

BRIGHAM HEALTH



BRIGHAM AND
WOMEN'S HOSPITAL

Clinical Decision Support Technologies for Oncologic Imaging

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HARVARD MEDICAL SCHOOL
Library of Evidence

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*

Reference: Institute of Medicine. Crossing the quality chasm. 2001



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?

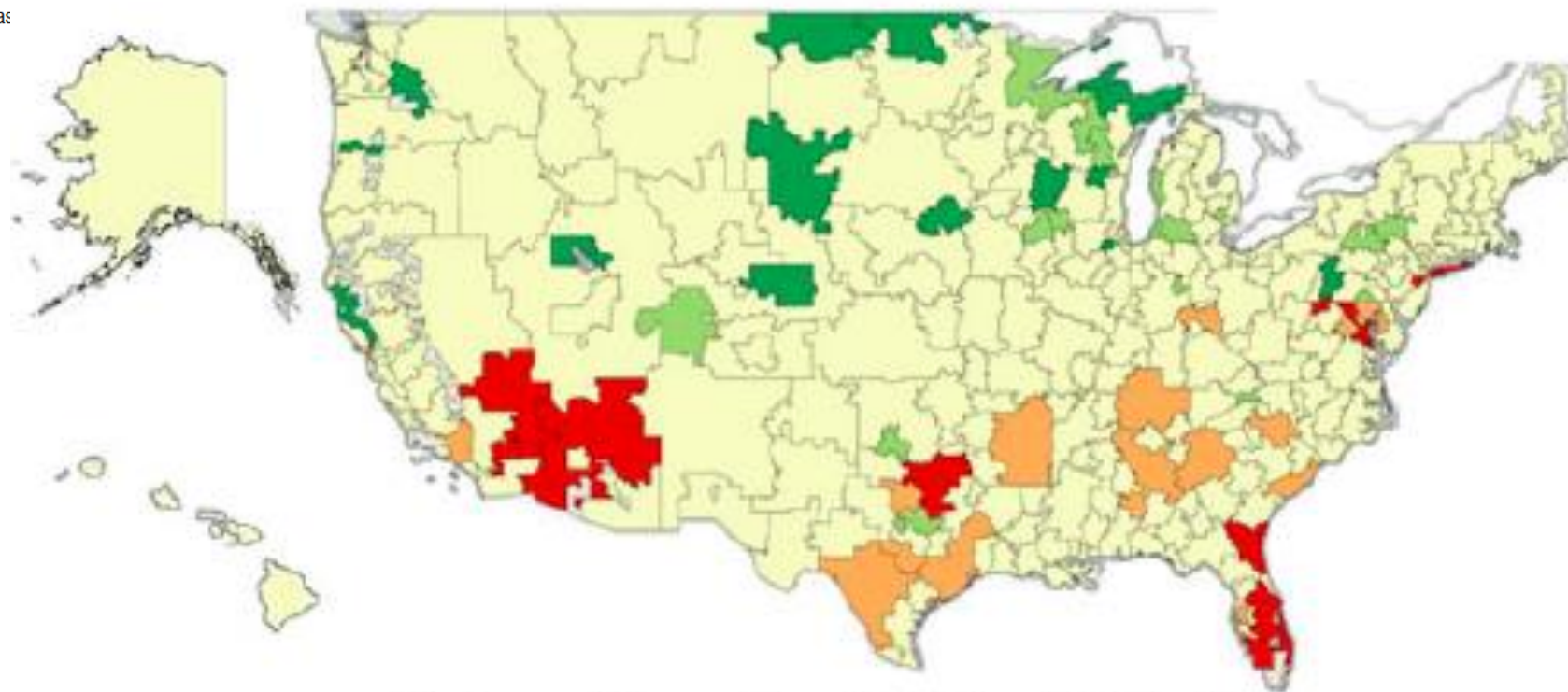


ePublished
February 2015

Use of Public Data to Target Variation in Providers' Use of CT and MR Imaging among Medicare Beneficiaries¹

