

# *Evaluation and Actions: Safety Overall and Medication Safety in the Perioperative Setting*

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# Disclosure Summary

*David W. Bates, MD, MSc*

Consultant; EarlySense

Cash compensation; CDI (Negev), Ltd

Equity; Ethosmart

Equity; Intensix

Equity; MDClone

❖ **Do not intend to discuss off-label/investigative use.**

# Overview

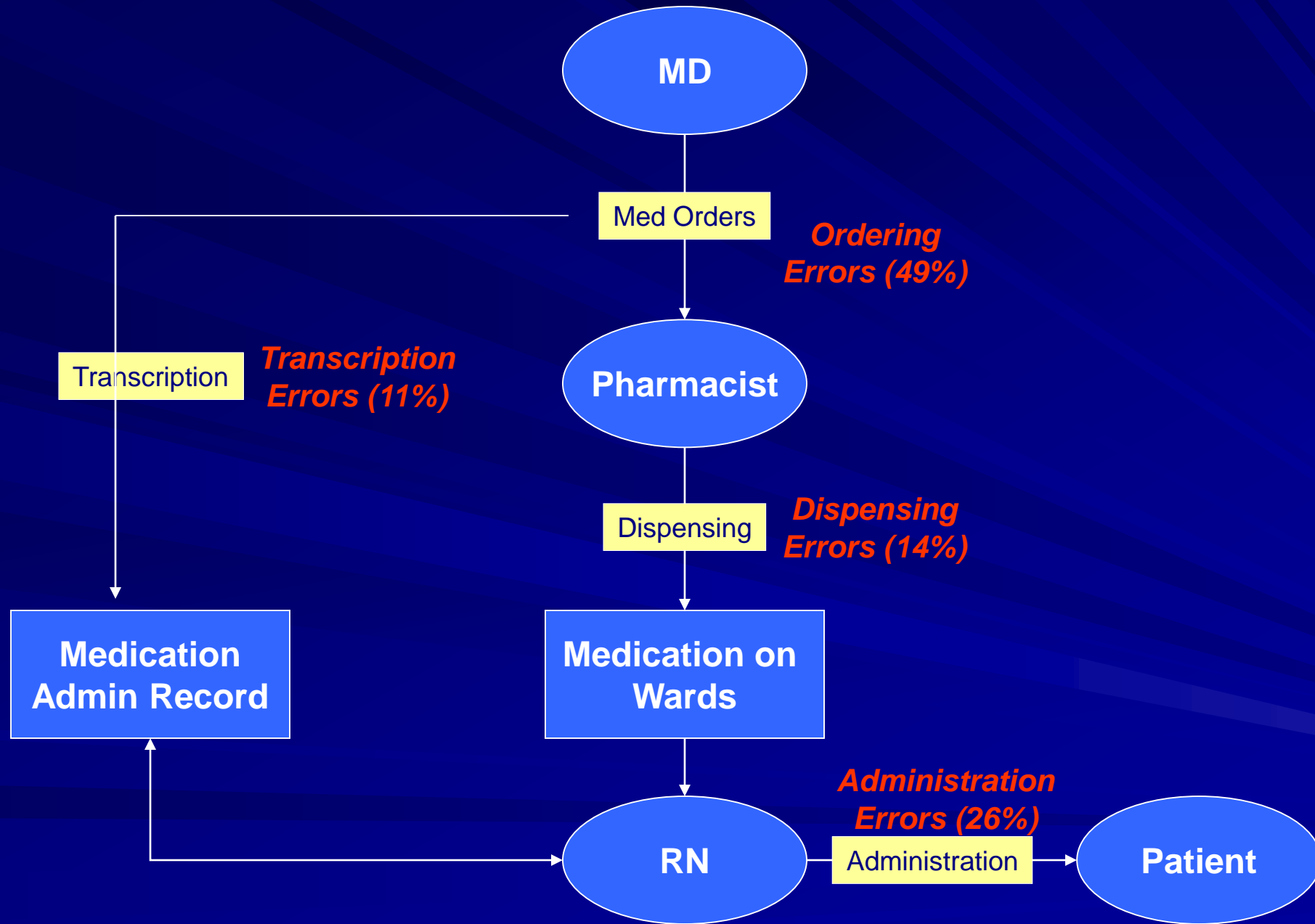
- Big picture with medications
- Medication safety in anesthesia
  - Nanji study
  - Next steps
- Additional approaches for improving—  
PROSPECT results
- Conclusions

