Understanding Differences in Medical versus Surgical Patients Alerted by the Modified Early Warning Score (MEWS) at Jefferson Hospital

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BACKGROUND

The Modified Early Warning Score (MEWS) was implemented at Jefferson in June 2017 to identify hospitalized patients who are experiencing clinical deterioration early. Although an early warning score is recommended for all in-patients, there is more data on validation of outcomes in medical patients compared to surgical patients.

AIMS

1. To identify characteristics of patients who trigger a red MEWS alert and to determine if these characteristics differ in medical versus surgical patients
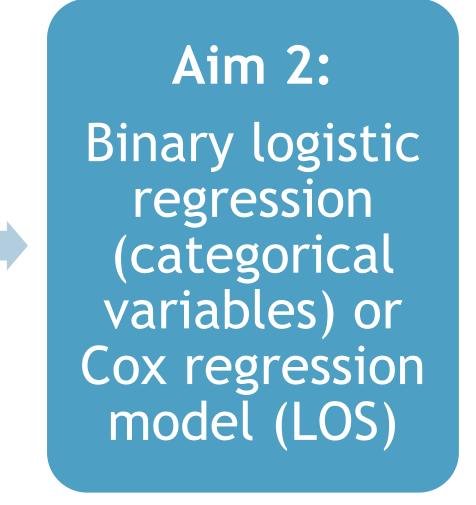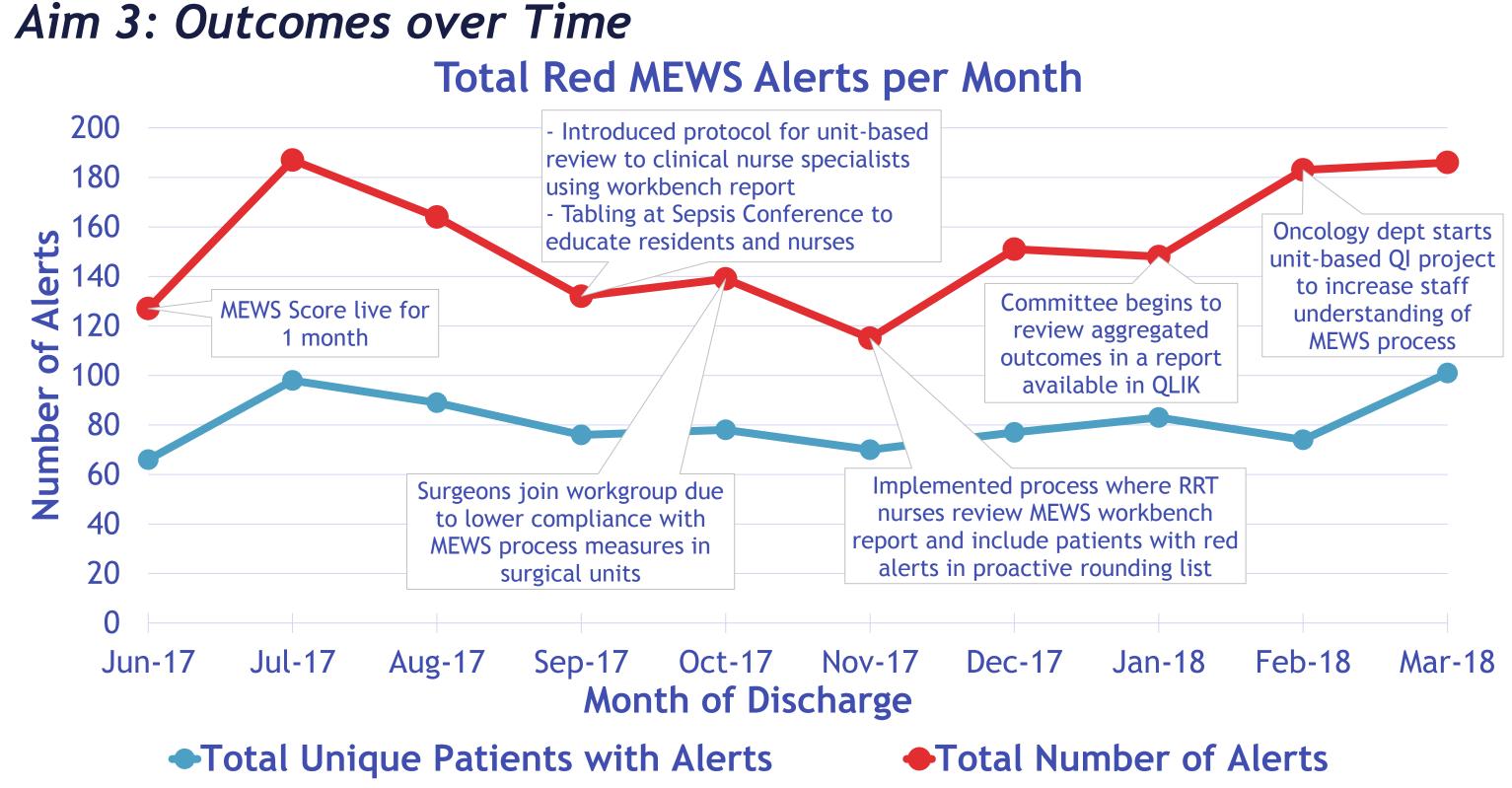
2. To determine if there is a significant difference in outcomes (in-hospital mortality, discharge to hospice, hospital LOS, RRT, ICU transfer, intubation) for patients who receive a red alert as a medical versus surgical patient when accounting for age, sex, and race

