CPR**LifeLinks**

9-1-1 and EMS united to save more lives.

CPR LifeLinks is a national initiative that encourages local collaboration between 9-1-1 and EMS to improve out-of-hospital cardiac arrest survival rates by improving care in the first links in the "Chain of Survival": early 9-1-1 access/intervention and early (and effective) CPR.

The CPR LifeLinks Implementation Toolkit

Find resources and a practical roadmap for how:

→ Any 9-1-1 agency can put Telecommunicator CPR protocols and training into place.

→ Agencies providing EMS can implement High-Performance CPR.

Learn strategies and explore case studies for how 9-1-1 and EMS can collaborate, working together to strengthen the Chain of Survival.

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CPR LIFELINKS

INTRODUCTION

9-1-1 and EMS United to Save More Lives

Imagine this scene: Margaret, 47, has just finished serving breakfast to her daughter, Jennifer, a senior in high school. Jennifer suddenly hears a crashing sound in the kitchen. She finds her mom lying on the floor, not moving. She kneels next to her and yells, "Mom, are you okay?" There is no response. Jennifer frantically dials 9-1-1.

Jennifer sobs as the public safety telecommunicator, Andy, confirms the address and phone number and asks the nature of the emergency. "My mother just collapsed in the kitchen, and I can't get her to talk to me," she tells him. Although he only gets calls for cardiac arrest a couple of times a year, Andy is trained to assume that every call is a cardiac arrest until proven otherwise.

"Is she breathing normally?" he asks. "I can't tell," Jennifer says, "she's gasping." Andy can hear noises faintly in the background and quickly recognizes they are agonal breaths, a sign that Jennifer's mom is indeed in cardiac arrest. "I'm dispatching an ambulance," he says. "You need to do chest compressions until they get there. I'm going to help you. Let's start."

For the next five minutes, Andy coaches Jennifer through effective chest compression-only CPR. She's alone, and he knows he needs to support her efforts to do continuous compressions at the proper rate and depth. "We can do this together," he assures her in a calm, assertive voice. "Just keep going. You can do it."

Firefighters arrive first. They assume pre-assigned positions around Margaret and take over compressions from Jennifer, with minimal interruption. Andy tells her he is going to hang up now, and that her Mom is in good hands — one of the firefighters, in fact, had recently trained him in compression-only CPR as part of Andy's telecommunicator CPR education. That training really helped Andy understand the physical challenge callers face when doing chest compressions.

The firefighters have been trained in High-Performance CPR and know how critical this intervention is for survival. Paramedics arrive and work seamlessly with the crew already on scene. After several shock attempts and rounds of CPR, Margaret regains a pulse and starts to breathe on her own. The rescuers perform a 12-lead ECG, stabilize her, and transport her to the nearest designated cardiac center.

A few months later, Margaret, Jennifer, and several family members join Andy and the firefighters and paramedics at the 9-1-1 center for a gathering arranged by agency leaders to celebrate the life saved. Although they are part of the same team, Andy doesn't see the firefighters and paramedics often; these opportunities to come together and celebrate the lives they save empower them all in their work.

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Early CPR Significantly Impacts OHCA

Out-of-hospital cardiac arrest (OHCA), a severe malfunction or cessation of the electrical and mechanical activity of the heart, is a leading cause of death in the United States and across the world. It is our most time-sensitive medical emergency, and early CPR is vital. Indeed, the chance a patient lives falls by about 7–10% per minute without CPR.[1, 2]
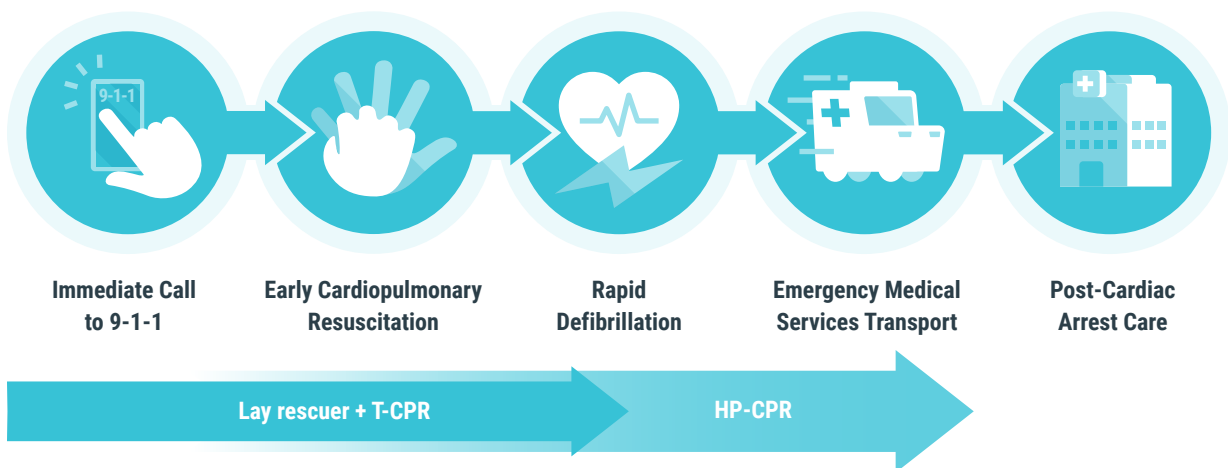
While many factors contribute to survival, years of study show the profound impact of two interventions: Telecommunicator Cardiopulmonary Resuscitation (T-CPR)[3, 4, 5, 6, 7, 8, 9] and High-Performance CPR (HP-CPR) by emergency medical services (EMS) responders.[10, 11, 12, 13] Telecommunicator CPR is also referred to as Telephone CPR or Dispatch-Assisted CPR, and High-Performance CPR is often referenced as Pit Crew CPR or High-Quality CPR.

T-CPR, in which bystanders perform chest compressions as directed by telecommunicators, generates essential blood flow to the heart and brain and is associated with better long-term outcomes. HP-CPR, in turn, ensures that trained responders maximize this blood flow so that electrical shocks and airway management can secure a successful outcome. These early links in the "Chain of Survival" are really a single, continuous effort to restore circulation as soon as possible. We know that much of the battle is won or lost in the initial minutes at the scene of a cardiac arrest.

In 2015, the Institute of Medicine recommended that EMS systems take steps to enhance T-CPR and HP-CPR to improve patient outcomes in their communities.[14] To help achieve this goal, the National Highway Traffic Safety Administration created CPR LifeLinks, a national initiative encouraging local 9-1-1 and EMS systems to collaborate on improving T-CPR and HP-CPR.

This CPR LifeLinks Implementation Toolkit provides resources and a practical roadmap for implementing Telecommunicator CPR and High-Performance CPR. The process and people involved in creating the Toolkit are described in PART SIX of this document.

Chain of Survival

| Immediate Call to 9-1-1 | Early Cardiopulmonary Resuscitation | Rapid Defibrillation | Emergency Medical Services Transport | Post-Cardiac Arrest Care |

Lay rescuer + T-CPR → **HP-CPR**

Figure 1. The Chain of Survival represents an integrated system of OHCA care. A bystander's prompt 9-1-1 call enables early T-CPR, which increases the chance that HP-CPR restores circulation.

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Out-of-hospital cardiac arrest (OHCA), a severe malfunction or cessation of the electrical and mechanical activity of the heart, is a leading cause of death in the United States and across the world. In 2015, the Institute of Medicine recommended that EMS systems take steps to enhance T-CPR and HP-CPR to improve patient outcomes in their communities.

A Stadium Full of Survivors

There are an estimated 250,000 cases of OHCA in the U.S. every year, and average survival rates are low — about 10% overall and about 30% when first responders find patients in ventricular fibrillation (VF), the shockable rhythm usually associated with arrest onset.

If survival rates were improved from 10% to even 12.5% nationwide, more than 60,000 lives could be saved over the course of a decade, enough to fill a stadium! And think of the many thousands of family members and friends who would have additional time with their loved ones.

How Does Your Community Measure Up?

Survival rates can be substantially different from one city to another,[15] *varying by as much as a factor of five*.[16] Unfortunately, where you live affects if you live. Do you know your own community's OHCA survival rate? Is your EMS system part of a standardized OHCA registry that details each event and provides important benchmarking and research opportunities?

Implementation

While T-CPR and HP-CPR are relatively simple interventions, implementing them can be challenging. *It is essential to identify barriers that stand in the way of providing these treatments*. Some are common and entrenched in agency culture and operations. Planning and commitment to change are required to overcome them. This document addresses these challenges and potential solutions for both T-CPR and HP-CPR.

Measurement is essential to optimize care and makes a huge difference in saving lives. Public safety answering points (PSAPs) and EMS agencies may face challenges implementing all aspects of the programs described in this document, but they should *take small*, *immediate steps* and build on them. These first steps — measuring the rate at which telecommunicators recognize OHCA in a three-month period, for example — bring mere concepts to life and foster the motivation to do more. Agencies sincere in their efforts to improve can practice most if not all the recommendations here and achieve a "culture of excellence."

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T-CPR & HP-CPR Cultures of Excellence

Cardiac arrest tests 9-1-1 centers and EMS systems more than any other time-sensitive medical condition, and performance responding to and treating OHCA has become an accepted benchmark for a system's overall performance. Agencies that seek a culture of excellence will save lives and realize additional benefits as the attention to training and performance translate to better care across the spectrum of acute medical and traumatic conditions.

