Impact of providing evidence-based answers to a broad base of clinical questions at the point of care

Technical Expert Panel on Clinical Decision Support

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UpToDate

AMIA Taxonomy of Clinical Decision Support Tools

- **Medication dosing support**
  - Medication dose adjustment
  - Formulary checking
  - Singe dose range checking
  - Maximum daily dose checking
  - Maximum lifetime dose checking
  - Default doses/pick lists
  - Indication-based dosing
- **Order facilitators**
  - Medication order sentences
  - Subsequent or corollary orders
  - Indication-based ordering
  - Service-specific order sets
  - Condition-specific order sets
  - Procedure-specific order sets
  - Condition-specific treatment protocol
  - Transfer order set
  - Non-medication order sentences
- **Point of care alerts/reminders**
  - Drug-condition interaction checking
  - Drug-drug interaction checking
  - Drug-allergy checking
  - Plan of care alerts
  - Clinical laboratory value checking
  - Duplicate order checking
  - Care reminders
  - Look-alike/sound alike medication warnings
  - Ticklers
  - Problem list management
  - Radiology ordering support
  - Intravenous (IV)/per os (PO) conversion
  - High-risk state monitoring
  - Polypharmacy alerts
- **Workflow support**
  - Order Routing
  - Registry functions
  - Medication reconciliation
  - Automatic order termination
  - Order approvals
  - Free-text order parsing
  - Documentation aids
- **Expert Systems**
  - Antibiotic ordering support
  - Ventilator support
  - Diagnostic support
  - Risk assessment tools
  - Prognostic tools
  - Transfusion support
  - Nutrition ordering
  - Laboratory test interpretation
  - Treatment planning
  - Triage tools
  - Syndromic surveillance
- **Relevant Information display**
  - Context-sensitive information retrieval
  - Patient-specific relevant data display
  - Medication/test cost display
  - Tall man lettering
  - Context-sensitive user interface

What I am talking about today doesn't fit into any of these categories

But it does fit many of the features of CDS systems that are correlated with improving patient care*

- Integrated into the workflow
- Electronic based
- Provide decision support at the time and location of care rather than prior to or after the patient encounter
- Provides recommendations for care, not just assessments

*Kawamoto, K, et al. Improving clinical practice using clinical decision support systems: a systematic review of trials to identify features critical to success. BMJ 2005; 330:740.

Contents of today's discussion

- Need for answering a broad base of clinical questions at the point of care
- Impact of answering questions on decision making and outcomes
- How/where to deliver these answers

Need for answering a broad base of clinical questions at the point of care

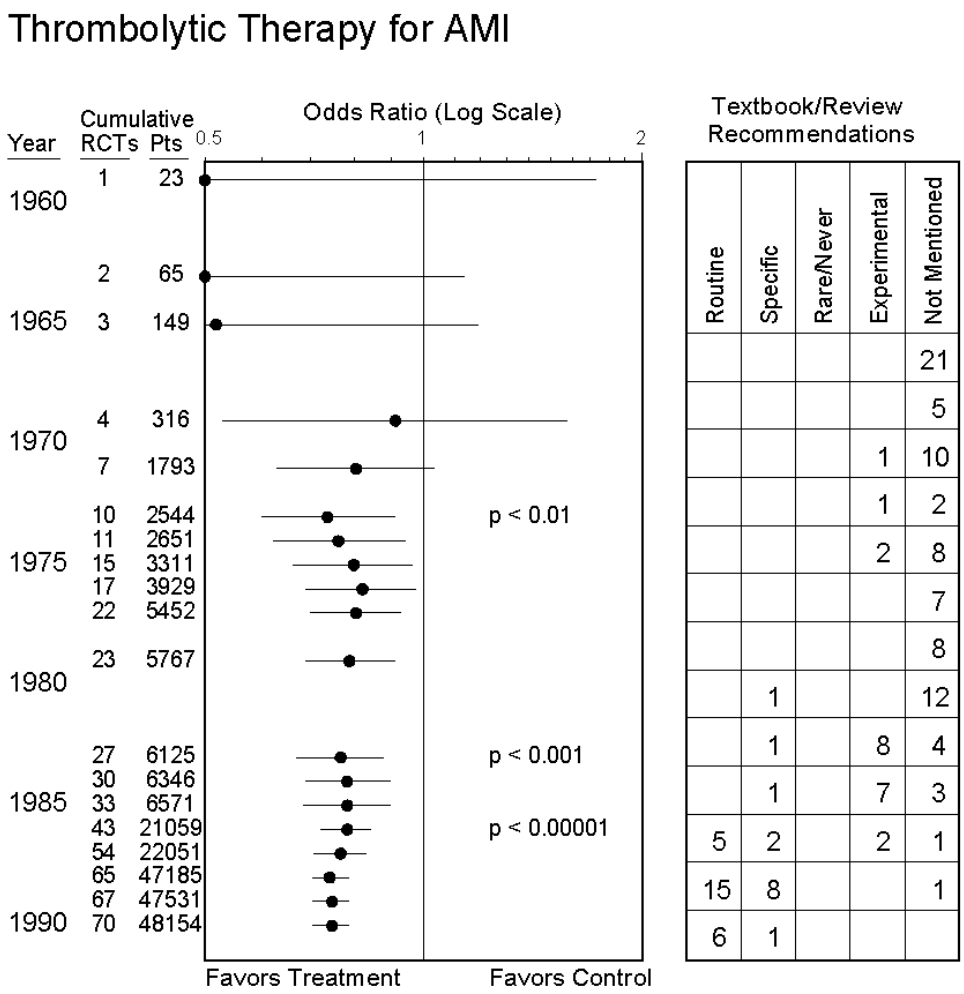
Unanswered clinical questions impact patient management decisions

