Evaluating Measures of Success Using Clinical Decision Support

January 21, 2009

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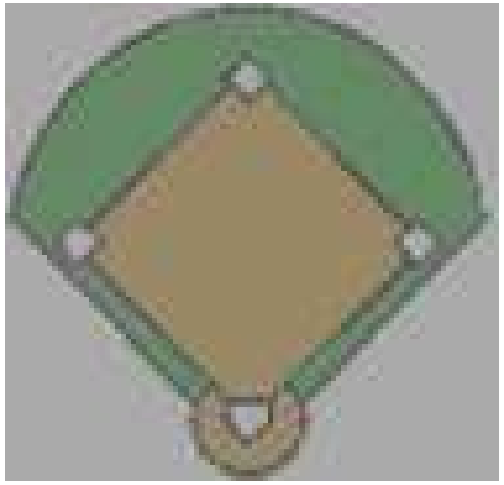
Smallball:
A Pragmatic Strategy for Evaluation in Clinical Decision Support

Charles P. Friedman, PhD
Deputy National Coordinator for Health IT
Department of Health and Human Services



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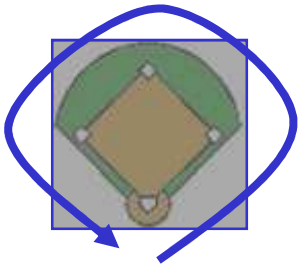
Background

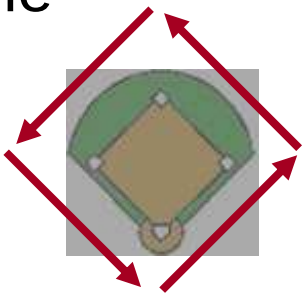
- Based on presentation at a 2004 NLM symposium on community-based interventions
  - See: Friedman CP. Smallball evaluation: a prescription for studying community-based information interventions. JMLA 93(4) Suppl 2005.
- I'm going to apply the argument to clinical decision support

What Does Evaluation Have to do with Baseball?

There are two basic offensive strategies in baseball:



1. Powerball: View every batter as a potential home run.
2. Smallball: Play for one run at a time.



I am going to argue that we need to play more "smallball" when doing evaluations in informatics

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Extreme Powerball Evaluation

Playing for the evaluation home run:

One big study:

- There is only one question of interest: Are patients or the population healthier (scientists more productive, trainees better educated), because of this intervention, at the end of the day?
- There is only one method possible: a randomized trial or the closest approximation thereto
- No evaluation is necessary until the end of the project
- Only result of interest is a difference between groups on some health (or other domain) outcome measures

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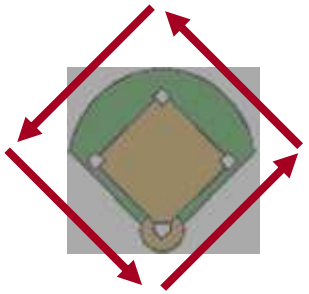
Smallball Evaluation



Do evaluation step by step:

Lots of small studies:

- Each stage of a project lifecycle presents important needs for evaluation
- There are many questions of interest at each stage
- Evaluation comprises many “small” studies

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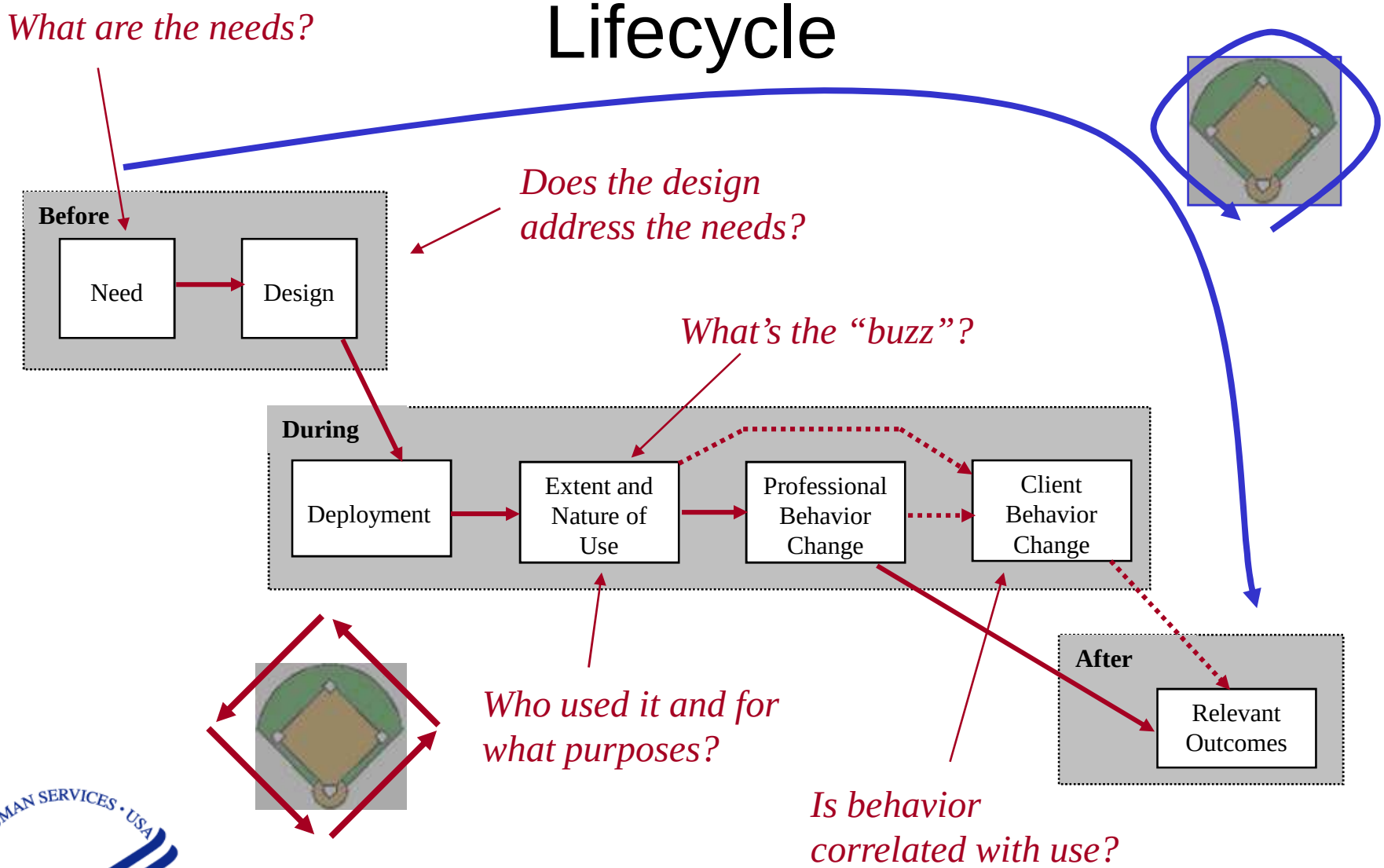
Powerball, Smallball, and the Project Lifecycle



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The Argument for Powerball

- It's what people expect
- Uses the methods of evidence-based practice
  - Generates an effect size
  - Results can in principle be meta-analyzed
- Seen as the only way to get published

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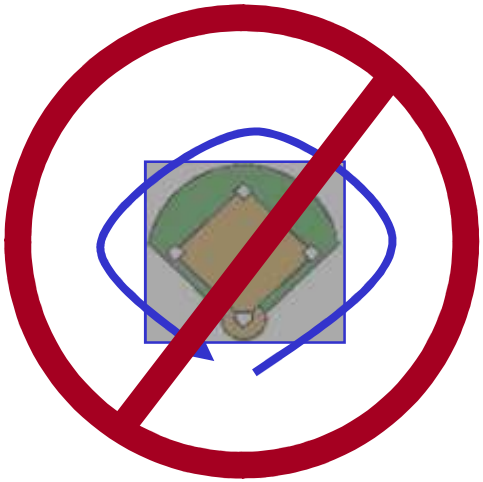
The Argument Against Powerball

- It's expensive
- It's slow
- It requires "freezing" the intervention
- It requires controlling the environment
- There are lots of questions it can't address



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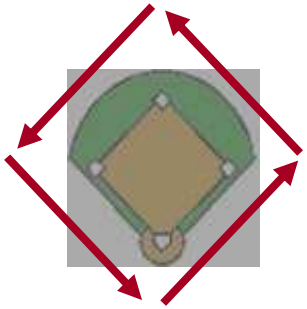
The Argument for Smallball



- It can be done on the cheap and thus is always possible
- It's agile: design and implementation become self-correcting processes
- No freezing or control required: evaluation can focus on what the project really did, as opposed to what was envisioned at the outset
- As in baseball, smallball best matched to low-budget operations (everything in 2009)

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Value of Smallball Studies in Clinical Decision Support: *Prior to Deployment*

- Broad cultural gulf between end-users and information professionals who build resources
- Smallball evaluations can bring “real” needs in focus and ensure that the resources designed and deployed can fit into professional workflow

Value of Smallball Studies in Clinical Decision Support : *During Early Deployment and Testing*

- In CDS, a lot of things have to “go just right” in order for benefit to occur
- Smallball evaluations can show where the chain is breaking down.
- Smallball evaluations can show if any harm is being done.

