Conclusion: An elevated shock index mirrors an elevated lactate and as such appears to provide a reliable “invisible lactate” surrogate for use in the field.

PCFR Sepsis Protocol

7 Impact of a Hospital Cyberattack on EMS Arrivals at Neighboring Emergency Departments

Dameff C, Farah J, Dotson M, Killeen J, Chan T/University of California, San Diego, CA

Study Objectives: Cyber attacks, including ransomware on health care delivery organizations (HDOs), are increasing in severity and frequency. Emergency medical services (EMS) plays a significant role in emergency care and disaster response, including the rapid transport of acute patients to receiving emergency departments (EDs). EMS ambulance diversion from one facility to another is a common occurrence with ED crowding, but it can be a result of internal or external disasters as well. The purpose of this study is to report regional EMS census impacts during an active cyber-attack on a neighboring HDO.

Methods: We performed a retrospective analysis of the daily combined EMS transport census of two large urban academic EDs in San Diego, CA during the week of a ransomware cyber-attack on a nearby multi-hospital HDO (May 2nd – 8th, 2021). We then compared the mean to the previous 4 weeks. A one-way analysis of variance (ANOVA) and Tukey test were used to compare EMS transport numbers by week.

Results: The mean combined daily EMS census for weeks 1 - 4 (no cyber-attack) were: week 1 (April 4th – 10th) = 69 (SD 6), week 2 (April 11th – 17th) = 68 (SD 5), week 3 (April 18th – 24th) = 71 (SD 7), and week 4 (April 25th – May 1st) = 75 (SD 9). For week 5 (week of the cyber-attack) the mean was 116 (SD 24). There was a statistically significant higher EMS census during the cyber-attack when compared to the 4 weeks prior (Table 1), with most days experiencing double the normal volume (Range 78 -144).

Conclusion: This study reports a significant increase in EMS ambulance arrivals at two EDs in proximity to a multi-hospital HDO under active cyber-attack. This result suggests cyber-attacks can have significant regional impacts on EMS volumes, and therefore, cyber disaster planning should take into consideration potentially large diversions of patients to other facilities via EMS.

<table>
<thead>
<tr>
<th>Week</th>
<th>Mean Daily Census</th>
<th>Standard Deviation</th>
<th>P value Compared to Week 5</th>
<th>P</th>
<th>P&lt;0.05</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1) April 4th – 10th</td>
<td>68.571</td>
<td>10.438</td>
<td>$&lt;0.000^*$</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>(2) April 11th – 17th</td>
<td>68.714</td>
<td>4.889</td>
<td>$&lt;0.000^*$</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>(3) April 18th – 24th</td>
<td>70.857</td>
<td>7.034</td>
<td>$&lt;0.000^*$</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>(4) April 25th – May 1st</td>
<td>75.428</td>
<td>8.923</td>
<td>$&lt;0.000^*$</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>(5) May 2nd – 8th</td>
<td>115.857</td>
<td>23.982</td>
<td>N/A</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

Table 1: Mean Daily EMS Census by Week

8 What’s Taking So Long: A Retrospective Review of Factors Influencing Bedside Time in Interfacility Transfer

Berkowitz J, Levinsky B, Kugler D, Lu T/Northwell Health, New York, NY

Study Objectives: The focus on reducing door-in-door-out times has created substantial scrutiny on the time emergency medical services (EMS) crews spend preparing patients for interfacility transport, referred hereafter as the “bedside time.” Several limited process improvement studies have shown that disease-state-specific interventions can reduce bedside time. Clinical complexity in the EMS transport environment are the clinical elements that need to be considered in managing the transport. Equipment and hemodynamic stability are the two major clinical considerations. The goal of this study was to determine the extent to which clinical complexity is associated with bedside time.

Methods: A dataset including clinical and operational data for two years (2018 and 2019) of inter-facility transfers was downloaded from the electronic patient care record system (HealthEMS, Stryker). This dataset included all inter-facility transfers at the Advanced Life Support (ALS) level or higher. Clinical complexity was measured using variables, including initial vital signs and the use of special equipment such as a ventilator, BiPap, intra-aortic balloon pump, and the number of infusion pumps. The number of crew on the transport assignment was captured as occasionally there are transports with an additional paramedic. Transports identified as a rescue for stroke, STEMI, cardiotoracic, or trauma were identified. A multivariable linear regression model was performed to identify factors related to clinical complexity associated with bedside time (minutes).

Results: Data from 1, 196 patient encounters were analyzed. Ventilator use (β=16.39), non-invasive ventilation (β=-7.19), balloon pump (β=14.38), initial heart rate (β=0.06 for each unit increase in heart rate), were independently associated with increased bedside time. Rescue/STEMI coding (β=-19.58) was independently associated with decreased bedside time.

Conclusion: Bedside time is a predictable function of clinical complexity of the patient being transported. Efforts to minimize bedside time should focus on reducing interventions that are not necessary for transport or reducing the task time for the individual components involved in transport. Further research is needed to assess the types interventions that can safely expedite bedside time.

9 Are There Positive Deviant Providers in the Speed of Ordering Antibiotics for Sepsis?

Saran N, Badgett R, Jackson B/Kansas University Medical Center, Kansas City, KS

Study Objectives: Positive deviance (PD) is an application of complexity leadership theory that fosters organizational learning of difficult tasks. PD may also be able to avoid the increased burnout associated the top-down management tactics of traditional quality improvement (QI). We assessed whether PD may be an appropriate strategy to improve sepsis care by testing for the presence of heterogeneity in provider antibiotic ordering time (AOT) for severe sepsis or septic shock patients and identifying the positive deviant providers.

Methods: We included all patients with severe sepsis or septic shock who presented to the University of Kansas Emergency Department over a 7-month period (September 2020 to March 2021), were cared for by categorical emergency medicine residents, and each member of the care team (resident physician, attending physician, and nurse) cared for at least three patients during the study period. First, we measured the percent heterogeneity (I²) of AOTs with separate random effects analyses for each personnel type. The results of the first analysis were displayed in forest plots. Second, to assess the contributions of each personnel type to the AOT, we performed regression analyses to measure the percent of variance (R²) of the AOTs attributable to each personnel type. The regression analyses were weighted by the inverse of the variance of the AOTs for each member of the patients’ care teams. The incremental contribution of each personnel type was measured by regression of their AOTs with the residual times of the positive deviant providers.

Results: Data from 71 patients were included. Random effects analyses showed statistically significant heterogeneity with “moderate” I² values of 42%, 58%, and 32% for the residents, nurses, and attendings, respectively. There were 3, 6, and 2 positive deviants,