Integration of Barcode Medication Administration in the Emergency Department: A Quality Improvement Project

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DISCLAIMER

The views expressed herein are those of the authors and do not reflect the official policy or position of the U.S. Navy, Department of Defense or the U.S. Government.

No financial or conflicts of interest to report.

Background/ Significance

- **Medication Errors** are the most frequent and costly adverse medical event with cost estimates of $2 billion annually (Hook et al., 2008)
- Healthcare institutions have turned to **barcode scanning** technology to mitigate medication administration errors
- More passive medication safety practices are available
- Medication error risk is heightened in the Emergency Department (ED)

Estimated medication error rate in the ED is 14% for adults and 39% for pediatric patients (Weant, Bailey & Baker, 2014).

Local Problem

- The Military Health System has been systematically switching to a new electronic health record (EHR) since 2018.
- The new EHR was introduced to this Academic Level II Trauma Center in January 2023. ***This is the first time barcode medication administration (BCMA) was available to this facility.***
- Due to the learning of the new EHR, deployments causing significant staffing challenges and inconsistency in the IT infrastructure, ***BCMA was utilized at a rate of only 13% in this 52-bed Emergency Department.***
- The Military Health System has defined a ***goal of 95% BCMA utilization***. They currently are only auditing the inpatient units and perioperative setting

Problem Statement

The project's initial phase identified a baseline BCMA utilization rate of 13%, which was significantly below the desired benchmark. Improving BCMA rates in the ED became a facility priority, backed by leadership commitment to allocating resources and support for intervention development.

Review of Literature

PICO: In the Emergency Department, what is the effect of barcode medication administration in comparison with standard nursing verification of medication rights on the prevention of medication-associated errors?

Search Strategy:

- **Databases:** PubMed, Cumulative Index to Nursing and Allied Health Literature (CINAHL), Embase and Web of Science.
- **Keywords:** Barcode, BCMA, scanning, medication error, emergency department

Resulted: 35 total records

- Duplicates removed, screening of abstracts for relevance→ 10 full text articles
- 6 articles removed for limited relevance to the PICO
- Grey literature searched with consistent themes from this systematic review

TOTAL: 4 records

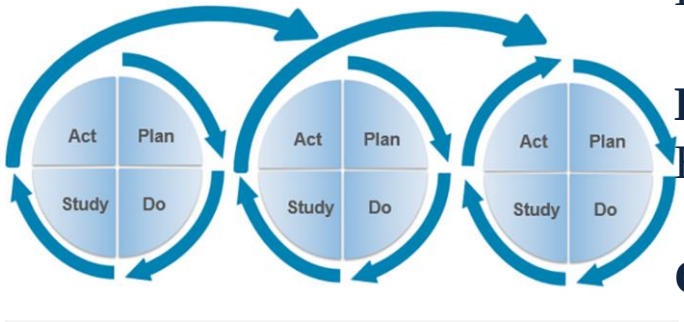
Synthesis of Evidence

- The Emergency Department is clinically unique and poses a high risk for medication errors (Weant, Bailey & Baker, 2014).
- BCMA has been shown to significantly reduce the rate of medication administration errors in the Emergency Department (Bonkowski et al., 2013; Owens et al., 2020; Gautier-Wetzel, 2022; Seibert et al, 2014)
- BCMA is not widely studied in the unique clinical care environment of the Emergency Department (Bonkowski et al., 2013; Owens et al., 2020; Gautier-Wetzel, 2022)
- BCMA has been shown to significantly reduce medication administration errors in the inpatient setting where it is more widely studied (Bonkowski et al, 2013)

Purpose

The purpose of this QI project was to improve BCMA compliance rate from 13% to 95% by January 2025

Project Structure: Continuous Quality Improvement



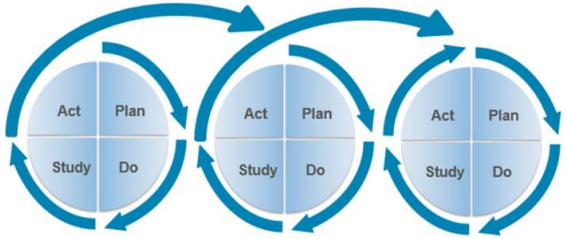
Define the problem: BCMA is a best practice and was utilized for only 13% of medications administered in the Emergency Department

