Afternoon

3:30 - 5:00 **DEM Plenary Presentation of Oral Abstracts**
Moderators: **Robert El-Kareh, MD, MPH / Laura Zwaan, PhD / Bradford Winters, PhD, MD**
Session open to all attendees. Oral presentations will be followed by brief question and answer periods.

3:30 p.m. SHOULD WE BLINK? .... OR THINK?

Author: Mark Graber, MD, Senior Fellow, RTI International, St James, NY
Email: mark.graber@va.gov

Learning Objective: After attending this lecture, the participant will analyze whether to trust their intuition, or rethink answers they aren't sure about on multiple choice tests, and possibly in clinical diagnosis.

Background: According to the dual-process paradigm of clinical reasoning, medical diagnosis reflects some combination of intuitive (System I) and deliberate (System II) consideration. Experts, and probably most experienced clinicians, rely largely on the intuitive system, because most new problems they see closely resemble problems they've seen before, and the vast majority of these diagnoses will be correct. We know, however, that System I is to some extent error prone, so the question becomes: Should physicians trust their intuition, or should they systematically reconsider their initial impressions?

Methods: To address this question we studied the keystroke response data from a random sample of 500 residents who took the 2010 Internal Medicine Certification Examination administered by the American Board of Internal Medicine. The exam is comprised of realistic clinical vignettes with multiple-choice single-best answers. We focused on the 80 questions regarding diagnosis. We measured level of cognitive skill (ability) by selecting the bottom and top quartile performers on the overall exam. Complexity was assessed from the percentage of examinees who correctly answered each question, and we compared the questions in the most difficult quartile (<60% correct answers) to the questions in the easiest quartile (>80% correct). We used multiple regression analysis to examine relationships between time to initial response and proportion of correct diagnosis made on the initial response, controlling for residents' ability.

Results: Overall, residents changed their answers on 12% of all diagnosis questions. With the exception of low-ability residents answering complex questions, changing an answer from wrong to right was almost twice as likely as changing an answer from right to wrong. When we examined residents' average time spent making their initial response to questions, we found that easy questions were answered faster than difficult ones, and when residents spent more time on initial responses to more difficult questions, they tended to make more correct diagnoses ($\beta = 0.14$, $p<0.001$).

Conclusion: These results show that reflection is generally beneficial for both simple and complex vignettes. The findings contradict the traditional belief held by many test-takers to "just trust your intuition," and support the hypothesis that routine reflection in clinical decision-making could reduce the likelihood of diagnostic error. Follow-up studies should explore how reflective reasoning can be fostered and invoked appropriately so that trainees can improve clinical decision-making, increase efficiency, and ultimately decrease errors and waste in medicine.

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3:45 p.m. REDUCING DIAGNOSITIC ERRORS BY CLOSING THE LOOP ON OUTPATIENT CARE

Author: Michael Kanter, MD, Medical Director Quality, Kaiser Permanente, Pasadena, CA
Email: Michael.H.Kanter@kp.org

Learning Objective: Identify where opportunities might exist in their operations to systematically address patient safety issues resulting in diagnostic errors outside of the traditional inpatient setting.

Statement of Problem: Results of diagnostic tests are not always followed up by physicians and situations arise where needed tests may not be ordered or completed. Identifying a solution to this problem became a top priority when a patient with an abnormal creatinine drawn in an urgent care clinic did not get proper follow up, resulting in a delay in diagnosis of chronic kidney disease.

Description of the Intervention or Program: The Southern California region of Kaiser Permanente created a centralized surveillance system using electronic data and a modest staff to close the loop on a variety of diagnostic tests and decrease errors related to failure to order relevant tests. The program covers 3.5 million patients in an integrated delivery system. The electronic data systems link laboratory results with data on ambulatory visits, pharmacy usage, and various elements of care. The system can monitor follow up of abnormal tests by detecting if appropriate appointments or procedures are completed in a timely fashion. The program also identifies missing laboratory orders related to diagnosing complications of drugs such as digoxin, diuretics, ace-inhibitors, and ant seizure medications.