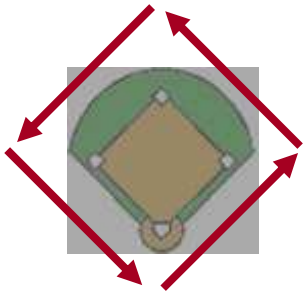
Value of Smallball Studies in Clinical Decision Support: *After Deployment*

- Smallball studies of effects are usually the best that can be done
- Complexities of patient care settings often preclude randomization and blinding, etc.
- Maybe do “dose-effect” or “extent of use” smallball studies instead
- Smallball can detect unforeseen outcomes

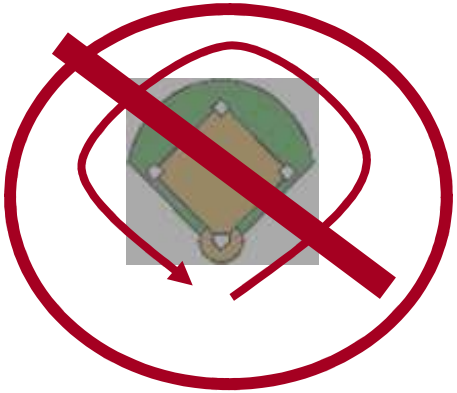
Case in Point: *An Anonymized Grant Summary Statement*

Review of an application for 2 years of funding totaling $100K…

- "No direct assessment …is planned. The role of this program in the main outcome assessment, decrease in the number of … infections, cannot be determined distinct from the other components. Statistics are not discussed adequately... No primary outcome variable…is given."
- "There … is no clear primary outcome, and no sample size calculations are done to determine the number of data points needed … to have sufficient power.



Conclusion



- It’s better to develop some insight into something really important than it is to find nothing in pursuit of knowing everything
- As a practical matter, the evaluations you should do are limited to the evaluation you can do
- This is not an argument for sloppy evaluation; it is an argument for “smallball” evaluations done well

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Further Implications for Evaluation Going Forward

- Obviously we need some powerball studies, but all projects need evaluation
- For most, smallball should be the rule and powerball the exception
- We need more agile evaluation!
- The real pathology is an expectation that every project will have a powerball evaluation
- Or that it's powerball evaluation or nothing

The Virtuosos of Smallball

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Thank You!

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DID OUR CDS INTERVENTIONS HELP OR HARM?

Evaluation Best Practices From A New CDS Implementer's Guide

Jerome A. Osheroff, MD, FACP, FACMI
Chief Clinical Informatics Officer, Thomson Reuters

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AGENDA

- CDS challenges and overview of a new CDS guide
  - Pearls/implications pertinent to evaluation
- Deeper dive on evaluation chapter
  - Obstacles and strategies to overcome
- (During Q&A)
  - Conversation about ***your*** CDS evaluation needs and challenges

Desired Outcome:
Useful takeaways for your CDS efforts: evaluation and beyond

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A CDS STARTING POINT: PROVIDER PAIN POINTS/IMPERATIVES

- Reimbursement
  - P4P (Executives/Staff too!)
  - Non-payment for never events (ADEs, VTEs, HAIs)
- Transparency/Accountability (e.g. from CMS/Payers)
  - Hospital Compare, State Initiatives, etc.
  - HCAHPS: “Did staff explain about medications before giving them?”
- Accreditation (e.g. The Joint Commission)
  - Patient Safety Goals (safe anticoagulation, medication reconciliation)
- Leverage IT investments
  - Use CDS effectively (e.g. Leapfrog CPOE Test)

Major Healthcare drivers create powerful performance improvement imperatives: *quality, safety, efficiency, costs, patient experience.*

COMPUTERIZED SYSTEMS WITH CLINICAL DECISION SUPPORT ARE THE ANSWER!?

Arch Intern Med. 2005;165:1111-1116

ORIGINAL INVESTIGATION

High Rates of Adverse Drug Events in a Highly Computerized Hospital

Jonathan R. Nebeker, MS, MD; Jennifer M. Hoffman, PharmD; Charlene R. Weir, RN, PhD; Charles L. Bennett, MD, PhD, MPP; John F. Hurdle, MD, PhD

- VA Hospital with CPOE, dispensing systems, etc.
- ¼ of admissions had at least 1 ADE; 9% caused serious harm
- Conclusion: "High rates of ADEs may continue to occur after implementation of CPOE and related computerized medication systems that lack decision support for drug selection, dosing and monitoring."

CDS/EVALUATION CHALLANGES

- How do we get resources/attention for our CDS evaluation efforts?
  - (We're not sure what effects our interventions are having)
  - (Actually, we're not even sure exactly what's deployed)
- Why aren't clinicians responding well to our CDS?
  - Why are there so many alert overrides?
  - Why aren't they using our order sets?
- How do we deal with information system limitations that constrain our ability to do "good" CDS?

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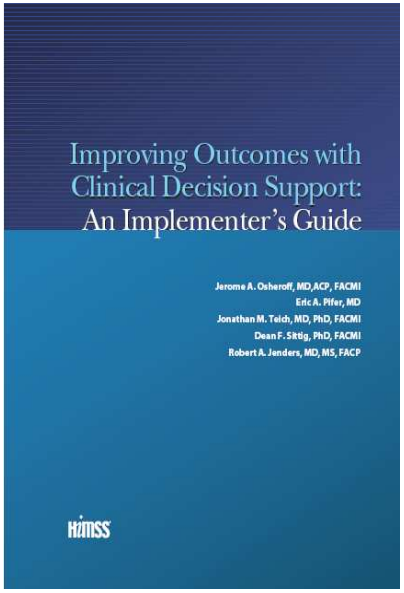
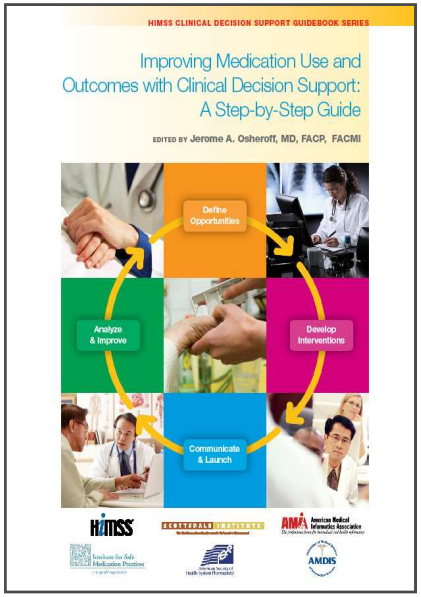
CDS IMPLEMENTERS OFTEN WORK IN RELATIVE ISOLATION ON THESE DIFFICULT ISSUES

ROADMAPS FOR SUCCESSFUL CDS INFRASTRUCTURE & IMPLEMENTATION

- National CDS Roadmap
  http://www.jamia.org/cgi/content/abstract/14/2/141
  - Calls for development/dissemination of CDS best practices
- CDS Implementation guides for Providers



- 2005 HIT book of the year
- All-time HIMSS bestseller
- Widely used by CMIOs/others



- Co-published 1/09 by leading societies
- Insights from nearly 100 contributors
- Co-sponsored by AHRQ, 3 CIS vendors
- Chapter 1 will be on NRC website
- "This is not a book"