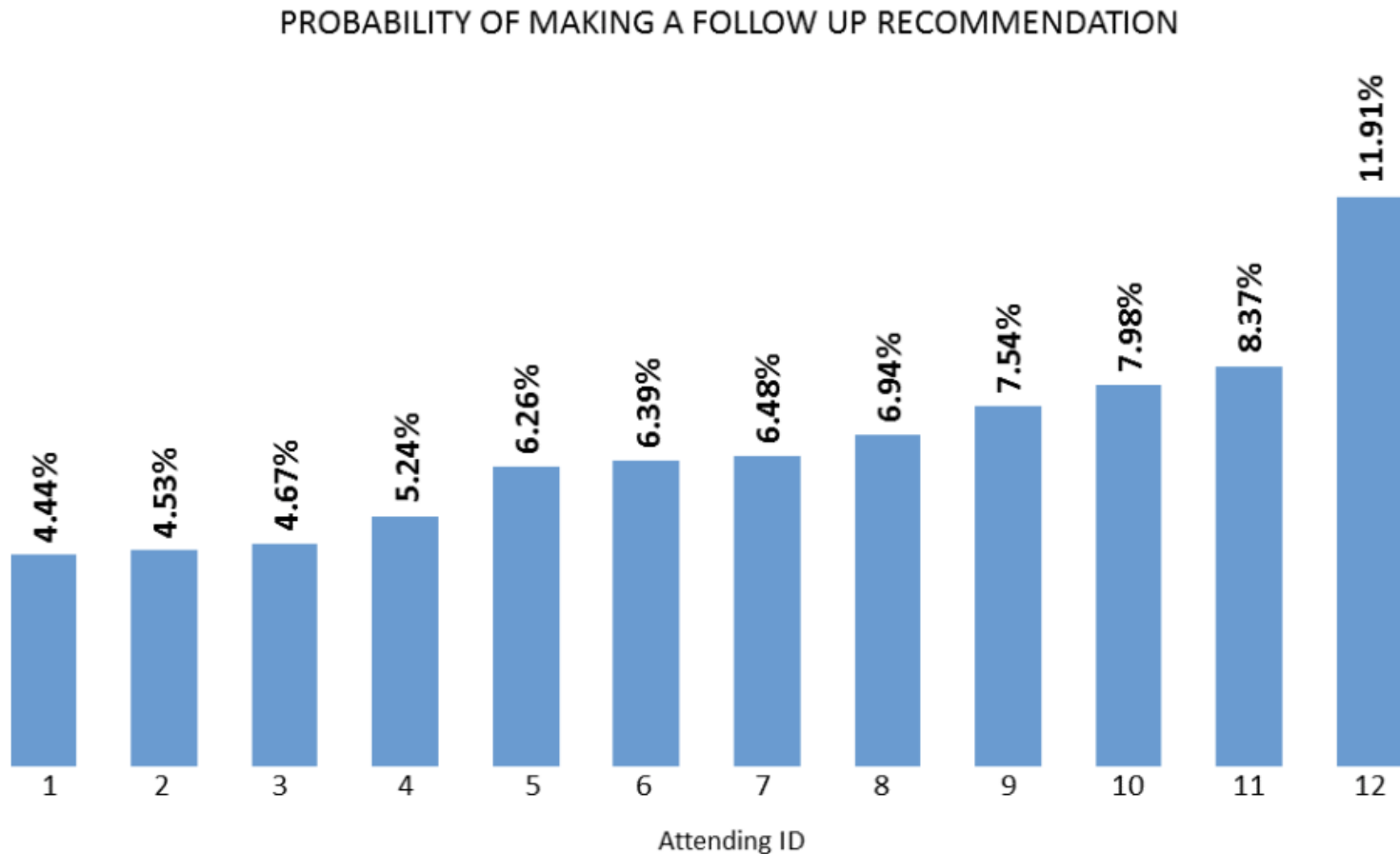
Ivan K. Ip, MD
Ali S. Raja, M
Steven E. Selt
Atul A. Gawar
Karen E. Joyn
Ramin Khoras

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



*There is a 2.68 fold difference between Attending 1 and 12 **p 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 5 E'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

Bates, DW, et al. JAMIA 10:6; November 2003.
Khorasani R, et al. AJR 203, November 2014.



