

VIRTUAL PATIENT SIMULATION: A METHOD TO VALIDATE A THEORY OF MEDICAL DIAGNOSIS

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VA Advanced Patient Safety Fellowship

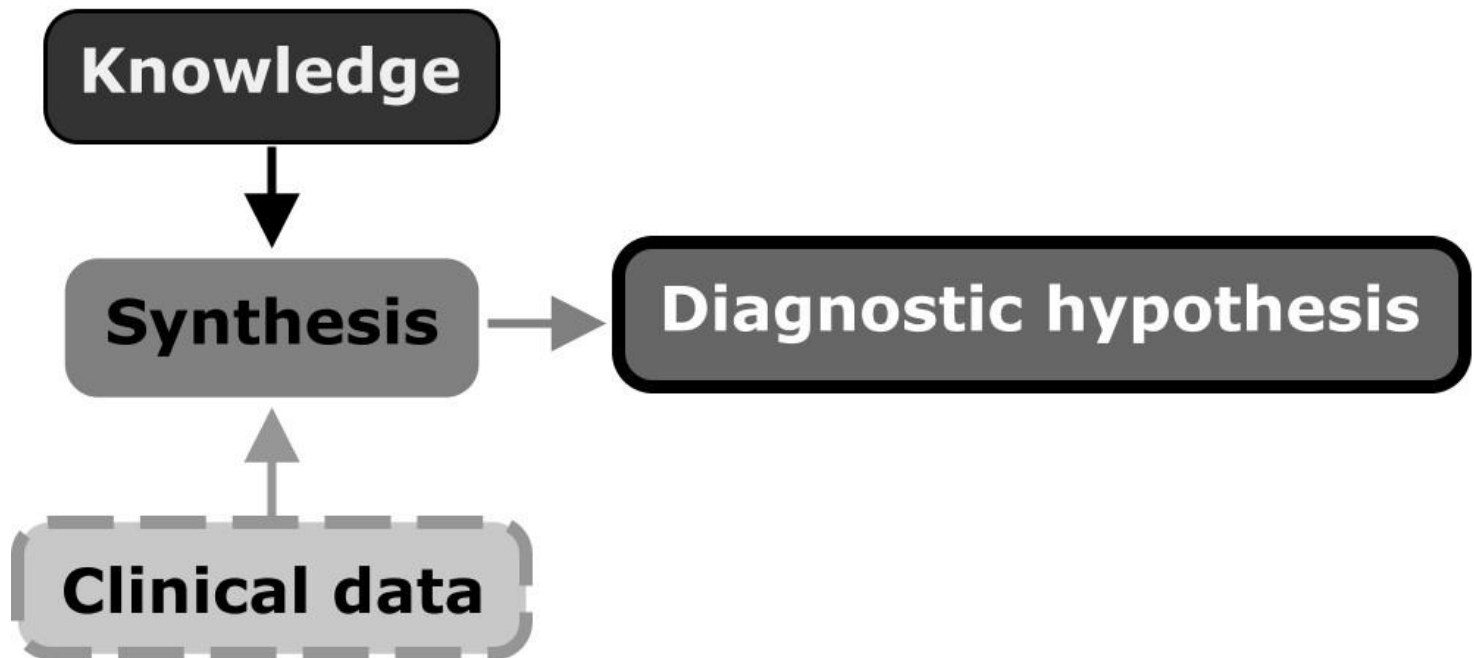
VA National Center for Patient Safety – Ann Arbor, MI

Outline

- Diagnosis
 - Development of a new model of diagnosis
 - Example/explanation of model
- Validating the model of diagnosis
 - Use of Decision Simulation software
 - Example of “classic” decision simulation scenario
 - Diagnosis-model simulation
 - Use of rules
 - Enhance fidelity of simulation
 - Measure situation awareness
- Wrap up
 - Questions/comments

In the beginning...

- Recognized deficiency in description of diagnosis
 - General model of diagnosis

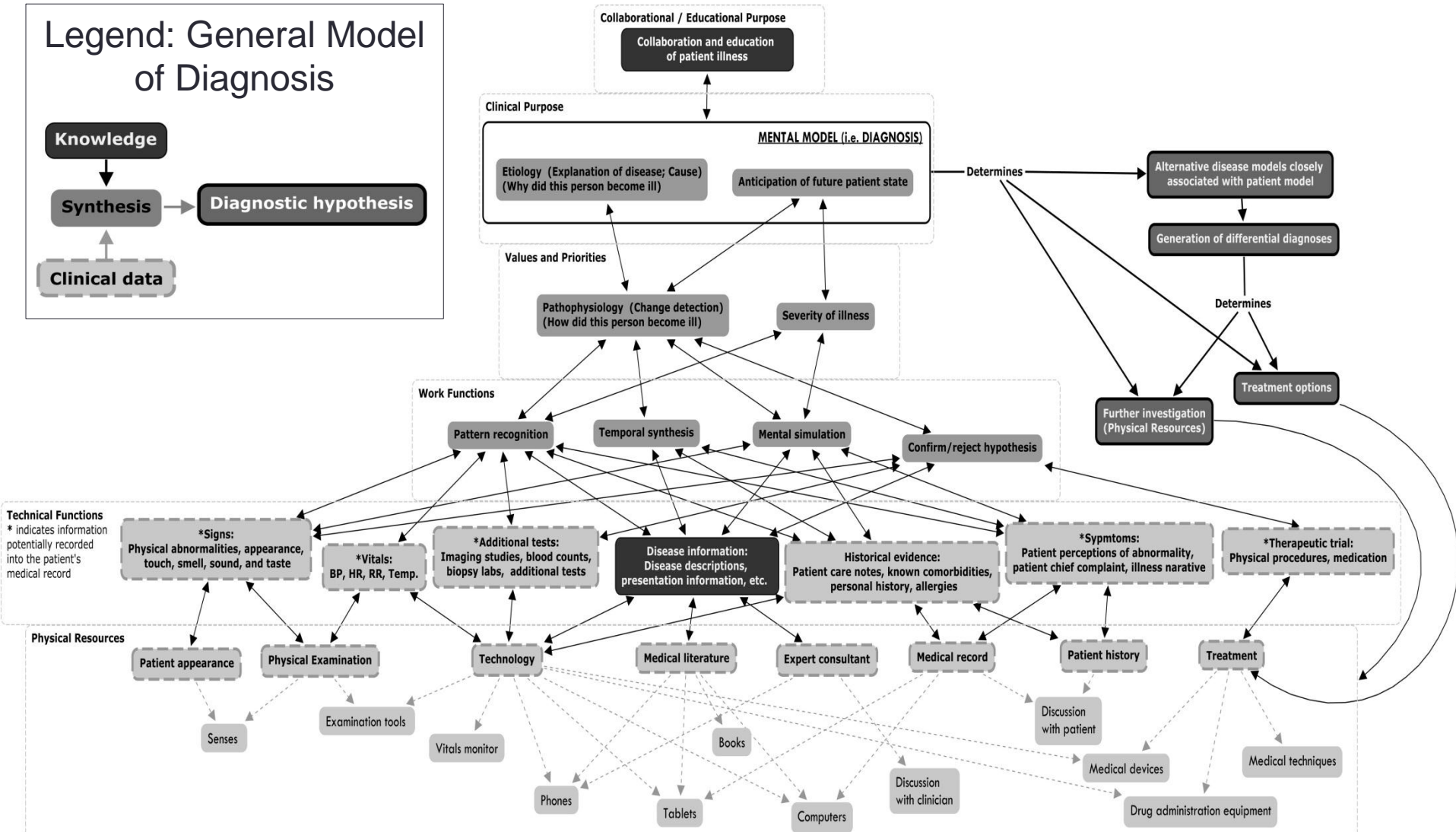
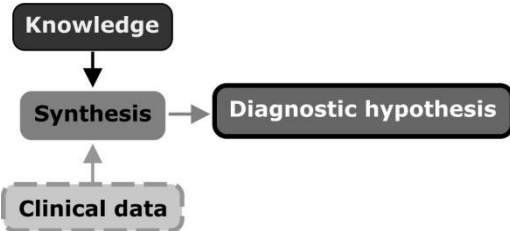


A new model of diagnosis

- Used Work Domain Analysis (WDA) to analyze diagnosis training literature
 - WDA Analyzes where information comes from in the environment and how the information is useful to fulfilling the purpose of a particular domain's work
- Resulted in a depiction/description of the diagnostic process

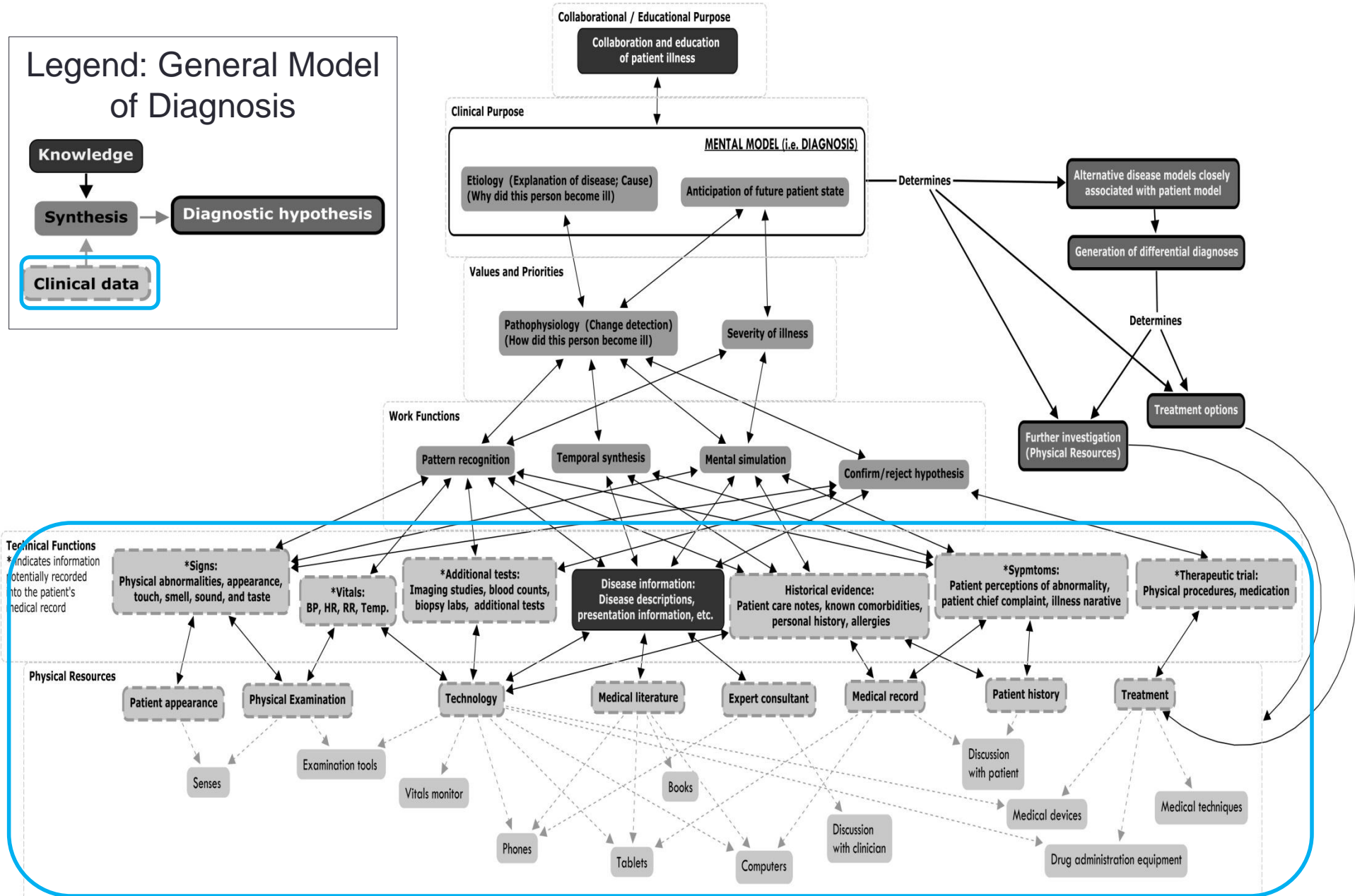
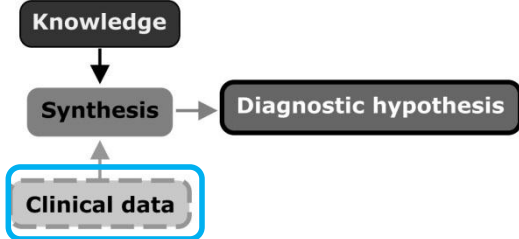
WDA model of diagnosis