Benchmark a goal: The long-term goal was to achieve a BCMA utilization rate of 95% by January 2025

Gather a team: Executive leaders, departmental leaders and deck plate champions were assigned to the BCMA improvement team

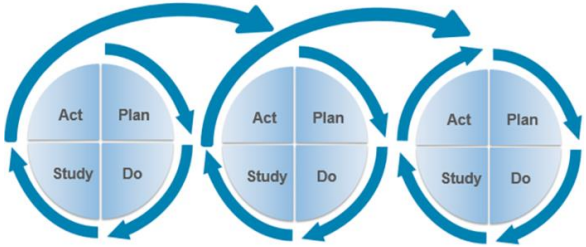
Iterative Quality Improvement Projects: Through three cycles of the Plan Do Study Act (PDSA) method we implemented iterative change in medication administration in the Emergency Department (IHI, n.d.)

Cycle 1 PLAN



- 6 months of pre-implementation data collected → 13% utilization
- Assigned team champions to be peer leaders and subject matter experts
- Established leadership support
- Needs assessment performed
- Established a team-based competition with time-off and monetary incentives

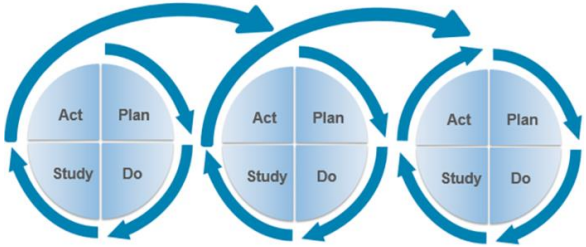
Cycle 1 PLAN



Needs Assessment Findings :

- Competing priorities and poor new EHR rollout
- IT inconsistencies primary driving force to low utilization
    - Frequent bedside tap in failures
    - Slow tap in log in
    - Tapping in logs you out on your primary computer
    - Not every individual had tap in access
    - Not enough computers on wheels

Cycle 1 DO



Mitigate Needs Assessment Barriers

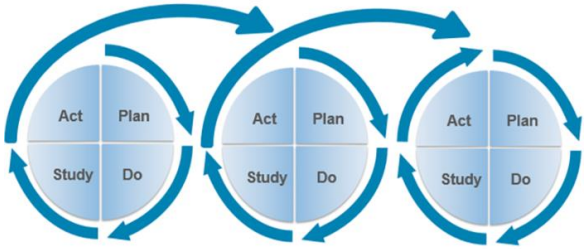
- IT in-situ for real time troubleshooting
- Provision of troubleshooting tip sheet
- 24/7 help desk established for tap in
- Acquired more mobile workstations

Launched Team Based competition with a goal at 75% by the end of 3 months

Transparent sharing of BCMA data by team

Leadership rounding to influence

Cycle 1 STUDY



- Pulled weekly data from the EHR BCMA report
- Met with BCMA champions for lessons learned, additional barriers
- Identified trends in the data
  - Most significant trend showed enlisted rate significantly lower
- Prepared for Cycle 2 interventions

