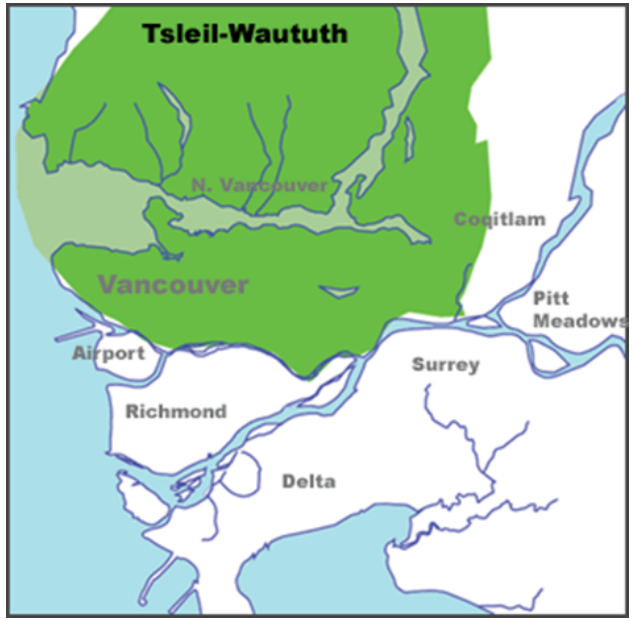
We would like to acknowledge that we are gathered today on the traditional territories of the Musqueam, Squamish and Tsleil-Waututh peoples.



Source: www.johomaps.net/na/canada/bc/vancouver/firstnations/firstnations.html

Diagnostic errors: what we know and how they can be prevented

Vancouver Coastal Health Family Medicine Grand Rounds

June 22, 2021

Christine Soong, MD, MSc, CCFP

Associate Professor, Sinai Health, University of Toronto

Hospital Medicine Division Head, Department of Family and Community Medicine

Objectives

1. define diagnostic errors
2. describe dual-process theory of clinical decision-making
3. appreciate cognitive biases as a cause of diagnostic errors
4. describe factors that contribute to diagnostic errors
5. list strategies to mitigate against diagnostic errors

Case – 58M

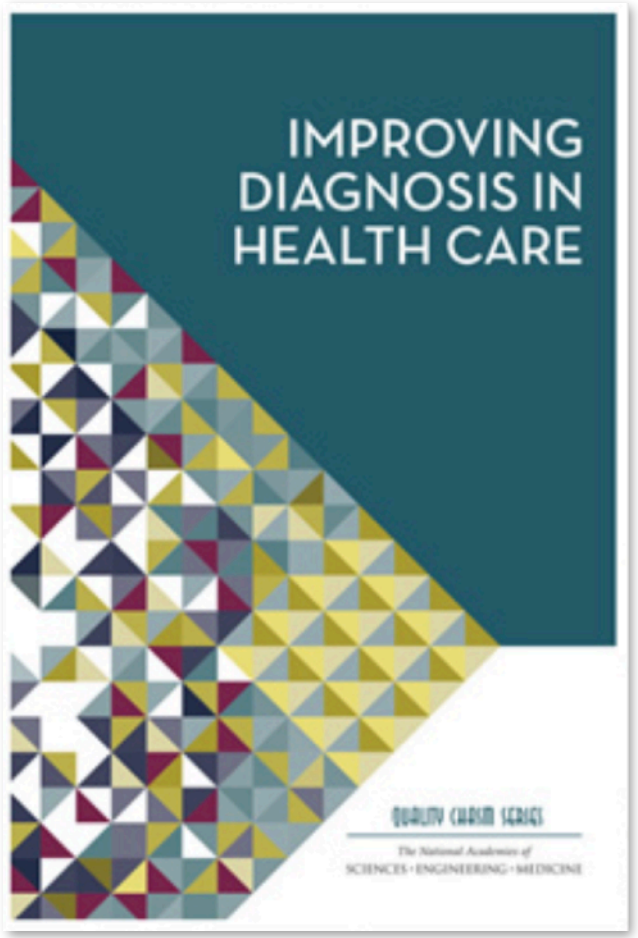
- long-term care ward
- anoxic brain injury
- non-verbal
- G-tube dependent

Day 1
- T 38.5 asymptomatic
- MD #1: labs, CXR, BC, Urine Cx
- Dx: aspiration

Day 2
- Fever continues, w/u negative

Day 3
- Desaturates to 80's requiring low-flow O2
- MD #2 orders NP swab, places patient in isolation
- COVID-19 +ve
- Family opts for palliation, patient passes peacefully

Diagnostic error: Definition



"The failure to (a) establish an accurate and timely explanation of the patient's health problem(s) or (b) communicate that explanation to the patient."

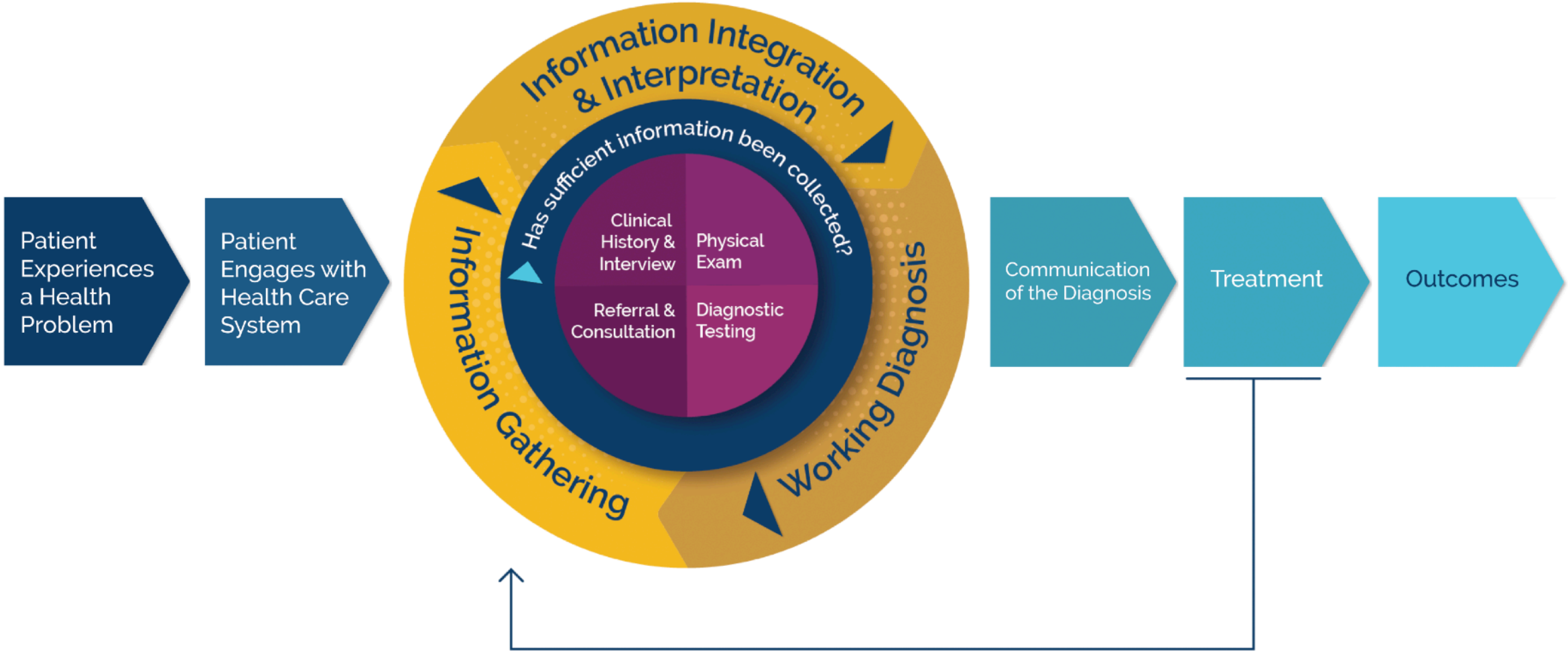
- Committee on Diagnostic Error in Health Care: 2015

