Best Practice

Improving Hands-on Compression Ratio

The Situation

In May 2009, Redmond Medic One learned that their service had a recorded compression hands-on ratio of 66%—the lowest in the entire county. Although their service performs more CPR on cardiac arrest calls than the national average for EMS responders, Redmond Medic One knew they had to improve. They were acutely aware of research showing that increasing the time spent on chest compressions and minimizing interruptions can lead to increased resuscitation.[1-6] The Redmond team went to work on a performance improvement plan.

Six months later, their hands-on time was 83%—the highest in the county. The improvement lasted—their hands-on compression ratio measured 80% or better for all of 2010. This best practice story demonstrates how a team of dedicated EMS professionals recognized a performance weakness impacting their patient care and collaboratively built a program for improvement.

The Recommendation

Recognizing the problem was the first step. To improve, Redmond Medic One needed to understand the cause, identify how to improve and implement the steps.

Their success came from a strong understanding of how all the components—people, process and tools—work together to deliver results.

"It was a real eye-opener for us" to learn that Redmond's compression fraction time was 66% compared to 70% for all of Seattle & King County Medic One, says Jim Duren, EMS chief for Redmond. "We recognized that to be successful, we had to become an educational and learning organization, to look at challenges with a different set of eyes." He tasked paramedic Dana Yost with improving the agency's CPR response.

Although much better than the 40-50% compression fraction for EMS agencies nationwide,[1,2] Redmond wanted to improve because "there is plenty of data showing that as you increase compression fraction time you increase resuscitation," says Yost.

"We now had the ability to look at our own data," said Yost, since Redmond had recently upgraded to LIFEPAK® 15 monitor/defibrillators, the LIFENET® System and CODE-STAT™ Data Review Software with Advanced CPR Analytics from Physio-Control.

"You can't figure out what you can do better if you don't collect data. And you can't figure out what you can do better if you don't LOOK at the data. Our new philosophy is 'measure, improve, measure, im-

prove'," Yost maintains. "And I'm not talking about administrators, I mean the people on the scene, the people who are going to change things out on the scene, the people working on cardiac arrests."

The Approach

- Focus on compression fraction
- Quality Improvement (QI) instead of Quality Assurance (QA)
- Peer review of cases by fellow paramedics
- Rapid feedback to paramedics
- Monthly review of statistics by all hands
- Mock code drills as a team
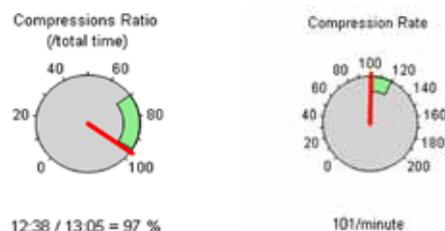
The Implementation

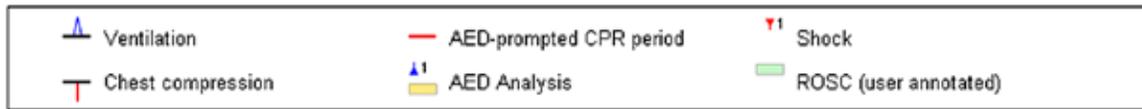#### Data where it needs to go

At the end of each cardiac call, medics push a button on the LIFEPAK 15 monitor/defibrillator to transmit the code data via high speed modem through the LIFENET System to the CODE-STAT database at Redmond Medic One. The LIFENET System then sends an alert to the smart phones of paramedics designated as "annotators" to let them know a case is ready for review.

Peer review by paramedics

The medic/annotator marks up the start and end of the cardiac arrest call, verifies the record is correct (such as looking for wave form artifact that is falsely recorded as compressions) and notes ROSC (Return to Spontaneous Circulation), if any. New annotators get up to speed after an hour of training and annotating three cases. Two annotators are designated for each shift. This aids in making sure at least one annotator is usually available.

"Any agency could do the exact same thing as us," using a handbook of step-by-step instructions on how to annotate the call and where to send the report, says Yost.

Compressions Ratio (/total time)

12:38 / 13:05 = 97 %

Compression Rate

101/minute

CPR QUIK-VIEW	Interval Statistics	
	Compr. Ratio, %	Compr. Rate
0:00	100	93
1:00	96	98
2:00	100	100
3:00	100	100
4:00	90	108
5:00	100	103
6:00	90	105
7:00	100	97
8:00	93	98
9:00	100	101
10:00	85	101
11:00	100	101
12:00	100	102
13:00	100	100
14:00	--	--

A detailed minute-by-minute record, with red hash marks depicting each compression, provides a quick overview showing compression consistency and any gaps in CPR such as to administer a shock, intubate a patient or transition EMTs between 2-minute stints of CPR. This allows medics to see areas that may need work.

The CODE-STAT software creates a progress report showing compression fraction ratio (percentage of time that CPR is performed during the total time on call) and compressions per minute.

Rapid Feedback for self-evaluation

"The annotator isn't saying whether it was good or bad, just what happened. Medics are just getting the facts," says paramedic Amy Moorhead, a member of the annotators team. The annotator sends the progress report to the paramedics on the call. An average call takes about an hour to annotate, and it's typically completed within 24 hours—sometimes even before the medics return to quarters.

"When they walk back in the station they can pull up their own cardiac arrest call and self-evaluate, using the raw data," says Yost. "Paramedics do their own review. It's not quality assurance—it's quality improvement."

