Biomedical Informatics 2013 Year in Review

Notable publications and events in Informatics since the 2012 AMIA Symposium

Nominated by the Fellows of the
American College of Medical Informatics
and presented by
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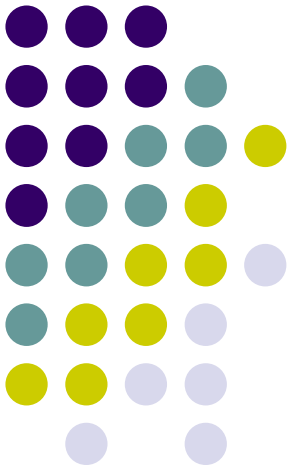
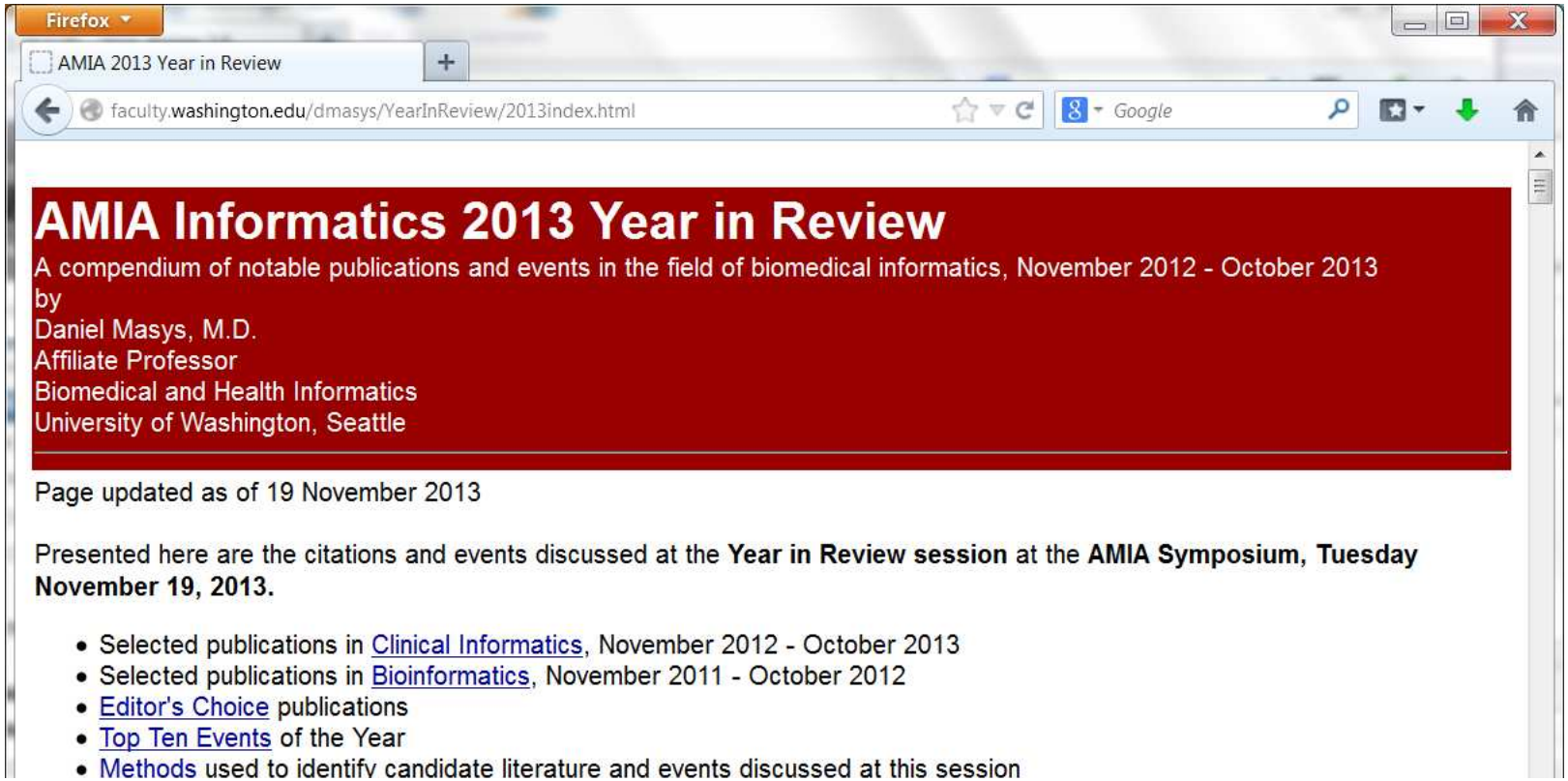


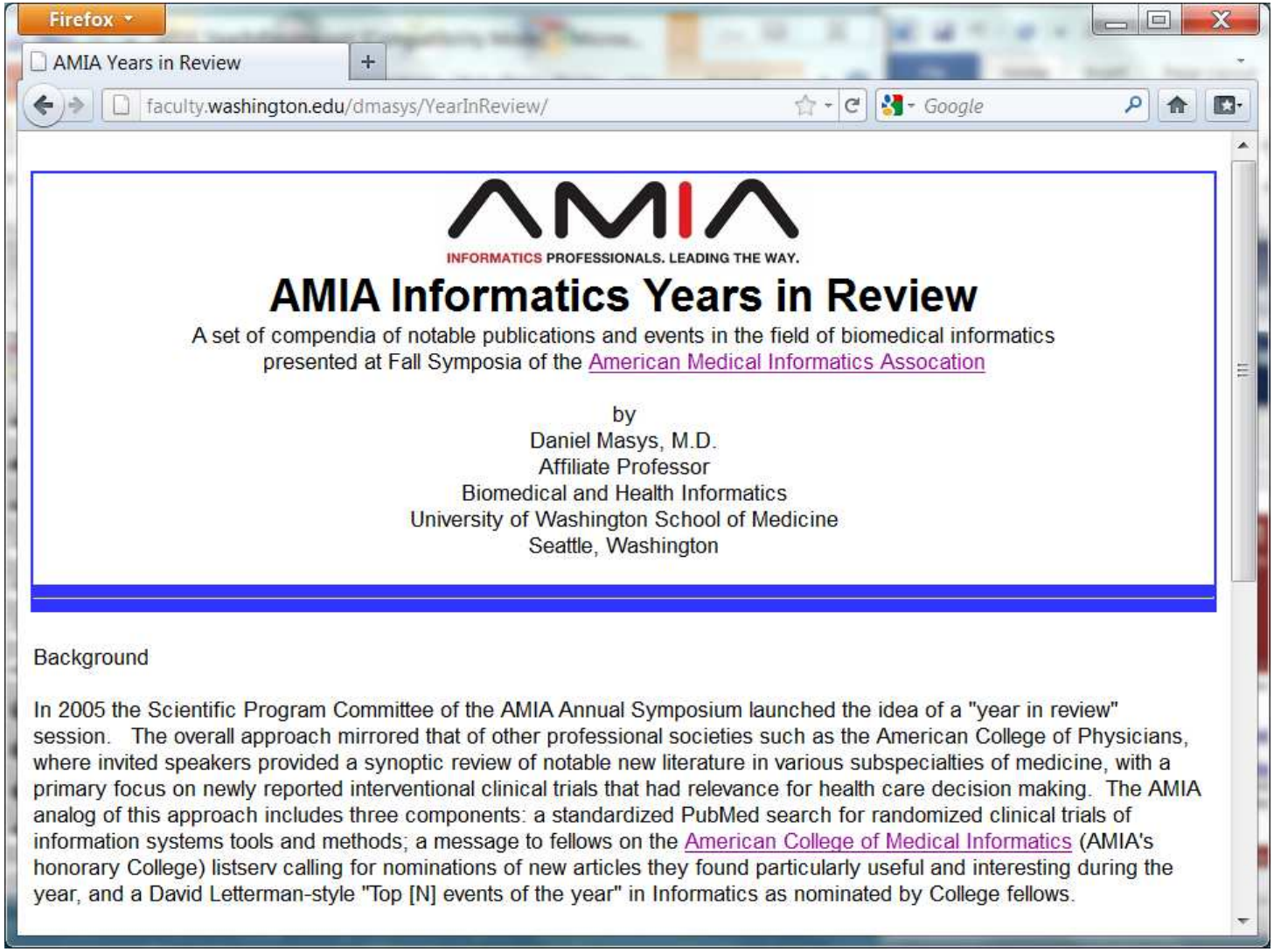
Content for this session is at:

http://faculty.washington.edu/dmasys/YearInReview
or Google: "AMIA Year in Review"
includes citation lists and links
and this PowerPoint



Index to all Years in Review (9)

http://faculty.washington.edu/dmasys/YearInReview



Design for this Session

- Originally modeled on American College of Physician “Update” sessions which focused on high impact randomized clinical trials literature
- Has evolved toward broader coverage of the subdisciplines of biomedical informatics
- Has both a literature search and a professional peer nomination component by Fellows of the American College of Medical Informatics

It takes a Village…

Special thanks to these 30 ACMI Fellows:

- Jos Aarts
- Andrew Balas
- David Bates
- Chris Chute
- Jim Cimino
- Don Detmer
- Gunther Eysenbach
- Reed Gardner
- Bill Hersh
- Betsy Humphreys
- George Hripcsak
- Bonnie Kaplan
- Ross Koppel
- Ira Kalet
- Zak Kohane
- Harold Lehmann
- Yves Lussier
- Alexa McCray
- Blackford Middleton
- Joyce Mitchell
- Lucila Ohno-Machado
- Judy Ozbolt
- Ted Shortliffe
- Dean Sittig
- Kent Spackman
- David States
- Jaap Suermondt
- Jonathan Teich
- Mark Tuttle
- Bonnie Westra

Source of Content for Session

1. Literature review of RCTs indexed by MeSH term “Medical Informatics”, “Clinical Decision Support”, “Telemedicine” & descendents, or keywords “Internet”, “mobile” and publication date between November 2012 and October 2013.
   - Further qualified by involvement of >100 providers or patients
2. Literature review of clinical bioinformatics and computational biology papers of past 12 months

Source of Content for Session

3. Poll of American College of Medical Informatics fellows list for other types of informatics literature (new methods and technologies, concept and issues papers) and notable events
4. New for 2013: Invitation to informatics journals via their ACMI editorial board members to nominate 5 top publications
5. Dessert: the Top Ten Events of the Year

New for 2013

- RCT ‘speed dating’: summaries of interventional trials by application type and subject domain
- People’s choice: ACMI Fellow nominations of notable literature *not* their own
- Editor’s Choice: journal editors top 5

RCT speed dating

speed dat·ing

noun

noun: **speed dating**; noun: **SpeedDating**

1. an organized social activity in which people seeking romantic relationships have a series of short conversations with potential partners in order to determine whether there is mutual interest.

RCT speed dating

1. Given the ubiquity of mobile electronics among AMIA Symposium attendees, synopses of new findings from the literature are given with just enough content to allow attendees to determine whether they wish to access the complete article. Either during the session in real time, later at their convenience, or as a diversion from incessant Tweeting and Facebook posting. ;-)

Notable 2013 informatics events, trends and literature

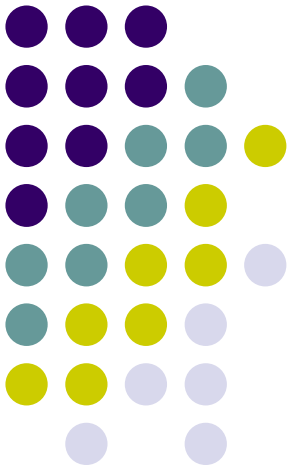
- EHRs pass the tipping point
- Clinical decision support confronts scalability challenges
- Telemedicine, particularly for chronic disease monitoring and psychiatric interventions, continues to work (but without attention to cost-effectiveness).
- Personal genomes and their issues get closer to the bedside
- The power of a website…

New Literature Highlights: Clinical Informatics

- Clinical Decision Support
- Telemedicine
- The practice of clinical informatics: new methods and technologies

Clinical Decision Support

24 new RCTs published meeting search criteria
November 2012 – October 2013



Clinical Decision Support for Providers: Infectious Diseases

- **Reference**
  - Kempe A, et. al, **Population-based versus practice-based recall for childhood immunizations: a randomized controlled comparative effectiveness trial**. Am J Public Health. 2013 Jun;103(6):1116-23
- **Source**
  - Children's Outcomes Research Program, The Children's Hospital, Denver, CO
- **Aim**
  - To compare the effectiveness and cost-effectiveness of population-based recall (Pop-recall) versus practice-based recall (PCP-recall) at increasing immunizations among preschool children.
- **Methods**
  - Cluster-randomized trial involving children aged 19 to 35 months needing immunizations in 8 rural and 6 urban Colorado counties.
  - In Pop-recall counties, recall was conducted centrally using the Colorado Immunization Information System (CIIS).
  - In PCP-recall counties, practices were invited to attend webinar training using CIIS and offered financial support for mailings.
  - The percentage of up-to-date (UTD) and vaccine documentation were compared 6 months after recall.