Legend: General Model of Diagnosis



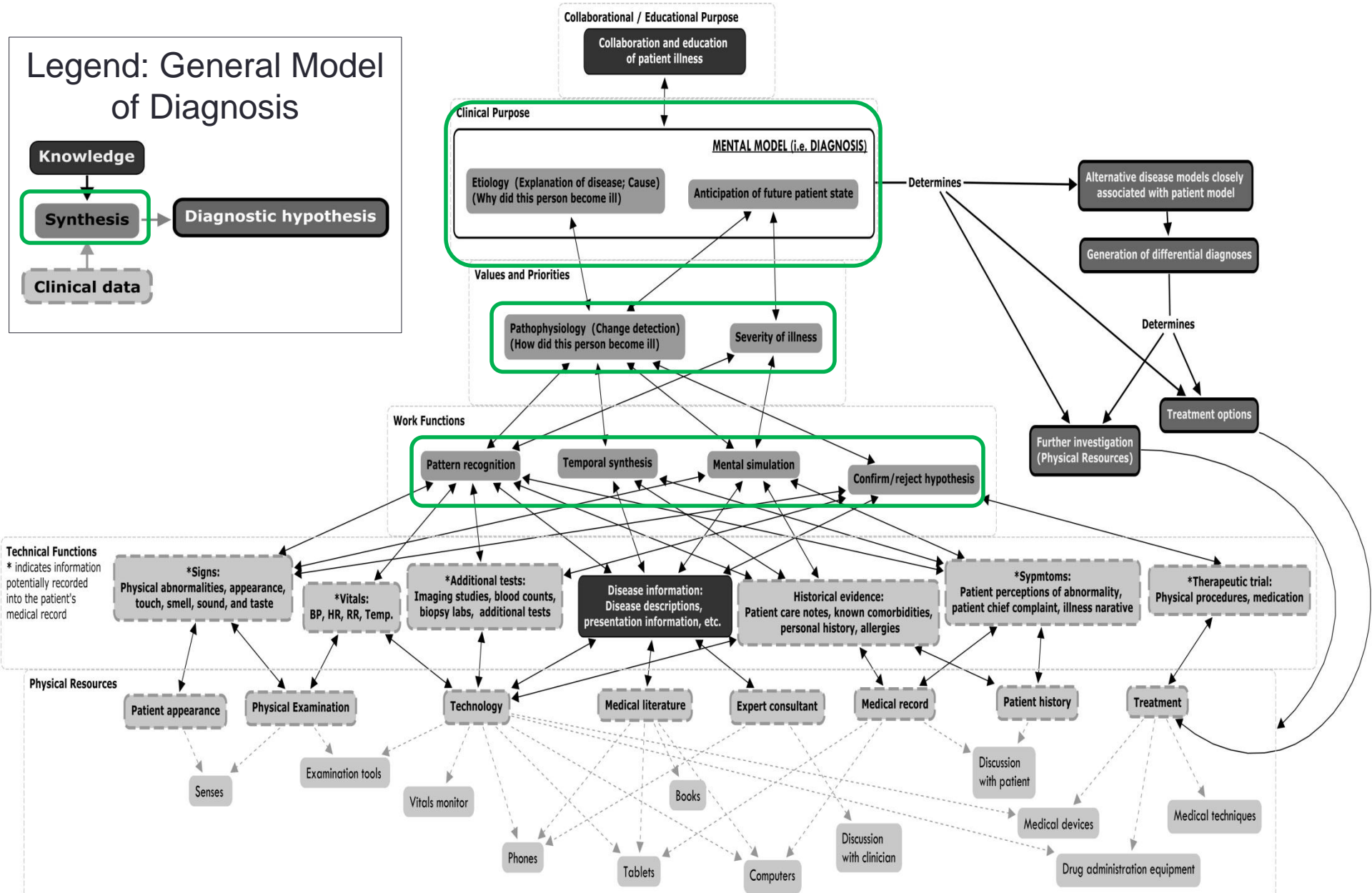
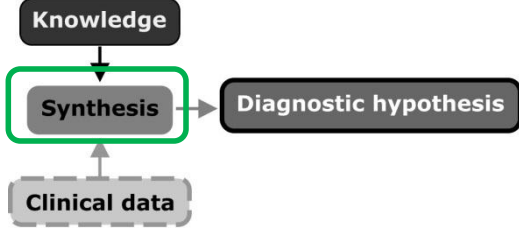
WDA model of diagnosis: Essentials

Legend: General Model of Diagnosis



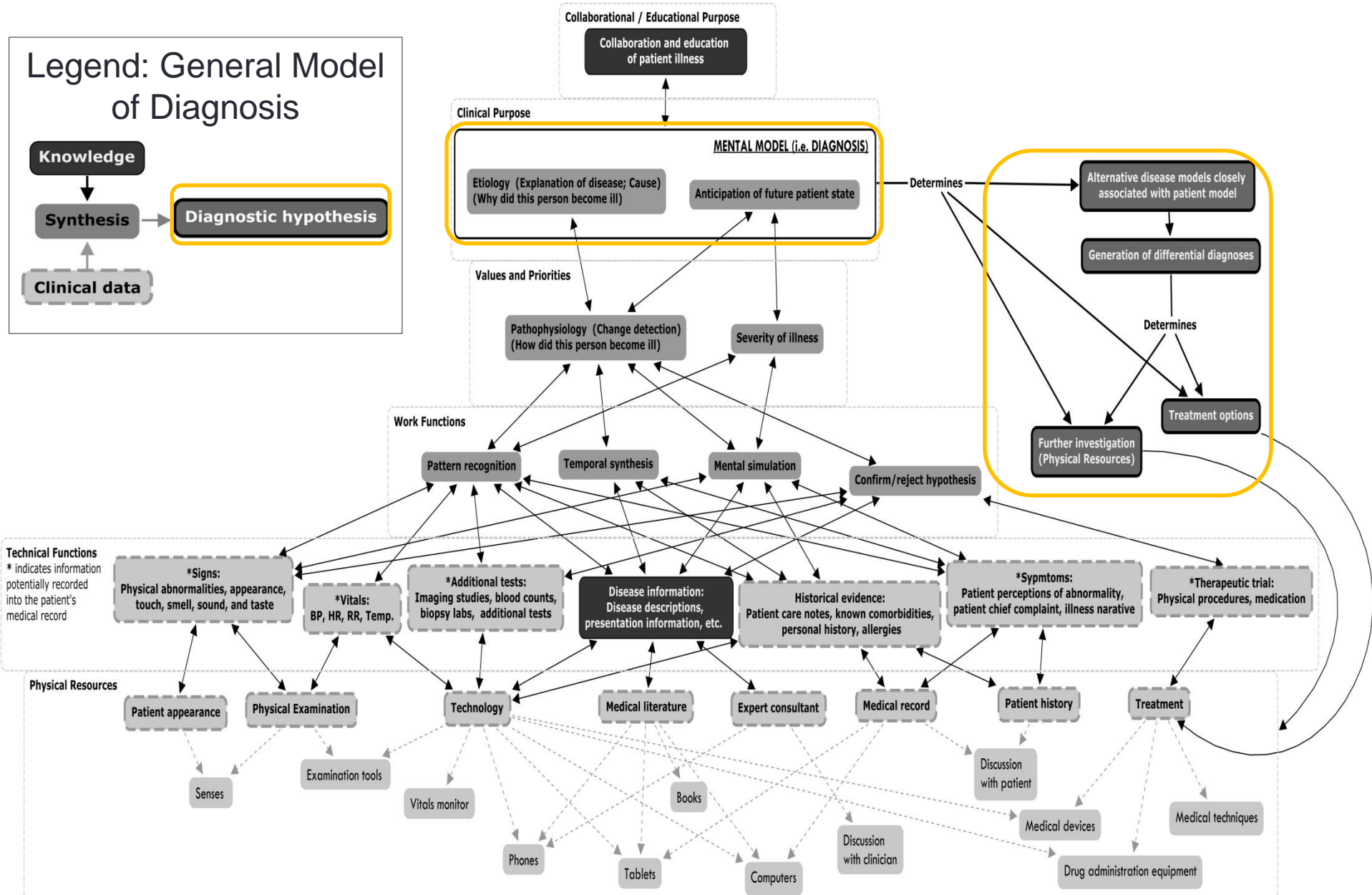
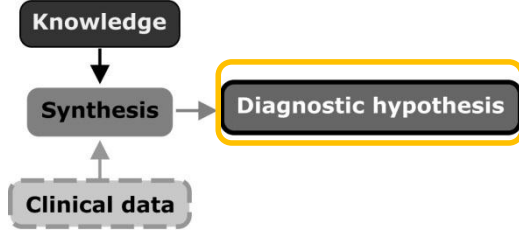
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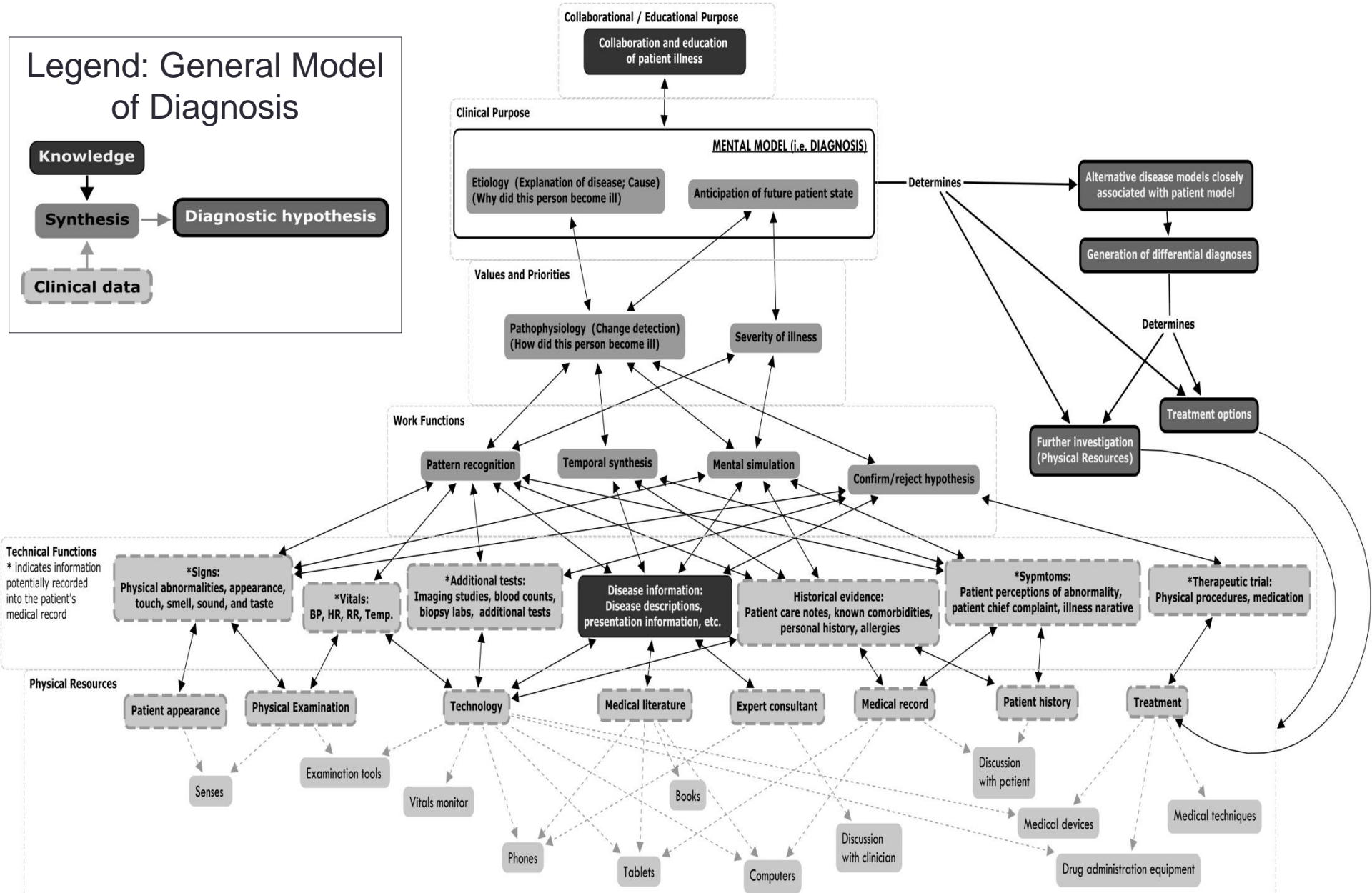
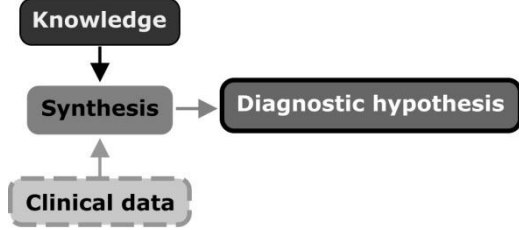
WDA model of diagnosis: Essentials

