



Teaching the Scarecrow: Critical Thinking to Improve Clinical decision making

Pat Croskerry MD, PhD

Clinical Reasoning in Medical Education

National Science Learning Centre, University of York

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Estimated number of preventable
hospital deaths due to diagnostic
failure annually in the US

40,000 – 80,000

Leape, Berwick and Bates JAMA 2002

Diagnostic failure is the
biggest problem in
patient safety

Newman-Toker, 2017

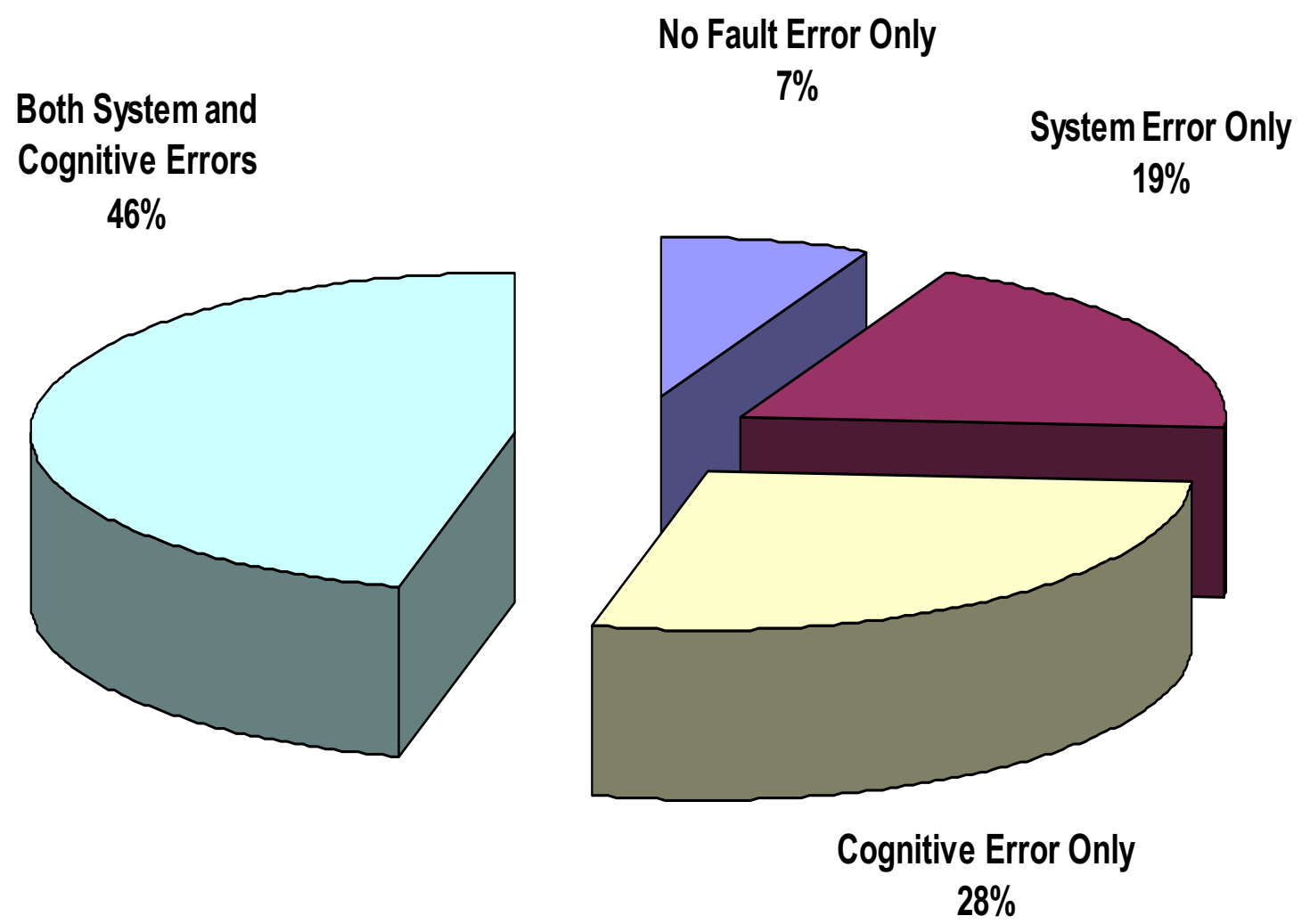
Many physicians are reluctant to believe this

- ❑ Lack of awareness of cognitive science issues in clinical decision making
- ❑ Not seen as a ‘medical’ problem
- ❑ Denial
- ❑ Distancing
- ❑ Discounting

Diagnostic Failure

15%

Graber et al. 2005. 100 Cases of Dx error



System Factors

Diagnostic Error



Table 4. Factors contributing to diagnostic errors.

Factor	No.	%*
Cognitive factors	76	96
Judgment	69	87
Knowledge	46	58
Vigilance or memory	32	41
Communication factors	28	35
Handoffs	19	24
Establishment of clear lines of responsibility	5	6
Conflict	2	3
Other communication factor	7	9
Systems factors	29	37
Supervision	24	30
Workload	18	23
Interruptions	4	5
Fatigue	3	4
Technology	0	0
Ergonomics	0	0
Patient-related factors	27	34
Patient nonadherence	8	10
Atypical presentation	6	8
Complicated medical history	6	8
Substance abuse	6	8
Poor historian	4	5
Psychiatric issue	3	4
Obesity	2	3
Language barrier	1	1

*Calculates as a percentage of 79 claims with identified errors.

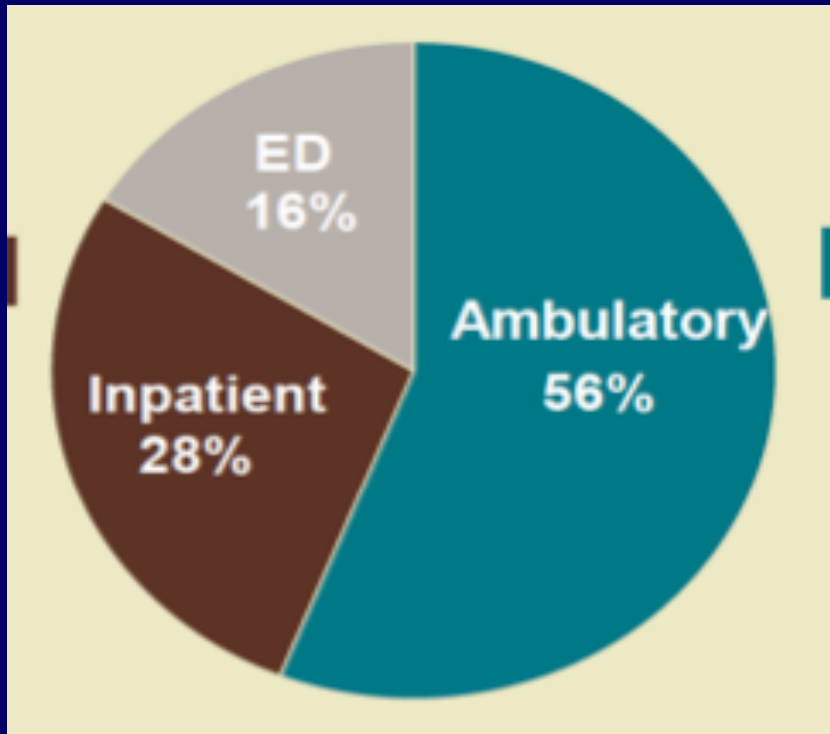
Kachalla et al,
Annals of
Emergency
Medicine 2007

It varies by specialty

Dermatology	}	(1-2%)
Radiology		
Anatomic pathology		
Internal medicine	}	(~15%+)
Family medicine		
Emergency medicine		

Why do they happen?

CRICO (Controlled Risk Insurance Company) 2014
Analysis of 4519 claims related to diagnostic error



Ambulatory care clinics—it's NOT just rare conditions.