3. To describe the rate of outcomes over time since MEWS implementation with medical and surgical patient subgroup analysis

METHODS

Data: Vizient database of all patients who received a Red MEWS alert during admission and discharged between June 2017-March 2018 (n=812).

Aim 1: Chi-square test (categorical variables) or independent samples t-test (continuous variables)

Aim 2: Binary logistic regression (categorical variables) or Cox regression model (LOS)

Aim 3: Line graphs of outcomes over time

Aim 2 Regression Models controlled for age, sex, and race:
$$Logit(\pi)= \beta_0 + \beta_1(SurgicalPt) + \beta_2(Age) + \beta_3(Female) + \beta_4(Non\text{-}white)$$

RESULTS

Aim 1: Patient Characteristics

	Total included (n=812)	Medical Patient (n=563)	Surgical Patient (n=249)	P-value
Sex: female, n (%)	370 (45.6)	253 (44.9)	117 (47.0)	0.589
Age, yrs; mean (s.d., range)	63.4 (16.1, 17-98)	64.3 (16.2, 18-98)	61.5 (15.8, 17-92)	**0.026**
Race, n (%)				
White	504 (62.1)	345 (61.3)	159 (63.9)	0.485
Non-White	308 (37.9)	218 (38.7)	90 (36.1)	
Source of Admission, n (%)				
Facility	268 (33.0)	196 (34.8)	72 (28.9)	0.099
Non-Facility	544 (67.0)	367 (65.2)	177 (71.1)	
Insurance Category				
Commercial/Medicare/ Commercial+Medicare	485 (59.7)	318 (56.5)	167 (67.1)	**0.005**
All Other Payers (includes Dual-Enrolled)	327 (40.3)	245 (43.5)	82 (32.9)	
Alerts per Patient (s.d., range)	1.89 (1.6, 1-17)	1.85 (1.5, 1-17)	1.97 (1.8, 1-14)	0.316

