Diagnostic Mistakes: Understanding How We Misdiagnose

American Academy of Dermatology Summer Meeting
Boston, MA

Gordon Schiff, MD

Associate Director, Center for Patient Safety Research and Practice
Brigham and Women’s Hospital Div. General Medicine

Safety Director, Harvard Center for Primary Care
Academic Improvement Collaborative

Associate Professor of Medicine, Harvard Medical School
Gordon Schiff, MD
S012: Diagnostic Mistakes: Understanding How We Misdiagnose

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Diagnostic Journey: Concepts & Data

- Welcome to Massachusetts
  - 2 recent studies showing prominence Dx Errors
- What is a “Diagnosis”; Diagnosis Error
  - 3 Models to help conceptualize Dx Error
- Illustrative Studies
  - DEER, PROMISES, Harvard Ctr 1º Care
- Health IT – Unrealized potential
  - Solution vs. part of problem
- Diagnostic Pitfalls
  - Construct to bridge cognitive vs. system silos?
MA Residents Involved in a Medical Error Situation

% saying personally involved in a situation where a preventable medical error was made in their own care or in the care of someone close to them

- Yes: 23%
- Don’t Know: 2%
- No: 75%
Most Common Types of Medical Error Experienced by MA Residents

% saying...

(Among the 23% who said they or a person close to them experienced a medical error)

Your/their medical problem was misdiagnosed

51%

You/they were given the wrong test, surgery, or treatment

38%

You were given wrong or unclear instructions about your follow-up care

34%

You/they were given an incorrect medication, meaning the wrong dose or wrong drug

32%

You/they got an infection as a result of your/their test, surgery, or treatment

32%
## Cases Closed: Allegations by Close Year

<table>
<thead>
<tr>
<th></th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>TOTAL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diagnosis-related</td>
<td>72</td>
<td>82</td>
<td>79</td>
<td>83</td>
<td>81</td>
<td>397</td>
</tr>
<tr>
<td>Medication-related</td>
<td>11</td>
<td>13</td>
<td>14</td>
<td>14</td>
<td>16</td>
<td>68</td>
</tr>
<tr>
<td>Medical Treatment</td>
<td>14</td>
<td>4</td>
<td>10</td>
<td>8</td>
<td>5</td>
<td>41</td>
</tr>
<tr>
<td>Communication</td>
<td>2</td>
<td>4</td>
<td>1</td>
<td>5</td>
<td>3</td>
<td>15</td>
</tr>
<tr>
<td>Violation of Rights</td>
<td>5</td>
<td>0</td>
<td>2</td>
<td>3</td>
<td>1</td>
<td>11</td>
</tr>
<tr>
<td>Safety &amp; Security</td>
<td>0</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>8</td>
</tr>
<tr>
<td>OB-related Treatment</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>6</td>
</tr>
<tr>
<td>Surgical Treatment</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>3</td>
</tr>
<tr>
<td>Breach of Confidentiality</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td><strong>Total Number of Cases</strong></td>
<td><strong>108</strong></td>
<td><strong>109</strong></td>
<td><strong>107</strong></td>
<td><strong>116</strong></td>
<td><strong>111</strong></td>
<td><strong>551</strong></td>
</tr>
</tbody>
</table>

N=551 CRICO and Coverys outpatient PL cases closed 2005–2009 naming General Medicine staff/fellow physicians (excl. Hospitalists) and excluding ED locations.

Schiff et al, JAMA Intern Med 2013
# Cases Closed: Top Final Diagnoses

<table>
<thead>
<tr>
<th>FINAL DIAGNOSES</th>
<th>NUMBER OF CASES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cancer</td>
<td>190</td>
</tr>
<tr>
<td>Diseases of the heart</td>
<td>43</td>
</tr>
<tr>
<td>Diseases of blood vessels</td>
<td>27</td>
</tr>
<tr>
<td>Infection</td>
<td>22</td>
</tr>
<tr>
<td>Cerebrovascular disease</td>
<td>16</td>
</tr>
<tr>
<td>Lower gastrointestinal disorders</td>
<td>9</td>
</tr>
<tr>
<td>Orthopedic injuries</td>
<td>7</td>
</tr>
<tr>
<td>Pneumonia</td>
<td>6</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>TOP CANCERS</th>
<th>NUMBER OF CASES</th>
</tr>
</thead>
<tbody>
<tr>
<td>Colorectal</td>
<td>56</td>
</tr>
<tr>
<td>Lung</td>
<td>29</td>
</tr>
<tr>
<td>Prostate</td>
<td>26</td>
</tr>
<tr>
<td>Breast</td>
<td>18</td>
</tr>
<tr>
<td>Other GI</td>
<td>10</td>
</tr>
<tr>
<td>Benign neoplasm</td>
<td>8</td>
</tr>
<tr>
<td>Urinary organs</td>
<td>8</td>
</tr>
<tr>
<td>Lymphatic and hematopoietic tissue</td>
<td>8</td>
</tr>
<tr>
<td>Head and neck</td>
<td>6</td>
</tr>
<tr>
<td>Uterus and cervix</td>
<td>5</td>
</tr>
</tbody>
</table>

