Update in Medical Informatics

(Some random papers that we found)

PCC Ojai, California
June 2014

Colin Banas, CMIO, Virginia Commonwealth University
Bill Galanter, Associate CHIO, University of Illinois Hospital and Health Sciences System

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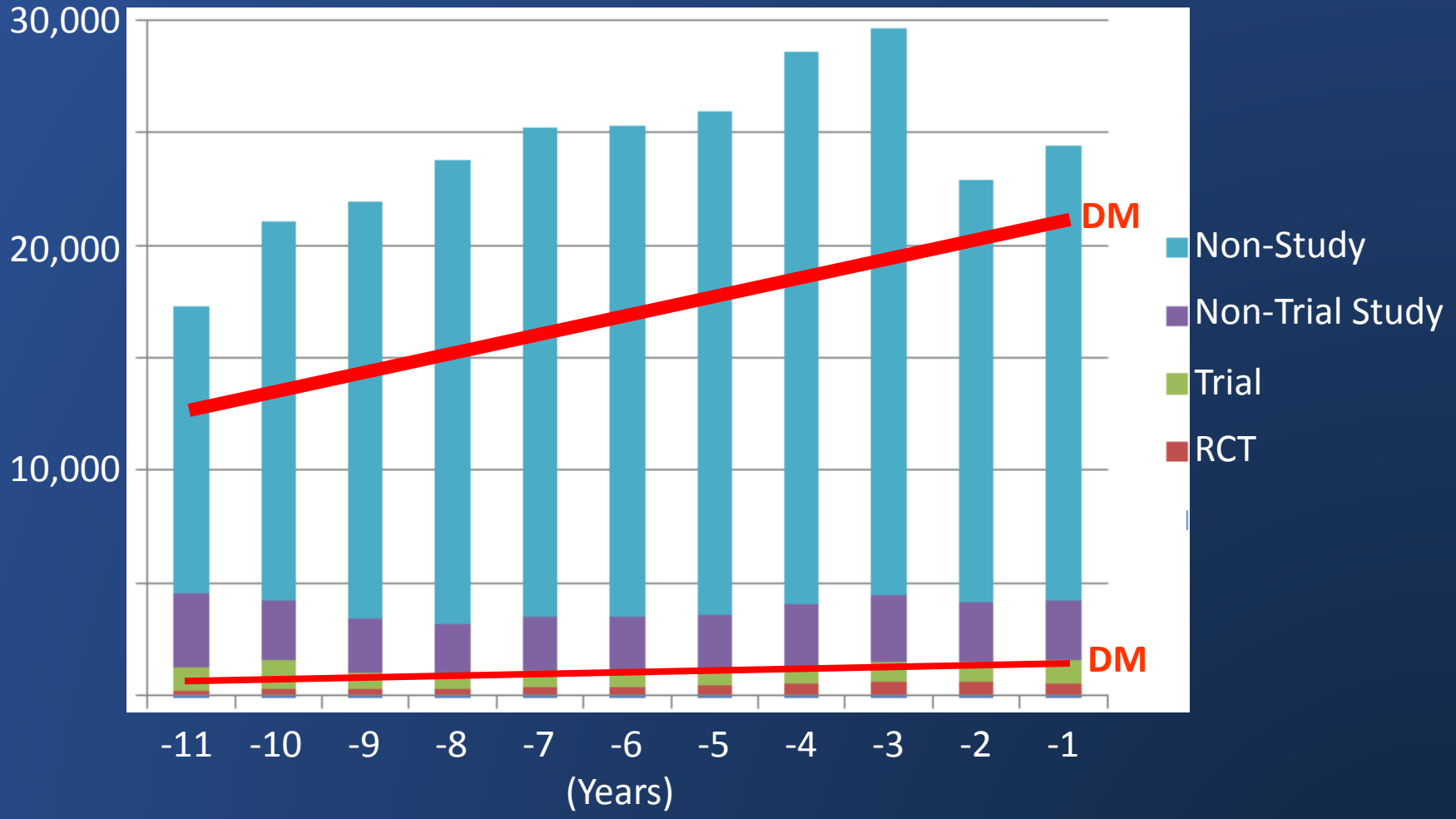
We are bigger than Diabetes!!!



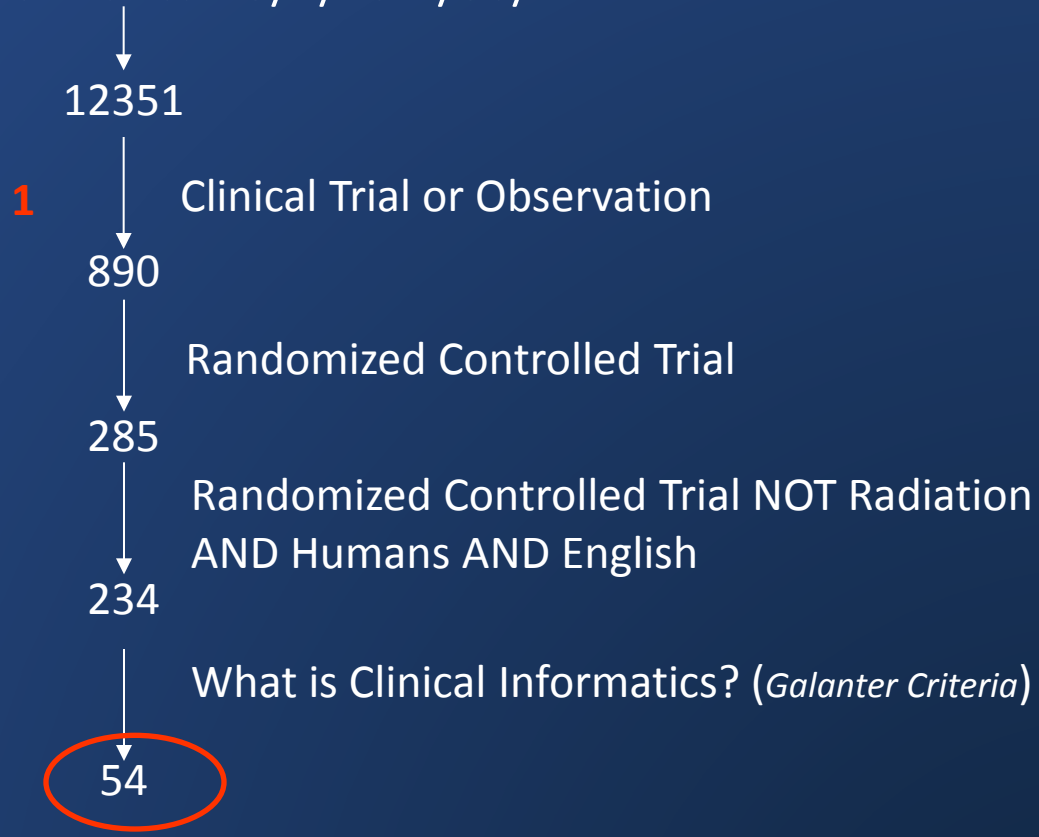
Talking vs. Learning Ratio®?