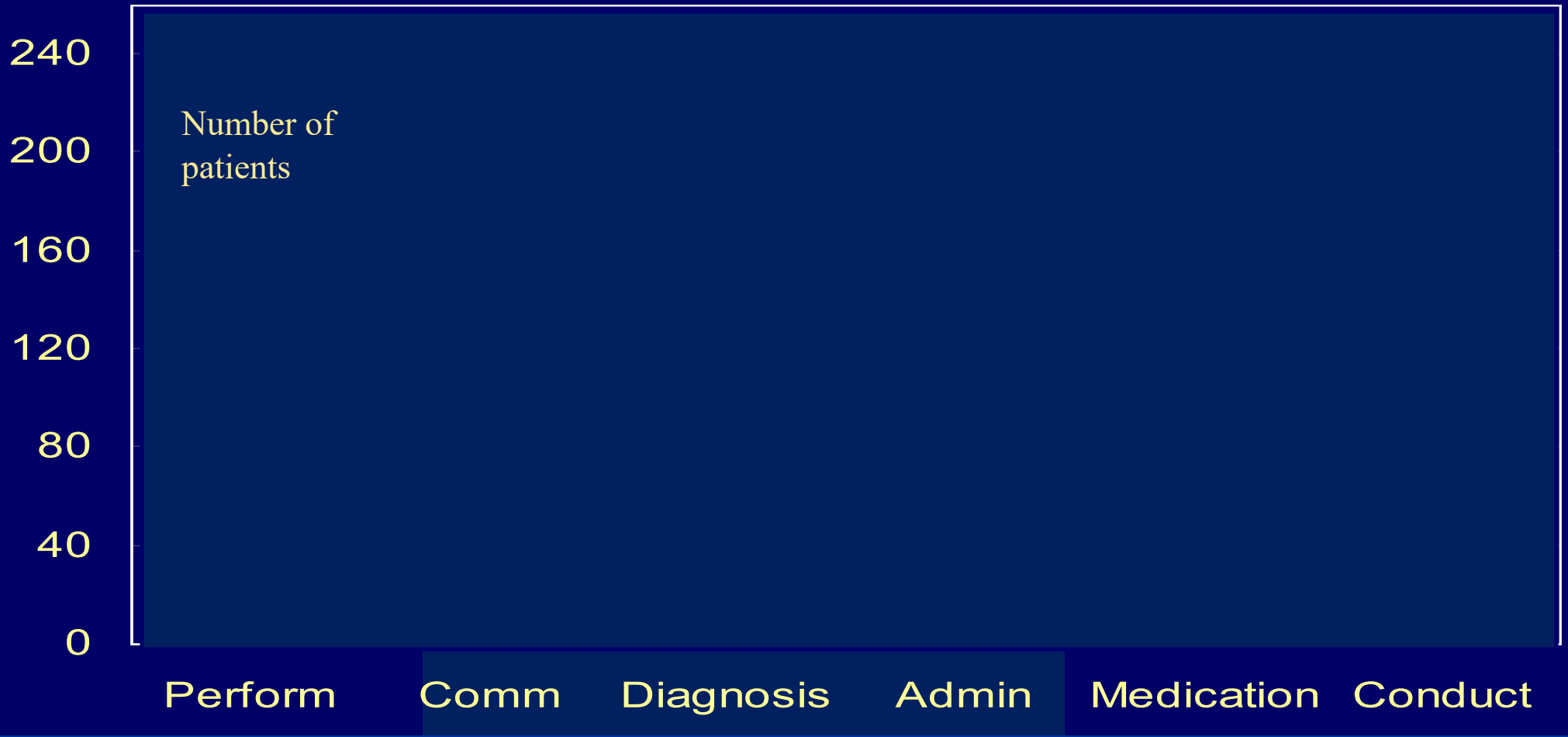
Dx errors are COMMON in patients with anemia, asthma, COPD