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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***



CMS Priority Clinical Areas

Coronary artery disease (suspected or diagnosed)

Suspected pulmonary embolism

Headache (traumatic and non-traumatic)

Hip pain

Low back pain

Shoulder pain (to include suspected rotator cuff injury)

Cancer of the lung (primary or metastatic, suspected or diagnosed)

Cervical or neck pain



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?



2018

Order #:1 Modified from #:0 Reque

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



Appropriateness rankings for a 73 year old female

Indications: BREAST CANCER STAGE 2 AND HIGHER [KNOWN DX]

Appropriateness	Procedure
Selected Procedure	
2	NM BONE SCAN WHOLE BODY
Alternate Procedures to Consider	
9	BI MAMMOGRAM DIAGNOSTIC (BILATERAL)
9	BI MAMMOGRAM DIAGNOSTIC (LEFT)
9	BI MAMMOGRAM DIAGNOSTIC (RIGHT)
9	BI MAMMOGRAM DIAGNOSTIC CALL BACK (BILATERAL)
9	BI MAMMOGRAM DIAGNOSTIC CALL BACK (LEFT)
9	BI MAMMOGRAM DIAGNOSTIC CALL BACK (RIGHT)
9	BI MAMMOGRAM DIAGNOSTIC NO CHARGE (BILATERAL)
9	BI MAMMOGRAM DIAGNOSTIC NO CHARGE (LEFT)
9	BI MAMMOGRAM DIAGNOSTIC NO CHARGE (RIGHT)
9	BI MAMMOGRAM DIAGNOSTIC POST PROCEDURE (LEFT)
9	BI MAMMOGRAM DIAGNOSTIC POST PROCEDURE (RIGHT)
9	BI MAMMOGRAM DIAGNOSTIC WITH TOMOSYNTHESIS NO CAD (BILATERAL)
9	BI MAMMOGRAM DIAGNOSTIC WITH TOMOSYNTHESIS NO CAD (LEFT)
9	BI MAMMOGRAM DIAGNOSTIC WITH TOMOSYNTHESIS NO CAD (RIGHT)
9	BI MRI BREAST (BILATERAL)
9	BI MRI BREAST (LEFT)
9	BI MRI BREAST (RIGHT)

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 your patient.

Submit



Balancing CDS goals v 2018 Realities

- Physician burnout as a ‘public health crisis’

