# Integrative Diagnostics: What it is and Who Does it

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**Department of Pathology**
**University of Texas Medical Branch**
**Galveston**

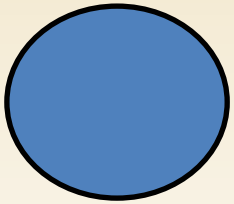
utmb Health

***Expert Diagnostic Colleague***
**has been established as an LLC in Texas (2022) and has not yet provided clinical interpretations to anyone**

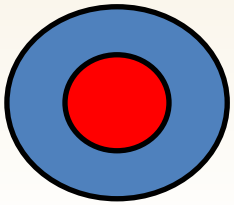
**The mission of the company is to bring diagnostic experts on many topics to every healthcare provider in the US**

# How Much Information is There to Know?

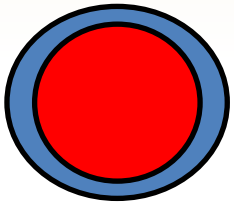
**1950**



**Amount of knowledge available about disease**

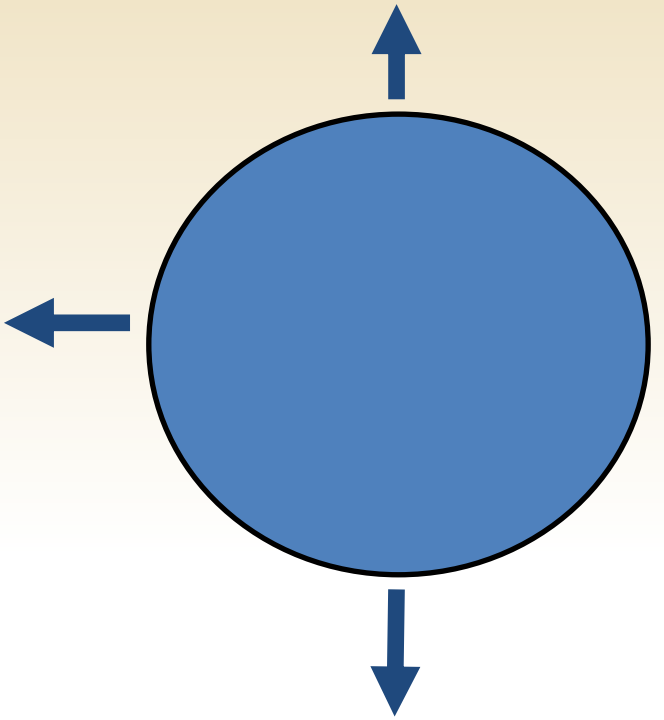


**Doctor does not know much about diagnosis**

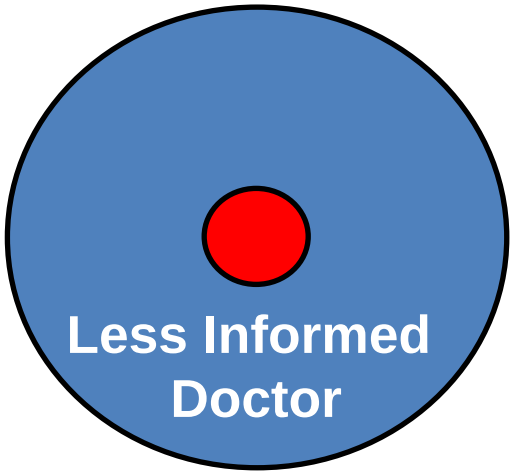


**Doctor knows much about diagnosis**

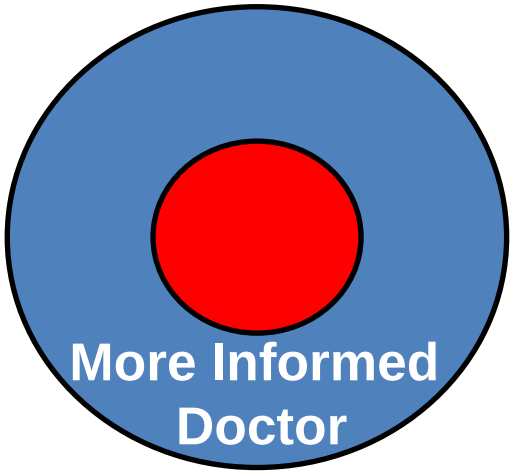
# Today



Amount of knowledge available about disease



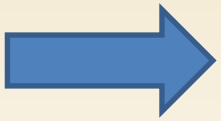

Too much for even one very good doctor to know



# Participation of Diagnostic Physicians

**Radiology <50 Tests**

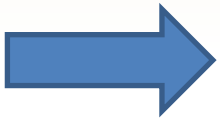
**Imaging Study**



***Automatic* Interpretation by Radiologist**

**Anatomic Pathology <50 Tests**

**Biopsy**

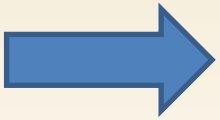


***Automatic* Interpretation by Anatomic Pathologists**

# Participation of Diagnostic Physicians

**Clinical Laboratory Tests with Genetics >10,000 Tests**

**Blood, Urine, Fluids**



**Patient Facing Clinician Must Select all the