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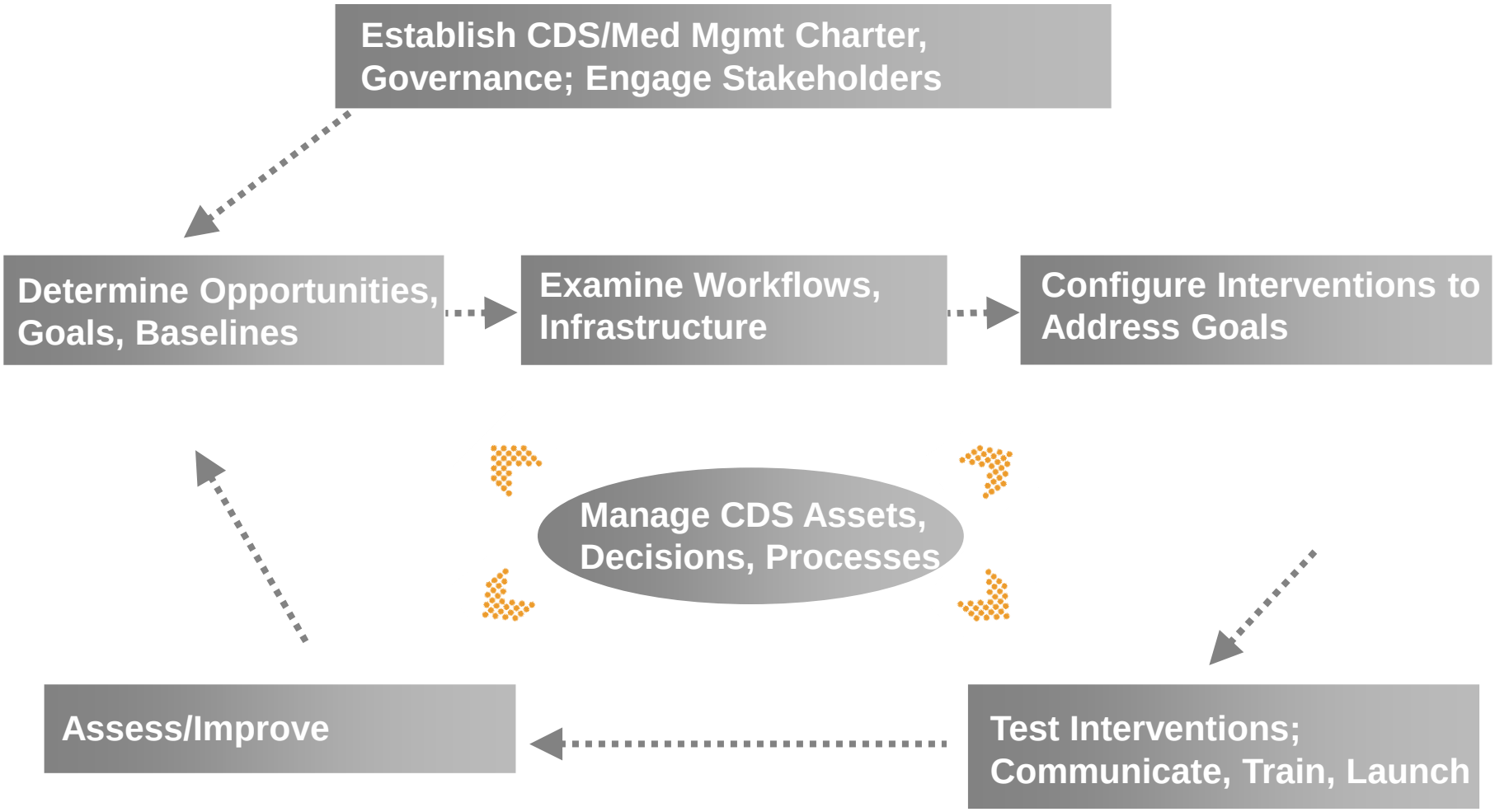
CDS APPROACH FROM NEW GUIDE



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A CDS DEFINITION

"**Providing clinicians or patients with clinical knowledge** and patient-related information, intelligently filtered or presented at appropriate times, **to enhance patient care**."

- Includes and builds on what's already being done on a daily basis in healthcare organizations…
- **NOT** just rules and alerts…

CDS INTERVENTION TYPES/EXAMPLES

- Relevant data presentation: *flowsheets, surveillance*
- Order creation facilitators: *order sentences, sets*
- Reference information: *infobuttons, Web*
- Unsolicited alerts: *proactive warnings*
- Documentation templates: *patient history, visit note*
- Protocol support: *pathways*

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A FORMULA FOR SUCCESS: THE CDS FIVE RIGHTS

To improve care outcomes with CDS you must provide:

- the Right Information…
  Evidence-based, useful for guiding action and answering questions
- …to the Right Stakeholder…
  Both clinicians and patients
- …in the Right Format…
  Alerts, Order Sets, answers, etc.
- …through the Right Channel…
  Internet, mobile devices, clinical information systems
- …at the Right Point in the Workflow
  to influence key decisions/actions

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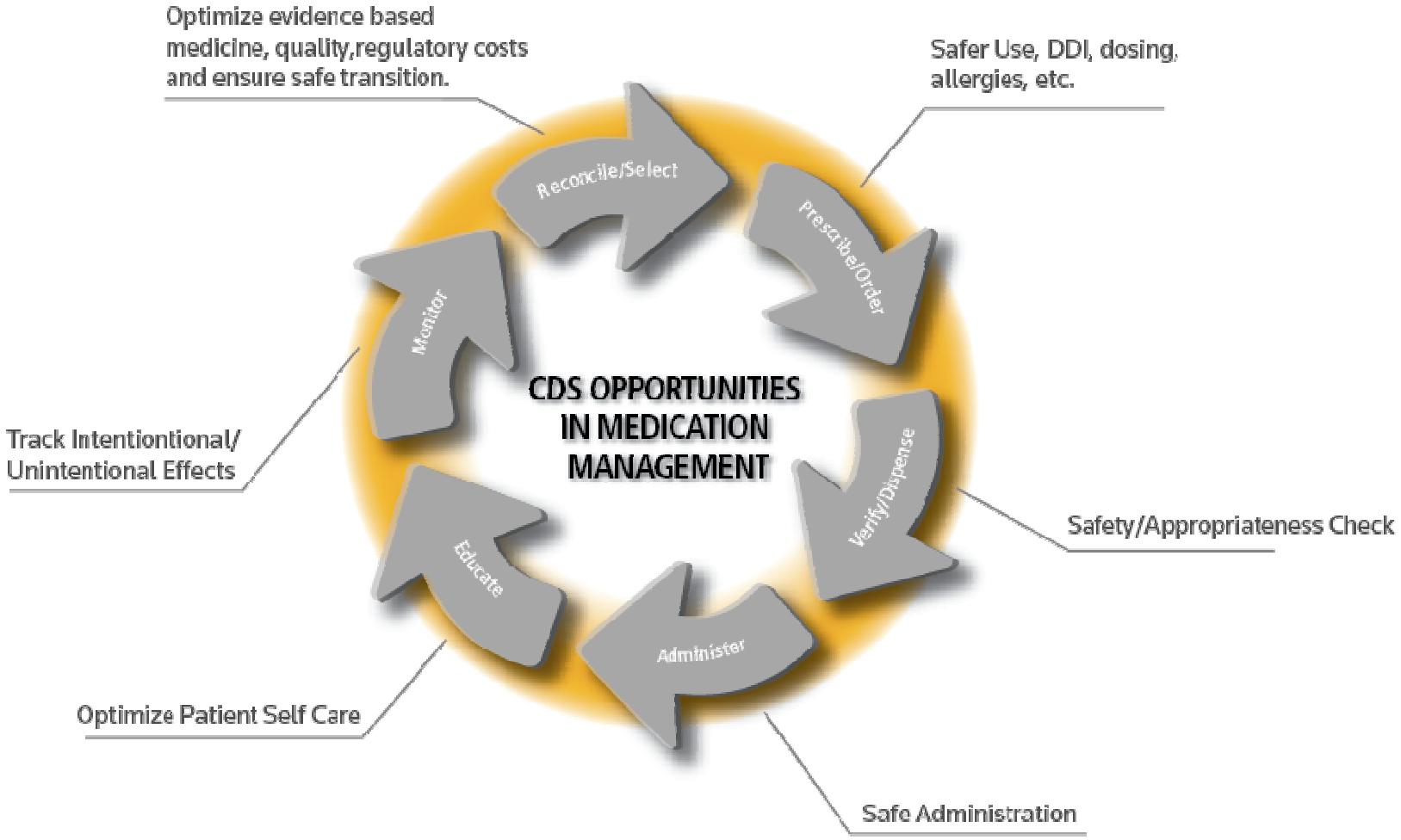
CDS GOALS IN THE MEDICATION MANAGEMENT LOOP



CDS 5 RIGHTS AND MEDICATION MANAGEMENT STEPS

CDS FIVE RIGHTS	MEDICATION MANAGEMENT CYCLE STEPS						
	WHY (Goal)	Optimize: EBM/ Quality/Regulatory, Cost, Safe Transition	Safer Use: DDI, dosing, allergies, etc.	Safety/ Appropriateness Check	Safe Administration	Optimize Patient Self-Care	Track Intention/ Unintentional Effects
	WHEN (Workflow)	Reconcile/Select	Prescribe/Order	Verify/Dispense	Administer	Educate	Monitor
	WHO (Person)	Prescriber, Nurse, Pharmacist, (Patient)	Prescriber	Pharmacist	Nurse, Other Clinician, (Patient)	Clinicians, Patient	Clinicians, Patient, Health System
	WHAT (Information)	Reference on drugs (selection, dosing, ID, pricing, etc.), diseases (treatment), condition-specific recommendations	Condition-specific Order Sets and Order Sentences; Order Checks and References	Reference/alerts on dosing/interactions	Reference information (e.g., administration, IV compatibility)	Patient-oriented reference (drug, disease, lab)	Reference drugs (effects/monitoring), Diseases (course), Labs (interpretation); Effect monitoring
	HOW (Format)	Order Sets, Reference (lookup/ InfoButton)	Reference (lookup/ InfoButton), Order Sets/Sentences	Reference (lookup/ InfoButton), Unsolicited alerting	Reference (lookup/ InfoButton),	Reference (lookup/ InfoButton),	Reference (lookup/ InfoButton); Rule checking/unsolicited alerting/relevant data
	WHERE (Channel)	Internet, EMR/ CPOE, Mobile, Med Rec Applications, Formulary Tools	CPOE, EMR, Internet, Mobile, Paper/electronic Order Forms	Pharmacy system, Internet, EMR	eMAR, EMR, Bar coding, Dispensing cabinets, IV pumps, Internet, Mobile, PHR	Internet, EMR, PHR	EMR/Surveillance systems, PHR, Internet, Mobile

A SAMPLING OF CHAPTER PEARLS => *EACH KEY TO EVALUATION!*

1. **Consider CDS Basics**
   - Define CDS broadly; consider CDS 5 Rights
2. **Establish Foundation**
   - Engage all pertinent stakeholders & establish governance
   - Select/prioritize targets; align with organization imperatives
   - Establish baselines
3. **Examine Workflow**
   - Study/observe, don't assume
4. **Optimize CDS in Available Systems**
   - Leverage major deployments and related goals
   - Think beyond CPOE/EMR to patient portal, eMAR, etc.