Medicine
UNIVERSITY OF TORONTO

INSULIN 100

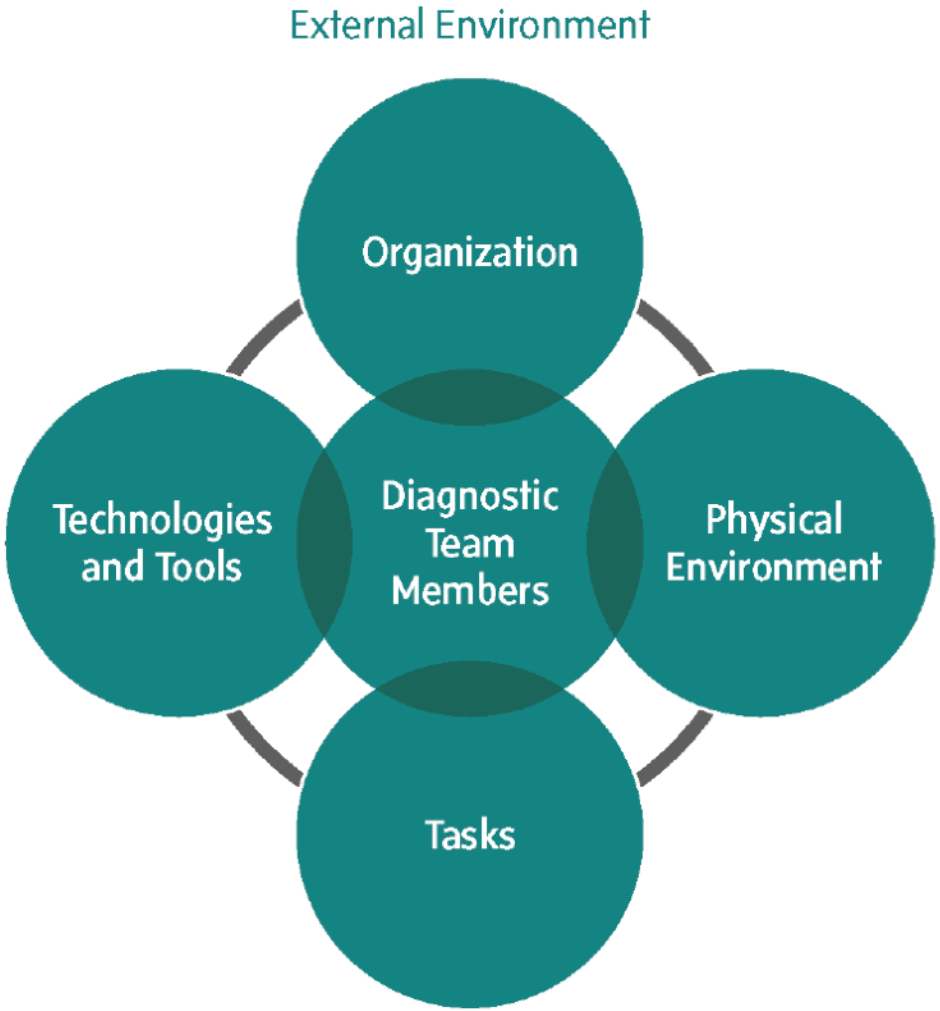
National Academies of Sciences, Engineering, and Medicine 2015. Improving Diagnosis in Health Care. https://doi.org/10.17226/21794.

Making a diagnosis is a complex, iterative process



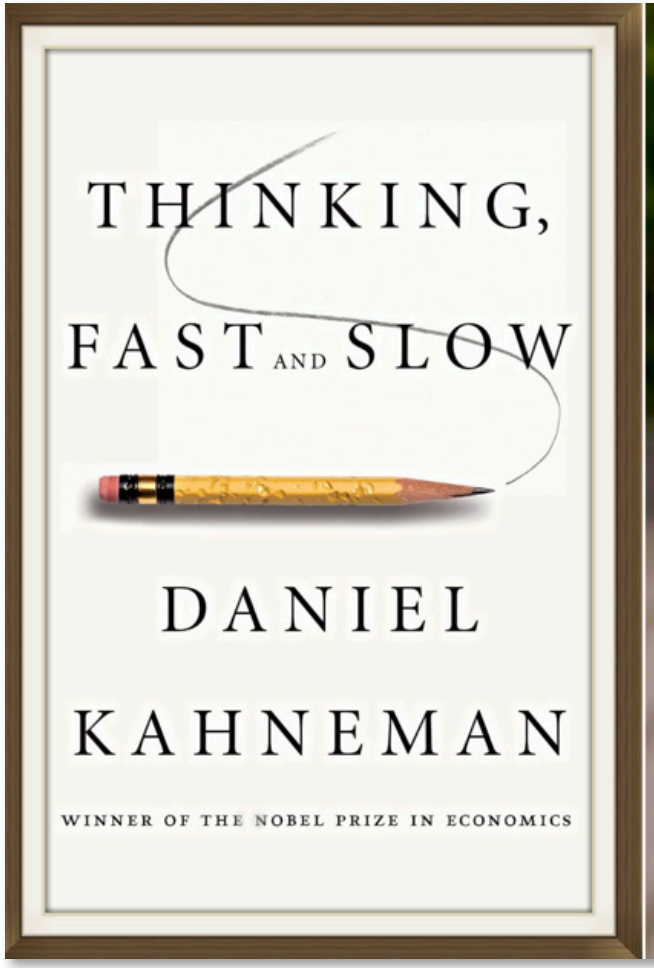
National Academies of Sciences, Engineering, and Medicine 2015. Improving Diagnosis in Health Care. https://doi.org/10.17226/21794.

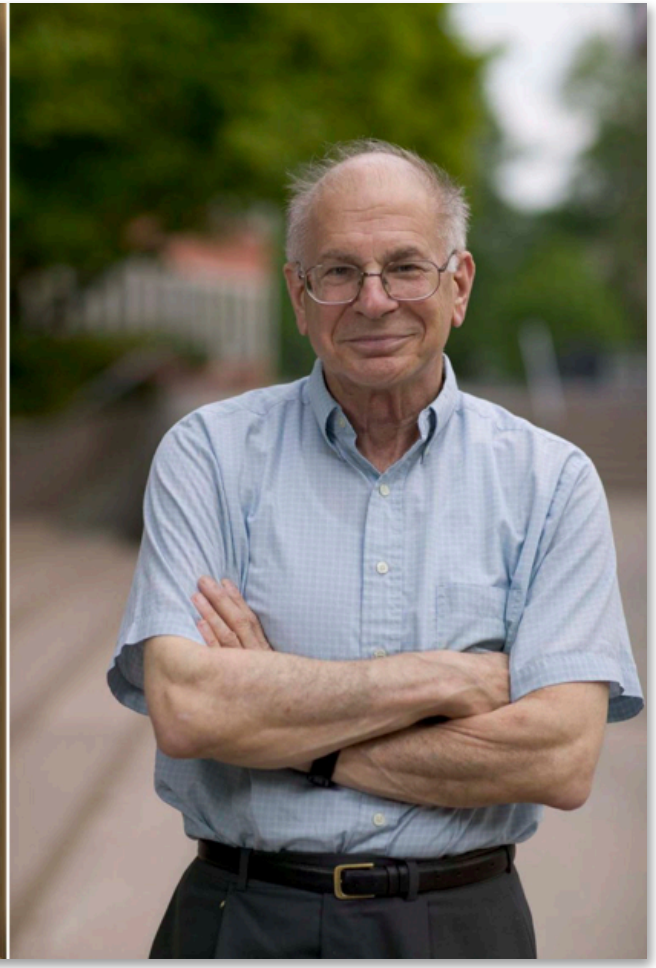
Systems factors interact to affect diagnostic process



National Academies of Sciences, Engineering, and Medicine 2015. Improving Diagnosis in Health Care. https://doi.org/10.17226/21794.

