How to Teach Clinical Reasoning in Medical Students: From Theory to Practice



Supaporn Dissaneevate
Araya Yuenyongviwat
Kanokpan Ruangnapa

Faculty of Medicine, Prince of Songkla University

Objectives

- Describe a contemporary model for diagnostic reasoning
- Apply teaching methods to assist learners by using expert thinking:
  - Problem representation
  - Illness scripts
- Apply strategies to promote clinical reasoning skills

Objectives

- Assessment reasoning tool
- Clinical reasoning difficulties

Acknowledgement

- Ref: slides

Satid Thammasitboon , MD, MHPE

Baylor College of Medicine, Houston, Texas, USA


Introduction

“

What is Clinical reasoning?

Clinical reasoning

The cognitive process by which “clinicians observe, collect, and analyze information that ultimately leads to an action (i.e., diagnosis and therapy).

Clinical reasoning

An important aspect of clinical skills

Fourth year medical students' experiences in transitioning to the clinical practice

Themes	Sub-themes
Clinical reasoning 	• Lack of confidence in clinical knowledge and reasoning skills • Inadequate analytical reasoning and pattern recognition skills learned from pre-clinical years • Capability in coping with diverse patients

When training medical students to think like doctors, what problems do we face?

- Clinicians often cannot express well how they think.
- The huge knowledge base required to think like an experienced clinician is not present in students.

How To Development Diagnostic Reasoning Skills?

How Physicians Make Diagnosis?

Patient story 1

- หญิงอายุ 35 ปี มีอาการเหนื่อยง่ายมา 1 เดือน เวลาทำงานบ้านหรือเดินไปจ่ายตลาดจะรู้สึกเหนื่อยมาก ใจสั่น เหงื่อออกทั้งตัวจนตัวเย็น รู้สึกหัวใจเต้นเหมือนจะกระแทกออกมานอกอกต้องนั่งพักถึงเดินต่อได้ ไม่อยากทำอะไรเลย รู้สึกเหนื่อย เพลีย หงุดหงิดง่าย กินจุ น้ำหนักลด ระยะหลังมีคนทักว่าคอโต และตาโปน

“ จงให้การวินิจฉัยเบื้องต้น ”

Graves’ Disease

Patient story 2

- A 2-year-old girl presents with a rash on her trunk. She had a high grade fever for 3 days and was taking paracetamol. Although, She has been more irritable than usual but can eat and has sufficient diapers. This morning, her fever had subsided but a pink rash appeared over her chest and back. On physical exam, there is a blanching, light pink rash with macules and papules on the trunk and back. She also has erythematous papules on her soft palate.

“ จงให้การวินิจฉัยเบื้องต้น ”

Roseola Infantum

Patient story 3

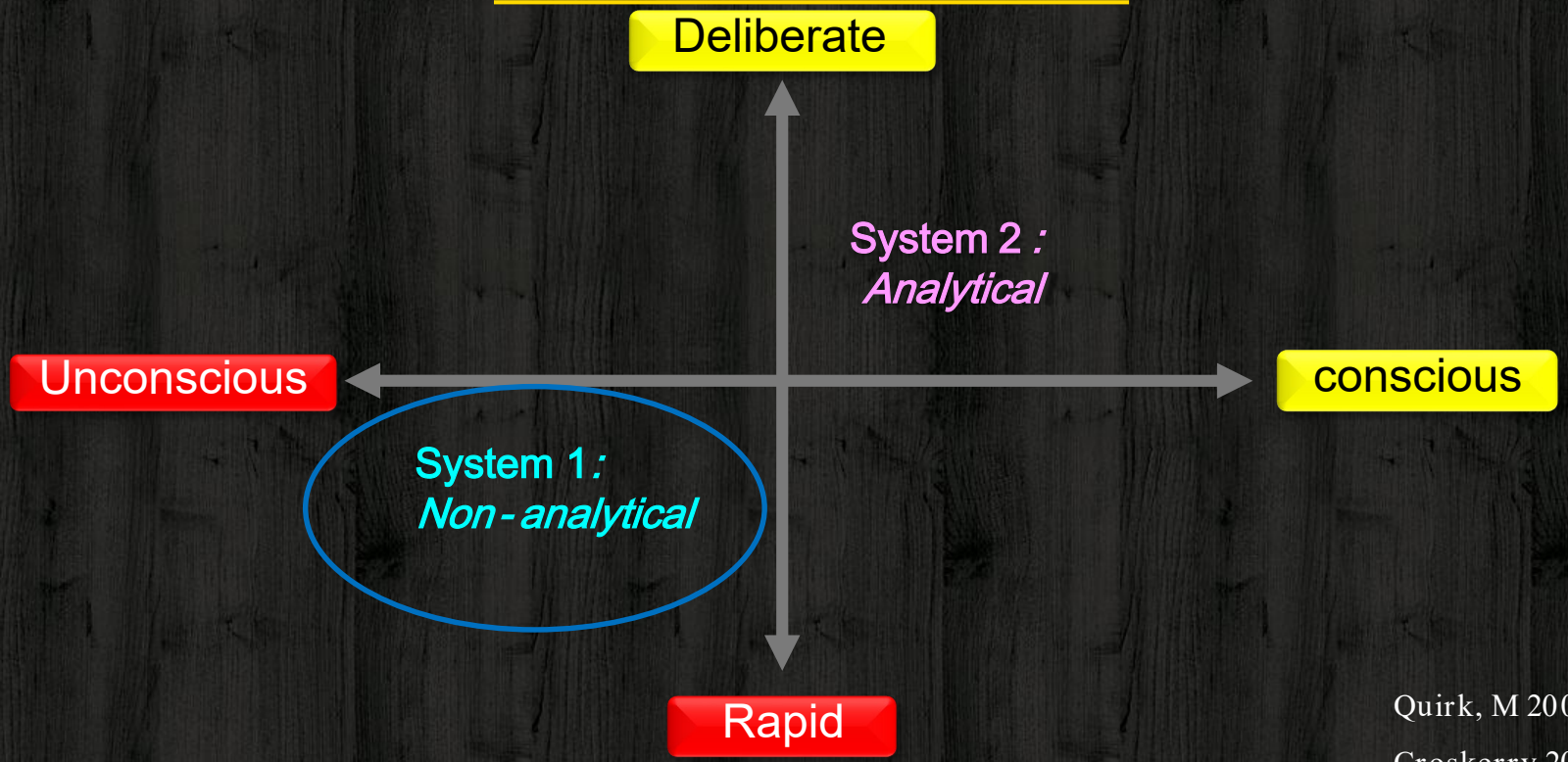
- A 5-year-old boy presents to the emergency room with abdominal pain. He also had a rash for about a week on his lower extremities along with joint pain and blood in his urine. Physical examination reveals palpable purpura on his buttocks and on his legs bilaterally as well as abdominal tenderness.

“ จงให้การวินิจฉัยเบื้องต้น ”

Henoch- Schonlein Purpura

How do you diagnose this patient?

Dual-Process Model of Reasoning



Quirk, M 2006

Croskerry 2003

System 1 FAST

- Auto-Pilot, automatic
- โหมดที่สมองทำงานแบบเร็ว ใช้ความรู้สึก สัญชาติญาณ ประสบการณ์สะสมจนเกิดเป็นภาพจำ เกิดรูปแบบ “ตายตัว”
- Nonanalytic reasoning, pattern recognition, effortless

Pattern Recognition

Graves' Disease

- Weight loss
- Palpitation
- Goiter
- Exophthalmos

Pattern Recognition

Henoch- Schonlein Purpura

- Palpable purpura
- Arthalgias
- Abdominal pain

Patient story 3

- A 72-year-old man presents with knee pain that woke him up from sleep; “the worst pain I’ve ever had”. The knee was normal before he went to bed; now it’s also swollen. He had similar problems 9 months and 2 years ago. It didn’t bother him between times. He is unsure of any fever.

What is your assessment?

System 2 SLOW

- **โหมดที่สมองทำงานแบบช้า สุขุม**
- Analytic: สมองใช้ตรรกะความคิดในการประมวลผล วิเคราะห์ จนไปถึงการตัดสินใจต่างๆ

How to approach the patient's problem?

- "Systematic analysis"
- "hypothetico-deductive reasoning"

Systematic Analysis

Organized and Logical :

- Start with
  - Acute vs. Chronic
  - Anatomy or Structure
  - Pathophysiology or Mechanism of illness
  - Organ System
- Then
  - Etiology

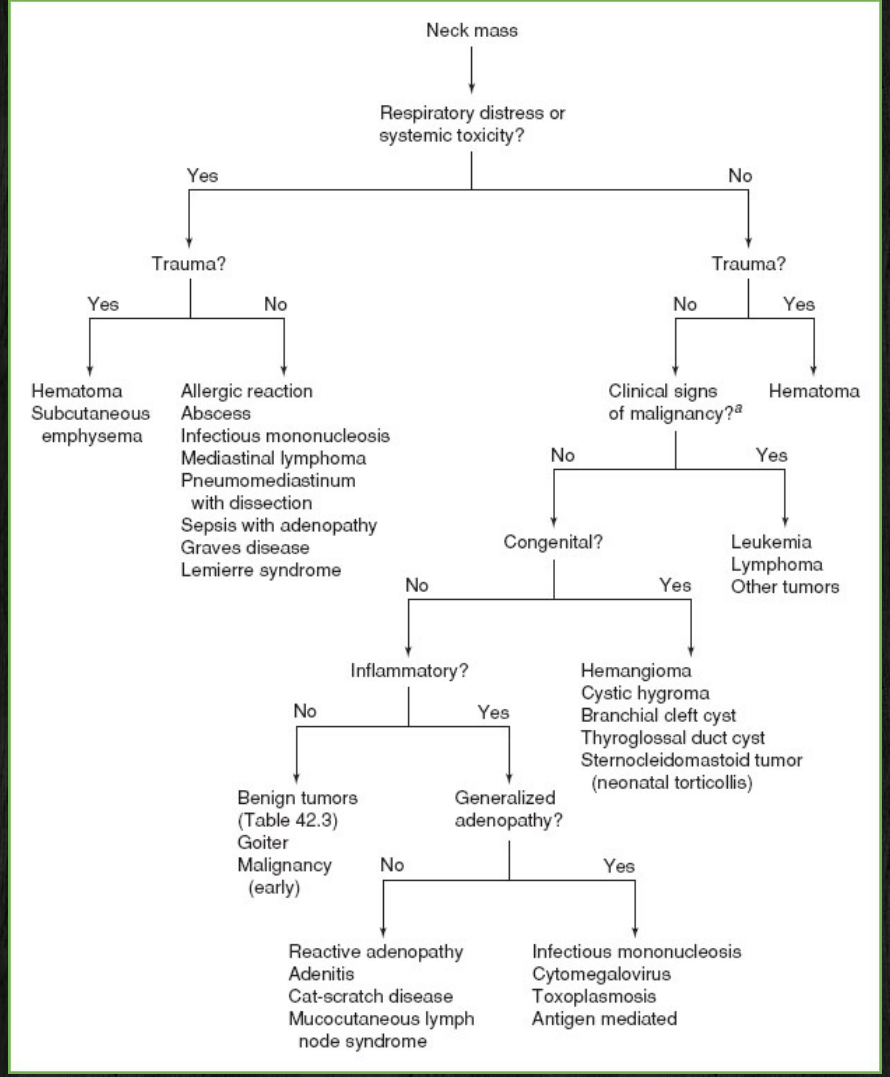
DDx Via Etiology

Traditional Mnemonic

“ VINDICATEMP ”

- **V** Vascular
- **I** Infectious, Inflammatory
- **N** Neoplastic
- **D** Degenerative, Deficiency, Drug
- **I** Iatrogenic, Idiopathic, Intoxication
- **C** Congenital
- **A** Autoimmune, Allergic, Anatomic
- **T** Toxin, Trauma
- **E** Endocrine, Environment
- **M** Metabolic/ Nutritional
- **P** Psychologic

Schema/Hypothesis Generation



Varied Paths, Same Destination :

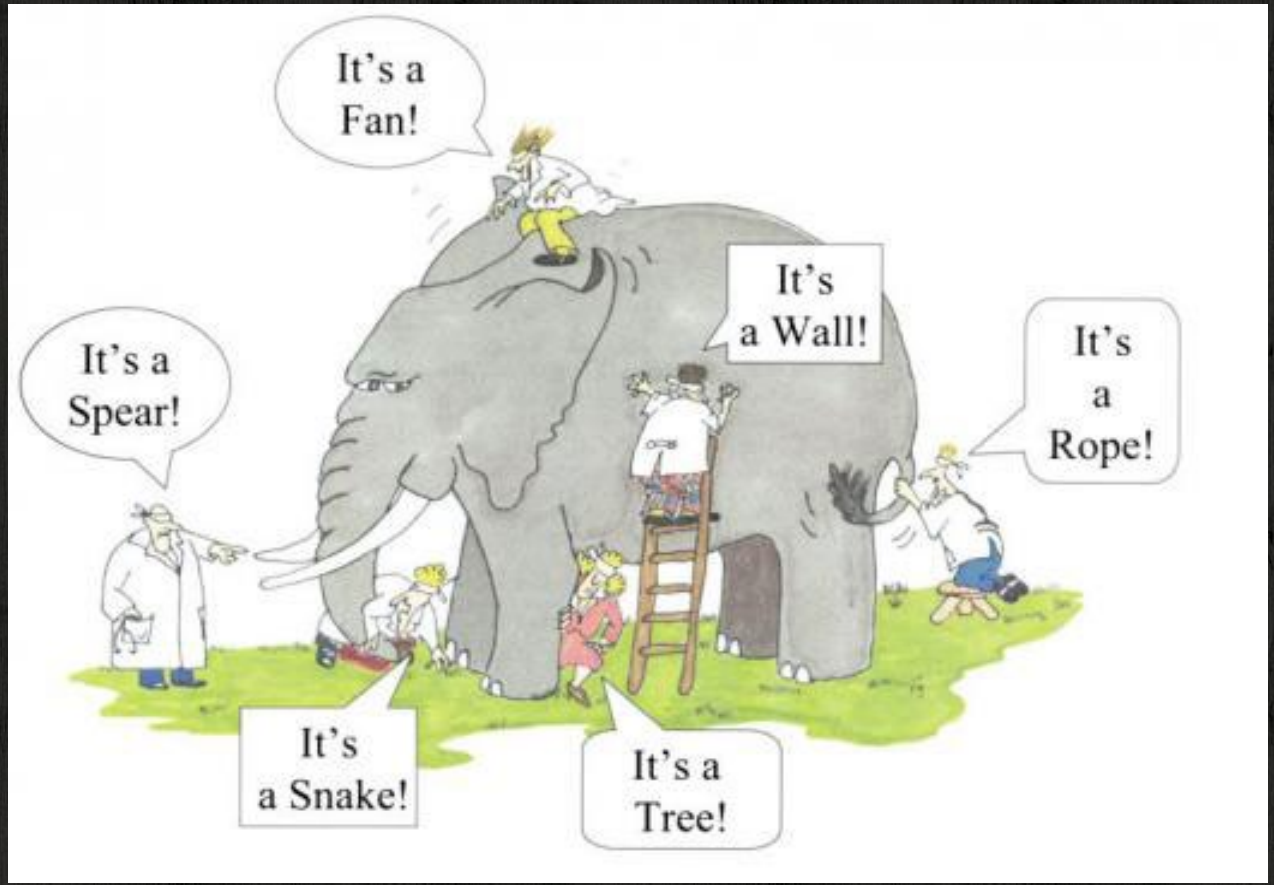
Navigating Through Clinical Diagnosis

Another Kind of "Making Assessment"

Problem Representation

Problem Representation

- Mental Synthesize the case to capture the BIG PICTURE in couple sentences
- Higher level of abstraction
  - Defining features
  - Discriminating features
  - Semantic qualifiers


It's a Fan!
It's a Spear!
It's a Wall!
It's a Rope!
It's a Snake!
It's a Tree!