N=551 CRICO and Coverys outpatient PL cases closed 2005–2009 naming General Medicine staff/fellow physicians (excl. Hospitalists) and excluding ED locations.
IOM Quality Reports

The IOM Health Care Quality Initiative

6 aims for improvement
- Safe
- Effective
- Patient-centered
- Timely
- Efficient
- Equitable

1999  TO ERR IS HUMAN
      BUILDING A SAFER HEALTH SYSTEM
      INSTITUTE OF MEDICINE

2001  CROSSING THE QUALITY CHASM
      A NEW HEALTH SYSTEM FOR THE 21ST CENTURY
      INSTITUTE OF MEDICINE

NATIONAL ACADEMY OF MEDICINE
8 IOM Goals to Improve Diagnosis and Reduce Diagnostic Error

GOAL 1  Facilitate more effective teamwork in the diagnostic process among health care professionals, patients, and their families.

GOAL 2  Enhance health care professional education and training in the diagnostic process.

GOAL 3  Ensure that health information technologies support patients and health care professionals in the diagnostic process.

GOAL 4  Develop and deploy approaches to identify, learn from, and reduce diagnostic errors and near misses in clinical practice.
## 8 IOM Goals to Improve Diagnosis and Reduce Diagnostic Error

<table>
<thead>
<tr>
<th>GOAL 5</th>
<th>Establish a <strong>work system</strong> and <strong>culture</strong> that supports the diagnostic process and improvements in diagnostic performance</th>
</tr>
</thead>
<tbody>
<tr>
<td>GOAL 6</td>
<td>Develop a <strong>reporting environment</strong> and <strong>medical liability system</strong> that facilitates improved diagnosis through <strong>learning from diagnostic errors and near misses</strong></td>
</tr>
<tr>
<td>GOAL 7</td>
<td>Design a <strong>payment</strong> and <strong>care delivery environment</strong> that supports the diagnostic process</td>
</tr>
<tr>
<td>GOAL 8</td>
<td>Provide <strong>dedicated funding for research</strong> on the diagnostic process and diagnostic errors</td>
</tr>
</tbody>
</table>
Leishmaniasis Dx Delays

- To first becoming concerned about lesions: (n=58)
- To first consulting medical personnel: (n=58)
- To first considering leishmaniasis: (n=54)
- To confirmation of diagnosis: (n=44)
- To release of sodium stibogluconate: (n=58)
- To start of therapy: (n=53)

Days from first noticing lesions:

lower 25%  
minimum  
median  
upper 25%  
maximum

15 May 1993 • Annals of Internal Medicine • Volume 118 • Number 10 783
What is a Diagnosis Error?

Adverse Outcomes

- Delayed
- Missed
- Misdiagnosis

Diagnostic Process Failures

Modified from Schiff Advances in Patient Safety AHRQ 2005, Schiff & Leape Acad Med 2012
<table>
<thead>
<tr>
<th>Where did it go wrong?</th>
<th>What went wrong?</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Access/ Presentation</strong></td>
<td>A: Failure/delay in presentation</td>
</tr>
<tr>
<td></td>
<td>B: Failure/delay denied care access</td>
</tr>
<tr>
<td><strong>History</strong></td>
<td>A: Failure/delay in eliciting critical piece of history data</td>
</tr>
<tr>
<td></td>
<td>B: Inaccurate/misinterpreted critical piece of history data</td>
</tr>
<tr>
<td></td>
<td>C: Failure in weighing critical piece of history data</td>
</tr>
<tr>
<td></td>
<td>D: Failure/delay to follow-up critical piece of history data</td>
</tr>
<tr>
<td><strong>Physical Exam</strong></td>
<td>A: Failure/delay in eliciting critical physical exam finding</td>
</tr>
<tr>
<td></td>
<td>B: Inaccurate/misinterpreted critical physical exam finding</td>
</tr>
<tr>
<td></td>
<td>C: Failure in weighing critical physical exam finding</td>
</tr>
<tr>
<td></td>
<td>D: Failure/delay to follow-up critical physical exam finding</td>
</tr>
<tr>
<td><strong>Tests (Lab/ Radiology)</strong></td>
<td>A: Failure/delay in ordering needed test(s)</td>
</tr>
<tr>
<td></td>
<td>B: Failure/delay in performing ordered test(s)</td>
</tr>
<tr>
<td></td>
<td>C: Error in test sequencing</td>
</tr>
<tr>
<td></td>
<td>D: Ordering of wrong test(s)</td>
</tr>
<tr>
<td></td>
<td>E: Tests ordered wrong way</td>
</tr>
<tr>
<td><strong>Ordering</strong></td>
<td>F: Sample mix-up/mislabeled (e.g. wrong patient/test)</td>
</tr>
<tr>
<td></td>
<td>G: Technical errors/poor processing of specimen/test</td>
</tr>
<tr>
<td></td>
<td>H: Erroneous lab/radiology reading of test</td>
</tr>
<tr>
<td></td>
<td>I: Failed/delayed reporting of result to clinician</td>
</tr>
<tr>
<td><strong>Clinician Processing</strong></td>
<td>J: Failed/delayed follow-up of (abnormal) test result</td>
</tr>
<tr>
<td></td>
<td>K: Error in clinician interpretation of test</td>
</tr>
<tr>
<td><strong>Assessment</strong></td>
<td>A: Failure/delay in considering the diagnosis</td>
</tr>
<tr>
<td><strong>Suboptimal Weighing/Prioritizing</strong></td>
<td>B: Too little consideration/weight given to the diagnosis</td>
</tr>
<tr>
<td></td>
<td>C: Too much weight on competing/coexisting diagnosis</td>
</tr>
<tr>
<td><strong>Recognizing Urgency/Complications</strong></td>
<td>D: Failure/delay to recognize/weigh urgency</td>
</tr>
<tr>
<td></td>
<td>E: Failure/delay to recognize/weigh complications</td>
</tr>
<tr>
<td><strong>Referral/ Consultation</strong></td>
<td>A: Failure/delay in ordering referral</td>
</tr>
<tr>
<td></td>
<td>B: Failure/delay obtaining/scheduling ordered referral</td>
</tr>
<tr>
<td></td>
<td>C: Error in diagnostic consultation performance</td>
</tr>
<tr>
<td></td>
<td>D: Failed/delayed communication/follow-up of consultation</td>
</tr>
<tr>
<td><strong>Follow-up</strong></td>
<td>A: Failure to refer patient to close/safe setting/monitoring</td>
</tr>
<tr>
<td></td>
<td>B: Failure/delay timely follow-up/rechecking of patient</td>
</tr>
</tbody>
</table>
**Health Care Reform**

**Diagnostic Error in Medicine**

**Analysis of 583 Physician-Reported Errors**

Gordon D. Schiff, MD; Omar Hasan, MD; Sejeoung Kim, RN, PhD; Richard Abrams, MD; Karen Cosby, MD; Bruce L. Lambert, PhD; Arthur S. Elstein, PhD; Scott Hasler, MD; Martin L. Kabongo, MD; Nela Krosnjar; Richard Odwazny, MBA; Mary F. Wisniewski, RN; Robert A. McNutt, MD

**Background:** Missed or delayed diagnoses are a common but understudied area in patient safety research. To better understand the types, causes, and prevention of such errors, we surveyed clinicians to solicit perceived cases of missed and delayed diagnoses.

**Methods:** A 6-item written survey was administered at 20 grand rounds presentations across the United States and by mail at 2 collaborating institutions. Respondents were asked to report 3 cases of diagnostic errors and to describe their perceived causes, seriousness, and frequency.

**Results:** A total of 669 cases were reported by 310 clinicians from 22 institutions. After cases without diagnostic errors or lacking sufficient details were excluded, 583 remained. Of these, 162 errors (28%) were rated as major, 241 (41%) as moderate, and 180 (31%) as minor or insignificant. The most common missed or delayed diagnoses were pulmonary embolism (26 cases [4.3% of total]), drug reactions or overdose (26 cases [4.5%]), lung cancer (23 cases [3.9%]), colorectal cancer (19 cases [3.3%]), acute coronary syndrome (18 cases [3.1%]), breast cancer (18 cases [3.1%]), and stroke (15 cases [2.6%]). Errors occurred most frequently in the testing phase (failure to order, report, and follow-up laboratory results) (44%), followed by clinician assessment errors (failure to consider and overweighing competing diagnosis) (32%), history taking (10%), physical examination (10%), and referral or consultation errors and delays (3%).

**Conclusions:** Physicians readily recalled multiple cases of diagnostic errors and were willing to share their experiences. Using a new taxonomy tool and aggregating cases by diagnosis and error type revealed patterns of diagnostic failures that suggested areas for improvement. Systematic solicitation and analysis of such errors can identify potential preventive strategies.

*Arch Intern Med. 2009;169(20):1881-1887*
What went wrong: DEER Taxonomy Localization

- Failure/delay considering dx: 10
- Failure/delay ordering needed test(s): 63
- Erroneous lab/radiol test reading: 61
- Too much weight competing dx: 44
- Failed/deay f/up of test result: 42
- Failure eliciting history data: 40
- Failure eliciting P.Exam data: 37
- Failure/delay reporting result: 30
- Error clinician test interpretation: 25
- Technical error processing specimen/test: 17
- Inaccurate interpretation history data: 15
- Inaccurate interpretation P Exam: 14
- Failure in performing ordered test: 11
- To little weight given to dx: 11
- Failure to recognize urgency: 11
- Failure to recognize complication: 11
Failure to Consider:

Cognitive vs. System Problem?