Judgement and decision-making

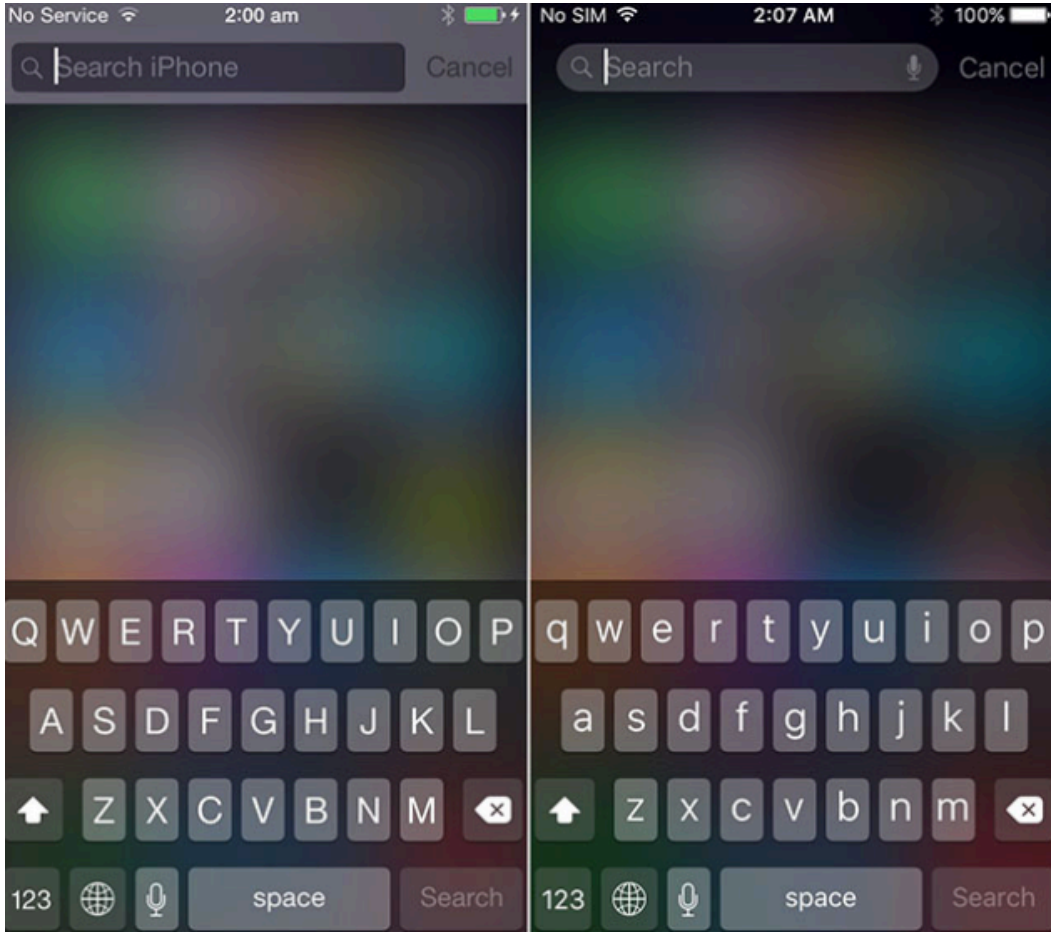




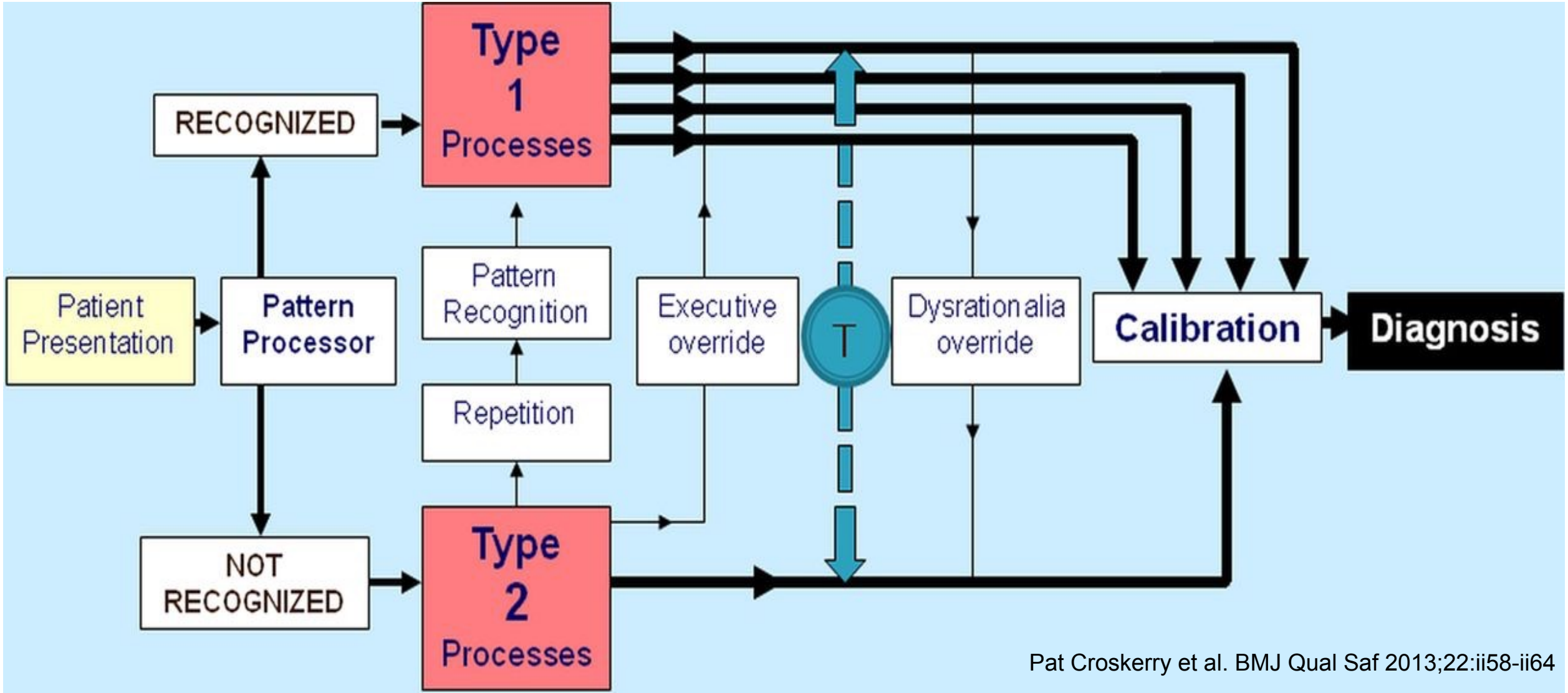
UBC
1978-1986

Type 1 (Fast)	Type 2 (Slow)
Unconscious, automatic, effortless Based on heuristics	Deliberate and conscious, effortful, controlled mental process, rational thinking
No self-awareness or control “What you see is all there is”	Uses self-awareness or control, is logical and skeptical
Assess the situation	Seeks new/missing information, makes decisions
98% of all thinking	2% of all thinking
Subject to cognitive biases and errors Works best in predictable environments	Time consuming and effortful Works best in relaxed and unhurried environments
e.g., recognizing faces, driving home on a familiar route	e.g., comparing different mortgage plans

Heuristics work best in predictable environments



Dual process model for decision making



Pat Croskerry et al. BMJ Qual Saf 2013;22:ii58-ii64

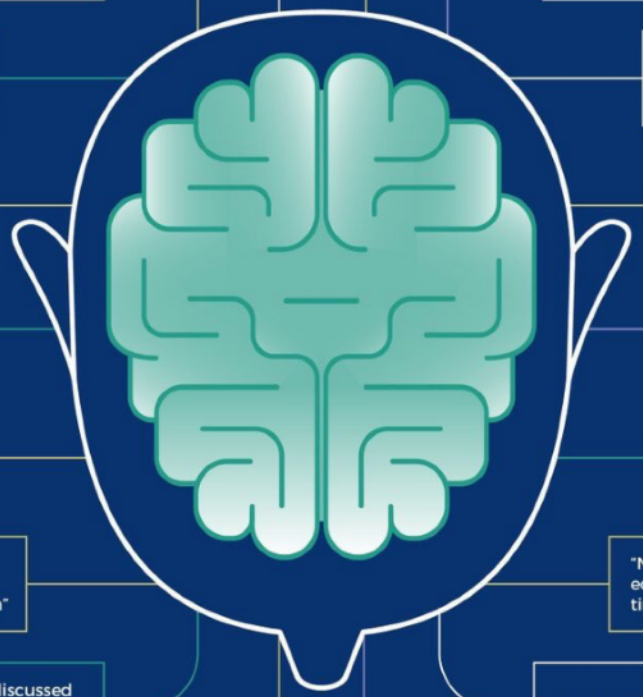
Cognitive bias

Social · Financial · Failure to estimate · Short-termism

When it comes to assessing risk, humans often fail to make rational decisions because our brains take mental shortcuts that prevent us making the correct choice. Since the 1960s behavioural scientists and psychologists have been researching these failings, and have identified and labelled dozens of them. Here are some that can cause havoc when it comes to assessing risks in business

ORIGIN

The notion of cognitive biases was first introduced by psychologists Amos Tversky and Daniel Kahneman in the early-1970s. Their research paper, 'Judgment Under Uncertainty: Heuristics and Biases', in the Science journal has provided the basis of almost all current theories of decision-making and heuristics. Professor Kahneman was awarded a Nobel Prize in 2002 after further developing the ideas and applying them to economics.



ANCHORING EFFECT
Relying too much on the initial piece of information offered when making decisions

"The first test seemed OK. Do we need to look any more?"

AVAILABILITY HEURISTIC
Overestimating the importance and likelihood of events given the greater availability of information

"I saw something very similar to this on LinkedIn. We need to take it seriously"

BANDWAGON EFFECT
Uptake of beliefs and ideas increases the more that they have already been adopted by others

"The whole department knows there's no problem here"

BELIEF BIAS
Basing the strength of an argument on the believability or plausibility of the conclusion

"I didn't quite follow your argument but the conclusion seems about right"

BLIND SPOT BIAS
Viewing oneself as less biased than others

"Let's ignore Sarah's views on this one. She's biased"

CLUSTERING ILLUSION
Erroneously overestimating the importance of small clusters or patterns in large data

"This is the second week in a row that this has happened. There must be a problem"

CONFIRMATION BIAS
Focusing on information that only confirms existing preconceptions

"We did loads of simulations. Most of them showed there's no problem"

COURTESY BIAS
Giving an opinion/conclusion that is viewed as more socially acceptable so as to avoid causing offence/controversy

"The last time we discussed this the meeting lasted for hours. Let's move on"

ENDOWMENT EFFECT
The tendency for people to ascribe more value to things merely because they already own/have them

"I know it will cost a fortune to fix but it cost us £15,000. We can't just throw it away."

"The conveyor belt broke three times last month. It's pretty unlikely it'll happen again."

