

Emergency Medical Services
Apply Perfecting Patient CareSM
to Prehospital Care



ANSWERING
THE CALL

ROOTS

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Emergency Medical Services Champions

Emergency medical services (EMS) play an integral role in the healthcare system, lying at the crossroads of public health, public safety, and emergency medicine. In the United States, EMS transports nearly 30 million patients every year to hospitals or other healthcare facilities.ⁱ EMS workers — including paramedics, prehospital nurses, and emergency medical technicians — are called upon at all hours of the day to treat and transport often complex and seriously ill patients.

In 2003, Paul Paris, MD, FACEP, LLD (Hon.), then chairman and professor at the University of Pittsburgh School of Medicine's Department of Emergency Medicine, approached Karen Wolk Feinstein, PhD, president and chief executive officer of the Jewish Healthcare Foundation (JHF), and described a previously overlooked problem. As a physician involved in EMS for the majority of his career, Dr. Paris realized that while other sectors of health care were focusing on improving safety and quality outcomes, prehospital care was not. The Institute of Medicine's seminal report, *To Err is Human: Building a Safer Health System* (1999), identified that as many as 98,000 people die in hospitals from preventable medical errors. This report, along with 2001's *Crossing the Quality Chasm*, spurred national efforts to address institutional safety and quality issues. Yet, in EMS, efforts to quantify and address these issues have been limited.

As Dr. Paris points out, nearly every American family is affected at some point by an emergency. "At any time or place, day or night, you may encounter a sudden onset of an injury or illness and when that occurs, the first link in the healthcare chain is first aid, but then somebody in the EMS system," he said. "So, for many serious illnesses or injuries, the final outcome is going to be highly dependent on the quality of care delivered by the EMS providers."

JHF Sponsors Early EMS Quality Study

In an effort to better understand the types and frequency of errors in EMS, Dr. Paris asked JHF to fund a study on the issue. In 2004, JHF partnered with the University of Pittsburgh School of Medicine and the Center for Emergency Medicine of Western Pennsylvania to do just that. EMS calls from multiple agencies were videotaped and then analyzed by experts, including EMS physicians, educators, and practitioners to detect errors that could adversely affect quality and safety.

The results were a series of educational vignettes and a "taxonomy of errors" that drew attention to numerous opportunities for improvement, including time management, pre-dispatch readiness, communications, driving and parking, and adherence to national medical and trauma protocols. The taxonomy of errors provided fuel for the development of additional EMS patient safety research and highlighted the need for additional monitoring and benchmarks to be put in place. According to Dr. Paris, the project "confirmed that even with the very best EMS providers in relatively unhostile circumstances, some fundamental deviations from ideal care still occur."

How Safe is EMS?

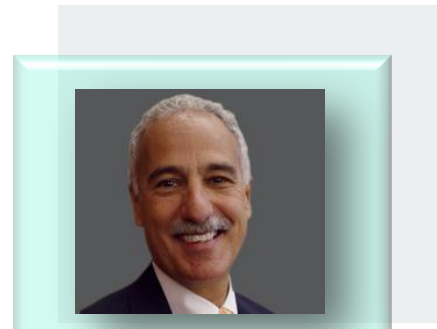
In the years since the EMS video study with Dr. Paris, only a handful of studies have exposed various safety and quality issues in EMS, but these issues have not been a major focus for the industry. In a 2008 editorial in *Prehospital Emergency Care*, Dr. Paris wrote, "How Safe is EMS? The truth is, we simply do not know. Aside from a small series of reports and anecdotes, we know very little about national patient safety in EMS. It is clear that prehospital care is challenged by many factors known to augment error: time urgency, interruptions, an uncontrolled environment, stress, variable initial training, and inconsistent continuing education."ⁱⁱ

These factors known to increase the risk of errors, such as the unpredictable and time-sensitive nature of EMS, likely contribute to a number of issues that have been uncovered by the rare studies of EMS safety. EMS providers have been the main focus of such studies, which reveal, for example, that the occupational injury rate for EMS personnel is five times the national averageⁱⁱⁱ and the fatality rate is more than twice the national average.^{iv} Workers commonly suffer sprains and strains due to moving patients, a leading cause of injury.^v Exposure to blood-borne pathogens from needle sticks and bodily fluids is another common safety risk^{vi vii} along with violence towards EMS personnel.^{viii} By far, the deadliest threat to EMS workers and patients is transportation.^{ix} Ambulance crashes result in twice as many injuries per crash as the national average^x and are the main cause of EMS fatalities.^{xi}

If research into EMS provider safety is rare, then EMS patient safety research is even more uncommon. While the magnitude of EMS patient safety issues is largely uncharted territory, research has revealed that adverse events and near-misses are prevalent, yet often go unreported due to the culture of EMS agencies.^{xii} Commonly identified errors in EMS patient care include poor airway management,^{xiii} medication errors,^{xiv} deviation from medical protocols,^{xv} interruptions during cardiopulmonary resuscitation,^{xvi} and inadequate pain management.^{xvii}

As a teacher, researcher, author and clinician, Dr. Paris has set the precedent for advancing emergency medicine through research, education, quality patient care and administrative leadership. He is internationally recognized as a leader in emergency medicine and is known for his teaching and innovation in acute pain management and prehospital emergency care.

In addition to serving as a professor in the Department of Emergency Medicine at the University of Pittsburgh School of Medicine, Dr. Paris is also the Chief Medical Officer of the Center for Emergency Medicine, the Medical Director of the Emergency Medical Service Institute, the Senior Medical Advisor of the City of Pittsburgh Department of Public Safety Bureau of EMS, Medical Director and one of the founding members of the Pittsburgh Emergency Medicine Foundation, and a past president of the National Association of EMS Physicians (NAEMSP).^{xviii}



Paul Paris, MD, FACEP, LLD (Hon.)

Dr. Paris provided invaluable guidance, mentorship, and expertise as the volunteer medical director of the EMS Safety/Quality Champions Fellowship. So important was his contribution that JHF and others nominated Dr. Paris for the prestigious 2011 EMS 10: “Innovators in EMS” award, presented by the Journal of Emergency Medical Services (JEMS). JEMS agreed with JHF’s assessment of Dr. Paris and honored him for his contribution to the Fellowship and his dedication to advancing the quality and safety of prehospital care.

In an interview about the award published in JEMS, Dr. Paris acknowledged the Fellowship’s role in advancing EMS’s awareness of the need for a culture of safety to be widely implemented. “Instead of having an environment of blame, which is what we have now, let’s have an environment of openness and anonymous reporting, in which we try to figure out where the system’s flaws are, and how we can try to help protect people from making mistakes by designing a safer system,” he said.

Dr. Paris is hopeful that the EMS Champions’ projects will have a far-reaching impact, with Fellows presenting at conferences and publishing their projects in peer-reviewed journals. He hopes to continue his collaboration with JHF, envisioning widespread online quality improvement education tailored to EMS providers. “The content will be interesting, with real-life situations, not talking heads, that will point out the issues and what will be necessary to address those issues to create a culture of safety.”^{xix}

Designing the Fellowship

In 2009, members of the JHF grant assessment team met again with Dr. Paris and his team, and evaluated their work retrospectively. It was clear that the modest investment JHF made in cataloging EMS errors and safety issues helped to ignite interest in furthering quality improvement in this sector. Dr. Paris expressed a strong interest in developing pilot quality improvement opportunities and training for EMS professionals that could be disseminated across the region and beyond.

Realizing that EMS, whose performance so markedly influences patient outcomes, was ripe with opportunity for improvements in safety and quality, JHF and Dr. Paris worked together to develop the EMS Safety/Quality Champions Fellowship. The EMS Champions Fellowship built upon the successes of four previous JHF Champions programs: Physician Champions, Nurse Navigators, Pharmacy Agents for Change, and Consumer Health Information Champions. The Pharmacy projects were also the subject of a previous edition of ROOTS (prhi.org/newspublications).

At the core of JHF's Champions programs is Perfecting Patient CareSM (PPC), the flagship healthcare process improvement methodology developed and taught by the Pittsburgh Regional Health Initiative (PRHI), an operating arm of the Jewish Healthcare Foundation. A powerful, proven education and training program, PPC equips healthcare providers in a variety of settings with the tools and resources needed to eliminate errors, decrease inefficiency and waste, and deliver more perfect patient care.

PPC empowers people at every level of the organization to constantly improve and redesign their work. The quality improvement methodology is taught in a variety of formats, giving healthcare providers the flexibility to choose an educational method that best suits their needs. Ongoing PPC training for the EMS Champions was accomplished through Tomorrow's HealthCareTM (THC), JHF's web-based quality improvement tool.

Fellowship Structure

The EMS Champions were recruited from the southwestern Pennsylvania region, representing frontline paramedics, as well as EMS chiefs and executive directors, to design and execute quality improvement programs. While previous Champions programs were limited to fewer than 10 participants, the use of Tomorrow's HealthCareTM allowed the EMS Champions program to be expanded to 18. The Champions committed to a year-long program, during which they developed the skills necessary to become successful change agents in prehospital care. The program included online PPC training via Tomorrow's HealthCareTM, quarterly meetings involving all of the Champions, JHF's coaching, and mentoring by experts in EMS.

Each Champion conducted a quality improvement project aimed at increasing safety, quality or efficiency in EMS. They were supported by Dr. Paris and Maria Koenig Guyette, MD, FACEP, associate chief of Emergency Services at UPMC Shadyside, who served as a senior mentor. Some of the Champions themselves acted as mentors, providing their expertise in research or quality improvement to other Champions. JHF quality improvement coaches Michelle Anderson, MOT, OTR/L, and Maureen Saxon-Gioia, BSN, RN, provided the core PPC education and coaching. Additionally, Nancy D. Zions, MBA, chief program officer of JHF, served as the project lead.

Through collaborations with each other, using the tools of Perfecting Patient CareSM, and in some cases, travelling abroad to learn best practices in other countries, the EMS Champions demonstrated the value of a focused quality improvement fellowship for EMS professionals.

This publication examines the Champions' impact in three areas: (1) developing process improvement tools with the ultimate goal of improving patient safety, (2) improving EMS provider health and education, and (3) advancing the EMS system at large.

Coaching and Mentoring

A key component of JHF's Champions programs is the coaching provided by JHF's experienced quality improvement specialists. Coaches support Champions in problem solving, overcoming barriers to success, and developing the skills necessary to become experts in Lean transformation. Although this was the first time JHF coaches worked with EMS providers, their experience with implementing Lean in physician offices, acute and long-term-care settings was transferable to the prehospital environment. "EMS providers encounter some of the same challenges as other healthcare workers," said Maureen Saxon-Gioia, JHF senior quality improvement specialist and Fellowship coach. "The benefits of using PPC methodology to improve communication, treat cardiac conditions or pain, and improve patient safety resonated with the EMS community as much as our past Champions."

The EMS Champions Fellowship brought with it a set of unique challenges. "Our face-to-face interaction with the Champions was somewhat limited," said Michelle Anderson, JHF program manager and Fellowship coach. "Although we met quarterly, a lot of the teaching and coaching was done remotely, through Tomorrow's HealthCare™, email, or by phone." Despite this variation, both Anderson and Saxon-Gioia noticed a sense of collegiality and passion for quality improvement among the Fellows.

To provide extra support to the Champions, mentors were assigned to each participant. As experts in EMS, the mentors were an invaluable resource for many of the Champions. Senior mentor Maria Koenig Guyette, MD, and Mentor/EMS Champion Daniel Patterson, PhD, both agreed that one of the most important aspects of serving as a mentor was helping the Champions choose an achievable project. "Ideas for improvement can become very large very quickly," said Guyette. "A lot of what I helped to do was to narrow the focus to what could be done in the time frame." Patterson agrees, remarking, "A lot of times, questions that we pose just can't be answered. They're too big or they're too specific. So a large part of my mentoring focused on developing a question that could be answered by collecting data that could be measured."

The benefits of having integrated coaching and mentoring in the program were readily apparent. "The desire to do something strengthens when you find out you are not the only one facing these problems, that you have many different people to either help coach you through the issues, or by sharing their experiences of what they've done or what has failed for them," said Patterson.

"The opportunity to meet, exchange ideas, and act as a sounding board was so important," said Guyette. "The diversity of backgrounds of both the EMS coaches and Champions brought different perspectives and ideas to the table."

Champions Advance Healthcare Safety and Quality

JHF's Champions prove the value of programs that develop the skills necessary to improve systems within hospitals, ICUs, pathology labs, skilled nursing facilities, and community practices. They expose the weaknesses of the status quo, showing how waste, error, inefficiencies, and substandard practices are negatively affecting patient outcomes and worker satisfaction. Champions document how leaders empowered with the tools of PPC can advance the safety, quality, and efficiency of health care.

A study by the RAND Corporation validated that participants in JHF's Champions programs have achieved higher success rates than non-Champions, who are simply exposed to a four-day introduction to PPC, in leading quality improvement initiatives in healthcare institutions. This is attributable in large part to the ongoing relationships established among the participants, as well as the continuous engagement with quality improvement coaches from PRHI and its quality improvement methodology, Perfecting Patient CareSM.

JHF CHAMPIONS PROGRAMS AT A GLANCE

Through years of experience in working with healthcare providers to advance safety, quality, and efficiency, JHF and PRHI discovered the key elements for ensuring the success of quality improvement projects — a Champion acting as a team leader, a change method that works, performance measurement, and commitment to performance excellence.

The Champions programs are a series of professional development programs and demonstrations that JHF initiated to bring process engineering principles, systems thinking, and other quality improvement tools into the hands of the region's healthcare professionals. Those trained in the programs are linked in learning networks to further develop and spread understanding of these methods. All participants in the Champions programs receive training in the PPC methodology.

PHYSICIANS

The **Physician Champions** Fellowship was a two-year program in which physicians identified quality improvement opportunities within their own healthcare institutions and worked with their clinical teams to address them using the quality engineering skills and work redesign methods of PPC. At the conclusion, participants reported significant reductions in hospital-acquired infections, fewer ambiguities in Pap smears, improved health indicators for diabetic patients, and improved outcomes for open-heart-surgery patients, among others. In a number of their projects, the Physician Champions reported that by improving efficiency, it translated into lower costs.

NURSES

The **Nurse Navigators** Fellowship was a 12-month program to help support frontline nurses in removing errors and using evidence-based knowledge to redesign and improve care delivery. Funded by JHF and the Robert Wood Johnson Foundation, the Fellowship hypothesized that guiding nurses to use data and measurement to improve patient outcomes would lead to more nursing autonomy, satisfaction, and employment retention. The use of PPC principles enhanced the frontline nurses' ability to remove obstacles to high-quality care and function as change agents in healthcare quality and safety. Participants tackled projects that reduced patient falls, lowered staff turnover, reduced hospital-acquired infections, among others, and were able to document financial savings at a number of the host institutions.

CLINICAL PHARMACISTS

Hospitalized patients who suffer from multiple chronic diseases are subject to complications of polypharmacy, an industry term for the use of multiple medications that may be

contraindicated, redundant or, in combination, dangerous. The **Pharmacy Agents for Change** Fellowship was built on a JHF-funded study at the University of Pittsburgh Center for Research on Health Care, which concluded that patients were often able to take fewer medications when pharmacists reviewed their prescription and dosing regimens.

The Pharmacy Agents for Change Fellowship showed how expanding the role of clinical pharmacists in medication management and administration can improve safety and quality of care for patients and potentially reduce costs. Their projects addressed various problems arising from polypharmacy and ranged from reducing patient falls, to improving the review of medications at discharge, to ensuring that patients discharged from one mental health facility had their filled prescriptions in hand.

LIBRARIANS

The **Consumer Health Information Champions** Fellowship was a program established to give public librarians the knowledge and skills needed to direct consumers to reliable health information. The Fellowship, with its partners, the Carnegie Library of Pittsburgh and the Allegheny County Library Association, trained two cohorts of Champions. Participants had access to healthcare professionals' expertise, and collaborated with health science librarians. The training included twelve hours of Medical Library Association (MLA) online continuing education, which allowed each librarian to apply for certification as a Consumer Health Information Specialist. Clinical simulation learning was utilized to provide an opportunity for the librarians to practice skills in researching, reporting, and communicating information to patrons.

The librarians discovered new sources of reliable information about healthcare providers, health conditions and healthcare quality. This program ultimately helped librarians develop guidelines and electronic resources to better direct patrons to health information.

Use of Tomorrow's HealthCare™

The successful Champions program's formula was augmented for the EMS Champions Fellowship with the addition of Tomorrow's HealthCare™ (THC). THC is a web-based platform for delivering precisely the learning and improvement tools needed for different teams in different venues with different targets for improvement, and facilitating the problem solving that transformation demands.

The site contains four sections: one for developing and implementing quality improvement projects, a quality improvement education library, a community portal, and an ePortfolio to track individual education and quality improvement achievements.

For example, THC supports collaboration on quality improvement efforts through user communities. These communities provide a vehicle for participants to share and discuss experiences, articles, events, best practices, case studies, and opportunities for improvement.

Users can join or create communities in various areas, such as infection control or laboratory medicine. A specific EMS Champions community was created for Fellowship participants.



THC Homepage

DEVELOPING PROCESS IMPROVEMENT TOOLS

Patient safety literature proposes that medical errors are often the result of systemic problems, not individual failures. Therefore, efforts to improve the system by using checklists, enhancing procedures, or adopting a safety culture are paramount to reducing medical errors. PRHI's Perfecting Patient CareSM methodology provided the EMS Champions with the tools necessary to identify, counteract, and evaluate responses to such errors in the system.

The following articles detail how the EMS Champions used PPC to improve processes, with the ultimate goal of improving patient safety. Projects ranged from improving the procedure of a life-saving intervention, to improving EMS provider communication. Each project proves the value of using PPC to make improvements in the quality, safety, and efficiency of EMS.

IMPROVING AIRWAY SAFETY

Patrick Lambert, BS, NREMT-P
Paramedic, City of Pittsburgh Bureau of EMS

Situation

Endotracheal intubation (ETI), the insertion of a breathing tube into the windpipe, is an important procedure for paramedics. For critically ill or injured patients, ETI secures the airway, facilitating ventilation of the lungs and preventing asphyxiation or airway obstruction. ETI has been the standard of care in EMS for more than 25 years.^{xx}

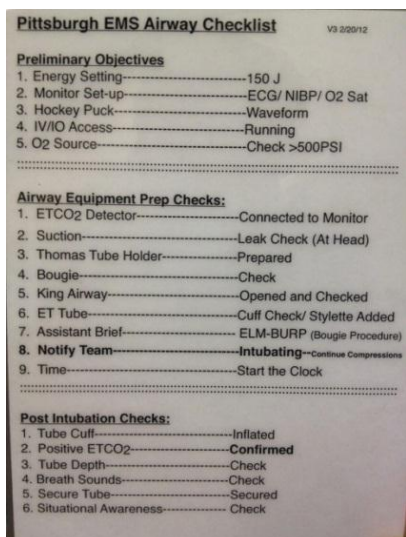
ETI is a difficult procedure to master. In the prehospital setting, 10-12 pieces of equipment must be on hand to perform the procedure. Substantial training and skill is required to maneuver the breathing tube into the proper position. An improperly placed tube can lead to oxygen deprivation and ultimately death. Making the procedure even more difficult, paramedics perform ETI in uncontrolled and stressful, out-of-hospital settings. Compounding the problem, most paramedics do not perform intubations regularly. In Pennsylvania, the majority of paramedics perform two or fewer intubations per year.^{xxi}

Patrick Lambert, a paramedic for the City of Pittsburgh EMS, noticed another serious problem in the chaos of treating patients requiring ETI — equipment was often disorganized or unavailable, leading to critical delays. Describing the typical scene, Lambert explained that “nothing is ideally placed and cords get tangled up. There is equipment in the way, or it could be all the way across the room just because the medics forgot to set it up.”

Countermeasures

Knowing that time is of the essence when performing ETI, Lambert sought to reduce the time needed to prepare for and perform the procedure. “We looked at a few ways we could attack the problem,” says Lambert. “We tried to do something that we could track easily.”

First, Lambert worked to design a checklist for performing intubations. The checklist outlined the necessary tasks to be completed before, during, and after intubation. Paramedics proceed through the checklist using a “challenge and response” system. Lambert explained, “As two people are working through these items, one person reads the item to be checked and the other person confirms that it's been done.”



Pittsburgh EMS Airway Checklist V3 2/20/12

Preliminary Objectives

1. Energy Setting	150 J
2. Monitor Set-up	ECG/ NIBP/ O2 Sat
3. Hockey Puck	Waveform
4. IV/IO Access	Running
5. O2 Source	Check >500PSI

.....

Airway Equipment Prep Checks:

1. ETCO2 Detector	Connected to Monitor
2. Suction	Leak Check (At Head)
3. Thomas Tube Holder	Prepared
4. Bougie	Check
5. King Airway	Opened and Checked
6. ET Tube	Cuff Check/ Stylette Added
7. Assistant Brief	ELM-BURP (Bougie Procedure)
8. Notify Team	Intubating
9. Time	Start the Clock

.....

Post Intubation Checks:

1. Tube Cuff	Inflated
2. Positive ETCO2	Confirmed
3. Tube Depth	Check
4. Breath Sounds	Check
5. Secure Tube	Secured
6. Situational Awareness	Check

The EMS Airway Checklist ensures that paramedics are prepared before intubating and that all steps are performed properly.

After creating the checklist, Lambert saw the need for even more ways to improve ETI outcomes. So he developed the “intubation mat,” a visual management tool that helps organize the necessary equipment. “It sort of shadows where equipment should go, just like tools on a pegboard in somebody’s garage,” said Lambert. “It puts the specific piece of equipment in the ideal location to set up for the intubation.”



Visual Management: Lambert's intubation mat, pictured with a mannequin and some of the necessary equipment required for ETI.

Another of the many ideas generated from Lambert's quest to reduce errors in ETI is the use of a 'gum elastic bougie' during intubations of difficult airways. The gum elastic bougie is “like a guide wire,” said Lambert, which helps providers insert the tube during situations where airway visibility is limited. For example, Lambert remarked, “We've postulated that if you're doing compressions, which are paramount to continue with high-quality during cardiac arrest, you should try to not stop compressions for anything. The bougie can help guide the provider who's looking into the airway while everything is moving around because of the compressions.”


Results

Initially, there was some pushback to using the new procedures. Some paramedics thought the airway checklist and intubation mat were unnecessary preparation processes that hindered timely care of the sickest patients. Lambert disagrees. “If you have the right safety mindset and a safety culture, you recognize that you have to take the time for this, and in fact, it ends up saving time by setting up the equipment before performing the procedure,” he said.

Lambert challenged one particular naysayer by saying, “How about this, we go and try it, and if your way is faster, I'll never talk to you about this again. But if the mat is faster, then you have to try it on an actual call.” The naysayer agreed and it turned out that using the checklist and mat indeed saved time. “It's not statistically significant, but using the mat proved faster in setting up the equipment from 5 to 15 seconds, on average,” Lambert said. During a medical emergency, those few seconds can save lives.

Lambert is already convinced of the checklist's efficacy. As an example, Lambert recalls recently treating a 17-year-old patient with gunshot wounds to the chest. “He was in cardiac arrest. We are setting up the intubation in the back of the ambulance while we are driving to the hospital on a very bumpy Pittsburgh road. Those conditions are about as difficult as you can get. The checklist was a big help, because we had suction right there when we needed it, and the equipment was ready.”

Quality Improvement Project



Improving Safety in Intubation during Cardiac Arrest in Prehospital Care
 Endotracheal intubation is a critical skill for pre-hospital healthcare providers and is often performed in conjunction with chest compressions during cardiac arrest. High quality chest compressions are essential to good outcomes in cardiac arrest patients however maintaining an airway is equally important. Our ability as prehospital providers to perform both chest compressions and airway management simultaneously is essential to good patient care and skill retention in EMS. This study aims to examine the use of the Gum Elastic Bougie as a tool to perform intubation more easily while chest compressions are carried out during cardiac arrest so that there is no compromise in the quality of chest compressions or the airway.
 Date Created: 9/25/2011
 Last Updated: 12/28/2011
 Status: In Progress

Summary **Steps** Members Comments

Print

Business Case

Many paramedics are not specifically trained in the importance of minimizing the interruption in chest compressions while establishing an advanced airway through Endotracheal Intubation (ETI). Furthermore, the success rate for ETI by paramedics in Pennsylvania is approximately 76% on the first attempt. This further jeopardizes the retention of Advanced Life Support (ALS) interventions in prehospital care as paramedics will not be permitted to perform such skills if the compliance with safety measures is not adhered to.

Current Condition

Problem:
 During cardiac arrest in EMS, many skills occur simultaneously—the most important of which is high quality chest compressions. Paramedics also need to secure the patient's airway during this time which can be difficult due to the movement caused by the compressions and other activity. Paramedics perform Endotracheal Intubation (ETI) relatively infrequently and the demands of the scene often lead to interruptions in chest compressions to perform the intubation which is detrimental to patient recovery.

Target Condition

Countermeasures:

- Problem: Equipment not set up prior to intubation attempt
 - Create a checklist that defines all steps and preparation prior to intubation
 - Train crews to use the checklist as soon as the need for a procedure to be performed is identified.
- Problem: The performer of intubation often asks to stop CPR during the intubation due to poor visualization of the airway
 - Train crews to use airway adjuncts such as the Gum Elastic Bougie for better visualization of the airway
 - Have an assistant prepared for Extra Laryngeal Manipulation

Implementation Plan

Task	Status
Travel to London UK for Observation of London's Air Ambulance in their specialized process of intubation for trauma patients	Complete
Literature review on intubation during cardiac	

Lambert's "A3" from the online tool THC. An "A3" is a one-sheet problem evaluation, root cause analysis, and corrective-action planning tool.

Next Steps

In order to formally evaluate the effectiveness of the checklist, intubation mat, and the gum elastic bougie, the City of Pittsburgh EMS and the University of Pittsburgh School of Medicine's Department of Emergency Medicine have embarked on a research collaboration. The organizations will conduct studies to determine if these interventions save time, reduce errors, and improve ETI success rates. Lambert hopes that this research will reveal better ways to care for patients. "It's this very arduous process, because in EMS there's such a high degree of variability on what is an acceptable technique that people do things their own way," he said. "This inconsistency in care is why formally evaluating variations in technique and procedure is so important."

Lambert's project reveals the utility of using the tools of Perfecting Patient CareSM in high-risk EMS procedures. By creating checklists and using visual aids, critical but rarely-used skills such as ETI can be performed more easily, more efficiently, and ultimately, safer for the patient.

Link to Perfecting Patient CareSM Visual Management

Lambert's intubation mat uses the PPC principle of visual management. When the normal and abnormal state can be clearly and visually defined, visual management is possible. In visual management, simple visual tools are used to identify the target condition, and any deviance from the target condition is met with corrective action.

PHYSIOLOGICAL-based AIRWAY MANAGEMENT for CARDIAC ARREST

Mark E. Pinchalk, MS, EMT-P

Paramedic Crew Chief, City of Pittsburgh Bureau of EMS

Situation

Maintaining an open airway is an essential task in any medical emergency. For critically ill or injured patients, endotracheal intubation (ETI) is considered the standard of care for securing the airway.

Yet, when treating the most critical patients, those in cardiac arrest, several studies have demonstrated that performing prehospital ETI actually increases the risk of death.^{xxii,xxiii} For patients in cardiac arrest, survival is dependent on performing continuous chest compressions,^{xxiv,xxv} which ensures a minimal level of blood flow to vital organs. Mark Pinchalk, paramedic crew chief with the City of Pittsburgh EMS, has been working for years to improve cardiac arrest survival rates in the city. Pinchalk echoes the importance of performing uninterrupted CPR on patients in cardiac arrest, “It appears that if you do anything to interrupt performing chest compressions, like doing advanced airway management — especially if you make multiple attempts to secure the airway — you then have negative outcomes.”

Despite the increased risk of death when ETI is performed during cardiac arrest, securing the airway of patients is still viewed as a crucial task for paramedics. Of the 300 cardiac arrests the City of Pittsburgh EMS treats each year, nearly all of them are intubated at some point. Pinchalk explained, “You are still going to have patients who are going to vomit, aspirate, or have other issues if you don’t have the airway protected.”

A study in 2007 evaluating interruptions in CPR while attempting ETI found that, on average, City of Pittsburgh paramedics interrupted chest compressions for 109.5 seconds over the course of two attempts to intubate.^{xxvi} During those precious seconds without compressions, blood pressure plummets, cutting off the oxygen supply to vital organs like the brain and causing tissue death.

However, after the endotracheal tube is in place, it becomes easier to maintain those vital, continuous chest compressions. Before a patient has been intubated, the standard model of CPR requires healthcare providers to perform 30 chest compressions, pause, and then give two ventilations. “Once you have a definitive airway in, it allows you to just do continuous chest compressions the entire time during the arrest,” said Pinchalk. “You’re able to ventilate through the compressions because you have the advanced airway in place.”

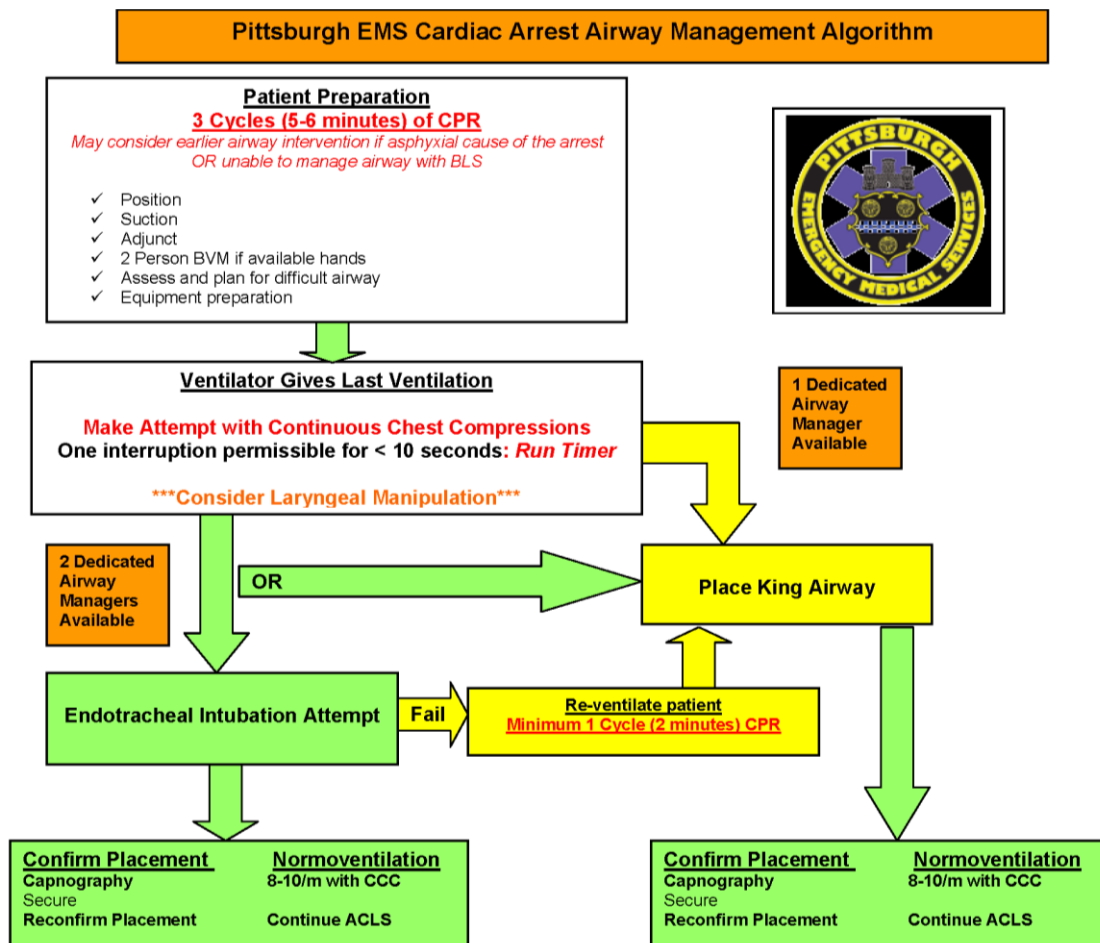
Clearly, performing ETI on patients in cardiac arrest has both benefits and dangers. Pinchalk and other researchers postulated that if paramedics could perform the procedure with minimal interruptions to chest compressions, then the benefits of having a secure airway would win out, thus increasing survival rates.

Countermeasures

Knowing that the current method of performing ETI during cardiac arrest was decreasing survival rates, Pinchalk introduced a new cardiac arrest airway management strategy. “We deferred the airway for the early part of the arrest, the first five minutes or so, and really concentrated on defibrillation, maximizing perfusion (by performing quality chest

compressions), getting vascular access, and giving vasopressors,” said Pinchalk. Only after this initial stage, using a team of two whose sole job was airway management, did city paramedics attempt ETI. When intubating, the new airway strategy focused on maintaining continuous compressions. “They had to place it with either no interruptions in chest compression or with less than a 10-second interruption,” explained Pinchalk. If the team wasn’t successful on their first attempt or only one provider was available for airway management, city paramedics were mandated to insert a supraglottic airway device, which requires no interruption in chest compressions, but cannot secure the airway as well as ETI.

Every paramedic working for City of Pittsburgh EMS was trained in the new airway management strategy in early 2011. In addition, guide cards containing instructions for the new procedure were placed in the airway kit in each ambulance. To reinforce the new procedure, supervisors reviewed each cardiac arrest and provided case-by-case feedback to the paramedics involved on the call.

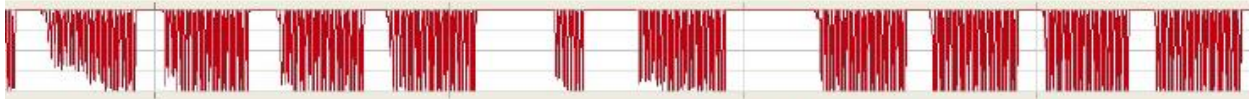


Results

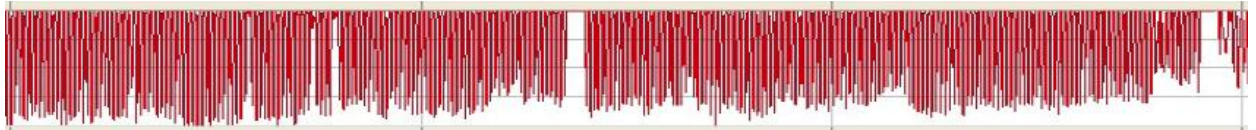
Because the City of Pittsburgh EMS collects meticulous records for all of its cardiac arrest calls, Pinchalk has been able to assess the impact of the new airway strategy, using numerous measures. “We looked at number of intubation attempts, CPR interruption times for airway placement, and CPR fraction — or percentage of time they’re actually doing chest compressions during the arrest — and we improved in all of those parameters,” said Pinchalk.

The average number of attempts to secure the airway was reduced from 2.0 in 2007 to 1.3 in 2011-12, reflecting better teamwork and preparation required by the new protocols. Over the same time period, the average interruption in chest compressions for ETI attempts was reduced

from 109.5 seconds to 11.16 seconds. Due to these improvements and Pinchalk's efforts over the years, the percentage of cardiac arrest patients who survived to be discharged from the hospital increased considerably. "Since we've been doing this, 15-16% of our cardiac arrests survive at discharge, which is an all-time high for us," said Pinchalk.



Before airway management strategy: CPR data from a City of Pittsburgh EMS cardiac arrest. Chest compressions, shown in the red channel, were routinely interrupted to manage the airway.



After airway management strategy: A focus on continuous chest compressions resulted in fewer interruptions and ensured adequate blood flow to vital organs.

Next Steps

Pinchalk's efforts to improve ETI outcomes are closely related to the project of fellow City of Pittsburgh paramedic and EMS Champion Patrick Lambert (previous article). Collaboration between the two has resulted in a system-wide rollout this year of an airway checklist developed by Lambert. The checklist helps reduce errors during ETI by "making sure the patient is adequately prepped, that you have an assistant working with you, and that all of your equipment is prepped," said Pinchalk.

When reviewing the outcomes for this project, Pinchalk noticed that the main inhibitor to survival was not the amount of time it took to intubate, but the number of attempts for successful intubation. Pinchalk continues to work on ways to ensure that intubation is successful on the first attempt. "Lambert's checklist is a step in that direction," said Pinchalk. "We think with better preparation we can improve first attempt success."

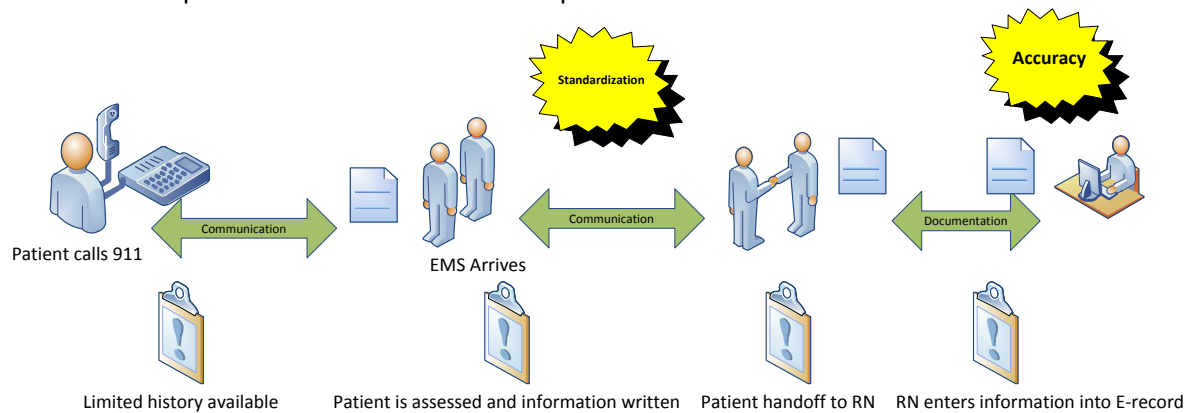
IMPROVING the HANDOFF PROCESS from EMS to EMERGENCY DEPARTMENT STAFF

Linda A. Reiger, MS, EMT-P

EMS Specialist – UPMC St. Margaret, UPMC Prehospital Care Program

Situation

Effective communication is crucial to providing excellent health care, and in EMS this is very true. From being dispatched with limited information, to collecting information on scene, to communicating essential facts to the Emergency Department (ED) during the patient handoff, there are many chances for miscommunication to occur. EMS providers must be very thorough and precise during the routine, yet essential task of the patient handoff, where responsibility for the care of the patient is transferred to the ED personnel.



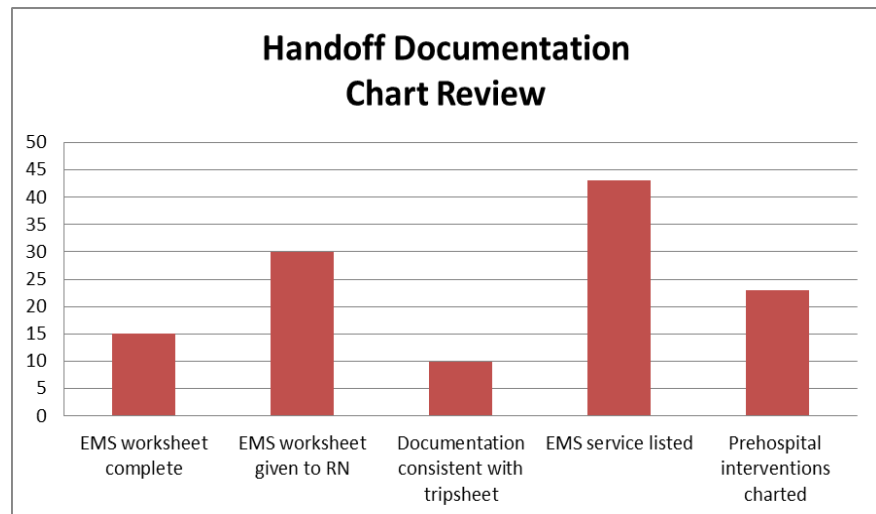
In EMS, the potential for miscommunication exists at multiple points in the process of treating and transporting patients.

During the handoff, the EMS provider must deliver a succinct report to ED staff, communicating vital information about the patient's condition and any treatment rendered. This transfer of information occurs through both written and verbal means. "These are very important, high-risk transfers," said Linda Reiger, an EMS specialist and educator at UPMC St. Margaret. "For instance, if the patient was given medications in the field, that is important information for the hospital to note so they don't redo those medications."

Despite the importance of the handoff, miscommunication during this process is frighteningly common. Studies have shown that ED staff members retain less than half the information EMS crews relay to them via verbal hand-offs.^{xxvii} Written handoffs are fraught with the same loss of information. Reiger noticed that the trip sheets that EMS gives to ED nurses are often incomplete or illegible. "Medics are recording the information en route to the hospital, often writing in situations where it may be difficult for them to write clearly," she said.

To better understand the extent of the problem in her home institution, Reiger observed 50 EMS-to-ED patient handoffs at UPMC St. Margaret. "I stood in the background, listened and watched by observing what was happening," recalls Reiger. "I listened to exactly what the providers had relayed about the patient to the ED staff and examined the EMS trip sheet." She then looked at how accurately the nurse's documentation reflected the EMS report. The results of her observations were staggering. ED documentation was consistent with the EMS worksheet only 20% of the time, and prehospital interventions were recorded less than 50% of the time. Furthermore, EMS worksheets were usually incomplete, and were given to hospital staff only 60% of the time.

Results of Reiger's observations of 50 patient handoffs between EMS and the ED.



Countermeasures

In order to ensure that the Emergency Department captures vital information from EMS, Reiger proposed a modification to the hospital's electronic health record (EHR). Currently, a field exists in the EHR to enter prehospital interventions when a patient arrives at the ED. However, this field is not mandatory. "They are just little checkboxes; many times, nothing is checked, nothing is on there," recalls Reiger. Sometimes, instead of checking the boxes, nurses will write a narrative, which is not standardized and not as useful.

Correct Date/Time?

Chief Complaint*

Information given by

Mode of Arrival*

Pre-Hospital Intervention

Ambulance Company

Tracking*

Triage Interventions*

From this screen, eliminate "Pre-Hospital Interventions" and Ambulance company.

If mode of arrival = Ambulance, then new pop-up window /screen would appear.

The current form that is completed for arriving patients by UPMC St. Margaret ED nurses, with Reiger's proposed changes noted.

Reiger proposed creating a mandatory prehospital interventions form in the EHR for patients arriving at the ED by ambulance. After the receiving nurse indicates that the patient was transported by EMS, the prehospital interventions form would immediately pop up.

The page would include fields to enter the most important data collected from EMS, including vital signs, mental status, medications, oxygen administered, and cardiac monitor findings. Since the ultimate goal is to improve patient outcomes by reducing miscommunication, Reiger is working to make her proposed mandatory page as simple as possible. "We don't want to make it so complicated that they are going to be there writing forever if they have a critical patient," she said.

Next Steps

Reiger is working with an ED nurse with expertise in informatics and UPMC St. Margaret's EHR team to implement her proposed changes. She hopes the changes to the EHR will roll out soon and is preparing education for ED nurses in anticipation of the new form.

"Improving communication among healthcare workers cannot be facilitated only through changes in the EHR," says Reiger. "Even before the handoff process, there is the potential for EMS providers to make errors in collecting and recording accurate information. We have to instill in the new folks the importance of taking accurate vitals, recording the patient's medications and communicating that to the nurse." Reiger has already begun instilling effective communication in her emergency medical technician (EMT) students. "Many of them thought ... you just have to do it because you need it to write your trip sheets, and they didn't really see it from the other side — the implications for miscommunication and how that would affect their patients."

So far, Reiger's students have been very receptive to her education on effective communication. "I see this as being a part of the curriculum for the EMT as we go forward," she said.

Link to Perfecting Patient CareSM

Observation

Reiger made excellent use of the Perfecting Patient CareSM method of observation. This simple tool allows someone doing quality improvement to see the work being done firsthand. Conducting observations ensures objectivity and allows a deeper understanding of the process being studied. The process of observation requires viewing the work being studied on multiple occasions:

- Record only what you see and hear
- Record everything you see and hear
- Record detailed time information
- Do not evaluate or judge
- Remain unobtrusive to avoid impacting the process
- Limit questions during observation

Thorough observations are essential for establishing baseline performance and identifying the root cause of problems. After an initial quality improvement cycle is completed, further rounds of observation are conducted so progress can be tracked.

IMPROVING EMS EQUIPMENT READINESS

Curtis W. Neill, EMT-P

Manager, Special Projects, UPMC Prehospital Care Program/Emed Health

Situation

The unpredictability of EMS necessitates that at all times, ambulances must be well stocked and each piece of equipment must work unfailingly. “The only thing that we can control in the EMS world is preparation,” said Curtis Neill, manager of special projects at the UPMC Prehospital Care Program, “because we don’t know what that next 9-1-1 call is going to be or what we will need in the way of supplies or personnel.”

Paul Paris, MD, the Fellowship’s volunteer medical director, acknowledges that having an unprepared ambulance is a huge and unfortunately prevalent safety concern in EMS. “For example, when our regional coordinating body, EMSI (Emergency Medical Service Institute) has done unannounced inspections of ambulances, they were surprised to find that required state equipment and drugs were missing, or expired, or weren’t working, which means that something as simple as a daily inspection of all equipment and drugs doesn’t occur as much as it should,” said Dr. Paris.

Realizing the importance of the issue, Neill investigated why EMS providers were not completing frequent equipment checks. Armed with the tools of Perfecting Patient CareSM, he began observing crews at a local EMS base. “I came into the organization wearing a different pair of glasses; I looked at things differently, said Neill.” During his observations, he found that many times, EMS providers received a 9-1-1 call in the middle of the equipment check, leading to it never being completed. When providers did complete an inventory check, it was very time consuming due to the magnitude of equipment to be checked and the convoluted equipment replacement process.

Expediting the Ambulance Equipment Check

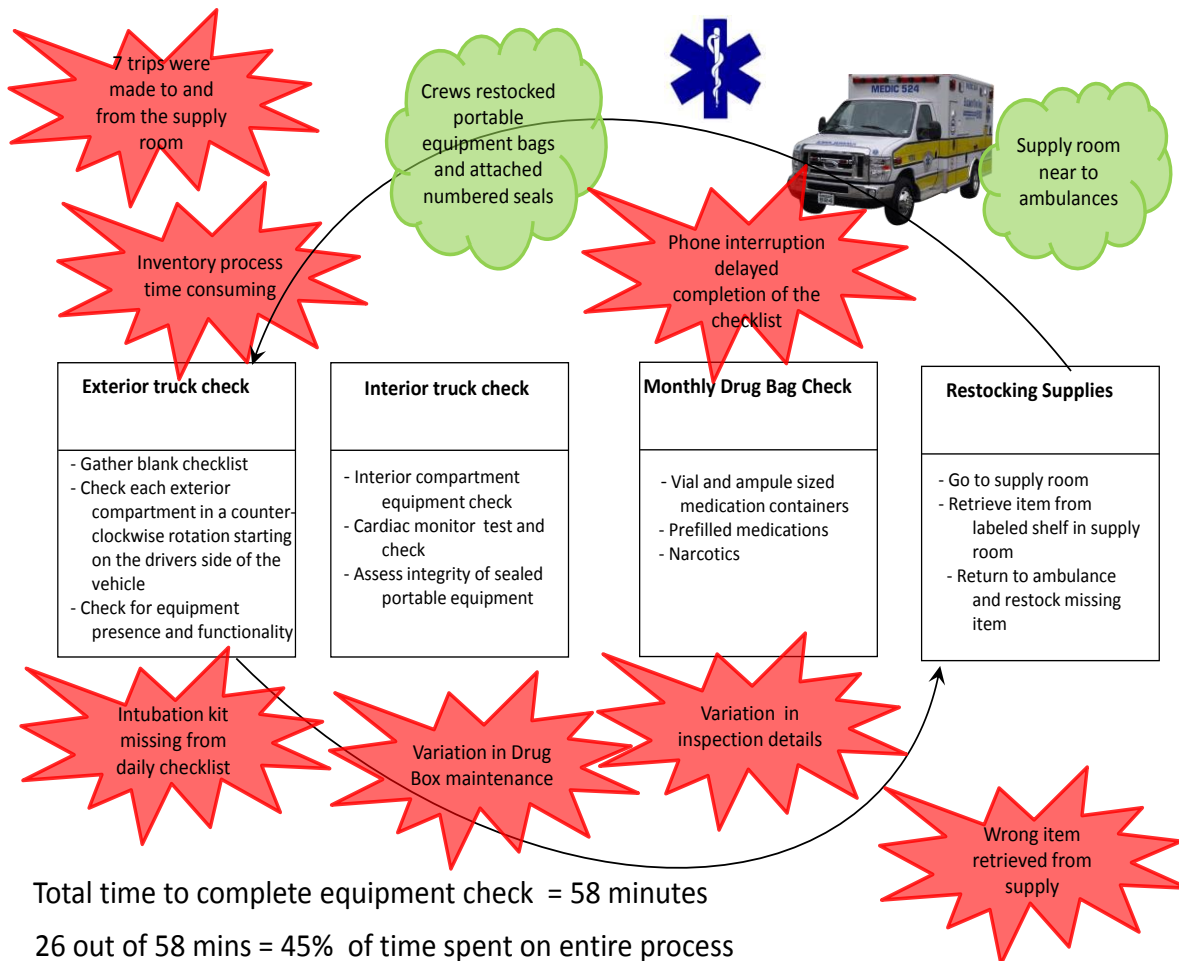
Part of the reason why equipment checks took so long was that low-use equipment was assessed at the start of every shift, even if it hadn’t been used in weeks. “We carry a lot of different kinds of tools, all of which need to be checked and all of which need to be functional, but yet don’t get a lot of use,” said Neill. He realized that providers would complete more equipment checks if the process was expedited by not having to assess low-use equipment.

So Neill came up with a “tagging” system that marks equipment that has already been assessed. In the “tagging” system, a small plastic tie is attached to fully-stocked cabinets and portable bags. During an equipment check, these tagged containers can be glossed over and the provider can be certain that the contents within are present and in working order. When equipment inside these sealed containers is needed, the tag is broken. The containers can only be re-tagged and sealed after they have been thoroughly checked.

Another issue that Neill found was that crews were making an excessive number of trips — up to seven — from the ambulance to the supply room during equipment checks. As soon as crews noticed equipment was missing, they would retrieve a replacement. “And then they would discover another missing item and leave and come back again,” Neill noted. To reduce the number of trips, he made a simple but effective suggestion — modifying their current checklist. Neill suggested creating some space on that checklist — a blank, lined area where they could

write down: 4x4s, six IV catheters, oxygen bottle, whatever it might be, and then make just one trip to the supply room.

Neill's tagging system and improvements to the checklist effectively reduced the time necessary to complete an equipment check. While conducting a follow-up observation, he noticed one crew did receive a 9-1-1 call during their equipment check, but they were able to get the critical pieces checked before they were dispatched. "Efficiency definitely has improved and staff at the EMS base have been very receptive to the changes," said Neill. "They took it very seriously and appreciated the time savings while simultaneously elevating accountability. The cabinets were tagged properly so other crews would have what they needed, when they needed it."



Neill's Process Map: He noticed several opportunities for improvement, marked with spiky red clouds, and a few areas of success, marked with puffy green clouds, in the map of his initial observation.

Next Steps

Neill is hopeful that he will be able to spread these simple, inexpensive, yet effective concepts to others in the region. He thinks that high-volume services will be particularly receptive because of the need to be efficient. However, less experienced providers at lower-volume or volunteer EMS agencies, “need to get their hands dirty, to open those bags and know what’s in there,” said Neill. “When you get the pedestrian hit, or the person not breathing, you don’t want to be thinking, ‘What’s in that bag? It’s always been sealed and I’ve never been in it!’” He plans to work to adapt the efficiency improvements he created to meet each service’s individual needs.

Looking forward, Neill is also investigating the use of machine-readable QR codes to expedite ambulance equipment checks. He envisions that most pieces of equipment could have a QR code attached, which could be easily scanned. This would allow the use of equipment to be tracked electronically, and software could automatically create alerts that would remind providers of equipment expiration and calibration dates. “That’s the next level that I’d like to go to and hopefully I’ll be able to get there.”

Link to Perfecting Patient CareSM *Eliminating Waste*

Waste is any activity that adds cost or time without adding value to the customer. This is non-value-added activity. There are eight types of waste: waiting, defects, unnecessary motion, unnecessary conveyance, over production, over processing, excess inventory, and unused employee creativity. Through observation, Neill identified that during equipment checks, EMS providers had unnecessary motion by making multiple trips to the supply room, and had wasteful “over processing” by checking equipment that had already been inspected by a previous crew. Using PPC, Neill was able to reduce this waste through simple interventions. Ultimately, Neill’s interventions not only increased the efficiency of EMS providers conducting equipment checks, but ensured that ambulances were well-stocked, preventing a situation where lifesaving equipment was missing in an emergency.

STANDARDIZING EMS PATIENT TRANSPORT REFUSAL FORMS

James Husar, NREMT–P

Clinical Education Specialist, Emergency Medical Service Institute

Situation

A common fear among EMS providers is that a patient they evaluate will refuse to go to the hospital and then later deteriorate or even die. To prevent this from happening, many states have developed protocols to guide EMS providers in assessing a patient who refuses medical treatment or transport to a hospital. In Pennsylvania, the Department of Health’s Bureau of EMS Basic Life Support Protocol 111 requires that EMS providers use a systematic patient refusal checklist when an ill or injured patient refuses care. The checklist ensures that the EMS provider assesses key signs and symptoms indicative of serious medical issues. If the patient is found to have alarming symptoms, such as chest pain, head injury, or very high blood pressure, the checklist requires the EMS provider to contact a medical command physician for consultation. The EMS provider must also explain to the patient the risks of not going to the hospital despite their illness or injury. Finally, the patient must sign a form saying that they understand their clinical situation and that they may change their mind and call 911 if assistance is needed later.

James Husar, clinical education specialist at the Emergency Medical Service Institute (EMSI), is a big proponent of the patient refusal form. “When using the statewide triage protocol — the refusal checklist and consulting a medical command physician — there is far less chance of a patient refusing medical care and transport when it is truly necessary and needed,” he said. Moreover, Husar believes that EMS providers should always encourage their patients to go to the hospital. “We are not trained to diagnose in the field,” he said. “[Patients] need to be seen by a higher level of medical care.”

Because he works for EMSI, the regional EMS council for southwestern Pennsylvania, Husar has access to trip sheets from hundreds of EMS agencies. He found a wide variation in refusal rates. Some had only 6% of their patients not transported, while others had as high as 20%. Husar fears that the numbers are even higher than this, noting that many times EMS will not document a patient who refuses treatment at all. “When you get to one of these calls where there are 15 people standing around at a vehicle accident, not everyone gets a refusal form, so that skews your numbers,” said Husar.

One of the problems Husar noticed when trying to determine why some agencies had a much higher refusal rate was because only about 40% of them were using the state’s patient refusal form. Some were using an older regional form, while others had created their own.

Husar realized the importance of having everyone use the state form. “If you have the state form signed and you have contacted medical command, and then something happens to the patient, your liability decreases immensely; whereas if you don’t do that and there is no documentation showing that you contacted medical command before you left, which is one of the criteria on the state form, it will not bode well.”

When Husar looked at a small sample of patient refusals from two EMS agencies, one using the state refusal form and the other the regional form, he found that 19% did not have a refusal form completed. This alarmed Husar, who notes that by not having the patient sign the form,

MOST COMMON MEDICAL CATEGORIES OF PATIENTS WHO REFUSED CARE:

Falls – 13% (12)
Traffic Accidents – 11% (10)
Diabetic Problems – 9% (8)
Unconscious/Fainting – 7% (6)
Other – 17% (15)

the EMS provider can be liable for any subsequent deterioration of the patient. Further, if the provider does not assess the key elements on the refusal checklist or contact medical command, a serious illness may be overlooked.

Standardizing Forms

Realizing the need to standardize agencies' refusal forms, Husar began the task of collecting alternate forms to see if they met the minimum requirements suggested by the state. What he found were glaring deficiencies. "Some have this half-sheet that says: patient refuses care – okay – sign here," he said. "There's no triage checklist on there; there's no copy to give to the patient. There are a lot of discrepancies and a lot of different ways people are doing this."

While Husar does not want to mandate that EMS agencies use the state refusal form, he is working to help them reduce deficiencies in their individual forms. To do this, he is beginning to create a checklist that agencies can use to see if their refusal form contains the minimum information in the state form. In addition, Husar plans to create education for providers on the proper method of obtaining patient refusal and the importance of documentation and completing the refusal checklist.

Link to Perfecting Patient CareSM *Standardization*

One of the principles taught through Perfecting Patient CareSM is that standardized activities are the foundation for continuous improvement and employee empowerment. Standardized work is established by examining the most efficient way to complete work based on the three "M's" of man, machine and material. A process using standardized work maintains clear and visible signals indicating what the "standard" is. Deviation from standard work is visible, calling attention to an opportunity to reinforce or redefine the standard. Husar realized that standardizing the EMS patient refusal form would improve patient outcomes and facilitate research on the subject.

EVALUATION of PREHOSPITAL OLIGOANALGESIA: WHY DOES PAIN GO UNTREATED?

Quincy Chopra, BS, NREMT-P, CCEMT-P
Flight Paramedic, STAT MedEvac

Situation

Quincy Chopra, a paramedic with 12 years of experience, has encountered a frustrating problem over the course of his career — patients in substantial pain often do not receive medication to treat it. At the beginning of his career, there were many obstacles to treating pain in the field. Paramedic protocols for treating pain were hand-binding and effective medications were not available.

Aside from the obvious discomfort of untreated pain, Chopra points out that it can cause serious medical problems. The anxiety and stress associated with pain “makes your heart rate go up; it increases your sympathetic response. It can put more strain on your heart which could lead to potential cardiac problems, simply from a broken arm.”

What about the potential downside of treating pain? “There is no perfect drug out there. All medications have side effects,” says Chopra. In large doses, pain medication can cause respiratory depression, nausea, or low blood pressure. But paramedic protocols, notes Chopra, “are within the range that we can control those side effects and if anything should happen, we have the antidote for it.”

Today, protocols are less restrictive, and paramedics can treat pain more autonomously. Yet, studies show that many patients who are treated by EMS do not receive pain medication.^{xxviii,xxix} Chopra finds the lack of prehospital pain treatment distressing. “Think about it, if you were in pain, wouldn’t you want to be treated?”

Asking “Why?”

So Chopra decided to embark on a quest to figure out why his colleagues were not providing pain medication when indicated. To find an answer, he distributed a survey on barriers to administering pain medications to paramedics and emergency medical technicians working across various ambulance services in the southwestern Pennsylvania region.

Results

Chopra’s survey revealed two main reasons — systems and personnel — for underuse of pain medication. One obvious personnel issue is that some ambulances provide only “basic life support,” meaning they are staffed by emergency medical technicians who are not certified to provide advanced interventions like IV pain medication. Patients receiving care in a basic life support ambulance simply do not have access to pain medication.

Yet, pain medication is often not given when indicated even when “advanced life support” (ALS) providers are available. Crews that have one emergency medical technician in addition to one ALS provider, typically a paramedic or prehospital nurse, might not want to provide ALS care to a patient in pain.

Part of the problem seems to be that ALS providers must deal with a cumbersome system of regulations when administering pain medication. “They have to start the IV, and then unlock the drug box, open up the drug box, open up the second lock on it to get out the narcotics, retrieve

the narcotics and administer them,” explains Chopra. “Then they have to complete three or four pieces of paper to show a waste log and usage log. Then they have to get them replaced, either by going to a hospital — potentially 25 minutes away for some ambulance services around here — or they have to go back to the base and find their supervisor, who has to go into another safe and get the narcotics, and then replace them and fill out more paperwork. There is a lot of time-consuming work.”

CHOPRA’S ROOT CAUSE ANALYSIS: 5 “WHYS”

Problem: Narcotics are not given to patients when indicated

- Why? Time consuming to replace medication when used
- Why? No in-house stock available at some ambulance bases
- Why? Not given by the health system
 - Why? No supervisor to dispense 24/7; no safe
 - Why? No money from service to buy a safe; not provided by health system

Next Steps

The most meaningful part of the Fellowship for Chopra was that he now feels empowered to tackle other problems. “I learned how to get organized, how to complete a root cause analysis, and how to define my problem and define my plan,” he said. “It is the multi-step process that I liked and now I can use that going forward.”

Chopra is still collecting data from his surveys. He plans to publish the results in a peer-reviewed journal. He believes that if steps were taken to make the process of replacing medications easier for ALS providers, then pain medication would be administered more often. This could involve reducing necessary paperwork or making medications more accessible at ambulance bases. Any intervention that can facilitate treatment of pain in the prehospital setting would be a victory for Chopra. “If you are in pain and we can treat it simply, then why shouldn’t we? Why should anyone live in pain?”

Link to Perfecting Patient CareSM *Root Cause Analysis*

The most basic underlying reason for an event or a condition is the root cause. Repeatedly asking the question “Why” (usually five times) can lead to the root cause of a problem, where action can be taken to prevent a recurrence of the issue.

IMPROVING EMS PROVIDERS' HEALTH and EDUCATION

One of the tenets of EMS care, reinforced in every training and certification, is that the safety of the EMS crew is a concern for EMS providers. After all, it takes a crew of at least two to care for a patient in the prehospital setting. If one crew member becomes incapacitated through injury, this creates a situation where there are now two patients.

Consequently, it is the responsibility of EMS providers to not only prevent injuries to themselves, but also keep up to date on the latest advances in EMS that affect patient safety. The following section highlights projects that fulfill these two objectives essential to both patient and provider safety.

USING AVIATION SAFETY STRATEGIES to INCREASE PATIENT SAFETY in the PREHOSPITAL SETTING

John W. Lovett, RN, MSN, MBA, CMTE, CFRN

Director of Clinical Operations, Center for Emergency Medicine / STAT MedEvac

Situation

In industries like nuclear power or aviation, potential dangers are faced every day. It is for this reason that such high-risk industries place an enormous emphasis on safety. For example, in aviation, pilots must go through an exhaustive pre-flight checklist to ensure that all parts of the aircraft are in working order before they take off. They also complete extensive training with a focus on improving communication, teamwork, and reducing the chance for errors.

Helicopter emergency medical services like STAT MedEvac are no stranger to the aviation industry's emphasis on safety. STAT's crews consist of a pilot, flight nurse, and flight paramedic. The whole crew is responsible for aviation safety; each crew member has the ability to abort a mission at any time. "We encourage that open communication with the pilot, where if they feel there is a safety issue, then they speak up," said John W. Lovett, STAT MedEvac's director of clinical operations. Indeed, STAT, which operates 18 helicopters across three states and the District of Columbia, has an outstanding aviation safety record, recognized by numerous awards.

Despite STAT's focus on aviation safety and the company's stellar safety record, patient safety errors were still occurring. As Lovett began to investigate STAT's patient safety incidents, he began to notice a common and puzzling theme. Crew members were often aware that a member of their team was about to make a mistake, but were afraid to speak up. For example, paramedics often have more experience in dealing with missions where a patient must be transported from an incident in the field. "The nurses tend to just listen to what the paramedic says, and the opposite is true on an inter-hospital mission," said Lovett. This attitude toward patient safety was completely contradictory to the open communication and teamwork skills used daily by STAT employees to prevent aviation errors.

Additionally, when a patient safety error occurred, STAT would discipline the flight crew. "With that discipline, people are afraid to report errors, and that creates a culture of fear," said Lovett. "If you don't find out about the errors you can't change the system. You are just setting up every other crew to fail."

Countermeasures

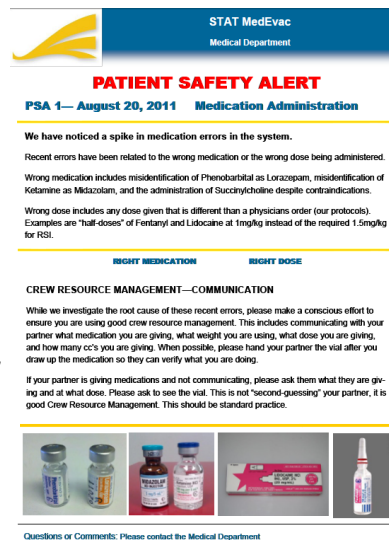
As part of STAT MedEvac's culture of aviation safety, crews are trained in "crew resource management" (CRM). Originally designed by NASA to reduce human errors, CRM teaches situational awareness, communication skills, teamwork, and decision making. Lovett realized that CRM skills and other aspects of STAT's aviation culture of safety, which the company was using so successfully to prevent aviation errors, were not being used to improve patient safety.

Lovett decided to translate some of the elements of STAT's aviation culture of safety to the company's patient safety culture. First, he created CRM education tailored to reducing clinical care errors. The education reinforced "that at any time, if two crew members do not agree with something, they must call medical command," said Lovett. Next, inspired by the success of checklists in preventing aviation errors, STAT created a number of clinical care checklists for providers. Crews are trained in the use of these checklists during STAT's annual simulation exercises.

As Lovett investigated the problem, he began to realize that an integral part of preventing medical errors is dealing appropriately with the errors that do occur. In order to encourage crews to report errors, STAT no longer disciplines the crews for making errors. Instead, it has adopted a “just culture,” in which errors are responded to with education and coaching. After errors are reported, patient safety alerts are now distributed system-wide. “Everyone knows that whenever these are issued it is related to an actual problem in the system,” said Lovett. “That way, everyone can see what happened, so if they’re in a similar situation, they might act differently.”

Lastly, STAT is now requiring every employee to obtain certification as a Certified Flight Registered Nurse or Certified Flight Paramedic. “We are trying to raise the expectations for the employees,” said Lovett.

Whenever a medical error occurs at STAT MedEvac, a Patient Safety Alert is issued so crews can learn from the mistakes of others and errors can be prevented.



Results

STAT employees have been very receptive to the changes in the organization. After implementing a “just culture,” crews have become more likely to report mistakes, because they know mistakes are no longer met with discipline, but with changes in the system.

Systems improvements have already been realized. Recently, a crew left their medication bag at the hospital. Before takeoff, crews are required to complete a checklist to ensure nothing is left behind. “Previously, if the crew left the medication bag somewhere, we used discipline because they didn’t follow the checklist,” reflects Lovett. Since STAT had implemented a “just culture,” management, instead of disciplining the crew, tried to determine why the checklist failed and how the system could be changed to prevent it from happening again.

“Looking at the root cause analysis, we found that when this crew left the medication bag at the hospital it was because when they looked in the back of the aircraft at night, they saw one of their black jackets rolled up on the stretcher. They thought that was the medication bag,” said Lovett. “We saw that it was a systems issue, and instead of having our medication bags be black like every other bag in the aircraft, we are making them bright yellow.”

Next Steps

Lovett plans to evaluate the effects of his interventions on error rates, with the help of fellow EMS Champion Daniel Patterson. “Once we can show that these items are working, then we can start educating other EMS agencies and other air medical programs,” said Lovett. “If we can give people the tools to succeed and raise the expectation level, they are going to have higher expectations for themselves, and hopefully reduce errors.”

HYPOXIA CHECKLIST

Desaturation of Patient on Mechanical Ventilation

Check vital signs to r/o hemodynamic compromise.

Check O₂ source and connection.

Increase F_IO₂ to 100% O₂. Does hypoxia improve?

Look at the ventilator for alarms, if no alarms (other than PIP):

Check Peak Inspiratory Pressure

High (>45 mmHg) ← → Normal/Low (<45 mmHg)

<p>Problem: Tidal volume is having trouble getting in. This may be secondary to:</p> <ol style="list-style-type: none"> Circuit obstruction <ul style="list-style-type: none"> Examine vent circuit ET Tube obstruction <ul style="list-style-type: none"> Patient biting / tube kinking Sedate and paralyze patient Secretions <ul style="list-style-type: none"> Suction patient Pt asynchronous w/vent <ul style="list-style-type: none"> Sedate and paralyze pt Ventilator malfunction <ul style="list-style-type: none"> Recheck for alarms Check for Auto-PEEP <ul style="list-style-type: none"> Disconnect from vent for 10 secs Tension Pneumothorax <ul style="list-style-type: none"> Examine pt for subQ air Suspicion based on hx Needle decompression Remove pt from vent <ul style="list-style-type: none"> Bag pt with 100% O₂ Contact Medical Command 	<p>Problem: Mechanics of oxygen exchange. Possible causes are:</p> <ol style="list-style-type: none"> Circuit disconnect / leak <ul style="list-style-type: none"> Examine vent circuit ET tube dislodged <ul style="list-style-type: none"> Check ETCO₂ waveform Check tube depth Check pilot balloon <ul style="list-style-type: none"> Check for cuff leak/deflated Inflate ET cuff Pulse ox malfunction <ul style="list-style-type: none"> Check on self Ventilator malfunction <ul style="list-style-type: none"> Recheck for alarms Remove pt from vent <ul style="list-style-type: none"> Bag pt with 100% O₂ Contact Medical Command
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STAT MedEvac uses checklists like this one to assist providers in dealing with complicated medical situations.

Link to Perfecting Patient CareSM

Building a Culture of Improvement

Lovett's project reflected many of the principles taught in Perfecting Patient CareSM. His work to implement a "just" patient safety culture enables providers to report patient safety issues, which then allows STAT MedEvac management to look into the root cause of the problem and implement a solution. STAT's policy that disagreements among its clinical crew regarding patient safety must be resolved by contacting medical command is similar to Toyota's "Andon Cord."

In Toyota plants, the Andon Cord can be pulled by anyone on the line, at any time, to stop the line if a problem arises. A manager immediately comes to help address the problem alongside the worker and to get the line moving again once the problem is remedied.

IMPROVING the HEALTH and FITNESS of EMS PROVIDERS

Megan Wood, BS, NREMT-P, FP-C, CCEMT-P
Flight Paramedic, STAT MedEvac

Situation

In many busy EMS agencies, providers are forced to eat on the run, and often choose unhealthy food. Further, many providers are sedentary in their leisure time and have insufficient strength and flexibility to prevent injuries.^{xxx} This is unfortunate due to the physically demanding nature of the job, which requires the ability to lift and maneuver patients through cramped environments or down many flights of stairs. As a result, sprains and strains due to lifting and moving patients are common and a leading cause of injury in EMS.^{xxxi}

Megan Wood, a flight paramedic at STAT MedEvac, was tired of seeing her co-workers sustain avoidable injuries. “I conducted a small survey before I started and almost everyone had some sort of injury,” she said. Wood has sustained injuries before as well. She recalls, “I was doing all of the proper lifting techniques and I still managed to pull a muscle in my back.” Wood saw a need to help her co-workers prevent injuries. In addition, she felt that EMS providers should be good role models for health and wellness. “We don’t eat right because we are always on the go; we don’t sleep well because we work such erratic shifts.”



EMS Champions practice stretching at one of the Fellowship meetings.

Countermeasures

In order to promote better health and wellness among her co-workers, Wood thought of ways to make it easy for them to exercise and eat right. To facilitate exercise, she created and posted walking paths at multiple STAT MedEvac bases. “During breaks in the day, said Wood, I set it up so that instead of sitting and watching TV, or getting in a quick nap, you could walk on the roof or do some simple isometric exercises.” Wood measured the length of each path so crew members were aware of the approximate distance they walked.

To communicate the importance of wellness, Wood began an email campaign encouraging people to exercise and eat healthy. She also developed and directed her co-workers to a website she created (<http://healthywackers.webs.com/>) that serves as a resource for prehospital providers to find exercise videos and tips for healthy eating. When Wood first started taking her daily walks, “people were laughing at me because I was walking around on the roof,” she recalls. But slowly, the crews started to see the benefit.

It wasn't just Wood's home base that caught on to her focus on fitness. In fact, her message reached STAT MedEvac employees across the region — the service operates 18 bases in three states. "I received an email from a girl who works in Erie who saw what we were doing and subsequently mapped a walking path in her base," noted Wood. Other bases are following suit.



Wood distributed a follow-up survey after implementing her program. While the rate of injuries did not decrease significantly, due to a small sample size, her co-workers lost weight. “One man lost 30 pounds; one of the girls lost 15,” she recalled. By getting everyone to think about health and wellness more, there were added benefits. “Two men quit smoking and nearly everyone started eating better. Our snacks are different and everybody is making more of a conscious effort to eat right as opposed to eating junk all of the time.”

Next Steps

Wood plans to continue to update her website by writing blog posts and sharing them on Facebook. Noting the success of the walking paths, she adds, “If I go to a base I haven’t visited before, I’ll map a walking path for them and encourage them to use it.” She also plans to consult with other EMS agencies to help them develop their own wellness programs. She thinks it will be an easy sell. Ultimately, for Wood, improving provider wellness is a safety imperative. “It is something you don’t think about when you think about safety; you don’t think about eating right, you think about other things,” she said.

DEVELOPING a CULTURE of SAFETY CURRICULUM for PARAMEDIC STUDENTS

Walt Stoy, PhD, EMT-P

Professor and Director, Emergency Medicine
University of Pittsburgh School of Health & Rehabilitation Sciences

Situation

It is often said that in moments of extreme stress, soldiers, police officers, pilots, and even clinicians, will fall back on their training to guide their behavior. This phenomenon reinforces the necessity of proper education and enforcing important concepts early in training, so proper responses will be automatic during stressful situations.

In training and continuing education for EMS professionals, safety principles are sprinkled throughout. For example, on practical certification exams, points are given to providers who verbalize that they are assessing whether a scene is safe and that they are wearing personal protective equipment. However, aside from a few instances of safety training in primary EMS education, most safety principles, from safe driving to properly lifting a stretcher, are left to individual EMS agencies to provide to their employees. Individual agencies are highly variable, with different safety cultures and training methodologies, oftentimes leading to clinical training that doesn't emphasize safety.

The University of Pittsburgh School of Health and Rehabilitation Sciences' (SHRS) undergraduate program in emergency medicine trains about 50 students each year, and gives them the skills to become leaders in their field. Students enter the program after two years of undergraduate education, and in their junior year are provided with instruction to become nationally registered paramedics. In their senior year, emergency medicine students take a variety of classes including EMS administration, advanced clinical topics, and business.

Realizing the need to instill in his students a focus on safety during their primary EMS education, Walt Stoy, director of the SHRS Emergency Medicine program, changed both the junior and senior year curriculum in to better emphasize the importance of safety. "We are stressing these principles in the classroom setting before they get out there so they will develop good habits and reduce their chance for error," said Stoy.

To achieve this goal, two topics proven to enhance safety were emphasized in the junior year paramedic curriculum, one of them being closed loop communication. According to Stoy, closed loop communication originated and proved its usefulness in the aviation industry. "Airline pilots will sit there and say out loud the position of the airplane. Then the co-pilot will confirm and repeat back the position, which enhances the likelihood of it being right," explains Stoy. "It's the equivalent of a doctor saying, 'I am going to push 100 milligrams of lidocaine,' and then the nurse repeating it back. It gives everyone a chance to pause and ensure they are doing the right thing; it reduces errors." Along with being taught to use closed loop communication when performing interventions, junior year paramedic students were trained to operate in a culture of safety.

The Agency for Healthcare Research and Quality defines a culture of safety as having the following key features:^{xxxii}

- acknowledgment of the high-risk nature of an organization's activities and the determination to achieve consistently safe operations

- a blame-free environment where individuals are able to report errors or near misses without fear of reprimand or punishment
- encouragement of collaboration across ranks and disciplines to seek solutions to patient safety problems
- organizational commitment of resources to address safety concerns

In didactic classes, faculty stressed the importance of a safety culture and closed loop communication. To reinforce the importance of these two principles, students were evaluated on their ability to use them during their required field training and practical skills examinations. “Nearly 99% of the (evaluation) forms indicated that the students did function in a culture of safety were taking steps to achieve closed loop communication,” remarked Stoy. “I sincerely believe these interventions reduced mortality and morbidity events because they were more aware of safety, versus just providing them with information.”

Despite the increased focus on safety training, there was one reported medication administration error by a paramedic student, which fortunately had no impact on the patient. Since the student was trained to operate within a culture of safety, they were comfortable reporting the error so it could be prevented in the future. “If you look at the number of IVs and medications administered during clinical rotations, there were thousands of them done by students,” he said. “If we only had one error during that time, and they were practicing a safety culture and closed-loop communication, that’s pretty good.”

For senior-year SHRS emergency medicine students, safety principles were taught in a Professional Issues in EMS course. The class syllabus was altered to include lectures by leaders in the field of EMS safety —Paul Paris, MD, on error reduction, and Daniel Patterson, PhD, on improving safety in health care. “Students learned a lot from the course,” said Stoy. “I could glean from their papers that they were thinking about a culture of safety and how they could take steps to improve their patients’ care by reducing errors.”

Clinical 2 – Clinical Site Rotations

CEM Center for Emergency Medicine Emergency Department Shift Evaluation Form

Student Name: [REDACTED] Preceptor Name: [REDACTED]

Site/Unit	Date	Time In	Time Out	Total Hrs	FISDAP Shift #
(U.S. NPSICOP or P.O. #184193)	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]	[REDACTED]

Student Instructions: Complete all shaded areas prior to submission to preceptor.

Preceptor Instructions: Review shift objectives with student at the start of each shift.

Please use the following rating scale.

<input type="checkbox"/> 1	Unsatisfactory Requires Assistance Needs more training	<input type="checkbox"/> 2	Tentative Needs Guidance	<input type="checkbox"/> 3	Competent Minimal Prompting Entry level EMT-P	<input type="checkbox"/> 4	Good No prompting	<input type="checkbox"/> 5	Excellent Experienced level EMT-P
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Student Rating	Preceptor Rating	Area of Performance
A	4	Professionalism/Attitude: The student's behavior demonstrated integrity, empathy, self-motivation, self-confidence, team work, diplomacy, respect, patient advocacy, careful delivery of service, appropriate time management, appropriate appearance and personal hygiene. Reported to work on time and in full uniform. Did the student maintain a culture of safety? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Did the student perform closed-loop communication? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No Preceptor comment:
B	3	Phase/Shift Objectives: Reviews current objectives and performs the tasks to the standard outlined. Requests and accepts constructive criticism, takes personal responsibility for self-improvement. Preceptor comment:
C	3	Psychomotor Skills: Student can thoroughly describe all elements of applicable procedures and accomplishes psychomotor skills independently and proficiently. Preceptor comment:

During clinical site rotations through both the SHRS emergency medicine program and the Center for Emergency Medicine's paramedic diploma program, preceptors now must assess each paramedic student's use of closed-loop communication and adherence to a culture of safety.

Next Steps

This year's round of senior-year emergency medicine students will be even better equipped with a focus on safety, as the principles they learned during their junior year paramedic training will be reinforced in upper-level courses. “These folks will be even more interesting to look at,” says Stoy. “They will be more exposed to information about a culture of safety and will be even better ambassadors for what they can do with that information.” Dr. Stoy is committed to permanently embedding safety concepts into the SHRS emergency medicine program. He views the new safety curriculum as a grassroots approach to improving EMS safety system-wide. “It won't be folks who have been out in the field for 30 or 40 years telling our graduates what to do,” said Stoy. Instead, it is a “bottom-up approach of having our rookies infuse safety throughout the system.”

FLU VACCINATION CAMPAIGN

Jennifer L. Hahn, MSL, RN, PHRN, CFRN

Clinical Manager, STAT MedEvac

Situation

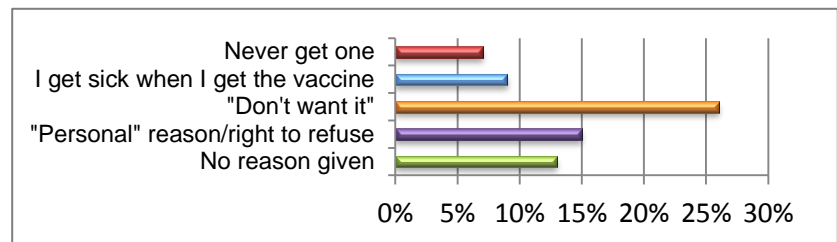
The patient compartment of a cramped ambulance or trim helicopter often leaves little room for providers to move around. However, these close-quarters environments provide a perfect opportunity for the spread of infectious diseases between patients and EMS providers. While precautions are taken to prevent infections from spreading in an ambulance, such as wearing personal protective equipment, washing hands, or placing a mask on sick patients, a very effective method of prevention is often overlooked — vaccination.

Influenza (flu) vaccination is a simple and effective way of preventing illness; the Centers for Disease Control and Prevention reports 50-70% efficacy.^{xxxiii} Because of their close and prolonged exposure to sick patients, EMS providers are at particularly high risk for contracting influenza. Infected providers run the risk of passing the illness to their patients or crewmates, even before they have symptoms, creating a safety concern. Yet, in 2010, STAT MedEvac estimated its flu vaccination rate at only 60%.

Countermeasures

Jennifer Hahn, clinical manager at STAT MedEvac, first wanted to get a better handle on just how many employees had previously declined to be vaccinated. “I only had sparse data for prior years,” said Hahn.

So she instituted a flu administration and refusal form to more accurately track vaccination rates across the company. She also circulated a survey to staff at all 18 STAT MedEvac bases to assess why employees declined the vaccination.



Results from Hahn's survey question, which asked unvaccinated respondents why they chose to decline vaccination.

Results

For the 2011 flu season, Hahn provided staff education about the importance of vaccination by posting informational fliers at each base and in STAT MedEvac's administrative offices. Hahn's tracking revealed that STAT MedEvac achieved a 68% flu vaccination rate, a slight increase from 2010. Hahn's survey revealed that STAT staff believed some myths about the flu that may have influenced their decision. Some believed that the vaccine could give you the flu, that it conferred no benefits, or that the flu produced mostly gastrointestinal symptoms (its primary symptoms are respiratory). Many EMS providers “believed that they were healthy enough so getting the flu was no big deal,” explained Hahn. The survey also revealed that many staff members came to work ill because they did not want to take a sick day; they felt able to perform their job duties despite being ill, or they did not want to cause a staffing issue.

Next Steps

Taking into account the results of her survey, Hahn hopes to refocus the upcoming flu vaccination campaign around preventing transmission. She hopes to increase vaccination compliance by educating staff on the potential patient safety consequences of coming to work sick or not getting vaccinated. Hahn remarked, “We want to promote the responsibility for patient safety among clinical staff in relation to the ethical obligation to ‘first, do no harm’.”

IMPROVING the EMS SYSTEM AT LARGE

Every hour, nearly 3,500 patients across the country are transported to a hospital by EMS. Responders seek to provide excellent care for each individual. A number of the EMS Champions projects, however, view EMS as one component of a broader system of care that, overall, determines the outcomes for each patient.

As Perfecting Patient CareSM teaches, many factors beyond individual EMS providers' abilities affect outcomes for patients treated in a prehospital environment. The articles in this section demonstrate that enhancing the ambitions of EMS providers and administration for perfecting care, the use of technology, continuity of post-discharge care, regional disaster preparedness, and emphasis on patient safety culture can substantially improve patient outcomes.

WHAT DRIVES SAFETY in EMS?

Daniel Swayze, DrPH, MBA, MEMS

Vice President, Center for Emergency Medicine of Western Pennsylvania, Inc.

Situation

In high-risk industries like aviation, nuclear power, or manufacturing, safety is often the highest priority. EMS is fundamentally a high-risk industry as well, with many of the same dangers endemic to other sectors of health care, coupled with the hazards of transportation and emergency management.

As a way of assessing the EMS Champions' baseline attitudes and beliefs towards safety, Daniel Swayze, vice president of the Center for Emergency Medicine of Western Pennsylvania, Inc., looked at what drives a safety culture in EMS. Through structured interviews and surveys of his fellow Champions, Swayze compiled their perceptions of the current state of safety in EMS and what can be done to improve it.

Results

One thing Swayze noticed was that his fellow EMS Champions viewed patient safety issues very differently from how they viewed provider safety issues. The Champions thought that patient safety issues were primarily the responsibility of EMS agency medical directors, while responsibility for provider safety issues was in the domain of EMS executive management.

Where are we now? How the EMS champions believe their agency is currently performing in preventing...	
MEDICAL ERRORS	EMPLOYEE INJURIES
Not effective at all (0%)	Not effective at all (0%)
Not very effective (17%)	Not very effective (25%)
Somewhat effective (58%)	Somewhat effective (42%)
Very effective (25%)	Very effective (33%)

To Swayze, this delineation of responsibility for safety was a bit troubling, since safety performance in EMS, like driving habits, affects both providers and patients.

Further, the Champions thought that having a negative patient safety experience would be very likely to increase interest in improving patient safety, but having a negative provider safety experience would not have the same result. EMS providers are often more worried about patient safety issues than they are with their own wellbeing. When asked how effective their EMS agency was at preventing medical errors or employee injuries, the majority of the Champions responded that their organization was merely somewhat effective, reflecting the potential lack of emphasis on safety. According to Swayze, EMS agencies are “struggling on a day-to-day basis to provide emergency care and keep their ambulances staffed with qualified people. Even though they said safety is an issue, it wasn’t high on their priority list.”

The EMS Champions had opinions on how the EMS industry could promote creating a culture of safety. When asked to rank the factors which most likely spark EMS executive management's interest in improving safety, the Champions' answers were similar for both patient and provider safety. They felt that increased regulation through the state would be the most effective way to increase interest in improving safety. They also felt that financial incentives, which reward adopting better safety practices with reduced costs or higher reimbursement, would also be effective. In order to get the issue of safety higher on EMS executives' priority list, says Swayze, "they basically said that we are going to have to rely on the regulators at the state EMS agency to tell local EMS agencies that if you are going to be licensed, these are the types of things you need to have in place."

Next Steps

Swayze plans to conduct a broader survey of EMS providers to find out if his findings hold true with a larger sample size. He will then discuss the results with statewide EMS advocacy agencies and encourage them to create those regulations.

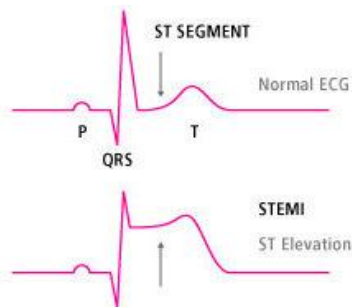
While Swayze's results indicate that there are things that can be done at the policy level to increase safety, the EMS Champions' individual projects described in this publication highlight the effectiveness of local EMS providers in devising original solutions to agency- or regional-level problems. Swayze added, "The EMS Fellowship was such a critical first step for a number of us who have been interested in this area and welcomed the opportunity to sit down and talk. There wasn't really a venue to do that outside of this Fellowship."

IMPLEMENTING TRAINING and TREATMENT PROGRAMS to IMPROVE STEMI CARE (partnership with AHA's Mission: Lifeline)

Shane Spielvogel, RN, BSN, PHRN
EMS Specialist, UPMC Prehospital Care Program

Situation

Each year, nearly 250,000 Americans experience an ST-elevation myocardial infarction (STEMI), the deadliest type of heart attack. During a STEMI, a coronary artery is completely blocked, and as a result the heart muscle supplied by the affected artery starts to die. For patients who suffer a STEMI, time is of the essence. The faster the STEMI is recognized and the artery is opened, the more heart muscle can be salvaged and lives saved.



Unfortunately, only 40% of STEMI patients receive appropriate therapy for this life-threatening condition within the recommended timeframe. Worse yet, 30% of STEMI patients do not receive proper treatment at all. In order to improve these outcomes, JHF partnered with the American Heart Association's (AHA) Mission: Lifeline. Launched in 2007, Mission: Lifeline aims to improve awareness, training, and treatment of STEMIs.

Top: a normal echocardiogram.

Bottom: an ST-elevation myocardial infarction as seen on an echocardiogram.

The time-related risks facing STEMI patients are formidable and include failure to recognize symptoms and failure to access needed health care quickly enough from trained staff and well-equipped facilities. Much progress has been made by the AHA in developing STEMI training courses and patient education materials. They are focused on disseminating information and ensuring that all personnel involved in the care of patients experiencing a STEMI — from EMS providers to cardiologists — are adequately prepared to deliver optimum care.

EMS plays an important role in recognizing STEMI events and subsequently preparing the receiving facility for the arriving patient. STEMIs can be recognized by characteristic changes in a 12-lead echocardiogram (ECG) test, which prehospital providers can conduct in the field and then transmit to the receiving facility. This allows the hospital to prepare their cardiac catheterization lab for the incoming patient.

Knowing the importance of having well-trained EMS providers delivering excellent STEMI care, AHA has developed classroom-style STEMI training for EMS providers. In an effort to expand this education regionally, JHF partnered with AHA's Western Pennsylvania Chapter to underwrite their STEMI training of 100 local EMS personnel over three years.

Shane Spielvogel was a perfect candidate to take on the mission of improving STEMI care. He has 20 years of experience in EMS, first as an EMT and later as a prehospital nurse. In addition, Spielvogel has worked as a nurse in a cardiac catheterization lab, post-cardiac care unit, and Emergency Department. He is well acquainted with the entire spectrum of STEMI care,

from the first link in the system — EMS to the Emergency Department, and from the catheterization lab where blocked arteries are opened, and then to recovery. “It’s nice to have perspective from both sides of the equation, so when people relay their experiences, you know the roadblocks that exist on each side,” said Spielvogle.

One of the benchmarks for effective STEMI care is a quick “door-to-balloon” (D-to-B) time. Spielvogle explains, “The goal is that from the time the patient arrives at the hospital to the time that the balloon is inflated in the affected artery is less than 90 minutes.” Each hospital aims to



*Mission: Lifeline ultimately hopes to fix the broken STEMI “chain of survival.”
The links can be divided into four components:*

- Time from symptom onset until patient recognition and decision to seek medical help
- EMS activation, evaluation, treatment and transport
- ED evaluation and initiation of a reperfusion strategy
- Pharmacologic or mechanical reperfusion therapy

(Source: American Heart Association, 2008 STEMI Provider Manual)

reduce their average door-to-balloon time by starting with a committee headed by the interventional cardiology staff. These committees began to notice that when EMS transmitted an ECG to the hospital before arriving with the patient, 20 minutes on average were shaved off the door-to-balloon time.

Clearly, heart tissue and lives are saved when everything goes smoothly, allowing patients to receive cardiac catheterization more quickly. EMS is “the first link in the chain of survival — early recognition, early (ECG) transmission and interpretation, and then transport to an appropriate care facility,” said Spielvogle.

But sometimes the process does not go smoothly. “We undertreat right now,” said Spielvogle. “We don’t recognize as many cardiac events in the field as we possibly could.” One of Spielvogle’s duties at the UPMC Prehospital Care Program is to work with EMS providers who transported a STEMI patient to the hospital but failed to transmit an ECG. Spielvogle heard many explanations, from patients not presenting with typical heart attack symptoms, to being too busy caring for a very sick patient to conduct the test. In each case, he provides education to improve care in the future.

In order to better understand the magnitude of the problem and why EMS does not always recognize STEMI cases, Spielvogle conducted a survey with a large sample of EMS providers throughout southwestern Pennsylvania. “Many of the respondents indicated that their services had 12-lead capabilities and that they could transmit them,” said Spielvogle. “However, they said that 12-lead interpretation is a difficult skill to master and maintain. Their competence level with it was not as high as it could be and that they would welcome additional training and technical support to be able to facilitate the transmission of 12-lead ECGs.” Survey results

revealed another factor contributing to the problem: most EMS providers did not know about the 90 minute door-to-balloon goal or Mission: Lifeline in general.

Countermeasures

In response to the call for additional training in ECG interpretation and transmission, Spielvogle worked with a regional committee formed through the Emergency Medical Service Institute (EMSI) to develop an AHA-supported, three-module, 12-lead ECG course for advanced life support providers. The course was rolled out to its first cohort of providers at EMSI's 2012 Annual EMS Update Conference. The course's third installment is a train-the-trainer module, which will create more educators and facilitate spread and dissemination.

Further, to create even more awareness in the EMS community about its important role in STEMI care, lessons from Mission: Lifeline will be integrated into EMS training throughout the region. "Right now, Mission: Lifeline has a nice menu of courses geared toward hospital Emergency Departments and cardiac catheterization labs," said Spielvogle. "But the piece that's really not on the playing field right now is prehospital care. So we are going to try to fix that."

UPMC Prehospital Care is updating the curriculum for the Advanced Cardiac Life Support (ACLS) certification classes it teaches. ACLS is a required certification for paramedics and prehospital nurses, and they must re-certify every two years. In upcoming classes, providers will be educated about the goals of Mission: Lifeline, including 90 minute door-to-balloon times and prompt transmission of ECG in the field.

Next Steps

Spielvogle will continue to work with AHA to determine how to better promote Mission: Lifeline and develop strategies for improving EMS STEMI care. In the meantime, door-to-balloon committees at hospitals have begun to focus on EMS's role in STEMI care. Soon, the committees will move "from 'D-to-B' to what they're calling 'E-to-B', which is first emergency contact to balloon time," said Spielvogle. "They are going to measure from the time the paramedic walked into the person's house and made contact with them until the time that the balloon is inflated." This new measure will serve as an indicator of the essential role EMS plays in ensuring that STEMI patients receive excellent and timely care.

REDIRECTING FREQUENT FLIERS

Wayne Epps II, EMT-P
District Chief
City of Pittsburgh Bureau of EMS

Jonathan Lever, MPH, NREMT-P
Coordinator of Medical Education
Center for Emergency Medicine of Western PA, Inc.

Situation

As healthcare costs rise, one of the goals of health reform is to reduce hospital readmissions. Medicare has created financial penalties for institutions that discharge patients with certain conditions who return within 30 days. A 2009 study in the *New England Journal of Medicine* reported that nearly 20% of Medicare patients discharged from a hospital were readmitted within 30 days at a cost of more than \$17 billion per year.^{xxxiv} Readmissions are not only costly, but are often an indicator of poor post-discharge care management. Indeed, of those who were readmitted within 30 days of discharge, more than half did not follow up with their primary care physician as recommended.

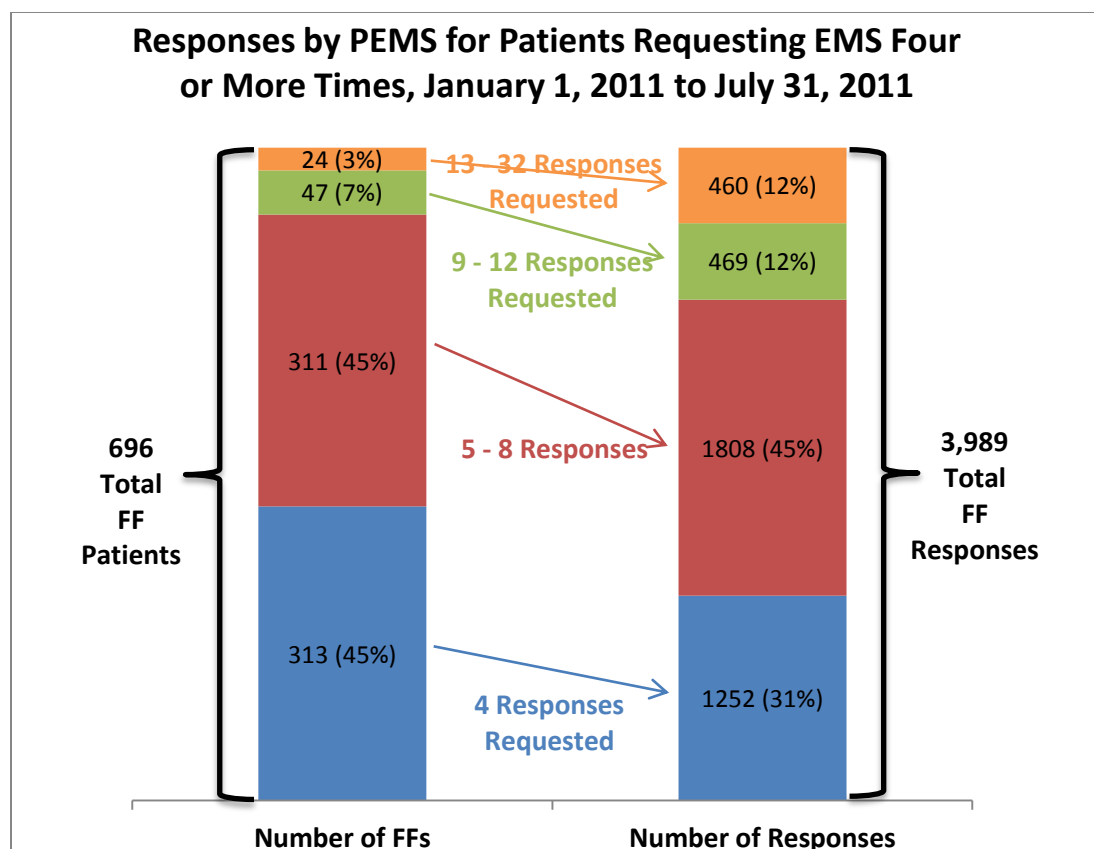
Contributing to the high prevalence of readmissions are “frequent flier” patients, those who call 9-1-1 for medical assistance who may not have an emergency. These patients require multiple responses per year and are often transported to hospital Emergency Departments, contributing to the cycle of readmissions.

Wayne Epps, district chief of the City of Pittsburgh EMS, and Jonathan Lever, coordinator of medical education at the Center for Emergency Medicine of Western Pennsylvania, noticed that although many frequent fliers use EMS for legitimate medical emergencies, many do not. “Some, if not most, of the patients have other issues that contribute to them being frequent fliers — living alone, unable to manage normal daily activities, or dealing with psychological issues,” said Epps. “The system is a safety net for them; they believe that they have a problem so they call and somebody comes.”

To get a better grasp of the magnitude of frequent flier EMS utilization, Epps and Lever conducted a retrospective review of patient care reports from the City of Pittsburgh EMS (PEMS). The team defined a frequent flier as a patient who was transported four or more times during a seven-month period, which translates to visiting the Emergency Department at least every other month via EMS. Using this criteria, 695 patients were identified, who required a total of 3,989 EMS responses. One patient requested PEMS 34 times during this seven-month period. Over the course of the year, these frequent fliers represented only 3.2% of the City of Pittsburgh EMS’s patients, yet accounted for 12% of all responses. The average frequent flier response required one hour for a paramedic crew of two to answer the call, accounting for 13,680 hours of labor and over \$1 million of services over the course of the year.

COMPARISON OF TOTAL EMS USE WITH ESTIMATED USE BY FREQUENT FLIERS (FF) REQUESTING PEMS FOUR OR MORE TIMES (2011)		
	Total	FF use (n, %)
Responses/year (n, %)	58,083	6,840 (12.0%)*
Patients/year (n, %)	37,002	1191 (3.2%)
Average Responses/month (n)	4,840	570*
Transports/year (n, %)	36,682	4,291*

*Average based on a seven-month data sample of patients requesting PEMS four or more times.



During the seven-month study period, 696 patients requested PEMS four or more times, accounting for 3,989 responses. 10% of these frequent flier patients requested PEMS nine or more times, representing 24% of frequent flier calls.

“Using valuable EMS resources to respond to frequent flier calls can place a dangerous burden on the system,” said Lever. The City of Pittsburgh is a very busy EMS agency, operating 11-13 ambulances around the clock. Essentially, there is one unit in service at any given time attending to frequent fliers. Additionally, each ambulance covers a set service area. “If a unit is tied up with a frequent flier patient and a serious medical emergency occurs in that unit’s service area, another ambulance will have to respond to the emergency from farther away, creating delays in urgent patient care,” explained Lever.

Getting in Touch with Frequent Fliers

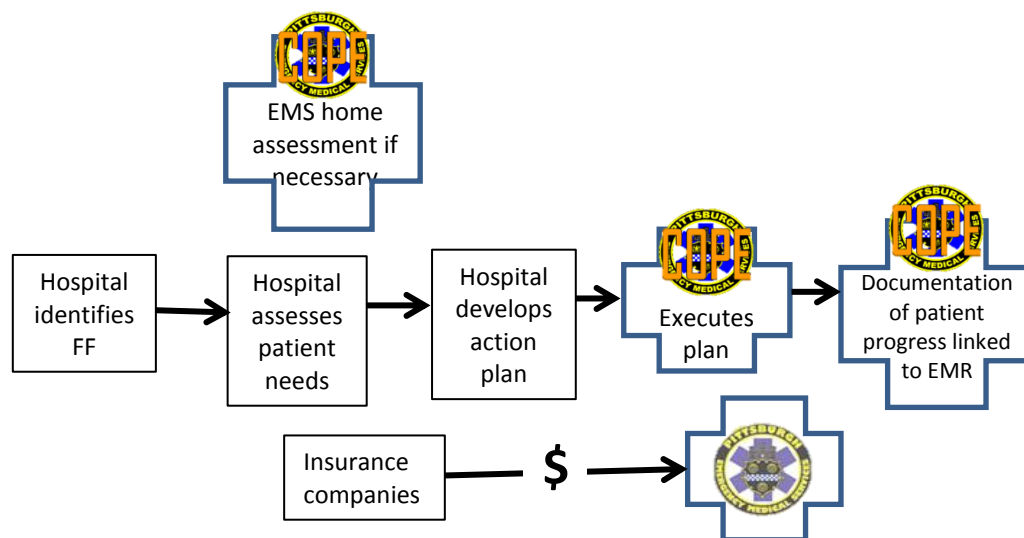
Epps and Lever decided to contact some of these frequent fliers to determine the best way to help. The team made 327 phone calls to schedule interviews with these patients. Of those, hardly anyone agreed. “The numbers were either disconnected, or they didn’t wish to talk to us, or felt they were already working with their provider to make adjustments,” explained Epps.

One patient, Mr. R, a 72-year-old male who requested PEMS 22 times in the seven-month study period, did agree to be interviewed. The team found that Mr. R had an extensive medical history. Ten months prior to the interview, Mr. R injured his knee. Apparently, his injury was poorly managed and a few months after that, he fell and broke his jaw. He is also a diabetic but could not manage it properly because of his injury. Mr. R, or his brother with whom he lives, would frequently call 9-1-1 due to exacerbations of his diabetes. “When the brother was sick, it made taking care of his normal activities difficult,” added Epps. “Then as a result, he would have other injuries that would complicate an already difficult situation.”

Mr. R was a classic case of poorly managed medical and social needs. Epps and Lever referred him to the county Area Agency on Aging (AAA), which provides support services to help older residents live safe, healthy, and when possible, independent lives. Yet, while AAA can help older patients get the support they require, no mechanism exists to ensure that younger frequent flier patients receive appropriate post-discharge care or have the support necessary to not be reliant on EMS.

Next Steps

One thing that Epps and Lever noticed when diving into their project is that frequent fliers often do not have good continuity of care. Many times, their contact with the medical system is erratic. Further, frequent flier patients don't necessarily travel to the same hospital or hospital system. This disjointed contact with healthcare providers makes it difficult for both EMS and hospitals to identify many frequent fliers and intervene, if necessary.



A potential model for merging EMS and hospital resources to better treat frequent flier patients.

The team is looking for innovative ways to identify these patients and arrange better post-discharge care, which will hopefully reduce 9-1-1 calls, as well as hospital admissions and readmissions. The team identified a possible collaboration between hospitals and the City of Pittsburgh EMS's Special Operations division as a potential mechanism for reducing frequent flier calls. Paramedics in the division could conduct home assessments to help hospitals gauge a patient's needs. They would then help execute the hospital's post-discharge plan, ensuring that patients have the resources to care for themselves, and documenting patient progress in an electronic health record. "We have patients who may have a slip-and-fall and then you arrive and find throw rugs in their home," said Epps. "Changing their personal environment could eliminate some of the calls."

Lever envisions computers in each ambulance that would provide EMS responders with information about a patient's previous 9-1-1 calls and to what facility they were previously transported. This information would help EMS direct patients to facilities that have an established rapport with the patient, and help healthcare systems identify and assist frequent fliers. Both Lever and Epps agree that frequent flier trips to the Emergency Department can only be reduced through better collaboration between the hospital and EMS. "A system has to be developed or this is only going to continue to get worse," said Epps. "If you get these patients connected with the right care, we can improve their quality of life."

MASS CASUALTY INCIDENTS: A REGIONAL APPROACH

Christopher M. Dell, AS, NREMT–P

Chief/Executive Director, Elizabeth Township Area EMS

Situation

Mass casualty incidents (MCIs), events in which the number or severity of patients overwhelms EMS resources, are something for which EMS providers train, but rarely encounter. Chris Dell, chief of Elizabeth Township Area EMS, anticipated a problem with the management of such incidents in the region. “Large-scale incidents with lots of patients are managed differently between communities,” said Dell. “That is okay until you need lots and lots of ambulances.” In a particularly large incident, multiple EMS agencies with different training must work together to manage the scene.

In order to facilitate interagency cooperation, Dell saw a need to standardize MCI training and equipment across EMS agencies. He started investigating the MCI preparedness of five agencies operating in the same dispatch zone as the Elizabeth Township EMS. He found broad variations in each agency’s training and equipment. “Basically we all need to be speaking the same language and using the same equipment,” said Dell.

Getting Started

As Dell’s project began to take off, he realized that the lack of uniformity in MCI management was widespread. So he took the project to the Pennsylvania Region 13 Task Force, a consortium of emergency preparedness and response agencies across 13 counties in southwestern Pennsylvania, covering a population of three million. Dell and representatives from the 13-county region created a uniform MCI kit, which could be used by every agency in the region. “We collaborated with a number of EMS leaders and debated each and every item that is in the kit,” said Dell.

Countermeasures

When designing the kits, the Pennsylvania Region 13 Task Force kept in mind that every ambulance crew has the potential to be the first to arrive to an MCI — first on scene, first in command. Therefore, the kit was designed so every EMS vehicle would include the necessary tools to empower its crew to manage and take command of an MCI. “How an incident is managed in the first five minutes is going to largely impact how things progress from there,” said Dell.

When the first crew arrives on the scene of an MCI, their job is to open the kit. The first responders, usually consisting of an ambulance staffed by two providers, each puts on a brightly colored vest included in the kit identifying them as either incident commander or triage officer. Attached to each vest are job aids — cards that explain the necessary tasks for each role and whistles used to call attention. The incident commander assesses scene hazards and the need for traffic control, rescue, medical helicopters, or other resources. The triage officer quickly evaluates the number of patients and then assesses the injury severity of each patient using a triage tagging system included in each MCI kit. That way, when additional resources arrive, care can be prioritized for patients identified with life-threatening injuries.

Additionally, each kit contains colored streamer tape and glow sticks, used for designating triage areas in day or night operations. The kits also include spray paint and instructions for use in a standardized urban search and rescue marking system, dry erase boards, pens, paper, scene barrier tape, and duct tape.



Dell's MCI Kit.

Results

The Pennsylvania Region 13 Task Force secured a \$550,000 federal grant from FEMA to generate 1,500 MCI kits. The kits were distributed to every ambulance, rescue truck, and quick-response vehicle in the 13-county region. Training in the use of the kits is strongly encouraged and is the responsibility of individual EMS agencies. However, Dell and his local EMS Council held multiple classes and train-the-trainer sessions on the use of the kits. The Council is also working to create online training that can be accessed through Pennsylvania's EMS education portal.

Next Steps

Dell has begun training providers at his agency, Elizabeth Township Area EMS, in the use of the kits. His crews are excited for the opportunity. "The fact of the matter is, we see patients every day, one at a time. We don't see lots of patients all at the same time, said Dell, so managing a mass casualty incident is simply something that we don't do every day, which is why training is so important." Providers in the region have already found unique uses for the equipment in the kit. This winter, a snowstorm in one suburb disabled multiple vehicles on the road. Emergency dispatchers were bombarded with calls reporting disabled vehicles. On the ground, emergency responders noticed that they were being dispatched unnecessarily to the same vehicle multiple times, tying up valuable resources. Dell recalls the responders' innovative use of the equipment, "They used the glow sticks to mark a vehicle that had already been checked, so that there were no repeat calls to that area."

This project demonstrated the need for standardizing the equipment and training used for mass casualty incidents. Perhaps the one piece that is missing from the puzzle of MCI preparedness in the region is the type of large-scale, routine MCI simulations employed in Israel that make their system so effective (see the project on page 50). These types of simulations would be particularly useful in the United States due to our fragmented EMS dispatch and management structure (Israel has a unified EMS system). Still, the widespread use of Dell's MCI kits and the innovative uses for the equipment are exciting. Dell is enthusiastic too, remarking, "The fact that we have 1500 kits, and they're going to be on every ambulance in the entire region, that's pretty neat."

A DATA ANALYSIS TOOL for EMS QUALITY IMPROVEMENT

Jeffrey Reim, BS, EMT-P

EMS Specialist, Quality Improvement, UPMC Prehospital Care Program

Situation

In his position as an EMS Specialist for the UPMC Prehospital Care program, Jeffrey Reim helps institute quality improvement programs to continually advance EMS care in the region. Reim routinely collects data from the 50 EMS agencies for which UPMC Prehospital Care provides medical command. He would then analyze the data and distribute a report describing the clinical effectiveness of the system as a whole.

Separately, every advanced life support EMS agency in Pennsylvania is required to complete two quality improvement projects per year. “No one was talking to one another,” said Reim. “We were doing quality improvement data gathering and compiling these statistics in a vacuum, while all of our ambulance services were out there doing whatever they were doing by themselves.”

After surveying 15 EMS agencies about their quality improvement procedures, he found that most of their efforts were focused on improving care on a case-by-case basis by reviewing individual trip reports. “No one knew how they actually compared against the system unless I broke it down for them,” recalled Reim. Since each agency was unaware of their performance as compared to other agencies, the reports did little to direct agency-level quality improvement efforts.

Stroke Audit

We performed an audit of 832 cases of patients age >35 years who were categorized as having a stroke/CVA or who were categorized as Neurological and had a positive Cincinnati Prehospital Stroke Scale. The components we reviewed were:

- Documentation of vital signs (heart rate, blood pressure, and respiratory rate)
- Documentation of Stroke Scale assessment
- Documentation of GCS
- Documentation of glucose level
- Documentation of pulse oximetry (SpO₂)
- Administration of oxygen if SpO₂ was <95%

Audit Results:

Agency X	Total Cases	Vital Signs	Stroke Scale	GCS	Glucose Check	O ₂ Sat	O ₂ Admin*
	62	62	59	61	56	60	7
		100%	95%	98%	90%	97%	100%
All UPMC Command Agencies	832	97%	72%	93%	83%	95%	88%
Goal		100%	100%	100%	100%	100%	100%

* O₂ Administration: % of cases with SpO₂ <95% who received oxygen

*A stroke audit sent in March, 2012 with the UPMC Prehospital Care Medical Memo.
The new reports include agency-specific information.*

Countermeasures

Reim wondered that if each EMS agency was able to see their own performance in clinical measures as compared to other regional EMS agencies, they would be able to choose where to focus their quality improvement efforts based on which areas were not up to par. To help drive this, Reim decided to create a uniform method of collecting clinical data, which would be used to create reports tailored to each EMS agency.

For the new reports, Reim developed a form that allows each EMS agency to easily enter data from its electronic trip sheets and transmit it to Reim with the click of a button. After receiving the data, Reim conducts statistical analyses and produces a “medical memo,” which is sent out quarterly to each EMS agency. On a rotating basis, each medical memo examines clinical metrics in the treatment of one of nine different high-risk patients, such as those with chest pains, involved in a motor vehicle accident, or requiring endotracheal intubation. The reports are then repeated at three-to-six-month intervals to gauge improvement. Each report is individualized, and contains information for that particular audit and how they compared against the entire system.

For the first few rounds of audits, Reim’s reports focus on ensuring EMS agencies are properly documenting their care on the electronic trip sheet. Within the trip sheet, there are often two or three places where information can be documented. Therefore, Reim’s initial medical memos direct agencies to input pertinent information into an activity log within the trip sheet that allows interventions to be time-stamped, an important metric to evaluate. “The next time we run that report, hopefully they’ll have made those corrections,” said Reim. “Then we’ll be able to see exactly where we stand as far as compliance is concerned.”

ASSESSING PERFORMANCE

UPMC Prehospital Care’s Medical Memos report quality data in the following areas:

- Chest Pain
- Continuous Positive Airway Pressure (CPAP) breathing therapy
- Shortness of Breath
- Suspected Intoxication
- Motor Vehicle Accidents
- Patient Refusals
- Seizures
- Strokes
- Endotracheal Intubation

After ensuring that agencies are properly using the electronic trip sheet, Reim’s medical memos will focus on directing clinical quality improvement within each organization. According to Reim, “I know several ambulance services had a lot of good discussion after they received their medical memo. Now they are coming up with new ideas to try to improve their own scores.”

Next Steps

Reim hopes that the medical memos will motivate EMS agencies to start additional quality improvement projects beyond the two they are mandated to complete per year. Additionally, the reports will allow Reim to identify best practices within the system. “If an ambulance service is constantly in the upper 90s as far as their scores, we need to go to them to figure out exactly what they’re doing to get such good numbers,” said Reim. “We can share that with the rest of the ambulance services who might not be getting as high a score.”

Utilizing best practices will help both the UPMC Prehospital Care program and individual EMS agencies tailor their educational programming. In addition to creating didactic educational modules in deficient areas, Reim plans to reach out to agencies directly. “We want this to be interactive, he said. We don’t want to be just dictating to them what we want them to do. We want them to come up with their own ideas.”

Reim’s project showcases that EMS agencies may not be aware of their performance in certain clinical areas. As the United States moves into the era of accountable care, hospitals and other healthcare facilities are becoming subject to quality monitoring and public reporting. EMS currently lags behind in this area because transparent clinical quality data is difficult to find for EMS agencies. While this level of public oversight in EMS may not be a reality for some time, Reim’s project reveals that EMS can use the data that are available on electronic trip sheets to drive internal quality improvements efforts. And while the era of accountable care for EMS might be far into the future, the ability for EMS agencies to compare performance with their neighbors provides the opportunity for communities to identify and disseminate best practices in EMS.

INTERNATIONAL LESSONS in EMS

When evaluating the effectiveness of systems in enabling healthcare workers to provide safe, high-quality patient care, it is useful to have a benchmark. In U.S. hospitals, a myriad of quality measures are collected by the government to help consumers, practitioners, and administrators compare performance across different facilities. Some hospitals are clear leaders, setting the bar high for competing hospitals.

Yet, no such system exists for EMS. This makes identifying best practices within high-performing EMS agencies or regions a difficult task.

But even without a benchmark, some elite EMS systems with proven records of delivering high-quality prehospital care stand out. Two of these — Israel and London — were investigated by a few EMS Champions who identified several best practices abroad that could be adopted in the U.S.

EMS and DISASTER PREPAREDNESS: The ISRAELI MODEL

Adam Z. Tobias, MD, MPH

Assistant Professor of Emergency Medicine, University of Pittsburgh School of Medicine

Situation

Disasters, such as Hurricane Katrina, emphasize the vital importance of disaster response and preparedness in the United States. They require large, coordinated medical responses and have the potential to quickly overwhelm local and regional systems. Unfortunately, threats of terrorism and the number of natural disasters have only increased over the past two decades^{xxxv}.

Alarming, the United States is, in many regions, ill-prepared to deal with disasters. The American College of Emergency Physicians' 2009 National Report Card on the State of Emergency Medicine gave the United States a C+ in the category of disaster preparedness. This low grade reflects increasing concern that the emergency care system in many communities is already stretched to the limit, and that surge capacity, staffing, and resources are inadequate to deal with the extraordinary demands of a major disaster^{xxxvi}.

Adam Tobias, MD, assistant professor of Emergency Medicine at the University of Pittsburgh School of Medicine, agrees that the United States is unprepared to adequately respond to many catastrophes. "With a few notable exceptions, our experience with true disasters and mass casualty situations is limited," he said.

Learning from an International Leader in Disaster Preparedness

Fortunately, the United States can look to other countries with more experience in disaster preparedness. For example, Israel has decades of experience in dealing with disasters. Due to ever-present threats of violence, the country has refined its disaster response to the highest degree and has designed extensive systems and trainings to prepare for such incidents. "Israel has established itself as a leader in this area and we can learn a lot from their experiences," said Tobias.

To better understand the Israeli disaster response system, Tobias travelled to Israel with the Jewish Healthcare Foundation and four other local leaders in emergency medicine, including fellow EMS Champion Dan Swayze. The group attended Israel's Emergency and Disaster Preparedness Course, offered annually through the Israeli Ministry of Health and the American Physicians Fellowship for Medicine in Israel. The intensive, five-day course teaches participants about Israeli medical emergency preparedness, contingency plans, and deployment of health organizations in emergencies and disasters.

Lessons Learned

The Israeli emergency medical system is designed with the capacity to respond to and treat large surges of patients. A unified EMS system, known as Magen David Adom (MDA), provides coverage for the entire country, which allows for flexibility in ambulance dispatch. MDA maintains a National Operations Center, supported by a network of regional dispatch centers, mass casualty centers, and ambulance dispatch posts staffed by over 1,500 paid employees and 11,000 volunteers. This vast network of emergency medical volunteers allows for rapid response to any incident. Each volunteer EMS provider is issued a cell phone with a GPS locator and a

basic critical care kit. In the event of a major incident, MDA's dispatching software automatically locates the five volunteers closest to the scene and asks them to respond via text message. If they agree to respond, they become visible on a digital map in the MDA operations center.

One unique aspect of Israel's disaster preparedness system that makes it so effective is the close coordination between MDA and the Israel Defense Forces (IDF). During major incidents, the IDF often evacuates casualties and provides air medical rescue services. Additionally, the IDF sends a



Combat triage simulation at an IDF Medical Corps training facility.

specialized team to the scene of any bombing to test for biochemical and radiological threats. Another important factor in the success of Israel's emergency medical system is the level of disaster training. Each hospital performs numerous disaster drills every year, often with more than 300 simulated patients. In addition, most Israeli paramedics are trained through the IDF Medical Corps, whose training program relies on simulation of battlefield mass casualty incidents. All Israeli emergency responders are trained in specific procedures to ensure that incidents are managed in an organized manner. "We could benefit from more large-scale drills involving larger segments of the healthcare community," said Tobias.

One of the biggest lessons Tobias learned is that in complicated situations "simple is better." "The more complex our disaster plans, the less likely that we'll be able to execute them when under duress," he said. For example, during mass casualty incidents, the Israelis use a simplified triage process to expedite evaluation and transport of patients. As EMS resources arrive on the scene of a mass casualty incident, rapid assessment of all patients begins with teams pausing only to quickly control external bleeding or open airways. Severely injured victims are marked for urgent evacuation with a special red armband. After the primary survey of all victims is made and enough personnel arrive, evacuations begin immediately with any necessary procedures performed en route to the hospital instead of in the field. The system ensures that as many patients as possible are quickly transported to Emergency Departments.

This simplified triage and evacuation process is part of the "scoop-and-run" theory used in Israeli disaster responses, which emphasizes rapid evacuation and minimizes interventions provided on scene. Generally, the most severely injured victims are the first to be transported to the nearest trauma center or, if unstable, to the nearest hospital for stabilization. Minor injuries are spread out among more distant hospitals.

Once EMS arrives at the ED with a trauma patient, EMS providers are trained to deliver a 20-second verbal report to ED staff. EMS providers are trained to use a standardized framework that expresses the most important information to ED staff in this “20-second shout-out.” Impressed by the success of this simple tool in Israel, Tobias is currently working with local hospitals to implement their own version of the standardized verbal patient handoff report.



Rambam Hospital Trauma Center in Haifa, Israel has a sign posted in its Emergency Department displaying the standardized patient handoff protocol.

In the event of a suspected chemical or biological attack, all decontamination is performed at hospitals, using simple hoses. Ambulances shuttle back and forth from the hospital to the scene, with attendants wearing full protective equipment and not decontaminating the ambulance between trips. While the decontamination of patients is delayed, these processes ensure that patients are evacuated as quickly as possible. In contrast, most mass casualty plans in the United States call for decontamination either at the scene or at a remote location. Often, these plans require assembling complicated decontamination tents and equipment and can delay the evacuation and care of seriously injured patients. The Israeli approach of using simple hoses at the hospital for decontamination is more practical in that it uses a centralized, primed location.



Decontamination hoses and tarps at Shaare Zedek Medical Center. In the event of a mass casualty incident, decontamination of patients and secondary triage occurs in the underground driveway of the Emergency Department.

Like the simple hoses installed at hospitals for decontamination and the standardized verbal patient handoff report, Tobias noted that “the Israelis are great at finding low-tech solutions to problems.” One example is that in a disaster, bystanders are often used to help carry stretchers, apply pressure to bleeding wounds, manually ventilate patients, or transport patients with minor injuries to distant hospitals. Ambulances transporting critical patients will simultaneously carry one to two additional patients with minor injuries to speed evacuation efforts. He also noted the widespread use of checklists and easy-to-read protocols for mass casualty events used in both EMS and in the Emergency Departments.

Another low-tech innovation was created at Shaare Zedek Medical Center. Through experience, the hospital noticed that the majority of bombing fatalities that entered the hospital were patients initially triaged into the yellow (delayed) category. These patients were dying from initially undetected internal bleeding. The hospital therefore decided to eliminate the yellow triage category and now triage all patients as either green (stable) or red (immediate care required).

Israel has also found ways to simplify and expedite the process of readying hospitals for a large influx of patients after a disaster. All Israeli EDs are required to prepare for casualties equal to 15-20% of each hospital’s respective capacity. The threshold for activating hospital mass casualty incident procedures is set very low to allow for rapid response. Upon activation, a centralized computer automatically notifies critical personnel, and procedures are set in place to clear as many patients as possible from the ED and intensive care units. A mass casualty incident command center is activated to coordinate the large influx of patients. Further, a group of nurses who are cross-trained to work in the ED immediately leave their normal duties and report to the ED. All surgical residents and attending physicians also report to the ED. Once the patients arrive, the EDs use their own intuitive triage system.

During a mass casualty incident, all traffic through the ED becomes one-way. As such, patients are stabilized in the ED but once they leave for testing or treatment, they are not brought back. Instead, the whole hospital is utilized, with patients rotating through different stations to treat different conditions.

Next Steps

Israel’s EMS, hospital, and military resources work together to provide an organized and efficient response to disasters. Tobias recommends that the United States emulate some of the Israeli disaster preparedness practices, as they have been tested and refined through military conflicts and terrorist attacks. He recommends three key learnings from Israeli EMS that should be considered in the United States:

1. focus on early scene evacuation of medical casualties,
2. eliminate on-scene decontamination, and;
3. establish a network of medical volunteers.

In the realm of hospital disaster preparedness, he suggests that the United States:

1. eliminate the yellow triage category, and;
2. adopt the Israeli hospital mass casualty protocol.

Tobias also suggests that the United States increase the simulation training for mass casualty events and the scope of such exercises. “We could move to simplify some of our plans with checklists and easily accessible information.” To help make his recommendations a reality, he plans to continue his involvement in the field of disaster preparedness to help hospitals and EMS agencies in the Pittsburgh area become better prepared, if and when disaster strikes.

LESSONS from LONDON'S EMS

Patrick Lambert, BS, NREMT-P

Paramedic, City of Pittsburgh Bureau of EMS

For his undergraduate thesis project at the University of Pittsburgh, Patrick Lambert had the opportunity to travel to London and fly with London's Helicopter Emergency Medical Service (HEMS). The service, which began in 1990, provides rapid treatment to and evacuation of victims of serious injuries. London's HEMS never ceases to operate, with the helicopter flying missions during daylight hours and rapid response cars taking over at night. The medical response team, which includes a senior trauma doctor and a specially trained paramedic, responds to an average of seven missions every 24 hours. They can perform lifesaving procedures in the field that are normally reserved for the Emergency Department or operating room.

Lambert's project focused on seeing how London's HEMS integrated principles from aviation's culture of safety into their clinical practices. For example, since the paramedics and physicians working for London's HEMS serve for only six to nine months and often switch partners, it can be difficult to establish a rapport among the crew. The aviation industry also faces such problems and has developed training to promote better teamwork and communication among crews, even if they haven't ever worked together. Similarly, to ensure that London's HEMS medical crews are able to work well together despite this shortcoming, the clinicians undergo a robust training program that emphasizes teamwork and following predetermined roles. Lambert recalls London's HEMS clinicians being very comfortable in their roles and ability to work with new partners, with one paramedic commenting, "Even though I've never worked with this guy before, or maybe only once or twice before, I know it will be very smooth tonight because we've trained for it."



A London's HEMS paramedic and physician review care protocols during down time in their shift.

London's HEMS providers constantly train and mentally prepare for even rare situations during their downtime, recalls Lambert. This was part of their culture of safety. For instance, Lambert remembers crews discussing the intricacies of a tracheotomy, in which access to a patient's airway is obtained by cutting through the throat. "It's a high-risk procedure that we don't do very often because there are a lot of things that can go wrong," said Lambert. "It's sort of a last-ditch effort if you can't get an airway on the patient in some other way." Despite the low

frequency of performing the procedure, he recalls a paramedic asking his physician partner, “If we do a tracheotomy tonight, on which side of the patient do you like to be positioned?”

This intensive approach to preparing for high-risk procedures and emphasis on teamwork had an impact on Lambert. He integrated these lessons into his EMS Champions project (see page 8). From the aviation industry, to London’s HEMS, and finally to the City of Pittsburgh EMS, the concept of embedding teamwork and preparation into the culture of high-risk industries has proven itself to be extremely useful in improving patient safety.

Link to Perfecting Patient CareSM

Rules in Use – Activities

The Rules in Use are based on Lean manufacturing, and govern how people work, how people interact with each other, how services flow, and how problems are identified and addressed. By standardizing work, London HEMS creates an environment where procedures are completed efficiently and with precision, resulting in better patient care.

CONCLUSION

Creating a Culture of Safety in Emergency Medical Services

Over the course of this Fellowship, the EMS Champions worked to make an impact on the safety and quality of prehospital care in the region. To help spread these successes, Daniel Patterson, PhD, MPH, MS, EMT-B, assistant professor in the University of Pittsburgh's Department of Emergency Medicine, was brought on board to help evaluate the outcomes and effectiveness of the Fellowship. Dr. Patterson has spent his career investigating quality, safety, and performance in EMS. In addition, he works in the field as an emergency medical technician a minimum of one shift per week. Dr. Patterson previously graduated from the Patient Safety Leadership Program, co-sponsored by the American Hospital Association and the National Patient Safety Foundation and is the first non-physician recipient of the prestigious Patient Safety Fellowship, co-sponsored by the Emergency Medicine Patient Safety Foundation. Given his research expertise and experience with other fellowship programs in healthcare safety, he is uniquely qualified to help spread the impact and lessons learned from the EMS Champions.

Patterson helped the Champions learn how to share their projects' results through his presentations at quarterly meetings. He educated the Champions on the difference between research and quality improvement, and provided tips on publishing the results of their work. He also actively coached one Champion through her project.

Further Dissemination

Dr. Patterson observed and extracted lessons from the Fellowship that he will document in a submission to a peer-reviewed journal. He views the article as a means of disseminating the outcomes of the EMS Champions Fellowship not only to the EMS community, but to the healthcare industry as a whole. "Hopefully it will help bring awareness to the rest of the healthcare community that safety is a huge concern for us and we are doing something about it," said Patterson. "We are not just sitting idly by."

The article will first introduce the current state of safety and quality in EMS. "Right now we are 10-15 years behind the rest of health care" in regards to a safety culture, remarked Patterson. After the release of the Institute of Medicine's seminal report, *To Err is Human* in 1999, most sectors of health care began focusing on improving safety. "It's been 12-13 years, and we are just now talking about that in EMS," said Patterson. "So we still don't even know what a safety culture means for us."

While a few small studies have shed some light on the magnitude of safety issues in EMS, the industry has not yet broadly emphasized safety as a central issue to focus on improving. Yet, things are beginning to change. Led by the American College of Emergency Physicians (ACEP), efforts are now underway to define and envision a broad strategy for improving the culture of safety in EMS. ACEP is collaborating with the public and representatives from national EMS and fire organizations to publish a *Strategy for a National EMS Culture of Safety*. "Hopefully this document will, much like the Institute of Medicine report, raise awareness of a safety culture in EMS," said Patterson.

Patterson does not feel that a national culture of safety strategy is sufficient. "EMS is so diverse," he said. "We have over 19,000 individual EMS agencies in the United States documented at this time, and I guarantee you there are 19,000 different cultures going on." That's why fellowships are so important. "We've got to have homegrown remedies because all of these organizations are different," said Patterson. "There are a lot of similarities among them, but there's a certain uniqueness to them that requires unique interventions and unique

responses.” In order to elicit innovative solutions to problems, workers on the ground require training in how to evaluate and develop countermeasures to problems they encounter.

After introducing the need for safety and quality improvement training in EMS, Patterson’s article will highlight the success of the EMS Champions Fellowship in meeting those needs. A major strength of the Fellowship was the core curriculum of Perfecting Patient CareSM, the Pittsburgh Regional Health Initiative’s flagship quality improvement methodology. This quality improvement training equipped the Champions with set of tools to improve safety and quality. Also essential to the achievements of the Fellowship was the mentoring provided by JHF staff and the Fellowship coaches. “When you combine that with the teachings and presentations, their eyes started to open a lot more, and they became more motivated,” said Patterson. “The program gives these individuals a common set of tools, a common set of knowledge and awareness so that they can go back to their unique organization with unique solutions.”

Another key to the Fellowship’s success was the collaboration of individuals with different duties from different organizations — from frontline paramedics to supervisors and quality assurance professionals. “You get them talking, telling stories, and sharing their fears about safety, whether it be for the patient or the provider, and that really opens the door for learning and being motivated to do something,” said Patterson. “I think motivation and learning was strengthened over the course of the Fellowship.”

Collaborations Continue

Even as Patterson submits his article to a peer-reviewed journal, the seeds of change that were planted during the Fellowship continue to grow. For instance, EMS Champion John Lovett, director of clinical operations at STAT Medevac, has begun collaborating with Patterson. “As an extension of the JHF program, we are trying to work on how best to measure and quantify a safety culture for HEMS (helicopter emergency medical services),” says Patterson. As a research methodologist, Patterson will help measure adverse events and teamwork within HEMS. “We are working on quite a few things that are an extension of being more aware of safety and the motivation to do something about it,” he said. Senior mentor Maria Guyette, MD, agrees that the Fellowship will continue to bear fruit in the months and years to come.

JHF Aims to Spread Lessons

Lessons from the EMS Champions Fellowship have already begun to spread regionally. EMS Champions presented their Fellowship projects at the Emergency Medical Service Institute’s 25th Annual EMS Update Conference. Mark Pinchalk, paramedic crew chief for the City of Pittsburgh EMS, presented his project on advanced airway management and Chris Dell, chief and executive director of Elizabeth Township Area EMS, shared his success in supplying every EMS vehicle in the region with uniform mass casualty incident management kits.

The Jewish Healthcare Foundation also hopes to impact the state of safety and quality in EMS on a national level with a presentation at the National Emergency Management Summit. Additionally, Daniel Patterson’s paper on the EMS Champions program has the potential to spark a host of EMS safety initiatives across the county.

One of the major successes of the EMS Champions Fellowship was the effectiveness of teaching Perfecting Patient CareSM online through Tomorrow’s HealthCareTM (THC). Because EMS providers are often on the go, they tend to prefer modular, online education, such as that provided through THC. Champions used many of the tools and principles of Perfecting Patient CareSM and THC to share learnings, successes, and challenges related to their projects.

Looking forward, a national meeting in Washington, DC will discuss ACEP's *Strategy for a National EMS Culture of Safety*. JHF will attend the meeting and advocate for widespread adoption of online quality improvement training for EMS providers. JHF believes that the EMS Champions Fellowship can be replicated in communities across the country, creating a national, grassroots network of safety and quality Champions. Best practices developed by these Champions could be shared through traditional means, such as journal publications, but also through an online, collaborative network for EMS safety like Tomorrow's HealthCare™. JHF welcomes the opportunity to collaborate with EMS organizations across the country, and invites interested partners to join our online community of EMS Champions.

Karen Wolk Feinstein, PhD, JHF president and chief executive officer, remarked, "The EMS Safety/Quality Champions Fellowship validated the role of Champions and the usefulness of our quality improvement methodology, Perfecting Patient CareSM, in prehospital care. We hope that this program will serve as a model for the rest of the nation."



The EMS Champions

(alphabetical order)

Quincy Chopra, BS, NREMT-P, CCEMT-P

Flight Paramedic, STAT MedEvac
*Evaluation of Prehospital Oligoanalgesia:
Why does pain go untreated?*

Christopher M. Dell, AS, NREMT-P

Chief/Executive Director
Elizabeth Township Area EMS
Mass Casualty Incidents: A Regional Approach

Wayne Epps, II, EMT-P

District Chief
City of Pittsburgh Bureau of EMS
and

Jonathan Lever, MPH, NREMT-P

Coordinator of Medical Education
Center for Emergency Medicine of Western PA
Redirecting Frequent Fliers

Jennifer L. Hahn, MSL, RN, PHRN, CFRN

Clinical Manager
STAT MedEvac
Flu Vaccination Campaign

James Husar, NREMT-P

Clinical Education Specialist
Emergency Medical Service Institute (EMSI)
*Standardizing EMS Patient Transport Refusal
Forms*

Patrick Lambert, BS, NREMT-P

Paramedic
City of Pittsburgh Bureau of EMS
*Improving Airway Safety &
Lessons from London's HEMS*

John W. Lovett, RN, MSN, MBA, CMTE, CFRN

Director of Clinical Operations
Center for Emergency Medicine/STAT MedEvac
*Using Aviation Safety Strategies to Increase
Patient Safety in the Prehospital Setting*

Curtis W. Neill, EMT-P

Manager of Special Projects
UPMC Prehospital Care Program/Emed Health
Improving EMS Equipment Readiness

Daniel Patterson*, PhD, MPH, MS, EMT-B

Assistant Professor
University of Pittsburgh School of Medicine
*Creating a Culture of Safety in Emergency
Medical Services: A Publication*

Mark E. Pinchalk, MS, EMT-P

Paramedic Crew Chief
City of Pittsburgh Bureau of EMS
*Physiological-based Airway Management
for Cardiac Arrest*

Linda A. Reiger, MS, EMT-P

EMS Specialist
UPMC St. Margaret - UPMC Prehospital Care
Program
*Improving the Handoff Process from EMS to
Emergency Department Staff*

Jeffrey M. Reim, BS, EMT-P

EMS Specialist - Quality Improvement
UPMC Prehospital Care Program
*A Data Analysis Tool for EMS Quality
Improvement*

Shane Spielvogel, RN-BSN, PHRN

EMS Specialist
UPMC Prehospital Care Program
*Implementing Training and Treatment Programs
to Improve STEMI Care (partnership with AHA's
Mission: Lifeline)*

Walt Stoy, PhD, EMT-P

Professor and Director of Emergency Medicine
University of Pittsburgh School of Health and
Rehabilitation Sciences
*Developing a Culture of Safety Curriculum for
Paramedic Students*

Dan Swayze*, DrPH, MBA, MEMS

Vice President
Center for Emergency Medicine of Western PA
What Drives Safety in EMS

Adam Z. Tobias*, MD, MPH

Assistant Professor of Emergency Medicine
University of Pittsburgh School of Medicine
*EMS and Disaster Preparedness: The Israeli
Model*

Megan Wood, BS, NREMT-P, FP-C, CCEMT-P

Flight Paramedic
STAT MedEvac
Improving Health and Fitness of EMS Providers

* Also served as a coach for fellow EMS Champions

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