Reducing Diagnostic Error: A Practical Workshop

Bob Trowbridge
Harry Hoar
Doug Salvador

Session M11
These presenters have nothing to disclose

December 6, 2015
8:30AM – 4:00 PM

Faculty

- Bob Trowbridge, MD
  Co-Director, Intro to Clinical Reasoning, TUSM
  Director, Faculty Development and General Internal Medicine
  Maine Medical Center

- Harry Hoar III, MD
  Division Chief, Pediatric Hospital Medicine
  Director, Pediatric Simulation
  Baystate Medical Center

- Doug Salvador, MD MPH
  Vice President, Medical Affairs
  Baystate Medical Center
INTRODUCTIONS

WHAT DO YOU WANT TO MAKE SURE WE COVER TODAY?
Session Objectives

- Discuss the epidemiology of diagnostic error
- Describe how cognitive biases contribute to diagnostic error
- Apply a specific tool to analyze diagnostic errors
- Identify methods to minimize errors in diagnosis in the clinical setting

Agenda

- Definition and Impact of Diagnostic Error
- Causes of Diagnostic Error
- Cognitive Errors/How Doctors Think
- Solutions
What is a diagnostic error?

Graber Definition

- A diagnosis that, on the basis of the eventual appreciation of more definitive information, was
  - Unintentionally delayed, or
  - Wrong, or
  - Missed altogether
Singh Definition

- The occurrence of a **missed opportunity** to make the correct diagnosis in a more timely manner

IOM Definition

- The failure to
  - Establish an accurate and timely explanation of the patient's health problem(s) or
  - Communicate that explanation to the patient
A couple of cases

- Split into small groups
- Determine
  - Was this a diagnostic error?

Was this a diagnostic error?

- Seems straightforward, but
  - Require clinical (diagnostic) expertise
  - Subjective
  - Recreating the context is impossible
    - Limited cognitive insight
  - Hindsight bias
How important is diagnostic error?

- Prevalence
- Impact

How Common is Diagnostic Error?

- Overall, likely rate of diagnostic error is about 10-15%
- Error rate varies by specialty and study
  - Anatomic pathology 2-5%
  - ED up to 12%
  - Medical admitting diagnosis ~6%
Ambulatory Medicine

- Examined frequency of diagnostic error via triggers
- 5% of all outpatient visits associated with a diagnostic error
  - 50% of these with potential to cause serious harm
- 12 million Americans affected annually

Pediatrics and Diagnostic Error

- 45% of pediatricians report making a harmful diagnostic error at least once or twice a year
- 5% of pediatric admissions subject to diagnostic error
What does the IOM say?

“It is likely that most of us will experience at least one diagnostic error in our lifetime, sometimes with devastating consequences.”

How important is diagnostic error?

- Prevalence
- Impact
Do these errors matter?

- Account for up to 17% of adverse events
- 40,000-80,000 US hospital deaths per year attributable to diagnostic error
- 5% of all autopsies show a lethal diagnosis that could have been treated ante-mortem

What do these errors look like?

<table>
<thead>
<tr>
<th>Diagnosis</th>
<th>Missed on initial evaluation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stroke</td>
<td>9%</td>
</tr>
<tr>
<td>Sub-arachnoid hemorrhage</td>
<td>5%</td>
</tr>
<tr>
<td>Pulmonary Tb</td>
<td>45%</td>
</tr>
<tr>
<td>Acute Coronary Syndrome</td>
<td>2-3%</td>
</tr>
<tr>
<td>Appendicitis</td>
<td>19%</td>
</tr>
</tbody>
</table>
Do these errors matter?