Clinical Decision Support for Providers: Infectious Diseases

- **Reference**
  - Kempe A, et. al, Population-based versus practice-based recall for childhood immunizations: a randomized controlled comparative effectiveness trial. Am J Public Health. 2013 Jun;103(6):1116-23.
- **Results, cont'd**
  - Ten of 195 practices (5%) implemented recall in PCP-recall counties.
  - Among children needing immunizations, 18.7% became UTD in Pop-recall versus 12.8% in PCP-recall counties ($P < .001$);
  - 31.8% had documented receipt of 1 or more vaccines in Pop-recall versus 22.6% in PCP-recall counties ($P < .001$).
  - Costs for Pop-recall versus PCP-recall were $215 versus $1981 per practice and $17 versus $62 per child brought UTD..
- **Conclusions**
  - Population-based recall conducted centrally was more effective and cost-effective at increasing immunization rates in preschool children.

Clinical Decision Support for Providers: Infectious Diseases

- **Reference**
  - Kempe A, et. al, Population-based versus practice-based recall for childhood immunizations: a randomized controlled comparative effectiveness trial. Am J Public Health. 2013 Jun;103(6):1116-23
- **Importance**
  - A message about the difficulty, effectiveness and cost of implementation of systems approaches to improving public health through independent practices.
  - A warning about 21st century herd immunity…

Clinical Decision Support for Providers: Infectious diseases

- **Reference**
  - Chambers LW, et. al, **Impact of the Ottawa Influenza Decision Aid on healthcare personnel's influenza immunization decision: a randomized trial**. J Hosp Infect. 2012 Nov;82(3):194-202.
- **Source**
  - Bruyère Research Institute, Ottawa, Ontario, Canada.
- **Aim**
  - To assess the impact of a web based decision support tool, and ascertain whether its use would increase the level of confidence in healthcare workers' influenza immunization decision and positively affect their intent to be immunized.
- **Methods**
  - Single-center, single-blind, parallel-group, randomized controlled trial of web-based educational program on influenza immunization.

Clinical Decision Support for Providers: Infectious diseases

- **Reference**
  - Chambers LW, et. al, Impact of the Ottawa Influenza Decision Aid on healthcare personnel's influenza immunization decision: a randomized trial. J Hosp Infect. 2012 Nov;82(3):194-202.
- **Results**
  - Eight per cent (151 of 1886) of the unimmunized healthcare personnel were randomized.
  - Of 107 eligible respondents, 48 were in the Ottawa Influenza Decision Aid (OIDA) group and 59 in the control group.
  - A statistically significant (P = 0.020) greater improvement in confidence in immunization decision was observed in the OIDA group compared with the control group.
  - The post-OIDA intent to be immunized in the OIDA and control groups compared to the pre-OIDA intent to be immunized showed that the OIDA had a significant effect on reducing uncertainty (P = 0.035)..

Clinical Decision Support for Providers: Infectious diseases

- **Reference**
  - Chambers LW, et. al, **Impact of the Ottawa Influenza Decision Aid on healthcare personnel's influenza immunization decision: a randomized trial**. J Hosp Infect. 2012 Nov;82(3):194-202
- **Conclusions**
  - Using an accessible, balanced, understandable format for all healthcare personnel about their influenza immunization decision appears to have an impact on both healthcare personnel's confidence in their immunization decision and in their intent to be immunized.
- **Importance**
  - Healthcare professionals are also people and patients in other roles
  - Don’t assume they do not also need decision support for their personal health decisions

Clinical Decision Support for Providers: Infectious diseases

- **Reference**
  - Forrest CB, et. al, **Improving adherence to otitis media guidelines with clinical decision support and physician feedback.** Pediatrics. 2013 Apr;131(4):e1071-81.
- **Source**
  - Department of Pediatrics, Children's Hospital of Philadelphia
- **Aim**
  - To assess the effects of electronic health record-based clinical decision support (CDS) and physician performance feedback on adherence to guidelines for acute otitis media (AOM) and otitis media with effusion (OME).
- **Methods**
  - Factorial-design cluster randomized trial with primary care practices (n = 24) as the unit of randomization and visits as the unit of analysis.
  - Between December 2007 and September 2010, data were collected from 139,305 otitis media visits made by 55,779 children aged 2 months to 12 years.

Clinical Decision Support for Providers: Infectious diseases

- **Reference**
  - Forrest CB, et. al, Improving adherence to otitis media guidelines with clinical decision support and physician feedback. Pediatrics. 2013 Apr;131(4):e1071-81.
- **Methods, cont'd**
  - When activated, the CDS system provided guideline-based recommendations individualized to the patient's history and presentation.
  - Monthly physician feedback reported adherence to guideline-based care, changes over time, and comparisons to others in the practice and network.
- **Results**
  - Comprehensive care (all recommended guidelines were adhered to) was accomplished for 15% of AOM and 5% of OME visits during the baseline period.
  - The increase from baseline to intervention periods in adherence to guidelines was larger for CDS compared with non-CDS visits for comprehensive care, pain treatment, adequate diagnostic evaluation for OME, and amoxicillin as first-line therapy for AOM.

Clinical Decision Support for Providers: Infectious diseases

- **Reference**
  - Forrest CB, et. al, Improving adherence to otitis media guidelines with clinical decision support and physician feedback. Pediatrics. 2013 Apr;131(4):e1071-81
- **Results, cont'd**
  - Although performance feedback was associated with improved antibiotic prescribing for AOM and pain treatment, the joint effects of CDS and feedback on guideline adherence were not additive.
  - There was marked variation in use of the CDS system, ranging from 5% to 45% visits across practices.
- **Conclusions**
  - Clinical decision support and performance feedback are both effective strategies for improving adherence to otitis media guidelines. Combining the 2 interventions is no better than either delivered alone.
- **Importance**
  - Easy to show statistically significant gains when starting with low baselines
  - Only in clinical informatics is 15% compliance considered a win…

Clinical Decision Support for Providers: Infectious diseases

- **Reference**
  - Robbins GK, et. al, **Efficacy of a clinical decision-support system in an HIV practice: a randomized trial.** Ann Intern Med. 2012 Dec 4;157(11):757-66.
- **Source**
  - Div. of Infectious Diseases, Massachusetts General Hospital
- **Aim**
  - To test the efficacy of a CDSS in improving HIV outcomes in an outpatient clinic.
- **Methods**
  - Randomized, controlled trial in the MGH HIV clinic.
  - Computer alerts were generated for virologic failure (HIV RNA level >400 copies/mL after a previous HIV RNA level ≤400 copies/mL), evidence of suboptimal follow-up, and 11 abnormal laboratory test results.
  - Providers received interactive computer alerts, facilitating appointment rescheduling and repeated laboratory testing, for half of their patients and static alerts for the other half.
  - Primary end point was change in CD4 cell count. Other end points included time to clinical event, 6-month suboptimal follow-up, and severe laboratory toxicity.

Clinical Decision Support for Providers: Infectious diseases

- **Reference**
  - Robbins GK, et. al, Efficacy of a clinical decision-support system in an HIV practice: a randomized trial. Ann Intern Med. 2012 Dec 4;157(11):757-66
- **Results**
  - 33 HIV care providers followed 1011 patients with HIV.
  - In intervention group, mean increase in CD4 cell count was greater ($P = 0.040$) and the rate of 6-month suboptimal follow-up was lower (20.6 vs. 30.1 events per 100 patient-years; $P = 0.022$) than those in the control group.
  - Median time to next scheduled appointment was shorter in the intervention group than in the control group after a suboptimal follow-up alert (1.71 vs. 3.48 months; $P < 0.001$) and after a toxicity alert (2.79 vs. >6 months; $P = 0.072$).
  - > 90% of providers supported adopting the CDSS as part of standard care.
- **Conclusions**
  - A CDSS using interactive provider alerts improved CD4 cell counts and clinic follow-up for patients with HIV.

Clinical Decision Support for Providers: Infectious diseases

- **Reference**
  - Robbins GK, et. al, Efficacy of a clinical decision-support system in an HIV practice: a randomized trial. Ann Intern Med. 2012 Dec 4;157(11):757-66
- **Importance**
  - Smart does not equal reliable (and patients pay the penalty for the difference)
  - Top tier academic centers also benefit from systems level CDSS interventions targeted to important process and clinical outcome measures.

Clinical Decision Support for Providers: Infectious diseases

- **Reference**
  - Were MC, et. al, **Computer-generated reminders and quality of pediatric HIV care in a resource-limited setting.** Pediatrics. 2013 Mar;131(3):e789-96.
- **Source**
  - Department of Medicine, Indiana University School of Medicine
- **Aim**
  - To evaluate the impact of clinician-targeted computer-generated reminders on compliance with HIV care guidelines in a resource-limited setting.
- **Methods**
  - Randomized, controlled trial in an HIV referral clinic in Kenya caring for HIV-infected and HIV-exposed children (<14 years of age).
  - For children randomly assigned to the intervention group, printed patient summaries containing computer-generated patient-specific reminders for overdue care recommendations were provided to the clinician at the time of the child's clinic visit.
  - For children in the control group, clinicians received the summaries, but no computer-generated reminders.

Clinical Decision Support for Providers: Infectious diseases

- **Reference**
  - Were MC, et. al, Computer-generated reminders and quality of pediatric HIV care in a resource-limited setting. Pediatrics. 2013 Mar;131(3):e789-96.
- **Methods, cont'd**
  - Compared differences between the intervention and control groups in completion of overdue tasks, including HIV testing, laboratory monitoring, initiating antiretroviral therapy, and making referrals.
- **Results**
  - During the 5-month study period, 1611 patients (49% female, 70% HIV-infected) were eligible to receive at least 1 computer-generated reminder (ie, had an overdue clinical task).
  - There was a fourfold increase in the completion of overdue clinical tasks when reminders were availed to providers over the course of the study (68% intervention vs 18% control, $P < .001$).
  - Orders also occurred earlier for the intervention group (77 days, SD 2.4 days) compared with the control group (104 days, SD 1.2 days) ($P < .001$).
  - Response rates to reminders varied significantly by type of reminder and between clinicians.

Clinical Decision Support for Providers: Infectious diseases

- **Reference**
  - Were MC, et. al, Computer-generated reminders and quality of pediatric HIV care in a resource-limited setting. Pediatrics. 2013 Mar;131(3):e789-96
- **Conclusions**
  - Clinician-targeted, computer-generated clinical reminders are associated with a significant increase in completion of overdue clinical tasks for HIV-infected and exposed children in a resource-limited setting.
- **Importance**
  - A serendipitous bookend to the Mass General study that had a similar intervention and similar design.
  - Resource rich or resource poor settings, patients benefit from their clinicians having a systems infrastructure to improve consistency of care.

