

# **Barcode Medication Administration: Implementation in an Intensive Care Unit**

Mary Wideman RN, MSN; Tim  
Anderson BS; Michael Whittler RPh,  
MBA; Nancy Dietz RPh, PhD

# Harry S. Truman Memorial VA Hospital

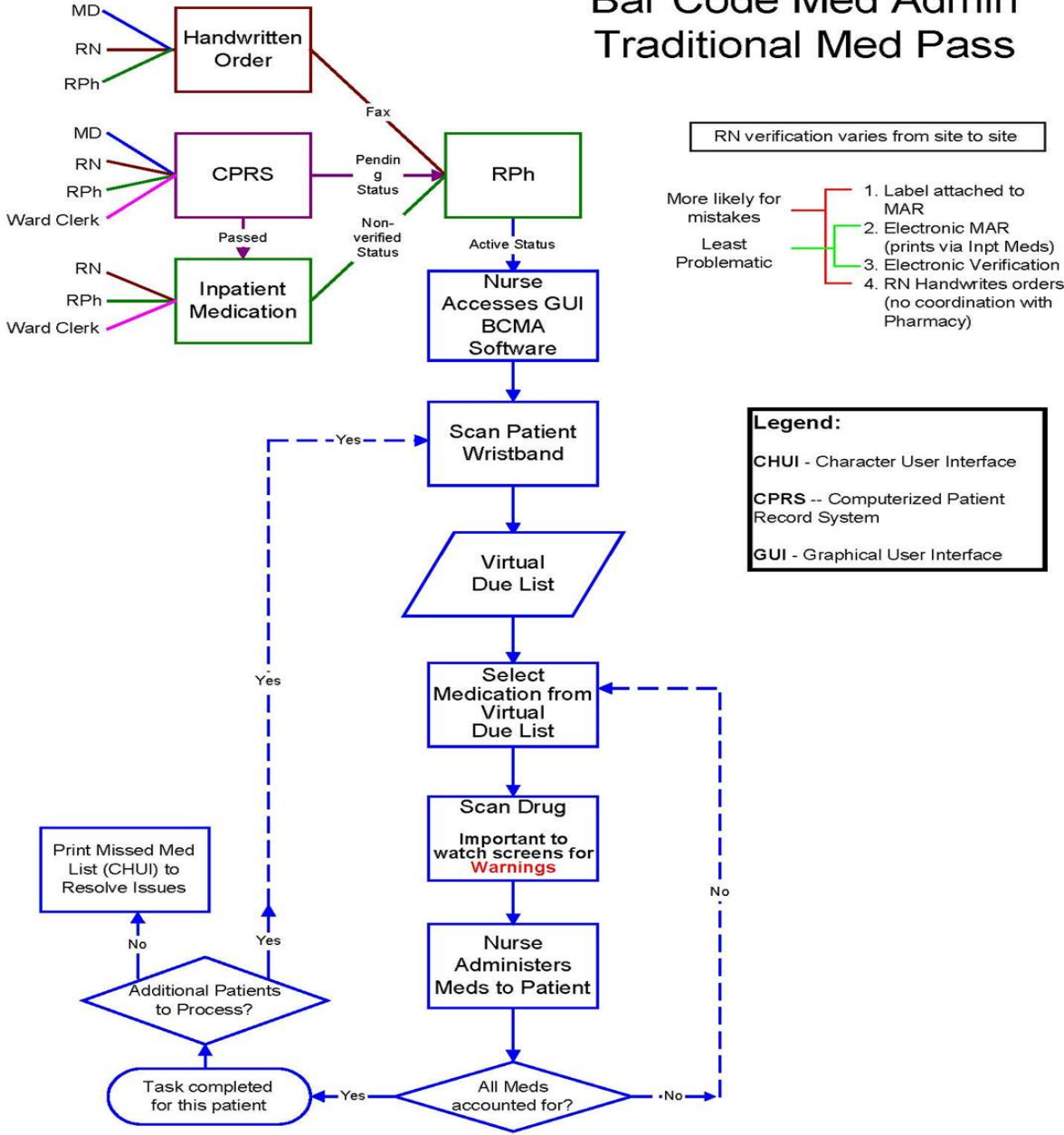
- VISN 15 Heartland Network
- 77 Acute Care Beds
- 41 Long Term Care Beds
- 10 ICU Beds
- 180-200 Open Heart Surgery Patients/Year



# What is Bar Code Medication Administration (BCMA)?

- The BCMA software automates the medication administration process.
- BCMA enhances accuracy and increases the efficiency of documentation.
- BCMA goal is Patient Safety:
  - **Right Patient**
  - **Right Drug**
  - **Right Dose**
  - **Right Time**
  - **Right Route**

# Bar Code Med Admin Traditional Med Pass



# BCMA Screen Shot

Bar Code Medication Administration - v3.0.4.18 - Patient Context is Joined

File View Reports Due List Tools Help

Missing Dose Medication Log Medication Admin History Allergies CPRS Med Order Flag

