**General Session:** Diagnostic Error in Medicine — The Next Imperative for Patient Safety

Speaker: Mark Graber

Northland Ballroom

Thursday, Oct. 27

2:40 – 3:40 p.m.

**Sponsored by:**

![MMIC Logo]

**Partnering for Safer Care**
Mark L. Graber, M.D., FACP

Mark L. Graber is a graduate of Yale College and the Stanford University School of Medicine. He is an internist and has worked in the VA health care system for 35 years. He is a senior fellow at RTI International, professor emeritus of medicine at the State University of New York at Stony Brook, and president of the Society to Improve Diagnosis in Medicine.

Dr Graber is a national leader in the field of patient safety and originated Patient Safety Awareness Week in 2002, an event now recognized internationally.

He is also a pioneer in efforts to address diagnostic errors in medicine. In 2008 he originated the Diagnostic Error in Medicine conference series, in 2011 he founded the Society to Improve Diagnosis in Medicine (www.improvediagnosis.org), and in 2014 he launched a new journal, DIAGNOSIS, devoted to improving the quality and safety of diagnosis and reducing diagnostic error.

Dr Graber received the 2014 John M Eisenberg Award from The Joint Commission and the National Quality Forum, recognizing individual achievement advancing patient safety.
VISION: We envision a world where diagnosis is accurate, timely, efficient, & SAFE; where no patients are harmed by diagnostic error.
Objectives

How likely is diagnostic error?
What are the major causes?
(How do doctors think?)
What can we do about this?
The Case: Rory Staunton

Wednesday:
12-year-old boy
3 days earlier: Scraped knee
Wakes from sleep:
Feels sick, chills, vomiting, pain at the abrasion site

Thursday, 6 PM – Pediatrician
Feels worse; Family calls pediatrician

- CC: vomiting, fever, weak, leg pain
- PE: T102; HR 140; RR36; BP 100/60
  - Skin: mottled; Abd benign
- ASSESSMENT: Gastroenteritis; Call made to ER
Thursday, 9 PM – Emergency Dept

– PE: T 100; HR 143; RR 20; BP 94/46
  • Abd benign; No skin exam documented
– ASSESSMENT: Gastroenteritis
– LABS: (Return after discharge): WBC 14.7 with 53% bands
– ASSESSMENT: Gastroenteritis
– PLAN: ondansetron, NS IV 1 L, home

Friday:
– Sx: fever, feels sick, skin sensitive to touch, turning splotchy and blue with red spots
– Family calls pediatrician multiple times: Advised acetaminophen

Saturday:
– Returns to ER, admitted to ICU;
– Dx = Strep sepsis.

Sunday: Dies in the ICU
Knowing is not enough, we must apply
Willing is not enough, we must do

Recommendations   Practice Improvement

Definition of Diagnostic Error
The failure to:
(a) establish an accurate and timely explanation of the patient’s health problem(s)
or
(b) communicate that explanation to the patient

The single biggest problem in communication is the illusion that it has taken place. George Bernard Shaw
Test Result Management
How Are We Doing?

Eric Poon et al: Survey of 168 primary care providers, all using an EMR

2004;164(20):2223-2228

Do you have a reliable system for tracking test results that you have ordered on patients from start to finish?

48%

Keep NO record of tests ordered
In the past 2 months can you recall at least 1 test result that upon review you wish you had known the results earlier?

81 %

Had 1 or more significant delays in the past 2 months

What Is the Incidence of Diagnostic Error?
What would you estimate the diagnostic error rate to be in your own practice?

A. 10% or more (weekly)
B. 1% (monthly)
C. almost never

Think about yourself and your family:

Can you recall when a diagnosis you were given was wrong?

Can you recall when a diagnosis could have been made much earlier?

Is there someone with a medical condition that is still causing symptoms but hasn’t been diagnosed?
Claims Data: High-severity Cases
Top allegation category: Diagnosis Error

<table>
<thead>
<tr>
<th></th>
<th>Claim Count</th>
<th>Total Incurred</th>
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<tbody>
<tr>
<td>Dx-related</td>
<td>250</td>
<td>$200,000,000</td>
</tr>
<tr>
<td>Surgical Tx</td>
<td>150</td>
<td>$150,000,000</td>
</tr>
<tr>
<td>Treatment Tx</td>
<td>100</td>
<td>$100,000,000</td>
</tr>
<tr>
<td>Obst-related Tx</td>
<td>50</td>
<td>$50,000,000</td>
</tr>
<tr>
<td>Med-related</td>
<td>100</td>
<td>$100,000,000</td>
</tr>
</tbody>
</table>

N=584 high-severity PL cases asserted 1/1/02-8/31/07.
Total Incurred-aggregate of expenses, reserves, and payments on open and closed cases.