Findings to Date: Over the past 4 years, the PSA safety net has been used to identify 745 prostate cancer diagnoses that would have been missed or delayed. From 2010-2012, we identified 5,324 patients with an unrepeated abnormal creatinine. Over three years, this safety net has yielded 3,511 patients (70%) with completed labs. Of those, 54.1% have been abnormal, resulting in 1,901 newly identified cases of CKD that would have been missed or delayed. Over the past three years (2009-2011) the medication monitoring program has identified the following:

- 2,429 patients taking digoxin who had not had their annual monitoring labs. After these members were contacted and tested, 170 patients with abnormalities of K+ or creatinine we identified.
- 10,210 patients taking Anticonvulsants who had not had their annual monitoring labs. Over half completed labs with 22% abnormal results.
- 256,000 patients taking ACE/ARB/Diuretics who had not had their annual monitoring labs. Over half completed labs with 15% abnormal results. One patient taking a thiazide presented to his physician with insomnia and headache where the safety net picked up a very low sodium of 119mg/dl that required hospitalization.

Lessons Learned: An electronic safety net can be implemented in a large population of patients to reduce errors in follow up or ordering of diagnostic tests.

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4:00 p.m. A STUDY OF VARIATIONS IN PHYSICIAN REACTIONS TO CRITICAL LABORATORY VALUES WHICH LED TO DIAGNOSTIC ERRORS

Author: Corey Chartan, MD, Resident, Baylor College of Medicine/Texas Children's Hospital, Houston, TX
Email: cxcharta@texaschildrens.org

Learning Objectives: Identify the presence of post-analytic errors in physicians' reactions to the transmission of data, their interpretation, and the action to take for the patient are prevalent even in potential life-threatening incidents such as hyperkalemia; Demonstrate the ability to recognize the need for the development of guidelines to improve clinical-laboratory interface and decrease the incidence of diagnostic errors.

Background: In the pediatric population, the dilemma of how to address hemolyzed specimens and hyperkalemia is a common challenge. When physicians choose to repeat testing and await results, without contemplating other causes for the increased potassium value, this may lead to diagnostic errors and treatment delays. Given technological advances in laboratory testing, the risk of errors has decreased significantly within the processes occurring in the laboratory. Recent studies, however, show that physician errors in test interpretation are unacceptably high and lead to diagnostic errors. We aimed to investigate the etiologies of diagnostic and treatment patterns for hyperkalemia at our institution as a prototype for the development of guidelines to improve clinical-laboratory interface and decrease the incidence of diagnostic errors.

Methods: We conducted a retrospective chart review of hospitalized patients with reported critical values (serum potassium (K) > 5.5) at a university-based children's hospital over one year period. We analyzed physician reactions to these abnormal potassium values by developing a checklist.

Results: A total of 1,004 incidents were reviewed and analyzed. In 46% of these incidents, no actions were taken with unknown consequences and of these incidents, 27% were reported as hemolyzed specimens. Common causes of hyperkalemia in this cohort were in vitro hemolysis (39%), decreased elimination/kidney injury (18%), increased intake of potassium (7%), and in vivo hemolysis (1%). The physician's reactions to the critical values were classified into: 1) did not react immediately but subsequently needed treatment (9%), 2) repeated and waited for confirmation (29%), 3) treated without confirming the results (11%) and 4) repeated the test and treated without waiting for confirmation (5%). Physicians who elected to do nothing or simply repeat the test resulted in a delayed diagnosis of clinically significant hyperkalemia 19% of the time. These diagnostic errors occurred even though only 44% were reported to be hemolyzed specimens by the laboratory. The potassium levels ranges were 5.6-9.9 and 5.6-9.7 for hemolyzed and non-hemolyzed specimens, respectively.

Conclusion: Post-analytic errors in physicians' reactions to the transmission of data, their interpretation, and the action to take for the patient are prevalent even in potential life-threatening incidents such as hyperkalemia. A closed loop clinical audit and feedback are recommended to evaluate and improve upon the critical task of test interpretation. Explicit guidelines to improve coordinated care between laboratory specialists and physicians are now being developed.

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4:15 p.m. DIAGNOSTIC ACCURACY IN CHILDREN PRESENTING WITH AN ACUTE ILLNESS IN A DISTRICT HOSPITAL SETTING

Author: Catherine Warrick, MBChB, Paediatric Registrar, North West London Hospitals, NHS Trust, London
Email: catherinewarrick@nhs.net

Learning Objective: Describe the incidence and aetiology of diagnostic error in children presenting with an acute illness in a district hospital setting.

Background: Misdiagnoses are an important cause of adverse patient outcomes, with estimated incidence of diagnostic errors derived from autopsy series at 10–15% in adult studies. Aetiology of misdiagnosis has been studied in adult internal medicine, classifying errors into 'no fault', 'system-related' and 'cognitive' errors. There are no studies of a similar ilk assessing diagnostic error in acute paediatrics. We aimed to determine incidence and aetiology of diagnostic errors in children presenting with an acute illness in a hospital setting.