Correct Tests and Interpret the Results *with Little or No Assistance***

**Major Source of Diagnostic Error and Unnecessary Healthcare Costs**

# 2014-2015

**The largest contributor to preventable death from medical error is**

# Diagnostic Error

**as reported by a committee sponsored by the National Academy of Medicine**

# Major Change in Progress: Artificial Intelligence

## Developing Quickly in Radiology and Anatomic Pathology

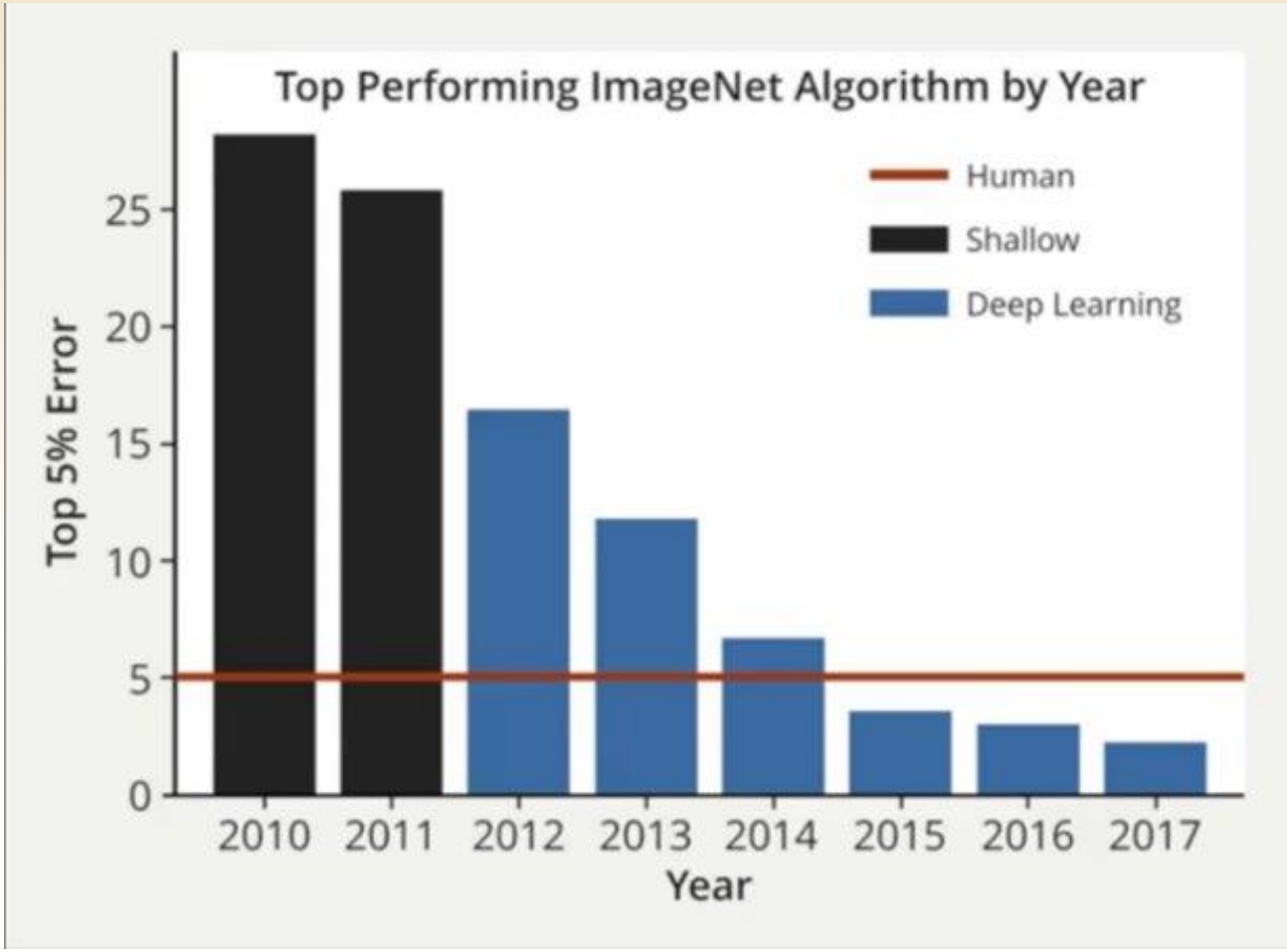
nature medicine

ARTICLES

https://doi.org/10.1038/s41591-018-0177-5

**Classification and mutation prediction from non-small cell lung cancer histopathology images using deep learning**

# Diagnostic Algorithms Can Detect Lung Cancer and Classify the Lesions




**Deep learning improved the performance of the reading instrument to match and then outperform the pathologist**

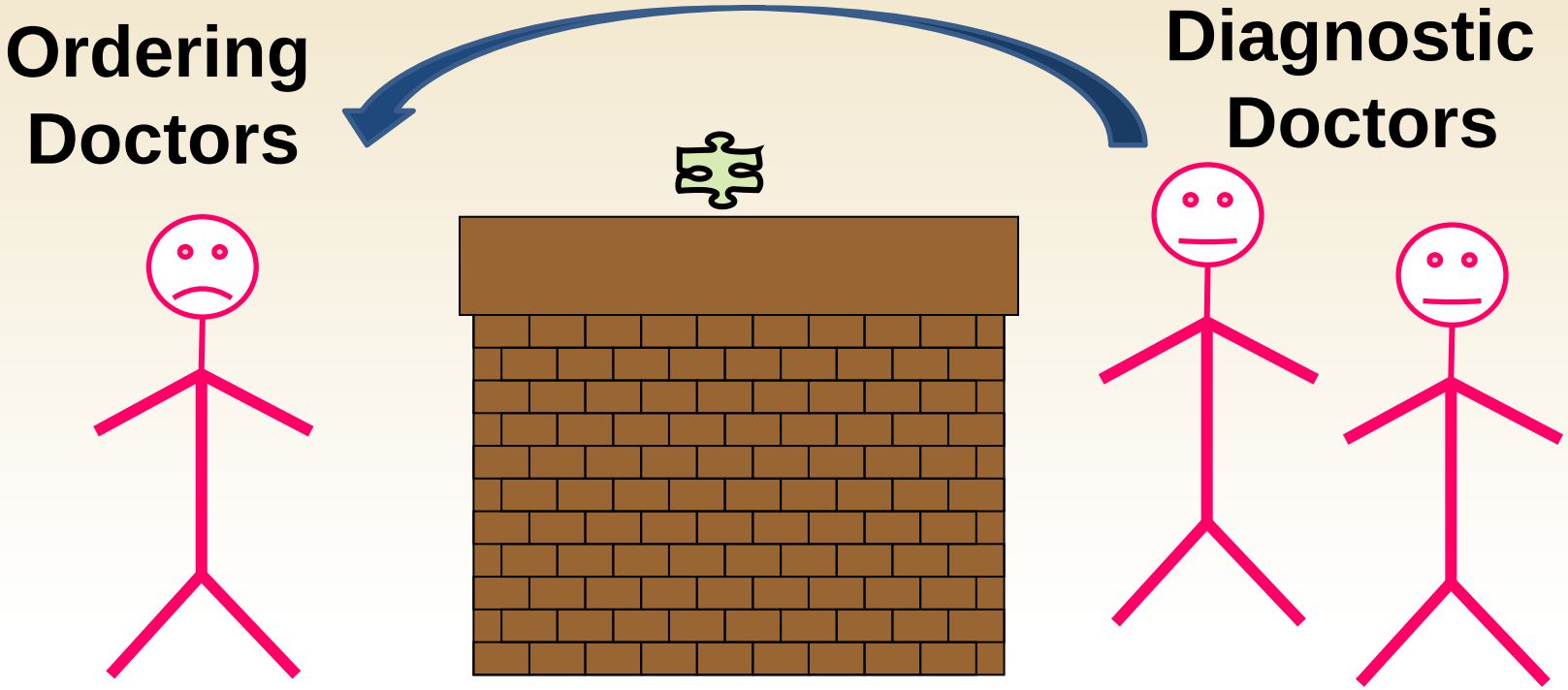
# So how do we optimize Diagnostic Medicine the problem of healthcare delivery in the US?

**Involve experts who can recommend when to use diagnostic tests and interpret diagnostic test results in highly specific disease categories**

**and pay the qualified experts for it**

**Codes have been created and are in use at UTMB to pay for advice on test selection and result interpretation**

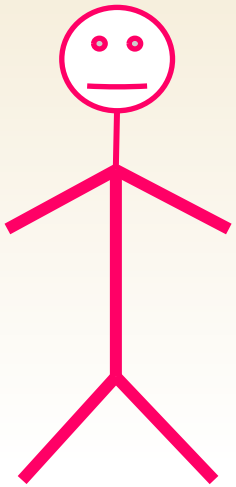
# The Passive Diagnostic Laboratory Only Performs Tests



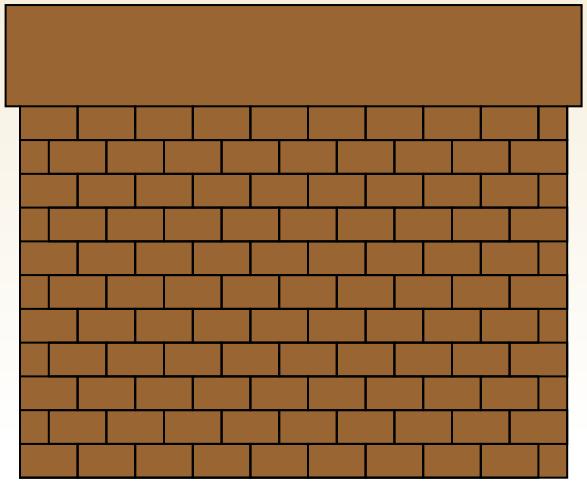

Isolated Diagnostic Bits of Data - Assembly by Ordering Physician Minimally Trained in Test Selection and Interpretation