EJBHUS,CLZHT HIPLUI (MALE)  
 SSN = 101-12-6010  
 DOB = 8/11/1949 (55)  
 Height = 170cm, Weight = 112.41kg  
 Location = 4 MED-CO 425-A-CO

Virtual Due List Parameters:  
 Start Time: 06/03@1500 Stop Time: 06/03@1700

Schedule Types:  
 Continuous  On-Call  
 PRN  One-Time

**ALLERGIES: no known allergies ADRs: No ADRs on file**

| Status | Ver | Hsm | Type | Active Medication   | Dosage                       | Route | Admin Time | Last Action           |
|--------|-----|-----|------|---|------------------------------|-------|------------|-----------------------|
| G      | MVW |     | C    | NITROGLYCERIN PATCH<br>NITROGLYCERIN 0.4MG/HR PATCH   | 0.4 MG/HOUR,<br>NP_QAM       | SKIN  | 06/03@0900 | GIVEN: 6/3/2005@0946  |
|        | MVW |     | C    | INSULIN REG HUMAN INJ<br>INSULIN REG HUMAN 100 U/ML INJ NOVOLIN R<br><150=0 UNITS, 151-200=2 UNITS,<br>201-250=4UNITS, 251-300=6 UNITS, 301-350=8<br>UNITS, 351-400=10 UNITS, <60 or >400=CALL HO | SLIDING SCALE,<br>QID AC&HS  | SQ    | 06/03@1630 | GIVEN: 6/3/2005@1104  |
|        | MVW |     | C    | ALBUTEROL SOLN,INHL<br>ALBUTEROL SO4 0.083% INHL 3ML<br>IPPB FOR 72 hours WHILE AWAKE Provide<br>Brochodilation   | 3 MLS, Q4H HFN               | INHL  | 06/03@1700 | REFUSED: 6/3/2005@... |
|        | MVW |     | C    | IPRATROPIUM SOLN,INHL<br>IPRATROPIUM BROMIDE 0.02% INH SOLN 2.5ML<br>IPPB w ALBUTEROL & IPRATROPIUM   | 1 AMPULE<br>(2.5ML), Q4H HFN | INHL  | 06/03@1700 | REFUSED: 6/3/2005@... |

Unit Dose  IVP/IVPB  IV

Scanner Status: **Ready** Scan Medication Bar Code:

BCMA Clinical Reminders

| Count | Activity          |
|-------|-------------------|
| 4     | PRN Effectiveness |

WIDEMAN, MARY V COLUMBIA, MO VAMC Server Time: 6/3/2005 15:32

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# History

- BCMA Version 1 implemented in ICU, 3/00
- Version 1 problematic for several reasons:
  - Lack of functionality to document IV fluids
  - Lack of CPRS Med Order Button to document stat and now medications
- ICU ceased using BCMA Version 1, 11/00
- ICU implemented BCMA Version 2, 11/02

# History Continued

- Staff and management confidence in the enhanced software remained weak so a dual system of medication administration documentation was used
- BCMA Collaborative Team focus: To use BCMA to safely administer/document CABG patient's medications in BCMA
- FDA mandated barcode packaging of medications by 2006

# Why did we choose to focus on the CABG Patient?

## Coronary Artery Bypass Graft (CABG)

6ICU - Patient Education  
Harry S. Truman Memorial Veterans' Hospital



1. Blood Products
2. IV Fluids
3. IV Pumps
4. Special Monitors
5. IV Pumps

6. Special Internal Heart Monitor
7. Internal Monitors
8. Chest Tub/Chest Dressings

9. Breathing Tube
10. Chest Tube
11. BP Cuff/Heart Cables
12. Urine Bag

13. ICU Bed
14. Chest Tube System
15. Breathing Machine
16. Heart Monitor



# BCMA Implementation Challenges

- Labeling all medications with barcodes which will successfully scan
- Administration of stat medications
- Documentation of IV fluids/medications
- Work-arounds
  - Entry of Internal Entry Numbers (IENs) and patient identification numbers