A SAMPLING OF CHAPTER PEARLS, CONT.

5. **Optimize CDS for Specific Targets**
   - Workflow analysis/CDS 5 Rights=alert fatigue antidote
6. **Deploy for Max Acceptance & Value**
   - Do CDS ***with*** users not ***to*** them
   - Start early with shared vision of goals/strategies (see Chap 2)
7. **Measure Effects and Refine Program**
   - Do it! (Examine intended/unintended effects; enhance)
   - Link assessment to organizational priorities/reporting
8. **Manage Knowledge Assets/Processes**
   - Approach proactively, systematically

A DEEPER DIVE INTO EVALUATION (Chap 7)

KEY TASKS

- Be systematic; consider key measurement ?s (what, how, why…)
- Examine structure, process, and outcome metrics to determine intervention benefits and unintended consequences
- Apply what you learn to continually improve interventions/results
- Prioritize measurement activities to derive greatest value

KEY LESSONS

- Tap into executive stakeholder accountability, evaluation process
- Make sure you have rich baselines (especially for targets)
- Plan/budget for measurement from the beginning

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A DEEPER DIVE INTO EVALUATION: WHAT

Measure **E**verything **T**hat **R**eally **I**mpacts **C**ustomers

- Customers = patients, clinicians, organization, etc.

- Structure Measures
  - What's deployed (inventory/KM)? How is it configured?
- Process Measures
  - How are interventions affecting users/decisions/actions?
  - Are they used? (Who? Why? How? When? Where?)
  - Useful? Overrides?
- Outcome measures
  - Are interventions getting us to goals? Creating problems?
  - Safety (Leapfrog test, Triggers), Quality, $, Satisfaction

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EVALUATION FRAMEWORK: LEVERAGE AVAILABLE INFRASTRUCTURE/PROCESS

- How you are getting data today for related efforts?
  - Time/resources required, collection method, user impact, timing
- Measurement options for each intervention?
  - Does intervention enable better ways to get data? (documentation forms)
  - Create a report to capture data from available ISs?
  - Augment capture with chart review, end-user shadowing, surveys, incident reports?
- Engage end users, as part of achieving shared goals
- Apply measurement protocol to each intervention
- Share results with all key stakeholders, respond to results for continuous performance improvement

CDS/EVALUATION CHALLENGES => SOLUTIONS

- How do we get resources/attention for our CDS evaluation efforts?
  - (We're not sure what effects our interventions are having)
  - (Actually, we're not even sure exactly what's deployed)
- Why aren't clinicians responding well to our CDS?
  - Why are there so many alert overrides?
  - Why aren't they using our order sets?
- How do we deal with information system limitations that constrain our ability to do "good" CDS?

➢ Governance/priorities; ***with*** not ***to***, CDS 5 Rights…

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SOME FOLLOW-ON COLLABORATIVE EFFORTS ON CDS

- Wiki to build/extend conversation in new Guide:
  - Share ideas about enhancements for next edition
  - Gather results from applying Guide recommendations
  - Many-many conversation about applying guidance
- HIMSS/Scottsdale Institute CDS Task Force
  - 6 sites (CMIO-types/co-editors) sharing/implementing best practices (for CDS/VTE); scale topics and participants
- Other conversations/efforts with various societies
  - AMIA, AMDIS, HIMSS, Scottsdale Institute
- Presentations/discussions like this one

SOME NEXT STEPS FOR YOU TO CONSIDER

- For work by you and your organization
  - What are the key clinical performance imperatives?
  - Are pertinent improvement objectives being realized?
  - Are current systems and tools being fully leveraged?
  - Are vital tools or support missing?
- Could your success be supported by:
  - Using recommendations/frameworks in the CDS guidebook to enhance your strategy and tactics?
    - Keep an eye on NRC website for Chapter 1 of Guide
  - Participating in CDS-related collaborations?

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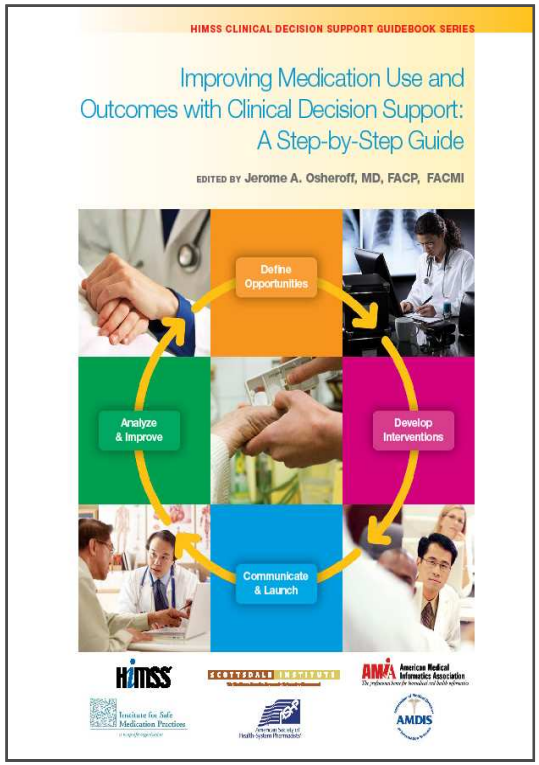
References

- The roadmap for national action on CDS: http://www.jamia.org/cgi/content/abstract/14/2/141

- The new CDS guide from which my talk is drawn: Improving medication use and outcomes with clinical decision support: a step by step guide. Osheroff JA, ed. HIMSS. 2009: www.himss.org/cdsguide

THANK YOU!

- For information visit http://www.himss.org/cdsguide



- Ordering info
- Link to Guide Community/Wiki
- Info about HIMSS CDS TF/VTE Project

❖ jerry.osheroff@thomsonreuters.com

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Evaluating Measures of Success Using Clinical Decision Support

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Summary

1. “Success” with CDS can be measured in several ways: “ever used”, “adoption”, user satisfaction, improved care processes, improved intermediate or “real” outcomes of patients.
2. Targets of CDS may be patients, providers, or other actors in systems: patient-level success should consider what you are trying to accomplish.
3. Provider-directed CDS can influence provider behavior (care processes) but, absent other interventions, may be less likely to influence patient outcomes.
4. Alert-fatigue is a treatable condition: filtering can improve specificity

Overview

1. Overview of DIG-IT (cluster trial to improve diabetes care and outcomes)
2. Measures of CDS success in DIG-IT
3. CDS design features intended to increase success.
4. CDS results in DIG-IT
5. System-related CDS and results
6. Rx for Alert-fatigue

CDS Definition

"Giving the right information* to the right person** at the right time and place, and making it easier to make the right decision."

