Improving Diagnostic Quality and Safety/Reducing Diagnostic Error: Measurement Considerations Web Meeting 4 Discussion Guide

Use Case 1: Cognitive Error—Missed Subtleties

Subtle clinical presentation of dangerous conditions when the disease "signal" is too low

Overview/Clinical Context

It is estimated that diagnostic errors occur in approximately 10-15 percent of cases in medicine.[1] There is a large body of literature that describes cognitive psychology and causes of diagnostic errors by clinicians. These fall broadly into two categories—those from cognitive biases and those from failures of expertise.

Much study in this area has focused on what are called "heuristics and biases." Broadly, clinicians learn heuristics (or shortcuts) to quickly determine a provisional diagnosis in the face of common symptoms. For example, a constellation of symptoms in a particular patient population represents a likely clinical syndrome or diagnosis (e.g., "strokes are diseases of older people"). However, these heuristics are prone to errors which can lead to misdiagnosis or other medical errors when they fail (e.g., missing a young patient with stroke). When heuristics go wrong, they are often called "biases." Examples of biases include availability bias, where diagnoses are made based on experience with prior cases, or anchoring bias, where clinicians rely on initial diagnostic impression and may prematurely close off other diagnostic possibilities despite subsequent information that disconfirms the initial impression. Although this issue is often discussed in the context of cognitive error, a growing body of scientific evidence suggests that this problem is both a secondary issue and not a good target for interventions.[2,3,4]

Instead, failures of expertise (i.e., due to inadequate medical knowledge, insufficient training and practice, or lack of feedback) increasingly appear to be the dominant cognitive factors in misdiagnosis,[5] particularly in clinical cases due to uncommon causes or where symptoms are subtle or "atypical." Solving problems of limited expertise can be approached "educationally" by honing the expertise of individual clinicians through problem-specific, deliberate practice, with prompt feedback;[6] alternatively, teamwork (e.g., "phone a friend" access to those with specific expertise via voice or tele-consult) or diagnostic decision support tools/systems can be used to provide greater expertise at the point of care.

This use case focuses on these types of errors—namely, the cognitive errors that occur when dangerous diseases are misdiagnosed because the initial diagnostic impression was incorrect due to "low signal" (i.e., subtle or atypical presentation) of the disease in question. This occurs in a variety of clinical settings including inpatient and ambulatory care but is often a principal concern of those who provide care in emergency departments (ED). In the ED, patients commonly present with new, undifferentiated symptoms where a primary is goal is to rule in and rule out immediate, life threatening conditions. When people have complaints that are "classic" for life threatening diseases, such as slurred speech and unilateral weakness in the case of a stroke, or high fever and low blood pressure in the case of sepsis—misdiagnosis is unusual. However, when people have atypical, "nonclassic", or nonspecific symptoms—

such as dizziness or generalized weakness—the risk of misdiagnosis rises. This is particularly important when such symptoms are caused by a time-sensitive or serious condition, such as stroke or sepsis.

Case Exemplars

There are a variety of clinical examples where cognitive errors due to missed subtleties may occur. The case examples below demonstrate cognitive errors that result in delayed or missed diagnosis.

Possible example 1

55-year old man with a history of hypertension presents to the ED with vertigo and vomiting for 3 hours since awakening. On examination, the patient has left-beating nystagmus that changes to slight right-beating when looking right (which goes undetected) and difficulty walking, but he is able to ambulate. Neurological examination is otherwise normal. No "HINTS" examination is documented. A noncontrast head CT is performed that demonstrates no acute stroke, and the patient improves somewhat with oral meclizine. The family voices concern that the patient is having trouble with balance. The ED diagnosis is peripheral vertigo ("labyrinthitis"), and the patient is discharged on meclizine treatment to follow up in 2-3 days with their primary care provider. The patient returns to a different hospital the next day with hemiplegia from a progressive brainstem stroke. The original ED and physician are never informed.