# Bar Code Labels



# Work-around



# Improvements Implemented Prior to BCMA Vr.2

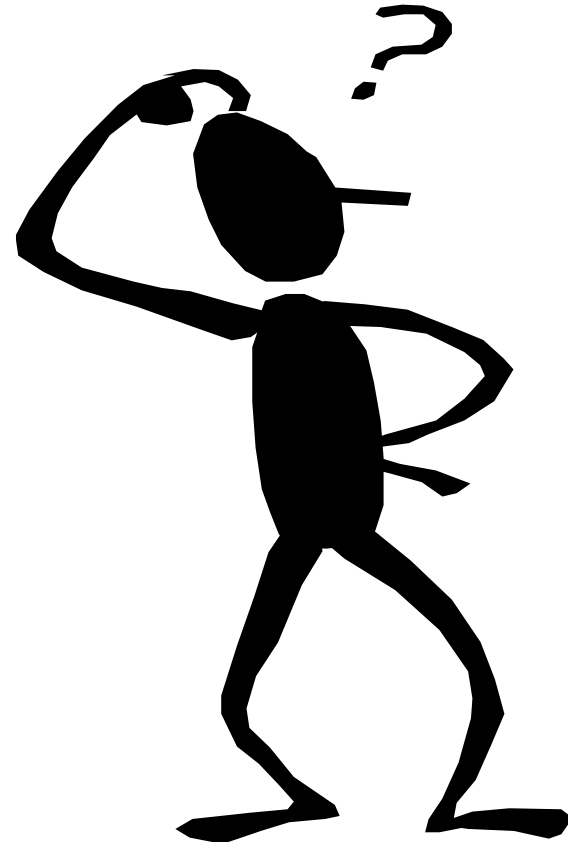
- Computer Hardware/Software:
  - Upgraded PCs at each ICU bedside with cordless scanners
  - Deployed roll-around laptop computer with scanner
  - IRM on-call 24 hours/day
  - BCMA Back-up System
  - Software change to allow entry of stat order/medication documentation
  - Cache software installation

# Ergonomics/Usability



# BCMA Collaborative

- **PDSA Cycles**
  - Plan
  - Do
  - Study
  - Act



# IVP/IVPB or IV Tab?

Bar Code Medication Administration - v3.0.4.18 - Patient Context is Joined

File View Reports Due List Tools Help

Missing Dose Medication Log Medication Admin History Allergies CPRS Med Order Flag

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Schedule Types:  
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**ALLERGIES: no known allergies ADRs: No ADRs on file**

| Status | Ver | Type      | Medication/Solutions   | Infusion Rate | Route | Bag Information         |
|--------|-----|-----------|--|---------------|-------|-------------------------|
| Active | MVW | Admixture | DEXTROSE 5% / NAACL 0.45% / KCL 20 MEQ ...<br>D5W/0.45 NAACL/20mEQ KCL 1000 ML | 125 ml/hr,    | IV    | INFUSING: 6/3/2005@1026 |
| Active | MVW | Admixture | SODIUM CHLORIDE 0.9% INJ<br>0.9% NAACL 1000 ML                                 | 100 ml/hr,    | IV    | INFUSING: 6/3/2005@1021 |

IV Bag Chronology

- 6/3/2005
  - 153839WS20 - INFUSING
    - D5W/0.45 NAACL/20mEQ KCL 1000 ML
  - 153839V11 - AVAILABLE
  - 153839WS19 - COMPLET
- 3/21/2005
- 3/1/2005

IV Bag Detail

| Date/Time               | Nurse | Action | Comments |
|-------------------------|-------|--------|----------|
| <b>No Bag Selected.</b> |       |        |          |

Unit Dose IVP/IVPB IV

Scanner Status: **Ready**

Scan Medication Bar Code:

BCMA Clinical Reminders

| Count | Activity          |
|-------|-------------------|
| 4     | PRN Effectiveness |

WIDEMAN, MARY V COLUMBIA, MD VAMC Server Time: 6/3/2005 14:32

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# Aim: Standardize Finishing IVP/IVPB/IV Orders

- **Plan**: Pharmacy/nursing defined criteria for finishing orders as IVP/IVPB/IV so they appear on the correct tab in BCMA.
- **Do**: Tool developed and published (IVP/IVPB/IV Chart).
- **Study**: All CABG patient's orders reviewed to determine if orders finished according to defined criteria.
- **Act**: Data analyzed. Chart modified related to order monitoring and staff feedback. Tool is being used to process all patient orders.