- Approximately 2 out of 3 clinical encounters generate a question
- Physicians have approximately 11 clinical questions per day
- Only 40% of questions are answered

Answering all clinical questions could change 5 to 8 management decisions each day

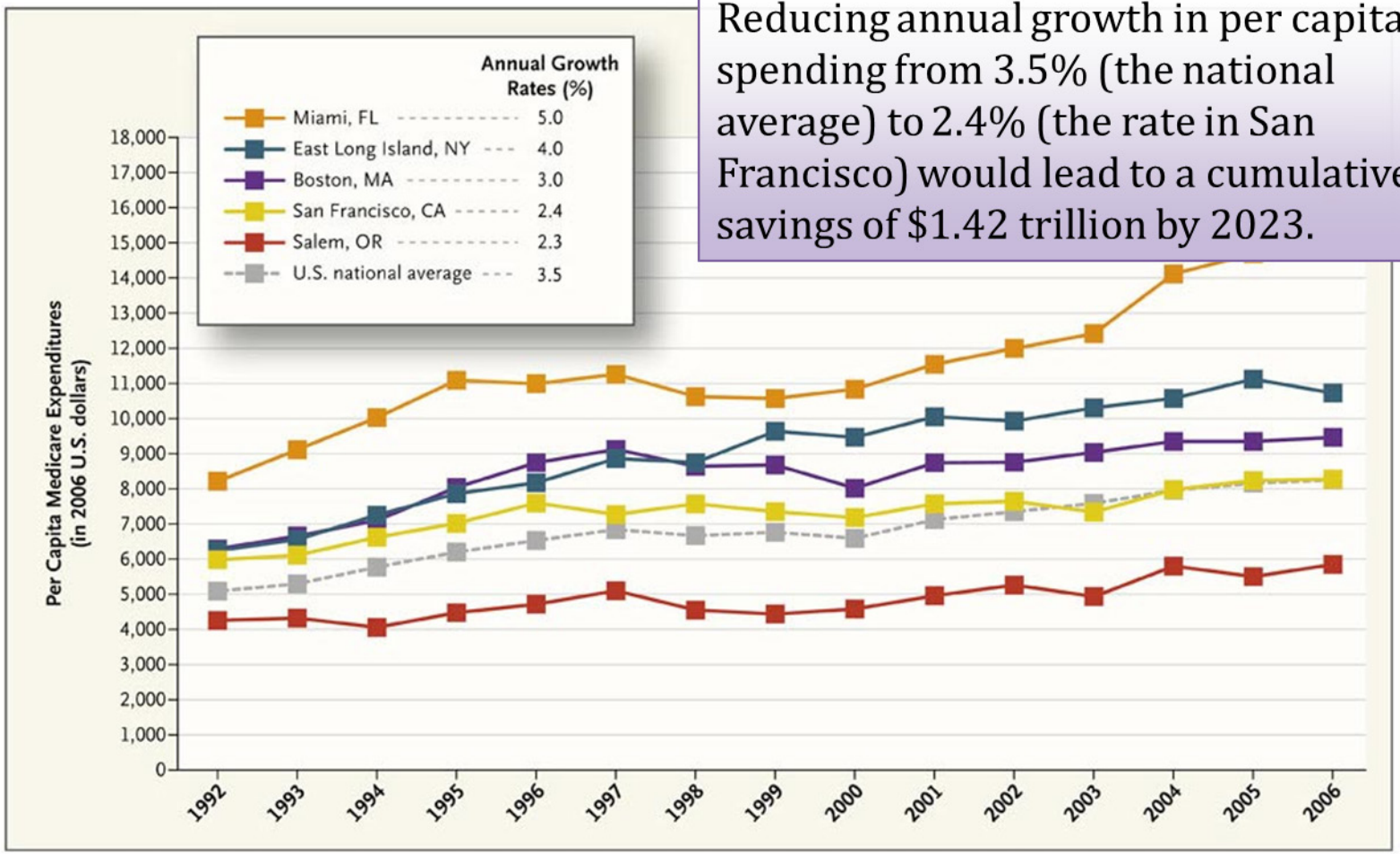
Covell, DG. Ann Intern Med 1985; 103:596; Green, ML. AM J Med 2002; 109:218; Osheroff, JA. Ann Intern Med 1991:575; Ely, JW. J Am Med Inform Assoc 2005; 12:217; Gorman, PN. Med Decis Making 1995; 15:113.