Methods: We performed a 3-stage retrospective case notes review comparing admission to discharge diagnosis of children admitted to the paediatric unit in an acute district hospital in London, UK, to determine incidence of diagnostic error. In stage 1, cases of suspected diagnostic error were identified. In stage 2, these cases were further examined in detail by two paediatrician reviewers. The reviewers assessed the initial clinical history, examination and management plan for no fault, systems related and cognitive errors. In stage 3, structured interviews were conducted with the clinicians involved in cases in which errors occurred, to identify contributory factors to the misdiagnosis, including cognitive biases.

Results: Stage 1: Incidence of diagnostic error in children presenting with an acute illness in the hospital setting was 5% (19/378) (95% CI 2.8-7.2%). Stage 2: Diagnostic errors were frequently multi-factorial in nature, most commonly involving cognitive biases (including "premature closure", errors in data gathering and verification of findings) and team factors (systems-related errors). Reviewer 1 identified a median of 3 errors/case and reviewer 2 identified a median of 4 errors/case). Inter-rater reliability was good, with no significant differences in proportions of errors identified (no fault errors: p=0.41, systems-related errors: p=0.81, cognitive errors: p=0.45). Stage 3: In 14 cases structured interviews were possible. Interviewed clinicians believed system-related errors contributed more commonly to misdiagnoses, whereas the reviewers found that cognitive factors contributed more commonly to diagnostic error (Figure).

Conclusion: Diagnostic errors occurred in 5% of children presenting to a district hospital with acute illness and were multi-factorial in aetiology. Premature closure was the most commonly identified cognitive bias contributing to these errors. Multi-site longitudinal studies further exploring aetiology of errors and effect of educational interventions are required to generalize these findings and to determine strategies for mitigation.

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4:30 p.m. THE RELATIONSHIP BETWEEN PHYSICIANS' DIAGNOSTIC ACCURACY, CONFIDENCE, AND RESOURCE UTILIZATION

Author: Ashley Meyer, PhD, Cognitive Psychologist and Postdoctoral Research Fellow, US Veteran's Affairs, Houston, TX
Email: ashley.meyer2@va.gov

Learning Objective: Describe the relationship between physicians' diagnostic accuracy, their confidence in that accuracy, and the use of additional diagnostic resources as the diagnostic process unfolds and to assess the potential implications of these relationships on diagnostic error.

Background: Overconfidence has been identified as a potential contributor to diagnostic error. However, evidence is unconvincing, because studies involved novice practitioners, small samples, or defined confidence as willingness to seek help. Furthermore, studies focused only on one phase of the diagnostic process (typically diagnostic test interpretation) even though confidence may vary as information is gathered. Confidence may also affect resource use, including seeking second-opinions and additional diagnostic tests, but this is underexplored. Our objective was to better define the impact of confidence on diagnostic error by evaluating the relationship between confidence, diagnostic accuracy, and resource utilization.

Methods: We recruited internal medicine physicians via QuantiaMD.com, an online physician community, to diagnose a series of four randomly ordered patient vignettes of varying difficulty presented via a web-based audiovisual format. Cases were divided into four phases: history, physical examination, general diagnostic testing data, and specific diagnostic testing data. After each phase, physicians provided 1-3 differential diagnoses and a confidence judgment for each diagnosis submitted. They also specified additional resources they would utilize to diagnose each case.

Results: Preliminary analyses of data from 50 participants show that while confidence and accuracy differed by case (i.e., some cases were more difficult and/or were associated with more confidence than others) ($p<.001$ for both), information added by subsequent phases of the diagnostic process did not significantly affect accuracy ($p=.11$). However, confidence increased nonlinearly with successive phases ($p=.005$). Additionally, while confidence and accuracy were significantly correlated ($p<.001$), confidence was higher than it should have been given the low accuracy levels (overconfidence occurred) (mean confidence= 70.5%; mean accuracy= 22.8%). Lastly, use of additional diagnostic resources was significantly and negatively correlated to both confidence and accuracy ($p<.001$ for both), but the particular resources sought differed in terms of their relation to confidence and accuracy. Specifically, use of additional tests and second-opinions decreased with increased confidence, but not with accuracy, whereas use of electronic decision-support and books decreased with increased accuracy, but not with confidence.

Conclusion: Our preliminary results indicate that physicians' diagnostic accuracy does not improve as they receive more diagnostic information, yet their confidence levels increase to higher levels of overconfidence throughout this process. Also, physicians tend to utilize certain types resources more in response to decreased confidence or accuracy. Our preliminary study provides evidence of relationships between confidence, diagnostic accuracy, and resource utilization that should be further explored to develop effective interventions to align these three concepts.

