Background: Prehospital identification of ST-segment elevation myocardial infarction (STEMI) using electrocardiography (ECG) confirmation can improve patient outcomes. Previous reviews of this research did not include evidence published prior to the release of a number of newer studies. The objective of this study was to present an updated review of prehospital identification of STEMI patients transported by EMS with 12-lead ECG confirmation versus standard or no cardiac monitoring.

Methods: EMBASE, PubMed, and Cochrane Library were searched for relevant studies and keywords. Randomized controlled trials and observational studies were included. Outcomes included short-term mortality (≤30 days), door-to-balloon/needle time, and first medical contact-to-balloon/needle time. Pooled estimates were determined, where appropriate. Results were stratified by percutaneous coronary intervention (PCI) or fibrinolyis. Results: The search yielded 1,857 citations of which 68 full-texts were reviewed and 16 studies met the final criteria: 15 included data on fibrinolysis (2 included both). Observational studies limited the quality of evidence; however, a number of studies were identified and there were no serious threats to validity, imprecision, or methodological bias that would further downgrade evidence from a low quality. Where PCI was performed, prehospital 12-lead ECG confirmation was associated with a 39% reduction in short-term mortality (8 studies; n = 6,339; RR 0.61; 95% CI = 0.54–0.93; p = 0.01). Fibrinolysis results were very similar to PCI and were consistent across 8 studies (range 0.54–0.93; p < 0.05). Conclusion: Prehospital 12-lead ECG confirmation was found to be associated with reductions in short-term mortality, first medical contact-to-balloon, door-to-balloon, and door-to-needle time. Further research should investigate these time delays and focus on methods to reduce transmission delays.

152. IMPLICATIONS OF PREHOSPITAL ELECTROCARDIOGRAPHY CONFIRMATION AND EMERGENCY DEPARTMENT RECEIVE TIMES ON PREHOSPITAL CARDIAC CATHETERIZATION LAB ACTIVATION

Timothy Lenz, Jeffrey Luk, Matthew Woller- man, Edward Michelson, Medical College of Wisconsin

Background: Chest pain warrants a rapid assessment, including an early 12-lead ECG. Rapid identification of myocardial infarctions (STEMIs) or new left bundle branch block is of critical importance. Established guidelines emphasize the importance of early STEMIs identification and minimization of door-to-balloon (DTB) times. Prehospital identification of STEMIs may result in earlier cardiac catheterization lab (CCL) activation. However, the timing of catheterization lab (CCL) activation may be challenging for the emergency department (ED) to comply with when using prehospital ECGs. Objective: To study the timeline of prehospital ECG arrival for review by ED physicians to identify potential delays. Such delays may be inappropriate and can negatively impact compliance of first ECG-to-CCL activation time of ≤5 minutes recommended by the Society of Chest Pain Centers. Design: Retrospective observational convenience sample. Setting: Urban tertiary academic hospital. Data set: All prehospital ECGs transmitted to the EDs of the 13 agencies through LifeNet System, Inc. from January 1, 2013, through June 30, 2013. Protocol: ECGs were reviewed for times obtained and received. The time difference for each ECG was calculated (i.e., obtained to received time = OTRT). The mean and median OTRTs were found. Average OTRTs were calculated for each agency. Results: Out of 1,700 ECGs, 35 had incomplete data, 1 was removed for an outlier (OTRT 22 hours 58 minutes 51 seconds), resulting in 1,664 ECGs with complete data. Mean and median OTRTs were 5 minutes 54 seconds and 3 minutes 27 seconds (range 14 seconds to 8 hours 56 minutes 28 seconds). Eleven of the 13 agencies had average OTRTs of no more than 8 minutes 14 seconds. Potential causes for prolonged OTRTs include 1) EMS delay in initiating ECG transmission; 2) network delays in processing; 3) incorrect reads due to lack of time synchronization; and 4) delay in recognition of ECG arrival in the ED. Conclusions: Printed prehospital ECG times do not accurately reflect the time information becomes available to the ED. Therefore, this study should not be used as a benchmark for first ECG-to-CCL activation times. Further research should investigate these time delays and focus on methods to reduce transmission delays.
primarily from vehicle fuel consumption, are the clear priority for EMS sustainability initiatives. Lean Six Sigma methodology can account for these EMS-related emissions. Reducing waste in the EMS supply chain could have dual benefits of reducing system operational costs and reducing greenhouse gas emissions.

154. EMERGENCY MEDICAL SERVICE SUPER-USER RESOURCE UTILIZATION: THE LOS ANGELES EXPERIENCE

Stephen Sanko, Marc Eckstein, Keck School of Medicine of USC, Los Angeles Fire Department

Background: Overutilization of emergency medical services (EMS) by a select group of “super-users” strains prehospital resources, though few systems have formally reported this. The objective of our study was to quantify the frequency of EMS responses, the resources mobilized, clinical interventions provided, and financial burden that this group represents for a large, urban EMS provider agency. Methods: A retrospective review of electronic medical records from the Los Angeles Fire Department (LAFD), the EMS provider for a city of 3.8 million people, was used to identify the 40 most frequent “EMS super-users” based on clinical EMS dispatches from January 1, 2011 to December 31, 2012. Outcomes reported included the number of fire department resources deployed for each patient encounter, total resource turnaround time (from time of alarm to being back in service), and the financial debt of each frequent user. Results: During the 12 months under study, LAFD providers responded to approximately 336,000 incidents, resulting in 204,900 patient transports. The top 40 EMS “super-users” accounted for 2,980 vehicles were involved in care of these patients, including 2,080 BLS and 900 ALS deployments. EMS turnaround time dedicated to these patients increased from 1,540 personnel-hours, including 540 hours of ALS service. The total charges for these 40 patients over the study period were $24.4 million, of which $22.5 million, or 92% of the median billed charges by each of these patients was $20,232. Conclusions: An identified small group of EMS “super-users” places an inordinate demand on our local EMS system. Emergency health-care stakeholders should make efforts to coordinate preventative care and seek additional use of the 9-1-1 system to provide these patients with the appropriate medical care, while relieving the EMS system of this burden.