Diffusion of knowledge is slow



Lau, J, N Engl J Med 1992; 327:248.

Clinical judgment in discretionary settings leads to variability in healthcare



Reducing annual growth in per capita spending from 3.5% (the national average) to 2.4% (the rate in San Francisco) would lead to a cumulative savings of $1.42 trillion by 2023.

Sirovich, et al. Health Aff (Millwood) 2008; 27:813; Fisher, ES, et al. N Engl J Med 2009; 360:849.

Impact of answering questions on decision making and outcomes

Use of preappraised EBM resources changes decisions

- Study of the use of a knowledge resource for answering questions during patient rounds on medicine and respiratory wards and in the medical intensive care unit of a tertiary teaching hospital in Singapore
- 157 searches conducted from junior doctors and consultants
- Each search took a median of three minutes
- The information led to a change in investigations, diagnosis, or management 37% of the time

Phua, J, See, KC, Khalizah, HJ, et al, Utility of the electronic information resource UpToDate for clinical decision-making at bedside rounds. Singapore Med J 2012; 53:116.

Better decisions improve quality and efficiency

- Random sample of 146 inpatients cared for by 33 internal medicine physicians
- Critical decisions assessed before and after providing knowledge support
- Main findings
  - Treatment changed in 18% of patients
  - Most changed decisions considered to have improved care of patient
- Some of these decisions may have prevented an adverse event

Problem	Original decision	New decision
Nonfunctioning AV graft	Place temporary vascular access	Fibrinolytic therapy
Severe labile HTN	Diltiazem	Stop diltiazem add atenolol
Community acquired pneumonia	IV antibiotics	Oral antibiotics
Diastolic heart failure	Furosemide, isosorbide, hydralazine	Stop hydralazine, add atenolol
Inoperable hepatocellular cancer	Transarterial chemo-embolization	Palliative care only

Lucas, BP. The impact of evidence on Physicians' inpatient treatment decisions J Gen Intern Med 2004; 19:402.

