Establishing an Emergency Cardiovascular Care Program

**The Improvement**

People who suffer SCA (sudden cardiac arrest) on Hilton Head Island have a 66 percent (Utstein) survival rate today, thanks to a partnership of the island’s Fire & Rescue and Hilton Head Hospital. It hasn’t always been that way. Until three years ago, cardiac arrest survival to hospital discharge wasn’t tracked here, and despite good intentions, EMS crews did not always provide care based on clinically proven best practices.

“It’s one thing to be a talented EMT or paramedic, but the reality for acute STEMI and SCA is that it takes a system to save a patient’s life,” says Captain Tom Bouthillet, a paramedic with Hilton Head Island Fire & Rescue who helps lead efforts to improve SCA survival on this barrier island off the southern tip of South Carolina.

The career Fire/EMS department has 46 paramedics and 108 firefighter/EMTs. The eight front-line ALS ambulances and eight engines operate out of seven fire stations, answering 4,000 EMS calls each year. Being the only hospital on the island, Hilton Head Hospital provides advanced cardiovascular services, including cardiac catheterization and open-heart surgery. Home to 38,000 people year-round, Hilton Head Island’s summertime population swells to 275,000. Some 2.4 million people visit annually, taking advantage of its 13 miles of beaches.

Whereas cardiac arrest calls once provoked some anxiety among crews, “Now we know the patient has at least an even-money shot at surviving to be reunited with their family,” says Bouthillet, a paramedic for 17 years. “That totally changes how we approach resuscitation. It’s been a huge paradigm shift. We expect to save that patient’s life.”

**Foundations of Care**

That change came about, Bouthillet says, by “taking ownership of the chain of survival with methodical steps to improve our survival rate.”

To build such a system took:

1. Committing the agency to save more lives, with backing from top management.
2. Beefing up response to suspected SCA.
3. Adopting protocols based on clinical evidence and taking a “pit-crew” approach to CPR, therapeutic hypothermia and early identification of STEMI.
4. Collaborating across the chain of survival, from community bystanders to hospital teams.
5. Capturing and monitoring performance data system-wide.
6. Creating a feedback loop to identify training needs and improve performance.

**The Implementation**

**Making a commitment with backing from management**

It all started with recognizing a problem and committing to solving the issues.

Like many in the EMS community, Bouthillet was troubled by the huge disparity in cardiac arrest survival from community to community, as brought to light when USA Today published “Six minutes to live or die” in 2005.

Applying national CA survival averages of roughly 5%, Bouthillet figured his EMS division likely saved a single cardiac arrest victim each year. Boosting survival to 35%, he estimated, would save an additional six lives annually—150 people over a firefighter’s 25-year career.

“Someone has to be responsible to be the custodian of the chain of survival in any community. If not EMS, then who is going to do it?” asks Bouthillet. “You have to have top management make it an **explicit goal** to improve survival from cardiac arrest. It becomes a centerpiece of your strategic plan. If you don’t start there, it’s going to be very difficult to achieve the kind of results we’ve achieved.”

To improve EMS response to cardiac arrest—and save more lives—required measuring current performance and survival rates. In 2010 HHI Fire & Rescue joined the Cardiac Arrest Registry to Enhance Survival (CARES). The tracking tool, developed by the Centers for Disease Control & Prevention and Emory University, links EMS performance measures with patient outcome data so communities can benchmark and improve their response to cardiac arrest.

“It was a little scary when we first joined the CARES registry,” admits Bouthillet, who is Fire & Rescue’s STEMI and CARES site coordinator. “It takes a lot of courage because you don’t know what the data will show. It was a real commitment to transparency.”

