

Lessons learned with Bar-coding and eMAR.



Thomas W. Cooley, RPh, MBA
Assistant Director
Pharmacy Services

Brigham and Women's Hospital
Boston, MA

Annual Volume Indicators

720 inpatient beds	45,000 admissions
Inpatient doses dispensed	6,200,000 doses
Medication Orders Reviewed and Approved	1,598,696 orders
Sterile Products prepared	211,903 patient specific admixtures
Barcode Repackage Center	1, 382,406 doses

Results

Total errors uncovered = 572
(2.96% of medications picked)

Staff Pharmacist intercepted only
69% (393/572) of total errors

19338
Medication
Doses Observed



393 (2.03%) errors
intercepted by
routine checking



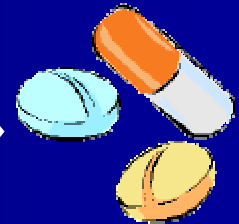
Checking by Staff
Pharmacist

179 (0.93%) errors
missed by staff
pharmacist



2nd Checking by
Research
Pharmacist

0.93% (179/19338)
of medications
picked would leave
pharmacy with
error



Medications Sent
to Patient Units

Medications Picking
by Pharmacy
Technician

Incentive: 99.1% accuracy is not good enough!

- ❑ **More than 44,000 errors occur per year in a 735-bed hospital (6 million doses/yr)**
- ❑ **Many dispensing errors have the potential to harm patients.**
 - **> 9500 errors with potential to harm patients occur per year in a 735-bed hospital**
 - **Only 1/3 of these serious errors intercepted prior to administration.**
 - **> 35 errors with potential to harm patients occur *per day* in a 720-bed hospital.**

Food for Thought

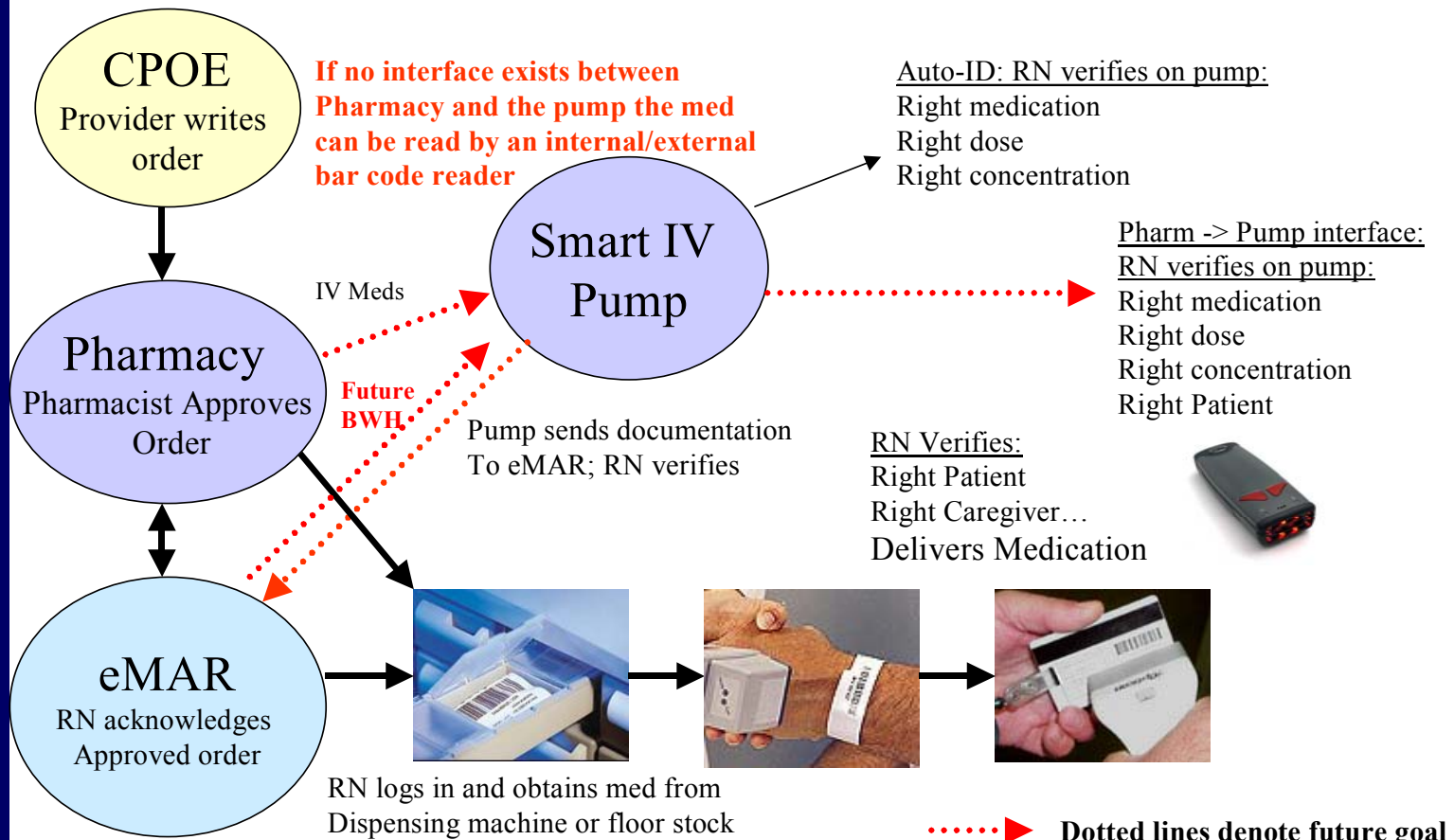
If 99.9% were good enough:

- ❑ There would be a major plane crash every 3 days.**
- ❑ 12 babies would be given to the wrong parents each day.**
- ❑ There would be 37,000 ATM errors every hour.**

Source : Institute for Healthcare Improvement

Ideal Gold Standard

Medication Administration System



Development of Integrated Pharmacy Software Solution

- ❑ Bi-directional interface with eMAR
- ❑ Prioritizes medication orders
- ❑ Bar code scanning in all preparation, dispensing and delivery processes

Development of Integrated Pharmacy Software Solution

- ❑ **FED-EX[®] like tracking system**
 - From computerized order to delivery
- ❑ **Standard times of administration and prioritization**
- ❑ **Closes loop by providing end times to Order Entry system**
- ❑ **Comprehensive clinical lab info and drug information**

Infrastructure Decisions to Support eMAR/Bar Coding

- ❑ **Wireless communication**
- ❑ **Medication bar coding**
- ❑ **Employee ID badges**
- ❑ **Patient ID bracelets.**
- ❑ **Hardware**
- ❑ **Software application design**



Bar Code Selection – Data Matrix

□ Advantages

- Lot number, exp. Date, NDC number readable.
- 30 times smaller than a code 39 bar code.
- Higher degree of accuracy
- Data matrix bar code fonts easily printed with standard printers.

□ Disadvantages

- Specially programmed imager.
- Limited use.
- Imagers are more costly.



Bar Code Selection – Data Matrix

- ❑ 100% of drugs are bar coded.
- ❑ User Feedback
 - Reflective drug packages
 - User's ability to scan
 - Placement of bar code on disposable package coverings
 - Improve Quality of Bar Code on IV bags



A Bar Code that can't scan.....

Is just bad artwork.



Hardware Decisions

❑ 2D Imagers

- Both 1 and 2 dimensional bar codes
- Blue tooth compatible



❑ Computer Hardware

- Full size laptop
- Complete desktop functionality
- Mobile carts



Hardware/ Scanners

- ❑ **Durability issues with scanners due to frequent dropping**
- ❑ **All scanners are now being replaced. Features of new devices include:**
 - **Rubber- like covering protects the device if dropped and provides grip like surface.**
 - **New Software**
 - **Need to Turn Device on When New Battery is Loaded.**



Development of Integrated eMAR Software Solution

- ❑ Eliminates transcription
- ❑ Prioritizes medication administration for nurse
- ❑ Uses bar code scanning to confirm the “5 rights”.