Why use Problem Representation?

- The expert 'intuitively ' gets the BIG PICTURE and understands the relationship of parts and whole, 'Problem Representation (PR)'
- PR helps expert recognize specific pattern
- Select the 'Illness script ' for an accurate diagnosis

What are Semantic Qualifiers?

"Abstract descriptors" :

- Help sort through and organize (eg. chunk) patient information
- "Useful adjectives" represent abstraction of situational clinical findings

What are Semantic Qualifiers?

"Abstract descriptors" with implied or explicit opposites:

- Acute – chronic
- Sudden – gradual


Group
Activity

“

เขียน semantic qualifiers (เป็นคู่) ให้มากที่สุด

What are Semantic Qualifiers?

"Abstract descriptors" with implied or explicit opposites:

- Acute – chronic
- Sudden – gradual
- Immediate - delayed
- Constant - intermittent
- Unilateral – bilateral
- Left-sided – right-sided
- At rest – with activity
- Sharp pain – dull pain
- Tender - nontender
- Painful - painless
- Exudate - nonexudate
- Productive - nonproductive
- Mild - severe
- Worsening - improving

Elizabeth Stuart, MD, MSEd, et al

Purpose of Semantic Qualifiers

- Compare and contrast relevant information
- Facilitate retrieval of stored information
- Forces reflection to embed patient experience in memory

“

How to Create Problem Representation

Problem Representation

- One-sentence summary highlighting the defining features of a case, helping clinicians generate a differential.
- Answers the following 3 Q's:
  - Who is the patient?
  - What is the temporal pattern of illness?
  - What is the clinical syndrome?

Problem Representation Overview | sgim.org

Problem Representation

Who is the patient?

- Pertinent demographics
- Risk factors

What is the temporal pattern of illness?

- Length (hyperacute, acute, subacute, chronic)
- Tempo (stable, progressive, resolving, intermittent, waxing and waning)

What is the clinical syndrome?

- Key signs and symptoms

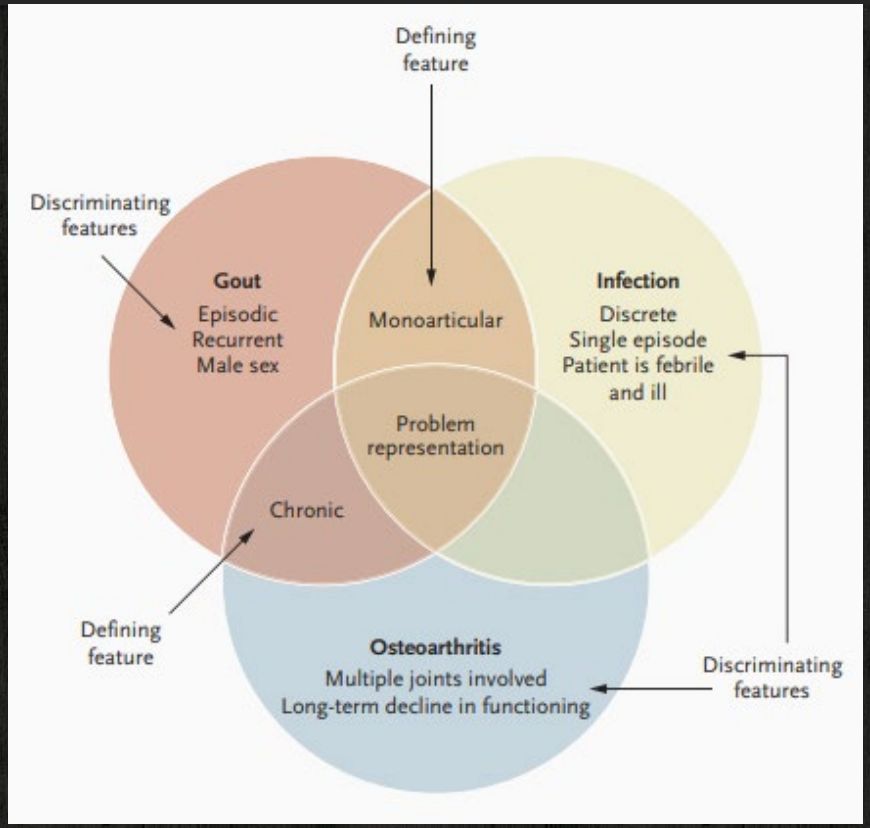
A 72-year-old man presents with knee pain that woke him up from sleep; “the worst pain I’ve ever had”. The knee was normal before he went to bed; now it’s also swollen. He had similar problems 9 months and 2 years ago. It didn’t bother him between times. He is unsure of any fever.

An old man with an acute, recurrent attack of severe pain in a single large joint, a mono-arthritis.

Problem Representation

Bowen,2006

Defining & Discriminating features



Bowen, 2006

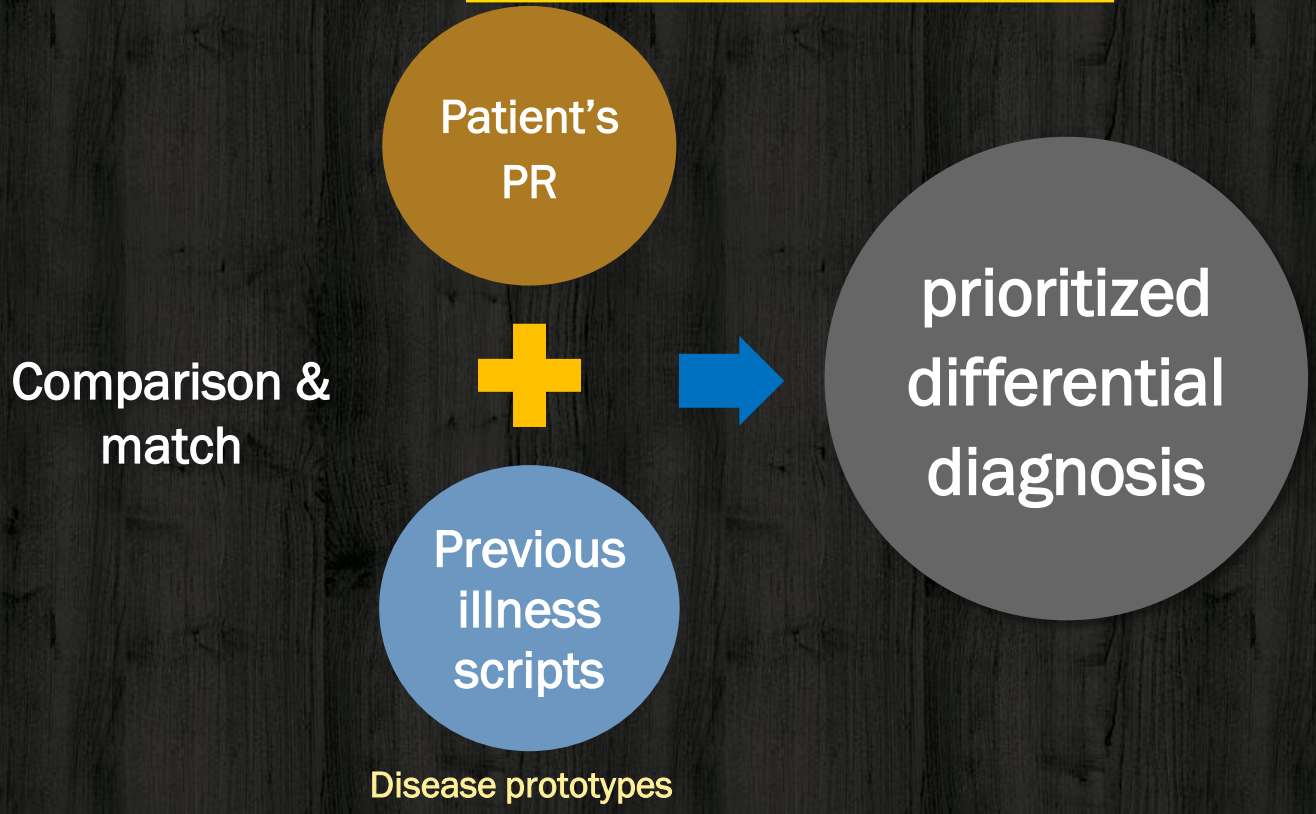
Problem Representation

- An old man with an acute, recurrent attack of severe pain in a single large joint, a mono -arthritis.

Semantic Qualifiers

Components	Patient history	Semantic qualifiers
Patient characteristic	Mr. S., 72 years	Old man
Site	Rt knee	Mono, large
Course	Last year	Episodic
Severity	Woke up from sleep	Severe
Context	Night	At rest
Onset	Last night	Acute

Problem Representation



An Index to Search for Illness Scripts

- Old man
- Acute onset
- Recurrent
- Mono, large joint

Gout, Septic arthritis

- Woman
- Gradual onset
- Chronic
- Poly, small joint

Rheumatoid arthritis

Problem Representation

- Effective PR reduce cognitive load
- Facilitate problem-solving
- Translating into medical terminology enables easier access knowledge stored in the clinician's illness scripts.

“

Problem representation exercise

An 8-month-old previously healthy male infant presented to the emergency department in the evening with low-grade fever, rhinorrhea, and sneezing for 2 days. His caregiver reported that his breathing sounds noisy and he has been coughing since this morning. After being fed, he also coughed until he regurgitated the milk that had been fed. He still had good appetite and actively crying. However, his chest area that sinked in with each breath concerns the caregiver and leads to this hospital visit.

Worksheet

Problem Representation

An 8-month-old previously healthy male infant presented to the emergency department in the evening with low-grade fever, rhinorrhea, and sneezing for 2 days. His caregiver reported that his breathing sounds noisy and he has been coughing since this morning. After being fed, he also coughed until he regurgitated the milk that had been fed. He still had good appetite and actively crying. However, his chest area that sinked in with each breath concerns the caregiver and leads to this hospital visit.

An 8-month -old previously healthy infant with URI symptoms and acute respiratory distress.

Problem Representation

A 60-year-old woman with rheumatoid arthritis presents with one day of left ankle pain and swelling as well one week of malaise. She has been on prednisone 20mg daily for the past 6 months. On exam, she is febrile and tachycardic, with left ankle edema, erythema, and tenderness with active *and passive range of motion. Blood work is significant for a WBC of 15,000*

Worksheet Problem representation

A 60-year-old woman with rheumatoid arthritis presents with one day of left ankle pain and swelling as well one week of malaise. She has been on prednisone 20mg daily for the past 6 months. On exam, she is febrile and tachycardic, with left ankle edema, erythema, and tenderness with active *and passive range of motion. Blood work is significant for a WBC of 15,000*

A 60-year-old woman with rheumatoid arthritis presents with ankle pain and swelling in the setting of malaise, with exam significant for tachycardia, fever, left ankle arthritis, and leukocytosis.

Problem Representation

Problem Representation Overview | sgim.org

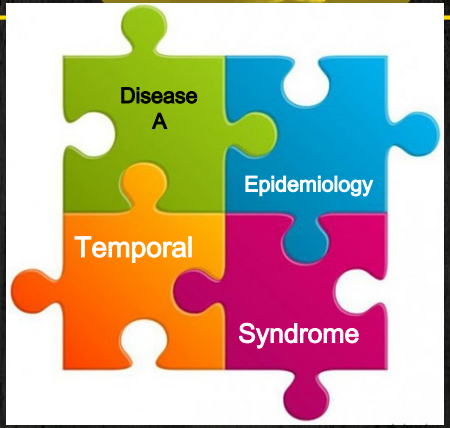
A 60-year-old woman with rheumatoid arthritis presents with one day of left ankle pain and swelling as well one week of malaise. She has been on prednisone 20mg daily for the past 6 months. On exam, she is febrile and tachycardic, with left ankle edema, erythema, and tenderness with active and passive range of motion. Blood work is significant for a WBC of 15,000

A 60-year-old immunocompromised woman Presents with acute monoarticular arthritis and SIRS.

Problem Representation

Illness Script

What is it?



“Illness Scripts”

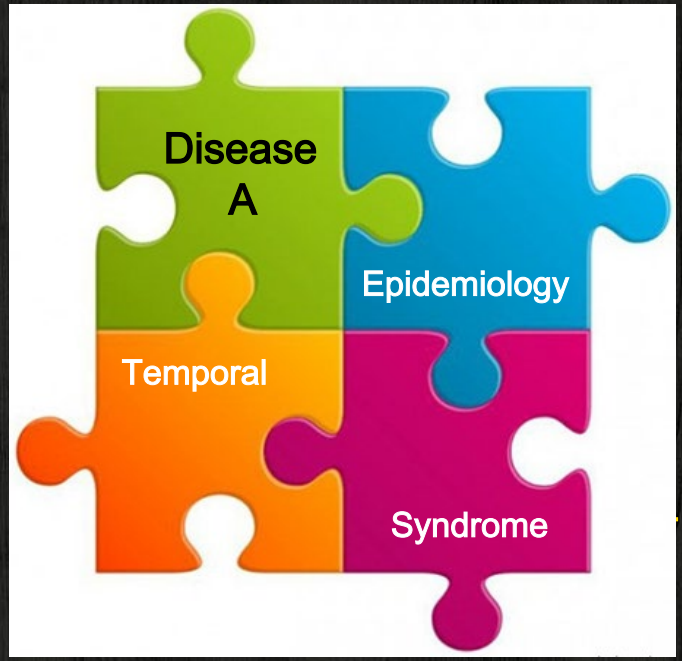
Keys to expert organized knowledge

An Illness Script

An abstract mental representation of an illness -developed and refined over time through new learning and experience.