With backing from top management, EMS took a hard look at their existing practices and recognized they needed to change on-scene treatment by:

- Dispatching more personnel to suspected cardiac calls including:
  1. A battalion chief
  2. An ambulance
  3. Two engine companies to work the scene
- Sending a supervisor to make sure benchmarks are met on every resuscitation attempt.
- Taking a pit crew approach, with command control established, similar to fire response, to eliminate confusion or ambiguity in roles and responsibilities.
Best Practice: Establishing an Emergency Cardiovascular Care Program

- Focusing on actions proven to affect survival:
  1. Quality CPR
  2. Early defibrillation
  3. Therapeutic hypothermia
  4. Downplaying less-proven therapies like tracheal intubation and IV drugs

Pit crew approach to cardiac arrest calls
Their highly choreographed “pit crew” concept minimizes confusion and systematizes the resuscitation attempt so that everyone has a job and everyone is on the same page, Bouthillet explains.

“We would never fight a fire without someone owning the scene and taking formal command,” he says. “Whoever is in charge of the resuscitation says ‘I have code command.’ They have to own the resuscitation.”

Protocols performed on the scene reflect principles of the 2010 AHA Emergency Cardiac Care guidelines:

- Minimizing interruptions to chest compressions
- Providing controlled ventilations
- Shocking on a two-minute cycle
- Minimizing the interval between stopping compressions and shocking
- Using real-time ETCO2 waveform capnography and trending to monitor the quality of chest compressions and help identify Return of Spontaneous Circulation (ROSC)
- Staying on-scene to attain ROSC rather than prematurely rushing patients to the hospital

“We know CPR quality in the back of a moving ambulance is poor and that high quality CPR is critical to saving the patient’s life after suffering cardiac arrest,” he says. “If the patient fails to get ROSC at the scene, all our data shows the odds of survival are very slim.”

Because approximately 10 percent of patients with ROSC re-arrest on the way to the hospital, HHI Fire & Rescue is evaluating a LUCAS® Chest Compression System that is applied to the patient before and during transport to the hospital. If the patient re-arrests, quality mechanical chest compression could be started with the push of a button, without requiring either stopping or having crews do manual chest compressions in a moving vehicle.

Post-resuscitation care
For patients with ROSC, crews focus on:

- Early identification of acute STEMI
- Therapeutic hypothermia for ROSC patients who are persistently comatose

The body-cooling process begins in the ambulance when the patient is given an intravenous cold saline solution and has ice packs placed around the groin, neck and in the armpits. At the hospital, patients are cooled for 24 hours, then slowly re-warmed with the aim of restoring their neurological functioning.

Because such tight coordination is needed between EMS and hospital teams for therapeutic cooling, a Code ICE is called from the field to alert the hospital, similar to a STEMI code that activates the cath lab.

Reality-based training
To support the highly choreographed cardiac arrest response, HHI Fire & Rescue completely revamped EMS training so everyone attending a resuscitation understands roles, responsibilities and protocols. “It meant changing years of doing things we didn’t know were potentially bad for the patient,” he says.

“At the scene of a cardiac emergency, your training takes over—whether that was good or bad training. That’s why we make them do it until it’s perfect,” says Bouthillet.

EMTs and paramedics train together because that’s how they respond to calls. Fire & Rescue runs “high-fidelity simulations,” with clothes on the manikins and crews carrying in the same equipment they’d carry to a typical call. EMTs and paramedics aren’t just taught WHAT to do. They practice HOW to do it. “It’s very system specific,” Bouthillet explains. “In our system very likely two will arrive first, followed by two or three, and so on. We build a modular process that’s scalable. As more rescuers arrive at the scene they know exactly what to do.”

Increasingly HHI uses checklists (see Fig. 1-3) to help responders be sure everything is covered, similar to a flight-crew checklist that must be completed before take-off. A separate checklist is used for post-ROSC treatment.

Partnering across the chain of survival
The best EMS care in the world can’t save lives unless all links in the chain of survival are strong.

Over the years, Fire & Rescue has built strong partnerships with Hilton Head Hospital to streamline patient care and ensure that the patient has the best possible odds of survival. For more than five years EMS and HH Hospital have used Code STEMI to speed treatment for MI patients identified with ST-segment elevation. This coordination extends to multidisciplinary teams at the hospital that include nurses, emergency physicians, cardiologists and critical care intensivists.