Changing decisions is associated with better outcomes

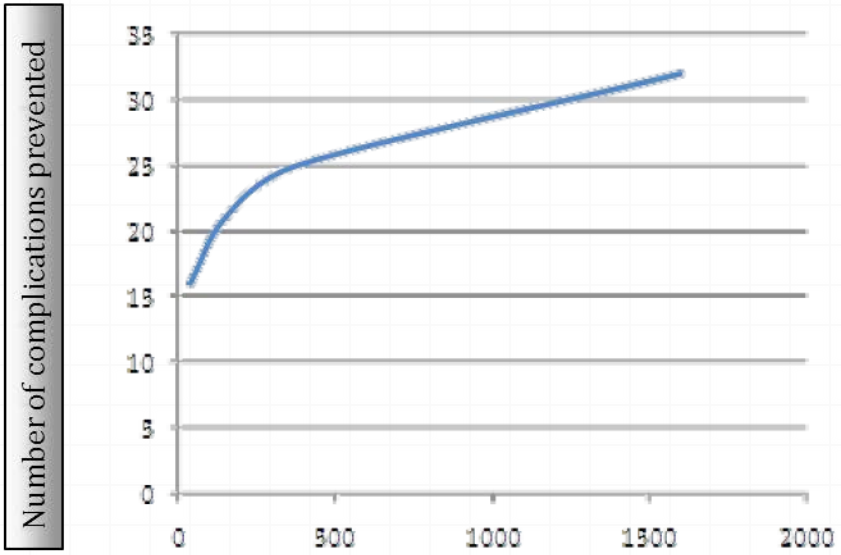
- Investigators at Solucient[1] studied the **impact of UpToDate on length of stay, complications, and patient safety[2]**
- Compared hospitals with and without access to UpToDate
- The study adjusted for hospital size, hospital type (teaching vs. non) and geographic location

- Hospitals that used UpToDate had **significantly lower risk-adjusted length of stay, on average .167 days/discharge *(p<.0001)***
- UpToDate hospitals also had statistically **significantly lower complication rates *(p<.0476)* and better patient safety outcomes *(p<.0001)***

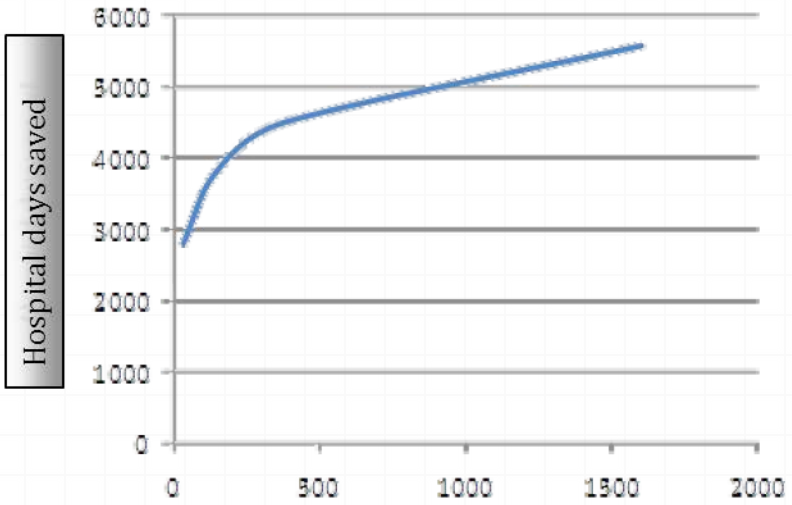
(1) Solucient maintains the nation's largest healthcare database, comprised of more than 26 million discharges per year from 2,900 hospitals
(2) Int J Med Inform. 2008 Nov;77(11):745-53.

“Dose-response” effect

More complications prevented with increasing use



More hospital days saved with increasing use



Average topic reviews viewed per week

Similar results noted in a second study, including mortality benefit

Use of *UpToDate* and Outcomes in US Hospitals

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BACKGROUND: Computerized clinical knowledge management systems hold enormous potential for improving quality and efficiency. However, their impact on clinical practice is not well known.

OBJECTIVE: To examine the impact of *UpToDate* on outcomes of care.

DESIGN: Retrospective study.

SETTING: National sample of US inpatient hospitals.

PATIENTS: Fee-for-service Medicare beneficiaries.

INTERVENTION: Adoption of *UpToDate* in US hospitals.

MEASUREMENT: Risk-adjusted lengths of stay, mortality rates, and quality performance.

RESULTS: We found that patients admitted to hospitals using *UpToDate* had shorter lengths of stay than patients admitted to non-*UpToDate* hospitals overall (5.6 days vs 5.7 days; $P < 0.001$) and among 6 prespecified conditions (range, −0.1 to −0.3 days; $P < 0.001$ for each). Further, patients admitted to *UpToDate* hospitals had lower risk-adjusted mortality rate for 3 of the 6 conditions (range, −0.1% to −0.6% mortality reduction; $P < 0.05$). Finally, hospitals with *UpToDate* had better quality performance for every condition on the Hospital Quality Alliance metrics. In subgroup analyses, we found that it was the smaller hospitals and the non-teaching hospitals where the benefits of the *UpToDate* seemed most pronounced, compared to the larger, teaching institutions where the benefits of *UpToDate* seemed small or nonexistent.