		Paper:RCT	Paper:Trial
2003	Med Informatics	66	12
	DM	18	10
2013	Med Informatics	41	13
	DM	18	9

We have a lot of opinions

Review Methodology

"Medical Informatics Applications"[Mesh] OR "Medical Informatics"[Mesh] OR "clinical informatics" 5/1/13-4/30/14



Meaningful Use and Quality of Care
JAMA Internal Medicine – April 2014

Letters

RESEARCH LETTER

Meaningful Use and Quality of Care

The American Recovery and Reinvestment Act of 2009 included $30 billion for implementation of the Electronic Health Record (EHR) Meaningful Use (MU) incentive program with a goal of increasing EHR adoption and improving quality of care. Stage

- EPs on Brigham's home grown system
- 90 days of attestation for MU1 in 2012
- Compared MD performance across 7 chronic disease metrics for those who attested vs those who had not

- Those who had attested were essentially no different than those who had not across these quality measures

Table 2. Association of Stage 1 Meaningful Use (MU) Status With Clinical Quality Measures

Clinical Quality Measure	MU Physicians, No.	Patients With High-Quality Care for MU Physicians, Mean (SD), %[a]	Non-MU Physicians, No.	Patients With High-Quality Care for Non-MU Physicians, Mean (SD), %[a]	*P* Value[b]
Hypertension: BP <140/90 mm Hg	471	44 (23)	155	38 (24)	.005
DM: HbA_{1c} level <8.0%	320	57 (25)	103	55 (29)	.60
DM: urine protein screen or ACE/ARB	358	76 (24)	135	78 (24)	.39
DM: LDL-C <100 mg/dL	373	81 (22)	139	76 (26)	.02
CAD: β-blocker therapy	128	96 (12)	19	99 (4)	.24
Asthma: chronic therapy	339	59 (24)	77	66 (28)	.03
Depression: treatment for ≥12 wk	93	42 (25)	6	68 (26)	.02

MU1 and Quality of Care - JAMA

MU1 and Quality of Care

- Many AMDIS comparisons to “building a highway”, laying the foundation
- Relief that there was not a **decline** in quality measures
- Agreement that the true benefit is intended to be measured in the later stages
- My thoughts – these folks share a mature EMR what was it that made them unable to attest? Potential confounder

Duplicate Laboratory Test Reduction Using a Clinical Decision Support Tool

Gary W. Procop, MD,[1] Lisa M. Yerian, MD,[1,2] Robert Wyllie, MD,[2] A. Marc Harrison, MD,[3] and Kandice Kottke-Marchant, MD, PhD[1]

- American Journal Clinical Pathology, 2014: 141: 718-723
- Cost savings and EHRs always a big topic, recall displaying fee data paper last year?
- The never ending struggle between EHRs making ordering some things too easy vs. leverage to make it more appropriate

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OPEN ACCESS Freely available online

PLOS | ONE

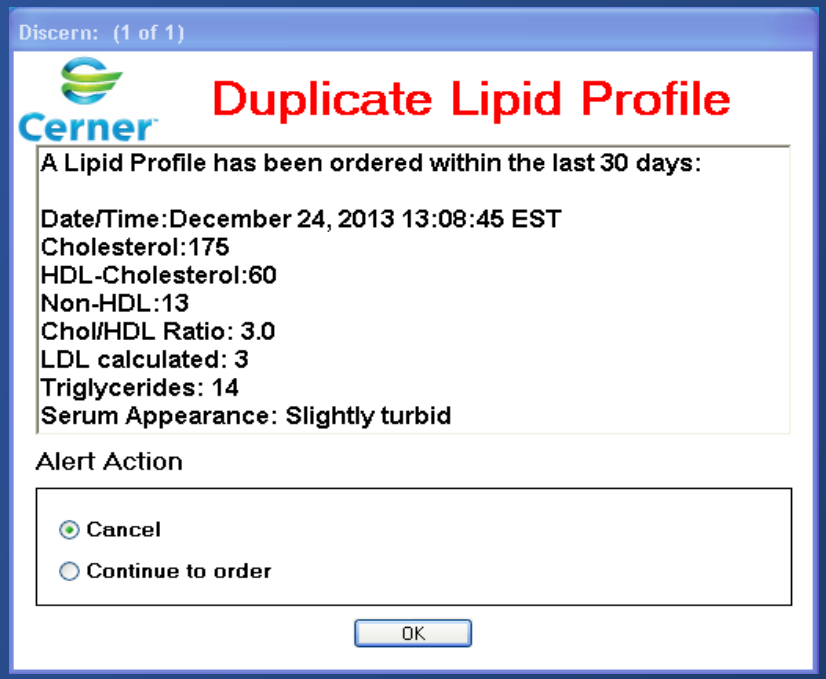
The Landscape of Inappropriate Laboratory Testing: A 15-Year Meta-Analysis

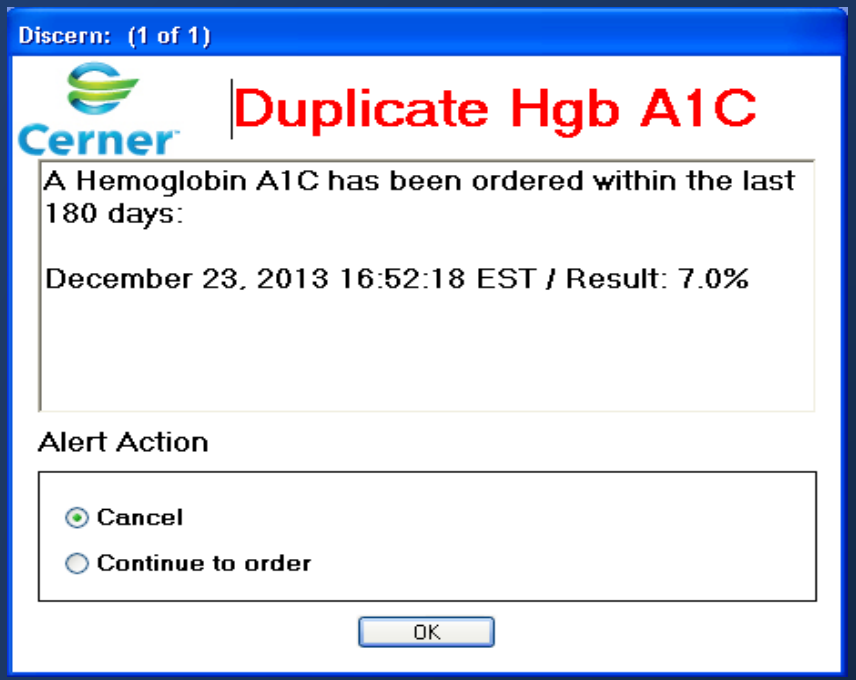
- PLOS One – November 2013
- Meta-Analysis performed for ~50 studies over 15 years
- Estimated 20-40% overutilization depending on criteria applied, more so on initial testing than repeat testing
- Lab testing accounts for 4-6% of total healthcare spend, but the downstream consequences are enormous

Reducing Lab Tests with CDS

- 2 year intervention at Cleveland Clinic
- Hard stop requiring a phone call to lab for same day repeat tests IP setting for ~1200 tests that are not appropriate for twice in one day
- Prevented 12,000 tests, saving approximately $180k

The VCU experience





Reducing Duplicate Lab Tests using CDS – Am Journal Clinical Pathology

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What were people doing RCT's on last year?

