ELSEVIER APRIL 2009

EMS 10

INNOVATORS IN EMS

2008

A supplement to *JEMS* sponsored by Physio-Control Inc.

EMS INNOVATORS in EMS 2008

Table of Contents

Vice President/Publisher
Jeff Berend

Editor-in-Chief
A.J. Heightman

Supplement Editor
Lisa Bell

Production Coordinator
Matt Leatherman

Advertising Director
Judi Leidiger

Disclosure of Author Relationships: Contributing authors have been asked to disclose any relationships they may have with commercial supporters of this supplement or with companies that may have relevance to the content of the supplement. Such disclosure at the end of each article is intended to provide readers with sufficient information to evaluate whether any material in the supplement has been influenced by the writer's relationship(s) or financial interests with said companies.

EMS 10 Innovators in EMS 2008 is a supplement sponsored by Physio-Control, Inc. and published by Elsevier Public Safety, 525 B Street, Ste. 1900, San Diego, CA 92101-4495; 800/266-5367 (Fed ID # 13-1958712).

Copyright 2009 Elsevier Inc. No material may be reproduced or uploaded on computer network services without the expressed permission of the publisher.

Subscription information: To subscribe to an Elsevier publication, visit www.jems.com. Advertising information: Rates are available on request. Contact Elsevier Public Safety, Advertising Department, 525 B Street, Ste. 1900, San Diego, CA 92101-4495; 800/266-536.

Bringing Ideas to Life

The anatomy of innovations & the people who create them

By A.J. Heightman, MPA, EMT-P

This special supplement, sponsored by Physio-Control Inc. and JEMS, profiles 10 EMS innovators selected by an expert panel based on their successful implementation of at least one EMS innovation in 2008. These individuals were nominated by their peers in recognition of their hard work, dedication and selfless efforts to make a difference in the delivery of EMS, the evaluation of it or the lives of those delivering or receiving it.

To reflect on these innovators and their innovations, it's important to first define innovation. Simply put, an innovation is a new way of doing something in an effort to bring about positive change. It can be an incremental change or a radical transformation in thinking, processes, products or organizations.

'Often, in common parlance, the words creativity and innovation are used interchangeably. They shouldn't be, because while creativity implies coming up with ideas, it's the "bringing ideas to life" ... that makes innovation the distinct undertaking it is."[1]

It's also important to note the difference between an *invention* and an innovation. Some people mistakenly think an invention is a physical object, device or product that's been developed. However, an invention is actually the first occurrence of an idea for a new process or object.

An *innovation*, on the other hand, is the first attempt to carry such an invention into practice. It occurs when someone uses an invention or idea to change how the world works, how people organize themselves or how they conduct their lives. Therefore, innovation occurs whether or not the act of innovating succeeds in generating value for its champions.

Innovation typically involves creativity, but is not identical to it. Like acting on an invention, innovation involves acting on creative ideas to make a specific and tangible difference. Therefore, creativity is a starting point for innovation, and innovation is the implementation of creative ideas within an organization.

An innovation is also differentiated from an improvement because it permeates society and can cause reorganization. It may also cause problems, and not everyone in an organization will be, or needs to be, happy or supportive of an innovation. Thus, in this view, innovation occurs whether it has positive or negative results.

It was with these definitions in mind that an expert panel of reviewers considered all the nominations for this year's EMS 10 and the nature of each EMS innovation. As in many fields, a change in an EMS system must often be substantial to be considered innovative. And while one might consider a particular innovation just part of the routine in a busy, urban EMS system, it can be considered innovative when implemented in a smaller or rural setting.

Read about the accomplishments of the 10 individuals selected for their 2008 achievements. Through their own words, masterfully set into context by author Cynthia Kincaid, you'll learn how their ideas, innovations and resulting processes may impact your world of EMS. Most importantly, learn how you, too, can become an innovator in EMS. Visit www.jems.com/ems10 for more information about this program. ■

References

1. Davila T, Epstein M and Shelton R: *Making Innovation Work: How to Manage It, Measure It, and Profit from It*. Wharton School Publishing: Upper Saddle River, 2006.

A.J. Heightman, MPA, EMT-P, is the editor-in-chief of JEMS *and the editorial director of Elsevier Public Safety. He has served as director of operations for a multi-jurisdictional BLS/ALS service and executive director of the Eastern Pennsylvania Emergency Medical Services Council, a six-county regional EMS agency. Contact him at a.j.heightman@elsevier.com.*

Cynthia Kincaid is an award-winning writer who has written numerous articles for medical and health-care publications and organizations. She was the recipient of a 2007 Excellence in Journalism award from the Society of Professional Journalists. Cynthia holds a Bachelor's degree in journalism and a Master's degree in public administration.

Referred Services & Alpha Trucks

Norma Battaglia leads Tucson Fire Department toward response efficiency

Like many urban systems, the Tucson (Ariz.) Fire Department (TFD) has experienced an increasing number of non-emergent 9-1-1 calls, which had reached 16% of its annual call volume. Fortunately, Norma Battaglia, prehospital manager for TFD, found an effective way to help reduce the non-emergent calls by connecting the people making the calls with other human services agencies who could better meet their needs.

Battaglia developed a program called the Human Service Referral Program (HSRP), formally launched in 2008, which provides a mechanism for getting people who were using 9-1-1 inappropriately the help they really needed.

Norma Battaglia

A Paradigm Shift

Over a period of several years, Battaglia looked for ways to alter the traditional EMS paradigm of triage, treat and transport. Based on her objective to provide alternatives to repeat encounters for those needing more basic care, Battaglia worked steadily to provide those alternatives by strengthening ties between EMS and human services agencies. "We can't afford to separate ourselves into little silos anymore," says Battaglia, a nurse who has also worked in maternal and child health and air medical transport.

By developing a workable referral system, Battaglia cultivated close relationships with providers of public health, veterans' health, behavioral health and case management services. She then developed EMS policies on how and when to make referrals and helped create a Web-based system that allows EMS responders to notify other agencies of the need for follow-up.

The project started with groundwork laid by one of TFD's inspectors, who had an interest in finding out why so many seniors were repeatedly calling 9-1-1 to make requests for non-emergent services. The inspector would go out on his own, or at the request of EMS crews, to talk with some of the repeat callers. Battaglia suggested he enlist the help of public health nurses and other organizations focused on elder care issues. "When he was reassigned a year later, I took up the cause," says Battaglia.

> ***'We all have a part of the skill set needed to manage these socially complex, as well as medically complex, cases.'***

"This issue isn't just about the elderly needing comfort and someone to talk to," says Battaglia. "We have people who call us to feed their dogs. We have people who can't clean themselves after they've gone to the bathroom, or who can't get themselves back into their wheelchair. It's about the isolated hoarder with 50 cats, whose house you can barely enter, and the senior who doesn't have a way to the doctor.

"Some people have learned how the system works," says Battaglia. "But anytime someone has a medical complaint, and we judge them to meet the definition of a patient, we need to intervene and ensure that they're going to be properly cared for."

The Bigger Picture

At the same time Battaglia was investigating possible solutions, TFD was putting together a program called the Alpha Response Truck (or Alpha Truck), designed to provide a non-emergent, code-two response to low-acuity calls. Based on certain criteria, the department would send a vehicle with two EMT/firefighters, and no other apparatus, to calls judged to require a lesser level of response.

Battaglia sold TFD administrators on the concept that the fire service could further contribute to improving the prehospital portion of the healthcare system by engaging other service providers. Rather than ignoring hospital issues, such as overcrowding and indigent care, Battaglia's goal was to have fire and EMS responders assume a larger role in patient and non-patient placement in lieu of emergency department (ED) care.

Battaglia's outreach began informally. "I started out asking crews to respond to me when they had concerns about someone. Then, we turned it into an e-mail or a paper trail," she says. "And I would call directly to public health and see if someone could go out and see the person. We began to network and realized just how many individuals and agencies are involved in their care."

It became obvious that the scope of the outreach required a more systematic approach. "So, we brought together a community group that started with public health nursing in the county and case managers from the Arizona Long Term Care System (ALTCS), the Veterans Administration

and behavioral health," says Battaglia.

"We looked at the referral process as a continuum of medical care, because with respect to medical privacy and HIPAA constraints, we wanted to make sure that we were giving out information only if the patient authorized us to do so, and only to another level of health-care provider," she says. "Our inspectors were the only non-medical referral that we included."

TFD created a secure Web-based system for transfer of information between the EMS responders and partnering agencies. The system allows crews to go online, identify the primary reason for intervention and note any accompanying issues, such as medication or durable medical equipment needs or evidence of neglect. The online form includes sections allowing EMS responders to record action taken, write a further narrative and indicate the patient has agreed to be contacted by another agency.

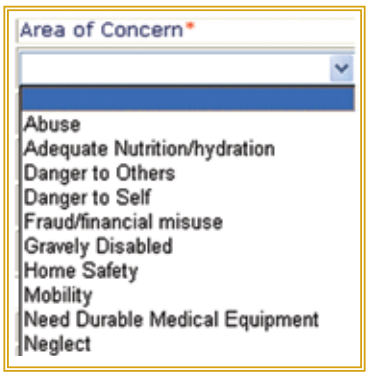
Once the form is completed, it can be sent to Pima County Health Nursing, Pima Health Systems for ALTCS, the Veterans Administration, the Community Partnership for Southern Arizona (CPSA, the regional authority for behavioral health services), TFD inspectors (for environmental health, safety or code violations) and Adult or Child Protective Services. Pima Health Systems, CPSA and VA serve as the "defaults" for all referral types.

"The agencies look to see if the client is part of their client database. If he or she is, they notify the person's case manager," says Battaglia. "It may take a few days for the various entities to weigh in, look people up and try to make contact, so it's not meant to serve as an emergent notification at all. However, our adult protective service office asked us to adjust our reporting, so that they could receive our mandatory adult protective services report electronically, instead of through a fax or by phone call."

Case managers can make notations in the system about actions they've taken, such as making appointments, talking to family members or arranging other services on behalf of the client. "We don't require that they tell us anything, but they've been very good about giving our crews just enough feedback to know that things are being followed up on," says Battaglia.

Measured Success

The approach has worked. From September 2007 to September 2008, even while Battaglia was still building the network of community partners and tweaking the system, the call rate for 50 people identified as being responsible for more than 300 non-emergency 9-1-1 calls dropped by 48%, following their entry into the referral system.



Through a unique Web-based system, TFD crews send partnering agencies the primary reason for intervention and note any other issues.

Other agencies, having heard of the program's success, have asked to join the network. "The Medicaid contract office has also asked us to work with them over time," Battaglia says. "Hospital discharge planning and case management staff are also beginning to ask if they can come to our quarterly human services meeting," she adds. "People look across the room to someone else and say, 'I need to know you.'"

Battaglia admits that EMS has a heart of gold, but they are not social workers. "Every group has the strength of what they can offer that patient, and we can't work without each other," she says. "EMS doesn't work without a hospital, and hospitals don't work without EMS. None of us can succeed without having the public health and community health sector involved either. We all have a piece of the puzzle, and we all have a part of the skill set needed to manage these socially complex, as well as medically complex, cases."

She also believes too many people have come to regard 9-1-1 as a safety net, resulting in an over-reliance on the system. "We've done a really good job of marketing 9-1-1 in this country, but we've also got to include the whole public and community education piece."

TFD also started using "Alpha Trucks" to respond to low-acuity calls.

Toward that end, Battaglia has compiled a list of community resources for placement on every TFD truck. "It includes our community partners, but it also includes other groups and organizations that have 24-hour, seven-day-a-week accessibility and may be able to be of some help."

Battaglia takes the spirit of cooperation with her into every endeavor. "I don't go into any situation, whether it's an EMS meeting at our department, or with the city, within the region, the state or with a hospital, without thinking, 'How can we work together on the issue being discussed?' That's how you have to think when you're looking at a system and not one entity. And you can't be proprietary." ■

Before the Fall

Jennifer Fernandes spearheads successful fall-prevention program in Edmonton, Canada

During the past few years, the number of calls to EMS in the City of Edmonton, Canada, from seniors who had fallen in their homes had reached an alarming rate, totaling 4,000–6,000 calls a year. Jennifer Fernandes, a community educator for the city's EMS, was an integral member of the team that devised a way to help reduce the number of fall-related calls among seniors within the city via a successful fall-prevention pilot program.

The increase in falls seen in recent years in Edmonton created a strain on EMS and other medical services and reflected a growing health hazard for older adults trying to remain independent. Fernandes cites one extreme case in which an elderly woman fell 13 times in 11 days.

Jennifer Fernandes

"She wasn't severely injured and didn't want to go to the hospital," says Fernandes. "It was her right to cancel our services, but the paramedics were saying, 'She's going to get severely hurt next time, and we're going to have to take her in.'"

So, while the increase in the number of calls was alarming, the good news was that Edmonton EMS, and Fernandes in particular, saw a situation in which they might have an impact on long-term intervention.

A Collaborative, Grassroots Approach

"In 2001, we thought we would look at our call volume to see what the number of top calls was," says Fernandes. "Senior falls were very high; they were the second most frequent calls we were responding to in the senior population. The first was breathing problems, and we didn't think we could do a lot with that, so we thought we would see what we could do with falls."

In trying to find a solution, EMS was at first stymied. "We tried to address this in 2001, but it just wasn't happening. It was a top-down approach and it just didn't work," says Fernandes. "So, I thought, let's try the grassroots approach and see if we can refer seniors who are using the health system by using a screening tool. And that's where this program originated."

> ***'We produced a video for training purposes for the paramedics to learn how they can show seniors how to get up after a fall.'***

Fernandes, who has a bachelor's degree in physical education and sport studies with a concentration in athletic therapy from the University of Alberta, is also an EMT. She found the challenge of trying to put together a workable solution a rewarding one, given her interests and expertise. "I've done some adaptive education and that's where I want to be," she says. "My niche is working with the senior population and in injury prevention."

Finding the right approach took several years, but in the end, Fernandes helped launch a successful one-year pilot program for senior fall prevention in Edmonton that lasted from November 2007 through November 2008. The pilot was limited to patients over the age of 65 within the city who fell, were not injured, and refused hospital transport.

Fernandes helped obtain $20,000 for the pilot project from the Alberta Centre for Injury Control & Research (ACICR) to help fund the development of educational materials and the evaluation process. "The province of Alberta provides support for injury prevention and senior falls as one of their main foci, so it was a perfect fit," she says. "They sat on the steering committee and helped us out with the project."

A key component of the pilot program was the use of paramedics responding to emergency calls from seniors who had fallen. The paramedics screened these patients for their risk of falling again. The screening process provided a means by which seniors could be referred to other service providers who focused on fall prevention or other social service needs.

Collaboration became an important element of the program's success, allowing EMS to develop a comprehensive referral system. It started with a call to Capital Health, the health board that provides health services to a region that includes Edmonton, so EMS could coordinate with local hospitals, home care and rehabilitation facilities. This collaboration is the cornerstone of the referral system.

Fernandes also found that Saskatoon, a city in a neighboring province with an existing fall-prevention consortium, had already developed a falls risk assessment form. Edmonton EMS adopted the form, rather than starting from scratch in creating and validating a new assessment tool.

"We went to Saskatoon and met with the team there and they said 'Absolutely, [we] would love to have EMS

involved," says Fernandes. "No one had thought of EMS being a participant in something like this."

Fernandes and others adapted the falls risk assessment form and used it as the starting point for a standardized referral process. The form, used by paramedics at the scene of a fall-related call, is sent to Fernandes for evaluation and disposition, which could include her calling other agencies to follow up with a high-risk patient.

Unique Training

Before the program was launched, paramedics received training on the risk factors associated with senior falls, including demonstrating to patients how to get up after a fall, as well as practice in completing the assessment tool. Fall-prevention toolkits were also developed for distribution by paramedics; kits contained the assessment tool, a fall-prevention refrigerator magnet, fall-prevention literature, and a list of seniors' services and resources in the Edmonton area.

"We produced a video for training purposes for the EMTs and paramedics to learn how they can show seniors how to get up after a fall," Fernandes says. "One woman remembered the training and even told us she remembered how to get up after a fall [after receiving instruction from the paramedics]. This was six months after the paramedics had done any education, and they were only in her home once."

The assessment form includes three sections: an Elderly Falls Screening Test, the Timed Up and Go Test, and a Multi-Factor Questionnaire. "If seniors were low [risk], we knew we could probably leave them at home and not worry so much about them," says Fernandes. "We didn't put them in the system right away. If they were moderate or high risk, the paramedics would go through the rest of the assessment tool and fill that out. If the seniors were over 14 seconds on the timed event, we put them at higher risk."

Paramedics forwarded the assessment forms to Fernandes, who then determined whether further follow-up was needed. Seniors with a low-risk ranking received no follow-up; the educational materials left with them at the scene were deemed sufficient. For seniors with moderate rankings, Fernandes enlisted the assistance of additional community services for follow-up, including Community Care Services, Home Care, Aids to Daily Living, Supportive Living, specialized geriatrics clinics, a specialized hospital-based fall assessment clinic and the patient's family physician.

"If [their risk factors] were high, it meant that they needed to have a pretty comprehensive assessment," says Fernandes. "So, I would notify Community Care Access or Aids to Daily Living."

The Edmonton Falls Prevention program has helped create a means by which seniors identified at risk of further falls can receive help from other service providers. "We needed to create that link," says Fernandes. "We thought there might be a niche for us to identify these people, screen them and get them into the system."

The Program's Impact

An evaluation of the program after its completion revealed that paramedics' initial contact with a senior who had fallen played a major role in whether or not the senior took advantage of the educational material provided.

The patient's perception of the crew being compassionate played a major role in whether the senior took advantage of the educational material provided.

"The biggest learning that we had from the patient's perspective was if the paramedics came across with compassion and caring, and truly cared about the patient, then the patients were willing to accept the fall-prevention education at that moment," says Fernandes.

Perhaps surprisingly, patients felt that fall-prevention education was essential, but felt guilty about calling EMS for help, even when they had nowhere else to turn. "The patients said, 'I don't know why EMS has to come and pick us up; there has to be a better way. But thank goodness we have something like this,'" says Fernandes.

Based on the pilot program, EMS has now opted for a shortened assessment tool. "We've cut the screening tool down to one page because ... it was too lengthy for the paramedics to complete on scene," says Fernandes. "They found that seniors wanted to share all of their history, so paramedics were spending 45 minutes to an hour on scene."

Community partners who have received the nearly 100 referrals from EMS consider the information increasingly valuable and have encouraged EMS to continue the program. Most importantly, the pilot and the woman who has spearheaded its inception and growth have created a much-needed referral process that now successfully identifies patients at risk for a fall, giving them access to potentially life-saving preventive health care.

"Everyone has been so positive regarding this program," says Fernandes. "I think it's going to grow into a provincial program. And understanding the impact the interventions make on the patients will continue to result in learning that will enhance best practices in EMS patient care." ■

Hospital in a Helicopter

Frank Guyette, MD, drives new interventions to take EMS beyond status quo

Frank Guyette, MD, comes from a long line of first responders. His grandfather started the second fire company in Guyette's hometown of North Brunswick, N.J., and his father was a police officer for 26 years. "When I was old enough, I joined the rescue squad, so [public service] has always been the family business."

Frank Guyette

Today, Guyette is assistant professor of Emergency Medicine at the University of Pittsburgh, School of Medicine, and associate medical director for STAT MedEvac, an air medical transport service that provides regional critical care throughout Western Pennsylvania, Eastern Ohio, Northern West Virginia, Maryland and Washington, D.C.

As part of the non-profit Center for Emergency Medicine of Western Pennsylvania, Guyette has helped lead STAT's success in advancing EMS through education, research and critical care transport service.

Progressive Medicine

While helping to lead STAT, Guyette has been heavily involved in organizing and implementing numerous innovative and life-saving medical advancements, such as therapeutic hypothermia for cardiac arrest patients. In 2008, the system implemented whole-blood lactate monitoring and King LT-D supraglottic airway for the pediatric patient. Under evaluation in 2008 was StO_2 tissue oxygenation monitoring, which Guyette expects to be in wide use in 2009.

The lactate and StO_2 monitoring assists the flight program in identifying and treating patients in early shock who present with compensated vital signs, helping to improve morbidity and mortality rates.

"One of the problems that we have in prehospital medicine is that vital signs don't always give us the whole picture," Guyette says. "So, one of the things we're trying to do is find other markers of shock that could allow us to determine when it would be appropriate to treat something."

The medical team routinely uses the lactate meter, which is similar to a glucometer and provides readings within 60 seconds. "We found trauma patients who had lactates greater than 4 had a mortality of 14.5%," says Guyette, "whereas our trauma patients who had a lactate less than 4 had a mortality of only 4%. So, doing just this one little quick blood test can give a lot of information about how the patient is doing, and I can use that information, in combination with their vital signs, to try to determine what I need to do to best treat a patient."

Guyette has also pushed to have the King LT-D supraglottic airway on board the aircraft. This rescue airway device has one tube and two balloons that can be inflated with a single syringe. "One of the first studies I did at STAT was to compare this type of rescue device to the older types that we carry, and we showed that we had better success using the King," says Guyette.

Because the device is easy to use, it frees up the paramedic and nurse to move on to other interventions. "The average time it takes to put one of these rescue devices in is only about 15–20 seconds, whereas the average time it takes to put in an endotracheal tube, using a blade and handle, is probably on the order of a minute to 90 seconds," he says. "We can dramatically reduce the time we need to control the airway with one of these rescue devices."

The King is also easier to use for paramedics who may not get enough practice intubating patients, such as those in the four ground services Guyette directs. "In the state of Pennsylvania, 60% of the paramedics intubate one time or less a year," he says. "So, if you're out of practice, it might be better to use one of these rescue devices because they don't take a lot of skill or practice to use. In rural communities, where the paramedics don't have a lot of experience or don't have a lot of opportunities to use endotracheal intubation, using more of these devices might be preferable."

> ***'I want to provide the same benefit to the patient outside the hospital that they would get inside.'***

To keep skills sharp, STAT requires every paramedic and nurse to intubate in the operating room 12 times a year, if they haven't done a dozen in the field, and they use simulators between one and four times a year. "They get a

combination of both operating room practice and practice in a simulator, in addition to whatever experience they get in the field," says Guyette.

The STAT team has also started therapeutic hypothermia on board the aircraft, before transporting to nearby Presbyterian Hospital. "If you survive to Presbyterian, which is our primary center, your chance of neurologically intact survival from cardiac arrest, is 41%, which is extraordinary," he says. This success owes something to starting treatment in the helicopter, which Guyette has pushed for. "The crews carry and administer ice-cold saline in flight, on the way in, to help cool the body and protect the brain," he says.

Whereas the local community hospitals might treat 10–12 cardiac arrest patients a year, Guyette and his crew treated 100 in 2008 alone. "That was largely because the people in the community hear about the advantages that we can provide and then call STAT and the local EMS services to bring the patients to us," he says.

The People in the System

According to Guyette, STAT is the largest non-profit, private air medical service in the country. "We have 17 helicopter bases, and we do about 11,000 transports a year."

STAT has its own aviation division and aircraft and employs its own pilots. "From a safety standpoint, this is good because our pilots are part of our family," says Guyette. "Our system works because we trust each other enough to speak up when we feel things are not right."

The medical crew usually consists of a paramedic and prehospital RN. "Our nurses typically have a lot of ICU experience and are good with our interfacility transports, and our paramedics have a lot of field experience, so their skills complement each other and they learn from each other," says Guyette.

The crews train extensively and have at least five years of experience before joining STAT. "In order to gain enough skill to be one of our providers, crews are put through a three-month intensive orientation, which is a combination of classroom, practical skills in the operating room and on simulators, rotations at various hospitals, and flying," says Guyette.

STAT also partners with the Center for Emergency Medicine at the University of Pittsburgh, which provides the program with additional resources and research access. "We have a bachelor's degree in Emergency Medicine through the university, which is a fairly rare thing," says Guyette. "And in addition to getting your paramedic certificate through their program, you can also take courses on management and finance, so that you're better prepared to work in the prehospital environment."

STAT's team also has one full-time and two part-time physicians who serve as medical directors, and three full-time clinical directors who are STAT's most senior nurses and paramedics. Two other physicians also volunteer their time at STAT's facilities at Johns Hopkins and Altoona.

"We have more than 200 prehospital nurses and paramedics who work for us," says Guyette. "We also fly occasionally with physicians on board the aircraft, so they can supplement the skills of the nurse and paramedic."

As might be imagined, the aircraft is as state-of-the-art as the equipment and personnel. The STAT team can perform intra-aortic balloon pump transports and extracorporeal membrane oxygenation with specialized equipment carried on board the helicopter. "We don't use aircraft that are more than seven years old," Guyette says. "[All aircraft] have collision avoidance systems, night vision and all kinds of safety features to protect us and the patients."

Photo Courtesy STAT MedEvac

The STAT medical team carries a lactate meter that provides readings in 60 seconds to help guide treatment and management.

During flights, STAT crews have 24/7 access to a physician by radio, satellite phone and cell phone. "Despite the fact that they are already highly skilled and have very extensive protocols, if they have a question about something at any time, or they think the patient's condition warrants deviating from protocol, they can call and get a physician at a moment's notice," says Guyette.

The program's three medical directors and three clinical directors read all 11,000 transport reports to make sure protocols were followed and, if warranted, give feedback to the medical crew. "We will send e-mails or call them and say, 'You could have done this better,' or 'Great job,'" says Guyette. "We're constantly trying to improve the service and improve their performance."

He expects no less from himself. "If I see something at a hospital, or in the ICU, that is doing well for the patients, I often think to myself, 'How can I bring that into the helicopter or ambulance?'" he says. "I want to provide the same benefit to the patient outside the hospital that they would get inside."

It is this kind of dedication that has made STAT so successful, but Guyette declines to take the credit. "I have an administration that is very supportive of us, and I have an organization that wants to do what is right for patient care," he says. "The nurses and medics I work with are just phenomenally hard working and dedicated people. They are the heroes." ■

A Serious Game

Gregg Lord leads the creation of a virtual preparedness educational tool

Chief Graydon "Gregg" Lord, through his work funded by the U.S. Department of Homeland Security (DHS), has transformed the way chemical, biological, radiological, nuclear and explosive (CBRNE) training is delivered to EMS professionals. During the past three years, Lord has spearheaded the development of Zero Hour: America's Medic, a unique educational model for training the EMS workforce through serious video game-based learning.

"We're just finishing all the testing now, and the game has been made available to some folks in EMS for testing," says Lord.

Zero Hour is a single-player point-of-view virtual game that simulates a variety of seemingly real-life disasters that EMS personnel might encounter. Players go through a defined process the first time they play in order to understand how the game works and to familiarize themselves with the learning objectives. "A player starts out in the training division and learns how to move around, access equipment and communicate," says Lord. "It comes complete with a soundtrack and patients yelling and screaming."

Gregg Lord

A Recognized Challenge

The project was born out of a 2005 federal grant from the DHS. Lord, who is an associate director and senior policy analyst for the Homeland Security Policy Institute at The George Washington University, wanted to examine the policy issues of preparedness and response capability for EMS in some of the largest U.S. cities.

"As a part of that grant, we were also going to develop an educational tool that we could disseminate to the prehospital community and providers that would better prepare them to deal with a mass casualty incident," says Lord.

This learning tool was important because Lord recognized the challenge that EMS faces in preparing for large-scale disaster events and mass casualty incidents. "It's very time consuming and expensive," says Lord, "and most communities cannot afford to run full-scale, real-time exercises because of the cost factor. Even the larger communities can only afford to do it once or twice a year."

Lord and his team decided the best learning approach would be to design a "serious game" that could be disseminated through the Internet and downloaded to authorized users' computers. The game would give EMS players a virtual but very realistic environment in which to practice their skills, make mistakes and, most importantly, learn. "They can practice triage anytime they want, or they can practice medical incident command anytime they want," says Lord.

Zero Hour is based on America's Army, which is a virtual serious game used by the U.S. Army to train troops. "We thought, why can't we do something like that for EMS?" says Lord. So, he asked the DHS for permission to create something "on the front edge" of Internet-based learning. "We wanted to see if we could build a serious game that would allow the players to go in, practice and learn simultaneously, and have fun doing it," says Lord.

Lord and GWU hosted two summits in Washington, D.C., in 2006 and 2007, bringing together EMS chiefs, directors and administrators from the largest cities in America to discuss the policy issues and challenges facing the industry. Summit attendees pointed out the glaring educational inadequacies that EMS personnel face.

"We teach people how to triage, but unless you've triaged many hundreds of patients, you're probably not going to be very good at it when the time comes," says Lord. "Treatment, although it's important, is the one thing that we do every day, so we didn't spend as much time and effort on treatment [in the game] because we didn't perceive it to be a major problem."

Based on feedback from the summits, Lord and his team created a virtual environment that is realistic and medically accurate, all within a framework that allows players to practice the basics of mass casualty incident response.

Scenarios & Evaluations

Zero Hour offers players four levels of play, each scenario progressively more challenging. The scenarios were designed using the 16 national planning scenarios developed by DHS as a platform. Some of these scenarios include F-5 tornadoes, hurricanes, biological releases, nuclear detonation, radiological dispersal devices and multiple explosives in a high populous area.

"We tried to take a cross-section of ones that we felt we could do some justice to in the limited environment that we were able to build," Lord says. "For instance, we wanted to build out a biologic [attack] so people had to think about what to do if they came across a highly communicable disease in their daily practice. Who do you notify? How do you manage it? How do you ensure that you're taking care of yourself and no one else is getting infected at the same time?"

In the first scenario, players are called out to aid a patient who is reportedly vomiting blood. When they arrive on the scene, however, they find out that the whole family is sick, forcing them to make decisions about biologics, notification issues and public-health concerns.

The second scenario involves the triaging of patients in a building collapse after an earthquake. Players will virtually touch patients, take their vitals and triage them just as they would if a real patient was lying in front of them.

"The third scenario is far more complicated, involving a terrorist act where someone has lit off explosives in a large venue," says Lord. "Players will have to manage the first 20 minutes of the incident, manage resources, request appropriate resources, and do all the things they would do if they were the first unit arriving at the scene."

Lord believes this scenario was of particular importance. "Explosive devices are still the number one cause of death and dismemberment from terrorist acts," he says. "Whether they take the form of a suicide bomber, or a vehicle-borne improvised explosive device (IED), it doesn't really matter. The results are pretty much the same, so we felt we had to address that."

The fourth scenario, and perhaps the most complex, presents a large chemical disaster where players will practice high-level incident command and triage. "This last scenario is one that we see frequently within this country," says Lord. "We have hazardous materials spills that occur all the time, train derailments and things that don't have anything to do with terrorism, so we wanted to address a large-scale chemical problem."

Lord hopes that all players will learn lessons, big and small, that will help them do a better job on the streets. To achieve this goal, the game tracks performance by housing Zero Hour within a learning management system. "Before you download the game, you'll take a pre-test that reflects the knowledge base and skill set within the game," says Lord. "You can get a pretty good idea of what your capability and understanding is in triage and treatment for various aspects of various scenarios."

Zero Hour (1.5 GB) will take approximately six to eight hours to play through the first time. Players don't have to play the whole game all at once, but can come and go as schedules and free time allow. Once players have completed all four scenarios the first time, then they can jump around different sub-scenarios to continue to hone their skills.

The fourth scenario presents a large chemical disaster that will help players master high-level incident command and triage.

"When they complete the game [the first time], they'll then go back to the learning management system and take a post-test," Lord says. "Did they really change how they answered the questions? Did they improve at all? Did their knowledge base improve?"

Ultimately, Lord and his team wanted Zero Hour to not only be innovative but to address some of the cognitive learning processes that are found in conventional education, whether it be Internet- or classroom-based. "It's not dissimilar from other Internet-based education; we just accomplished it through serious gaming," he says.

Just the Beginning

In the future, Lord would like to build Zero Hour into a much larger platform and multi-player educational system capable of incorporating other response organizations that can simultaneously participate in a multi-level disaster.

"I would like to build Zero Hour: America's Firefighter and Zero Hour: America's Cop," he says. "That would allow firefighters, EMTs, paramedics and cops to play together. It would be a great thing if people could do other people's jobs from the standpoint of just learning."

> ***'They can practice triage anytime they want, or they can practice medical incident command anytime they want.'***

Lord also believes the whole field of serious gaming may become an extraordinarily effective tool for mass casualty exercises. "It's not inexpensive to do this sort of programming, but given the right resources, this can be built out into a multi-level, multi-jurisdictional exercise environment, where you can have hundreds of people playing from all over the world simultaneously at an event," he says. "Our hope is that with some additional funding, we will be able to move in that direction."

With so much at stake, Lord's innovative ways of thinking may well change the way EMS responders all over the world learn new skills and adapt to ever-changing environments of the future. ■

The Data Man

Greg Mears, MD, leads the EMS Data System for North Carolina's quality improvement at the local, state & national levels

In the world of Greg Mears, MD, simple math rules the day: Improving quality added to EMS professionalism plus excellence in service delivery equals distinction in patient care. In other words, Mears is all about the numbers. And to this end, he has developed data systems and performance improvement toolkits designed to measure and track the many factors that will achieve this equation.

Greg Mears

"You have to be able to look at EMS, how they deliver service, the paramedics and the professionals that take care of the patients, and ultimately the care you provide those patients," he says. "About the only way that you can do that well is by using a data system."

This is especially true for agencies that have to track resources over a large service area and/or population base. "Data systems leverage that for you," he says.

Mears, who is North Carolina's EMS medical director, associate professor with the Department of Emergency Medicine at the University of North Carolina, Chapel Hill, and director of the EMS Performance Improvement Center, began his work with data systems by working at the local level at UNC Chapel Hill. From there, he was asked to work on a state data system, and then asked to be principle investigator for NEMSIS, the national EMS data system. "It was one of those rare opportunities, where you get to do something at the local, state and national levels," Mears says.

This work has now spawned the creation of the statewide EMS Data System, which includes the Pre-hospital Medical Information System (PreMIS), the Credentialing Information System (CIS), the State Medical Asset Resource Tracking Tool (SMARTT) and the EMS Performance Improvement Toolkits.

The EMS System Response toolkit has improved response times by 10%, which means EMS could save an extra 100 lives a year in North Carolina alone.

System by System

As the state data system for North Carolina, PreMIS collected information on 1.2 million call reports in 2008. "The purpose of the system is to allow local EMS agencies to learn from that information and apply it back to their service delivery or patient care," says Mears. In addition to North Carolina, South Carolina and West Virginia are now using the data system.

The Credentialing Information System is an application used by the states to document all regulatory and credentialing functions for EMS personnel, ambulances and EMS agencies. This includes licensing of EMS professionals, regulating agencies to permit and inspect vehicles, documenting state regulatory requirements, as well as tracking the education and disciplinary actions of professionals.

The State Medical Asset Resource Tracking Tool is a disaster management and communication application that was designed to collect information that can be used for real-time management of a disaster. The tool allows real-time communication between EMS agencies and hospitals. "If you had a hurricane that came through, you might have a nursing home with 50 patients that need to be moved," says Mears. "You could use this application very quickly to find a hospital for those patients and to communicate with the EMS agencies to get the vehicles to transport them."

To keep track of all these systems, and to avoid confusion, Mears created and implemented the EMS Performance Improvement Center (EMSPIC) to connect these Web-based data systems and provide a high level of IT support and quality management expertise for EMS-based projects. "We consolidated all of these programs under the EMS Performance Improvement Center, and that way we can provide service in a very transparent way," he says.

In addition, the EMSPIC has nine extramurally funded projects, totaling $3 million. The funding came from the Centers for Disease Control and Prevention, Duke Endowment, NHTSA, and state funding from North Carolina, South Carolina, Mississippi, and West Virginia.

As part of EMSPIC's funded projects, six EMS Performance Improvement Toolkits were also developed. The six toolkits are topic based—EMS System

Response, Trauma Care, Cardiac Arrest Care, Acute Stroke Care, Acute Cardiac Care (STEMI), and Pediatric Care.

These toolkits create a sophisticated group of Web-interfaced reports, generated from EMS data submitted to PreMIS, which provides guidance to agencies to improve and optimize patient care, as well as allowing comparisons to similar systems. "So, for instance, in the state of North Carolina, an agency running a report could see how they were doing, as compared to a similar sized agency, as well as to the entire state average," says Mears. "These are benchmarking tools that have performance measures. They can repeat the use of these tools over time to see how their service is changing," Mears says.

"The thing that really makes [these toolkits] unique is that, based on each of their individual results, it will also give [agencies] suggestions on how they can make changes, in either their service delivery or patient care, to optimize what they are doing," says Mears.

The data systems are set up so that information coming in is available within 24 hours of an event. "We try to make decisions based on information that is as real time as possible," says Mears.

For those wanting to do research with the data, Mears says the North Carolina EMS office is currently evaluating how to make the information available.

The streamlined collaboration between the North Carolina EMS office, the Duke endowment and the EMS Performance Improvement Center will allow agencies to identify and fix problems using the toolkit and data systems. "The Duke endowment provides the resources to fix those problems, and then the state EMS office distributes those funds to make sure that the loop is closed and that things are addressed," Mears says.

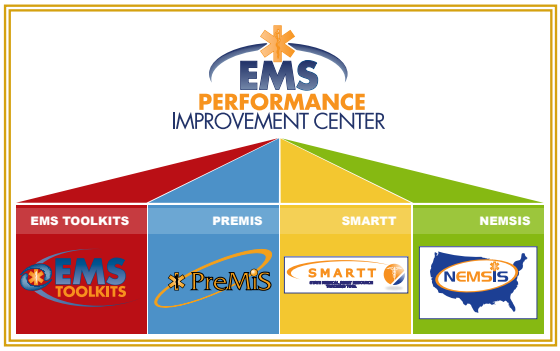
Mears believes that these systems and toolkits have given North Carolina one of the "most mature" state data systems in the U.S., although there are several other states following suit. "The goal is to have a state data system in every state and territory," he says. "Each state will provide a subset of the data that they collect that will be sent to and maintained at a national database."

Success in Strides

Mears has found that the EMS System Response toolkit has already improved emergency response times by almost 10%. "That 10% can result in a team getting to a site two to three minutes quicker," he says. "In a cardiac arrest, that two to three minutes can make a huge difference." Mears and his team extrapolated figures and concluded that the EMS Response System toolkit could save more than 100 lives a year in North Carolina alone.

Without question, Mears acknowledges that this kind of work could not be possible without the technology we enjoy today, and so, not surprisingly, technology improvement has been at the heart of Mears' work. "Situations are often remote and disconnected from health care, and they often have these technology challenges," he says. "Part of the challenge of the EMS Performance Improvement Center is to use technology, and apply it where we can, to benefit patients and those that are caring for them."

Mears continues to look for ways to better collect information and improve the management of data because the outcome can affect so many. "A performance measure is not just something you measure, it's something that equates to better performance, better patient care, and better service delivery," he says. "So, the data system helps determine where to make a change, what has to be done to cut back or adjust service delivery, and then do it in a way as to be attentive to quality. You have to do it in a way that is least likely to cause a negative impact."



A sophisticated group of Web-interfaced reports generated from EMS data submitted to PreMIS provides guidance to agencies to improve and optimize patient care.

As the state medical director for North Carolina, collecting and disseminating this information is personal for Mears. "I consider that I have 9 million patients, which is the population of North Carolina," he says. "We are truly trying to craft a prehospital health-care system to make sure that every one of our patients, regardless of where they are or what happens to them, receive the best care that they can."

The heart of Mears' drive is bringing people together and making a difference that will generate a return. "From my expertise as an emergency physician, and with my IT background and experience, this is the investment that I make to touch lives," he says. "There is a very diverse group of agencies, as well as professional associations, that have worked with us on these projects, and it's nice to see that level of collaboration. I've been fortunate that people have been willing to listen to me and support these efforts."

He adds, "In these challenging times, with rising health-care costs, smaller budgets and reimbursements, and a growing and aging population, we have to be able to be smart and reactive. And these data systems allow us to do that." ■

Cold Genius

Brent Myers, MD, pioneers prehospital hypothermia & delivers the proof

Back when Brent Myers, MD, was a second-year medical resident in North Carolina, he spent time with the Seattle Police Department and Seattle Fire Department's Medic One program as part of a summer internship program. The director of Seattle's poison control center at the time told him something that would forever change his career path—and his life.

Brent Myers

"She told me that I could be a great clinician and work hard seeing, perhaps, 15 to 20 patients a day in the emergency room," he says. "Or, I could fix a system of care and multiply that impact several fold." This convinced Myers that EMS could make a big impact on people's lives, and he has devoted himself to just that.

Now director of the Wake County Department of EMS in Raleigh, N.C., Myers' department "sees" 200 patients a day, which he admits would be impossible for him to do one on one. "We [in EMS] have the opportunity to have a greater reach and impact on a much larger patient population," he says.

To achieve this continuing impact, Myers has worked tirelessly to teach, inspire and encourage first responders, EMTs and paramedics to give their best at all times. And he has practiced what he preaches by helping to develop and enhance life-saving procedures in 2008.

The Science Prevails

At the 2008 Society for the Academic Emergency Medicine conference, Myers presented co-authored research that illustrated improved outcomes for cardiac arrest patients resuscitated after induced prehospital hypothermia. But the groundwork for this landmark presentation goes back several years.

In 2006, Myers established and expanded partnerships with Rex Hospital and WakeMed Health & Hospital's Raleigh campus to implement an induced hypothermia procedure for patients resuscitated from cardiac arrest. This procedure, which is initiated by paramedics in the field, reduces the core body temperature of resuscitated cardiac arrest patients and is designed to protect neurological function in survivors.

Through these same hospital partnerships, Myers has also worked to initiate a cutting-edge protocol that moves patients suspected of ST-elevated myocardial infarction (STEMI) to the heart catheterization labs in a fraction of the time. This program has helped prevent a second STEMI, stroke or death in one of every 15 affected patients.

"What makes me happiest about the STEMI management and hypothermia programs is that we have cardiologists, emergency physicians, hospital administrators, EMS, firefighters and political folks front all of this, and we can bring the data back and prove that they did get return on their investment," Myers says.

This return on investment is important to Myers. "When the economic climate tightens, you see those things that are data-driven, and that can produce outcomes, continuing to get funded, and those things that don't are the things that get pushed by the wayside," he says. "So, more than ever, we've got to be focused on demonstrating return on investment and justifying that this is a cost savings to the community."

The focus on cost savings seems to be working. Wake County EMS has an annual operating budget of $19.5 million a year. The hypothermia program cost EMS $5,000 to start and now costs them $4 a patient. That's right, $4.

When the procedure was adopted by Wake County EMS in October 2006, only three other EMS systems in the U.S. had implemented similar protocols.

The life-saving part is working, too. Initially, Myers and his staff recognized that cardiac patients could be resuscitated, but many of them weren't leaving the hospital because of the ensuing complications. "That's what drove us to start looking at hypothermia and the science behind it," Myers says. "We got everyone around the table and said, 'This is what we need to be doing for our patients; how are we going to make that happen?'"

> ***'When the economic climate tightens, you see those things that are data-driven ... continuing to get funded.'***

Myers estimates that the hypothermia program, along with im-

proved CPR, saves 25 people a year. "Every other week, somebody [is going] home who would not have gone home if we left the system the way it was," he says. "That can drive you to keep trying."

The STEMI program has been equally successful, and Myers attributes that, in part, to taking patients where they will receive the best care, even if that location is further than other facilities. "This is probably the revolutionary part from the EMS side," he says. "We want to take care of patients, and if that means bypassing two other facilities and driving 30 miles with a STEMI, we will do it, because we know that our patients will do better if they are at that facility."

A Matter of Perspective

The success of both of these programs, says Dr. Myers, is due to the measures that have been taken to emphasize patient focus, not necessarily EMS protocols. "We view measures not as to what EMS did, but how the patient did," he says. "So when we look at it from that perspective, the evidence is very clear about what we need to do with cardiac patients and patients who are not neurologically intact after a cardiac event."

Myers says it was this "leap of logic" that they were not in it for better response times and making people happy, but to provide the very best in patient care and good outcomes, that resulted in their focus change. "We spend a lot more time looking at clinical measure than we do operational measures," he says. "It's not that operational measures don't matter. Those are a part of it, but not the end."

For the programs to be successful, Myers had to get EMS and the hospitals together to come to a consensus about how patients were going to be treated in the community. "We had to do this in the light of day, sitting around the table, and not waiting until three in the morning when it happens and then trying to recreate the wheel," he says.

So far, the city of Memphis, Tenn., has adopted a similar protocol, and Miami and Fort Lauderdale, Fla., have done the same. Austin, Texas, is also utilizing these programs, and the Fire Department of New York City rolled out a hypothermia resuscitation protocol on Jan. 1, 2009. "It's not all because of us," says Myers, "but they are certainly using our information."

A scientific manuscript on the original research on resuscitated patients is under peer review. Myers is also the lead author of a position paper from the U.S. Metropolitan Medical Director's Consortium published in *Prehospial Emergency Care*. The paper outlines an approach for the measurement of clinical success in EMS systems, presenting critical interventions for serious medical conditions commonly treated by EMS. This approach to clinical quality measurement highlights a way to calculate "number-needed-to-treat," which allows EMS systems to calculate the number of lives saved, or degree of harm avoided, when EMS responders intervene in evidenced-based ways.

"This is a way to measure the success of an EMS system beyond response time," says Myers. "Right now, we report EMS success by, say, 'I met my response time goal, and I resuscitated X number of people from cardiac arrest.' But that has nothing to do with how well we do in the other 98% of patients we encounter. Less than 2% of our patients are in cardiac arrest."

Photo Julie Macie/WakeMed Health & Hospitals

The hypothermia program at Wake County EMS cost $5,000 to start and now costs only $4 a patient and saves at least 25 people a year.

He adds, "What about patients with heart attacks, what about patients with strokes, what about patients having seizures, what about patients having trauma, and what about patients having respiratory distress? What are the measures that we should be reporting about how we care for those people?"

Myers' research and the resulting paper are the culmination of two years' worth of work outlining the impact that these programs are having on cardiac patients. "Every time we do [these procedures], we can prevent someone from having a second heart attack, or stroke, or dying," says Myers. "So we encountered 45 people having a heart attack, and we prevented four of them from having a second heart attack, just by what we did."

In 2008, Myers also spearheaded the effort to launch a new category of EMS provider—the Advanced Practice Paramedic (APP). After attending a special EMS academy, the APPs now respond to calls and conduct focused follow-ups with high-risk patients to ensure they're on the proper road to recovery. It's a program that much of America is watching closely.

Myers sees his role in all of this as getting a group of people around a table to talk and create methods that will ultimately impact a lot of lives. "Five percent of my job is determining the right thing to do, and that's generally not difficult," he says. "Ninety-five percent of my job is convincing the players all the way across the spectrum that this is what we need to be doing—and then making it happen."

And make it happen, he does. ■

Centralized Disaster Response

Richard Serino heads development of a center for multi-agency coordination during large-scale disasters

In November 2008, Boston EMS officially opened a state-of-the art regional communications and command center, called Lawlor Medical Intelligence Center, for managing the medical aspects of public health and mass casualty emergencies. Known as the "MIC," the center provides space for multi-agency coordination of medical logistics and response during large-scale disasters. And a major force behind its creation was Richard Serino, Boston EMS chief.

Inside the MIC

Despite its newness, the MIC is already a national model for other large cities because of its technology. It has a seating capacity for 68 individuals, with Internet access, power and telephone connections at each station. Laptop computers purchased for the MIC are on a single network, allowing for file sharing in real time. Departments and agencies that require representation at most events have a designated seat and phone number; other representatives at the center occupy one of the "temporary" seats for more incident-specific events.

Richard Serino

The center is equipped with television screens for viewing news stations, projecting briefing materials and monitoring Web-based systems, such as the Web EOC hospital bed reporting or patient tracking summaries. Video conferencin g capabilities allow for communication with multiple external locations, including the Mayor's Office of Emergency Preparedness, Boston Emergency Operations Center, Unified Command Center, Boston Fire Department headquarters, Massachusetts Emergency Management Agency and other regional coordinating centers.

"With 26 health centers and 10 primary receiving hospitals within the City of Boston, the city's EOC (Emergency Operations Center) was not large enough to accommodate each health-care institution or agency that plays a role in a disaster response," says Serino. The extra space provided by the MIC expands opportunities for more comprehensive representation, encompassing not only EMS and public safety, but also liaisons from hospitals, public health departments, community health centers, long-term care facilities and other first responders.

"A lot of EOCs across the country include [representatives from] public safety and EMS, but some don't include the hospitals," says Serino. "It makes a lot of sense to bring in people from the medical community, too."

One of the benefits of including hospitals in the EOC lies in coordinating efforts among multiple institutions with similar needs. "An EOC is dealing with a lot of things, and you don't want to have a lot of separate EOCs," says Serino. "For instance, when we had week-long drills, we found that the hospitals were doing simple things like getting staff in from outside the city. They would send a bus to the city to pick up some of their staff. Another hospital was doing the same thing. And another hospital was doing the same thing. We wondered, 'Can't we consolidate this?'"

In addition to serving as an intelligence center during disasters, the MIC is also used as a site for drills, exercises, training and weekly briefings related to emergency preparedness. "Another purpose of the MIC is information sharing," says Serino. "It's a place for the medical community, the hospitals, EMS, public health, community health centers and others, who may not always be in the information sharing, intelligence loop, to meet.

He adds, "When we had the initial concept of the MIC, one of the things we were looking for was a place to bring people together, both from the intelligence side and the integrated emergency management trainings that we have for people, from all different disciplines."

As news of the opportunities for information sharing afforded by the MIC grew, so did the number and type of agencies wanting to participate. "When we started talking about the idea to the law enforcement community, the FBI asked to be a part of it so they could be aware of the medical community's needs," says Serino. "They get information on the latest emerging diseases because we have someone from the CDC giving updates, as well."

He adds, "The fire department and the Massachusetts Port [the airport fire department] are part of it, too, as well as the Boston police. Other agencies, like the transit police, were interested, so now they come."

Serino underscores the importance of the briefings as a chance for participants to become acquainted with leaders from other agencies. "At the weekly briefing, everyone getting to know each other is key," he says. "You don't want to be exchanging business cards at the scene of an incident or disaster. You want to have a good relationship with people beforehand. You want to

be able to pick up your phone at three in the morning, and, with the relationships you've built, get things done."

The concept behind the MIC grew out of lessons learned while preparing for Boston's hosting of the Democratic National Convention in 2004. "We brought together the medical community and were able to manage the event so well that the Secret Service recognized us with a Director's Award," says Serino. "We helped Denver and Minneapolis-St. Paul with their conventions; they used our plans as templates. We already had good relationships with the hospitals, and hosting the Democratic National Convention helped us go to the next level. We needed to figure out how we could build on that."

Funding for the development of the center came from the Urban Area Security Initiative grant funds, through the Boston Mayor's Office of Emergency Preparedness, and from a Partnership for Effective Emergency Response grant, managed by Boston University and awarded by the Assistant Secretary for Preparedness and Response (ASPR) office of the U. S. Department of Health and Human Services (HHS).

Boston EMS responds to more than 100,000 9-1-1 calls annually, placing the system at the heart of the city's emergency care. "We look at EMS as being a link to bringing different people together," he says.

The EMS Chief feels his department has been able to successfully bring a variety of stakeholders together with different perspectives, but shared interests, for problem solving and innovation. "First responders are trained in a certain way and are reactionary. On the other hand, public health sits back, slows down and studies things," he says. "You have to be able to bridge that gap, and we've been able to play a key role in bringing the different groups together."

> ***'You don't want to be exchanging business cards at the scene of an incident or disaster. You want to have a good relationship with people beforehand.'***

Always Innovating

Another example of where public health, safety and medical interests converged, with a bit of help from EMS, occurred in November 2008, when Boston EMS used their patient tracking system to track recipients of a vaccine at a flu clinic. The technology was purchased in 2006 to track patients in emergency incidents, and Boston EMS had used the system during disaster exercises—to keep tabs on injured runners during the Boston Marathon and to monitor first aid stations during July 4th celebrations. The data gathered during the flu clinic presents multiple potential public health uses, such as tracking batch numbers and vaccine types and serving as the basis for comparison with results of past flu seasons.

Serino foresees many other opportunities in the future for inter-agency collaboration. "Nothing is set in stone. We will continue to change because people have different ideas, and we're learning as we go," he says. "There isn't one agency or one city or one group of people that can manage any large incident by themselves. I think that's been shown clearly over the years. But there are many opportunities to continue to build relationships and connect people who may not already be connected. And this is something that EMS can continue to foster."

The state-of-the-art Lawlor Medical Intelligence Center is equipped with screens for viewing news stations, monitoring hospital bed reporting and video conferencing.

Chief Serino continues to champion efforts of his department to obtain the best training; perform the best prehospital care; secure funding sources for equipment and training; and collaborate with area first responders, hospital and health-care agencies, as well as private ambulance companies.

His background certainly qualifies him to spearhead many of these initiatives. He began his career with Boston EMS in 1973 as an EMT. Over the years, he became a paramedic, rose through the ranks, and in 1999, became chief of the department, with the title of assistant director for the Boston Public Health Commission, which was added in 2007.

Despite his many accomplishments, Serino is quick to emphasize that the credit for what EMS has been able to achieve in Boston rests squarely on the shoulders of his colleagues. "A good EMT or paramedic is somebody who must be able to effectively talk with police officers, firefighters, family members and physicians in a way that everyone can understand," says Serino. "And it's the women and men of EMS, the EMTs and paramedics, who are the ones who really make things happen." ■

The Safety Bureaucrat

William Troup champions efforts at the national level to protect our own

To say William Troup, fire program specialist for the U.S. Fire Administration (USFA) in Emmitsburg, Md., is passionate about finding ways to advance emergency vehicle and roadway safety for emergency responders is an understatement. Troup has worked tirelessly in concert with many other organizations to study the problem, provide education, and apply innovative but practical solutions in his quest to save responders' lives.

"Vehicle crashes are one of the leading causes of on-duty deaths of firefighters, second only to cardiac-related causes," says Troup. "We lose approximately 20–25 [responders] a year because of this, so one of the goals of the U.S. Fire Administration is to reduce the rate of on-duty fatalities in the fire service. Every EMS responder or firefighter has the right to go home at the end of their shift."

William Troup

Partnerships & Projects

Representing USFA, Troup has collaborated on safety studies with such agencies as the International Association of Firefighters (IAFF), the International Association of Fire Chiefs (IAFC), the National Volunteer Fire Council (NVFC), the International Fire Service Training Association (IFSTA), the U.S. Department of Justice, National Institute of Justice (NIJ), the National Institute of Occupational Safety and Health (NIOSH), the Society of Automotive Engineers (SAE), and the U.S. Department of Transportation (DOT). The recommendations stemming from these studies have influenced the decision-making of national consensus standards committees. The USFA has also involved NHTSA's Office of EMS in several projects.

"This all started because of a project we did called the Emergency Vehicle Safety Initiative (EVSI) that develops recommendations and solutions on how we can stop the horrific and unnecessary deaths of emergency responders from motor vehicle crashes, as well as being struck while operating on the roadway," says Troup. "We all came to a common conclusion that we needed to stop these tragedies. So, in 2002, the U.S. Fire Administration asked our partners to work with us and develop solutions, and they stepped up to the plate."

> ***'In a perfect world, there would be no firefighters or EMS responders or police officers who die from vehicle crashes or by being struck in the roadway.'***

The EVSI's initial published report indicated why a multi-faceted approach was necessary to help tackle a complex and multi-factorial problem: "Since 1984, 20–25% of firefighter fatalities annually resulted from motor vehicle crashes. From 1990 to 2000, 18% of the fatalities occurred responding to an alarm, and 4.1% occurred returning from an alarm. Of the firefighters who died in motor vehicle crashes, 25% were killed in privately owned vehicles (POVs.) Following POVs, water tankers, engines, and airplanes were most often involved in fatal crashes." Troup also noted that these data include EMS personnel who work in fire services and that EMS calls account for 3% of firefighter fatalities.

The partnership among the agencies started with some basic recommendations on apparatus safety devices, traffic control measures, highway operations, private vehicle use and driver training. "There is one in particular that I'm proud of—the implementation of red seat belts in fire apparatus," says Troup. "We recognized that you can't find seat belts in fire apparatus at night, nor can you distinguish them from the self-contained breathing apparatus straps. We needed to make them a distinctive and recognizable color, so the firefighters in the back of the fire truck could grab the belts and put them on. The increased visibility of the belts also helped ensured compliance."

Following publication of the initial EVSI report, the USFA has delved deeper into particular areas of interest. One study, conducted in conjunction with the International Fire Service Training Association and funded by the NIJ, examined how to enhance emergency vehicle visibility with use of retroreflective striping and chevrons, high-visibility paint and built-in passive lighting.

"We were looking to find the best practices on making the vehicles much more visible in day and nighttime conditions, so they won't be struck, as well as how to protect those who are working around the vehicles," says Troup.

One of the key issues discovered was that motorists became disoriented by the day and nighttime use of

emergency warning lights. This finding led USFA to work with the Society of Automotive Engineers in finding ways to effectively reduce the disorientation through changes in the design, flash rate, color and amount of lighting on vehicles.

The USFA has also partnered with NIOSH on studies that use analyses of ambulance and EMS vehicle crash data for modeling crash scenarios, improving crash test methodologies, developing occupant restraint systems and understanding the effects of human factors on the task performance of EMS personnel in ambulance patient compartments.

Following recommendations from the Emergency Vehicle Safety Initiative, the USFA has been instrumental in developing educational outreach on such issues as seat belt use, intersection safety, emergency vehicle safety design, driver selection and training, and policies involving alcohol and driving. "In one of the emergency roadway safety online programs that we did with the IAFF, we actually took real-life crashes and documented what was the true and real cause of them and developed case studies," says Troup. "That's one of the three main online training programs that we developed."

They've also developed one with the IAFC and one with the NVFC. "We wanted to target their constituent populations," says Troup. "In the case of the IAFF, it is career firefighters [we are targeting], in the case of the NVFC it is volunteers, and with the IAFC, it is those setting policy."

Working with the IAFC, USFA developed the Guide to Model Policies and Procedures for Emergency Vehicle Safety, a comprehensive Web-based educational resource that provides in-depth information for developing policies and procedures required to support the safe and effective operation of emergency vehicles, as well as privately owned vehicles.

As part of this project, the IAFF also developed a similar innovative Web- and computer-based training and educational program called Improving Apparatus Response and Roadway Operations Safety in the Career Fire Service. This comprehensive program includes both instructor and participant guides that cover seat belt use, intersection safety, roadway operations safety on crowded interstates and local roads, and driver training.

The NVFC developed the Emergency Vehicle Safe Operations for Volunteer and Small Combination Emergency Service Organizations, which covers emergency vehicle safety best practices self-assessment, standard operating guidelines, and behavioral motivation techniques to enhance emergency vehicle safety. "What's the leading type of vehicle that kills firefighters? It's personal vehicles driven by firefighters to fires or incidents," says Troup. "We have a full program with the NVFC to address this problem."

"We've got a lot of technology, which is why we developed these programs in a Web-based environment," Troup adds. "Anyone, at any time, can access information, whether it's a career or volunteer firefighter or EMS responder. It's a terrific way to outreach."

Personal Motivation

In addition to serving as a fire program specialist for 19 years with the USFA, Troup has been an active volunteer firefighter and EMT with Alpha Fire Company No. 1 of Littlestown, Pa., for 10 years. "These terrific folks are from all walks of life from off-duty government employees to those who work in industry, factories and farms," he says. "They raise funds to help their community and go out and help their neighbors in need."

Aside from the pursuit of reducing risks for emergency responders, Troup's contribution has also been to bring together government agencies with minimal funding and no real mandate to create carefully researched and actionable recommendations. Still, Troup discounts the significance of his own role, preferring to spread recognition around. "The people who I work and partner with—these are the people who really make it happen."

Through the USFA, Troup has been involved in studies that use analyses of ambulance and EMS vehicle crash data for modeling crash scenarios and improving crash test methodologies.

Troup points to the cost-effectiveness of this multi-agency approach, as well. "For the taxpayers, it's a win-win because they're getting a lot of bang for the buck," he says. "We're all working on one comprehensive project instead of disparate projects."

It's easy to see that given such an important mission and the resolve to see it through, Troup is encouraged by, but not altogether satisfied with, the progress made to date. He admits, "We have not gotten to zero. In a perfect world, there would be no firefighters or EMS responders or police officers who die from vehicle crashes or by being struck in the roadway," he says.

Developing these programs is a way to work toward that goal. "I look at every EMS responder or firefighter on-duty fatality and ask if there is anything that [we] could have done to have prevented such a death," he says. ■

Double-Duty Innovator

Larry Wiersch leads efforts to reduce local response times & fights for national Medicare ambulance relief

Larry Wiersch, CEO of Cetronia Ambulance Corps, a non-profit company serving the Lehigh Valley in eastern Pennsylvania, knew that to save more lives, Cetronia needed to reduce its response times for Priority One patients. To accomplish this reduction, Wiersch risked not only his reputation but also organizational capital and resources for the technology and training needed to convert Cetronia into a fully high-performance EMS system, the only one known in the Commonwealth of Pennsylvania.

But his efforts go beyond his own EMS system. For 15 years, Wiersch has served as Region II Director of the American Ambulance Association (AAA) and currently serves as chair of the organization's Legislative and Regulatory Committee. This second role positioned him for another level of EMS progress.

Larry Wiersch

Supply & Demand

A high-performance EMS system uses historical data and predictive models to determine the best locations for ambulances to be stationed, increasing the chances that an emergency team can respond to Priority One emergencies, such as cardiac arrest, respiratory distress and major trauma, within the target time of 8 minutes and 59 seconds, 90% of the time. Since implementation of the high-performance system in January 2008, Cetronia has seen a significant improvement in its response times.

"Is it perfect? No," says Wiersch. "This is not about saying that we can predict that a call is going to happen here at two o'clock in the afternoon. It's about using probability and statistics to determine the likelihood that putting that ambulance at that spot at that time of day is what's going to perhaps make the difference between life and death."

High-performance systems base their deployment on statistical patterns of the geographic occurrence of EMS calls and then factor in variations by time of day. The location of unit deployment may change from one day of the week to the next (as well as from one hour of the day to the next), depending on the pattern within the service area.

To accomplish the conversion to a high-performance system, Wiersch had Cetronia purchase specialized software, Resource Planner and Dispatch Pro, that works with the company's computer-aided dispatch (CAD) software. He also had staff upload years of historical data to create response zones in the CAD. Given the response zones, Cetronia's "posting committee," composed of both staff and managers, now looks at demand and plots where vehicles have to be to meet a response time requirement, says Wiersch.

"We try to take into consideration the safety and comfort of the crew in making sure they are posted in a safe environment," he says. "In other words, they are not out in the middle of a bad traffic pattern, or a dangerous parking lot, or someplace where it's dark in a high crime area, although we don't have a lot of that in our service area."

What Cetronia has accomplished with the new system is excellent customer service and accountability, according to Wiersch. "It helps us grow our business and monitor any missed opportunities or mutual aid," he says. "If our volume is decreasing or increasing, we can add another shift or realign our schedule to the existing demand."

Although improving patient outcomes was Wiersch's primary objective in introducing the high-performance system, he also knew it could match staffing levels to predicted demand. As a result, Cetronia can better manage human resources and provide a more equitable distribution of call volume per employee, reducing the potential for exhaustion and burnout.

Cetronia's scheduling committee creates work schedules based on predicted demand as well as personal preferences. "Our committee is comprised of Gen Xers and Yers, senior paramedics and EMTs, single moms and dads, so that we get a nice cross-section of our overall employee demographic," says Wiersch. "They can decide what shift they want to work, what days they want to work, and then they come up with a schedule that covers our entire demand. So, it's an efficiency for the organization, but it also incorporates the needs of individuals."

> ***'We try to take into consideration the safety and comfort of the crew in making sure they are posted in a safe environment.'***

In addition, a variety of shifts and schedules are available. "We do online scheduling so that people can see who's bidding on what shift," says Wiersch. "It's a way to make seniority count, so the longer you're with the organization, the more likely you are to get a shift that is desirable. We try to make sure there is no totally undesirable shift, to the best of our abilities, based on the predicted demand."

The high-performance EMS system represents a step forward in the profession. Wiersch has experienced firsthand the progress achieved in EMS during the past 33 years, starting as a volunteer. He later became a paramedic, earned a bachelor's in Safety Management and a master's in Emergency Health Services. He joined Cetronia in 1989 as operations supervisor and became CEO in 1996. As CEO, he directs a staff of 200 career and volunteer personnel and a company with an annual budget of more than $7 million.

"And yet, as much as we have advanced as an EMS system, throughout the Commonwealth of Pennsylvania and the country, we still see too many patients who don't receive the level of care they need and deserve simply because the systems in many parts of the country aren't in place to save lives," Wiersch says. "Unfortunately, it's not easy to make that happen because you're not only changing the system, but the mindset and the culture."

A Big Relief

Also in 2008, Wiersch, in his role with the AAA, spearheaded efforts in Congress for temporary Medicare ambulance relief. These efforts helped spur enactment of the Medicare Improvements for Patients and Providers Act of 2008, which included a 2% urban and a temporary 3% rural Medicare reimbursement increase for ambulance service providers. The relief provided an additional $170 million in critical Medicare funding for ambulance services. As chair of the AAA Legislative and Regulatory Committee, Wiersch directed the successful lobbying for this Medicare relief.

"I do a great deal of work at the national level in helping to promote increased support for EMS," he says. "We've lobbied extensively for better reimbursement, recognizing EMS as a profession, and recognizing EMS as a separate entity that should not be lumped together with other public safety services. We're also looking at legislative fixes that can help decrease the paperwork, and other burdens, imposed by the government, so that it will make it easier to do our billing processes at a reduced cost."

Operational efficiency is now critical for the survival of EMS agencies, according to Wiersch, as Medicare and other types of government reimbursement programs decline and an increasing number of patients can't afford private insurance. "If agencies don't operate smarter and more business-like over time, they are going to fail to exist," says Wiersch. "You can't ignore the economics of it. You have to pay attention to the economics for your patient care to be able to survive. If you have all the latest and greatest stuff, but you can't afford to continue it, are you really helping your patients and your community? The answer is 'probably not.'"

Cetronia, now a high-performance system, uses specialized software that works with its CAD to deploy resources based on demand.

Moving Forward

Wiersch plans to continue refining the processes Cetronia has already put into place and developing additional systems, scorecards and metrics to enhance reporting and planning. "If you're not looking at your metrics and raising the bar on a daily basis, you're probably not doing as well as you could for your patients," he says. "It's all about patient care and making sure we can offer the best available service out there—that's what drives us."

Perhaps the greatest reward for Wiersch comes in knowing how constantly improving services can save lives. One of the most dramatic examples was reported in his local newspaper about the remarkable response time Cetronia achieved in responding to a call for an infant with a life-threatening fever. A couple, returning home from taking their 11-month-old daughter to the doctor for treatment of an ear infection, suddenly witnessed the infant experiencing a seizure. They called 9-1-1, and the crew from Cetronia arrived in just over four minutes. While in the ambulance, the child went into full respiratory arrest, so the crew provided assisted ventilation with oxygen. The child, Trinidey, started breathing again on her own en route to the hospital.

If Wiersch, or anyone else, ever wonders whether what he and Cetronia risked to implement a high-performance EMS system capable of such a rapid and significant "save" was worth it, he can just think of Trinidey and re-read the excerpt from the newspaper: "In addition to their expert emergency care, the speed of [Cetronia's] arrival may have been what saved Trinidey's life." Then, they'll have their answer. ■

Champion of the Underdog

Gary Wingrove leads the pack in rural EMS initiatives & curriculum around the world

According to the 2000 Census, more than 20% of the U.S. population—some 60 million people—live in rural areas. But a severe shortage of practicing physicians leaves millions of those people with either the option of doing without health care or driving sometimes dozens of miles to see a practitioner. And, as the rural health-care workforce shrinks in some areas of the country, many areas are finding themselves more desperate to access fundamental health care for its residents.

But Gary Wingrove would like to change all that.

"I choose to spend a lot of my time in rural health, and rural EMS specifically, because it's a voice that's virtually unheard," says Wingrove, director of strategic affairs for Mayo Clinical Medical Transport in Rochester, Minn.

Gary Wingrove

Wingrove sees his role almost as a champion of the underdog. "[Rural EMS] doesn't have the resources that bigger providers have," he says. "Big providers have resources to send people places and create their own systems. But the rural ambulance provider is the guy that orders the medical supplies, provides continuing education and stocks the ambulance."

He adds, "We have places in our country where the average ambulance [call] time is a three-hour transport. And you don't hear from those people because they're just busy taking care of their community."

Community Curriculum

As a rural health champion, Wingrove has been on the forefront of trying to connect EMS rural health-care personnel with their counterparts across the nation and around the world in order to strengthen the rural health-care system. To this end, he was one of the founders of the International Roundtable on Community Paramedicine, which is designed to facilitate discussions, meetings and research focused on designing systems to ensure access to health-care services where they are less available. The roundtable has so far held four meetings, with a fifth scheduled for October 2009 in New Zealand.

"We also put together a project team from Nebraska, Minnesota, Nova Scotia and Australia to develop what we call an internationally standardized community paramedic curriculum," says Wingrove. "In December 2008, we started distributing that curriculum free of charge to accredited colleges and universities anywhere in the world."

The group first met in 2005, and has now had at least half a dozen other countries participating at each meeting. Because other countries around the world are also grappling with their own issues regarding rural health-care access, the goal of the roundtable is to develop a cross pollenization of ideas between countries. "Out of the four meetings we have conducted, only one of them has been in the United States," says Wingrove. "We've had two in Canada, one in Australia, and the next will be in New Zealand. We've had a lot of worldwide interest in addressing this topic of health-care access in rural areas, and EMS was the conduit."

The pilot program and curriculum is being funded with federal rural health funds that pass through Minnesota and Nebraska. Wingrove estimates that the pilot has received $75,000 to support the development of the curriculum program. "We provide the curriculum to accredited colleges and universities by download," says Wingrove, "so it's ready for them to implement."

The curriculum content is drawn from input of various "homegrown" rural EMS public health programs. "It doesn't change the scope of paramedics, but it focuses on using them in different roles, such as social service roles," says Wingrove. "It also enhances clinical capabilities. So, for example, community paramedics might give shots of Valium and immunizations. Paramedics would start an IV drip of dopamine; the community paramedic would do that, too, but they would also mix the antibiotic drips."

> ***'The [boot camp] is tailored toward giving the newly elected leader ... the essential pieces that they need to run an effective organization.'***

What Wingrove hopes to achieve is a standardized curriculum that will move homegrown programs into the educational system and allow local and regional agencies to find common solutions across geography. "Rather than an ambulance company doing something to solve its local issue, we've got the issues ad-

equately addressed in the curriculum, so they will be standardized now," says Wingrove. "We can do research on its effectiveness, and it's an educational system that people can get in on as part of their degree."

Any accredited college or university in the world can download the curriculum, and it's free of charge. "We are pilot testing the curriculum in Minnesota right now," he says, "and trying and discover the best ways to deliver the curriculum, so that we can pass that on to the colleges and universities that are planning to implement it."

Leading the Leaders

Wingrove is also concerned about the lack of management education for rural EMS providers and has created a Boot Camp series to address the issue. "There are no standardized programs put together for rural ambulance managers, particularly those who operate volunteer systems," he says. "There are a handful of degree programs in the United States that are tailored toward people who can actually go to college in their community, but the ones that exist are in urban places. So, the rural ambulance manager is hampered in trying to participate in that."

So, in October 2008, Wingrove and other volunteers of the North Central EMS Institute put together three-day boot camps for field training officers, supervisors and managers. The first camp was so successful that he is hoping to offer another one in a different location this year.

"It's a three-day session to give EMS people who have no formal management education the essential tools that they need to begin their job as a field training officer, supervisor or manager," says Wingrove. "We structured it carefully so that it didn't compete with anything that exists." Information can be found at http://bnc.ncemsi.org, which stands for "Big National Conference for leaders of little and medium EMS agencies." The camps are offered through the North Central EMS Institute in St. Cloud, Minn., and cover such areas as conflict resolution, mentoring, competence assessment, risk management, program development and working with boards.

"Many of the volunteer systems have leaders who are elected in popularity contests, so they don't function like a normal company, with a job description that people apply for and the person with the best background getting the job," says Wingrove. "The [boot camp] is tailored toward giving the newly elected leader, with no degree or background in management, the essential pieces that they need to run an effective organization."

Wingrove also led the development of the EMS Performance Improvement Academy, which was held simultaneously with the boot camps. "We wanted to address the quality improvement person inside the EMS agency that has no formal training, so we used a combination of techniques," says Wingrove. "We use the Balanced Scorecard system and Six Sigma, and then we intertwined the Principles for Research."

Wingrove wanted to use all three tools to enhance improvement within the participant's organization. "So, if you have a 20-minute response time, a Balanced Scorecard and Six Sigma would give you the tools you need to reduce it to some arbitrary number like 18 minutes," he says. "But by inserting the Principles for Research, which has you looking externally to your organization, the community standard may be nine minutes. So, you'll score a success with either the Balanced Scorecard or Six Sigma by reducing response time from 20 to 18 minutes, but you're still way off the mark [when compared to] the Principles of Research."

> ***'It's disheartening to see people reinventing the wheel, and if we can build something once and spread it, then it will be that much more effective.'***

For many new managers, the exposure to such things as the Balanced Scorecard, Six Sigma and other management principles is a first-time, eye-opening experience. "Sometimes, they go home changed people," says Wingrove. "As a result of the piloted Performance Improvement Academy, we had three people go home with the intent to go back to college."

His Hope

In all, Wingrove's work in the rural health-care community is driven by a desire and passion to make a difference, community by community. He thinks the way to succeed is through standardization and allowing a wide variety of input from professionals around the world in order to address some of the most challenging problems facing EMS and rural health care today.

"I think the need for a standardized way of doing things is a key to opening doors to share more ideas," he says. "If we can build something once and spread it, then it will be that much more effective, not only in what it costs to produce, but in that it will allow more people to get off the ground quicker."

Wingrove also hopes that by making the Community Paramedic curriculum available through colleges and universities, the resulting research will have an impact on people's lives. "In the end, we can actually produce research to find out if these things make a difference or not." ■

Save more lives. We can help.

You get there first. You have the first look. You start the clock. We can help.

Now you can easily transmit a patient's 12-lead ECG to everyone who needs it by using the LIFEPAK 12 Defibrillator/Monitor with our ST Trending feature and the LIFENET Cardiac Care Network — the newest STEMI solution from Physio-Control.

Empower your medics to send a STEMI alert to a network of users with the touch of a button. Care teams will receive your prehospital 12-lead ECG so they can prepare for your patient. The unique ST Trending feature of the LIFEPAK 12 Defibrillator/Monitor continually monitors the patient's ECG for changes, and automatically transmits to inform the receiving hospital of the patient's status.

Plus, if the patient suffers cardiac arrest while en route, you've got the power of up to 360J to give you the best chance of converting VF.

LIFENET® Cardiac Care Network ▪ LIFEPAK® 12 Defibrillator/Monitor

For more information visit our website at www.physio-control.com
or call us toll free at 1.800.442.1142.

PHYSIO CONTROL

©2008 Physio-Control, Inc. Redmond, WA USA. All rights reserved.