

Accuracy, Resource Utilization, and Sex and Race Differences of Myocardial Infarction (MI) Alerts: A Single-Center Experience in the Application of a Pre-Hospital Personnel Electrocardiogram (ECG) Education and Transmission Intervention

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Accuracy, Resource Utilization, and Sex and Race Differences of Myocardial Infarction (MI) Alerts: A Single-Center Experience in the Application of a Pre-Hospital Personnel Electrocardiogram (ECG) Education and Transmission Intervention

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Introduction

- Acute myocardial infarction (AMI) is a life-threatening process, the rapid treatment of which is critical in reducing resultant morbidity and mortality.
- A subset of these, ST-elevation myocardial infarction (STEMI) carries a particularly high acute mortality rate if left untreated, especially for a prolonged time. It is well recognized that decreasing time to intervention by revascularization is critical in reducing morbidity and mortality associated with cardiac tissue death.
- Paramedics are trained in EKG interpretation and can activate the cath lab prehospitally (MI Alert) in many systems.
- Paramedic training can be inconsistent, and more subtle manifestations of STEMI are often missed. Additionally, monitors commonly misinterpret EKGs.
- It is unknown if characteristics of patients presenting via ambulance affect false MI alert (definition below), as literature on whether age, sex, or race makes a difference in MI alerts and is minimal and conflicting.
- In 2015 at Lehigh Valley Health Network (LVHN), the NEAR criteria were implemented, and EKGs transmission devices were installed in ambulances.
- The NEAR criteria:
 - there must be a narrow complex <120ms,
 - ST elevation >1mm in 2+ contiguous leads,
 - the patient must have anginal chest pain
 - rate <120

Problem Statement

Of all patients where an MI alert was activated at LVHN, was there a difference age, sex, and race in false cardiac catheterization lab activations before and after February 2015 when the NEAR criteria and EKG transmissions were implemented?

Methods

- Reviewed an IRB-approved MI alert Redcap database maintained by the Department of Cardiology which tracks all MI alerts called from all LVHN Emergency Departments (EDs)
- A “False MI Alert”:
 - vetoed MI alert by ED and/or Cardiology
 - false activation
 - false positive: STEMI on ECG without culprit lesion
 - primary discharge diagnosis for the hospitalization not including ACS, AMI, STEMI, NSTEMI.
- Age, gender, and race pre-2015 vs post-2015 were assessed for their association with false alerts.

Results

- 8,089 patients included
- Pre-intervention: 5,837(72.2%)
- Post-intervention: 2,252(27.8%)
- The mean age of the patients was 58.42±14.69
- Greater proportion of males than female: 5,646 (70.0%)
- Greater proportion of white race: 7,115 (88.0%)

POST INTERVENTION:

- Patients were significantly older in age (64.29±13.0 vs 56.16±14.7; p <0.01)
- Patients were more likely to be female: 713(31.9%) vs 1,712(29.3%); p =0.03
- Patients were more likely to be of white race: 2,037(90.5%) vs 5,078(87.0%); p <0.01
- Fewer false alerts for females, non-white patients, and older patients (see Table 2)
- After accounting for age, gender, and race, patients in the post-intervention period were significantly more likely to have a False MI Alert (OR, 6.21; 95% CI, 5.11 to 7.56)
 - Indicates increased sensitivity

Table 1. Characteristics of the Patients with Ambulance Arrival to the ED

	Overall	Study Period		P
		Pre-Intervention n = 1,092(47.9)	Post-Intervention n = 1,188(52.1)	
Age	63(53.72)	58(49.67)	66(58.76)	<0.001
Gender				0.09
Male	1,591(70.0)	783(71.7)	808(68.4)	
Female	683(30.0)	309(28.3)	374(31.6)	
Race				<0.001
White	2,000(87.7)	914(83.7)	1,086(91.4)	
Non-White	280(12.3)	178(16.3)	102(8.6)	
Pre-Hospital MI Alert Activation				<0.001
Yes	1,641(72.2)	1,088(99.6)	553(46.8)	
No	633(27.8%)	4(0.4)	629(53.2)	
Pre-Hospital ECG				<0.001
Yes	843(37.0)	1(0.1)	842(70.9)	
No	1,437(63.0)	1,091(99.9)	346(29.1)	

Discussion

- There was a short interval between implementation of NEAR criteria and ECG transmission, so the data was analyzed as a single intervention.
- Race data was gathered from EMR or ambulance chart, but this can be largely provider defined.
- We don't know why there were more women in the post-intervention group, but it may be due to more subtle symptoms. Objective criteria for MI Alert may be the cause.
- New definitions for “False MI Alert” removing primary discharge diagnosis and instead focusing on appropriate MI Alerts will increase usefulness for ED providers.
- This study is related to SELECT by describing the characteristics of a process to determine areas of quality improvement and patient safety.
- Age, gender, and race characteristics are important in the work of inherent biases and equality.
- Self-Directed Learning included IRB submission & team communication.

Conclusions

- While studies are quite limited, this data is useful to help us understand how training and ECG transmission affected the demographics and accuracy of prehospital MI Alert activations.
- This study is limited by being performed at a single site.
- It appears that women and older patients were more often recognized to have AMI, but more research will need to be conducted to investigate why fewer non-white patients met criteria for pre-hospital MI Alert Activation.

Table 2. Odds of False MI Alert Among Ambulance Arrival Patients

	Unadjusted OR	95% CI	P	Adjusted OR	95% CI	P
Age	1.22	(1.15,1.29)	<0.001	1.02	(0.95,1.09)	0.57
Gender			0.18			0.92
Male	Reference			Reference		
Female	1.13	(0.94,1.35)		1.01	(0.83,1.23)	
Race			0.16			0.001
Non-White	Reference			Reference		
White	0.83	(0.65,1.07)		0.62	(0.47,0.82)	
Study Period			<0.001			<0.001
Pre-Intervention	Reference			Reference		
Post-Intervention	6.04	(5.03,7.26)		6.21	(5.11,7.56)	

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