Diagnosis is the
canary in the
coal mine for
decision failure

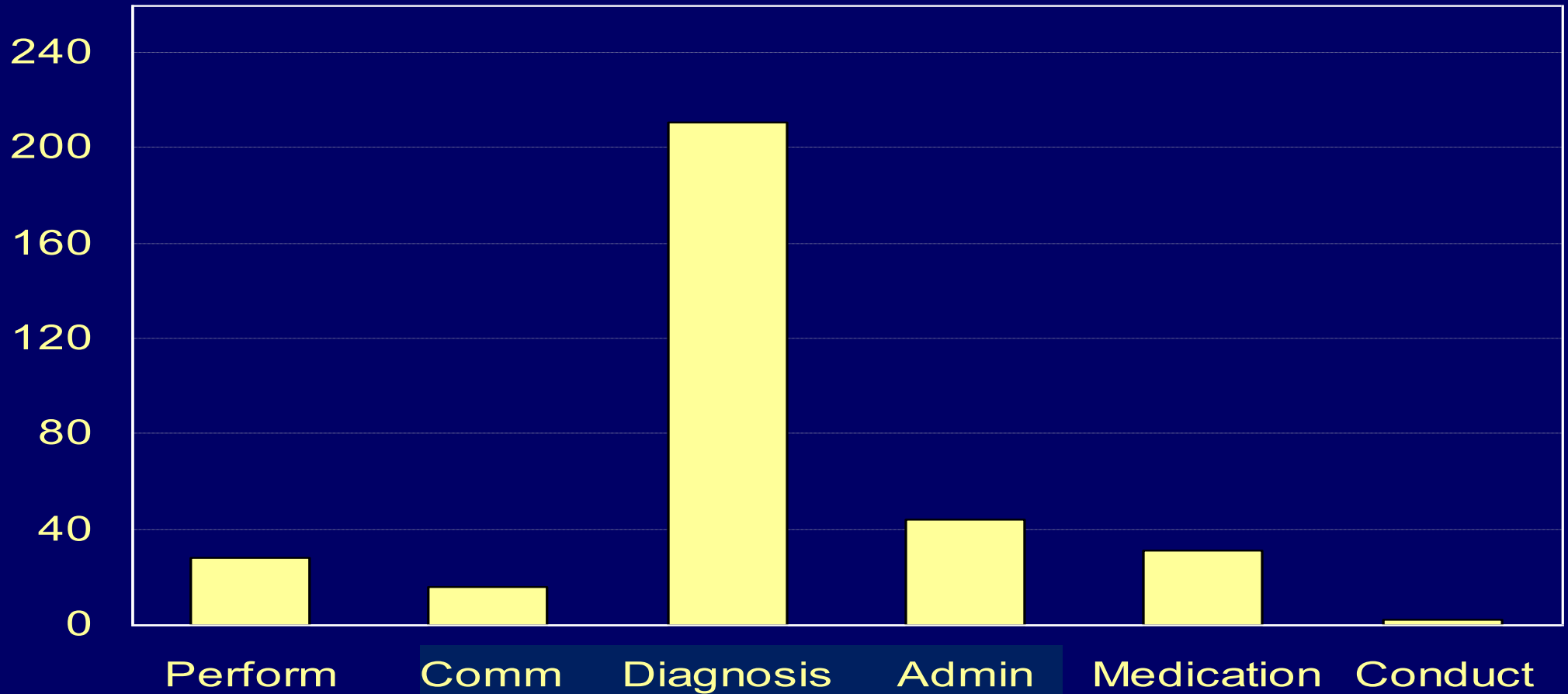
Legal outcome by critical incident

CMPA Data : 347 legal actions closed 2005 - 2009



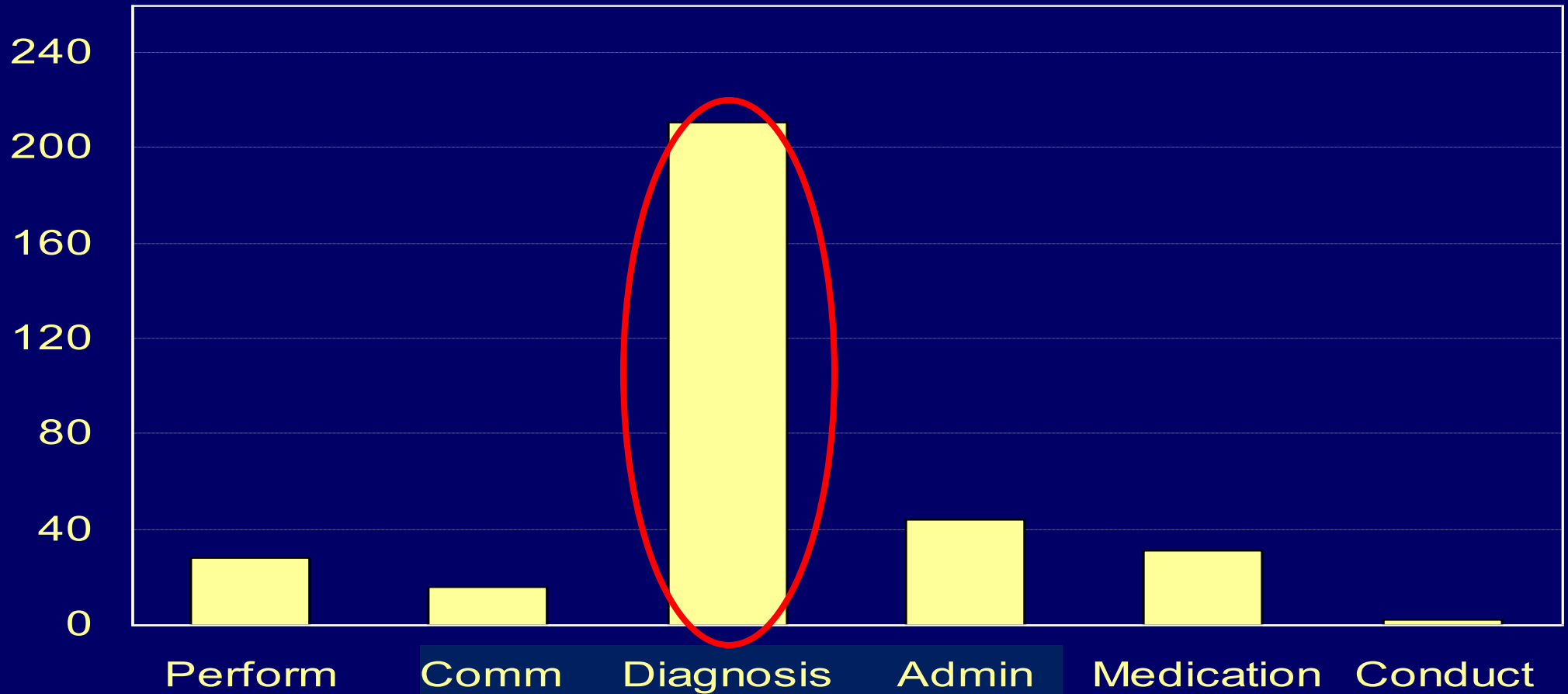
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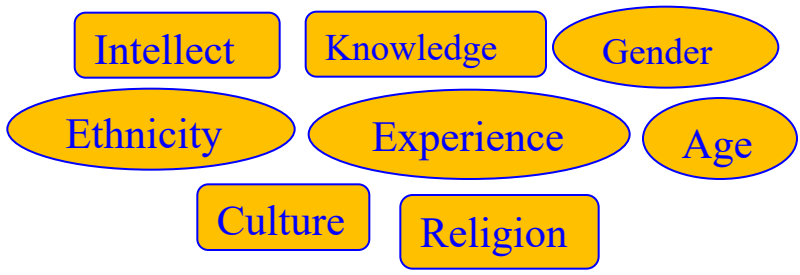
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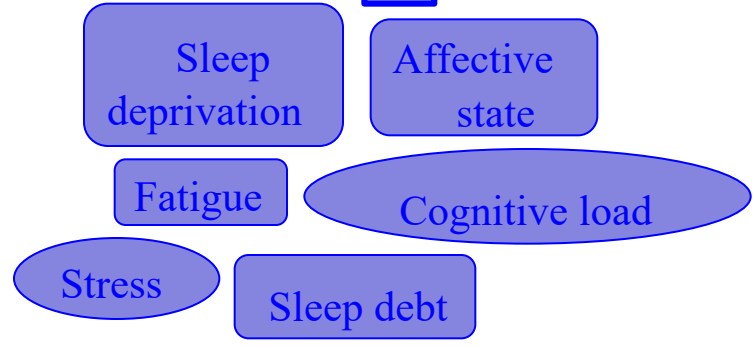


The complexity of diagnostic decision making

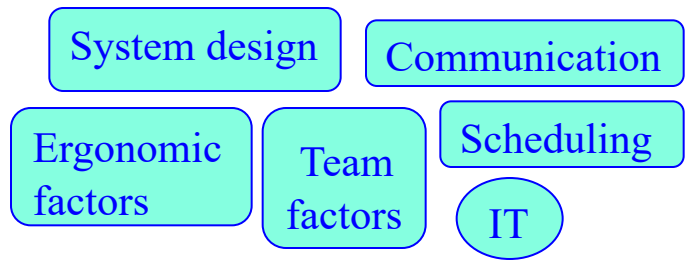
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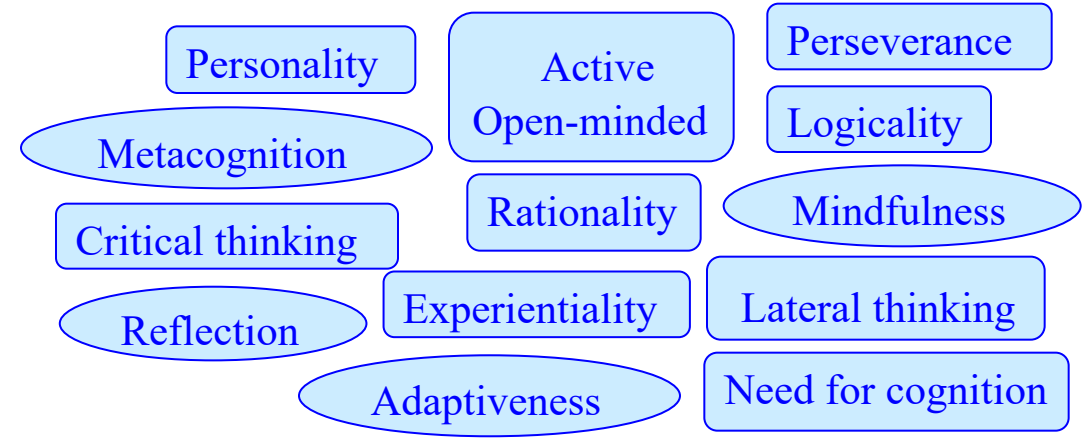
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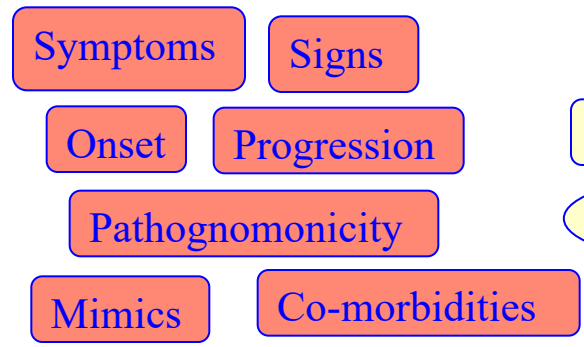
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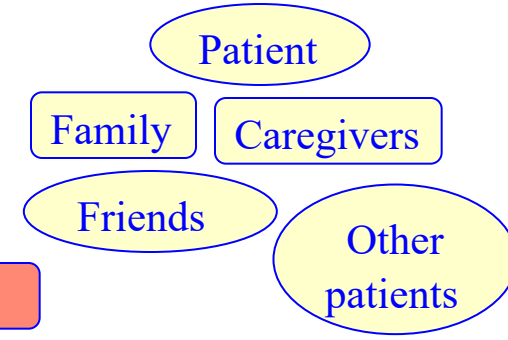
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Understanding clinical decision making

Dual Process Theory

Decision Making

```
graph TD; DM[Decision Making] --> I[Intuitive (System 1)]; DM --> R[Rational (System 2)]; I --> I_Char[Fast  
Informal  
Subjective  
Context-dependent  
Qualitative  
Flexible]; R --> R_Char[Slow  
Formal  
Objective  
Context-independent  
Quantitative  
Rigorous];
```

Intuitive
(System 1)

Fast
Informal
Subjective
Context-dependent
Qualitative
Flexible

Rational
(System 2)