# ADE Rate By Site in Massachusetts Community Hospitals

	Total	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6
ADE Rate*	15	19.5	11	15.5	17	15	12.5
% Prev	75	72	82	71	85	73	68

*\*Per 100 admissions*

Range: 11-19.5 for rate  
68-85 for percent preventable

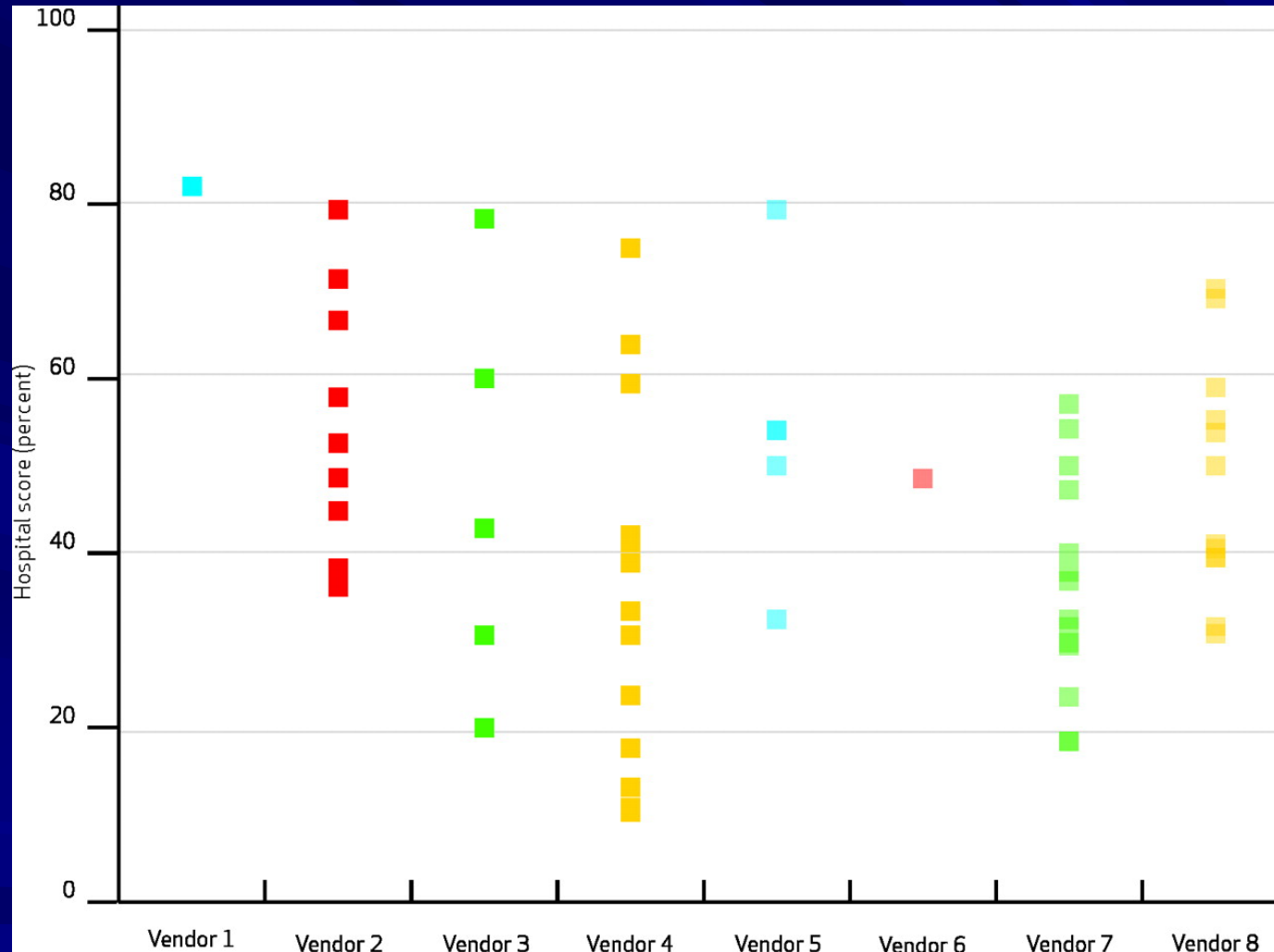


# Safety Results of CPOE Decision Support Among Hospitals

- 62 hospitals voluntarily participated
- Simulation detection only 53% of orders which would have been fatal
- Detected only 10-82% of orders which would have caused serious ADEs
- Almost no relationship with vendor