# IVP/IVPB/IV CHART

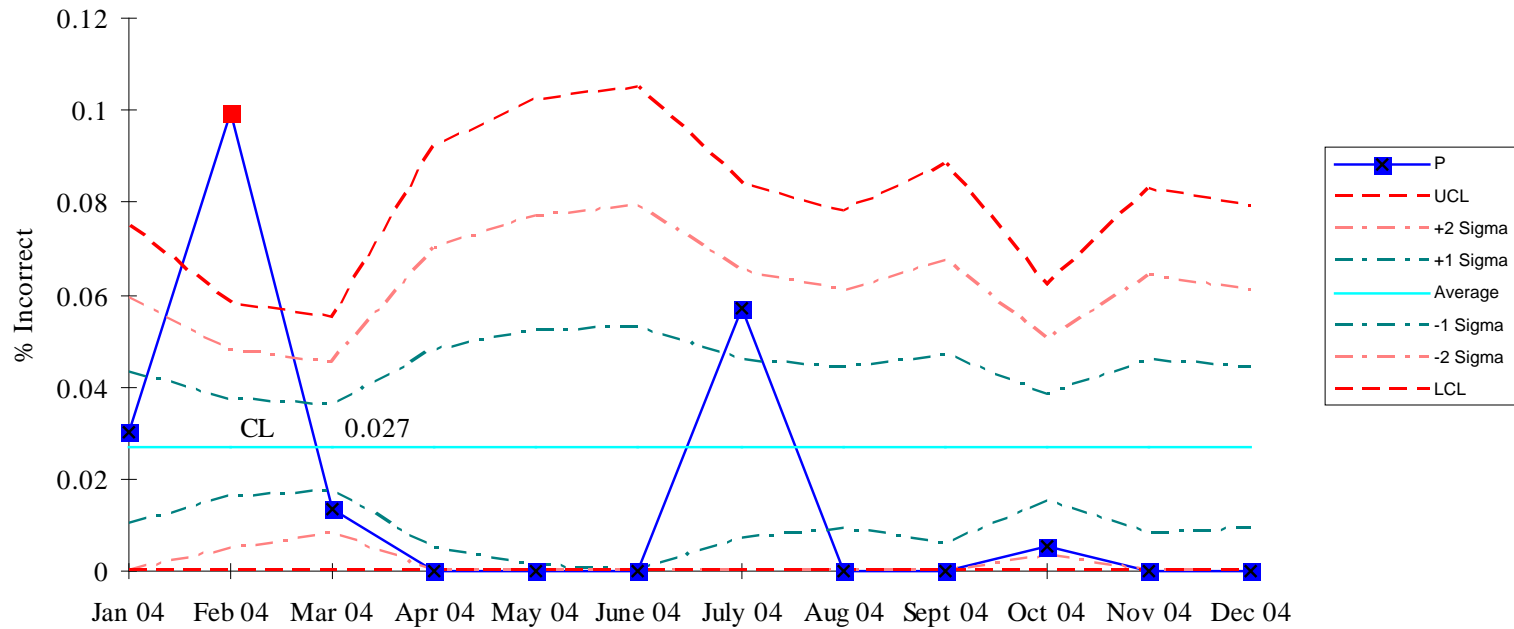
| GENERIC | TRADE | SPECIAL ADMINISTRATION INSTRUCTIONS | BCMA ROUTE TAB |
|---------|-------|-------------------------------------|----------------|
|---------|-------|-------------------------------------|----------------|

IV ADMIXTURES

|                   |                  |  |                   |
|-------------------|------------------|--|-------------------|
| ACTH Hormone      |                  | Must be given by large volume infusion only.   | CONT. IV INFUSION |
| Abciximab         | <b>Reopro</b>    |  | CONT. IV INFUSION |
| Amiodarone (Main) | <b>Cordarone</b> | 900mg/500cc in glass. Special tubing provided. | CONT. IV INFUSION |
| Amphotericin B    |                  | 25mg/250cc, or >25mg/500cc in D5W only.        | CONT. IV INFUSION |