*** "appropriately filtered"***

**** The doctor may not always be the right person***

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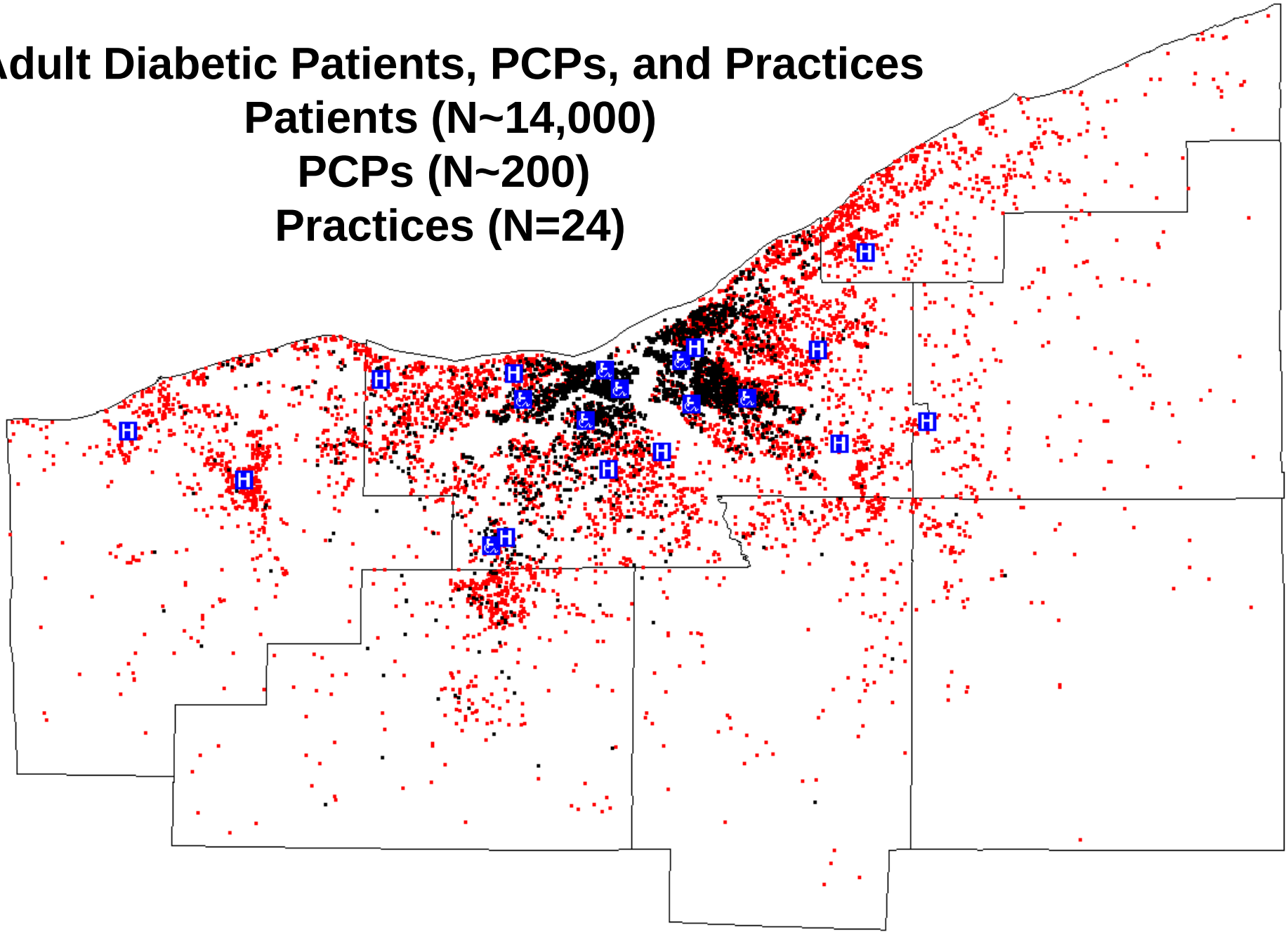
Adult Diabetic Patients, PCPs, and Practices

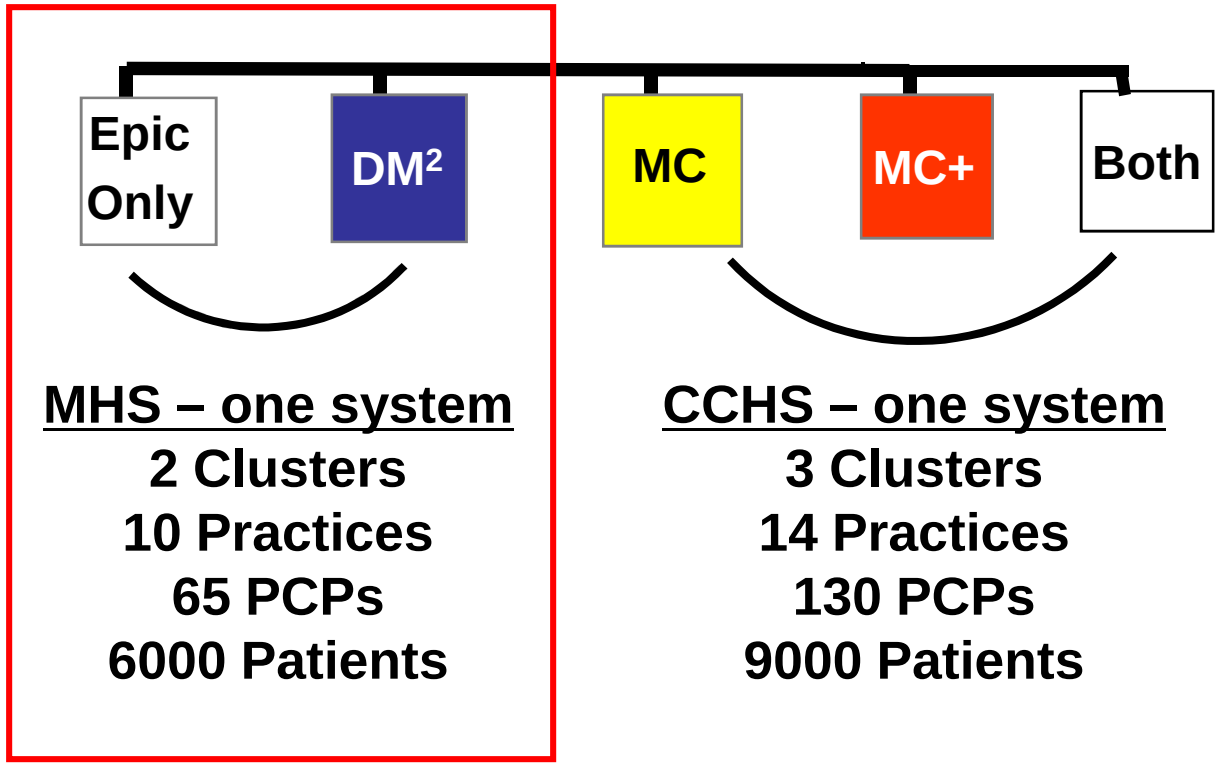
Patients (N~14,000)

PCPs (N~200)

Practices (N=24)



Cluster Trial of Decision Support: Diabetes Improvement Group – Intervention Trial (DIG-IT)



Love TE, Cebul RD, Einstadter D, *et.al.* Electronic medical record-assisted design of a cluster-randomized trial to improve diabetes care and outcomes. *J Gen Intern Med.* 2008 Apr;23(4):383-91.

CDS in DIG-IT

- **Real-time Alerts, Linked Order Sets**
- **Patient and Physician Education**

Practice Panel Tools

- **Patient Registry, Current Pt. Status**
- **Performance feedback on practice**

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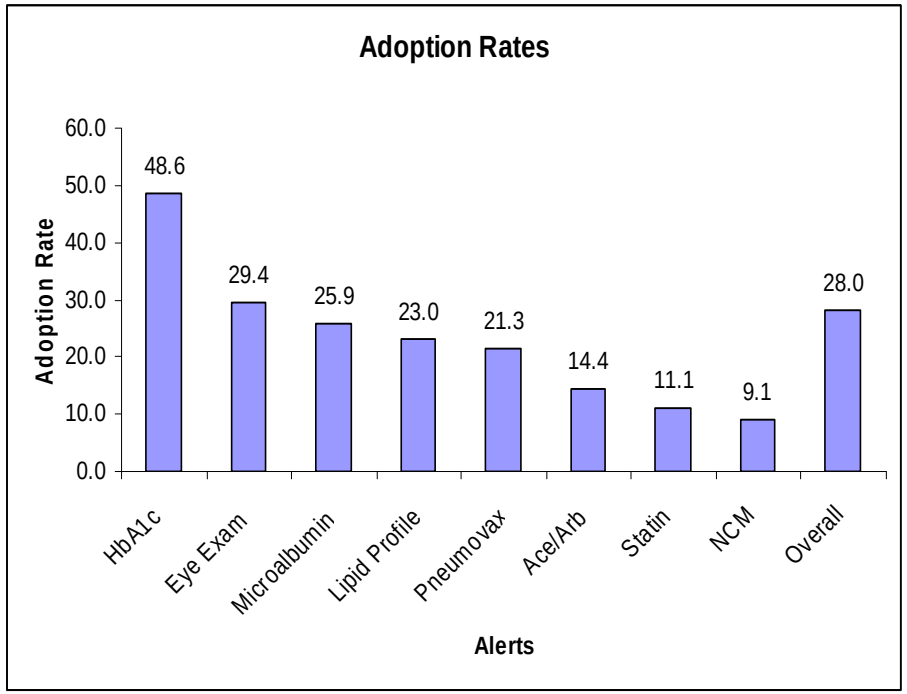
CDS-related Success Measures