A culture of excellence requires a shared organizational vision. Using the vision as a foundation, members of the team must understand and appreciate their roles and confidently reach for success. Leadership must also insist on accountability and continuous quality improvement (CQI).

Leaders, whether administrators or clinicians who treat patients in the field, orchestrate the effort. They need to communicate "the OHCA story" in a way that fosters true engagement from 9-1-1 centers and EMS personnel. The story is about much more than statistics: It's about human lives. A survivor who visits the alarm room or station at a chief's invitation humanizes everything — the value of such concepts as "protocol compliance" and "team choreography" suddenly becomes real. Meeting survivors can truly inspire frontline providers to engage the challenges and change required to optimize care.

Leaders also realize that we cannot improve what we do not measure. They demand to shine a light on the truth about the care their agencies provide by measuring key performance indicators and comparing the results to recommended standards. They engage their agencies to develop, declare and refine the process of evaluation and improvement. In these ways they catalyze a culture that embraces OHCA and the chance to save lives. Through these efforts, members of their organizations come to view failure to provide early and effective CPR as a preventable harm. They identify gaps between actual performance and evidence-based best practices, define a plan to narrow them, and seek out and share examples of success in other systems.

Each member of the team is responsible for the process. This shared accountability is essential; individual excellence is a fundamental building block for team success. With the push for excellence, we must appreciate that perfection is a never-ending goal. Thus, we must review challenges, shortfalls, and missteps in ways that instill resilience and advance care rather than dispense discipline.

Leadership is responsible for interpreting results, charting the path forward, and inspiring their teams to seek continual improvement. Leadership needs to recognize individual and organizational success and in turn empower frontline providers to take initiative and strive for best practices. This approach connects both the individual and the organization to community health; it is a powerful tool for saving lives.

Note: For more on T-CPR and HP-CPR cultures of excellence, please see pages 32 and 59.

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Implementing a T-CPR Program: Just Having a Protocol isn't Enough

Bend Fire Department and Deschutes County 9-1-1, Deschutes County, Oregon

In 2012, Petar Hossick attended the acclaimed Resuscitation Academy in Seattle. "At the time I thought the Academy was strictly related to field practice," says Hossick, the training captain for Bend Fire Department in Oregon. But while there, he noted that a significant portion of the course was spent discussing dispatch systems. The training reaffirmed the critical value that bystander CPR brings. "Time makes a difference," he says. "EMS can never get there faster than the telecommunicators."

When he returned to Bend, the largest city in central Oregon's Deschutes County, Hossick looked at the department's out-of-hospital cardiac arrest (OHCA) survival numbers. The EMS chief at the time said he thought they were doing OK, but the department hadn't really been tracking the data. In doing the research, Hossick discovered they weren't OK—they were actually below the national average and way below what the best systems were reporting.

Hossick realized that to make a difference in his community's OHCA survival rate, he would not only have to convince his department of the need for high-performance CPR, but he would also need to enlist the help of the communications center with effective telecommunicator CPR.

He approached Megan Craig, training coordinator for Deschutes County 9-1-1, the county's centralized emergency call center that handles nearly 70,000 calls annually. Telecommunicators had a protocol for telecommunicator CPR but didn't know how well and consistently it was being applied and how long it was taking to get hands on chest. "We started by just listening to relevant calls," Hossick says. "We didn't have any metrics—we thought we knew where we were, but we really didn't."

What they did know was that a heavy-handed mandate to improve T-CPR wasn't going to give them the results they wanted. Armed with data about unrecognized cardiac arrest calls and the length of time to get hands on chest, they instead took an approach that involved continuous improvement, with plenty of coaching and feedback.

Teaching the "Why" of CPR

In teaching telecommunicators the principles of CPR, the organization initially used a traditional CPR class. But when that didn't seem to be igniting the spark they wanted, they brought in High-Performance CPR instructors from the Bend Fire Department. It started to click after that, Craig says. "We put our telecommunicators in the place of the caller, and they got it."

As Hossick and his colleagues passionately shared the science behind what happens in the body during cardiac arrest, telecommunicators got deep insight into the importance of time. They heard recordings of agonal breathing and saw videos showing how blood flows during CPR. They came away with a thorough understanding of why they needed to be aggressive in determining when a patient was not breathing and assertive with callers about quickly starting effective chest compressions.

During the roll-out of the T-CPR program, first with new hires and eventually with all telecommunicators, Hossick was working with his fire department colleagues and with the Bend Police Department to successfully implement HP-CPR. The programs really jump-started once they began seeing more and more survivors. In 2012, the survival rate in Bend for bystander-witnessed, shockable-rhythm cardiac arrest was just 20%; by 2018, they achieved a 70% survival-to-discharge rate. That means dozens of people—parents, grandparents, siblings, friends—have been given a second chance at life.

Keys to Success

Having a baseline knowledge of your OHCA survival rate and tracking outcomes is fundamental to any program, Hossick says. Bend subscribes to the CARES registry, which allows the department to track OHCA cases using defined criteria that allow them to benchmark and improve.

But measurement is just one piece. "I believe that the only way to be successful at HP-CPR and T-CPR is to collaborate," Hossick says. "We cannot be in silos—we

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have to be connected. Each link is so important and vital to the next." He also notes that the impact of the partnership between EMS and dispatch on T-CPR has been invaluable in other ways. With field providers and telecommunicators sharing ride-alongs and sit-alongs, both agencies now have a much better appreciation for each other's role, with greater interaction that benefits all callers.

Part of that collaboration involves the feedback loop. Craig and Hossick meet monthly to listen to cardiac arrest calls and identify areas for improvement. Their team makes regular visits to the dispatch floor to provide feedback – with the intent not to penalize or judge anyone, but rather to teach and continuously improve.

Craig also recommends feedback beyond the more formal quality improvement process, through timely emails or conversations discussing tough calls, or complimenting good technique. And even when patients don't survive, she says, telecommunicators need to hear that giving the patient every chance at survival is still doing the best job possible.

"Our best today is going to be different than our best in a year," she explains. "We're always evolving. As we have access to more information, we have a responsibility to learn and continue to improve."

The Ultimate Inspiration— Meeting Survivors

Bend Fire began inviting telecommunicators to regular survivor celebrations, where they meet survivors, their family and friends, the fire crews and law enforcement officers who responded and often other bystanders who performed CPR. This experience allows everyone a chance to connect and see the impact of their collaboration.

On the wall in Deschutes County 9-1-1 is a sign on a bulletin board that says, "What's your why?" It's filled with notes and photos from survivors. "When our telecommunicators started meeting survivors and started seeing the outcomes, it changed everything," Craig says.

"Meeting a survivor and their family is like a battery recharge for the team," Hossick says. Whether the survivor is a four-year-old who had a respiratory arrest or a man in his forties whose step-daughter and wife performed CPR on him, making that connection and closing the loop makes all the difference.

Overcoming Challenges

Implementation has not come without its challenges. Chief among them, Craig and Hossick say, is changing the culture. People get used to the way things are and aren't necessarily eager to change. They have to believe that they can make a difference for OHCA patients. "You're going to have tough conversations," admits Craig. "Identifying potential snags and critics – and listening to their concerns – is essential," she says.

"In that first six months," Hossick adds, "it took repeated trainings and reinforcement and reaching out with data to get the results we were hoping for." Craig and Hossick suggest patience and incremental change, rather than sweeping top-down decrees. "You don't have to do this all at once," Craig says. Doing so could actually be detrimental.

Hossick also suggests getting stakeholders involved early on—everyone from line level staff to your chief or executive director and governing board. They also worked closely with the Bend Police Department and the local health system, important partners in different ways.

Their recommendation for other agencies looking to collaborate to improve cardiac arrest survival in their community? It comes down to basic communication. "Start having conversations with each other," says Craig. "Find a person from each agency that has a passion for this."

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PART ONE

TELECOMMUNICATOR CARDIOPULMONARY RESUSCITATION

CPR**LifeLinks**

What is Telecommunicator CPR?

Telecommunicator CPR (T-CPR), or Dispatcher-Assisted CPR, is a three-stage process where telecommunicators:

- Work together with 9-1-1 callers to identify potential OHCA patients
- Provide callers with pre-arrival CPR instructions
- Coach callers to perform continuous CPR until professional rescuers assume care

T-CPR has been linked to improved patient outcomes across the world[3, 4, 5, 6, 7, 8, 9] and is extremely cost-effective, requiring almost no capital expense. The value in lives saved cannot be measured.

In the following pages, you will find information to help you start and/or improve Telecommunicator CPR in your 9-1-1 center, including a brief overview of T-CPR, T-CPR protocols, training tips and suggestions for establishing a culture of excellence within your agency.

A BRIEF OVERVIEW

The Three Stages of T-CPR

Telecommunicators must work with 9-1-1 callers to identify potential cardiac arrest patients, provide pre-arrival CPR instructions, and coach lay rescuers to continue CPR until professional rescuers arrive and assume care. This section gives an overview of the opportunities and challenges inherent in each of these three stages of T-CPR.