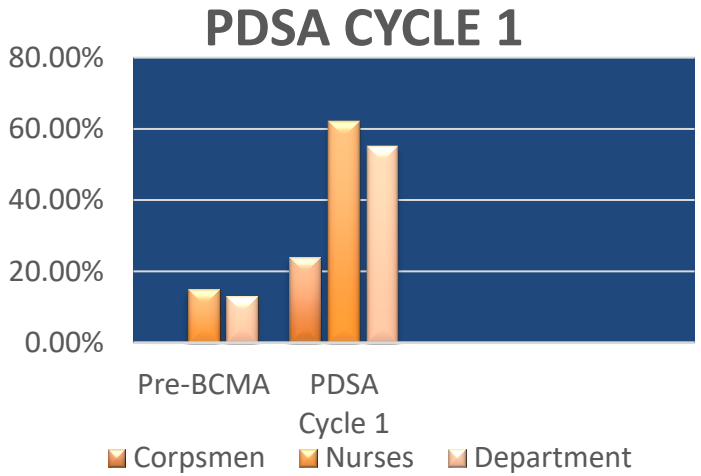


Image Courtesy of Author

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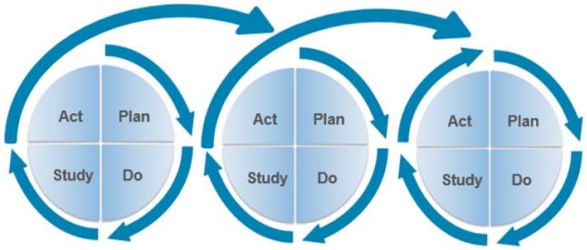
Cycle 1 ACT



	Medications Given (Monthly Ave)			Medications Scanned (Monthly Ave)					
	Corpsman	Nurse	Total	Corpsman		Nurse		Total	
Pre-BCMA	689	4,597	5,285	5	0.7%	692	15.0%	697	13.2%
PDSA 1	616	2,636	3,253	170	24.5%	1,633	61.5%	1,803	55.4%

- ✓ Utilized data trends to target Cycle 2 interventions
- ✓ Concluded team competition and awarded the winners
- ✓ Began PDSA Cycle 2

BCMA increased 13% → 55%

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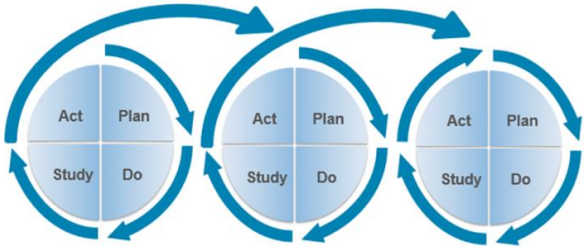
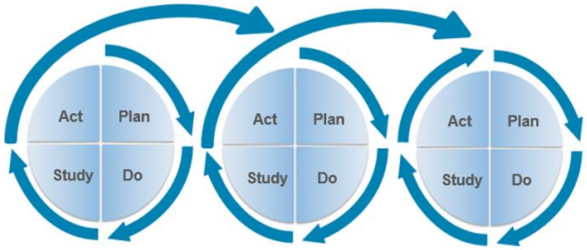
Cycle 2 PLAN



- **Engage with enlisted leadership to target Corpsmen medication safety practices**
- **Transition from team-based data sharing to individual performance**
  - Creation of visual management board
  - Individual email reminders with direct supervisor included
  - Inclusion of BCMA compliance in annual performance evaluations

Cycle 2 DO



Transparent Data Sharing

- Visual Management Board and bi-monthly emails to individual staff displaying their scanning rate