"Paramedics are Type A personalities. They're always way harder on themselves than I could ever be. I let them beat themselves up with their own the data," Yost laughs. "Change came because they saw data themselves that they never got to see before and said, 'Wow, I need to improve.'"

Paramedics share the report with the EMT team that partnered with them on the call. "It's not about fault, it's about improvement," says EMT Shannon Norman. Some reports are cause for congratulations. Others are learning opportunities.

The report "gives us another way to talk about what went well and what could be better," says Moorhead, who has had her own cardiac

arrest calls reviewed. "It increases our relationship with the EMTs. It's a great tool."

Paramedic Skip Boylan says the report is "like looking in a mirror to see how well did I do. These reports don't lie." He likens them to firefighters' debriefings after a fire. "Cardiac arrest is a major event…I don't like walking away from a call not knowing how I did. These reports let you do self-analysis and group analysis."

Practicing code drills as a team

It wasn't enough that paramedics could see where they needed to improve, said EMS Chief Duren. The agency needed to focus training on areas that could improve and reach EMTs and firefighters who perform most of the hands-on chest compressions.

Duren tagged paramedic Mark Donnell to lead the training effort. He created a mobile training unit, using a surplus medic van and a SimMan® patient simulator, a Laerdal product. Mock drills are staged at the stations using the mobile unit and an ALS unit, to help choreograph the multiple teams that typically respond to a cardiac arrest call.

Looking at the CODE-STAT reports, which break down the cardiac calls minute-by-minute "really opened our eyes," said Donnell. Training focuses on elements that make a difference in CPR time and quality:

- Limiting each EMT to 2 minutes of CPR, before handing off to another responder. One person is designated as timer to enforce the 2-minute cycles and set up transitions between EMTs.

- Improving choreography among all the responders to minimize gaps in CPR as a result of delivering shocks and other advanced care.

- Pre-charging the LIFEPAK 15 defibrillator to reduce non-CPR time.

- Training paramedics to monitor rhythm changes and perform advanced procedures—like inserting a central IV line and intubating a patient—without stopping CPR.

The mobile unit lets teams practice cardiac arrest scenarios, look at the progress report and refine their teamwork and techniques.

"If something could use improvement, when the code drill ends you can hit the reset button and go right back into it. You can run it as many times as you need to," says EMT Shannon Norman.

On mock drills "you get to work side-by-side with the whole team so when the real thing happens, you click," says Boylan. The result is a closely choreographed cardiac arrest call where everyone knows what they are doing.

Summing up the drills, Yost's advice to other EMS teams: "Think of ways you can give instant feedback to people on cardiac arrest teams, practice your team so you know how to work together, and look at your data to see what can you do better."

Standardized Performance

"We are not doing anything that's magic," Yost says. "This can be duplicated."

Steps:

1. Determine your current compression fraction as a benchmark for improvement.

2. Make cardiac data available immediately after calls. (Data can be transmitted immediately from LIFEPAK 15 monitor/defibrillators. The LIFENET System sends the data to Redmond Medic One's database, which automatically populates the medic station desktops. The LIFENET System also sends alerts, so annotators have immediate access.)

3. Designate paramedics on each shift as annotators. Redmond has created a handbook with step-by-step instructions to guide those new to the role.

4. A qualified administrator of the program over-reads annotator work to ensure aquality and look for areas to improve annotator training.

5. Send the annotated report directly to paramedics, and task them with sharing the report with EMT crews.

6. Review overall performance on a monthly basis.

7. Use the minute-by-minute reports to determine training needs.

8. Hold mock drills to train ALS and BLS as a team, the same as on a real call.

The Keys to Success

- Quick feedback to paramedics after each cardiac arrest call—sometimes as soon as they return to their station.

- Clear, succinct reports on hands-on compression ratio and compressions per minute, plus a minute-by-minute record showing compression interruptions.

- Having medics review their reports with the EMT crews that partnered on the call.

- Monthly review of cardiac arrest data by the entire paramedic team.

- Training medics and EMTs as teams to finely choreograph their cardiac arrest calls.

The Tools

LIFEPAK 15 monitor/defibrillator automatically captures continuous ECG waveforms and impedance data showing chest compressions and ventilations. The code data can be sent to CODE-STAT software through the LIFENET System using a gateway device (broadband modem, wireless gateway, etc.).

LIFENET System, the Physio-Control web-based data network, routes the data to the appropriate CODE-STAT database and automatically sends alerts to annotators.

CODE-STAT Data Review Software with Advanced CPR Analytics receives the data from the LIFENET System and allows Redmond Medic One to review and analyze the code data. The software generates a succinct report of a cardiac arrest call, with chest compressions superimposed onto the patient's continuous ECG report. The report also shows compression fraction time and compressions per minute. The software can also provide summary reports for specific time periods (i.e. monthly or yearly) to quickly identify statistics for a given period.

Redmond Medic One is one of six providers that respond to medical emergencies for Seattle & King County Medic One. Redmond Medic One covers 200 square miles and serves 270,000 people in northeast King County. The system uses a tiered response, with paramedic units dispatched only to advanced life support calls. There is one paramedic unit per 100,000 people. The BLS units handle less critical calls and assist on others.

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For further information, please contact Physio-Control at 800.442.1142 (U.S.), 888.879.0977 (Canada) or visit our website at www.physio-control.com.