Automated Care Extenders

CDS

Decision Aids

Data Mining

Telehealth

Image Analysis

Automated Care Extenders

-Use phone, texting, e-mails, Web Material, to try to improve care without or minimizing live people. (↓$$)

<u>Diseases</u>

Mental Health 65%

HIV
RA
Flu
HPV

CVA
DM
Adherence

Titov N, Dear B, Johnston L, Lorian C, Zou J, Wootton B, Spence J, McEvoy P, Rapee R. Improving Adherence and Clinical Outcomes in Self-Guided Internet Treatment for Anxiety and Depression: Randomised Controlled Trial. PLoS ONE 8(7): e62873.

Abstract

Background: Depression and anxiety are common, disabling and chronic. Self-guided internet-delivered treatments are popular, but few people complete them. New strategies are required to realise their potential.

Aims: To evaluate the effect of automated emails on the effectiveness, safety, and acceptability of a new automated transdiagnostic self-guided internet-delivered treatment, the Wellbeing Course, for people with depression and anxiety.

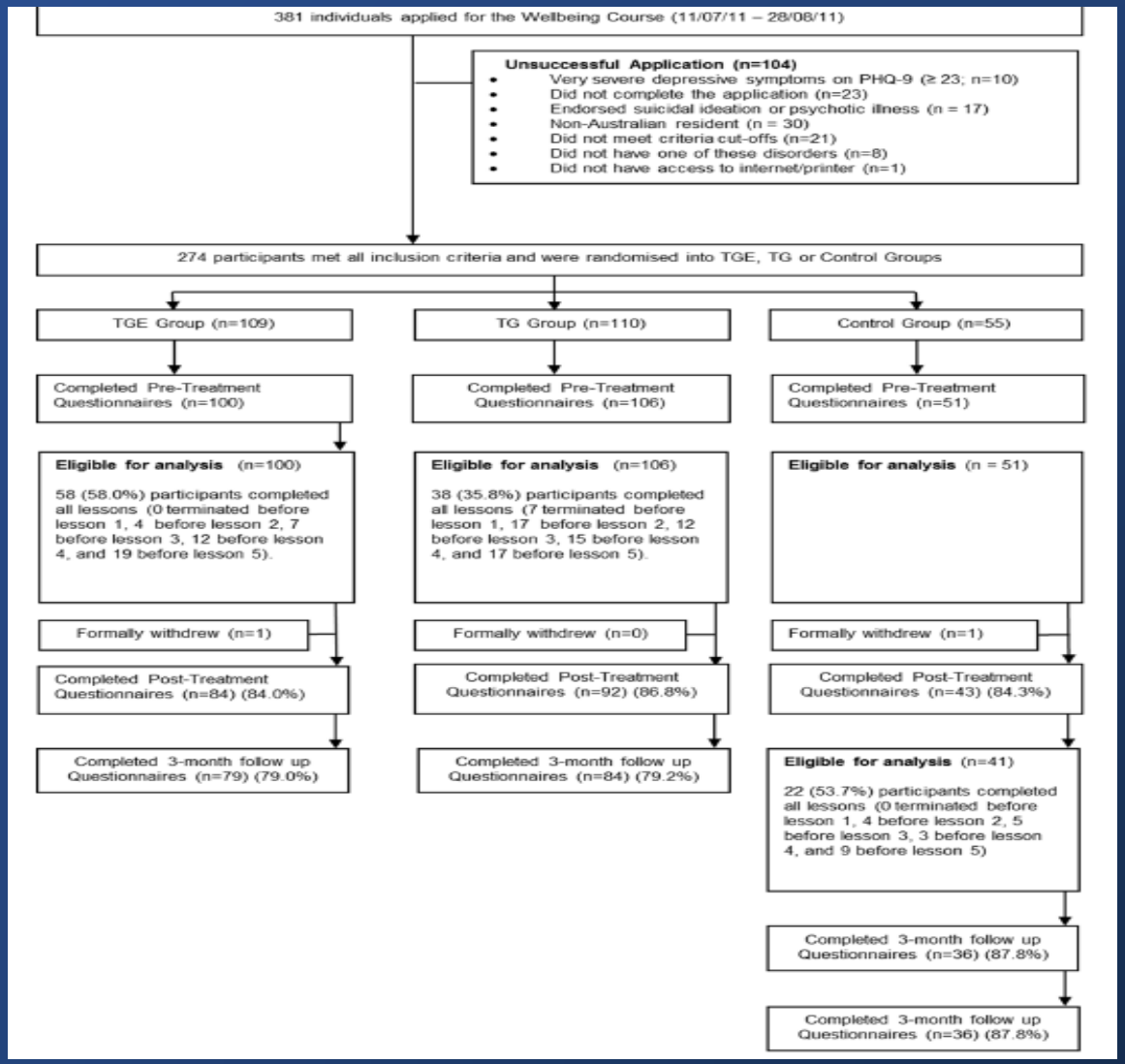
Method: A randomised controlled trial was conducted through the website: www.ecentreclinic.org. Two hundred and fifty seven people with elevated symptoms were randomly allocated to the 8 week course either with or without automated emails, or to a waitlist control group. Primary outcome measures were the Patient Health Questionnaire 9-Item (PHQ-9) and the Generalized Anxiety Disorder 7-Item (GAD-7).

Results: Participants in the treatment groups had lower PHQ-9 and GAD-7 scores at post-treatment than controls. Automated emails increased rates of course completion (58% vs. 35%), and improved outcomes in a subsample with elevated symptoms.

Conclusions: The new self-guided course was beneficial, and automated emails facilitated outcomes. Further attention to strategies that facilitate adherence, learning, and safety will help realise the potential of self-guided interventions.

Trial Registration: Australian and New Zealand Clinical Trials Registry ACTRN12610001058066

Improving Adherence and Clinical Outcomes in Self-Guided Internet Treatment for Anxiety and Depression: Randomised Controlled Trial. PLoS ONE 8(7): e62873.



Improving Adherence and Clinical Outcomes in Self-Guided Internet Treatment for Anxiety and Depression: Randomised Controlled Trial. PLoS ONE 8(7): e62873.

Table 4. Proportion of participants in the Overall and Diagnostic Sample, by group, above and below cut-off scores of clinical significance (remission).

Overall Sample	TEG		TG		Control		Chi Square	
	n	%	n	%	n	%	Between group	TGE vs. TG
PHQ-9								
Pre-treatment score ≥10/Total	68/100	68.0	67/106	63.2	29/51	56.9	χ^2 (2) = 1.84, P = 0.398	
Post-treatment score <10 (Remission)	38/68	55.9	36/67	53.7	7/29	24.1	χ^2 (2) = 9.05, P = 0.011	χ^2 (1) = 0.06, P = 0.802
Follow-up score <10 (Remission)	45/68	66.2	42/67	62.7	–	–		χ^2 (1) = 0.18, P = 0.672
GAD-7								
Pre-treatment score ≥8/Total	76/100	76.0	74/106	69.8	32/51	62.7	χ^2 (2) = 2.96, P = 0.228	
Post-treatment score <8 (Remission)	44/76	57.9	42/74	56.8	7/32	21.9	χ^2 (2) = 13.20, P = 0.001	χ^2 (1) = 0.02, P = 0.888
Follow-up score <8 (Remission)	45/76	59.2	44/74	60.3	–	–		χ^2 (1) = 0.00, P = 0.975

Computer-assisted therapy for medication-resistant auditory hallucinations: proof-of-concept study†

Julian Leff, Geoffrey Williams, Mark A. Huckvale, Maurice Arbuthnot and Alex P. Leff

Background

One in four patients with schizophrenia responds poorly to antipsychotic medication, continuing to hear persecutory auditory hallucinations. Patients who are able to sustain a dialogue with their persecutor feel much more in control.