Pathophysiology

Time course, When



Who, Predisposing conditions

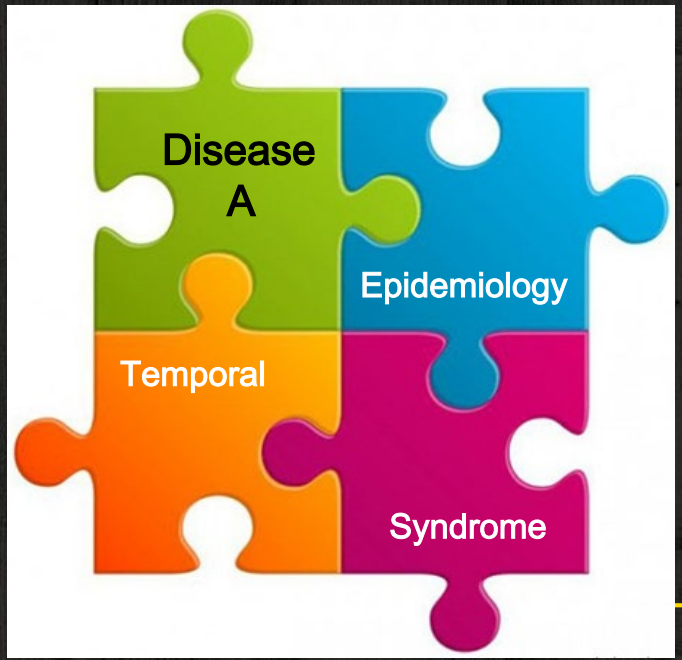
Symptoms, Clinical presentation

Illness Scripts: Semantic Qualifiers

Time Course:

- Hyperacute – minutes
- Acute – hours
- Subacute – days to weeks
- Chronic – months to years

Acute vs. Chronic
Progressive vs. Stable
Constant vs. Episodic



Neonate vs. older
Immunocompromised
Race

Colicky vs. Visceral
Bilious vs. non-bilious
Medical vs. Surgical

An Illness Scripts

- Comprehensive Unit Storage
- Triggered Retrieval
- Facilitate Comparison
- Diagnostic Hypothesis Generation

Experts Create & Compile Illness Scripts

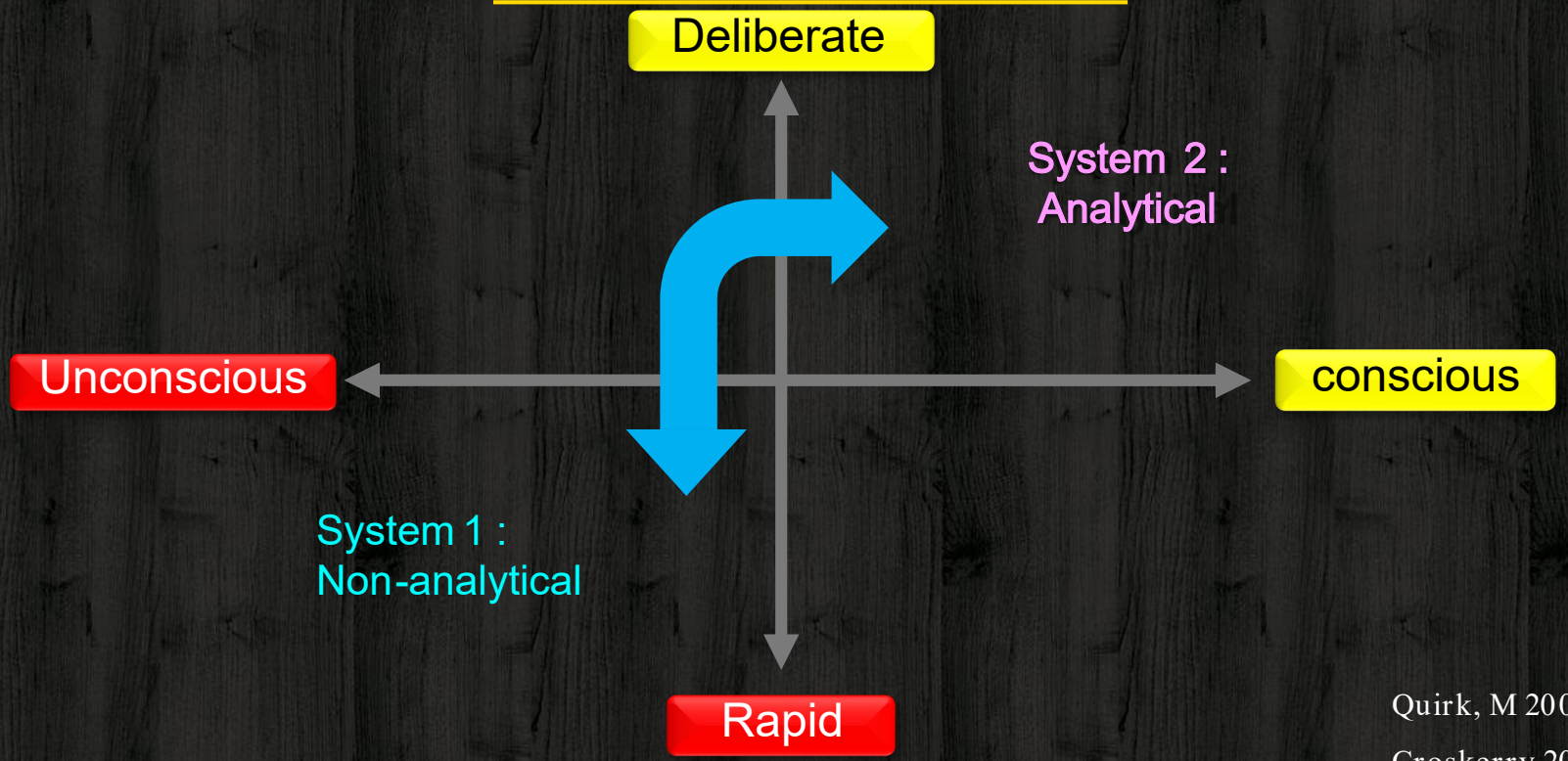
- Content of scripts:
  vary between clinicians, but contain *key features*

Problem Representation

- Activates *illness scripts*,
- Mental representations of potential diagnoses within the clinician's memory

Clinician prioritizes differential diagnosis based on the degree of match between the patient's problem representation and previous illness scripts (or disease prototypes).

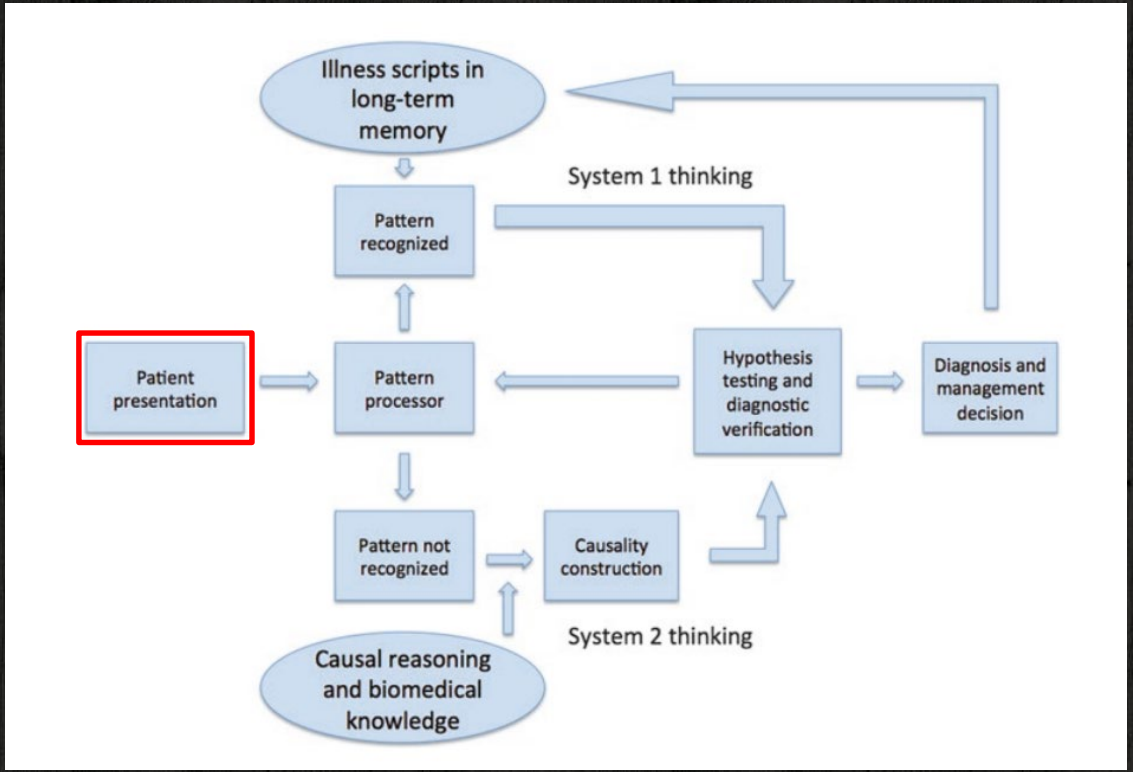
Dual-Process Model of Reasoning



Quirk, M 2006

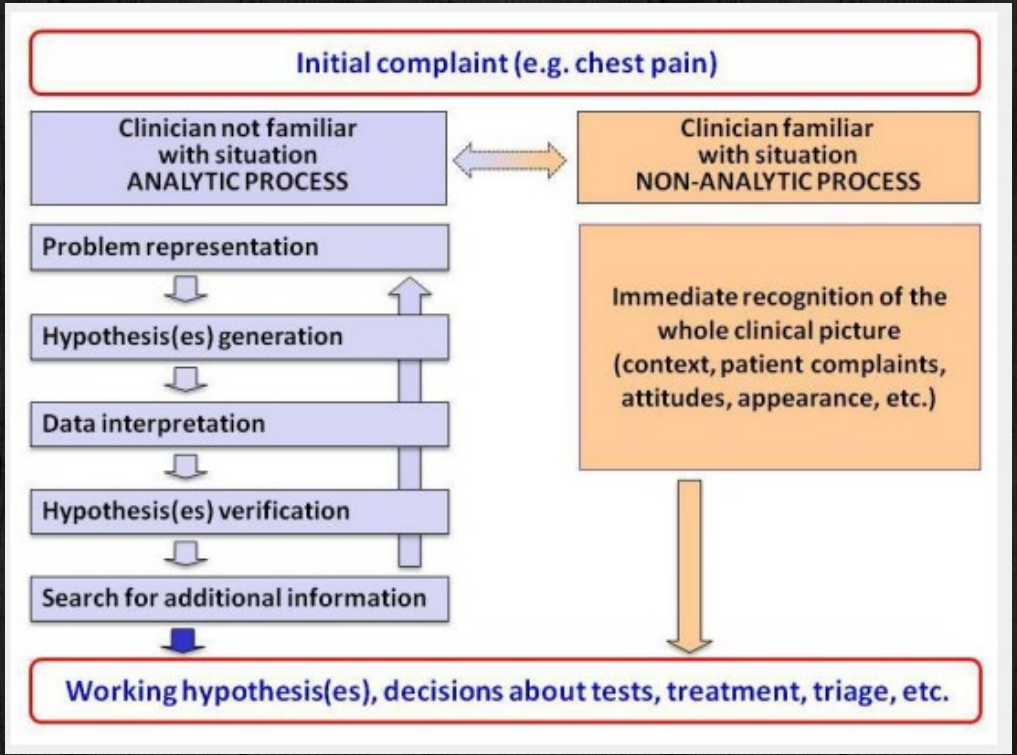
Croskerry 2003

Schematic representation of the dual process of reasoning



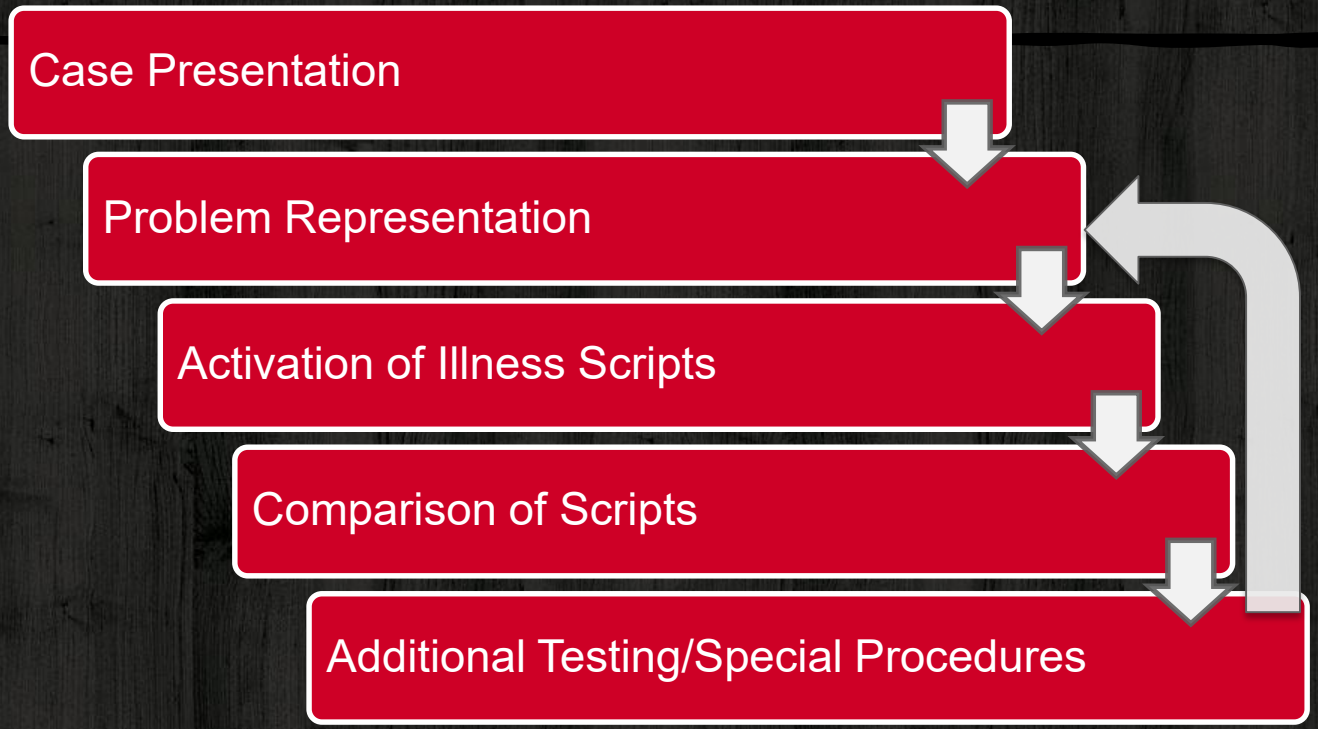
Adapted from Croskerry 2009

Schematic representation of the dual process of reasoning

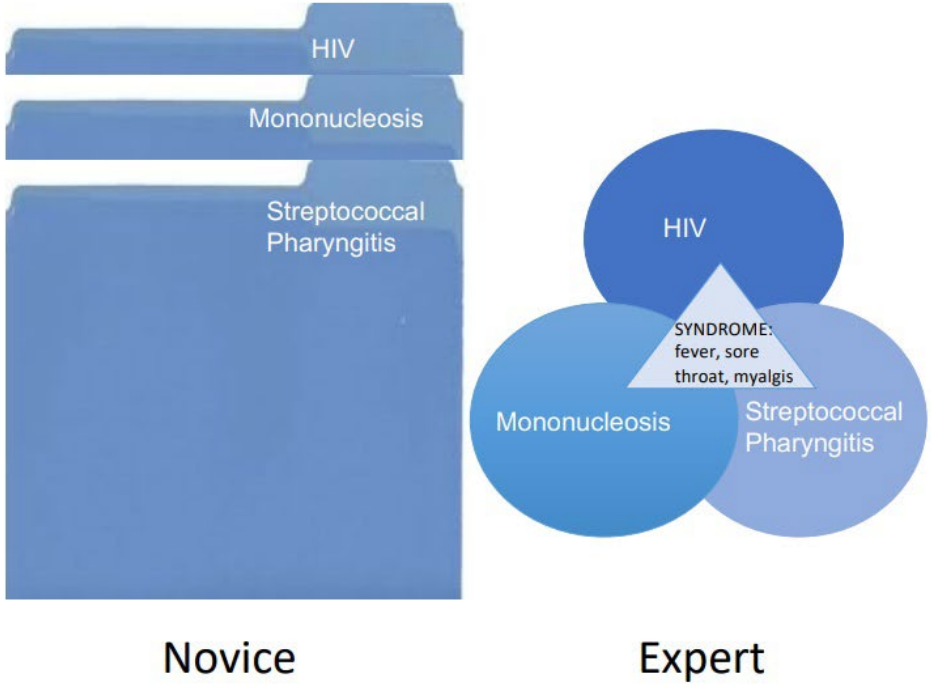


Nendaz M, Diagnostic errors and flaws in clinical reasoning: mechanisms and prevention in practice, Swiss MedWkly, 2012; 142: w 13706

