Clinical Decision Support Technologies for Oncologic Imaging

Ramin Khorasani, MD, MPH

Professor of Radiology
Harvard Medical School

Distinguished Chair, Medical Informatics
Vice Chair, Department of Radiology
Director, Center for Evidence Based Imaging
Brigham and Women’s Hospital
Boston, MA
Disclosures

• **Current (active):**
  – Chair, Governing Council
    • Harvard Medical School Library of Evidence
  – External expert (Consultant) to QPLEs
    • Memorial Sloan Kettering Evidence Based Cancer Imaging Governing Council
    • Weill Cornell Medical College Imaging AUC Governing Council
Disclosures

• Prior (Inactive):
  – NIH UC4EB012952-01 (Principal Investigator)
    • Impact of decision support and accountability tools on adoption of evidence
  – DHHS/CMS 95-W-00279/1 (Project Director)
    • Medicare Imaging Demonstration (MID)
  – Consultant, Medicalis Corp. (Health IT vendor)
Overview topics for the session

• Background
• What is Clinical Decision Support (CDS)
• Federal law and imaging CDS
• Implementation challenges and opportunities
• The case for broad collaboration
  – A potential framework
• Patient engagement
• Take home message
Attributes of high quality healthcare

- Safe
- Patient-centered
- Evidence-based; “best practices”
- Timely
- Efficient
- Cost-effective
- Equitable

Although discovery will continue to excite and inspire us...

Our major challenge is...
“Failure of Execution” Atul Gawande, MD

Do what we know works-consistently

• What do we know?
  – E.g., guidelines, best practices, decision rules, etc.
    • Are they ‘trustworthy’?
  – How easy to find it? How easy to remember it?

• How long to adopting new evidence into practice?

• Do our ‘systems’ promote ‘right care’?
  – ‘Working harder and smarter is not the answer’
  – Is the ‘right care’ embedded in our workflow?

• How do we know how we are doing, to improve?
  – To manage change in behavior we need to measure performance
  – How do we promote adherence to best practice ‘evidence’ to reduce unwarranted variations in care?
Use of Public Data to Target Variation in Providers’ Use of CT and MR Imaging among Medicare Beneficiaries

Heatmap of MR Utilization by Payment ($)

Heatmap of Impact Hospital Referral Region for Diagnostic MR (overlapping intensity and payment)
Variation in Imaging Follow Up Recommendations by Cancer Imaging Specialists at a Single Institution

PROBABILITY OF MAKING A FOLLOW UP RECOMMENDATION

*There is a 2.68 fold difference between Attending 1 and 12  \( p \text{ value} \ 0.0344 \)
Clinical Decision Support

An expert system to improve the performance of non-expert clinician

*Iterative* interaction of a care provider with a computer to *improve* clinical decision making

*to improve:* transitive verb; to enhance, make better

Goal: Reduce unwarranted variation in Care; adherence to what we know benefits patients
Imaging Clinical Decision Support

• At the time of requesting an imaging study: (computerized provider order entry within EHR)
  – Reduce unnecessary testing (costs/waste)
  – Impact on experience of care for patients (unnecessary downstream diagnostic and therapeutic procedures)

• At the time of image interpretation: (computer aided detection or diagnosis) to improve accuracy

• At the time of reporting: improve quality of recommendations for additional imaging
Effective Imaging CDS: The 5E’s

- Efficient
  - Embed evidence in workflow; reduce redundant data entry

- Educate, Evidence-Based
  - Brief, actionable, unambiguous
  - Evidence from any source
  - Source and strength of evidence transparent to user
  - Minimize ‘low value’ alerts and alert fatigue

- Encourage or Enforce adoption of evidence
  - Consequences for ignoring evidence matter

Impact of effective CDS
“Choosing Wisely”

• CT for suspected pulmonary embolism: (ACEP)
  – ED use ↓20%; yield up 69% over 2 years
  – Inpatient use ↓13% over one month, then stable

• MRI for low back pain: (ACP)
  – Outpatients: MRI use ↓30% on day of PCP visit;
    ↓12.3% within 30 days of index PCP visit

• CT for minor traumatic brain injury (ACEP)
  – ↓13.4% in use of CT in ED

All above now published or in press in peer reviewed journals
Federal Law and Regulations in imaging clinical decision support

Protecting Access To Medicare Act (PAMA; 2014)
Broad Goals of PAMA (section 218b)

• Promoting evidence-based care
  – Begin with imaging
  – Expand scope over time
    • e.g. Priority Clinical Areas for ‘advanced Imaging’
    • Beyond imaging

• Improve quality of care and reduce waste
  – Reduce/eliminate unnecessary imaging
  – Protect provider workflow
    • CDS in lieu of onerous pre-authorization programs
    • Integrate CDS into EHR
Protecting Access to Medicare Act (2014)