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4:45 p.m. MISSED DIAGNOSIS OF STROKE IN EMERGENCY DEPARTMENT PATIENTS WITH DIZZINESS OR HEADACHE: CROSS-SECTIONAL ANALYSIS OF A LARGE POPULATION-BASED SAMPLE

Author: David Newman-Toker, MD, PhD, Associate Professor, Johns Hopkins University School of Medicine, Baltimore, MD
Email: toker@jhu.edu

Learning Objectives: Describe the frequency and importance of stroke misdiagnosis in the emergency department. List the clinical and demographic groups at highest risk of misdiagnosis.

Background: Stroke is common and costly. Some patients are not diagnosed promptly, resulting in death or disability from missed opportunities to give proven treatments. No national estimates of stroke misdiagnosis are available. Patients presenting with dizziness or headache may be at higher risk. We sought to estimate the likelihood of missed stroke and examine associations with patient, emergency department (ED), and hospital characteristics.

Methods: Cross-sectional analysis of missed stroke using linked inpatient discharge and ED visit records from the 2009 Healthcare Cost and Utilization Project State Inpatient Databases and 2008-2009 HCUP State ED Databases across nine US states. We identified adult patients admitted for stroke with a treat-and-release ED visit in the prior 30 days, considering those given a non-cerebrovascular diagnosis as potential (any other diagnosis) or probable (dizziness or headache diagnosis) missed cerebrovascular events.

Results: There were 19,698 potential and 2,238 probable (n=1,432 ischemic strokes, n=400 transient ischemic attacks, n=406 hemorrhages) missed strokes representing 10.5% and 1.2% of stroke admissions, respectively. Benign dizziness and headache were the most common diagnoses at the initial ED visit. Odds of a probable misdiagnosis were lower among men (OR=0.75; p<0.001), older individuals (18-44yo:[base]; 45-64yo:OR=0.43; 65-74yo:OR=0.28; ≥75yo:OR=0.19; p<0.001), and Medicare (OR=0.66; p<0.001) or Medicaid (OR=0.70; p<0.001) recipients compared to privately-insured patients. Odds were higher among Blacks (OR=1.17; p<0.03), Asian/Pacific Islanders (OR=1.29; p<0.03), and Hispanics (OR=1.30; p<0.001). Odds were higher in non-teaching hospitals (OR=1.45; p<0.002) and hospitals with low volume (OR=1.57; p<0.008).

Conclusion: We estimate 12,000-140,000 misdiagnosed cerebrovascular events annually presenting to US EDs, disproportionately with dizziness and headache. Physicians evaluating patients with these symptoms should be particularly attuned to the possibility of stroke in younger patients, women, and nonwhites.

POSTER PRESENTATIONS

3:30 – 5:00 **Poster Presentations and Tour** *(This session is not eligible for AMA PRA Category 1 Credit™.)*
Moderator: **Robert El-Kareh, MD, MPH,** University of California, San Diego, CA

Poster Session allow attendees to delve into and discuss the specifics of an abstract with the author in a one-on-one or small group setting.