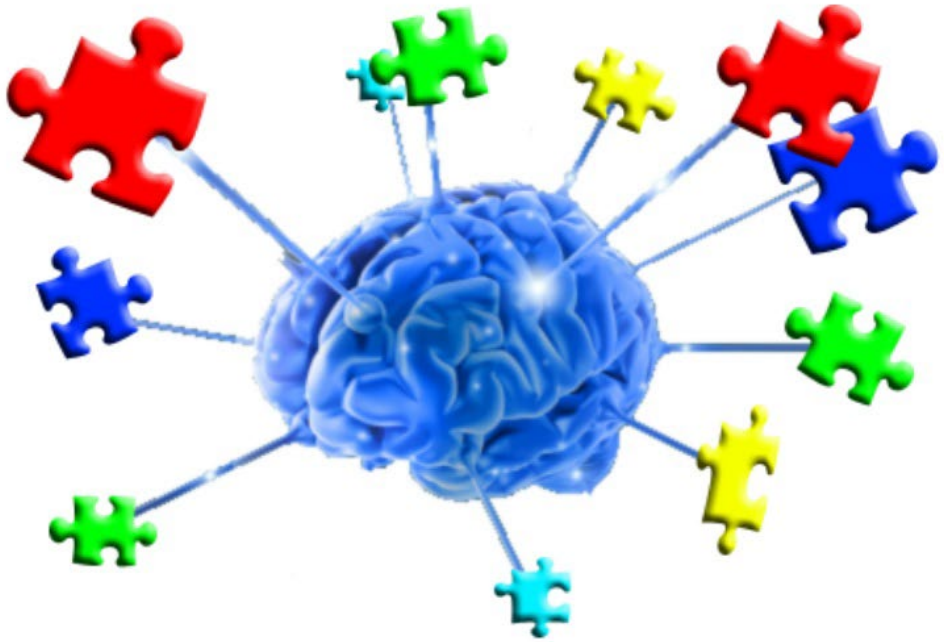
Making a Diagnosis



How to Organize “Your” Knowledge



Organized knowledge = Expertise



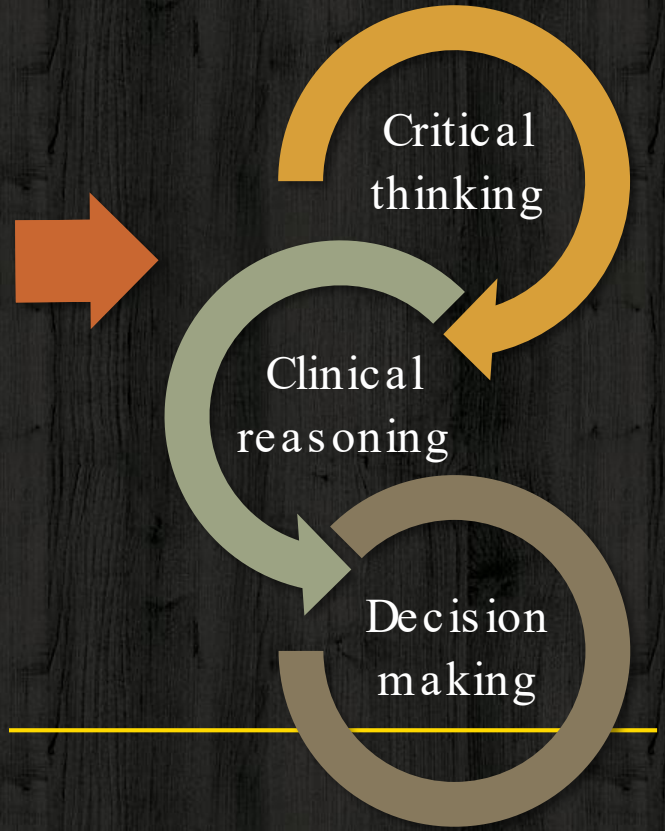
Clinician ที่เก่ง(Expert)ไม่ใช่มี Knowledge ที่มาก

แต่มีความสามารถในการ

organize *knowledge & experience* ที่ดี

Teaching Strategies

Development of



Menezes et al2015

Critical Thinking

To eliminate *Bias*

Thought Process

Analyze

Assess

Reconstruct

Morrissey B, J Med Educ Curric Dev, 2017

How to Build Clinical Reasoning Skills in Medical Students?

Box 1.3 Summary of Recommended Approaches to Teaching Clinical Reasoning (Guerrasio and Aagaard 2014; Rencic 2011; Posel et al. 2014; Chamberland et al. 2015; Balslev et al. 2015; Bowen 2006)

Let students

- Maximize learning by remembering many patient encounters.
- Recall similar cases as they increase experience.
- Build a framework for differential diagnosis using anatomy, pathology, and organ systems combined with semantic qualifiers: age, gender, ethnicity, and main complaint.
- Differentiate between likely and less likely but important diagnoses.
- Contrast diagnoses by listing necessary history questions and physical exam maneuvers in a tabular format and indicating what supports or does not support the respective diagnoses.
- Utilize epidemiology, evidence, and Bayesian reasoning.
- Practice deliberately; request and reflect on feedback; and practice mentally.
- Generate self-explanations during clinical problem solving.
- Talk in buzz groups at morning reports with oral and written patient data.
- Listen to clinical teachers reasoning out loud.
- Summarize clinical cases often using semantic qualifiers and create problem representations.

Olle Ten Cate, et al. Principles and practice of case-based clinical reasoning education: A method for preclinical students, 2018

3- Step Clinical Reasoning Teaching

1

Collecting Illness Scripts

- Foundational knowledge (Illness scripts)
- Learn how to create an Illness Script
- “Breadth”
- Short cases, Key features, Large quantity

2

Case-Based Learning

- Problem Representation
- Prioritize DDx
- “Breadth & Depth”
- Longer &complex cases, smaller quantity

3

Clinical Rotations

- Problem Representation
- Prioritize DDx
- Refine, recalibrate Illness Scripts
- Workplace-based

How to create Illness scripts?

Case scenario 1

เด็กชายอายุ 4 ปี มีหายใจเสียงวี้ด และผื่นลมพิษขึ้นทั่วตัวขณะกำลังได้รับยา Ceftriaxone ทางหลอดเลือดดำเพื่อรักษาโรคติดเชื้อทางเดินปัสสาวะ

ตรวจร่างกาย: BT 37.1 °C, PR 120/min, RR 32/min, BP 80/60 mmHg; O_2 sat 95% room air. Generalized urticarial rashes on face and trunk. Lungs: expiratory wheezing both lungs. Heart: normal S_1S_2, no murmur

Diagnosis?

เด็กชายอายุ 4 ปี มีหายใจเสียงวี้ด และผื่นลมพิษขึ้นทั่วตัวขณะกำลังได้รับยา Ceftriaxone ทางหลอดเลือดดำเพื่อรักษาโรคติดเชื้อทางเดินปัสสาวะ

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Illness Scripts

Diagnosis: Anaphylaxis

Epidemiology	
Temporal relation (Time course)	
Syndrome (Clinical Presentation)	
Pathophysiology	

Case scenario 2

เด็กหญิง อายุ 7ปี ไข้สูง 4วัน ปวดท้อง และอาเจียน 3ครั้ง/วัน admit เมื่อคืนเพื่อให้ intravenous fluid วันนี้ไข้ลดลง ปวดท้องมากขึ้น กระสับกระส่าย ถ่ายเป็นสีดำ 1ครั้ง

PE BT 36.8°C, PR 140/min, RR 28/min, BP 70/70 mmHg, capillary refill 4 sec, BW 30 kg, flush face, restless, generalized petechiae, right costal margin and tender

CBC Hct 46%, WBC 25,000/mm³ (N 36, L 56, Mono 8%) platelet 61,000/mm³

Illness Scripts

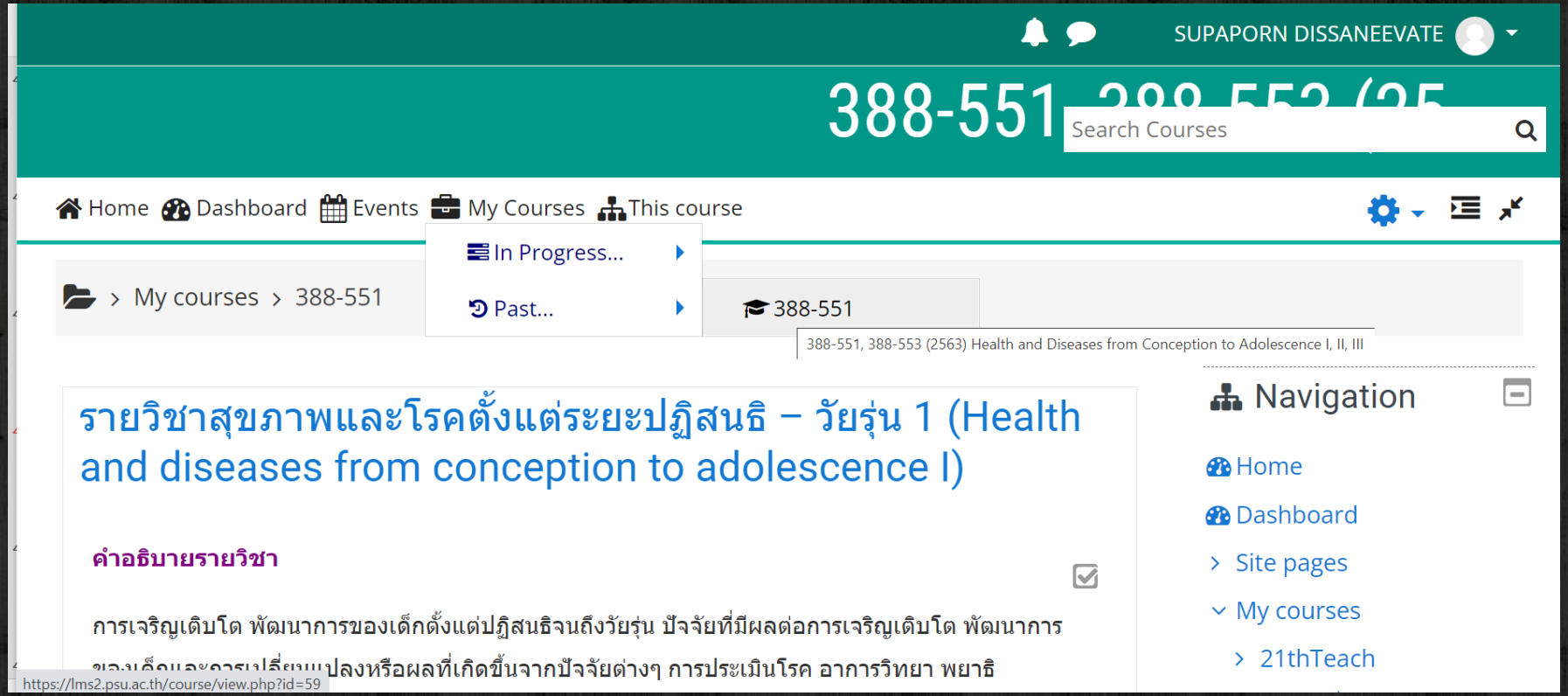
Diagnosis: DHF

Epidemiology	
Temporal relation (Time course)	
Syndrome (Clinical Presentation)	
Pathophysiology	

“

PSU- Creating Illness Scripts Exercise

P- CISE


SUPAPORN DISSANEEVATE
388-551
Search Courses
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Events
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In Progress...
Past...
My courses
388-551
388-551
388-551, 388-553 (2563) Health and Diseases from Conception to Adolescence I, II, III
รายวิชาสุขภาพและโรคตั้งแต่ระยะปฏิสนธิ – วัยรุ่น 1 (Health and diseases from conception to adolescence I)
คำอธิบายรายวิชา
การเจริญเติบโต พัฒนาการของเด็กตั้งแต่ปฏิสนธิจนถึงวัยรุ่น ปัจจัยที่มีผลต่อการเจริญเติบโต พัฒนาการ
Navigation
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https://lms2.psu.ac.th/course/view.php?id=59

Topic 27: PSU-Creating Illness Scripts Exercise (P-CISE)

- เอกสารประกอบการสอน Clinical reasoning
- VDO: Slide Clinical reasoning สำหรับ นศพ.
- Quiz 1
- Quiz 2
- Quiz 3
- Quiz 4

Question 1

Not complete

Marked out of 1.00

Flag question

Edit question

ทารกแรกเกิดเพศชายอายุครรภ์ 32 สัปดาห์ มีอาการหายใจเร็วตั้งแต่แรกเกิด ประวัติมารดาฝากครรภ์ปกติ คลอด normal labor APGAR score 7,8 ที่ 1 และ 5 นาทีตามลำดับ PE: BT 36.8oC, PR 160/min, RR 70/min; O2 sat 88% room air. Grunting, flaring alae nasi, subcostal retraction; Heart: normal S1S2, no murmur

โรคหรือสาเหตุของภาวะหายใจลำบากที่เป็นไปได้มากที่สุดของทารกรายนี้คือข้อใด

Select one:

- a. Hypothermia
- b. Pneumonia
- c. Respiratory distress syndrome
- d. Transient tachypnea of the newborn
- e. Meconium aspiration syndrome

Check

Question 2

Not complete

Not graded

Flag question

Edit question

จงเขียน Illness script ของโรคนี้เป็นภาษาอังกฤษ (สามารถดูเฉลยโดยใช้ mouse แตะที่คำตอบ)

Epidemiology	
Temporal relation (Time course)	
Syndrome (Clinical presentation)	
Pathophysiology	

Check

Finish attempt ...