- Account for up to 17% of adverse events
- 40,000-80,000 US hospital deaths per year attributable to diagnostic error
- 5% of all autopsies show a lethal diagnosis that could have been treated ante-mortem
- Tort claims data

VA Tort Claims 1988-2000

<table>
<thead>
<tr>
<th>Type of Error</th>
<th>Number of Claims</th>
<th>Amount Paid</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surgery-related</td>
<td>2625</td>
<td>$77,000,000</td>
</tr>
<tr>
<td>Medication-related</td>
<td>1309</td>
<td>$27,000,000</td>
</tr>
<tr>
<td>Diagnostic</td>
<td>2477</td>
<td>$93,000,000</td>
</tr>
</tbody>
</table>

J Law Med Ethics 2001; 29:335-345
Closed Claims Review

<table>
<thead>
<tr>
<th>Type of Error</th>
<th>Total Claims</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surgery</td>
<td>29%</td>
</tr>
<tr>
<td>Obstetrics</td>
<td>24%</td>
</tr>
<tr>
<td>Diagnosis</td>
<td>29%</td>
</tr>
<tr>
<td>Medication</td>
<td>18%</td>
</tr>
</tbody>
</table>

NEJM 2006; 354:2024-33

NPDB Review

- Reviewed 25 years of claims
- 350,000 total claims
  - Diagnostic error
    - Leading cause of claims (29%)
    - Highest proportion of pay-outs (35%)
    - More often resulted in death (40%)
    - 25 year sum cost of $38 billion
    - Median cost per claim of $213,000

BMJ Quality and Safety 22: 2013
Claims Paid

Costs related to
- inappropriate/unnecessary testing
- delayed evaluation
- patient dissatisfaction

How important is diagnostic error?

- Prevalence
- Impact
Causes of Diagnostic Error

- Three general categories of diagnostic error
  - “No Fault”
    - Very unusual presentations, patient-related error
  - Systems-related
    - Technical failure, organizational issues
  - Cognitive errors
    - Faults in knowledge, data gathering, information processing or affective issues

Systems-related Errors

- Technical Failures
  - Faulty test or data
  - Lack of appropriate testing
- Organizational Failures
  - Poor coordination of care
  - Inadequate supervision of trainees
  - Poor communication
  - External interference
Causes of Diagnostic Error

- Three general categories of diagnostic error
  - “No Fault”
    - Very unusual presentations, patient-related error
  - Systems-related
    - Technical failure, organizational issues
  - Cognitive errors
    - Faults in knowledge, data gathering, information processing or affective issues

Basis of Cognitive Errors

- Cognitive Errors
  - Faulty knowledge
  - Faulty data gathering
  - Faulty synthesis
  - Affective error
Basis of Cognitive Errors

- Cognitive Errors
  - Faulty knowledge
  - Faulty data gathering
    - Failure to ask or look
    - EMRs
  - Faulty synthesis
  - Affective error

Basis of Cognitive Errors

- Cognitive Errors
  - Faulty knowledge
  - Faulty data gathering
    - Failure to ask or look
    - EMRs
  - Faulty synthesis
  - Affective error
Basis of Cognitive Errors

- Cognitive Errors
  - Faulty knowledge
  - Faulty data gathering
  - Faulty synthesis
    - Premature closure
    - Misjudging the importance of a finding
    - Faulty context generation
  - Affective error

Basis of Cognitive Errors

- Cognitive Errors
  - Faulty knowledge
  - Faulty data gathering
  - Faulty synthesis
  - Affective error
    - Metacognitive failure
Causes of Diagnostic Error

- Three general categories of diagnostic error
  - “No Fault” (7%)
    - Very unusual presentations, patient-related error
  - Systems-related (19%)
    - Technical failure, organizational issues
  - Cognitive errors (28%)
    - Faults in knowledge, data gathering, information processing or affective issues

46%

- No-Fault Factors Only (7%)
- System-Related Error Only (19%)
- Cognitive Error Only (28%)
- Both System-Related and Cognitive Factors (46%)
Cognitive Errors/How Doctors Think
We think in 2 ways: **Fast** and **Slow**
Chicken-sexing: Type 1 reasoning

What are these people feeling?
**Features of ‘System 1’**

- Fast
- Effortless
- Largely below the level of consciousness
- Usually accurate but prone to systematic biases
- Does not understand statistics or logic
- Unable to be turned off

**Vulcan logic: Type 2 reasoning**
17 x 24 = ?

Features of ‘System 2’

- Effortful
- Accurate

Muscles tense, HR increases, BP increases, pupils dilate
Diagnosis: Chicken-sexing or vulcan logic?

