Building a Robust Conceptual Foundation for Defining and Measuring Diagnostic Errors

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Where Do We Start?

- Measurement is the first step to improvement
- But, we cannot measure what we cannot define
- Experts still debating definitions of “diagnosis”
  - lack of standards, agreed upon definitions for most concepts involving diagnosis
- Operational definitions of diagnostic error harder
  - often confused with screening and treatment errors
- “Basic science” of diagnostic errors evolving
  - harm often involves relatively common conditions
- Outpatients (including ER) fertile environments

Singh et al. BMJQS 2014
Singh et al. JAMA Intern Med 2013
Singh & Weingart Adv Health Sci Educ 2009
What are Diagnostic Errors?

• Case analysis reveals evidence of a missed opportunity to make a correct or timely diagnosis
  o something different could have been done to make the correct diagnosis earlier
  o may result from cognitive and/or system factors, or
  o more blatant provider factors (accountability/negligence)

• Missed opportunity is framed within the context of an “evolving” diagnostic process
  o Accounts for uncertainty

• Opportunity could be missed by the provider, care team, system, and/or patient
A Model for “Defining” Diagnostic Error

- **A** Misused opportunities in diagnosis due to system and/or cognitive factors
- **B** Preventable diagnostic harm
- **C** Delayed/wrong diagnosis associated with patient harm but no clear evidence of missed opportunities
- **D** Delayed/wrong diagnosis but no clear evidence of missed opportunities

Adapted from Singh Jt Comm J Qual Patient Saf 2014
Missed Opportunities-based Definition

- Used in multiple studies, thousands of record-reviews
- Accounts for broad stakeholder perspectives: patients, clinicians, health systems & consistent with safety/QI
- Useful to advance the “basic science” of diagnostic error
  - Avoids overestimating/overcalling: all diagnoses are delayed/wrong at some point in time
- Universal definition needed for all settings and stakeholders (consumers, providers, researchers/QI)
- However, specific diseases might require specific operational criteria for what is a missed opportunity
  - E.g.: lung cancer - 7 day delay on abnormal chest x-ray

Singh et al. BMJQS 2012
Singh et al. Am J Gastroenterol 2009
Singh et al. J Clin Oncol 2010
Singh et al. Arch Intern Med 2007
Foundation for Rigorous Measurement

- Few valid and reliable data sources
- Error measurement must reflect real-world practice
  - more than just what’s in “the doctors head”
  - systems, team members, and patients, all inevitably influence clinicians’ thought processes
- “Structure”- complex adaptive sociotechnical system - technological and non-technological dimensions
- “Process”- diagnosis evolves in distributed dimensions beyond the doctors visit
- “Outcomes”- safe (correct and timely) diagnosis vs. missed/delayed/wrong/over diagnosis; but should also account for patient and care outcomes

Singh BMJQS 2013
Sarkar et al BMJQS 2012
Framework for Measurement and Reduction of Diagnostic Errors

Sociotechnical Work System*

Diagnostic Process Dimensions
- Patient-provider encounter & initial diagnostic assessment
- Diagnostic test performance & interpretation
- Follow-up and tracking of diagnostic information
- Subspecialty consultation/referral issues

Measurement of diagnostic errors
- Reliable
- Valid
- Retrospective
- Prospective

Changes in policy and practice to reduce preventable harm from missed, delayed, wrong or over diagnosis
- Collective mindfulness
- Organizational learning
- Improved calibration
- Better measurement tools and definitions

Safer Diagnosis

Feedback for improvement

Improved value of health care

Improved Patient Outcomes

* Includes 8 technological and non-technological dimensions

Sittig & Singh Qual Saf Health Care 2010
Singh et al BMJQS 2012
Singh & Weingart Adv Health Sci Educ 2009
Weick et al Research in Organizational Behavior 1999
Methods of Retrospective Measurements

• Signals from administrative data are too weak
  o If validated, could provide clues on possible missed opportunities that warrant additional clinical evaluation
  o Current evidence insufficient for rigorous measurement

• Stronger signals to bolster error measurement
  o Try more autopsies: virtual autopsies in selected cases?
  o Try high-risk cohorts (cancer ~ 1/3rd delays; abnl results)
  o Provider surveys (30% missed results with care delays)
  o Incident reports from providers
    • Not covered comprehensively by AHRQ Common Formats
    • ER experience with MD champion and QI team; in reality, organizations don’t provide “protected time”
  o Future potential of incident reports from patients?
Triggers: Promises and Challenges

• Algorithms to select high-risk patient records for further reviews to look for missed opportunities
  o should leverage clinical (EHR) data
• Application retrospective or prospective surveillance
• Diagnostic missed opportunities found so far:
  o patient-provider encounter related breakdowns common,
  o lack of timely recognition/follow-up of predefined diagnostic clues such as abnormal test results
• Documentation-dependent; not easy to identify contributory factors esp. precise cognitive origins
• Challenges of lack of definitions & standards

Murphy et al BMJQS 2013
Singh & Thomas AHRQ Special Report 2009
Time for Triggered Reviews?