Question 1

Not complete

Marked out of 1.00

Flag question

Edit question

ทารกแรกเกิดเพศชายอายุครรภ์ 32 สัปดาห์ มีอาการหายใจเร็วตั้งแต่แรกเกิด ประวัติมารดาฝากครรภ์ปกติ คลอด normal labor APGAR score 7,8 ที่ 1 และ 5 นาทีตามลำดับ PE: BT 36.8oC, PR 160/min, RR 70/min; O2 sat 88% room air. Grunting, flaring alae nasi, subcostal retraction; Heart: normal S1S2, no murmur

โรคหรือสาเหตุของภาวะหายใจลำบากที่เป็นไปได้มากที่สุดของทารกรายนี้คือข้อใด

Select one:

- a. Hypothermia
- b. Pneumonia
- c. Respiratory distress syndrome
- d. Transient tachypnea of the newborn
- e. Meconium aspiration syndrome

Check

ส่วนที่ 1 MCQ นักศึกษาเลือกตอบ แล้วตรวจคำตอบจะได้คำวินิจฉัยโรค
เพื่อไปสร้าง Illness script ต่อ

Question

Complete

Marked out of 1.00

Flag question

Edit question

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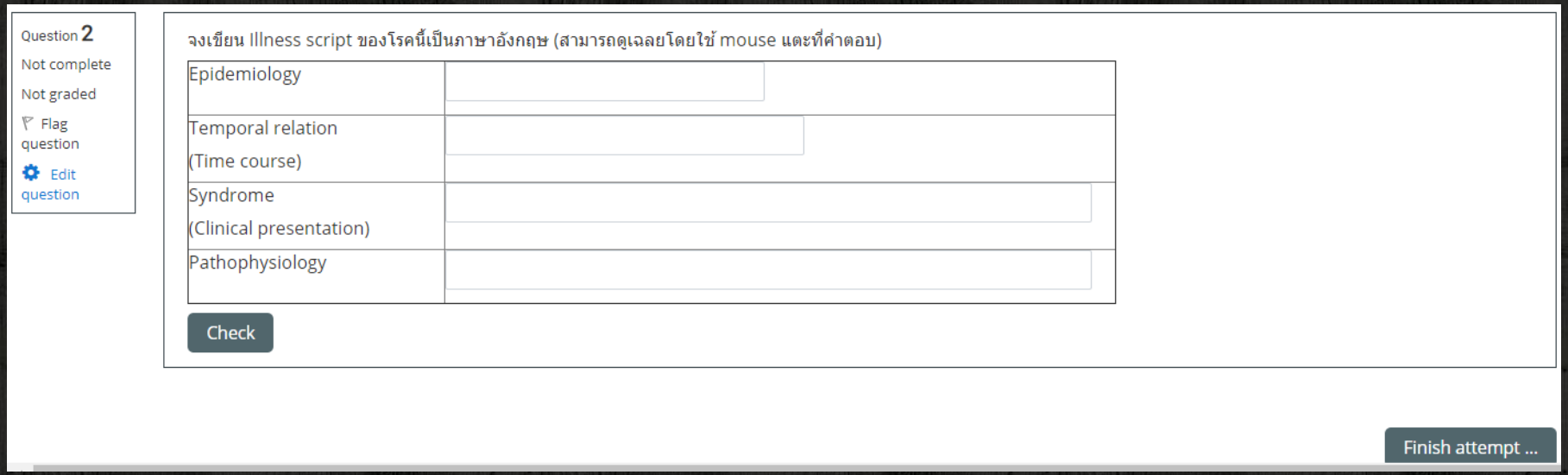
Select one:

- a. Pneumonia
- b. Transient tachypnea of the newborn
- c. Meconium aspiration syndrome
- d. Respiratory distress syndrome
- e. Hypothermia

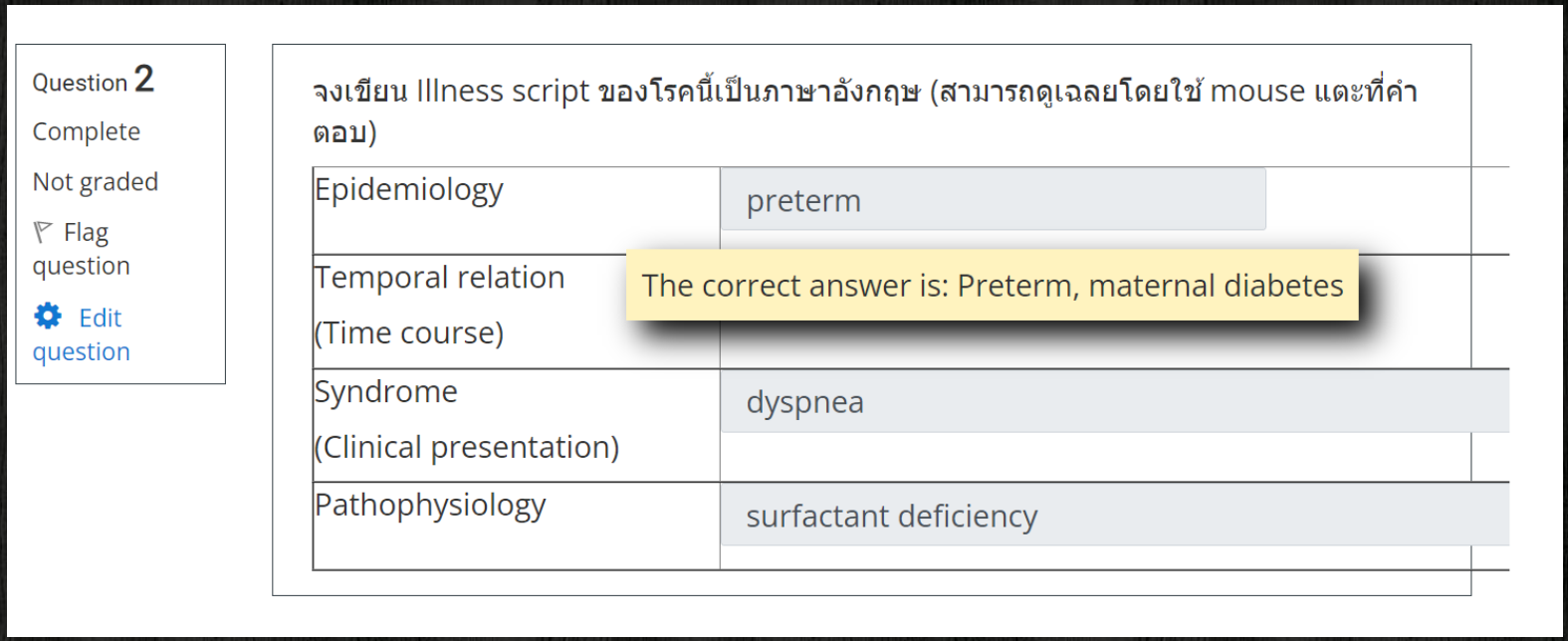
Your answer is incorrect.

The correct answer is: Respiratory distress syndrome

ส่วนที่ 1 MCQ นักศึกษาเลือกตอบ แล้วตรวจคำตอบจะได้คำวินิจฉัยโรค
เพื่อไปสร้าง Illness script ต่อ



ส่วนที่ 2 นักศึกษาเขียน Illness script ตามหัวข้อที่กำหนดให้ แล้วกด “Check” เพื่อตรวจคำตอบโดยใช้ mouse แตะที่คำตอบ



ส่วนที่ 2 นักศึกษาเขียน Illness script ตามหัวข้อที่กำหนดให้ แล้วกด “Check” เพื่อตรวจคำตอบโดยใช้ mouse แตะที่คำตอบ

Home Dashboard Events My Courses This course

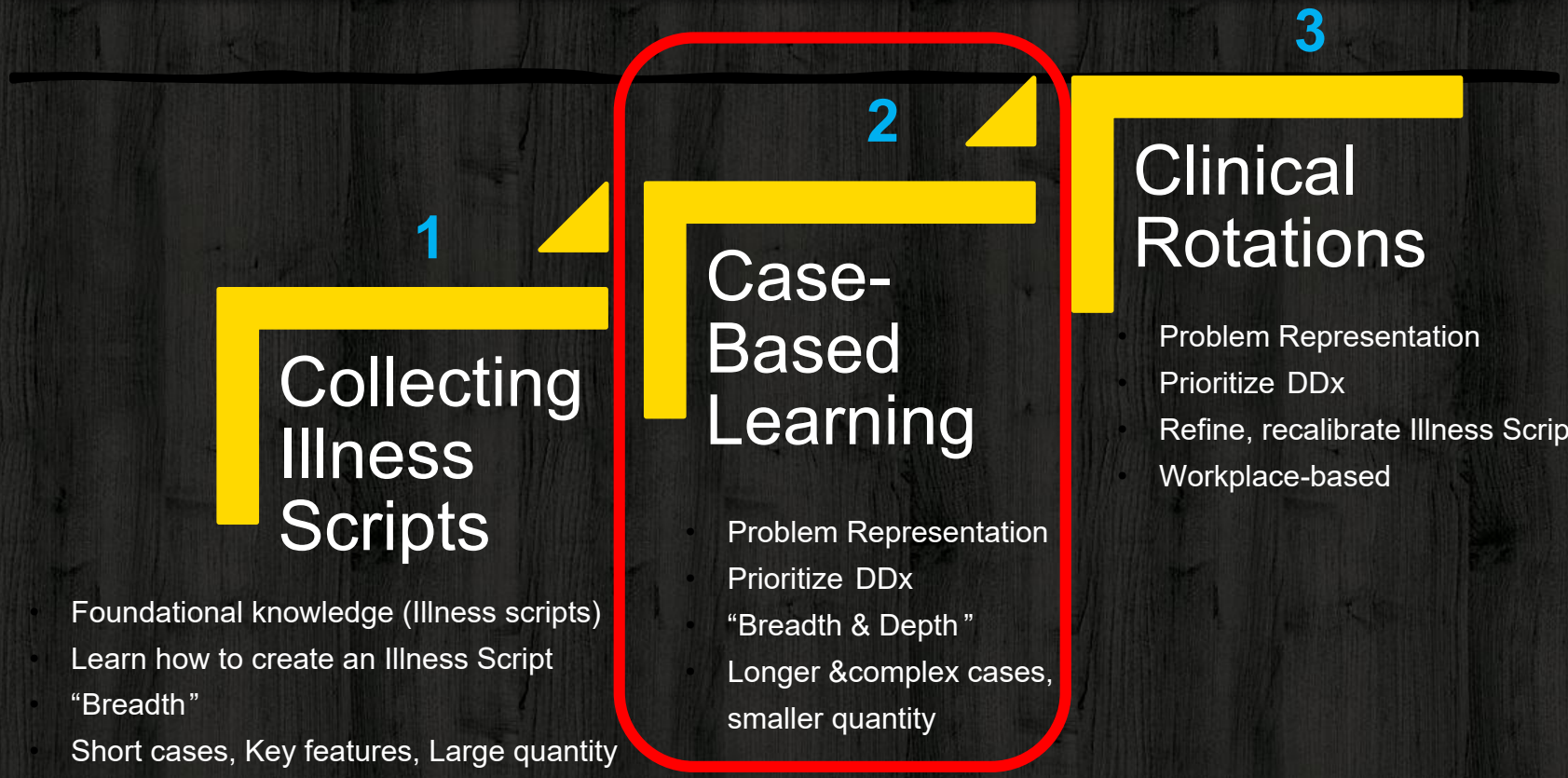
Announcements

Topic 1

PSU-Creating Illness Scripts Exercise (P-CISE)

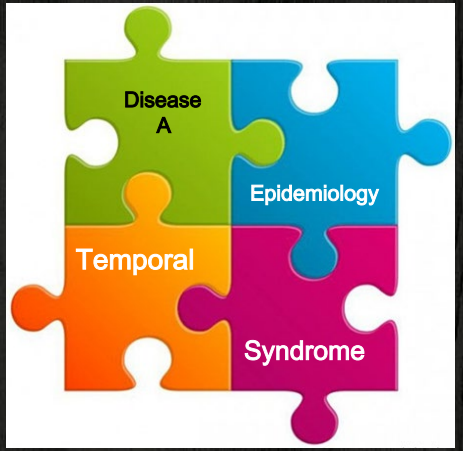
- Dashboard
- Site pages
- My courses
  - 21thTeach
  - หมวดเพิ่มพูนความรู้ฯ
  - Clinical reasoning
  - เตรียมความพร้อม (อ.ฐากร)
  - กิจกรรมเตรียมความพร้อม (อ.อารยา)
  - เตรียมความพร้อม (อ.โอสรี)
  - เตรียมความพร้อม (อ.กนกพรรณ)
  - **เตรียมความพร้อม (อ.สุภาภรณ์)**

3-Step Clinical Reasoning Teaching



Case- Based Learning: Zoom

- Case: Longer and More details (distractors for broaden DDx)
- Problem Representation: Case synthesis, Sematic Qualifier
- Prioritized DDx: 3-5 diseases
- Illness Scripts: Compare and Contrast
  - Epidemiology
  - Temporal
  - Syndrome
  - Pathophysiology



An 8-month-old previously healthy male infant presented to the emergency department in the evening with low-grade fever, rhinorrhea, and sneezing for 2 days. His caregiver reported that his breathing sounds noisy and he has been coughing since this morning. After being fed, he also coughed until he regurgitated the milk that had been fed. He still had good appetite and actively crying. However, his chest area that sinked in with each breath concerns the caregiver and leads to this hospital visit.

An 8-month-old previously healthy infant with URI symptoms and acute respiratory distress.

Problem Representation

“

Compare & contrast 3 DDx

Illness script	Differential DX #1	Differential DX #2	Differential DX #3
Epidemiology			
Temporal (Time course)			
Syndrome			
Pathophysiology			

Illness script	Differential # 1	Differential #2	Differential # 3
	Viral pneumonia	Bronchiolitis	Asthmatic attack
Epidemiology			
Temporal (time course)			
Symptoms (clinical presentation)			
Pathophysiology			

A 2-week-old female infant presents to the pediatric clinic with a chief complaint of vomiting for 1 day. She has been fine until 4 days ago when she was not acting normally. She has had decreased appetite for 3 days. Since last night, she has been vomiting every time she eats. The vomiting is projectile with a small amount of secretion or formula after feeding. Mom says the baby has had intermittent spitting since birth and has been told by her PCP that she has reflux. She has no diarrhea, no bloody stool, no fever, no congestion, and no sick contact. Mom notices she sleeps a lot today. She was born full term, NSVD, BW 3,200 g, GBS-negative, passed meconium on the first day PE: Temp 36 °C, PR 180, RR 55, BP 60/40, SpO2 95% GA: toxic looking, pale, good skin turgor HEET: dry lips, moist membranes, flat fontanelle, normocephalic, atraumatic Respiratory: slightly distress, mild retractions, no rales, no wheezing Cardiovascular: normal S1S2, no murmur, CR 4 sec, cool feet Abdomen: diminished bowel sounds, no distension, no hepatosplenomegaly, no mass, no tenderness Neuro: lethargic, grossly intact CN, normal DTR, no clonus, no stiff neck, negative kerning & brudzinski.

A 2- week- old female infant presented with non- bilious vomiting

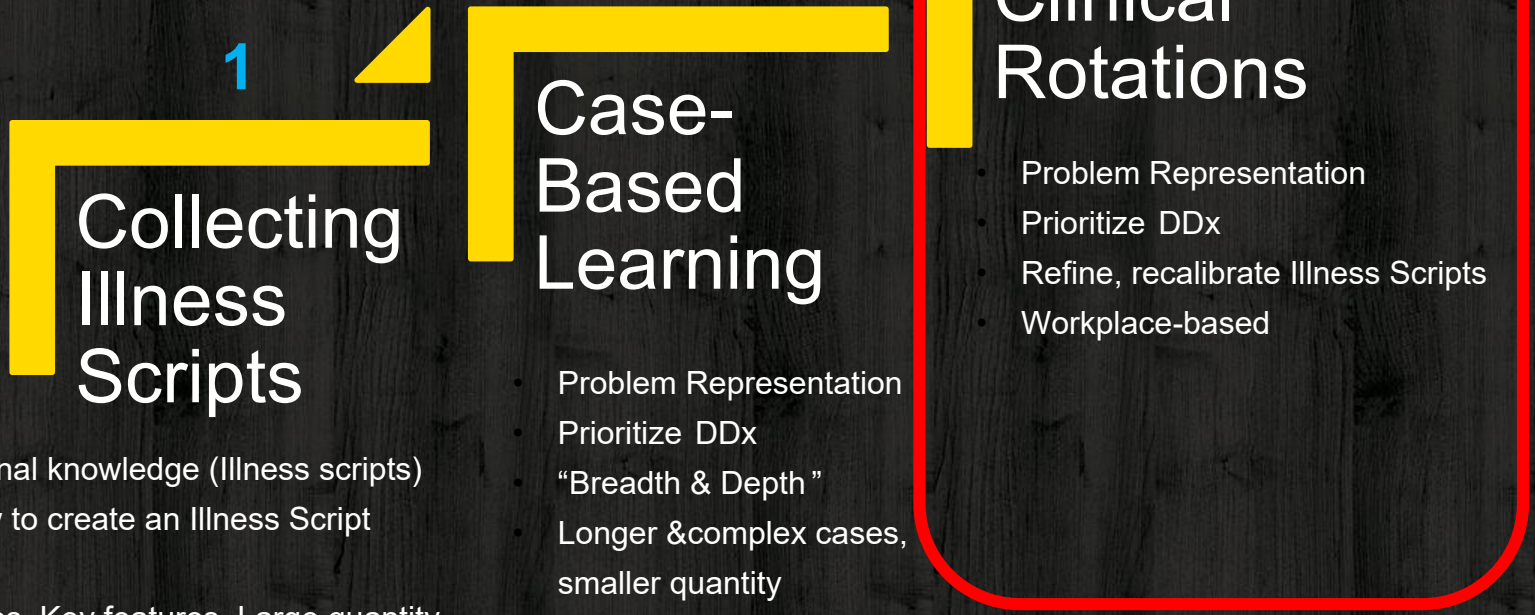
Compare & Contrast Scripts

Script No.1	Script for No.2
	
Diagnosis 1:	**Diagnosis 2:**

Compare & Contrast Scripts

Younger, higher risk Toxic appearing Gradual onset Respiratory distress Fever or hypothermia Acidosis	
	