We are all chicken-sexers (with Vulcan potential).
The interaction of system 1 and system 2

11/24/2015

**Heuristics**

- Shortcuts or “rules of thumb” that are learned “on the job”
- Quick, practical, and usually adequate
- > 60 different heuristics have been described in medicine
- Classic example- representativeness heuristic: If it looks like a duck, quacks like a duck...

It’s usually a duck..., but not always.

Illness Scripts

- Stored mental model for a particular diagnosis
- ‘Script’ is composed of the predisposing conditions, pathophysiologic cause, and clinical manifestations of the disorder
- Diagnosis involves mentally scanning for the illness script that most closely resembles the clinical presentation

We are all chicken-sexers with Vulcan potential.

A Quiz

(Eight seconds per question; write down your answers)
A bat and a ball cost $1.10 in total. The bat costs $1.00 more than the ball.

How much does the ball cost?

If it takes 5 machines 5 minutes to make 5 widgets, how long would it take 100 machines to make 100 widgets?
In a lake, there is a patch of lily pads. Every day, the patch doubles in size. If it takes 48 days for the patch to cover the entire lake, how long would it take for the patch to cover half the lake?

Now we’ll go back and you can check your answers.

Take as much time as you like.
A bat and a ball cost $1.10 in total. The bat costs $1.00 more than the ball.

How much does the ball cost?

If it takes 5 machines 5 minutes to make 5 widgets, how long would it take 100 machines to make 100 widgets?
In a lake, there is a patch of lily pads. Every day, the patch doubles in size. If it takes 48 days for the patch to cover the entire lake, how long would it take for the patch to cover half the lake?

Correct answers:

- 5 cents
- 5 days
- 47 days
We are all chicken-sexers with Vulcan potential.
System 1 Failures - Cognitive and Affective Biases
How fast were the cars going when they **bumped** into each other?

How fast were the cars going when they **smashed** into each other?
Framing effects (framing bias)

- The manner in which a case is presented (framed) influences subsequent thinking about the case

Write down the last 2 digits of your SSN
How much would you pay for this bottle of wine?

Crisp and vibrant, gaining lift to the structure from acidity and fine tannins, with dark berry and coffee flavors. Lingers pleasantly. Rating: 87 - Wine Spectator

Anchoring

- Relying too heavily on initial impressions and failing to adequately adjust in light of new information
- “You never get a second chance to make a first impression”
Why We Taste Blind

There’s a reason that status of justice portray a woman wearing a blindfold. Impartiality is crucial to fairness; good judges base their decisions on facts, not偏见.

At Wine Spectator, this simple truth stands as the foundation of our wine ratings. We believe that evaluating wines blind ensures that our tastes remain impartial and that our reviews are unbiased, with all wines presented on a level playing field.

You may be surprised to learn that not all wine writers share this approach. Some critics review wines non-blind, and even alongside the winemakers at the wineries. They argue that honesty and independence can overcome the expectations that are inevitably triggered by knowing the identity of a wine, its reputation and its price. We respectfully disagree.

Avoiding Bias

Simply put, in a blind tasting the taster is deprived of information that may bias his or her judgment of the wine in the glass.

Now, you may think that a conscientious taster should be able to ignore the influence of extraneous factors. But research has shown that it’s not so easy. We are all very prone to a cognitive error called “confirmation bias,” which plays a large, but largely unacknowledged, role in everyday judgment.

The distorting effects of confirmation bias are easy to demonstrate when it comes to wine. A famous experiment that took place in 2003 is a case in point.

Fredrich Bochet, a professor at the University of Bordeaux School of Enology, gave 51 people tastes of two red wines. One was labeled as a simple vin de table, the other as a prestigious Grand Cru.

The tasters described the two samples in very different terms. The “Grand Cru” received more positive descriptors than the “vin de table”. 40 called it “good,” as opposed to only six using that term for the “loser” wine. Conversely, the “vin de table” was described as “weak” by 22 tasters, compared with only nine using that term for the “better” wine. In fact, it was all the same wine: a red Bordeaux whose quality level fell between the extremes of the two false labels.