*Why* did clinician fail to consider?

- Lack knowledge, memory recall
- Inadequate time
- Failure to elect key hx or physical
- Competing diagnoses, symptoms
- Rare, atypical
- Tests threw off
- Distractions
- Biases; heuristic

What are the causes?

What are the remedies?
Are Test Results Reliably Acknowledged and Acted on?

<table>
<thead>
<tr>
<th>Test</th>
<th>Count</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>TSH</td>
<td>251</td>
<td>16%</td>
</tr>
<tr>
<td>Cr</td>
<td>572</td>
<td>37%</td>
</tr>
<tr>
<td>K</td>
<td>278</td>
<td>18%</td>
</tr>
<tr>
<td>INR</td>
<td>213</td>
<td>14%</td>
</tr>
<tr>
<td>PSA</td>
<td>148</td>
<td>10%</td>
</tr>
<tr>
<td>Guaiac+</td>
<td>10</td>
<td>1%</td>
</tr>
<tr>
<td>Abnl Colonspy</td>
<td>18</td>
<td>1%</td>
</tr>
<tr>
<td>Abnl Mamgrm</td>
<td>11</td>
<td>1%</td>
</tr>
<tr>
<td>Abnl Pap</td>
<td>4</td>
<td>0%</td>
</tr>
<tr>
<td>Pulm Nodule</td>
<td>22</td>
<td>1%</td>
</tr>
<tr>
<td>Abdom Mass</td>
<td>17</td>
<td>1%</td>
</tr>
</tbody>
</table>

Result Found in Chart: 97.1%
Abnormal Acknowledged: 90.1%
Action Plan Documented: 78.7%
Action Plan Completed: 80.0%
Patient Notified: 77.4%

Preliminary data PROMISES Project Unpublished 2012
ONLY ~50-50 chance this order results in colonoscopy actually being performed!
2 Key Improvement Concepts:

• Situational Awareness

• Safety Nets
Diagnostic Risk, Situational Awareness

- Specialized type of situational awareness
- High reliability organizations/theory
  - High worry anticipation of what can go wrong
  - Preoccupied w/ risks recognizing/preventing
- Appreciation diagnosis uncertainty, limitations
  - Limitations of tests, systems’ vulnerabilities
  - Knowing when “over head” need for help
- Making failures visible
- Don’t miss diagnoses, red flag symptoms
- Diagnostic pitfalls – potentially useful construct
“Perhaps the most important distinguishing feature of high-reliability organizations is their collective preoccupation with the possibility of failure. They expect to make errors and train their workforce to recognize and recover them. They continually rehearse familiar scenarios of failure and strive hard to imagine novel ones. Instead of isolating failures, they generalize them. Instead of making local repairs, they look for system reforms”

Diagnostic Risk, Safety Nets

- Recognizing inherent uncertainties/risks, build in mitigation, protections, recovery structures and processes
- Proactive, systematic follow-up, feedback via closed loop systems
- Major role for HIT to hard-wire
  - To automate, ensure reliability, ease burden on staff/memory, ensure loops closed and outliers visible
Use of health information technology to reduce diagnostic errors

Robert El-Kareh,¹,² Omar Hasan,³ Gordon D Schiff⁴,⁵

ABSTRACT

Background Health information technology (HIT) systems have the potential to reduce delayed, missed or incorrect diagnoses. We describe and classify the current state of diagnostic HIT and identify future research directions.

Methods A multi-pronged literature search was conducted using PubMed, Web of Science, backwards and forwards reference searches and contributions from domain experts. We included HIT systems evaluated in clinical and experimental settings as well as previous reviews, and excluded radiology computer-aided diagnosis, monitor alerts and alarms, and studies focused on disease staging and prognosis.

Results HIT approaches, tools and algorithms were identified and organised into 10 categories related to those assisting: (1) information gathering; (2) information organisation and

INTRODUCTION

Unaided clinicians often make diagnostic errors. Vulnerable to fallible human memory, variable disease presentation, clinical processes plagued by communication lapses, and a series of well-documented ‘heuristics’, biases and disease-specific pitfalls, ensuring reliable and timely diagnosis represents a major challenge.¹⁻³ Health information technology (HIT) tools and systems have the potential to enable physicians to overcome—or at least minimise—these human limitations.