Estimates of the Diagnostic Error Rate

<table>
<thead>
<tr>
<th>Expert guess</th>
<th>Arthur Elstein: 10 - 15%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Second reviews</td>
<td>Radiology, Pathology: 2-5% missed findings</td>
</tr>
<tr>
<td>Standard Patients</td>
<td>Internists misdiagnosed 13% of patients presenting with common conditions to clinic (COPD, RA, others)</td>
</tr>
<tr>
<td>Look backs</td>
<td>Dissecting AAA: 39% delayed diagnosis Cervical cancer: 25-50% of last nl PAP are abnl</td>
</tr>
<tr>
<td>Autopsies</td>
<td>Major unexpected discrepancies that would have changed the management are found in 10-20%</td>
</tr>
</tbody>
</table>
The toll of Dx Error

US
40,000 – 80,000 deaths/yr
1 in 20 primary care visits involves a preventable dx error; half are potentially harmful

Your Hospital
10 deaths every year
10 patients harmed every day in your clinics or ER

IOM:
“It is likely that most of us will experience at least one diagnostic error in our lifetime, sometimes with devastating consequences.”
We don't get enough meaningful feedback

Where do they happen?

CRICO - Analysis of 4519 claims related to diagnostic error

Ambulatory care clinics—it’s NOT just rare conditions. Dx errors are COMMON in patients with anemia, asthma, COPD
What Is the Cause of Diagnostic Error?

Diagnosis is HARD!

**PATIENT VARIABLES**
- Stage of disease
- How it manifests
- How it is perceived
- How it is described
- When help is sought

**PHYSICIAN VARIABLES**
- Knowledge and experience
- Access to patient data, tests, consults
- Skill in clinical reasoning
- Stress, distractions, mood, time to think

**SYSTEM COMPLEXITY**
- Disjointed care
- Communication barriers
- Production pressure
- Tight coupling
- Access to care & expertise
How Many Diseases Are There?

World Health Organization:
- ICD 1 1893 161
- ICD 8 1965 1000+
- ICD 9 1979 8000?
- ICD 10 1999 12,420

NLM:
8000 MESH terms
Growing - 200+/year

New Diseases

<table>
<thead>
<tr>
<th>Disease</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yellow Nail Syndrome</td>
<td>Yellowish nails, lymphedema, pleural effusions</td>
</tr>
<tr>
<td>Alien Hand Syndrome</td>
<td>Apraxia perceived as being caused by an alien force</td>
</tr>
<tr>
<td>Donohue Syndrome</td>
<td>Extreme insulin resistance due to insulin-binding region mutation; Autosomal dominant</td>
</tr>
<tr>
<td>Cryoporin periodic syndromes</td>
<td>Hives and end-organ damage due to cryoporin mutations; Autosomal dominant</td>
</tr>
</tbody>
</table>
DIAGNOSTIC ERROR
(Wrong, missed &
delayed diagnosis)

Silent disease
Too early; atypical
Patient misleads us
Patient doesn’t f/u

Error in the Diagnostic Process

“No Fault” Causes

Inconsequential
HARM

“Root cause analysis”

NPSF study: 100 cases – 535 root causes
Graber et al. Arch Int Med 165:1493-9, 2005

BLUNT end

SYSTEM

Communication, coordination, training, policies, procedures

SHARP end

Me
Cognitive

Patients Clinical Course
Of all system errors (n = 215), the most common were:

<table>
<thead>
<tr>
<th>TYPE</th>
<th>EXAMPLE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Communication</td>
<td>Critical lab abnormality lost</td>
</tr>
<tr>
<td>Coordination of care</td>
<td>Medical records aren’t available</td>
</tr>
<tr>
<td>Expertise available</td>
<td>No radiologist on nights</td>
</tr>
<tr>
<td>Culture of safety</td>
<td>No system to find dx errors</td>
</tr>
<tr>
<td>Supervising trainees</td>
<td>Trainee errors on weekends</td>
</tr>
<tr>
<td>Workload, stress, distractions</td>
<td>Short exam: missed a key finding</td>
</tr>
<tr>
<td>Reliability of lab, X-rays</td>
<td>Small lung nodule missed on X-ray</td>
</tr>
<tr>
<td>Staff – training, dedication, competency, compatibility</td>
<td>Residents mis-read chest X-ray on PACS system</td>
</tr>
</tbody>
</table>

Normalization of deviance
Cognitive Errors: 320

- Faulty Knowledge: 3%
- Faulty Data Gathering: 14%
- Faulty Synthesis: 83%

How Do Doctors Think?
How Do Doctors Think?

This past weekend the patient was clearing brush from his backyard, wearing shorts. He now has a very itchy rash: vesicles, linear, just where his skin was exposed.

1. Morphea
2. Chicken pox
3. Poison Ivy
4. Pemphigoid
System 1: Automatic, subconscious processing
EXPERT | HEURISTIC

System 2: Deliberate, conscious thought

? → Recognized? → Diagnosis → Repetition
Heuristics = Mental Shortcuts

Intuition
Pattern Recognition

And 100+ others ….
See Croskerry: Academic Medicine 78: 775-780, 2003

Availability Heuristic

• The Benefits
  – Fast, effortless
  – Approximates the base rate of disease
  – Very often correct

• The Drawbacks
  – Discourages the consideration of a broad differential
  – Our experience is limited
  – Available does not necessarily mean correct
  – We remember too vividly the ‘big case’
Think about the letter “R.”
Which is more common?

A. R as the FIRST letter of a word?
B. R as the THIRD letter of a word?

What advice did you receive to get the best score on multiple choice tests?

A. Trust your intuition
B. At the end of the test, go back and reconsider the questions you weren’t sure about
Wrong to Wrong | Right to Wrong | Wrong to Right

<table>
<thead>
<tr>
<th>AUTHOR</th>
<th>YEAR</th>
<th>SETTING</th>
<th># Students</th>
<th>Total Questions</th>
<th>% Changed</th>
<th>% of answers changed</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Wrong to Wrong</td>
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<td></td>
<td>Right to Wrong</td>
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<td></td>
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<td></td>
<td></td>
<td></td>
<td></td>
<td>Wrong to Right</td>
</tr>
<tr>
<td>Davis</td>
<td>1929</td>
<td>College Education Courses</td>
<td>28</td>
<td>22000</td>
<td>2.50%</td>
<td>26%</td>
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<tr>
<td>Shahabudin</td>
<td>1929</td>
<td>Not stated</td>
<td>&gt; 262</td>
<td>TLF</td>
<td>2.90%</td>
<td>34%</td>
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<tr>
<td>Bath</td>
<td>1967</td>
<td>College Psychology Courses</td>
<td>77</td>
<td>7700</td>
<td>4.30%</td>
<td>20%</td>
</tr>
<tr>
<td>Mathews</td>
<td>1975</td>
<td>1st &amp; 2nd Year Medicine Courses</td>
<td>188</td>
<td>11630</td>
<td>5.40%</td>
<td>22%</td>
</tr>
<tr>
<td>Lowe and Crawford</td>
<td>1983</td>
<td>2nd Year Med Students: Physiology National boards: Ob/Gyn</td>
<td>353</td>
<td>39380</td>
<td>4.60%</td>
<td>32%</td>
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<tr>
<td>Fabry and Case</td>
<td>1985</td>
<td>National boards: Internal Med</td>
<td>692</td>
<td>Mix</td>
<td>123,175</td>
<td>3.80%</td>
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<tr>
<td>ABIM</td>
<td>2012</td>
<td>National boards: Internal Med</td>
<td>500</td>
<td>MC</td>
<td>40,000</td>
<td>12.00%</td>
</tr>
</tbody>
</table>
My Right Foot

1. Sit up straight
2. Swing your right foot slowly in nice circles
3. Make a pointer with your index finger
4. Draw the number 6 in the air
**Q2: How do doctors think?**

A: For the most part, using our “intuition” = subconscious, automatic, thinking

This works extremely well, but it’s not perfect, and MANY diagnostic errors arise from errors in these processes.