CONCLUSIONS: We found a very small but consistent association between use of *UpToDate* and reduced length of stay, lower risk-adjusted mortality rates, and better quality performance, at least in the smaller, non-teaching institutions. These findings may suggest that computerized tools such as *UpToDate* could be helpful in improving care. *Journal of Hospital Medicine* 2011;000:000–000 © 2011 Society of Hospital Medicine.

Four major databases consolidated

- **AHA data**
  - Hospital structural characteristics
- **MIIF**
  - Medicare Inpatient Impact Files (more hospital characteristics)
- **MEDPAR**
  - Medicare Provider Analysis review (patient-level discharge info)
- **HQA**
  - Hospital Quality Alliance (publicly available data for inpatient quality measures)

Consolidated database of hospital performance 2004-2006 (2004-2007 for hospital quality data)

Adoption of UTD was associated with shorter LOS

TABLE 2. Risk-Adjusted Length of Stay for Hospitals Using *UpToDate* Compared to Non-Users

Conditions	Using *UpToDate* (Days)	Not Using *UpToDate* (Days)	Difference (CI) (Days)	P Value
Total	5.6	5.7	−0.1 (−0.2 to −0.0)	0.001
AMI	5.3	5.5	−0.2 (−0.3 to −0.2)	<0.001
CHF	5.6	5.7	−0.2 (−0.3 to −0.1)	<0.001
PN	6.3	6.5	−0.2 (−0.2 to −0.1)	<0.001
Stroke	5.9	6.0	−0.1 (−0.2 to −0.1)	<0.001
GIH	5.3	5.4	−0.2 (−0.3 to −0.2)	<0.001
Hip fracture	6.7	6.8	−0.1 (−0.2 to −0.1)	<0.001

NOTE: Quarterly data from 2004 through 2006. All analyses are adjusted for hospital characteristics including size, census region, urban vs rural location, ownership (for-profit, not-for-profit private, not-for-profit public), teaching status (member of the Council of Teaching Hospital vs not), and the presence or absence of a medical intensive care unit (ICU). Analyses were also adjusted for patient-level factors and comorbidities using methodology developed by Elixhauser.

Abbreviations: AMI, acute myocardial infarction; CHF, congestive heart failure; CI, confidence interval; GIH, gastrointestinal hemorrhage; PN, pneumonia.

Adoption of UTD was associated with lower mortality

TABLE 3. Risk-Adjusted 30-Day Mortality Rates Among Hospitals Using *UpToDate* Compared to Non-Users

Conditions	Using *UpToDate* (%)	Not Using *UpToDate* (%)	% Difference (CI)	P Value
Total	9.0	9.1	−0.1 (−0.2 to 0.0)	0.04
AMI	18.4	19.0	−0.7 (−1.2 to −0.2)	0.03
CHF	11.1	11.3	−0.2 (−0.4 to −0.1)	0.21
PN	12.1	12.6	−0.5 (−0.7 to −0.2)	<0.001
Stroke	19.9	19.9	−0.02 (−0.5 to 0.5)	0.91
GIH	6.9	7.3	−0.4 (−0.7 to −0.2)	0.001
Hip fracture	8.8	8.6	0.2 (−0.2 to 0.5)	0.41

NOTE: Rates from 2004 through 2006. All analyses are adjusted for hospital characteristics and patient characteristics.

Abbreviations: AMI, acute myocardial infarction; CHF, congestive heart failure; CI, confidence interval; GIH, gastrointestinal hemorrhage; PN, pneumonia.

Adoption of UTD was associated with better hospital quality

TABLE 4. *UpToDate* Use and Performance on the Standard Quality Indicators

Conditions	Using *UpToDate* (%)	Not Using *UpToDate* (%)	% Difference (CI)	*P* Value
AMI summary score	93.4	90.2	3.2 (2.6, 3.6)	< 0.001
CHF summary score	81.0	75.1	5.9 (5.0, 6.8)	< 0.001
PN summary score	83.7	83.1	0.6 (0.3, 0.9)	0.003
SIP summary score	80.0	78.1	1.9 (1.0, 2.9)	0.002