1	INCLUSION OF DIAGNOSTIC COGNITIVE ERRORS IN A MEDICAL SCHOOL CURRICULUM: DEVELOPMENT OF A BIOMEDICAL INFORMATICS COURSE	Melchor Sánchez-Mendiola, MD, MHPE
2	THE EFFECT OF COGNITIVE DEBIASING TRAINING AMONG FAMILY MEDICINE RESIDENTS – A PILOT STUDY	Brent Smith, MD
3	EFFECTS OF THE USE OF DIFFERENTIAL DIAGNOSIS CHECKLIST AND GENERAL DE-BIASING CHECKLIST ON DIAGNOSTIC PERFORMANCE IN COMPARISON TO INTUITIVE DIAGNOSIS	Yasuharu Tokuda, MD, MPH
4	EPIGASTRIC PAIN AND ELEVATED SERUM AMYLASE CAN MASQUERADE AS ACUTE PANCREATITIS	Watari Takashi, MD, MS
5	RACIAL AND GENDER DISPARITIES IN CARDIAC TROPONIN TESTING: FINDINGS FROM TWO HOSPITALS	Janetta Bryksin, PhD
6	BACK TO BACK MISSED DIAGNOSIS: LESSONS FOR BETTER FRAMING AND UNDERSTANDING OF DIAGNOSTIC ERRORS	Joshua Liao, MD
7	TRUST YOUR RADIOLOGIST COMPLETELY BUT ALWAYS LOOK AT THE IMAGE YOURSELF	Ross Rozycki, MD
8	APPLYING ACTIVE UTILIZATION MANAGEMENT TO SEND-OUT LABORATORY TESTING IMPROVES PATIENT CARE	Jane Dickerson, PhD
9	ACUTE STROKE DIAGNOSED AS URINARY TRACT INFECTION IN AN ELDERLY FEMALE	Christopher Chang, MD
10	ENTITIES SHOULD NOT BE MULTIPLIED UNNECESSARILY- BELL'S PALSY WITH BACK PAIN	Ross Rozycki, MD
11	BRAIN ABSCESS	Kentaro Matsumoto, MD
12	DELAYED DIAGNOSIS OF ACUTE CHOLANGITIS PROVED DEADLY: IDENTIFYING COGNITIVE ERRORS IN DIAGNOSTIC PROCESS	Deborah Akinniyi, MD, MS
13	WHY DOES OU MC MANIPULATION DECREASE THE MISDIAGNOSIS BY ABDOMINAL PALPATION FOR WOMEN WITH ABDOMINAL PAIN?	Ming Cheh Ou, MD, PhD
14	ACUTE LOWER ABDOMINAL PAIN: A UROLOGIST'S REFERRAL TO PRIMARY CARE	Derek Meeks, MD

POSTER PRESENTATIONS (continued)

3:30 – 5:00 **Poster Presentations and Tour** *(This session is not eligible for AMA PRA Category 1 Credit™.)*
Moderator: **Robert El-Kareh, MD, MPH,** University of California, San Diego, CA

Poster Session allow attendees to delve into and discuss the specifics of an abstract with the author in a one-on-one or small group setting.

15	COGNITIVE REASONING: CAN IT BE TAUGHT THROUGH SIMULATION?	Nickolas Dawlabani, MD
16	DELAYED DIAGNOSIS OF PERICARDIAL EFFUSION AND CARDIAC TAMPANADE	Corey Chartan, MD
17	ANALYSIS OF A HIGHLY PUBLICIZED DIAGNOSTIC ERROR IN THE EMERGENCY DEPARTMENT	Laura Medford-Davis, MD
18	LANGERHANS CELL HISTIOCYTOSIS	Kazuya Kita, MD
19	EFFECT OF A METACOGNITIVE INTERVENTION ON COGNITIVE HEURISTIC USE DURING DIAGNOSTIC REASONING	Velma Payne, PhD, MS, MBA, MS
20	NURSING PERSPECTIVES ON DIAGNOSTIC ERROR IN THE NEONATAL INTENSIVE CARE UNIT	Sheila Gephart, PhD
21	DESIGNING A RANDOMIZED CONTROL TRIAL TO DECREASE DELAYS AND MISSED DIAGNOSIS OF ADVERSE DRUG EFFECTS FOR NEWLY STARTED MEDICATIONS	Joshua Liao, MD
22	ON HIGHER GROUND: ETHICAL REASONING AND ITS RELATIONSHIP TO ERROR DISCLOSURE	Alexander Cole, BA
23	QUANTITATIVE VIDEO-OCULOGRAPHY FOR DIAGNOSING STROKE AT THE BEDSIDE IN ACUTE VERTIGO: AN “ECG” FOR THE EYES	Ali Saber Tehrani, MD
24	A MIXED PICTURE: A CASE BASED REVIEW OF SEROTONIN SYNDROME AND LITHIUM TOXICITY	Susan Peterson, MD
25	DIAGNOSTIC ERRORS IN RADIOLOGY—REVIEW OF THE NEUROSCIENCE AND COGNITIVE BIASES LEADING TO MISDIAGNOSIS	Cindy Lee, MD
26	DIAGNOSTIC COMPUTERIZED DECISION SUPPORT SYSTEMS IN THE EMERGENCY DEPARTMENT: A SYSTEMATIC REVIEW	Amer Saati, MD, MS
27	IMPROVING DIAGNOSTIC ACCURACY IN EVALUATING DEEP TISSUE INJURY	Arjun Chanmugam, MD, MBA
28	SPINAL CORD STROKE: A FREQUENTLY MISSED DIAGNOSIS?	Peter Galan, MS
29	IMPROVING THE PRACTICE OF MEDICINE THROUGH DELIBERATE PRACTICE	Rodney Omron, MD, MPH