Possible example 2

65-year old woman with a history of chronic obstructive pulmonary disease (COPD) presents with fever of 101, diffuse myalgias, and shortness of breath during viral season. The ED is very busy that day, with numerous patients who have fevers and apparent viral syndromes. EKG shows sinus tachycardia but is otherwise normal, chest x-ray and routine laboratory tests are normal, but no blood or urine cultures are sent. The patient symptomatically improves with albuterol/ipratropium nebulizers in the ED and is discharged with presumed viral syndrome and COPD exacerbation. The patient dies at home of sepsis.

Possible example 3

80-year old woman living independently with only a history of hypertension and mild osteoarthritis of the knees presents to an outpatient primary care clinic with 1 week of new, bifrontal headache. After assessing that the symptoms are worse when the patient places her head between her legs, the provider diagnoses a "pressure" phenomenon from sinusitis and prescribes antibiotics. No laboratory tests are obtained. The patient returns twice more, at weekly intervals, with persistent headache symptoms. On the third visit, the provider obtains a head CT to "rule out a brain tumor." Within one week of the CT, the patient goes blind in both eyes from untreated giant cell arteritis.

Diagnostic Challenges and Solutions

The case exemplars demonstrate a class of cognitive errors resulting in delayed or missed diagnosis, some of which can result in serious harms. Each case exemplar highlights diagnostic challenges and points to causal factors that likely contributed to the error. Various stakeholders, including clinicians, researchers, and payers, can help implement, develop, or incentivize solutions to overcome the error(s).

Diagnostic Challenge/Causal Factor	Global Solution(s)	Granular Solution(s)
Subtle or nonclassical presentation with gaps in expertise ("low signal" is overlooked or missed)	• Enhance clinician expertise through education or feedback • Increase access to consultants with specialized expertise • Deploy artificial intelligence (AI) enhanced diagnostics	• Educate clinicians about known pitfalls for common, high-risk chief complaints • Use simulation or symptom-oriented education to hone bedside skills in diagnosing uncommon causes of common, high-risk chief complaints • Provide systematic feedback on patient outcomes (e.g., re-visits, hospitalizations, adverse events, deaths) to providers • Provide peer-to-peer feedback on diagnostic performance using a combination of chart and video review • Create symptom-specific diagnostic protocols and consult teams • Increase access to specialists by leveraging telemedicine capabilities • Provide access to evidence-based AI diagnostics once validated and available

Diagnostic Challenge/Causal Factor	Global Solution(s)	Granular Solution(s)
"Red herrings" and other cognitive distractors ("low signal" is overshadowed)	• Use meta-cognitive "forcing" strategies • Encourage external input from "curbside" second opinions or consultations • Increase real-time access to computer-based diagnostic tools, knowledge repositories, and diagnostic decision support systems • Reduce unnecessary cognitive loading through "live" or "digital" workflow enhancements	• Use cue-based diagnostic time-outs with general diagnostic error checklists (e.g., consider bias, ask "what else?") • Use cues to initiate second opinion (e.g., patient re-visiting for same complaint, diagnosis of "new" symptom is attributed to "old" disease) • Create "phone-a-friend" hotlines for access to other providers for same discipline and other disciplines • Provide access to online risk calculators and validated decision support tools or systems, where such systems exist • Decrease time pressures and distractions • Improve EHR usability via user interfaces and data visualization tools • Improve EHR interoperability for easy access to relevant patient data

Diagnostic Challenge/Causal Factor	Global Solution(s)	Granular Solution(s)
Premature closure from "common-things-are-common" complacency or clinical overconfidence ("low signal" is ignored)	• Create an environment where all care team members take shared ownership for getting the correct diagnosis and are expected to voice concerns about the diagnostic process or diagnosis • Implement externally driven diagnostic reminder tools (e.g., checklists, differential diagnosis generators, or virtual image databanks) and/or EHR-based decision support reminders • Empower patients, nurses, and allied health professionals to be part of the diagnostic care team • Implement clinician education on patient-and family-centered diagnosis	• Mandate the use of symptom/sign-specific checklists or differential diagnosis generators in all encounters • Create EHR alerts/rules to address specific known pitfalls in diagnosis (e.g., ordering CT rather than MRI for stroke in dizziness/vertigo) • Teach patients how to prepare for an office or ED visit • Build and encourage use of active listening skills by providers • Leverage "open notes" platform for patient input and diagnosis plan co-creation