Aims

To develop a computerised system that enables the patient to create an avatar of their persecutor. To encourage them to engage in a dialogue with the avatar, which the therapist is able to control so that the avatar progressively yields control to the patient.

Method

Avatar therapy was evaluated by a randomised, single blind, partial crossover trial comparing the novel therapy with treatment as usual (TAU). We used three main outcome measures: (a) the Psychotic Symptom Rating Scale (PSYRATS), hallucinations section; (b) the Omnipotence and Malevolence subscales of the Revised Beliefs About Voices Questionnaire (BAVQ-R); and (c) the Calgary Depression Scale (CDS).

Results

The control group showed no change over time in their scores on the three assessments, whereas the novel therapy group showed mean reductions in the total PSYRATS score (auditory hallucinations) of 8.75 ($P=0.003$) and in the BAVQ-R combined score of omnipotence and malevolence of the voices of 5.88 ($P=0.004$). There was no significant reduction in the CDS total score for depression. For the crossover control group, comparison of the period of TAU with the period of avatar therapy confirmed the findings of the previous analysis. The effect size of the therapy was 0.8.

Conclusions

Avatar therapy represents a promising treatment for medication-resistant auditory hallucinations. Replication with a larger sample is required before roll-out to clinical settings.

Declaration of interest

None.

Computer-assisted therapy for medication-resistant auditory hallucinations: proof-of-concept study†

Patients with persecuting auditory hallucinations

Patient develops an Avatar of auditory hallucination 

Patient/therapist select voice of Avatar

Therapist becomes Avatar

Avatar submits/stops persecuting patient in virtual reality

Computer-assisted therapy for medication-resistant auditory hallucinations: proof-of-concept study†

Table 2 Mean values (s.d.) for the main three outcome measures at all time points

	Immediate therapy group, mean (s.d.)			Delayed therapy group, mean (s.d.)			
	Baseline	Post-treatment	3-month follow-up	Baseline	Pre-treatment	Post-treatment	3-month follow-up
Psychotic Symptom Rating Scale	29.25 (4.86)	23.63 (8.03)	18.88 (8.90)	31.75 (5.39)	31.88 (8.10)	20.00 (13.10)	17.75 (9.41)
Revised Beliefs About Voices Questionnaire	22.63 (7.58)	18.88 (7.24)	15.57 (8.96)	21.38 (8.85)	21.00 (11.33)	12.37 (12.61)	13.43 (9.38)
Calgary Depression Scale	6.88 (4.02)	8.50 (5.29)	3.71 (2.98)	9.25 (2.37)	8.63 (8.49)	4.00 (1.41)	2.88 (3.52)

The CAD-MDD: A Computerized Adaptive Diagnostic Screening Tool for Depression

Robert D. Gibbons, Ph.D.[1], Giles Hooker, Ph.D.[2], Matthew D. Finkelman, Ph.D.[3], David J. Weiss, Ph.D.[4], Paul A. Pilkonis, Ph.D.[5], Ellen Frank, Ph.D.[5], Tara Moore, M.A., M.P.H.[5], and David J. Kupfer, M.D.[5]

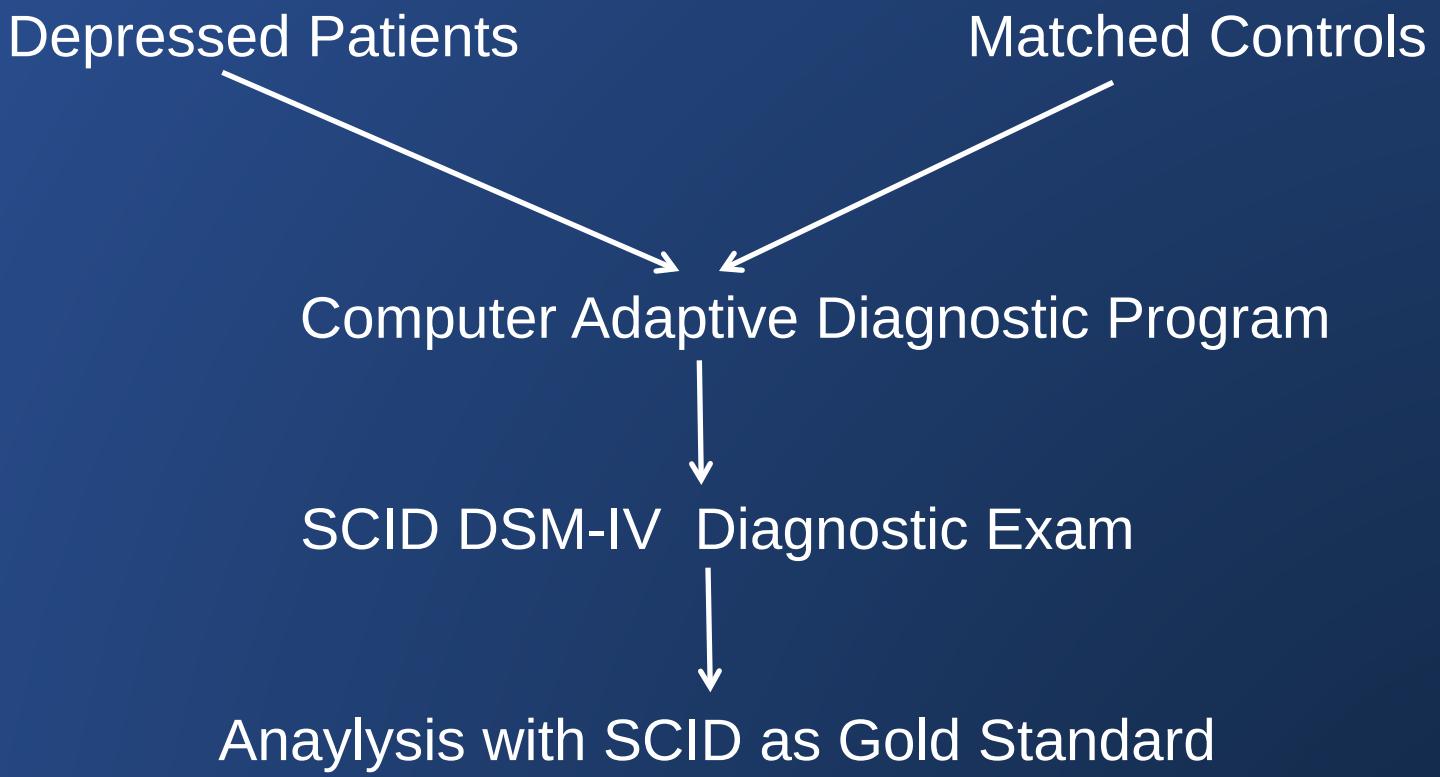
Objective—To develop a computerized adaptive diagnostic (CAD) screening tool for depression that decreases patient and clinician burden and increases sensitivity and specificity for clinician-based DSM-IV diagnosis of major depressive disorder (MDD).