Sepsis, Inborn error	Pyloric stenosis

3-Step Clinical Reasoning Teaching

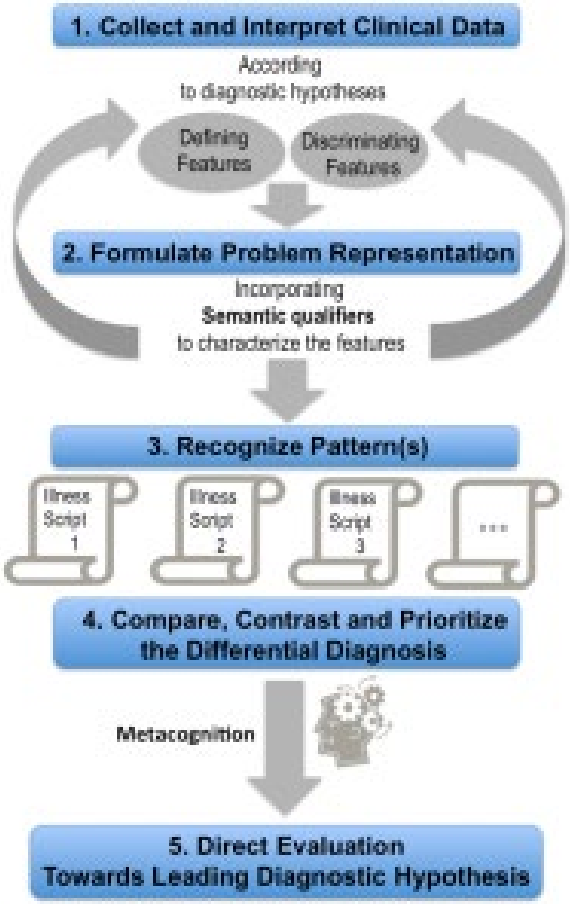


The Teaching Rounds….

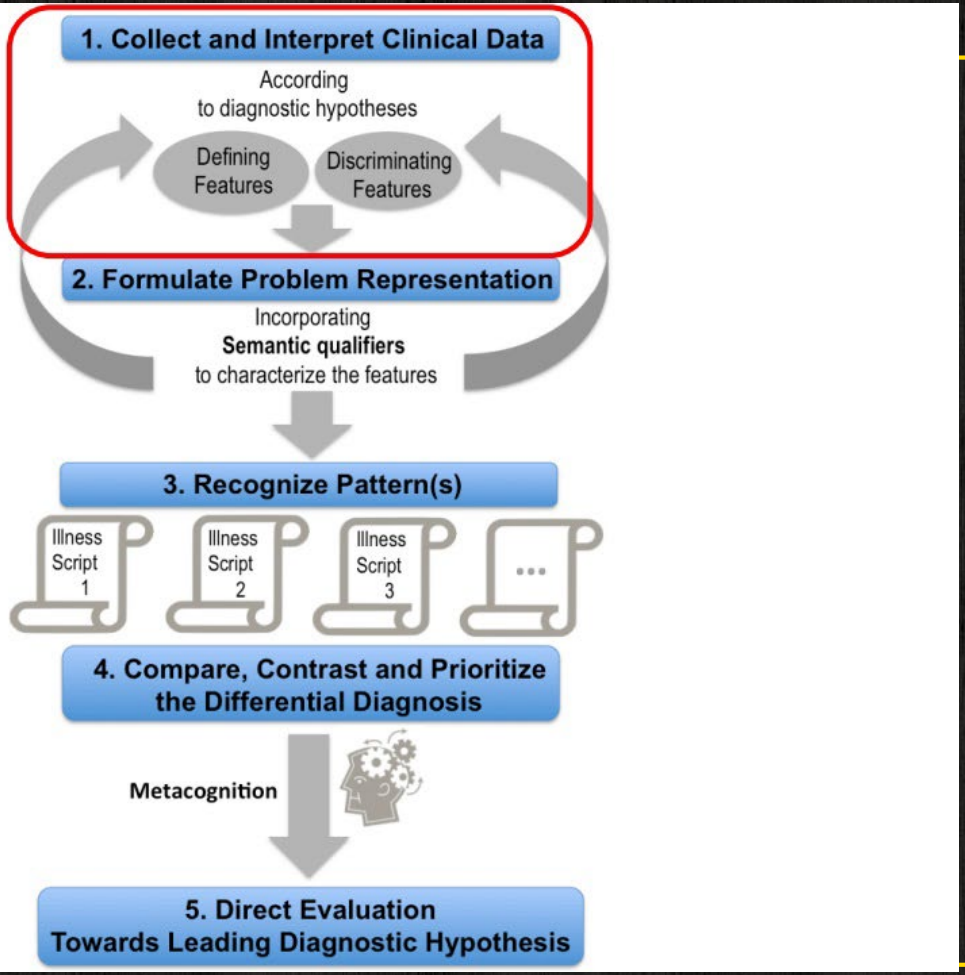
The Diagnostic Process

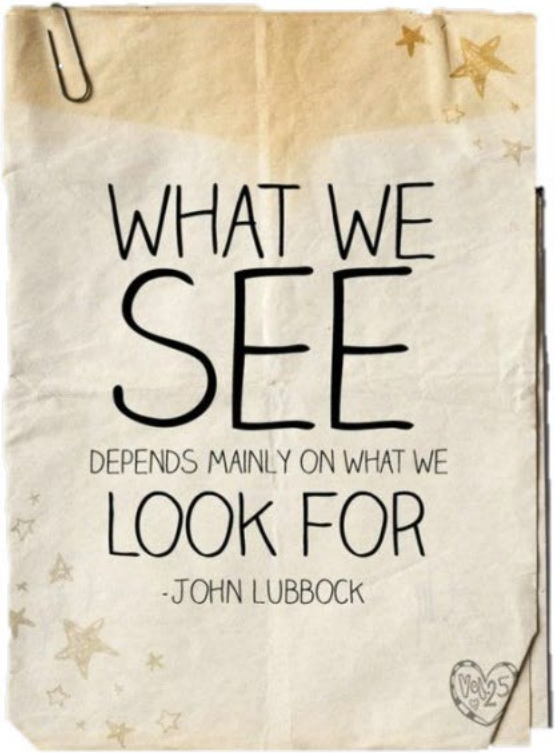
How do you judge the presentation by this leaner?

Conceptual framework for Clinical reasoning process



Thammasitboon, S., Rencic, J.J., Trowbridge, R.L., Olson, A.P., Sur, M., Dhaliwal, G. (2018). The Assessment of Reasoning Tool (ART): Structuring the conversation between teachers and learners. Diagnosis, 5, 197-203


1. Collect and Interpret Clinical Data
According
to diagnostic hypotheses
Defining Features
Discriminating Features
2. Formulate Problem Representation
Incorporating
Semantic qualifiers
to characterize the features
3. Recognize Pattern(s)
Illness Script 1
Illness Script 2
Illness Script 3
...
4. Compare, Contrast and Prioritize the Differential Diagnosis
Metacognition
5. Direct Evaluation
Towards Leading Diagnostic Hypothesis



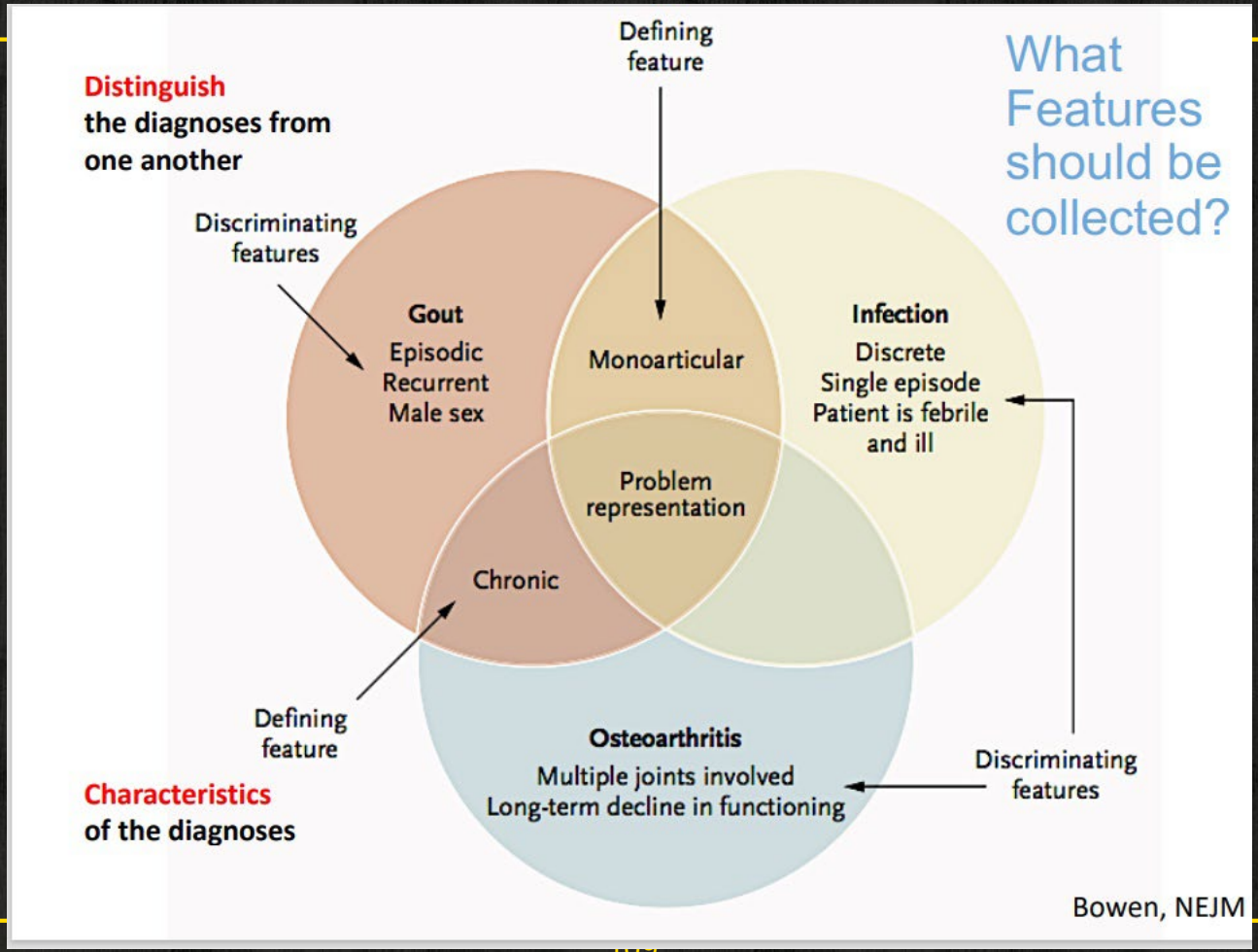
Hypothesis-Directed Data Collection

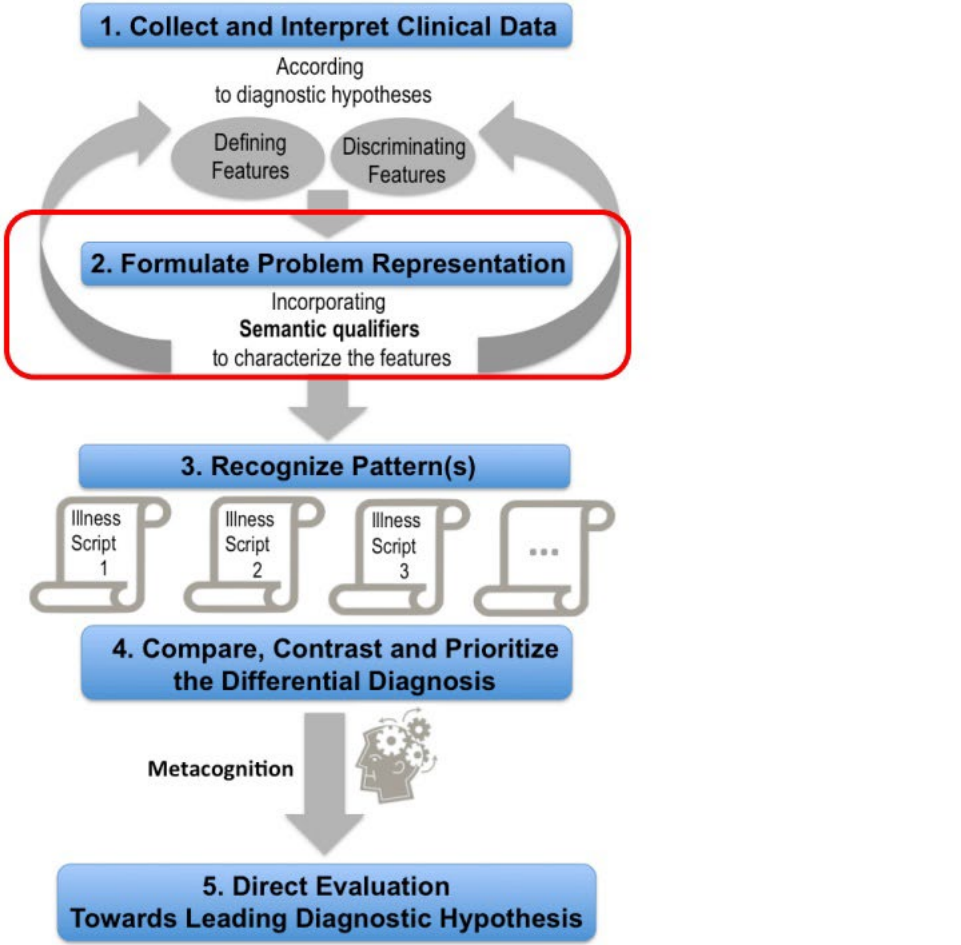
Co-Selection”

Diagnosis A **Data**

Diagnosis B **Data**

Diagnosis C **Data**


Distinguish
the diagnoses from
one another
Defining
feature
What
Features
should be
collected?
Discriminating
features
Gout
Episodic
Recurrent
Male sex
Monoarticular
Infection
Discrete
Single episode
Patient is febrile
and ill
Problem
representation
Chronic
Defining
feature
Osteoarthritis
Multiple joints involved
Long-term decline in functioning
Discriminating
features
Characteristics
of the diagnoses
Bowen, NEJM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...
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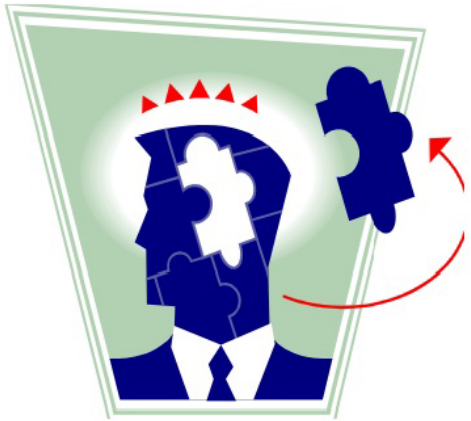
5. Direct Evaluation
Towards Leading Diagnostic Hypothesis

Problem representation

"Here's an **older** man with an **acute**, **recurrent** attack of **severe** pain in a **single**, **large** joint, a **mono**-arthritis.