# Diagnostic Management Team (DMT) Approach

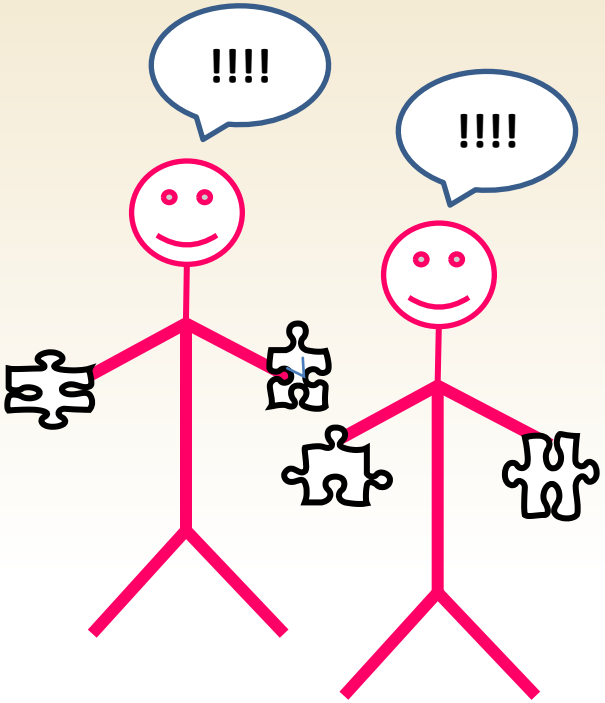
**Ordering Doctors**



**Caring for More Patients While Diagnostic Puzzle is Being Assembled**



**Conferring Diagnostic Doctors**

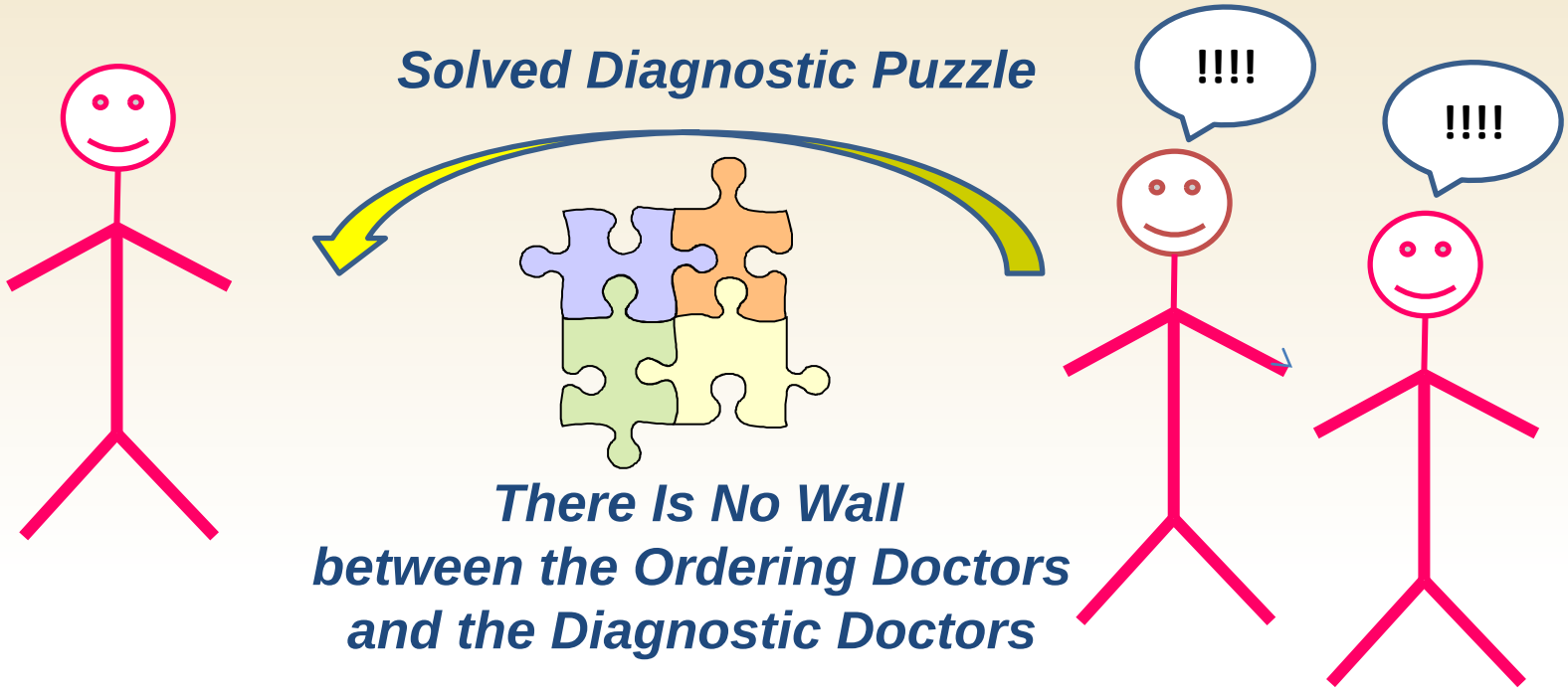



**Isolated Diagnostic Bits of Data Being Merged with Clinical Data about the Patient by the Diagnostic Doctors**

# Diagnostic Management Team Approach

**Ordering Doctors**

**Conferring Diagnostic Doctors**




**Receives Accurate Diagnosis Quickly as a Completed Puzzle**

# Data Presentation in the Medical Record for Coagulation Studies One Day Prior to Initiation of the Coagulation DMT at Vanderbilt

## JUNE 30, 2010

**Pat-PT: 13.9 PT-inr: 1.1 PTT-pt: 43.6* PoolNP: 28.1 P+N0Hr: 38.3 P+N1Hr: 36.2 P+N2Hr: 35.9 Pat-TT: 15 F8Act: 95 F9Act: 102 RVVT: 1.5* DRVVT: Lupus Anticoagulant Confirmed DMX: 1.3 F11Act: 96 F12Act: 54**

# Report in the Medical Record After Initiation of the Daily Rounds to Interpret All Complex Evaluations from the Special Coagulation Laboratory

# DMT Report

**This is a patient with a prolonged PTT based upon the presence of a lupus anticoagulant. There is no increased bleeding risk in this patient, despite the prolonged PTT.**