Confirmation bias

- The tendency to look for evidence that confirms our suspicions and ignore or misinterpret data that does not
More fun with wine…

$13 $90

Think, pair, share…
- Refer back to the case
- Think about any examples of framing, anchoring, and confirmation bias that occurred in this case
- Turn to someone next to you and discuss
- Share as a group
The cognitive cascade

DIAGNOSIS MOMENTUM

ANCHORING

FRAMING

CONFIRMATION

BIAS

PREMATURE

CLOSURE

Diagnosis Momentum

- Tendency for a particular diagnosis to become established without adequate evidence.
- The farther along it gets, the more momentum it has and the less likely anyone is to question the diagnosis.

Premature closure

- Concluding that a patient has a particular diagnosis before there is actually enough evidence to make that diagnosis
- Premature closure tends to stop any further thinking about the diagnosis
Think, pair, share…

- Refer back to the case
- Think about how the provider’s affect/emotional state(s) may have influenced their decisions
- Turn to someone next to you and discuss
- Share as a group
### Principal Characteristics of Type 1 and Type 2 Decision-Making Processes*

<table>
<thead>
<tr>
<th>Cognitive style</th>
<th>Type 1: Heuristic, intuitive</th>
<th>Type 2: Systematic, analytical</th>
</tr>
</thead>
<tbody>
<tr>
<td>Computational principle</td>
<td>Associative</td>
<td>Rule based</td>
</tr>
<tr>
<td>Responsiveness</td>
<td>Passive</td>
<td>Active</td>
</tr>
<tr>
<td>Capacity</td>
<td>High</td>
<td>Limited</td>
</tr>
<tr>
<td>Cognitive awareness/control</td>
<td>Low</td>
<td>High</td>
</tr>
<tr>
<td>Automaticity</td>
<td>High</td>
<td>Low</td>
</tr>
<tr>
<td>Rate</td>
<td>Fast</td>
<td>Slow</td>
</tr>
<tr>
<td>Reliability</td>
<td>Low</td>
<td>High</td>
</tr>
<tr>
<td>Errors</td>
<td>Relatively common</td>
<td>Rare</td>
</tr>
<tr>
<td>Effort</td>
<td>Low</td>
<td>High</td>
</tr>
<tr>
<td>Emotional attachment</td>
<td>High</td>
<td>Low</td>
</tr>
<tr>
<td>Scientific rigor</td>
<td>Low</td>
<td>High</td>
</tr>
</tbody>
</table>

System 2 failures are caused by:

- Inattentiveness
- Distractions
- Fatigue
- Time pressure
- Incomplete information
- Cognitive “miserliness”

“System 2 approaches can be employed by well-rested, well-slept decision makers under conditions in which there are no distractions or untoward intrusion of affect and all the required data are available.”
Creating better diagnosticians

- Teach trainees about the diagnostic process
  - Metacognition
  - Cognitive debiasing
- Make system 1 more accurate
  - Experience matters
  - Progressive problem solving
  - Feedback on diagnostic decisions
- Activate system 2 more frequently
  - Cognitive forcing strategies
  - Checklists
  - With time, activating system 2 can become automated...

Teach trainees about the diagnostic process

- Metacognition
- Cognitive debiasing

Context
Ambient conditions
Task difficulty
Task ambiguity
Affective state
Modular responsibility

Type 1 Processes
- Pattern Recognition
- Repetition
- Calibration
- Diagnosis

Type 2 Processes
- Pattern Processor
- Intellectual ability
  - Education
  - Training
  - Critical thinking
  - Logical competence
  - Rationality
  - Feedback

Make system 1 more accurate
Experience matters
Progressive problem solving
Feedback on diagnostic decisions

Activate system 2 more frequently
Cognitive forcing strategies
Checklists
With time, activating system 2 can become automated...

"There are some things they don't teach you in medical school. I think you've got one of those things."

SOLUTIONS
What are you doing at your institution to improve diagnosis?