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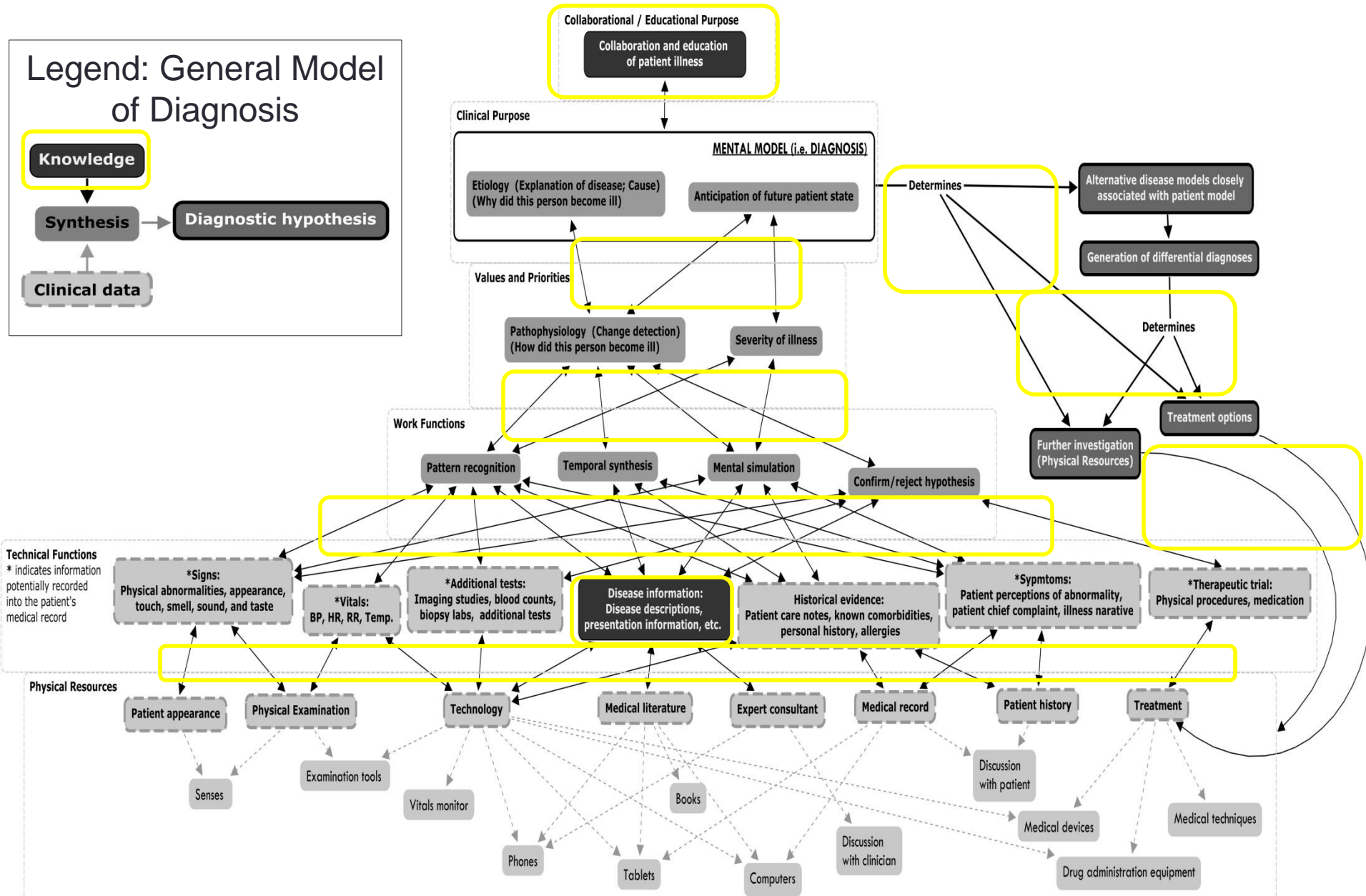
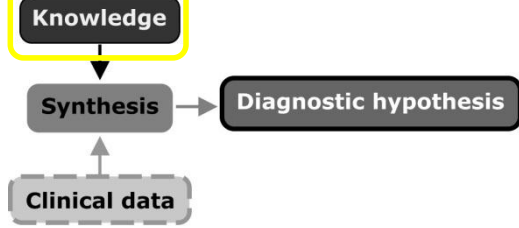
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WDA model of diagnosis: Essentials


Legend: General Model of Diagnosis



Remainder of fellowship: Validation of WDA model of diagnosis

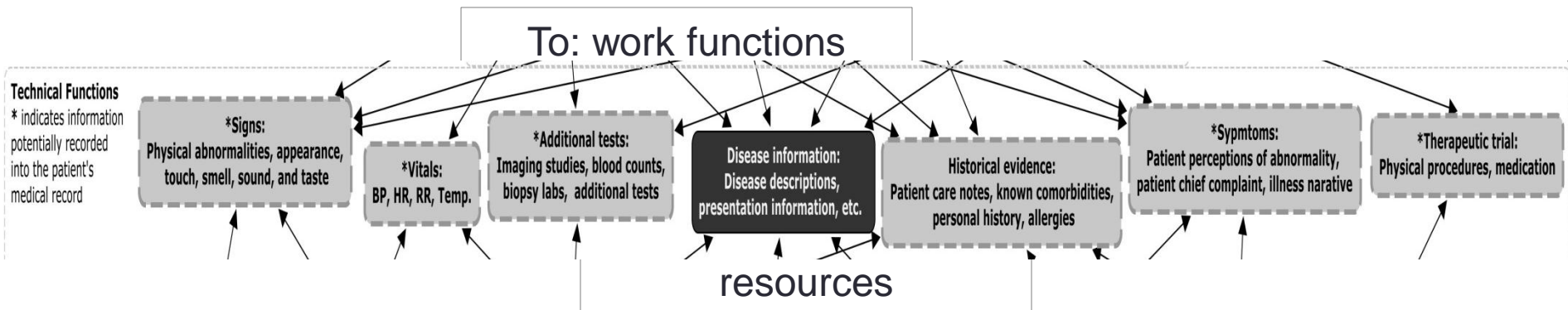
- Method
 - Virtual patient simulation using Decision Simulation software
 - Participants:
 - Medical students, residents, faculty participating in training sessions offered by NCPS
- Assess strength of relationships between:
 - Situation Awareness (SA)
 - Time to diagnose
 - Diagnostic Accuracy
 - Expertise

Remainder of fellowship: Validation of WDA model of diagnosis

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 - Time to diagnose ↓
 - Diagnostic Accuracy ↑
 - Expertise ↑
- 

Building the simulation scenario

- Developed a difficult diagnostic case to elicit differences between experts and novices
- Took a fundamental portion of the WDA model of diagnosis to act as the “spine” for the scenario