HealthAffairsBlog

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

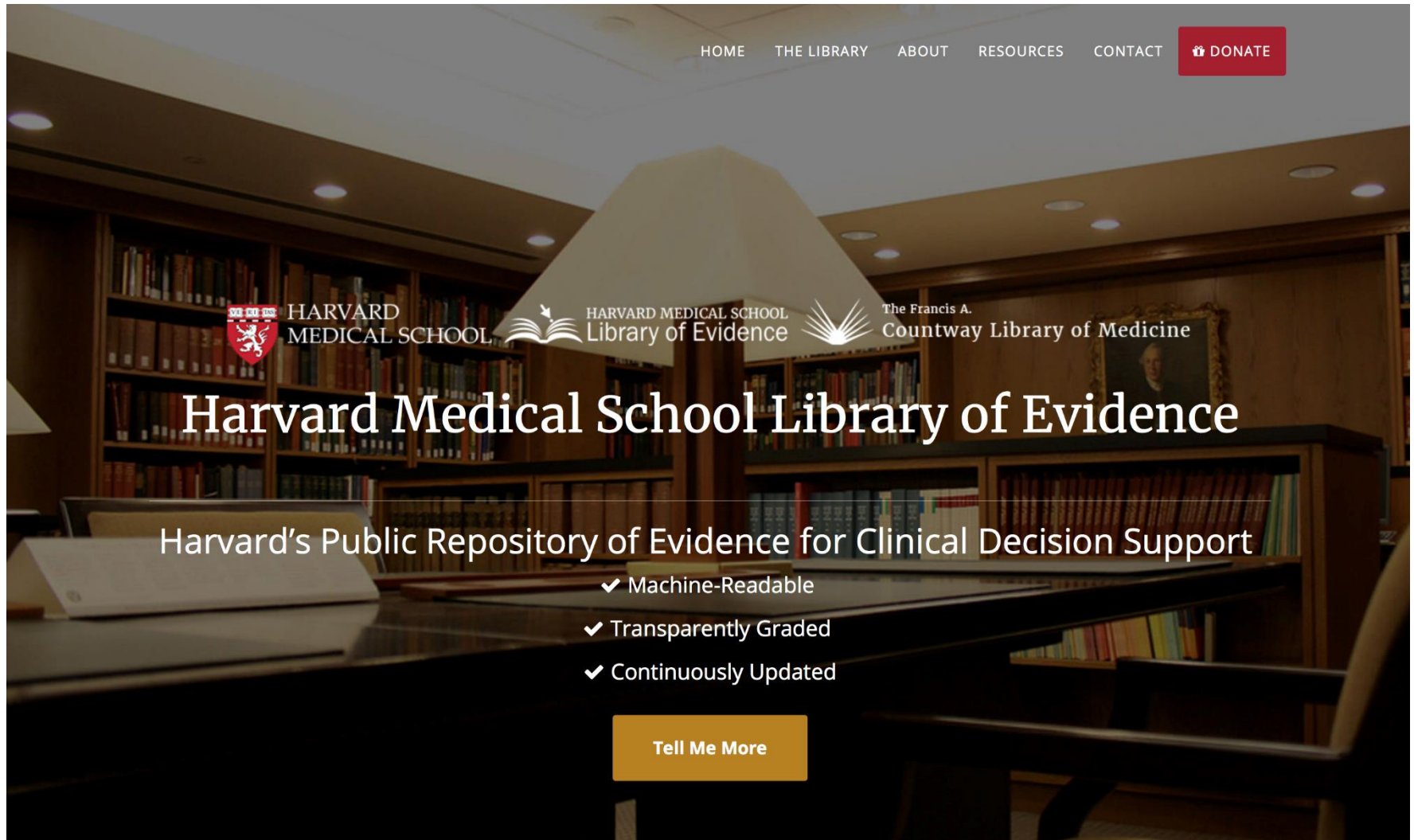
- Develop, evaluate and accelerate dissemination of best practices
 - Accelerate AUC/guideline development process
 - Implementation and dissemination of evidence
 - Close the ‘evidence-gap’
 - Higher quality evidence covering expanding clinical conditions