Method—656 individuals with and without minor and major depression were recruited from a psychiatric clinic, community mental health center, and through public announcements (controls without depression). The item bank consists of 88 depression scale items drawn from 73 depression measures. The focus of this study was the development of the CAD-MDD diagnostic screening tool based on a decision-theoretic approach (random forests and decision trees). Sensitivity and specificity for predicting clinician-based SCID DSM-IV diagnoses of MDD were the primary outcomes. Diagnostic screening accuracy was then compared to the PHQ-9.

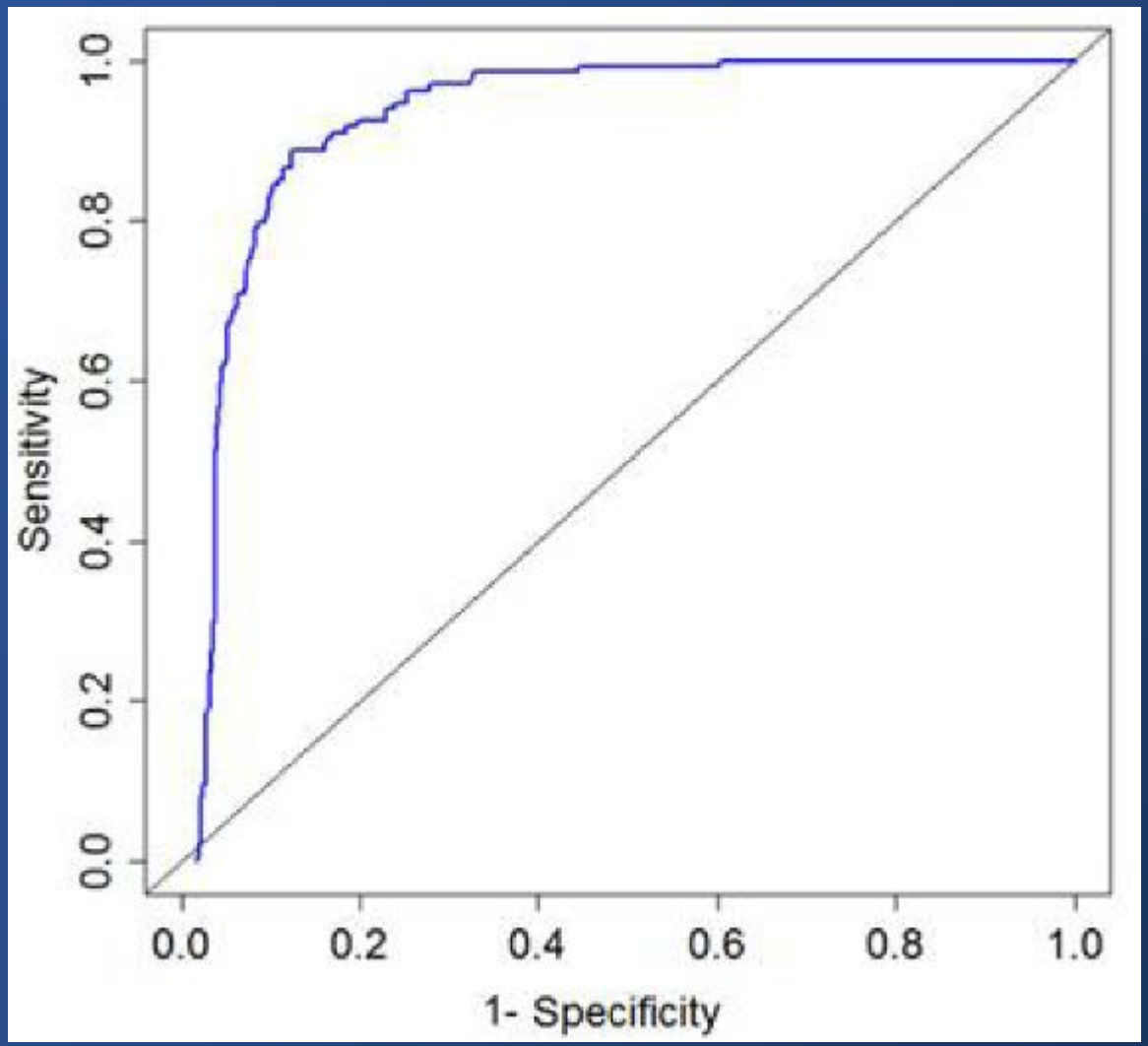
Results—An average of 4 items per participant was required (maximum of 6 items). Overall sensitivity and specificity were 0.95 and 0.87 respectively. For the PHQ-9, sensitivity was 0.70 and specificity was 0.91.

Conclusion—High sensitivity and reasonable specificity for a clinician-based DSM-IV diagnosis of depression can be obtained using an average of 4 adaptively administered self-report items in less than one minute. Relative to the currently used PHQ-9, the CAD-MDD dramatically increased sensitivity while maintaining similar specificity. As such, the CAD-MDD will identify more true positives (lower false negative rate) than the PHQ-9 using half the number of items. Inexpensive (relative to clinical assessment), efficient and accurate screening of depression in primary care settings, psychiatric epidemiology, molecular genetics, and global health are all direct applications of the current system.

The CAD-MDD: A Computerized Adaptive Diagnostic Screening Tool for Depression



The CAD-MDD: A Computerized Adaptive Diagnostic Screening Tool for Depression



CAD-MDD

Sens: 95%
Spec: 87%

4.2 Questions/Patient

PHQ-9

Sens: 70%
Spec: 91%

9 Questions/patient

The Road toward Fully Transparent Medical Records

Jan Walker, R.N., M.B.A., Jonathan D. Darer, M.D., M.P.H., Joann G. Elmore, M.D., M.P.H., and Tom Delbanco, M.D.

- NEJM – December 2013
- Perspective piece on the OpenNotes initiative
- A nod to the Shenkin and Warner piece from 40 years prior – care will improve with transparency

Open Notes

- 2 million already have access
- 80% of those reading the notes reported better recall with careplan and 66% better adherence with medication
- 50% want to add comments to notes
- 85% of patients indicate open access will be a future deciding factor in choosing care

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Transparent Medical Records – Open Notes : NEJM

Physician Shoots Off A Few Adderall Prescriptions To Improve Yelp Rating

NEWS IN BRIEF • Doctors • Local • Healthcare • ISSUE 50•14 • Apr 7, 2014

REDDING, CA—Noting that his practice's rating on the business review website had dipped to just 3.5 stars, local primary care provider Dr. Frank Hawley reportedly dashed off several Adderall prescriptions Monday to give his Yelp average a needed boost. "I keep a pretty close eye on my reviews, and whenever I see my number fall below four stars I just write out a few extra Adderall or Dexedrine scripts and it's back up in no time," said Hawley, adding that he usually ups the dosage to 30 milligrams and makes sure to prescribe two refills to ensure he stays near the top of the local general practice rankings. "Patients are

