



Pre-Hospital Notification in Time-Sensitive Medical Emergencies What EMS Agencies and Emergency Departments Should Know

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For over 40 years, the medical community has recognized the “golden hour” as the standard of care for seriously injured trauma patients. Later, the importance of the “golden hour” in combination with stroke alert protocols was demonstrated to maximize the survivor’s chance of a disability-free life. Recent research has shown that the “golden hour” concept also applies to a number of other medical conditions such as ST-Elevation Myocardial Infarction (ST-EMI) and Sepsis.

These conditions account for nearly 1 million deaths in the nation each year. According to current guidelines, definitive stroke care should occur in less than 60 minutes and less than 90 minutes for STEMI. The benefits of tPA to treat stroke patients are highly time-dependent and, for every minute a large vessel stroke goes untreated, as many as 1.9 million neurons and 14 billion synapses are potentially lost.¹ Even small differences in door-to-needle and onset-to-needle times may produce clinically relevant differences in stroke functional outcomes. Sepsis Shock mortality increases 9% each hour until antibiotic therapy is initiated.² Patients in these categories almost always require rapid intervention by a team of specialists.



¹ “Emergency Medical Service Hospital Prenotification Is Associated With Improved Evaluation and Treatment of Acute Ischemic Stroke” - <http://circoutcomes.ahajournals.org/content/5/4/514>

² “Septic shock patients suffer most from delayed antibiotics”, American Journal of Respiratory and Critical Care Medicine - <https://www.mdedge.com/chestphysician/article/135460/critical-care/septic-shock-patients-suffer-most-delayed-antibiotics>

Since elapsed time from the onset of symptoms to appropriate treatment is a critical component, it is clear that EMS plays a significant role in the care and long-term outcomes for these patients. One crucial step in reducing delays in treatment during time-sensitive medical and traumatic emergencies is efficient pre-hospital notification.

Successful pre-hospital notification protocols have a number of benefits to the patient, as well



as to the EMS agency and the hospitals involved, but there are also some challenges to be aware of. These include the use of disparate or inefficient technologies, lack of effective policy, and the need for appropriate training. New emerging technologies such as the advent of FirstNet, the National Public Safety Broadband Network (NPSBN), and Next Generation 911 (NG-911) will greatly increase the ability of EMS to provide enhanced information to hospital Emergency Departments (ED). While these

pre-hospital notifications will support pre-arrival actions by the ED, they will also require attention to policy and education issues in order to be effective.

Current Landscape

National recommendations exist which define best practices for stroke alert, STEMI alert, and trauma alert patient treatment and transport. Standards also exist for hospital certification on each of those emergencies. Most EMS systems are required by their regulatory authorities to have two-way voice communications between EMS personnel and the hospital ED. However, use of this technology to issue a pre-hospital notification and the viability of transport to a specialty hospital is highly variable, based on a large number of factors.

A number of differences with pre-hospital alerting are seen between urban, suburban, and rural settings. There are a multitude of reasons for these variations. Large EDs are less likely to desire notification of incoming patients due to the volume of EMS patients arriving and a misconception of the value in receiving the information. Urban and suburban EMS agencies may only notify the emergency department of Advance Life Support (ALS) patients, or when needing medical direction. Rural EDs are most likely to desire consistent pre-hospital notification in order to manage limited bed and staffing resources. Rural EMS providers typically have longer transport times to stroke, STEMI, and trauma certified hospitals requiring initial transport to smaller regional hospitals, which may require call back of specialized clinical personnel including radiologic technicians.

There are also technology barriers that affect pre-hospital alerting to the ED. Some EMS agencies have complex radio systems that make it difficult for personnel to navigate to the correct talkgroup for a particular hospital. Some hospitals use radio systems that rely on an antenna at their facility, which reduces the coverage area of the radio system used by EMS. An EMS unit may only be able to contact the ED by radio in the final 5 minutes of their transport, which would not allow sufficient time to mobilize specialty resources. In some EDs, the EMS radio is not located in an area accessible to most ED staff.