Clinical Decision Support for Providers: Medication Management

- **Reference**
  - Piazza G, et. al, Randomized trial of physician alerts for thromboprophylaxis after discharge. Am J Med. 2013 May;126(5):435-42.
- **Source**
  - Cardiovascular Division, Brigham and Women's Hospital, Boston
- **Aim**
  - To test whether a thromboprophylaxis alert to an Attending Physician before discharge would increase the rate of extended out-of-hospital prophylaxis and, in turn, reduce the incidence of symptomatic venous thromboembolism at 90 days.
- **Methods**
  - From April 2009 to January 2010, enrolled hospitalized Medical Service patients using a previously developed point score system to identify Pts at high risk for venous thromboembolism who were not ordered to receive thromboprophylaxis after discharge.
  - A multicenter trial with Pts randomized by computer in a 1:1 ratio to the alert group or the control group

Clinical Decision Support for Providers: Medication Management

- **Reference**
  - Piazza G, et. al, Randomized trial of physician alerts for thromboprophylaxis after discharge. Am J Med. 2013 May;126(5):435-42.
- **Results**
  - 2513 eligible patients from 18 study sites.
  - Patients in the alert group were more than twice as likely to receive thromboprophylaxis at discharge as controls (22.0% vs 9.7%, P <.0001).
  - Based on intent-to-treat analysis, symptomatic venous thromboembolism at 90 days (99.9% follow-up) occurred in 4.5% of patients in the alert group, compared with 4.0% of controls (hazard ratio 1.12; 95% confidence interval, 0.74-1.69).
  - Rate of major bleeding at 30 days in the alert group was similar to that of the control group (1.2% vs 1.2%, hazard ratio 0.94; 95% confidence interval, 0.44-2.01).

Clinical Decision Support for Providers: Medication Management

- **Reference**
  - Piazza G, et. al, Randomized trial of physician alerts for thromboprophylaxis after discharge. Am J Med. 2013 May;126(5):435-42.
- **Conclusions**
  - Alerting providers to extend thromboprophylaxis after hospital discharge in Medical Service patients increased the rate of prophylaxis but did not decrease the rate of symptomatic venous thromboembolism.
- **Importance**
  - Improved process does not equal improved outcome. Be sure to measure both if feasible.

Clinical Decision Support for Providers: Behavioral health

- **Reference**
  - Rindal DB, et. al, **Computer-assisted guidance for dental office tobacco-cessation counseling: a randomized controlled trial**. Am J Prev Med. 2013 Mar;44(3):260-4.
- **Source**
  - HealthPartners Institute for Education and Research, Minneapolis
- **Aim**
  - To determine whether dentists and dental hygienists would assess interest in quitting tobacco, deliver a brief intervention, and refer to a tobacco quitline more frequently as reported by patients if given computer-assisted guidance in an electronic patient record versus a control group providing usual care.
- **Methods**
  - A blocked, group-randomized trial was conducted from November 2010 to April 2011. Randomization was conducted at the clinic level. Patients nested within clinics represented the lowest-level unit of observation.
  - Participants were patients in HealthPartners dental clinics.
  - Intervention clinics were given a computer-assisted tool that suggested scripts for patient discussions.

Clinical Decision Support for Providers: Behavioral health

- **Reference**
  - Rindal DB, et. al, Computer-assisted guidance for dental office tobacco-cessation counseling: a randomized controlled trial. Am J Prev Med. 2013 Mar;44(3):260-4.
- **Methods, cont'd**
  - Usual care clinics provided care without the tool.
  - Primary outcomes were post-appointment patient reports of the provider assessing interest in quitting, delivering a brief intervention, and referring them to a quitline.
- **Results**
  - Patient telephone surveys (72% response rate) indicated that providers assessed interest in quitting (control 70% vs intervention 87%, p=0.0006); discussed specific strategies for quitting (control 26% vs intervention 47%, p=0.003); and referred the patient to a tobacco quitline (control 17% vs intervention 37%, p=0.007) more frequently with the support of a computer-assisted tool integrated into the electronic health record.

Clinical Decision Support for Providers: Behavioral health

- **Reference**
  - Rindal DB, et. al, Computer-assisted guidance for dental office tobacco-cessation counseling: a randomized controlled trial. Am J Prev Med. 2013 Mar;44(3):260-4.
- **Conclusions**
  - Clinical decision support embedded in electronic health records can effectively help providers deliver tobacco interventions.
  - Support CDSS approach to improve provider-delivered tobacco cessation.
- **Importance**
  - Healthcare providers of all types have an important role in promoting healthy behaviors, and everybody on the team can benefit from CDSS.

Clinical Decision Support for Providers: Inpatient safety

- **Reference**
  - Chen YY, et. al, Using a criteria-based reminder to reduce use of indwelling urinary catheters and decrease urinary tract infections. Am J Crit Care. 2013 Mar;22(2):105-14.
- **Source**
  - Taipei Veterans General Hospital, Taipei, Taiwan
- **Aim**
  - To determine whether a reminder approach reduces the use of urinary catheters and the incidence of catheter-associated urinary tract infections.
- **Methods**
  - A randomized control trial was performed in 2 respiratory intensive care units in a 2990-bed tertiary referral medical center.
  - Patients who had urinary catheters in place for more than 2 days from April through November 2008 were randomly assigned to either the intervention group (use of a criteria-based reminder to remove the catheter) or the control group (no reminder).

Clinical Decision Support for Providers: Inpatient safety

- **Reference**
  - Chen YY, et. al, Using a criteria-based reminder to reduce use of indwelling urinary catheters and decrease urinary tract infections. Am J Crit Care. 2013 Mar;22(2):105-14. .
- **Results**
  - A total of 278 patients were entered on-study.
  - Utilization rate of indwelling urinary catheters was decreased by 22% in the intervention group compared with the control group (relative risk, 0.78; 95% CI, 0.76-0.80; P < .001).
  - Intervention significantly shortened the median duration of catheterization (7 days vs 11 days for the control group; P < .001).
  - The success rate for removing the catheters in the intervention group by day 7 was 88%.
  - The reminder intervention reduced the incidence of catheter-associated infections by 48% (relative risk, 0.52; 95% CI, 0.32-0.86; P = .009) in the intervention group compared with the control group.

Clinical Decision Support for Providers: Inpatient safety

- **Reference**
  - Chen YY, et. al, Using a criteria-based reminder to reduce use of indwelling urinary catheters and decrease urinary tract infections. Am J Crit Care. 2013 Mar;22(2):105-14.
- **Conclusions**
  - Use of a criteria-based reminder to remove indwelling urinary catheters can diminish the use of urinary catheterization and reduce the likelihood of catheter-associated urinary infections.
  - This reminder approach can prevent catheter-associated urinary infections, and its use should be strongly considered as a way to enhance the safety of patients.
- **Importance**
  - A classical inpatient alerting based CDSS study with both a process outcome and a gratifying disease-related outcome.

Clinical Decision Support for Providers: Care transitions

- **Reference**
  - Dalal AK, et.. al. **Impact of an automated email notification system for results of tests pending at discharge: a cluster-randomized controlled trial.** J Am Med Inform Assoc. 2013 Oct 23.
- **Source**
  - Division of General Medicine and Primary Care, Brigham and Women's Hospital, Boston
- **Aim**
  - To evaluate the impact of a system that notified physicians of test results pending at discharge (TPAD) on self-reported awareness of TPAD results by responsible physicians, a necessary intermediary step to improve management of TPAD results.
- **Methods**
  - A cluster-randomized controlled trial at a major hospital affiliated with an integrated healthcare delivery network in Boston, Massachusetts.
  - Adult patients with TPADs who were discharged from inpatient general medicine and cardiology services were assigned to the intervention or usual care arm if their inpatient attending physician and primary care physician (PCP) were both randomized to the same study arm.

Clinical Decision Support for Providers: Care transitions

- **Reference**
  - Dalal AK, et.. al. Impact of an automated email notification system for results of tests pending at discharge: a cluster-randomized controlled trial. J Am Med Inform Assoc. 2013 Oct 23. .
- **Methods, cont'd**
  - Surveyed these physicians 72 h after all TPAD results were finalized.
  - The primary outcome was awareness of TPAD results by attending physicians.
  - Secondary outcomes included awareness of TPAD results by PCPs, awareness of actionable TPAD results, and provider satisfaction..
- **Results**
  - 441 patients analyzed
  - Sent surveys to attending physicians and PCPs with response rate of 63%.

Clinical Decision Support for Providers: Care transitions

- **Reference**
  - Dalal AK, et.. al. Impact of an automated email notification system for results of tests pending at discharge: a cluster-randomized controlled trial. J Am Med Inform Assoc. 2013 Oct 23.
- **Results, cont'd**
  - Intervention attending physicians and PCPs were significantly more aware of TPAD results (76% vs 38%, $p<0.001$; 57% vs 33%, $p=0.004$, respectively).
  - Intervention attending physicians tended to be more aware of actionable TPAD results (59% vs 29%, $p=0.13$).
  - One hundred and eighteen (85%) and 43 (63%) intervention attending physician and PCP survey respondents, respectively, were satisfied with this intervention.

Clinical Decision Support for Providers: Care transitions

- **Reference**
  - Dalal AK, et.. al. Impact of an automated email notification system for results of tests pending at discharge: a cluster-randomized controlled trial. J Am Med Inform Assoc. 2013 Oct 23.
- **Conclusions**
  - Automated email notification represents a promising strategy for managing TPAD results, potentially mitigating an unresolved patient safety concern.
- **Importance**
  - Use of asynchronous messaging via secure email can help with transitions of care (handoffs) when patient has left the inpatient environment.

Clinical Decision Support for Providers: Diagnostic Accuracy

- **Reference**
  - Szucs-Farkas Z, et. al, **Comparison of dual-energy subtraction and electronic bone suppression combined with computer-aided detection on chest radiographs: effect on human observers' performance in nodule detection**. AJR Am J Roentgenol. 2013 May;200(5):1006-13.
- **Source**
  - University Hospital and University of Bern, Berne, Switzerland
- **Aim**
  - To compare the effect of dual-energy subtraction and bone suppression software alone and in combination with computer-aided detection (CAD) on the performance of human observers in lung nodule detection.
- **Methods**
  - One hundred one patients with from one to five lung nodules measuring 5-29 mm and 42 subjects with no nodules were retrospectively selected and randomized.
  - Three independent radiologists marked suspicious-appearing lesions on the original chest radiographs, dual-energy subtraction images, and bone-suppressed images before and after postprocessing with CAD.

Clinical Decision Support for Providers: Diagnostic Accuracy

- **Reference**
  - Szucs-Farkas Z, et. al, Comparison of dual-energy subtraction and electronic bone suppression combined with computer-aided detection on chest radiographs: effect on human observers' performance in nodule detection. AJR Am J Roentgenol. 2013 May;200(5):1006-13.
- **Methods**
  - Marks of the observers and CAD marks were compared with CT as the reference standard.
  - Data were analyzed using nonparametric tests and receiver operating characteristic methods.
- **Results**
  - Using dual-energy subtraction alone ($p = 0.0198$) or CAD alone ($p = 0.0095$) improved the detection rate compared with using the original conventional chest radiograph.
  - The combination of bone suppression and CAD provided the highest sensitivity (51.6%) and the original non-enhanced conventional chest radiograph alone provided the lowest (46.9%; $p = 0.0049$).
  - Dual-energy subtraction and bone suppression provided the same false-positive ($p = 0.2702$) and true-positive ($p = 0.8451$) rates.

Clinical Decision Support for Providers: Diagnostic Accuracy

- **Reference**
  - Szucs-Farkas Z, et. al, Comparison of dual-energy subtraction and electronic bone suppression combined with computer-aided detection on chest radiographs: effect on human observers' performance in nodule detection. AJR 2013 May;200(5):1006-13.
- **Results**
  - Up to 22.9% of lesions were found only by the CAD program and were missed by the readers.
- **Conclusions**
  - Dual-energy subtraction and the electronic bone suppression image enhancement provided similar detection rates for pulmonary nodules, which were better than baseline radiograph.
  - CAD alone or combined with bone suppression can significantly improve the sensitivity of human observers for pulmonary nodule detection.
- **Importance**
  - Image analysis extracts new value from a familiar and inexpensive imaging test

Clinical Decision Support for Providers: Reducing Costs

- **Reference**
  - Gimbel RW, et. al, **Radiation exposure and cost influence physician medical image decision making: a randomized controlled trial.** Med Care. 2013 Jul;51(7):628-32.
- **Source**
  - Department of Biomedical Informatics, Uniformed Services University of the Health Sciences, Bethesda, MD
- **Aim**
  - To determine whether safety and cost information will change physician medical image decision making.
- **Methods**
  - Double-blinded, randomized controlled trial.
  - Following standardized case presentation, physicians made an initial imaging choice.
  - This was followed by the presentation of guidelines, radiation exposure and health risk, and cost information.