GAMBLER'S FALLACY
Believing that future probabilities are altered by past events, when in fact they are unchanged

"Let's just get the deal done ASAP"

HYPERBOLIC DISCOUNTING
Preferring a smaller, sooner payoff over a larger, later reward

"This worked fine in the factory in the Korea, it should work fine here"

ILLUSION OF VALIDITY
Overestimating our ability to make accurate predictions, especially when data appears to tell a coherent "story"

"Looks like we've run out of time to discuss this"

OSTRICH EFFECT
Avoiding negative financial information by pretending it doesn't exist

"We made a good call on that one"

POST-PURCHASE RATIONALISATION
Tendency to retroactively ascribe positive attributes to an option one has selected

"Our competitors are only doing well because their products are cheap"

REACTIVE DEVALUATION
Devaluing an idea because it originated from an adversary or opponent

"Now we've got the new equipment we can cut the time spent on maintenance"

RISK COMPENSATION
Taking bigger risks when perceived safety increases; being more careful when perceived risks increases

"If it ain't broke - don't fix it"

STATUS QUO BIAS
Preferring the current state of affairs over change

"Dave from tech is worried - but frankly the tech team are always pessimists"

STEREOTYPING
Assuming a person has characteristics because they are a member of a group

RACONTEUR

Name the cognitive bias illustrated by this example:

The family medicine clinician seeing a patient with recent onset of low back pain immediately settles on a diagnosis of lumbar disc disease without considering other possibilities in the differential diagnosis.

A. Availability bias

B. Anchoring bias

C. Affective bias

D. Premature closure

Name the cognitive bias illustrated by this example:

New complaints from patients labelled as “frequent flyers” in the emergency department are not taken seriously.

A. Availability bias

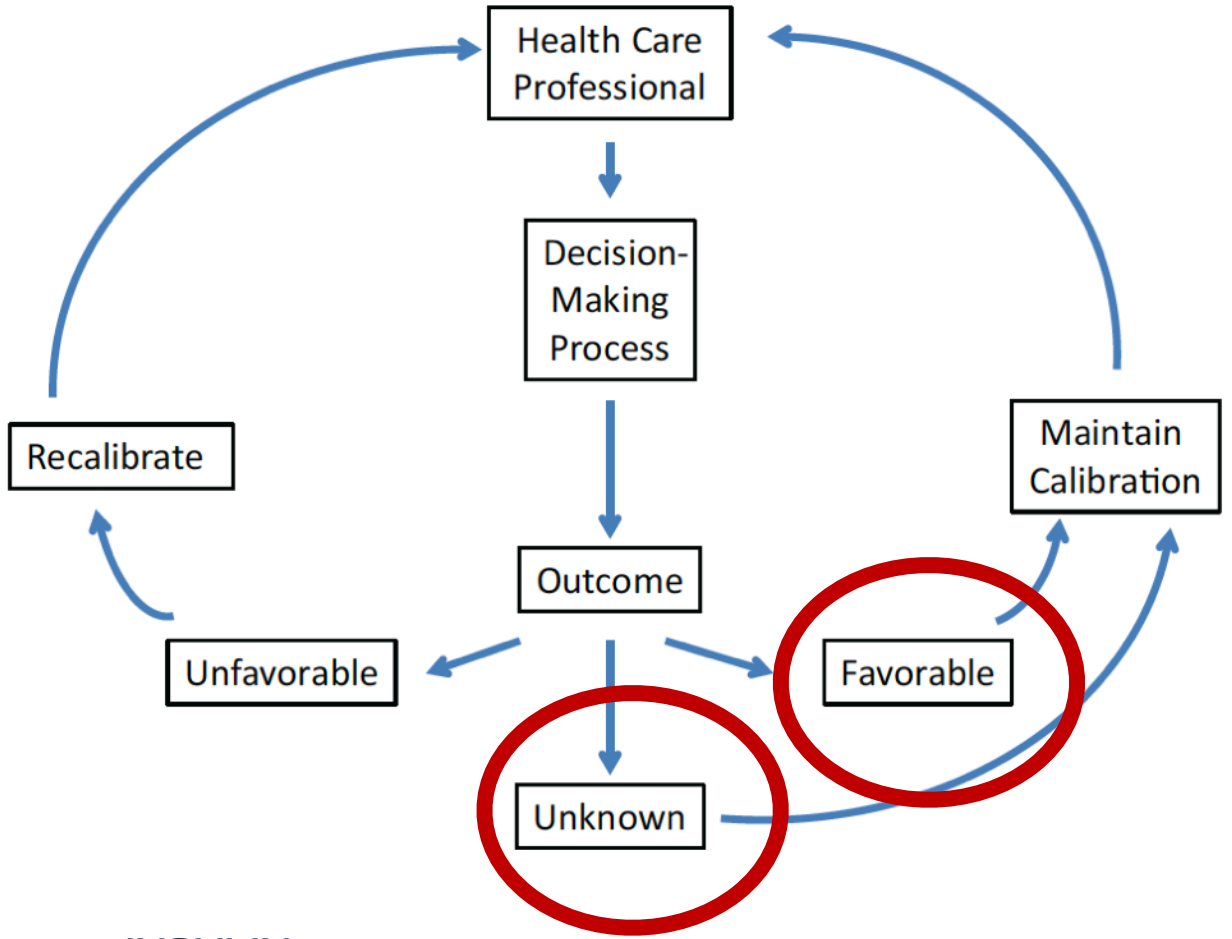
B. Anchoring bias

C. Affective bias

D. Premature closure

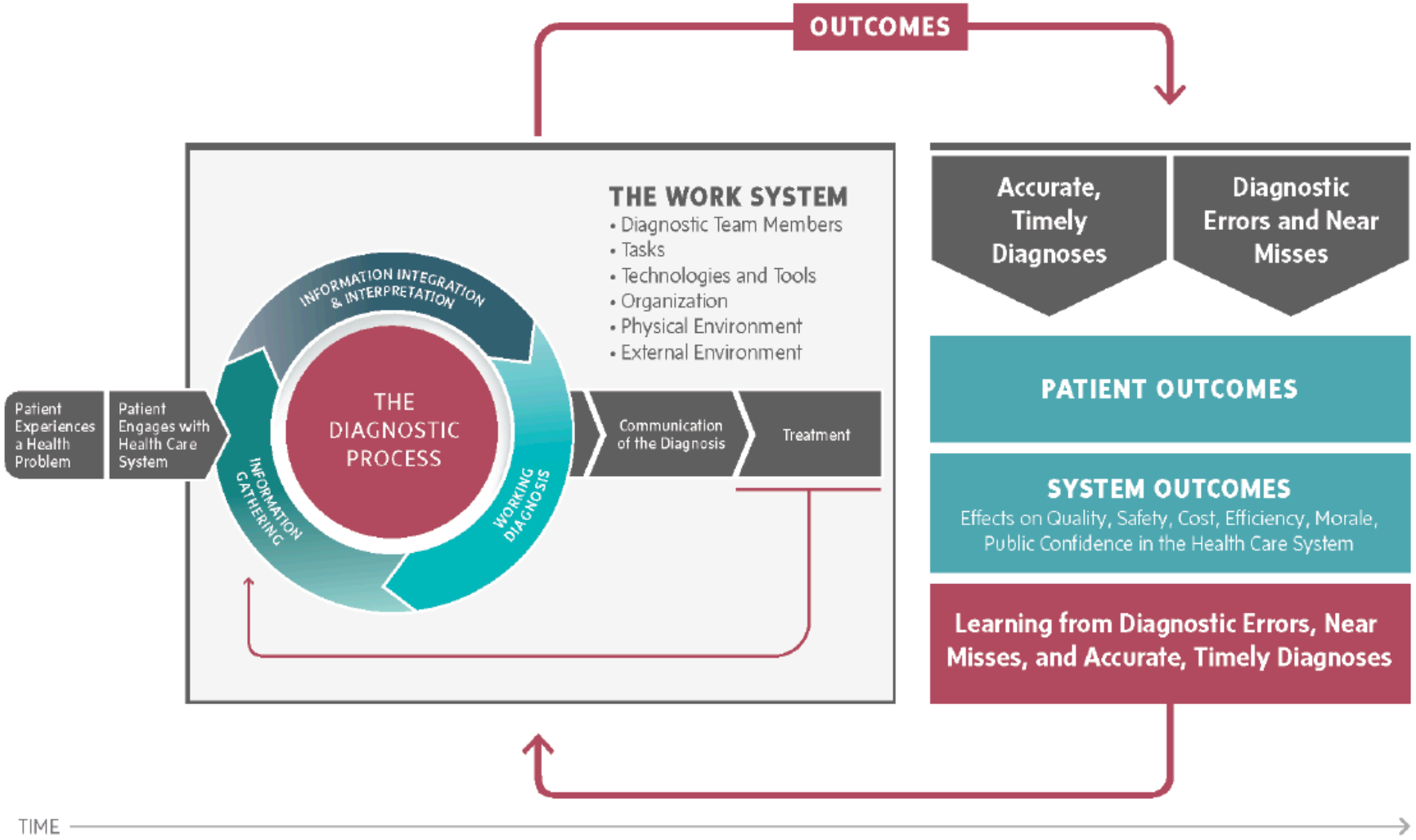
Heuristic or bias	Clinical example
Anchoring: tendency to lock onto salient features in the patient's initial presentation and failing to adjust this initial impression in the light of later information.	A patient is admitted from the emergency department with a diagnosis of heart failure. The hospitalists who are taking care of the patient do not pay adequate attention to new findings that suggest another diagnosis.
Affective bias: the various ways that emotions, feelings, and biases affect judgment.	New complaints from patients labelled as "frequent flyers" in the emergency department are not taken seriously.
Availability bias: tendency to more easily recall things that we have seen recently or things that are common or that impressed us.	A clinician who just recently read an article on the pain from aortic aneurysm dissection may tend toward diagnosing it in the next few patients he sees who present with nonspecific abdominal pain, even though aortic dissections are rare.
Context errors: instances where we misinterpret the situation, leading to an erroneous conclusion.	We tend to interpret that a patient presenting with abdominal pain has a problem involving the gastrointestinal tract, when it may be something else entirely: for example, an endocrine, neurologic or vascular problem.
Premature closure (search satisficing): tendency to accept the first answer that comes along that explains the facts at hand, without considering whether there might be a different or better solution.	The emergency department clinician seeing a patient with recent onset of low back pain immediately settles on a diagnosis of lumbar disc disease without considering other possibilities in the differential diagnosis.