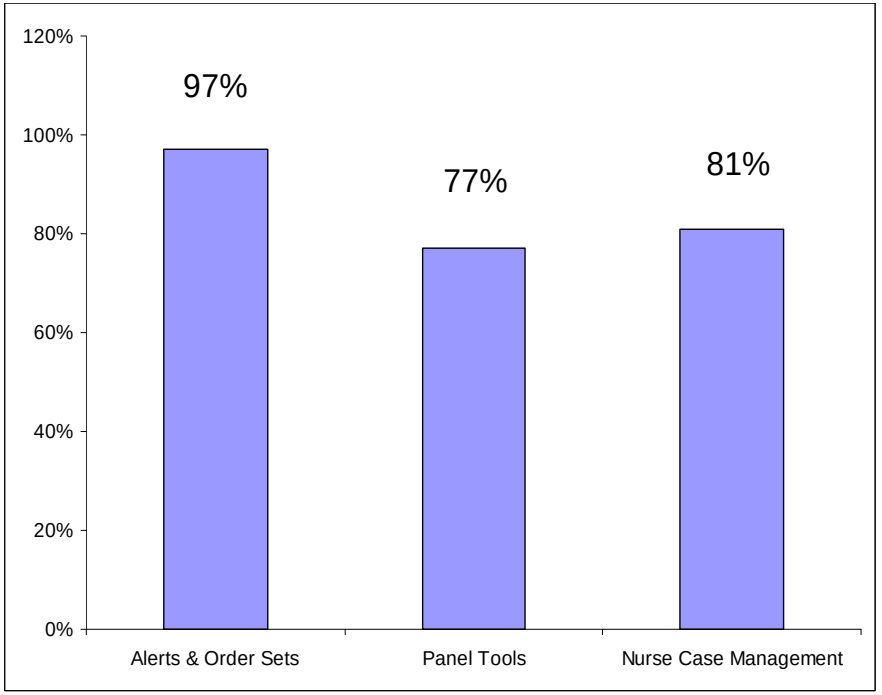
1. Alert-related Adoption.
   - [Appropriate Action Taken/Opportunities]
2. CDS-related Provider Satisfaction
   - "Keep the [CDS] after the trial is completed?"
3. Difference in care processes (MD-centered)
   - Timely receipt of tests/Rxs: A1c, LDL, U/A, Pneumovax, ACE inhibitor/ARBs
4. Difference in good outcomes (pt-centered)
   - A1c<7; BP<130/80; LDL<100; BMI<30; non-smoker

CDS Success Measures: Alert Adoption and PCP Satisfaction

Alert Adoption



"Keep the CDS"



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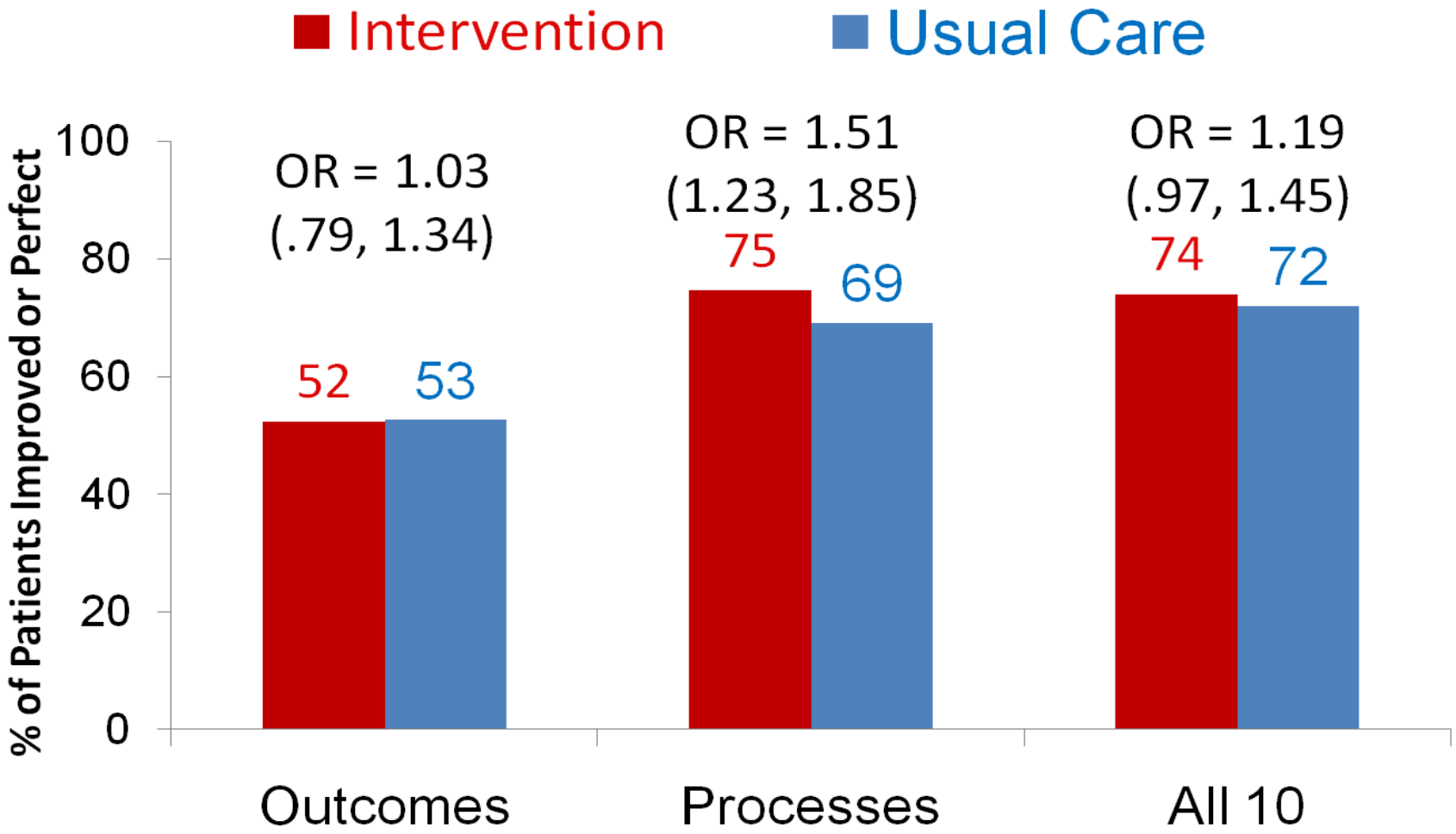
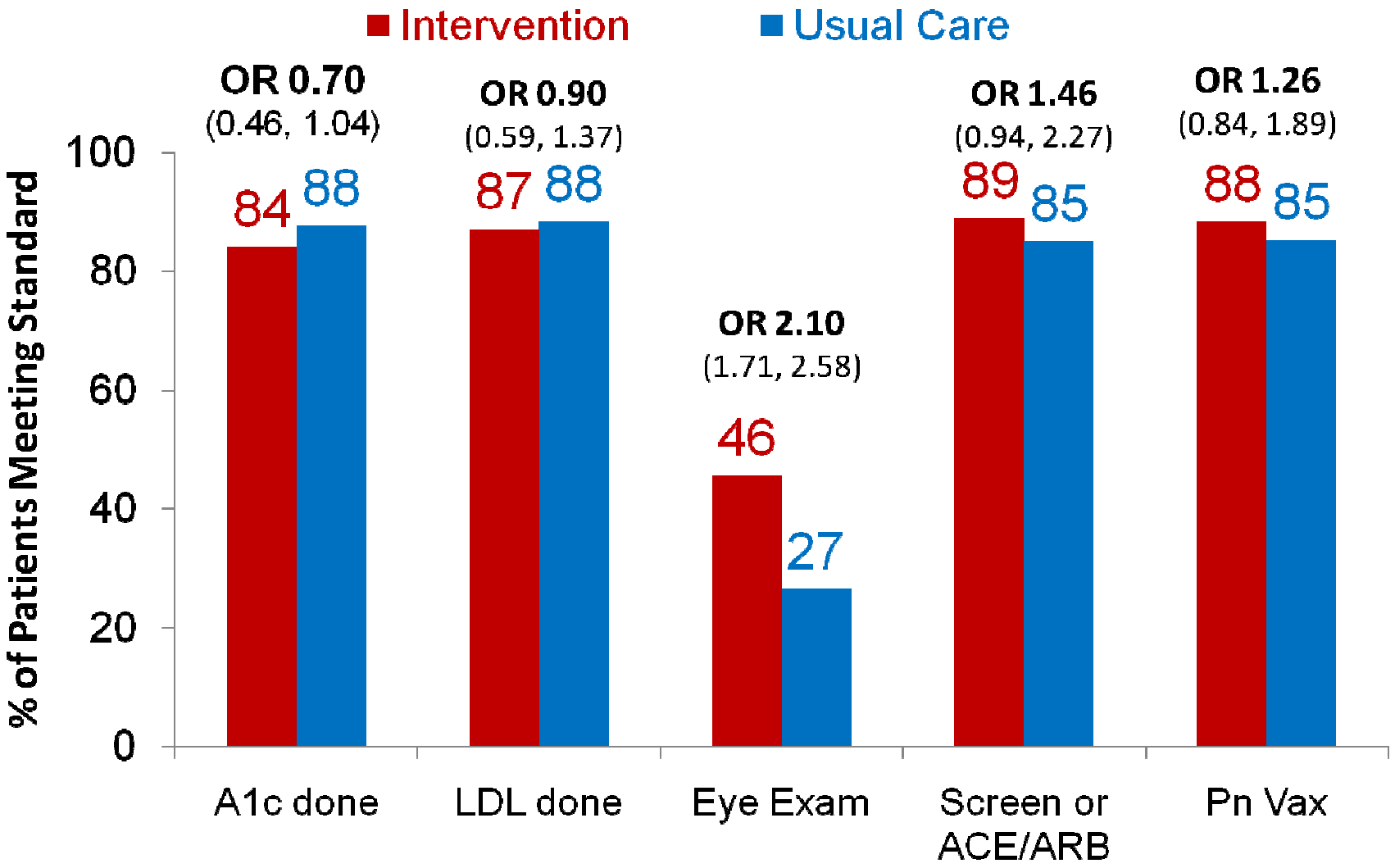
CDS Success Measures: % of Patients Improved or Met All Standards



*OR (95% CI) from covariate-adjusted logistic regression models that account for site-level clustering.