Improving Diagnosis

- National Academies Report Goals
- Diagnostic Process
- System1 and System 2 Processing
National Academies Report Goals

- Facilitate more effective teamwork in the diagnostic process – HC professionals, patient, families
- Enhance HC professional education and training in the diagnostic process
- Ensure health information technologies support the diagnostic process
- Develop and deploy approaches to identify, learn from, and reduce diagnostic errors in clinical practice
- Establish a work system and culture that supports the diagnostic process and improvements in diagnostic performance
- Medical liability, payment system, research funding

National Academies Goals

- Teamwork
- Education and Training ✓
- Health Information Technology
- Learn from Diagnostic Errors ✓
- System and Culture
National Academies Goals

- **Teamwork**
- **Education and Training**
- **Health Information Technology**
- **Learn from Diagnostic Errors**
- **System and Culture**

**Figure 3.2** Places in the diagnostic process where failures can occur that contribute to diagnostic errors.
Patients are Members of the Team!

Velma Payne, DEM conference 2014

- Recruited 35 patients and family members
- Patient Stereotyping
  - Labelling
  - Assumed Mental Health Issue
- Lack of Respect
  - Not Listening to Patients
  - Dismissive of Patient Views
- Resident Supervision
Sir William Osler

"Listen to your patient, he is telling you the diagnosis"

What about the role of nurses?
Improving the Diagnostic Process: Steps EVERY nurse could take NOW

1. Know the major diagnoses of your patients
2. Be the voice of your patients and their advocate in navigating their health care
3. Be the eyes of the diagnostic team in detecting, reporting and documenting changes in your patients' symptoms, signs, complaints, or conditions
4. Be the monitor of the diagnostic team. Is your patient responding to treatment as expected?

5. Help optimize communication between your patient and the care team
6. Be the watchdog for appropriate care coordination
7. Educate patients about the diagnostic process
8. Learn about how diagnostic errors arise and how they can be avoided
Support interprofessional and intra-professional teamwork in the diagnostic process

Diagnostic Management Teams
Vanderbilt – Michael Laposata

Coagulation Rounds

- Neurology
- Cardiology
- Rheumatology
- Hematology
- Oncology
- Ob-Gyn
- Multiple Attendings
- Expert Driven, Patient Specific Diagnostic Interpretation
- Financial Benefits: On Test Selection On Diagnosis But Difficult to Quantify
- Diagnostic Test Selection Algorithms Selected by Treating Physicians
This patient has an elevated PTT, with a normal PT/INR and normal thrombin time.

A PTT mixing study failed to correct into the normal range. These results were consistent with the presence of an inhibitor (such as a lupus anticoagulant) in the sample.

The Dilute Russell Viper Venom time (dRVVT) is used for detection of Lupus Anticoagulant, and the test was positive, indicating the presence of Lupus Anticoagulant.

Taken together, this is a patient with a prolonged PTT based upon the presence of a lupus anticoagulant.

National Academies Goals

- Teamwork
- Education and Training
- Health Information Technology
- Learn from Diagnostic Errors
- System and Culture
KP Safety Nets, since 2009

**Kaiser Permanente Creatinine Safety Program: A Mechanism to Ensure Widespread Detection and Care for Chronic Kidney Disease**

John J. Sim, MD; Mark P. Kutkowsk, MD; David C. Selevan, BS; Michael Batech, BPh; Renay Timmins, RN; Jeff M. Slezak, MS; Steven J. Jacobson, MD, FACP; Michael K. Kanter, MD

Department of Nephrology and Hypertension, Kaiser Permanente Los Angeles Medical Center, Los Angeles, Calif. Regional Quality and Clinical Analytics, Kaiser Permanente Southern California Region, Kaiser Permanente Southern California, Pasadena. Department of Research and Evaluation, Kaiser Permanente Southern California, Pasadena.

**ABSTRACT**

**BACKGROUND:** Chronic kidney disease is highly prevalent but is challenging to diagnose because of the need to establish chronicity. Within the current healthcare environment, a single abnormal creatinine measurement often can go unrecognized, which can lead to missed diagnoses or diagnostic errors. The Kaiser Permanente Southern California creatinine safety program (Creatinine SureNet) was created to help ensure that all single abnormal results were followed up.

**METHODS:** In the period February 1, 2010, to March 1, 2014, the electronic health results were used to capture individuals with single abnormal creatinine results that went >90 days without a repeat measurement. A continued effort among a centralized region and providers was used to communicate with patients and order a repeat creatinine measurement.