Despite substantial progress during the 1970s and 1980s in modelling and simulating the diagnostic process, the impact of these systems remains limited. A historic 1970 article⁴ predicted that, by 2000, computer-aided diagnosis would have ‘an entirely new role in medicine, acting as a powerful extension of the physician’s intellect’.⁵ Revisiting this prediction in 1987, the author conceded that it
Box 1 Condensed set of categories describing different steps in diagnosis targeted by diagnostic health information technology (HIT) tools

- Tools that assist in information gathering
- Cognition facilitation by enhanced organisation and display of information
- Aids to generation of a differential diagnosis
- Tools and calculators to assist in weighing diagnoses
- Support for intelligent selection of diagnostic tests/plan
- Enhanced access to diagnostic reference information and guidelines
- Tools to facilitate reliable follow-up, assessment of patient course and response
- Tools/alerts that support screening for early detection of disease in asymptomatic patients
- Tools that facilitate diagnostic collaboration, particularly with specialists
- Systems that facilitate feedback and insight into diagnostic performance
Can Electronic Clinical Documentation Help Prevent Diagnostic Errors?

Gordon D. Schiff, M.D., and David W. Bates, M.D.

The United States is about to invest nearly $50 billion in health information technology (HIT) in an attempt to push the country to a tipping point with respect to the adoption of computerized records, which are expected to improve the quality and reduce the costs of care. A fundamental question is how best to design electronic health records (EHRs) to enhance clinicians’ workflow and the quality of care. Although clinical documentation plays a central role in EHRs and occupies a substantial proportion of physicians’ time, documentation practices have largely been dictated by billing and legal requirements. Yet the primary role of documentation should be to clearly describe and communicate what is going on with the patient. Electronic prescribing appears to be one of those practices that have been refined and optimized through years of use, but many questions about it persist. For example, can it be leveraged to improve quality without adversely affecting clinicians’ efficiency? Will the quality of electronic notes be better than that of paper notes, or will it be degraded by the widespread use of templates and copied-and-pasted information?

A fundamental part of delivering good medical care is getting the diagnosis right. Unfortunately, diagnostic errors are common, outnumbering medication and surgical errors as causes of outpatient malpractice claims and settlements. EHRs promise multiple benefits, but we believe that one key selling point is their potential for preventing, minimizing, or mitigating diagnostic errors. Admittedly, evidence to support the existence of such a benefit is currently lacking, and physicians from the patient, discouraging independent data gathering and assessment, and perpetuating errors. But we envision a redesigned documentation function that anticipates new approaches to improving diagnosis, not one that relies on the putative “master diagnosticians” of past eras. The diagnostic process must be made reliable, not heroic, and electronic documentation will be key to this effort. Systems developers and clinicians will need to reconceptualize documentation workflow as part of the next generation of EHRs, and policymakers will need to lead by adopting a more rational approach than the current one, in which billing codes dictate evaluation and management and providers are forced to focus on ticking boxes rather than on thoughtfully documenting.
Clinical Documentation

CYA
Canvass for Your Assessment
Canvass for Your Assessment

- Differential Diagnosis
- Weighing Likelihoods
- Etiology
- Urgency
- Degree of certainty
What is a **Diagnostic Pitfall**?

Clinical situations where patterns of, or vulnerabilities to errors leading to missed, delayed or wrong diagnosis
## Reliable Diagnosis Challenges (RDC) Taxonomy

<table>
<thead>
<tr>
<th>Challenge Category</th>
<th>Specific Challenge</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Challenging Disease Presentation</strong></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>Rare diagnosis</td>
</tr>
<tr>
<td>B</td>
<td>Atypical presentation</td>
</tr>
<tr>
<td>C</td>
<td>Nonspecific signs and symptoms</td>
</tr>
<tr>
<td>D</td>
<td>Unfamiliar/outside specialty</td>
</tr>
<tr>
<td>E</td>
<td>Masking/mimicking diagnosis</td>
</tr>
<tr>
<td>F</td>
<td>Red herring misleading finding-</td>
</tr>
<tr>
<td>G</td>
<td>Rapidly progressive</td>
</tr>
<tr>
<td>H</td>
<td>Slowly evolving</td>
</tr>
<tr>
<td>I</td>
<td>Deceptively benign course</td>
</tr>
<tr>
<td><strong>Patient Factors</strong></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>Language/communication</td>
</tr>
<tr>
<td>B</td>
<td>Signal/noise (noisy pts)</td>
</tr>
<tr>
<td>C</td>
<td>Patient fails to share</td>
</tr>
<tr>
<td>D</td>
<td>Patient fails to follow</td>
</tr>
<tr>
<td><strong>Testing Challenges</strong></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>Test availability, access, cost</td>
</tr>
<tr>
<td>B</td>
<td>Logistical issues</td>
</tr>
<tr>
<td>C</td>
<td>False positive/negative results</td>
</tr>
<tr>
<td>D</td>
<td>Performance/interpretation</td>
</tr>
<tr>
<td>E</td>
<td>Equivocal results/reports</td>
</tr>
<tr>
<td>F</td>
<td>Test follow-up issues</td>
</tr>
<tr>
<td><strong>Stressors</strong></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>Time constraints</td>
</tr>
<tr>
<td>B</td>
<td>Discontinuities</td>
</tr>
<tr>
<td>C</td>
<td>Fragmentation of care</td>
</tr>
<tr>
<td>D</td>
<td>Memory reliance/challenges</td>
</tr>
<tr>
<td><strong>Broader Challenges</strong></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>Recognition of acuity/severity</td>
</tr>
<tr>
<td>B</td>
<td>Diagnosis of complication</td>
</tr>
<tr>
<td>C</td>
<td>Recognizing failure to respond to treatment</td>
</tr>
<tr>
<td>D</td>
<td>Diagnosis of underlying cause</td>
</tr>
<tr>
<td>E</td>
<td>Recognizing misdiagnosis</td>
</tr>
</tbody>
</table>
## Diagnostic Error Evaluation and Research (DEER) Taxonomy