Committee Discussion Questions:

1. Are any causal factors/diagnostic challenges missing?
2. Are any solutions missing? Which solutions rise to the top?
3. What specific actions can payers take to support the solutions?
4. What specific actions can researchers take to identify and test new solutions, and build an evidence base to support existing solutions?

Measurement Considerations for Use Case 1

In order to ensure that clinicians and healthcare systems reduce the likelihood of misdiagnoses in "low signal" situations, there are a variety of approaches to measuring quality. Measure developers can use these concepts and approaches to develop and test new clinical quality measures, either as process measures to support diagnosis or as clinical outcomes. Payers can use these measures in improvement and payment programs to incentivize adoption of diagnostic best practices and improve quality of care.

Measurement Approach	Measure Concepts	Rationale
Measure short-term outcomes of acute care visits	• Rate of accurate diagnosis of peripheral vestibular disorders based on follow-up • Rates of misdiagnosis-related harms from stroke as assessed by SPADE method	• Linking visits that are potentially related will allow for further review
Link outcome measures with measures of utilization	• Rate of utilization for consultation, CT imaging, MRI imaging, and/or hospital admission • Match/mismatch between process measures and diagnosis rendered (e.g., rate of CT use for diagnosis of inner ear disease benign paroxysmal positional vertigo [BPPV])	• Using balancing measures will help ensure clinical teams are using testing appropriately
Detect deviations from protocols	• Availability/access to neurology consultants, MRI neuroimaging • Diagnostic teamwork and culture measures in ED	• Conducting chart, image, and/or video review will identify cases where protocols and/or decision support was not adhered to and will support feeding this information back to clinical teams
Ask for patient feedback	• Patient-reported understanding of diagnosis/diagnostic uncertainty after discharge	• Engaging the patient to understand medical history, visits over time, and potential misdiagnoses will help overcome fragmented systems and records

Use Case 2: Systems Error—Communication Failure

Failure to "close the loop" on communicating diagnostic tests results for important conditions

Overview/Clinical Context

The delivery of medical care is becoming increasingly complex with the advancing of medical technologies and treatments, where multiple care team members—sometimes in different specialties and disciplines—caring for the same patient may be dispersed over time and space. Increasingly complex care and teams are superimposed on rising requirements to interact with electronic health records (EHR) and other information technologies.

Increased complexity can increase the risk of communication failure where there may be an important test result that may go unrecognized, and as a result may lead to a delay in diagnosis or a misdiagnosis. Delays and misdiagnosis may lead to patient harm, particularly in the case where earlier treatment for a diagnosis may lead to improved outcomes, such as cancer which can progress if unrecognized.

Use case 2 focuses on reducing the likelihood of communication failures that arise in healthcare. To reduce the risk of these communication failures, effective communication systems are vital. An example of effective communication is 'closed-loop' communication, which involves not only the sending of information but also an acknowledgement of information receipt and follow-up action that will occur. In

the process of closed-loop communication, critical questions emerge such as: (1) who is responsible, and (2) what processes/IT systems may deployed to ensure that it occurs and that no important information is lost or delayed. Below we describe some common case examples of communication failure leading to delays in diagnosis and/or misdiagnosis, some causal factors, the potential impact of quality measurement, solutions, and the potential impact of solutions.

Case Exemplars

There are a variety of clinical examples where communication issues may occur, leading to diagnostic delay and poor outcomes. The case examples below demonstrate communication failures that result in delayed or missed diagnosis.