STAGE 1

Identifying OHCA

Because survival depends closely on the time from patient collapse to first chest compression, it is vital that telecommunicators identify OHCA as early as possible. Success depends on factors both within and outside their control. For example, a caller's emotional distress and the position of the patient can challenge identification and are often outside the telecommunicator's control. However, telecommunicators do control the approach they use to calm callers and to encourage them to take action.

Clear, concise protocols can help telecommunicators swiftly identify OHCA. This document discusses protocols in more detail in Section 1.4. In many cases, identification is challenging and requires application of the strategies and tactics discussed in Section 1.5. For now, it should be noted that protocols should allow telecommunicators to quickly identify potential OHCAs and to start CPR instructions without delay.

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CPR Instructions

After telecommunicators recognize potential OHCA, they should provide CPR instructions as soon as possible. As we will discuss later, T-CPR increases the chance that professional rescuers successfully restore circulation through HP-CPR. Often, telecommunicators have to support the efforts of callers trying to get patients from a bed, couch, chair, or even a toilet onto the floor for CPR. Other common barriers include callers' fears they will hurt the patient when moving them to the floor or when doing compressions. We'll cover these and other barriers in Section 1.5.

In a large majority of cases, instructions will be for compression-only CPR. Studies have shown this type of CPR to be as effective as CPR with rescue breaths. The instructions are also easier to deliver and easier for the lay rescuer to execute. In addition, callers are less likely to refuse to do compression-only CPR than they are to refuse CPR with rescue breaths.

CPR Coaching

After CPR is started, telecommunicators should stay on the line with callers to provide CPR coaching and psychological support until professional rescuers assume care. This function is essential: Proper coaching can minimize pauses to chest compressions and can help maintain good compression rate, depth, and recoil (allowing the chest to come all the way up between pumps).

1.2 The Commitment to Act: Challenges and Perspectives

A number of challenges must be addressed to implement T-CPR. Below is a list of potential challenges and considerations that can help you identify strategies to overcome them.

CHALLENGE 1

Staffing

Most PSAPs face ongoing staffing challenges and may be concerned that OHCA calls will take a significant amount of time and delay answering other 9-1-1 calls.

Considerations

- OHCA calls represent only 1–2 percent of all 9-1-1 calls and therefore make only a small impact on receiving, processing, and dispatching calls.
- OHCA calls could be transferred to a designated PSAP: In Minnesota, five secondary PSAPs (PSAPs to which 9-1-1 calls are transferred from the primary PSAPs where they are first answered) currently provide emergency medical dispatch (EMD) instructions for a number of primary PSAPs. While the state does not mandate such arrangements, it intends to pursue a more formal and inclusive EMD program.
- **Wisconsin** and **Kentucky** laws require PSAPs that do not provide T-CPR instructions to transfer suspected OHCA calls to a PSAP that does provide T-CPR instructions.
- Some PSAPs in Michigan and New Hampshire transfer OHCA calls to an EMS agency that provides instruction and coaching to callers.

CHALLENGE 2

Lack of Medical Direction

Many PSAPs lack ongoing, active medical oversight. They may not know "where to start" or whom to contact to establish it.

Considerations

- 9-1-1 collaboration with local EMS agencies may provide a useful model to consider.
- Since 2017, the **Alabama 9-1-1** Board has partnered with the state Department of Public Health's Office of EMS, whose medical director reviewed and approved statewide EMD protocols, including instructions for T-CPR. The medical director has agreed to provide medical oversight for any PSAP using these protocols.

Perceived Liability Concerns

PSAPs may be concerned that implementing T-CPR may open them to liabilities.

Considerations

- **Florida** established a law protecting 9-1-1 agencies and telecommunicators from liability related to injuries resulting from the use of EMD protocols, including protocols for T-CPR. **Minnesota** has a similar law protecting EMD-certified telecommunicators.

- EMS medical directors may provide liability coverage as part of their role in providing medical oversight for T-CPR.

- The likelihood of a successful claim in cases involving T-CPR is exceedingly low when PSAPs follow a medically approved dispatch protocol. In fact, the failure to provide pre-arrival instructions (PAIs) is far more likely to result in a lawsuit, as they are now clearly the standard of care in emergency dispatch.

- **Wisconsin** and **Kentucky** have enacted laws requiring that PSAPs provide T-CPR instructions on suspected OHCA calls (or transfer the call, as noted above).

Costs

PSAPs of all sizes face budget constraints.

Considerations

- Florida allows 9-1-1 surcharge funds to be used to cover training, certification/recertification, protocol systems, continuing education, and labor costs associated with processing 9-1-1 calls.

- A number of states (e.g., Arkansas, Indiana, Maine, Tennessee) provide funding for 9-1-1 training, which could include training for T-CPR.

- Maine allows 9-1-1 surcharge funds to be used for initial EMD training and recertification, as well as for EMD software licenses, set-up support, and annual maintenance fees.

- In-kind forms of support (e.g., "donation" of time and resources) can be tapped to assess baseline performance and process improvements that serve as an impetus for the provision of resources needed for full implementation. Arizona uses revenue from a state tobacco tax earmarked for public health improvement to help fund a resuscitation program that includes T-CPR implementation. Other states may be able to access tobacco tax revenue for similar purposes.

Charter/Perceived Scope of Practice

Many PSAPs, especially those with a law enforcement focus, may think T-CPR is beyond their scope of practice.

Considerations

- CPR is generally considered first aid under the purview of all potential rescuers rather than a medical intervention that only trained medical professionals can perform. This clearly places CPR instruction in the scope of telecommunicators.

- Exposure to colleagues at a resuscitation academy may provide examples of how other PSAPs have navigated scope-of-practice concerns.

Privacy & Use of Data

The Health Insurance Portability and Accountability Act (HIPAA) prescribes rules regulating the use of patient health information.

Considerations

HIPAA does not prevent hospitals from sharing patient outcomes with 9-1-1 centers and EMS agencies that share data for the purposes of quality improvement (QI) in compliance with standard security policies and procedures:

US Department of Health & Human Services: Sharing Patient Health Outcomes Information between Hospitals and EMS Agencies for Quality Improvement	**LEARN MORE** 🌐
US Department of Health & Human Services: Uses and Disclosures for Treatment, Payment & Health Care Operations	**LEARN MORE** 🌐

Because OHCA has been designated a major public health problem in Arizona, the **Save Hearts in Arizona Registry & Education (SHARE) program** is able to collect 9-1-1 patient data as part of a state-recognized, HIPAA-exempt, public health quality-improvement program.

Next Generation 9-1-1 Implementation

As PSAPs upgrade existing infrastructure, capacity will expand far beyond the current "voice only" environment; communication centers will be able to receive, process, and share text "calls" to 9-1-1, as well as photos, video, and digital health data from a variety of sources. What changes in current T-CPR protocols will be necessary to accommodate these technological changes? Addressing these changes should be part of any implementation plan.

Action Steps for Implementing T-CPR

- ☑ Make the Commitment
- ☑ Form a team or advisory board
- ☑ Actively involve appropriate stakeholders and individuals
- ☑ Establish roles and responsibilities
- ☑ Establish written/verbal agreement between 9-1-1 and EMS to collaborate on specific tasks
- ☑ Establish and execute a plan for implementation (including funding)
- ☑ Include technical, administrative, operational, and training components
- ☑ Create a compelling argument to achieve buy-in from agency personnel.
- ☑ Summarize scientific evidence supporting T-CPR into checklists
- ☑ Set specific goals
- ☑ Utilize AHA performance measures
- ☑ Provide continuous feedback on performance measures to teams
- ☑ Communicate progress within the agency and to the community
- ☑ Support, advocate, and celebrate lives saved

1.3 American Heart Association T-CPR Program Recommendations

In 2017, the American Heart Association published six program and five performance recommendations for timely delivery of T-CPR instructions. Adopting these recommendations will give your agency a roadmap to improve your T-CPR program and show a commitment to improving OHCA survival in your community.

The table on page 15 addresses the six program recommendations, while the specific performance recommendations are further addressed in Section 1.6: T-CPR CQI on pages 34-36.

American Heart Association Program and Performance Recommendations	**LEARN MORE** ⊕

Reviewing OHCA recordings can be time- and labor-intensive. It is important to note that, if your 9-1-1 center isn't able to review all cardiac arrest recordings as recommended, **it should create a sustainable plan for reviewing as many as possible**. When used for process reporting and feedback with individual telecommunicators, these reviews are an indispensable CQI tool.

American Heart Association T-CPR Program Recommendations	
Commitment to Telecommunicator-CPR	¬ The emergency communications center will commit to providing effective T-CPR. ¬ The dispatch center director must provide leadership and hold the staff accountable for implementation.
Train and Provide Continuing Education in T-CPR for All Telecommunicators	¬ Require initial training for all call takers and telecommunicators. Initial training will require an estimated 3–4 hours. ¬ Require ongoing continuing education. This will require 2–3 hours annually.
Conduct Ongoing Quality Improvement (QI) for All Calls in Which a Cardiac Arrest Is Confirmed by EMS Personnel and in Which Resuscitation Is Attempted	¬ All calls in which resuscitation is attempted must have the 9-1-1 call audited for QI purposes. ¬ Must collect key time intervals and reasons for non-recognition of cardiac arrest and reasons for delays. ¬ Individual QI review of every cardiac arrest call provided by the supervisor (or designated QI person) including helpful feedback. ¬ QI reports must be summarized annually and secular trends reported. ¬ QI reports should be used to identify training needs.
Connection to EMS Agency	¬ Close engagement with the EMS agency is required to link data from dispatch audio with EMS run report data. ¬ Linkage with EMS is required to identify the denominator of total cardiac arrest cases and the percentage of all cardiac arrests that are recognized as cardiac arrest by the telecommunicator/dispatcher.
Designated Medical Director	¬ There should be a designated communications center medical director who shall issue the dispatch protocols for T-CPR and be able to work closely with the EMS agency.[17, 18] Ideally, there should be a combined medical director for the dispatch center and EMS agency.
Recognition for Outstanding Performance	¬ Telecommunicator recognition program for outstanding performance in the recognition of cardiac arrest and delivery of T-CPR instructions.