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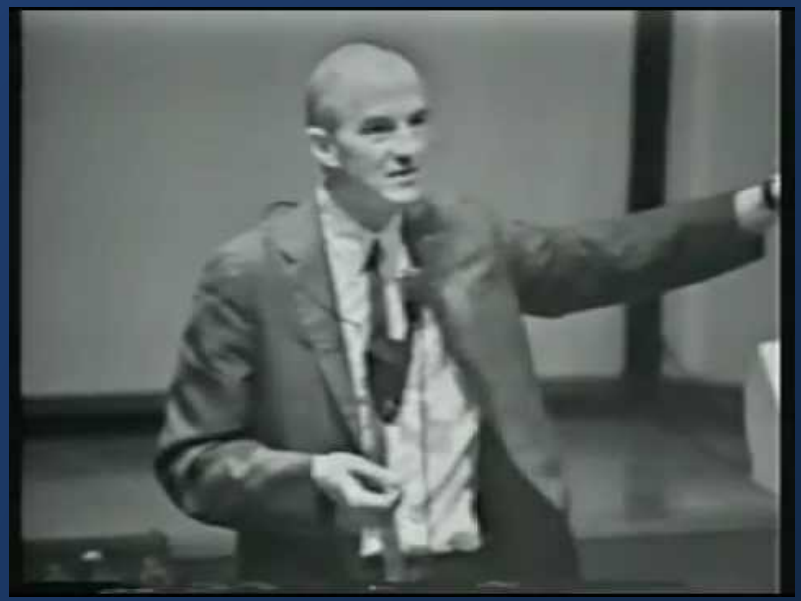
Make Your Problem List Wiki Wiki

Neeraj H. Tayal, MD; Robert Murden, MD; and Sarah Jonaus, MD

EHRs in a Web 2.0 World: Time to Embrace a Problem-List Wiki

Neil Mehta, MBBS, MS[1], Nirav Vakharia, MD[2], and Adam Wright, PhD[3]

"Wiki for care? Really? The current generation of learners is, and should be, castigated for using sites like Wikipedia as a medical reference. Yet, we boldly suggest that the wiki approach can be effectively applied to electronic medical documentation."



Wiki based Problem Lists?

- SGIM Forum 2012; 35(11)
- JGIM 23(3); 434-6
  - 2 short opinion pieces about the utility of wiki for a more problem based and evolving medical record
    - Ohio State University
    - Cleveland Clinic

Wiki based Problem Lists

- Worth a read as well: JAMIA – June 2014

Bringing science to medicine: an interview with Larry Weed, inventor of the problem-oriented medical record

Adam Wright,[1,2] Dean F Sittig,[3] Julie McGowan,[4] Joan S Ash,[5] Lawrence L Weed[6]

Galanter WL, Bryson ML, Falck S, Rosenfield R, Laragh M, Shrestha N, Schiff GD, Lambert BL. Indication Alerts Intercept Drug Name Confusion Errors During Computerized Entry of Medication Orders. PloS One, 2014 in press.

Background: Confusion between similar drug names is a common cause of potentially harmful medication errors. Interventions to prevent these errors at the point of prescribing have had limited success. The purpose of this study is to measure whether indication alerts at the time of computerized physician order entry (CPOE) can intercept drug name confusion errors.

Methods and Findings: A retrospective observational study of alerts provided to prescribers in a public, tertiary hospital and ambulatory practice with medication orders placed using CPOE. Consecutive patients seen from April 2006 through February 2012 were eligible if a clinician received an indication alert during ordering. A total of 54,499 unique patients were included. The computerized decision support system prompted prescribers to enter indications when certain medications were ordered without a coded indication in the electronic problem list. Alerts required prescribers either to ignore them by clicking OK, to place a problem in the problem list, or to cancel the order . Main outcome was the proportion of indication alerts resulting in the interception of drug name confusion errors. Error interception was determined using an algorithm to identify instances in which an alert triggered, the initial medication order was not completed, and the same prescriber ordered a similar-sounding medication on the same patient within 5 minutes. Similarity was defined using standard text similarity measures. Two clinicians performed chart review of all cases to determine whether the first, non-completed medication order had a documented or non-documented, plausible indication for use. If either reviewer found a plausible indication, the case was not considered an error. We analyzed 127,458 alerts and identified 176 intercepted drug name confusion errors, an interception rate of 0.14±.01%.

Conclusions: Indication alerts intercepted 1.4 drug name confusion errors per 1000 alerts. Institutions with CPOE should consider using indication prompts to intercept drug name confusion errors.

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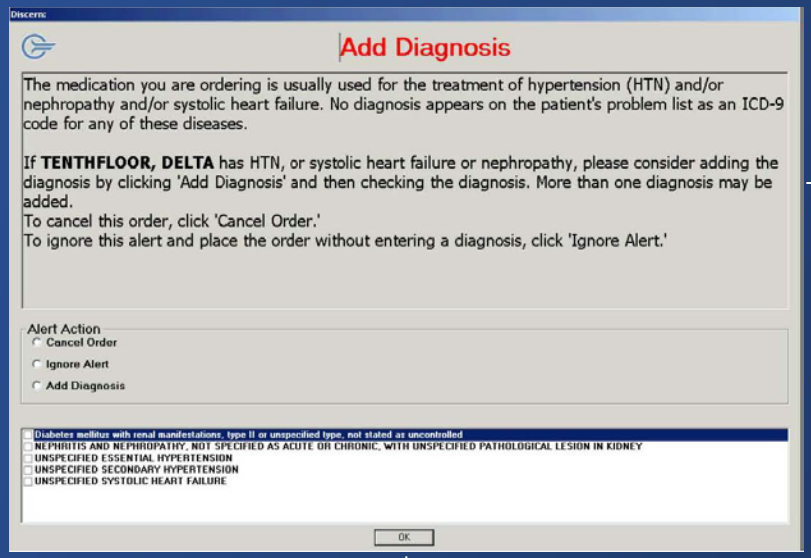
Indication Alerts Intercept Drug Name Confusion Errors During Computerized Entry of Medication Orders. PloS One, 2014 in press.

Start a med order



Do not complete med order
Why?

Finish med order

Indication Alerts Intercept Drug Name Confusion Errors During Computerized Entry of Medication Orders. PloS One, 2014 in press.

Distribution of Drug Pairs in Intercepted Errors

Canceled Order	Completed Order	No. Errors	No. Alerts	Error Rate (%)[a]	Std. Err. (%)
fluticasone	fluticasone-nasal	100	4565	2.19	0.22
metoprolol	metoclopramide	16	9936	0.16	0.04
nitroprusside	nitroglycerin	6	19	31.6	10.7
hydralazine	diphenhydramine	6	4346	0.14	0.06
propranolol	propofol	5	2931	0.17	0.08
nimodipine	famotidine	3	511	0.59	0.34
clonidine	famotidine	3	2350	0.13	0.07
metformin	metronidazole	3	6148	0.05	0.03
fluticasone-salmeterol	fluticasone-nasal	2	3166	0.06	0.04
hydralazine	hydromorphone	2	4346	0.05	0.03
hydralazine	hydroxyzine	2	4346	0.05	0.03
methyclothiazide	methylergonovine	1	1	100	0.00
minoxidil	minoxidil-topical	1	48	2.08	2.06
tenofovir	atenolol	1	101	0.99	0.99
metolazone	metoclopramide	1	132	0.76	0.75
ibandronate	ibuprofen	1	133	0.75	0.75
methyldopa	methylprednisolone	1	138	0.73	0.72
Actonel®	Actos	1	150	0.67	0.66
felodipine	Feldene	1	177	0.57	0.56

Indication Alerts Intercept Drug Name Confusion Errors During Computerized Entry of Medication Orders. PloS One, 2014 in press.