- Ordering professionals for ambulatory ‘applicable’ advanced imaging services *must* be exposed to specified Appropriate Use Criteria (AUC) via a certified CDS mechanism
  - Consequence for failure—imaging provider (pro to tech) will not be paid
  - Implementation date delayed, (now January 1, 2020)

*AUC: evidence-based criteria linking a clinical condition to an imaging service with an assessment of appropriateness*
AUC ~ ‘medicine’
CDS (IT) ~ ‘syringe’

CMS certifies:
‘syringe’ vendors

CMS delegates:
‘medicine’ creation to qualified provider-led entities

New PAMA regulations promote competition and collaboration
<table>
<thead>
<tr>
<th>CMS Priority Clinical Areas</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coronary artery disease (suspected or diagnosed)</td>
</tr>
<tr>
<td>Suspected pulmonary embolism</td>
</tr>
<tr>
<td>Headache (traumatic and non-traumatic)</td>
</tr>
<tr>
<td>Hip pain</td>
</tr>
<tr>
<td>Low back pain</td>
</tr>
<tr>
<td>Shoulder pain (to include suspected rotator cuff injury)</td>
</tr>
<tr>
<td>Cancer of the lung (primary or metastatic, suspected or diagnosed)</td>
</tr>
<tr>
<td>Cervical or neck pain</td>
</tr>
</tbody>
</table>
Publishers of AUC (QPLEs) as of July 30, 2017

- American College of Cardiology
- American College of Radiology
- Banner University Medical Group-Tucson
  University of Arizona*
- CDI Quality Institute
- Cedars-Sinai Health System*
- Intermountain Healthcare
- Massachusetts General Hospital, Department of Radiology
- Medical Guidelines Institute*
- **Memorial Sloan Kettering Cancer Center***
- **National Comprehensive Cancer Network**
- Sage Evidence-based Medicine & Practice Institute*
- Society for Nuclear Medicine and Molecular Imaging
- University of California Medical Campuses
- University of Utah Health*
- University of Washington School of Medicine
- Virginia Mason Medical Center*
- Weill Cornell Medicine Physicians Organization
PAMA ‘big picture’ for Imaging CDS

- Financial burden: radiologists and technical providers of imaging services
- Workflow burden: ordering providers
“Successful” CDS Implementation

Clinical relevance & Simplicity

Are the Health IT systems in 2018 optimized (or at least capable) to deliver evidence at the point of care?
Order #: 1    Modified from #: 0
Order: HEAD - ED - CT
Special View(s):

Pertinent History/Reason for Exam:
wrong place, wrong time

Reason for Exam:

Contraindications:
Comments:
Physician Name/Pager: ed

Diabetic: Not Diabetic
Latex Allergy: None Known - No Latex Allergy
CREAT: 64 UMOL/L    2013-07-31
EGFR: >120 ML/MIN    2013-07-31
Structured Indication:
Breast Cancer Stage 2 & higher

Free Text Indication:
? Bone mets
Clinical Relevance v Simplicity: Well’s Criteria for Evaluation of Suspected Pulmonary Embolism

Decision Support

To accurately assess the probability of pulmonary embolism in this patient based on Well's Criteria you MUST check all that apply below.

☐ Clinical Signs and Symptoms of DVT
☐ PE is #1 Diagnosis, or Equally Likely
☐ Heart Rate >100
☐ Immobilization at least 3 days, or Surgery in the Previous 4 weeks
☐ Previous, objectively diagnosed PE or DVT
☐ Hemoptysis
☐ Malignancy with Treatment within 6 months, or palliative
☐ None of the Above

Please see "More Info" for references.

This information is presented to assist you in providing care to your patients. It is your responsibility to exercise your independent medical knowledge and judgment in providing what you consider best for the patient.
Balancing CDS goals v 2018 Realities

• Physician burnout as a ‘public health crisis’

Health Affairs Blog

Physician Burnout Is A Public Health Crisis: A Message To Our Fellow Health Care CEOs
John Noseworthy, James Madara, Delos Cosgrove, Mitchell Edgeworth, Ed Ellison, Sarah Krevans, Paul Rothman, Kevin Sowers, Steven Strongwater, David Torchiana, and Dean Harrison
March 28, 2017

– Technology (‘EHRs’) a major driver of burnout
  • Interruptions, distractions, inefficiencies
  • Federal regulations, performance measures, etc.