Table 1. American Heart Association T-CPR Program Recommendations

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T-CPR and Comprehensive Pre-Arrival Instructions

The formal process of providing pre-arrival instructions to 9-1-1 callers reporting medical emergencies began in isolated communities in the late 1970s and has evolved to become a national standard of care, a public expectation[19, 20, 21, 22, 23, 24, 25] and, in some states, such as Wisconsin and Kentucky, a legislative mandate.

While cardiac arrest patients can benefit greatly from the provision of pre-arrival instructions (PAIs), it needs to be stressed that cardiac arrest constitutes a small percentage of all medical calls. Skill in identifying cardiac arrest and providing proper instructions to the caller requires frequent training and practice. There are data to demonstrate that low call volumes are linked to poorer patient outcomes.[26] For these and other important reasons, including caller, patient, and responder safety, we stress the importance of implementing a comprehensive dispatch protocol process that addresses safety, response allocation and priority, patient care, and information for responders on all emergency medical calls.

However, a comprehensive dispatch protocol process is **not** a pre-requisite for implementing PAIs for Telecommunicator CPR in your 9-1-1 center. Please visit the following for sample T-CPR protocols:

Sample T-CPR Protocols for Suspected OHCA	**LEARN MORE** 🌐

There are several commercial EMD programs available, including but not limited to **Priority Dispatch**, **PowerPhone 9-1-1**, and the **APCO EMD program**.

Just because an agency has a protocol system in place does not mean the OHCA protocol is being implemented effectively. Some agencies develop their own protocols under the guidance of a medical director. After confirming the incident address and caller phone number, your protocols (whether you develop them or they are part of a commercial dispatch system) should allow telecommunicators to identify OHCA and start CPR instructions as soon as possible. Some commercial EMS programs direct telecommunicators to assess scene safety before beginning the triage process. Protocols and telecommunicators should avoid questions that do not relate directly to scene safety, patient status, response allocation, PAIs, and necessary information for responders. Such questions can delay the start of CPR. In OHCA, recognition, immediate dispatch, and prompt delivery of PAIs are paramount to survival.

The following example shows how unnecessary questions can delay the start of CPR:	**LISTEN** 🔊

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Identification

Cardiac arrest can often be identified by simply understanding the scenario presented by the caller, i.e., what happened. For example, the sudden, unexpected collapse of someone who appeared okay just moments before strongly suggests cardiac arrest.

In addition, AHA recommends that telecommunicators ask callers two questions as early in calls as possible:

- Is the patient conscious?
- Is the patient breathing *normally*?

If the answer to both of these questions is "no," then telecommunicators are advised to start CPR instructions without delay. This *"No, No, Go!"* approach applies to all cardiac arrests and is a useful tool to remind telecommunicators to start CPR instructions without delay when indicated. It will cast a wide net to maximize OHCA identification.

Following is an example of swift OHCA identification through the two-question approach:	**LISTEN** 🔊

> Protocols should help telecommunicators quickly identify OHCA and start CPR instructions as early in calls as possible.

CPR Instructions

For adults who suddenly collapse, or who are found unconscious and not breathing normally, instructions should be for compression-only CPR. For adult arrests that stem from a respiratory cause such as drowning, choking, or drug overdose, instructions should be for conventional CPR (CPR with compressions and rescue breaths). Conventional instructions should also be given in pediatric cases since respiratory causes of cardiac arrest are more common in children. Please see Appendix 3.2 on page 65 for more information on conventional instructions.

Here is an example of scripting for chest compressions:

- *"Listen carefully — we can do this together."*
- *"KNEEL by his/her side."*
- *"Put the HEEL of your hand on the CENTER of the chest."*
- *"Put your other hand on top of that hand."*
- *"WITH YOUR ARMS STRAIGHT, PUSH DOWN HARD AND FAST WITH THE HEELS OF YOUR HANDS. Let the chest COME ALL THE WAY UP between pumps."*

CPR Coaching

Protocols should provide scripting for continuous, supportive CPR coaching after CPR is started. T-CPR with callers who have little or no previous CPR training is as effective as bystander CPR by trained bystanders. This is due in part to CPR coaching — telecommunicators can have a positive impact on compression rate, depth, and recoil by providing feedback and guidance over the phone. Below is a sample protocol for coaching callers after CPR is started.

- *"Good job. Keep going. Count with me: 1, 2, 3, 4 …"*
- If the caller stops counting, remind them: *"I need you to count out loud for me: 1, 2, 3, 4 …"*
- **At intervals, remind the caller to**:
  - ∟ *"Keep your arms straight."*
  - ∟ *"Push hard and fast."*
  - ∟ *"Let the chest come all the way up between pumps."*
- Encourage the caller: *"You're doing a great job … keep going."*
- If the caller complains they're tired or that what they're doing isn't working, continue to provide calm, assertive support.

> Telecommunicators can have a positive impact on compression rate, depth and recoil by providing feedback and guidance until professional rescuers assume care.

Other Considerations

Protocols should allow telecommunicators to forgo scripted questions when elements of the patient's status are obvious or known. That is, they should allow some flexibility to fast-track forward in the algorithm to identify possible cardiac arrest patients. For example, if a caller says, "I found my husband on the ground and I cannot wake him up," she has indicated that the patient is an unconscious adult. Requiring the telecommunicator to ask "Is he conscious?" would be unnecessary. Two audio examples of such calls can be found on page 22.
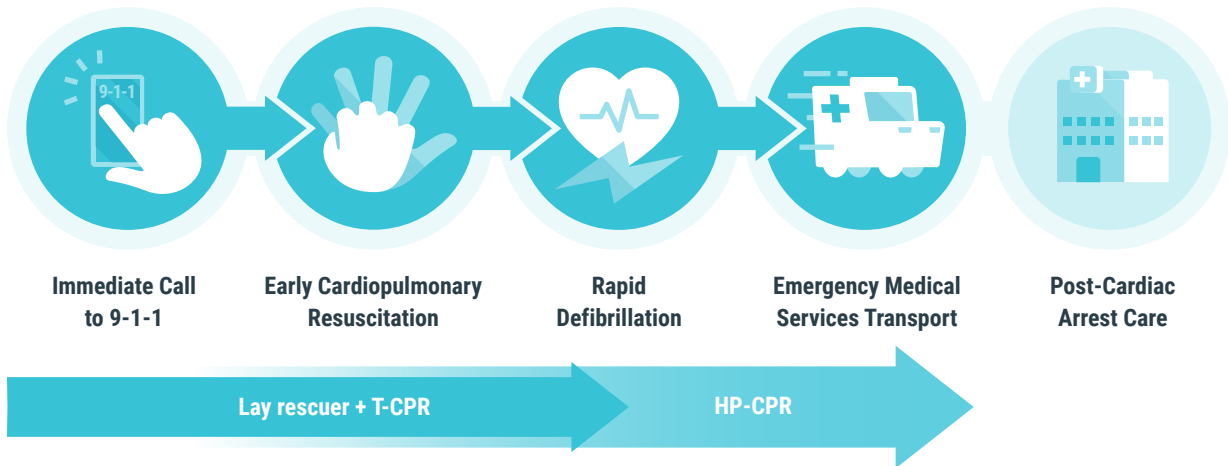
Protocols should also provide:

- Simple language encouraging telecommunicators to assertively direct callers
- Conditions under which to seek an automated external defibrillator (AED)
- Support for AED use if an AED is acquired

Essential Importance of the Telecommunicator

Your education program should discuss the essential role telecommunicators play in the Chain of Survival. Telecommunicators directly contribute to patient care and outcomes. Their ability to act quickly and decisively is essential in these time-critical emergencies.

Immediate Call to 9-1-1	Early Cardiopulmonary Resuscitation	Rapid Defibrillation	Emergency Medical Services Transport	Post-Cardiac Arrest Care

Lay rescuer + T-CPR	HP-CPR

Figure 1. Of the five links in the chain of survival, telecommunicators directly influence the first four.

Initial training should require at least three hours. Another two to three hours should be dedicated to continuing education each year. In this section, we recommend a learning program that follows the "Circle of Telecommunicator CPR."

SEGMENT ONE
Know the Recommendations

SEGMENT TWO
Practice CPR Skills

SEGMENT THREE
Master Three Stages of T-CPR

SEGMENT FOUR
Simulate T-CPR

SEGMENT FIVE
Measure & Improve

Figure 2. Telecommunicator CPR Circle of Learning

Know the Recommendations

AHA's T-CPR Program and Performance Recommendations lay out the vision and methods for optimizing OHCA outcomes. Please see pages 14–15 and 34-36.

