



Pharmacy Face-Off

*Why BCMA Should
Come Before CPOE*

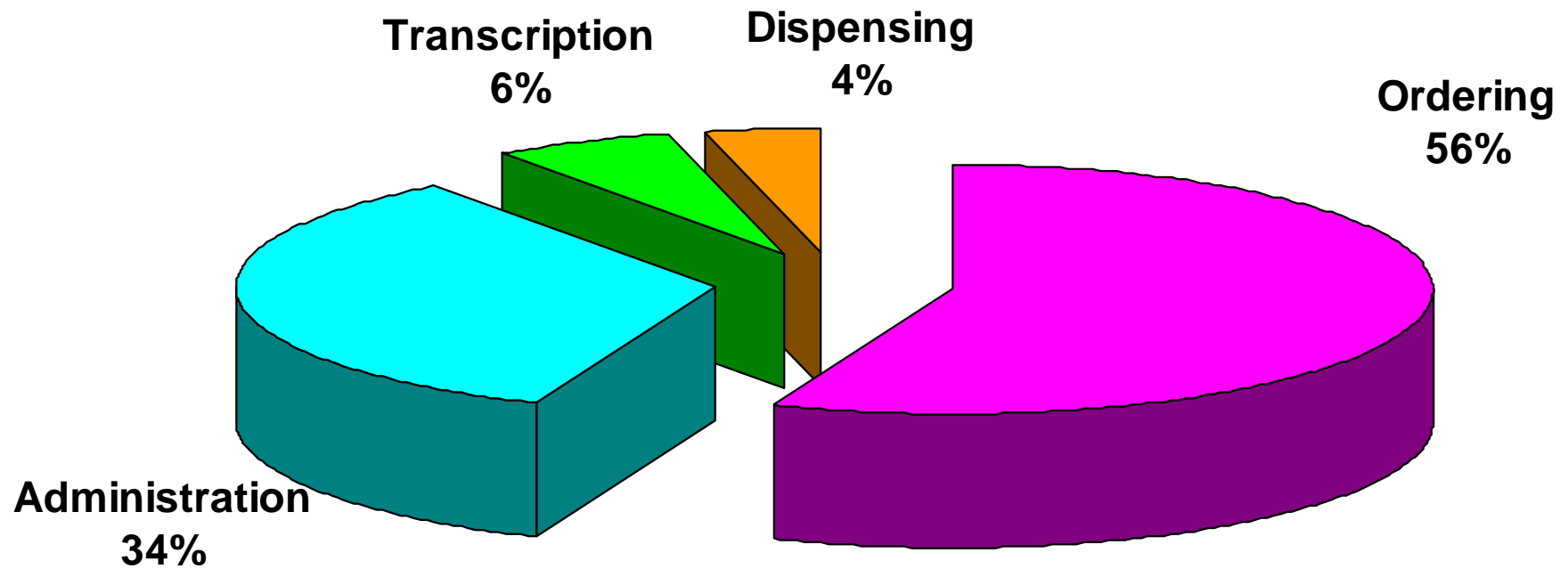
Why BCMA first?

- **BCMA:**
 - More effective in avoiding errors
 - Least costly and easier to implement
 - Easier to successfully maintain
 - Generates an immediate ROI
 - Just plain common sense



BCMA:
*More Effective in
Avoiding Errors*

Where do Errors Occur in the Medication Use Process?