# DMTs Currently in Operation at UTMB

Coagulation

Toxicology

Autoimmunity

Complex Transfusions

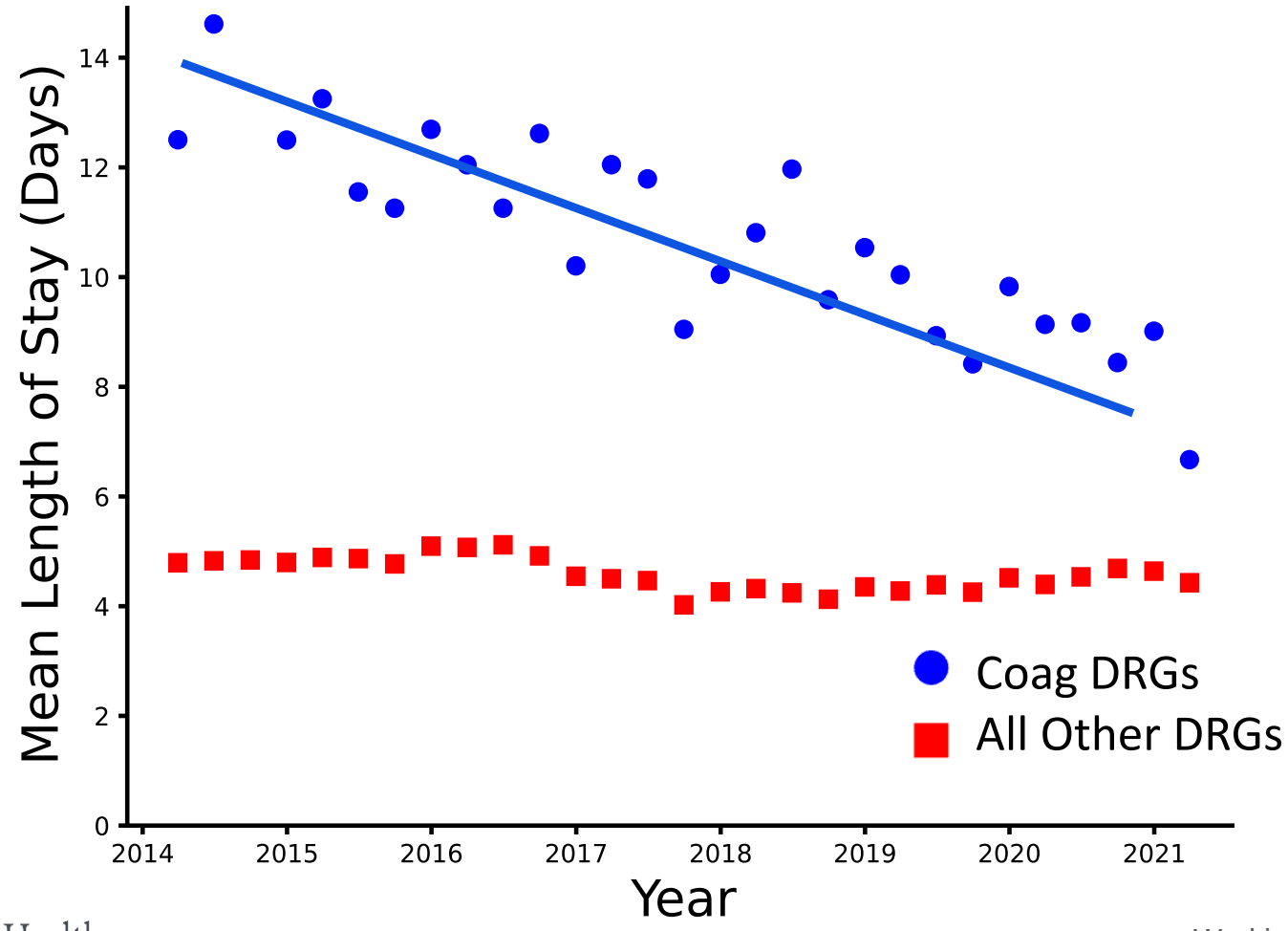
Pharmacogenomics

Anemia

COVID Testing

# Clinical Impact of Two Diagnostic Management Teams

# Length of Stay for Coagulation DRGs vs All Others

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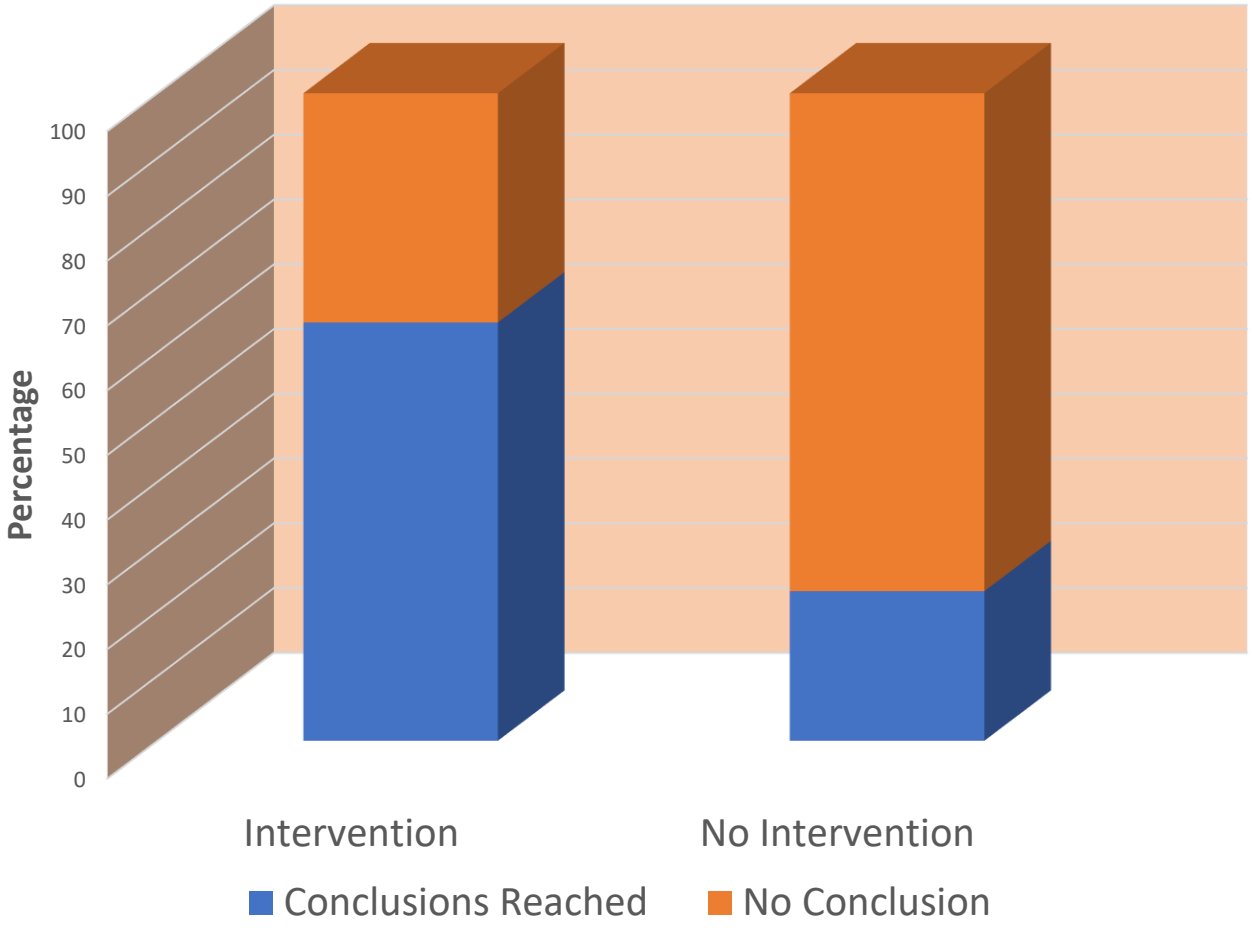
Working Together to Work Wonders

**CJ Zahner et al, submitted**

# Conclusions Reached After Coagulation Testing

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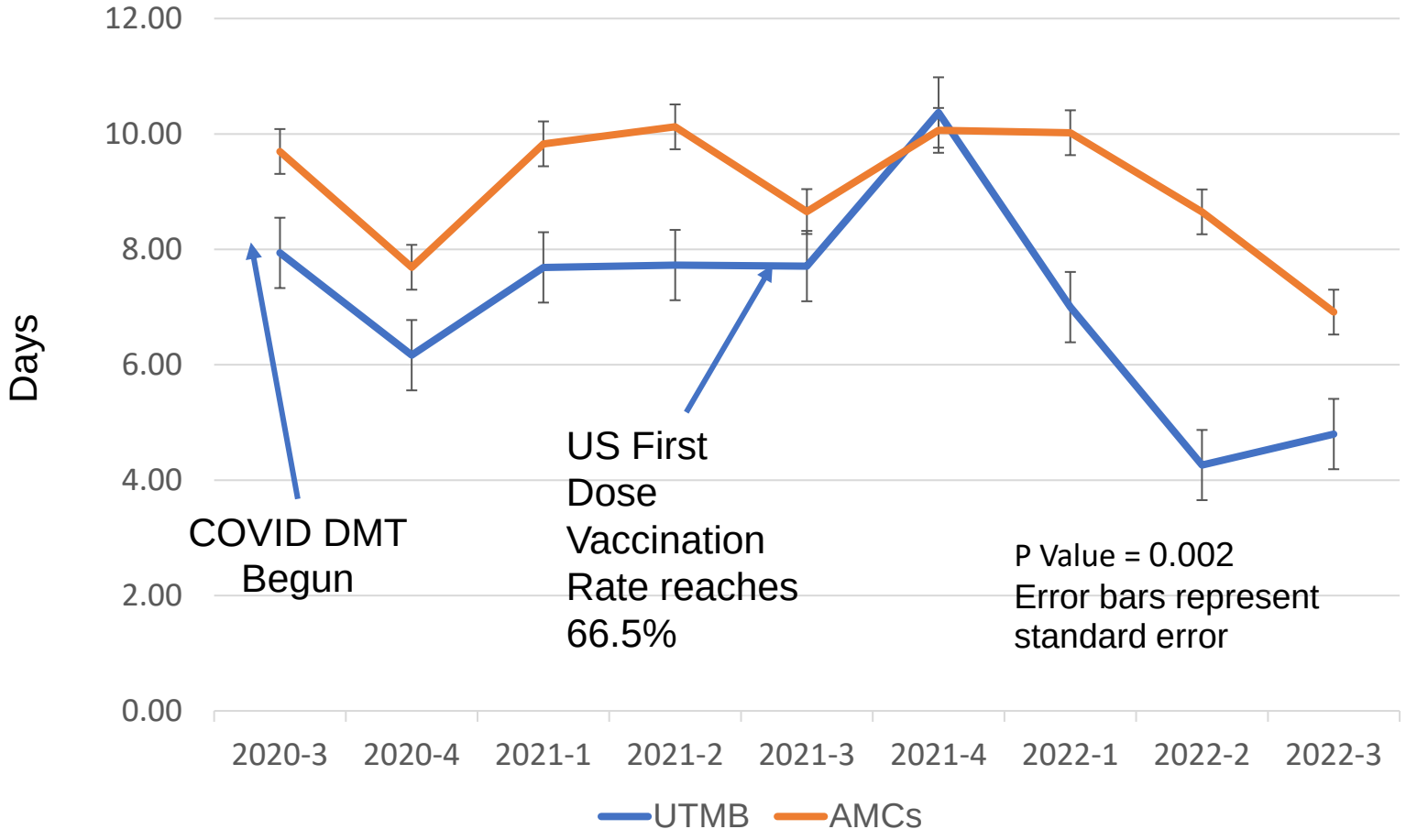
**CJ Zahner et al, submitted**