- Surgical patients were younger than medical patients by approximately 2.7 years (95% CI: 0.329-5.124).
- Being a surgical patient increased the odds of having Commercial/Medicare/Commercial+Medicare insurance by 56.9% (95% CI: 1.148, 2.144).
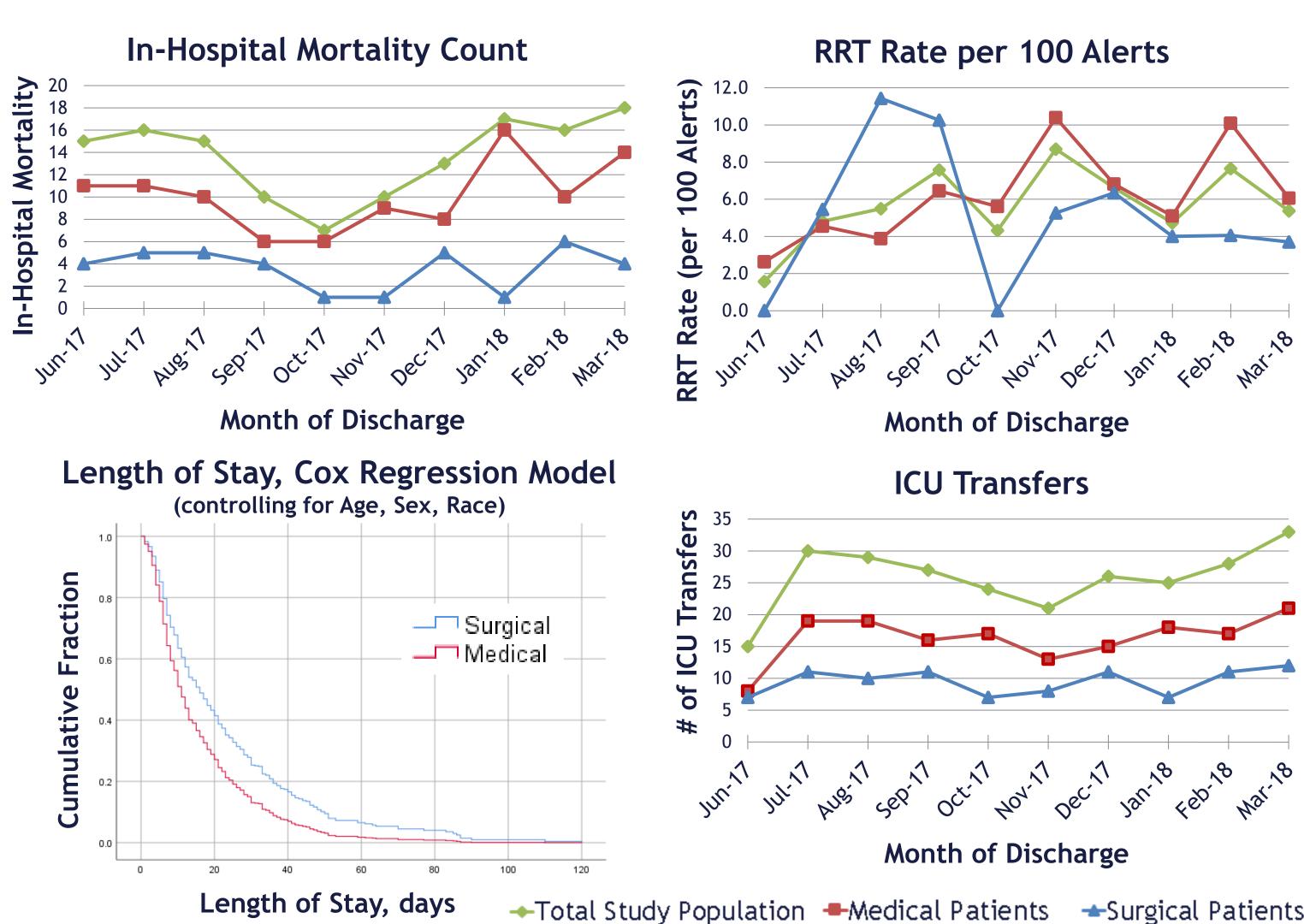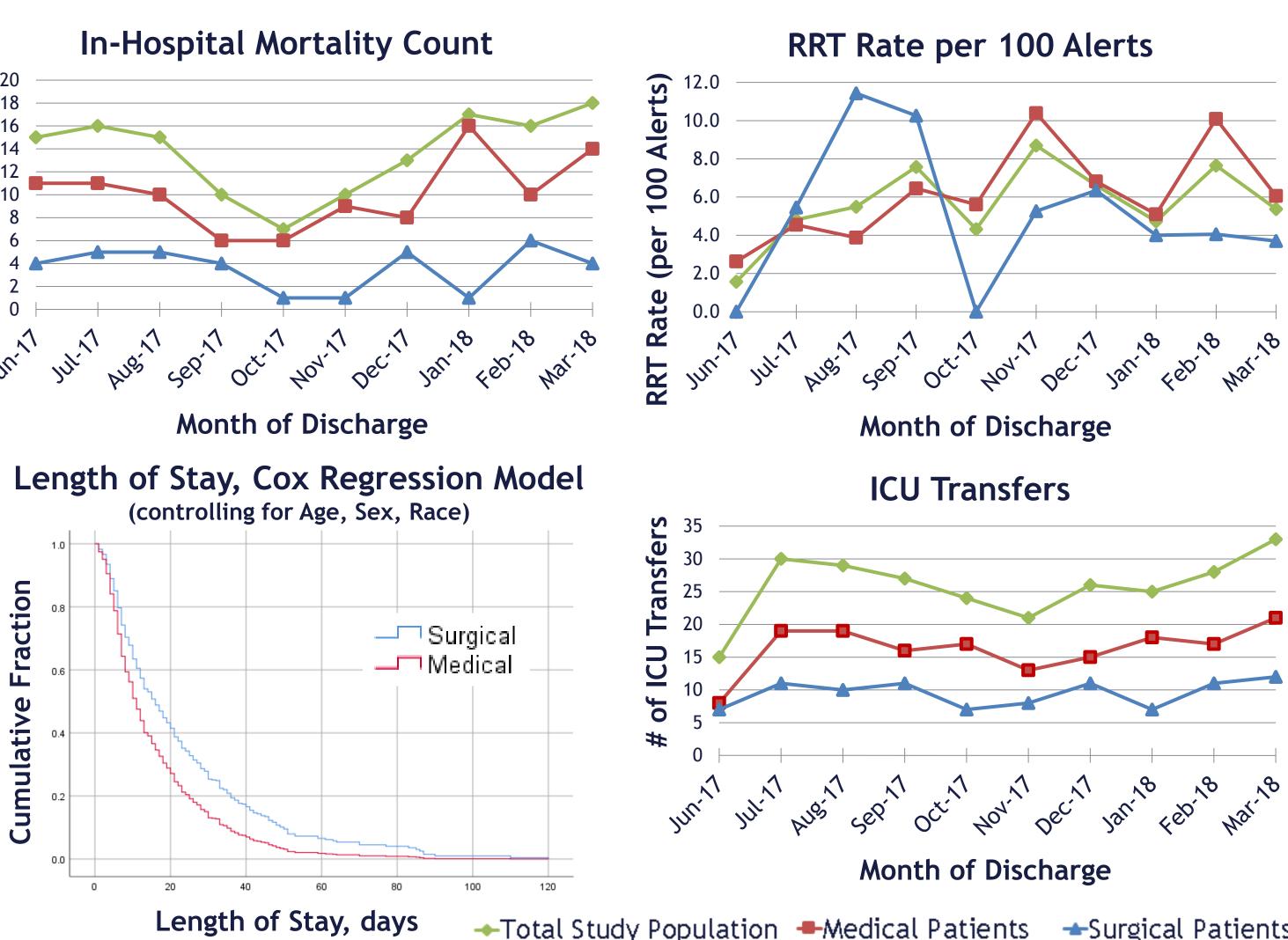
Aim 2: Differences in Outcomes