155. THE IMPACT OF LEAN SIX SIGMA METHODOLOGY ON OFFLOAD DELAY IN A CANADIAN EMS SYSTEM

Sheldon Cheskes, Peter Dundas, Mary Ellen Duff, Claudia Mititelu, Oscar Karbi, Kiki Ferrati, Naveed Mohammad, Cindy Hawkswell, Kelly Todd, Sunnybrook Centre for Prehospital Medicine, Peel Region Paramedic Service

Background: Emergency department (ED) arrival to transfer of patient care continues to significantly impact paramedic operational costs, ED efficiency, and the availability of paramedics to provide emergency coverage in their communities. Lean Six Sigma is a methodology commonly used in industry to simplify systems and improve efficiency. The objective of this study was to examine the impact of Lean Six Sigma strategies on offload delay times in a Canadian EMS system. Methods: We conducted a before and after study in a large community hospital ED with historically high offload delay times. Front-line stakeholders, including paramedics, nurses, physicians, and managers, were trained in the Lean Six Sigma formal approach to process improvement. Key performance metrics and mean offload delay times were collected before (January 1–December 31, 2011) and after (January 1–June 30, 2012) implementation of Lean Six Sigma strategies. Results: Mean (SD) offload delay time decreased from 33.5 (56.0) minutes before the Lean Six Sigma intervention to 40.3 (32.1) minutes (beta 13.2 mm; 95% CI: 12.1, 14.2; 25% decrease) in the post-implementation phase. Similarly, 90th percentile offload time decreased from 109.3 min to 74.9 min in the after phase (delta 34.4 mm; 95% CI: 29.3, 38.6; 31% decrease). Individual components of offload delay that showed the most improvement post implementation of Lean Six Sigma findings were time to transfer of care (51.4 vs. 19.0 min; delta 32.4 min; 63% decrease), time to registration (9.0 vs. 7.0 min; delta 2.0 min; 22% decrease), and time to ED departure (40.5 vs. 33.5 min; delta 5.2 min; 13% decrease). Based on a mean monthly EMS transport rate of 1,569 patients, process improvements resulted in 344 hours of additional availability in the community per month. EMS cost savings as a result of process improvements were $75,336 per month, and $904,032 per year. Conclusions: With the implementation of Lean Six Sigma, agencies providing medical transport, and receiving EDs, Lean Six Sigma methodology may result in significant reductions in ambulance offload delay times. Further study is required to determine whether these findings can be sustained over time and replicated in other EMS systems.

156. CHARACTERISTICS OF THE MOST FREQUENT “SUPER-USERS” OF EMERGENCY MEDICAL SERVICES

Stephen Sanko, Marc Eckstein, Keck School of Medicine, Los Angeles Fire Department

Background: A small group of “super-users” account for a disproportionate number of emergency medical service (EMS) encounters and transports. The EMS system is more sporadic, uncoordinated care at disparate sites, leading to redundant testing, high system costs, and ultimately ineffective care plans. The objective of our study was to describe the demographic attributes and diversity of transport destinations of the most frequent users in our large urban EMS system. Methods: A retrospective review of electronic medical records from the Los Angeles Fire Department (LAFD), the EMS provider for a city of 3.8 million people, identified the 40 most frequent EMS users from July 2011 to June 2012. Patient demographics, living situation, insurance status, and hospital destination information were collected. Results: During the 12 months under study, LAFD providers responded to approximately 336,000 incidents, resulting in 204,900 patient transports. The top 40 EMS “super-users” accounted for 2,980 vehicles were involved in care of these patients, including 2,080 BLS and 900 ALS deployments. EMS turnaround time dedicated to these patients increased from 1,540 personnel-hours, including 540 hours of ALS service. The total charges for these 40 patients over the study period were $24.4 million, of which $22.5 million, or 92% of the median billed charges by each of these patients was $20,232. Conclusions: An identified small group of EMS “super-users” places an inordinate demand on our local EMS system. Emergency health-care stakeholders should make efforts to coordinate preventative care and seek additional use of the 9-1-1 system to provide these patients with the appropriate medical care, while relieving the EMS system of this burden.

157. MEDICAL RECORDS AS A SOLUTION TO EMERGENCY MEDICAL SERVICES (EMS) OFFLOAD DELAY IN THE EMERGENCY DEPARTMENT: A PROCESS MAP AND HAZARD ANALYSIS

Alix Carter, James Gould, Peter Vanberkel, Jan Jensen, Jolene Cook, Steven Carrigan, Mark Waleahey, Andrew Travers, EHS Nova Scotia, Dalhousie University

Background: Offload delay is a prolongation of the interval between ambulance arrival in emergency department (ED) and time of transfer to definitive care. This reduces the availability of ambulance resources for emergency response in the community. The offload zone (OZ), which can accommodate an ED bed, has been implemented as a