Clinical Decision Support:

What's next

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Disclosure

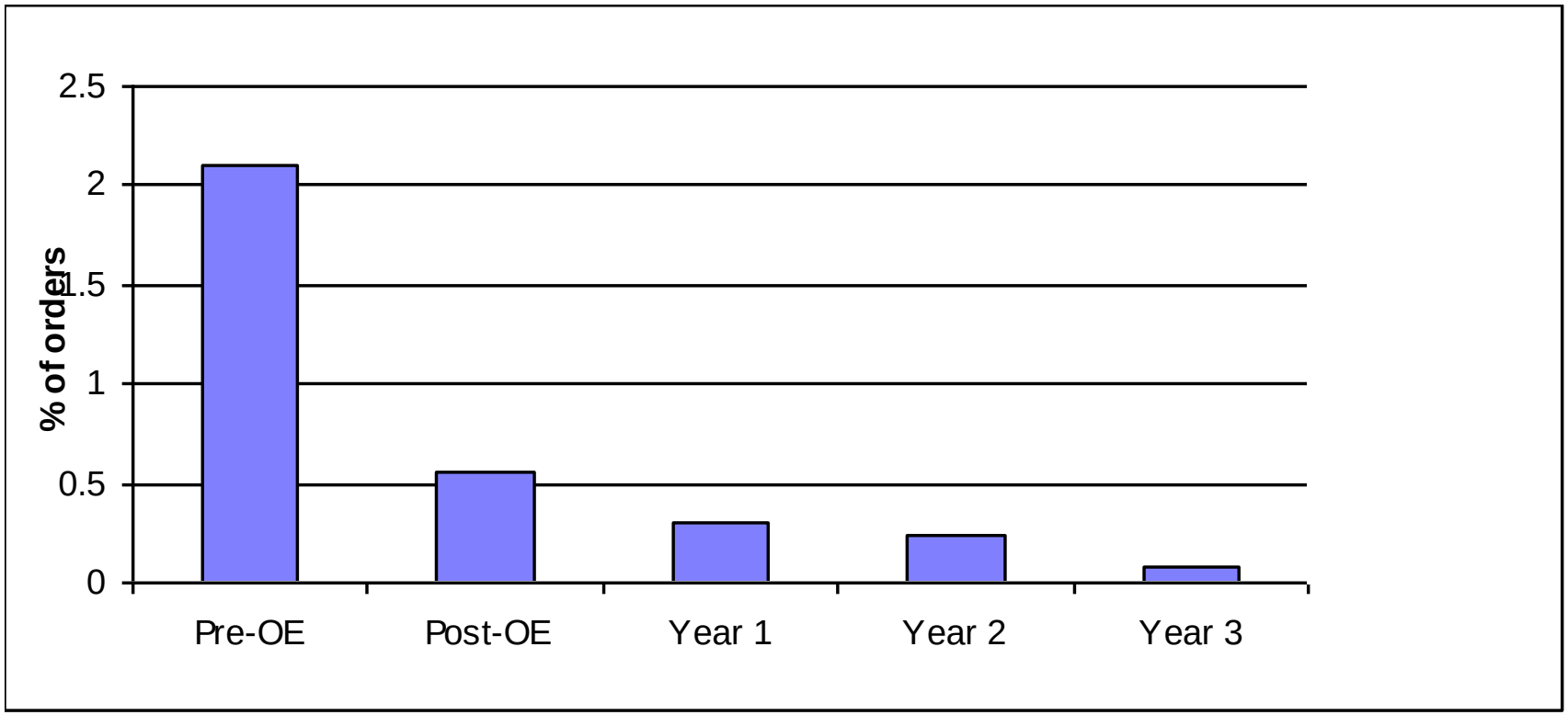
- Elsevier provides management tools and content for order sets, care plans, clinical pathways, drug information, smart reference, analytics, and probably other stuff I don't even know about.

- This talk contains a few examples from Elsevier, some from the Brigham, and a lot from general sources.

- None of the material is intended to be commercial.

Good CDS is good for healthcare

reduced dosing errors after implementing CDS with CPOE



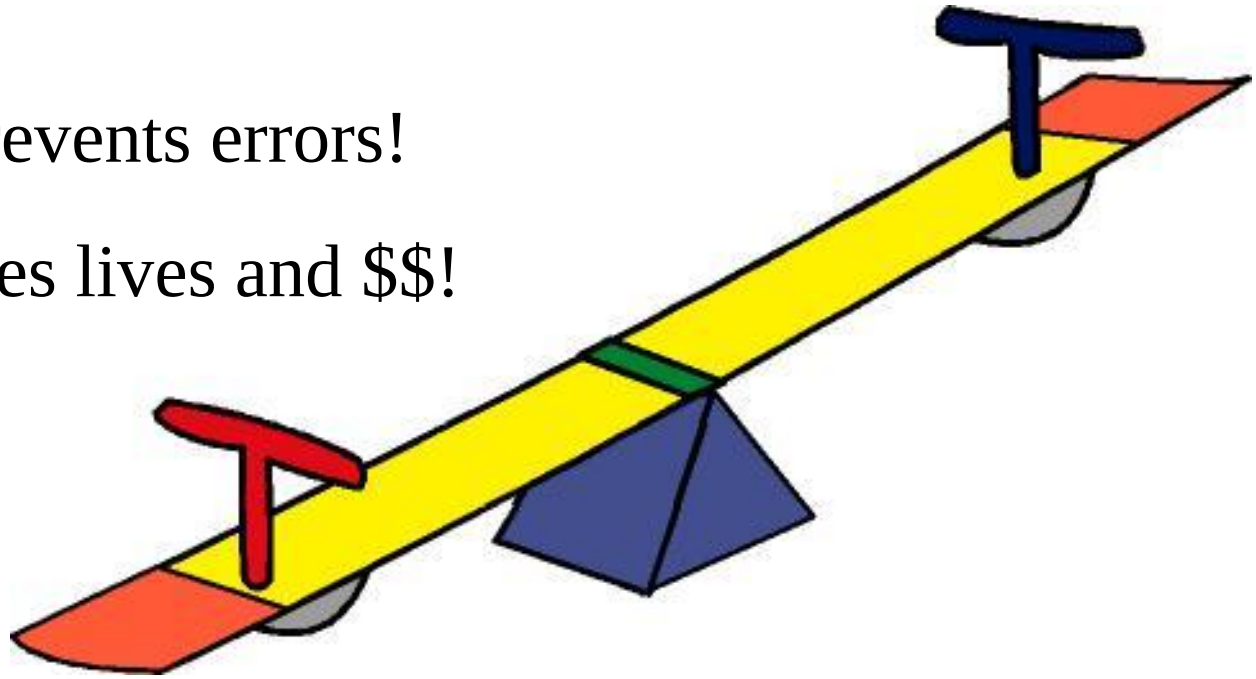
News seems to fluctuate

Causes errors!

Hurts patients!

Prevents errors!

Saves lives and $$!



Grand Challenges (2008)

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Available online at www.sciencedirect.com

ScienceDirect

Journal of Biomedical Informatics 41 (2008) 387–392

Journal of Biomedical Informatics

www.elsevier.com/locate/yjbin

Grand challenges in clinical decision support

Dean F. Sittig [a,b,*], Adam Wright [b,h], Jerome A. Osheroff [c,d], Blackford Middleton [e], Jonathan M. Teich [f,g], Joan S. Ash [b], Emily Campbell [b], David W. Bates [h]

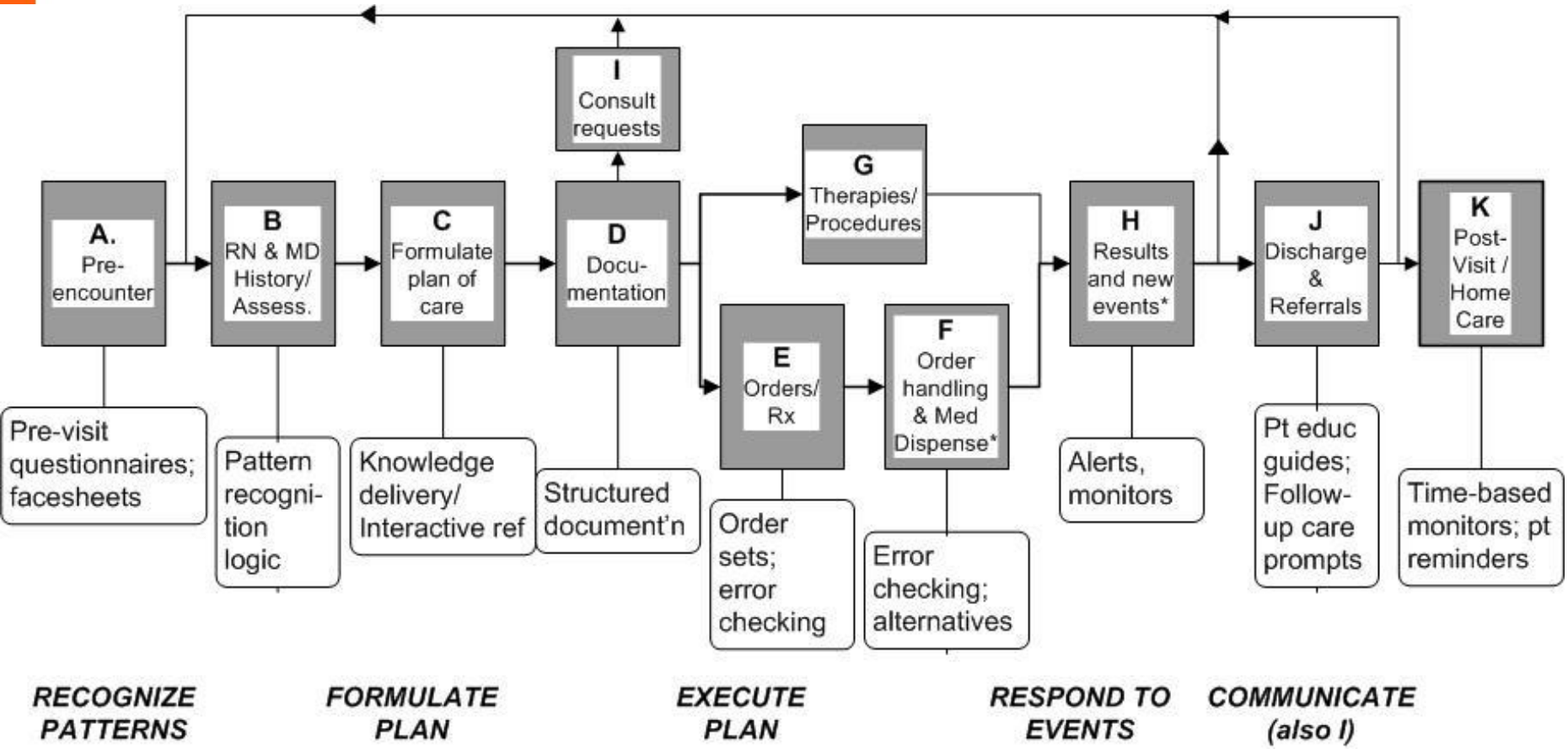
- Usability
- Share CDS artifacts (executable/readable)
- Provide CDS repositories
- Communicate best practice CDS
- Filter for co-morbidities
- Make use of free text information
- Learn new CDS from big data