	Total included (n=812)	Medical Patient (n=563)	Surgical Patient (n=249)	P-value	Effect Size (95% CI)
In-Hospital Mortality (n, %)	137 (16.9)	101 (17.9)	36 (14.5)	0.402	OR=0.835 (0.549-1.272)
RRT Post-Alert (n, %)	87 (10.7)	63 (11.2)	24 (9.6)	0.486	OR=0.837 (0.508-1.380)
Length of Stay, days; median (s.d., range)	10 (15.2, 1-120)	9 (12.0, 1-77)	13 (19.7, 1-120)	<0.001	HR=0.675 (0.571-0.798)
Sepsis Diagnosis (n, %)	416 (51.2)	300 (53.3)	116 (46.6)	0.072	OR=1.284 (0.693-2.379)
ICU Transfer (n, %)	258 (31.8)	163 (29.0)	95 (38.2)	**0.011**	OR=1.504 (1.097-2.062)
Intubation Post-Alert (n, %)	39 (4.8)	19 (3.4)	20 (8.0)	**0.006**	OR=2.470 (1.289-4.732)
Survived to Discharge	Total (n=675)	Medical (n=462)	Surgical (n=213)	P-value	Effect Size
Discharge to Hospice (n, %)	98 (14.5)	81 (17.5)	17 (8.0)	**0.006**	OR=0.452 (0.258-0.793)

- Each additional year of **age** *increased* the odds of in-hospital mortality by 3.0% in the total study population and discharge to hospice by 4.6% in those who survived to discharge.
- Being identified as **White** *increased* the odds of having an RRT call after alert by 72.1%.

Aim 3: Outcomes over Time

Total Red MEWS Alerts per Month

- Introduced protocol for unit-based review to clinical nurse specialists using workbench report
- Tabling at Sepsis Conference to educate residents and nurses

MEWS Score live for 1 month

Committee begins to review aggregated outcomes in a report available in QLIK

Oncology dept starts unit-based QI project to increase staff understanding of MEWS process

Surgeons join workgroup due to lower compliance with MEWS process measures in surgical units

Implemented process where RRT nurses review MEWS workbench report and include patients with red alerts in proactive rounding list

Total Unique Patients with Alerts — Total Number of Alerts

In-Hospital Mortality Count

RRT Rate per 100 Alerts

Length of Stay, Cox Regression Model (controlling for Age, Sex, Race)

ICU Transfers

Total Study Population — Medical Patients — Surgical Patients

DISCUSSION & LIMITATIONS

- Most differences between medical and surgical patients who receive red MEWS alerts are not statistically significant or indicate that surgical patients, *while younger and more likely to have Commercial and/or Medicare insurance*, have *higher* odds of having poor outcomes (longer length of stay, ICU transfer, and intubation post-alert).
- This evidence supports MEWS score implementation for both medical and surgical in-patients at Jefferson.
- Further research:
  - Examination of outcomes directly related to alert, such as intubation and ICU transfer within 2 hours of alert
  - Validation of outcomes by comparing patients with a red MEWS alert against a control group.
  - Examination of differences in follow-up actions and their effect on patient outcomes
  - Follow-up of alerted patients and their outcomes for a longer period of time

CORE COMPETENCIES

- Applies ethical principles in accessing, collecting, analyzing, using, maintaining, and disseminating data and information
- Identifies gaps in data
- Describes how evidence is used in decision-making
- Conveys data and information to professionals and the public using a variety of approaches
- Describes the diversity of individuals and populations in a community
- Describes the value of a diverse public health workforce
- Retrieves evidence from print and electronic sources to support decision making
- Contributes to the public health evidence base

ACKNOWLEDGEMENTS