Lack of effective policy can also influence EMS notification to EDs. Some EMS agencies do not have policy and procedures governing when pre-hospital notifications must be issued, how they are issued, and for providing quality assurance review of this element of patient care. Many EDs do not have any policy regarding EMS notification, which creates an inconsistent response when a radio call is received. Emergency department team members, radiology specialists, trauma team, stroke team, cardiologists, cardiac catheterization lab, neuro-interventional suite, and the ICU all rely on disparate communications technologies and methods. These include the use of cell phones, pagers, radios, and software applications. Use of these different devices among specialty team members and among different specialty teams may contribute to delays in notification and mobilization.

Training issues also impact the effectiveness of pre-hospital notifications. Some EMS personnel are not familiar with the agency requirements for issuing pre-hospital alerts (which may vary between different receiving hospitals). EMS personnel may also be transporting patients to more distant tertiary care facilities and be unaware of how to contact that facility. ED personnel also need training to ensure that they understand the use of the pre-hospital radio systems, the importance of prehospital notification, and the expectations for managing these calls.

New and Emerging Technology

A variety of new and emerging technologies are on the horizon that will impact EMS response as well as the type, validity, and amount of communication and coordination between EMS and the ED, allowing for more patient data sharing with EDs in real time. With appropriate policy and training in place, these technologies can greatly improve the efficiency and effectiveness of pre-hospital notification as well as patient information exchange.



- Software applications now allow rapid notification and sharing of data by EMS personnel from the scene to the ED and to designated specialists. These applications capture detailed patient assessment information unique for each patient care type (e.g., STEMI, stroke) and allow for a data alert to be transmitted to the ED. These applications supplement voice communications with medical control and the ED staff.
- One study³ demonstrated that use of an EMS-based application improved the communication flow and resulted in a 28 to 46% improvement in door-to-needle (DTN) therapy for stroke and a 22% improvement in door-to-balloon (DTB) in STEMI. Use of a software application was further associated with a modest improvement in meeting the national benchmarks of door-to-needle (DTN) < 60 minutes in stroke, and DTB < 90 minutes in STEMI.
- Software applications allow for real-time feedback to EMS providers on their diagnosis and treatment and become an important part of an agency's quality assurance program.
- NG911 systems will allow sensor alerts to be transmitted directly to EMS dispatch centers. This may include a patient sensor that has detected a Ventricular Fibrillation Cardiac Arrest. Other sensor systems would detect a high-speed car crash involving four occupants in which the vehicle was struck broadside and rolled over. All four of the passengers have a high probability of critical injuries. NG911 systems also allow video transmission during a 911 call. The EMS dispatcher will be able to see a patient with stroke symptoms and conduct a stroke screening assessment.
 - Some of this critical data could flow directly to the ED, providing an early warning alert and documentation on the patient's condition during onset of symptoms.
- The NPSBN will provide improved access to high-speed broadband network connectivity to support public safety, including law enforcement, fire, and EMS.

³ "Improving Systems of Care in Time-Sensitive Emergencies" - <http://www.jems.com/articles/print/volume-42/issue-1/features/improving-systems-of-care-in-time-sensitive-emergencies.html>

- EMS agencies will be able to share patient telemetry; including 12 lead EKGs, more reliably and will also enable video consultation between the EMS personnel and the ED. Some EMS regions are developing data “dashboards” for EDs that will display the status of all EMS units enroute to their facility. The dashboard identifies the EMS Unit, their estimated time of arrival, Patient Chief Complaint, and Triage Severity code. This allows ED personnel to have better situational awareness of EMS activity.



Recommendations

Successful pre-hospital notification protocols based on efficient policy, emerging technologies, and effective training benefit the patient, the EMS agency, and the hospital. Patient outcomes are consistently more favorable based on early intervention, EMS agencies benefit by reducing handoff and turnaround times, and hospitals will benefit by maximizing the use of critical resources such as equipment and personnel.

Best practices for management of all time urgent medical emergencies include common elements:

- Timely pre-hospital notification and medical direction with the ability for the patient information to be electronically transferred to ensure quality during patient handoff to the ED and successive departments.
- Shared, interactive, case management technology solution that connects EMS/ED/Acute Care Teams with patient data and mobile telemedicine for coordination and collaboration, from first medical contact through intervention and treatment.
- Secure transmission and sharing of patient data and metrics (e.g., ECG, photos, video, and last-known well times, etc.)
- Pertinent stroke/sepsis/trauma/STEMI scores and templates to define acuity.
- Transport to the most appropriate facility.
- Real-time ambulance ETA tracking dashboard with alerts.
- Direct triage to appropriate treatment area (e.g., Vascular lab/CT scanner) while the patient is still on the EMS stretcher when appropriate.
- Prompt outcome data feedback to EMS to confirm diagnosis and treatment.

EMS agencies should consider the following recommendations:

- Assess the efficiency of the current pre-hospital notification process to include a review of agency policy, technology, and training.
- Meet with local ED personnel to better understand their operational needs and how they can work with you to jointly improve the notification process.
- Discuss how emerging technologies like EMS notification software applications, NG911, and the NPSBN may impact pre-hospital notification.
- Consider alternate avenues of communication for large- scale events or during radio system failure. On larger incidents, pre-hospital notifications may be done by Incident Command personnel on the scene rather than the EMS transport unit. Communication centers should have a policy and procedure in place to direct the telecommunicators in the event they are required to relay the information to the hospital if the EMS personnel are busy or unable to reach the receiving facility.

Emergency Departments should consider the following recommendations:

- Assess the current pre-hospital notification process to identify areas of improvement across the different EMS agencies that bring patients to the ED.
- Meet with EMS agency representatives to discuss ways to enhance pre-hospital notification based on existing best practices and the operational needs of the ED.
- Meet with specialty care teams to assess current alerting procedures to determine what improvements can be made. Policy, training, and technology issues should all figure into the discussion.
- Meet with EMS agencies to discuss emerging and future technologies and how they can be integrated into the pre-hospital notification process.

Outside of the recognized medical emergency categories noted in this report as requiring pre-hospital notification, there are a number of other pre-hospital communications issues to address when creating policy:

- Mass Casualty Incidents (MCI). A regional policy should exist which describes how all area hospitals will be immediately notified to allow for sufficient preparatory actions and staffing to support EMS transported patients and those patients who will arrive through an alternate means of transportation.
- Hospital Security. Incidents that may threaten the security and safety of the ED, such as gunshot wounds, stabbings, assaults, and other violent incidents may require early notification for security readiness and to incorporate safety measures.
- Hazmat Incidents. Adequate and timely notification of the chemicals involved and the estimated number of patients exposed allows for ED preparedness and

establishes a high index of suspicion for patients who may arrive at the hospital who were transported by other means. Some patients, especially those not transported by EMS, may require additional decontamination prior to entry to the ED.

- Infectious Disease. Early notification allows the ED to be prepared for isolating the patient to ensure the welfare of other occupants of the ED. This applies to not just pandemic viruses, but situations other more common communicable diseases.

Although trauma, stroke, STEMI, and sepsis differ in etiology, presentation, and treatment priorities, common themes in best practices exist that can be incorporated into EMS and hospital systems of care to improve outcomes for patients experiencing any of these time-sensitive emergencies. Having a collaborative policy, the appropriate technology, and effective training helps to build the necessary processes, workflow and mutual confidence across the continuum of care-- MS, ED, and hospital acute care teams. It also improves EMS and ED utilization and capacity which relate to cost savings. This improved acute care workflow efficiency can significantly decrease time-to-treatment and increase the patient's chances for improved outcomes, which is always the ultimate goal.