Development of Integrated eMAR Software Solution

- ❑ Drug information links**
- ❑ Real time clinical lab data**
- ❑ Bi-directional wireless communication with pharmacy and Order Entry**

Estimated Costs

❑ Software development	\$2,703,000
❑ Hardware (laptops, carts)	\$1,000,000
❑ Scanners	\$ 625,000
❑ Construction/renovation	\$ 275,000
❑ Implementation /	\$3,700,000

Staff Training

❑ Total cost	\$8,303,000
--------------	-------------

Nurse Training

- ❑ **Mandatory 4-hour class**
- ❑ **Supplemental Computer Based Training Modules**
- ❑ **On-site Experts**
 - **Super Users**
 - **IS Analysts**
 - **Pharmacists**



Enhancement of Order Entry System

- ❑ Several deficiencies and software bugs identified**
- ❑ Several work arounds and practices issues identified.**
 - Required software support and MD practice changes around medication ordering.**
 - Verbal order practices needed to be addressed.**

Beware of Pharmacy Work Arounds

- ❑ Not scanning full dispense quantity – scan same item multiple times.**
- ❑ Cutting and pasting NDC information from database to dispensing system**
- ❑ Photocopying drug package bar codes**
- ❑ Pharmacist skips final scan – just sends it up and deal later**

Beware of Nursing Work Arounds

- ❑ Not scanning drug
- ❑ Not scanning patient at bedside
- ❑ Not scanning at all – overuse of emergency procedures
- ❑ Giving drugs from “stash” then scanning after the process is complete.

**Be careful what you wish
for....**

**“To err is human but to really
mess things up... you need a
computer”**

Anonymous



eMAR Lessons Learned

- ❑ **“Close-looped” MAS drives many practice changes for all disciplines**
- ❑ **Education and training costs vital to success.**
- ❑ **Clinicians must teach clinicians.**

eMAR Lessons Learned

- ❑ **Uncover and fix unknown processes that have been supporting the existing MAS**
- ❑ **Extreme variances in staff acceptance.**

eMAR Lessons Learned

- ❑ **Staff must to be involved in equipment decisions**
- ❑ **Must understand the workflow of all clinicians**
 - How to integrate eMAR and bar code scanning into their daily activity.
- ❑ **Must engage medical staff early on:**
 - * Screen design * Implementation * Training

eMAR Next Steps

- ❑ Design and implement Chemotherapy application.
- ❑ Integration of Emergency Department, Labor and Delivery, PACU, and Neonatal nurseries into eMAR process.
- ❑ Interface of Smart Pump platform:
 - Wireless server
 - Pharmacy and eMAR
- ❑ Role of RFID tags

Dispensing Process: *After* Barcode Technology

Dispensing Errors Uncovered

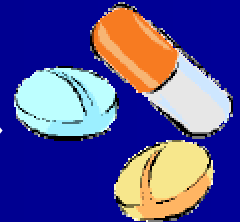
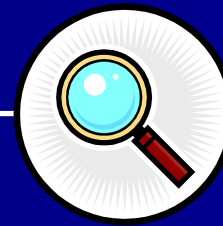
Dispensing Error
Detected for After
Period



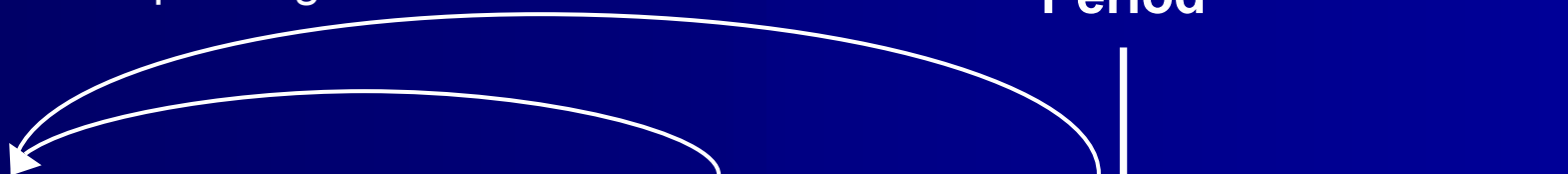
Medications Filling
by Pharmacy
Technician