We know very little about how this actually works, and none of this is available for conscious review.

Diagnosis is too important a process to rely solely on intuition

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**Delayed Diagnosis of Sepsis**

**Cognitive Errors**
- Knowledge: OK?
- Data collection: Incomplete
- Synthesis: Faulty
  - Wrong context; Premature closure

**System Errors**
- Lab results not available fast enough
- Inadequate plan for follow-up
- No system to learn from errors
“Say … What’s a mountain goat doing way up here in a cloud bank?”
Premature closure = Satisficing

= Falling in love with the first puppy …

(Herbert Simon)

So where are we?
The Coalition to Improve Diagnosis

American Board of Internal Medicine and the ABIM Foundation
American Board of Medical Specialties
American College of Emergency Physicians
American College of Physicians
American Society of Healthcare Risk Managers
Consumers Advancing Patient Safety
Leapfrog Group
National Patient Safety Foundation
National Partnership of Women and Families
National Association of Pediatric Nurse Practitioners
Society to Improve Diagnosis in Medicine
Department of Veterans Affairs – Veterans Healthcare Agency

.......... 25 organizations as of Sept 2016

Advisory: AHRQ, CDC

System Problems
Suggestions from the IOM Report

Work in Teams  (Nurses !! Pathologists, Radiologists)

Make the patient a partner in the process

Pay attention to the work environment: Reduce stress, allow enough time for diagnosis, provide adequate support, including a good EMR

Improve communication
Addressing Cognitive Problems

Problems System 1 → Solutions System 2

- Faulty context
- Premature closure
- Failed heuristic

- Practice reflectively
- Consider the opposite
- Be comprehensive

The universal antidotes:
- What else could this be?
- A differential diagnosis

"It sort of makes you stop and think, doesn't it."
VITAMIN C C & D

Vascular
Infections & intoxications
Trauma & toxins
Auto-immune
Metabolic
Diopathic & iatrogenic
Neoplastic
Congenital
Conversion (psychiatric)
Degenerative

CHECKLISTS

Feeling cold (chills)
- Advanced age
- Psychiatric (anxiety)
- Hypothyroidism
- Shock
- Sepsis

Raynaud’s phenomenon
- Anemia
- Malnutrition
- Hypoglycemia
- Renal failure

John Ely
Available at: www.improvediagnosis.org
Aids for Differential Diagnosis

Dxplain
http://www.lcs.mgh.harvard.edu/projects/dxplain.html

Isabel
www.isabelhealthcare.com

Derm
www.visualdx.com

Isabel – Isabelhealthcare.com
IMPACT OF ISABEL

Studied pediatric ICU admissions who did NOT have a diagnosis on admission (n = 206). Correct diagnosis rates:

- Residents on their own: 89.4%
- Residents + Isabel: 92.5%
- Residents + Isabel + Attending: 95%


Google

Googling a Diagnosis:
Sensitivity – 58%
Specificity - 0 %

Tang and Ng; BMJ 2006 Dec 2;333(7579):1143-5
PATHOLOGY \ RADIOLOGY - Second opinions provide a different diagnosis in 2 – 20% of cases

Nakleh et al 2015 Arch Pathol Lab Med

INTERNAL MEDICINE AND SURGERY - Second opinions provide a different diagnosis in 10 – 40% of cases

Healthcare Systems - What can I Do?

Find and discuss diagnostic errors
Address the common system flaws that contribute to diagnostic error: Lost test results; failure to follow-up; expertise not available;
Provide decision support resources
Develop pathways for feedback
Facilitate second opinions
Follow up on patients seen in the ED

PHYSICIANS - What can I do?

Be thoughtful and reflective
Learn why dx errors occur and how to avoid
Always construct a differential diagnosis
Take advantage of second opinions
Use decision support resources
Make the patient your partner
PATIENTS - What can I do?

Be a good historian
Take advantage of cancer screening
Keep accurate records of your tests
SPEAK UP! What else could this be?
Ask what to expect & how to follow-up
Give feedback about diagnostic errors

“Improving the diagnostic process is not only possible, but it also represents a moral, professional, and public health imperative.”

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