***Can A Public Repository of
Evidence Promote Collaboration
and Dissemination of Evidence?
A Case Example***



LibraryOfEvidence.med.harvard.edu

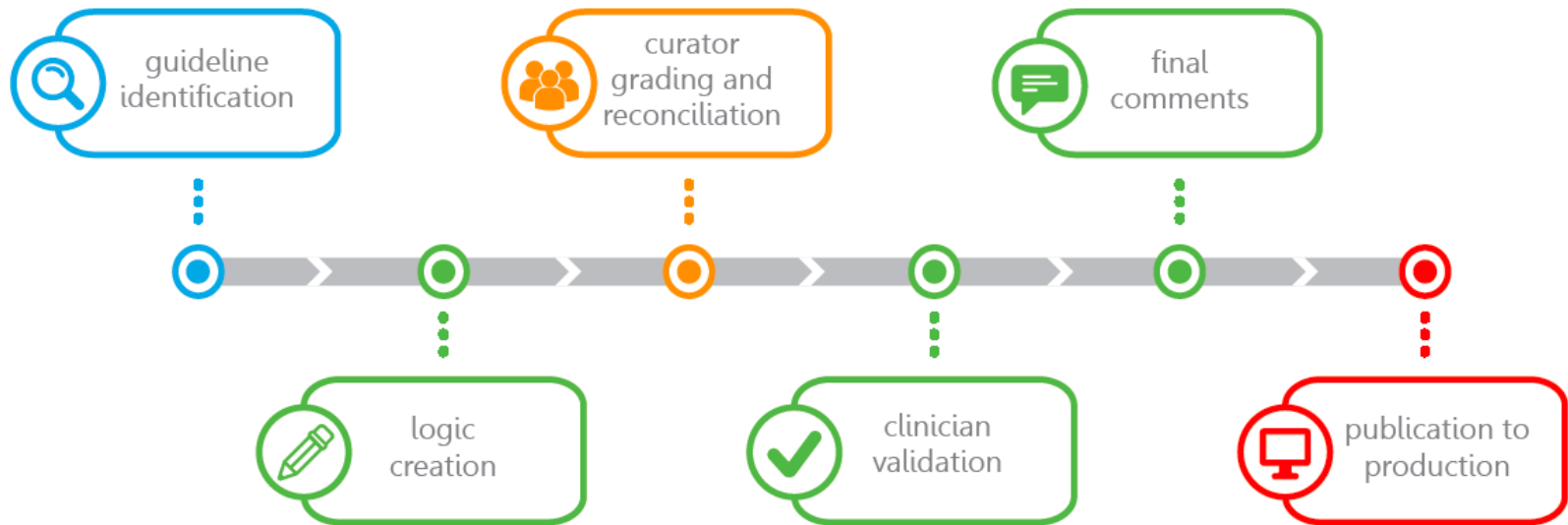
The banner features a background image of a library interior with bookshelves and a desk. At the top right, there is a navigation menu with links: HOME, THE LIBRARY, ABOUT, RESOURCES, CONTACT, and a red button labeled DONATE. Below the navigation, the Harvard Medical School logo is on the left, and the text 'HARVARD MEDICAL SCHOOL Library of Evidence' and 'The Francis A. Countway Library of Medicine' is in the center. The main title 'Harvard Medical School Library of Evidence' is prominently displayed in large white text. Below it, the subtitle 'Harvard's Public Repository of Evidence for Clinical Decision Support' is shown. A list of three bullet points follows: '✓ Machine-Readable', '✓ Transparently Graded', and '✓ Continuously Updated'. At the bottom center, there is a yellow button labeled 'Tell Me More'.

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**





- leadership
- administration
- providers
- librarians

Sample piece of clinical logic:

IF ([Loss of consciousness] **OR** [Post-Traumatic Amnesia]) **AND NOT** ([Focal neurologic deficit] **OR** [Coagulopathy] **OR** [Vomiting] **OR** [GCS<15] **OR** [Severe headache] **OR** [Physical signs of basal skull fracture] **OR** [Dangerous mechanism of injury] **OR** [Trauma >24h ago] **OR** [Hemodynamically unstable]) **AND** [Age ≤60] **THEN NOT** [CT Head]



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



How to Decide Whether a Clinical Practice Guideline Is Trustworthy

David F. Ransohoff, MD

Michael Pignone, MD, MPH

Harold C. Sox, MD

favorable balance of harms and benefits and should then become recommended practice.³ Because benefits and harms are often measured in different units, quantitative estimates of net benefit is necessarily subjective and therefore potentially

Quality/Grade of Evidence matters (e.g. Oxford Evidence-Based Medicine)

JAMA, January 9, 2013—Vol 309, No. 2



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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.

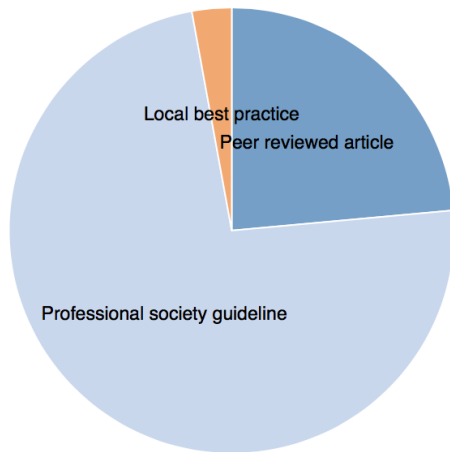
Categories of Evidence Included

- Clinical Decision Rules
- Professional Society Guidelines
 - Without a Numerical Scale
 - With a Numerical Scale
- Local Best Practice