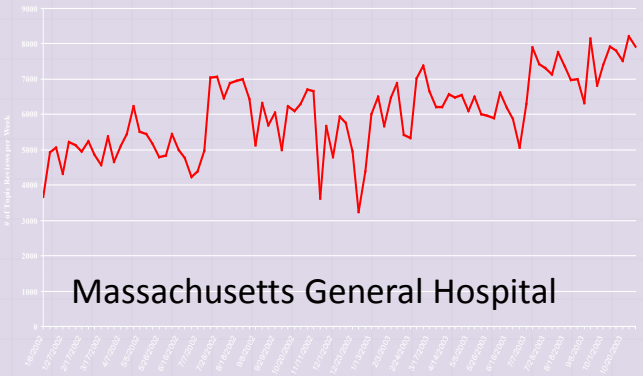
NOTE: All analyses are adjusted for hospital characteristics and patient characteristics. Data are based on performance on the Hospital Quality Alliance (HQA) indicators; *UpToDate* use and HQA scores among all hospitals, 2004 through 2007.

Abbreviations: AMI, acute myocardial infarction; CHF, congestive heart failure; CI, confidence interval; PN, pneumonia, SIP, surgical infection prevention.

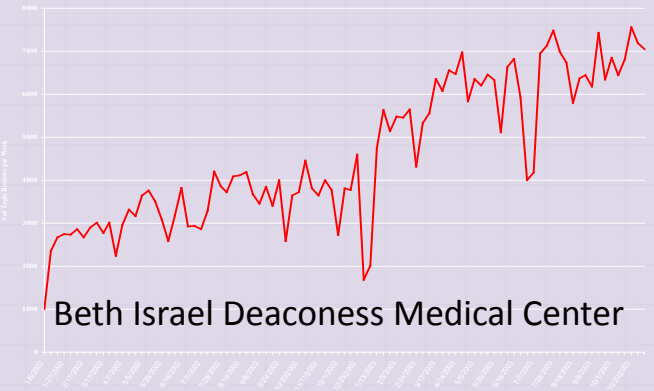
These measures are publicly reported and represent 4 of the 6 measures that will be used in Medicare's Value Based Purchasing Program (beginning October 2012)

How/where to deliver these answers

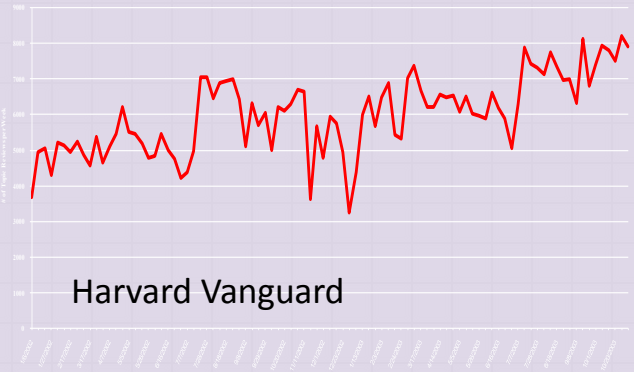
Physicians adopt and use UpToDate without integration