CDS Success Measures: % of Patients Who Improved or Met Process Standards



*OR (95% CI) from covariate-adjusted logistic regression models that account for site-level clustering.

CDS Measures of Success: Summary #1

1. Reasonable “Soft” Measures:
   - “Adoption” (actions/opportunities)
   - Provider satisfaction (keep it or not)
2. Useful alerts can enhance care by PCPs
   - Comparison/control group is useful
3. Alerts to PCPs may not improve outcomes
   - E.g., most PCPs are likely aware of poor A1cs
   - Need to engage patients, facilitate delivery system interventions

CDS for Delivery System Support: Pneumococcal Vaccine Example

Intervention:

1. Identify scheduled patients who meet criteria for vaccine and who have not received it:
   - Health maintenance field
   - Patients ID'd by age, dx'd conditions
2. Provide daily list to receptionists and RNs
3. Establish Standing Orders for RN offer and administration before visit.

Pneumococcal Vaccine Rates among Diabetics in 35 Group Practices in Greater Cleveland

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Alert Fatigue as a Treatable Condition

Peter J. Greco, M.D.
Case Western Reserve University at
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Cleveland

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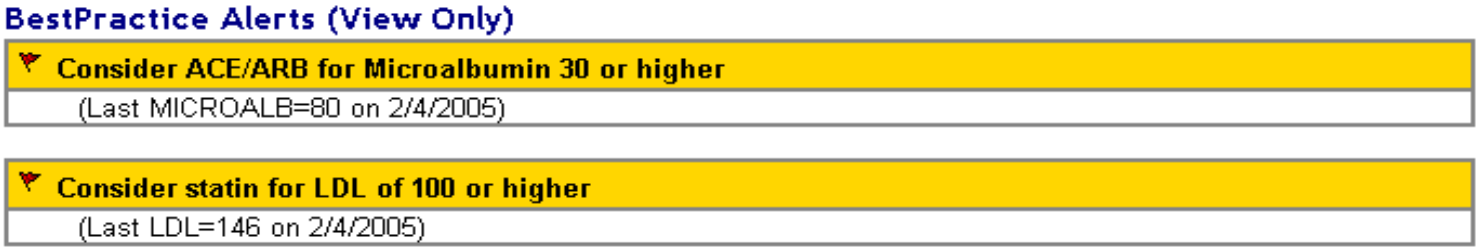
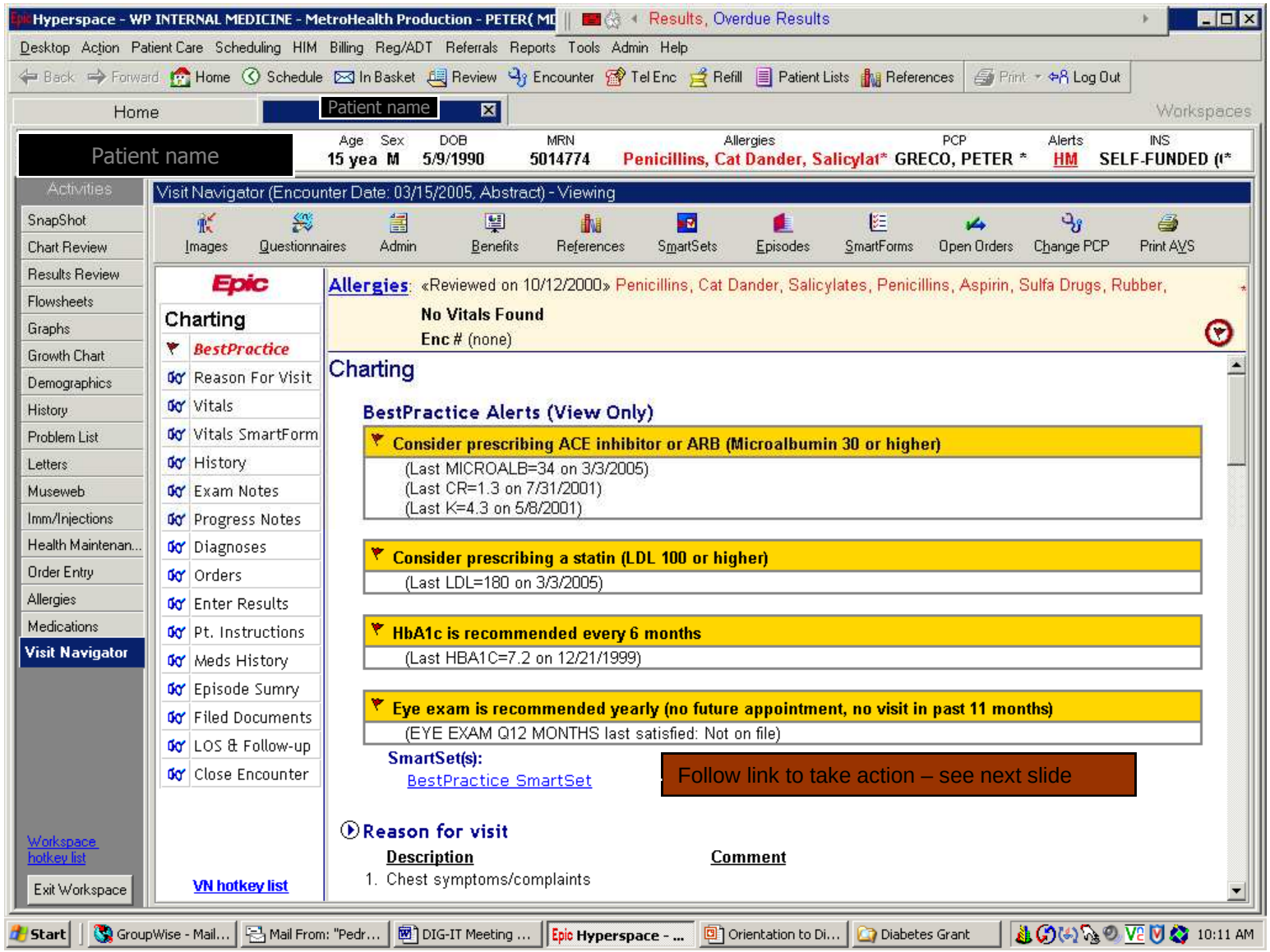
Minimizing "alert fatigue" by Filtering: what do we know about this patient at the time that decisions can be made?



- She has diabetes and is visiting her doctor
- Her kidneys are leaking protein and her LDL cholesterol is above recommended levels.
- She is not on ACE inhibitors, ARBs, or statins, and has no documented allergies to them.
- She does not have other contraindications to these medications
- There are several alternative drugs/doses