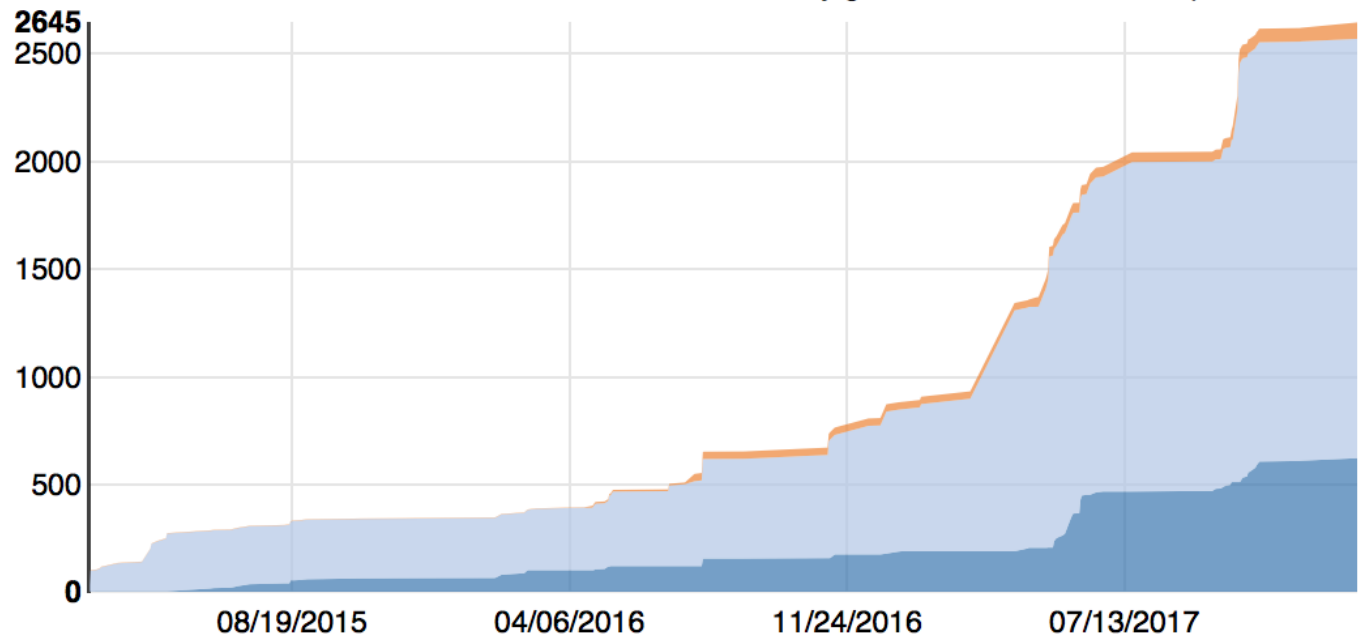
Rules by Type

● Peer reviewed article ● Professional society guideline ● Local best practice



of Rules

● Peer reviewed article ● Professional society guideline ● Local best practice



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 Search in guideline name, dx/symptom or piece of logic

Filter by:

Modality ▾
 Body Region ▾
 Contrast ▾
 1a x 1b x 1c x 2a x 2b x 2c x
 Oxford Grade
 USPSTF

Professional Society ▾
 Choosing Wisely ▾
 Endorsed by ▾

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Quick Filters:

[All \(374\)](#)
[Choosing Wisely \(7\)](#)
[Oxford Grade 1-2 \(37\)](#)
[Oxford Grade 1-4 \(39\)](#)
LIBRARY

currently displaying 1-37 of 37 results

[EXPORT](#)