Feedback Sanction



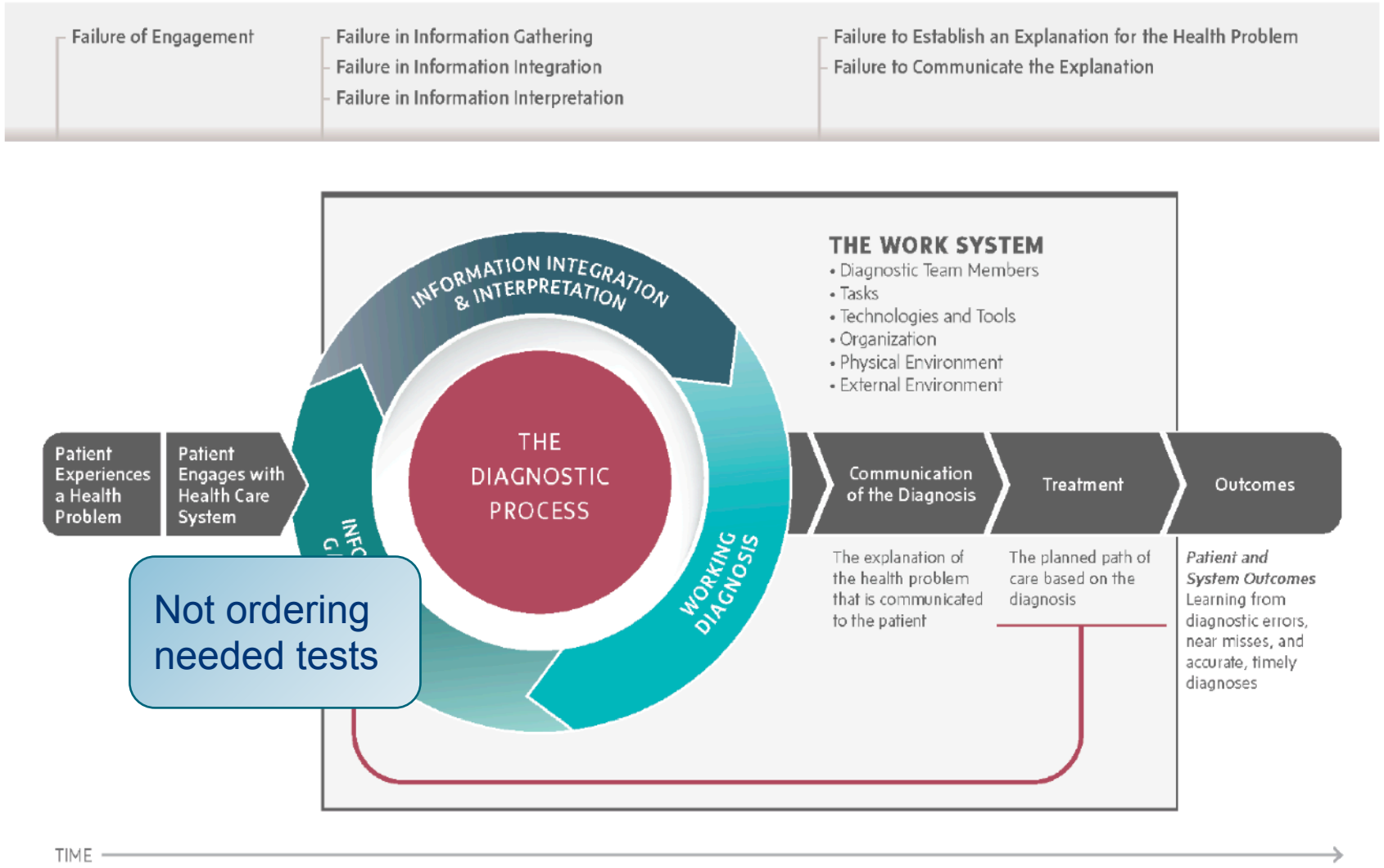
National Academies of Sciences, Engineering, and Medicine 2015. Improving Diagnosis in Health Care. https://doi.org/10.17226/21794. Adapted from Pat Croskerry. *Acad Emergency Med.* 2000; 7:1232–1238

Diagnostic process and outcomes



National Academies of Sciences, Engineering, and Medicine 2015. Improving Diagnosis in Health Care. https://doi.org/10.17226/21794.

Failures in the diagnostic process



National Academies of Sciences, Engineering, and Medicine 2015. Improving Diagnosis in Health Care. https://doi.org/10.17226/21794.

Measuring diagnostic errors

1. Postmortem (autopsy)
2. Medical record review
3. Malpractice claims review
4. Health insurance review
5. Diagnostic testing
6. Medical imaging
7. Clinician surveys
8. Patient surveys

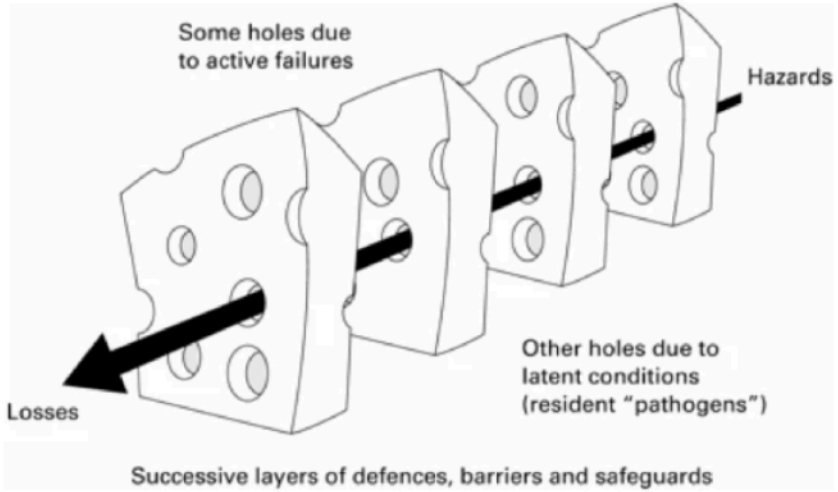
The Elephant of Patient Safety: What You See Depends on How You Look