*Metzger et al, Health Affairs 2010*

# Hospital Scores by Vendor



Jane Metzger, Emily Welebob, David W. Bates, Stuart Lipsitz, and David C. Classen,  
Mixed Results In The Safety Performance Of Computerized Physician Order Entry,  
Health Affairs, Vol 29, Issue 4, 655-663

HealthAffairs



# Current Situation at Partners

- Just implemented Epic 5/2015
- Getting one alert for every two medication orders
  - Over 95% are overridden (appropriately)
  - Serious warnings being overridden at same rate as less important
  - Can't deliver some of the clinically most important suggestions for technical reasons
- In process of trying to get back to where we were



# Perioperative Medication Error Data

## Direct Observation

- Alan Merry and colleagues<sup>1</sup>
- 5 operating rooms in New Zealand
- 11.6% ME rate using manual record keeping
- 9.1% ME rate using a homegrown electronic anesthesia documentation system

Merry AF, Webster CS, Hannam J, Mitchell SJ, Henderson R, Reid P, Edwards KE, Jardim A, Pak N, Cooper J, Hopley L, Frampton C, Short TG. Multimodal system designed to reduce errors in recording and administration of drugs in anaesthesia: prospective randomised clinical evaluation. *BMJ*. 2011;343:d5543.

## Evaluation of Perioperative Medication Errors and Adverse Drug Events

Karen C. Nanji, M.D., M.P.H., Amit Patel, M.D., M.P.H., Sofia Shaikh, B.Sc., Diane L. Seger, R.Ph., David W. Bates, M.D., M.Sc.

### ABSTRACT

**Background:** The purpose of this study is to assess the rates of perioperative medication errors (MEs) and adverse drug events (ADEs) as percentages of medication administrations, to evaluate their root causes, and to formulate targeted solutions to prevent them.

**Methods:** In this prospective observational study, anesthesia-trained study staff (anesthesiologists/nurse anesthetists) observed randomly selected operations at a 1,046-bed tertiary care academic medical center to identify MEs and ADEs over 8 months. Retrospective chart abstraction was performed to flag events that were missed by observation. All events subsequently underwent review by two independent reviewers. Primary outcomes were the incidence of MEs and ADEs.

**Results:** A total of 277 operations were observed with 3,671 medication administrations of which 193 (5.3%; 95% CI, 4.5 to 6.0) involved a ME and/or ADE. Of these, 153 (79.3%) were preventable and 40 (20.7%) were nonpreventable. The events included 153 (79.3%) errors and 91 (47.2%) ADEs. Although 32 (20.9%) of the errors had little potential for harm, 51 (33.3%) led to an observed ADE and an additional 70 (45.8%) had the potential for patient harm. Of the 153 errors, 99 (64.7%) were serious, 51 (33.3%) were significant, and 3 (2.0%) were life-threatening.

**Conclusions:** One in 20 perioperative medication administrations included an ME and/or ADE. More than one third of the MEs led to observed ADEs, and the remaining two thirds had the potential for harm. These rates are markedly higher than those reported by retrospective surveys. Specific solutions exist that have the potential to decrease the incidence of perioperative MEs. ([ANESTHESIOLOGY 2016; 124:25-34](#))

# Key Findings

- 277 operations observed
- 3,671 medication administrations
- 193 errors and/or ADEs (5.3%)
  - ADEs in 51 instances
  - 70 potential ADEs

# Potential of Solutions in Periop Setting Based on Nanji Study

## Technology

- Bar code-assisted anesthesia documentation (17.0% of MEs and 25.5% of PADEs)
- Specific drug decision support (28.8% of MEs, 13.7% of PADEs and 58.8% of ADEs)
- Alerts (52.9% MEs, 32.4% PADEs and 94.1% ADEs)