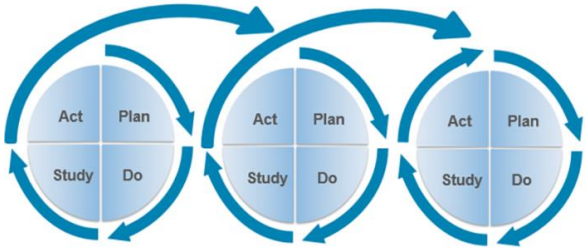
Performance Evaluations

- Staff signed their new element of performance with the inclusion of BCMA

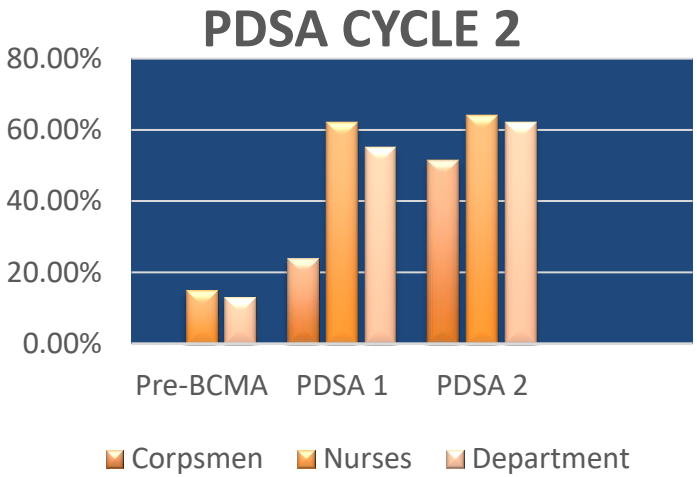
Corpsmen Leadership

- Corpsmen leadership engagement, discovered and mitigated access issues
- IT support in the Fast Track area of the ED
- Inclusion of tap-in access in the orientation of new staff

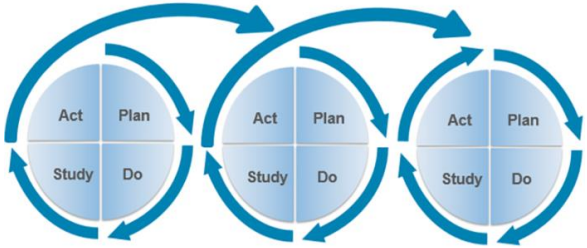
Cycle 2 STUDY



- Individual reminders and visual management board enlightened to the same late adopters
- Corpsmen scanning rate improved from 24% → 52%



Cycle 2 ACT



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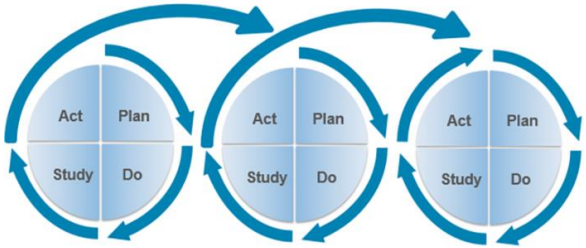
PDSA 2	966	3,764	4,730	520	51.6%	2,406	63.8%	2,926	61.9%

- ✓ Conclusions from these data trends highlight the importance of leadership accountability for the late adopters

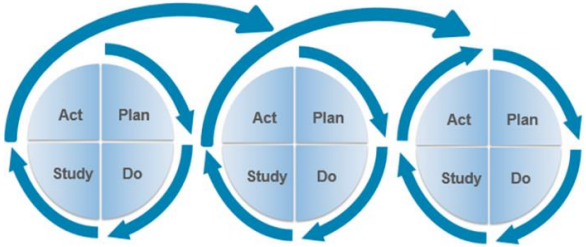
BCMA increased 55% → 62%

Cycle 3 PLAN



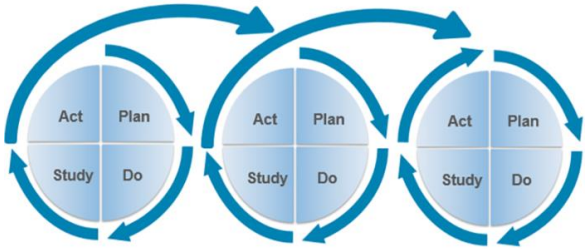
- **Engaged with all levels of leadership to establish an accountability plan for late adopters**