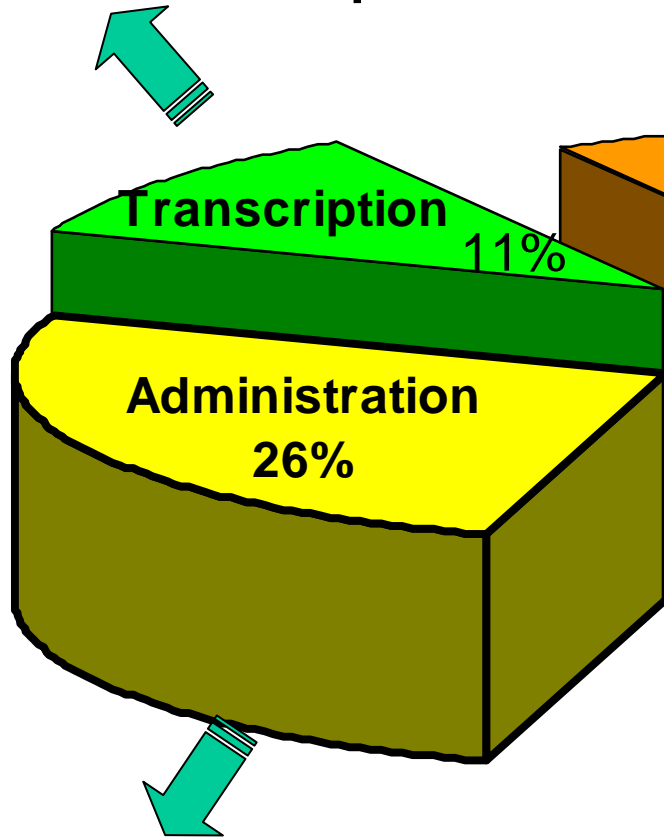


Errors resulting in preventable ADEs

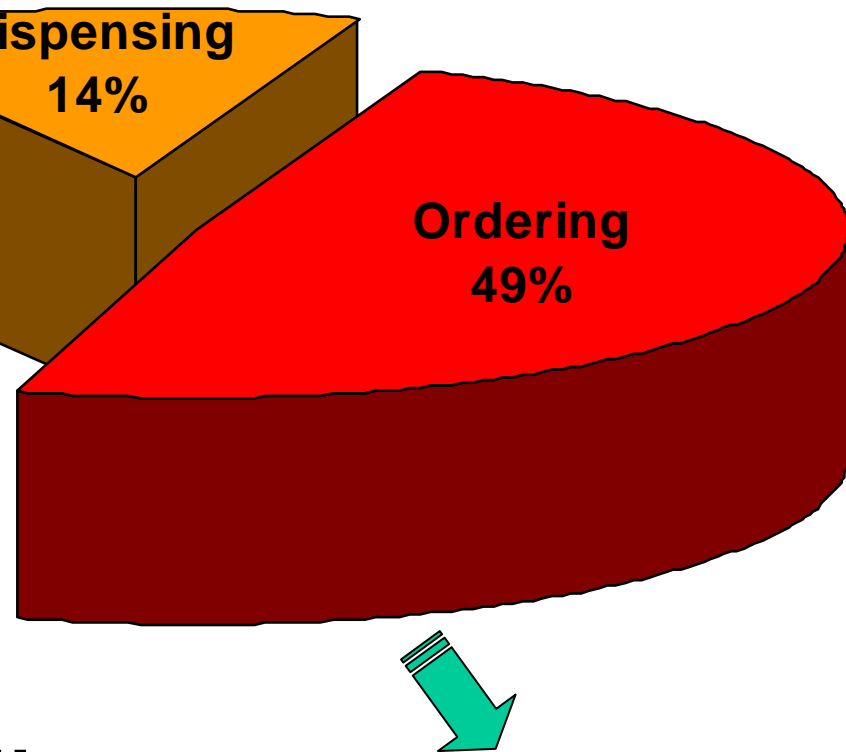
Errors Resulting in Preventable & Potential ADEs

(Bates et al. JAMA. 1995;274:29-34.)

23% of errors intercepted



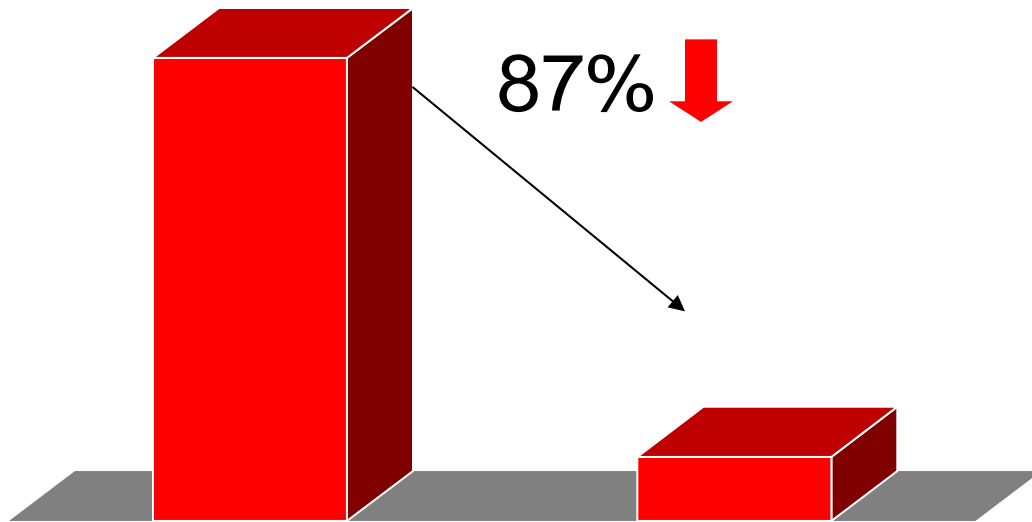
37% of errors intercepted



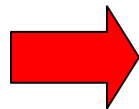
No errors intercepted!!!

48% of errors intercepted

Overall medication administration error rate



**13,340 admin
errors/year
on pilot unit**



**1,822 admin
errors/year
on pilot unit**

Wrong Dose	100% ↓
Wrong Dosage Form	100% ↓
Omitted doses	92% ↓
Wrong time	77% ↓
Wrong drug	51% ↓

- Forces witness for high-alert medications (MDVs and drips)
- Forces nurses to verify pharmacist order entry prior to first dose administration
- Forces patient ID band identification
- Forces documentation
- Can't prepare medications for multiple patients at one time



BCMA:
*Less Costly and
Easier to Implement
and Maintain*

BCMA vs CPOE

	BCMA ¹	CPOE ²
Initial cost (\$) to implement	0.4-2 million	8 million
Time to implement	4-6 months	1-4 years

1. Roundtable meeting, 2006 HIMSS Conference.

2. Computerized Physician Order Entry: Costs, Benefits, and Challenges, First Consulting Group for the American Association and the Federation of American Hospitals, January 2003.

Current Adoption of Pharmacy Informatics in US Hospitals

- BCMA = 25% (was 1.5% in 2002)
- Electronic medication administration record = 83%
- CPOE with decision support = 12% (but, 34% of respondents have < 50% of orders entered by prescribers)
- Fully implemented electronic medical record = 5.9%

350 Bed Hospital Resource Requirements

■ BCMA

- 3 FTE repackaging technicians
- 1 FTE Nursing Project Coordinator
- 0.5 FTE pharmacist project coordinator
- 0.5 FTE inventory/formulary maintenance technician
- RF Network
- Repackaging Technology
- 4 hours new nurse orientation
- Software
- Hardware

■ CPOE

- Pharmacy informatics (13 FTE)
- ITS Systems Analysts (50 FTE)
- Nursing Informatics (9 FTE)
- Medical Informatics (4 FTE)
- Many project managers (6)
- “Redcoats”
- Public affairs
- FTEs can exceed 50!!!
- 8-16 hours new nurse, pharmacist, physician orientation
- Politics and bureaucracy
- Software
- Hardware