“Our success with Code STEMI helped forge our relationship with Hilton Head Hospital and became a template for Code ICE,” says Bouthillet. In 2011 the hospital and Fire & Rescue jointly launched the Code ICE Program for seamless transitions from the field to the ED and then either the Cardiac Cath Lab or Intensive Care Unit.

A multi-disciplinary STEMI and Therapeutic Hypothermia Steering Committee gives stakeholders from both EMS and the hospital a

CARDBIC ARREST CHECKLISTS

Advanced airway management or drug therapy should not significantly delay chest compressions or defibrillation.

<table>
<thead>
<tr>
<th>Complete</th>
<th>Cardiac Arrest should be worked on scene</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Someone is in charge (the “Code Commander”) Lead the scene management.</td>
</tr>
<tr>
<td></td>
<td>Minimally interrupted chest compressions (rate &amp; depth)</td>
</tr>
<tr>
<td></td>
<td>Oxygen and capnography circuit hooked up to BVM</td>
</tr>
<tr>
<td></td>
<td>Ventilations are controlled (30:2 or every 6-8 sec. w/advanced airway in place)</td>
</tr>
<tr>
<td></td>
<td>Shocking in a 2 minute cycle as appropriate (VF or VT)</td>
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<td></td>
<td>Minimizing peri-shock pause (interval between stopping compressions and shocking)</td>
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<tr>
<td></td>
<td>Immediate post-shock compressions (allow rise in capnography to identify ROSC)</td>
</tr>
</tbody>
</table>

Figure 1: Resuscitation Management Checklist
No urgent need to move the patient until after post-resuscitation is complete.

<table>
<thead>
<tr>
<th>Complete</th>
<th>Cardiac Arrest should be worked on scene</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Attached pulse oximetry</td>
</tr>
<tr>
<td></td>
<td>Full set of vital signs</td>
</tr>
<tr>
<td></td>
<td>12-lead ECG (Capture &amp; Transmit)</td>
</tr>
<tr>
<td></td>
<td>Announce Code STEMI and/or Code ICE</td>
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<tr>
<td></td>
<td>Obtain baseline temp (at least 94 F)</td>
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<tr>
<td></td>
<td>IV or IO access</td>
</tr>
<tr>
<td></td>
<td>Iced saline and external cooling</td>
</tr>
<tr>
<td></td>
<td>When possible obtain: age, name and cardiologist</td>
</tr>
<tr>
<td></td>
<td>Attached pulse oximetry</td>
</tr>
<tr>
<td></td>
<td>Full set of vital signs</td>
</tr>
</tbody>
</table>

Figure 2: Post Resuscitation Care Checklist

Other Duties to complete at the scene.

<table>
<thead>
<tr>
<th>Complete</th>
<th>Cardiac Arrest should be worked on scene</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Act as family liaison (emotional support, ride to hospital, securing property, scene clean-up)</td>
</tr>
<tr>
<td></td>
<td>Collect names and contact info of bystanders who rendered aid (CPR/AED, other)</td>
</tr>
</tbody>
</table>

Figure 3: Scene Management Checklist

Forum to address concerns, share data and identify opportunities for improvement. During one such meeting, cardiologists on the committee made the decision that ROSC patients with STEMI should go directly to the Cath Lab, as do STEMI patients who have not arrested.

Bringing EMS and hospital teams together “gets everyone on the same page and builds trust,” says Bouthillet. The shared forum helps each side see the other’s perspective and the pressures they face. “In the beginning, most of them didn’t know the difference between an EMT and a paramedic,” he notes. In turn, EMS didn’t understand the reason for certain hospital protocols. “These relationships we’ve built over time have been extremely helpful.”

Partnering with the community is also essential to improving survival, says Bouthillet. The department encourages businesses and other community organizations to buy automated external defibrillators and keeps a registry so AEDs can be quickly located when needed.