Cycle 3 DO

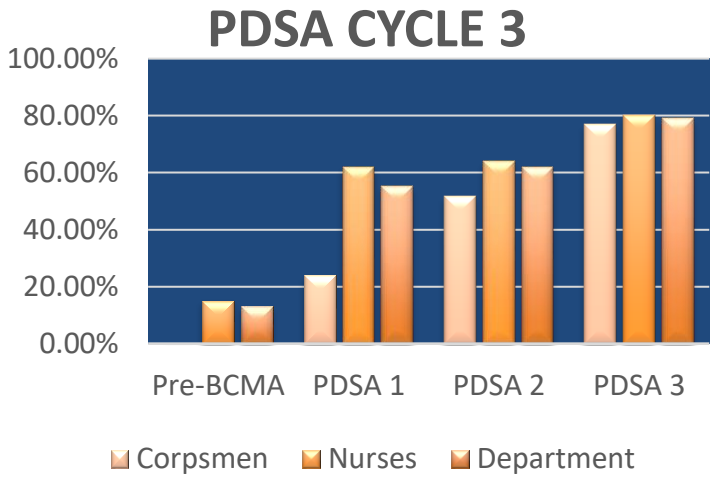


- **Nurse manager, medical director and enlisted leadership committed to consequences for individual's whose BCMA rate was below 80%**
  - Time off contingent on BCMA rate
  - Holiday payback
  - Formalized counselling for low BCMA rate

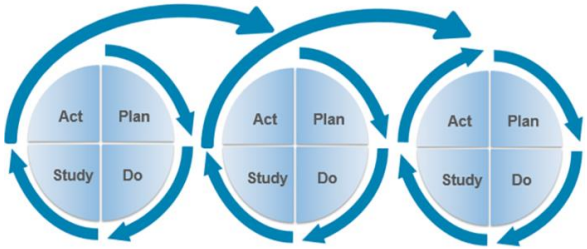
Cycle 3 STUDY



- BCMA rate 62% → 79%
- Nurse BCMA rate 64% → 80%
- Corpsmen BCMA rate 51% → 77%



Cycle 3 ACT



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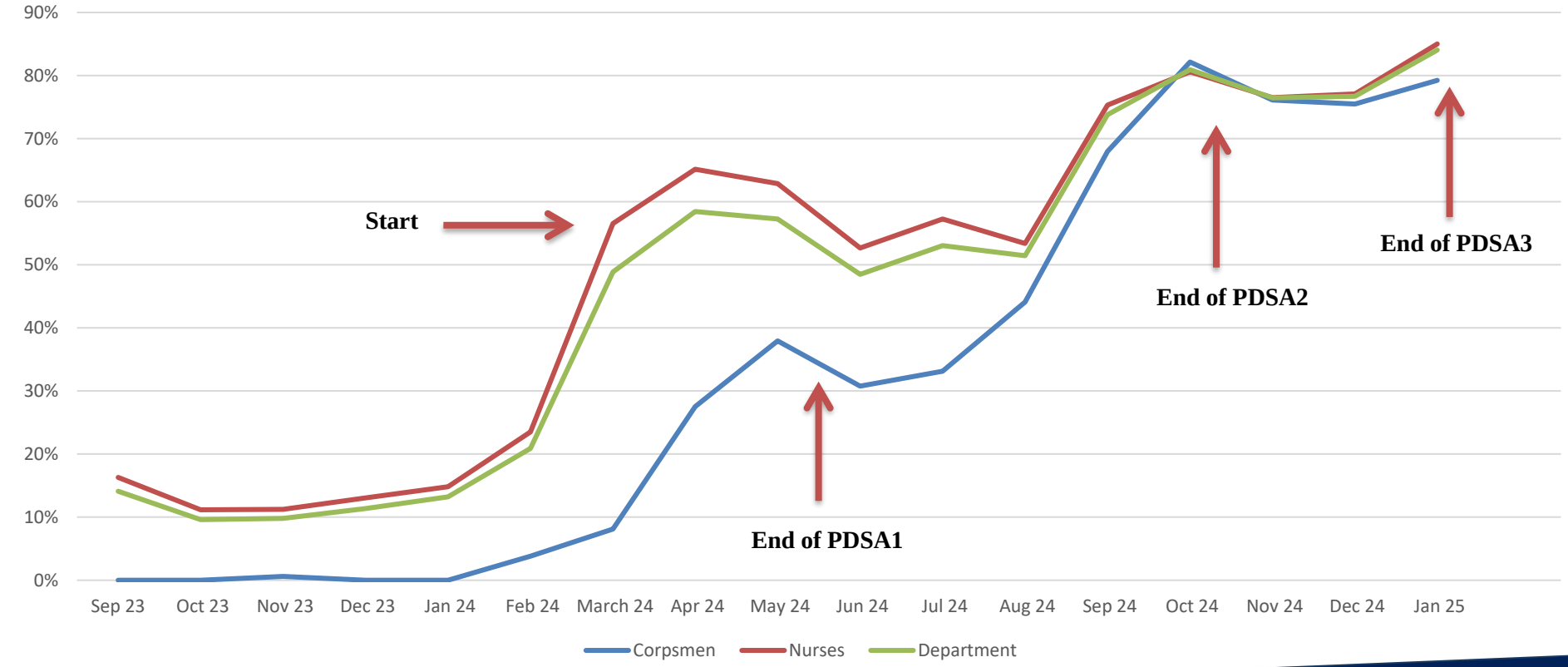
PDSA 2	966	3,764	4,730	520	51.6%	2,406	63.8%	2,926	61.9%
PDSA 3	963	4,045	5,008	741	77.0%	3,235	79.5%	3,975	79.1%