# Potential of Solutions Based on Nanji Study

## Process

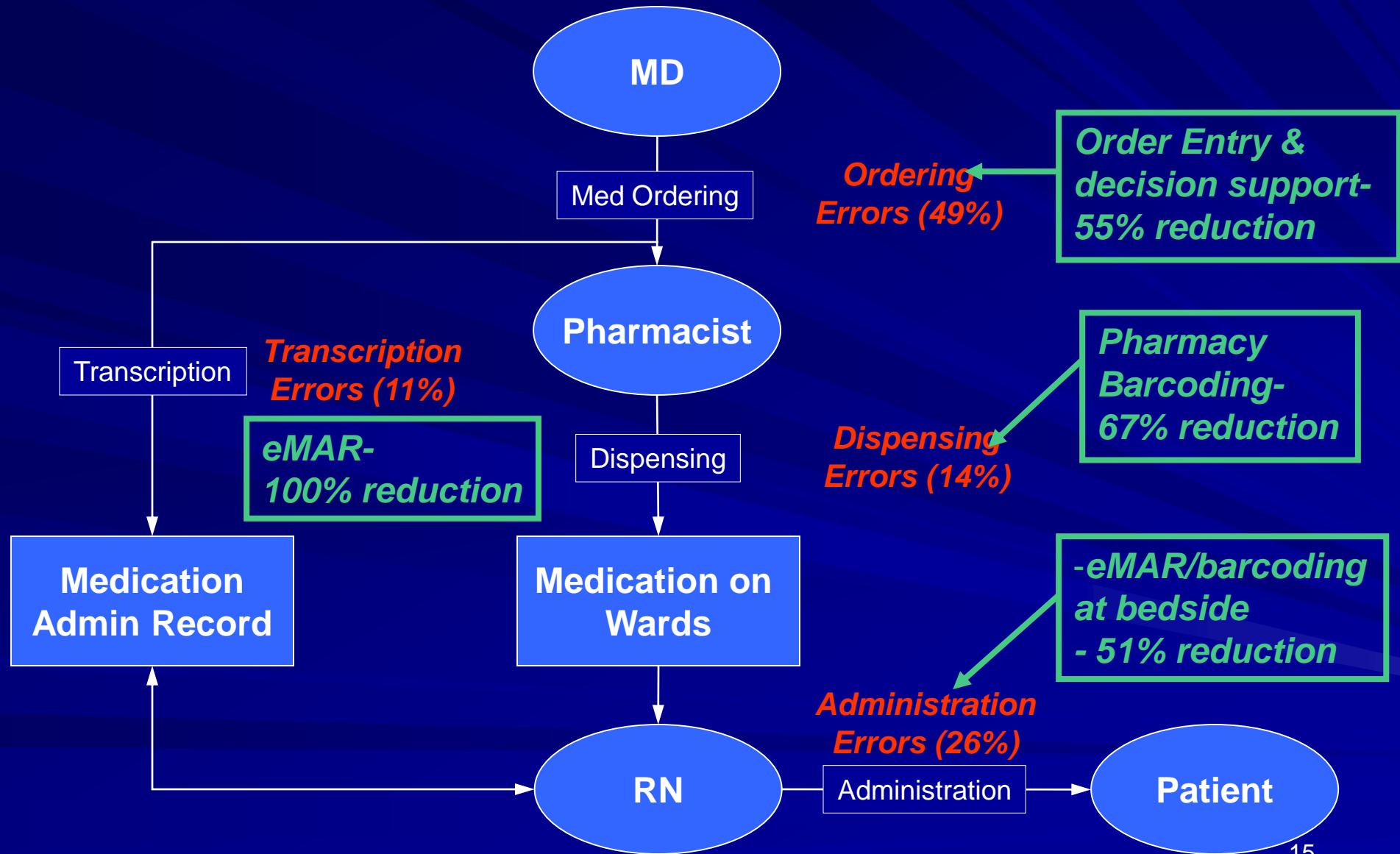
- Timing of documentation (35.3% MEs, 21.6% PADEs and 62.8% of ADEs)
- Reducing opportunity for workarounds (24.2% MEs and 36.3% PADEs)
- Connecting infusions to most proximal IV port (1.3% MEs and 2.0% PADEs)

# Next Steps

- Have developed a set of safety-related rules using a consensus process which can be used in the OR
- Implementing these in Epic
  - Issues with doing outside Epic, writing back
- Will test in RCT



# Impact of CPOE and Bar-Coding on Serious Med Errors





# PROSPECT Goal

- To transform the acute care environment through implementation of a patient-centered intervention
  - Focus on patients and care partners
  - Intensive care and oncology units