Clinical Decision Support for Providers: Reducing Costs

- **Reference**
  - Gimbel RW, et. al, Radiation exposure and cost influence physician medical image decision making: a randomized controlled trial. Med Care. 2013 Jul;51(7):628-32. .
- **Results**
  - Approximately half (57 of 112, 50.9%) of participants initially selected computed tomography (CT).
  - When presented with guideline recommendations, participants did not modify their initial imaging choice (P=0.197).
  - A significant reduction (56.3%, P<0.001) in CT ordering occurred after presentation of radiation exposure/health risk information;ordering changed to magnetic resonance imaging or ultrasound (US).
  - A significant reduction (48.3%, P<0.001) in CT and magnetic resonance imaging ordering occurred after presentation of Medicare reimbursement information; ordering changed to US.
  - The majority of physicians (31 of 40, 77.5%) selecting US never modified their ordering.
  - No significant relationship between physician demographics and decision making was observed.

Clinical Decision Support for Providers: Reducing Costs

- **Reference**
  - Gimbel RW, et. al, Radiation exposure and cost influence physician medical image decision making: a randomized controlled trial. Med Care. 2013 Jul;51(7):628-32.
- **Conclusions**
  - Physician decision making can be influenced by safety and cost information and the order in which information is provided to physicians can affect their decisions.
- **Importance**
  - An opportunity for ‘multidimensional’ decision support

Clinical Decision Support for Providers: Increasing Income

- **Reference**
  - Freundlich RE, et. al, A randomized trial of automated electronic alerts demonstrating improved reimbursable anesthesia time documentation. J Clin Anesth. 2013 Mar;25(2):110-4
- **Source**
  - Department of Anesthesiology, University of Michigan Medical School, Ann Arbor, MI
- **Aim**
  - To investigate whether alerting providers to errors results in improved documentation of reimbursable anesthesia care
- **Methods**
  - Prospective randomized controlled trial in the U of M operating rooms.
  - Anesthesia cases were evaluated to determine whether they met the definition for appropriate anesthesia start time over 4 separate, 45-day calendar cycles: the pre-study period, study period, immediate post-study period, and 3-year follow-up period.
  - During the study period, providers were randomly assigned to either a control or an alert group.

Clinical Decision Support for Providers: Increasing Income

- **Reference**
  - Freundlich RE, et. al, A randomized trial of automated electronic alerts demonstrating improved reimbursable anesthesia time documentation. J Clin Anesth. 2013 Mar;25(2):110-4.
- **Methods**
  - Providers in the alert cohort received an automated alphanumeric page if the anesthesia start time occurred concurrently with the patient entering the OR, or more than 30 minutes before entering the OR
  - Three years after the intervention period, overall compliance was analyzed to assess learned behavior.
- **Results**
  - Baseline compliance was 33% ± 5%.
  - During the intervention period, providers in the alert group showed 87% ± 6% compliance compared with 41% ± 7% compliance in the control group ($P < 0.001$).
  - Long-term follow-up after cessation of the alerts showed 85% ± 4% compliance.

Clinical Decision Support for Providers: Increasing Income

- **Reference**
  - Freundlich RE, et. al, A randomized trial of automated electronic alerts demonstrating improved reimbursable anesthesia time documentation. J Clin Anesth. 2013 Mar;25(2):110-4
- **Conclusions**
  - Automated electronic reminders for time-based billing charges are effective and result in improved ongoing reimbursement.
- **Importance**
  - Notable persistent educational effect seldom observed in CDSS studies (but perhaps predictable since most CDSS interventions do not directly align with personal self-interest).
  - Hopefully equal attention was given to clinical effectiveness and patient safety decision support.
  - Perhaps Detroit should ask U of M for a consult…

Clinical Decision Support for Providers and Patients: Infectious Disease

- **Reference**
  - Fiks AG, et. al, **Effectiveness of decision support for families, clinicians, or both on HPV vaccine receipt**. Pediatrics. 2013 Jun;131(6):1114-24.
- **Source**
  - Pediatric Research Consortium, Children's Hospital of Philadelphia
- **Aim**
  - To improve human papillomavirus (HPV) vaccination rates, we studied the effectiveness of targeting automated decision support to families, clinicians, or both.
- **Methods**
  - Twenty-two primary care practices cluster-randomized to receive a 3-part clinician-focused intervention (education, electronic health record-based alerts, and audit and feedback) or none.
  - 22,486 girls aged 11 to 17 years due for HPV vaccine dose 1, 2, or 3 were randomly assigned within each practice to receive family-focused decision support with educational telephone calls.
  - Randomization established 4 groups: family-focused, clinician-focused, combined, and no intervention.

Clinical Decision Support for Providers and Patients: Infectious Disease

- **Reference**
  - Fiks AG, et. al, Effectiveness of decision support for families, clinicians, or both on HPV vaccine receipt. Pediatrics. 2013 Jun;131(6):1114-24.
- **Methods**
  - Measured decision support effectiveness by final vaccination rates and time to vaccine receipt, standardized for covariates and limited to those having received the previous dose for HPV #2 and 3.
  - 1-year study began in May 2010.
- **Results**
  - Among controls, vaccination rates for HPV #1, 2, and 3 were 16%, 65%, and 63%.
  - The combined intervention increased vaccination rates by 9, 8, and 13 percentage points, respectively.
  - Control group achieved 15% vaccination for HPV #1 and 50% vaccination for HPV #2 and 3 after 318, 178, and 215 days.
  - The combined intervention significantly accelerated vaccination by 151, 68, and 93 days.

Clinical Decision Support for Providers and Patients: Infectious Disease

- **Reference**
  - Fiks AG, et. al, Effectiveness of decision support for families, clinicians, or both on HPV vaccine receipt. Pediatrics. 2013 Jun;131(6):1114-24.
- **Results, cont'd**
  - The clinician-focused intervention was more effective than the family-focused intervention for HPV #1, but less effective for HPV #2 and 3.
- **Conclusions**
  - A clinician-focused intervention was most effective for initiating the HPV vaccination series, whereas a family-focused intervention promoted completion.
  - Decision support directed at both clinicians and families most effectively promotes HPV vaccine series receipt.
- **Importance**
  - Healthcare is a team sport. Engage as many players as possible (Participatory Medicine) for promoting healthy behaviors.

Clinical Decision Support for Patients: Cancer Detection and Care (3 studies)

- **References**

  - van Tol-Geerdink JJ, et. al, **Choice between prostatectomy and radiotherapy when men are eligible for both: a randomized controlled trial of usual care vs decision aid.** BJU Int. 2013 Apr;111(4):564-73. [Department of Radiation Oncology, Radboud University Medical Centre, Netherlands].

  - Green BB, et. al, **An automated intervention with stepped increases in support to increase uptake of colorectal cancer screening: a randomized trial**. Ann Intern Med. 2013 Mar 5;158(5 Pt 1):301-11. [Group Health Research Institute, Seattle]

  - Schroy PC 3rd, et. al, **Aid-assisted decision making and colorectal cancer screening: a randomized controlled trial**. Am J Prev Med. 2012 Dec;43(6):573-83.e [Department of Medicine, Boston University, Boston]

Clinical Decision Support for Patients: Cancer Detection and Care (3 studies)

- **Interventions**
  - Netherlands: online decision aid for newly diagnosed prostate cancer patients to help choose between surgery, external beam radiation or brachytherapy, in 240 patients with localized cancer.
  - Group Health Seattle: EHR-linked automated mailings +/- telephone assistance +/- nurse navigation vs. usual care, to promote colorectal cancer screening, in 4675 adults aged 50-73 followed by 21 medical centers
  - Boston Univ.: Shared Decision Making decision aid +/- personalized risk assessment vs. usual care to promote colorectal cancer screening in 825 adults aged 50-75
- **Results**
  - Netherlands: more patients chose brachytherapy, fewer undecided as a result of using the decision aid.
  - Group Health: intervention groups 2-3x more likely to get screening (up to 65% of those getting highest intensity intervention)
  - Boston Univ: increase from 35% compliance to 43% in getting CRC screening among those in either intervention arm vs. usual care.

Clinical Decision Support for Patients: Cancer Detection and Care (3 studies)

- **Conclusions**
  - Netherlands: Men eligible for both prostatectomy and radiotherapy mostly preferred prostatectomy, and the treatment choice was influenced by the hospital they visited. Giving patients evidence-based information by means of a decision aid, led to an increase in brachytherapy.
  - Group Health: Compared with usual care, a centralized, EHR-linked, mailed CRC screening program led to twice as many persons being current for CRC screening over 2 years.
  - Boston Univ: Decision aid-assisted SDM has a modest impact on CRC screening uptake.
- **Importance**
  - Continues a sustained trend that giving patients information directly changes health choices vs. usual care.
  - Caution: studies also consistent with a Hawthorne effect and show information dose intensity proportional to outcome.

Clinical Decision Support for Patients: Psychological and Behavioral Health

- **Reference**
  - Arndt J, et. al, **The interactive effect of mortality reminders and tobacco craving on smoking topography**. Health Psychol. 2013 May;32(5):525-32.
- **Source**
  - Department of Psychological Sciences, University of Missouri, Columbia
- **Aim**
  - Although fatal consequences of smoking are often highlighted in health communications, the question of how awareness of death affects actual smoking behavior has yet to be addressed.
  - Two experiments informed by the *terror management health model* were conducted to examine this issue. Previous research suggested that effects of mortality reminders on health-related decisions are often moderated by relevant individual difference or situational variables.

Clinical Decision Support for Patients: Psychological and Behavioral Health

- **Reference**
  - Arndt J, et. al, The interactive effect of mortality reminders and tobacco craving on smoking topography. Health Psychol. 2013 May;32(5):525-32.
- **Methods**
  - In both studies, relatively light smokers completed a brief questionnaire about cigarette cravings, were reminded of their mortality or a control topic, and then smoked five puffs from a cigarette while the volume, duration, and velocity of their inhalations was recorded.
- **Results**
  - Significant craving × death reminder interactions emerged in both experiments.
  - After reminders of mortality, stronger cravings predicted greater smoking intensity.
  - Further, reminders of mortality increased smoking intensity for those with stronger cravings in both studies.
  - There was also some indication that mortality reminders decreased smoking intensity for those with weaker cravings.

Clinical Decision Support for Patients: Psychological and Behavioral Health

- **Reference**
  - Arndt J, et. al, The interactive effect of mortality reminders and tobacco craving on smoking topography. Health Psychol. 2013 May;32(5):525-32.
- **Conclusions**
  - "These findings indicate a nuanced effect of mortality reminders on smoking intensity and suggest that careful consideration needs to be given to when and how reminders of death are used in communications about smoking."
- **Importance**
  - Stress a smoker and he's gonna wanna light up…

"Looks like I picked the wrong week to quit smoking."

Roy Scheider.
Jaws, 1975.

3 New CDSS RCTs showing no difference for intervention vs. control

- **References**

  - Duke JD, et. al, **Adherence to drug-drug interaction alerts in high-risk patients: a trial of context-enhanced alerting**. J Am Med Inform Assoc. 2013 May 1;20(3):494-8. [Riegenstrief Institute, Indianapolis]

  - Beeckman D, et. al, **A multi-faceted tailored strategy to implement an electronic clinical decision support system for pressure ulcer prevention in nursing homes: a two-armed randomized controlled trial**. Int J Nurs Stud. 2013 Apr;50(4):475-86. [Dept Public Health, Ghent Univ., Belgium]

  - Nieuwlaat R, et. al, **Randomised comparison of a simple warfarin dosing algorithm versus a computerised anticoagulation management system for control of warfarin maintenance therapy**. Thromb Haemost. 2012 Dec;108(6):1228-35. [McMaster University, Ontario, Canada]

3 New CDSS RCTs showing no difference for intervention vs. control

- **Intervention**
  - Riegenstrief: 6-month randomized controlled trial involving 1029 outpatient physicians randomized to getting or not getting “context-enhanced” drug-drug interaction alerts on high risk patients with hyperkalemia, on multiple drugs known to cause the condition. High risk = baseline potassium >5.0 mEq/l and/or creatinine ≥1.5 mg/dl. Enhancement: show recent lab values.
  - Belgium: interactive education, CDSS reminders, feedback and ‘organizational leadership’ program to promote adherence to pressure ulcer prevention guideline-based care for 118 healthcare professionals with 464 at risk nursing home residents.
  - McMaster: Simple one-step warfarin dosing algorithm compared to a widely used computerized dosing system (DAWN AC) for dosing in 1068 warfarin Pts followed by an anticoagulation clinic.