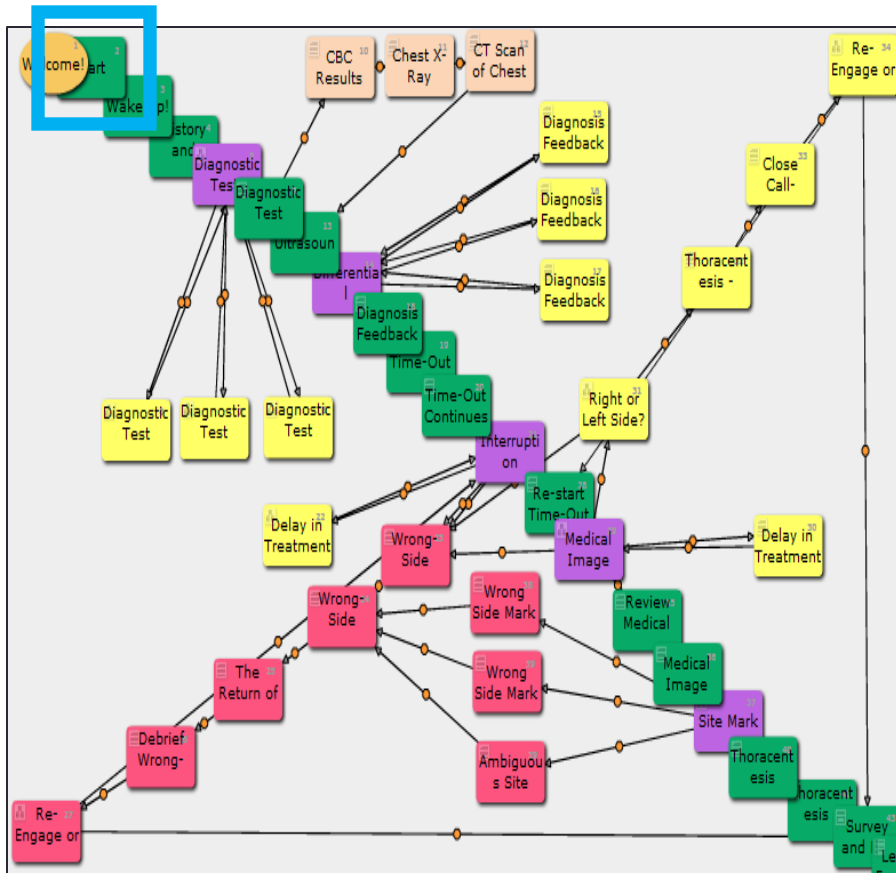


Decision Simulation Software

- Developed for education purposes
- Create stories for students to experience consequences of their decisions
 - Similar to powerpoint but with choices
- Keeps track of:
 - Nodes participants visited in scenario
 - Time spent at each node
 - Time spent in the scenario

Decision Simulation Example

Author View



Participant/"In scenario" view

Start



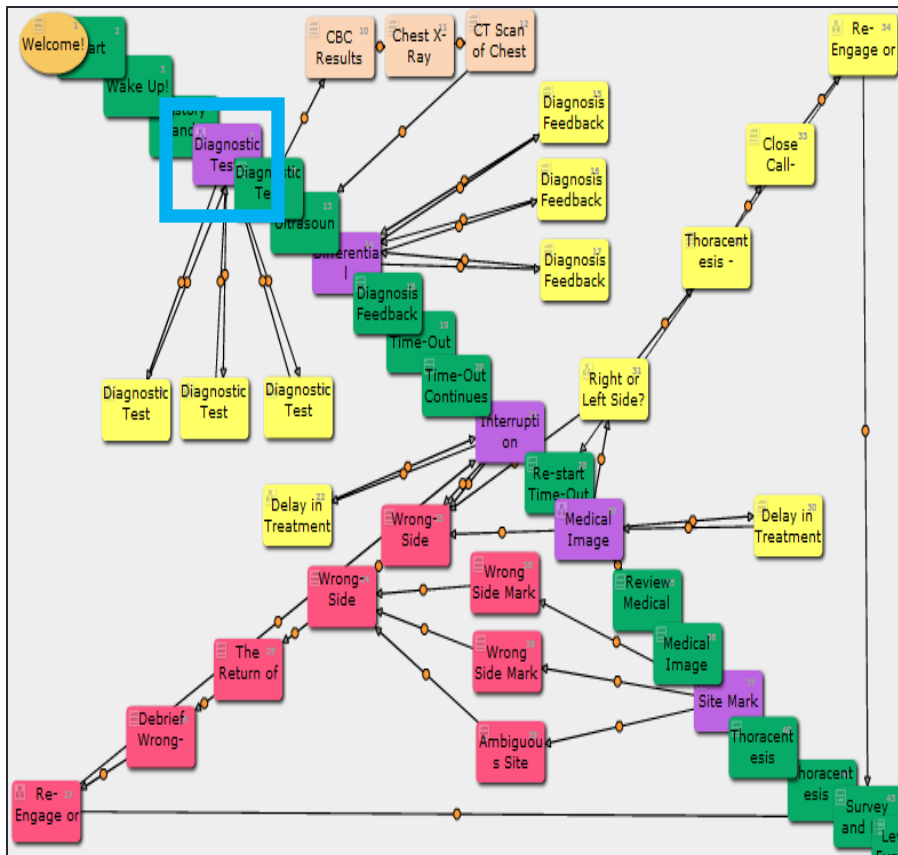
Resident-Dr. Lindsey Edwards (That's You!)

You'll experience a "Day in the Life" as a Resident, Dr. Lindsey Edwards, at a Medical Center. You will receive instructions from and interact with your Chief Resident and others, provide care for a patient, and experience the consequences of your decisions.

Continue

Decision Simulation Example

Author View



Participant/"In scenario" view

Diagnostic Tests

Having completed the history and physical exam, you are ready to order laboratory studies and tests to investigate why Mr. Hernandez has not improved despite antibiotics.

You: (Thinking to yourself) Ah, the benefits of the computerized physician order entry (CPOE). Now, let's just see . . .

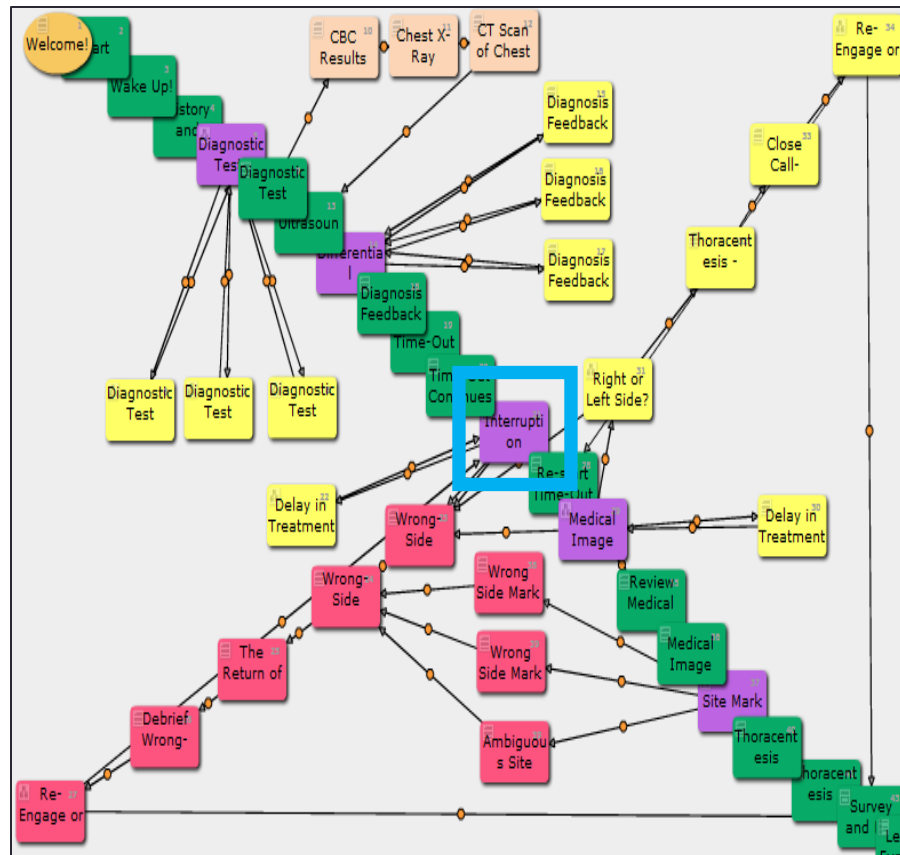


Select the best answer.

- Chest X-Ray, CBC, metabolic panel, and MRI
- Chest X-Ray, CT Scan, and Pulmonary Function Tests (PFT's)
- Chest X-Ray, CT Scan, CBC, and Ultrasound
- Ultrasound, Metabolic Panel, MRI, and Coagulation Profile

Decision Simulation Example

Author View



Participant/"In scenario" view

Interruption

Bobbie Rose: (Interrupting) Lindsey, I just admitted a G.I. bleeder next door. Can you draw a new type and cross? Apparently, the Blood Bank did not receive the specimen that the ER sent. We have got to get going, busy day . . .

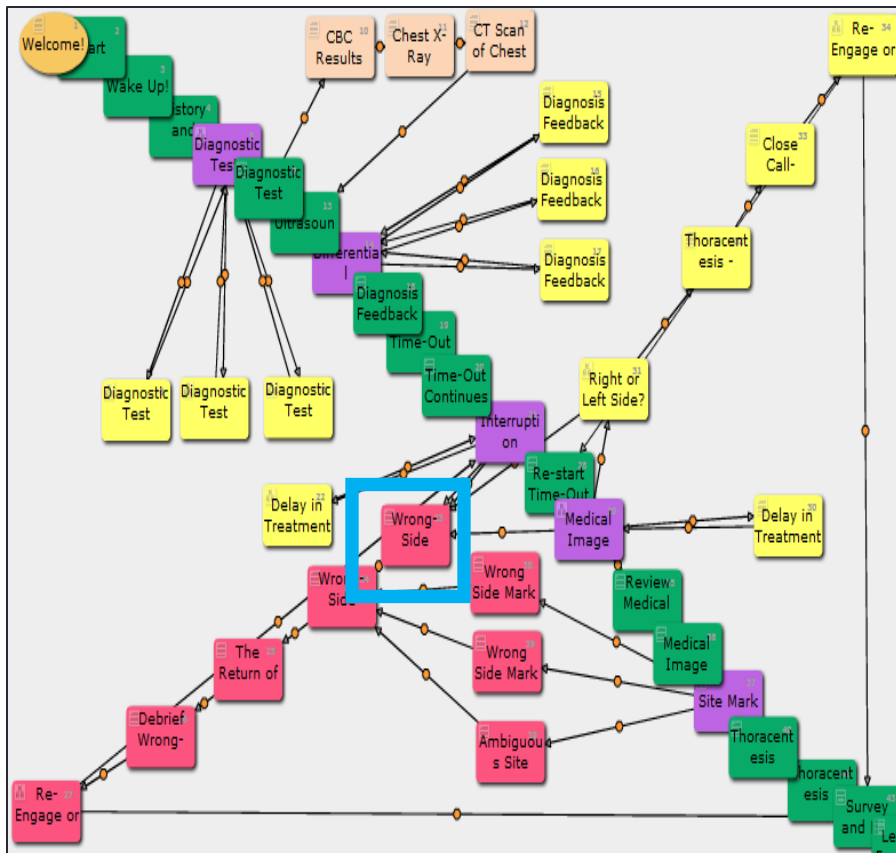


Your next step. Select the best answer.