Frontiers

- Knowledge access
- Clinical pathways
- CDS sharing
- Back to the roots

Knowledge Access

Knowledge access



From *Improving Outcomes with Clinical Decision Support*, © HIMSS 2012

Knowledge access

- At *Recognize* and *Formulate* time, it's about Q&A
  - Confirm things I know
  - Tell me about things I didn't know
  - Tell me about new things
- The "smart doc on my shoulder":

Understanding information needs and queries

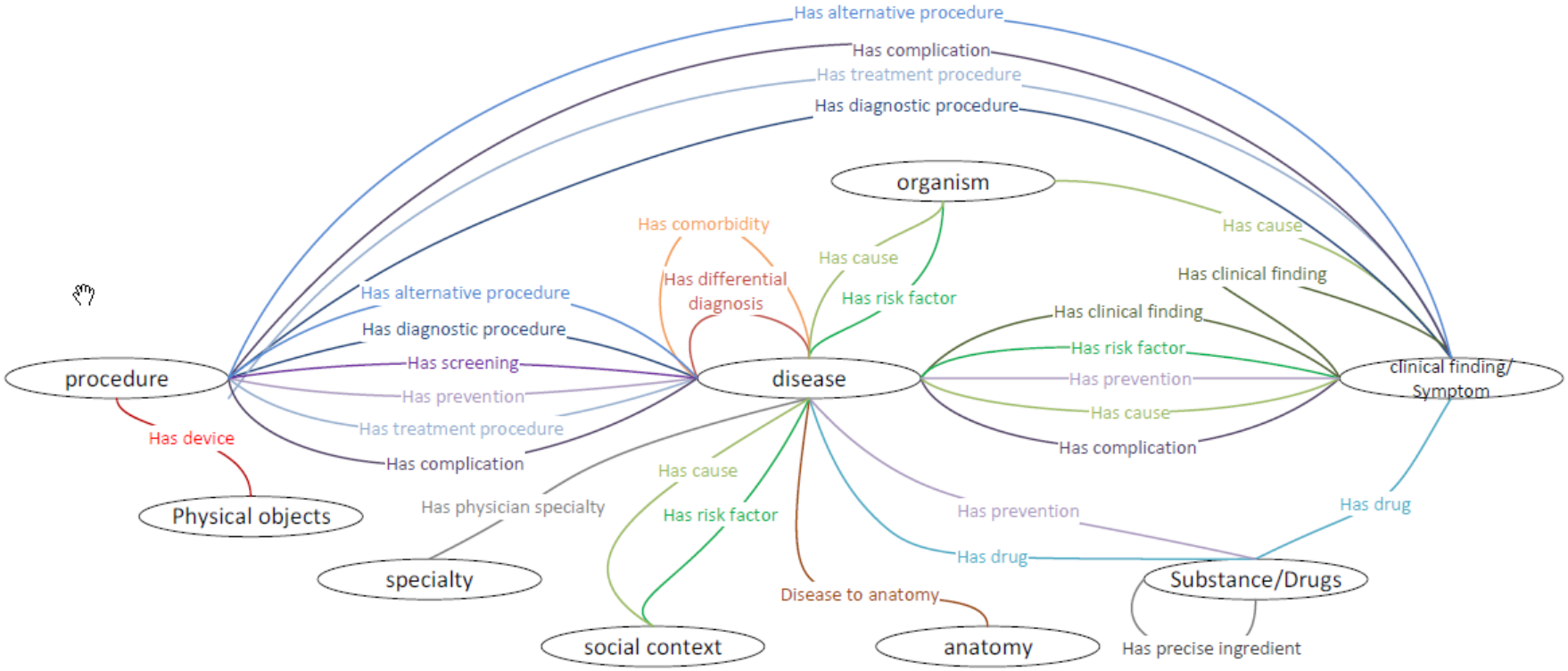
- 300,000 consecutive queries to MDConsult, ClinicalKey
- Synthesized ontology of information needs
- Agrees with and extends work of Ely et. al.

1	Sample search query	NEW: Mapping to standard question template	N
66	**treatment of hyperhidrosis**	How do I treat CONDX?	
67	**atrial fibrillation anticoagulation**	How effective is MED in the treatment of CONDX?	
68	**(anemia) and diagnosis**	How do I work up a patient with CONDX?	
69	**(septic shock) and diagnosis**	How do I work up a patient with CONDX?	
70	**corticosteroids in bronchiolitis**	How effective is MED in the treatment of CONDX?	B
71		How do I use MED in the treatment of CONDX?	B
72	**"insulin pump therapy in children" and adolescents**	How do I use MED in the treatment of CONDX?	D
73		How is OTHERTX used in the treatment of CONDX?	D
74	**thrombolysis in myocardial infarction**	How effective is MED in the treatment of CONDX?	A
75		How do I use MED in the treatment of CONDX?	A
76	**indications for tpn**	What are the risks and benefits of using OTHERTX in the treatment of CONDX?	N
77	**deep brain stimulation for parkinson's disease**	What are the risks and benefits of using OTHERTX in the treatment of CONDX?	P
78		How is OTHERTX used in the treatment of CONDX?	P

Doctors only ask about 80 questions

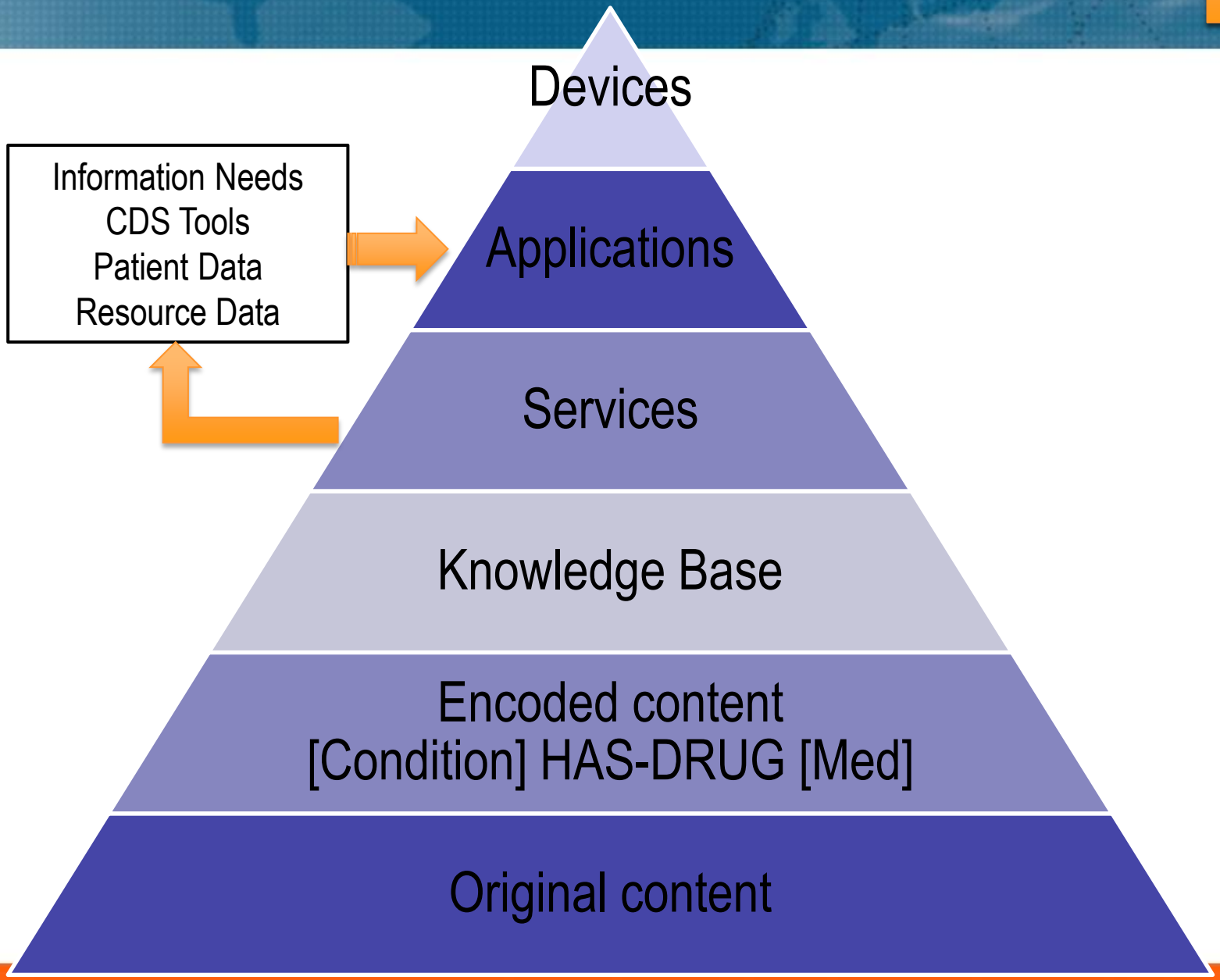
59	How do I perform STUDY?
60	What DX could cause lab test finding RESULT?
61	* **Diagnosis: Differential Diagnosis (by Topic 1…2…n)**
62	How do I distinguish CONDX from CONDX2…n?
63	Compare DX1…DXn as the cause of OBS1…OBSn (differential diagnosis)
64	What DXs could cause history finding OBS?
65	What DXs could cause physical finding OBS?
66	What DXs could be the cause of OBS1+…OBSn?
67	What DX could cause lab test finding RESULT?
68	* **Diagnosis: Consultation**
69	In what circumstances should I obtain consultation in the workup of CONDX?
70	* **Treatment: Summary Approach**
71	What are the best treatment options for CONDX?
72	How should I manage condition CONDX (not specifying diagnostic or therapeutic)?
73	Compare MED1…MEDn (or med class 1…n) for treating CONDX
74	Compare medical vs. surgical vs. other treatment for CONDX
75	* **Treatment: Medications: (by Drug 1…2…n)**
76	What is the best medication treatment for CONDX?
77	How effective is MED in the treatment of CONDX?
78	What is the dosing of MED?
79	What are the side effects and adverse effects of drug MED, and how do I avoid/manage them?
80	Are there contraindications to using MED?