This could be gout or septic arthritis."



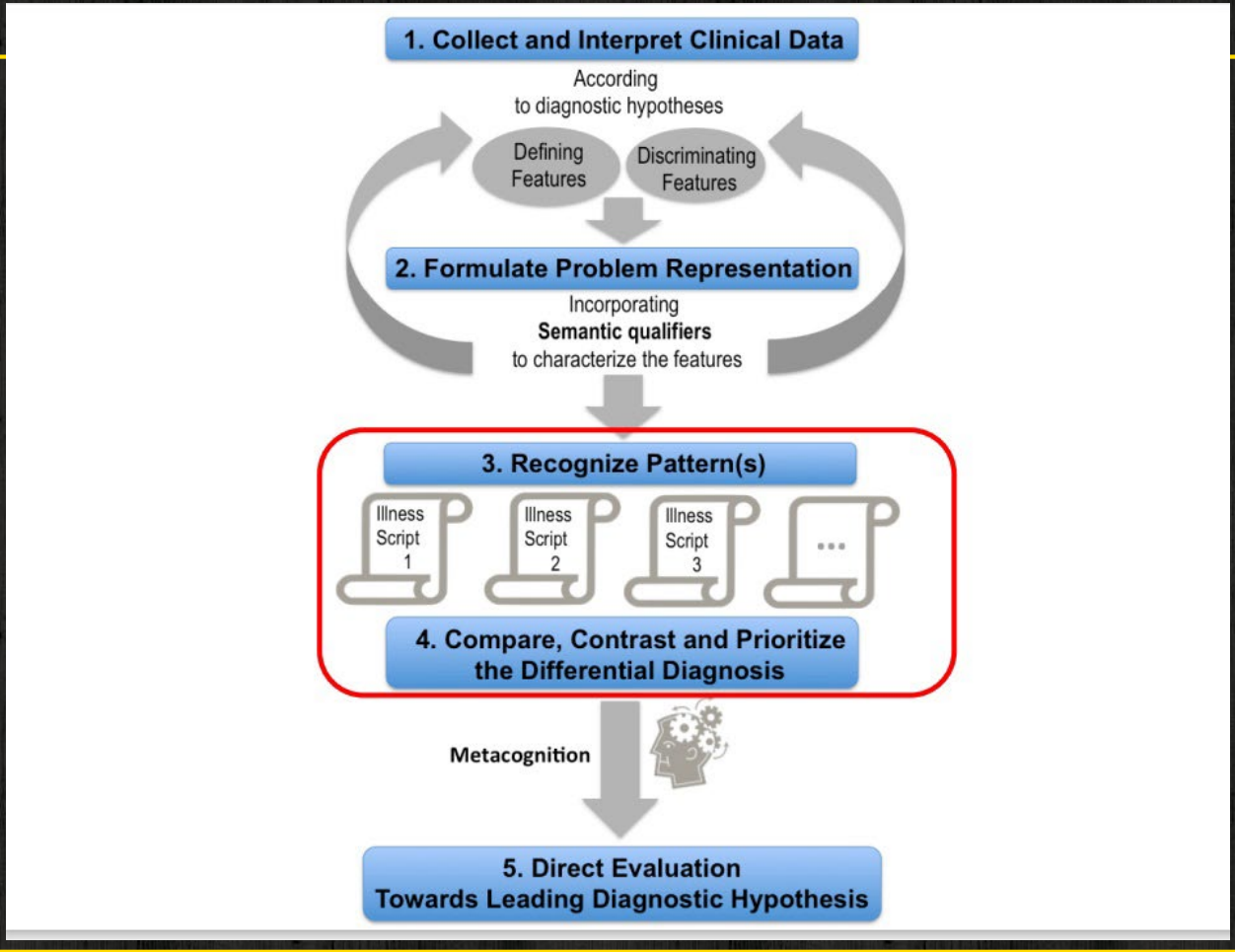
Problem Representation

Activate

Illness scripts

Prioritizes differential diagnosis

→ patient's problem representation VS previous illness scripts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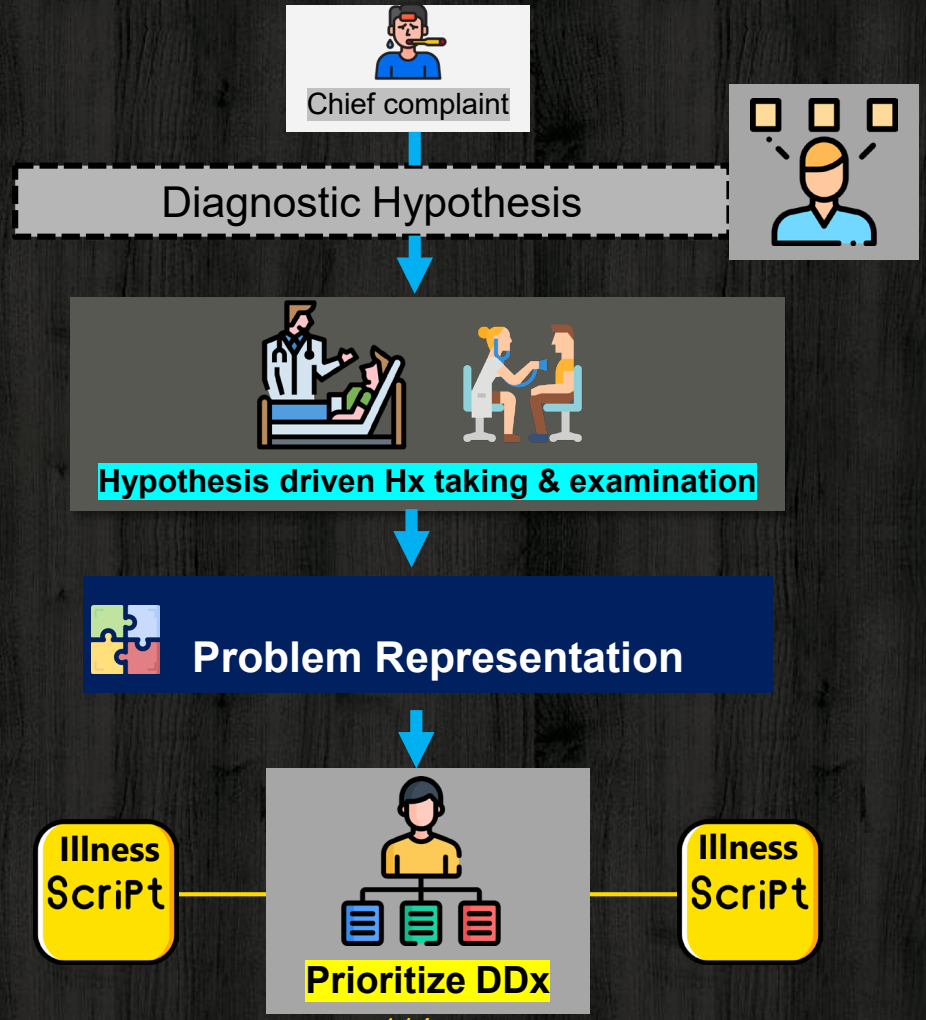
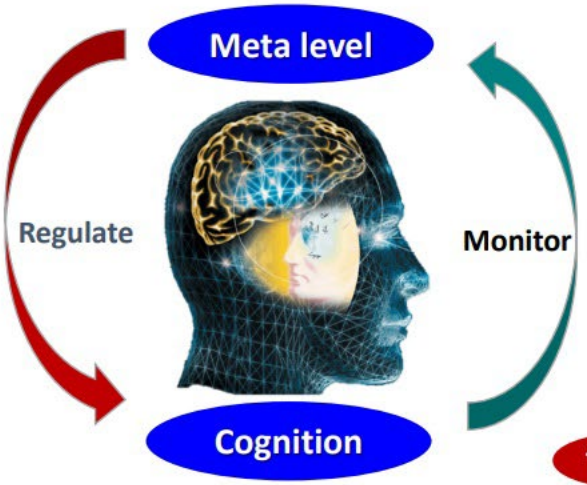
Clinical Reasoning Practice

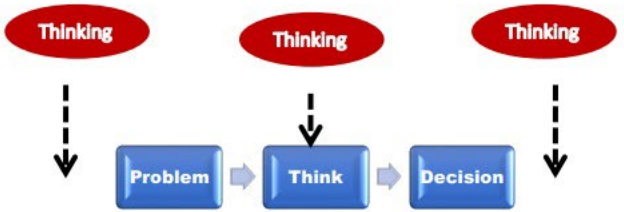


Sort Out Illness Scripts

A man with knee pain

Metacognition





"Thinking About one's own and others' Thinking"

Strategies for teaching clinical reasoning and critical thinking skills

1

Clinical teachers:

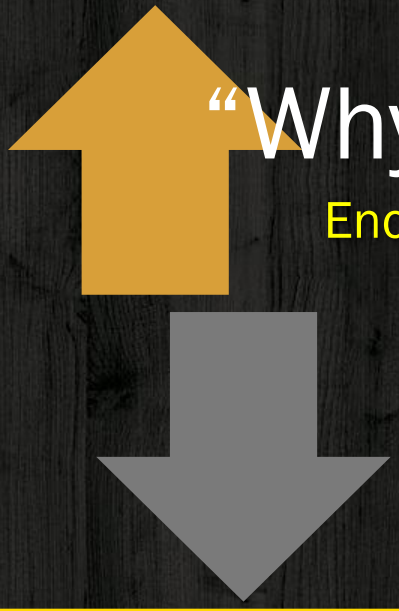
- Extract clinical reasoning from learners

Parsell & Bligh 2001; Ramani 2003,

Clinical teachers:

1

- Posting questions to learners



"Why or How"

Encourage learner to explain the reason

"What"

Parsell & Bligh 2001; Ramani 2003, *Richards JB, et al Chest 2020, 158(4):1617-28*

2

Model of Clinical Teaching:

- One-minute preceptor model

Richards JB, et al Chest 2020, 158(4):1617-28

One-Minute Preceptor

Microskills of Clinical Teaching	Example of Learner Performance	Example of Attending Action
Get a commitment	Early in the discussion with the attending, the learner should commit to a diagnosis, workup, or therapeutic plan. The commitment can even be a hunch or a guess about they think is going or what should be done next for the patient	The attending can ask the learner: "What do you think is going on?" "What diagnostic studies do you think are indicated?" "What would you like to accomplish with this patient?"
Probe for supporting evidence	After committing to a diagnosis or a plan of action, the learner should reflect on how they arrived at that decision. The goal of this step is to help both the learner and attending identify what the learner knows and does not know about the clinical topic, diagnostic, and/or management plan	The attending can ask the learner: "Where are the pertinent positives that led to your diagnosis?" "Why did you choose that diagnostic study?" "What else did you consider in evaluating this patient?"
Teach general rules	From what the attending has learned from "getting a commitment" and having the learner "prove for supportive evidence," gaps in knowledge or understanding can be addressed at this stage	The attending should teach to specifically identified deficits in the learner's knowledge, understanding, or reasoning, ideally providing "general rules" rather than anecdotes or idiosyncratic preferences
Reinforce was done right	The learner should be asked about what went well during the encounter and/or their evaluation of the patient. Specific behaviors that were done well should be identified and reinforced at this stage of the one-minute preceptor	The attending should comment on specific behaviors that the learner should be able to repeat consciously and intentionally. In addition, informing the learner about the positive impact of their action(s) on others is appropriate at this stage
Correct mistakes	The learner should be asked about what could have gone better during the encounter and/or their evaluation of the patient	Constructive feedback, focused on specific behaviors, should be provided to learners, particularly if they are unable to independently identify errors or issues with their reasoning

Richards JB, et al Chest 2020, 158(4):1617-28

3

Model of Clinical Teaching:

- The SNAPPS model

(The modification of one-minute preceptor)

Richards JB, et al Chest 2020, 158(4):1617-28

SNAPPS Components With Examples of Learner Performance and Attending Responses

SNAPPS Component	Example of Learner Performance	Example of Attending Response or Action
Summarize	The learner summarizes the case of a patient admitted to the ICU with hypotension and acute respiratory failure. He incorporates relevant information from the history, physical examination, and available diagnostic studies, and concludes with an ordered differential diagnosis for the patient's primary clinical issues	The attending comments on the content, order, and organization of the learner's summary and differential diagnosis. She provides specific, focused guidance about what the learner did well in synthesizing and organizing the summary and differential, as well as what could be improved for future presentations
Narrow	The learner narrows his differential diagnosis for both hypotension and acute respiratory failure to the 2 or 3 most likely processes that could be causing each issue	The attending comments on the learner's selection of most likely diagnoses, providing guidance and modification as indicated
Analyze	The learner identifies specific pertinent positives and negatives for hypotension and acute respiratory failure, to explicitly justify his narrowed differential diagnosis as well as to demonstrate his clinical reasoning in selecting those diagnoses	Using "why" and "how" questions, the attending prompts the learner to expand upon his reasoning in identifying and selecting specific pertinent positives and negatives. At the end of this component of SNAPPS, the primary, unifying diagnosis for the patient's presentation is submassive pulmonary embolism
Probe	The learner identifies areas of uncertainty and is expected to state what he does not know about the clinical and/or pathophysiological aspects of the patient's presentation and/or the entities in the differential diagnosis. In this instance, the learner notes that he does not exactly understand how pulmonary embolism causes hypoxemia	Ensuring that the learner does not offer superficial or ego-protective examples of what he does not understand is critical for this component of SNAPPS. Helping the learner to honestly reflect on his understanding, and to identify relevant and meaningful areas of uncertainty, is the key role of the attending during the "probe" portion of SNAPPS
Plan	The learner offers his plan for diagnostic evaluations and therapeutic interventions to evaluate and address the most likely processes delineated in the differential diagnosis	In addition to encouraging the learner to explain his reasoning with regard to the diagnostic evaluations and therapeutic interventions he suggests, the attending offers guidance, modifications, and revisions to the learner's plan
Self-study	The learner identifies a specific question for self-study for him to independently address after the clinical encounter. In this case, the learner's question is "By what pathophysiological mechanisms does pulmonary embolism cause hypoxemia?"	The attending may offer suggestions about or modifications to the learner's question. In addition, the attending and learner need to identify a specific date and time when the learner will present what he found in researching his self-study question

Richards JB, et al Chest 2020, 158(4):1617-28

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Richards JB, et al Chest 2020, 158(4):1617-28

4

“Reflection and reflective writing”