Slow
Formal
Objective
Context-independent
Quantitative
Rigorous

Dual Process Decision Making

System 1

Fast / Automatic

Emotional

- Impulses / Drives
- Habits
- Beliefs



System 2

Slow / Effortful

Logical

- Reflection
- Planning
- Problem solving



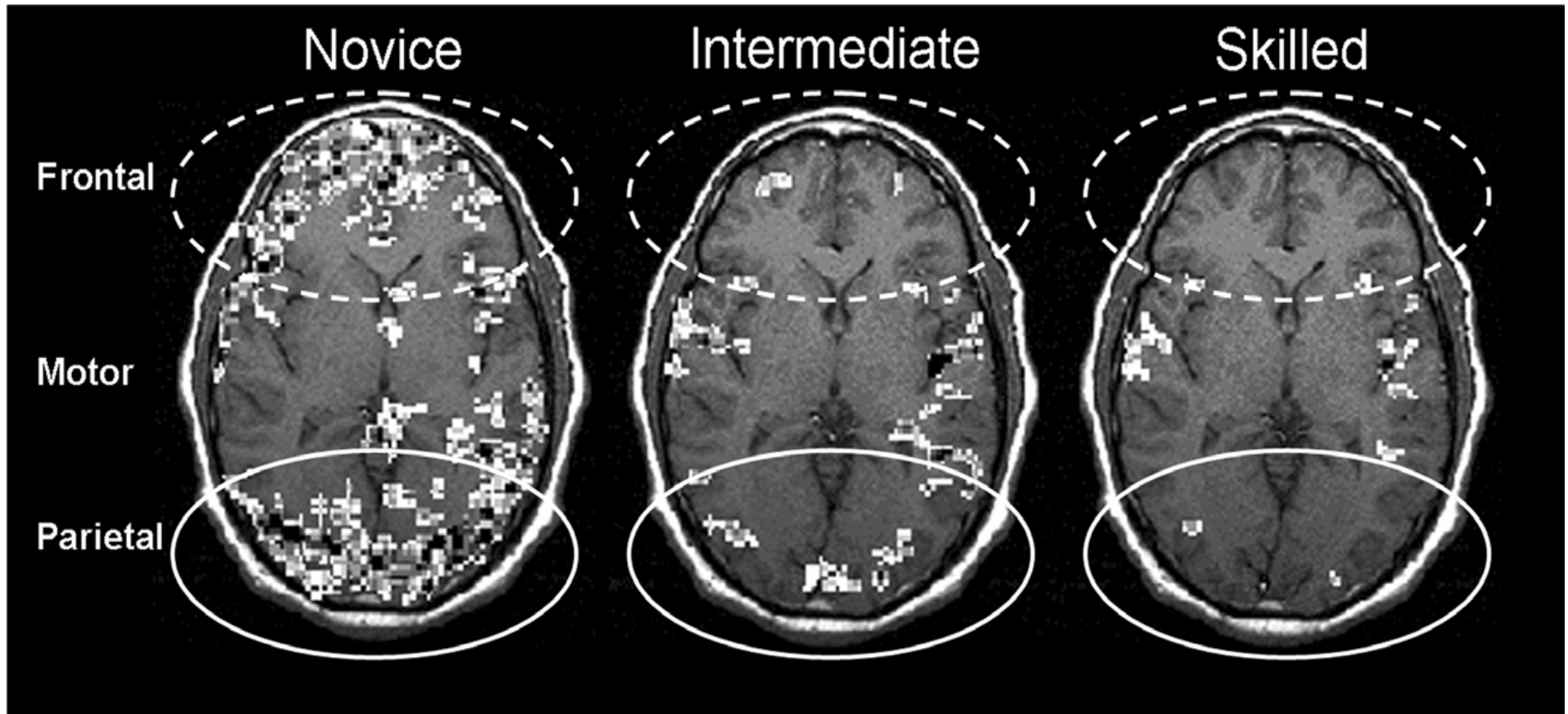
Dual Process Decision Making

System 1: Automatic/streamlined



System 2: Cautious/complex

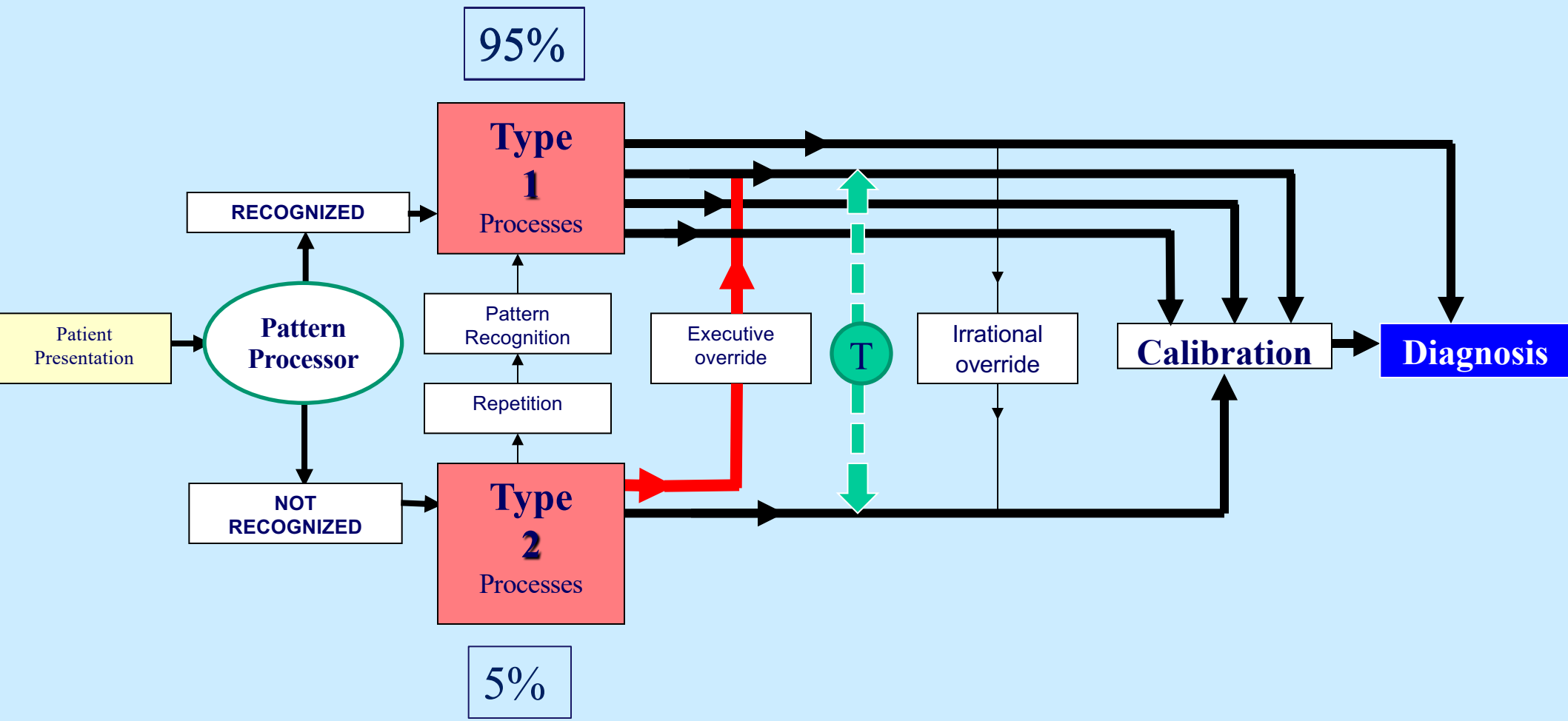




Axial view of fMRI activation of the brain as a function of practice over 60 minutes

Hill and Schneider, 2006

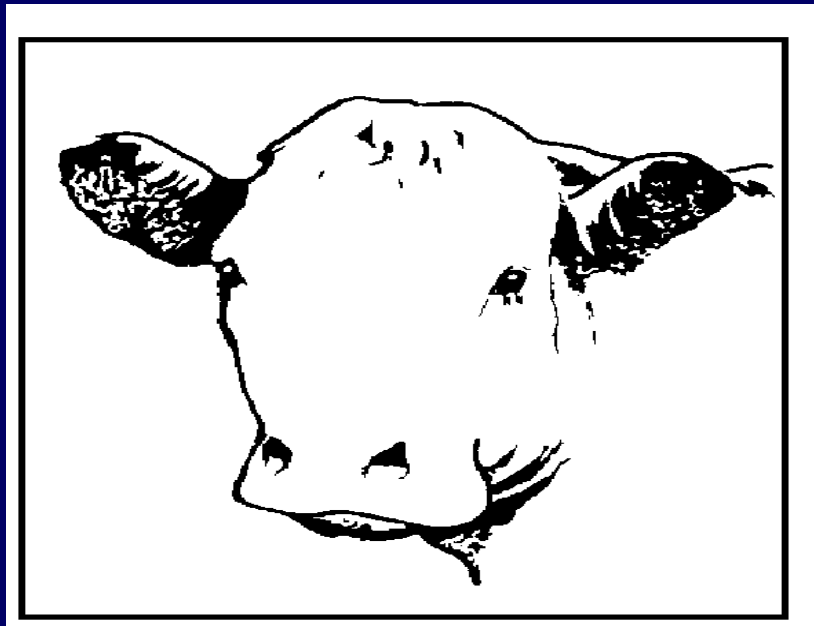
A schematic model of how the
systems work together