- Begin the thoracentesis under supervision
- Cancel the procedure
- Re-start the time-out
- Complete the time-out from where you left off on the checklist

Decision Simulation Example

Author View



Participant/"In scenario" view

Wrong-Side Thoracentesis

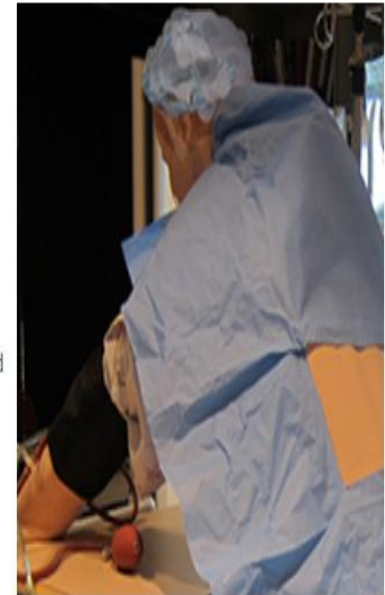
You: (After anesthetizing the left side and inserting thoracentesis needle) That's odd. No fluid. I suspected plenty.

Ritchie Hernandez: (Coughing, and trying to catch his breath) Doc, that hurts quite a bit when I take a breath.

You: (Talking to yourself) Wait a minute . . .let's take a look at that chest X-ray

Tony Patton: Doc, looks like your site mark is kind of covered by the drape over there on the patient's right side.

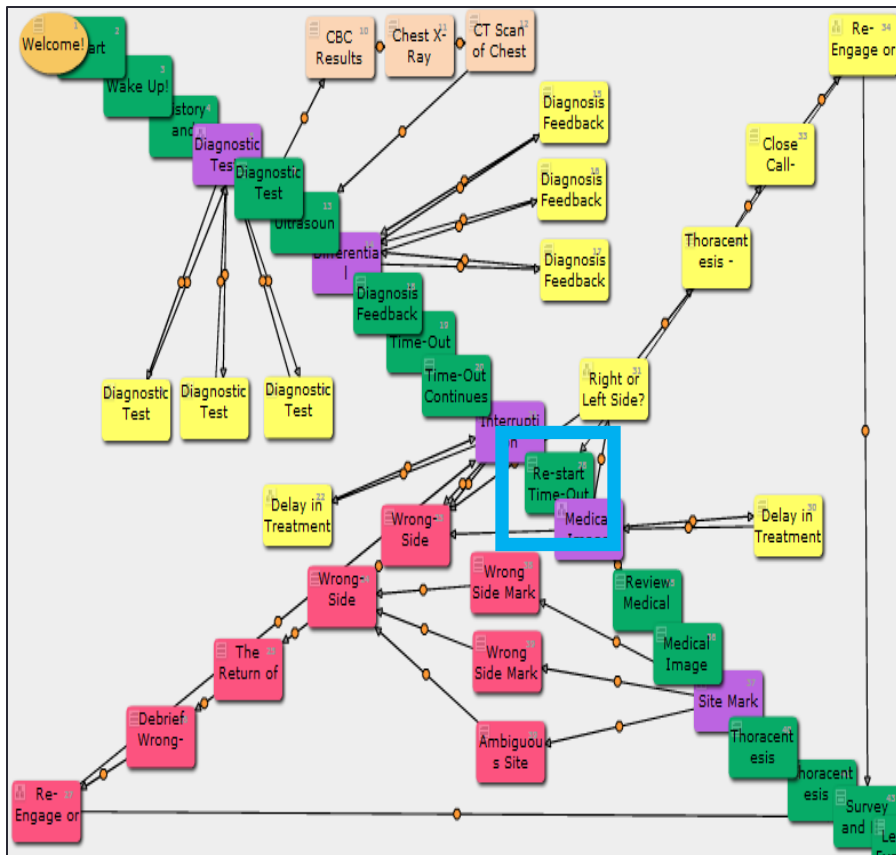
Ritchie Hernandez: (Coughing and trying to catch his breath)



Continue

Decision Simulation Example

Author View



Participant/"In scenario" view

Re-start Time-Out




You: Sorry about that. Sir, could you re-state your name and date of birth?

Ritchie Hernandez: Ritchie Hernandez, 5/9/49.

Tony Patton: (*Reading patient's wristband*), Ritchie Hernandez, 5/9/49. Confirmed. Consent for right thoracentesis.

You: Let's review the medical images.

Out of OR Time Out - Do We All Agree? 

Patient Identity	Two (2) identifiers: Patient name and SSN, birthday, or other VA-approved identifier
Consent Form	Confirms patient, procedure, side/site, reason
Procedure	Procedure name and description
Side/Site	Confirm laterality: Surgical site marked (visible after draping) and/or special purpose wristband verified
Imaging (as applicable)	Two (2) members confirm imaging studies are available and properly labeled and presented
Specialty or Unit Specific Element	Include specific directions regarding other checklist elements such as implants, patient position, cultures, special equipment, etc.

REV 12.14.2012

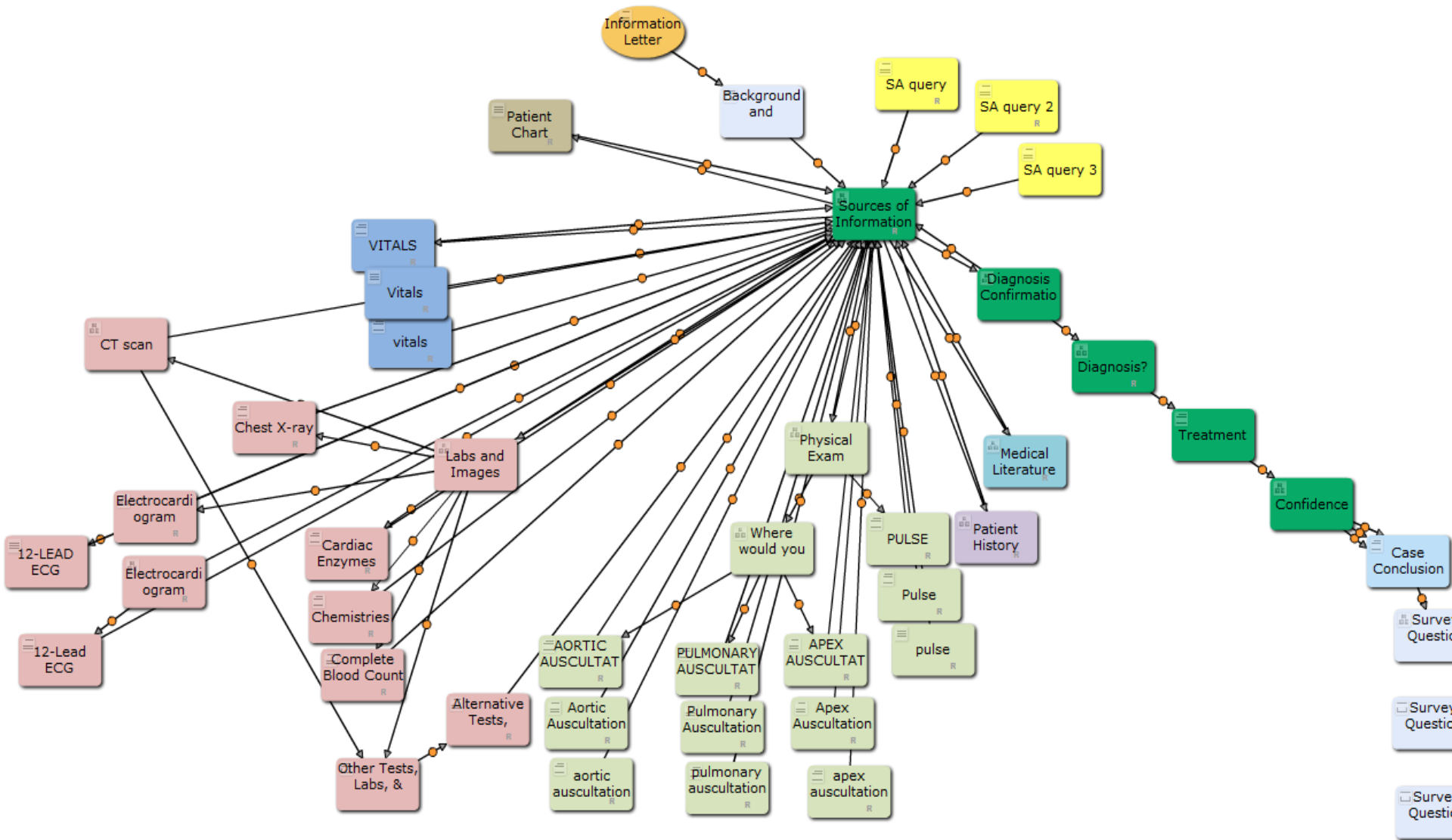


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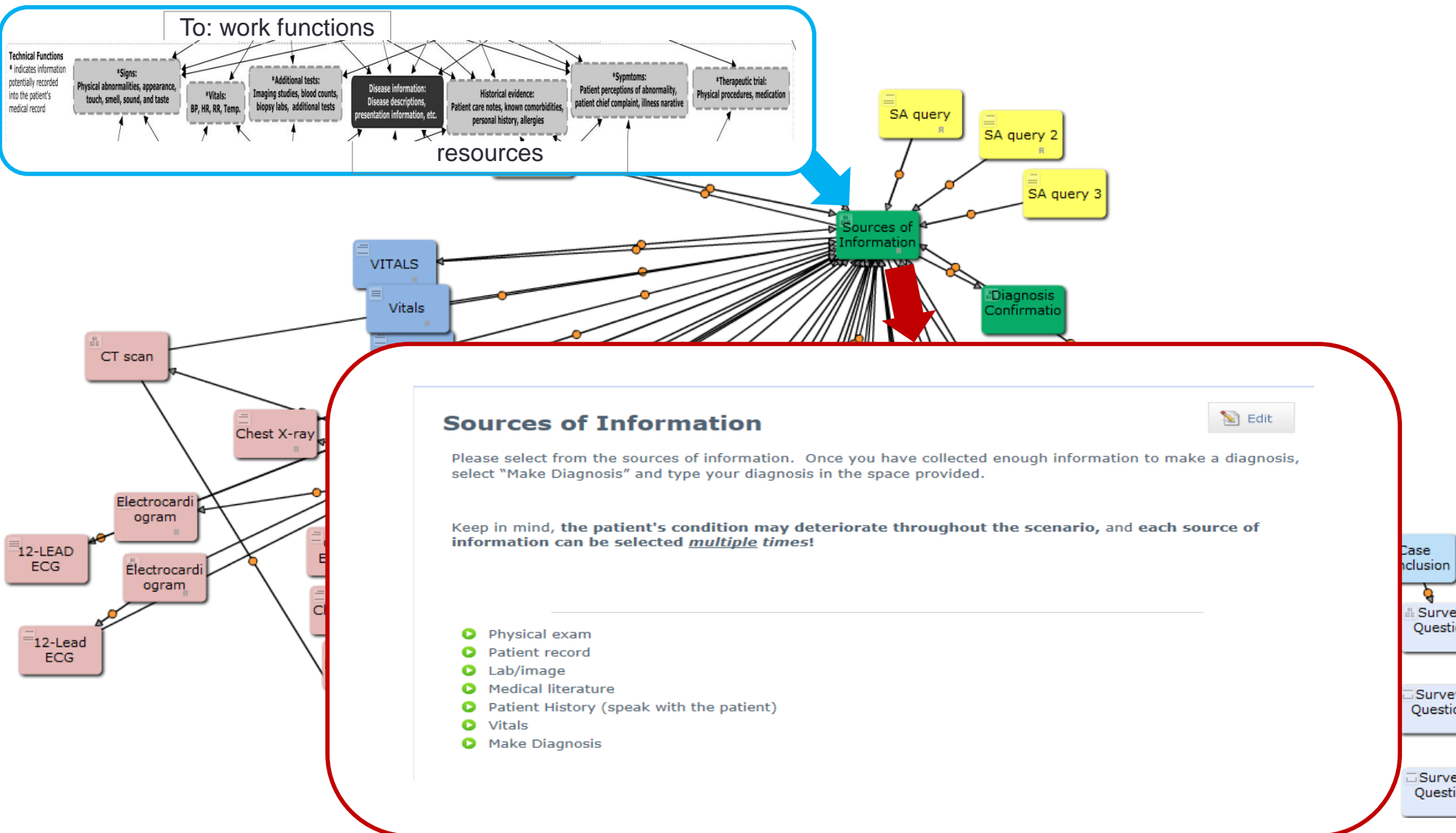
Validating WDA model of diagnosis with Decision Simulation