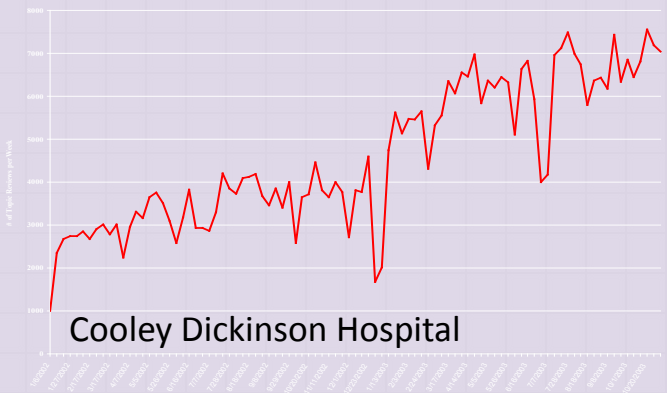
Massachusetts General Hospital



Beth Israel Deaconess Medical Center



Harvard Vanguard



Cooley Dickinson Hospital

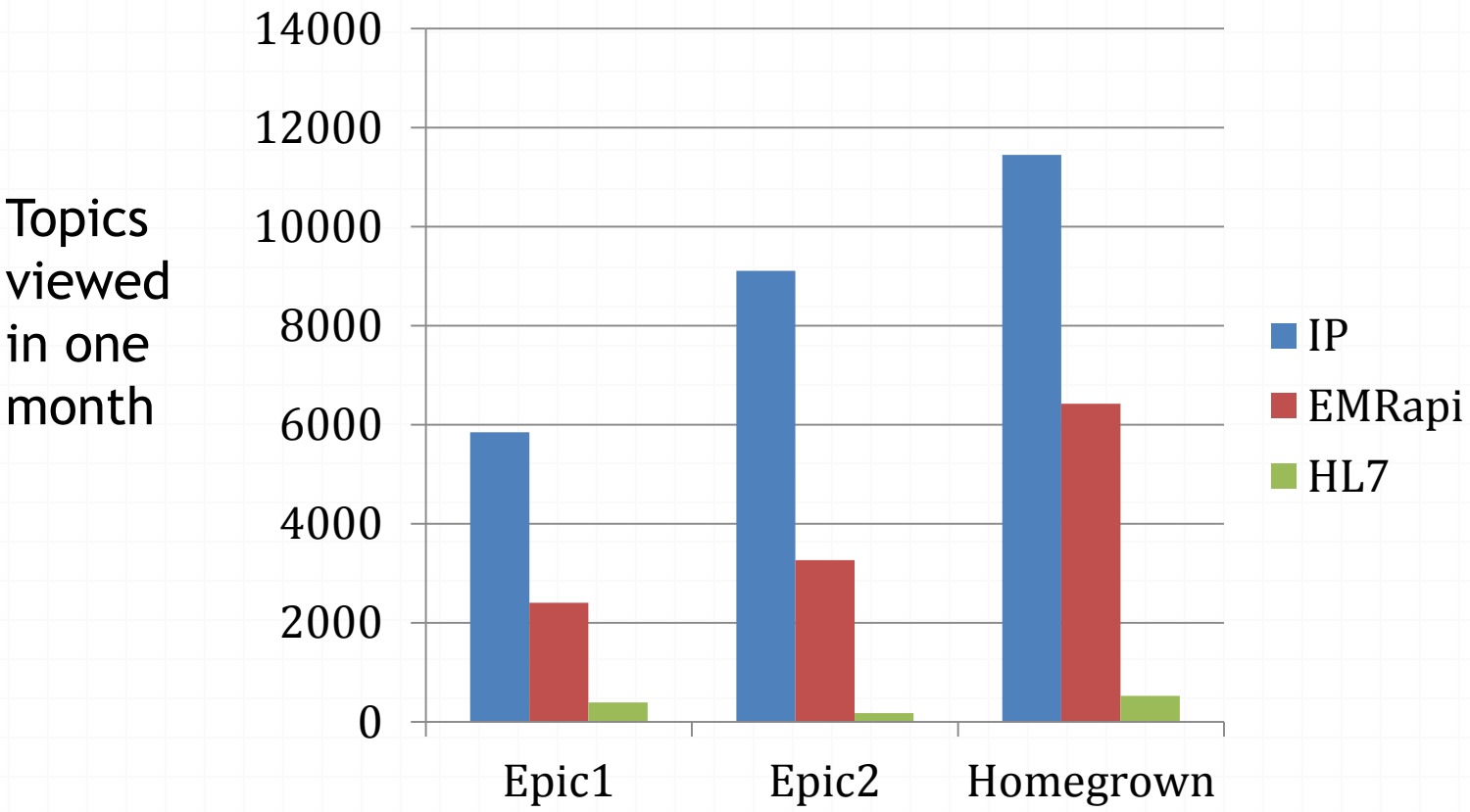
Keys to driving usage/acceptance

- Simple and quick to use at point of care
  - Average time spent under 3 minutes
  - One answer to a question
- Answers found around 90% of the time
- Available on multiple platforms – can be used anywhere
- Clinicians trust the answer

“Integration” points for UpToDate

- EMR API (search box)
- HL7 infobutton (search results)
- Order sets (recommendations)
- Practice changing updates (order sets, R&D)
- Laboratory results

So far, when given a choice, most use is through IP authentication



Summary

- A relatively simple technology is accepted by physicians and used widely at the point of care
- Providing answers to clinical questions changes decision making for a broad range of important decisions that goes beyond quality measures and available decision rules
- Changing these decisions is associated with improvements in the quality and efficiency of care
- "Pushing" information into the workflow has the promise of a much larger impact on clinical outcomes – this remains largely in an R&D phase