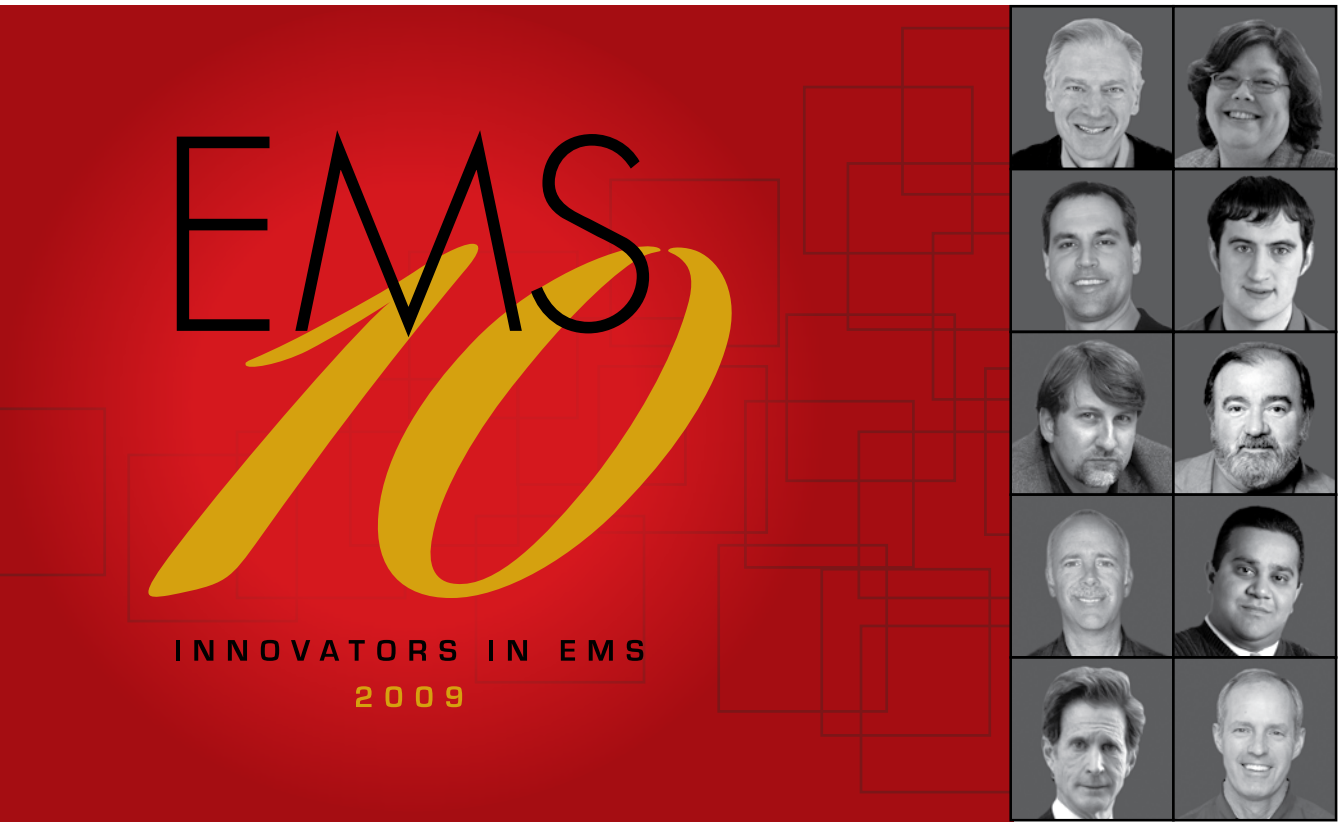

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Editor-in-Chief
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Production Coordinator/Designer
Matt Leatherman

Advertising Director
Judi Leidiger

Vice President/Publisher
Jeff *Berend*

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Leaders of the Pack in 2009

How these innovators have advanced EMS
By A.J. Heightman, MPA, EMT-P

This special supplement, sponsored by Physio-Control Inc. and *JEMS*, profiles 10 EMS innovators who were selected by an expert panel from dozens of nominees. Each finalist was selected based on their successful implementation of at least one key EMS innovation in 2009, and was nominated by an individual or organization that recognized their hard work, dedication and unselfish efforts to make a difference in the delivery of EMS or the lives of those delivering or receiving it.

This year's "EMS 10" and the five honorable mention nominees aren't the industry's only innovators. Hundreds more made major contributions this past year. But the peers of these winners felt their contributions made a difference in EMS and nominated them for developing creative programs, concepts or procedures that improved EMS in 2009.

We recognize them because their efforts can drive the EMS profession forward and motivate others to apply the same ideas in their communities and think about ways in which they, too, can be innovative in creating solutions.

Dr. Mickey Eisenberg wrote a book on resuscitation that provides 25 steps for EMS systems to improve cardiac arrest survival in their communities.

Dia Gainor led the draft and approval process for a national position paper that will help EMS systems develop, improve and expand for years to come.

Eric Longino developed an apprenticeship program that employs non-certified workers in support positions while funding their EMS education and training.

T. Ryan Mayfield created a program that enables EMS providers to initiate a "Sepsis Alert" for a patient who exhibits symptoms of sepsis and/or septic shock.

Geoffrey Miller spearheaded development of a centralized national repository of data related to occupational illnesses, injuries or deaths of U.S. EMS providers.

Dr. Paul Pepe led the team that introduced estrogen's potential role in care of patients suffering from cardiac arrest, post-traumatic shock, severe head injury, myocardial infarction, stroke and massive burns.

John Pringle led implementation of a data program that allows hospitals and EMS units to share patient data in real time, allowing EMS to easily obtain a patient's discharge diagnosis to evaluate and improve their system.

Terence Ramotar led the research, design and implementation of a "green initiative" that created solar panels to keep equipment batteries charged and reduce the electrical load of ambulances.

Dr. Robert Boyd Tober developed a tiered medical response system that helped his county achieve an ROSC of 49% for VF/VT cardiac arrests and 31% for all cardiac arrests.

Matt Zavadsky created community care plans for his systems' top users, reducing critical overloading of EMS system transportation resources and offering them alternative treatment and transportation options.

The individuals responsible for the application of an innovation are often called pioneers. When you read about the accomplishments of this year's EMS 10, all written by Cynthia Kincaid, you'll appreciate the pioneering efforts of these dedicated providers. And we hope they inspire you to develop and implement an innovative project, protocol or procedure that will impact your life, the lives of your colleagues and, most importantly, the lives of your patients.

2009 Honorable Mentions

Tim Butler, chief
St. Paul (Minn.) Fire Department

Nicholas Eschmann, lead author
2009 NAEMSP Best Scientific Abstract winner

Mark Glencorse, blogger
The Project and Chronicles of EMS

Amar Patel, manager
WakeMed Health & Hospitals Medical Simulation Center

Justin Schorr, blogger
The Project and Chronicles of EMS

A.J. Heightman, MPA, EMT-P, is the editor-in-chief of JEMS *and the editorial director of Elsevier Public Safety.*

Cynthia Kincaid is an award-winning medical and healthcare writer. Contact her at cynthia@cynthiakincaid.com.

The Resuscitator

Dr. Mickey Eisenberg identifies 25 factors to improve cardiac arrest survival rates

You could call Dr. Mickey Eisenberg's book, *Resuscitate! How Your Community Can Improve Survival from Sudden Cardiac Arrest*, a labor of love. But that wouldn't fully encompass his passion—or mission—for saving people who have suffered cardiac arrest.

"The book is a culmination of 35 years of experience in EMS research, a culmination of everything I have been taught by others, and everything I have learned over the years," says Eisenberg, who is medical director for Seattle's King County Emergency Medical Services and professor of medicine at the University of Washington and long considered one of the pioneers of cardiac arrest resuscitation. "I've lived this for 35 years. It's a passion and a career. It's the way I was taught to practice medicine."

Dr. Mickey Eisenberg

An Unexplained Gap

Eisenberg wrote the book because of the large disparity of cardiac arrest survival rates across the nation.

"The catalyst was the fact that cardiac arrest survival has a disparity like nothing else I can think of in terms of its outcome—namely survival," he says. "Why do some communities, particularly large urban cities, have zero, three percent, five percent, seven percent survival rates from ventricular fibrillation and other communities have 46 percent survival? There's got to be an explanation for that."

Resuscitate! is an attempt to answer why some communities have excellent cardiac survival rates while others don't, and to suggest areas systems that can focus on to increase their resuscitation rates. Eisenberg presents 25 suggestions for improving cardiac survival rates in our communities.

He also outlines 50 factors his experience has shown him affect survival and breaks them into four groups: patient, event, system, and therapy. He then details the characteristics of each factor, the research underscoring their importance, and their link to higher rates of survival.

> **'There are some serious messages here, and if they start percolating through an organization, it will begin to create that culture of excellence.'**

"A lot of factors determine whether someone lives or dies, and of those 50 factors, some are strongly associated with survival. Others are more speculative, or we don't have enough information," he says. "For example, there are likely to be genetic factors that explain why some people are more resuscitatable than others. But we don't yet have the science to understand that."

Eisenberg believes a large percentage of the factors fall into the patient and event groupings, which can't be changed. "There is nothing you can do to alter that situation; it's fate or circumstance," he says. "Whether the cardiac arrest is witnessed or unwitnessed has nothing to do with the quality of an EMS system, but it has everything to do with the circumstances. Those things can't be changed, and you just have to accept that."

The Links to Understanding

Eisenberg is quick to point out that the system and therapy factors can be altered for the better because they're under the control of a medical director or EMS administrator. "How you set up your dispatch system, how you set up your response system, how you perform CPR, and how it interacts with defibrillation are all system factors," Eisenberg says. "Those are the ones that can be changed, and that's what the book describes in great detail."

Eisenberg admits that even though the groupings drawn together can shed light on the best ways to improve cardiac arrest survivability, they still only provide a partial understanding of the overall factors influencing the survivability disparity between communities.

"The links in the chain of survival are quantifiable factors. They have to do with [people] calling 9-1-1 early, the actions of the dispatcher, early CPR, early defibrillation, early advanced care and early post-resuscitative care," he says. "But I don't think that explains all of the disparity. Surrounding those links is a qualitative frame, which I think is difficult to measure, and that has to do with medical leadership, a culture of excellence, and the training and quality of EMS providers."

He thinks if both the qualitative and quantitative factors could be reliably measured, a true picture would emerge

of why survivability rates vary between communities. "If you could measure them, you would begin to truly understand why some systems are so much different than others," he says. "And that really is the message that summarizes why the disparity exists."

At its heart, Eisenberg feels that successful cardiac arrest survivability rests in every aspect of a community. This is why he says there are no quick fixes—and why he wrote the book.

"You first have to intensely study the community you are in and tear apart everything you can measure," he says. By doing this, EMS agencies may begin to discover that they're taking longer to arrive at a scene than they think. "For example, paramedics may think they're getting somewhere in six minutes. But when we really started measuring every piece of that response [from call to dispatch center to arrival at the patient's side] it turns out to be 12 minutes. No wonder we weren't saving anybody," Eisenberg says. "Unless you take a hard, honest look, you'll never get to the root of the problem."

Measuring Success

Eisenberg would also like EMS agencies to take a closer look at critical cases, especially cardiac patients with witnessed V-fib who die. "I think every community should be looking at every person who dies from ventricular fibrillation and asking why the patient died. What could we have done to prevent that death?" he says. "If you take the mindset that says, 'This patient should have lived. What could we have done differently?' then I think you're starting to get at quality improvement."

This work isn't hard, Eisenberg emphasizes. It simply requires the right people to look at the data and be accountable. Without making sense of the data and then making the right decisions based on the data, the answers will remain elusive. "It requires somebody to tear the data apart and make sense of it," he says.

He adds, "I suppose the bottom line is, are you there just to answer calls, or are you there to say how can we do better?" *Resuscitate!* aims to help readers work with the data and notice other variables that can impact the percentages of survivability.

The book has been warmly received, especially by those in the EMS community, a response Eisenberg finds satisfying.

"People have told me that they've bought the book for their entire crews or shifts, or asked everyone in their department to read it," he says. "I think that when you get that kind of response, it is indeed gratifying. There are some serious messages here, and if they start percolating through an organization, it will begin to create that culture of excellence, so I'm thrilled."

In the book *Resuscitate!*, Dr. Mickey Eisenberg presents 25 suggestions for improving cardiac arrest survival rates.

As a testament to Eisenberg's devotion to his mission, all proceeds from the book go to fund cardiac arrest resuscitation research. "We have ongoing projects trying to look at new ways of providing care, and new ways of looking at the information we get," Eisenberg says. "In ventricular fibrillation, we can learn from the signal coming from the heart that may help guide the resuscitation, so there is a lot to learn."

Pay Attention to the Signs

Eisenberg stresses that measuring and considering all data concerning the cardiac arrest event will help systems find the gems that may reveal transformative solutions.

"Step one is to look at what you're doing. If you can't answer the question of 'How are we doing right now, what is our true response time from the moment the 9-1-1 call comes in until the moment we arrive at the patient's side?' and if you are not measuring every key aspect of that resuscitation, you can't begin to improve," he says. "So that has to be the first step."

He also encourages sharing information with national reporting systems, such as the Cardiac Arrest Registry to Enhance Survival site at mycares.net. "Much of it is automated," he says. "With 10 or 15 minutes per case, you get back an incredible wealth of information that allows you to look at your own system's performance as well as make peer comparisons."

Although Eisenberg wrote *Resuscitate!* on his own, he credits the many people who have influenced and supported him throughout his career. "Over those 35 years, there's been an incredible number of people I've had the great joy of working with, and they have taught me a great deal," he says. "People in the EMS community have a kind of mission-driven purpose in their work. There are an awful lot of people out there who have that same drive to succeed in what they do, so I've had some great role models—in particular Dr. Leonard Cobb and Dr. Michael Copass."

Even so, Eisenberg stresses that all the experience and training in the world won't necessarily make a difference in cardiac arrest survival rates unless attention is paid to the myriad factors that go into quickly arriving at a scene and providing state-of-the-art care throughout the whole process.

He asks simply: "How can you begin to improve unless you know how you are performing right now?"

It's a thought-provoking question to keep in mind. ■

The Big-Picture Thinker

Dia Gainor works to unify and fund EMS on a national level

Even as a teenager, Dia Gainor was fascinated with EMS. Her first job, working in a county EMS office, allowed her to personally experience the challenges and excitement of the industry. Most importantly, she got to see what was necessary for an EMS system to work successfully. She learned that everyone had to contribute individually and as a group, much like performers in an exquisite, choreographed dance.

"I realized that systems are patients, too, with their own chief complaints and levels of consciousness," Gainor says. "And thanks to some people who had faith in me when I was young, I was appointed to the Pennsylvania Turnpike Ambulance Task Force." The opportunity allowed her to see EMS on a larger scale. "A newly certified paramedic at 19 years old, I suddenly saw the big picture at the state level and said, 'this is what I want to do,'" she says.

Now, 27 years later, after dedicating 18 years of her career as the Idaho Department of Health and Welfare. In this role, she not only sees the big picture; on most days, she's *responsible* for it.

Dia Gainor

Crafting Important Messages

Perhaps one of Gainor's most encompassing, big-picture challenges has been her role as National EMS Advisory Council (NEMSAC) chair. It was in this role that she led the draft and approval process of a position statement that "an accountable and sustained community level emergency medical care system is essential and must be assured in the debate and implementation of health-care reform."

Another document, *EMS Makes a Difference: Improved clinical outcomes and downstream healthcare savings* was finalized in December and includes 10 guiding principles that underscore why health-care reform must ensure the stability and performance of a viable, funded EMS system. It notes that any health-care reform bill should include permanent funding for the National EMS Information System, EMS research, EMS readiness and surge capacity.

Gainor admits expectations were high for the Advisory Council from the start. "Our members, individually and collectively, did not want to be a bunch of bench-sitters," she says. "We wanted to do something that would make an impact on EMS systems at large, but more importantly, on those parties that don't yet know how to spell EMS."

In early exercises to develop the position statement, the committee identified 88 distinct issues in EMS that warranted attention at a national level, with the fundamental and weightiest issues centering squarely on the economics of EMS.

"How do you begin to assert the importance of EMS if you can't defend the difference that it makes?" Gainor asks. Answering that question was at the root of the committee's challenge and the resulting paper.

"The references are three-quarters of the value of the document, because there wasn't a place where you could turn and find all of those references," Gainor says. She insisted that every committee that contributed to the document use a business case problem-and-statement model when writing and include as many references as possible.

"That's what makes this document so ground breaking," Gainor says. "I am personally not aware of any place or time where this breadth and depth of proof of the impact of EMS was captured in a single document."

NEMSAC documents are at ems.gov.

Laying the Groundwork

The education begins immediately in the Executive Summary with the statement: "In the context of health care reform, the capabilities and potential of EMS and their impact on health care costs remain largely unrecognized."

"We don't have the kinds of research initiatives, the types of studies, the demonstration projects, and the think tanks that the rest of health care seems to enjoy," Gainor says. "As a result, we don't have a large body of knowledge, let alone substantial peer-reviewed-journal-caliber research to hang our hat on."

But Gainor is also quick to point out that EMS is still a relatively young industry with much to learn—and contribute. "I don't think we should fault ourselves for where we are, but we can't shrug and say, 'I guess that's the way it is in this business.' We simply can't accept status quo today as acceptable," she says.

The Advisory Council also found another challenge facing EMS: the adoption of national guidelines and protocols developed through a rigorous examination of the scientific evidence and systematic guideline process.

"EMS stands to learn from industry and engineering more than it does from health care and hospitals," Gainor says. "[When we're] performing an important task, 'winging it' or doing it because

that's the way we've always done it, is not the way to be safe or effective. We have very little structured, demonstrated, proven decisions that guide what we do and how we do it."

The Advisory Council would also like to see an expanded role for EMS, one that's more integrated with preventive services and acute care while also promoting overall community health.

"You have to start with the admittedly overused reference to EMS being at the intersection of public health, public safety, and emergency medicine; our foot in three worlds and our home in none," she says. "That, in and of itself, is the root cause of the problem."

This diversity—the variation of personnel, the kinds of organizations that EMS finds itself based in (hospital, fire, county, etc.) and the varying levels of EMS sophistication—certainly add a measure of texture to the industry. They also help create confusion.

"Pretty soon you have to use a calculus formula to come up with the number of variations of EMS agency types and configuration challenges," Gainor says. "We don't even recognize each other in our own industry because of that diversity. That breeds the sense of homelessness that the statement is alluding to."

Standardizing Care

As far as standards are concerned, Gainor points to the industries that already enjoy consistent state and federal standards and regulations, such as K–12 education, the interstate highway system, agriculture and transportation.

'You have to start with the admittedly overused reference to EMS being at the intersection of public health, public safety, and emergency medicine; our foot in three worlds and our home in none.'

"These all match up with the names of federal agencies that have the regulatory authority to set some things in place, because they are too important to drop below a set standard from location to location," she says. "We feel good that the FAA exists and ensures that the way planes take off and land happens in a very precise way, no matter what state or city or county you are landing in." She would like to see some of the same standardization in EMS.

Gainor highlights the transport of patients as a specific example. "Why in all the modes of transport, such as freight, commercial trucking and transit, are [regulations] so clearly dictated, monitored, and accounted for, but not in the transport of patients? Where did that disconnect start?" she asks. "Why is a load of cattle rolling down the interstate highway safer than the patient in the back of an ambulance? How do you explain that we don't have a comparable level of assurance for the safety of the driver, the crew and the patient that we do for other cargo?"

Dia Gainor received the James O. Page/ *JEMS* Leadership Award at the 2010 EMS Today conference in Baltimore.

She also points to the invisibility that EMS sometimes feels in the overall health-care picture. Many people around the world have been impacted by EMS, by having a paramedic save either their life or the life of a friend or neighbor. Gainor acknowledges that most people understand that EMTs and paramedics save lives, but she would like the awareness to go deeper.

"It is often the case that Joe Citizen believes that," she says. "We have to get to the point where the health-care industry at large knows that. It has to be imbued in everything. That's the gap that we've got to bridge."

Gainor hopes the position statement will resonate with many in the health-care industry, including policy makers on Capitol Hill who are currently wrestling with health-care reform.

"Before you tamper with something as fragile as health care, you better make sure that the safety net is intact, because that's EMS," she says. "My fear is that it will all fall on deaf ears in the absence of a unified voice for EMS."

Gainor also hopes the statement will spawn additional research on the impact of EMS.

"I hope that essentially it will speak to every level of participant in the EMS system in a voice they recognize for the piece they can contribute," she says. She includes EMTs, paramedics, administrators, national associations, research organizations and universities in this call, "because it touches every one of us," she says.

And the end of the day, as Gainor looks squarely at the big picture, she's more optimistic than pessimistic because of the kinds of positive changes that she sees being made in EMS. "We're not going backward," she says. "I think it's more a case of growing pains than a stall mode, and I have to be hopeful because we are in motion." ■

Beyond Status Quo

Eric Longino stopped a paramedic shortage with apprenticeship and state funding

Like many counties around the nation, Greenville County (S.C.) EMS is grappling with how to address an ongoing paramedic shortage. The busy EMS agency fields some 60,000 calls a year, and the need for qualified paramedics is sometimes acute.

"We are one of the largest emergency medical services in the state, so we have a lot of paramedics," says Eric Longino, captain of human resources for Greenville County EMS (GCEMS). "That magnifies our current situation in the need for procurement, so instead of living day-to-day, we tried to look into the future to see how we could correct the shortage."

Not satisfied with leaving things status quo, Longino analyzed and corrected the problem, both in the short and long term.

Eric Longino

For Longino, the process began with carefully examining the way the agency typically handled recruiting and staffing. He began talking with other businesses outside of EMS about how they dealt with worker shortages, and many recommended developing an apprenticeship program. "Apprenticeships have been around for years, but they are more typically found in plumbing and electrical engineering," Longino says.

Still, the idea intrigued him. Longino inquired about developing an apprenticeship program between Greenville EMS and Greenville Technical College, which was receptive to the idea.

"We are fortunate in this area because we have several community colleges," he says.

With the community colleges on board as willing participants, Longino mapped out a program that would allow Greenville to capture people interested in an EMS career early on. GCEMS would then sponsor them, help pay for their educational costs and eventually have fully trained paramedics ready to go.

"The actual industry shortage is what motivated us to start thinking outside of the box," Longino says.

> 'Instead of living day-to-day, we tried to look into the future to see how we could correct the shortage.'

Program Liftoff

The basic components of the program were started in 2009, and to Longino's knowledge, the apprenticeship program is the first of its kind in South Carolina's history. A $60,000 grant awarded by the South Carolina Department of Commerce funds the program, and the program is registered with the U.S. Department of Labor.

The apprenticeship program was designed to take someone with high EMS interest—but no experience—and bring them on as an employee.

"We look for attitude, work ethic and dependability, because those are the things that we experience in our actual day-to-day operations," Longino says. "Just because you have a paramedic certification doesn't mean you can come to work late and not have a good work ethic. So we try to identify people who have those things."

In finding qualified candidates, Longino places special emphasis on the interview process in order to really hone in on those candidates who are very interested in EMS, as opposed to those who are simply looking for a job—any job.

"When we meet with them, we try to find out why they want to be in EMS by asking behavioral-type interview questions," he says. "I'm all about giving people chances. But with the bad economy, we have to be particular about who we hire. It's very obvious in some of the interviews that some people only want a job and have no real interest in EMS."

Longino estimates that almost 90 percent of current hires are displaced workers. They are people who have been interested in EMS for a long time, but haven't had the opportunity to pursue the career path until now.

"I was blessed because I've had several doors in my life open up because of EMS," Longino says. "What we try to do in the apprenticeship program is give opportunity to people who may or may not have had those opportunities previously in their life."

Program Logistics

The apprentice starts his or her training in Greenville's logistics department. They work for six months, making sure the ambulances are clean and properly stocked with the requisite medi-

cal supplies and equipment.

"They work 35 hours per week during the week and go to EMT school at night," Longino says. "Once they graduate EMT school, we put them through a modified orientation process, and then they transition to the ambulance and work in the field. At that time, they become full-time Greenville County EMS employees and work out of the ambulance. They are considered second-man status on the ambulance, and they are actually out there saving lives."

Once this phase is completed, the apprentice graduates to intermediate school and then moves on to paramedic school. "The whole process, from start to finish, takes about two years," says Longino.

As of January, 18 apprentices were making their way through the program. "At this point, the program is still new enough that we haven't had somebody actually complete the paramedic program yet, but we have a couple that are actually toward the end," Longino says.

So far, the program has worked very successfully. Longino admits that those candidates who have children sometimes have difficulty managing 35 hours of work, night school and family obligations. But all in all, he says the program has been successful.

From the minute apprentices begin the program, they receive wages, starting at $10.30 an hour. Once they get their basic EMT training, they're bumped to $11.15 an hour. As a paramedic-in-training, they make $13.29 an hour, and as a fully trained paramedic, they make $15.16 an hour. Once a candidate passes their basic EMT training, they receive 11 paid holidays, state retirement, and full medical, dental and vision benefits.

The candidates who enter the program quickly find themselves not only immersed in EMS training, but also in the excitement of EMS culture. "They want to get out there and start saving lives, but there's a foundation that you have to build to optimally finish, and learning basic EMS is the first step," Longino says. "They can get a little frustrated back in logistics, and they want to get in the truck, but it's a slow methodical process that we put them through to get them through their classes and get them certified."

Granting Access

Greenville Technical College assumes the educational role and provides all the educational components of the program as an accredited college. GCEMS provides the hands-on experience. Combined, the two form the apprenticeship program.

Less than two years into an apprenticeship program that's unique to South Carolina, Greenville County EMS is almost 100 percent staffed.

"When we were thinking outside the box, the South Carolina Department of Commerce was pushing workforce grants," says Longino. "They actually released a solicitation proposal, so we developed the documentation and justification and applied for the grant." The South Carolina Department of Commerce has been funding a variety of apprenticeship programs for years, and, as mentioned, Greenville County is the state's first EMS apprenticeship program.

"The grant pays for all the [candidate's] education and books, as well as paying a 50 percent match of their salaries for the first three months," Longino says. "Then the county is 100 percent responsible for their salaries. We also buy all our new apprentices uniforms, boots, stethoscopes and a blood-pressure cuff for school."

Hiring and training quality EMS personnel is critical to Greenville County, since they field 60,000 calls a year. "That's 60,000 times we have to get it right," says Longino. "So we have to make sure we have the right people with the right training. We have to focus on patient care, so we try to get the best candidates we can get."

Despite some difficulties, Longino has found the program to be very rewarding. "You get people that have never been given an opportunity, and they get out there and start really experiencing EMS," he says. "They come into the office and they are all excited because they've helped save somebody, and it's nice to see that."

The program has also had a considerable impact on Greenville County's staffing shortage. Longino reports that the agency is now, essentially, 100 percent staffed. "It has helped in our logistics department by having people to stock the medical supplies for the ambulances. It's been a win-win."

Longino has been instrumental in spearheading the program and driving it to a successful outcome. But he's reluctant to take much of the credit.

"I am nobody special. I work with some incredible administrators and employees, and, as a group, we realize how we can make this work," he says. "This has never been done in South Carolina before, so we didn't have a template to go from. Everything we created had to be from scratch, so many times we were scratching our heads and asking how we were going to do this. But so far, we have been very pleased." ■

Spotlight on Sepsis

T. Ryan Mayfield improved EMS education and treatment of patients in septic shock

It's no secret that EMS providers have to be up on the latest medical technologies and conditions. This can be challenging given how quickly things change, and it sometimes might seem better to just ignore it all. However, T. Ryan Mayfield, EMS educator and quality assurance/quality improvement (QA/QI) research specialist for Porter, Littleton, Parker EMS in South Denver Metro, noticed an educational gap in paramedic training that he simply couldn't ignore.

"There is such a huge gap in effectively identifying patients in septic shock," he says. "I honestly didn't know that septic shock was a problem, and there is so little education done on sepsis for EMS. a current paramedic textbook has less than two pages out of 2,000 spent on this topic."

With the support of his medical director, Mayfield started educating himself and soon realized the enormity of the problem. The mortality rate from septic shock is 50 percent. "So that means that every other patient you see in septic shock is going to die, if they follow the laws of statistics," Mayfield emphasizes.

"It was unbelievable to me that it was something I didn't know about," he says. "I consider myself a pretty good paramedic, and I had no idea."

Mayfield decided it was time to do something about the lack of EMS education around septic shock.

"I had patients who I thought in the back of my mind were probably septic, but I didn't have a good understanding of what that actually meant, what that meant to their mortality rate, and what could be done," he says. "And that's where this started."

T. Ryan Mayfield

Looking for Clues

To better understand the seriousness and underlying implications of septic shock, Mayfield began comparing patients with sepsis to those with chest pain to identify commonalities. "I started comparing all the chest pain patients and septic shock patients that came into the hospital, and the numbers were hugely different," he says. "Most of the chest pain patients would walk out of the emergency department." But that wasn't so with the sepsis patients.

Part of the problem with early detection of sepsis, Mayfield discovered, is the lack of a definitive test. When checking for glucose, a properly administered test can definitely point to low blood sugar. But detecting sepsis can take a little more effort.

"It's a conglomerate of signs, symptoms and vital-sign changes," Mayfield says. "It can be a little bit sneaky. Patients can be in septic shock and not showing any outward signs of hypoperfusion, so their blood pressure is still fine, but internally they are going into shock."

He adds that EMS isn't alone in struggling to identify and treat sepsis. "Every emergency [physician] has those cases where the patient looks fine, and 20 minutes later they are circling the drain," he says.

Research further indicates elevated lactate levels are an indicator of shock even before vital sign changes are seen and can suggest cryptic sepsis. "They are going into shock, but their vital signs aren't showing it yet," he says.

Some in-depth research unearthed an effective and inexpensive lactate meter, which is available in the U.S. and as easy to use as a glucometer. "It was developed for endurance athletes for training," Mayfield says. "We purchased them through a generous contribution by three of the foundations we work with. We were able to outfit 50 ambulances in the area."

The meters are easy to use and easy to read. "We take a little blood sample and are able to take a lactate reading to determine if the patient has cryptic sepsis," Mayfield says.

He also created training materials that paramedics could use out in the field, including a Sepsis Alert Criteria card that outlines the criteria for septic shock.

For instance, the patient must have at least two of the Systemic Inflammatory Response Syndrome (SIRS) criteria, such as a temperature greater than 100.4 degrees Fahrenheit, a pulse greater than 90 and respiratory rate greater than 20. Patients must also have a suspected or documented infection and hypoperfusion. Mayfield also created a simple card that calculates mean arterial pressure.

"We reintroduce the concept of mean arterial pressure because that is something that's a pretty good application in EMS work," he says. "Unfortunately, when it's taught in paramedic school, it's taught with a formula attached to it that is not easy to do in your head. So I developed a quick reference card to calculate the mean arterial pressure based on the

systolic and diastolic [pressure].

We train paramedics on why that is important and then give them this tool to use. It negates the need to do long division in your head at three o'clock in the morning."

Mayfield's training had also taught him enough to know that the key to surviving septic shock is early recognition and treatment, and the first treatment modality is fluid.

"Paramedics can be a little afraid to give, say an elderly patient, lots of fluid because they are afraid of sending them into congestive heart failure," Mayfield says. "So they'll give them maybe 200 to 500 ccs of fluid, worried that they're going to overload them. But some of the septic shock patients that we've had coming through have received 30 liters of fluid in the first few days."

Armed with this information, Mayfield developed a two-hour continuing education class on septic shock, and the EMS team he works with taught 900 paramedics and EMTs in 30 days. "This was a group effort to get the education out there," he says.

The Goal of a Sepsis Alert

If a paramedic in the field suspects a patient of being in septic shock prior to hospital arrival, EMS personnel are taught to start the initial steps of Early Goal-Directed Therapy. This also allows EMS personnel to call a "Sepsis Alert."

Although many hospitals in the country have in-house sepsis alerts, Mayfield thinks this may be first in the country that allows EMS personnel in the field to call the alert.

> **'It was unbelievable to me that it was something I didn't know about. I consider myself a pretty good paramedic, and I had no idea.'**

"In Early Goal-Directed Therapy, ED staff have things they have to do within a certain window of time, like antibiotics within the first hour of recognition," says Mayfield. "EMS can start this Early Goal-Directed Therapy to treat septic shock, prior to getting to the emergency department, and the emergency department can carry it on from there."

The alert is modeled after the successful stroke, trauma and cardiac alert programs. This warning gives emergency departments (EDs) the time to assemble the multidisciplinary staff required to aggressively treat a sepsis patient, improving the odds of providing necessary treatment within the recommended six-hour window.

Preliminary data shows patients with a Sepsis Alert called prior to the arrival at the emergency department have a significantly decreased mortality rate.

Mayfield says the three hospitals his department works with share an emergency physician group, which unifies the treatment. The physicians in the program are an experienced and tight-knit doctor group. By the time the patient arrives, the ED is ready for them. "The doctor—and at least one nurse—is there," says Mayfield. "They have a central line kit and an ultrasound already in the room."

He adds that they also have a radiology and respiratory therapy response. "By the time the patient arrives, everybody who needs to be there is there," he says.

Treatment usually begins with lots of fluids. "We also teach paramedics protective ventilation strategies to do less damage to the lungs, if necessary," he says.

Most published literature supports the belief that the earlier you start treatment on a sepsis patient, the better the outcome, and Mayfield's program is definitely having an impact. "I think that's what we're showing here," he says. "We are starting before patients even hit the emergency department, and our outcomes are doing very well right now."

Final numbers are still being collected, but preliminary data shows patients in septic shock with a Sepsis Alert called prior to the arrival at the emergency department have a significantly decreased mortality rate. Additionally, EMS patients with a Sepsis Alert called have shown a decreased length of hospital stay and a decrease in total health-care costs.

Even patients who were not called, but were later discovered in the ED to have sepsis, had a lower mortality because of the education now surrounding septic shock.

"Part of that is heightened awareness because we have been talking about it so much," Mayfield says. "We're looking at those patients that were called for septic shock, but also those that EMS should have called, and didn't, to determine if those who had training didn't recognize it."

Although final numbers for the program aren't expected for a few months, Mayfield and the EMS providers and ED doctors involved in the program already know they have a winner. ■

Preventive Measures

Geoffrey Miller spearheaded the creation of a national database to record job-related illnesses and deaths

Every year, hundreds of EMS personnel fall ill or die due to job-related illnesses or circumstances. Just how many succumb, where, how often and why, is still somewhat of a mystery. It's a riddle that has always bothered Geoffrey Miller.

Miller, who is associate director for research and curriculum development at the Gordon Center for Research and Medical Education at the University of Miami's Miller School of Medicine, recognized the lack of a centralized and organized national repository of data related to the occupational illnesses, injuries, and deaths of EMS providers throughout the U.S., and he decided to change that.

He has spearheaded the development of the first and only National EMS Health Surveillance System in the country.

Geoffrey Miller

The Need for Tracking

Although some statewide systems do exist for reporting deaths to the Occupational Safety & Health Administration (OSHA), perhaps surprisingly, there's currently no central database where EMS organizations of all system configurations can report specifically on EMS personnel.

"If you're a fire department, you can track the types of injuries your employees are sustaining and some of the contributing causes and factors that tie into it. On the EMS side of the house, we don't have that," Miller says. "If we are to look after the well-being of the men and women who are providing EMS, regardless of the service-delivery model, we need a system to try to track the causes of these injuries, the human factors that may lead to them, and the deaths that are associated with some of them."

To begin such a daunting undertaking, Miller approached the board of the International Association of Emergency Medical Service Chiefs (IAEMSC), who wholeheartedly supported the idea. IAEMSC took the idea to Intermedix, a market leader in revenue-cycle management for EMS. Intermedix offered to provide the technical support and build the data-collection tool and Web site needed as foundational support of the program.

"Intermedix also provided the appropriate levels of security we needed," says Miller. "We have the same type of security you would have with a patient care record."

> 'We're hoping to make some big changes to reduce some of the preventable injuries that are occurring out there.'

The system is currently in the beta-testing phase. Eventually, it will allow EMS organizations across the U.S., as well as other countries, to voluntarily report the occupational illnesses, injuries and deaths of EMS personnel, using a common Web-based tool. By capturing this data, IAEMSC will be able to conduct research and potentially find solutions to reducing the annual number of EMS illnesses and deaths.

"We have four agencies that are participating, and they represent several different delivery models," Miller says. "There is no state or federal mandate to participate in this type of reporting system. We're just hoping that people will be interested in it."

System Execution

EMS organizations will register for the system through an online registration system; users will be verified. "The system doesn't track individual-level data, but it does have sensitive information that we want to make sure is maintained in a secure format," Miller says. "So once an agency registers, their authorized users will be verified with the department head to ensure that these people are who they say they are."

Organizations will be asked to set up an agency profile. Once the profile is established, they can submit specific information related to on-the-job illnesses, injuries, or deaths. Miller will be the lead researcher analyzing the data and reporting to the EMS community and governmental leaders.

"We've done some things to make it user-friendly. It will be all Web-based, and it's modeled after the law enforcement and fire service injury and data collection systems," Miller says. "Hopefully we'll be able to make a lot of correlations throughout public safety as a whole and within our own industry."

The surveillance system, which is still relatively new, is working well in beta testing. This includes the reported ease of use, which was an important consideration when developing the program. The system is driven in large part by drop-down menus.

"We haven't experienced any major problems," says Miller. "There are some pretext entries for things that are outside the normal expected causes, and that's part of the beta testing. We want to see if there are things popping up with any kind of frequency that we need to add to drop-down lists."

The drop-down menus were created for ease of use, but Miller also wants the surveillance system to be conventional across agencies. "We are trying not to have to customize the system for every agency, because then it makes it very difficult for us to make correlations or comparisons across regions, states or the nation," he says.

Getting the Word Out

To advertise the system, IAEMSC will be working with state EMS directors and Intermedix on a marketing plan. "It will be a grassroots campaign, and with these different bodies, we can get the message out to nearly every agency in the U.S. to get them enrolled and tracking information," says Miller. "It will serve to augment what other agencies and departments are doing to track injuries for personnel."

Miller sees the surveillance system as a real win-win for EMS. Agencies will enter information that will help build a picture of what's happening to the men and women of EMS. At the same time, those agencies can generate specific reports to attach to personnel files or other human resources documents produced for an injury or incident.

"We're trying not to duplicate the amount of paperwork," Miller says. "We're trying to augment what they already have and then create a system that will also allow us to track what's happening at the state, regional and national level."

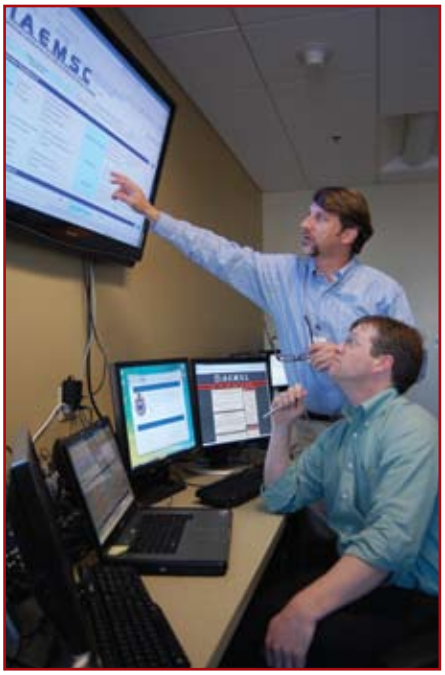
Miller acknowledges that there are other databases that track medical information, but they are more focused on patient care and don't usually include much data on what's happening to responders.

"We're trying to create something fairly synonymous and use a lot of the same language," he says. "Hopefully one day, all of this information will be integrated into a more comprehensive operational and patient clinical care data-collection system."

Once the system is fully operational and available—targeted for this spring—it will be at no cost to agencies wishing to access the system and use the software.

"We are trying to do this at no cost to encourage the greatest number of users, and fortunately, we have been able to do that because of the gracious work of Intermedix volunteering to pay for the technology and the development of the security," Miller says.

"We are hoping that people will get on board and start entering their data, using the system to their advantage, and, more importantly, we are hoping they will take advantage of the reporting we want to also offer."



The National EMS Health Surveillance System software will be available at no cost to agencies when it's launched.

A Broad-Based View

Ultimately, Miller hopes the national surveillance system will be just that—a system that will take snapshots of state, regional, and national areas and offer up information concerning trends.

"The ones we are most concerned with are preventable injury trends, so that we can offer advice back to the community to make safety changes, or make policy changes regarding certain activities, and also help lead the equipment technology industry," he says.

Miller would also like to see the information support lobbying and advocating efforts for the health and safety of EMS providers.

"You see stories about ambulance accidents or paramedics assaulted," he says. "These stories are not collected in any type of main repository that allows us to pull out any meaningful information to turn around to the state and federal governments and say, 'We have a problem and we need to fix this.'" Miller hopes the gathering of such stories will influence future legislation and fund research for better safety systems and protective equipment for EMS personnel.

"EMS is a very precious resource and we can't afford to lose providers to things that we can prevent. We need to start carrying a bigger voice for ourselves, and we won't be able to do that until we actually have some data that we can turn to to show the trends and activities that are occurring."

To date, agency interest in the system is growing, with some agencies already announcing plans to participate. Miller couldn't be more pleased.

"We know through some of the associations that there is pretty keen interest to get it into full distribution," he says. "It's good to have that kind of proactive thinking on the part of agencies who are trying to look after the men and women working for them." ■

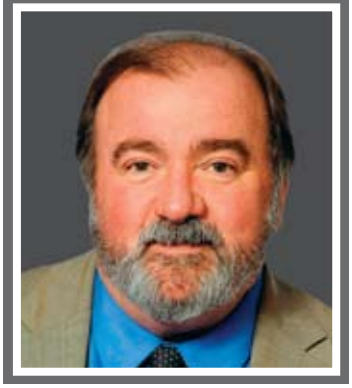
The Change Agent

Dr. Paul Pepe continues to further prehospital care with new concepts in resuscitation

An internationally respected leader in prehospital care, Dr. Paul Pepe's contribution to EMS spans more than three decades. While the depth and breadth of his work is unmatched, the bulk of his research—and passion—is in prehospital cardiac arrest and trauma resuscitation and prehospital care, most recently evaluating how estrogen can improve resuscitation rates with a team of prehospital care experts.

Renowned for his grass-roots, street-wise style in planning, implementing and overseeing a systems approach to saving lives—both operationally and through clinical trials—Pepe's programs have resulted in some of the highest cardiac arrest and trauma survival rates in the world.

Dr. Paul Pepe



Pepe, a tenured full professor of medicine, surgery, pediatrics and public health, and Riggs Family Chair in Emergency Medicine at the University of Texas Southwestern Medical Center in Dallas, heads a ground-breaking academic emergency medicine program based at Parkland Hospital, the county emergency-trauma center.

Pepe sees himself more as a change agent, one who looks at a situation and tries to understand how it could be enhanced. This has been exemplified by his research and innovation regarding trauma and sudden-death cardiac arrest patients.

Most recently, Pepe has added to his long-standing portfolio in resuscitation medicine with new research on the role that sex hormones may play in outcomes.

Breathing New Life into Resuscitation

Pepe was one of the thought leaders who saw that patient outcomes could be significantly improved by creating specific facilities to treat specific problems. For example, many years ago, he thought that gathering a group of highly skilled specialists at a particular receiving hospital, specific for the purpose of treating stroke, would improve a patient's chance of recovering.

"Here we are eight years later, and stroke centers have become mainstream. The Joint Commission on Accreditation for Hospitals now accredits them," Pepe says.

Similarly, along with a close-knit group of colleagues across the nation, he has championed the cause of creating resuscitation centers with a cardiac-arrest focus.

"When you have a centralized receiving center for a particular emergency type, the care providers are more effective because they are used to doing it on a day-to-day basis," he says. "We think the same concept holds true when treating cardiac arrest, because we know so many things that can affect the outcome are provided or continued in the hospitals."

He is now using a similar approach to set up resuscitation centers. Facilities should use therapeutic hypothermia, be up-to-date on the latest standards of chest compression, and, of course, have quality controls in place.

"Quality has not been so good in either prehospital or in-hospital," he says. "Weak links have been shown. Can they demonstrate quality CPR and chest compression in their own staff members? Are they actually monitoring this?"

Pepe insists that by measuring and monitoring quality, hospital performance will improve.

"Sometimes what we want from a hospital is to know that they have identified the problem, what they did to fix it, and what happened to make it better," he says. "So we have to have the quality assurance and data collection component to measure it."

Pepe admits that not every hospital has to be a designated cardiac resuscitation center. In fact, sometimes the fewer the centers, the better the data and individual experience at each center due to the higher volume of patients treated.

"To some extent, a smaller number of resuscitation centers makes it easier to collect and collate data. It's more efficient if you only have to work with seven or eight places versus, say, three dozen," he says.

'What I think I contribute best is bringing the right group of people together, in the right milieu, to get the right scientific answers.'

Clinical Research

Pepe has also spent three decades conducting major clinical trials that have achieved significant notoriety. Many of his research initiatives have successfully challenged sacred cows and opened up new avenues of investigation.

Pepe believes that the greatest gains in research can be made by getting groups of scientists together to tease out all of the important factors that can impact treatment. With an understanding of best practices, treatment protocols can be not only be standardized, but will also improve outcomes just by renewed focus and attention to details.

"Even if the intervention itself is not effective, when you start training people, focusing on the right treatment, and paying attention to quality assurance, you save lives," he says.

This effect was recently seen in Dallas during the implementation of scientific studies for the NIH. "We were hoping to get the survival rates up 10–20 percent. They actually went up more than 50 percent in Dallas alone and 60 percent across the county. In some cities, the survival rate almost quadrupled," says Pepe. "I'm a big advocate of conducting research studies because, just by doing them, you can produce and demonstrate a life-saving effect."

Estrogen's Role in Resuscitation

In more recent research, Pepe and his team of researchers have begun to demonstrate the powerful impact that sex hormones may have on resuscitation medicine.

"When I first came to UT Southwestern, one of my chief residents was looking at the concept that women have worse outcomes than men with heart attacks," Pepe says. "That's what the widely held opinion was at the time."

But Pepe and that chief resident, Dr. Jane Wigginton, thought otherwise and set out to discover the real story. For example, it had been questioned that women may present with different symptoms, or that they may not be treated as aggressively, for various reasons.

In May 2000, at an annual meeting of the Society of Academic Emergency Medicine in San Francisco, Dr. Wigginton delivered a scientific presentation based on their research that demonstrated that women, though older on the average, actually had much better outcomes than men in out-of-hospital cardiopulmonary arrests.

"The cool part about dealing with cardiac arrest is that the diagnosis is easy and everyone gets the same therapy. Men and women both were shown to get the same kinds and same numbers of drugs for each protocol and the same length of treatment," Pepe says. Differences in outcomes had to be explained some other way.

"At first, we thought it would be unlikely to be hormones because the average age of a woman who has a cardiac arrest is 69, so we expanded our study further until we got to 10,000 patients. Suddenly, we could study a very large number of women who were under the age of 50," says Pepe. "It turned out that almost all of the differences between men and women were completely explained by the cohort of women under the age of 50; they had much better survival rates than the men."

Dr. Wigginton is now leading researchers nationally in exploring resuscitative endocrinology (as she calls it), with the support of Pepe and world-famous resuscitation researcher, Dr. Ahamed Idris. Having demonstrated differences in outcomes in the laboratory by infusing estrogen for a myriad of critical conditions, from head injury to burns and other insults, they are leading the effort to eventually take estrogen infusion to the streets.

As a safe, inexpensive, and simple-to-use treatment, it may dramatically improve cardiac arrest survival arrests, head injury, and burns in both men and women.

A safe, inexpensive, and simple-to-use treatment, it's believed prehospital infusion of estrogen may dramatically improve survival rates for cardiac arrest, head injury, and burns in both men and women.

A Collaborative Style

Such work has helped set national priorities in resuscitation research. Most notably, UT Southwestern Emergency Medicine and its affiliated 16 partner cities in the Dallas EMS System have been designated jointly as an NIH Center for Resuscitation Research, working with 10 other sites throughout North America. For this purpose, Pepe and his team are scheduled to conduct 10 or so federally funded clinical trials in cardiac arrest and trauma resuscitation over the next five to 10 years.

"What I think I contribute best is bringing the right group of people together, in the right milieu, to get the right scientific answers," Pepe says. "This is done by gathering a critical mass of terrific thinkers and doers, who are oriented toward prehospital care."

Pepe believes that the right prehospital care, including the proper resuscitation protocols, will not only significantly save lives—but also ICU costs. He has devoted his professional life to supporting the research efforts and advances that will continue to improve resuscitation protocols and strengthen prehospital care.

"Now many more people are not only surviving, but more importantly, in some study circumstances, almost everyone is waking up before they get to the hospital," he says. "As a result, we are sparing people from going into the ICU on ventilators. An ounce of good prehospital care can save a ton of ICU care. That's why I have spent—and will continue to spend—a lot of my focus and time in the prehospital arena." ■

The Connector

John Pringle's persistence led to the creation of a program that facilitates complete electronic sharing of patient information between EMS and hospitals

As an electronic documentation manager for the San Diego Fire-Rescue Department, John Pringle experienced first-hand the disconnect field providers feel in sharing patient information with local hospitals. He thinks there's been a need for some time for the entities to be linked electronically to allow sharing of patient information in real time.

"One of the weaknesses we see globally in what we are doing in EMS with our patient electronic care record is the inability to speak to the hospitals or have our records communicated between one another," says Pringle, who is also a paramedic/firefighter.

John Pringle

A Man on a Mission

This was on Pringle's mind three years ago when he decided to do something about the disconnect. He began proactively talking about the problem, presenting at in-house medical records conferences and discussing the latest electronic data-collection efforts and methodologies.

"I was letting folks know that patient care information is available in the EMS community and that we should find a way to share that," he says.

His three years of work have proved fruitful, because many in both the EMS and hospital communities are now more aware of the problem than ever. But awareness alone didn't fix the problem, so Pringle's quest also included finding an effective and workable solution that would help EMS providers avoid having to duplicate the exchange of similar information with every hospital. He knew that he would need to tap outside expertise to accomplish that goal.

"We needed to find a vendor that had already broken down all of the security barriers in working with in-hospital records systems that could help us integrate into those systems," Pringle says. "The biggest challenge we have as EMS providers is integrating with all of the different hospitals that we work with. It would be extremely cost- and time-prohibitive to reinvent that with each one."

The Power of Synchronicity

All of this came up when one of Pringle's colleagues was having a beer with a next-door neighbor. Call it luck, or call it chance. Or, call it one of those mysterious, synergistic moments when two people with seemingly unrelated goals come together to create something extraordinary.

Pringle's unflinching pursuit of a way to integrate the San Diego EMS system with the local hospital system was no secret to many of his colleagues. It just so happens that one of the sales representatives of ImageTrend, San Diego Fire-Rescue's current software vendor, lives next door to a sales representative for a software developer known as Novo Innovations Inc., (now known as Medicity Inc.).

Over a beer in one of the sales representative's driveways, the two discussed what Pringle wanted to do and whether it could be achieved. An idea began to form.

"Medicity connects in-hospital patient records systems with any number of different satellite facilities that work outside the hospital system, such as pharmacies, radiologists and private care practitioners, and allows them to exchange information, even though they are on different record systems," Pringle says. "As they are already integrated into the hospital system, it seemed like a great match for us."

The two representatives brought the two companies together to discuss possibilities.

Since the EMS market is not a customer base that Medicity had initially targeted, the company had to think about how they would approach pricing and agreements. Eventually, they came up with a program that everyone was happy with. Medicity agreed to work with ImageTrend on linking San Diego Fire-Rescue with a local hospital, which eliminated the use of multiple vendors.

With the technology in place, San Diego Fire-Rescue went looking for a hospital that would be willing to work with them in beta testing the data collection program. Since they had collaborated extensively with the University of California, San Diego (UCSD) School of Medicine on other studies, UCSD was the natural first choice.

"We took it to the CEO of the medical school," Pringle says. "Once the CEO saw the immense value of the program—not only on their side, but on our side as an EMS provider—they quickly jumped on board to help us move forward."

The partnership has proved successful. For now, the program remains with UCSD only. Pringle admits that other hospitals have expressed interest in being part of the program and

that San Diego Fire-Rescue wants them to be a part of the program eventually. But for now, the goal is to get through beta testing before rolling it out on a broader local, regional and national level.

"We want to focus on getting it right with UCSD and then let the other hospitals decide whether or not they want to be involved," Pringle says. "All indications from the feedback we've gotten from other facilities so far are that they are very interested in this."

Beta testing for the program is concluding and the service is expected to be more locally available by mid-2010.

Use of Smart Technology

San Diego Fire-Rescue ambulances are equipped with Windows Smartphone technology. Paramedics use hand-held devices to enter and send patient information, such as vital signs, that may be collected, specific to the patient. Once sent, UCSD receives the patient information that has been collected.

"Any user in the field can use the device to collect data, create a patient record, and transmit data," Pringle says. "We have approximately 210 handheld devices that we have deployed on our ambulances and fire engines."

Once a paramedic in the field creates a report, the record can be updated multiple times, and then given as a final report. The hospital where the patient is transported will also will be able to get several preliminary reports and a final report.

"On the hospital side, our data input creates a new electronic record in the emergency room physician's records system that shows up as a referral," says Pringle says. "The physician will be able see all of that information in their patient records system and be able to complete the record. If the patient has been there before, the new information will be linked to the existing record, but it will initially show up as a referral from us before we even arrive at the facility."

The hope is that the technology will make it easier for paramedics in the field to transmit current data on a patient right to the hospital in real time. That will give physicians at the hospital an early look at vital statistics and the status of a patient who's en route. It should also prepare physicians in advance for any special procedures they may encounter.

A Warm Reception

"The program has been very well received. People are thrilled at the possibility of this not only happening at one facility, but with everybody," says Pringle. "It's going to cut down on some of our workload from the field perspective because the patient reports will already be there."

San Diego hospitals and EMS will soon be able to access and share patient data in real time.

He adds, "We won't have to find a way to get our patient records attached to the hospital's patient record. It will also give us the ability to reach out and receive patient outcome data a day or a week after we've left the patient at the hospital."

In addition, the data-collection software is set up so that insurance and billing information can be gathered and transmitted. This is expected to speed up payment, as well as lessen the need to collect that information at a much later date, saving time and money.

Once the program is underway, it's hoped that software enhancements eventually will allow photographic images to be collected and sent to the hospital, thereby enhancing the patient's record.

Pringle's unwavering desire to create a means of electronically linking patient records between EMS providers in the field and surrounding hospitals has led to the development of a partnership that could usher in more partnerships that could ultimately save thousands of lives.

> **'The biggest challenge we have as EMS providers is integrating with all of the different hospitals that we work with. It would be extremely cost- and time-prohibitive to reinvent that with each one.'**

This idea may be long overdue, and its ramifications for both EMS and hospital treatment could be long lasting.

"I've seen this as a huge potential value to our system, as well as every other EMS system out there," says Pringle. "I believe it will enable EMS systems, not only locally and nationally, but globally, to have a much more healthy ability to exchange information and collect data on those patients that we deliver to the hospital."

Sometimes, all it takes to create something extraordinary is a little thought, a little persistence, a little luck and one man's refusal to give up. That and two people talking in a driveway. ■

The Green Builder

Terence Ramotar dreams up a way to harness sunshine to power ambulances in the Sunshine State

Energy and power have been an increasing problem in this country, especially when it comes to powering the equipment in ambulances. With a need to energize power stretchers, portable radios, ECG monitors and a host of other equipment on an ambulance, the need for fresh, fully charged batteries is a constant challenge.

It was a particular problem for Sunstar Paramedics, the sole provider for emergency services in Pinellas County, Fla., one of the busiest systems in the country. Sunstar provides service for more than 1 million people and runs close to 400 transports every day, transporting some 130,000 patients annually. So it's essential to keep their ambulances in top shape and ready at all times.

"With all the advances in equipment, we've become battery dependent in our ambulances, and we found ourselves having to constantly replace batteries," says Terence Ramotar. "When you're in a high-performing system, it's critical to have all of your units out spotting the calls and keeping ambulances in service. We were losing time in the field because of battery replacements."


Terence Ramotar

A Better Idea

The more Ramotar thought about it, the more he wanted a solution to the problem of having to constantly replace and recharge vehicle batteries.

"I was trying to think of a different way to attack a problem," he says. "We are deployed out in the field, and the only access to power that we have is the one coming from the ambulance." With more than 70 ambulances, replacing batteries also became a significant cost. Another problem: providing enough outlets to recharge all the existing batteries in ambulances before the next shift.

In grappling with the problem, Ramotar, who is now vice president for TransCare Ambulance in Tampa, Fla., wondered how other mobile environments dealt with batteries and power issues. He began to do some research and asked around, and someone pointed out to him that sailboats have the same problem.

"They are out on the water for days and sometimes months at a time, and they are dependent on radios and microwaves. How did they deal with that?" Ramotar asks. The answer: solar panels. "The idea popped into my head: Wouldn't it be neat if our ambulances were powered by the sun?"

Some people may have just left it as an interesting, maybe somewhat far-fetched idea, but Ramotar is an unconventional man. Sure, the idea of having ambulances powered by solar power hadn't been done before, but that didn't mean it couldn't be done, right? Ramotar decided to find out.

Going Back to School

"I contacted one of our expert sales guys who sold solar panels and asked him to come in and teach us about solar panels and solar energy," he says. "We went back to school to learn about simple electricity, watts and ohms."

Ramotar and his team from Sunstar put pencil to paper and calculated the energy they would need to power a fully loaded ambulance all day. "We figured out that we could probably charge our batteries continuously with an 85-watt solar panel," he says. Since the technology has advanced, thereby shrinking the size of solar panels while boosting their energy output, Ramotar thought they could achieve the power they needed with a 4' x 3' panel on each ambulance.

"At that point I thought it could be a valid idea, and I thought I could solicit support," he says. Ramotar went to his boss, and the two proposed the idea to the president of Paramedics Plus, illustrating the costs and feasibility of such a project.

The whole idea looked not only feasible, but surprisingly realistic. The solar panels and battery chargers were fairly inexpensive, relatively speaking. The biggest expense would be the battery chargers for the packs that had to accompany the solar panels.

All in all, the total cost to outfit each ambulance with solar panel, batteries and rechargers would come in at less than $3,000 per vehicle, a relative bargain in an age of million-dollar equipment.

"We decided that when we purchased new vehicles, we could roll that cost in," Ramotar says. "It's going to prove cost-effective in battery replacement, in addition to the savings in manpower that we are now using to manage these batteries."

Perhaps most importantly, Sunstar is saving energy by utilizing the sun, without continuing to draw down power in the vehicles. It's a win-win all the way around.

"We got full support from our corporate administration to go ahead with the project," Ramotar says.

Designing the Future

A solar panel and set of designs were given to the fleet supervisor to test. Another innovative thinker, the supervisor attached the panel to a shed, which he then attached to a battery, and then to meters, which allowed the energy output to be measured and stored.

"We found that the solar panel would keep the battery topped off," says Ramotar. "We also found that when we disconnected the solar panel and attached the chargers to the battery, even if there was no sun, we could keep them charged for upwards of 72 hours."

American Emergency Vehicles, a leading manufacturer of ambulances and other emergency vehicles, was asked to design the solar-panel topped ambulance. AEV's engineers grabbed hold of the idea with gusto. Sunstar Paramedics shipped the necessary equipment and then flew to Jefferson, N.C., to meet with the AEV crew.

"When we got there, they had already laid everything out and had started coming up with the design on how we were going to actually mount the panel on the ambulance," Ramotar says.

Because a panel needs airflow underneath it, they were set about four inches off the top of the ambulance and placed at an angle, with the front of the panel mounted slightly higher than the back. So if anything hit it, the object would slide down, as opposed to the panel taking a direct hit that could possibly shatter it.

Mounting the battery chargers also required some thought and ingenuity. "We mounted the chargers in the back, making sure they were in the right location and not in the way of the crews doing their daily work," Ramotar says.

It worked perfectly.

"The crews don't have to come back in or find a supervisor to switch batteries," says Ramotar. "They've become entirely self-sufficient for a least a 12-hour period."

In essence, the solar panel now acts as a backup power system for the entire ambulance. "We've designed a solar panel connected to a tertiary battery that powers all of our charged equipment and also provides a backup for the rest of the ambulance," says Ramotar. "People love it. In the long run, it saves money, it saves time, and it saves the environment."

Solar panels give crews the freedom to not worry about equipment batteries failing in the field.

Sunstar Paramedics has now reconfigured a half-dozen of its ambulances. The agency expects to equip its entire fleet of more than 70 ambulances with the vehicles that have solar panels over the next five years.

Embracing the Idea

Perhaps the biggest compliment comes from the EMTs and paramedics themselves, who are thankful they can focus on their jobs without worrying about the logistics of power.

"Whether they are using a power stretcher, or applying a 12-lead monitor, or using their portable radios, most paramedics are always wondering, 'When is the battery going to die?'" Ramotar says. "This has relieved that issue, allowing them to focus on patient care."

Ramotar believes that it's important to relieve ambulances of the need for continuous dependency on power, thereby allowing personnel to achieve more efficiency, better response times, and better patient care.

"It relieves us of the burden of the logistics behind managing batteries in all of our equipment," he says. "We can power everything we need to travel. It's essential for us to be out there every minute responding to patients and taking care of their needs, and not wasting our time."

'I truly believe that no matter what industry you're in, there's no excuse for not going green. Not only are we going green, but we're providing a better level of service.'

Ramotar also believes that the solar power solution lends itself to the importance of supporting greener initiatives, in EMS and in other industries.

"All industries need to embrace green initiatives," he says. "I truly believe that no matter what industry you're in, there's no excuse for not going green. Not only are we going green, but we're providing a better level of service."

Ramotar hopes other industries will critically evaluate whether solar-powered vehicles—or other machinery for that matter—may be a feasible solution within their environment.

"Most agencies that have traveled along this technology path have also become battery dependent, and we are all facing the same issues and challenges," he says. "This actually fixes the root of the problem and doesn't require a continuous design process. My hope is that more industries and agencies will use this."

If they do, they'll have Terence Ramotar, Sunstar Paramedics, and AEV to thank. ■

The EMS Pit Crew Chief

Dr. Robert Boyd Tober created a program that has decreased paramedic skill degradation and increased ROSC rates

To say that Robert Boyd Tober, MD, FACEP, has been involved in all aspects of medical direction for Collier County, Fla., would be an understatement. The 30-year veteran, who is medical director for Collier County EMS, has been a driving force in protocol development, in-service curriculum development, and the creation of innovative programs and technologies that have saved thousands of lives over the years. His most recent innovation, a tiered medical care program, has led to return of spontaneous circulation (ROSC) rates that are far above the national average.

Dr. Robert Boyd Tober

History of Achievement

A brief run-down of Tober's accomplishments includes the introduction of a new technology in 2004 to treat both congestive heart failure and acute ischemia in the prehospital environment. He replaced the standard 12-lead ECG with a device known as AUDICOR, which helps paramedics identify subtle heart sounds that in the proper clinical context are highly correlated with acute decompensated heart failure.

In 2005, Tober initiated use of the AutoPulse, which he says is 400 percent more effective than manual compressions and reaches coronary and cerebral blood flows of close to 100 percent of normal. He also implemented the use of the ResQPOD, an impedance threshold device that improves cardiac output during CPR by increasing cardiac preloading.

Tober was not satisfied to rest on his laurels when, in 2005, he adapted the renowned Pit Crew concept to cardiac arrest. He designed the innovative system, whereby each person on an EMS team in the field has a specific task when responding to a patient in cardiac arrest, similar to how a pit crew at a NASCAR event has a specific job, which overall saves time getting the race car back on the track. This organized and choreographed approach to cardiac arrest management allowed Collier County EMS, and all of Collier's first responders, to gain a return of spontaneous circulation in an amazing 53 percent of V-fib/V-tach (VF/VT) cardiac arrests in 2008. The concept is so popular that he has taught the EMS Pit Crew concept to other districts, some as far away as upstate New York.

> **'We all have a niche, and I have tried to simply place the tools in the hands of the people who use those tools the most often. From my standpoint, it's common sense.'**

Medical Pit Stop

Tober has now taken the Pit Crew concept a step farther and developed the "tiered medical care" concept to paramedics in the field.

Concerned that large numbers of paramedics would have insufficient opportunity to use their advanced abilities, leading to a deterioration of vital skills and diagnostic capabilities, Tober instituted advanced paramedic practitioners who self-dispatch to serious calls. They are not confined to geographical zones. Thus, when a patient calls, they're ensured to get an experienced paramedic trained specifically for their needs.

They equipped four out of nine of the county's independent fire districts, studying their utilization over 27 months. "And much to my surprise, I had no idea how little medicine the fire department medics were actually using, and how infrequently they got to make independent medical decisions, prior to the arrival of the EMS paramedics who have a lot more experience and training," Tober says.

So Tober decided to take a smaller group of transport medics who would respond to calls in their areas of expertise. For example, rather than dividing 600 intubations county-wide among 250 medics, the 120 transport medics are more likely to perform all field intubations.

The goal is to get a skilled BLS provider on scene in less than four minutes, with care focusing on the first 10–15 minutes. Next is the goal of having an ALS transport on the scene in less than eight minutes. They transport the medic and the patient, assessing the needs of the patient en route to the hospital.

"When a 9-1-1 call comes down, the call is graded according to its severity; the Alpha and Bravo are pretty minor calls; Charlie, Echo or Delta are pretty severe calls," he says. "For the most part, the system works pretty well. The call may or may not gener-

ate a tiered response, meaning that if it's a very minor call, maybe only EMS will go or maybe only Fire will go. We are still working on the perfect mix of who should go on what type of call."

More experienced paramedics commonly referred to as Medcoms, can also arrive on the scene to provide support care in the worst cases. If a rare procedure, such as a cricothyrotomy, needs to be performed, the Medcoms assist with the procedure and assist the transport medic, who may have only performed the skill in a lab training setting.

"The Medcoms are a subset of about 15 highly experienced medics who have demonstrated a lot of good leadership and patient skills, along with clinical excellence. They travel in rapid response vehicles," Tober says.

Based on Specialty

The entire tiered-medical care approach, founded on evidence-based medicine, has set the standard of care for other EMS systems. However, tiered medical care, while familiar in hospital settings, is still controversial in prehospital settings.

"Every RN in a hospital has the same RN degree, but their skills are vastly different depending on where they work," Tober says. "You have nurses who work in the operating room, nurses who work in cardiac cath, nurses who work in the CCU, the surgical intensive care or the emergency department. They are all very different people with different subsets of skills, but they're all nurses."

Likewise, Tober tries to educate others that a paramedic is not a one-size-fits-all profession. "We all have the same degree, but we're not the same people," he says. "We all have a niche, and I have tried to simply place the tools in the hands of the people who use those tools the most often. From my standpoint, it's common sense."

More studies are supporting the concept that the addition of multiple paramedics on scene is counterproductive and contributes to a decrease in positive patient outcomes. Tober wants to have fewer paramedics on the scene, but he also wants the *right* paramedics on the scene, especially where cardiac arrest is concerned.

"If you look nationwide at cardiac arrest, it's probably only 1 percent of the emergency medical calls. But it's studied intensively as a benchmark of the system functionality because it's so time-dependent," says Tober. "If you don't get to the cardiac arrest patients pretty darn quick, certainly within five to six minutes, they almost all die."

Despite its controversy, the tiered-medical care concept seems to be working. The approach has contributed to Collier County maintaining a ROSC in 49 percent of VF/VT cardiac arrest cases, and 31 percent for all cardiac arrests in 2009. Discharge from the hospital in good neurologic shape has averaged, quarter to quarter, from 20–40 percent of all V-fib cardiac arrests. This is far above the national average of 6–10 percent.

Recognizing the Impact

Tober is justifiably proud of the impact some of his innovations and approaches have had on his community.

"I came from a very busy metropolitan emergency system in St. Louis and moved to this paradise called Naples, Florida, where they didn't even have paramedics riding in ambulances," he says. "I came to basically a frontier to do what I've been trained to do, and I built it from scratch. That's really why I came down here."

Tober has been recognized and supported by many organizations, including the Florida Association of Medical Directors, the American College of Emergency Physicians, the Academic Association of Emergency Physicians, the National Association of EMS Medical Directors, the Florida Department of Health and Collier County Medical Society, which represents more than 500 physicians in his community.

Collier County (Fla.) EMS' tiered-medical care concept has helped it achieve a ROSC in 49 percent of VF/VT cardiac arrest cases, and 31 percent for all cardiac arrests in 2009.

He also works closely with other outstanding organizations, such as the Sarver Heart Center at University of Arizona at Tucson, Richmond EMS and Wake County EMS, to provide quality, evidence-based patient care.

To launch the first ALS ambulance system in 1979, Collier County spent $1.5 million getting the program off the ground. Not surprisingly, Tober's superiors wanted to see results—specifically in lives saved. He got his chance on the second day when a call came in for a 55-year-old cardiologist in cardiac arrest. The system, and the team that Tober helped put in place, saved the cardiologist's life.

"That's why I keep putting up with [some of the aggravations]," Tober says. "I've sort of affixed my little microscopic identity on a dot on the landscape. Given the limitations of human interaction, the system works very well, and it has been very, very successful." ■

Community Outreach

Matt Zavadsky dramatically cut unnecessary 9-1-1 use through a program to deliver proactive care

Every day, EMS providers in communities around the U.S. respond to thousands of 9-1-1 medical calls. Most of these calls are, indeed, emergencies, which require the expertise and aid of paramedics. There are, however, a small percentage of calls made to 9-1-1 by people who could be better served through alternate means of support.

In the community of Fort Worth, Texas, Matt Zavadsky, associate director for operations at MedStar Emergency Medical Services, decided to analyze the problem and see if he could come up with some solutions to lift some of the burden off 9-1-1 dispatch.

He wanted to create a program that would target the top two-dozen users of the MedStar EMS system and find ways to help them outside of calling 9-1-1.

Matt Zavadsky

Diagnosing the Problem

Being response time compliant has been challenging for MedStar, Zavadsky says. "One of the reasons we have trouble meeting those response times is because we are responding to a bunch of calls we shouldn't be going on."

Convinced there had to be a better way, Zavadsky started analyzing data, trying to pinpoint trends.

"We as an EMS industry need to stop responding to calls that we can prevent," he says. "There is a fair amount of our population that we service, and a fair amount of calls that we respond to, that are preventable. They would be unnecessary if the people who we were serving were better medically managed in a more appropriate setting."

Lessening MedStar's burden was important. The regional, high-performance EMS agency provides exclusive emergency and non-emergency ambulance service for the city of Fort Worth and 14 surrounding suburban cities. It covers 421 miles and a population of 860,000, which generates more than 100,000 ambulance service requests every year.

"We have folks in our community who fall into two categories," Zavadsky says. "A lot of people call 9-1-1 because they have no other health care or primary care outlet, and we as an industry have become the primary care provider. Ask any paramedic in EMS today, and they will tell you that half or more of the patients that they respond to really didn't need an ambulance."

'We can either take a $20-an-hour paramedic once or twice to teach someone how to seek his own medical care, or we can keep sending ambulances three or four times a day at $106 an hour.'

Next, Zavadsky identified frequent 9-1-1 callers who had no other social interaction or means of support. "Their health-care issues weren't being managed well at home, or they had social issues that they needed addressed," he says.

As Zavadsky closely scrutinized the patient care reports of some frequent 9-1-1 callers, he realized the need for a program that would deliver the right care to the right person at the right time. "If we know that there are a handful of patients who are frequently using EMS and emergency rooms, let's identify those folks, look at how many times we have responded to them, and what we are responding to them for," he says. "We needed to go and talk to them, and see if we could proactively manage their health care, or teach them a better way to get health care, rather than calling 9-1-1."

Assembling the Team

A team of paramedics was picked to participated in an advanced practice paramedic program, which added an additional eight weeks of training to their existing EMS training.

The program "not only certified them for critical care transport, but gave them the advanced practices that they needed to treat community health patients," Zavadsky says. "They spent clinical rotations with the local mental health agency, which taught them how to do crisis intervention." They were also familiarized with social and medical resources available in the community.

With the team in place, community care plans were developed for the targeted 9-1-1 callers, the majority of whom needed assistance with such things as recurrent hypoglycemia, seizure disorders, and mental health disorders. The goal was to offer short-term aid, which would result, hopefully, in long-term de-

creased EMS utilization.

"We wanted to see if we could get them to stop calling 9-1-1 by bringing them needed resources on a prescheduled or episodic basis," he says.

The program has had an impact. Zavadsky offers a dramatic example of a man who was calling 9-1-1 multiple times a day for more than 20 years. "He was bored and lonely and wanted someone to talk to, and we had no recourse but to take him to the hospital," Zavadsky says. "So we developed a care plan that got someone to visit daily to check his vital signs and make sure he was taking his medication." The paramedic assigned to the patient also went over the myriad community options available. "The guy had no idea there were resources in the community that could get him medical coverage and a primary care physician."

The paramedic also secured bus passes and taught the patient how to ride the bus. "One of our community care paramedics went to his house, walked him to the bus stop, rode on the bus with him to his doctor's appointment, waited in the doctor's office with him, and at the end of the doctor's visit, escorted him back home on the bus, so that he knew how to do that," Zavadsky says.

Return on Investment

Initially, addressing these frequent 9-1-1 callers can be time- and labor-intensive, but Zavadsky believes the initial price in the short term is more than justified in the long term. "We can either take a $20-an-hour paramedic once or twice to teach someone how to seek his own medical care on a proactive basis, or we can keep sending ambulances three or four times a day at $106 an hour," Zavadsky says.

The program is actively managing 11 patients. An additional six patients have graduated from the program, having sufficiently learned how to manage their own medical and psychiatric needs. "We are still monitoring them, and they still have the ability to call us for a home visit, but we don't actively go out and see them every day because they are doing great," Zavadsky says.

To make the program successful, Zavadsky linked area hospitals and other resource agencies. "We've gone to the homeless shelters and taught the staff that if they have a patient who meets the criteria for non-emergency response, they should call us on a non-emergency number and we will send a community health paramedic out to assess the patient," Zavadsky says.

In fact, a large local-area hospital has asked to use the advanced practice paramedic program to follow up with high-risk patients who have been discharged from the hospital after a cardiac procedure. This avoids having the patient bounce back to the emergency department. "We can pay X amount of dollars each time one of these paramedics goes out and sees one of these patients, or we can pay X amount of dollars to the fourth power when that patient comes back to the emergency room seven days later," says Zavadsky.

Managing frequent 9-1-1 callers, identifying areas of low incidence of bystander CPR and arranging for training has broadened MedStar EMS' community impact.

The county mental health authority is also on board. Rather than sending a suspected psych patient directly to the emergency department (ED) and tying up a bed waiting for a psychiatric placement, the advanced practice paramedic can do a preliminary assessment and speed up the placement, sometimes avoiding the ED altogether.

"Our paramedics have spent time in the field with the crisis-intervention folks," Zavadsky says. "We can make a couple of phone calls and ask to either have the mobile crisis team meet us on scene or bring a patient to the [facility] for a psychological evaluation and then bring them right there."

In addition, Zavadsky has worked tirelessly to promote bystander CPR in his community. "We took all of our cardiac arrest calls, and did latitude and longitude plotting on a [Geospatial Information System map] of our service area. We found the clusters where we had a lack of bystander CPR," he says. They're now asking the local community influencers in those areas to arrange for MedStar to provide free CPR training for community members.

"We may find that the biggest influencer in a community is a local church, so we will go to the church and ask them to help us sponsor a free CPR class, so that we can get more people certified in CPR," he says.

Zavadsky is also asking the city council and county commission to host community CPR training programs. "We want to take that cluster of no-bystander CPR and change it to a cluster of high-incidence bystander CPR," he says. "That's how we are going to impact survivability."

With a combination of better managing frequent 9-1-1 callers and training community bystanders in CPR, Zavadsky hopes to impact community health on a wider basis.

"We as a profession need to figure out a way to make our communities healthier," he says. "The patients that we are managing in our community health program have reduced their 9-1-1 use by 57.2 percent. Imagine now that we could do that for the general population."

He adds, "This is going to reduce unnecessary 9-1-1 use exponentially and save the system a ton of money. We're doing it, and it's working well." ■

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INNOVATORS IN EMS

2009










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