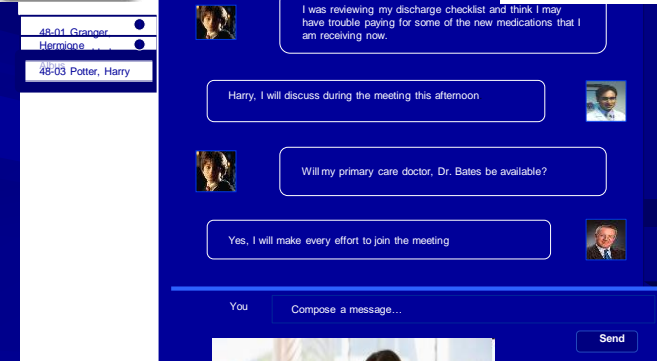
# Patient-Centered Tool Kit (PCTK) Components

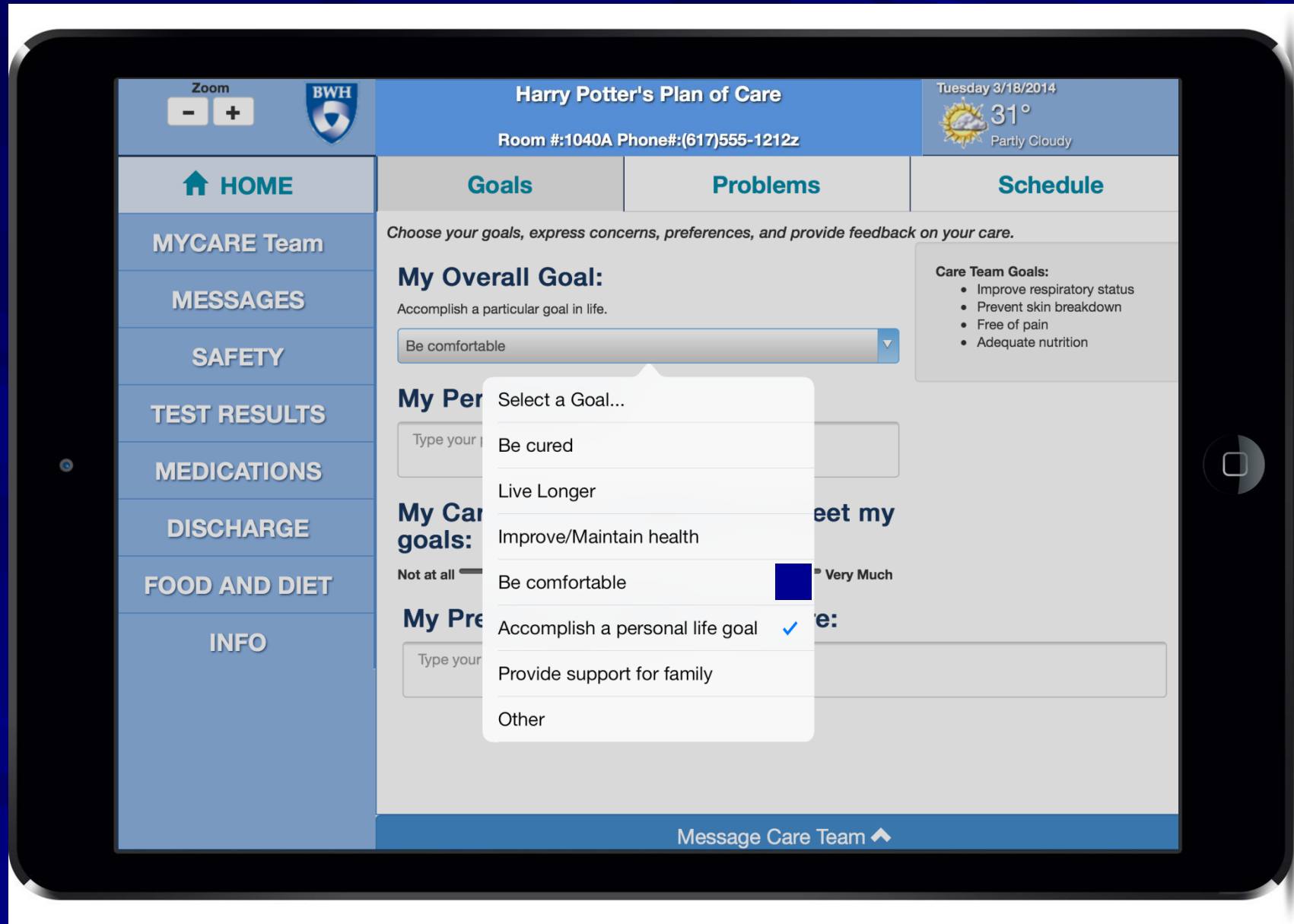


“Patient-facing”