Convert evidence ➔Knowledge graphs, triples



Strep pharyngitis —has drug (SOE: 10 SOR: 9)→ penicillin

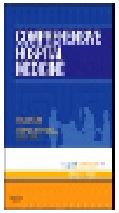
Knowledge as a service tuned to need



Precision Information to answer queries

Find an answer to: what is the difference between seizure and syncope? Go

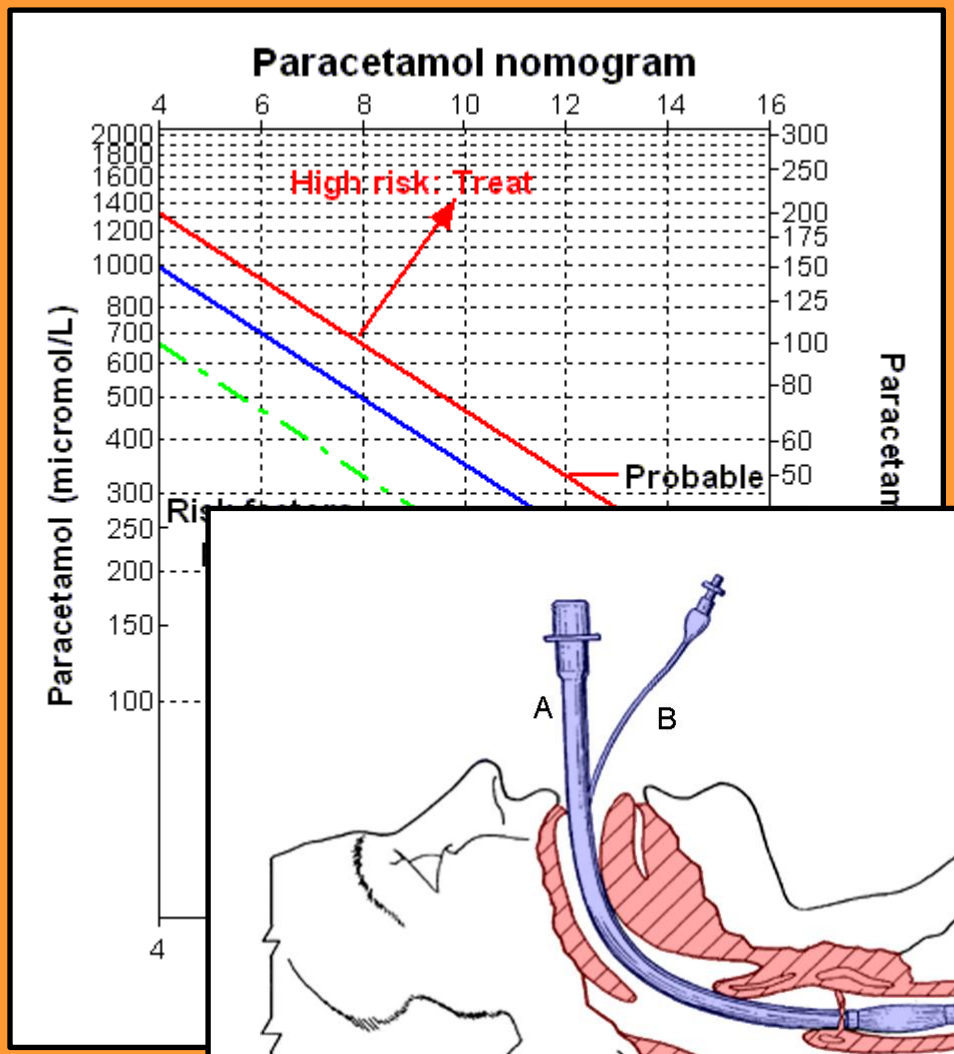
ASSESSMENT Differential Diagnosis Syncope versus Seizures

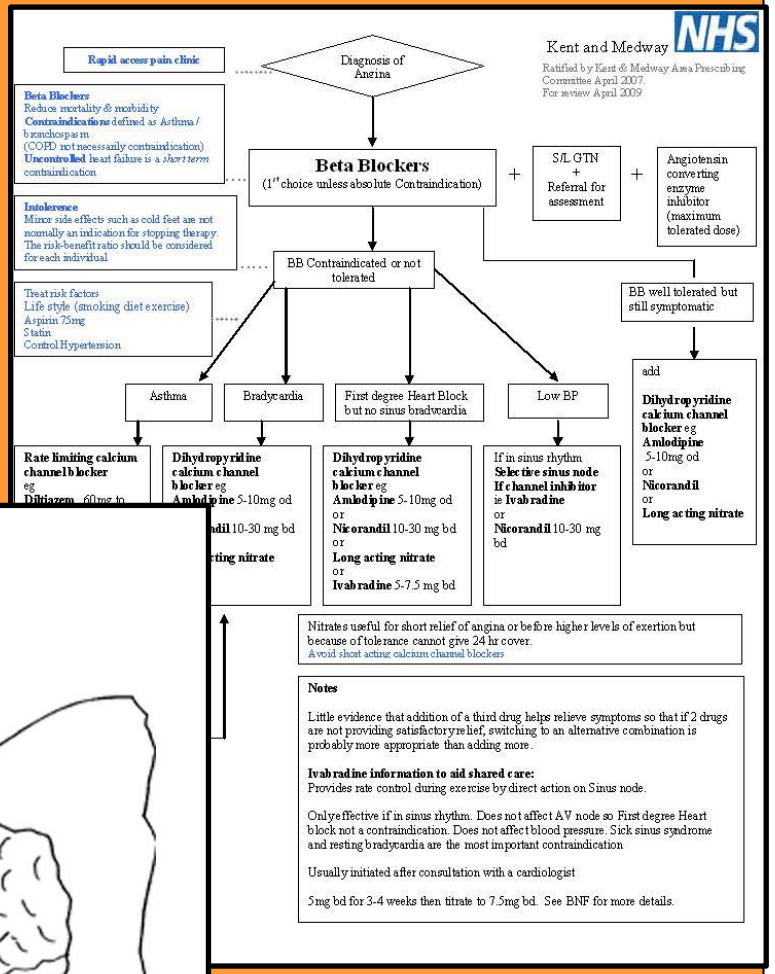


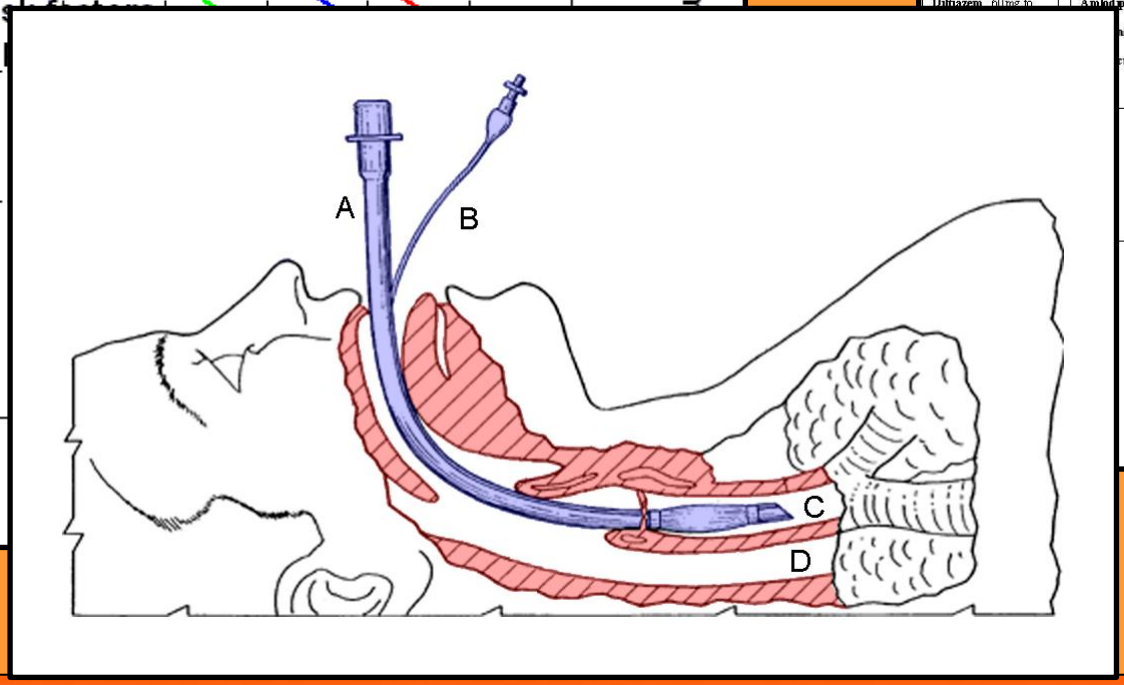
From Syncope
Source: *Comprehensive Hospital Medicine* *(YEAR)*

The differentiation between syncope and seizures is important, and it is not always obvious. Tongue biting or oral trauma, incontinence (especially fecal), lack of pallor or cyanosis, persistent tonic-clonic movements, slow return to consciousness, post event headache or confusion, or myalgias indicate seizures. Symptoms of nausea or diaphoresis prior to the event suggest syncope, whereas an aura (an auditory phenomenon, an upset stomach, complex visual experiences, or unpleasant olfactory sensations) is associated with seizures. Patients with syncope do not remember actually hitting the ground. Post event confusion has been described with syncope, but the confusion should not last more than 30 seconds. Seizure-like activity can occur with syncope (convulsive syncope) if the patient is held in an upright posture. However, convulsive syncope is not sustained and also rarely lasts longer than 30 seconds. Seizures generally last for at least 1-2 minutes. Seizures are associated with stertorous breathing and tachycardia, whereas syncope is usually associated with pallor and a slow, thready pulse.