BCMA:
*Generates an
Immediate ROI*

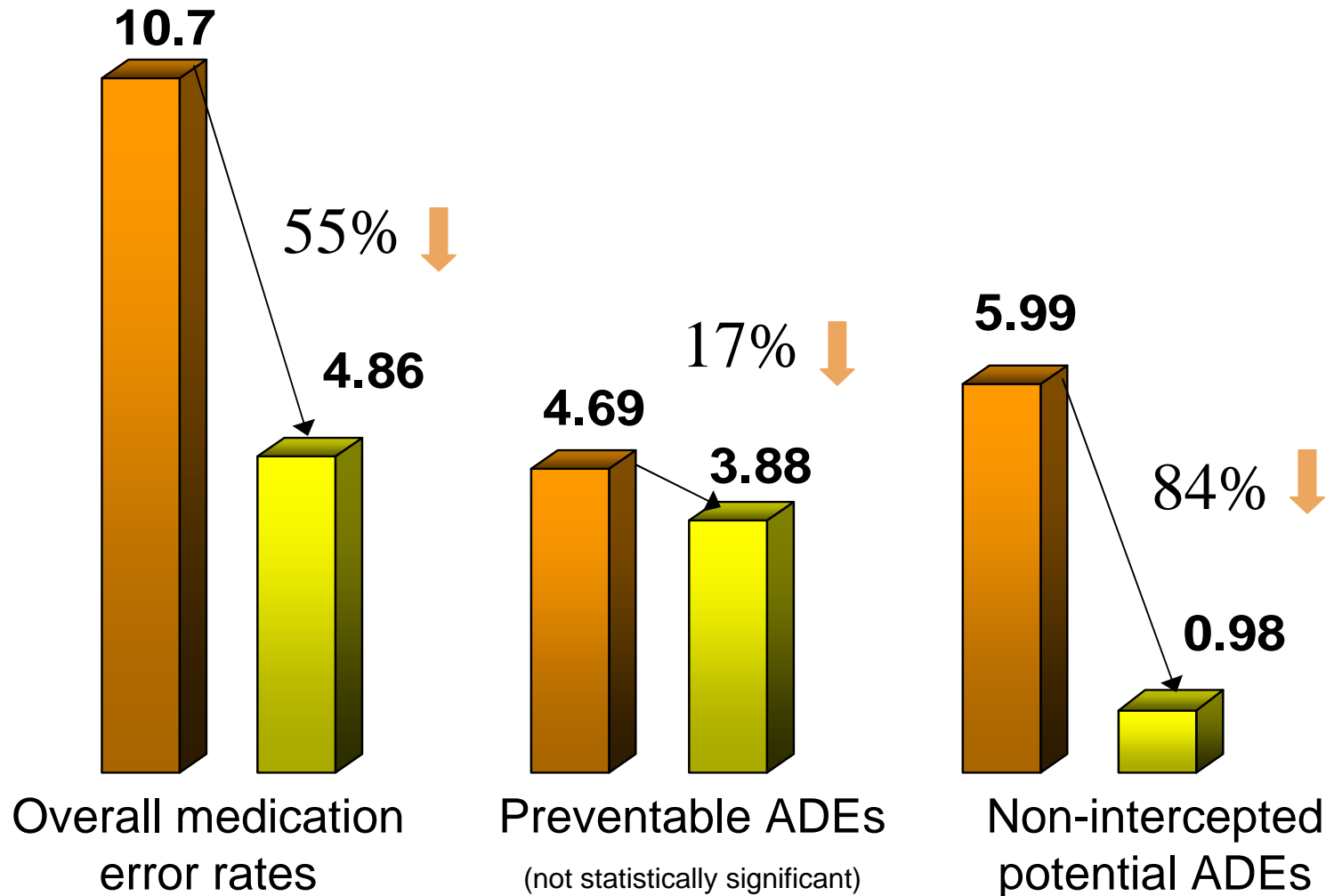
BCMA Cost-Avoiance

<u>Assumptions:</u>	Literature method	Conservative method ¹
Annual doses administered per year:	3,650,000	3,650,000
Administration error rate before BCMA in manual system	9.10%	9.10%
Total administration errors per year before BCMA in manual system	332,150	332,150
Administration error avoidance as determined via direct observation study	87%	87%
Administration errors avoided per year following BCMA implementation	288,971	288,971
% of medication errors that result in harm or a PADE (per 1995 Bates study)	1%	0.10%
Total harmful errors avoided per year at Model Hospital	2,890	289
Cost of a harmful medication error (per 1995 Bates study)	\$4,700	\$4,700
Total harmful error cost avoidance per year as a result of BCMA	\$13,581,614	\$1,358,161