Shojania KG. *Jt Comm J Qual Patient Saf*. 2010 Sep;36(9):399-401

A systems approach to diagnostic errors

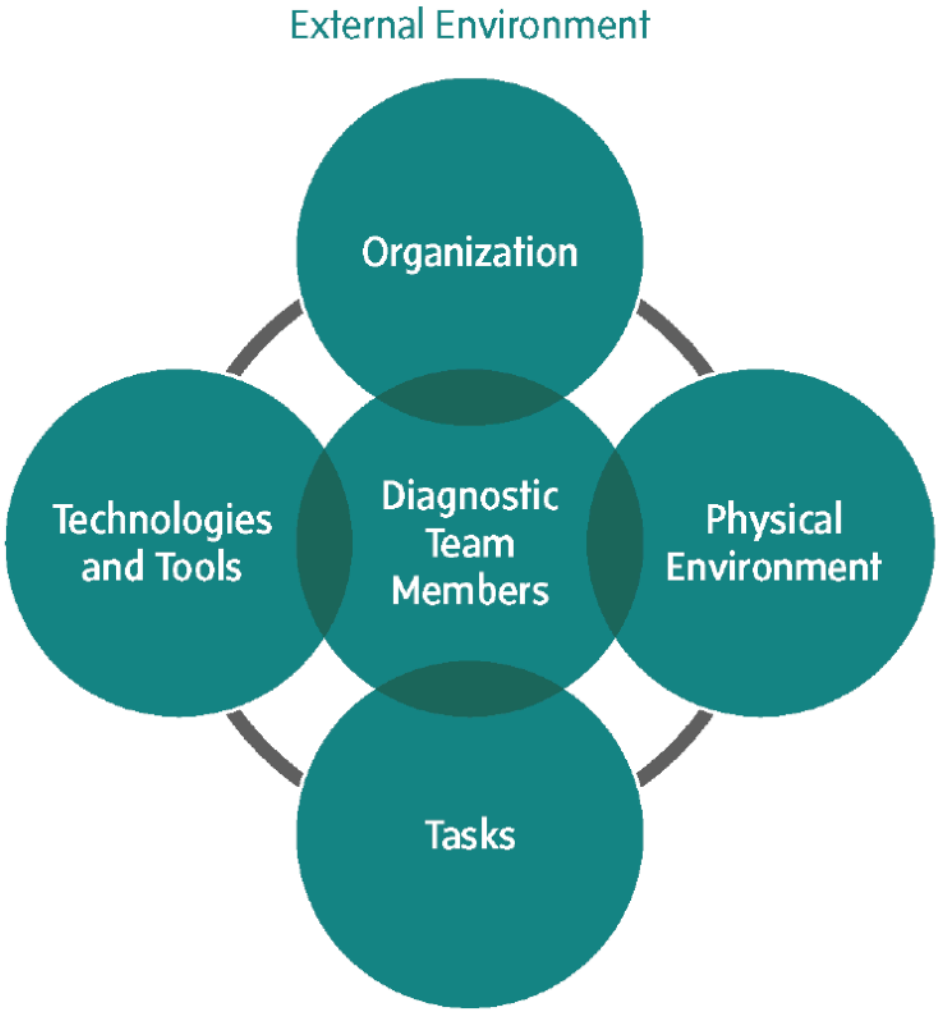
"The common initial reaction when an error occurs is to find and blame someone. However, even apparently single events or errors are due most often to the convergence of multiple contributing factors…Preventing errors and improving patient safety for patients require a systems approach in order to modify the conditions that contribute to errors."

Institute of Medicine. *To Err is Human: Building a Safer Health System.* 2000, p. 69



Perneger, T.V.. *BMC Health Serv Res* **5,** 71 (2005)

Systems factors contribute to diagnostic process



National Academies of Sciences, Engineering, and Medicine 2015. Improving Diagnosis in Health Care. https://doi.org/10.17226/21794.

Case – 58M

- long-term care ward
- anoxic brain injury
- non-verbal
- G-tube dependent

Day 1
- T 38.5 asymptomatic
- MD #1: labs, CXR, BC, Urine Cx
- Dx: aspiration

Day 2
- Fever continues, w/u negative

Day 3
- Desaturates to 80's requiring low-flow O2
- MD #2 orders NP swab, places patient in isolation
- COVID-19 +ve
- Family opts for palliation, patient passes peacefully

Making Health Care Safer: A Critical Review of Evidence Supporting Strategies to Improve Patient Safety | March 5, 2013

Patient Safety Strategies Targeted at Diagnostic Errors FREE

A Systematic Review

109 Studies
14 RCTs

Table. **Categories of Organizational Interventions to Decrease Diagnostic Errors**

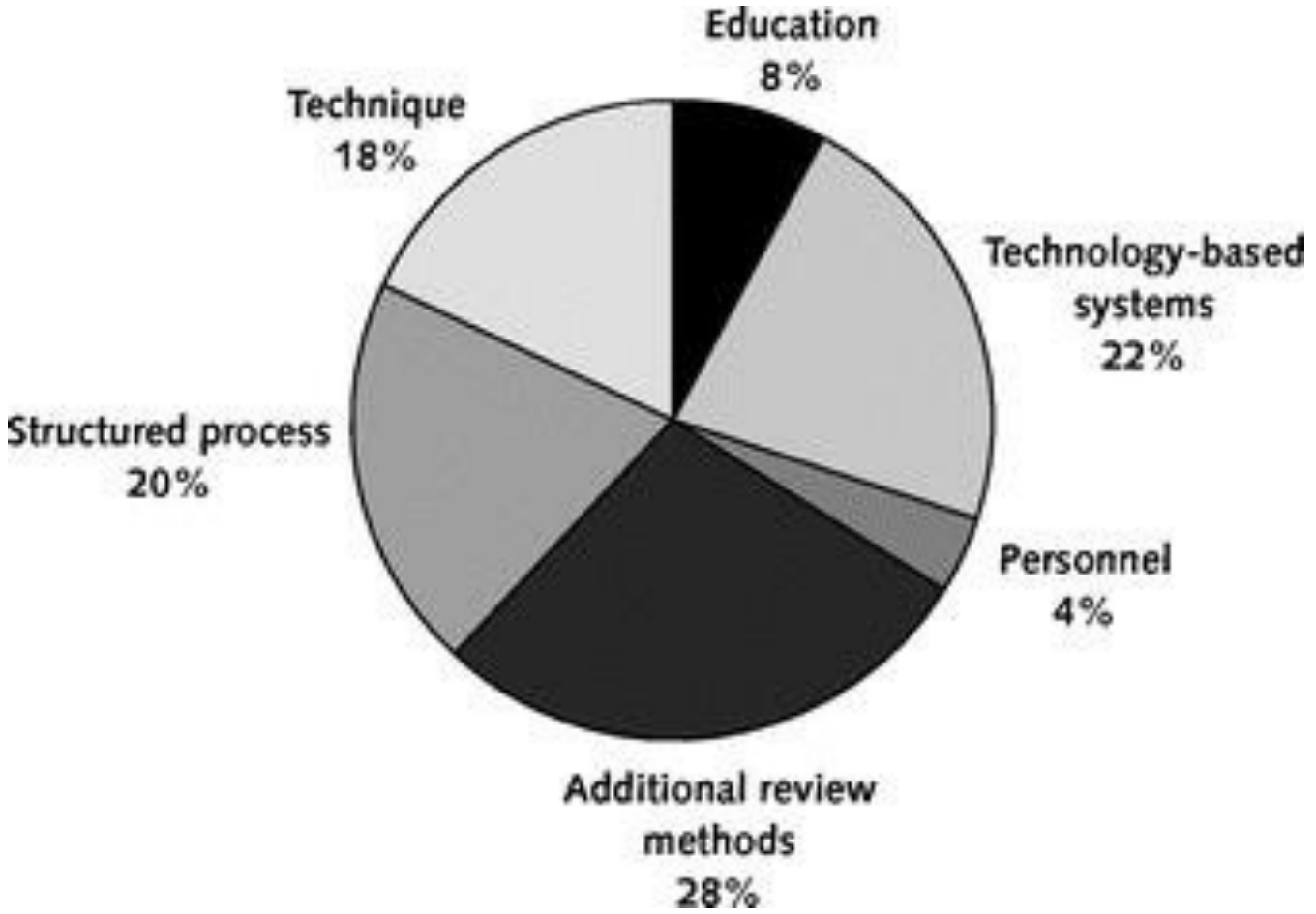
Category	Example
Technique	Changes in equipment, procedures, and clinical approaches that target diagnostic performance in clinical practice
Personnel changes	Introduction of additional health care members and replacing certain professionals with others
Educational interventions	Implementation of educational strategies, residency training curricula, and maintenance of certification changes
Structured process changes	Implementation of feedback loops or additional stages in the diagnostic pathway
Technology-based system interventions	Implementation at the system level of technology-based tools, such as computer assistive diagnostic aids, decision-support algorithms, text message alerting, and pager alerts
Additional review methods	Introduction of additional independent reviews of test results, from reporting through interpretation

Medicine
UNIVERSITY OF TORONTO

INSULIN 100

Ann Intern Med. 2013; 158(5_Part_2):381-389. doi:10.7326/0003-4819-158-5-201303051-00004