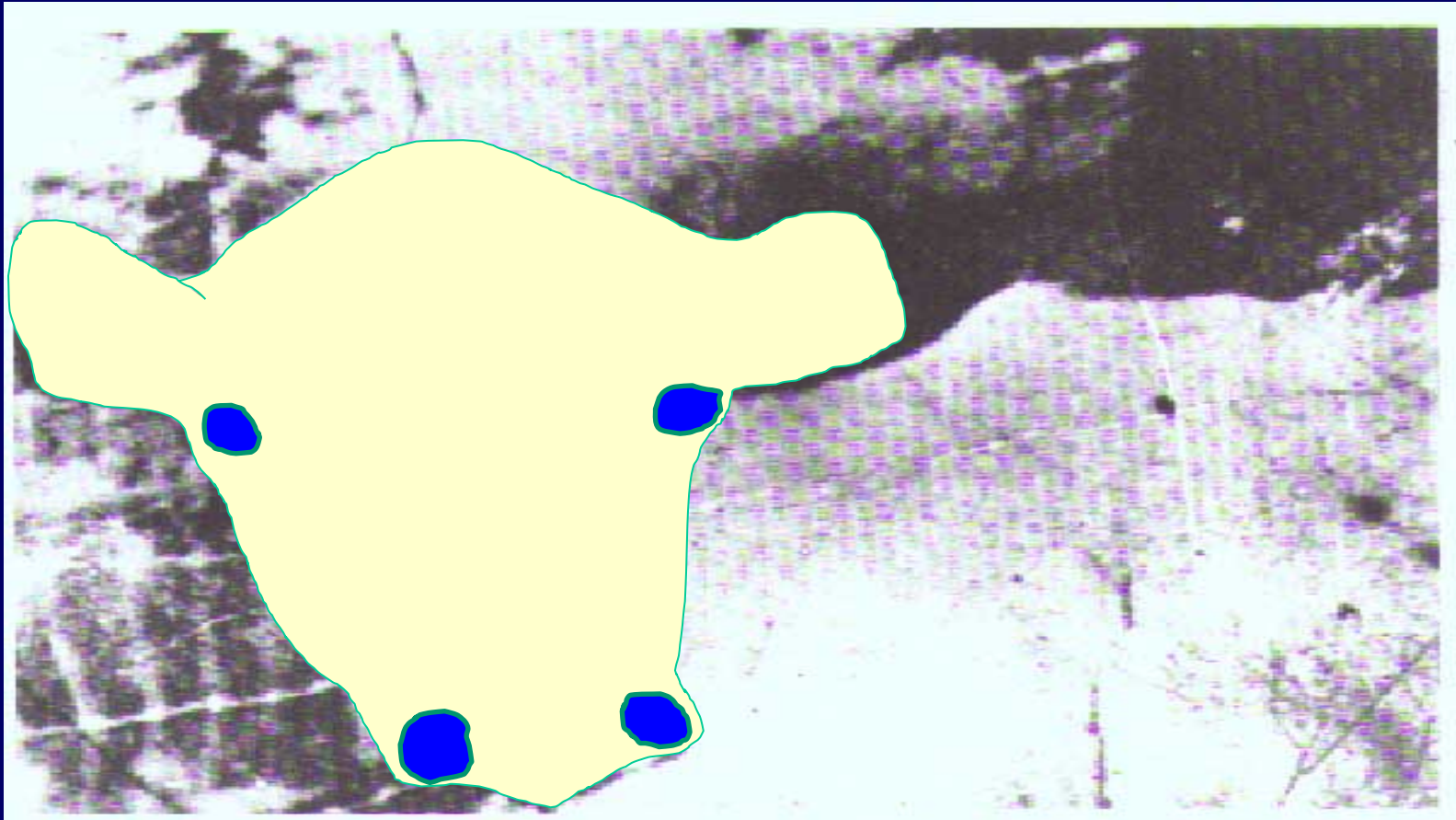


Decision making involves learning the basic patterns



COW





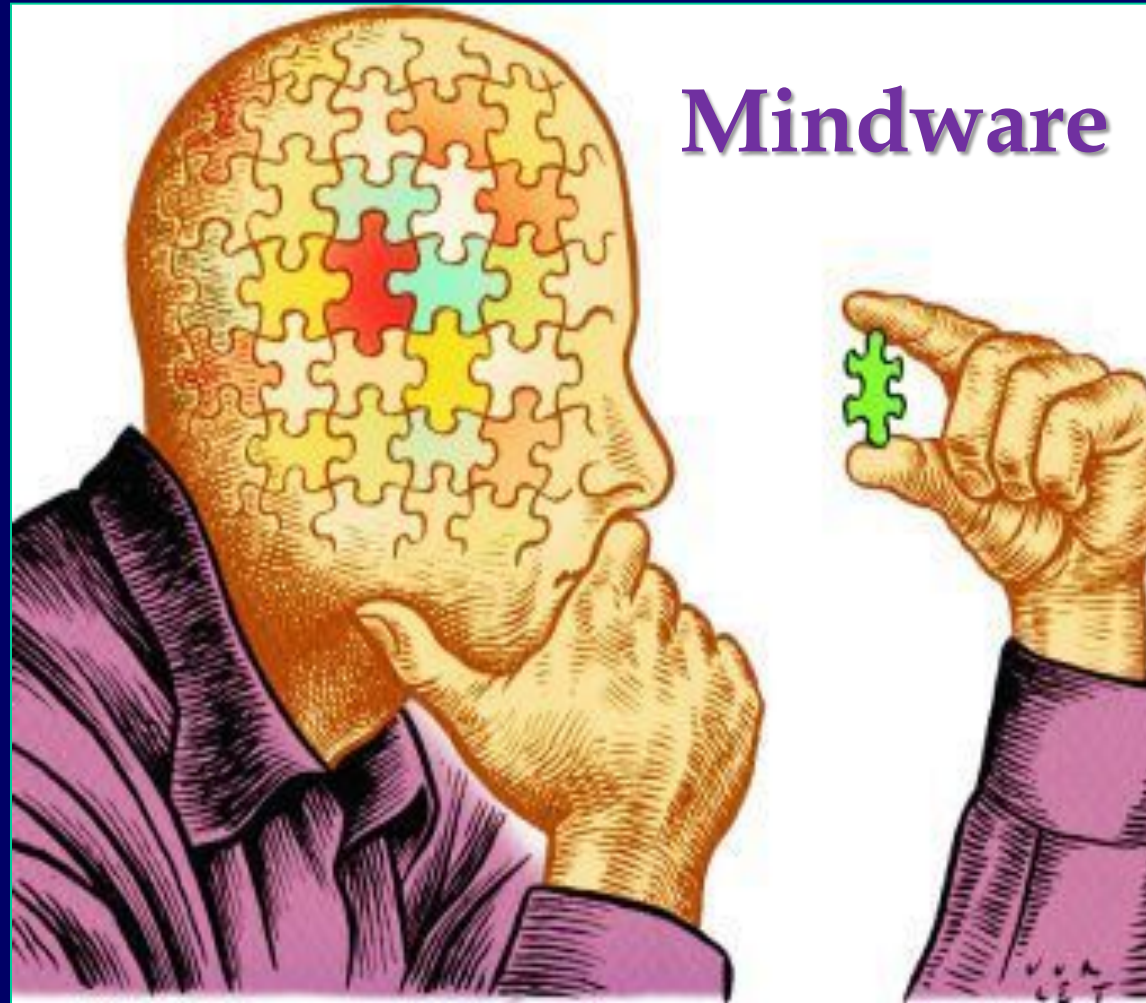




The best calibrated
decisions are described as
'rational' – they come from
a blend of System 1 and
System 2 decisions

Being rational

- ❑ The best possible decision given the available evidence and the prevailing conditions
- ❑ Assuming you are well-slept, well-rested, well-fed, and can give the problem your undivided attention
- ❑ And you are aware of and know how to deal with bias i.e. have the 'mindware'



Mindware

The software of the brain

Rationality Failure

Processing problems

Content problems

Cognitive miserliness

Mindware gaps

Mindware contamination

WYSIATI

Minimising cognitive effort
Accepting things at face value
Insufficient breadth and depth
Avoiding complexity

Knowledge deficits

Impaired scientific thinking
Impaired probability thinking
Ignoring alternate hypotheses
Sub-optimal critical thinking