# Standardization of IVP/IVPB/IV Orders Outcomes

**Aim 2:  
IVP/IVPB/IV ORDERS  
2nd 24 Hours**

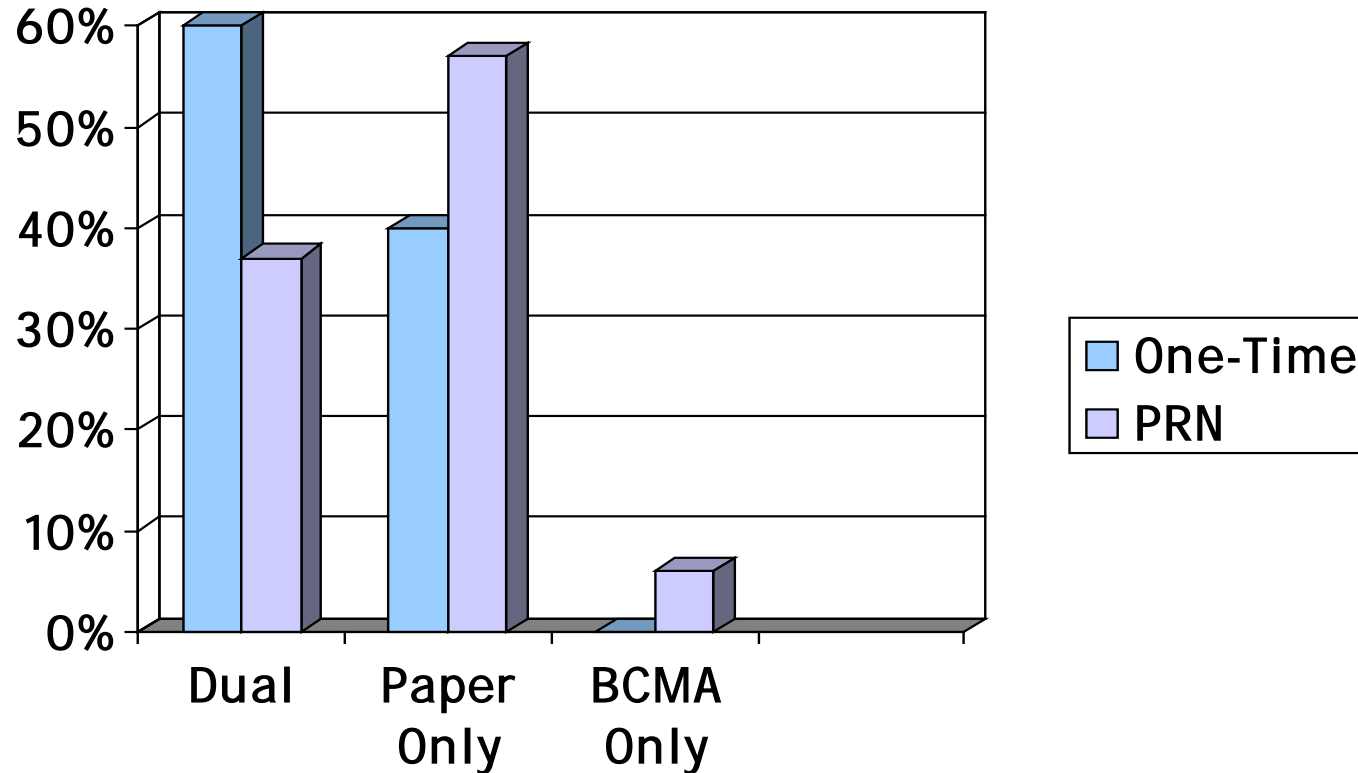


**Total # Orders= 1333 # Incorrect= 37**

# Human Factors/Patient Safety

- Dual documentation
  - Is hazardous
  - Patients can miss medications or be double dosed
  - Frustrating to nurses
  - Time consuming

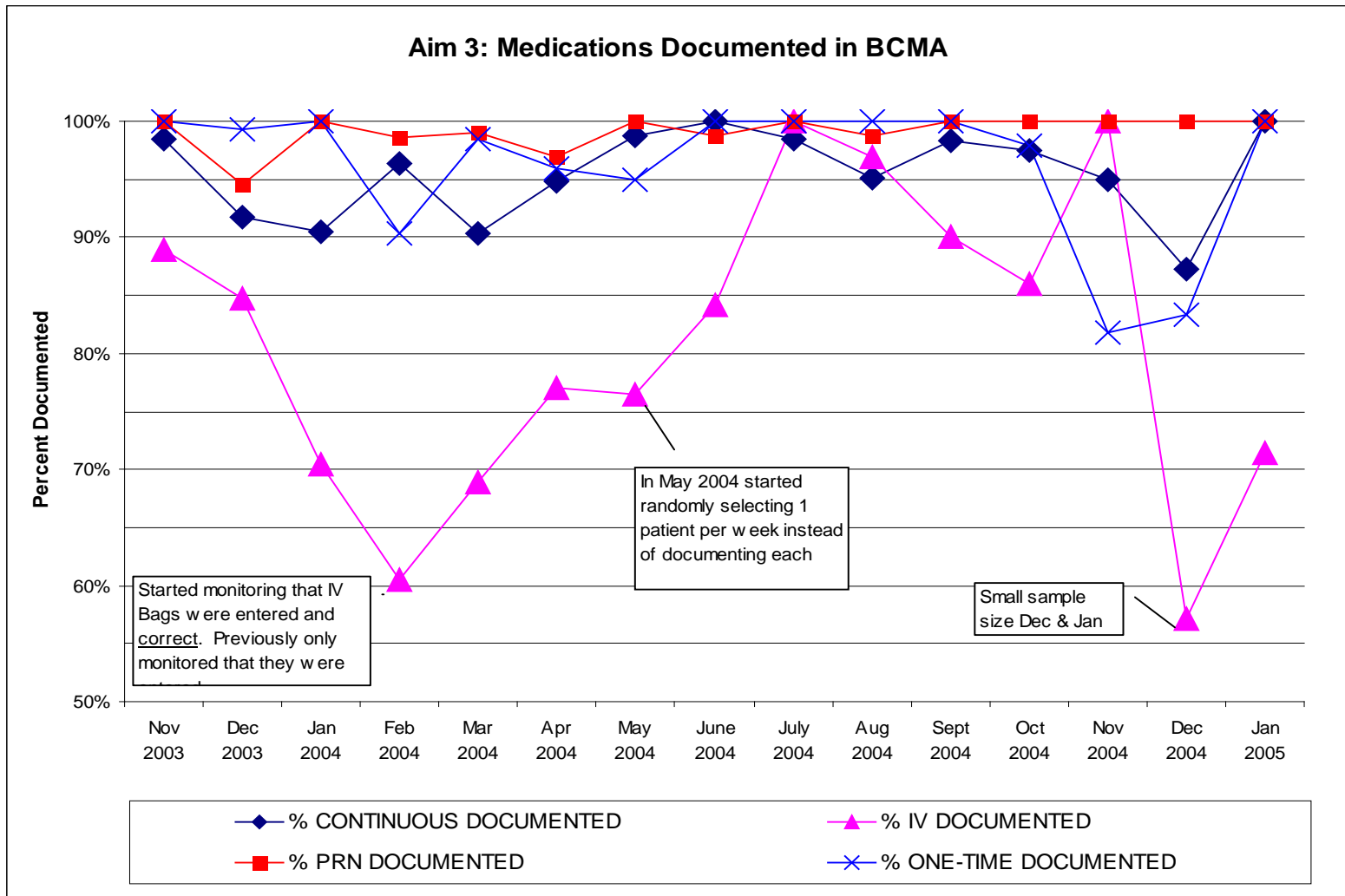
# Baseline Data: Documentation on Paper MARs & BCMA 9/03