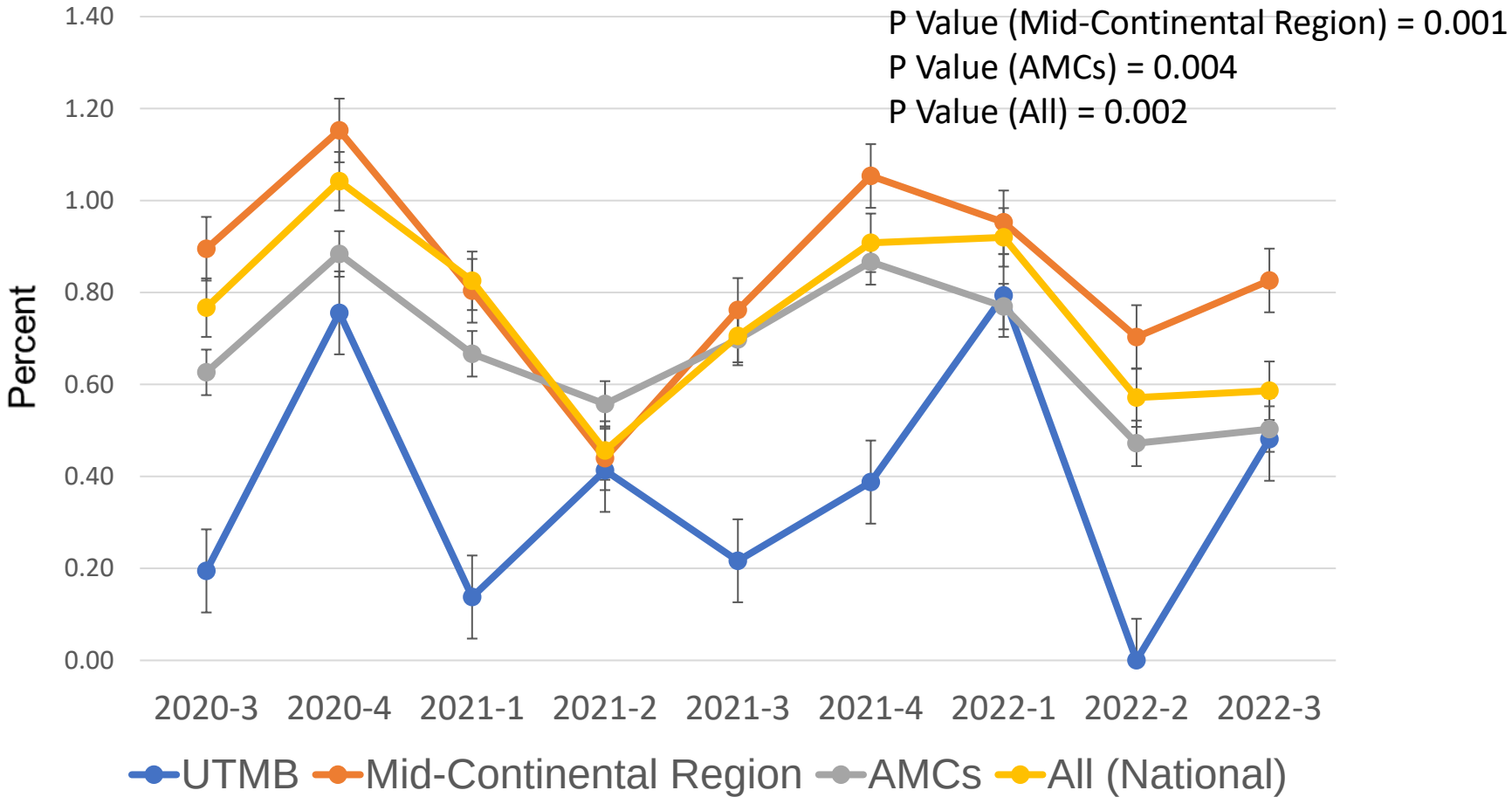
Working Together to Work Wonders

# COVID Length of Stay by Quarter




CJ Zahner et al, submitted

# % Early Deaths




CJ Zahner et al, submitted

# Goals of a DMT

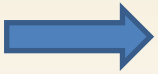
**Involve diagnostic experts with high-level content knowledge to:**

- **Shorten the time to diagnosis**
- **Increase the accuracy of diagnosis**
- **Optimize the utilization of laboratory tests**

# One Plan is to Create a National Diagnostic Management Team with Experts Across the US

# The Flow of Diagnostic Information

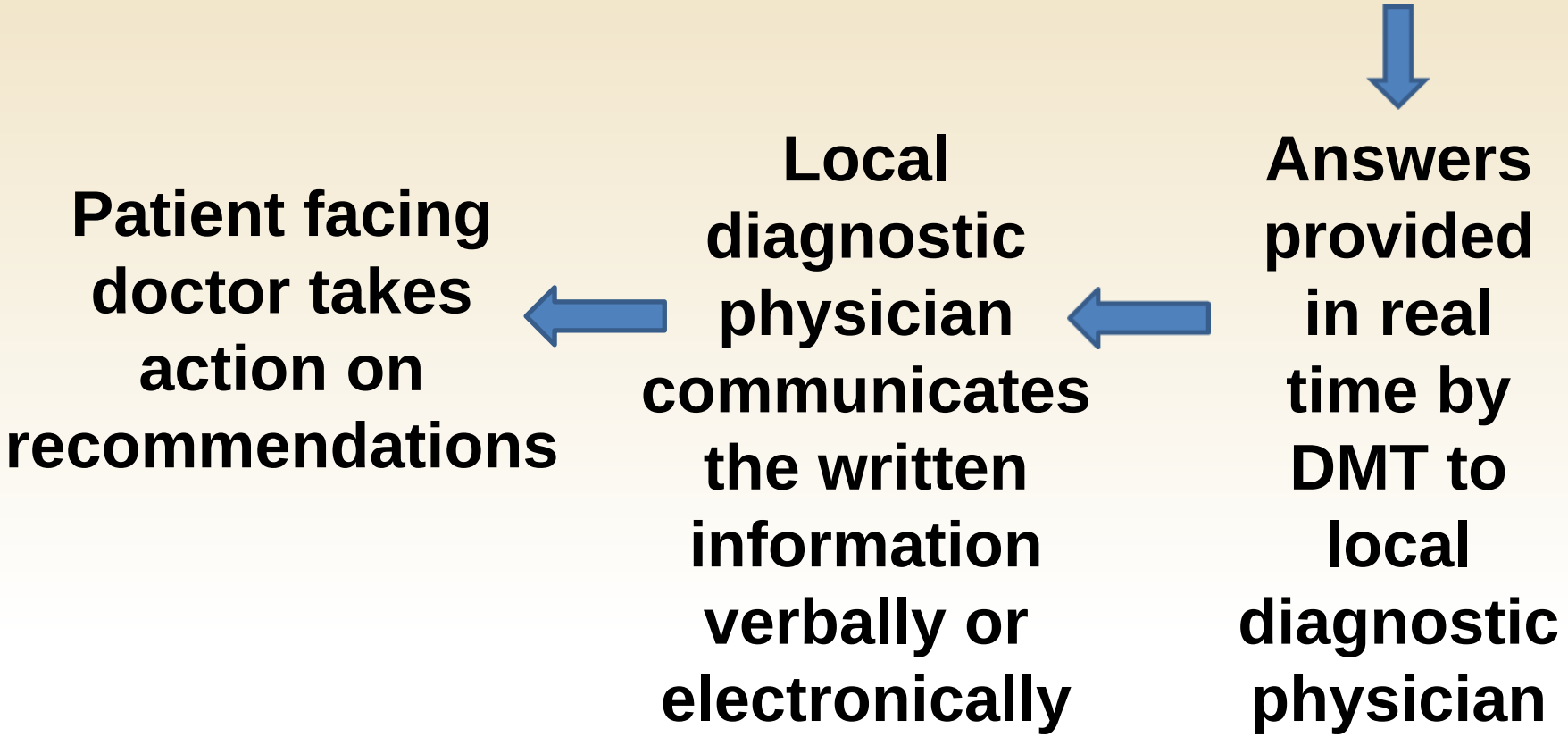
**Patient's initial evaluation generates diagnostic questions from patient facing provider**