3 New CDSS RCTs showing no difference for intervention vs. control

- **Results**
  - Riegenstrief: No significant difference in alert adherence in high-risk patients between the intervention group (15.3%) and the control group (16.8%) (p=0.71).
  - Belgium: No significant improvement was observed on pressure ulcer prevalence or the knowledge of the professionals.
  - McMaster: The mean time in therapeutic range was 71.0% (standard deviation [SD] 23.2) for the computerized system and 71.9% (SD 22.9) for the algorithm; p-value for non-inferiority=0.002; p-value for superiority=0.34).
- **Importance**
  - One reason why RCTs need to be done…

Methods and Issues in Clinical Decision Support

- **References**

1. Zhou L, et. al, **Structured representation for core elements of common clinical decision support interventions to facilitate knowledge sharing**. Stud Health Technol Inform. 2013;192:195-9.* [Partners Healthcare, Wellesley]

2. Kawamoto K, et. al, **Key principles for a national clinical decision support knowledge sharing framework: synthesis of insights from leading subject matter experts**. J Am Med Inform Assoc. 2013 Jan 1;20(1):199-207.* [Dept Biomed Informatics, Univ Utah]

3. Dixon BE, et. al, **A pilot study of distributed knowledge management and clinical decision support in the cloud**. Artif Intell Med. 2013 Sep;59(1):45-53.* [Indiana Univ., Indianapolis]

Methods and Issues in Clinical Decision Support

- **Aims & Methods**
  - Partners: to identify key requirements for the representation of five widely utilized CDS intervention types: alerts and reminders, order sets, infobuttons, documentation templates/forms, and relevant data presentation.
  - Utah: ONC-sponsored expert panel convened to identify key principles for establishing a national clinical decision support (CDS) knowledge sharing framework.
  - Indiana: build and test a prototype CDS rules engine in the cloud and securely transmit data to the service and receive real time alerts and reminders for hypertension, diabetes, and coronary artery disease.
- **Results**
  - Partners: developed and validated an XML schema, available via public portal
  - Utah: knowledge sharing roadmap developed
  - Indiana: 1139 Pt encounters successfully exchanged; lessons learned. Found cloud architecture feasible.

Unintended Consequences of CDSS Systems: Information Overload

- **References**

1. Dixon BJ, et. al, **Surgeons blinded by enhanced navigation: the effect of augmented reality on attention**. Surg Endosc. 2013 Feb;27(2):454-61. [Univ. Toronto, Canada]

2. Singh H, et. al, **Information overload and missed test results in electronic health record-based settings.** JAMA Intern Med. 2013 Apr 22;173(8):702-4. [Houston VA and UTHSC Houston]

3. Phansalkar S, et. al, **Drug-drug interactions that should be non-interruptive in order to reduce alert fatigue in electronic health records**. J Am Med Inform Assoc. 2013 May 1;20(3):489-93.* [Partners HealthCare Systems, Wellesley]

Unintended Consequences of CDSS Systems: Information Overload

- **Interventions**
  - Toronto: Endoscopic navigation exercise on a cadaveric specimen. The subjects randomized to either a standard endoscopic view (control) or an augmented reality view consisting of an endoscopic video fused with anatomic contours. Two unexpected findings were presented in close proximity to the target point: one critical complication and one foreign body (screw). Task completion time, accuracy, and recognition of findings were recorded.
  - Houston VA: survey of VA primary care physicians regarding potential for and actual experience of missed lab results in EHR system; sociotechnical analysis of results
  - Partners: expert panel to address alert fatigue and 90% override rate of drug-drug interactions.

CDSS Unintended Consequences

- **Results**
  - Toronto: Detection of the complication was 0/15 in the AR group versus 7/17 in the control group (p = 0.008). Detection of the screw was 1/15 (AR) and 7/17 (control) (p = 0.041).
  - Houston VA: 56% of 2590 PCPs reported that EHR notification system made it possible to miss test results, and 30% had experienced that. Median number of alerts PCPs reported receiving each day was 63; 86.9% perceived the quantity of alerts they received to be excessive, and 69.6% reported receiving more alerts than they could effectively manage (marker of information overload).
  - Partners: created list of 33 class-based low-priority DDI that do not warrant being interruptive alerts in EHR. In one institution, these accounted for 36% of the interactions displayed.
- **Importance**
  - The art and science of systems development: more information is not necessarily better

Avoiding Unintended Consequences: Implementation Science

- **Reference**

  Novak LL, et. al, **Mediation of adoption and use: a key strategy for mitigating unintended consequences of health IT implementation**. J Am Med Inform Assoc. 2012 Nov-Dec;19(6):1043-9.*

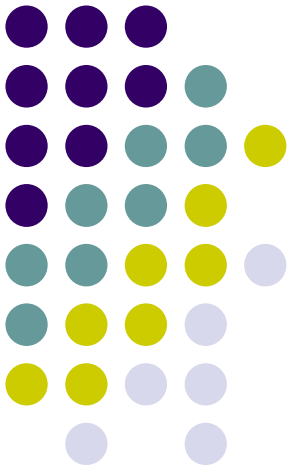
- **Source**
  - Implementation Science Lab, Dept Biomedical Informatics, Vanderbilt Univ., Nashville
- **Aim**
  - Analyze the work of nurse mediators in adoption and use of a barcode medication administration (BCMA) system in an inpatient setting.
- **Methods**
  - Ethnographic methods: field notes from observations, documents, and email communications. This variety of sources enabled triangulation of findings between activities observed, discussed in meetings, and reported in emails.

Avoiding Unintended Consequences: Implementation Science

- **Reference**
  - Novak LL, et. al, Mediation of adoption and use: a key strategy for mitigating unintended consequences of health IT implementation. J Am Med Inform Assoc. 2012 Nov-Dec;19(6):1043-9.
- **Results**
  - Mediation work integrated the BCMA tool with nursing practice, anticipating and solving implementation problems.
  - Three themes of mediation work include: resolving challenges related to coordination, integrating the physical aspects of BCMA into everyday practice, and advocacy work.
- **Conclusions**
  - Institutionally supported clinicians who facilitate adoption and use of health IT systems can improve the safety and effectiveness of implementation through the management of unintended consequences.
  - Technology use mediation can provide decision-makers with theoretically durable, empirically grounded evidence for designing implementations.

Clinical Decision Support for Providers and Patients

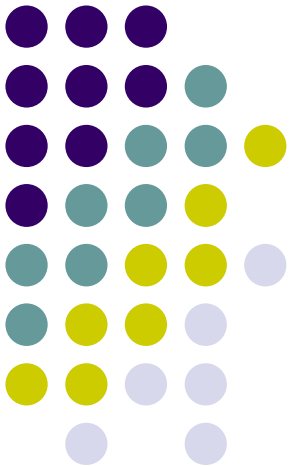
Questions and Comments



Telemedicine

25 new ‘medium and large’ RCTs published November 2012 – October 2013

- 6 cardiovascular diseases
- 3 diabetes
- 17 Psychiatric and behavioral health
- 1 each: infectious diseases, medication management, joint replacement rehab, trauma/life support training, contraception, physiotherapy, atopic dermatitis



Telemedicine – blood pressure control
5 RCTs

- **References**

1. Margolis KL, et. al, **Effect of home blood pressure telemonitoring and pharmacist management on blood pressure control: a cluster randomized clinical trial**. JAMA. 2013 Jul 3;310(1):46-56. [HealthPartners, MN]
2. McKinstry B, et. al, **Telemonitoring based service redesign for the management of uncontrolled hypertension: multicentre randomised controlled trial**. BMJ. 2013 May 24;346:f3030. [Univ Edinburgh, UK]
3. Bove AA, et. al, **Managing hypertension in urban underserved subjects using telemedicine--a clinical trial**. Am Heart J. 2013 Apr;165(4):615-21. [Temple Univ Schl of Med, Philadelphia]
4. Magid DJ, et. al, **A pharmacist-led, American Heart Association Heart360 Web-enabled home blood pressure monitoring program. Circ Cardiovasc Qual Outcomes**. 2013 Mar 1;6(2):157-63. [Kaiser Permanente Colorado]
5. Jackson GL, et. al, **Racial differences in the effect of a telephone-delivered hypertension disease management program**. J Gen Intern Med. 2012 Dec;27(12):1682-9. [Durham VA]

Telemedicine – blood pressure control

- **Interventions**
  - All studies included home telemonitoring, with as needed telephone intervention by health professional [pharmacist, nurse, PCP]
- **Results**
  - All studies showed statistically significant and sustained lowering of BP associated with telemedicine intervention, relative to usual care.
  - All showed effectiveness. Only UK NHS study commented on cost-effectiveness, noting the higher level of NHS resources required.
- **Commentary**
  - Extends blood pressure management literature that has always shown improvement with a higher intensity intervention compared to usual care.
  - None answer the question of comparative effectiveness (i.e., same additional resources put into telemedicine vs. put into an alternative care enhancement). Another Hawthorne effect conundrum.
  - Probably time for a moratorium on home telemonitoring studies of blood pressure control that do not address cost-benefit.

Telemedicine – diabetes (3 RCTs)

- **References**

1. Tang PC, et. al, **Online disease management of diabetes: engaging and motivating patients online with enhanced resources-diabetes (EMPOWER-D), a randomized controlled trial**. J Am Med Inform Assoc. 2013 May 1;20(3):526-34. [Palo Alto Medical Foundation, Palo Alto, CA]

2. Trief PM, et. al, **Adherence to diabetes self care for white, African-American and Hispanic American telemedicine participants: 5 year results from the IDEATel project**. Ethn Health. 2013;18(1):83-96. [SUNY Upstate Medical University, Syracuse, NY]

3. Stone RA, et. al, **The Diabetes Telemonitoring Study Extension: an exploratory randomized comparison of alternative interventions to maintain glycemic control after withdrawal of diabetes home telemonitoring**. J Am Med Inform Assoc. 2012 Nov-Dec;19(6):973-9. [VA Pittsburgh. PA]

Telemedicine - diabetes

- **Interventions**
  - Palo Alto: 415 pts with Type II DM randomized to usual care or to (1) wirelessly uploaded home glucometer readings with graphical feedback; (2) comprehensive patient-specific diabetes summary status report; (3) nutrition and exercise logs; (4) insulin record; (5) online messaging with the patient's health team; (6) nurse care manager and dietitian providing advice and medication management; and (7) personalized text and video educational 'nuggets' dispensed electronically by the care team.

Telemedicine - diabetes

- **Interventions, cont'd**
  - SUNY upstate: randomized medically underserved Medicare patients (n=1665) to telemedicine case management (televideo educator visits, individualized goal-setting/problem solving) or usual care. Hispanic and African-American educators delivered the intervention in Spanish if needed.
  - Pittsburgh VA: After completion of home monitoring + telephone med management trial, 150 participants randomized to home monitoring without med management or monthly phone calls without telemonitoring.

Telemedicine - diabetes

- **Results**
  - Palo Alto: Intervention group had better A1c's at six and 12 months compared to usual care.
  - SUNY upstate: Intervention groups A1c better than control. Adherence was a significant mediator of A1c ($p<0.001$) and minority subjects were consistently less adherent than whites. Also, greater comorbidity and diabetes symptoms predicted poorer adherence, greater duration of diabetes and more years of education predicted better adherence.
  - Pittsburgh VA: HbA1c improvements seen in original telemedicine intervention were sustained six months after reducing intensity of intervention.
- **Comment**
  - Same therapy intensity problem and lack of cost-effectiveness analysis as BP telemonitoring studies.