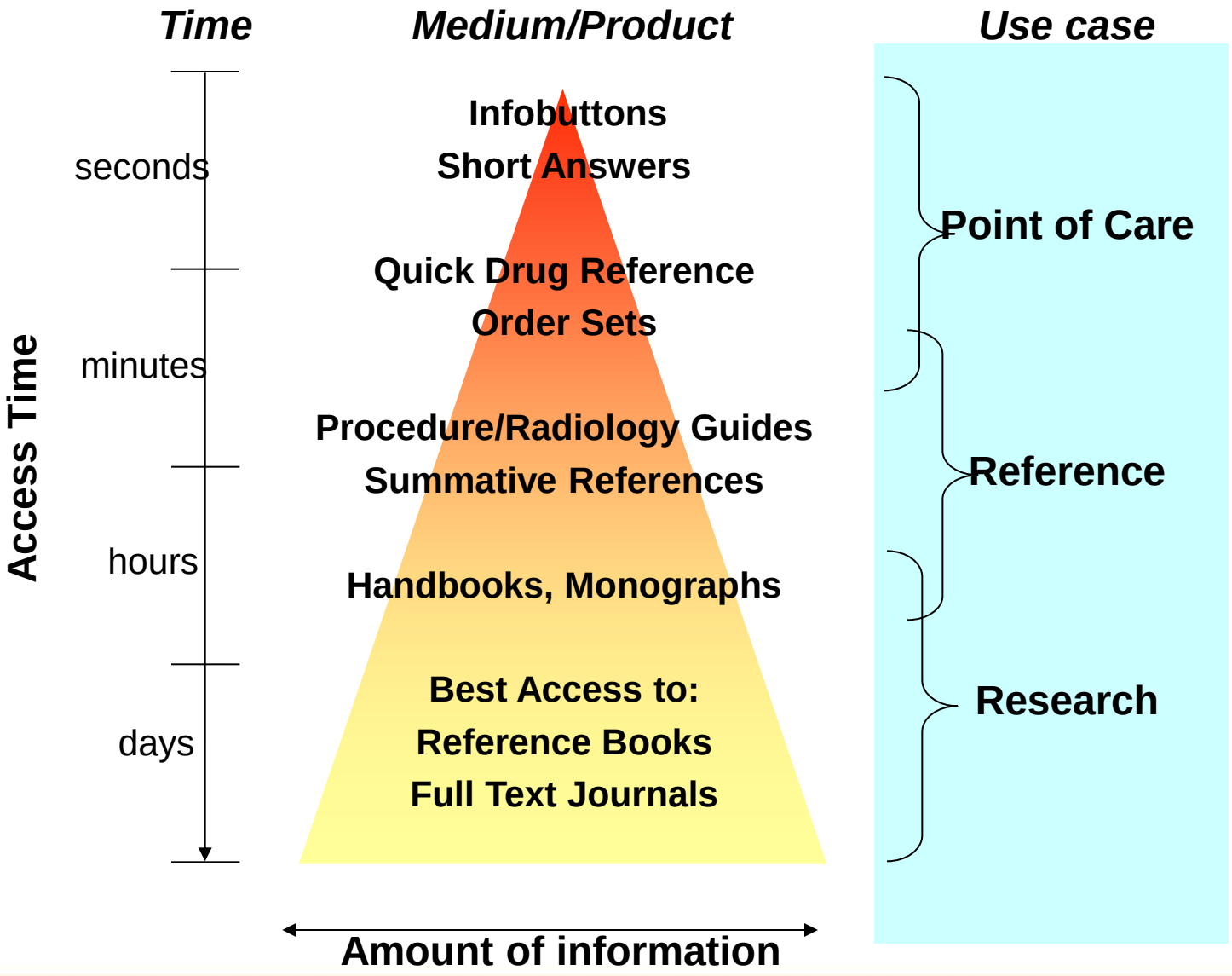
Knowledge in the right form



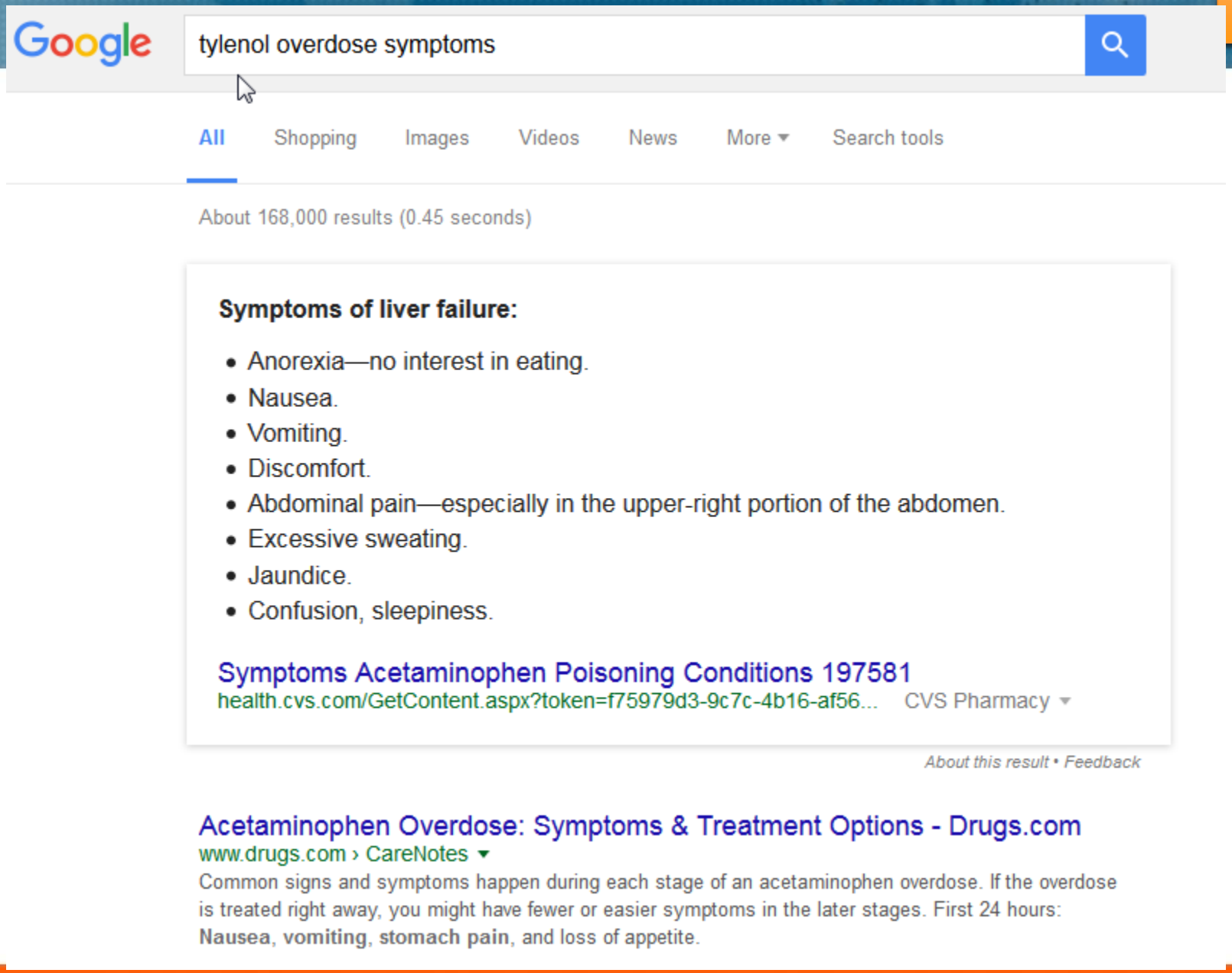




Knowledge at the right depth

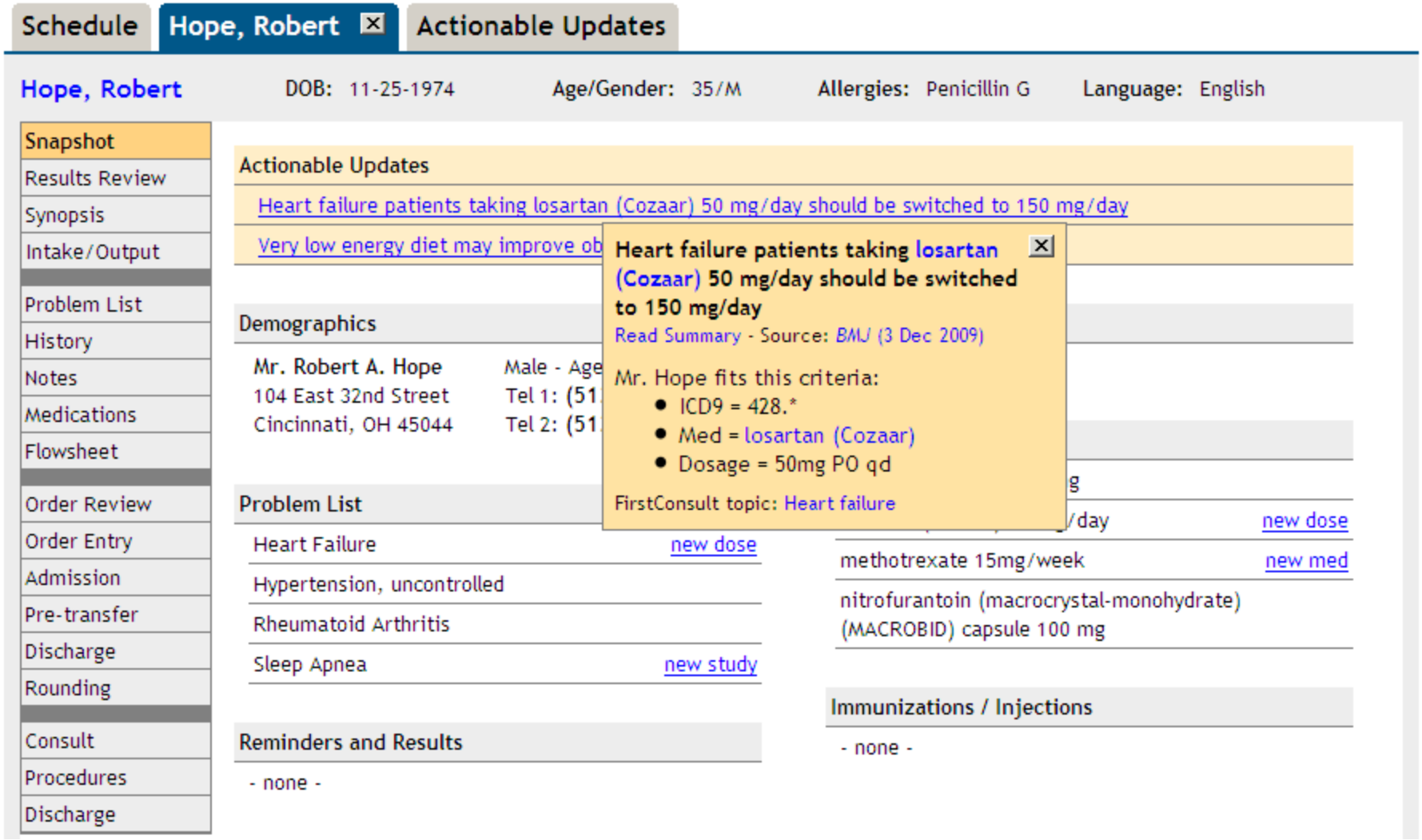


There is precedent for converting knowledge to Q&A

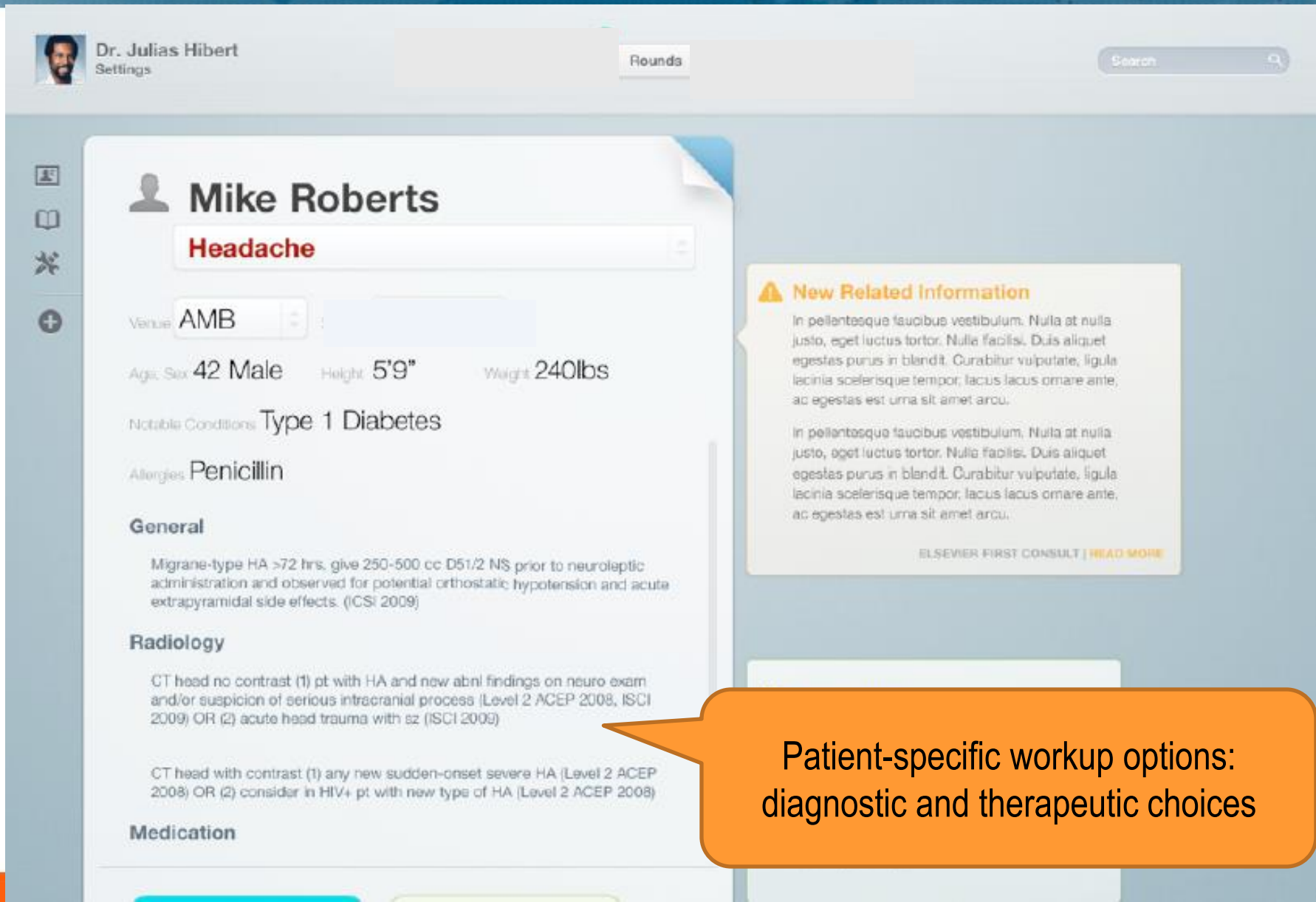


-38 AT&T
6:27 PM
80%
“ How do I treat a pulmonary embolism ”
OK, here you go:
Input interpretation
pulmonary embolism and infarction
drugs prescribed at visit
Result
male
female
all
coumarins and indandio⋱nes
34%
40%
38%