<table>
<thead>
<tr>
<th>Where did it go wrong?</th>
<th>What went wrong?</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Access/ Presentation</strong></td>
<td>A  Failure/delay in presentation</td>
</tr>
<tr>
<td></td>
<td>B  Failure/denied care access</td>
</tr>
<tr>
<td><strong>History</strong></td>
<td>A  Failure/delay in eliciting critical piece of history data</td>
</tr>
<tr>
<td></td>
<td>B  Inaccurate/misinterpreted critical piece of history data</td>
</tr>
<tr>
<td></td>
<td>C  Failure in weighing critical piece of history data</td>
</tr>
<tr>
<td></td>
<td>D  Failure/delay to follow-up critical piece of history data</td>
</tr>
<tr>
<td><strong>Physical Exam</strong></td>
<td>A  Failure/delay in eliciting critical physical exam finding</td>
</tr>
<tr>
<td></td>
<td>B  Inaccurate/misinterpreted critical physical exam finding</td>
</tr>
<tr>
<td></td>
<td>C  Failure in weighing critical physical exam finding</td>
</tr>
<tr>
<td></td>
<td>D  Failure/delay to follow-up critical physical exam finding</td>
</tr>
<tr>
<td><strong>Tests (Lab/ Radiology)</strong></td>
<td>A  Failure/delay in ordering needed test(s)</td>
</tr>
<tr>
<td></td>
<td>B  Failure/delay in performing ordered test(s)</td>
</tr>
<tr>
<td></td>
<td>C  Error in test sequencing</td>
</tr>
<tr>
<td></td>
<td>D  Ordering of wrong test(s)</td>
</tr>
<tr>
<td></td>
<td>E  Tests ordered wrong way</td>
</tr>
<tr>
<td><strong>Performance</strong></td>
<td>F  Sample mix-up/mislabeled (e.g. wrong patient/test)</td>
</tr>
<tr>
<td></td>
<td>G  Technical errors/poor processing of specimen/test</td>
</tr>
<tr>
<td></td>
<td>H  Erroneous lab/radiology reading of test</td>
</tr>
<tr>
<td></td>
<td>I  Failed/delayed reporting of result to clinician</td>
</tr>
<tr>
<td><strong>Clinician Processing</strong></td>
<td>J  Failed/delayed follow-up of (abnormal) test result</td>
</tr>
<tr>
<td></td>
<td>K  Error in clinician interpretation of test</td>
</tr>
<tr>
<td><strong>Assessment</strong></td>
<td>A  Failure/delay in considering the diagnosis</td>
</tr>
<tr>
<td><strong>Hypothesis Generation</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Suboptimal Weighing/Prioritizing</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Recognizing Urgency/Complications</strong></td>
<td></td>
</tr>
<tr>
<td><strong>Referral/ Consultation</strong></td>
<td>A  Failure/delay in ordering referral</td>
</tr>
<tr>
<td></td>
<td>B  Failure/delay obtaining/scheduling ordered referral</td>
</tr>
<tr>
<td></td>
<td>C  Error in diagnostic consultation performance</td>
</tr>
<tr>
<td></td>
<td>D  Failed/delayed communication/follow-up of consultation</td>
</tr>
<tr>
<td><strong>Follow-up</strong></td>
<td>A  Failure to refer patient to close/safe setting/monitoring</td>
</tr>
<tr>
<td></td>
<td>B  Failure/delay in timely follow-up/rechecking of patient</td>
</tr>
</tbody>
</table>
Results

- Literature search
  - 155 diagnostic pitfall-related articles
    - 201 DEER
    - 204 RDC

- Patient safety event reports (n=4,352)
  - 75 diagnostic pitfall-related reports
    - 106 DEER
    - 101 RDC

- Morbidity & Mortality reports (n=24)
  - 10 diagnostic pitfall-related reports
    - 15 DEER
    - 15 RDC

- Closed malpractice claims (n=403)
  - 396 diagnostic pitfall-related claims
    - 711 DEER
    - 625 RDC