Possible example 1

56-year old male smoker presents to an ED with a 4-day history of a cough illness at 3 am. There is no radiologist available at night. A chest x-ray is performed and read by the clinician as negative, and the patient is sent home with a diagnosis of bronchitis with an albuterol inhaler, cough suppressant, and counseled on smoking cessation. The next day, there is an overread by the radiologist of a 6mm noncalcified pulmonary nodule and a follow-up x-ray is recommended in 6 months. This is communicated back to the physician on duty in the ED who tries to contact the patient. Unfortunately, the patient is homeless, unemployed, and has no working cell phone or stable address to be reached. Eighteen months later, the patient is diagnosed with a large lung mass that has metastasized to the spine.

Possible example 2

A 70-year old female, Spanish-speaking only with atrial fibrillation on apixaban is admitted to a surgical service with a diagnosis of appendicitis diagnosed on CT scan. Given the early stage nature of the appendicitis and that she is on anticoagulants, she is treated conservatively with antibiotics as opposed to operatively and clinically recovers after three days. However, on the CT report, a follow-up CT is suggested at 3 months to ensure resolution of the radiographic finding. The surgeon communicates this to the patient in broken Spanish (without a formal interpreter), and she also assumes that the patient's primary care physician will order the follow-up test. The patient nods but does not understand because she does not wish to offend the physician. The primary care physician sees the report and assumes that the surgeon will order the test and follow-up with the patient. Two years later, the patient is diagnosed with large appendiceal carcinoma that has metastasized to the liver.

Possible example 3

A 4-year old female patient is seen in an urgent care clinic for cough illness and fever. A chest radiograph is performed that is read as negative by the treating clinician. An overread by a radiologist detects a healing posterior rib fracture with concern for child abuse. The report is sent by email to the patient's pediatrician. The email is not explicitly flagged to have an important finding. He opens the email but does not do anything to follow up on the findings, as he receives approximately 40-50 emails per day about his patients. One year later, the same patient returns with major trauma secondary to child abuse and is admitted to the intensive care unit.

Diagnostic Challenges and Solutions

The case exemplars demonstrate communication failures resulting in delayed or missed diagnosis, some of which can result in serious harms. Each case exemplar highlights diagnostic challenges and points to

causal factors that likely contributed to the error. Various stakeholders, including clinicians, researchers, and payers, can help implement, develop, or incentivize solutions to overcome the error(s).

Diagnostic Challenge/ Causal Factor	Global Solution(s)	Granular Solution(s)
Incomplete handoffs or diffusion of responsibility across clinical providers	• Enhance diagnostic handoffs and transitions of care • Create rules that assign follow-up to a specific team member • Define requirements for synchronous communication	• Standardize forms, protocols, and communication methods • Create secondary safety nets to identify and remedy failures during transitions • Design EHR systems to facilitate clearer assignment of responsibility • Create requirements for phone or face-to-face exchanges for critical results or actionable revised results
Failures of test results receipt	• Eliminate secondary distractions and competing priorities • Increase interoperability of EHRs • Automate clinical actions in the EHR based on high-risk results (e.g., scheduling follow-up appointments or follow-up tests) • Create EHR "safety nets" • Empower patients to ensure test result follow-up	• Reduce alerts and alert fatigue for low-risk or low-importance items • Decrease unnecessary documentation requirements • Create visual presentations in EHRs that enhance recognition of outstanding tests or findings • Use flags and other electronic processes to highlight e-mails containing test results • Improve data visualization for trends • Use electronic trigger tools to identify and remedy "dropped the ball" scenarios (e.g., new iron-deficiency anemia not followed up by colonoscopy within a specified time frame) • Educate patients that "no news" is not "good news"

Diagnostic Challenge/ Causal Factor	Global Solution(s)	Granular Solution(s)
Patient-clinician communication failures	• Create a communication plan prior to discharge for how results will be communicated to the patient, caregiver, and/or family • Empower patients to ensure test results follow-up and to ask questions about test results • Ensure patients understand their diagnosis and results	• Confirm contact information prior to discharge to ensure clinicians have a way to follow up • Provide direct-to-patient results reporting and use patient portals • Optimize patient portals to overcome language and health literacy challenges • Use read-back and hear-back techniques • Use interpreters to support communicating in a patient's native or desired language • Train employees on communication techniques, listening skills, and empathy

Committee Discussion Questions:

1. Are any causal factors/diagnostic challenges missing?
2. Are any solutions missing? Which solutions rise to the top?
3. What specific actions can payers take to support the solutions?
4. What specific actions can researchers take to identify and test new solutions, and build an evidence base to support existing solutions?

