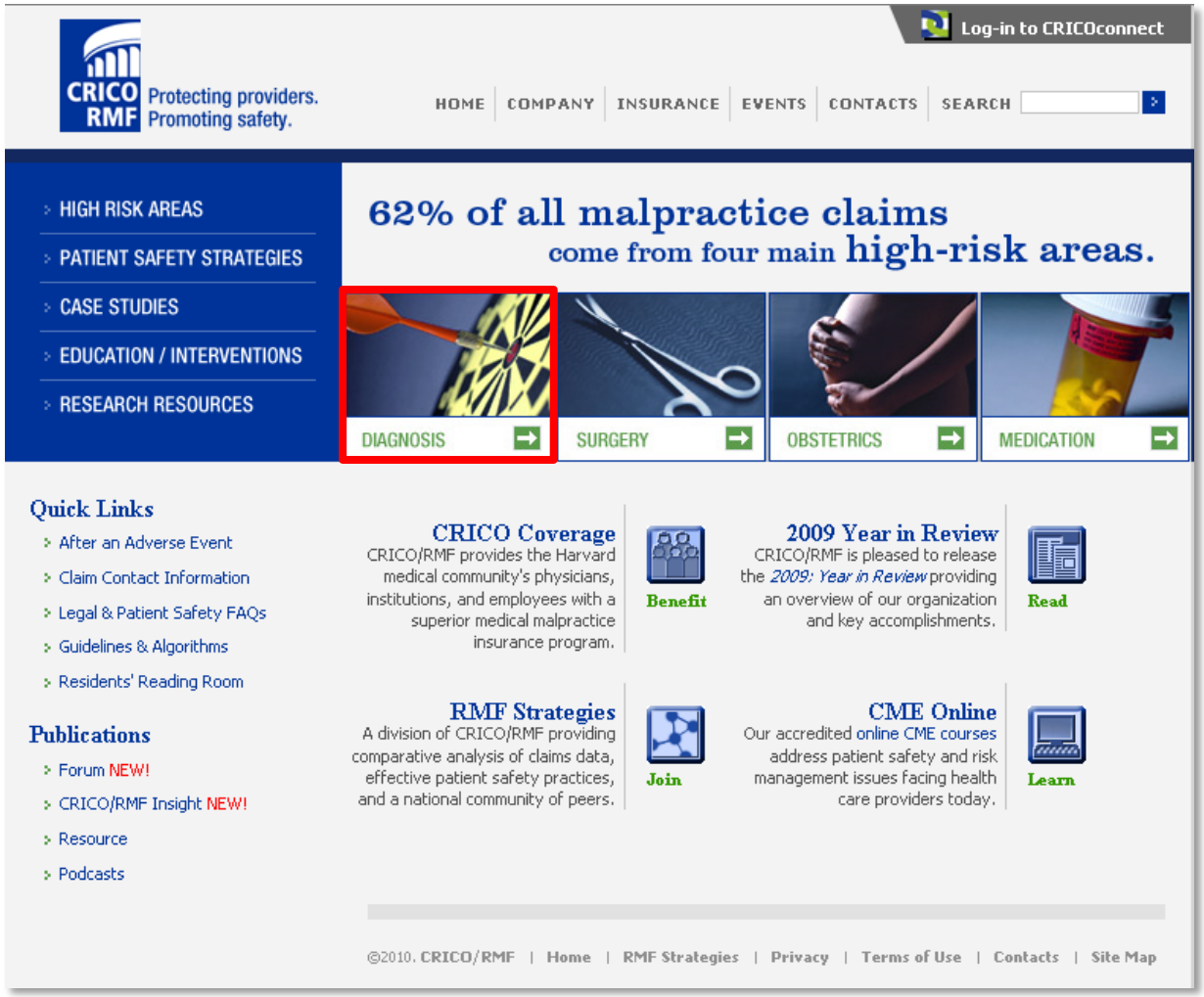
Saas-Fee

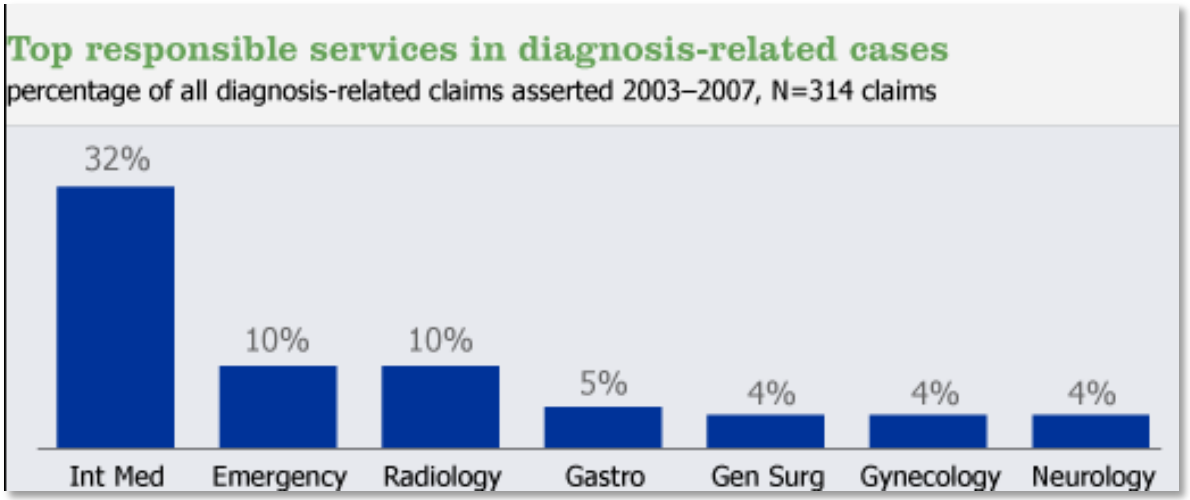
How do internists reason?

Diagnostic errors are frequent



Cited in Schiff GD & Bates DW. N Engl J Med. 2010;362:1066-9.
Can electronic clinical documentation help prevent diagnostic errors?