# Aim: Elimination of Paper MARs

- **Plan**: Eliminate the use of paper MARs
- **Do**: Trial conducted with select stable CABG patients.
- **Study**: BCMA documentation of medications studied. Data analyzed to identify improvements, and several quick codes/order sets were modified.
- **Act**: MARs were eliminated on 11/18/03 for ALL patients in the ICU.
- **Plan**: Investigate automated infusion pump programming/verification to provide two-way communication for IV documentation. Implement RT scanning of medication.

# Elimination of Paper MARs Outcome

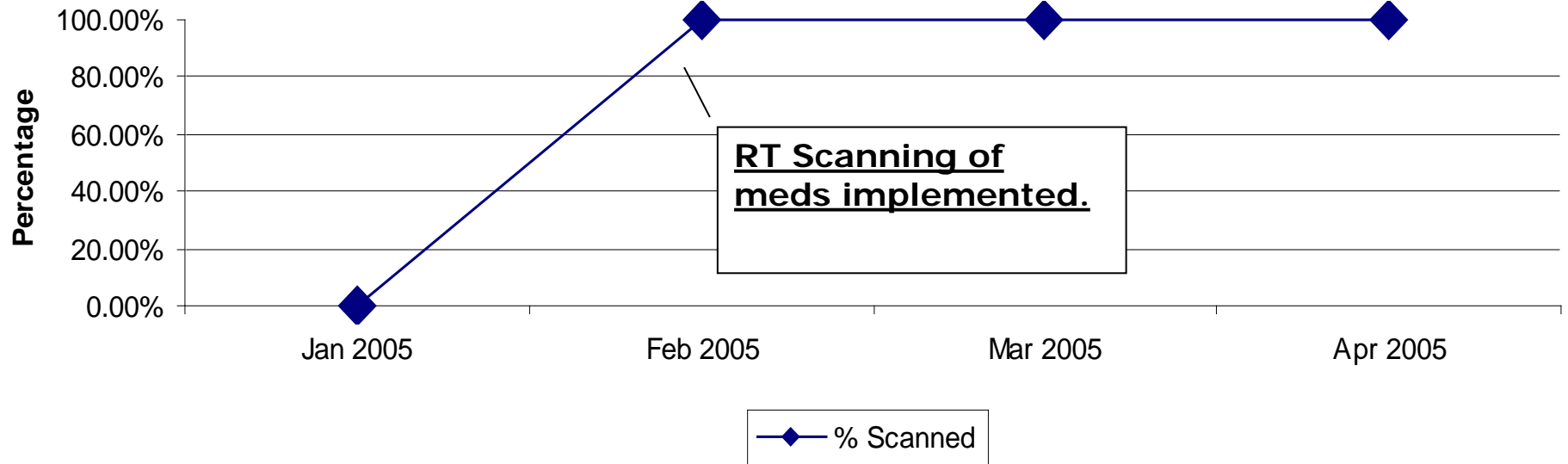


# RT Scanning Medication in BCMA

- **Plan**: Respiratory Therapy will scan medications into BCMA.
- **Do**: Multidisciplinary Team comprised of RT, Pharmacy, CAC, IRM, and Nursing met to flowchart process. Bar-coded medications procured. Trial conducted with one Respiratory Therapist scanning medications in BCMA.
- **Study**: Study identified need to revise RT order sets and the need for additional equipment.
- **Act**: Order sets were updated. Additional equipment was deployed. RT staff were trained. Implemented 2/7/05.
- **Outcome**: 100% of RT medications being scanned into BCMA (random sample)

# RT Scanning Medications Outcomes

Aim 7: RT Scanning Meds





# Aim : Pharmacy/Nursing Training Program

- **Plan**: Pharmacy/Nursing BCMA Training Program developed and conducted in IRM training room with test patients. Pharmacists/nurses “job shadow” each other.
- **Do**: Conducted classes beginning 3/18/04. Pharmacists/nurses “job shadowing” program begun.
- **Study**: Evaluations/feedback from the class and job shadowing experiences.
- **Act**: Feedback is positive, and program changes made based on evaluations/feedback.
- **Plan**: Continue training and job shadowing program.