Distribution of Drug Pairs in Intercepted Errors

Canceled Order	Completed Order	No. Errors	No. Alerts	Error Rate (%)*	Std. Err. (%)
nimodipine	morphine	1	511	0.20	0.20
paroxetine	pyridoxine	1	1071	0.09	0.09
tiotropium	teniposide	1	1581	0.06	0.06
nifedipine	prednisone	1	2111	0.05	0.05
clonidine	ranitidine	1	2330	0.04	0.04
lansoprazole	alprazolam	1	2381	0.04	0.04
propranolol	lansoprazole	1	2931	0.03	0.03
amlodipine	amitriptyline	1	3183	0.03	0.03
amlodipine	famotidine	1	3183	0.03	0.03
atorvastatin	multivitamin	1	3204	0.03	0.03
hydralazine	chlorpromazine	1	4346	0.02	0.02
sertraline	tetracycline	1	4529	0.02	0.02
levothyroxine	levofloxacin	1	5642	0.02	0.02
hydrochlorothiazide	hydrocortisone	1	6040	0.02	0.02
hydrochlorothiazide	hydroxyzine	1	6040	0.02	0.02
metformin	metoprolol	1	6148	0.02	0.02
metformin	multivitamin	1	6148	0.02	0.02
metoprolol	ketorolac	1	9936	0.01%	0.01%
metoprolol	metronidazole	1	9936	0.01%	0.01%
simvastatin	simethicone	1	13625	0.01%	0.01%

*The interception rate is the number of errors (confirmed by clinician chart review) divided by the total number of alerts for that drug

Total 1.4 Intercepted Errors/1000 Alerts

NNT ~700

Key principles for a national clinical decision support knowledge sharing framework: synthesis of insights from leading subject matter experts

Kensaku Kawamoto,[1] Tonya Hongsermeier,[2] Adam Wright,[3] Janet Lewis,[2] Douglas S Bell,[4] Blackford Middleton[5]

A pilot study of distributed knowledge management and clinical decision support in the cloud

Brian E. Dixon[a,b,c,*], Linas Simonaitis[b,d], Howard S. Goldberg[e,f], Marilyn D. Paterno[f], Molly Schaeffer[f], Tonya Hongsermeier[f], Adam Wright[e,g], Blackford Middleton[e,f]

- JAMIA – 2013;20: 199-206
- Artificial Intelligence in Medicine 59 (2013) 45-53

National CDS Framework in the Cloud

- First paper is a position piece on what it would take to create shareable cloud based CDS
- SMEs from key institutions and vendors participated in consensus building for principles of sharing CDS nationally
  - Prioritize and Create the framework
  - Facilitate open-source content development
  - Accelerate standards development
  - Address medicolegal concerns
  - Establish a self-sustaining business model

Framework for national cloud based CDS

- Sounds very reminiscent to the journey towards HIEx
- Critical role for the government / ONC
- Would only be widely adopted if it meets an unmet business need and does so in a cost-efficient manner
  - Also a nod towards payment reform
- Chicken-before-the-egg phenomenon
  - Most admitted waiting for it to be built before jumping in

A pilot study of CDS in the cloud

- Partners and Regeinstrief collaboration with the "ONC Advancing CDS" effort
  - 2 completely separate EHRs
- Cloud hosted in Partners – CDS around Preventive Care Reminders
  - CAD / DM / HTN
    - Get a BP / No anti-platelet / Get an A1C / Start an ACE
  - Sent **passive** alerts to message centers
  - 1351 visits over 6 months, at least one reminder 73% of the time

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A pilot study of CDS in the cloud

- Difficulty with synchronicity
  - Seconds to minutes at times
- Semantic interoperability….
  - SNOMED CT for diagnoses / problems LOINC for labs / procedures but…
    - Regenstrief uses “8459-0: SBP Sitting” and Partners CDS was looking for “8480-6: SBP” so a lot of false positives initially
      - Different concepts are preferred at different locations
      - Need for ongoing semantic reconciliation

Scheepers-Hoeks AM, Grouls RJ, Neef C, Ackerman EW, Korsten EH. Physicians' responses to clinical decision support on an intensive care unit--comparison of four different alerting methods. Artif Intell Med. 2013 Sep;59(1):33-8

Background: In intensive care environments, technology is omnipresent whereby ensuring constant monitoring and the administration of critical drugs to unstable patients. A clinical decision support system (CDSS), with its widespread possibilities, can be a valuable tool in supporting adequate patient care. However, it is still unclear how decision support alerts should be presented to physicians and other medical staff to ensure that they are used most effectively.

Objective: To determine the effect of four different alert presentation methods on alert compliance after the implementation of an advanced CDSS on the intensive care unit (ICU) in our hospital.

Methods: A randomized clinical trial was executed from August 2010 till December 2011, which included all patients admitted to the ICU of our hospital. The CDSS applied contained a set of thirteen locally developed clinical rules. The percentage of alert compliance was compared for four alert presentation methods: pharmacy intervention, physician alert list, electronic health record (EHR) section and pop-up alerts. Additionally, surveys were held to determine the method most preferred by users of the CDSS.

Results: In the study period, the CDSS generated 902 unique alerts, primarily due to drug dosing during decreased renal function and potassium disturbances. Alert compliance was highest for recommendations offered in pop-up alerts (41%, $n = 68/166$), followed by pharmacy intervention (33%, $n = 80/244$), the physician alert list (20%, $n = 40/199$) and the EHR section (19%, $n = 55/293$). The method most preferred by clinicians was pharmacy intervention, and pop-up alerts were found suitable as well if applied correctly. The physician alert list and EHR section were not considered suitable for CDSSs in the process of this study.

Conclusion: The alert presentation method used for CDSSs is crucial for the compliance with alerts for the clinical rules and, consequently, for the efficacy of these systems. Active alerts such as pop-ups and pharmacy intervention were more effective than passive alerts, which do not automatically appear within the clinical workflow. In this pilot study, ICU clinicians also preferred pharmacy intervention and pop-up alerts. More research is required to expand these results to other departments and other hospitals, as well as to other types of CDSSs and different alert presentation methods.

Physicians' responses to clinical decision support on an intensive care unit--comparison of four different alerting methods. Artif Intell Med. 2013 Sep;59(1):33-8

Table 1
Content of the thirteen clinical rules implemented in the ICU.