Diagnostic errors are frequent



Diagnostic errors are frequent

Breakdowns in the Process of Care

percentage of all diagnosis-related claims asserted 2003–2007, N=314 claims

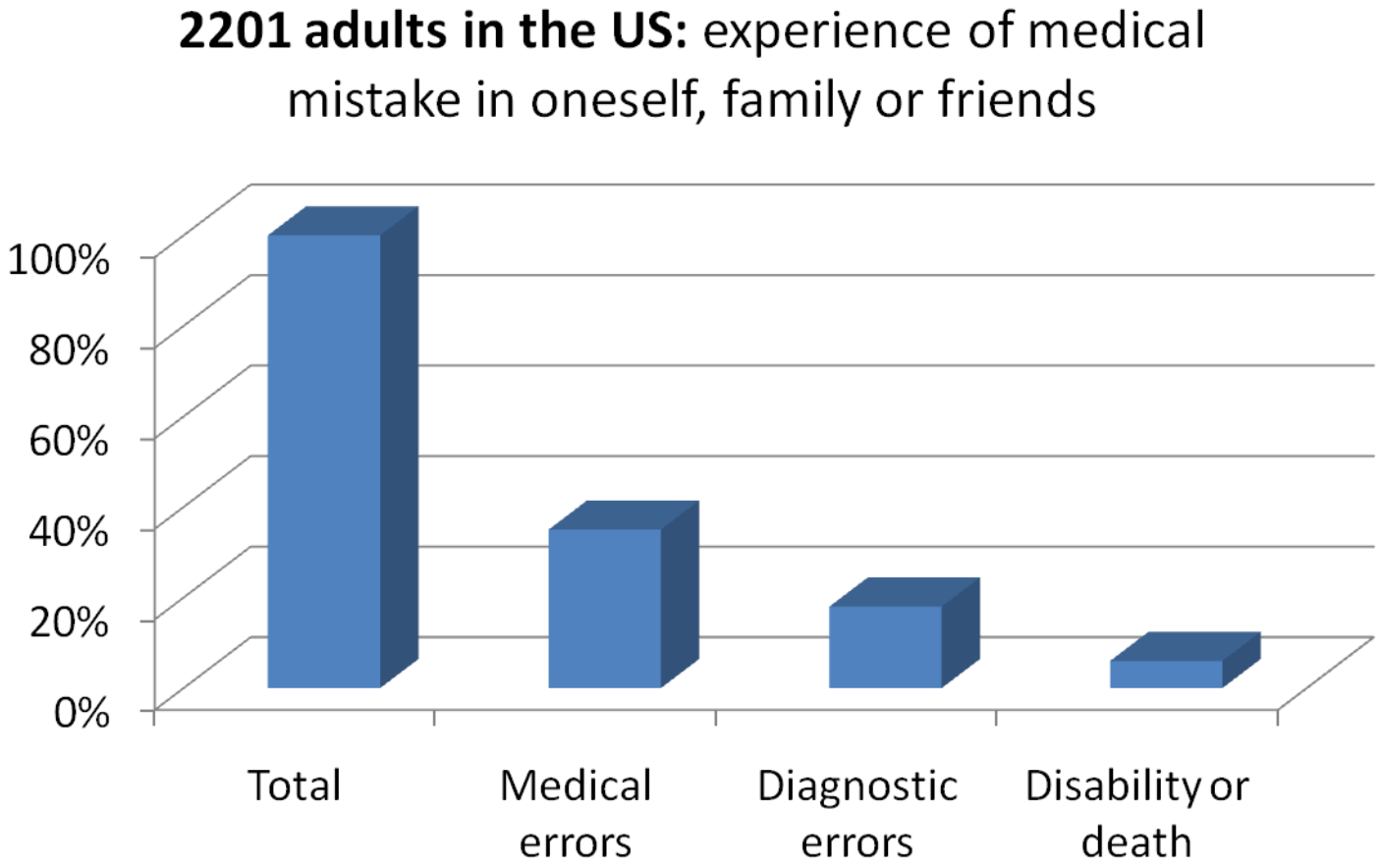
Process of Care	% of cases*
Patient notes problem and seeks care	6%
History & physical, evaluation of symptoms	42%
Order of diagnostic labs/tests	60%
Test performance	7%
Test interpretation	35%

Process of Care	% of cases*
Receipt/transmittal of test result	14%
Physician follow-up with patient	18%
Referral management	22%
Patient compliance	5%

*A case may have more than one breakdown in the process of care.

How frequent are diagnostic errors?

YouGov survey of medical misdiagnosis. Isabel Healthcare–Clinical Decision Support System, 2005. Available at: http://www.isabelhealthcare.



How frequent are diagnostic errors?

Am J Med 2008;121:S2–S23

- Less frequent in "visual disciplines" (radiology, pathology): around 5%
- In clinical disciplines, on average **15% of our diagnoses are wrong!**
- Demonstrated in:
  - Autopsy studies
  - Emergency medicine
  - Family medicine (standardized patients)

A clinical case

- 85-year old male colleague
- Previous history:
  - Paroxysmal atrial fibrillation treated successively by amiodarone, beta-blockers and flecainide
  - Treated HTA
  - Heart murmur since teen-age (mitral prolapse)
- Present history:
  - **Worsening dyspnea** since 2 months
- Cardiological consult: (minus 2 months)
  - Unremarkable physical examination
  - Sinus rythm

85-year old male ex-physician

- Pulmonology consult: (minus 3 weeks)
  - Normal lung function tests
  - Reduced distance on 6-minute walking test, no drop in O2 sat.
  - Conclusion: physical deconditioning
- Returns to his cardiologist:
  - Echocardiogram: normal LV function, known mitral regurgitation
- Evolution:
  - grade II to gr. III-IV dyspnea, weight gain
  - Stopped his blood pressure medication (ACE) because of poor tolerance (malaise and hypotension)
  - BP remains well-controlled
  - No chest pain

85-year old male ex-physician

- Physical examination:
  - BP 140/80 mmHg. HR 76 per min. Afebrile. RR 20 per min.
  - Poor general condition
  - Elevated JVP. Peripheral edema +
  - High-pitched 2/6 holosystolic murmur with axillar irradiation.
  - No rales. Hypoventilation and dullness of the right lower lung field.

Chest X-ray

Working diagnosis

- Heart failure with normal ejection fraction decompensated due to high BP (stop medications)

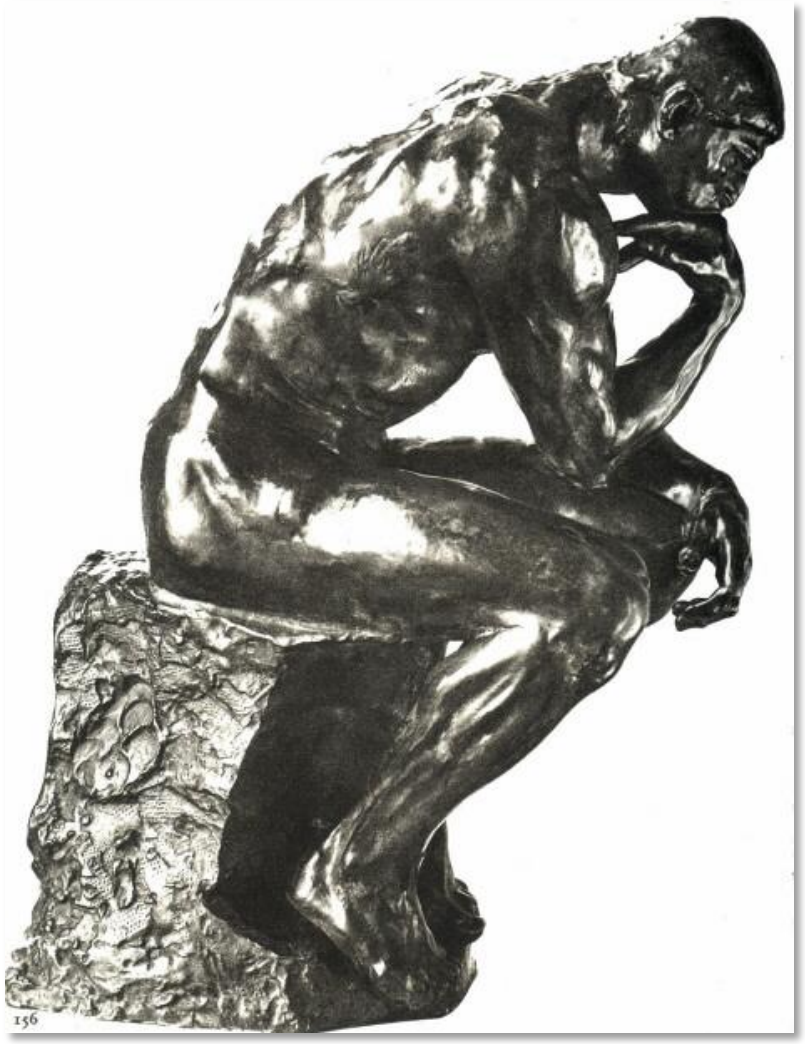
- Treatment:
  - ACE inhibitor restarted
  - furosemide

85-year old male ex-physician

- Evolution under treatment:
  - Increasing weakness and dyspnea
  - No weight loss
  - Low blood pressure after iv diuretics

⇨ Where have we gone wrong???