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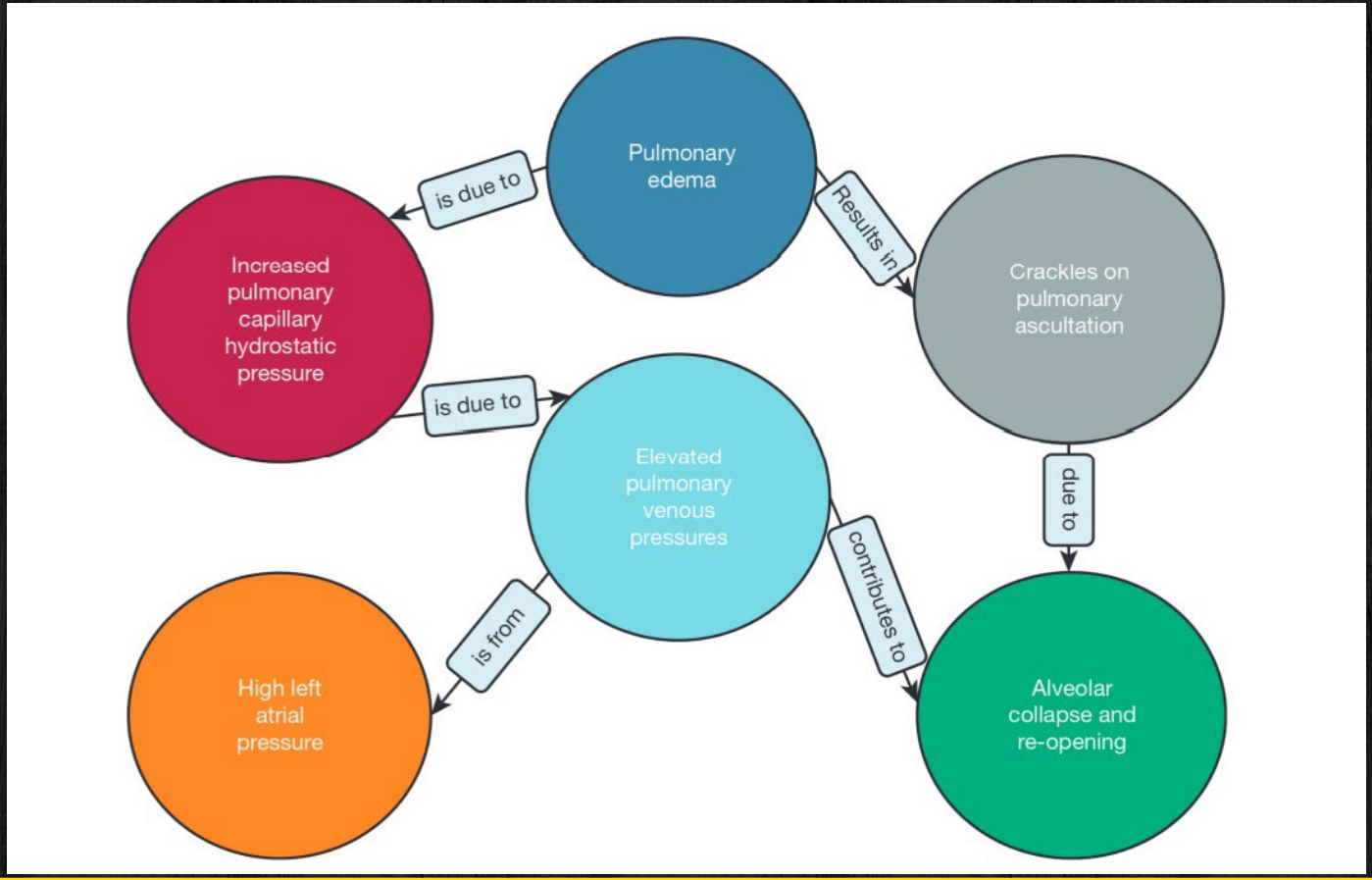
5

“Concept, Mechanism Maps”

Richards JB, et al Chest 2020, 158(4):1617-28



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6

Clinical teachers:

“Role-Modeling”

- Demonstrate the clinical reasoning process

“To reason aloud”

Irby & Bowen 2004; Bowen 2006; Reilly 2007

Clinical Reasoning Process

- Organizing knowledge & interpreting clinical information
- Data synthesis & problem representation development
- Illness script scanning & differential diagnosis formation
- **Awareness of cognitive biases**

“

*มาสร้าง **Illness Scripts** กัน*

“

สร้าง **scenario** และ **illness scripts**

กลุ่มละ 1 **case**


Reflection &
Sharing

กรุณาประเมินการอบรม


Thank You

Assessment

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:

www.improvediagnosis.org | info@improvediagnosis.org | @ImproveDx

https://www.improvediagnosis.org/art/

An Assessment for Learning Tool

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 testing and treatments toward unlikely/unimportant diagnoses • Did not order tests or treatments 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 one's 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** ☐

https://www.improvediagnosis.org/art/

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SOCIETY to IMPROVE DIAGNOSIS in MEDICINE

- Provides standardized structure for assessment of diagnostic reasoning
- Facilitates formative feedback
- Validity of the instrument determined using Messick's validity framework

https://www.improvediagnosis.org/art/

DECONSTRUCTED ART (ART-D)

Rate the learner's case presentation using 5-point Likert scale: 1= Poor, 2 =Fair, 3 = Average, 4 =Good, 5 = Excellent
The learner's ability to follow a clear line of inquiry towards specific diagnoses when gathering information from the patient.
The learner's ability to direct questions in a manner that increased/decreased the likelihood of specific diagnoses when gathering information from the patient.
The learner's ability to conduct the physical exam in a manner that increased/decreased the likelihood of specific diagnoses.
The learner's ability to give a clear synopsis of the clinical problem.
The learner's ability to emphasize important positive and negative findings in the assessment.
The learner's ability to employ descriptive medical terminology (semantic qualifiers) in the assessment.
The learner's ability to clearly rank the differential diagnoses.
The learner's ability to include likely and can't miss diagnoses.
The learner's ability to include key diagnoses in the differential diagnosis.
The learner's ability to direct evaluation towards most likely and can't miss diagnoses.
The learner's ability to direct evaluation in an efficient order.
The learner's ability to defer tests directed towards less likely or less important diagnoses.
The learner's ability to recognize one or more potential cognitive tendencies that might have influenced decision.
The learner's ability to recognize one or more potential emotional/situational factors that may have influenced decision.
The learner's ability to describe the ways in which cognitive/emotional/situational factors may have influenced decision.

“

Clinical Reasoning Difficulties

Practical Coaching Strategies

To address Clinical Reasoning Difficulties

Your 3rd year Medical student in clinic sees a 69-year-old man with difficulty initiating urinary stream for past three weeks. He reports the following:

• “Middle aged man here who is having trouble urinating. The urine just dribbles out and he has a hard time getting the urine stream started. It happens up to three times per day. No blood. He denies abdominal pain, but does have a cough. I asked him about a stone, but he doesn’t think he has one. His heart, lung, and abdominal exam are normal. There’s no murmur. The triage nurse asked if we needed labs, so I got a CBC that shows a little anemia; the creatinine is normal, so it’s not a kidney problem. It still could be a kidney stone but I’m also worried about bladder cancer.”

• Correct diagnosis is benign prostatic hypertrophy

Group 1: Symptoms of Faulty Clinical Reasoning

PROBLEMS WITH PRESENTATION OF DATA

UNFILTERED DATA DUMP

DISORGANIZED

MISSING IMPORTANT INFORMATION

Underlying Difficulties?

Insufficient knowledge

Organization of knowledge

Hypothesis-Directed Data Gathering (Co-selection)

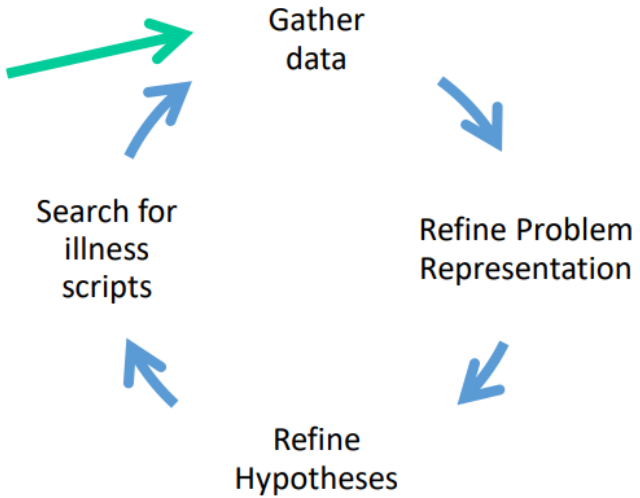
Attention to defining, discriminating features

Coaching to Promote Co-selection

Chief Complaint

↓

Prime:
- Initial DDx?
- What information?



COACHING TO PROMOTE CO-SELECTION CONTINUED

Example: Priming before a patient encounter

You are about to see James, a previously healthy, ex-full-term 9-month old with a chief complaint of cough for the past week.

1. Based on the limited information available before you see the patient, outline an initial DDx for cough.

2. List the top 5 details that you will want to elicit in the history of present illness in order to narrow the differential and make a diagnosis.

3. List 3-5 physical findings that will be essential in narrowing the differential and making a diagnosis.

4. List 3-5 findings that will be essential in determining the severity/urgency of illness.

Group 2: Symptoms of Faulty Clinical Reasoning

Inaccurate assessment

Missing assessment

Underlying Difficulties?

- Inadequate problem representation

Articulated Problem Representation

This is a

- school-aged child with
- acute onset of
- exudative pharyngitis,
- high fever,
- tender cervical adenopathy, and a
- diffuse, sandpaper-like rash

who also has headache, abdominal pain and no symptoms of viral upper respiratory tract infection.

Articulated Problem Representation

- Force leaner to write a 1-2 sentence “summary”
- Summary vs. Synthesis
- Capturing the Big Picture
- Competition: the most number of SQs

Problems with Formulation of Differential Diagnosis (DDx)

- **Disembodied DDx:**
  Student presents a generic differential for the initial complaint rather than a differential specific to the patient.

- **Silo DDx:**
  Student presents a separate DDx for each symptom or key finding, rather than a differential for the constellation of findings taken together.

- **Frozen DDx:**
  Student continues to include items on the DDx that have been ruled out by new information – or continues to present a multi-item differential after a final diagnosis has been confirmed.

- **Unprioritized/inappropriately prioritized DDx:**
  Student assigns inappropriate weight/probability to items on the DDx.

- **Zebra DDx:**
  DDx includes one or more rare, esoteric, highly unlikely diagnoses.

Diagnose the learner

- Disembodied DDx
- Silo DDx
- Frozen DDx
- Unprioritized DDx
- Zebras, unicorns, snakes in high heels

Underlying Difficulties?

Insufficient knowledge

Incomplete Illness scripts

Unlinked Illness scripts

Failure to seek a new illness script

Inadequate problem representation

Clinical Reasoning Process

- Organizing knowledge & interpreting clinical information
- Data synthesis & problem representation development
- Illness script scanning & differential diagnosis formation
- **Awareness of cognitive biases**

Cognitive Biases

- Predictable patterns of deviation in judgment that occur in particular situations and lead to cognitive errors:
  - perceptual distortion
  - illogical interpretation
  - inaccurate judgment

Cognitive Biases

Croskery P, Acd Emerg Med 2002

- Aggregate Bias
- Anchoring
- Ascertainment Bias
- Availability
- Base Rate Neglect
- Commission Bias
- Confirmation Bias
- Diagnostic Momentum
- Fundamental attribution error
- Gender Bias
- Hindsight Bias
- Multiple alternatives Bias
- Omission Bias
- Older Effects
- Outcomes Bias
- Overconfidence Bias
- Playing the Odds
- Posterior Probability Error
- Premature Closure
- Psych out Error
- Representativeness Restraint
- Search Satisfying
- Triage Cues
- Visceral Bias
- >100

Common Biases Encountered in Clinical Medicine and Their Associated De -biasing

Cognitive Bias	Description/Definition	Clinical Examples	Suggested De-biasing Strategies
Overconfidence bias	Tendency to be confident in one's diagnosis/hypothesis	A patient presents with headache, neck stiffness, and fever. The physician begins treatment for meningitis and decides not to perform a lumbar puncture because the diagnosis is "classic"	Explicitly acknowledge uncertainty
Anchoring bias	Anchoring on a certain aspect of case early in the workup	A physician diagnoses a patient with pneumonia and continues to treat the patient for pneumonia despite accumulating evidence that the patient has acute pulmonary edema from congestive heart failure	Consider alternative diagnoses; explicitly acknowledge uncertainty
Availability bias	Judging a diagnosis or hypothesis more likely if it quickly and easily comes to mind	A physician admitted 3 patients with acute pancreatitis last week. Today, a patient is being admitted with abdominal pain, nausea, and vomiting, and the physician immediately begins to treat the patient for acute pancreatitis while results of diagnostic studies are pending	Taking accountability for diagnoses

Richards JB, et al Chest 2020, 158(4):1617-28

Cognitive Bias	Description/Definition	Clinical Examples	Suggested De-biasing Strategies
Framing effect	Organizing a case in a particular way to influence the leading diagnosis	A physician calls a surgery consult, stating "I have a homeless patient here who comes in all the time. This time, he says he has abdominal pain and tenderness. He might be a little tender on exam, but it's not impressive. If you could come see him and confirm it's OK to discharge him, that would be great." The surgeon sees the patient quickly and does not perform her usual thorough evaluation, because the consult was framed in a manner that was dismissive of the patient's symptoms	Consider alternative diagnoses
Premature closure	Finalizing a diagnosis before one has all the data; closing one's mind to other possible diagnoses	A patient presents with wheezing and shortness of breath, and the physician diagnoses and starts treating the patient for an acute COPD exacerbation. When the patient subsequently develops a fever, the physician does not pursue further workup because the physician has settled on the diagnosis of COPD	Consider alternative diagnoses; seek feedback on diagnoses

Richards JB, et al Chest 2020, 158(4):1617-28

Cognitive Bias	Description/Definition	Clinical Examples	Suggested De-biasing Strategies
Diagnostic momentum	Failure to revisit diagnostic labels once they are attached to a patient	A patient is evaluated in clinic for shortness of breath. She is diagnosed with pneumonia and sent to the ED. In the ED, the patient is treated for pneumonia, and no further diagnostic evaluations are pursued. The patient is admitted to the hospital, and treatment for pneumonia is continued. After 3 d of treatment without improvement, a chest CT angiogram is ordered, and the patient is found to have a large pulmonary embolism	Consider alternative diagnoses
Confirmation bias	Selectively searching for evidence to confirm a diagnosis rather than refute it	A patient presents with chest pain, and the physician diagnoses him with GERD. The patient subsequently undergoes an ECG, demonstrating inferior ST- physician discounts as artifact. The patient subsequently develops nausea and abdominal discomfort, which the physician interprets as confirmation of the diagnosis of GERD	Acknowledging uncertainty

Richards JB, et al Chest 2020, 158(4):1617-28

Metacognition-Cognitive Pause

Did I put enough effort toward this problem?

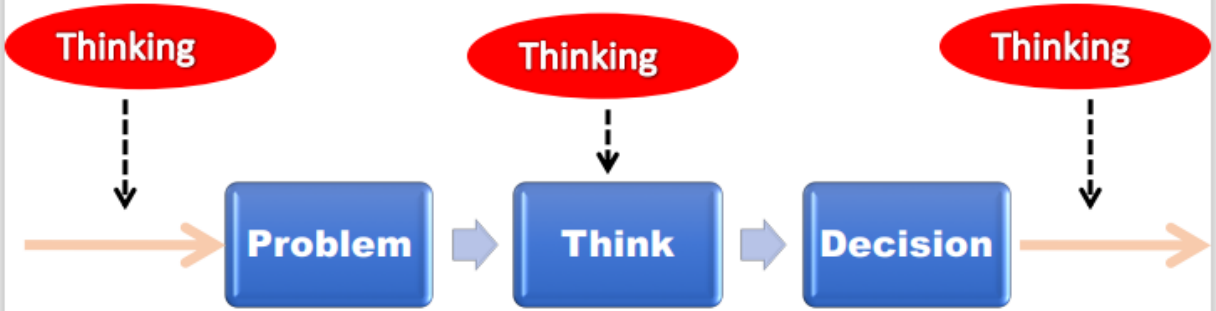
Did I omit anything serious/life threatening?

Am I about to repeat my past mistakes?

Does it make clinical/logical sense?

Let's think outside the box!

Metacognitive approach



- Planning before thinking episode
- Regulating thought during episode
- Reflecting afterwards to revise the decision, and plan future practices