• Do interventions deliver desired results?
  – Impact of imaging CDS interventions? Mixed:
    • IT interventions alone have generally not been effective
    • Multi-faceted CDS-enabled quality improvement initiatives have had some promising results
Discovery crucial to future of medicine but
...for the growing knowledge base:

(help address ‘failures of execution’)

• A public domain repository of objectively graded, health IT consumable evidence can help

• ‘iTunes Library’ of Evidence
  – Curate ‘what we know’; deliver it ‘easily’ to systems of care and its stakeholders using IT standards
  – Expose evidence gaps to stimulate discovery
  – Accelerate adoption and creation of evidence
  – Promote broad collaboration
  – Harmonize CDS content across various ‘publishers’
Potential goals of collaboration

• Develop, evaluate and accelerate dissemination of best practices
  – Accelerate AUC/guideline development process
  – Implementation and dissemination of evidence
  – Close the ‘evidence-gap’
    • Higher quality evidence covering expanding clinical conditions
Can A Public Repository of Evidence Promote Collaboration and Dissemination of Evidence? A Case Example
HMS Library of Evidence
‘A resource for the public good’

• It is not a publisher of guidelines or a vendor of clinical decision support systems (CDS)
• It does not develop new guidelines
• It is a public repository of evidence that exists in the public domain, transparently graded, machine readable, continuously updated
• A resource to accelerate AUC development
• May serve as a framework for collaboration
Sample piece of clinical logic:

Grading System

• Oxford Centre for Evidence-Based Medicine
  – 1a-4c based on quality, 5=expert opinion

• United States Preventative Services Task Force categorization for Oxford Level 5 Evidence
  – ”I”: insufficient evidence - not supported by direct validation or a general body of evidence
  – “non-I”: non-insufficient – synthesis of a large body of evidence
Quality/Grade of Evidence matters (e.g. Oxford Evidence-Based Medicine)

Box. A Summary of the Institute of Medicine (IOM) Standards for Trustworthiness

1. Transparent process: The processes by which a clinical practice guideline is developed and funded should be described transparently.

2. Conflicts of interest: Potential guideline development group members should declare conflicts. None, or at most a small minority, should have conflicts, including services from which a clinician derives a substantial proportion of income. The chair and co-chair should not have conflicts. Eliminate financial ties that create conflicts.

3. Guideline development group composition: The group should be composed of methods experts, clinicians, representatives of stakeholders, and affected populations.

4. Systematic reviews: Essential to the process, systematic reviews must meet the IOM’s methodological standards.

5. Evidence quality and recommendation strength: Explain the reasoning behind each recommendation, summarize evidence for benefits and harms, characterize the quality and quantity of relevant evidence and the role of subjective judgments. Rate the level of evidence and the strength of the recommendation. Describe differences of opinion about recommendations.

6. Articulating recommendations: Describe the action recommended by the guideline and when it should be used; wording should facilitate measurement of adherence.

7. External review: Essential to the process, external review should include a full spectrum of stakeholders, reviewers not identified by name, explain all changes done in response to reviewers, and post for public comment.

8. Updating: Document the dates of the guideline, systematic review, and planned update; monitor the literature and update the guideline when new evidence suggests the need for change.
Categories of Evidence Included

• Clinical Decision Rules
• Professional Society Guidelines
  – Without a Numerical Scale
  – With a Numerical Scale
• Local Best Practice
<table>
<thead>
<tr>
<th>Dx/Symptom</th>
<th>Source Type</th>
<th>Publisher</th>
<th>Choosing Wisely</th>
<th>Endorsed by Professional Society</th>
<th>Imaging Modality</th>
<th>Body Region</th>
<th>Contrast</th>
<th>Final Oxford Grade</th>
<th>Strength of Evidence</th>
<th>Final USPSTF</th>
<th>Select All</th>
<th>Select None</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minor Head Trauma</td>
<td>Local best practice</td>
<td>N</td>
<td>CT</td>
<td>Head</td>
<td>N/A</td>
<td>1a</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Source Title:** Piece of Clinical Logic:

**Source Link:**

1. Go to: libraryofevidence.med.harvard.edu or Google “Harvard Library of Evidence”

2. Go to the RESOURCES drop-down

3. Click on

Direct Link to App: https://apps.smarthealthit.org/app/55
Engaging patients
patient reported data and shared decision making

• Optimizing ‘patient experience’ now a priority, focused on survey and feedback, however,

• Need for patient reported data:
  – EHR data primarily a ‘billing’ and ‘physician’ perspective of patient presentation
  – Enrich the ‘EHRs’, promote discovery
  – Reduce physician burden of documentation
  – Opportunity to further engage patients in decision making via evidence delivery models
Take Home Message

• Suboptimal implementation and varied adoption, “Failure of execution”, of what we already know, consistently, is the major challenge in transforming healthcare delivery today
  – Diminishes impact of new discoveries (precision medicine, artificial intelligence/machine learning)
  – Current state of health IT is a significant challenge for implementation science

• Multi-faceted clinical decision support-enabled improvement initiatives can help close the ‘adoption gap’ for best practices in healthcare and will improve patient’s experience of care
  – Collaboration in formulating and disseminating best practices to fuel CDS can help accelerate the needed change