# Provider View

Vista CPRS in use by: Wideman, Mary V (KantestBrokerserver)

File Edit View Action Options Tools Help

EJBHUS\_CLZHT HIPLUI      \*4TH 425-A-CO      CO-WHITE TEAM / Phillips,Doak A  
 101-12-6010    Aug 11,1949 (55)    Current Provider Not Selected    Attending: Phillips,Doak A    Flag    Remote Data    Postings D

View Orders    Active Orders (includes Pending & Recent Activity) - ALL SERVICES

Active Orders (includes Pending)

| Service   | Order  | Start / Stop                                  | Provider    | Nrs | Clk | Chart | Sts     |
|-----------|--|---|-------------|-----|-----|-------|---------|
| Inpt. Mec | *ACETAMINOPHEN TAB<br>650MG PO Q6H PRN FOR BACKPAIN<br>*UNSIGNED*  | Start: 01/25/05 09:17<br>Stop: 01/30/06 23:59 | Physician,D |     |     |       | active  |
|           | DIGOXIN (LANOXIN) TAB<br>0.125MG PO NOW STAT For elevated<br>Pulse rate *UNSIGNED*                                     | Start: 06/03/05 09:35<br>Stop: 06/03/05 09:42 | Physician,D | MVW |     |       | expired |
|           | SERTRALINE TAB<br>12.5MG PO QD   | Start: 03/21/05 13:16<br>Stop: 06/28/05 14:00 | Kruse,M     |     |     |       | active  |
|           | *NAFCILLIN INJ<br>2 GM IVPB Q4H Duration of Therapy: x10<br>days *UNSIGNED*  | Start: 01/25/05 09:17<br>Stop: 01/30/06 23:59 | Physician,D | MVW |     |       | active  |
|           | ALBUTEROL SOLN,INHL 0.083%<br>3 MLS INHL Q4H HFN IPPB FOR 72 hours<br>WHILE AWAKE Provide Brochodilation<br>*UNSIGNED* | Start: 01/25/05 09:17<br>Stop: 01/30/06 23:59 | Physician,D | MVW |     |       | active  |
|           | ALBUTEROL SOLN,INHL 0.083%<br>3 MLS INHL Q4H HFN PRN IPPB (SEE<br>NON-PRN ORDER) *UNSIGNED*                            | Start: 01/25/05 09:17<br>Stop: 01/30/06 23:59 | Physician,D | MVW |     |       | active  |
|           | IPRATROPIUM SOLN,INHL 0.02%<br>1 AMPULE (2.5ML) INHL Q4H HFN IPPB w<br>ALBUTEROL & IPRATROPIUM<br>*UNSIGNED*           | Start: 01/25/05 09:17<br>Stop: 01/30/06 23:59 | Physician,D | MVW |     |       | active  |
|           | IPRATROPIUM SOLN,INHL 0.02%<br>1 AMPULE (2.5ML) INHL Q4H HFN PRN<br>IPPB w ALBUTEROL & IPRATROPIUM<br>*UNSIGNED*       | Start: 01/25/05 09:17<br>Stop: 01/30/06 23:59 | Physician,D | MVW |     |       | active  |
|           | NITROGLYCERIN PATCH 0.4MG/HR<br>0.4 MG/HOUR SKIN NP_QAM<br>*UNSIGNED*  | Start: 01/25/05 09:17<br>Stop: 01/30/06 23:59 | Physician,D | MVW |     |       | active  |

Write Delayed Orders

Write Orders

- Activity Orders
- ADD NEW ORDERS
- Allergies
- Consults
- Dietetic Orders
- Discharge Orders Menu
- DNR Order Menu
- EKG Orders
- Lab Orders
- Lab~Surg Path/Cytology
- Med Generic Orders
- Med Inpt Quick Orders
- Med IV Fluid Orders Menu
- Med Outpt Quick Orders
- Meds, Non-VA
- Nursing Orders
- Radiology/Nuc Med
- Respiratory Therapy Orders
- Specialty Menus/Order Sets

Cover Sheet    Problems    Meds    Orders    Notes    Consults    Surgery    D/C Summ    Labs    Reports

start    Inbox - Microsoft Out...    CPRS - Patient Chart    4:37 PM

# Pharmacist View

Vista - KEA! 420

File Edit View Tools Options Help

ACTIVE UNIT DOSE Jun 03, 2005@14:07:58 Page: 1 of 2

EJBHUS,CLZHT HIPLUI Ward: 4 MED-C  
PID: 101-12-6010 Room-Bed: 425-A-C0 Ht(cm): 170.18 (12/15/04)  
DOB: 08/11/49 (55) Wt(kg): 112.41 (01/13/05)