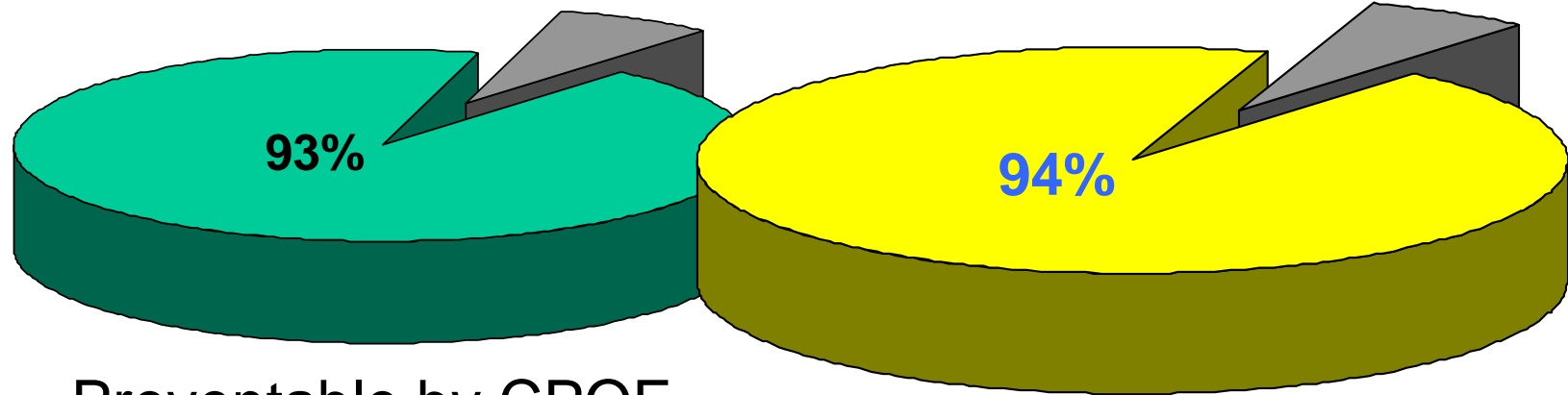
1. Assumes only 1 in 1000 errors result in harm that add cost to the organization; lowers estimates from 1995 Bates et al research by 10-fold.



Some thoughts on CPOE



- Review of 10,778 pediatric inpatient medication orders



Preventable by CPOE

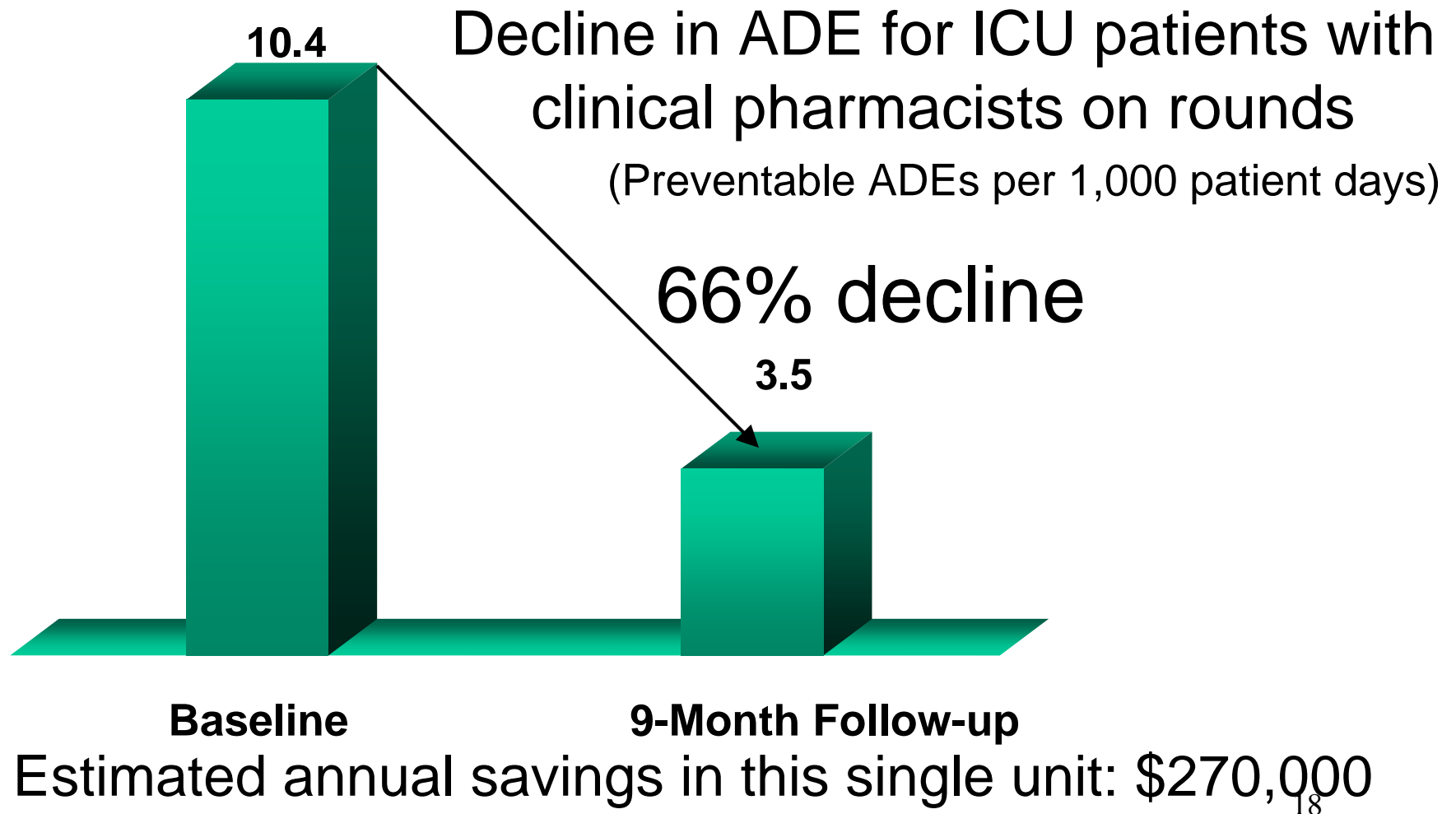
Preventable by
decentral clinical pharmacists