“Provider-facing”





# Unit-Level Dashboard

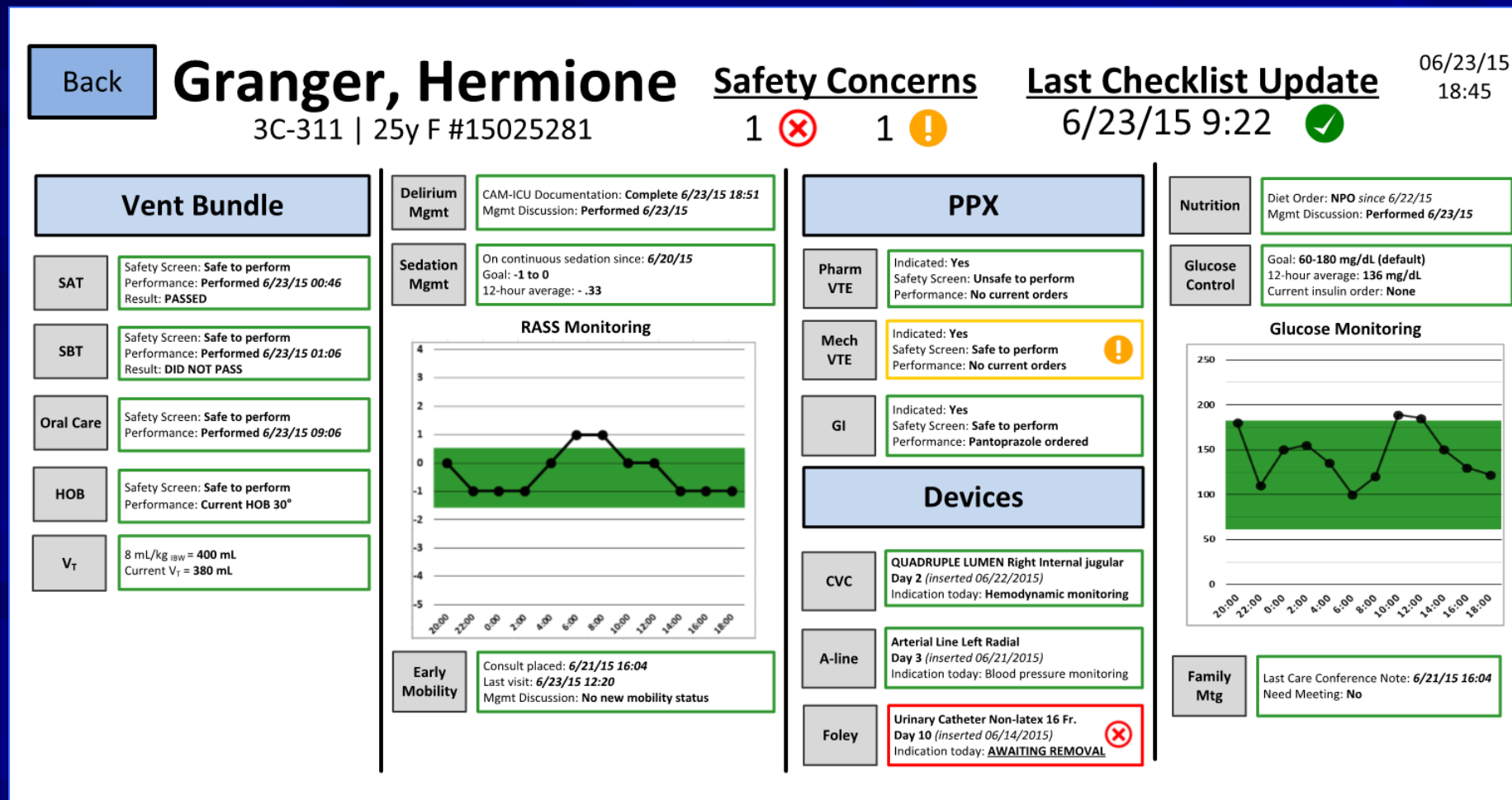
MICU-3B Unit Safety Dashboard

06/23/15  
18:45

		Vent					Delirium Mgmt	Sedation Mgmt	Early Mobility	Family Mtg	Glucose Control	Nutrition	PPX			Devices		
		SAT	SBT	Oral Care	HOB	Vr							Pharm VTE	Mech VTE	GI	CVC	A-line	Foley
31	GR, HERMIO	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Green	Yellow	Green	Green	Green	Green	Red
32	DU, DUDLEY	Gray	Gray	Gray	Gray	Gray	Gray	Gray	Green	Green	Green	Green	Green	Green	Gray	Gray	Gray	Gray
33	MA, DRACO	Green	Yellow	Gray	Yellow	Green	Green	Gray	Yellow	Green	Green	Red	Green	Green	Green	Yellow	Green	Yellow
34	WE, WILLIA	Green	Green	Green	Green	Green	Red	Green	Red	Green	Green	Gray	Gray	Gray	Red	Green	Gray	Green
35	HI, DOBBY	Red	Gray	Green	Green	Green	Green	Gray	Green	Gray	Red	Green	Green	Green	Green	Green	Gray	Green
36	VA, EMMELI	Gray	Gray	Gray	Gray	Gray	Gray	Green	Gray	Gray	Green	Green	Green	Green	Gray	Gray	Yellow	Gray
37	UM, DOLORE	Green	Yellow	Green	Green	Red	Green	Green	Green	Green	Green	Red	Yellow	Red	Green	Green	Green	Gray
38	TO, THEODO	Gray	Gray	Gray	Gray	Gray	Gray	Green	Red	Red	Green	Green	Green	Green	Gray	Green	Green	Green
39	SQ, ROCKET	Gray	Gray	Gray	Gray	Gray	Gray	Gray	Green	Red	Green	Gray	Green	Gray	Gray	Gray	Gray	Green
40	MO, BULLWI	Green	Green	Green	Green	Green	Green	Green	Red	Green	Green	Green	Green	Green	Green	Red	Green	Green

# Patient-Level Dashboard

- Data from EHR (and Safety Checklist in MICU) used to describe high-risk states alerted in unit-level dashboard





# PROSPECT Results:

## Preventable Medical Harms

	Pre Intervention (n=1047)	Post Intervention (n=1092)	P Value