Applications: Knowledge as surveillance



Knowledge on rounds



Clinical Pathways

Definition of a Clinical Pathway (Cochrane)

1. **Structured, multidisciplinary** plan of care
2. **Standardizes** care for a specific clinical problem or procedure
3. **Translates** guidelines or evidence into local action
4. **Shows all the care steps** in some structured form
5. **Advance to next step** at certain times or after certain events happen

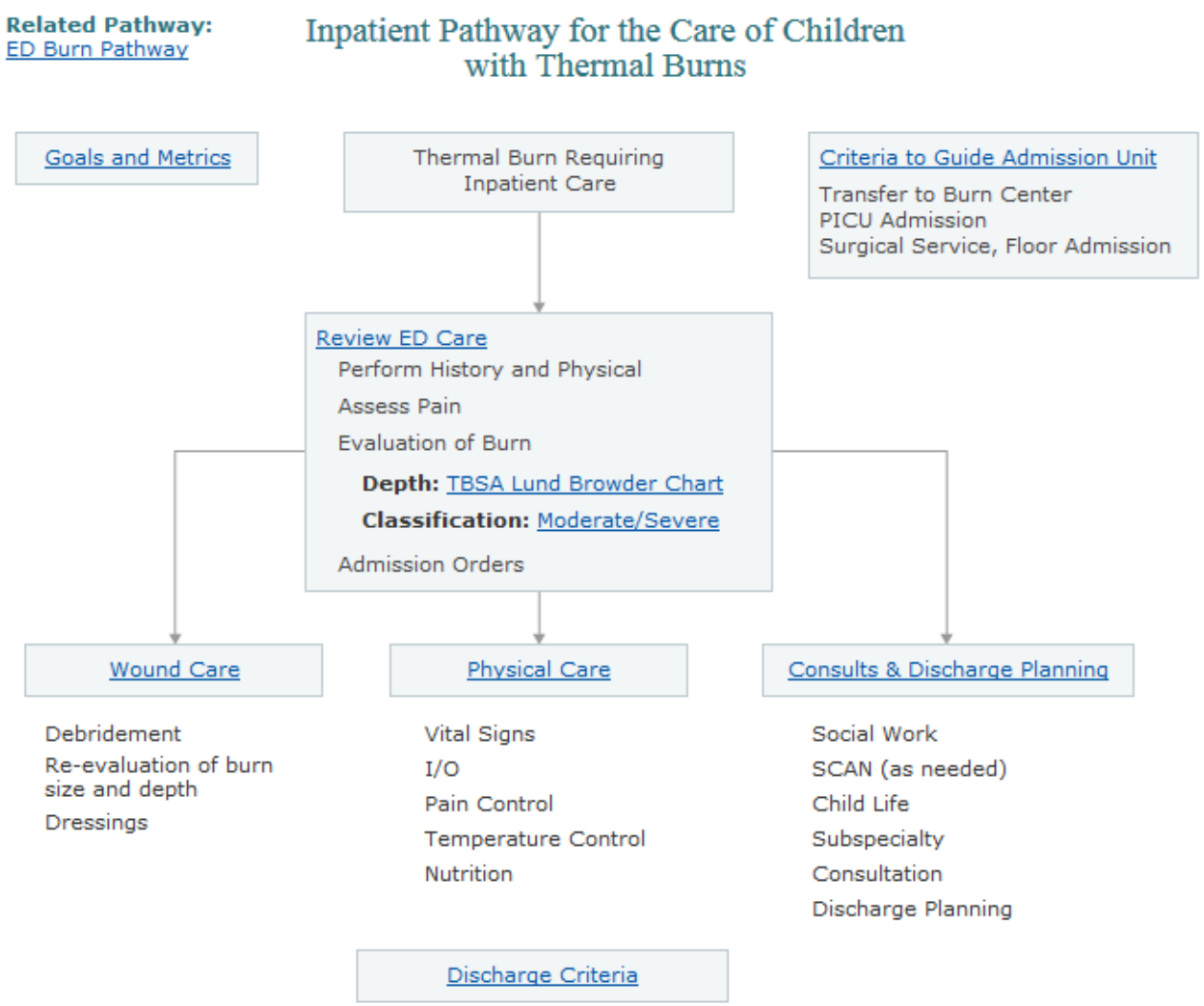
Found in 80% of US hospitals

Kinsman et. al., BMC Med 2010; 8:31

Role in modern healthcare

- Complex, chronic care
- Accountable care model – multi-site, multi-clinician, synchronized
- Standard care models, e.g., prenatal
- Acute inpatient protocols
- Under-resourced, developing countries

Pathways can be multi-threaded



Learn More

American Burn Association

Videos

Trunk Burns Dressing

Hand Burns Dressing

Source: CHOP

Criteria to Assist in Determining Admission Unit

Admit to Floor	NO inhalation injury NO airway edema NO significant oral burns < 15% TBSA partial thickness burn (minor and moderate burns) NO hyperbaric oxygen treatment
Transfer to Burn Center	> 15% TBSA partial thickness or > 5% TBSA full thickness thermal burn (major burns) Severe electrical or chemical burn Potential need for grafting Consult with trauma and call Transport Communication Center at 4-2160 Chester-Crozer Burn Unit: 610-447-2800 St. Christopher Burn Center: 215-427-6900
Admit to PICU	Intubated, potential airway edema, potential inhalation injury, severe oral burns > 15% TBSA burns with delayed transfer to Burn Center due to instability or bed availability Other injuries requiring ICU care Hyperbaric oxygen treatment for elevated carboxyhemoglobin Severe pain requiring aggressive pain management

Consults and Discharge Planning

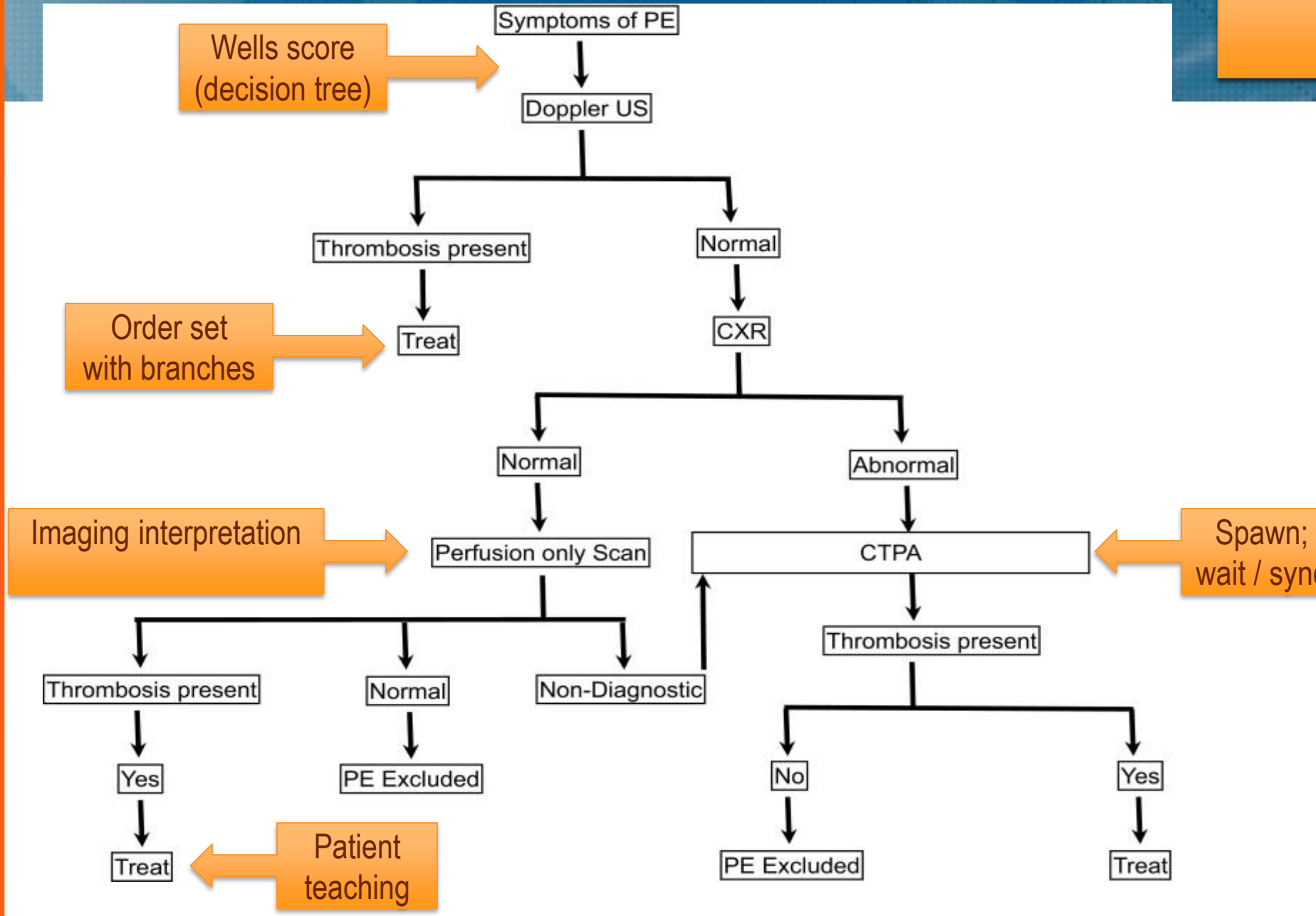
Consults

Social Work	PRN for altered coping Lack of insurance Rule-out abuse
SCAN Team if concern for abuse	Patterned contact burns with insufficient history Cigarette burn Stocking, glove pattern to burn Mirror image burns of the extremities Symmetric burns on buttocks Immersion burn Multiple burn sites