SEGMENT TWO
Practice CPR Skills

Telecommunicators should practice continuous compressions on a training manikin for several consecutive minutes to simulate the physical challenge of performing CPR on a "real call." Such practice can:

- Give telecommunicators a deeper sense of what it means to achieve proper rate, depth, and recoil
- Help telecommunicators appreciate the value of the techniques they tell callers to use (e.g., how keeping your arms straight helps achieve proper depth, or how not leaning on the chest helps achieve full recoil)
- Help telecommunicators establish empathy with callers while they perform continuous compressions until professional rescuers assume care.

CPR certification is not required but should be encouraged. Agencies should consult local policies and laws regarding CPR certification for telecommunicators.

EMS agencies can often provide in-person CPR instruction and training manikins if needed.

> Several short videos are available online and can supplement CPR instruction. Here is an example: **WATCH** ▶

Note: It is not necessary to bare the chest, as shown in the video.

SEGMENT THREE
Master the Three Stages of T-CPR

Telecommunicators who understand how CPR works will have a basic medical foundation on which to master the three stages of T-CPR. For this reason, we give a brief overview.

How CPR Works

Cardiac arrest, the sudden failure of all electrical and mechanical activity in the heart, results in unexpected collapse. The heart may quiver for a few minutes (the shockable "VF" rhythm noted earlier), but circulation of the blood is entirely lost.

The time from the 9-1-1 call to the moment professional rescuers arrive at the patient's side can be 10 to 15 minutes in urban areas and even longer in rural areas.

As noted previously, the chance of survival falls rapidly in the absence of care. Bystander CPR is therefore essential; it more than doubles the chance a patient survives[27] for two reasons:

1. Chest compressions generate blood flow to the heart, brain and vital organs while professional rescuers travel to the scene.
2. Chest compressions prolong the duration of VF, increasing the chance for successful defibrillation by lay rescuers or professional rescuers when they arrive with an AED.

It is important to note that, if a caller reports that they just saw someone collapse, that person is more likely to be in VF during the call than a patient found unconscious some unknown minutes later. These "witnessed" cases, then, represent patients we have the best chance of saving. We emphasize, however, that **chest compressions can benefit all patients, those in VF as well as those not in VF**.

Telecommunicators can profoundly increase rates of bystander CPR by instructing 9-1-1 callers to start CPR after identifying OHCA.[4, 5, 6, 7, 8] Instructions should be for compression-only CPR for adults who suddenly collapse or who are found unconscious and not breathing normally. The blood flow generated by compressions drops sharply with even short pauses in compressions, as shown here:

The Problem of Pauses in Chest Compressions	WATCH ▶

Courtesy of Sarver Heart Center.

For this reason, bystanders rescuing adults should not stop compressions to give rescue breaths (unless the arrest stems from a respiratory cause, in which case telecommunicators should provide instructions for CPR with rescue breaths).

For more detail on the physiology of how CPR works, please see Appendix 3.1, on pages 64.

Empowering Telecommunicators

Training should not only provide the tools telecommunicators need to succeed — it should also foster the motivation. People who see value, take pride, and feel empowered in their work perform better than people who don't. Training can cultivate these intangibles by emphasizing several points:

- The role telecommunicators play is understood and appreciated now more than ever. In recognizing OHCA and directing bystanders to start CPR, they facilitate what has been called "the anchor link" in the Chain of Survival. It is fair to say that "their time has come."
- Telecommunicator CPR is as effective in saving lives as conventional CPR.[8, 9]
- Telecommunicator CPR is often more common than bystander CPR without telecommunicator instructions.[8, 9]
- In many places, survivors are twice as likely to have received T-CPR than CPR without telecommunicator assistance.[6, 8, 9]
- Few callers understand that the person they are calling for is in cardiac arrest. The telecommunicator plays a crucial role in determining the patient's status.[28]
- The two-question model is highly effective in identifying cardiac arrest.
- Contrary to what you may have heard in the past, chest compressions performed on patients not in cardiac arrest are not dangerous. One study evaluating such patients found that compressions resulted in no injuries to vital organs and were a likely cause of minor injuries (e.g., rib fracture) in only 2% of cases.[29]
- Most callers are relatives or friends of the patient. They are often alone and terribly distressed. Only telecommunicators can provide the immediate help they need.

Prepare for success: the telecommunicator's mindset

Because OHCA comprises only 1–2% of call volume, it's natural to assume the next call will not be a cardiac arrest. Telecommunicator education should flip this mindset. Ideally, we should assume that every call is a cardiac arrest until proven otherwise.

Identifying cardiac arrest is the first step in the T-CPR process. One study found that patients were more than three times more likely to survive if telecommunicators simply recognized the arrest during the emergency call.[28]

> Every call should be assumed to be a cardiac arrest until proven otherwise.

Callers often report most or all of the information needed to identify OHCA after the telecommunicator asks what the nature of the emergency is. **Active listening**, then, *fostered by the assumption that every call is a cardiac arrest until proven otherwise*, is an essential skill.

Importance of **Active Listening** One	LISTEN 🔊

Here, before we even confirm the incident location, the caller has told us that his wife (an adult) has collapsed in the backyard. All we need to ask, then, is whether she is breathing normally. If not, we should start compression-only CPR instructions as soon as possible.

Here is another example. What information does the caller provide and what do we need to find out to determine whether the patient is potentially in cardiac arrest?

Importance of **Active Listening** Two	LISTEN 🔊

The first step in the triage process, and in identifying OHCA, should be determining if the patient is conscious. If the caller reports that the patient is conscious, OHCA can be ruled out and the telecommunicator can move forward exploring the chief complaint.

If the caller reports the patient is not conscious, however, then telecommunicators should immediately ask if the patient is breathing normally. If the answer is "no," then telecommunicators should start CPR instructions without delay. (Note that, for calls on patients with signs and symptoms of a heart attack, telecommunicators should be prepared to give CPR instructions if needed.)

Telecommunicators begin the triage process after confirming the incident location and the caller's phone number. The goal of triage is to determine the level of help to dispatch based on the chief complaint, signs, and symptoms the caller reports.

> # Active listening is an essential skill that can expedite OHCA identification in the opening seconds of a call.

Identifying OHCA: Common barriers and tactics

In a perfect world, callers would provide clear, concise, "yes" and "no" answers to protocol questions. In the real world, of course, their answers are often unclear even when patients are in cardiac arrest. Such challenges are among several common barriers to recognizing OHCA. We will now take a look at such barriers and the tactics telecommunicators can use to overcome them.

Barrier: Emotional distress

The large majority of OHCAs occur in homes. Callers are usually family members or friends of the patient and are therefore often in grave emotional distress. This can make communication very challenging.

Here is an example:	**LISTEN** 🔊

Tactic: Be assertive

Telecommunicators should use plain language and a persistent, assertive tone when needed to focus a caller's attention.

Barrier: Caller does not understand the word "conscious"

Callers are not always clear what "conscious" means.

Here are some examples:	**LISTEN** 🔊

Tactic: Rephrase the question

To clarify their meaning, telecommunicators can use alternate wording such as:

- *"Is the patient awake?"* or
- *"Does the patient respond to you when you talk to them or touch them?"*

Here is an example:	**LISTEN** 🔊

Barrier: Open eyes and brief, seizure-like movements

Callers sometimes report that the patient's eyes are open, or that the patient is moving. A report of a patient's eyes being open, however, should not be mistaken for consciousness. Minor movements by OHCA patients are not unusual. Patients may display brief movements associated with, and often mistaken for, a seizure. These movements are not purposeful, however, and do not indicate consciousness. A conscious patient will respond, if only in a small way, to verbal or physical stimuli.

Tactic: Shake and shout

Telecommunicators can tell callers to shake patients by the shoulders and shout their name to see if they respond.

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Barrier: Agonal breathing

If the patient is reported unconscious, the telecommunicator should ask if the patient is breathing normally.

Agonal breathing (or "gasping") is a kind of abnormal breathing common in the first few minutes of cardiac arrest. It is caused by brainstem reflexes and is the body's last-ditch effort to deliver oxygen to the vital organs during OHCA. However, it is completely ineffective. It is typically slower than the rate for regular breathing and presents in a variety of ways. Here are a few examples of what agonal breaths can sound like over the phone:

Here are some examples:	LISTEN 🔊	LISTEN 🔊	LISTEN 🔊

These breaths can confuse callers and telecommunicators alike, who may mistake them for signs of life. The presence of these breaths can thus obstruct the T-CPR process. Yet patients with agonal breathing have an inherently greater chance of surviving than patients without it because agonal breathing is linked to residual oxygen in the brain. **It is imperative that training programs address (1) how telecommunicators can recognize agonal breathing and (2) the importance of starting CPR instructions for unconscious patients with agonal breathing**.