<b>Preventable Medical Harms</b>			
<b>All preventable medical harms</b>	<b>64.8 (6.7-74.1)</b>	<b>47.5 (41.3-54.6)</b>	<b>.0013</b>
Medication errors	6.42 (4.2-9.9)	4.08 (2.25-7.4)	.23
Catheter associated urinary tract infection	3.73 (2.4-5.9)	1.24 (.56-2.8)	.02
Bloodstream infection	1.72 (.83-3.6)	1.04 (.44-2.5)	.38
Ventilator associated events	11.07	9.94	
Falls	0.18 (0.03-1.3)	0.35 (0.1-1.4)	0.60
Pressure ulcers	41.70 (34.9-49.8)	30.2 (25.1-36.5)	0.01

\*Adjusted for age, sex, Caucasian race, insurance, Charlson score, median income, and care unit LOS

*Critical Care, 2017*

# PROSPECT Results:

## Patient/Care Partner Experience

	Pre Intervention	Post Intervention	P Value
Overall hospital rating (HCAHPS Top Box Score, range 0-100)	68.0 (59, 55.8-82.2)	92.1 (85.2-99.0)	.03
Overall Satisfaction (F-S Total Score, range 0-100)	83.86 (108, 80.8-86.9)	90.21 (168, 88.3-92.1)	.002
Satisfaction with care	84.65 (109, 81.8-87.5)	91.35 (163, 89.6-93.1)	<.0001
Satisfaction with decision making	82.70 (107, 78.8-86.6)	88.67 (169, 86.4-91.0)	.1004
Mean Global Concordance Score: %, 95% CI	26.9% (133, 4.8-49)	34.0% (74, 10.9-57.1)	<.0001

\*Adjusted for age, sex, Caucasian race, insurance, Charlson score, median income, and care unit LOS



# Conclusions

- Anesthesia safety remains an issue
  - Medication safety particular opportunity now
- Need to automate medication process in OR
- Utilize modern checks around medications, especially for drugs in smart pumps and syringes
  - Have EHR and these devices communicate
- Key next step in improving anesthesia safety

“Insanity is doing the same  
things the same way and  
expecting different results”

*Albert Einstein*