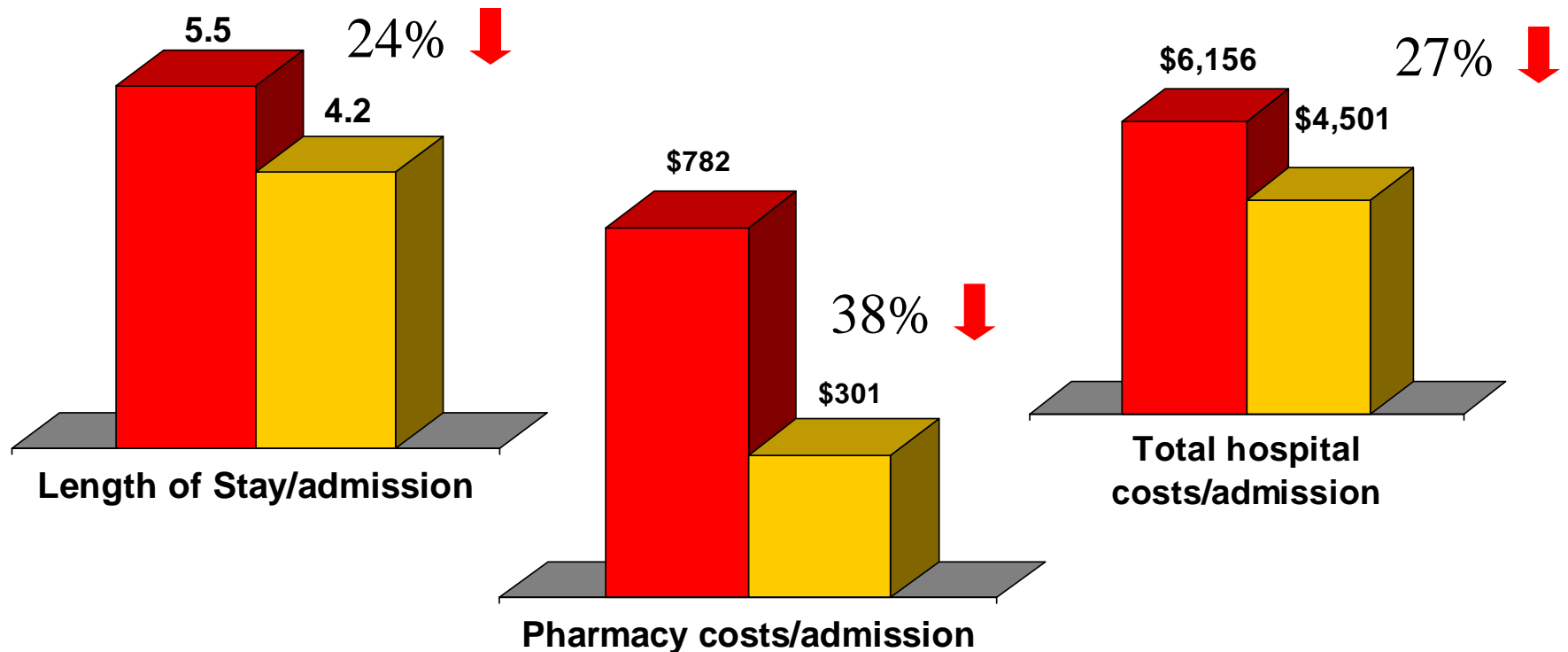
Benefit to Cost Ratio	1988-1995	1996-2000
Lowest	\$1.08 : \$1	\$1.70 : \$1
Highest	\$75.84 : \$1	\$17.01 : \$1
Median	\$4.09 : \$1	\$4.68 : \$1
Mean	\$16.70 : \$1	\$5.54 : \$1

1. Advisory Board Company. Prescription for Change. 2001.

2. Schumock GT, Butler MG, Meek PD, Vermeulen LC, et al. *Pharmacotherapy* 2003;23:113-132.

Value of RPh Clinical Services





- Control (without clinical RPh services)
- Clinical RPh on a Patient Care Team

- Improving the safety of the ordering phase of the medication use process has the largest potential to improve patient safety
- Clinical decision support must maximize sensitivity and specificity so as not to inundate physicians with bogus alerts (eliminate the false positives)
- A “shrink-wrapped” CPOE system does not exist
- Pharmacists are more effective than CPOE at reducing errors and expense
- Pharmacists must play an active role in CPOE system selection and implementation

Workarounds and New Sources of Error

■ BCMA

- Printing extra wristbands
- Photocopying common medication bar code labels
- Scanning after administration to avoid waking the patient
- Deciding to bypass scanning altogether
- Alert fatigue
- Complacency
 - People assume that because it is automated, it must be safe and accurate

■ CPOE

- Alert fatigue, often alerts turned off
- Wrong patient and drug selection
- Use of comment fields to convey order intent
- Verbal orders
- Pharmacists turn into HUCs
- Commercial systems have very limited decision support
- Complex orders still written on paper

To Be Fair about BCMA Systems....

Advantages

- Safety and accuracy of medication administration
- Accuracy of documentation
- Improve nurse efficiency resulting in time savings
- Improve charge capture/accuracy
- Patient confidence in care

Limitations

- “Vaporware”
- Safety advantage requires that all medications are bar coded
- If want pure unit dose, can't use many manufacturer supplied doses
- Interface requirements
- Radio frequency demands
- Personnel required to manage
- New sources of error and workaround

To be Fair to CPOE...