\*(1)Orderable Item: ACETAMINOPHEN TAB  
Instructions: 650MG  
\*(2)Dosage Ordered: 650MG  
Duration: \*(3)Start: 01/25/05 09:17  
\*(4) Med Route: ORAL  
BCMA ORDER LAST ACTION: 06/03/05 09:52 GIVEN \*(5) Stop: 01/30/06 23:59  
(6) Schedule Type: FILL on REQUEST  
\*(8) Schedule: Q6H PRN  
(9) Admin Times:  
\*(10) Provider: PHYSICIAN,DEMO [v]  
(11) Special Instructions: FOR BACKPAIN

| (12) Dispense Drug      | U/D | Inactive Date |
|-------------------------|-----|---------------|
| ACETAMINOPHEN 325MG TAB | 2   |               |

+ Enter ?? for more actions

DC Discontinue ED Edit AL Activity Logs  
HD Hold RN Renew  
FL Flag VF (Verify)

Select Item(s): Next Screen//

start V. B. p. I.. B.. 3.. D. v.. 2:08 PM

# BCMA Nurse View

Bar Code Medication Administration - v3.0.4.18 - Patient Context is Joined

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|--------|-----|-----|------|--|------------------------------|-------|------------|------------------------|
|        | MVW |     | P    | ALBUTEROL SOLN,INHL<br>ALBUTEROL SO4 0.083% INHL 3ML<br>IPPB (SEE NON-PRN ORDER)                                 | 3 MLS, Q4H HFN<br>PRN        | INHL  |            | REFUSED: 6/3/2005@1300 |
|        | MVW |     | P    | ACETAMINOPHEN TAB<br>ACETAMINOPHEN 325MG TAB<br>FOR BACKPAIN   | 650MG, Q6H PRN               | PO    |            | GIVEN: 6/3/2005@0900   |
| G      | MVW |     | C    | NITROGLYCERIN PATCH<br>NITROGLYCERIN 0.4MG/HR PATCH  | 0.4 MG/HOUR,<br>NP_QAM       | SKIN  | 06/03@0900 | GIVEN: 6/3/2005@0900   |
| R      | MVW |     | C    | IPRATROPIUM SOLN,INHL<br>IPRATROPIUM BROMIDE 0.02% INH SOLN 2.5ML<br>IPPB w ALBUTEROL & IPRATROPIUM              | 1 AMPULE<br>(2.5ML), Q4H HFN | INHL  | 06/03@1300 | REFUSED: 6/3/2005@1300 |
| G      | MVW |     | C    | FUROSEMIDE TAB<br>FUROSEMIDE 20MG TAB  | 20MG, BID<br>DIURETIC        | PO    | 06/03@1300 | GIVEN: 6/3/2005@1300   |
| R      | MVW |     | C    | ALBUTEROL SOLN,INHL<br>ALBUTEROL SO4 0.083% INHL 3ML<br>IPPB FOR 72 hours WHILE AWAKE Provide<br>Bronchodilation | 3 MLS, Q4H HFN               | INHL  | 06/03@1300 | REFUSED: 6/3/2005@1300 |
| G      | MVW |     | C    | AMOXICILLIN CAP,ORAL<br>AMOXICILLIN 250MG CAP  | 250MG, Q8H                   | PO    | 06/03@1300 | GIVEN: 6/3/2005@1300   |

Unit Dose  IVP/IVPB  IV

Scanner Status: **Ready** Scan Medication Bar Code:

BCMA Clinical Reminders

| Count | Activity          |
|-------|-------------------|
| 4     | PRN Effectiveness |

WIDEMAN, MARY V COLUMBIA, MO VAMC Server Time: 6/3/2005 14:12

start [Taskbar icons] 2:12 PM

# Lessons Learned/Keys to Successful Implementation

- **Collaborative relationship between pharmacy, nursing and information management must exist**
- **Active Multidisciplinary BCMA Committee to implement PDSA cycles of change**
- **Leadership must promote and endorse a culture of support for the system**
- **Effective communication is essential**
- **Sufficient amount of functional equipment must be available**
- **IM staff on-call 24 hours/day**



# Lessons Learned

- **Focus on Patient Safety**
  - Punitive medication error policy was eliminated and a non-punitive reporting system implemented
  - Nurses want to administer medications in BCMA, if they are unable to do so it is a systems issue not a staff issue
  - Proactive Management Patient Safety and BCMA Rounds promote a non-punitive culture
  - Frame all changes by focusing on patient safety

# Publication

- Manuscript written titled “Barcode Medication Administration: Lessons Learned from an Intensive Care Unit Implementation”
- Published February 2005 by the Agency for Healthcare Research and Quality (AHRQ) in *Advances in Patient Safety: From Research to Implementation, Vol.3, p.437-451*