**RESULTS:** A total of 12,366 individuals were identified (34% ambulatory care encounter). A total of 698 individuals (52%) followed up with a repeat measurement. Female patients, non-Hispanic white, and older individuals were more likely to obtain a repeat measurement. Subsequently, 366 individuals had chronic kidney disease confirmed. Within 6 months, 150 patients had chart documentation of their chronic kidney disease and 366 patients had a laboratory consultation.

**CLINICAL SIGNIFICANCE**

- The Kaiser Permanente creatinine safety program (SureNet) sought to confirm or rule out chronic kidney disease in people with a single abnormal creatinine measurement and no repeat measurement beyond 90 days.
- By using an electronic health record-based approach, 12,366 individuals were captured in the SureNet program over a 5-year period.
- The program led to 6981 persons (52%) obtaining a repeat creatinine measurement, in whom chronic kidney disease was confirmed in 366.

Larry Weed

“...minds are constrained in two ways that no training can overcome: limited capacities for information retrieval and processing, plus heuristics and biases built into human cognition.... It is pointless for diagnosticians to try to recognize and overcome their cognitive limits and vulnerabilities. The point is not to overcome these human constraints but to bypass them altogether....”

Weed LL and Weed L, Diagnosis 2014; 1(1):13-17

---

National Academies Goals

- Teamwork
- Education and Training
- Health Information Technology
- Learn from Diagnostic Errors
- System and Culture
Modified Graber Checklist

- Obtain a complete history
- Perform a complete but focused exam
- Use a systematic approach to obtain diagnostic possibilities to be considered
- Take time to pause and reflect (SAFER)
- Be a skeptic

Ely JW, Diagnosis 2014;1(1):131-34
Winters BD et al, Academic Medicine 2011;86(3):279-81

Diagnostic Checklist in Action
Diagnostic Checklist

- **SAFER**
  - Serious diagnoses
  - Alternative diagnoses
  - Feelings affecting thinking
  - Extraneous data…is it really extraneous?
  - Reasons why this happened

Diagnostic Pause Exercise

- Please form groups of 2 or 3 people

- Read the exercise handout

- One person take the role of attending and lead the group through the SAFER checklist
CULTURE

Psychological Safety
The Impact of Rudeness on Medical Team Performance: A Randomized Trial

Background and Objectives: Introgenesis often results from performance deficiencies among medical team members. Team-targeted rudeness may underline such performance deficiencies, with individuals exposed to rude behavior being less helpful and cooperative. Our objective was to explore the impact of rudeness on the performance of medical teams.

Methods: Twenty-four NICU teams participated in a training simulation involving a preterm infant whose condition acutely deteriorated due to necrotizing enterocolitis. Participants were informed that a foreign expert on team reflexivity in medicine would observe them. Teams were randomly assigned to either exposure to rudeness (in which the expert’s comments included mildly rude statements completely unrelated to the teams’ performance) or control.