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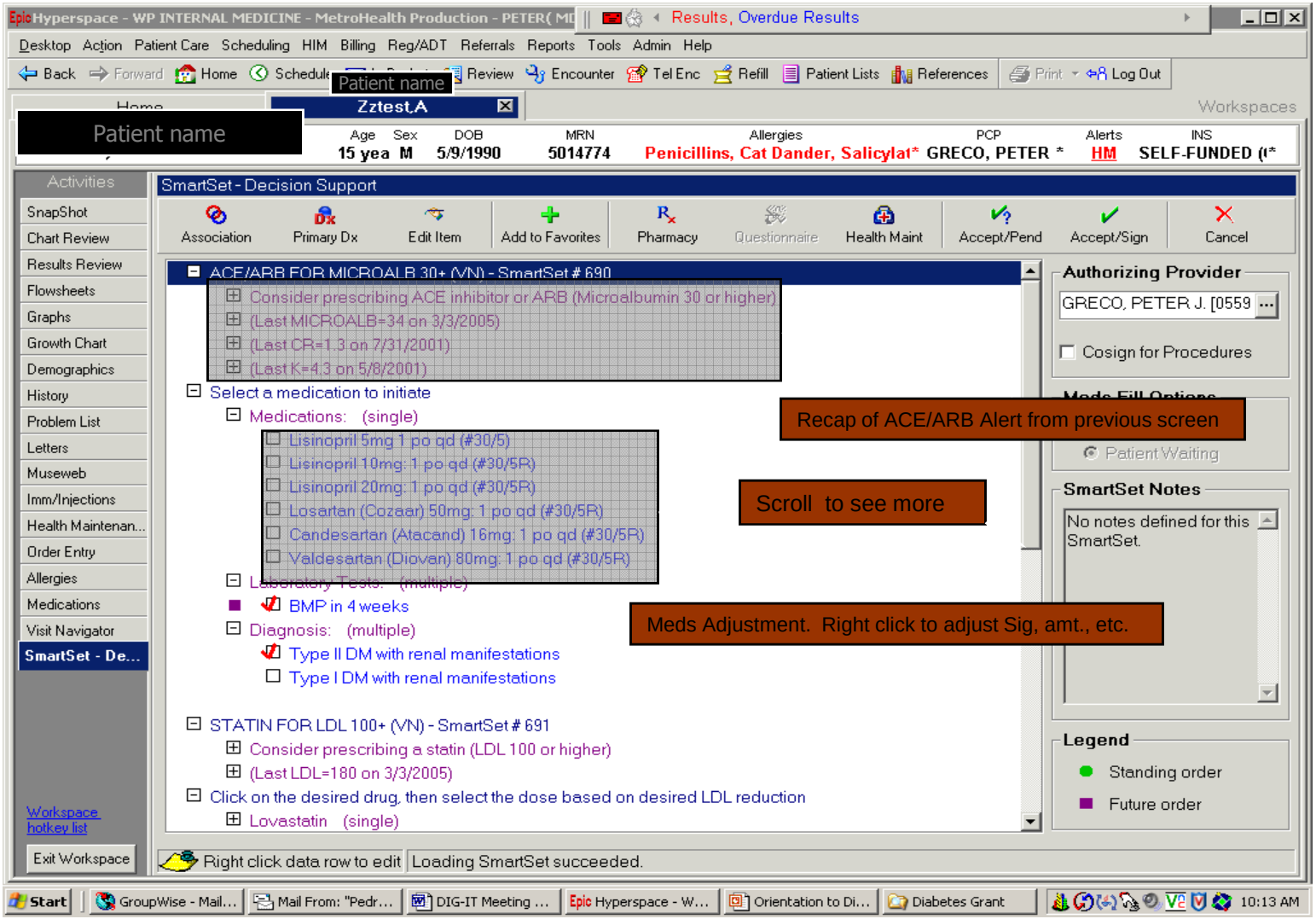
SmartSet Linked to Alerts



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Drug-Drug Interaction Filtering

- Background:
  - We sought to improve provider attention to alerts by reducing “nuisance” alerts.
  - Our 3rd party vendor categorizes drug interaction alerts by severity (major, moderate, minor) and by documentation level (doubtful/unknown, suspected, possible, probable, established), creating 15 possible combinations.

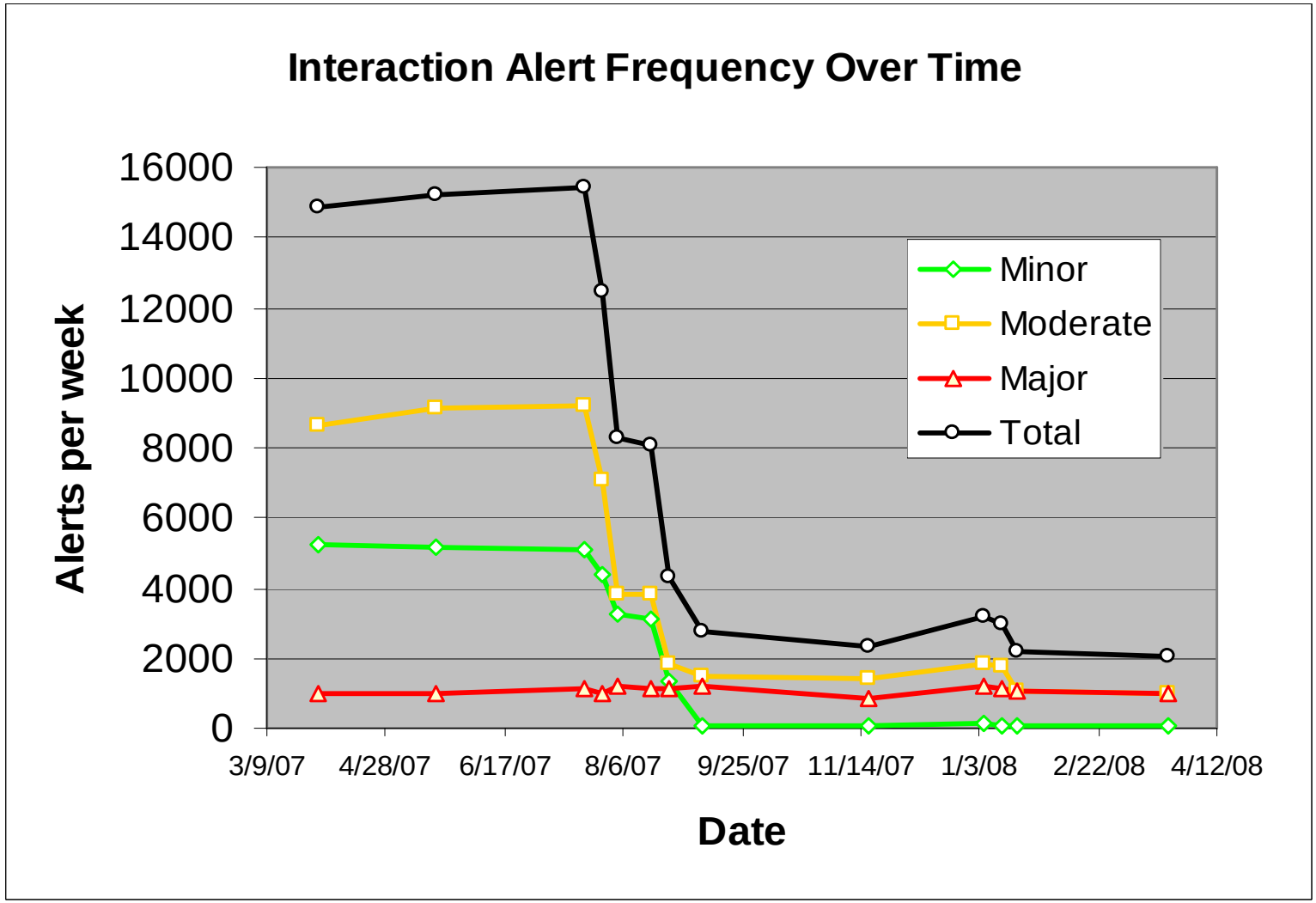
Drug-Drug Interaction Filtering

- Methods:
  - Two general internists reviewed the 200 most frequently displayed drug-drug interaction alerts in our system, and devised a filtering scheme to hide the alerts deemed clinically unimportant.
    - All major alerts would be displayed
    - Moderate alerts that were at least possible would be displayed
    - Minor alerts that were at least probable would be displayed.

Drug-Drug Interaction Filtering

- Methods:
  - Appropriate specialists also reviewed the 200 most frequently displayed drug-drug interaction alerts, to determine any exceptions to the severity/documentation filtering scheme
    - A small number of alerts were raised in severity (to prevent them from being filtered)
    - A larger number of alerts were inactivated (to preven them from being displayed)
  - We periodically reviewed the results of our filtering and made refinements as necessary

Results



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User Response To Alerts

ALL SEVERITIES	Pre-Filtering (3/31/07-5/11/07)	Post-Filtering (2/17/08 – 3/29/08)
# of alerts displayed	94,679	13,356
# of alerts canceled	826	438
% of alerts canceled	**0.87%**	**3.28%**

MAJOR SEVERITY	Pre-Filtering	Post-Filtering
# of alerts displayed	6120	8053
# of alerts canceled	159	349
% of alerts canceled	**2.60%**	**4.33%**

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Conclusion

- With fewer alerts displayed, a much greater proportion of alerts were attended to.
  - greater proportion of the clinically important displayed alerts
  - even among major severity alerts, user response increased significantly
- We believe this represents reversal of what is commonly referred to as “alert fatigue”

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Thank You!

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Questions & Answers

Our Panel:

Charles P. Friedman, PhD, Deputy National Coordinator for Health Information Technology in the Office of the Secretary for Health and Human Services

Jerry Osheroff, MD, FACP, FACMI, Chief Clinical Informatics Officer for Thomson Reuters

Randall D. Cebul, MD, Professor of Medicine and Epidemiology and Biostatistics at Case Western Reserve School of Medicine

Peter J. Greco, MD, Assistant Professor of Medicine, Case Western Reserve University School of Medicine

Annotated Bibliography

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Coming Soon!

Our Next Event

First in our three-part series on Medication Management

Stay tuned for exact date and time and information on how to register

Thank You for Attending

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