Cognitive biases

Cultural conditioning
Group culture
Illogical reasoning
Egocentric thinking

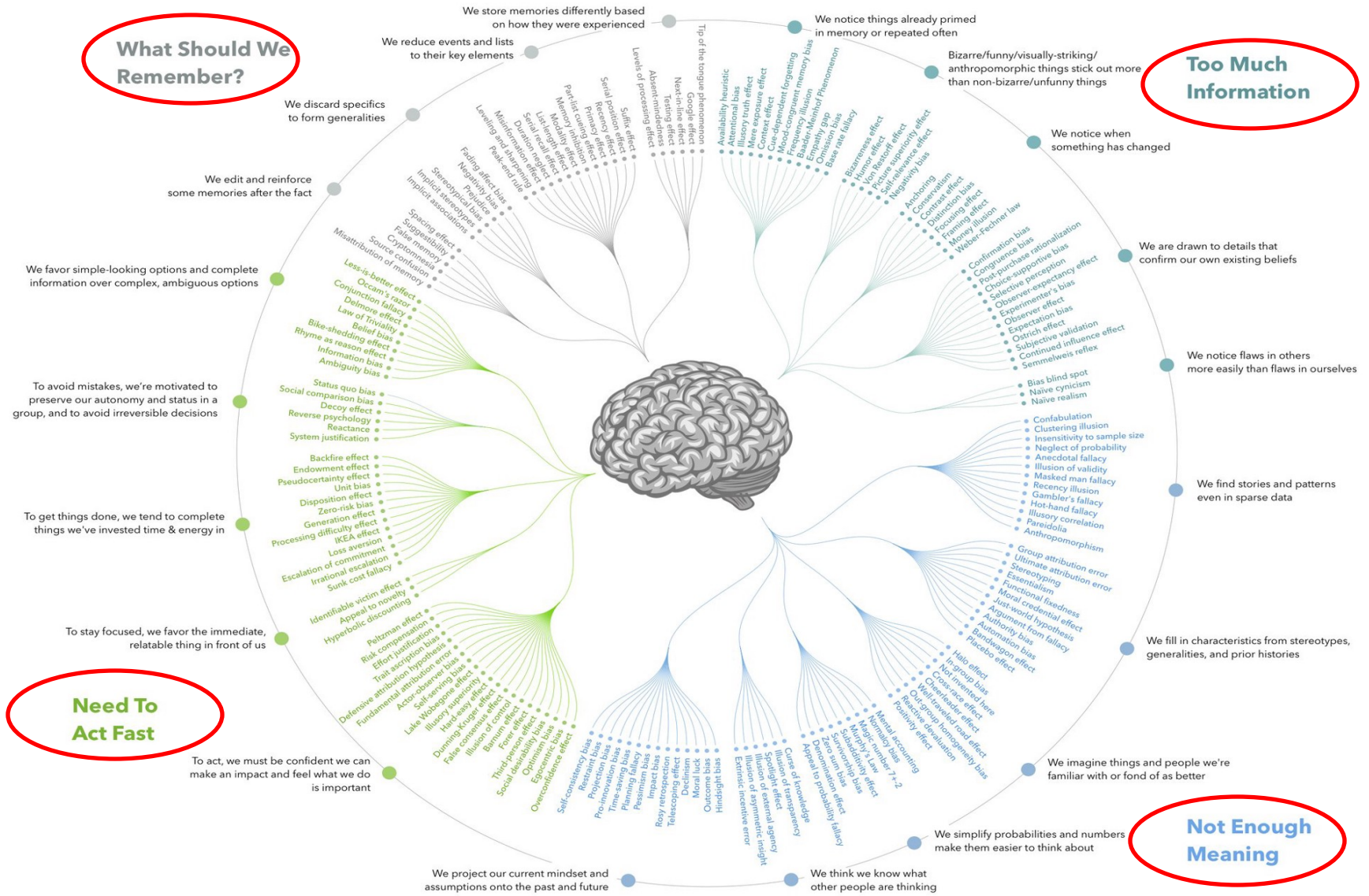
Hasty Judgments

*Distorted
Probability estimates*

Biased Judgments

Biased Judgments

COGNITIVE BIAS CODEX, 2016



The Cognitive Autopsy

A root cause analysis of medical decision making



Pat Croskerry MD, PhD

The Behaviour of Biases

- ❑ Detailed cognitive analysis of 42 cases from EM
- ❑ Rich variety of clinical diagnoses from all disciplines
- ❑ Biases are common – total of 232 instances
- ❑ Few instances of knowledge-based errors (~6)
- ❑ Usually 5-6 cognitive errors in each case
- ❑ Typically appear at certain points in the diagnostic process
- ❑ Cognitive errors outnumbered knowledge-based errors 40:1

Breakdown by discipline (42 cases)

- Medicine 19
- Neurosurgery 6
- Surgery 5
- Ophthalmology 3
- Orthopedics 3
- ObGyn 3
- Psychiatry 3
- Urology 2