The percentage of studies as categorized by the 6 types of interventions

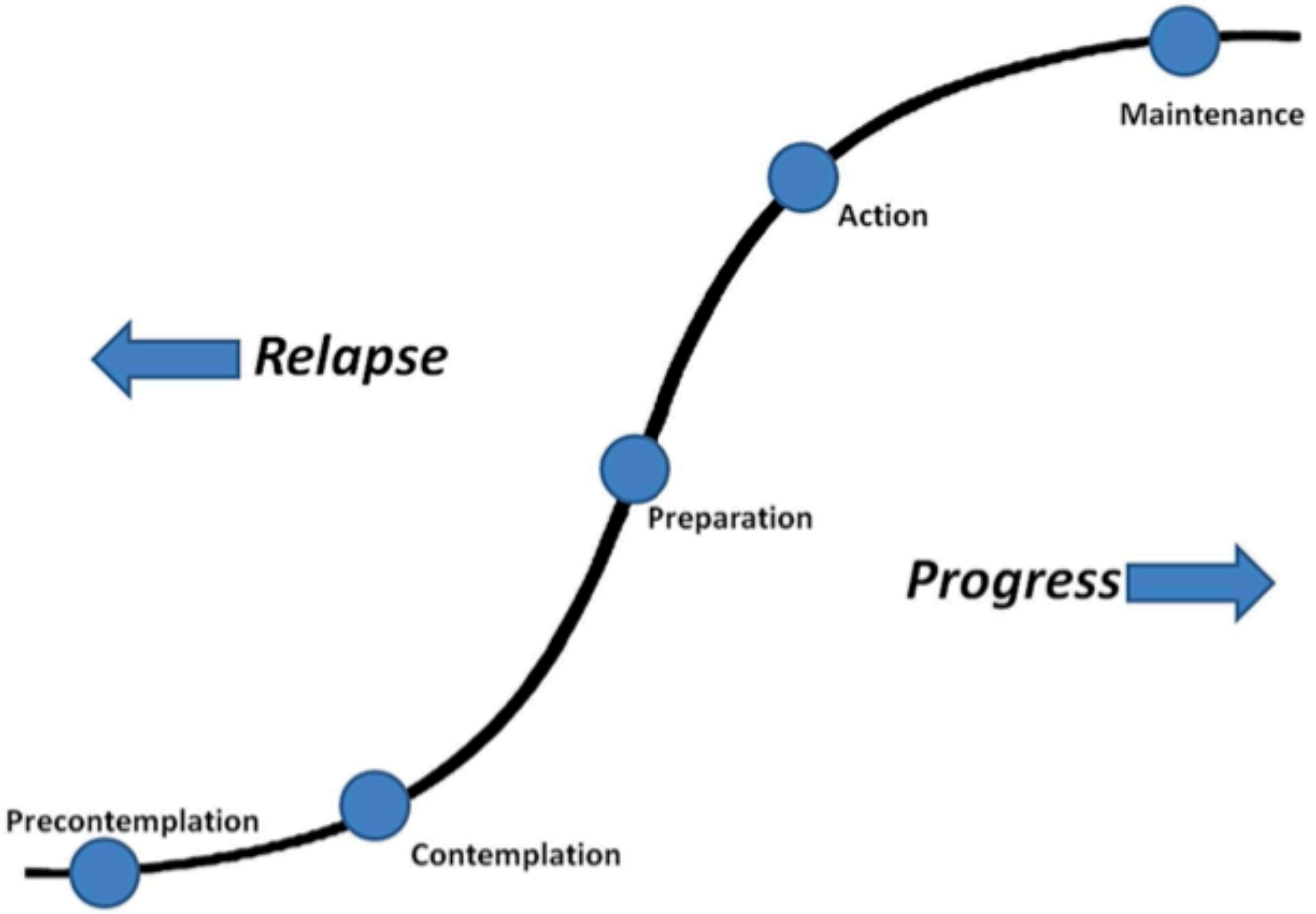


Medicine
UNIVERSITY OF TORONTO

INSULIN 100

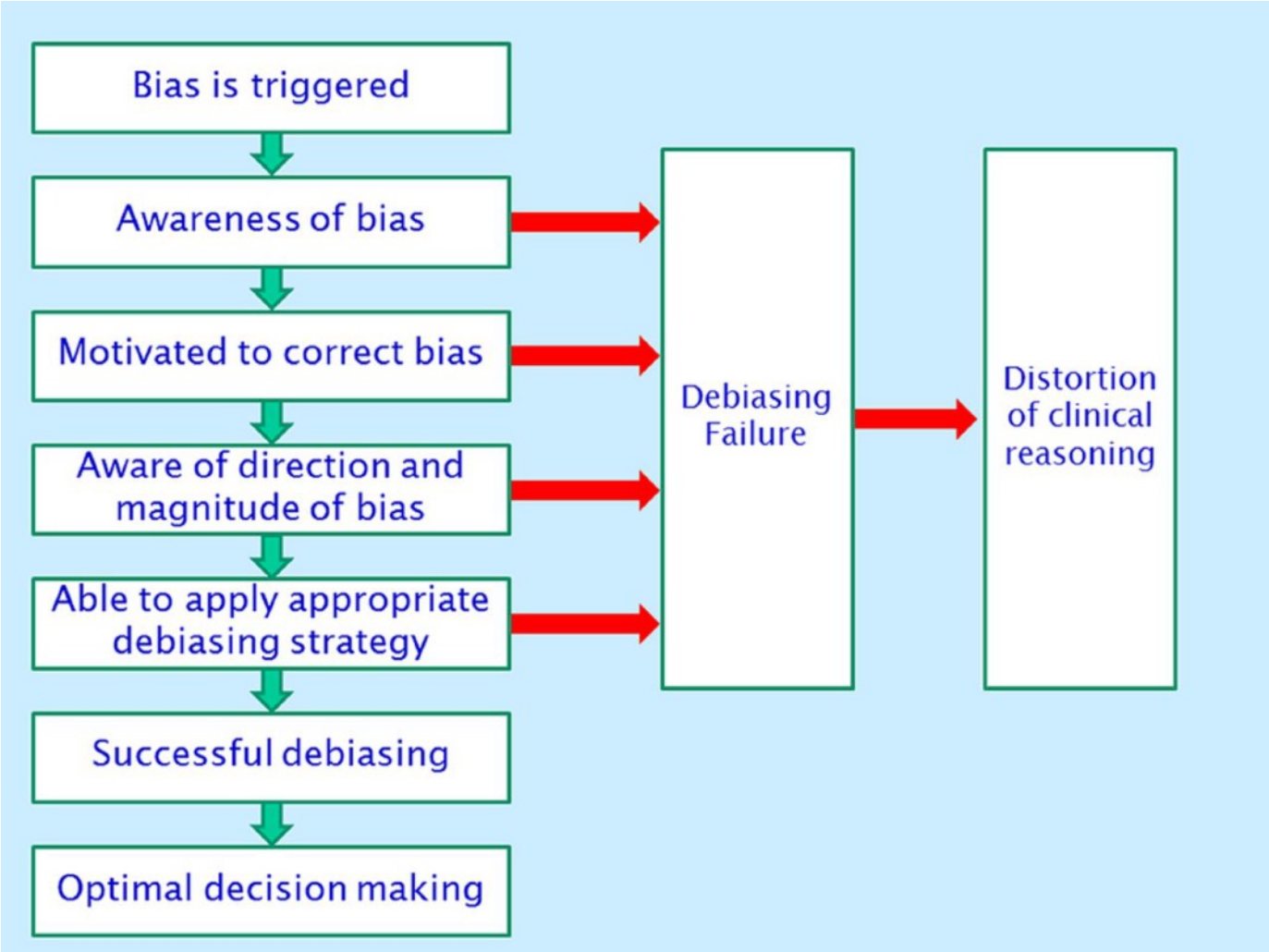
Ann Intern Med. 2013; 158(5_Part_2):381-389. doi:10.7326/0003-4819-158-5-201303051-00004

Debiasing: Reducing bias



Croskerry P, Singhal G, Mamede S. BMJ Qual Saf 2013;22:ii65–ii72

Successive steps in cognitive debiasing (adapted from Wilson and Brekke).35 Green arrows=yes; Red arrows=no.



Pat Croskerry et al. BMJ Qual Saf 2013;22:ii58-ii64

Debiasing interventions

1. Education: seminars on bias, case-based reasoning seminars emphasizing explicit reasoning steps, Bayesian reasoning, self-reflection
2. Workplace interventions:
    1. Checklists
    2. Cognitive forcing strategies: clinicians prompted to re-diagnose after adding clinical details; using alternatives scaffold, reviewing decision-making step diagrams and showing correct steps; clinicians asked to argue for alternative dx
    3. Guided reflection: interpret cases using guided reflective reasoning
    4. Instructions at test: instructed on how to diagnose cases

Systematic review

Dual-process cognitive interventions to enhance diagnostic reasoning: a systematic review

Kathryn Ann Lambe [1], Gary O'Reilly [2], Brendan D Kelly [3], Sarah Curristan [1]