**Questions directed to local diagnostic physician by patient facing doctor**

**Diagnostic physician answers questions from personal knowledge and consults one or more available DMTs for others**

# The Flow of Diagnostic Information

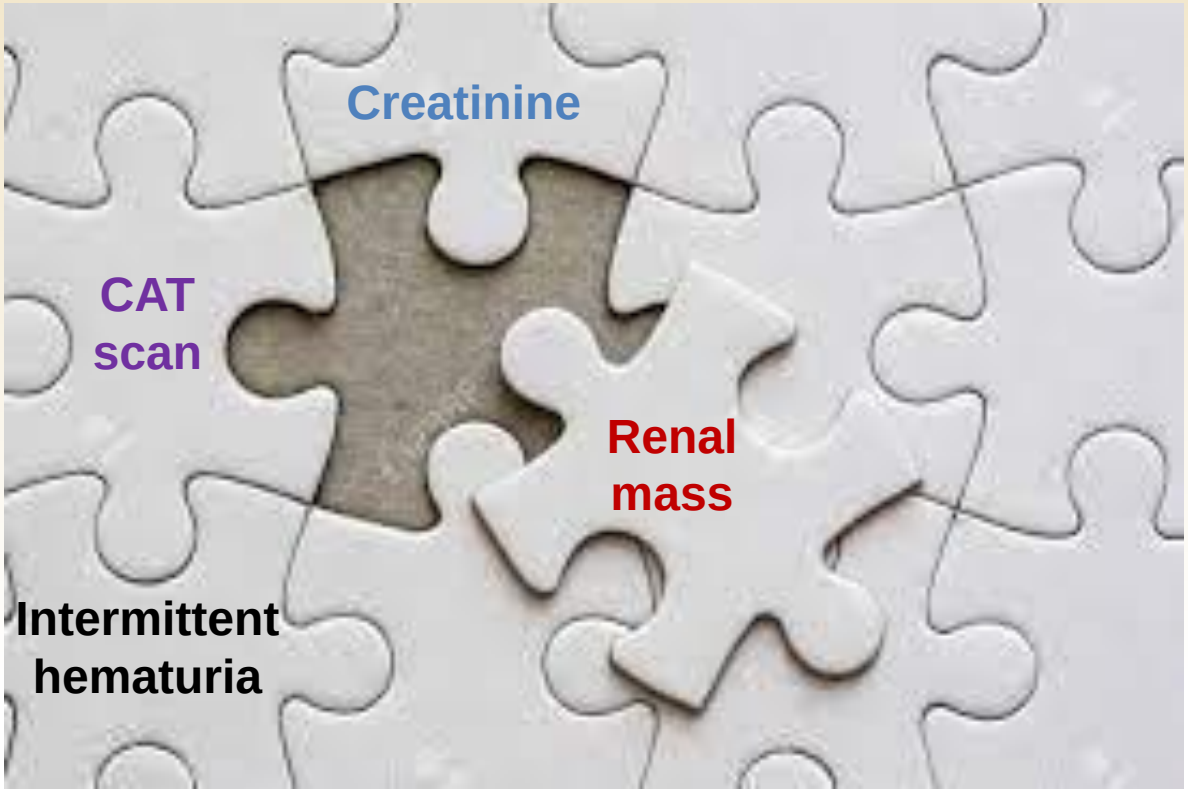


**The DMT integrates all relevant diagnostic information without requiring patient facing clinicians to do so**

**No longer:**

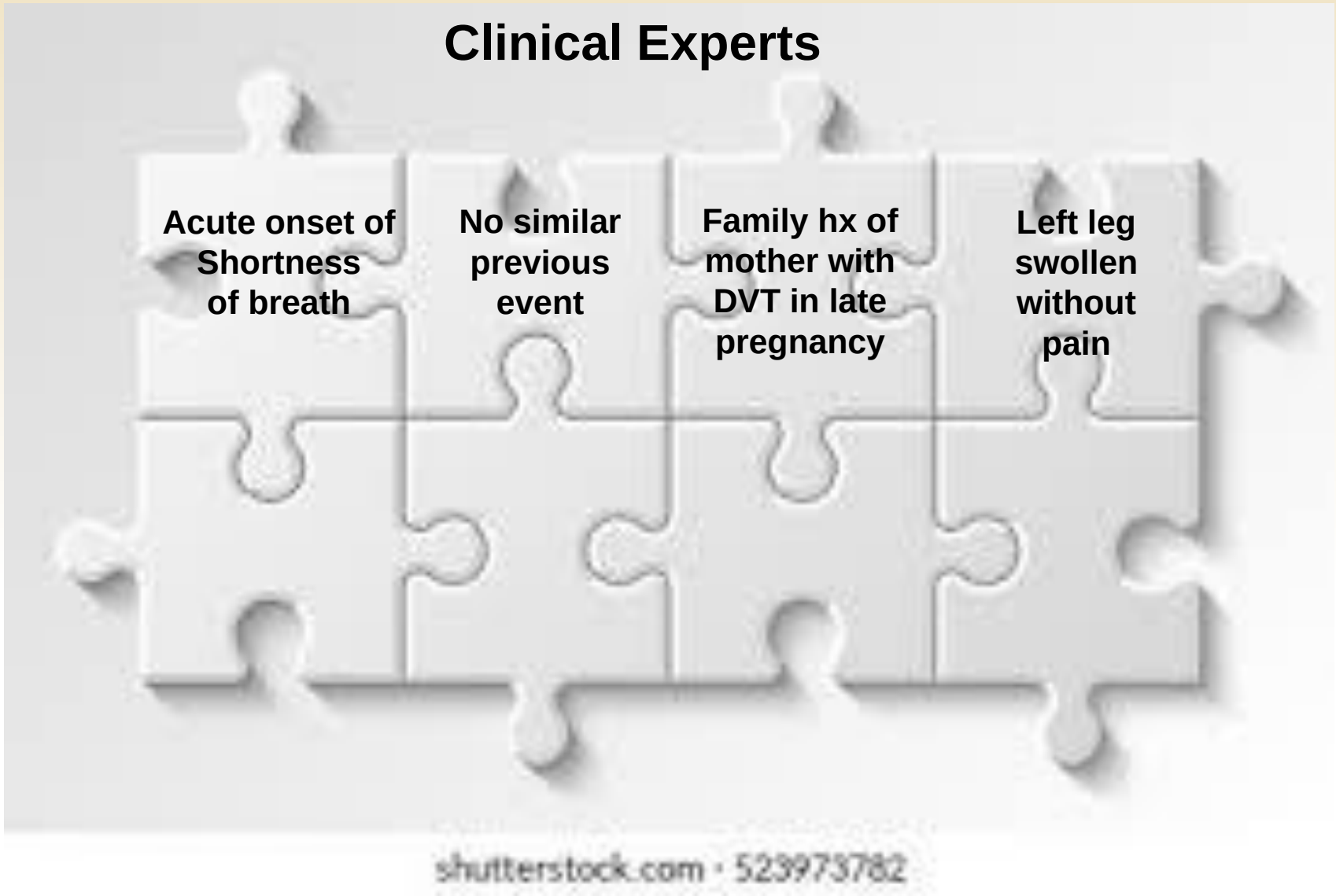
**Order this test → Result →**
**Order next test → Result…**