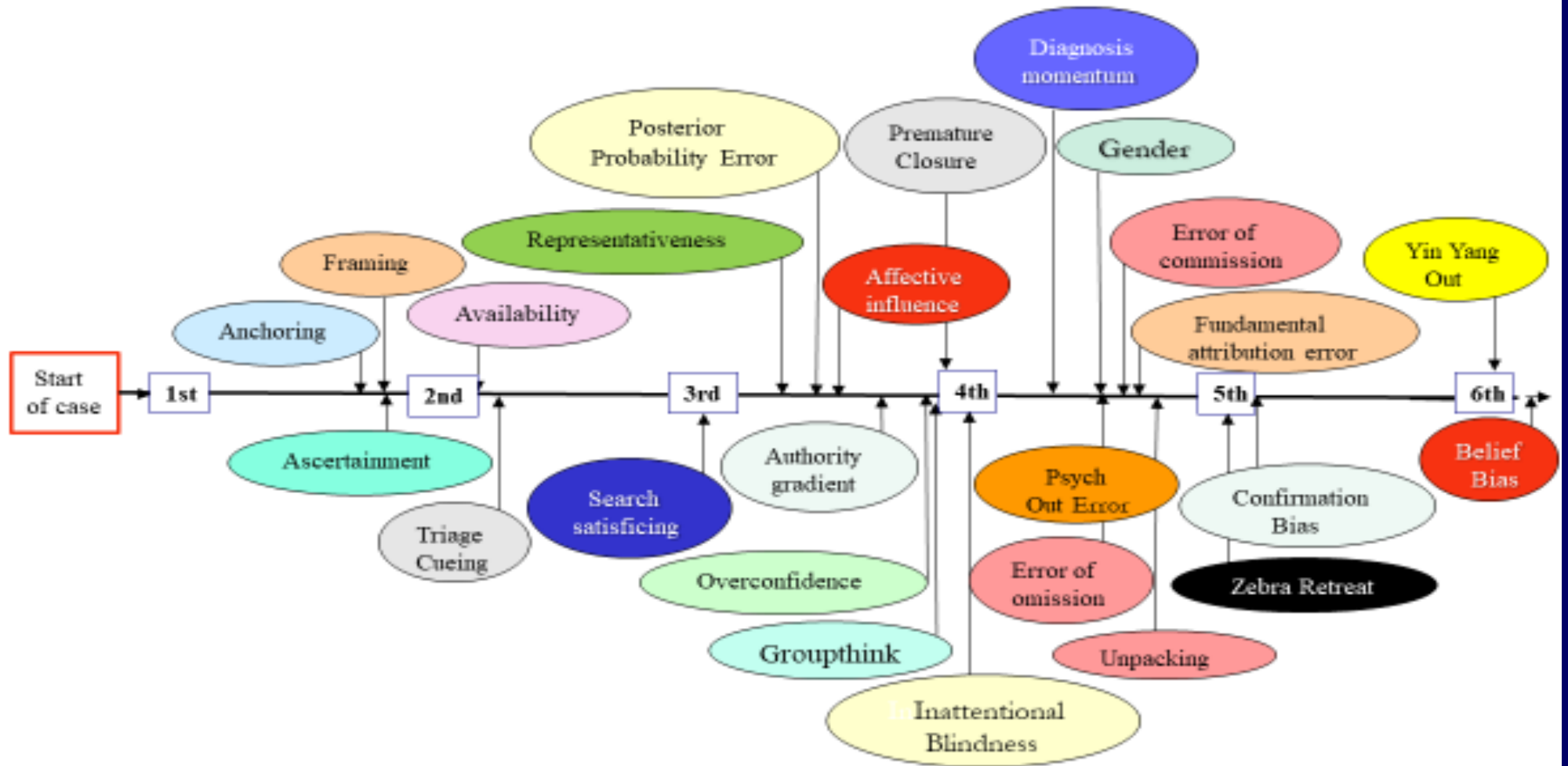
Diagnoses

<u>Case #</u>	<u>Diagnosis</u>	<u>Case #</u>	<u>Diagnosis</u>
1	Hypothermia	21.	Aseptic meningitis
2	Salicylate overdose	22.	Chronic salicylate toxicity
3	Traumatic rupture of spleen	23	Non-suicidal self-injury disorder
4	Upper respiratory tract infection	24	Splenic trauma
5	Pulmonary embolus	25	Retinal detachment
6	Cauda Equina Syndrome	26	Hand fractures
7	Sub-arachnoid hemorrhage	27	Frontal lobe tumour
8	Medication error	28a	Comminuted scapular fracture
9	Methanol toxidrome	28b	Traumatic pneumothorax
10	Abdominal pain NYD	29	Medication error
11	Traumatic paraplegia following seizure	30.	Giant pulmonary bullae
12	Skull fracture and penetrating brain injury	31.	Medication overdose
13	Guillain-Barré syndrome	32.	Medical procedure error
14	Ophthalmic Siderosis	33.	Alcoholic gastritis
15	Temporal lobe epilepsy	34	Tricyclic overdose
16a.	Aspiration pneumonia	35	Acute inferior myocardial infarction
16b	Ectopic pregnancy	36	Urinary tract infection
17	Imperforate hymen	37	Herpes zoster ophthalmicus
18	Acute inferior myocardial infarct	38	Renal colic
19	Ludwig's Angina	39	Profound hypoglycemia
20	Intercarpal ligamentous injury	40	Cervical vertebra (C1) fracture

Top 12 biases

<i>Rank#</i>	<i># of times</i>	<i>Bias</i>
1	17	Anchoring
2	16	Diagnosis Momentum
3	14	Confirmation Bias
4	13	Unpacking Failure
5	12	Search Satisficing
6	12	Framing
7	11	Ascertainment Bias
8	11	Psych-Out Error
9	10	Fundamental Attribution Error
10	10	Triage Cueing
11	9	Premature Closure
12	9	Omission Error

Ordinal position of bias in case development →



Cognitive autopsy of a case

Case 1

- ❑ A 58 y/o male arrives at the ED from the city airport. c/o abrupt onset dyspnea, chest tightness, headache, bilateral arm tingling. Complicated story about family not meeting him due to flight delay. PMH: HTN, DMII, abdominal Sx (ileostomy): v/s stable, EKG, CXR, bloodwork, cardiac enzymes all (N). Kept in ED overnight, consult to Social Services → men's shelter
- ❑ 7 days later – returns to ED – problems with ostomy (excoriation and prolapse) + double vision + dizziness + headache. Referred to ostomy clinic + SS → alternate shelter
- ❑ Returned to ED by shelter. Unable to look after himself. Family member contacted – described as ‘con-man’, claimed to have PhD, Colonel in US military in Korean war, top security clearance, active in reserves. Severe bed shortage at hospital, spent 3 days in ED → Psych referral → 27/30 on mental status exam → no Psych Dx; no follow-up recommended.
- ❑ Returned again to ED. Problems with ostomy. Challenged he is deliberately making problems with ostomy. Discharged to DVA who arranged a hotel room for him. Also referred to surgery for possible ostomy reversal. Admonished by social worker for repeat visits to the ED - told not to expect hospital to keep arranging accommodation.
- ❑ 5th visit to ED. Arrived boarded with C-spine collar – found after fall in bath-tub ‘full of feces’. Somnolent, unkempt → CT scan of head

ALG:J375\3

CE:

Model:SOMATOM Definition Flash

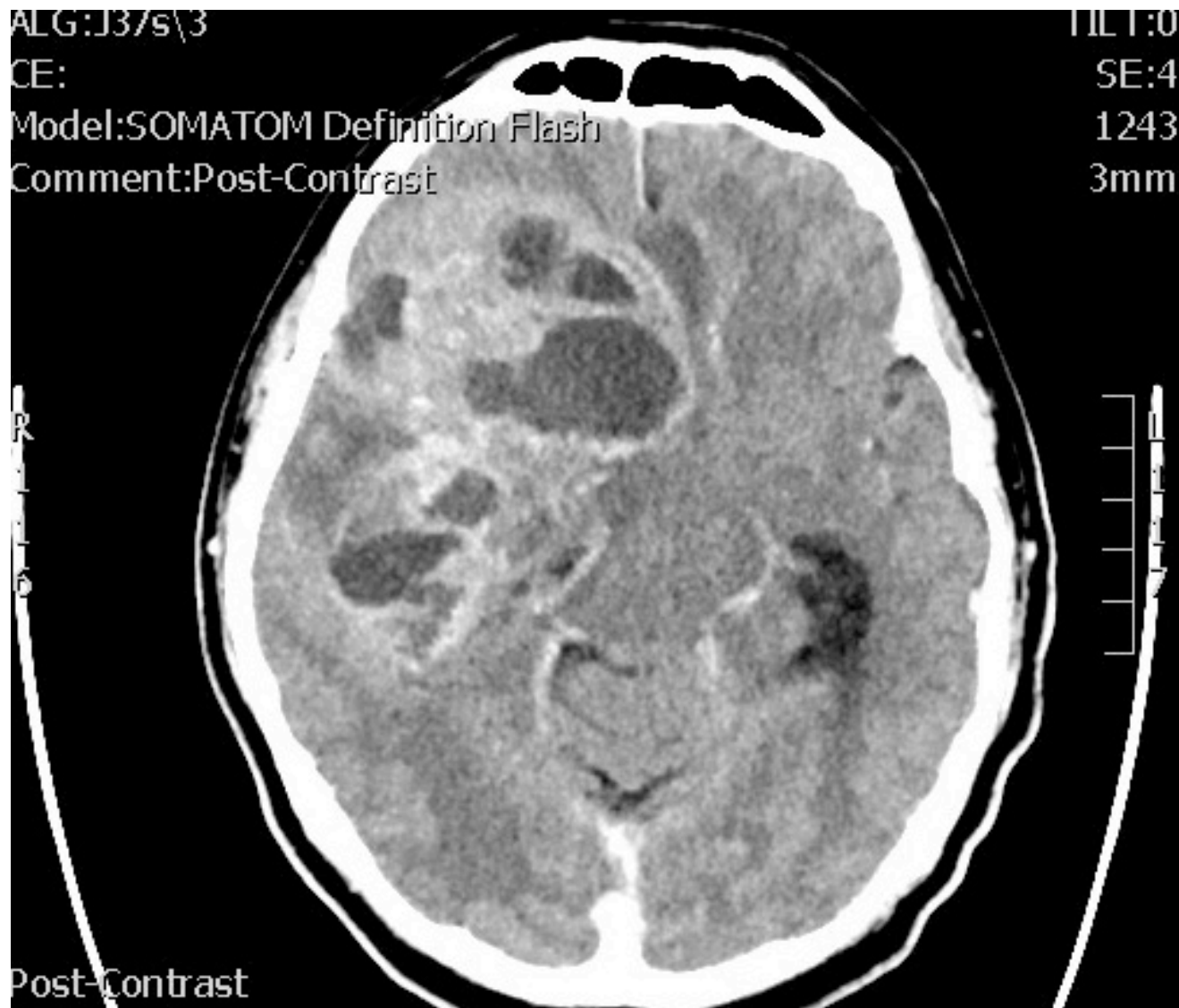
Comment:Post-Contrast

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SE:4

1243

3mm



Cognitive biases

Framing error: problem is initially framed as acute coronary syndrome which is investigated and ruled out

Yin Yang Out: belief that repeat assessments and examinations will add nothing further to what has already been found, may lead to *Premature closure*.

Affective bias: experience of revulsion or disgust at a patient's appearance or condition will dissuade some providers from getting too close

Unpacking failure: to unpack important information

Psych Out Error: attribution of patient's problems to underlying psychiatric or psychosocial problems and not medical ones

Diagnosis momentum: The diagnosis of a psychosocial problem easily gathers momentum without gathering any evidence.