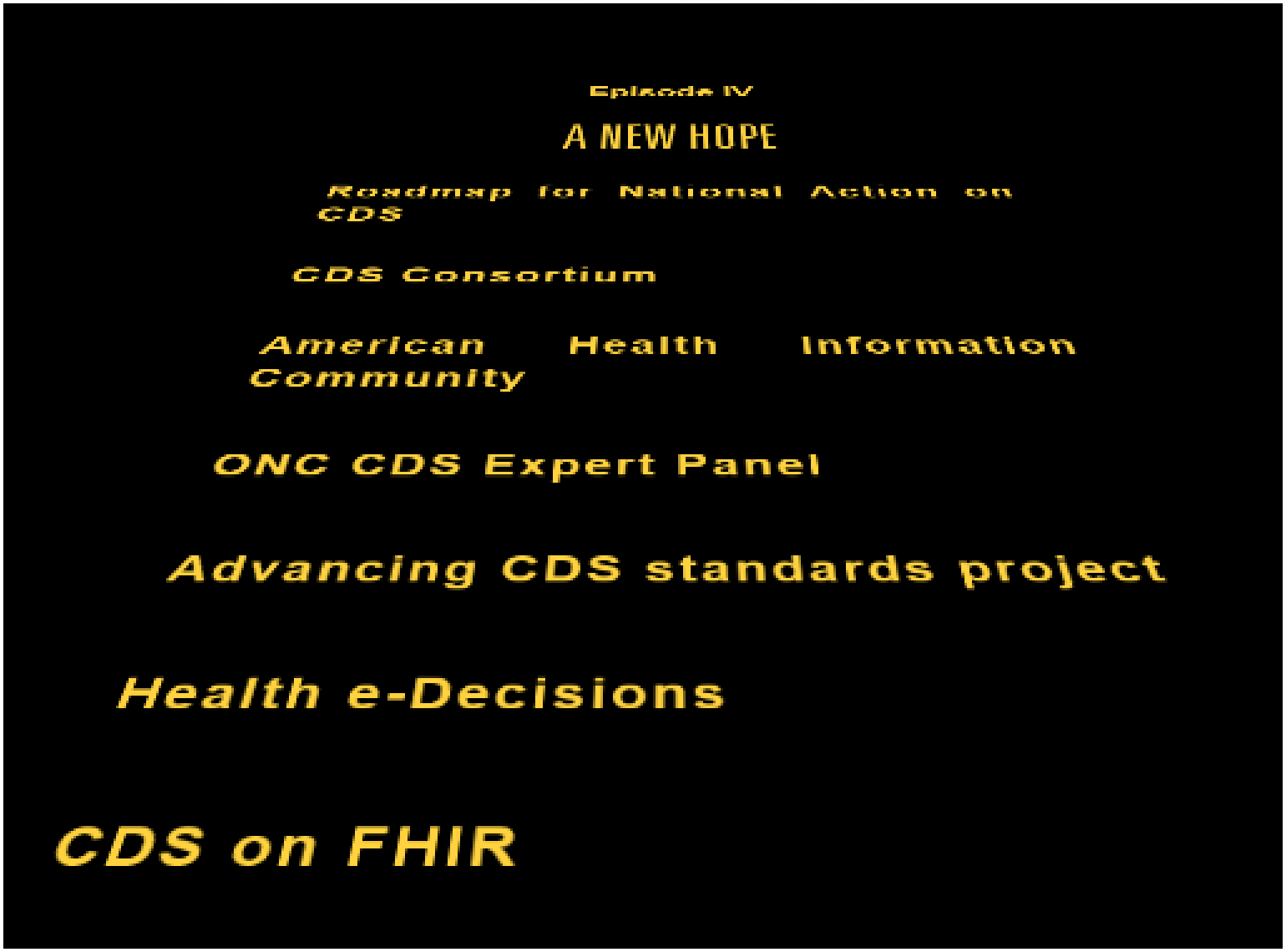
Subspecialty Consults

Ophthalmology	Burns in or near eyes
Plastic Surgery	Ear burns Full thickness burns that might need skin grafts
Speech Therapy	Oral burns
Occupational and/or Physical Therapy	Burns over joints Limited range of motion Possible splinting to prevent scar contractures
Pain Team	Opioid PCA

Multi-step pathway with occasional CDS outputs



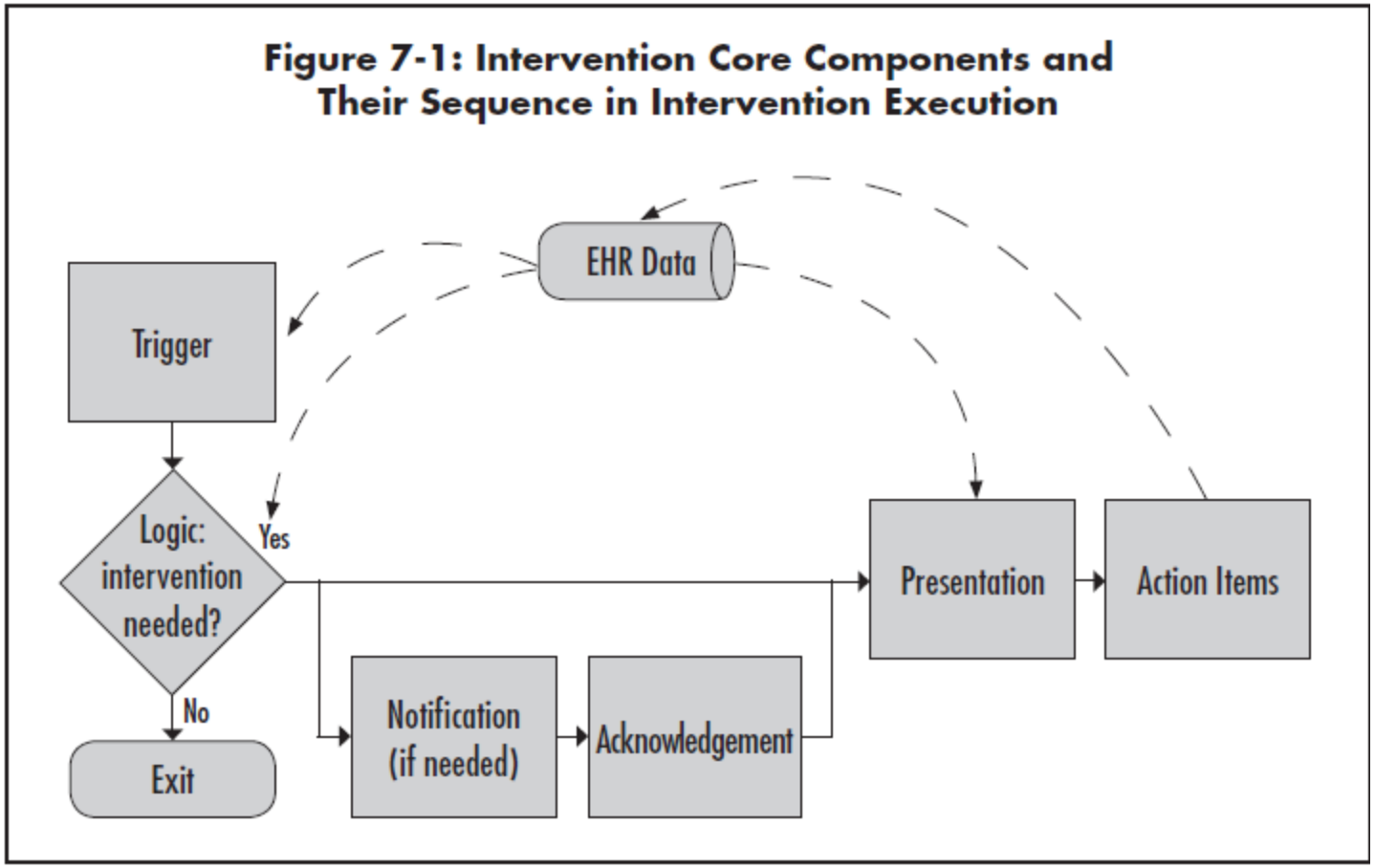
CDS Sharing


Episode IV
A NEW HOPE
Roadmap for National Action on CDS
CDS Consortium
American Health Information Community
ONC CDS Expert Panel
Advancing CDS standards project
Health e-Decisions
CDS on FHIR

What I Want: The CDS Pyxis machine

- Disseminate
  - Standard format
- Select
  - By target, intervention type, setting
- Download
- Measure
- Collect Feedback

Getting there: Standard CDS main components



Standard CDS elements

Trigger points

- Register
- ADT
- Observation
- Order start
- Med select
- Test result

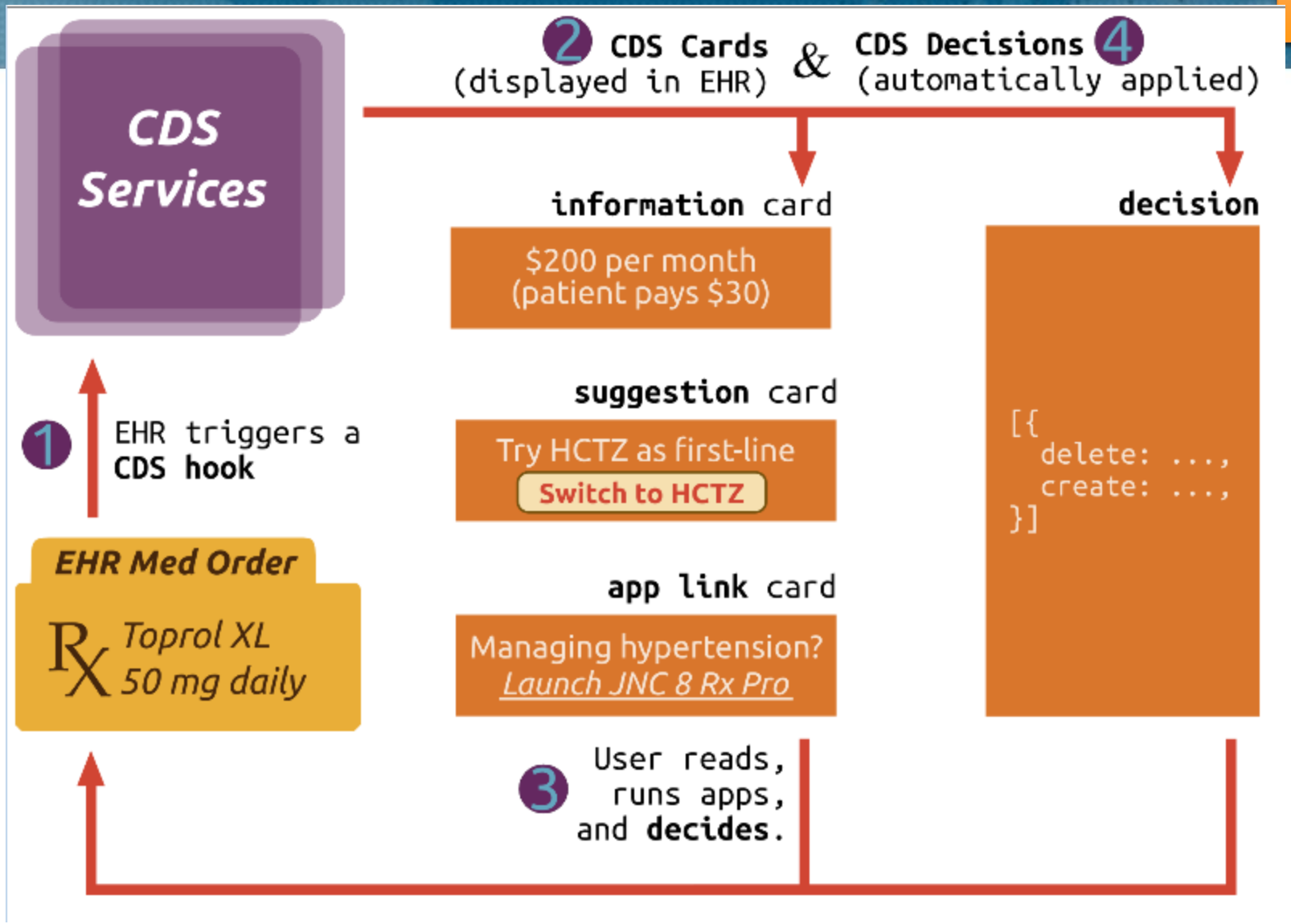
Present'ns

- Alert
- Order set
- Smart Docu
- Advisory (infobutton)