- ✓ Sustainment will require continued leadership accountability

BCMA increased 62%→ 79%

BCMA Rates In the Emergency Department



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Additional Findings

- In 2023 the total number of medication errors reported that would have been prevented with medication scanning was 19.
- In 2024 there were 3 reported medication errors that could have been prevented.
- Sister ED's with similar volume and acuity are reporting BCMA rates hovering around 60%.

Conclusion

While this project did not meet the 95% benchmark in 11 months there was significant improvement from the previous state. In February and March of 2025 the BCMA rate was 92% and the reduction in reported medication errors was immense!

This project contributes to the existing literature by evaluating BCMA's effectiveness in a high-stress ED setting. It offers insights into strategies for achieving high compliance rates in medication administration, even within complex clinical environments. This project also underscores the challenges of culture change and the significance of IT success, peer leaders and leadership commitment in change.

Sustainment Plan

- Executive leadership continues to report out on facility compliance with BCMA utilization
- The ED's BCMA rate will be audited in the facility compliance very soon
- Financial reimbursement is available for hospitals who maintain a BCMA rate >95%

Cost-Benefit Analysis

COST AVOIDANCE							
Doses/month	Possible Error Prevented	Percent of Harmful Error	Total Monthly Errors	Total Monthly Harmful Errors	Cost of Harmful Errors*	Annual Cost Savings	5 year savings projection
5,000	1.1%	9%	55	4.95	$ 2,706.95	$ 32,483.40	$ 162,417.00

FINANCIAL INCENTIVE			
Doses/month	Cost/dose	Annual Reimbursement	5 year Reimbursement
5,000	$ 10.00	$ 600,000.00	$ 3,000,000.00

COST OF BCMA		
BCMA-enabled Bed Cost over 5 years*	Total ED Beds	5 year cost of BCMA
$ 27,069.00	52	$ 1,407,588.00

5 year ROI	
$ 1,754,829.00	125%

(Sakowski & Ketchel, 2013)

*Inflation Calculator Utilized for calculation from 2013-2024 from https://www.usinflationcalculator.com/

Ethical Considerations

- IRB determined project to be quality improvement, exempt from oversight
- **Beneficence –**
  - BCMA is a proactive strategy which promotes safer medication practices and contributes to safer outcomes
- **Nonmaleficence –**
  - BCMA is a proven strategy for reducing medication errors, supporting the healthcare directive of "do no harm."

Special Considerations

BCMA utilizes technology to eliminate human bias during medication administration in support of health equity. This can be particularly helpful in the vulnerable pediatric population that has an estimated rate of medication error up to 39% (Weant, Bailey &Baker, 2014).

In this project when rolling out BCMA utilization we were sensitive to alternative training modalities and overcome barriers for staff members with limited technology familiarity. Additionally, we supported the staff on shifts with less accessibility to IT and administrative support. The team champions and subject matter experts served as liasions as real time peer leaders and the implementation of 24/7 IT support became available to prevent any disparity in resources for alternate shifts.

Special Acknowledgements

- ED Nurses and Corpsmen
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*Courtesy of University Communications, UVA

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