Effectiveness of an Educational and Interdisciplinary Intervention in Reducing Continuous Cardiac Monitoring in an Academic Medical Center

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BACKGROUND

- Continuous cardiac monitoring (CCM) was first used in the 1960s for cardiac intensive care unit (ICU) patients and has since expanded to use for non-ICU patients[1]
- Individual institutions and the American Heart Association and American College of Cardiology (AHA/ACC) have developed guidelines for appropriate CCM use by indication[2,3]
- Despite guidelines, patients are placed on CCM for off-guideline indications, remain on CCM longer than recommended, and/or are discharged to unmonitored settings with ongoing CCM orders at time of discharge[4]
- Inappropriate CCM use increases healthcare costs and interferes with patient care (discomfort, difficulty mobilizing, interrupted sleep, etc.) without improvement in health outcomes[5,6]
- Prior to our first intervention below, hospital administration implemented attending-level education and a structured "Patient-Centered Rounding" format which placed emphasis on discussion of CCM indication and reason for ongoing need for each patient (Physician PCR)

SMART AIM STATEMENT

- Our study aimed to assess the effect of a combined resident-education-and rounding-checklist-protocol intervention on the percentage of patients discharged with active CCM orders on teaching general medicine services.
- We hypothesized that our intervention would reduce the number of patients discharged on CCM (an estimate of overall inappropriate CCM use) by 50% over a 6-8 week period

DATA COLLECTION AND MEASURES

- Baseline and post-intervention data was collected using Qlik software to determine number of CCM orders placed and percent of patients whose CCM orders were still active at time of discharge
- Patients on hospital medicine CCM floors (10 Thompson, 10 Pavilion, 9 Gibbon, 5 Gibbon, and 3 Gibbon) at Thomas Jefferson University Hospital were included and evaluated in two week intervals after our team interventions were rolled out
- Chi-square analysis was used to test statistical significance
- Primary outcome: Percentage of patients on CCM whose order was not discontinued by time of discharge

INTERVENTION

- After reviewing our institutional CCM guidelines and identifying our institution's most common CCM indications, we developed an educational handout for residents (Figure 1)
- This handout targeted the most common indications and provided suggestions for monitoring timeframes consistent with AHA/ACC and institutional guidelines
- During a change-of-service day for residents, our team provided residents on hospitalist teams a brief education session and laminated handouts
- Two weeks later, in a modified stepped-wedge approach, nurses on a subset of general medicine teams on the 3NE unit were provided a new templated checklist for interdisciplinary rounds which includes not only whether a patient is on telemetry (control) but also the guideline-consistent end time and if the patient was placed on a 14-day monitoring timeframe

Figure 1: Resident Intervention Reference Card

Continuous Cardiac Monitoring Quick Reference Guide	
AS ALWAYS, USE CLINICAL JUDGEMENT WHEN DECIDING TO ORDER CCM	
NOTE: If patient no longer has described indication, D/C CCM, ASSESS DAILY	
NOTE: Continuous pulse oximetry can be ordered SEPARATE from CCM	
YES, Start CCM	**Until When?**
ACTIVE bleeding, WITH shock or >4 units of blood transfused	48 hours
Acute withdrawal (EtOH, benzos)	48 hours
Arrhythmia (tachy with ventricular rate >140, brady <45, symptomatic	48 hours
Clinically significant lung disease WITH tachycardia, hypoxemia, or hypote	48 hours*
Infective Endocarditis	Clinically Stable
Moderate/Equivocal chest pain, negative biomarkers	24 hours
NEW placement of ICD or pacemaker	24 hours
PE, Hemodynamically unstable	48 hours
Sepsis	48 hours
Severe electrolyte imbalance or EKG changes	Normalization of lytes
NO, DO NOT Start CCM	
Arrhythmia (previously known or asymptomatic, 45<HR<140)	-
Hemodialysis, no other indication	-
History of ICD or pacemaker, admitted for other reason	-
Low cardiac risk chest pain (negative biomarkers, normal ECG)	-
Moderate electrolyte imbalance, no EKG changes	-
PE, HDS	-
S/p noncardiac surgery, HDS	-
Wearable defibrillator, unrelated admission	-
*Consider continuous pulse-ox only if appropriate	
This reference was constructed using 2017 Updated ACC/AHA guidelines for telemetry use	
This reference was constructed using current TJUH hospital guidelines for telemetry use	