Actions

- New Order
- Del/Chg Order
- View info
- Post assertion
- Exception
- [Track]

CDS on FHIR

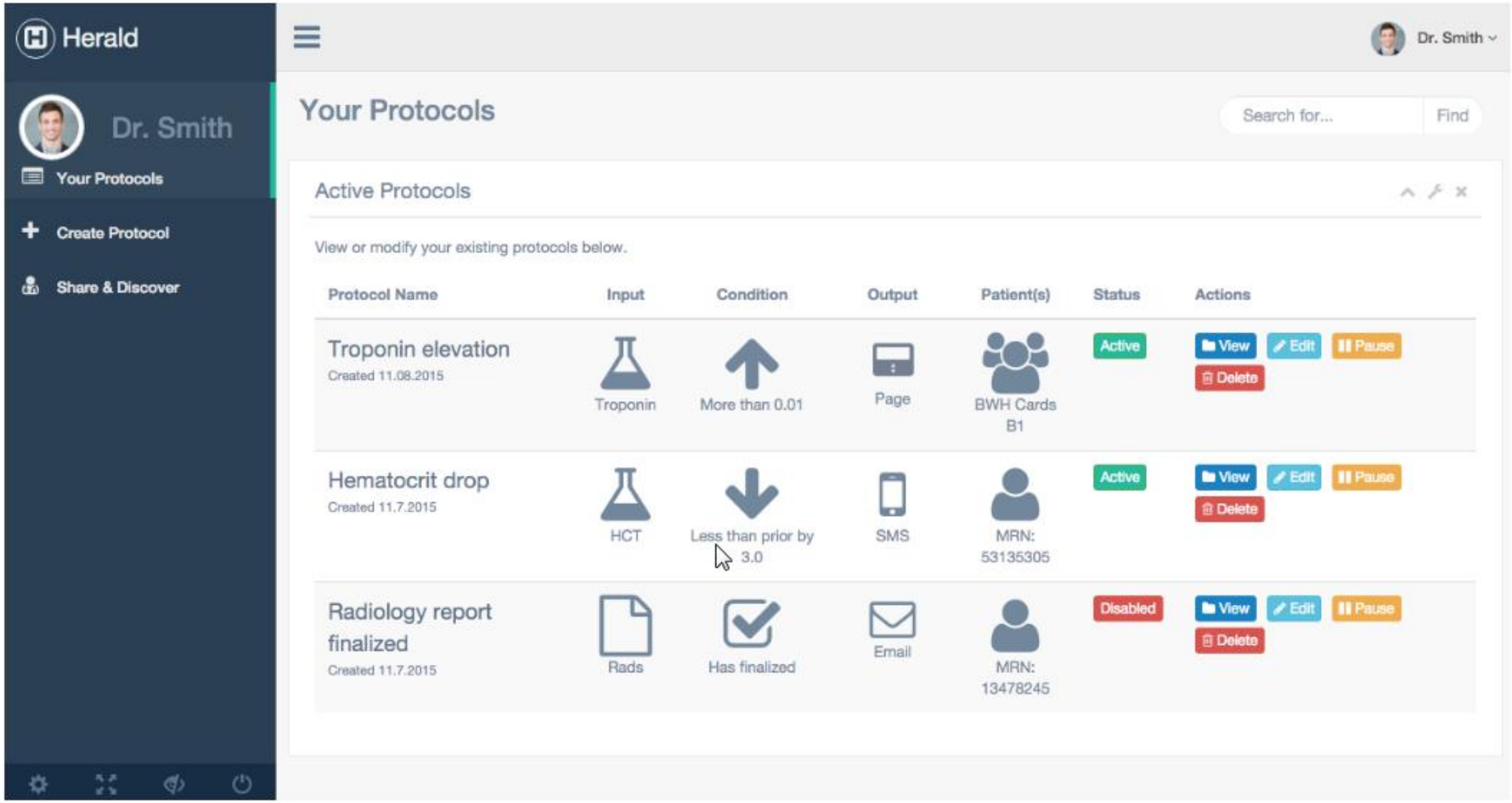

CDS Services
2 CDS Cards (displayed in EHR)
&
CDS Decisions 4 (automatically applied)
information card
$200 per month (patient pays $30)
suggestion card
Try HCTZ as first-line
Switch to HCTZ
app link card
Managing hypertension?
Launch JNC 8 Rx Pro
decision
[{
delete: ...,
create: ...,
}]
1 EHR triggers a CDS hook
EHR Med Order
Rx Toprol XL 50 mg daily
3 User reads, runs apps, and decides.

Latest efforts

- NAM Workgroup on CDS
  - Authoring
  - Distribution
  - Integration (EHR and workflow)
  - Technology
- A few companies springing up to connect CDS to any EHR
- The CDS Construction Kit
  - Type of health episode (well visit, chronic condition…)
  - Type of process (admit, communicate, discharge, order, print, administer)
  - Type of intervention, key parameters

Other stuff

Simple-to-build CDS



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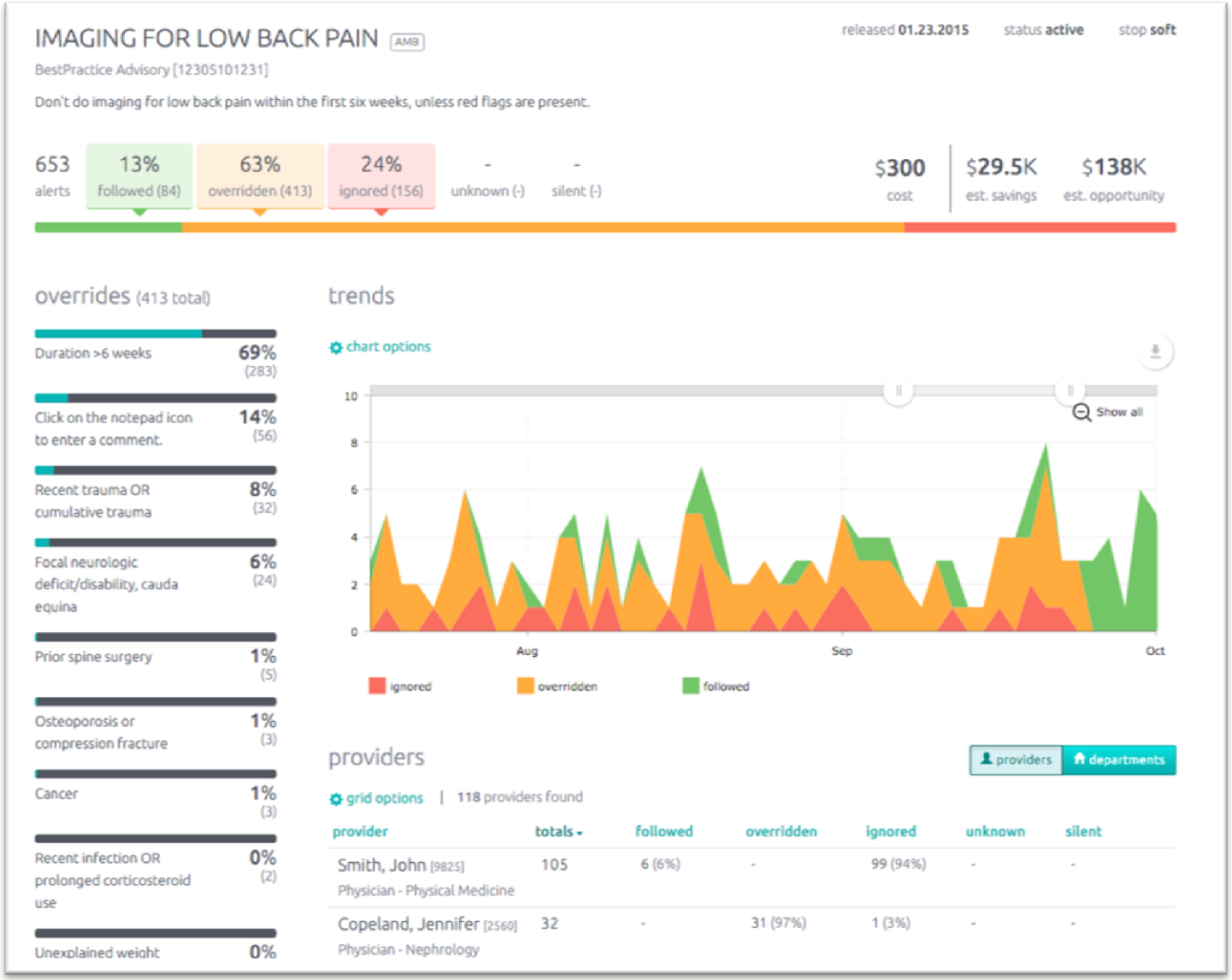
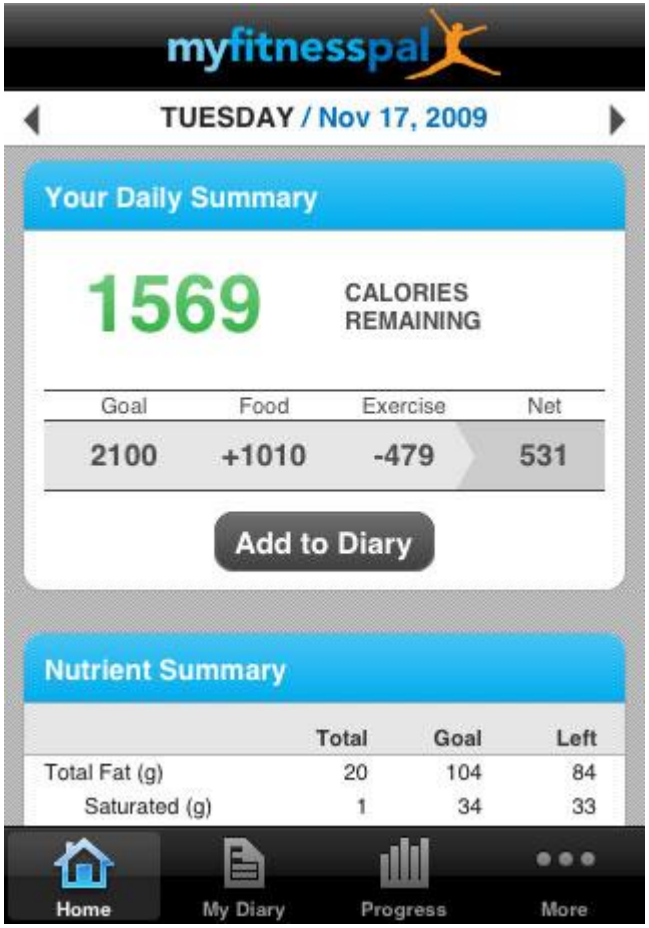
How is your CDS doing?