- Can free a lot of pharmacist time for patient care
- Eliminates error prone abbreviations
- Orders are legible
- Long-term upside when integrated with decision support is extraordinary

- Published studies (observational) since January 2008 demonstrating improved accuracy of medication administration and successful BMCA implementation
 - Marini SD. Stud Health technol Inform. 2009;146:439-44
 - Caputo KM. J Am Med Inform Assoc. 2009 Jun 30.
 - Mims E. AJHP. Vol 66 (12). 1125-31.
 - Jaculin. AJHP. Vol 66 (12). 1110-15.
 - Helmons PJ. AJHP. Vol 66 (13). 1202-10.
 - Pa Patient Saf Advis 2009. Dec 5 (4) 122-6.
 - Healthcare IT New. January 22, 2009.
 - Poon EG. J Nurs Adm. 2008 Dec; 38(12):541-9.
 - Fitzhenry F. AMIA Annu Symp Proc.
 - Morriss FH Jr. Pediatr. 2008. Sep 27.
 - Sakowski J. AJHP. Vol 65 (17). 1661-66.

UWHealth

University of Wisconsin
Hospital and Clinics

Thanks!!!



CPOE v BCMA

What to do first?

John Poikonen, Pharm.D.

<http://RxInformatic.com>

<http://RxInformatics.wordpress.com>

Resources

- <http://friendfeed.com/pharmacy-informatics>
- Disclaimer, Disclaimer, Disclaimer
 - I have no conflict of interest with any CPOE or BCMA vendor or consultant.
 - The views expressed here do NOT represent any former, current or future employer.
 - These views may not even necessarily represent my own views. This position is taken solely and hopefully for your intellectual stimulation.

CPOE v BCMA

- Evidence Based Practice
- Meaningful Use
- Government, Purchasers and Experts

Evidence Based Practice?

	Qualitative Metric Scores ^b			Selected References
	Feasibility	Financial Return	Quality and Safety Return	
<i>Medication safety</i>				
Machine-readable coding in medication administration	XXXX	\$\$\$\$	++++	61, 62
Use of order sets	XX	\$\$\$\$	+++	68-70
Computerized prescriber-order entry	XXXX	\$\$	++++	71-75
Pharmacy computer decision support	XXXX	\$\$\$	++++	76-79

“The identified evidence base consists mainly of case studies and anecdotal reports.”

Strategic approach for improving the medication-use process in health systems: The high-performance pharmacy practice framework
 Am. J. Health Syst. Pharm., Aug 2007; 64: 1699 - 1710.

Evidence Based Practice

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“Prospective time series analysis, with four periods.”

“Medication errors (those with the potential to cause injury) fell 86 percent from baseline”

Strategic approach for improving the medication-use process in health systems: The high-performance pharmacy practice framework

Am. J. Health Syst. Pharm., Aug 2007; 64: 1699 - 1710.

Evidence Based Practice?

- AHRQ Paper BCMA
http://healthit.ahrq.gov/images/dec08bcmareport/bcma_issue_paper.htm
- “Research has demonstrated successful reductions in the rate of **medication administration** and dispensing errors after the implementation of barcoding systems (8 - 16) ”
 - Reference 8 and 9 are on the dispensing process that are elegant and very convincing for the dispensing process not BCMA.
 - Reference 10-16 are not research studies showing reduction in errors but opinion pieces.
 - They assume that BCMA will decrease errors and give commentary from that perspective.
 - None of the references are research to show decrease medication errors.

Evidence Based Practice?

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 - 8. Poon EG, Cina JL Churchill W, Patel N, et al. Medication dispensing errors and potential adverse drug events before and after implementing bar code technology in the pharmacy. *Ann Intern Med* 2006 Sep 19 ;145 (6):426-34.
 - 9. Poon EG, Cina JL, Churchill WW, et al. Effect of bar-code technology on the incidence of medication dispensing errors and potential adverse drug events in a hospital pharmacy. *AMIA Annu Symp Proc* 2005:1085.
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 - 10. Patterson ES, Rogers ML, Render ML. Fifteen best practice recommendations for bar-code medication administration in the veterans health administration. *Jt Comm J Qual Saf* 2004 Jul ;30 (7):355-65.
 - 11. Wright AA, Katz IT. Bar coding for patient safety. *N Engl J Med* 2005 ;353:329 -31.
 - 12. Patchett JA. Bar coding: A practical approach to improving medication safety. *ASHP Advantage; North Shore LIJ; Hospira* ; 2004:1-11.
 - 13. Department of Health and Human Services: Food and Drug Administration. Bar code label requirements for human drug products and biological products; final rule. *Federal Register* 2004 ;69 (38):201-601.
 - 14. Department of Health and Human Services: Food and Drug Administration. Bar code label requirements for human drug products and biological products; final rule. *Federal Register* 2004 ;69 (38):201-601.
 - 15. The Joint Commission. <http://www.jointcommission.org/>. Accessed August 30, 2008.
 - 16. Kohn LT, Corrigan JM, Donaldson MS. *To err is human: building a safer health system*. Washington , DC : National Academy Press; 1999.