Telemedicine – Psychiatric and behavioral health Depression (6 RCTs)

- **References**

1. Glozier N, et. al, **Internet-delivered cognitive behavioural therapy for adults with mild to moderate depression and high cardiovascular disease risks: a randomised attention-controlled trial**. PLoS One. 2013;8(3):e59139. [Univ. Sydney, Australia]

2. Fortney JC, et. al, **Practice-based versus telemedicine-based collaborative care for depression in rural federally qualified health centers: a pragmatic randomized comparative effectiveness trial**. Am J Psychiatry. 2013 Apr 1;170(4):414-25. [Univ Arkansas, Little Rock]

3. Moreno FA, et. al, **Use of standard Webcam and Internet equipment for telepsychiatry treatment of depression among underserved Hispanics.** Psychiatr Serv. 2012 Dec;63(12):1213-7. [Univ Arizona]

Telemedicine – Psychiatric and behavioral health Depression, cont'd (6 RCTs)

- **References**

4. Hunkeler EM, et. al**, A web-delivered care management and patient self-management program for recurrent depression: a randomized trial.** Psychiatr Serv. 2012 Nov;63(11):1063-71. [Permanente Medical Group, Oakland, CA]

5. Moritz S, et. al, **The more it is needed, the less it is wanted: attitudes toward face-to-face intervention among depressed patients undergoing online treatment**. Depress Anxiety. 2013 Feb;30(2):157-67. [University Medical Center Hamburg-Eppendorf, Hamburg, Germany]

6. Lintvedt OK, et. al, **Evaluating the effectiveness and efficacy of unguided internet-based self-help intervention for the prevention of depression: a randomized controlled trial**. Clin Psychol Psychother. 2013 Jan-Feb;20(1):10-27. [University of Tromsø, Norway.]

Telemedicine – Psychiatric and behavioral health

Depression, cont'd (6 RCTs)

- **Intervention**
  - 5 of 6 trials used web-based variants of Cognitive Behavioral Therapy for mild to moderate depression. 6th trial (Univ. Arizona) was a 'classical' telemedicine study with webcam + audio (cf. Skype) interaction at a distance between psychiatrist and patient. All compared to usual care.
- **Results**
  - All showed statistically significant improvement in depressive symptoms vs. usual care controls.
  - None addressed cost-effectiveness
- **Commentary**
  - Telemedicine for mild depression joins blood pressure control and diabetic glucose control in the 'no further need to prove efficacy; what is needed are cost and comparative effectiveness analyses, adjusted for intensity of interventions.

Telemedicine – Studies showing No difference between intervention & control (3)

- **References**

1. Wagner G, et. al, **Internet-delivered cognitive-behavioural therapy v. conventional guided self-help for bulimia nervosa: long-term evaluation of a randomised controlled trial**. Br J Psychiatry. 2013 Feb;202:135-41. [Medical University of Vienna, Austria]

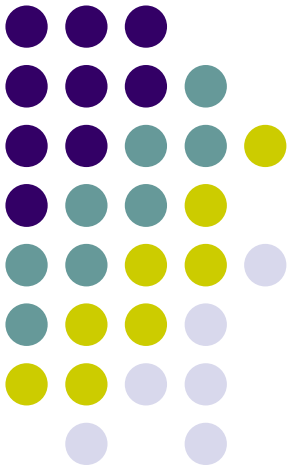
2. Schopf T, et. al, **Impact of interactive web-based education with mobile and email-based support of general practitioners on treatment and referral patterns of patients with atopic dermatitis: randomized controlled trial**. J Med Internet Res. 2012 Dec 5;14(6):e171. [University Hospital of North-Norway, Tromsø, Norway]

3. Cartwright M, et. al, **Effect of telehealth on quality of life and psychological outcomes over 12 months (Whole Systems Demonstrator telehealth questionnaire study): nested study of patient reported outcomes in a pragmatic, cluster randomised controlled trial.** BMJ. 2013 Feb 26;346:f653. [City University London, London, UK].

Health Applications of Mobile Electronics

7 new ‘medium and large’ RCTs published November 2012 – October 2013

- 1 featuring data acquisition via smart phones
- 6 featuring healthcare interventions via iPads, smartphones, SMS text enabled phones.



Health Applications of Mobile Electronics
Acquiring data from study participants

- **Reference**

1. Kristjánsdóttir ÓB, et. al, **A smartphone-based intervention with diaries and therapist-feedback to reduce catastrophizing and increase functioning in women with chronic widespread pain: randomized controlled trial**. J Med Internet Res. 2013 Jan 7;15(1):e5.
[Institute of Nursing, University College of Applied Sciences, Oslo, Norway]

Health Applications of Mobile Electronics
Acquiring data from study participants

- **Intervention**
  - 1 face-to-face session and 4 weeks of written communication via a smartphone diary app for 140 women with chronic widespread pain

- **Summary outcomes**
  - Reduced ‘catastophizing’
  - Improved functioning and symptom levels vs. usual care.

Health Applications of Mobile Electronics Delivering Healthcare interventions (4 RCTs)

- **References**

1. Junod Perron N, et. al, **Text-messaging versus telephone reminders to reduce missed appointments in an academic primary care clinic: a randomized controlled trial**. BMC Health Serv Res. 2013 Apr 4;13:125. [Geneva University Hospitals, Switzerland]
2. Lin H, et. al, **Effectiveness of a short message reminder in increasing compliance with pediatric cataract treatment: a randomized trial. Ophthalmology**. 2012 Dec;119(12):2463-70. [Guangzhou, China]
3. Evans WD, et. al, **Pilot evaluation of the text4baby mobile health program**. BMC Public Health. 2012 Nov 26;12:1031. George Washington Univ.]
4. Mbuagbaw L, et. al, **The Cameroon Mobile Phone SMS (CAMPS) trial: a randomized trial of text messaging versus usual care for adherence to antiretroviral therapy**. PLoS One. 2012;7(12):e46909. [Yaoundé Central Hospital, Cameroon]

Health Applications of Mobile Electronics Delivering Healthcare interventions (3 RCTs)

- **Interventions**
  1. Geneva, Switzerland: automated SMS text messages vs. telephone appointment reminders for 6450 primary care patients,
  2. Guangzhou, China: automated SMS text message appointment reminders to 258 parents for childhood cataract surgery followup appts
     .
  3. George Washington U: educational text messages via SMS to cell phones of 123 traditionally underserved pregnant women and new mothers to change their health, health care beliefs, practices, and behaviors in order to improve clinical outcomes

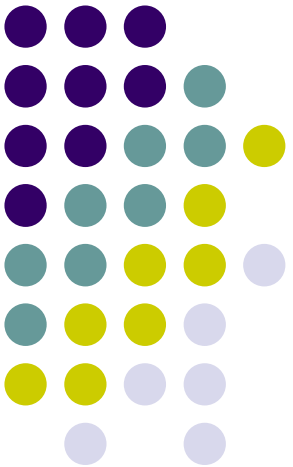
  4. Cameroon: 200 HIV-positive adults on ART randomized to receive a weekly standardized motivational text message about important of taking HIV meds, versus usual care alone.

Health Applications of Mobile Electronics Delivering Healthcare interventions (11 RCTs)

- **Results**
  - Swiss, Chinese, and GWU interventions showed statistically significant improved outcome measures using the cell phone intervention vs. control group.
  - Cameroon intervention did not improve ARV therapy adherence. One complaint about loss of confidentiality.

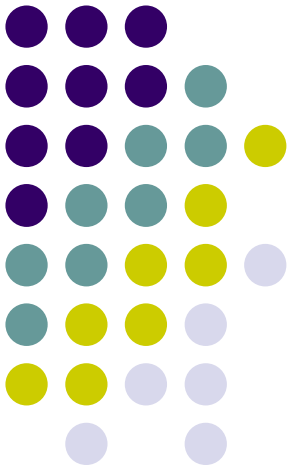
Telemedicine and Health Applications of Mobile Electronics

Questions and Comments



The Practice of Clinical Informatics and Bioinformatics

New methods, technologies, position papers, reviews



Practice of Informatics:
Models and new methods papers (5*)

- **References**

1. Smith SW and Koppel R. **Healthcare information technology's relativity problems: a typology of how patients' physical reality, clinicians' mental models, and healthcare information technology differ**. J Am Med Inform Assoc. 2013 Jun 26.* [Dartmouth, Hanover, NH]

   An analysis of 45 scenarios of ‘misalignment between patients' physical realities, clinicians' mental models, and EHRs, and categorization into 5 types. Notes that EHRs both reflect and shape care, and intended to be useful to healthcare IT designers and implementers reducing the unintended negative consequences of their use.

Practice of Informatics: Models and new methods papers, cont'd

- **References**

2. Lauer MS and D'Agostino RB. **The randomized registry trial--the next disruptive technology in clinical research**? N Engl J Med. 2013 Oct 24;369(17):1579-81.* [NIH NHLBI]

   Describes a low cost, high efficiency model for organizing EHR data into RCTs using consented registries of patients with specific conditions, and analyzing real world outcomes.

3. Boland MR, et. al, **Discovering medical conditions associated with periodontitis using linked electronic health records**. J Clin Periodontol. 2013 May;40(5):474-82.* [DBMI Columbia Univ., NYC]

   Describes a high-throughput method for associating periodontitis with systemic diseases using linked electronic medical and dental records, with validation of previously reported associations and discovery of a new one (BPH).

Practice of Informatics:
Models and new methods papers, cont'd

- **References**

4. Cassa CA, et. al, **A novel, privacy-preserving cryptographic approach for sharing sequencing data**. J Am Med Inform Assoc. 2013 Jan 1;20(1):69-76. [Div. Genetics, Brigham and Womens\

   Describes a novel way to securely share genetic sequence data via public networks by encrypting it using a key derived from the sequence itself.

5. Samwald M, et. al, **Pharmacogenomics in the pocket of every patient? A prototype based on quick response codes**. J Am Med Inform Assoc. 2013 May 1;20(3):409-12. [Medical University of Vienna, Austria]

   Describes method for encoding personal molecular variation data with a two-dimensional barcode that can be carried in a patient's wallet. Encoded data about 385 genetic polymorphisms and were able to decode and interpret quickly with common mobile devices.

Practice of Informatics: New technologies

- **References**

1. Loughran SP, et. al, **No increased sensitivity in brain activity of adolescents exposed to mobile phone-like emissions**. Clin Neurophysiol. 2013 Jul;124(7):1303-8. [Univ Zurich, Switzerland]

   Key findings: Concurrent mobile phone RF emissions do not change the EEGs or cognitive performance of teenagers.

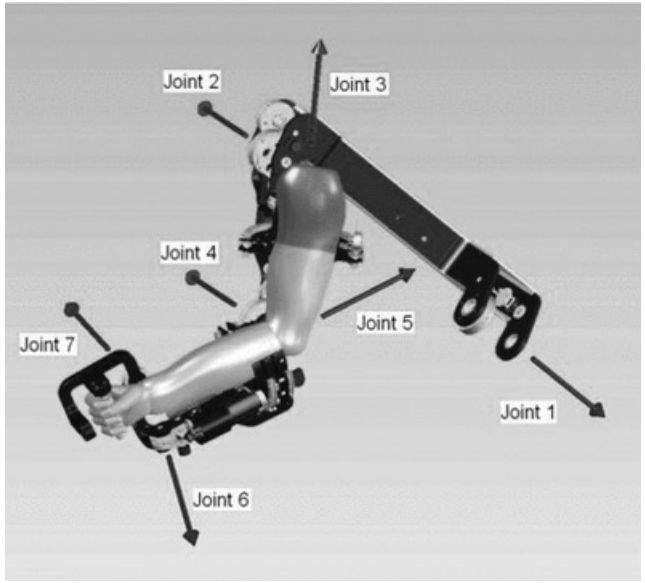
2. Tennant JN, et. al, **Reliability and validity of a mobile phone for radiographic assessment of ankle injuries: a randomized inter- and intraobserver agreement study**. Foot Ankle Int. 2013 Feb;34(2):228-33.

   Key findings: RCT of Apple fourth generation iPod Touch vs. 23 in. PACS computer monitor for diagnosing 16 different ankle injury radiographs. 93 orthopaedic surgeons diagnostic accuracy as good with mobile device as with workstation; 2/3 comfortable using it vs. dedicated display device.

Practice of Informatics:
New technologies

- **Reference**
  1. Kim H, et. al, **Kinematic data analysis for post-stroke patients following bilateral versus unilateral rehabilitation with an upper limb wearable robotic system**. IEEE Trans Neural Syst Rehabil Eng. 2013 Mar;21(2):153-64. [UC Santa Cruz, EE Dept.]

     Key finding: teaching stroke patients with a wearable robot arm to play high intensity video games improves their control of the robot.