- Specialist focus groups (n=6)
  - 355 focus group responses
    - 175 DEER
    - 96 RDC

TOTAL DEER = 1208    TOTAL RDC = 1041
Generic Diagnostic Pitfalls
w/ Dermatology-specific Examples Identified

- **Disease A repeatedly mistaken for Disease B**
  - Psoriasis dx as fungal infection; bilateral stasis dermatitis as cellulitis

- **Failure to appreciate test/exam limitations**
  - Failure negative skin cultures after topical antibiotics;
  - “Botched” skin bx False + ANA

- **Atypical presentation**
  - Atypical presentation of pemphigus
Pemphigus Mimicking Common Skin Diseases – Atypical Presentation Delaying Correct Diagnosis: Case Series of Five Patients

Lev Pavlovsky MD PhD, Daniel Mimouni MD, Shlomit Halachmi MD PhD, Varda Katzenelson MD and Michael David MD

Department of Dermatology, Rabin Medical Center (Beilinson Campus), Petah Tikva, and Sackler Faculty of Medicine, Tel Aviv University, Ramat Aviv, Israel

Key words: pemphigus, immunofluorescence

Pemphigus, a rare skin disorder, encompasses a class of mucocutaneous autoimmune blistering diseases characterized by loss of cell-cell adhesion (acantholysis) mediated by autoantibodies to epidermal cell surface proteins [1]. The presence of flaccid non-inflammatory blisters and erosions that arise on normal-appearing skin and variable involvement of the mucous membranes characterize its three major variants: pemphigus vulgaris, pemphigus foliaceus, and paraneoplastic pemphigus. Depending on the severity, pemphigus can be life-threatening.

<table>
<thead>
<tr>
<th>Patient #</th>
<th>Age (yrs)</th>
<th>Gender</th>
<th>Initial diagnosis</th>
<th>Initial treatment</th>
<th>Time to diagnosis of pemphigus</th>
<th>Current status</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 (Index case)</td>
<td>50</td>
<td>M</td>
<td>Psoriasis</td>
<td>Topical steroids, acitretin</td>
<td>5 months</td>
<td>Remission</td>
</tr>
<tr>
<td>2</td>
<td>82</td>
<td>F</td>
<td>Burn</td>
<td>Sulfadiazine silver</td>
<td>2 months</td>
<td>Remission, maintained with prednisone 30 mg/day</td>
</tr>
<tr>
<td>3</td>
<td>69</td>
<td>M</td>
<td>Generalized herpes zoster</td>
<td>Acyclovir (per os)</td>
<td>10 days</td>
<td>Partial remission, maintained with triamcinolone 8 mg/day</td>
</tr>
<tr>
<td>4</td>
<td>74</td>
<td>M</td>
<td>Squamous cell carcinoma</td>
<td>Cryotherapy</td>
<td>4 months</td>
<td>Partial remission, maintained with prednisone 10 mg/day</td>
</tr>
<tr>
<td>5</td>
<td>53</td>
<td></td>
<td>Solar keratoses</td>
<td>Cryotherapy</td>
<td>3 months</td>
<td>Prednisone initiated</td>
</tr>
</tbody>
</table>
Generic Diagnostic Pitfalls
w/ Dermatology-specific Examples Identified

• Disease A repeatedly mistaken for Disease B
  • Psoriasis dx as fungal infection; bilateral stasis dermatitis as cellulitis

• Failure to appreciate test/exam limitations
  • Failure negative skin cultures after topical antibiotics;
  • “Botched” skin bx False + ANA

• Atypical presentation
  • Atypical presentation of pemphigus

• Presuming chronic disease accounts for new sx
  • Chronic leg ulcer → missed squamous cell cancer

• Failure to monitor evolving symptom(s)
  • Topical steroids for basal cell cancers
Diagnostic Situational Awareness Model

- Red Flag Sx
- Don’t Miss Dx
- Dxic Pitfalls
Role for Patient
In Minimizing and Preventing Diagnosis Error and Delay

- Push for timely access
- Reliable follow-up, continuity
- Keen observer, reporter sx
- Proactive on test results
- Sharing hunches
- Curiously reading on own
- Meticulously adhering w/ empiric trial regimens
- Active as co-investigator
- Being patient: time & tests
- Recruiting family for support
- Respecting limits on staff time, society resources
- Agreeing to disagree
- Help in building, maintaining trust and communication
- Getting involved with patient organizations
**Role for Patient**

**In Minimizing and Preventing Diagnosis Error and Delay**

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**Key question is:**

What will it take at the provider and institutional end to support these roles and help them flourish?
Nothing about us without us is for us.
SUPPLEMENTAL SLIDES
So what, concretely should I do?