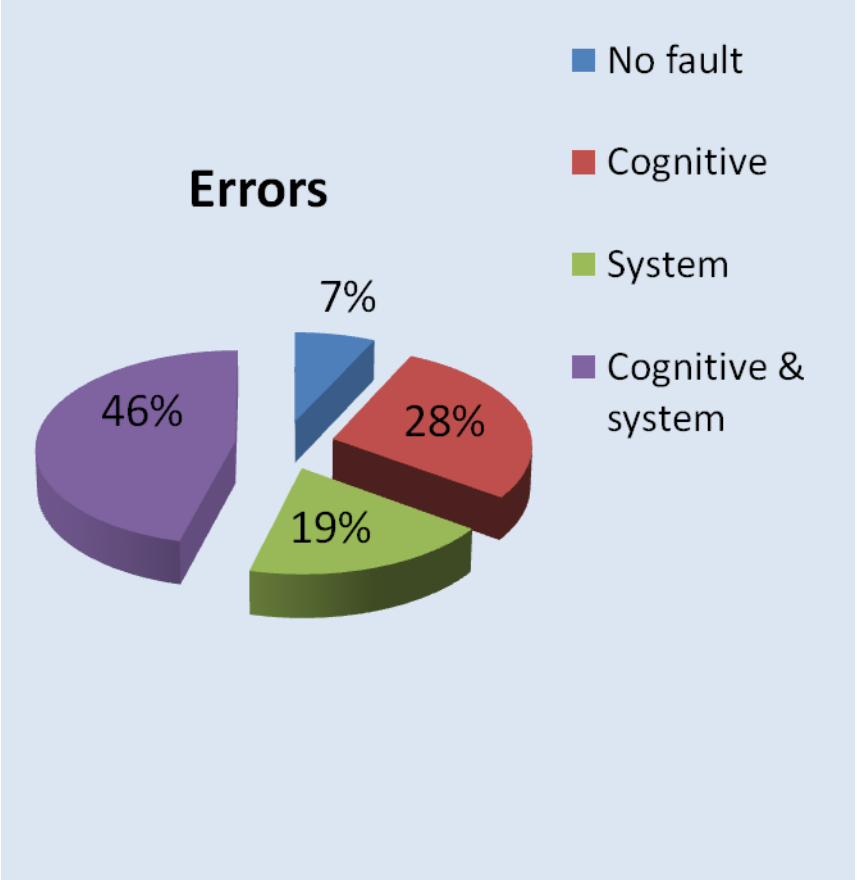
Diagnostic mistakes and cognitive error



Cognitive errors

Arch Intern Med. 2005;165:1493-1499

- 100 autopsy-verified Dx errors
- 90 injuries, 33 deaths
- Analysis:
  - 93 cases with errors
  - Mean of 6.5 factors per case
  - Cognitive factors 74%



Cognitive errors

Arch Intern Med. 2005;165:1493-1499

Cognitive factor contributing to error	N
Faulty knowledge	11
Faulty data-gathering - Failure to collect **appropriate information** from the initial interview and examination - …	45
Faulty synthesis: faulty information processing - Overestimating or underestimating usefulness or salience of a finding - Faulty detection or perception - Failed heuristics - Faulty interpretation of a test result -…	159
Faulty synthesis: faulty verification - **Premature closure**: failure to consider other possibilities once an initial diagnosis has been reached -Failure to periodically review the situation - …	106

Heuristics in medical reasoning

Klein JG. Five pitfalls in decisions about diagnosis and prescribing. BMJ 2005;330:781–4

Representativeness heuristic

- Categorical judgements made on the basis of how much an individual example resembles the stereotype of the category, largely ignoring the relative likelihood of falling into each category.

Availability heuristic

- Place particular weight on examples of things that come to mind easily because they are easily remembered or recently encountered

Overconfidence

- To use our knowledge effectively, we must be aware of its limitations

Dr Missouri

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

→ **Representativeness bias**

Dr Available

- Recently worked up a patient admitted for severe hypertension
- Diagnosis: Cushing's disease!
- Thinks of Cushing's disease in every hypertensive patient

→ **Availiability bias**

Overconfidence

Am J Med 2008;121:S2–S23

The American Journal of Medicine (2008) Vol 121 (5A), S2–S23

ELSEVIER

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Overconfidence as a Cause of Diagnostic Error in Medicine

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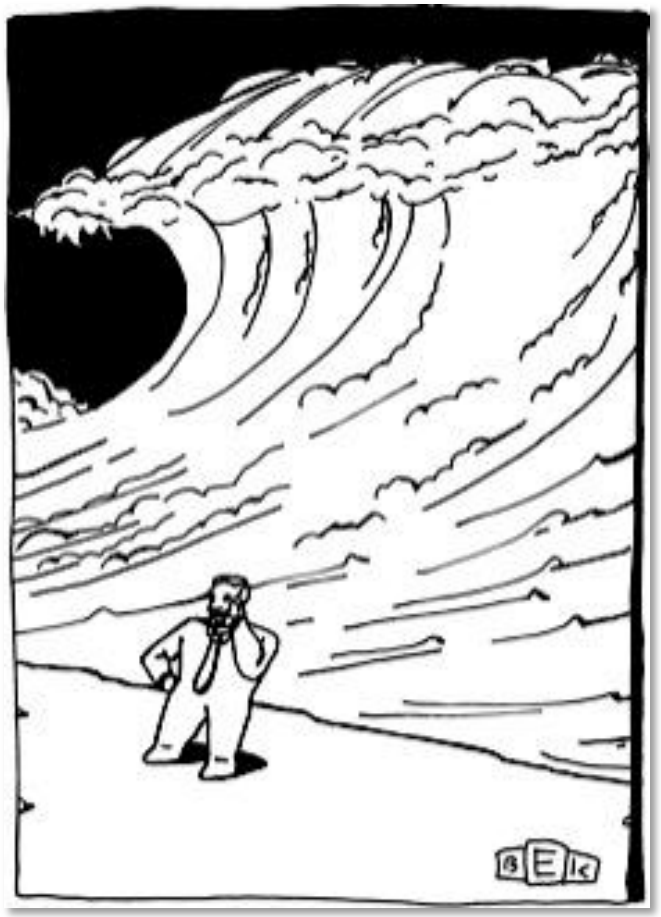
ABSTRACT

The great majority of medical diagnoses are made using automatic, efficient cognitive processes, and these diagnoses are correct most of the time. This analytic review concerns the exceptions: the times when these cognitive processes fail and the final diagnosis is missed or wrong. We argue that physicians in general underappreciate the likelihood that their diagnoses are wrong and that this tendency to overconfidence is related to both intrinsic and systemically reinforced factors. We present a comprehensive review of the available literature and current thinking related to these issues. The review covers the incidence and impact of diagnostic error, data on physician overconfidence as a contributing cause of errors, strategies to improve the accuracy of diagnostic decision making, and recommendations for future research.