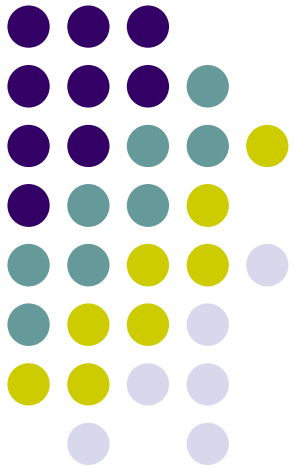
Practice of Informatics:
New technology “Are you sure about that?” candidate

- **Reference**
  1. Cai Y, et. al, **Design and development of a Virtual Dolphinarium for children with autism**. IEEE Trans Neural Syst Rehabil Eng. 2013 Mar;21(2):208-17. [Nanyang Technological University, Singapore]

Key finding: Proposal to use an immersive 3D environment to create an underwater world where autistic children can act as dolphin trainers to learn (nonverbal) communication through hand gestures with the virtual dolphins.

(Made my head swim)

New literature category: Editor's Choice



Journal of the American Medical Informatics Association (JAMIA): Editor's Choice

- **References**

1. Witten DM, et. al, **Scientific research in the age of omics: the good, the bad, and the sloppy**. J Am Med Inform Assoc. 2013 Jan 1;20(1):125-7.

   Notes high potential for errors in 'omics science and calls for an online, open-access, postpublication, peer review system that will increase the accountability of scientists for the quality of their research and improve ability of readers to distinguish good from sloppy science.

2. White RW, et. al, **Web-scale pharmacovigilance: listening to signals from the crowd**. J Am Med Inform Assoc. 2013 May 1;20(3):404-8. [Microsoft Research, Redmond, WA]

   Showed how novel drug-drug interactions can be data mined from internet search engine logs.

Journal of the American Medical Informatics Association (JAMIA): Editor's Choices, cont'd

- **References**

3. Radley DC, et. al, **Reduction in medication errors in hospitals due to adoption of computerized provider order entry systems**. J Am Med Inform Assoc. 2013 May 1;20(3):470-6. [Institute for Healthcare Improvement, Cambridge, MA]

   A systematic literature review and meta-analysis to derive a summary estimate of the effect of CPOE on medication errors. Processing a prescription drug order through a CPOE system decreased the likelihood of error on that order by 48%. Estimated a 12.5% reduction in medication errors, or ~17.4 million medication errors averted in the USA in 2008.

4. Embi PJ, et. al**, Computerized provider documentation: findings and implications of a multisite study of clinicians and administrators**. J Am Med Inform Assoc. 2013 Jul-Aug;20(4):718-26. [DBMI, Ohio State Univ.]

   Held 14 focus groups at five Department of Veterans Affairs facilities, Found CPD has dramatically changed documentation processes, impacting multiple groups, and current systems do not meet user needs due to being electronic version of paper chart. .

Journal of the American Medical Informatics Association (JAMIA): Editor's Choices, cont'd

- **References**

5. Deutsch MB, et. al, **Electronic medical records and the transgender patient: recommendations from the World Professional Association for Transgender Health EMR Working Group**. J Am Med Inform Assoc. 2013 Jul-Aug;20(4):700-3. [UCSF]

   Working group recommendations for EMR coding and care of transgender and gender variant persons, addressing issue that transgender patients may have a chosen name and gender identity that differs from their current legally designated name and sex. Addresses sex-specific health information, for example, a man with a cervix or a woman with a prostate.

Journal of Biomedical Informatics (JBI): Editor's Choice

- **References**

1. Rothman MJ, et. al, **Development and validation of a continuous measure of patient condition using the Electronic Medical Record. J Biomed Inform**. 2013 Oct;46(5):837-48. [PeraHealth, Inc., Charlotte, NC]

   Used 26 clinical measurements from four EMR categories: nursing assessments, vital signs, laboratory results and cardiac rhythms, then constructed a heuristic model to predict hospital readmission and mortality, independent of specific disease diagnosis.

2. Weiskopf NG, et. al, **Defining and measuring completeness of electronic health records for secondary use**. J Biomed Inform. 2013 Oct;46(5):830-6. [DBMI Columbia Univ. NYC]

   Describes four prototypical definitions of EHR completeness and approaches to the measurement of completeness. Applied these measures representative data from local clinical data warehouse and and found that by any definition, the number of complete records in the clinical database is far lower than the nominal total.

Journal of Biomedical Informatics (JBI): Editor's Choices, cont'd

- **References**

3. Friedman C, et. al, **Natural language processing: state of the art and prospects for significant progress, a workshop sponsored by the National Library of Medicine**. J Biomed Inform. 2013 Oct;46(5):765-73.

   Workshop report that provides overview of the state of the art, strategies for advancing the field, obstacles that need to be addressed, and recommendations for a research agenda intended to advance the field of NLP.

4. Post AR, et. al, **The Analytic Information Warehouse (AIW): a platform for analytics using electronic health record data**. J Biomed Inform. 2013 Jun;46(3):410-24.

   Describes an architecture for an Analytic Information Warehouse that supports transforming data represented in different physical schemas into a common data model for anaysis, along with open source software to accomplish that. .

Journal of Biomedical Informatics (JBI): Editor's Choices, cont'd

- **References**

5. Valizadegan H, et. al**, Learning classification models from multiple experts**. J Biomed Inform. 2013 Sep 13. pii: S1532-0464(13)00122-6.

   Describes a new multi-expert learning framework that assumes the class labels are provided by multiple experts and that these experts may differ in their class label assessments. Explicitly models different sources of disagreements and permits combining of labels from different human experts to obtain: a consensus classification model Tests the proposed framework by building a model for the problem of detection of the Heparin Induced Thrombocytopenia (HIT) where examples are labeled by three experts. Shows how new method is better than standard machine learning approaches.

New Literature Highlights: Bioinformatics and Computational Biology

- New molecular findings relevant to Human Health and Disease

See 2013 Year in Review website:

Google: “AMIA Year in Review”

Top Ten List of Notable Events in the Past 12 months

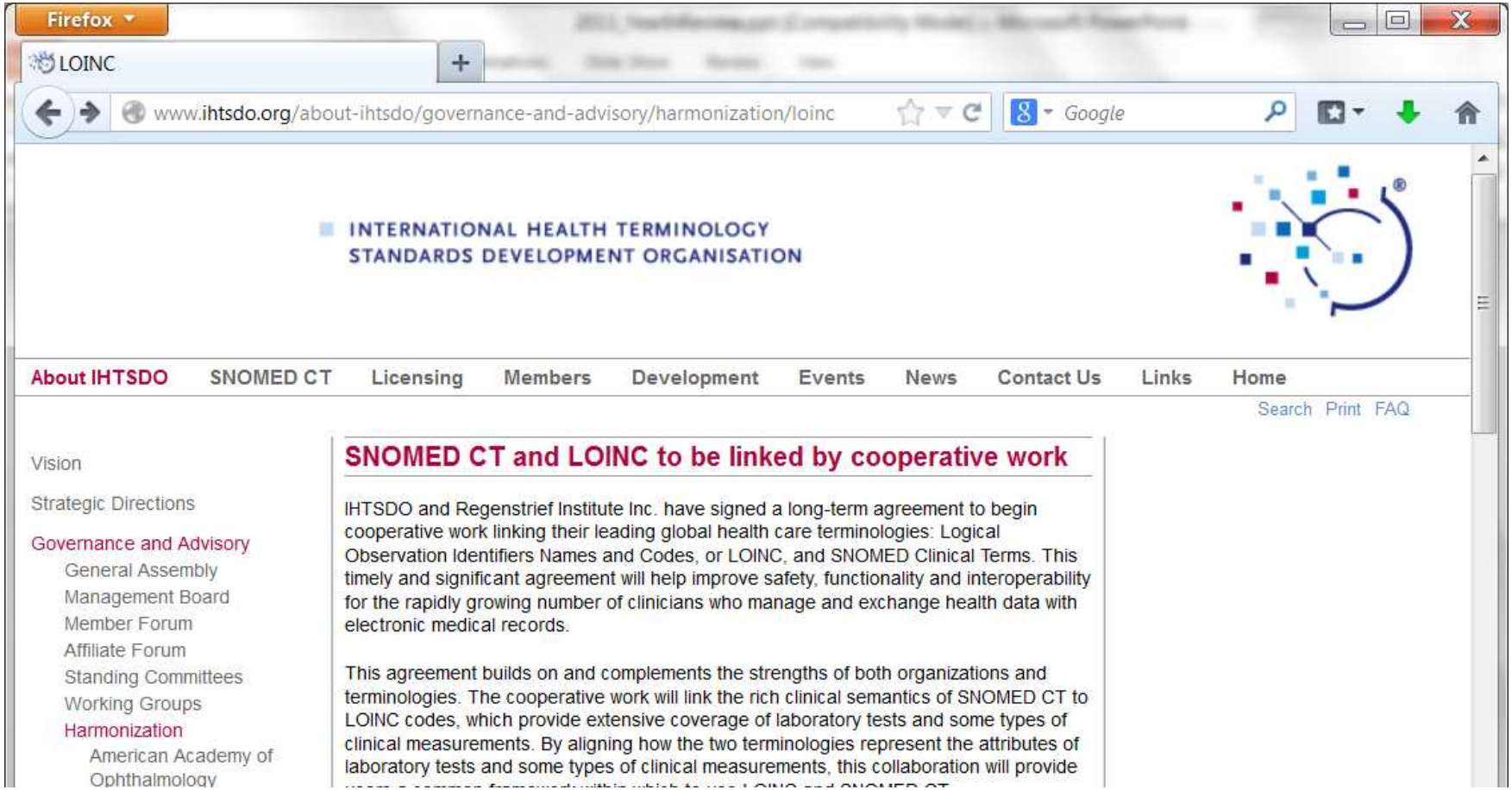
Top 10 events

10 - NY Times article headlines "Search of DNA Sequences Reveals Full Identities"… then title changed.
- January 17, 2013

Top 10 events

10 - NY Times: "Search of DNA Sequences Reveals Full Identities

9 - SNOMED CT and LOINC to be linked – July 24, 2013



Top 10 events

10 - NY Times: "Search of DNA Sequences Reveals Full Identities

9 - SNOMED CT and LOINC to be linked

8 - Supreme Court rules genes cannot be patented – June 16, 2013

Top 10 events

10 - NY Times: "Search of DNA Sequences Reveals Full Identities”

9 - SNOMED CT and LOINC to be linked

8 - Supreme Court rules genes cannot be patented

7 - NIH funds consortium for genome variants of clinical significance – Sept 25, 2013

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New NIH-funded resource focuses on us...

www.nih.gov/news/health/sep2013/nhgri-25.htm

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NIH News in Health

For Immediate Release: Wednesday, September 25, 2013

New NIH-funded resource focuses on use of genomic variants in medical care

Three grants totaling more than $25 million over four years will help three research groups to develop authoritative information on the millions of genomic variants relevant to human disease and the hundreds that are expected to be useful for clinical practice. The awards are from the

Institute/Center

National Human Genome Research Institute (NHGRI)

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Top 10 events

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8 - Supreme Court rules genes cannot be patented

7 - NIH funds consortium for genome variants of clinical significance

6 - White House tells federal agencies: research data needs to be shared - Feb 22, 2013

EXECUTIVE OFFICE OF THE PRESIDENT
OFFICE OF SCIENCE AND TECHNOLOGY POLICY
WASHINGTON, D.C. 20502

February 22, 2013

MEMORANDUM FOR THE HEADS OF EXECUTIVE DEPARTMENTS AND AGENCIES

FROM: John P. Holdren
Director

SUBJECT: Increasing Access to the Results of Federally Funded Scientific Research

1. Policy Principles

The Administration is committed to ensuring that, to the greatest extent and with the fewest constraints possible and consistent with law and the objectives set out below, the direct results of federally funded scientific research are made available to and useful for the public, industry, and the scientific community. Such results include peer-reviewed publications and digital data.