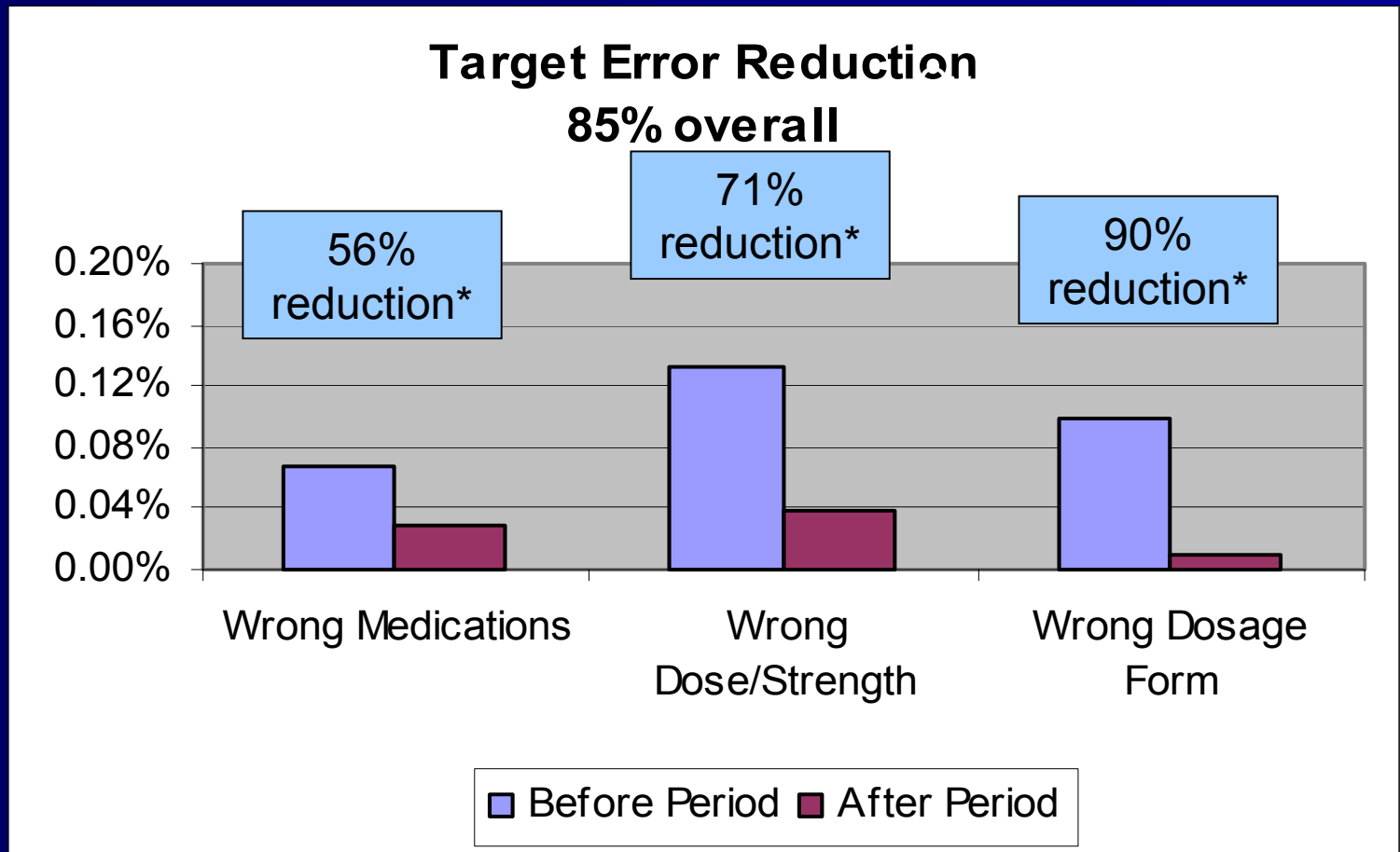
Checking by Staff
Pharmacist



Medications Sent
to Patient Units

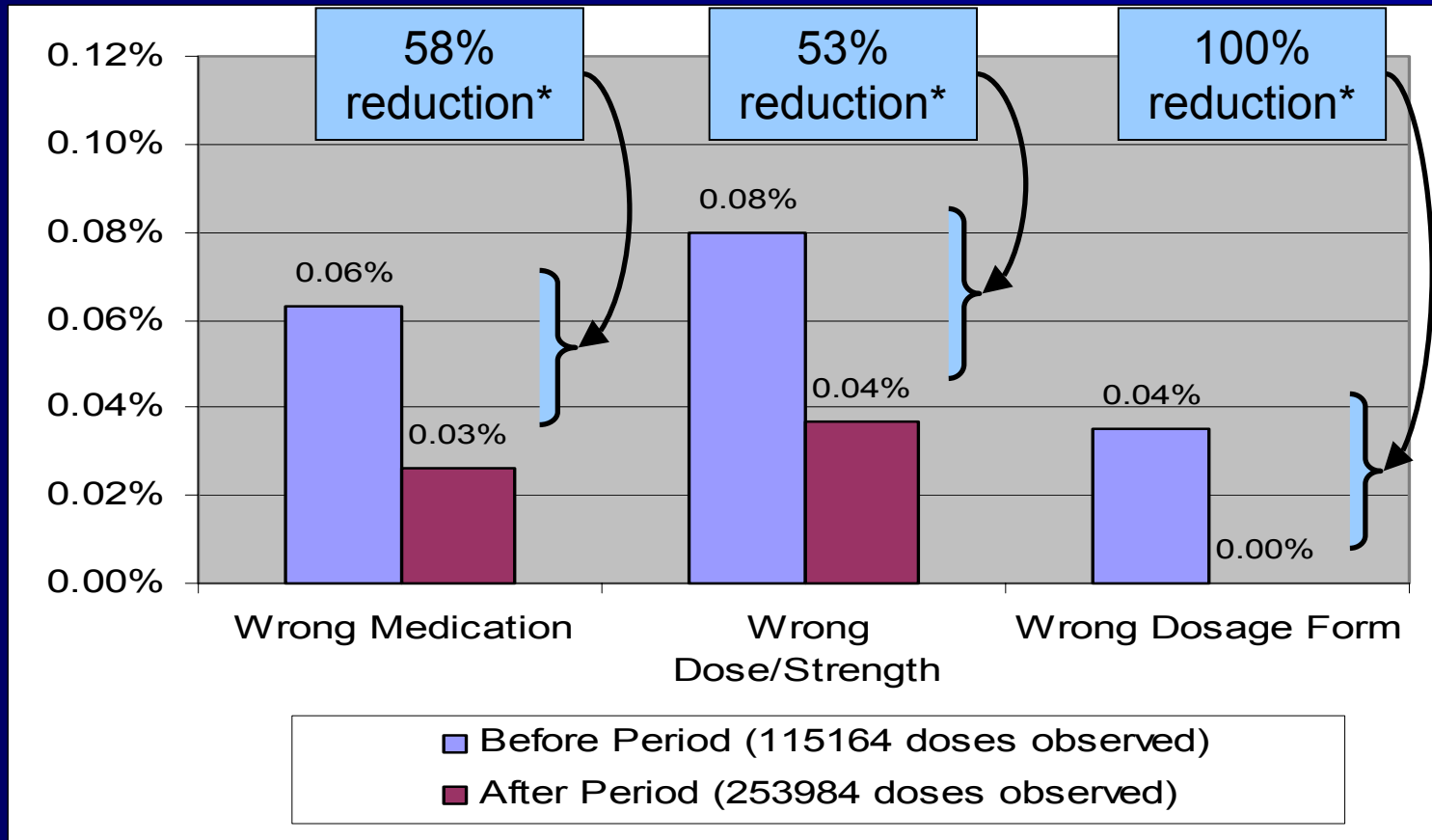


Barcode Technology Value: Dispensing Errors



* $p < 0.001$ (Chi-squared test)

Barcode Technology Value: Potential ADEs



* $p < 0.001$ (Chi-squared test)

Go USA !