KEYWORDS: Cognition; Decision making; Diagnosis; Diagnosis, computer-assisted; Diagnostic errors; Feedback



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Representativeness heuristic

- assumption that something that seems similar to other things in a certain category is itself a member of that category

Availability heuristic

- Place particular weight on examples of things that come to mind easily because they are easily remembered or recently encountered

Overconfidence

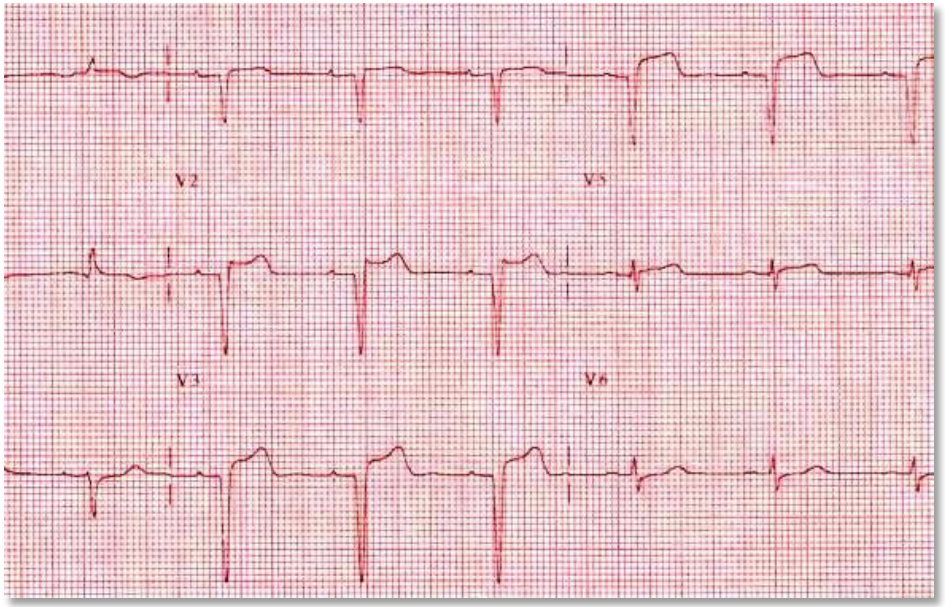
- To use our knowledge effectively, we must be aware of its limitations

Confirmatory bias

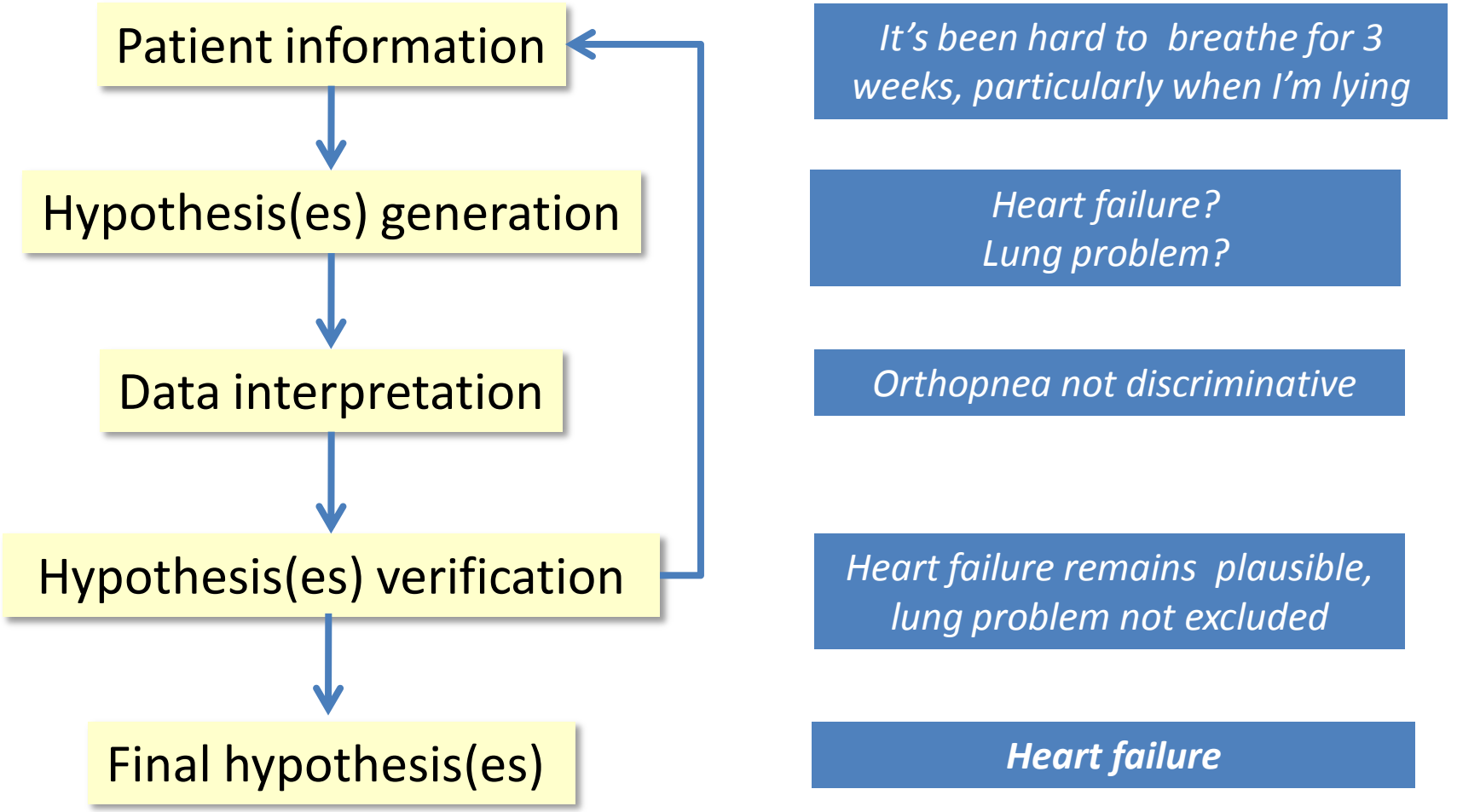
- Tendency to look for, notice, and remember information that fits with our preexisting expectations

Which diagnostic strategies?

Immediate recognition



Hypothetico-deductive process
e.g. dyspnea



Clinical reasoning: a hybrid process

Elstein AS. Eval and the Health Prof 1990; 13:5-36. Schmidt HG. Acad Med 1990; 65:611-21. Patel VL. Mem Cogn 1990; 18:394-406. Elstein AS. Teach Learn Med 1994; 6:121-123. Norman GR. Teach Learn Med 1994; 6:114-120.