Feedback loops and Quality Improvement

HHI takes multiple approaches to quality assurance:

- Having a battalion chief on scene at every suspected cardiac arrest.
- Conducting QI on 100% of dispatch for cardiac arrest.
- Analyzing code data from LIFEPAK defibrillators and issuing “CPR report cards” (see Fig. 4) to responding crews.
- Participating in the CARES registry, which consolidates performance measures from EMS and hospital teams with patient outcomes.

HHI Fire & Rescue monitors responders’ performance by downloading code data from defibrillators into CODE-STAT™ Data Review Software with Advanced CPR Analytics. The software shows how successful responders are at minimizing interruptions to chest compressions and shocking on a 2-minute cycle. Crews are given feedback in a non-punitive way and encouraged to discuss the call with each other.

“We vowed from the beginning that feedback would be non-punitive. We try to catch our guys doing something right,” Bouthillet says. “You can’t be a culture of learning if people think they’ll get in trouble for making mistakes.”

Data review often prompts revisions to training. “If you’re giving the same feedback to more than one crew, it likely reflects a system weakness,” Bouthillet says. “If you peel back the layers to see why mistakes happened, it helps you understand your operation in ways you didn’t understand before.”

Parting words

“You achieve excellence one step at a time, so the best thing you can strive for is a culture of continuous improvement,” says Bouthillet. “The most important thing coming out of this is a culture of excellence and the expectation of saving people.”
Best Practice: Establishing an Emergency Cardiovascular Care Program

Keys to Success

- Getting commitment throughout the organization to save more lives, from management on down.
- Taking a system-wide approach based on a culture of learning, not blame.
- Strengthening the entire chain of survival, from community to EMS to hospital.
- Using a pit-crew approach on the scene.
- Honing evidence-based best practices with reality-based training.
- Monitoring performance and giving non-punitive feedback for quality improvement.

The Tools

**LIFEPAK® 12 monitors/defibrillators**—which can capture and transmit 12-lead ECGs, are carried by Hilton Head Island Fire & Rescue ambulances. In paddles mode, the devices automatically capture continuous ECG waveforms and impedance data showing chest compressions and ventilations. Its capnography monitoring gives real-time feedback on chest compressions and ROSC. The code data can be sent from the LIFEPAK device through the LIFENET System using a gateway device (broadband modem, wireless gateway, etc.).

**LIFEPAK 1000 defibrillators**—are carried by engines and the AEDs are being installed in all command vehicles.

**LIFENET® System**—Physio-Control’s web-based data network, automatically sends alerts to team members and routes data (from LIFEPAK defibrillator/monitors and other sources) to the appropriate CODE-STAT database.

**CODE-STAT™ Data Review Software with Advanced CPR Analytics**—receives the data from the LIFENET System, allowing for quality review of the code data and “CPR report cards” for responding crews that include CPR fraction times and compressions per minute, along with other analytics. The software generates a succinct report of a cardiac arrest call, with chest compressions superimposed onto the patient’s continuous ECG report. The software can also provide summary reports for specific time periods (i.e. monthly or yearly) to quickly identify statistics for a given period.

**LUCAS® Chest Compression System**—under evaluation by HHI Fire & Rescue—is designed to help improve outcomes of sudden cardiac arrest victims and improve operations for medical responders. Performing at least 100 compressions per minute with a depth of 2 inches, LUCAS can be deployed quickly with minimal interruption to patient care.

Hilton Head Island Fire & Rescue provides fire suppression and EMS services to residents and visitors of this barrier island in the Atlantic Ocean off the very southern tip of South Carolina. Home to 38,000 people year-round, Hilton Head Island’s summertime population swells to 275,000, with an additional 2.4 million visitors annually. The career Fire/EMS department has 46 paramedics and 108 firefighter/EMTs. Its eight front-line ALS ambulances and eight engines operate out of seven fire stations, responding to 4,000 EMS calls each year. The island’s only hospital—Hilton Head Hospital—provides advanced cardiovascular services, including cardiac catheterization and open-heart surgery.

For further information, please contact Physio-Control at 800.442.1142 (U.S.), 800.895.5896 (Canada) or visit our website at www.physio-control.com