# Color Codes for Diagnostic Inputs from Each Diagnostic Specialist

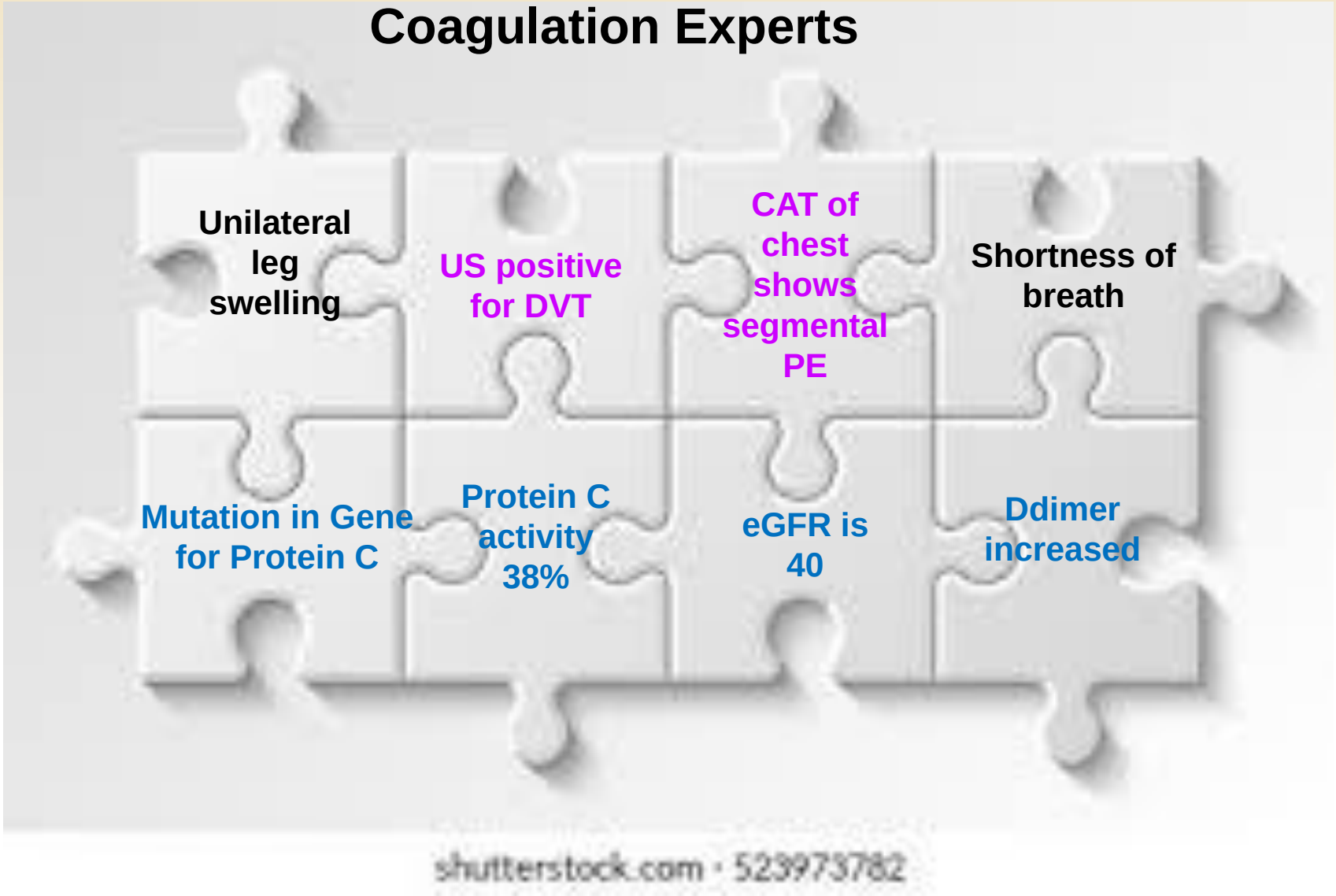



- History and physical exam
- Clinical pathology with genetics
- Anatomic pathology
- Radiology

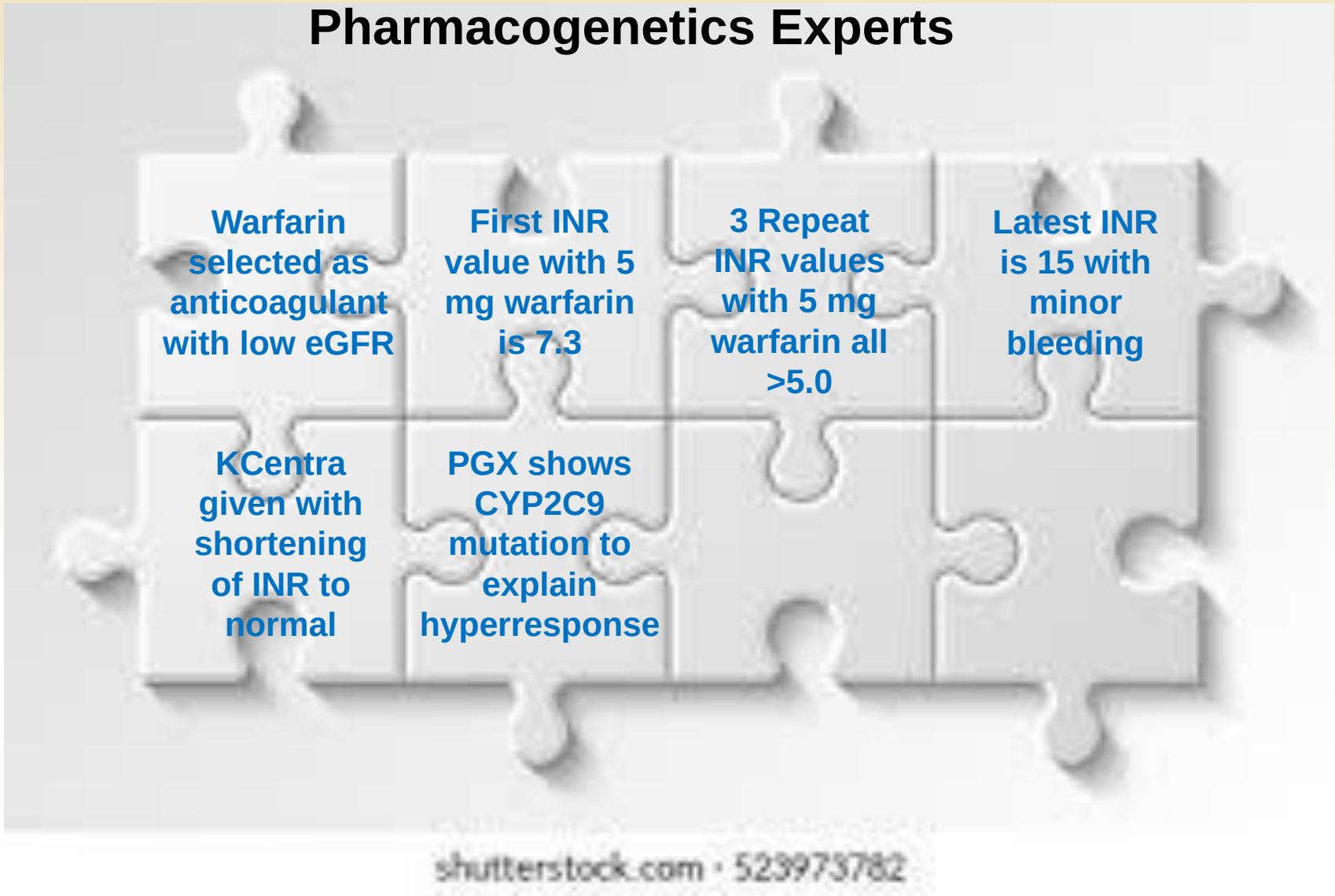
# Diagnostic Information from History of a Case of Deep Vein Thrombosis and Physical Examination



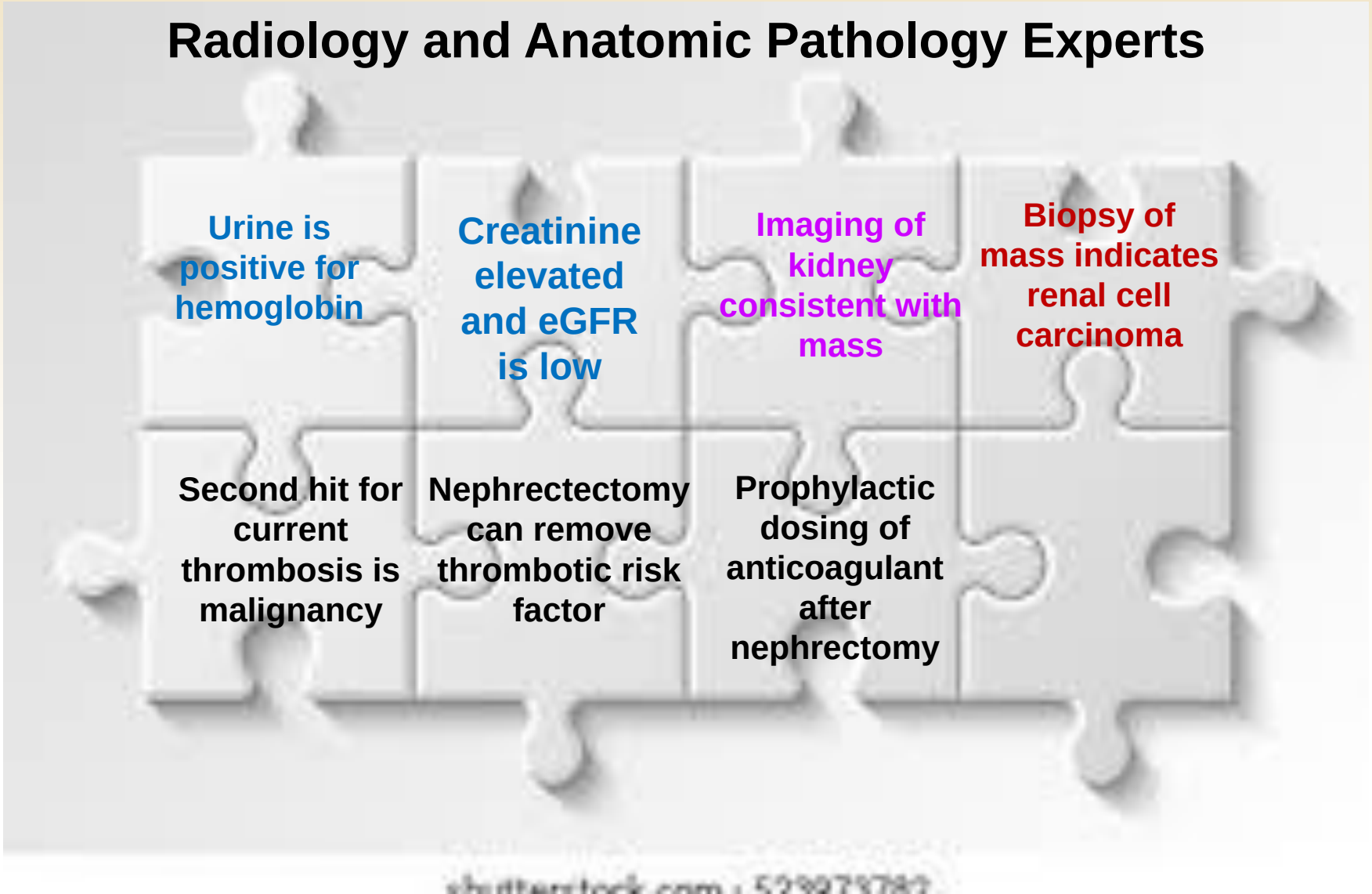
# Evaluation for Presence and Location of Thrombosis and Cause for Thrombosis