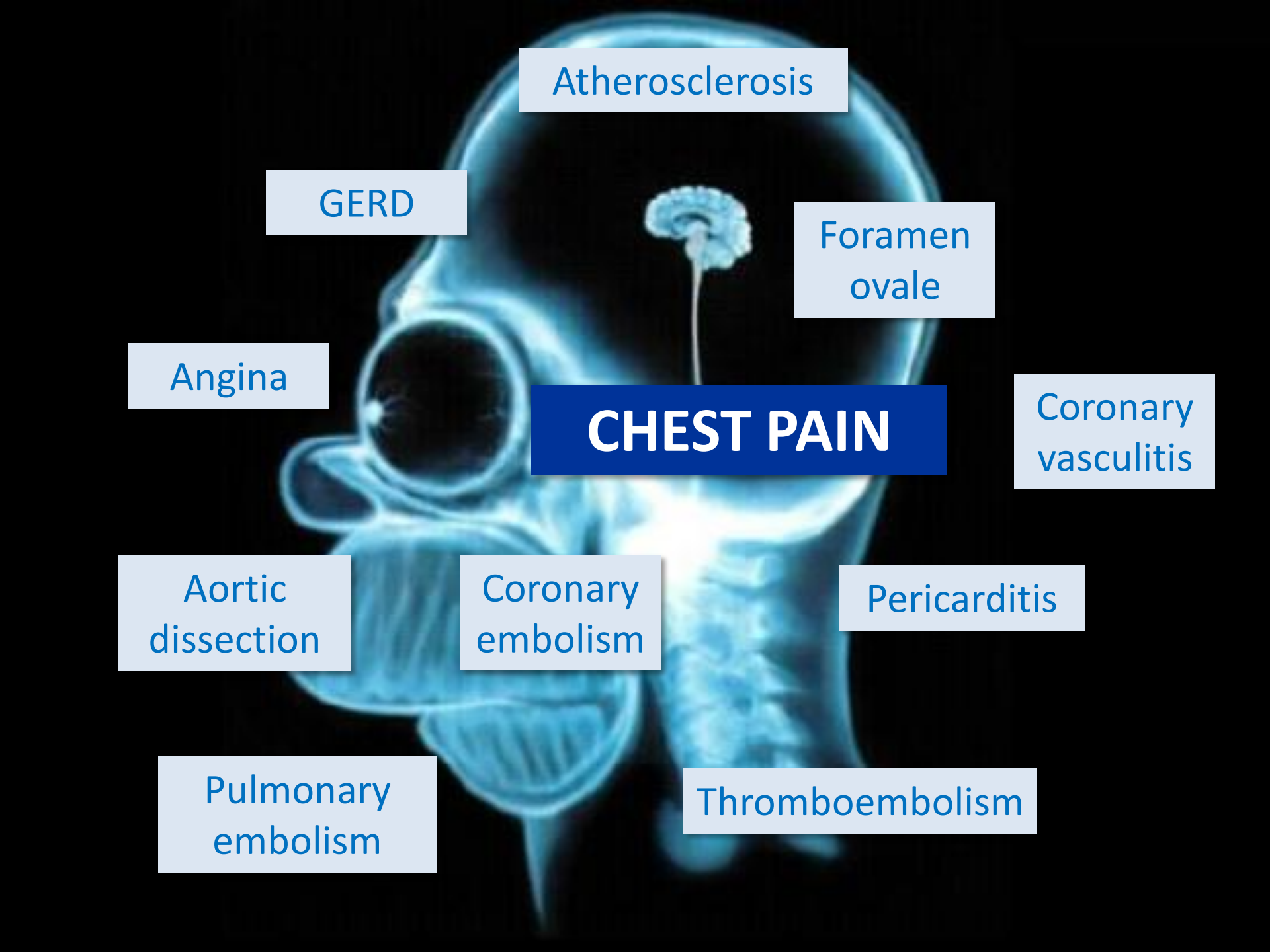
Approach is case-dependent

- Clinician is familiar with the case (« experts »)

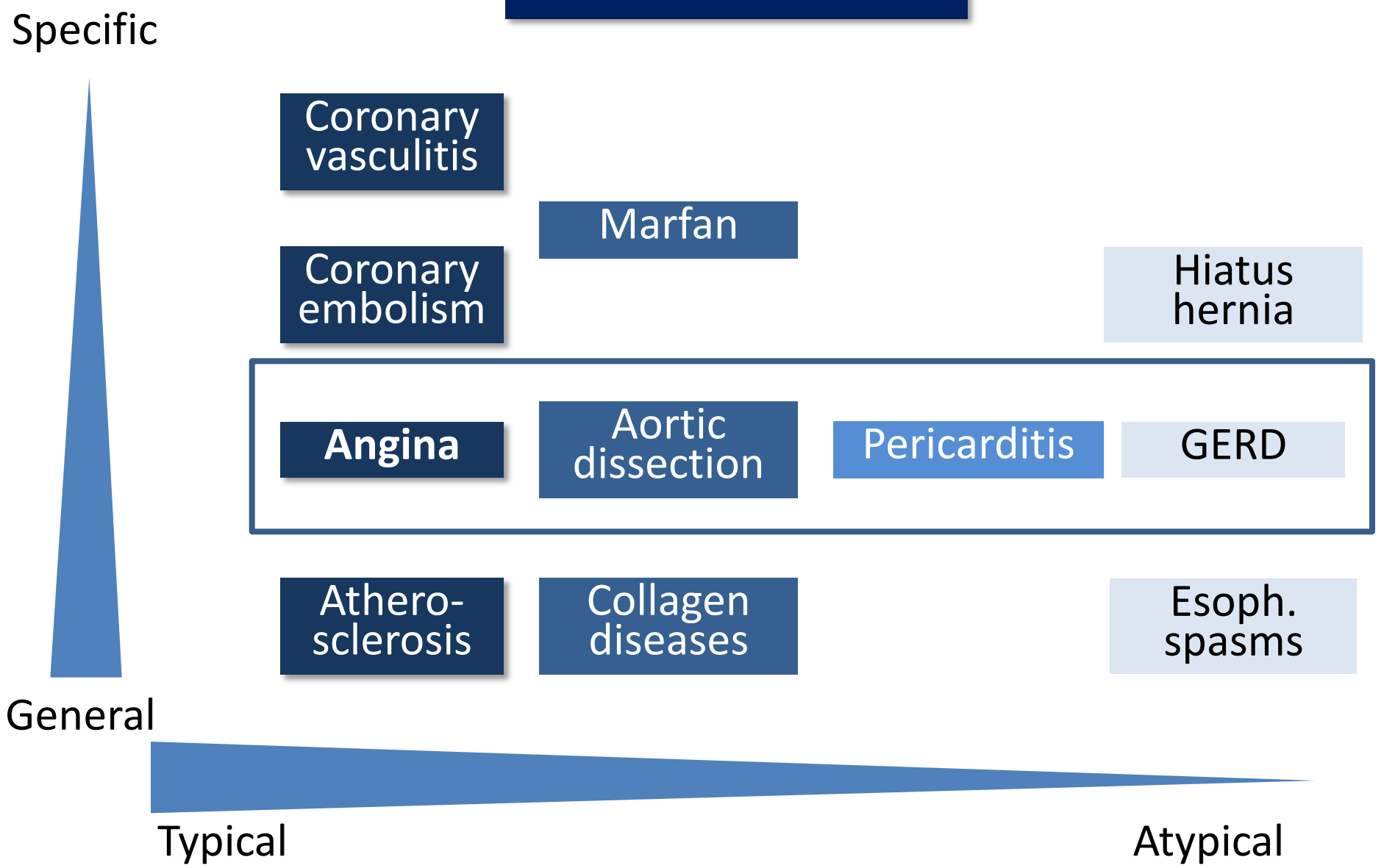
  Immediate recognition

- Clinician is not familiar with the case (« learners »)

  Hypothetico-deductive process


Atherosclerosis
GERD
Foramen ovale
Angina
CHEST PAIN
Coronary vasculitis
Aortic dissection
Coronary embolism
Pericarditis
Pulmonary embolism
Thromboembolism

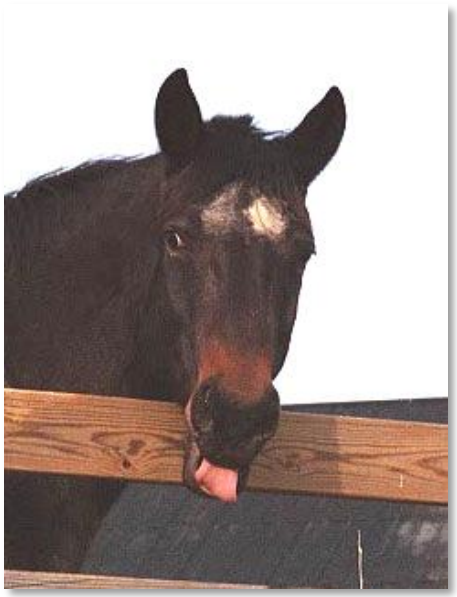
CHEST PAIN



Bordage & Zacks. Med Educ 1984;18:406-16. Papa. Acad Med 1996;71:S10-2. Bordage. Med Educ 1987;21:183-8.

Prototypes: implications for teaching?

- Hoof sounds in Saas Fee…?



Horses not zebras!

- Back to the patient!