- Multiple reviewers; time investment
  - Institutions/practices have too many competing priorities
  - Will it give bang for the buck outside of research?
- Different mental models for what's an error
  - High level of disagreement on presence/absence of error
  - Higher reliability with explicit criteria: failure to act on predefined “red-flag” signs/symptoms or abnormal tests
- Diagnostic Error Evaluation Tool: ongoing effort to convert subjective error judgment to objective criteria to facilitate error determination

Singh et al BMJQS 2012
Singh et al Am J Gastroenterol 2009
Singh BMJQS 2013
More “Prospective” Measurements

• Direct observations resource intensive
• Simulations/vignettes: generalizability issues
• Gain insights from safety huddles, active monitoring of patient complaints and peer-review data
• Checklist-type tool for Proactive Risk Assessment at organizational or practice level
  o Self-assessment of specific “recommended practices” to ensure safer diagnosis
  o Prototype: Office of the National Coordinator (ONC) Sponsored “Safety Assurance Factors for EHR Resilience” Project (SAFER Guides)

Meeks et al BMJQS 2014
Singh BMJQS 2013
Singh et al BMC Med Inform Decis Mak 2009
http://www.healthit.gov/safer/safer-guides
Collective Mindfulness for Diagnostic Safety

• Organizations and practices need to
  o Be “preoccupied” with diagnostic errors: they are unaddressed by current safety measures
  o Gather “intelligence” related to diagnostic safety through any retrospective and prospective surveillance method (ideally multiple methods)
    • leverage existing safety/QI infrastructure: risk managers
  o Learn, improve and evaluate both intended and unintended consequences of interventions

• Critical to inform good measures and solutions based on science vs. belief

Weick et al Research in Organizational Behavior 1999
Sittig & Singh JHRM 2013
Reflections on Measurement

• Measurement ready for QI purposes (e.g. specific triggers with more refinement, test results follow-up, possibly others)
• Not ready for public reporting, performance measurement or penalties
• Still need more evidence and research in measurement
  o data, standards and operational definitions
  o sharp-end outcome measures for errors
  o blunt-end measures for systems’ diagnostic performance
• Need to go beyond the VA and few other institutions!
  o Others should start measuring for transparency

Smith et al BMJQS 2013
Wachter Diagnosis 2014
Singh et al In preparation
Giardina et al Health Affairs 2013
Health IT & Diagnostic Safety

• Few leveraging health IT to measure diagnostic safety
  o Our measurement revealed e-communication breakdowns
  o Innovation slow due to focus on “meaningful use”
  o Copy/paste issues & absent reflections/differential diagnosis

• Measuring diagnostic safety in EHR settings:
  o Current EHRs provide inadequate cognitive support for
    provider or team situational awareness
  o Potential to interfere with provider cognition (info overload)
  o Data display issues leading to ambiguity/missed findings
  o “iPatient” and effect on critical thinking skills?

Singh et al  BMJQS 2012
Singh et al Arch Int Med 2009 and Singh et al AJM 2010
Sittig & Singh NEJM 2012
Giardina et al Health Affairs 2013
Singh et al JGIM 2011
Singh et al JAMA Intern Med 2013
Feedback on Diagnostic Performance

• Could improve provider calibration (i.e. alignment between diagnostic accuracy and confidence in that accuracy)
• Could improve system calibration (i.e. alignment between safety measurement and reality)
• Diagnostic performance = individual + system performance so need both provider-centric and system-centric approaches
• Preliminary experiences with provider feedback
  o Uncertain responsiveness: Examples from work on secure emails and phone calls about missed test results
  o Will be challenging to integrate into workflow
  o Only ½ wanted EHR alerts-related performance feedback
Unknowns in Formal Feedback

• First, robust definitions and measurements critical

• Unknown attributes; not easy to borrow lessons
  o Content: Signal strength (unplanned hospitalization vs. preventable diagnostic adverse event?)
  o Delivery: Methods verbal vs. written?
  o Timing: Delayed when event is clear or more real-time when details evolving or unavailable?
  o Quality: Unambiguous, non-threatening, non-punitive?

• Shared accountability beyond the clinician/s involved

• Unintended consequences need to be monitored
  o More testing/treatment could occur
THANK YOU!

Institute of Medicine &
Funding Agencies

• Department of Veterans Affairs
• Agency for Health Care Research & Quality
• National Institute of Health
• Multidisciplinary team at Houston-based VA Health Services Research Center of Innovation
• Baylor College of Medicine

Email: hardeeps@bcm.edu
### References: Slides 2-7

#### Slide 2
- Singh et al *BMJQS* 2014
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- Singh & Weingart *Adv Health Sci Educ* 2009

#### Slide 3 & 4
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- Singh *BMJQS* 2013
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## References: Slides 8-11

**Slide 8**

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## References: Slides 12-15

**Slide 12**
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- **Wachter** *Diagnosis* 2014
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