- Slightly different approach to node map development
 - Developed to explore process of diagnosis
 - Not developed for educational purposes

WDA model of diagnosis node map

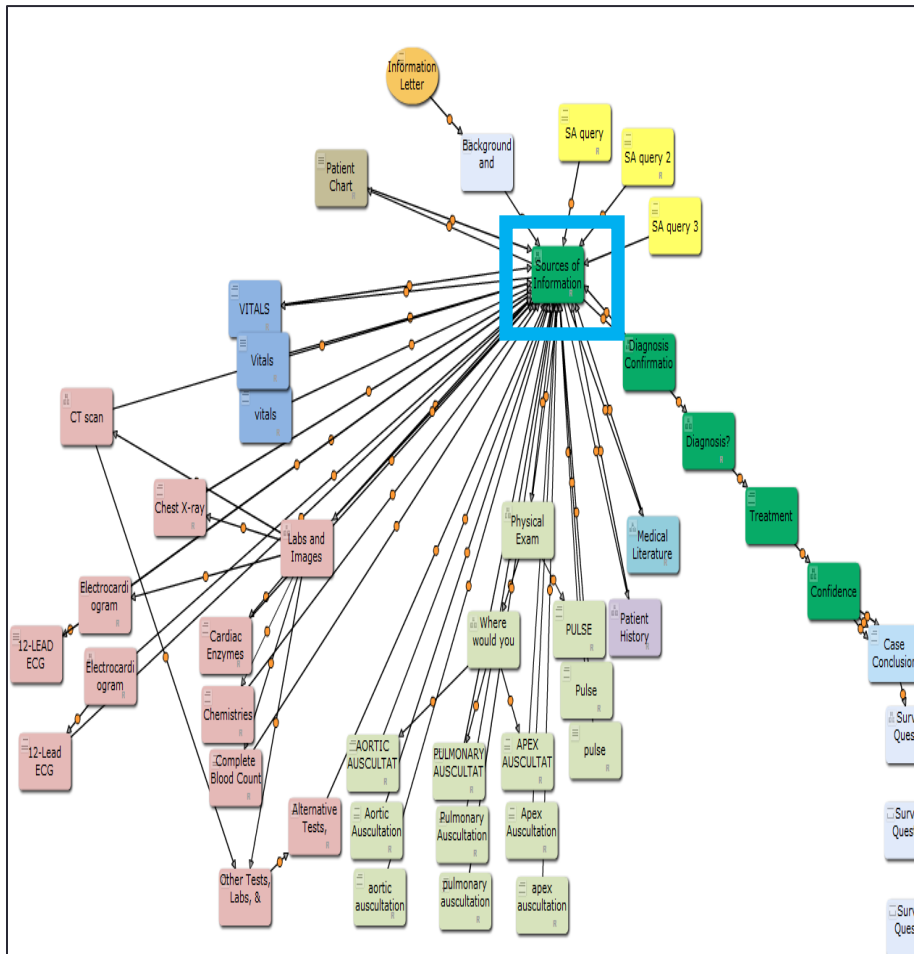


Decision Simulation: WDA model of diagnosis node map



WDA Decision Simulation Example

Author View



Participant/"In scenario" view

Sources of Information



Please select from the sources of information. Once you have collected enough information to make a diagnosis, select "Make Diagnosis" and type your diagnosis in the space provided.

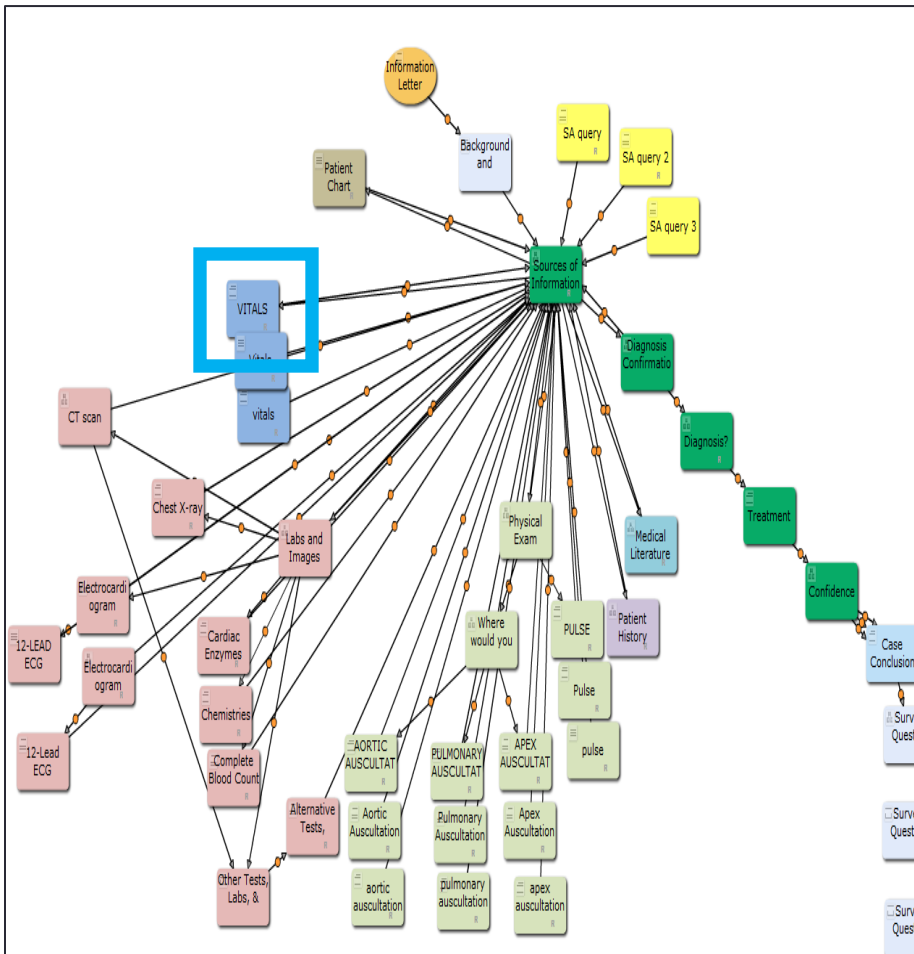
Keep in mind, the patient's condition may deteriorate throughout the scenario, and each source of information can be selected multiple times!

- Physical exam
- Patient record
- Lab/image
- Medical literature
- Patient History (speak with the patient)
- Vitals
- Make Diagnosis

WDA Decision Simulation Example

Author View

Participant/"In scenario" view



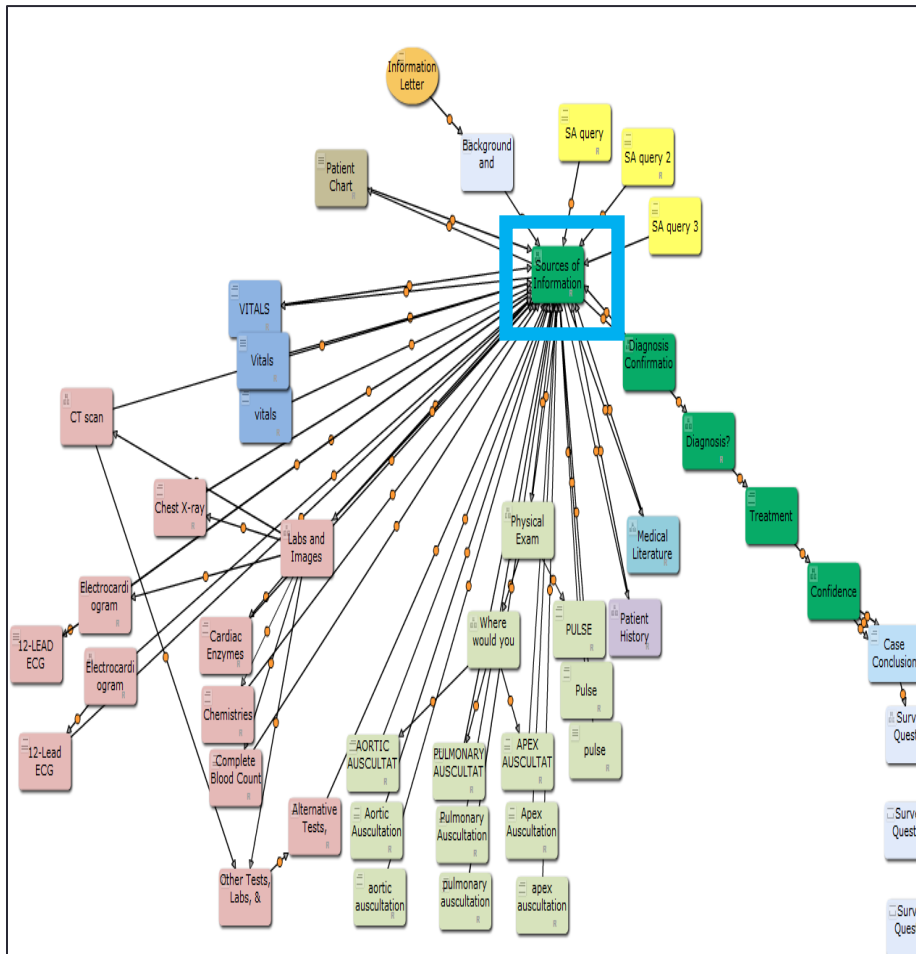
The Participant/"In scenario" view displays a "VITALS" dashboard. The dashboard shows various vital signs and waveforms:

- HR (Heart Rate):** 85 (green)
- SpO₂ (Oxygen Saturation):** 95 (yellow)
- Pulse:** 78 (yellow)
- awRR (Apical Radial Ratio):** 18 (white)
- Tperi (Transcutaneous Oxygen Saturation):** 98.6 (green)
- NBP (Non-Invasive Blood Pressure):** Sys. 159/99 (red), 160/90 (red)
- Diagnosis:** (95) (red)

The dashboard also features a 12-lead ECG waveform at the top and a Pleth (Plethysmography) waveform below it. The interface includes a navigation bar at the bottom with icons for Home, Back, Stop, Light, and Main Screen. A "Go back (Back to sources of information)" button is located at the bottom left.