Diagnostic Performance

<table>
<thead>
<tr>
<th>Variable</th>
<th>Control Group Mean (n = 33)</th>
<th>Rudeness Group Mean (n = 35)</th>
<th>t Test</th>
<th>P (One-Tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diagnosed respiratory distress</td>
<td>3.59 (1.07)</td>
<td>3.29 (1.00)</td>
<td>0.772</td>
<td>.2215</td>
</tr>
<tr>
<td>Diagnosed shock</td>
<td>2.68 (1.32)</td>
<td>2.08 (1.08)</td>
<td>2.359**</td>
<td>.0445</td>
</tr>
<tr>
<td>Suspected infection</td>
<td>3.13 (1.01)</td>
<td>3.06 (1.13)</td>
<td>0.372</td>
<td>.3535</td>
</tr>
<tr>
<td>Diagnosed NEC</td>
<td>3.08 (1.23)</td>
<td>2.82 (0.85)</td>
<td>1.76*</td>
<td>.0415</td>
</tr>
<tr>
<td>Good stage 1 diagnostic skills</td>
<td>3.52 (0.89)</td>
<td>2.71 (0.73)</td>
<td>1.886</td>
<td>.0595</td>
</tr>
<tr>
<td>Diagnosed deterioration</td>
<td>4.05 (0.75)</td>
<td>3.54 (0.89)</td>
<td>2.562**</td>
<td>.0435</td>
</tr>
<tr>
<td>Suspected perforation of bowel</td>
<td>2.99 (1.47)</td>
<td>2.94 (0.86)</td>
<td>0.297*</td>
<td>.7715</td>
</tr>
<tr>
<td>Diagnosed cardiac tamponade</td>
<td>3.18 (1.30)</td>
<td>2.15 (1.10)</td>
<td>2.714**</td>
<td>.0401</td>
</tr>
<tr>
<td>Good stage 2 diagnostic skills</td>
<td>3.13 (1.21)</td>
<td>2.35 (1.07)</td>
<td>2.881**</td>
<td>.0025</td>
</tr>
<tr>
<td>Overall diagnostic</td>
<td>3.18 (0.82)</td>
<td>2.85 (0.89)</td>
<td>2.799**</td>
<td>.0053</td>
</tr>
</tbody>
</table>

*P < .05, **P < .01.
TABLE 1: Comparison of Mean Procedural Performance Variables (N = 72)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Control Group (n = 33)</th>
<th>Rudeness Group (n = 39)</th>
<th>t Test</th>
<th>P (One-Tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Performed resuscitation well</td>
<td>3.05 ± 0.04</td>
<td>2.49 ± 0.73</td>
<td>3.00</td>
<td>.002</td>
</tr>
<tr>
<td>Vented well</td>
<td>3.43 ± 0.84</td>
<td>3.01 ± 0.81</td>
<td>2.026</td>
<td>.0023</td>
</tr>
<tr>
<td>Verified place of tube well</td>
<td>3.56 ± 0.88</td>
<td>2.85 ± 0.82</td>
<td>3.466</td>
<td>.0005</td>
</tr>
<tr>
<td>Asked for right radiographs</td>
<td>3.29 ± 1.23</td>
<td>2.96 ± 1.00</td>
<td>0.994</td>
<td>.322</td>
</tr>
<tr>
<td>Asked for right laboratory tests</td>
<td>3.78 ± 0.80</td>
<td>3.24 ± 0.84</td>
<td>2.597</td>
<td>.010</td>
</tr>
<tr>
<td>Gave right resuscitation medications</td>
<td>3.55 ± 0.81</td>
<td>3.17 ± 1.08</td>
<td>1.650</td>
<td>.093</td>
</tr>
<tr>
<td>Stopped permanent control line on time</td>
<td>2.95 ± 1.33</td>
<td>2.56 ± 1.44</td>
<td>1.764</td>
<td>.041</td>
</tr>
<tr>
<td>Prepared and performed pericardiotomies</td>
<td>2.71 ± 1.55</td>
<td>2.24 ± 1.39</td>
<td>1.301</td>
<td>.099</td>
</tr>
<tr>
<td>Good general technical skills</td>
<td>3.17 ± 0.88</td>
<td>2.81 ± 0.73</td>
<td>2.098</td>
<td>.025</td>
</tr>
<tr>
<td>Overall procedural</td>
<td>3.26 ± 0.72</td>
<td>2.77 ± 0.67</td>
<td>2.974</td>
<td>.0032</td>
</tr>
</tbody>
</table>

*P < .05, **P < .01

FIGURE 1: Path model of the effect of rudeness on performance, mediated by information sharing and help-seeking. Numbers denote standardized coefficients for the mediation path shown by the arrow. The relationship between information sharing and help-seeking was .67. The relationship between information sharing and procedural performance and between help-seeking and diagnostic performance were not significant. *P < .05, **P < .01.
Solutions

- Teamwork
- Education and Training
- Health Information Technology
- Learn from Diagnostic Errors
- System and Culture
  - Diagnostic Environment

Wrap Up
First Year Medical Student

https://www.youtube.com/watch?v=V8l8_G_ce_Q

Diagnosis Celebration

https://www.youtube.com/watch?v=rRBq-6IVxzU&feature=related