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5 - EHR adoption by hospitals nearly 70% in US. October 2013

Implementing Health Reform: The State Of The Exchanges, Income Verification, And More »

Hospital Progress To Meaningful Use: Status Update

October 15th, 2013


by Jennifer King and Julia Adler-Milstein

After languishing in the single digits for many years, hospital EHR adoption rates are dramatically increasing. A major driver is the Medicare and Medicaid EHR Incentive Programs, or the "Meaningful Use" program. A recent *Health Affairs* study suggested hospital participation in the program was lagging. In this post, we report the latest data, which paint a different picture — as of July 2013, two-thirds of hospitals have achieved Stage 1 Meaningful Use, and nearly all are engaged with the program in some way.

The incentive programs were designed to support greater adoption and use of EHRs, with the ultimate goal of improving patient care and health system outcomes. Eligible hospitals have received $9 billion in incentive payments since the programs began in 2011. Starting in 2015, eligible hospitals that do not demonstrate Meaningful Use will be subject to Medicare payment penalties. Beyond the Meaningful Use incentives, the

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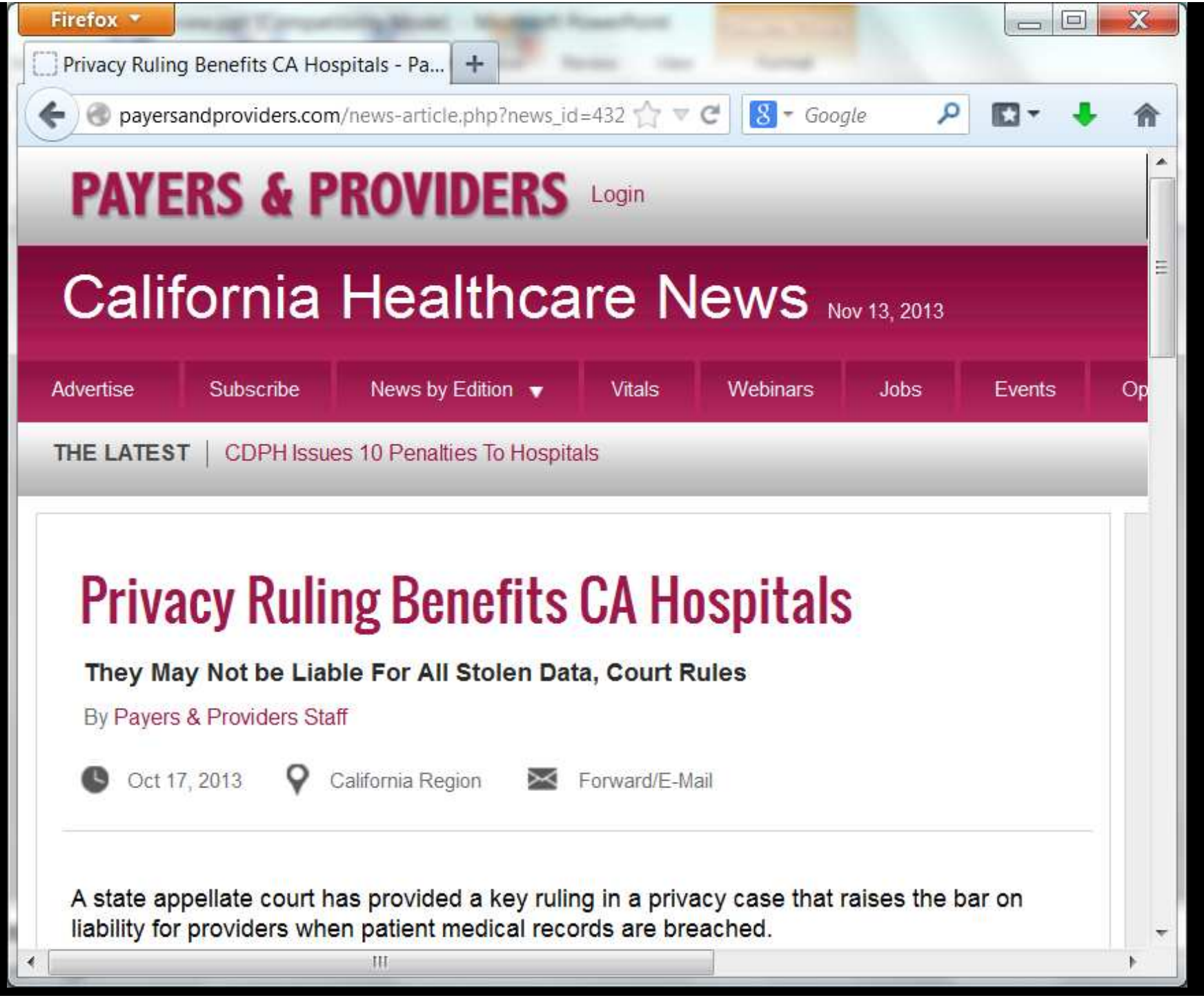
4 - Court: providers do not necessarily liability to patients when medical records are stolen. October 2013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CDPH Issues 10 Penalties To Hospitals
Privacy Ruling Benefits CA Hospitals
They May Not be Liable For All Stolen Data, Court Rules
By Payers & Providers Staff
Oct 17, 2013
California Region
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A state appellate court has provided a key ruling in a privacy case that raises the bar on liability for providers when patient medical records are breached.

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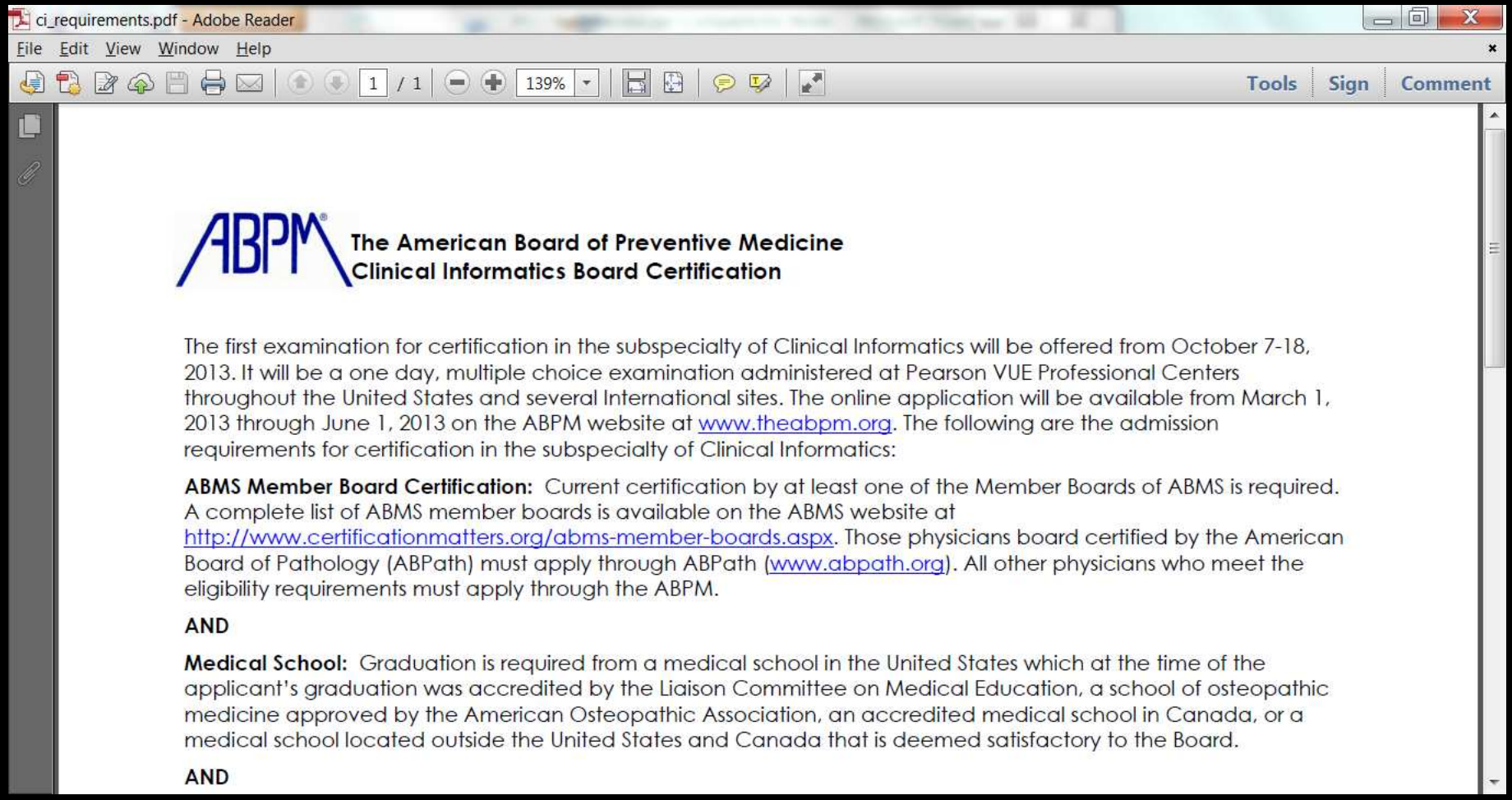
3 - Clinical informatics exam given for the first time, October 7-18, 2013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The American Board of Preventive Medicine
Clinical Informatics Board Certification
The first examination for certification in the subspecialty of Clinical Informatics will be offered from October 7-18, 2013. It will be a one day, multiple choice examination administered at Pearson VUE Professional Centers throughout the United States and several International sites. The online application will be available from March 1, 2013 through June 1, 2013 on the ABPM website at www.theabpm.org. The following are the admission requirements for certification in the subspecialty of Clinical Informatics:
ABMS Member Board Certification: Current certification by at least one of the Member Boards of ABMS is required. A complete list of ABMS member boards is available on the ABMS website at http://www.certificationmatters.org/abms-member-boards.aspx. Those physicians board certified by the American Board of Pathology (ABPath) must apply through ABPath (www.abpath.org). All other physicians who meet the eligibility requirements must apply through the ABPM.
AND
Medical School: Graduation is required from a medical school in the United States which at the time of the applicant's graduation was accredited by the Liaison Committee on Medical Education, a school of osteopathic medicine approved by the American Osteopathic Association, an accredited medical school in Canada, or a medical school located outside the United States and Canada that is deemed satisfactory to the Board.
AND

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2 - Morrie Collen turns 100

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Morris F. Collen at 100: A Tribute to "The Father of Medical Informatics"

D. A. B. Lindberg[1]*; M. J. Ball[2]**

[1]National Library of Medicine, Bethesda, MD, USA;
[2]IBM Research, Baltimore, MD, USA

This editorial is dedicated affectionately to Morris F. Collen, MD, "the father of Medical Informatics", on the occasion of his 100th birthday, November 12, (1913–2013). Serving for 30 years, from 1970 to 1999, on the Editorial Board of Methods of Information in Medicine, Dr. Collen is on rank 6 on the list of persons contributing the longest to this journal [1]. It is also the occasion to celebrate the new specialty of Clinical Informatics this year in the U.S. – a long sought after objective of our centenarian. These two milestones offer an ideal opportunity to honor this

tribute, "He is a world-class scientist, an advisor to American presidents, and a profound humanist, who started out as an exemplary clinician. Dr. Collen's qualities put him from the start in the midst of an environment rife with innovation and opportunity, and marked by other giants"[3].

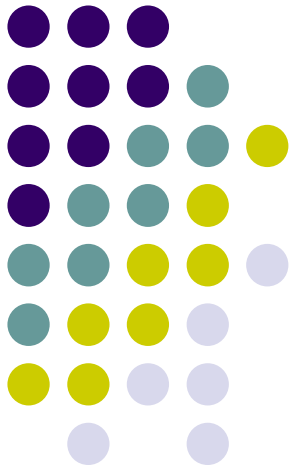
From his time as a young doctor administering to Henry J. Kaiser's shipyard workers in Richmond, Calif., in 1942, to the present day, Dr. Collen, has made many important contributions to the field of medical informatics, and to the public's health.[2]

From 1953 to 1961, Dr. Collen served

Dr. Morris F. Collen

Lindberg DA, Ball MJ. Methods Inf Med. 2013 Oct 11;52(5):371-3.

And the #1 top event of 2013 is…



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2 - Morrie Collen turns 100

1 - Healthcare.gov inadvertently shows the societal power of the web


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2 - Morrie Collen turns 100

1 - Healthcare.gov inadvertently shows the societal power of the web

Special thanks to these 30 ACMI Fellows:

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