Evidence Based Practice

- AHRQ Paper CPOE
http://healthit.ahrq.gov/images/jan09cpoereport/cpoe_issue_paper.htm
- CPOE systems and CDS can improve medication safety (8-11), quality of care (12-15) and reduce costs of care.(16) They can also improve compliance with provider guidelines,(17-18) as well as the efficiency of hospital workflow. (19-20)
 - Prospective, Comparative Studies
 - Randomized Trials
 - Meta Analysis

Evidence Based Practice

- AHRQ Paper CPOE

http://healthit.ahrq.gov/images/jan09cpoereport/cpoe_issue_paper.htm

- 8. Bates DW, Leape LL, Cullen DJ, Laird N, Petersen LA, Teich JM, et al. Effect of computerized physician order entry and a team intervention on prevention of serious medication errors. *JAMA* 1998 Oct 21; 280(15):1311-16.
- 9. Bates DW, Teich JM, Lee J, Seger D, Kuperman GJ, Ma'Luf N, et al. The impact of computerized physician order entry on medication error prevention. *J Am Med Inform Assoc* 1999 Jul-Aug; 6(4): 313-21.
- 10. Kaushal R, Shojania KG, Bates DW. Effects of computerized physician order entry and clinical decision support systems on medication safety: a systematic review. *Arch Intern Med* 2003 Jun 23; 163(12): 1409-16.
- 11. Teich JM, Merchia PR, Schmitz JL, Kuperman GJ, Spurr CD, Bates DW. Effects of computerized physician order entry on prescribing practices. *Arch Intern Med* 2000 Oct 9; 160(18):2741-7.
- 12. Shojania KG, Yokoe D, Platt R, Fiskio J, Ma'luf N, Bates DW. Reducing vancomycin use utilizing a computer guideline: results of a randomized controlled trial. *J Am Med Inform Assoc* 1998 Nov-Dec; 5(6):554-62.
- 13. Dexter PR, Perkins SM, Maharry KS, Jones K, McDonald CJ. Inpatient computer-based standing orders vs. physician reminders to increase influenza and pneumococcal vaccination rates: a randomized trial. *JAMA* 2004 Nov 17; 292(19):2366-71.
- 14. Chertow GM, Lee J, Kuperman GJ, Burdick E, Horsky J, Seger DL, et al. Guided medication dosing for inpatients with renal insufficiency. *JAMA* 2001 Dec 12; 286(22):2839-44.
- 15. Peterson JF, Kuperman GJ, Shek C, Patel M, Avorn J, Bates DW. Guided prescription of psychotropic medications for geriatric inpatients. *Arch Intern Med* 2005 Apr 11; 165(7):802-7.
- 16. Tierney WM, Miller ME, Overhage JM, McDonald CJ. Physician inpatient order writing on microcomputer workstations: effects on resource utilization. *JAMA* 1993; 269(3):379-83.
- 17. Overhage JM, Tierney WM, Zhou XH, McDonald CJ. A randomized trial of "corollary orders" to prevent errors of omission. *J Am Med Inform Assoc* 1997 Sep-Oct; 4(5):364-75.
- 18. Dexter PR, Perkins S, Overhage JM, Maharry K, Kohler RB, McDonald CJ. A computerized reminder system to increase the use of preventive care for hospitalized patients. *N Engl J Med* 2001 Sep 27; 345(13):965-70.
- 19. Taylor R, Manzo J, Sinnott M. Quantifying value for physician order-entry systems: a balance of cost and quality. *Healthc Financ Manage* 2002 Jul; 56(7):44-8.
- 20. Lee F, Teich JM, Spurr CD, Bates DW. Implementation of physician order entry: user satisfaction and self-reported usage patterns. *J Am Med Inform Assoc* 1996 Jan-Feb; 3(1):42-55.

Observational Studies on BCMA

- AJHP Vol. 64, Issue 5, 536-543. 2007
 - Paper to BCMA, eMAR value unclear
- AJHP Vol. 65, Issue 17, 1661-1666. 2008
 - majority of errors detected by a BCMA system were judged to be benign and pose minimal safety risks
- AJHP Vol. 66(12):1110-5. 2009
 - MICU decrease in wrong time errors
- AJHP Vol. 66(13): 1202-1210. 2009
 - No change in errors for Med/Surg units
 - Better charting in ICU
- J Pediatr 2009;154:363-8
 - Neonatal ICU – generalizable?

May not be the technology

- UCSF Integrated Nurse Leadership Program 7 Hospitals comparison
 - 56.8% reduction in medication administration errors
 - achieved through adherence to a set of six "best practice" procedures
- Kaiser Permanente (KP) MedRite is a comprehensive program focused on improving the safety and reliability of medication administration in the hospital setting.
- Conclusion: Improve the process before you implement technology.

Observational Study Conclusions

- eMAR to BCMA gap in knowledge
- eMAR to best practice gap.
- It is the process not the technology with medication administration.

Evidence Base Practice

REVIEW ARTICLE

The Effect of Computerized Physician Order Entry on Medication Prescription Errors and Clinical Outcome in Pediatric and Intensive Care: A Systematic Review

Floor van Rosse, MSc^a, Barbara Maat, PharmD^b, Carin M. A. Rademaker, PharmD, PhD^b, Adrianus J. van Vught, MD, PhD^a, Antoine C. G. Egberts, PharmD, PhD^c, Casper W. Bollen, MD, PhD^a

- Conclusion: Introduction of computerized physician order entry systems clearly reduces medication prescription errors

Evidenced Based Practice

Improvements in MD performance resulting from computerized prompting systems are so striking and consistent that further randomized trials could be considered unethical.

Austin. Effect of physician reminders on preventive care: meta-analysis of RCTs. [SCAMC Proceedings 1994;18-121-5](#)

Evidence Based Practice

Doing what matters

- Mortality Improvements with CPOE
 - One Study showed increase in Mortality
 - Other follow ups showing no change to slight decrease.
 - 50% decrease (Children's Hospital of Pittsburg)
 - 2.49% versus Medicare Average 4.41% (Methodist Peoria)
- Hospitals with automated notes and records, **order entry, and clinical decision support** had fewer complications, lower mortality rates, and lower cost
 - Amarasingham R, Plantinga L, Diener-West M, Gaskin DJ, Powe NR. Clinical information technologies and inpatient outcomes: a multiple hospital study. *Arch Intern Med.* 2009;169(2):108-114.
- BCMA evidence of better outcome?