Hypothetico-deductive process
application to clinical case

Patient information

Worsening dyspnea, weight gain, orthopnea, normal echocardiogram

Hypothesis(es) generation

Heart failure, ***causes?***

Data interpretation

Normal echocardiogram not discriminative

Hypothesis(es) verification

Search for causes of heart failure

Final hypothesis(es)

Heart failure due to…

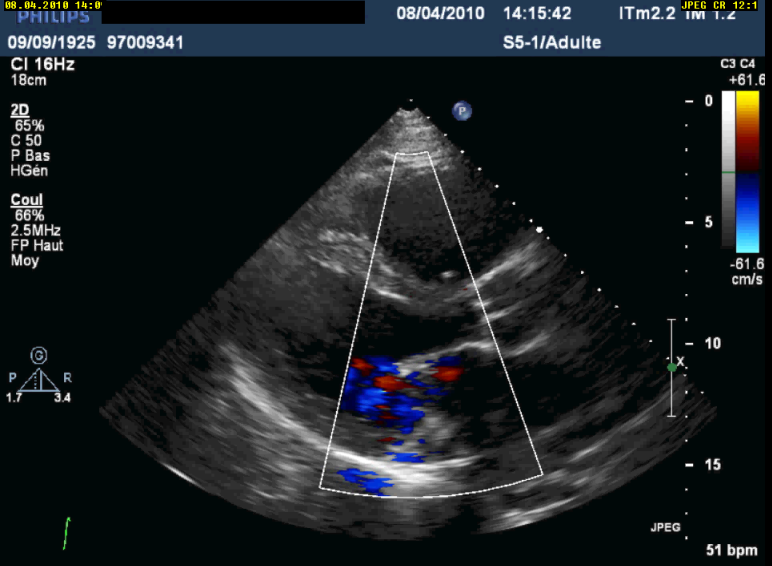
Causes of heart failure syndrome

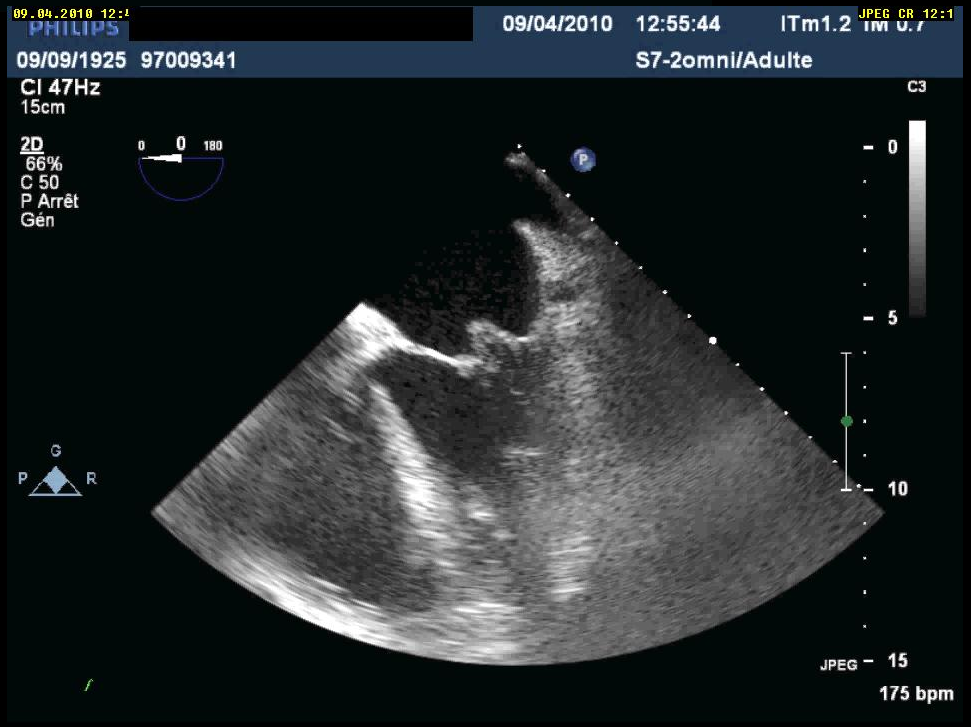
Left heart failure

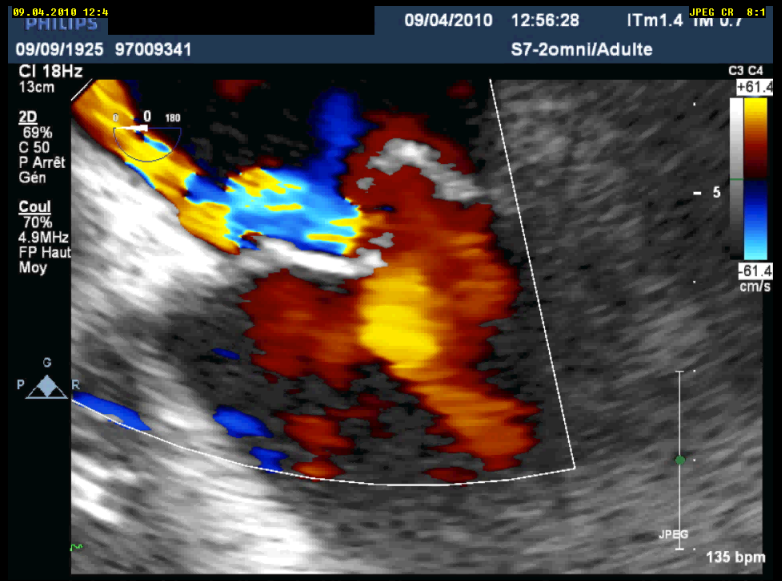
- ~~Arhythmia (tachy-, brady-)~~
- ~~Ischemia~~
- ~~High blood pressure~~
- ~~Infection~~
- Pulmonary embolism +
- Valvular disease +++
- Constritive pericarditis +
- Tamponade +

Repeat echocardiogram!