Telecommunicators can identify agonal breathing not only by the sounds patients make, but also by the words and phrases callers use to describe these sounds. Figure 2 shows the frequency with which callers used certain terms to describe agonal breathing in one study.
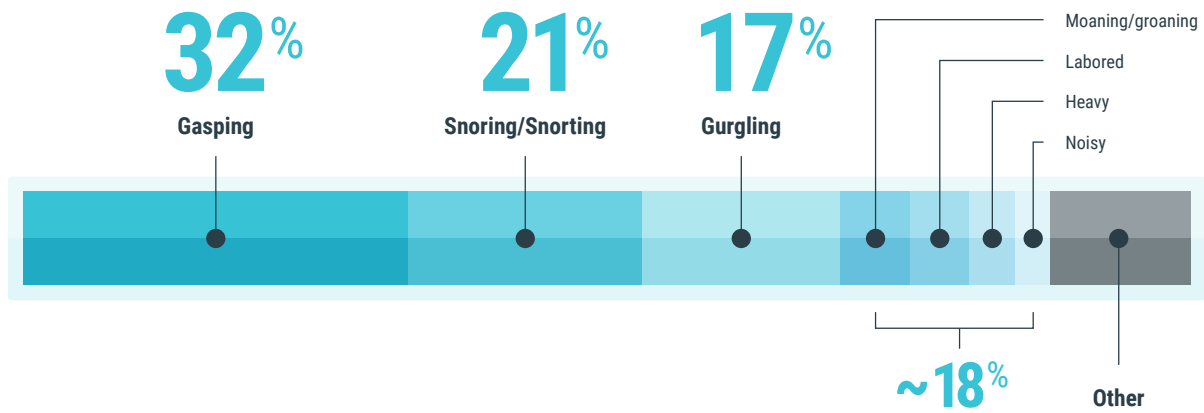

32% Gasping **21**% Snoring/Snorting **17**% Gurgling Moaning/groaning Labored Heavy Noisy **~18**% Other

Figure 3. Frequency of terms callers used to describe abnormal breathing[30]

These audio recordings provide a few examples of such descriptions:

Abnormal breathing descriptions:	LISTEN 🔊	LISTEN 🔊	LISTEN 🔊

CPRLifeLinks

"Gasping" is the most common term used to describe abnormal breathing.

Tactic: Ask the caller to put the phone by the patient's mouth
If telecommunicators aren't sure whether the patient is breathing or breathing normally, they can direct the caller to put the phone by the patient's mouth so they can listen for the breathing firsthand.

Here is an example:	**LISTEN** 🔊

If telecommunicators hear no breathing or only agonal respirations, they should conclude the patient is not breathing normally and start CPR instructions. Background noise in the PSAP, it should be noted, can make it hard for telecommunicators to listen for breathing.

Tactic: Ask the caller to observe the patient's chest, watching for it to rise and fall normally and rhythmically

If telecommunicators are unsure whether a patient is conscious and/or breathing normally, they should start CPR instructions as soon as possible — "when in doubt, there is no doubt." The chance that chest compressions injure adults not in cardiac arrest is very small — *one study found that the chance of injury (e.g., rib fractures) to adults not in cardiac arrest was just 2%.*[29] The study found zero cases where patients sustained any serious injury, such as damage to internal organs.

When in doubt, there is no doubt: Start CPR instructions right away!

Barrier: Caller is a healthcare professional
Telecommunicators should not make assumptions about the competency of callers or veer away from protocols simply because a caller is a healthcare professional.

Tactic: Treat all callers the same, even if they are healthcare professionals
Assess consciousness and breathing according to your protocol and, when indicated, start CPR instructions.

Summary

Barrier	Tactic
Caller emotional distress	Be assertive
Caller does not understand "conscious"	Rephrase the question (e.g., *"Is he awake?"*)
Open eyes, seizure-like movements	Shake and shout
Agonal breathing	Ask to hear patient's breathing; listen for key descriptive terms; have caller look to see if chest rises and falls normally and rhythmically

Table 2. Identifying OHCA: Common barriers and tactics

T-CPR STAGE 2
CPR Instructions

After telecommunicators recognize potential OHCAs, they should start CPR instructions as soon as possible. Because the majority of calls come from cell phones, telecommunicators should ask callers if they are on a cell phone and, if so, direct them to put it on speaker function. This helps communication while callers attempt to follow instructions. As with OHCA identification, however, there are barriers to providing CPR instructions.

Telecommunicators can help overcome each of these barriers:

Barrier: Caller hesitates or refuses instructions
There are many reasons why callers may hesitate, or even refuse, to perform CPR. They may lack confidence in their ability to perform CPR or fear they may hurt the patient, believing the patient is not really in arrest. They may think they have to perform rescue breaths or may think the patient is already dead.

Tactic: Be decisive
A telecommunicator who is decisive and confident in giving instructions will help the caller overcome hesitation and doubt in their ability to perform CPR. By providing encouragement and support, the telecommunicator creates an informal partnership with the caller that can increase the caller's confidence to perform CPR.

Barrier: Patient positioning
Perhaps the most challenging obstacle to starting CPR is patient positioning. Chest compressions should be performed with patients on their backs on a hard, flat surface (usually the floor), but patients are often found on a bed, couch, chair, or even the toilet. Sometimes they are wedged between any of these and a wall.

Callers often say the patient is too heavy to get to the floor. One study found that compressions were about half as likely to start and were delayed by more than one-and-a-half minutes because callers either couldn't get patients into position or took considerable time to do so.[31]

Tactic: Get help
Callers in emotional distress may not think to get help from people (e.g., family members) who are readily available to assist. Telecommunicators should ask, "**Is there anyone there who can help you?**" Patients are far more likely to receive compressions when callers facing this barrier have at least one other lay rescuer present.

Tactic: Sheet drag

If the patient is on the bed, telecommunicators can advise callers to grab and drag the blanket or sheet to move the patient to the floor.

Tactic: Insist and assure

Telecommunicators should encourage and support callers in their efforts to position patients. Sometimes telecommunicators must simply insist that callers get patients to the floor and assure them they can succeed. It may be said that callers don't always know their own strength. Females in one study were as likely to get males to the floor as males were to get females to the floor.[31]

Telecommunicators, however, must be aware of the impact of time on the patient's chance of survival. There are times when callers simply can't get patients to the floor. In these cases, CPR should be started with the patient on the bed. While not ideal, the choice here is no CPR or some CPR. Always attempt CPR when possible.

Barrier: Fear of hurting patients

Callers are often afraid they will hurt patients (especially their heads) when trying to get them to the floor.

Tactic: Reassure the caller

While the caller's concern is understandable, reassure them they will not hurt the patient and continue directing them to move the patient to the floor.

Summary

Barrier	Tactic
Caller refuses instructions	Be decisive
Patient positioning	¬ Get help ¬ Sheet drag ¬ Assist and assure
Fear of hurting patient	Reassure the caller

Table 3. CPR Instructions: Common barriers and tactics

CPR**LifeLinks**

Compression-only CPR

In the vast majority of adult OHCAs, telecommunicators should provide instructions for compression-only CPR. Most patients have enough oxygen in their lungs and blood to keep the vital organs healthy for several minutes if compressions are performed to circulate the blood.

There are three key components in lay rescuer chest compressions: **compression rate, compression depth, and compression recoil**.

Compression Rate

A rate of 100–120 compressions per minute (CPM) is optimal.[12] Metronomes are inexpensive, and it is a best practice to use them. Several free metronome desktop and smart phone applications are available.

To confirm that the caller has begun compressions at the appropriate rate, the caller should be asked to count out loud. Counting out loud may tire the caller, though, so it is not necessary for them to count for the entire duration of the call. The goals in asking the caller to count out loud are to ensure compliance with instructions and to confirm that the caller is delivering compressions at the appropriate rate. Once compliance and proper rate have been established, the telecommunicator may take over counting for the caller.

Compression Depth

Evidence suggests that proper compression depth is associated with survival. A depth of 2 inches is optimal, but how is a caller to be expected to assess that depth? The reality is, they really can't. So, when providing instructions, callers should be encouraged to "push as hard as you can." With lay rescuers, there is little concern that they will push too deep. In fact, typically callers do not push deep enough.

Compression Recoil

During the compression phase, oxygenated blood is moved out of the heart and lungs to the brain and other vital organs. However, it is only in the decompression phase ("recoil") that blood comes into the heart. When the chest recoils, decreased pressure in the chest cavity creates a vacuum, causing the heart and lungs to refill with blood that will once again be moved through the body with the next compression.

Continuous CPR Coaching after CPR has started

When proper compressions are delivered, it will take approximately 20 compressions before sufficient pressure is created to begin circulating blood through the body. If compressions are stopped or interrupted, it takes only a few seconds for blood pressure to fall to zero.

Telecommunicators can have a profound effect on the quality of chest compressions through continuous CPR coaching. Telecommunicators should count out the proper rate and then have callers take over the counting. This allows the telecommunicator to monitor the rate and to encourage callers to speed up or slow down as needed.

The telecommunicator should also periodically remind callers to push "hard" or "deep" and to let the chest come all the way up between pumps. (Please see sample scripting for coaching in Section 1.4 on page 18.) Once compressions have begun, it is important that telecommunicators not distract callers (by asking unnecessary questions, for example) because distractions can cause callers to pause their compressions.

Continuous coaching may explain studies finding that Telecommunicator CPR is as closely associated with survival as bystander CPR.[8, 9] Clear communication with the person doing CPR is essential for proper coaching. The following are barriers to and tactics for assuring this communication.