Evidence Based Practice?

BCMA Studies

- Weak Study designs
 - Compare to Unit Dose studies
 - More observational studies appearing
- General decrease to no change in errors (with wrong time filtered out)
- Mostly timing improvements
- No Outcome or mortality results
- No Comparison with eMAR to BCMA
- Non-Tech interventions similar result

Evidence Based Practice CPOE Studies

- Several prospective comparatives
- Numerous Systematic Reviews
- Strong Study designs
- Strong evidence of decrease in errors
- Moderate evidence of decrease in mortality, costs and complications

Meaningful Use – Initial Statement

Meaningful Use Matrix of June 16

- “Conduct medication administration using bar coding”

Comment Period

Comment

- Conduct medication administration using bar coding – This objective should not be included until the benefit of bar-code medication administration (BCMA) technology is proven to promote safe and efficient care to patients. The Committee should consider replacing this 2013 objective with “documenting medication administration with an electronic medication administration record (eMar).”

Meaningful Use

Final August 2009

- “Conduct closed loop medication management, including **eMAR** and Computer-assisted administration”. (2013)
- Use CPOE for all orders (2011)
 - Hospitals must show 10% (2011)
- Use CPOE for all orders (2013)
- Use CDS at point of care (2011 & 13)

Government, Purchasers and Experts

- Massachusetts Mandate
- Leapfrog Group
- National Quality Forum

Massachusetts Law

- Massachusetts Bill 2863
- CPOE by October 1, 2012
- BCBS Requirement
- MA Report
 - ADE's
 - Renal Dosing
 - Guidelines

**Saving Lives,
Saving Money:**

**The Imperative for
Computerized Physician Order Entry
in Massachusetts Hospitals**

Leapfrog Group for Patient Safety

- Consortium of major companies and other large private and public healthcare **purchasers** provide health benefits to more than 37 million Americans.
- Mission: Promote High Value Healthcare
 - Evidenced based Hospital Referral
 - ICU Physician Staffing
- **Adoption of CPOE!**

National Quality Forum

- 34 Safe Practices for Better Healthcare 2009
- Only practices that have been demonstrated to be effective in reducing adverse events
- Examples:
 - Hand Hygiene
 - Influenza Prevention
 - Venous Thrombosis Prevention
 - Pharmacist Leadership Structures
- **Adoption of CPOE!**

CPOE Isn't Easy, but Worth It...

From the Iliad, when Odysseus finds himself alone and on enemy territory:

**“Be strong saith my heart; I am a soldier;
I have seen sights worse than this”**

- The following are anticipated arguments in light of spotty and incomplete evidence that we still should implement BCMA.
- Each side of the argument has legitimate reasons
- The right hand column supports CPOE over BCMA

The Arguments

- **Argument 1: We Cannot Wait**
- **Argument 2: Any Effort to Improve Is Better Than the Current State of Affairs**
- **Argument 3: Emulating Successful Organizations Can Speed Improvement**
- **Argument 4: The Effectiveness of Some Quality-Improvement Strategies Is Obvious**
- **Argument 5: Promising but Unproven Strategies Can Catalyze Innovation**
- **Argument 6: The Framework of Evidence-Based Medicine Does Not Apply to Quality Improvement**
- **Argument 7: Developing Evidence in Quality Improvement Is Too Costly**

We cannot wait — the need to improve the quality of care is urgent.

Why proceeding quickly is critical

Thousands of patients are injured or killed each year by medical errors.

Why evaluation is critical

The need to improve the treatment of many diseases is equally urgent, yet we demand rigorous evidence that a therapy works before recommending it widely.

Any effort to improve quality is better than the current state of affairs.

Why proceeding quickly is critical

- On balance, the harms of quality improvement are likely to be far less than those of the status quo.

Why evaluation is critical

- Knowledge of the harms and opportunity costs of quality improvement is important for an understanding of the net benefit to patients and health care systems, which is often small.

Emulating successful organizations can speed effective improvement.

Why proceeding quickly is critical

- Emulation and collaboration provide an efficient means of disseminating potentially effective solutions.

Why evaluation is critical

- Emulation and collaboration can incorrectly promote or even overlook interventions that have not worked.

The effectiveness of some quality improvement strategies is obvious.

Why proceeding quickly is critical

- Insistence on evidence may lead us to underuse interventions that are obviously effective.

Why evaluation is critical

- Even though many quality improvement practices have a simple rationale, they may be less effective than expected and can be difficult to implement fully.

Innovation can be catalyzed by dissemination of strategies that have promise but are unproven.

Why proceeding quickly is critical

- Preliminary data provide an important opportunity to speed innovation and improve care rapidly.

Why evaluation is critical

- Flawed, biased, or incomplete data may lead to adoption of interventions that are ineffective or harmful.

The framework of evidence-based medicine does not apply to quality improvement.

Why proceeding quickly is critical

- The nature of quality improvement exempts it from the usual strategies of assessment.

Why evaluation is critical

- Given the complexity of quality and safety problems, the complexity of their causes, and how little we understand them, we should use rigorous study designs to evaluate them.

Developing evidence in quality improvement is too costly.

Why proceeding quickly is critical

- The resources and expertise required to evaluate quality and safety interventions rigorously make trials impractical, particularly when the field is moving so quickly.

Why evaluation is critical

- As compared with the large opportunity costs incurred by wide implementation of ineffective quality and safety strategies, investments in better evaluation would be small.