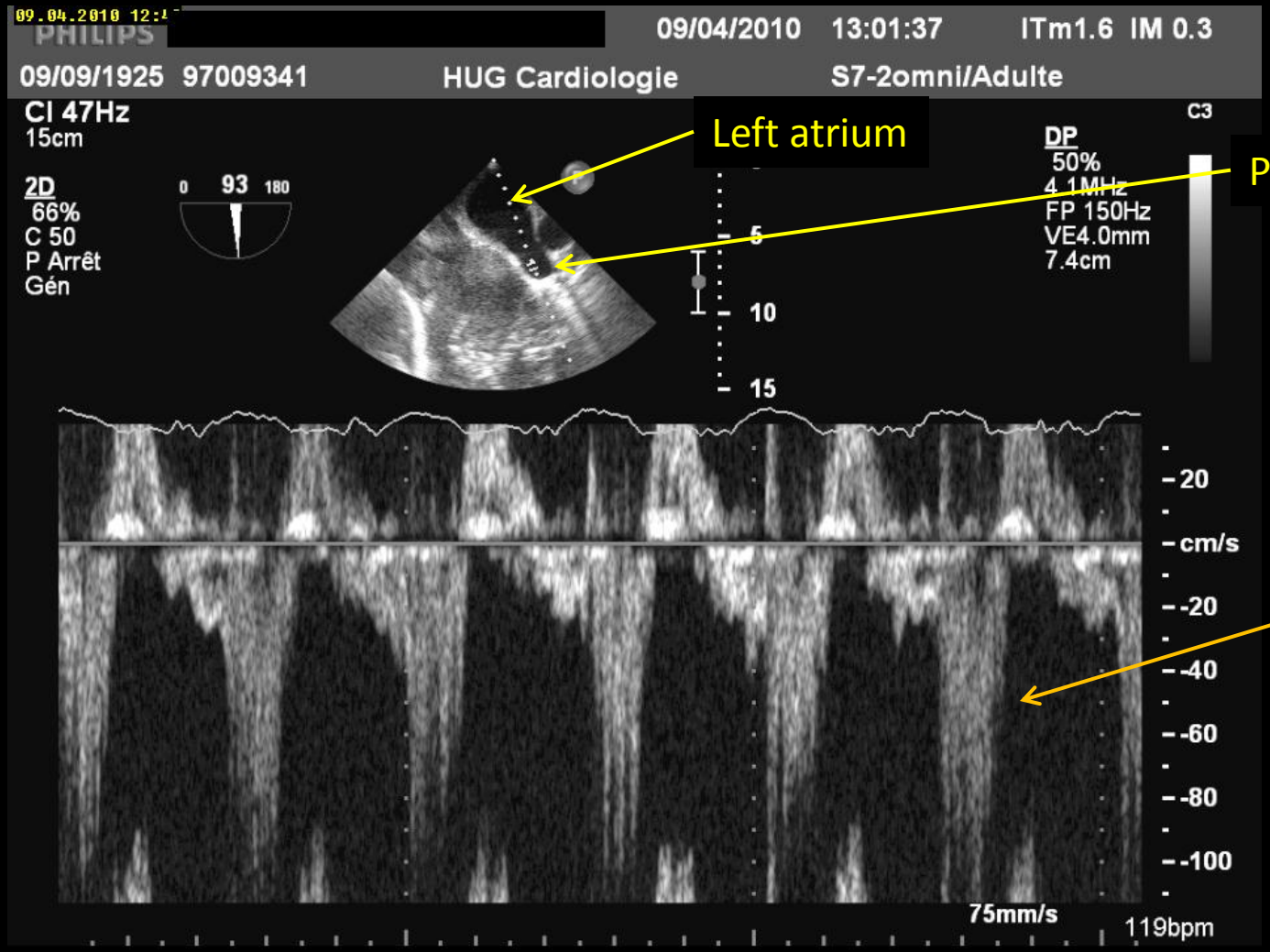
85-year old patient: echocardiogram







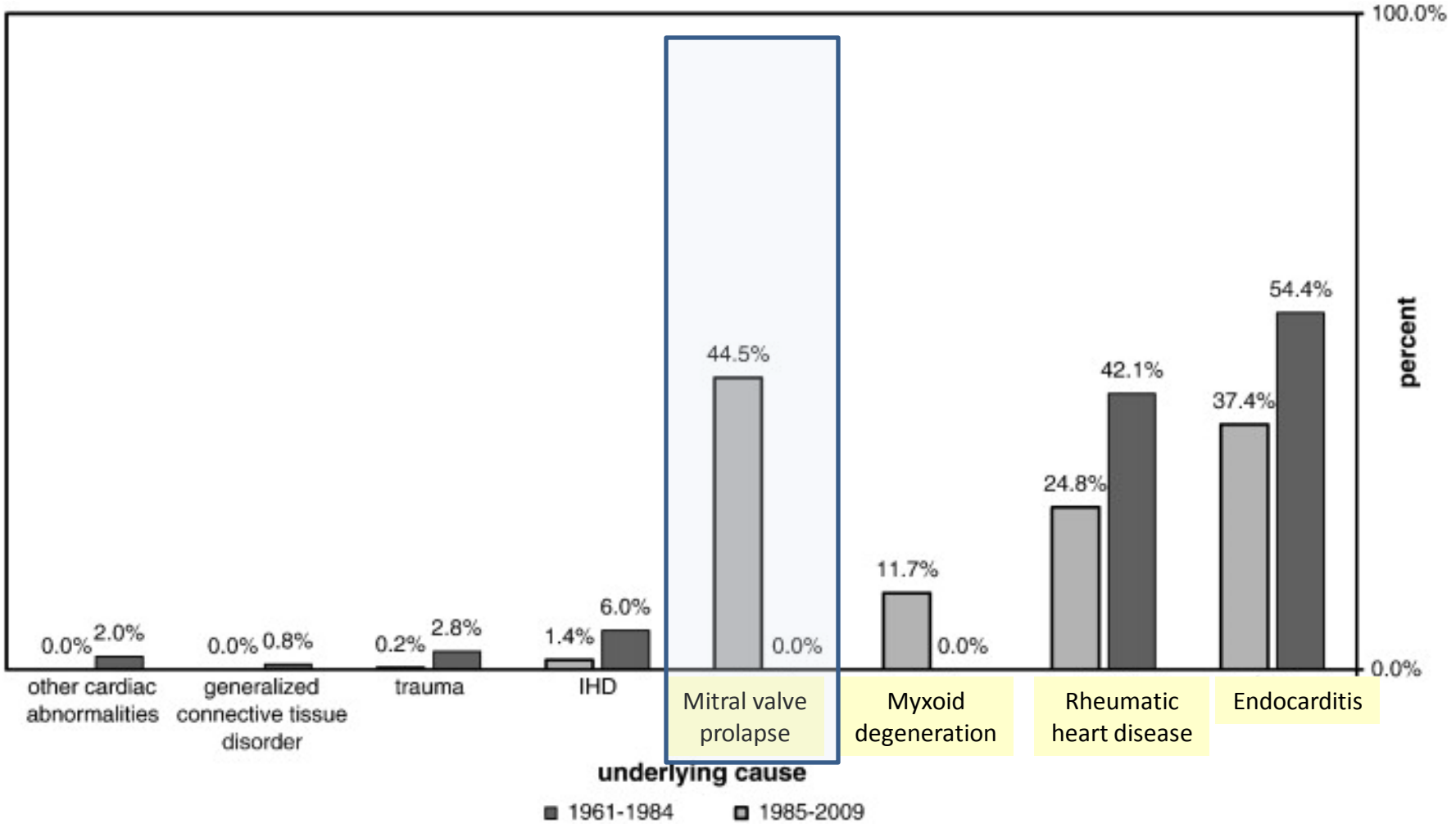
Mitral regurgitation



Mitral valve prolapse and rupture of chordae tendinae

Gabbay & Yosefy, Int J Cardiol. 2010 Mar 6. [Epub ahead of print]

The underlying causes of chordae tendinae rupture: A systematic review.



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  - To use our knowledge effectively, we must be aware of its limitations.
- **Confirmatory bias**
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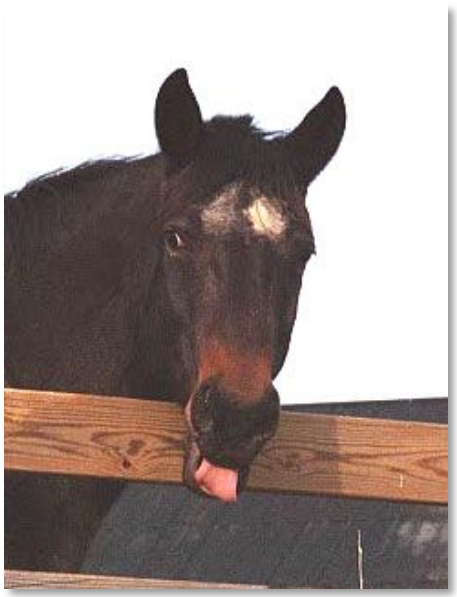
Premature closure
Absence of verification

Frequent is frequent and rare is rare…

- A strange horse with stripes?



But rare happens!

What can we do to prevent it?

Teaching

Medical students participating in bedside teaching during ward rounds under the guidance of Professor Richard Lovell, at left, 1957. Royal Melbourne Hospital.

Can clinical reasoning be taught?

Patient encounter conditions associated with diagnostic competency

- Neufeld VR et al. Med Educ 1981;15:315-22
- Barrows H et al. Clin Invest Med 1982;5:49-55
- LeBlanc V Acad Med 2001;76:S18-20
- LeBlanc V Acad Med 2002;77:S67-9
- LeBlanc V Med Educ 2004;38:17-24
- Nendaz M et al. Med Teach 2005;27:415-21
- Nendaz M et al. J Gen Int Med 2006;21:1302-5

How do experts do it?