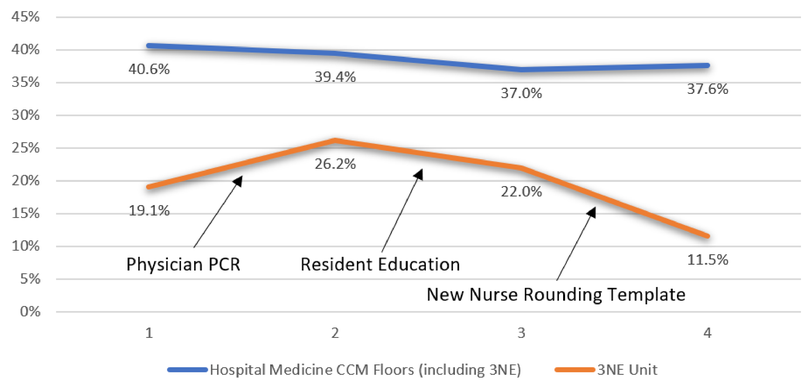
RESULTS

Table 1: Percentage of Patients Discharged on CCM

INTERVENTION POINT	TOTAL CCM	3NE CCM	TOTAL (P-VALUE)	3NE (P-VALUE)
BASELINE, PRE-PCR INTERVENTION	1320	188	40.6%	19.1%
POST-PCR, PRE-RESIDENT INTERVENTION	2011	252	39.4% (0.48)	26.2% (0.08)
POST-RESIDENT, PRE-TEMPLATE INTERVENTION	208	18	37.0% (0.33)	22.0% (0.77)
POST-TEMPLATE INTERVENTION	226	20	37.6% (0.40)	11.5% (0.35)

- Data collected for patients discharged on CCM on all hospital medicine CCM floors and specifically on the 3NE unit stratified by intervention time. P-values calculated relative to respective baseline unit data
- In a large academic hospital setting, approximately 40% of patients started on CCM are discharged on CCM
- There was no statistically significant change in CCM at discharge when comparing all hospital medicine CCM floors with resident education interventions over all floors (39.4% vs. 37.0%, p=0.33)
- When comparing all floors with 3NE, where the template intervention focused, there is a statistically significant reduction in the discharges on CCM after nursing-driven rounding template intervention (39.4% vs 11.5%, , P=0.0027)
- When looking at 3NE only data, there was a trend toward reduction of CCM discharges (P=0.10) when comparing post PCR data (26.2%) with post RN rounding template (11.5%)

Figure 2: Percentage of Patients Discharged on CCM Run Chart



DISCUSSION

- The major limitations in our study design was lack of power in our post-intervention data (2 weeks of intervention data). Future studies will be needed to evaluate implemented changes over a longer period of time in order to provide a more robust comparison between pre- and post-intervention outcomes
- Our study data comparisons were *a posteriori*, rather than *a priori*, in design
- The hospital medicine CCM floors cohort results likely under-estimate discharge on CCM for floors 10, 9, 5, and non-3NE units since this cohort also includes data from 3NE
- Total CCM rate does not change between the resident education (37%) and template intervention (37.6%), which seems to internally validate the step-wedged model
- Baseline and post-PCR intervention for 3NE rates of patients discharged on CCM were also overall lower than all floors rates, which suggests the presence of other confounders
- There was a stepwise decrease in CCM discharges with both resident education and nurse rounding template interventions on the 3NE unit

CONCLUSION

- A combined educational and modified-rounding-checklist-template intervention shows promise in reducing the percentage of patients started on CCM who are discharged with active CCM orders

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