WDA Decision Simulation Example

Author View



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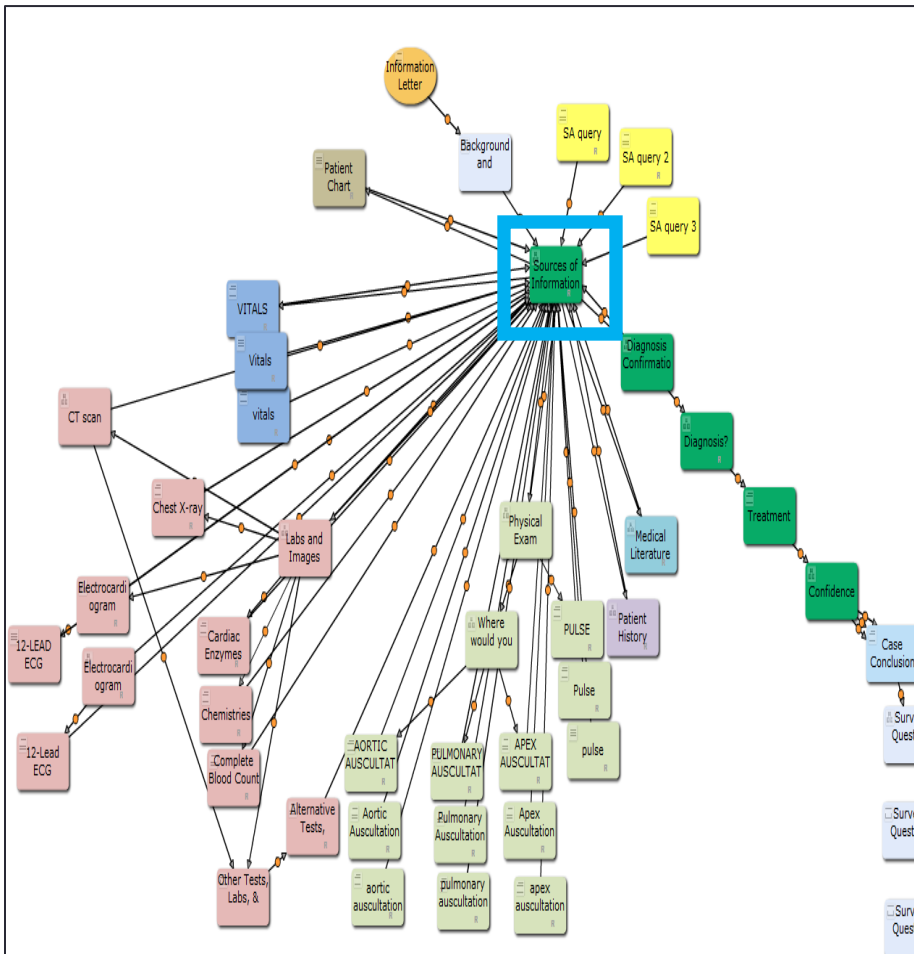
Rules within simulation

- Enhance fidelity
 - Adds a sense of time to the scenario
 - Patient will continually deteriorate as scenario unfolds
- Important to implement SA queries

Rules: Time Example

Author View

Participant/"In scenario" view



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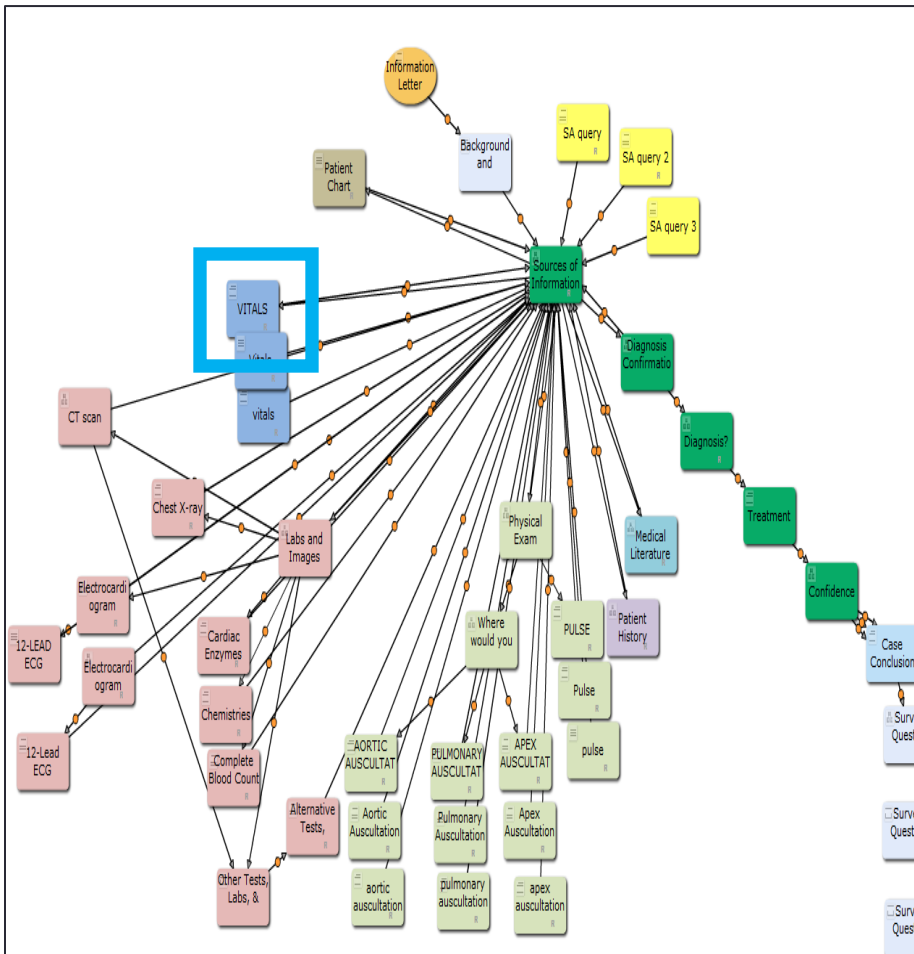
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Rules: Time Example – T1

Author View

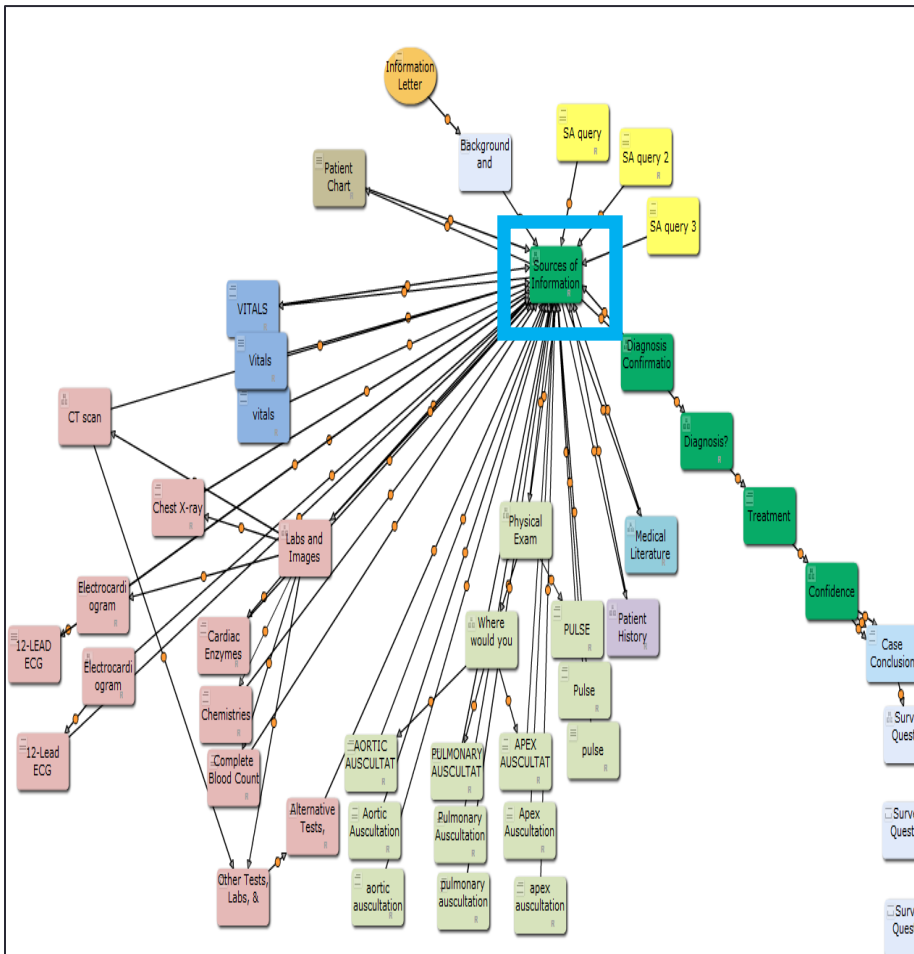
Participant/"In scenario" view



Rules: Time Example – T2

Author View

Participant/"In scenario" view



Sources of Information



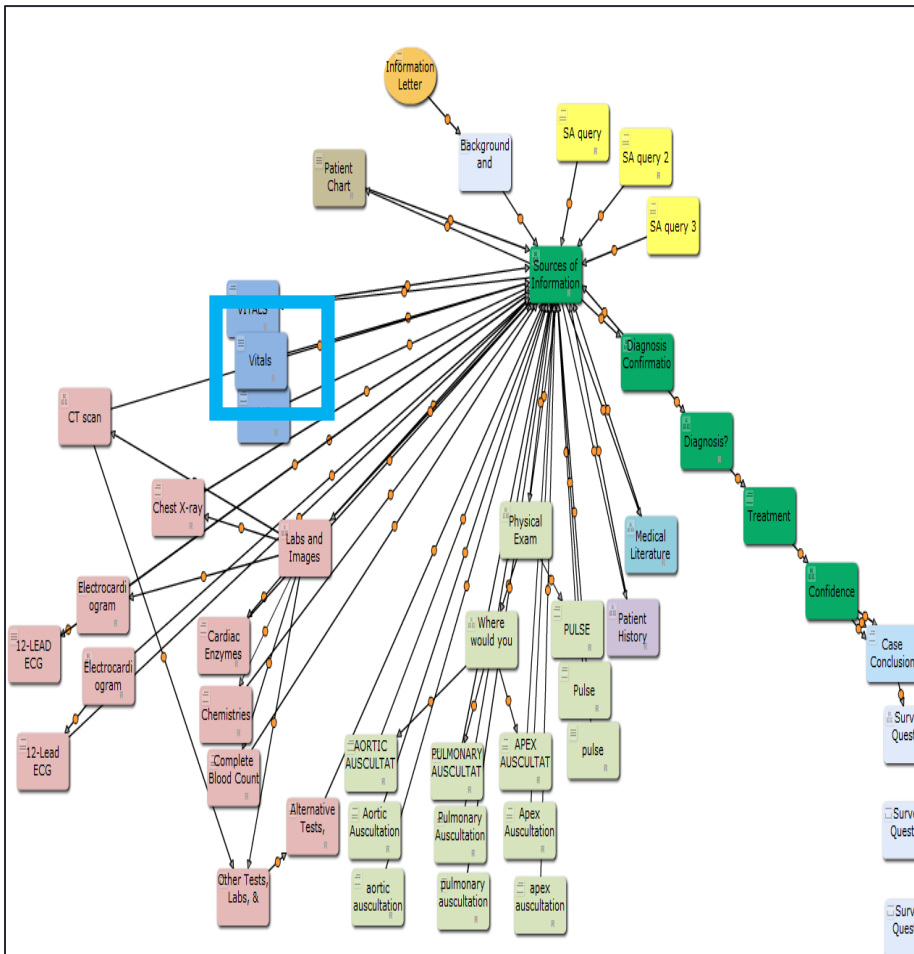
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- Physical exam
- Patient record
- Lab/image
- Medical literature
- Patient History (speak with the patient)
- Vitals
- Make Diagnosis