Measurement Considerations for Use Case 2

In order to ensure that clinicians and healthcare systems reduce the likelihood of missing important findings and/or miscommunication, there are a variety of approaches to measuring quality. As a general principle, the Committee thought it was important that all clinicians involved in communication have a shared responsibility for ensure communication across settings. Measure developers can use these concepts and approaches to develop and test new clinical quality measures, either as process measures to support diagnosis or as clinical outcomes. Payers can use these measures in improvement and payment programs to incentivize adoption of diagnostic best practices and improve quality of care.

Measurement Approach	Measure Concepts	Rationale
Ask about communication quality on patient surveys	• Patient-reported understanding of diagnosis/ diagnostic uncertainty after discharge	• Gathering information from the patient may be the only way to measure quality related to communication in instances where only the patient is aware of a miscommunication across clinicians and settings

Measurement Approach	Measure Concepts	Rationale
Measure the use of electronic trigger (e-trigger) tools	• Proportion of diagnoses where an e-trigger tool is used	• Using electronic trigger tools, although still in research, may be a valuable way to identify errors across settings
Measure interoperability of health information technology	• Percentage of systems to support closed-loop communication and safety net for test results	• Holding health systems accountable for interoperability of health information and information sharing across settings may help reduce communication issues
Assess rates of delayed diagnoses	• Rates of delay in acting upon critical action lab values • Time from first symptoms to diagnosis of various cancers; number of visits • Number of missed opportunities in diagnosis antecedent to cancer diagnoses • Frequency/ number of late-stage or emergency cancer presentations	• Measuring specific outcomes (e.g., late-stage cancer) that may be related to communication errors may provide information on the rates of delayed diagnoses
Measure the use of language interpreter lines in patient's preferred language	• Rate of use of interpreters or interpreter lines when English is not a patient's preferred language	• Ensuring that patients communicate in their language of choice is important to ensure understanding, and measuring the use of interpreters may help improve communication
Audit charts for high-risk findings to ensure follow-up and verbal handoffs occur	• Proportion of policies and procedures that structure handoff communications for diagnosis	• Auditing charts could be used as a measure of system performance to ensure that high-risk findings are communicated and followed up on appropriately

Committee Discussion Questions:

1. Are any measurement approaches missing?
2. What specific actions can developers and payers take to facilitate the measurement solutions?

References

[1] Higgs J, Elstein A. Clinical reasoning in medicine. In: Higgs J, ed. *Clinical Reasoning in the Health Professions.* Oxford, England: Butterworth-Heinemann Ltd; 1995:49-59.

[2] Monteiro S, Sherbino J, Sibbald M, Norman G. Critical thinking, biases and dual processing: The enduring myth of generalisable skills. *Med Educ*. 2020;54:66-73. First published August 29, 2019. [Epub ahead of print]

[3] Dhaliwal G. Premature closure? Not so fast*. BMJ Qual Saf.* 2017;26(2):87-89. Epub March 15, 2016.

[4] Norman GR, Monteiro SD, Sherbino J, et al. The causes of errors in clinical reasoning: cognitive biases, knowledge deficits, and dual process thinking. *Acad Med.* 2017;92(1):23-30.

[5] Sherbino J, Norman GR. Reframing diagnostic error: maybe it's content, and not process, that leads to error. *Acad Emerg Med.* 201421(8):931-933.

[6] Ericsson KA, Charness N, Feltovich PJ, et al., eds. *The Cambridge Handbook of Expertise and Expert Performance.* New York, NY: Cambridge University Press; 2006.