BMJ Quality & Safety 2016;25:808-820

ASSESSMENT of REASONING TOOL

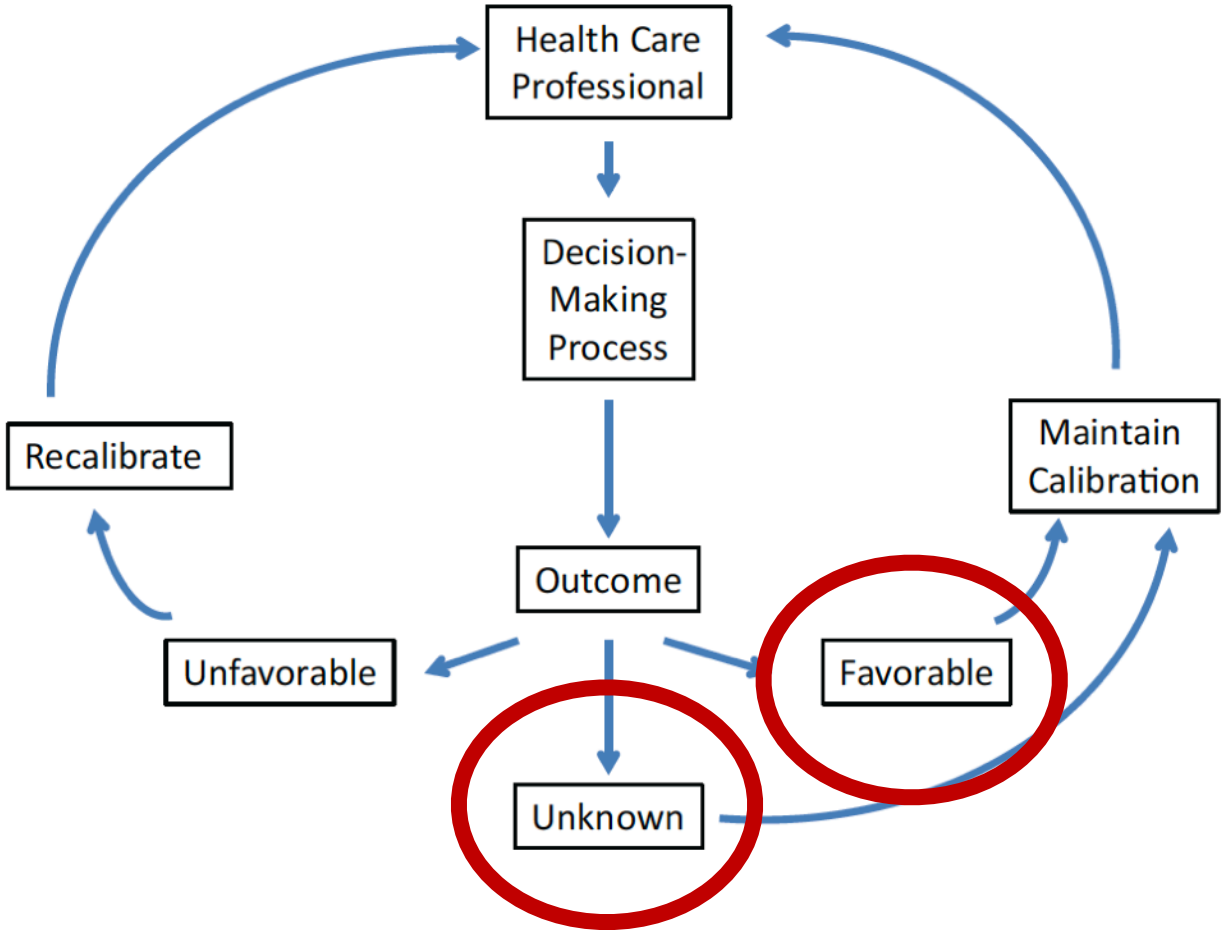
SOCIETY to IMPROVE DIAGNOSIS in MEDICINE

Learner: _____ Evaluator: _____

Did the Learner…	Assessment		
	Minimal	**Partial**	**Complete**
Collect/report history and examination data in a **hypothesis-directed manner**?	• Non-directed in questioning and exam • Asked questions without clear focus on potential diagnoses	• Questioning and exam generally reflective of potential diagnoses, but some less relevant or tangential questions	• Followed clear line of inquiry, directing questioning and exam to specific findings likely to increase or decrease likelihood of specific diagnoses
Articulate a complete **problem representation** using descriptive medical terminology?	• Included extraneous information • Missed key findings • Did not translate findings into medical terminology	• Generally included key clinical findings (both positive and negative) but either missed some key findings or missed important descriptive medical terminology	• Gave clear synopsis of clinical problem • Emphasized important positive and negative findings using descriptive medical terminology
Articulate a **prioritized differential diagnosis** of most likely, less likely, unlikely, and "can't miss" diagnoses based on the problem representation?	• Missed key elements of differential diagnosis, including likely diagnoses or "can't miss" diagnoses	• Gave differential diagnosis that included likely and "can't miss" diagnoses but either missed key diagnoses or ranked them inappropriately	• Gave accurately ranked differential diagnosis including likely and "can't miss" diagnoses
Direct evaluation/treatment towards **high priority diagnoses**?	• Directed evaluation and treatment toward unlikely/unimportant diagnoses • Did not evaluate or treat for most likely/"can't miss" diagnoses	• Major focus of evaluation and treatment was likely and "can't miss" diagnoses but included non-essential testing	• Efficiently directed evaluation and treatment towards most likely and "can't miss" diagnoses • Deferred tests directed towards less likely or less important diagnoses
Demonstrate the ability to **think about their own thinking** (metacognition)? Consider asking: *Is there anything about the way you are thinking or feeling about this case that may lead to error?*	• Not able to describe the influence of cognitive tendencies or emotional/ situational factors that may have influenced decision-making	• Can name one cognitive tendency or emotional/situational factor that may have influenced decision-making	
OVERALL ASSESSMENT	**NEEDS IMPROVEMENT** ☐	**MEETS COMPETENCY** ☐	**EXCELLENCE** ☐

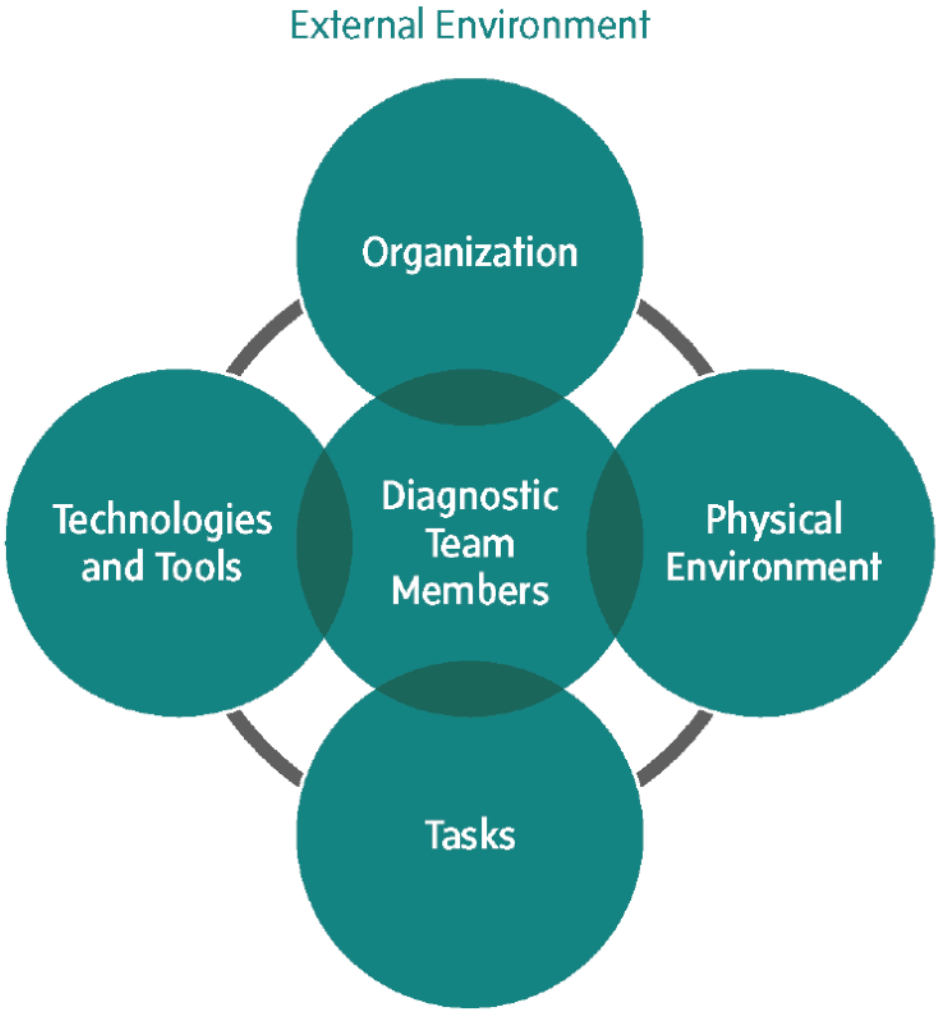
Comments:

What can individual clinicians do?



National Academies of Sciences, Engineering, and Medicine 2015. Improving Diagnosis in Health Care. https://doi.org/10.17226/21794. Adapted from Pat Croskerry. *Acad Emergency Med.* 2000; 7:1232–1238

What can Systems do?



Medicine
UNIVERSITY OF TORONTO

INSUI

National Academies of Sciences, Engineering, and Medicine 2015. Improving Diagnosis in Health Care. https://doi.org/10.17226/21794.

Summary

1. Diagnostic errors are common and can occur anywhere along the diagnostic process
2. Diagnostic errors occur due to cognitive biases and heuristic failures
3. Systems factors contribute to diagnostic errors: team (clinicians and patients), tasks and workflow, physical environment, technology and tools, organizational factors and external environment
4. Studies of intervention effectiveness inconclusive but those focused on technology-based systems and debiasing (reflective reasoning) hold early promise