Evidence-Based Performance Measures: Beyond Defibrillation and Speed

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“Nothing succeeds like the Appearance of success”
-- Christopher Lasch
Traditional Performance Measures

- Response time intervals
- Cardiac arrest resuscitation rates
- Perhaps patient safety issues
  - Intubation/airway complications
  - Vehicle crashes
Response Time Intervals

- Very little (if any) evidence suggests improved patient outcomes with rapid ALS response

- Strong evidence suggests improved outcomes for cardiac arrest with defibrillator response <5 minutes

- Improving ALS response time intervals may have undesirable consequences
Proportion of Patient’s Surviving Vs. Response Time of Defibrillator

Adjusted Odds Ratios for Survival to Hospital Discharge

- Age < 75 years
- Bystander Witnessed (1st link)
- Bystander CPR (2nd link)
- Response ≤ 8 min (3rd link)
- Phase III ALS (4th link)

Spaite, D. NAEMSP Annual Conference, Naples, FLA, January 2005
Cardiac Arrest Survival

- ~1% of patient volume
- Survival requires coordination with receiving hospitals
- Important but not sufficient measure of performance
So What Have We Done?

- Reviewed the evidence regarding EMS interventions for a larger group of patients
- Utilized the Number Needed to Treat (NNT) concept to estimate the magnitude of this benefit
- Wrote a manuscript
Types of Patients

- ST Segment Elevation MI
- Pulmonary Edema
- Asthma
- Seizure
- Trauma
- Cardiac Arrest
Number Needed To Treat

- Does not require graduation from MIT (Texas A and M will work just fine)

- Gives a magnitude of the benefit of a particular treatment

- Formula = $\frac{1}{\text{Absolute reduction in risk}}$
STEMI

Elements of treatment bundle:

- ASA
- 12 lead with pre-arrival activation of the interventional cardiology team
- Direct EMS transport to PCI for EKG-to-PCI interval <90 minutes

NNT to avoid death, 2nd MI, or stroke:

- 15
If all patients received the full treatment bundle, there was the potential to avoid 2nd MI stroke, or death for: 14,000 patients
This benefit was realized by: 10,000 patients

Scene Time <15 Minutes or Justified
Prehospital 12-Lead Acquisition

ASA Administration Since Pain Began or Documented Contraindication
Primary PCI Center Selected for Hospital Destination
Pulmonary Edema

- Elements of treatment bundle:
  - Nitroglycerin in the absence of contraindications
  - Non-invasive positive pressure ventilation (NIPPV)
- NNT with NIPPV to avoid intubation:
  - 6
Seizure

Elements of treatment of bundle:

- Blood glucose measurement
- Provision of benzodiazepine for status epilepticus
- NNT with benzodiazepines to terminate seizure that would have otherwise continued

4
Trauma

Elements of treatment bundle:

- Limit scene time to 10 minutes
- Direct transport to trauma center for those meeting ACS trauma criteria
- Appropriate air medical policy

NNT with ISS > 15 to avoid death

- 11

NNT over 65 with ISS >21 to avoid death

- 3
<table>
<thead>
<tr>
<th></th>
<th>Scene Alert</th>
<th>Scene Time</th>
<th>911 to ED Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>C. Trauma One</td>
<td>N = 243</td>
<td>29</td>
<td>Average</td>
</tr>
<tr>
<td></td>
<td>% = 95</td>
<td>44</td>
<td>90th Percentile</td>
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</tbody>
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**90th Percentile Scene Time in Minutes**

**Average Scene Time in Minutes**

**Scene Alert Given**
Cardiac Arrest

- Element of treatment bundle
  - Response time interval for defibrillator equipped resource < 5 minutes

- NNT for patients in VF/pulseless VT if defibrillator arrives in <5 minutes rather than <8 minutes to avoid death:
  - 8
Asthma

- **Element of treatment bundle:**
  - Administration of beta-agonist

- Evidence demonstrates this medication can be safely administered by BLS personnel
Summary

- Response time intervals and cardiac arrest survival remain important measures of EMS System performance.

- We now have evidence to measure performance for a broader array of clinical encounters.