Clinical rule	Explanation
Amiodarone dosing	Guiding correct dosing of amiodarone in the ICU
Anticoagulation (INR)	Guiding oral anti-coagulation by INR values and the use of vitamin K
Calcium	Guiding therapy of patients with severe hypo- or hypercalcemia
Heart failure	Prevention of contra-indicated drugs in patients with heart failure
LMWH with high INR	Advice to stop LMWH-therapy when INR value increases
Potassium	Guiding therapy of patients with severe hypo- or hyperkalemia
Renal function	Recommending dosage adjustments during decreased renal function
Sodium	Guiding therapy of patients with severe hypo- or hypernatremia
TDM of aminoglycosides	Monitoring accuracy of TDM of aminoglycosides
TDM of clozapin	Monitoring accuracy of TDM of clozapin
TDM of digoxin	Monitoring accuracy of TDM of digoxin
TDM of fenytoin	Monitoring accuracy of TDM of fenytoin
TDM of lithium	Monitoring accuracy of TDM of lithium

INR: international normalized ratio to measure blood coagulation; LMWH: low-molecular weight heparins; TDM: therapeutic drug monitoring.

Physicians' responses to clinical decision support on an intensive care unit--comparison of four different alerting methods. Artif Intell Med. 2013 Sep;59(1):33-8

(1) *Pharmacy intervention*: Once a day at noon, an Excel list of alerts is generated by the system and placed on the electronic pharmacy desktop. A hospital pharmacist first evaluates the relevance of each alert and then consults the ICU physician on duty to discuss the recommendations. Subsequently, the ICU physician decides whether or not to follow the recommendations.

(2) *Physician alert list*: Once a day at noon, an Excel list of alerts is generated and placed on the electronic desktop of all ICU physicians. Physicians have to open the document themselves to see the recommendations of that day.

(3) *EHR section*: In the EHR, all the information is stored in a specific section of the EHR, a tab. If the CDSS tab is clicked, the system checks the CDSS content for a specific patient at that particular moment. It takes about 20 s for a possible recommendation to appear. Otherwise, the system indicates 'no advice for this patient'.

(4) *Pop-up alert*: When the physician evaluates the EHR of an admitted patient, irrespective of the section of the EHR, a pop-up message appears automatically and continuously if a recommendation is available. The pop-up alert disappears when the advice is followed, or when a snooze or discard button is clicked in case the alert was deemed not relevant.

Physicians' responses to clinical decision support on an intensive care unit--comparison of four different alerting methods. Artif Intell Med. 2013 Sep;59(1):33-8

Table 3
Total number of (unique) alerts and compliance percentages of the four studied alert presentation methods.

Presentation method	Unique alerts (*N*)	Unique alerts followed (*N*/%)
Pop-up alert	166	68 (41%)
Pharmacy intervention	244	80 (33%)
Physician alert list	199	40 (20%)
EHR section	293	55 (19%)
Total	902	243 (27% avg.)

Physicians' responses to clinical decision support on an intensive care unit--comparison of four different alerting methods. Artif Intell Med. 2013 Sep;59(1):33-8

Table 4

Survey outcomes ($N=6$).

Questions	Pharmacy intervention	Physician alert list	EHR section	Pop-up alert
Did you receive the alert at least once? (yes)	6/6 (100%)	6/6 (100%)	4/6 (67%)	6/6 (100%)
Did you follow the alert recommendation at least once? (yes)	6/6 (100%)	3/6 (50%)	0/6 (0%)	6/6 (100%)
Satisfaction with method (scale 1–5: average)	4.3	3.3	3	3.7
Suitability of method (scale 1–5: average)	4.3	2.7	2.3	3.3

By Julia Adler-Milstein, David W. Bates, and Ashish K. Jha

Operational Health Information Exchanges Show Substantial Growth, But Long-Term Funding Remains A Concern

- Health Affairs, August 2013
- Confirming once again what a lot of us already knew…

HIEx are slow to grow: Health Affairs

HIEx show growth, but….

- National survey of all organizations engaged in facilitating HIEx
- 3 sets of questions:
  - How many HIEx are there? How many more since HITECH?
  - What sorts of data is actually flying through the ether?
  - What are the barriers to getting this right and sustaining?

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HIEx are slow to grow: Health Affairs

HIEx - Results

- Operational HIEx total 119 – up 60% from 2010
- ~1400 hospitals (30%) and ~23k Ambulatory practices (10%) are participating in the 119 operation HIEx
  - This a 2-3 fold increase from 2010
- Most commonly exchanging lab results / summary of care/ discharge summaries

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HIEx are slow to grow: Health Affairs

HIEx - Results

- Grants and contracts (gov't) are the primary source of funding for over 50% of the HIEx
- Less than 25% are able to cover operational costs with revenue
- 75% identified lack of a sustainable business model as barrier
- And – 90% of practices are not yet participating in exchange

HIEx are slow to grow: Health Affairs

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HIEx - Implications

- Federal $600M into the State Health Information Exchange Cooperative Program – it is enough?
- Policy implications? Payer implications – what's their cut?
- This was a very loose interpretation of "exchange", could more initial energy focus on "availability" of the data as a pre-cursor foundation?

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HIEx are slow to grow: Health Affairs

Core Drug-Drug Interaction Alerts for Inclusion in Pediatric Electronic Health Records With Computerized Prescriber Order Entry

Marvin B. Harper, MD, Christopher A. Longhurst, MD,†‡ Troy L. McGuire, MD,§ Rod Tarrago, MD,|| Bimal R. Desai, MD, MBI,¶ and Al Patterson, PharmD,# and on behalf of the Children's Hospital Association CDS working group.*

- Journal of Patient Safety – Jan 2014
- Pediatric extension of the prior work on adult DDIs
- Multiple vendors and content management represented in the SME group
- Arrived at 19 DDIs for the pediatric population

Pediatric DDIs

- Vendor severity classification varies greatly with clinical classification
- These 19 were agreed upon to be the most potentially severe and **recommended interruption**
- Even more impressive – the number of pairs for which consensus could not be reached

Pediatric DDIs

TABLE 2. Drug pairs for Which There Was Consensus that DDI Alerts Are Important for Patient Safety

Amiodarone	Digoxin, Methadone, and Warfarin
Amitriptyline	Sertraline, trazodone
Ciprofloxacin	Theophylline
Citalopram	Linezolid
Clopidogrel	Omeprazole, fluconazole
Digoxin	Amiodarone
Fluconazole	Clopidogrel
Fosamprenavir	Rifampin
Lamotrigine	Valproic acid
Linezolid	Citalopram, sertraline, sumatriptan
Meropenem	Valproic acid
Methadone	Amiodarone
Metronidazole	Warfarin
Omeprazole	Clopidogrel
Phenobarbital	Voriconazole
Rifampin	Fosamprenavir, tacrolimus, voriconazole
Sertraline	Amitriptyline, linezolid
Sirolimus	Voriconazole
Sumatriptan	Linezolid
Tacrolimus	Rifampin
Theophylline	Ciprofloxacin
Trazodone	Amitriptyline
Valproic acid	Lamotrigine, meropenem
Voriconazole	Phenobarbital, rifampin, sirolimus

Moment of Levity – Best Abstract Ever

Can apparent superluminal neutrino speeds be explained as a quantum weak measurement?

M V Berry[1], N Brunner[1], S Popescu[1] and P Shukla[2]

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Abstract
Probably not.

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Questions?