Fundamental attribution error: Holding the patient's disposition responsible for their problems and not the underlying disease

Case 2

- ❑ A 21 y/o male arrives at the ED with multiple stab wounds to the chest, arms and head. One of the chest wounds is inferior to the L scapular.
- ❑ OE: Talking, cooperative, inebriated, no dyspnoea or SOB, AE = bilaterally, O₂ Sat N; 130/80, HR 80-90. Lac on scapula deep – local wound exploration → did not penetrate the pleural cavity, ribs palpable with pleura behind. EDTUS: good views, no free fluid. Serial abdominal exams N, rectal exam N. CXR N.
- ❑ Lacerations irrigated, explored, and repaired. Discharge Dx: Stab wound chest. D/C Home
- ❑ 5 days later presented to a different hospital with vomiting, blurred vision and difficulty concentrating
- ❑ CT scan of brain

Model:Aquilion

AI

R
1
1
2



L
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1

DFOV223.1
TILT:-3
SE:2
68
4mm

PS

Cognitive biases

Anchoring: locking onto specific features of a problem and failing to adjust to other aspects

Search satisficing: after potentially most serious injury is addressed, search is called off for other serious injuries.

Posterior probability error: vast majority of scalp wounds previously seen have been benign and WYSIATI.

Overconfidence (hubris): Resident is in year 5

Cognitive miserliness: ED very busy, fatigue, sleep deprivation, dysphoria

Ambient Influences on Dx

- Cognitive overloading
- Interruptions/distractions
- Sleep deprivation/sleep debt
- Negative mood/emotion
- Fatigue

Main Points

- ❑ The barometer for failed clinical reasoning is diagnostic failure
- ❑ The current estimate of diagnostic failure is 10-15%
- ❑ The sources of diagnostic failure are the System (25%) and the Individual (75%)
- ❑ The principle source of individual failure is how the individual thinks and less what they know
- ❑ The main factor that determines thinking competence is rationality
- ❑ A major cause of rationality failure is vulnerability to cognitive bias
- ❑ Medical education needs to promote rationality
- ❑ We can all improve our cognitive skills with training

Most of us do not reach
our potential for
rational thinking



The Ethical Imperative to Think about Thinking

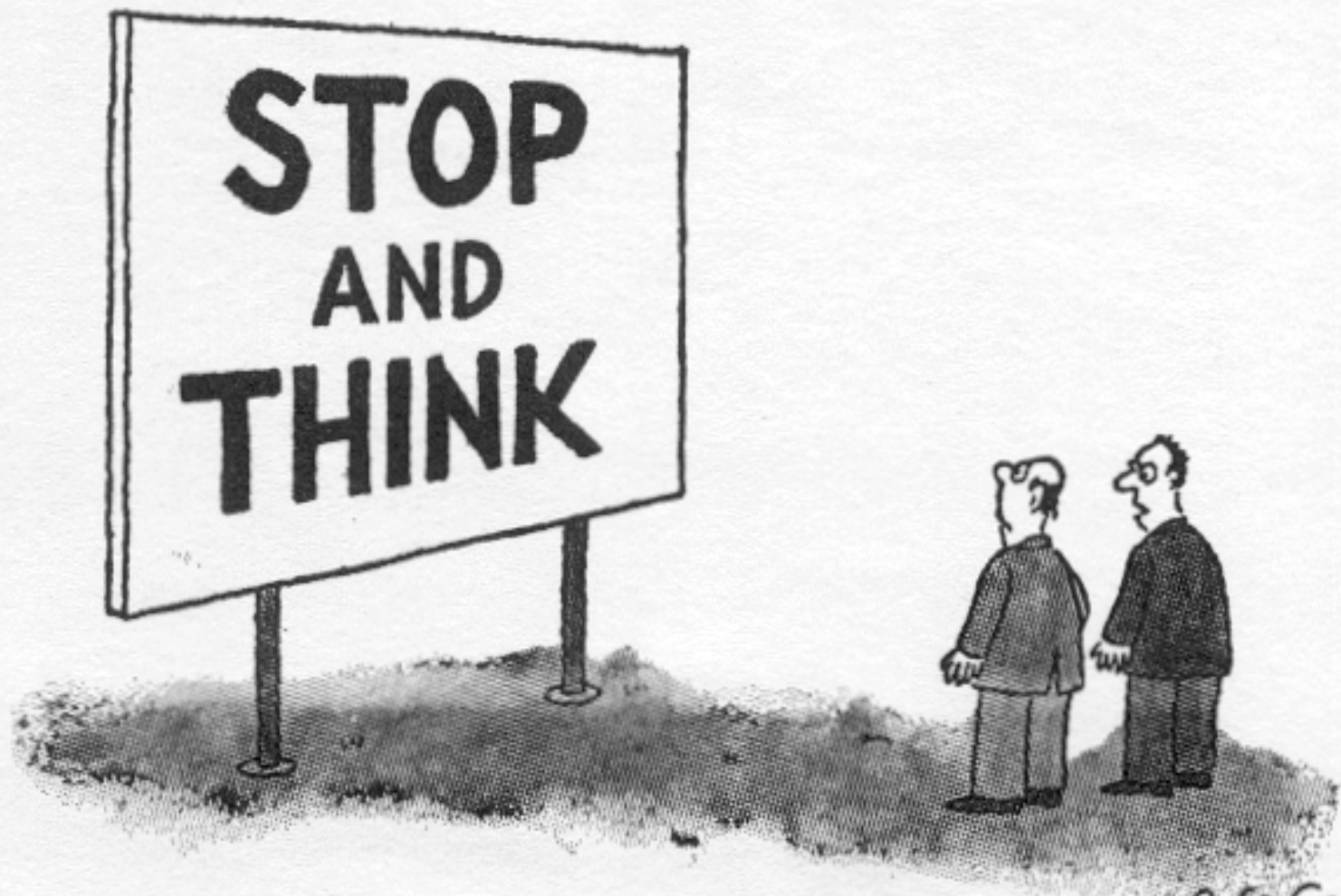
Diagnostics, Metacognition, and Medical Professionalism

MEREDITH STARK and JOSEPH J. FINS

Abstract: While the medical ethics literature has well explored the harm to patients, families, and the integrity of the profession in failing to disclose medical errors once they occur, less often addressed are the moral and professional obligations to take all available steps to prevent errors and harm in the first instance. As an expanding body of scholarship further elucidates the causes of medical error, including the considerable extent to which medical errors, particularly in diagnostics, may be attributable to cognitive sources, insufficient progress in systematically evaluating and implementing suggested strategies for improving critical thinking skills and medical judgment is of mounting concern. Continued failure to address pervasive thinking errors in medical decisionmaking imperils patient safety and professionalism, as well as beneficence and nonmaleficence, fairness and justice. We maintain that self-reflective and metacognitive refinement of critical thinking should not be construed as optional but rather should be considered an integral part of medical education, a codified tenet of professionalism, and by extension, a moral and professional duty.

Keywords: medical decision making; medical ethics; professionalism; medical education; medical error; diagnostic error; patient safety; cognition; judgment; metacognition

No longer an option...

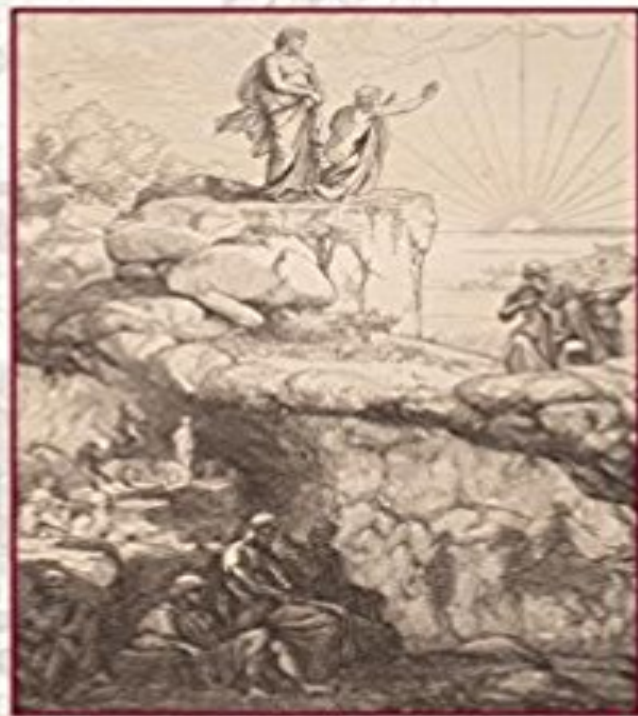


S. GROSS

"It sort of makes you stop and think, doesn't it."

DIAGNOSIS

interpreting the shadows



PAT CROSKERRY • KAREN S. COSBY
MARK L. GRABER • HARDEEP SINGH

 CRC Press
Taylor & Francis Group