Barrier: Caller leaves the phone to do CPR

Emotionally distressed callers and callers who have had CPR training may leave the phone to start compressions.

Tactic: Tell callers to stay on the line

Tell callers to stay on the phone and to bring the phone next to the patient if possible. If the call is placed from a cell phone, be sure the caller has the phone on speaker function.

Barrier: CPR is in progress

Sometimes a bystander who is not the caller is doing CPR when the call is received. This can give telecommunicators the false sense that all they need to do is dispatch the proper units.

Tactic: Tell the caller to bring the phone next to the person doing CPR

Once the phone is next to the person doing CPR, tell that person or the caller to count the compressions out loud so you can monitor and improve the rate if needed.

Here is an example of continuous coaching for several minutes before professional rescuers assume care:	**LISTEN** 🔊

Additional Considerations

Automated External Defibrillators

- Early T-CPR will help keep oxygenated blood circulating to the vital organs. Automated External Defibrillators (AEDs) applied by lay rescuers can restart the heart. As a general rule, however, telecommunicators should only ask if an AED is available if the event is in a public location with more than one lay rescuer present. The priority should be on continuous chest compressions.

- AEDs are found commonly in schools, sports arenas, public buildings, airports, shopping malls, and department stores.

Dispatching of Resources

- Telecommunicators must quickly dispatch EMS and law enforcement responders.

- Once the event location has been verified and it is known the patient is unconscious, sufficient information has been obtained to initiate a call for service and to dispatch help.

- Telecommunicators should notify EMS that CPR is in progress when lay rescuers start compressions. This directly affects the mindset of responders traveling to the scene, particularly if the call starts as a "Chest Pain" or "Cardiac Incident" complaint.

SEGMENT 4

Simulate T-CPR

Training should include simulation of suspected OHCA calls. Simulations allow telecommunicators to apply their knowledge in environments where they can safely learn from mistakes and oversights.

Simulations can be based on real OHCA calls and should present scenarios with different learning objectives. Simulate not only "typical" cases (e.g., cases where the patient is a male in his 60s who suddenly collapsed and requires compression-only instructions) but also less common ones (e.g., cases where the patient is a child, where a caller objects to doing CPR, where a language barrier complicates communication, or where an adult was apparently choking).

Simulations can be done in a number of ways. Telecommunicators at their terminals can process mock OHCA calls from colleagues to practice using protocols and call-handling skills, for example. Alternatively, colleagues can sit back-to-back, one person with a caller's script, the other with T-CPR protocols to choose from given the situation the "caller" describes.

Here are sample scripts for consideration	**LEARN MORE** 🌐	**LEARN MORE** 🌐

- Simulations should encompass each of the Three Stages of T-CPR. That is, they should require telecommunicators to identify OHCA, start CPR instructions, and provide continuous coaching for several minutes.
- After such exercises, colleagues should debrief in small groups where they can challenge, learn from, and support each other. They can then run the simulations again, applying feedback and lessons learned.
- T-CPR practice through simulation is important in light of data suggesting patient outcomes may be linked to the number of OHCA calls a telecommunicator processes in a given period of time.[26] Telecommunicators should process at least 10 OHCA calls per year, either real or simulated.

SEGMENT 5

Measure and Improve

Performance measurement is essential for performance improvement. It is important to note that performance review should occur in a non-punitive environment — the objective is to teach, encourage, and support telecommunicators. While not strictly part of T-CPR training, measurement should be central to a telecommunicator's continuing education. It provides essential feedback that can take three forms:

- Standardized reports showing overall performance on key T-CPR process measures. These measures shed light on collective strengths and weaknesses and are detailed in the T-CPR CQI section on pages 34–36. A free reporting template is available **here**.
- Standardized audio reviews of individual telecommunicator performance on OHCA calls. These reviews can be conducted by supervisors, by peers, or by the telecommunicators who processed the call themselves. PSAPs should try to conduct these reviews within a week and no later than a month after the call. In general, the sooner a review occurs, the more effective it is. Free standardized review forms are available **here** and **here**.
- Real-time feedback on call handling as telecommunicators process OHCA calls.

Other Topics to Consider

There should be two to three hours of continuing education annually. Learning sessions should be frequent and fairly short, such as 30- to 45-minute increments at least quarterly throughout the year. In addition to reviewing standard process reports and sharing insights gained through audio reviews, these sessions can cover such topics as:

Unusual circumstances that pose challenges to the delivery of T-CPR instructions, including:

- Patients with a Do Not Resuscitate order or Physician Order for Life-Sustaining Treatment
- Patients on ventilators
- Post-Op patients
- Electrocution
- Drowning

- Strangulation
- Two-rescuer ventilations
- Cardiac arrest secondary to trauma
- Pregnant patients
- Obese patients
- Stoma patients

Critical Incident Stress Management

PSAPs need to emphasize the importance of caring for one's mental health. Providing PAIs for T-CPR exposes telecommunicators to acutely stressful circumstances that sometimes call for immediate debriefing and support. Continuing education sessions provide an opportunity to point telecommunicators to mental health resilience and support resources. For more on Critical Incident Stress Management, please see Appendix 3.3, page 66.

1.6 Achieving a T-CPR Culture of Excellence

The importance of leadership, accountability, and continuous quality improvement in creating a culture of excellence were addressed briefly on pages 5–7. This section addresses how PSAP leaders can build necessary bridges between stakeholders across the Chain of Survival, recommended elements of T-CPR CQI, and additional steps PSAPs can take toward a culture of excellence.

Building Bridges

Leaders can foster accountability and essential cooperation among PSAPs, EMS agencies and hospitals by convening review committees to evaluate OHCA events, outcomes, and opportunities to improve care. These committees can help celebrate successes and advise executive stakeholders of unmet needs. Committee members should include:

- PSAP operational telecommunicator representative
- PSAP QI representative
- EMS agency and First Responder operational (paramedic, EMS Lieutenant, etc.) representatives
- EMS agency and First Responder QI representatives
- Medical Director/Oversight representative
- Hospital Emergency Room operational (RN, paramedic) representative
- Hospital QI representative

Leaders can also convene executive committees to oversee policy and resource direction. An executive committee could include:
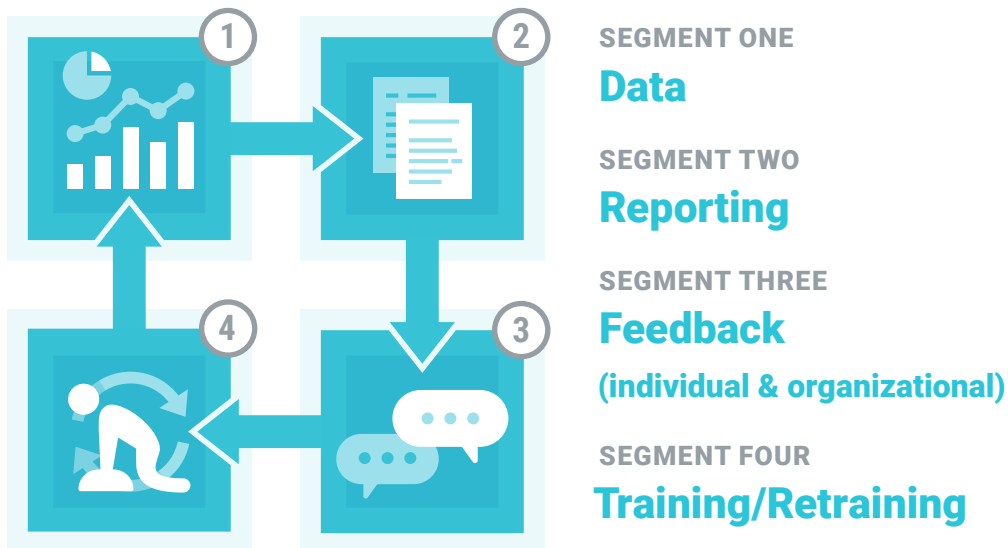
- Medical Director/Oversight executive
- PSAP QI representative
- PSAP Director
- EMS Agency and First Responder QI representatives
- EMS and First Responder Chiefs
- Emergency Room Clinical Manager
- Hospital QI representative

The PSAP and EMS QI representatives should participate in both the review and executive committees. Not only does this give executives an opportunity to learn from the operational perspective; it also indirectly provides a sense of empowerment and a voice to the "front line" 9-1-1 and EMS personnel. The executive committee can assess recommendations from the review committee, approve policy, and provide resources to improve OHCA care and outcomes.

Recommended Elements of T-CPR CQI

CQI is, by definition, ongoing and devoted to measuring and improving care. It is meant to support and encourage telecommunicators in their work.

Measuring T-CPR process and patient outcomes is central to assessing quality of care. It sheds light on challenges and inspires improvement in both process and outcomes.

SEGMENT ONE
Data

SEGMENT TWO
Reporting

SEGMENT THREE
Feedback
(individual & organizational)

SEGMENT FOUR
Training/Retraining

Figure 5. A model for CQI. Data collection, reporting, and feedback to individual providers can help agencies refine their regular trainings in an ongoing effort to enhance OHCA care.