Rules: Time Example – T2

Author View



Participant/"In scenario" view

Vitals

Adult 4/1/2014 08:18 PM Swire

HR 130 50 **101**

Pleth SpO2 100 90 **94**

NBP Sys. 160 90 **153/95 (94)**

Pulse 130 50 **98**

awRR 30 8 **18**

Tperi 101.0 79.0 **98.6**

Go back (Back to sources of information)

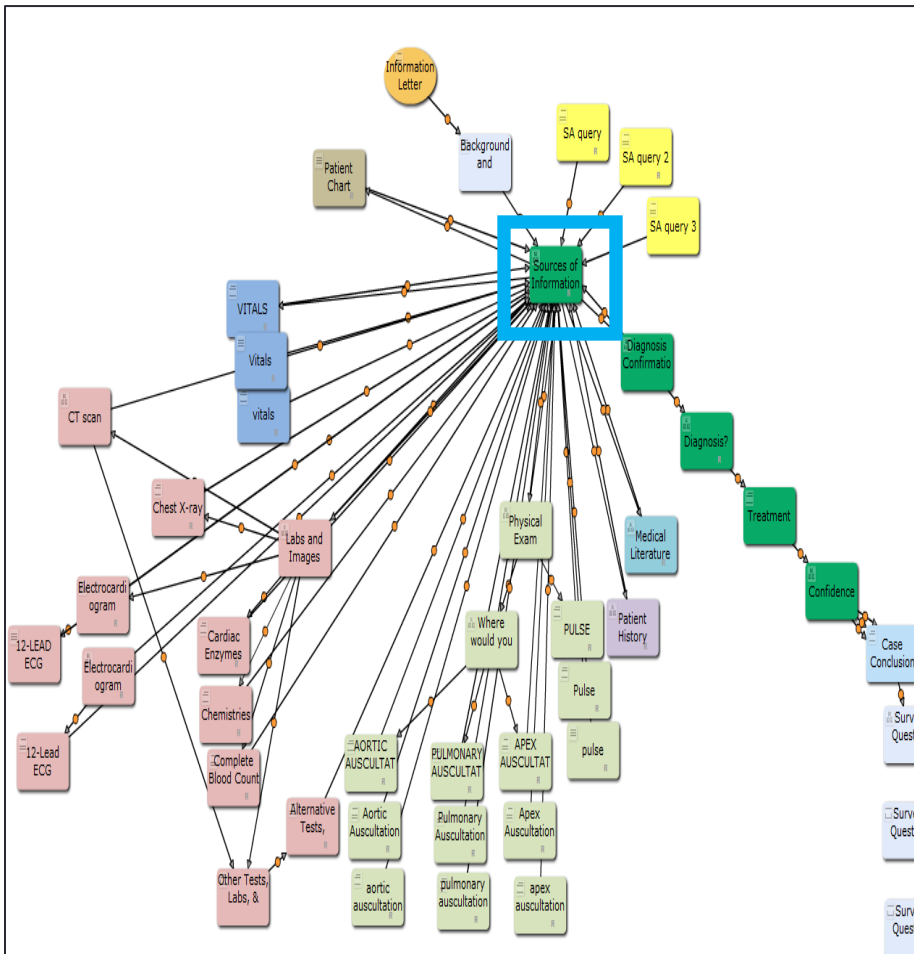
Situation Awareness Queries

- Situation Awareness General Assessment Technique (SAGAT)
 - Freeze simulation scenario
 - Query participants on details of scenario including:
 - Information they have collected
 - Their comprehension of this information/situation
 - Where they anticipate this situation is headed in the near future
- Use of rules are vital to implement this technique!

Rules: SA Queries Example

Author View

Participant/"In scenario" view



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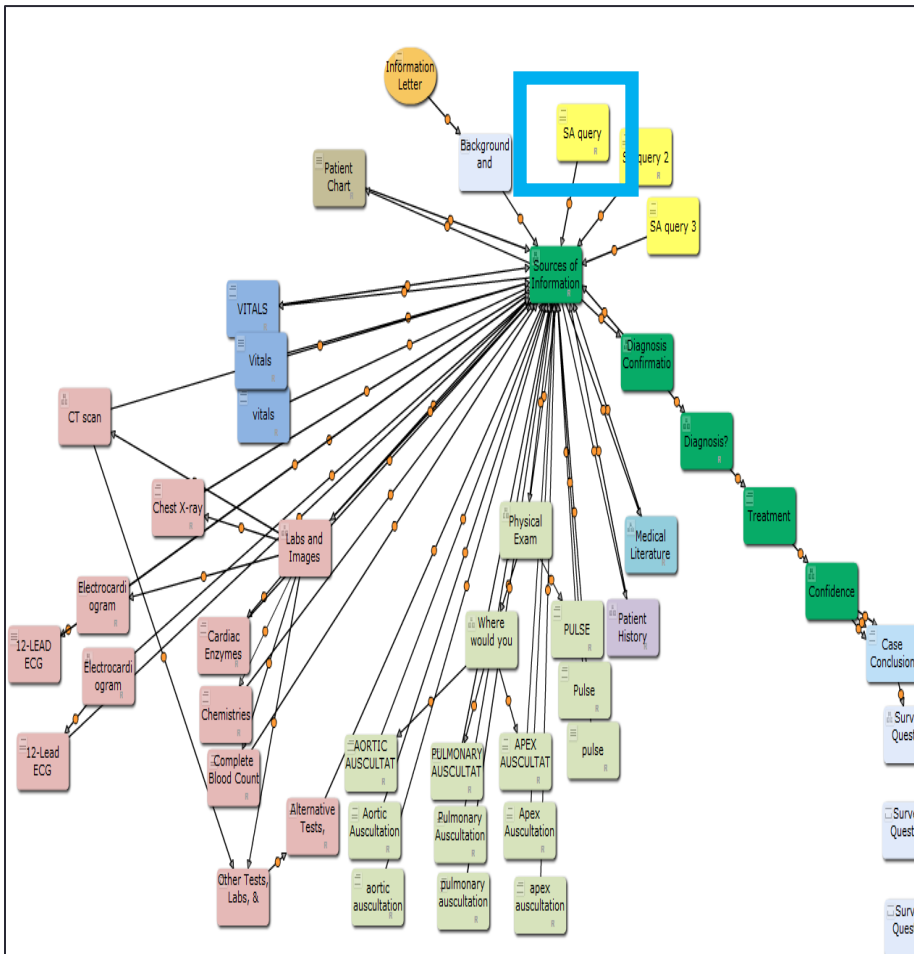
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Rules: SA Queries Example

Author View

Participant/"In scenario" view



Situation Awareness Query 1/6

Explain "FREEZE!"

Based on your understanding of this patient, write a brief SOAP note or give a brief report about the status of this patient.

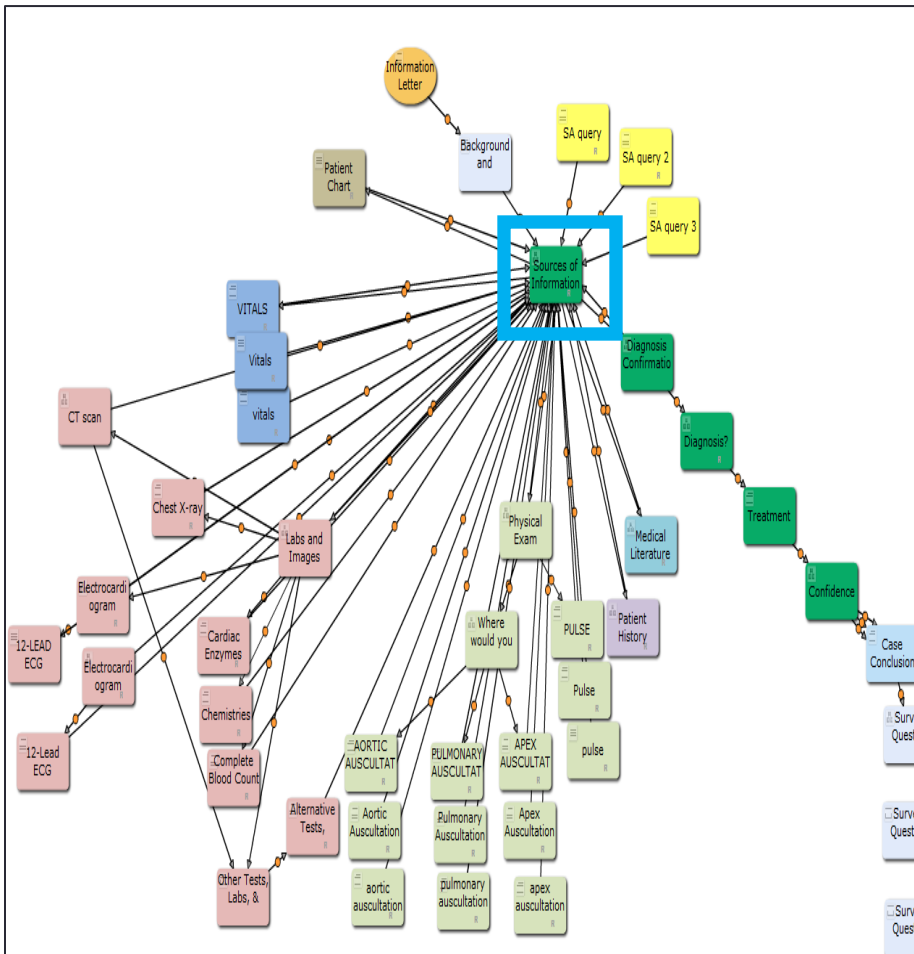
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Continue

Rules: SA Queries Example

Author View

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Post-diagnosis information collection

- Participants record diagnosis & anticipated treatment plan
- Complete a 10 question survey inquiring about their experience with diagnosis
- Debrief
 - Tell them the actual diagnosis of the case
 - Provide information regarding this study

Currently...

- Finishing up the details of the simulation scenario
- Pilot testing

- Fingers-crossed
 - Data collection will start in July

Questions / Comments?

- Development of a new model of diagnosis
- Validating the model of diagnosis
 - Use of Decision Simulation software

Acknowledgements

- Doug Paull, Linda Williams, Ted Dushane, Mark Graber, Gavan Lintern
- All National Center for Patient Safety staff
- Each and every patient safety fellow and fellow educator!

Legend: General Model of Diagnosis