Source: Stanson Health



Patient-facing CDS

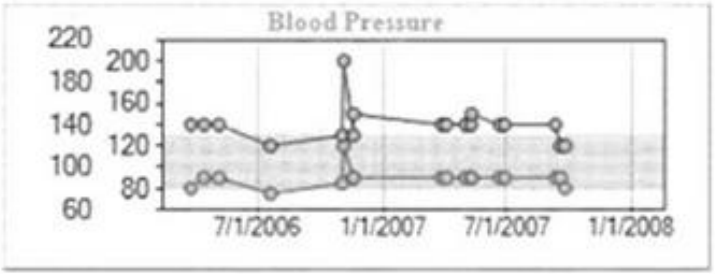


Aspirin

Because you have diabetes or heart disease, you might benefit from aspirin or another similar medication to prevent heart attacks and strokes, but there may be a good reason why your doctor has not prescribed it. Talk with your healthcare provider to find out if you should take aspirin regularly. Tip: Enteric-coated aspirin is effective and often safer than non-coated aspirin.

Blood Pressure

On average, your blood pressure has been running high recently (average of 120/85 from your last two visits). The recommended blood pressure goal is 130/80. If your blood pressure medicine has not been recently adjusted or you are not on blood pressure medicine, you should talk with your provider about steps you can take to help lower your blood pressure.



Urine Protein

People with diabetes have a higher risk of kidney

Health surveillance

google.org Flu Trends

Language: English (United States)

Google.org home

Flu Trends

Select country/region

Home

How does this work?

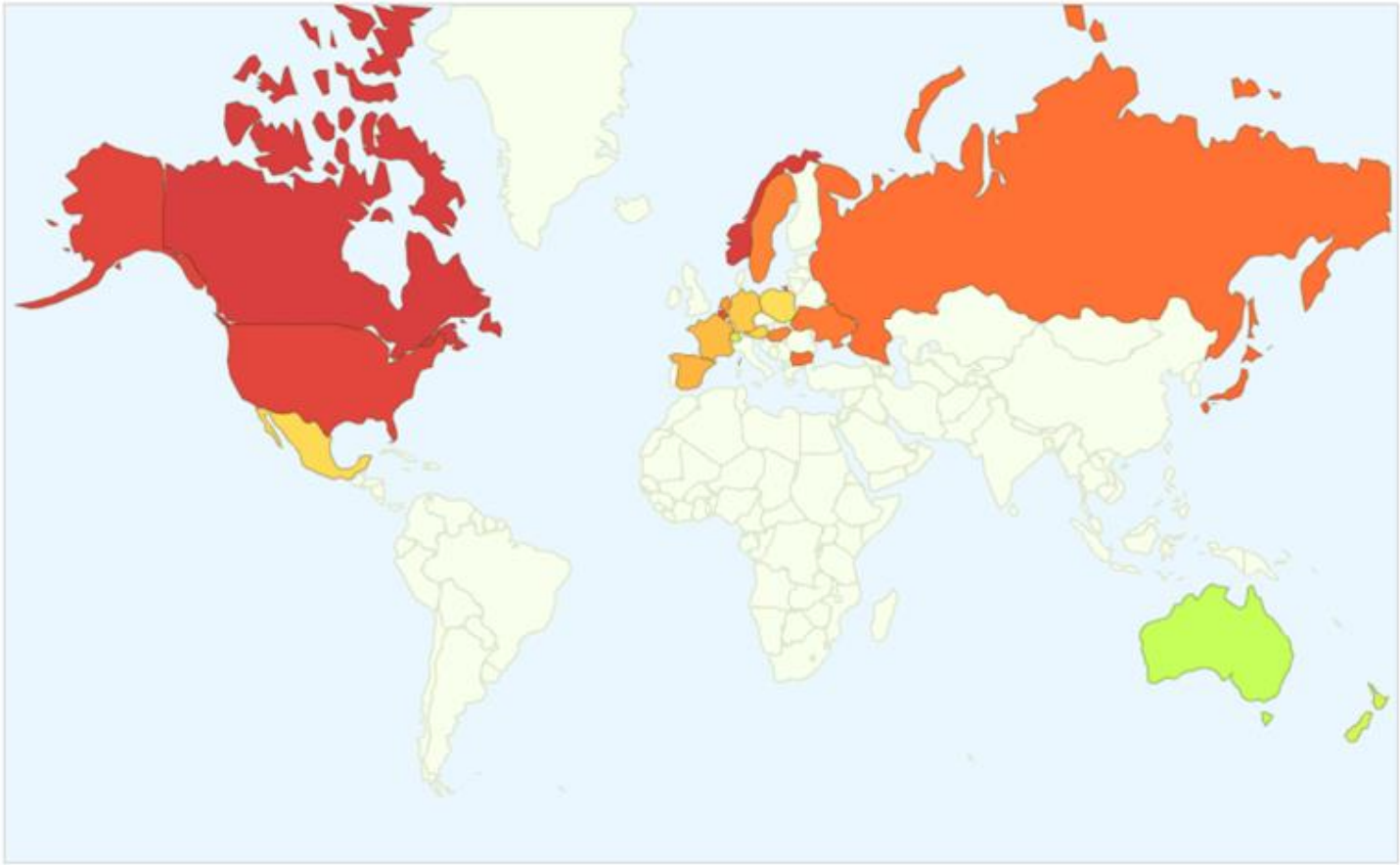
FAQ

Flu activity

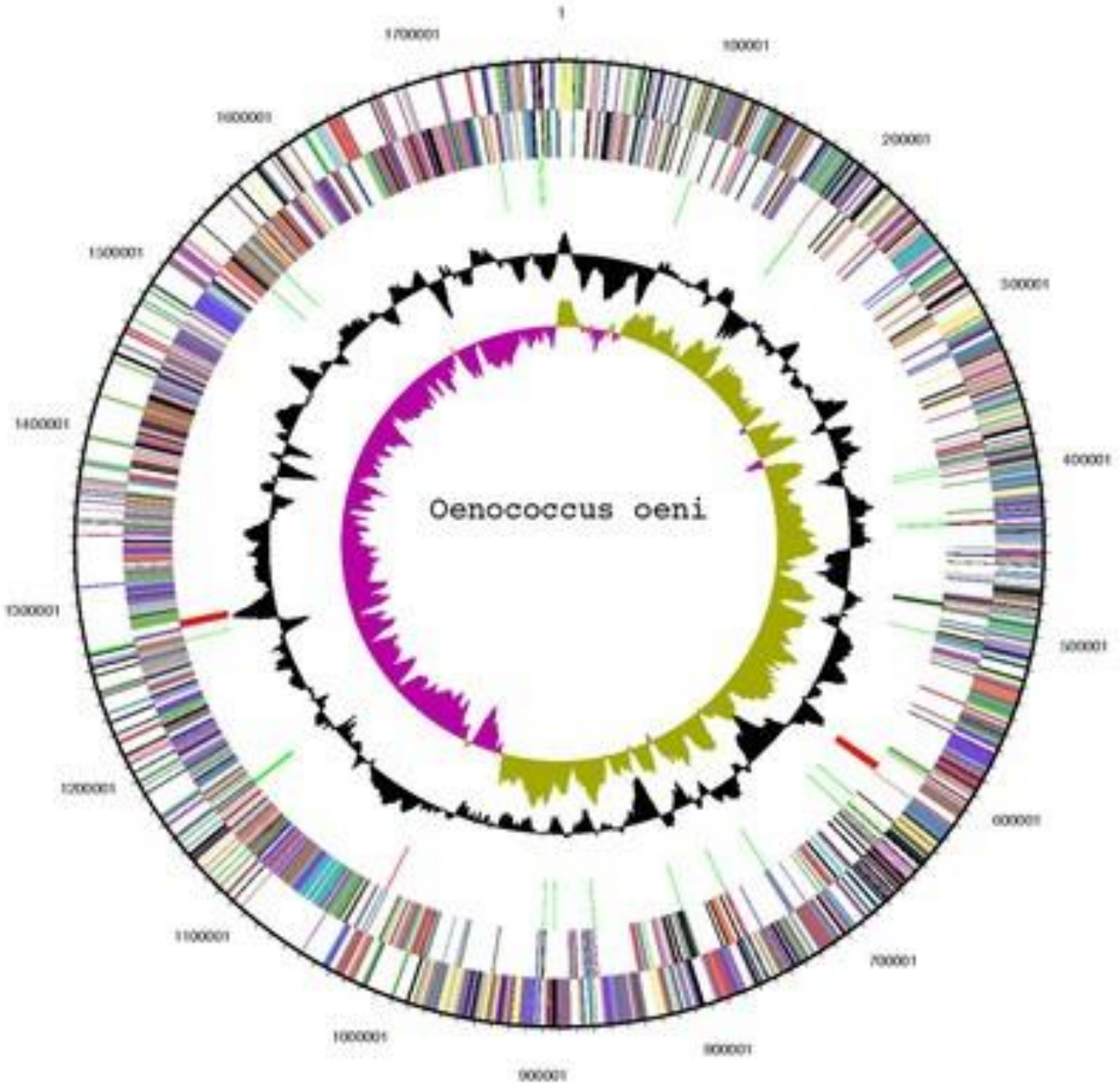
- Intense
- High
- Moderate
- Low
- Minimal

Explore flu trends around the world

We've found that certain search terms are good indicators of flu activity. Google Flu Trends uses aggregated Google search data to estimate flu activity. Learn more »



Clinical genomics



Back to our roots

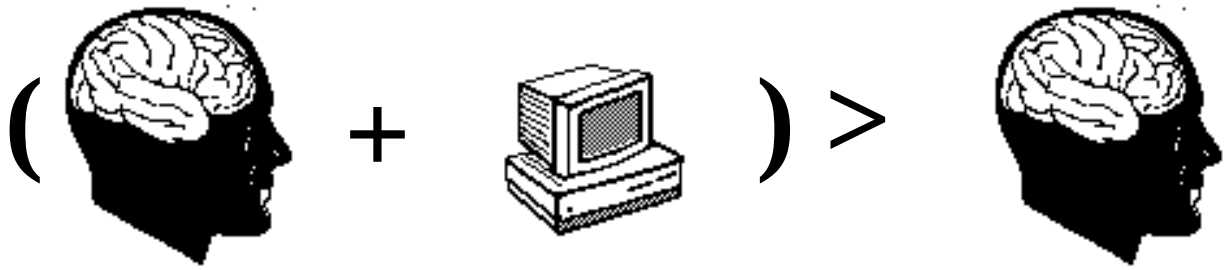
Smart documentation:

- “Hi doc, I have a problem”
  - “Have you ever had it before?”
  - “Do you also have this other relevant condition?”
  - “Do you have risk factors?”
  - “You might have X or Y”
  - “Here, this is the best treatment for your symptoms and for your problem”
    - I’ll give you this, You do that
  - “Let’s schedule something to find out more”

CDS-driven smart documentation can make noting much better

What are the current grand challenges?

Quick knowledge (Smart Doc)	Deliver the most relevant info in a small, actionable package (mostly acute)
Facilitate complex processes	Simplify, optimize, keep track (pathways)
Share CDS	The CDS Pyxis machine – choose 'n' use **logic and operation.**
Simple CDS building	Lego blocks for the key components – for any CDS type. Teaching file of good examples
Big data	Focus: provide **filtered, highest priority** recommendations
Monitor itself	reduce fatigue by focusing on the important stuff
Easy EHR	Documentation and optimization bundles for conditions instead of E&M codes

CDS is still the promise of HIT

As Chuck Friedman said: