EMS1’S 2017 GUIDE TO EMERGING TECHNOLOGIES

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LETTER FROM THE EDITOR

Many of the EMS technologies now in use are adaptations and miniaturizations of devices that were first used in hospitals, such as defibrillators and patient beds. This won’t be the case for the next wave of technology in EMS. There is no end in sight to the capacity and capability of the software and hardware we have in our pockets, on our desktops and built into the devices around our homes.

The future of EMS is in applying widely used consumer technology like touch screens, high-definition video, collision avoidance, live video capture and streaming and cloud-based, secure data storage to improve patient assessment, care and documentation.

This Paramedic Chief Digital Edition, EMS1’s 2017 guide to emerging technologies, features articles on the challenges of and lessons learned from several important innovations:

• Designing and delivering virtual instructor-led training to re-certification students.
• Adoption of high-definition video and portable ultrasound for patient assessment.
• Use of body-worn cameras to improve EMS provider safety and transform documentation.
• Transition from a patient care report to a permanent and individualized electronic health record.
• Opportunities to bring voice-activated consumer technology to EMS patient assessment, care and documentation.

Our advisors and contributors conclude this issue of Paramedic Chief with predictions for the distant technology that will significantly impact EMS in 10 to 20 years. Only time will tell if we see a continuation of the application of consumer technology or something entirely different.

Greg Friese, MS, NRP
Editor-in-Chief, EMS1.com
Virtual EMS education:

GROWING PAINS AND LESSONS LEARNED

Longtime EMS educator shares the lessons he has learned from developing and delivering EMS curricula in a virtual and flipped classroom

By Kelly Grayson

I’ve been an EMS educator for 24 years, and in those 24 years, I’ve developed a pretty effective schtick. I’m good at breaking down complex concepts into easily understood terms. I can switch gears from inspirational to educational to entertaining and back again, all within the same lecture. I can read an audience with the best of them, and adapt my teaching methods on the fly. I can make an audience laugh or cry. I firmly believe that the most effective learning occurs between bouts of laughter.

As I like to say in my lectures, “We’ll reserve you a whole seat, but you’ll only need the edge.”

And very little of that was useful to me in a virtual classroom.

As the EMS Education Coordinator for ACE4EMS, the educational wing of the Louisiana Ambulance Alliance, my job for the past year has been to develop curricula and teaching materials for our initial and continuing EMS education programs. We make extensive use of the internet for virtual, instructor-led training and the flipped classroom model. We utilize a hybrid classroom, a combination of live instruction and self-paced online study. Using the internet allows us to greatly expand our educational footprint, beaming our classes to multiple sites and agencies simultaneously.

In a flipped classroom, students do their classwork at home and their homework in class. Rather than have an instructor impart medical facts in the classroom, and then have the student go home and try to apply those facts in EMS practice, the flipped classroom allows our students to pursue knowledge acquisition at home at their own pace, via their preferred learning methods. In class, we focus on knowledge synthesis and application.

In fact, that’s what we call our live classes: knowledge integration sessions. We do a lot of
team-based and scenario-based learning, rather than “death by PowerPoint.”

And it works ... very well.

Virtual educator growing pains and lessons
But there have been some hiccups along the way; I thought I’d share some of the growing pains, pearls and pitfalls we’ve encountered.

1 Not every student buys in, even among millennials
It takes a disciplined student to do a constant stream of assignments and projects at home, and then come to class prepared to discuss what we’ve learned. Every EMS educator stresses to their students that homework and reading the material beforehand is essential to classroom success. However, we all know that in a traditional classroom students can often get away with taking notes or mindlessly highlighting passages in their textbook while you lecture. It isn’t ideal, but often, it’ll pass.

This does not work in a flipped classroom. If students don’t do their study assignments, they’re going to be utterly lost in the live class. If you use this model as an educator, strict enforcement of assignment deadlines is essential. Weight scoring for self-study assignments reflects their importance.

Even some of the students who are conscientious about doing their assignments aren’t going to like the flipped model. As one student said to me, “It feels like I’m getting cheated. You’re supposed to teach me, and I’m supposed to learn. Here, I’m just teaching myself.”

At the time, he had the highest grade in the class, and he admitted that he scored much better in my hybrid classroom than he ever had in any traditional learning environment. He passed his NREMT psychomotor exam on the first try, and passed his computer exam in 70 questions. But, at heart, he was a passive learner, and just wanted to memorize the information necessary to get the certification required by his employer.

2 You’ll need an entirely different set of skills
When you’re not looking directly at your audience, it’s almost impossible to read the mood of the room. In a live classroom, you can change pace and keep things interactive with students by using a question-and-answer format and later mixing in scenarios.

But in an internet webcast, it’s much harder. Question and answer just leads to long stretches of dead air, and three-quarters of your students are probably furiously Googling the answer instead of thinking.

Instead, use polls and surveys to gauge student comprehension. They’re much more interactive, and there are a number of inexpensive plugins available that you can use in your webcast platform.

I can easily hold a classroom’s attention for an hour or more if I’m talking to them face-to-face. In an internet classroom, it gets boring easily. Keep PowerPoint lectures, if you must do them, to no more than 30 minutes.

You’ll need to make much more extensive use of multimedia in a virtual classroom. Use videos and photos to illustrate your teaching points.

In return, you’ll need more classroom prep. In a live class, I know my material well enough that if you give me 10 minutes to cull the fat from my slide deck and insert a few videos, I can teach on the fly with little planning. This isn’t the case in a virtual classroom. You’ll need every bit of that “three-hour prep for every one hour of lecture” standard, if not more.

3 You’ll have to abandon your old classroom paradigm
But that’s not necessarily a bad thing. In a traditional classroom, having students focused on their tablets, smartphones or laptops is considered rude. In a hybrid class, it’s almost a necessity. We have the sum total of human knowledge available at the click of a mouse, so why not use it?
I have quoted medical studies in class and struggled to remember the exact statistics, and had students pull up the relevant research while I was talking about it. I’ve also had students pull up contradictory studies and challenge me on certain positions. Isn’t that what we want in our students – critical thinkers who do not accept dogma at face value?

Allowing personal data devices in your classroom can tremendously enrich the experience, but you have to remain vigilant. For every critical thinker who is engaged in the discussion, there is a slug who is surfing Amazon or updating his Facebook status while you talk. Some VILT platforms allow the instructor to remotely view a student’s desktop, or even activate his webcam. In live class, patrol the classroom frequently to make sure the students are staying on task, and have a written policy in place on use of electronic devices in the classroom.

Even such mundane policies as attendance are turned upside down in the hybrid or virtual classroom. We’ve all had the adult student who couldn’t get a babysitter on a particular class day or someone who was ill and couldn’t attend class because he was contagious. In a virtual classroom, I’ve had students attend from their living rooms, cars, ambulances and even airplanes while on vacation. One particularly dedicated fellow even attended from his hospital room. Moreover, I record all of my live classes and post the videos on the learning management system. This way, students can go back and review later or make up a class they missed.

4 It need not be expensive

In fact, if you use Google Hangouts and a free online learning management system like My Course Sites, it can even be free. For any virtual classroom, you’ll need to address three needs: deliver content, obtain feedback and evaluate comprehension. There are numerous web conferencing platforms that will allow you to do all three. Higher end webcasting platforms, such as iLinc, have greater functionality, but inexpensive options like Adobe Connect or Blue Jeans Network aren’t exactly drawing on a cave wall with a Mastodon bone.

You’ll need, at minimum, a stable broadband internet connection at each end. Avoid satellite internet; too much latency for interactive discussions and bandwidth restrictions make videos unworkable.
You’ll need a good videoconferencing omnidirectional microphone on your end, and your students logging in remotely will need a decent microphone/speaker headset, both of which can be acquired for under $30. Discourage your students from using their built-in laptop speakers and microphone, because background noise and feedback can become quite distracting.

In a similar vein, ask your students to mute their personal microphones unless they are speaking. Of all the elements of an interactive webcast — audio, video and graphics — audio is by far the most important. Audio quality can make or break a webcast.

If you need to deliver content, but don’t require live interaction, a simple narrated PowerPoint lecture makes an effective computer-based teaching assignment. I use a PowerPoint plugin called iSpring (roughly $900) that integrates testing and quizzes into my PowerPoint lectures, and imports grades to my learning management system. Not only will it grade quizzes, but I can also set it to require a certain amount of time to be spent viewing the slides, or a minimum number of slides to be viewed; there’s no skipping straight to the post-test unless I enable it.

Using the internet can broaden the reach of your classroom and make EMS education a richer, more interactive experience for your students. By avoiding some of my mistakes, I hope that you can utilize distance education to the benefit of your students and the communities you serve.

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He is a frequent EMS conference speaker and contributor to various EMS training texts, and is the author of the popular blog A Day In the Life of an Ambulance Driver. Kelly’s books are available on his author page at Amazon.com. You can follow him on Twitter (@AmboDriver) or Facebook, or email him at kelly.grayson@ems1.com. Kelly is a member of the EMS1 Editorial Advisory Board.
OK Google, deliver a shock:

5 opportunities for voice-activated devices in EMS

Here’s how the technology in Siri, Amazon Echo and Google Home can transform EMS patient assessment, care and documentation

By Greg Friese

“Alexa, start medication cross check,” said Paramedic Hal.

“What medication are you administering?” Alexa asked.

“I am giving Zofran,” Hal replied.

“Are you giving Zofran to treat nausea?” Alexa asked.

“Yes.”

“What dose are you administering?”

“40 milligrams.”

“Hal, stop,” ordered Alexa. “The correct dose of Zofran is 4 milligrams, slow IV push.”
Alexa, in this imagined scenario, wasn’t an actual paramedic but a voice-activated and controlled device built into the tablet of the ambulance. Alexa responded to the activation of a skill – medication administration cross check – to assist a paramedic treating a patient with nausea.

This scenario is not farfetched and is one of many examples of how voice-activated and controlled devices could quickly become a part of EMS patient assessment, care and information exchange.

Consumers have had voice-activated search and device control since the 2011 debut of Siri in iOS 5. In late 2014, Amazon untethered voice control from a smartphone when it introduced a stand-alone, voice-controlled virtual assistant for music streaming, shopping and home automation. The Google Home device builds off Android and Chrome functionality to trigger similar features as Echo and Siri by saying, “OK Google.”

Developers can add the Amazon Voice Services technology, available in a variety of Amazon devices, into other electronic devices such as coffee pots, refrigerators or alarm clocks. Mobile data terminals, cardiac monitors, tablets for ePCR documentation, intravenous infusion pumps and automatic transport ventilators are all candidates for significant upgrades in user interface and usability. A continuing reliance on analog inputs such as keyboards, dials, buttons and switches is out of sync with how we are all regularly interacting with smart devices.

Here are five ways voice-activated virtual partners could become commonplace in EMS.

1. **Access the internet with a question**
   Every EMS provider should know how to find a medication in a drug guidebook, learn about the dangers of a chemical using the Emergency Response Guidebook and search the web to learn about disease conditions. Questions can be answered with a question to a voice-activated device, asked after activating the device with the appropriate “wake” word. These include Alexa, Computer, Echo, Hey Siri or OK Google, which activate the voice-controlled device and prepare it to receive a question or command, such as:
   “OK Google, what is levothyroxine used for?”
   “Hey Siri, look up placard 1203 in the Emergency Response Guidebook.”
   “Alexa, what is hemophilia?”

2. **Apps become skills**
   EMS providers increasingly use smartphone apps to ensure protocol compliance, track medications and interventions during cardiac resuscitation and calculate drug doses and infusion rates. Many of these apps, like the medication administration cross check example, can be converted into skills. Skills on Amazon devices are activated with a voice command and can be used to receive a current weather report, start a timer, set an alarm, receive a news briefing, convert pounds to kilograms or begin a metronome at 100 beats per minute.

3. **Use voice command for devices**
   Voice controls, built into devices already in use by paramedics, could be used to perform automated assessments or interventions like taking blood pressure, printing a lead II EKG strip or ETCO2 waveform or acquiring a 12-lead EKG. It’s easy to imagine asking for a patient status update: “Computer, what are the patient’s vital signs?”
“Computer, what is your 12-lead EKG interpretation?”

“Computer, deliver a shock.”

Voice command could be taken a step further to initiate transmission of a patient report to the hospital, including vital signs and a 12-lead EKG.

4 Launch a checklist

One of the recommendations of high-performance CPR is to use a checklist, including the delivery of interventions or patient assessments at specific time intervals.

“OK Google, start the CPR checklist.”

“Echo, start the ventricular fibrillation algorithm.” Once launched, the checklist could remind providers of interventions and best practices for performing skills such as compressions with messages like, “Remember to push hard, push fast,” or “Do you want me to start a metronome at 100 beats per minute?”

5 Enhance patient comfort

One of the top home uses for an Amazon Echo or Google Home is music streaming. Patients and providers with an internet connection have instant access to Pandora, TuneIn, iHeart Radio and Spotify. Alexa can also be asked to play white noise, rain sounds or nature sounds – all things that might help an anxious patient relax or sleep during a long-distance transport.

Interactive games might help a patient, especially a child, pass the time during an ambulance transport. Launch a game of 20 questions, The Magic Door or state capital trivia to distract a child as you perform assessments, provide care or document exam findings.
This is emerging technology

You may have tried some of the commands or skills mentioned in this article. Or you might have been dictating a list of reasons this won’t work to the voice-activated assistant in your hand or on your desktop. There are certainly some obstacles to adaption and implementation of this emerging technology to EMS.

The patient care compartment always has at least two voices, a provider and a patient, and can often have additional personnel, who might all be speaking at once, making it difficult for an always-listening device to hear its wake word.

Patients, as we well know, are sometimes very vocal. Ambient noise in a living room, on the shop floor at a manufacturing plant or on the side of the road can be high. Adding a provider yelling, “OK Google,” isn’t likely to cut through the ambient noise easily or make the incident less stressful for all involved. Noise from the HVAC system, mechanical ventilator and tires rolling on the road create a constant level of background noise in the ambulance that might be too high for current technology to hear wake words, questions and commands.

Despite these limitations, imagine the possibilities of voice-activated and controlled devices to improve patient assessment and treatment. Share your ideas with me, other EMS colleagues and, most importantly, with EMS product designers and software developers.

Greg Friese, MS, NRP, is Editor-in-Chief of EMS1.com. He is an educator, author, paramedic and marathon runner. Ask questions or submit tip ideas to Greg by emailing him at greg.friese@ems1.com.
Body-worn cameras: 5 key considerations for EMS leaders

Body-worn cameras can provide important support for EMS providers, but it’s important to understand the key issues before implementing a BWC program.

By Doug Wyllie

Body-worn cameras for law enforcement have been a hot topic ever since the officer-involved shooting death of Michael Brown in Ferguson, Missouri, in August 2014. The equipment existed prior to that time, but the adoption rates of body-worn cameras by law enforcement agencies went through the roof following the incident.

What is less well known is that as police adoption of BWCs started, EMTs and paramedics began discussing the probability of BWCs coming to EMS. In fact, BWCs have been part of the conversation – albeit at a lower level and with far less public discourse – for at least the past five years, if not longer.

In the past several months, that conversation has begun heating up, in part because of the increase in violence against EMS providers – attacks by patients, caregivers and bystanders on EMTs and paramedics.

This violence has always existed and it has been largely excused incorrectly with the thinking that a person in an altered mental state – diabetic shock, drunkenness and the like – could not be held responsible for his or her actions. Plus, there were not sufficient ways to document the assault. It was really just the provider’s word against the
patient’s word. Now, with body-worn cameras, documentation of an assault is all but automatic.

BWCs certainly increase the likelihood that assault charges will be taken seriously. But what other issues should EMS leaders consider when thinking about the purchase and use of BWCs? What other benefits might there be? What are some of the potential problems?

Here are five things for paramedic chiefs, EMS leaders and policymakers to consider.

1. **Video supports more accurate reporting and documentation**

   Just as has been the case with law enforcement, EMS providers increasingly accept the fact that bystanders will be recording video of them in the home, on the street and even in the patient care compartment, so there should also be a record that captures the EMS provider’s point of view.

   For EMS, in addition to supplying evidence of an assault this may be a boon for better documentation of patient care. Any omission of care that was provided (or not provided) from the patient care report can cause problems down the road, especially if legal action is taken against the provider.

   At any call there is a lot going on, and remembering everything that happened and including every last detail in a patient care report can be daunting. Recollection after a high-stress, rapidly unfolding event can in fact be quite inaccurate. With BWCs, paramedics and EMTs can review the video and ensure that their reports are accurate and complete.

   “For any responder who responds to a thousand or 10,000 calls in the course of a year, documentation isn’t always good enough to refresh the recollection to be able to answer questions about it,” said David Givot, an EMS defense attorney. “For example, let’s say you go on a hundred chest pains in a couple-
month period of time. It’s not hard to conceive that someone might remember the facts about one patient and assign them to another patient. When you have a video and audio recording of it, there’s no mistaking it – there’s no misremembering.”

Video can be an excellent training tool

If pictures are worth a thousand words, video may be worth millions. While ensuring the appropriate protection around distribution and usage of video (more on that later) video can be added to case review training. Instead of merely having the training officer or the medical director read from the patient care report, EMTs in training can actually see what happened at the call with a video recording.

Video is especially helpful for the high-risk, low-frequency types of calls. Even if a provider works in a busy urban system, he or she can go months or even years between a really sick pediatric call, but maybe your crewmates have a call and you’re able to learn from it by watching what they did.

“Paramedic students study on what’s normal so that when they get out they can readily identify what’s not normal. What’s not normal doesn’t always jump out as being what it is,” Givot said. “If they have video and audio to hear the words that the patients use to describe certain things and to see what the skin color looks like, to see what tripod position looks like, it’s going to be way more valuable than just trying to describe it to 30 different imaginations in the classroom.”

Adding video adds another layer to HIPAA and information security concerns

Because of HIPAA, which governs the electronic transmission of private medical information, patient records are tightly controlled. Every EMS organization has to ensure that they have the right policies in place to protect any type of data from improper release or transmission. This has been the case for years, and most agencies have a good handle, with the assistance of their lawyers, on what can and cannot be shared and with whom. But video adds another dimension to this security issue.

“The biggest problem is implementing and creating a system where the images and the audio are so thoroughly encrypted and protected that they can’t possibly get out,” Givot said. “If that mechanism is not in place, then this really good tool can end up being really dangerous.”

Policies must be in place to account for the protection of all data, and video is just another layer – albeit a layer consisting of many terabytes of data – that must be accounted for and protected.

Policy must be crafted to determine activation of cameras

This is a three-pronged piece of policy: when cameras are to be worn, by whom and what level of discretion providers will have in deciding to not activate them.

Givot said that as long as the images and audio are protected and access is restricted, he believes that there’s more upside to having cameras on at all times.

There have been instances in which EMTs or paramedics have been given the opportunity to wear body armor on the job and elected to only wear it sometimes, like calls on which they think they’re going to need it.

That’s not how body armor works. Body armor – like a firearm or a parachute – is something a police officer or paramedic will need quite suddenly and quite desperately. If that need arises and the safety equipment is not available, there’s a high probability that you’ll never have a need for it again.

BWCs are no different. Once issued, they need to always be on the provider’s body and always recording.

Policy should not allow for one provider to wear a camera while a colleague in the ambulance does
not. That will cause confusion and produce an incomplete record of an incident.

EMS providers also need to be aware of local or state regulations which may govern the need to get consent from a patient or other bystanders when inside a private home or business. Givot described this as an intriguing legal challenge to understand before recording.

“When one is out in public there’s no expectation of privacy, so video recording in public is really not a problem. But when one is communicating with a health care provider, there is an expectation of privacy,” Givot said. “If that exists, then you need to get consent to record. And if that’s the case, do you need to get that consent before turning it on?”

Furthermore, policy must be carefully crafted such that the discretion of the provider to turn off the camera must clear a very high hurdle. The cameras should be on at the outset of every call. Scenarios in which the cameras can or should be shut off, such as when interviewing an underage victim of a sexual assault, need to be clearly articulated in the policy document.

5 Storage of terabytes of video data is costly and complex

In addition to the very important policy issues related to provider discretion, how video files are accessed or transmitted and other concerns related to the purchase of BWCs, data storage has to be high on the agenda for EMS leaders.

When BWCs first came on the market for police, the elephant in the room that nobody talked about was data storage. The public pressure was so high for agencies to “just get it done” and adopt BWCs that some agencies rushed in without adequately considering the cost and complexity of video storage.

EMS leaders should seek to learn from the mistakes of their law enforcement colleagues and have a mature conversation about the ongoing costs of video storage.

Conclusion

Video is inevitable, and EMS leaders should be asking the right questions – and getting the right answers – to make informed decisions as they purchase and deploy body-worn cameras.

Leaders must take into consideration not only the initial purchase cost but also repair and replacement costs and storage costs. There also must be some acknowledgement of training costs and that providers will now have one more device that needs to be charged and ready to use as part of their standard EMS equipment.

Doug Wyllie is editor at large for PoliceOne, providing police training content on a wide range of topics and trends affecting the law enforcement community. Wyllie has authored more than 1,000 articles and tactical tips, and he hosts the Policing Matters podcast. Doug is a member of International Law Enforcement Educators and Trainers Association, an associate member of the California Peace Officers’ Association and a member of the Public Safety Writers Association.

Related:

Are cameras in EMS worth it?

How body-worn cameras improve EMS documentation
A former firefighter/EMT turned medical student describes the functional components, diagnostic uses and roadblocks of using this imaging technology

By Sarah Calams

Women who are or have been pregnant are very familiar with the quick, non-invasive and painless capability of ultrasound.

But what about the EMS provider in the back of a rig with a cardiac arrest patient en route to a hospital?

There are many tools at providers’ disposal when it comes to patient care and assessment, but point-of-care ultrasound can take patient treatment to the next level.

And while some argue that agencies should be paring down equipment placed on ambulances rather than adding diagnostic tools, others couldn’t disagree more.

Jason Bowman, a fourth-year medical student planning a career in emergency medicine and critical care and a member of EMSPOCUS, has a different philosophy and mindset when it comes to using ultrasound in the field.

**Hocus POCUS**

Bowman got his start in medicine as a volunteer firefighter/EMT in 2004. He worked for several different EMS agencies, from county to hospital to fire-based. Eventually, he worked his way up to critical care paramedic and was a medic instructor for a few years. He has been dubbed a “bonafide ultrasound nerd” by his colleagues – a nickname he’s quite proud of.
“Since 2009, I’ve carried an ultrasound machine with me, either in my bag or in my truck,” Bowman said. “I’ll show it off to anyone who will listen.”

Point-of-care ultrasound, the use of ultrasound to answer simple yes/no clinical questions at the patient’s bedside, differs from comprehensive ultrasounds that sonographers perform. Ultrasound, according to Bowman, may be classified as an imaging modality, but it’s not like a photograph or X-ray.

“To do the ultrasound, you have to touch your patient. It’s like having X-ray vision during your physical exam,” he said. “It becomes an extension of your eyes and hands and lets you peer under their skin to see exactly what’s going on. And when you clinch that surprise diagnosis and completely change a patient’s care, there’s nothing else like it.”

Bowman also stated that point-of-care ultrasound is more versatile than 12-lead EKGs and can be performed in roughly the same amount of time.

“We can truly diagnose people in the field – something we can rarely do without imaging,” he said.

Bowman’s philosophy is to make sure to train the providers using point-of-care ultrasound to the max so that when you put an additional piece of equipment on a rig it gets used as often as possible.

Functional components of ultrasound
From the first enormous and hefty ultrasound scanners, circa 1965, to today’s pocket-sized and portable scanners, EMS providers now have more information at their fingertips – literally. Several manufacturers even make portable ultrasound systems that link to smartphones or tablets.

Although systems vary, all ultrasound tools have a screen to display the image and a probe to obtain it. There are multiple types of probes. While there’s some overlap, they’re not completely interchangeable.

“For most uses, I recommend having at least a linear and phased array probe for EMS, but curved arrays are nice to have if you can afford it,” Bowman said.

More basic are the necessary accessories. Ultrasound systems hate air; providers will need gel on hand to keep the probe in fluid contact with the patient.

And new uses for ultrasound keep getting added every year. Ten years ago, lung ultrasound was thought impossible by most. Now, it’s an EMS provider’s most useful exam.

“I think the actual scope of point-of-care ultrasound is far from filled out,” Bowman said. “This tool will only get more useful as time goes on.”

Prehospital uses for ultrasound
The most commonly performed exam, Bowman says, is the FAST exam looking for free fluid in trauma patients. But he said he doesn’t see a lot of utility in performing this type of exam.

“It takes about 500 milliliters of free fluid to leak into your abdomen before you can see it, and people that bleed that much in the 15 minutes it takes an ambulance to get there rarely look stable without ultrasound,” he said.

The same exam can also be used to diagnose a ruptured ectopic pregnancy. And ultrasound can detect pneumothorax, fluid overload, heart failure, sepsis, pulmonary embolism, PEA versus hypotension in cardiac arrest, assist with difficult IVs and even spot a middle cerebral artery stroke.

“We’ve had cardiac arrests that we were able to determine their rhythm without stopping chest compressions,” Bowman said. “We’ve diagnosed massive pleural effusions causing cardiorespiratory failure. And the field has changed significantly since then. There are multiple new exams that are considered mainstream that weren’t even around in 2010.”

There are, however, both benefits and drawbacks of using ultrasound to assess, treat and monitor patients.
Daniel Theodoro, MD, emergency medicine ultrasound section director at Washington University School of Medicine in St. Louis, said providers using point-of-care ultrasound can make a diagnosis of life-threatening emergencies in a matter of seconds.

“Conditions that cause death, if not recognized and treated within minutes, can be promptly addressed with point-of-care ultrasound,” Theodoro said, “for example, peritoneal hemorrhage in cases of trauma and abdominal aortic aneurysms and cardiac tamponade. It even helps in cases of septic shock, since we can quickly assess heart and fluid status and choose the right resuscitation strategy.”

For most, the biggest drawback is the cost. Indisputably, ultrasound isn’t cheap, and the proper training is hard to come by.

“The indications for point-of-care ultrasound haven’t been laid out yet – even for emergency physicians – so designing a ‘one size fits all’ curriculum is currently impossible,” Bowman said.

On the physician side, Theodoro said the biggest hurdle to using point-of-care ultrasound is the educational component.

“It usually takes 15 to 20 years before physicians start implementing advances in their everyday practice,” he said. “So when you run into a seasoned physician who wasn’t exposed to emergency medicine ultrasound training, they sometimes ask out loud why they should learn something new when they’ve been doing just fine without it.”

But while there’s more than one way to solve medical emergencies, Theodoro said he believes that point-of-care ultrasound is the best way.

“Point-of-care ultrasound represents new knowledge that must be absorbed, and that’s a challenge for new and seasoned physicians,” he said. “It can make any doctor the smartest doctor in the room once you know just how powerful of a tool it can be.”

Bowman said his crews often knew more about ultrasound than the ED doctors during patient transfer.

“Fortunately, the doctors tended to still be very receptive, and inviting them to your training classes to get free ultrasound training is a great way to make strong allies in the ER,” he said.

**Real-world example**

One of Bowman’s most surprising cases was a call for abdominal pain in an 18-year-old female. When crews arrived, they found that the woman was 28 weeks pregnant and in active labor.

“It’s rush hour and we are a good 45 minutes from the high-risk OB center and about 15 minutes from the local hospital,” Bowman said. “Anything past 23 weeks is potentially viable. The question in our mind was if this was a preterm labor or a miscarriage.”

Without ultrasound, most providers would have called a helicopter to get the patient to the high-risk center as soon as possible. Fortunately, Bowman’s crew had ultrasound on board. They had learned how to check fetal heart rates with ultrasound, but checking for fetal demise wasn’t part of the training.

“We pulled out the ultrasound, and immediately we could see the heart was not beating,” Bowman said. “A second paramedic performed the exam to confirm and agree – no fetal heartbeat. We called medical control with our findings and were told to treat for pain and take her to the local hospital. This case was a completely unexpected use of ultrasound that drastically changed her care.”

Theodoro’s “patient zero” was a 60-year-old female also complaining of abdominal pain. She was hypotensive, and he thought she was septic from an infection.

“I did a point-of-care ultrasound within five minutes of her arrival and found an 8-centimeter aortic aneurysm,” he said. “I called in our vascular surgeon, showed him our findings, and he said ‘let’s go’ and repaired her.”
What happened next, however, is what made Theodoro a believer in point-of-care ultrasound.

“The surgeon came down, after he had repaired her and saved her life, to give me a high five and said, ‘Thank goodness you did that, because she was starting to rupture just as we began our repair.’ I rarely do things that have that kind of impact. Point-of-care ultrasound gives you that power.”

**Keeping interest high**

Bowman’s mission is proving the powerful and positive impact on patient outcomes.

As a result, he started an ultrasound program at the fire department where he was working, sparked by a research project he needed to complete as part of his bachelor’s degree in emergency health sciences.

Bowman met Dave Spear, an ED doctor and former paramedic who started the first EMS ultrasound program in Odessa, Texas, at an EMS conference. Spear took Bowman under his wing and gave him an old ultrasound machine to use in the field.

Bowman trained his colleagues and got the program up and running, but things started going downhill.

“The chiefs were never really interested in doing ultrasound,” he said. “It sort of became ‘my’ thing and was no longer a ‘department’ thing. A lot of the guys stopped doing ultrasounds once they got the impression that it wasn’t going to stick around.”

Not long after, Bowman left the department to go to medical school. The chiefs had him pack up the machines and send them back.

“We’ve seen a lot of services start doing point-of-care ultrasound and then stop,” he said.

Bowman and Theodoro said the lack of support may have to do with the futility of the FAST exam.

“Nobody likes to do something that they don’t think is changing patient care,” Bowman said.

Theodoro and a small group of physicians trained in emergency medicine meet biweekly to review ultrasounds that were performed in the ED.

“Our group is committed to doing more advanced imaging techniques, such as evaluation of deep venous thrombosis, advanced cardiac imaging to determine cardiac function, lung ultrasound, ocular ultrasound and more,” Theodoro said.

Aware of the roadblocks, both in EMS and in hospitals, Bowman and Theodoro agree that point-of-care ultrasound unifies the concept of medicine and taking care of patients.

“I think any reasonable paramedic will see that what you get out of it is totally worth it,” Bowman said.

Sarah Calams is the associate editor for EMS1, FireRescue1 and Fire Chief.
WHY ELECTRONIC HEALTH RECORDS WILL REPLACE EMS PATIENT CARE REPORTS

Access to patient records through prehospital and hospital EHR integration will help paramedics improve patient outcomes

By Nathan Stanaway

While working for a 911 service, I responded to a morbidly obese patient having respiratory difficulty. We arrived to find a patient in severe respiratory distress with an extremely low SpO2 reading. The patient and her family were poor historians but denied a history of CHF, asthma, COPD or any other chronic pulmonary disease.

We transported the patient emergently to the local hospital without much improvement to her condition despite CPAP, high-flow oxygen by nasal cannula and other interventions. Later in the shift I checked in on the patient, who was in less distress but still had a rather low SpO2 saturation.

I spoke with the attending physician, who was able to pull up the patient’s history and learn that she had significant atelectasis from a chronic condition. The patient normally had a low SpO2 saturation and frequently presented in severe respiratory distress, but had yet to require intubation or other invasive interventions.

The respiratory therapist and the physician attending the patient were initially very concerned about the patient’s condition, but were able to quickly gain perspective by referencing the patient’s electronic health record. As a paramedic, I didn’t have this opportunity to understand the patient’s condition or use it to inform my care.

Emerging technology to overcome information isolation

Perhaps one of the largest barriers to population health, especially care of chronic diseases, in the United States is the communication failure between health care providers in the hospital and health care providers outside the hospital. Every day EMS providers assess and treat tens of thousands of patients without the benefit of previously captured patient history and records of treatment provided.

Fortunately, emerging technology for patient care documentation is making the days of information isolation in the ambulance patient care compartment or the patient’s home obsolete. Making patient health records from multiple
specialties available to all health care providers should be a priority for health care managers.

The issue of information sharing hasn’t escaped the scrutiny of Centers for Medicare and Medicaid Services. Currently in the pilot phase, Bundled Payments for Care Improvement initiatives are designed to encourage a medical home and tear down the communication silos that inhibit a well-executed care plan. Instead of paying for procedures, health care organizations receive a bundled payment based on the patient’s condition. This model shifts incentives away from doing things to patients and toward keeping patients healthy.

**Legacy PCR software**
Currently, many services force their EMTs and paramedics to operate in an information vacuum devoid of any outside health data. Legacy single encounter-focused patient care reporting software does not allow EMS providers access to any patient information beyond what they are able to glean from their own assessment.

Traditional single encounter-focused reporting systems typically focus on the data required for reporting to the government and to billing companies. This approach does not typically allow for information sharing and clinical improvement efforts.

**Electronic Health Records in EMS**
In 2012 the Centers for Medicare and Medicaid Services defined an electronic health record as an electronic version of a patient’s medical history maintained over time that “has the ability to support other care-related activities directly or indirectly through various interfaces, including evidence-based decision support, quality management, and outcomes reporting [1].” (Electronic Health Records, 2012)

Most paramedics can recount a time when their patient had non-specific 12-lead EKG changes. Deciding if there are any new ST changes on the 12-lead is impossible if the paramedic is unable to compare the current EKG to past EKGs.

In another common scenario, EMS providers are unable to obtain any medical history from an unconscious patient. If the EMT can find identifying information and the EMS organization has access to the patient’s electronic health record, the patient’s complete medical history is obtainable in seconds. The unconscious seizure patient is suddenly less ominous with the knowledge of the patient’s history of epilepsy.

As EMS moves from an emergency response-focused mindset toward a more preventative and proactive approach, the EHR becomes more critical. For example, the community paramedicine revolution has improved patient health and reduced 911 call volumes through repeat visits with frequent EMS users. Successful programs rely on information sharing and communication between all of the patient’s care providers.

Paramedics depend on current and timely data to achieve the best clinical results. Just like the AHA’s emphasis on interlocking links in a chain, patients fare best when their health care is a group effort. Several EHR vendors believe integration with hospital providers is the future
of EMS documentation and these companies are constantly evolving to meet these goals.

**HealthCall** takes a proactive approach to care plan coordination by integrating in-hospital and out-of-hospital digital information.

“The importance of timely communication escalates for paramedics within community paramedicine programs,” said HealthCall President and CEO Dan Hayes. “Analogous to a HIPAA-compliant social network, paramedics can quickly and securely create patient-specific care teams. Providers within a care team receive patient encounter reports, for example, in real time without extra effort from the paramedic.”

An informal social media poll found widespread support for **ESO**. The software facilitates bi-directional information sharing so that paramedics have access to not only the health records from previous EMS encounters, but also the health records from in-hospital patient encounters.

Hurschell Mathews, director of emergency transport services for **Greenville Health System**, is working with ESO to include the ability to populate patient information based on CAD information. Imagine being able to review patient history and previous encounter information before you even arrive at the patient’s side. It’s smart, revolutionary and coming soon.

Some larger EMS companies have developed their own proprietary in-house charting systems, but these options do not typically integrate with the hospitals, which limits their effectiveness. The 2012 CMS definition of an electronic health record makes it hard to argue that these non-integrated software options truly meet the definition of an EHR.

**Barriers to EHR implementation**

If paramedics are to successfully move away from a fee-for-service transport model, it will be critical for us to have access to extensive patient medical records. Surviving on the data gleaned from a single call is no longer adequate. We owe it to our patients to use the technology available and rise above this level of care.

For all the EHR companies, the largest hurdle continues to be the reluctance on the part of health care systems to allow access to their patient data. This hesitation will decline as hospital administrators realize the vital role EMS can and does play in their patients’ health.

**Training is the gateway to EHR success**

Any time an emerging technology is introduced, managers should anticipate growing pains. To reduce the pain, managers must put a heavy emphasis on training.

Organizations that fail to adequately train their employees on a new software system will invariably
experience a great deal more implementation pain. Employees get frustrated, erroneous data pollutes system metrics, managers incorrectly adjust system settings and patients experience a lower level of care. Many software design complaints can be traced back to user error when a setting is changed by a well-meaning manager.

In 2016, the NAEMT conducted its National Survey on EMS ePCR Usability. The survey found that the level of training for EMS providers predicted who found the software usable. EMS providers who received no training rated the software 3.7 out of 7. EMS providers who received interactive training rated the software consistently higher at 4.66 out of 7. It is critical that EMS organizations and EHR vendors work together to provide adequate training.

High-performing EHR vendors are aware that paramedics and EMTs will quickly become frustrated with their product, so they provide training to their customers prior to an organization implementing the software. If you are considering a vendor that does not provide training as part of your purchase, be very cautious. You may be setting your organization up for failure.

The next phase, the transition from ePCR to EHR, will take a similar level of vision and dedication to success. It will require that EHR vendors listen to and engage EMS providers, managers, visionaries, health information management professionals and regulatory agencies to ultimately achieve success. We will all enjoy the improvements, but ultimately our patients will see the greatest benefit from the well-informed and well-connected EMS providers arriving at their sides.

Works cited

Works referenced


EMS IN 2030:
WHAT TECHNOLOGIES WILL BE WIDELY AVAILABLE?

EMS1 contributors and editorial advisory board members predict the future technologies that will transform patient assessment, care and transport.
We asked Paramedic Chief contributors and EMS1 advisory board members to imagine the future technologies that will widely impact prehospital care in the next 20 years. Their responses predict improved patient care and safer working conditions as our use of technology changes.

As you read their predictions, consider the specific impacts of distant technologies on EMS providers, leaders and patients. Share your predictions with editor@ems1.com or Paramedic Chief on LinkedIn.

**Field labs and imaging**

One of the top suggestions was increasing the availability of point-of-care labs and portable imaging to all prehospital providers.

**David K. Tan, MD:** Field lactate monitors and biomarkers for stroke, STEMI and sepsis will become widespread. I think biomarkers, like finger stick glucose checks, to identify acute stroke from mimics as well as myocardial infarction will revolutionize transport destination decisions and increase lead time for receiving facilities.

**Art Hsieh:** Portable labs will become less expensive, easier to use and more accurate for field use. If those labs are meaningful to field medicine, I foresee a greater gatekeeping role for EMS providers in terms of destination decisions.

**Ryan Greenberg:** Rapid testing equipment will allow EMS professionals to run more field tests, including rapid blood work and other patient assessments.

**Catherine R. Counts:** I expect a large increase in the number of companies that provide applications for streamlining the process to definitive care for more serious conditions, namely stroke and STEMI. It wouldn’t surprise me if integrating mobile technology into the care cascade becomes an accreditation requirement for stroke and STEMI centers.

**Dave Konig:** I believe augmented reality will have the biggest impact on EMS by allowing advanced diagnostics to occur in the field, increasing data flow between the provider on scene and the command or control center, ultimately bringing many hospital-based assessments to the patient.

**Ann Marie Farina:** We’ll see tech continue to shrink, but I’m not sure if it will progress to the point where a Star Trek tricorder-like device is FDA approved, cost-effective and better than using the latest version of a cardiac monitor.

**Smart, driverless ambulances won’t be in collisions**

Driverless personal vehicles are already being tested in the United States. Collision avoidance technology is built into new vehicles and smart vehicle features are likely to become part of the electronics built into new ambulances.

**Ryan Greenberg:** Imagine the benefits of a driverless ambulance on patient care if two providers can focus on the patient. A driverless ambulance could give EMS providers additional down time while not on assignment, allow providers to review protocols on the way to call or let one provider rest during super-rural, long-distance transports.

**Ann Marie Farina:** Even if self-driving ambulances become a reality, I don’t think that means we will drop below two-person crews because one person just isn’t practical in most cases.

**Doug Wolfberg:** Vehicle-to-vehicle technologies will allow for smarter and safer traffic management for emergency vehicles. V2V will transmit advance warning messages directly to the displays of private vehicles of approaching or overtaking emergency vehicles. When V2V is coupled with existing vehicle-to-infrastructure technology, such as red light pre-emption, it will afford a safer alternative to red lights and siren responses.

**Tim Nowak:** Motorists will receive notification of responding, emergent vehicles via their car radio’s FM broadcast. This may also include “Emergency scene ahead, be prepared to stop” notifications, along with “Alert, approaching emergency response vehicle, be prepared to pull over.”
Nancy Magee: Smart ambulances will have an auto-pilot feature to correct driving errors and avoid hazards. There would probably be no need for sirens and little need for lights other than as an identifier. I would not want time savings from automation to be used to get back in service faster, but to allow time for the provider to eat, use bathroom facilities or call home before redeployment.

EMS providers won’t lift patients
Lifting and moving patients are top causes of on-the-job injury for EMS providers. Eliminating the need to manually lift a patient is an opportunity to reduce operating costs and improve wellness.

Rom Duckworth: Within 10 to 20 years, military advances in the research and design of exo-suits, which are wearable machines for increased strength and endurance, will translate directly into uses for emergency responders. Exo-suits reduce the wear, tear and fatigue of long hours of heavy physical work and boost lifting and moving performance.

Ryan Greenberg: The use of technology will allow an EMS crew to work a “No Lift Shift” — an entire shift without lifting a single patient.

Dave Konig: We will see self-automation becoming integrated within EMS in self-driving ambulances and self-propelled stretchers that will maneuver themselves in a heeled fashion to the provider.

Voice activation
Ann Marie Farina: Voice-activated tech could be integrated into current devices. Being able to say “ZOLL, mark event” or “LIFEPAK, start print” could be helpful in reducing equipment contamination and preventing people from standing up when they should be seat-belted.

Kelly Grayson: Why don’t cardiac monitors have Bluetooth and voice-activated event recordings?

I can train my smartphone to recognize my voice, type text and carry out simple commands with Siri and Apple CarPlay.

If I can drive down the road and, without picking up my phone, say, “Hey, Siri, plot me a route to Dallas,” and the route immediately comes up on my dash display, why can’t I say, “Hey, LIFEPAK, record a history note?”

Intelligent 911
Activation of EMS is expected to improve from a 911 call to application of communications technology and machine learning.

Art Hsieh: Intelligent 911 will combine data streams so that when someone activates an unscheduled request for assistance, information from the patient’s electronic health record, call location data, routing to the incident and live connectivity between the responder and patient will provide better triage capabilities and more anticipatory care plans.

Tim Nowak: A touchtone dispatch or app-driven 911 software will give callers the ability to dial-in their complaint/request without even talking to a dispatcher, and the app will request the best resource in as little as five to 10 caller selections.

Distant clinical partners
Telemedicine is already showing promising application for assisting in stroke patient assessment and transport destination decision-making. Two-way video communication and near-real time exchange of monitoring data will allow telemedicine to broaden its utility to more patient presentations.

Nancy Magee: A reliable wide-scale communication system with the ability to transmit information on every patient transported and with a physician or paramedic available by telemedicine at all times is a priority.

Ryan Greenberg: A distant paramedic or other clinician, linked to EMS crews in the field, will
provide an additional ALS evaluation on complex medical calls. In rural areas, linking a distant paramedic with an on scene EMT will allow for use of expanded protocols. A distant paramedic could also add a mental health professional with video conferencing to assessments of patients with behavioral emergencies.

Tim Nowak: EMS-to-ED communications will enable face-to-face videoconference with a smartphone or tablet on any 911 response, interfacility transfer or community paramedicine encounter.

Catherine R. Counts: A handful of the community paramedicine programs are pushing the envelope of telehealth, in which the EMS agency acts as a conduit to definitive sources of care without the need to physically move the patient from their environment. In many cases patients don’t need to go to the hospital in that moment, but they do need to be evaluated and receive instructions.

Ann Marie Farina: I wonder how much of the EMS tech will be technology that replaces EMS.

How long will it be before an in-home medical kiosk can assess vitals, do an EKG, draw blood and take X-rays, all run remotely with two-way video to a doctor or a nurse behind a desk? Add that in with self-driving cars and we’d be about 90 percent redundant.

Dave Konig: Patients will no longer be taken to the hospital, even for what today would be considered complex issues. Home care management via telemedicine will become normalized and preferred, largely due to its cost-effectiveness.

Connecting patients to technology

We are hopefully a long time away from removing humans from patient care. Effectively applying technology and inputting information almost always requires the emotional intelligence of a caregiver.

Nathan Stanaway: When considering machine learning, I believe the larger role health care providers will play is to facilitate information
exchange between patients and software. I think a not-insignificant role for EMS providers will be the emotional connection and help that humans will provide beyond the capability of software.

**Nancy Magee:** EMS is a people care profession. New technology should be used as an adjunct to enhance the capabilities of an educated, compassionate human being. The focus needs to be on what needs to be done for the patient, not what can be done to the patient.

**How distant technology becomes actual EMS tech**

Some of the impacts of technology are specific, while others will require fundamental shifts in the profession and in the expectations of the public.

**Ann Marie Farina:** I’m not sure some of our predictions count as distant tech, since it could probably be accomplished in the next couple years with the technology already in our smartphones and in devices like Amazon’s Echo.

**Art Hsieh:** For EMS providers, more education and training are needed. For EMS leaders, creating policies and procedures that protect both providers and agencies, while proving the value of such services for reimbursement is the priority. For patients, new technology means better care, lower cost and better outcomes.

**Dave Konig:** Providers will have an expanded range of care they are able to provide, while simultaneously their educational requirements will drop. Augmented reality ambulances will give step-by-step instructions, requiring only rudimentary knowledge by the technician. This will place EMS of tomorrow in a similar workforce category as the fast-food industry worker of today.

**Ryan Greenberg:** Increased safety with the use of technology that allows for greater career longevity and greater patient outcomes from integration of providers who are experts with specific medical conditions will yield improved patient outcomes and patients getting the right care, at the right time, in the right place.

**Catherine R. Counts:** I expect that as the technology within the prehospital setting increases, the integration between the care provided by EMS personnel and those in brick-and-mortar facilities will also increase.

**Nancy Magee:** EMS needs to be careful about the public thinking that humans are replaceable. Artificial intelligence is no substitute for emotional intelligence.
About the Contributors

Catherine R. Counts is a health services researcher completing her doctorate at Tulane University School of Public Health and Tropical Medicine.

Rom Duckworth has more than 25 years of experience working in fire departments, hospital health care systems, and public and private emergency services.

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Tim Nowak is a paramedic and founder of Emergency Medical Solutions LLC. He has worked in fire-based, municipal-based and private nonprofit EMS systems.

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Nathan Stanaway, BS, NRP, has experience in a variety of health care organizations. Nathan’s passions are improving EMS through education, marketing and leadership.

Doug Wolfberg is a founding partner of Page, Wolfberg & Wirth and one of the best-known EMS attorneys and consultants in the United States.
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FEATURED E-BOOK

Paramedic Chief Digital Edition: Trends in EMS Education and Training
This issue of Paramedic Chief focuses on the latest trends in EMS training, from social media platforms to online techniques.

In this edition, we explore how to find and evaluate free medical information on social media. We also share examples of how educators are incorporating technology into their EMS training programs.

Read about this and more inside.

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