1. Diagnosis error case conferences/M&M’s
   - Extreme safety culture & learning climate
2. Hard wire feedback/follow-up, closed loops
   - Proactive systematic follow-up; Open Notes
3. Engineering uncertainty into diagnosis
   - Differential diagnosis, sharing uncertainties w/ pt
4. HIT/Electronic documentation redesign
   - Get out of the way; get (helpfully) into the fray
   - Eliminate useless info/noise; voice in real info

*Involve patients in all of the above*
Open Loop System

Water goes on the same time each day, regardless of whether it is raining or lawn is flooded

Schiff AJ Med 2008
Minimizing Diagnostic Error: The Importance of Follow-up and Feedback

An open-loop system (also called a “nonfeedback controlled” system) is one that makes decisions based solely on preprogrammed criteria and the preexisting model of the system. This approach does not use feedback to calibrate its output or determine if the desired goal is achieved. Because open-loop systems do not observe the output of the processes they are controlling, they cannot engage in learning. They are unable to correct any errors they make or compensate for any disturbances to the process. A commonly cited example of the open-loop system is a lawn sprinkler that goes on automatically at a certain hour each day, regardless of whether it is raining or the grass is already flooded.\(^1\)

To an unacceptably large extent, clinical diagnosis is an open-loop system. Typically, clinicians learn about their diagnostic successes or failures in various ad hoc ways (eg, a knock on the door from a server with a malpractice subpoena; a medical resident learning, upon bumping into a surgical resident in the hospital hallway that a patient he/she
improve diagnosis. Whereas their emphasis centers around the question of physician overconfidence regarding their own cognitive abilities and diagnostic decisions, I suspect many physicians feel more beleaguered and distracted than overconfident and complacent. There simply is not enough time in their rushed outpatient encounters, and too much “noise” in the nonspecified undifferentiated complaints that patients bring to them, for physicians, particularly primary care physicians, to feel overly secure. Both physicians and patients know this. Thus, we hear frequent complaints from both parties about brief appointments lacking sufficient time for full and proper evaluation. We also hear physicians’ confessions about excessive numbers of tests being done, “overordered” as a way to compensate for these constraints that often are conflated with and complicated by “defensive medicine”—usually tests and consults ordered solely to block malpractice attorneys.

The issue is not so much that physicians lack an awareness of the thin ice on which they often are skating, but that
Feedback – Key Role in Safety

• Structural commitment patient role to play
• Embodies/conveys message: uncertainty, caring, reassurance, access if needed
• Allows deployment of test of time, more conservative diagnosis
• Enables differential diagnosis
• Emphasizes that disease is dynamic
• Reinforces culture of learning & improvement
• Illustrates how much disease is self limited
• Makes invisible missed diagnoses visible
Examples of Feedback Learning

Feeding back to upstream hospital
  - spinal epidural abscess

IVR follow-up post urgent care visit
  - UAB Berner project

Dedicated Dx Error M&M

Autopsy Feedback
  - 7/32 MDs aware disseminated CMV

ED residents post admission tracking

Feedback to previous service

Tracking persistent mysteries

Chart correction by patients

Radiology/pathology
  - systematic second reviews

2nd opinion cases
  - Best Doctors dx changed

Linking lab and pharmacy data
  - to find signal of errors (missed ↑ TSH)

Urgent care
  - call back f/up systems

Malpractice
  - knock on the door
Feedback – Challenges

- Effort, time, support required
- Discontinuities
- Can convey non-reassuring message
- Feedback fatigue
- Non-response not always good predictor of misdiagnosis as multiple confounders
- Tampering – form of availability bias
What is a “Diagnosis”?

- Preliminary diagnosis
- Working diagnosis
- Differential diagnosis
- Syndromic diagnosis
- Etiologic diagnosis
- Possible diagnosis
- Problem on Problem List
- Tissue diagnosis
- Computer diagnosis (EKG read)
- Deferred diagnosis
- Multiple/dual diagnoses
- Preclinical diagnosis
- Diagnosis/disease risk factor
- Incidental finding
- Diagnosis complication
- Billing diagnosis
- Telephone diagnosis
- Postmortem diagnosis
- Prenatal diagnosis
- Rare diagnosis
- Difficult/challenging diagnosis
- Undiagnosed disease
- Contested diagnoses
- Novel diagnosis
- Futile diagnosis
- **Erroneous diagnosis**
Results – DEER Taxonomy Errors (n = 1208)

Diagnostic Process Steps

- Access/Presentation: 7
- History: 154
- Physical Exam: 141
- Tests: 503
- Assessment: 260
- Referral/Consult: 101
- Follow-up: 42

Frequency
Results - RDC Taxonomy Issues (n = 1041)

- Challenging disease presentation: 305
- Patient factors: 111
- Testing challenges: 314
- Stressors: 89
- Broader challenges: 222

Diagnosis Challenges
3rd Generation Dx Support

Cerner with Isabel integration
Patient is a 20 year old female with target shaped rash, eschar and nausea.