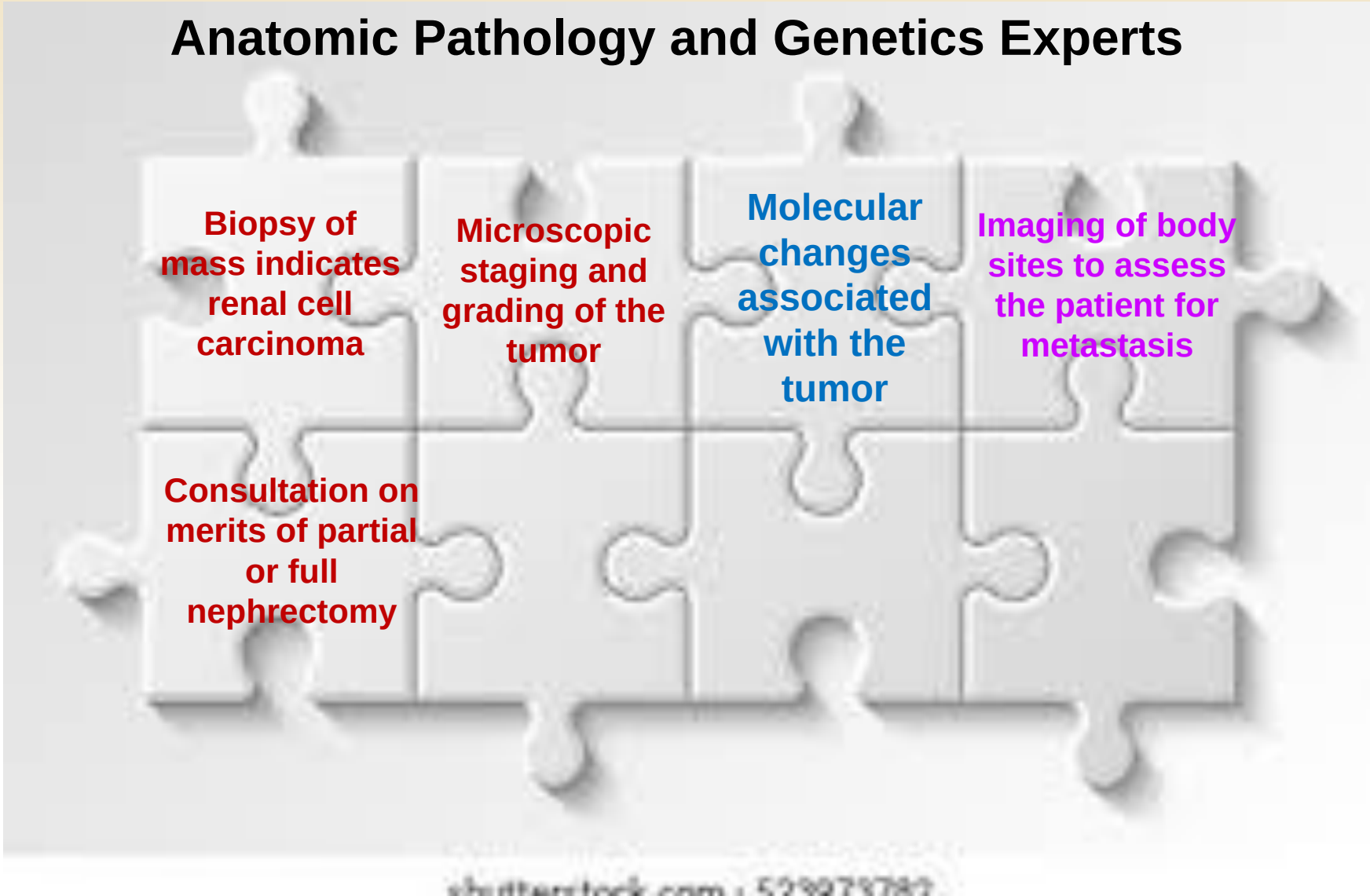
# Evaluating the Selection and Response to Anticoagulant Therapy



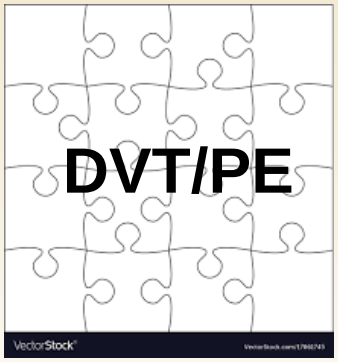
# Further Evaluation for Thrombotic Risk to Identify New "Second Hit" for Thrombosis

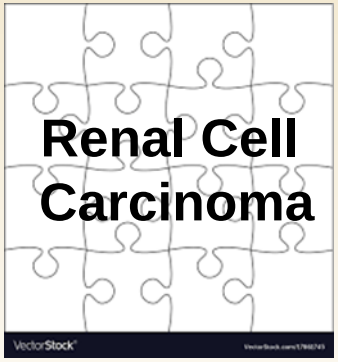


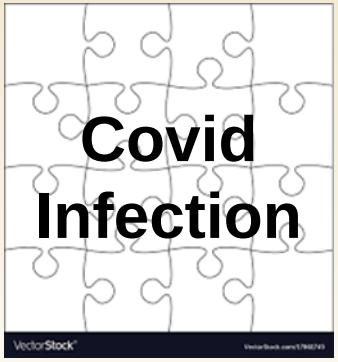
# Evaluation of the Renal Cell Carcinoma

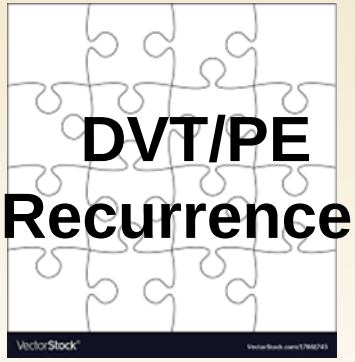


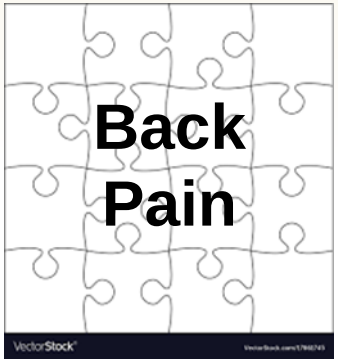
# A lifetime of clinical experiences – look at all the completed puzzles in 10 minutes before seeing the patient for a full patient history

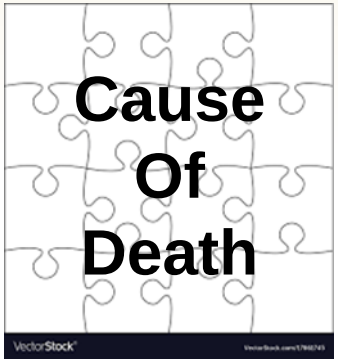




# What Will Surely Happen if Done Well

**Dramatic Increases in the Number of Accurate Diagnoses Will Occur Within a Much Shorter Timeframe of the Patient's Illness**

**Rapid and Accurate Diagnosis will Significantly Reduce the Number of Patients Who Would Otherwise Develop Painful and Expensive Chronic Disease**