Nendaz et al. Med Teach 2005;27:415-21

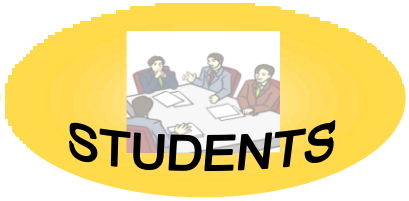
Differences	Similarities
Number of collected items (53-102)	Key questions asked early (within 1st 20 questions)
Goals of collected information	Characterize and precise the complaint (30% of questions)
Encounter progression strategies	Summarize information at hand (1.9 times)
Number of diagnostic hypotheses generated (9-15)	Use key hypotheses to frame clinical data collection
	Test final diagnosis early (10, 7-14)

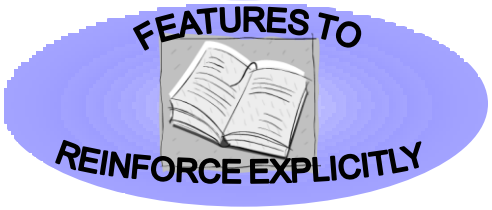
Teaching students how to acquire relevant diagnostic information efficiently

Nendaz et al., AAMC meeting 2007

- Successive 3-month internal medicine elective rotations of students
- 30 students assigned to:
  - standard case-based reasoning seminars (control)
  - intervention seminars
- End of the elective, videotaped encounters of students with two standardized patients and summary chart
- **Results:**
  - No difference in accuracy of final diagnosis
  - Correct diagnosis more frequently listed in the differential
  - More relevant differential diagnosis

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





Presentation of the chief complaint and the demographics of the patient

Establish a strategy of data collection for this chief complaint according to the initial spontaneous diagnostic hypotheses if any

Ask the preceptor for additional information

Before providing the requested information:
- ***What is the purpose of the information collected ?***
- ***Is chief complaint clarified enough ?***
- ***Summarize, rephrase, and reformulate the information at hand***
- ***What is/are the diagnostic hypothesis(es) tested ?***

Raise, compare, and contrast diagnostic hypotheses

- ***Prioritize the hypotheses elaborated***
- ***Which data support the hypotheses ?***
- ***Which additional information is needed to confirm the hypothesis ?***

Final diagnosis and patient management

- **Non-analytic diagnostic impression**
- **Directed and relevant data acquisition**

- **Characterization of chief complaint**
- **Problem representation**
- **Early elaboration of diagnostic hypotheses**
- **Early collection of key information**

- **Elaboration of relevant, prototypical diagnostic hypotheses to frame further data collection**

Teaching students how to acquire relevant diagnostic information efficiently

Nendaz et al., AAMC meeting 2007

Results:

- No difference in accuracy of final diagnosis
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Take-home messages

Do's

- Collect information targeted to specific Dx hypotheses
- Elaborate hypotheses early
- Review the hypotheses according to new information
- Think of frequent conditions first
- Do not narrow down the differential too early
- Check backwards: does the diagnosis explain all the symptoms and findings

Don'ts

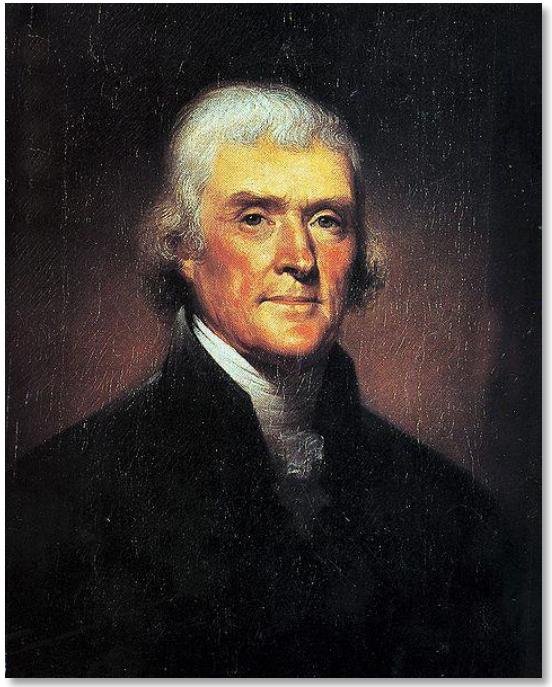
- Do not fire in all directions
- Do not ask questions without having any idea what Dx you are testing
- Do not be stubborn!
- Do not think of rare conditions first
- Do not forget completely about rare conditions
- Do not wear glasses with prisms
- Do not be overconfident!

Zebras do exist… and you might cross one sometime!

Conclusions

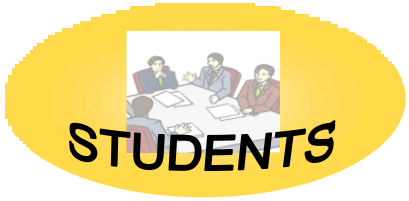
- Diagnosis is a key activity in internal medicine
- Diagnostic errors are frequent (15%) and potentially harmful
- Clinical reasoning is complex and involves a mix of immediate recognition and hypothetico-deductive reasoning
- Diagnostic errors are more often due to cognitive errors than insufficient knowledge
- There is preliminary evidence that appropriate teaching may reduce those errors

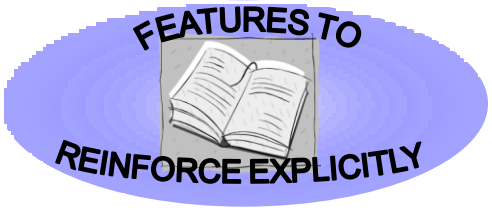
“He who knows best knows how little he knows.”



Thomas Jefferson

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





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Teaching students how to acquire relevant diagnostic information efficiently

Nendaz et al., submitted

- **Intervention**: active and directed feedback during the case resolution to reinforce strategies used by experts
  a) setting up a plan for the collection of the information once the presenting complaint is exposed
  b) characterizing each complaint (*e.g.* duration, characteristics, etc.)
  c) regularly summarizing the information at hand
  d) generating early the diagnostic hypotheses to be evaluated by a directed enquiry and using these hypotheses to frame the collection of further information
- Results:
  - No difference in accuracy of final diagnosis
  - Correct diagnosis more frequently listed in the differential
  - More relevant differential diagnosis

Cognitive errors

Am J Med 2008;121:S2–S23; Arch Intern Med. 2005;165:1493-1499

Faulty Synthesis: Faulty Information Processing (n = 159)			
26	Faulty context generation	Lack of awareness/consideration of aspects of patient's situation that are relevant to diagnosis	Missed perforated ulcer in a patient presenting with chest pain and laboratory evidence of myocardial infarction
25	Overestimating or underestimating usefulness or salience of a finding	Clinician is aware of symptom but either focuses too closely on it to the exclusion of others or fails to appreciate its relevance	Wrong diagnosis of sepsis in a patient with stable leukocytosis in the setting of myelodysplastic syndrome
25	Faulty detection or perception	Symptom, sign, or finding should be noticeable, but clinician misses it	Missed pneumothorax on chest radiograph
23	Failed heuristics	Failure to apply appropriate rule of thumb, or overapplication of such a rule under inappropriate/atypical circumstances	Wrong diagnosis of bronchitis in a patient later found to have pulmonary embolism
15	Failure to act sooner	Delay in appropriate data-analysis activity	Missed diagnosis of ischemic bowel in a patient with a 12-week history of bloody diarrhea
14	Faulty triggering	Clinician considers inappropriate conclusion based on current data or fails to consider conclusion reasonable from data	Wrong diagnosis of pneumonia in a patient with hemoptysis: never considered the eventual diagnosis of vasculitis
11	Misidentification of a symptom or sign	One symptom is mistaken for another	Missed cancer of the pancreas in a patient with pain radiating to the back, attributed to GERD
10	Distraction by other goals or issues	Other aspects of patient treatment (eg, dealing with an earlier condition) are allowed to obscure diagnostic process for current condition	Wrong diagnosis of panic disorder: patient with a history of schizophrenia presenting with abnormal mental status and found to have CNS metastases
10	Faulty interpretation of a test result	Test results are read correctly, but incorrect conclusions are drawn	Missed diagnosis of *Clostridium difficile* enteritis in a patient with a negative stool test result