Dx/Symptom	Source Type	Publisher	Choosing Wisely	Endorsed by Professional Society	Imaging Modality	Body Region	Contrast	Final Oxford Grade	Strength of Evidence	Final USPSTF	Select All Select None
Minor Head Trauma	Local best practice		N		CT	Head	N/A	1a		Non-I	☐
Source Title: BWH Percipio - Minor Head Trauma Source Type: Local best practice	Source Link:	Piece of Clinical Logic: IF NOT ([LOC] OR [Post-Traumatic Amnesia]) AND NOT ([Focal neurologic deficit] OR [Coagulopathy] OR [Vomiting] OR [GCS<15] OR [Headache] OR [Physical evidence of trauma above the clavicles] OR [Deficits in short-term memory] OR [Post-traumatic seizure] OR [Drug] OR [alcohol intoxication] OR [Trauma more than 24h ago] OR [Hemodynamically unstable]) AND [Age <65] THEN NOT [CT Head]						Validating Clinician Name: Ivan Ip Curator Name: David Osterbur Curator Name: Julia Whelan	Grading Dates: Mar 4, 2015 Public Comment:	OPEN	



HMS Library of Evidence on App

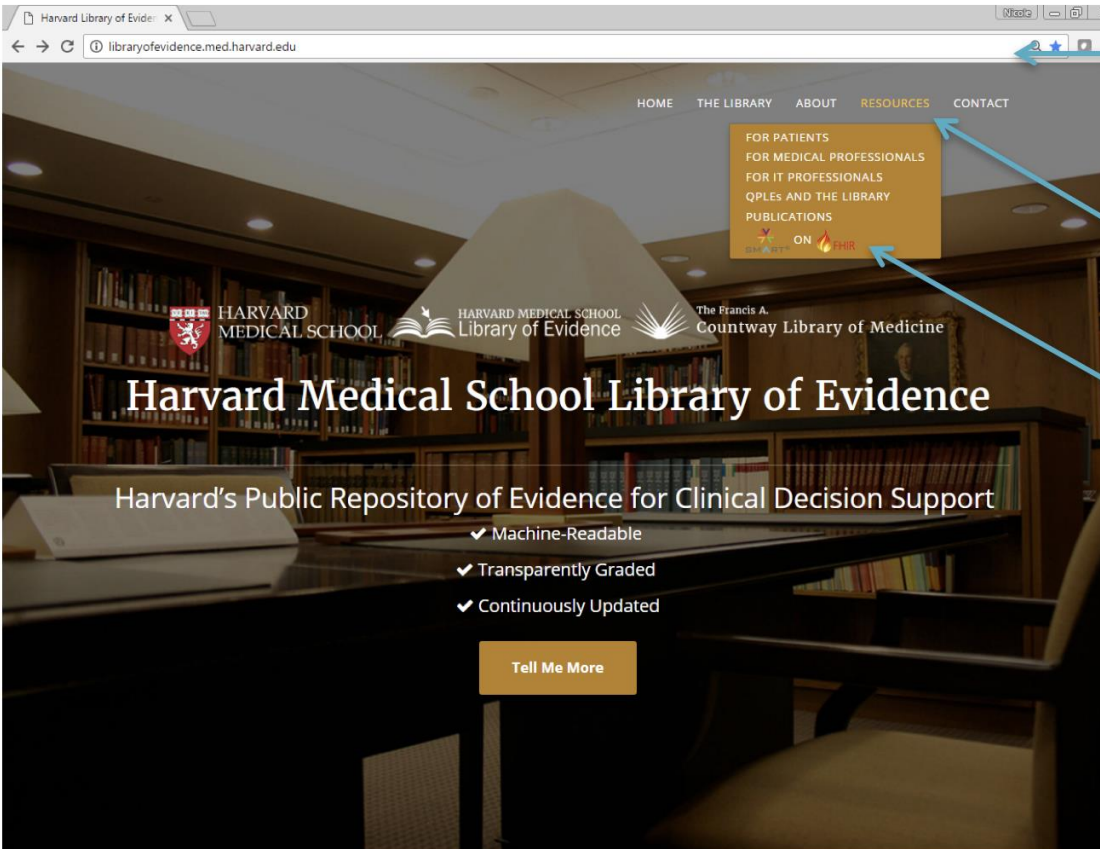
1. Go to:
libraryofevidence.med.harvard.edu
or
Google “**Harvard Library of Evidence**”

2. Go to the **RESOURCES** drop-down

3. Click on  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