CASE STUDY

Collaborative training effort helps change minds in Michigan

South East Regional Emergency Services Authority, Macomb County, Michigan

When Macomb County, Michigan, consolidated its 9-1-1 services into a single emergency communications center, one of the challenges was training telecommunicators from several agencies on a single T-CPR protocol. Although some telecommunicators initially resisted, the program became a success thanks in part to training that emphasized the "why."

"T-CPR makes a difference and that's why we got in this job," says Cherie Bartram, executive director of the South East Regional Emergency Services Authority (SERESA), the county's municipal consolidated 9-1-1 center. "It saves lives."

Bringing in medics from the center's partner agencies helped the telecommunicators see the entire chain of survival. The EMTs and paramedics who helped conduct the training could relay firsthand just how vital the pre-arrival instructions were to giving patients a chance of survival. They also got the telecommunicators out of their chairs and doing CPR themselves so they knew just what they were asking of callers.

The field providers taught the telecommunicators the basic science of CPR and cardiac arrest, and placed a large emphasis on understanding agonal respiration, which has been shown to have a significant impact on the patient's outcome. The training also outlined what dispatch should be listening for and what callers might describe so they can get hands to chest more quickly.

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"The field providers really help people understand the reasoning behind what they're doing," Bartram explains.

Once SERESA's telecommunicators gained a better understanding of the science behind T-CPR and built those relationships with providers in the field, resistance to the initiative faded quickly.

"We got in this line of work to make a difference, and so one of the best perspectives I have is to look at it, evaluate it, and embrace it and not fight against it," Bartram says. "The minute you fight against it, it becomes hard."

American Heart Association Performance Recommendations for T-CPR

A Cardiac Arrest Registry to Enhance Survival (CARES) or CARES-like OHCA data registry should be in use in the EMS system(s) your PSAP serves. Ideally, PSAPs can evaluate all OHCA calls in their region (there are an estimated 55 OHCAs per 100,000 people.)[32, 33] If this is not possible, however, PSAPs should create a sustainable plan for reviewing as many calls as possible. The AHA recommends that 9-1-1 centers track the following performance metrics for T-CPR:

RECOMMENDATION ONE
Percentage of total OHCA Cases Correctly Identified by Telecommunicators

Definition
Telecommunicator recognized OHCA / total OHCA (confirmed by EMS impression).

Numerator
Number of QI-reviewed EMS-confirmed OHCA with recognition noted.

Denominator
EMS-confirmed OHCA.

Performance Goal: At least 75%

RECOMMENDATION TWO
Percentage of Recognizable OHCA Cases Correctly Identified by Telecommunicators

Definition
Telecommunicator recognized OHCA / number of cases deemed identifiable.

Numerator
Number of QI-reviewed EMS-confirmed OHCA with recognition noted.

Denominator
Number of QI-reviewed EMS-confirmed OHCA deemed identifiable by supervisor.

Exclusions from denominator
- Third-party calls
- Hang-up
- Hysterical/extreme emotion
- CPR in progress
- Language barrier
- Other circumstances supervisor deems "unidentifiable"

Performance Goal: At least 95%

Percentage of Telecommunicator-Recognized OHCA Receiving T-CPR

Definition
Number of telecommunicator-recognized OHCA cases receiving T-CPR / number of QI-reviewed EMS-confirmed OHCA with recognition noted.

Numerator
Number of QI-reviewed EMS-confirmed OHCA with recognition noted where T-CPR is performed.

Denominator
Number of QI-reviewed EMS-confirmed OHCA with recognition noted.

Exclusions from denominator
- CPR already in progress by bystander
- Caller is unable to physically perform CPR (e.g., caller is not with the patient)
- Caller is unable to get patient into position for CPR due to physical limitations
- Caller refuses to do CPR
- Scene unsafe for CPR to be performed (trauma, disaster scenario)
- Caller disconnected
- Other circumstances supervisor deems T-CPR could not be performed

Performance Goal: At least 75%

Median Time Interval Between 9-1-1 Call and OHCA Recognition

Definition
Median amount of time in seconds between 9-1-1 call connected and OHCA recognition.

Benchmark
60-120 seconds (the 60-second mark is achievable by high-performing systems).

- This goal may be challenging in the short-run due to PSAP call transfer protocols that may lie outside the authority of the PSAP responsible for EMS dispatch.
- Measurement of intervals prior to call transfer to the PSAP responsible for dispatching EMS should be included. Where this is impractical, however, the minimal acceptable performance recommendation should revert to less than 60 seconds from address acquisition to telecommunicator recognition of OHCA.

Performance Goal: 60-120 seconds

Median Time Interval Between 9-1-1 Call and First Telecommunicator-Directed Compression

Definition
Median amount of time in seconds between 9-1-1 call connected and first chest compression directed by telecommunicator.

Benchmark
120-180 seconds (the 120 second mark is achievable by high-performing systems).

- This goal may be challenging to meet in the short-run due to PSAP call transfer protocols that may lie outside the authority of the PSAP responsible for EMS dispatch.

- Measurement of intervals prior to call transfer to the PSAP responsible for dispatching EMS should be included. Where this is impractical, however, the minimal acceptable performance recommendation should revert to less than 120 seconds from address acquisition to first telecommunicator-directed compression.

Performance Goal: 120-180 seconds

In addition to these five metrics, it is helpful to track how often you identify particular barriers to T-CPR. This can inform continuing education. For example, if you notice that "distressed caller" is a frequent barrier, you can emphasize the importance of, and techniques for, managing distressed callers.

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Additional steps PSAPs can take toward a culture of excellence

- Make a clear statement of mission and specific goals.
- Come to a clear understanding of why time to care is so important in OHCA.
- Create a visible presence of leaders and have PSAP staff meet them.
- Do not hand out discipline (unless an incident involves clear violation of policies) for mishandled calls. Instead ask: How can we do better? What can we learn?
- Make sure telecommunicators are aware of AHA performance standards.
- Provide recognition and awards for excellent call-processing.
- Introduce telecommunicators to survivors.

Empowering Telecommunicators in the Last Frontier

Anchorage Fire Department, Anchorage, Alaska

The fire department in Anchorage, Alaska, had a problem: cardiac arrests were sometimes not recognized during the call-taking process; bystander CPR was not happening quickly enough.

Knowing that others had already found solutions to similar problems, several AFD emergency telecommunicators traveled south to King County, Washington, to learn about their emergency medical dispatch system, Criteria-based Dispatch (CBD).

"The CBD methodology bases its entire foundation on [the fact] that the dispatchers have a significant impact on patient outcome and allocating the most appropriate resources to the patient," says Stephenie Wolf, AFD's Lead Dispatcher.

The training AFD's telecommunicators received in King County was also eye-opening. Instead of simply learning what questions to ask a 9-1-1 caller and how to deliver CPR instructions, they also learned from field clinicians about the anatomy and physiology of cardiac arrest, including agonal breathing.

At first, many telecommunicators were skeptical. What if they did chest compressions on someone who didn't need them? The partnership with field medics, who could explain what it's like to do CPR and how critical it is to patients in cardiac arrest, was a big part of alleviating those concerns. The fire department's medical director and operational chiefs also spoke to the telecommunicators, demonstrating to the team just how important these changes were and how critical the call-takers are to a cardiac arrest patient's chance of survival.

One of the key challenges has been changing the mindset of telecommunicators and empowering them to feel comfortable walking callers through CPR. To address this, the telecommunicators started doing analysis on calls. "It's hard sometimes, but they learn," said Wolf. To ease discomfort, Wolf started the analysis with one of her own calls.

Now, Wolf facilitates a Post Incident Analysis (PIA) of every out-of-hospital cardiac arrest (OHCA) call. During the PIA, everyone in the room listens to a recording of the entire 9-1-1 call. These analyses are focused on improving the system for patients and empowering telecommunicators to make the right decisions. Wolf often reminds her team, "It's ok to not be 100 percent perfect."

Wolf strongly believes that the best way to make a program better is to try to "break it" early on by reaching out to the skeptics and asking them to poke as many holes in it as possible. "Get those key people together and break the program. Run it from head to toe. Compare it to other programs," she says. It's through this type of collaborative problem-solving that people really begin to see the impact and the benefits of the change.

"When they see the success of the program," she adds, "they're gonna change their tune pretty quickly."

PART TWO

HIGH-PERFORMANCE CARDIOPULMONARY RESUSCITATION

CPR**LifeLinks**

Overview

What is High-Performance CPR?

High-Performance CPR is an expertly performed, choreographed and measured OHCA response consisting of individual and team performance that meets or exceeds current evidence-based performance recommendations.

HP-CPR **is the foundation of successful resuscitation and is the most important EMS therapy in treating OHCA**. Other interventions, such as advanced airway management and drug administration, should never interrupt CPR or compromise chest compression quality.

Current guidelines and collective experience suggest measuring detailed performance metrics in these key areas of HP-CPR:

Individual Performance	Definitions/Notes
Compression Rate	Number of compressions per minute
Compression Depth	Depth of each compression
Chest Recoil	Full release of compressor's hands off the chest
Ventilation Rate	Number of ventilations per minute
Ventilation Volume	Volume of each positive pressure ventilation
Real-time CPR performance feedback	Use of feedback or prompt devices that enhance real-time performance (e.g., metronome, puck)

Table 1. Individual Performance Metrics

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HP-CPR is strongly associated with improved survival and is common to communities that save the most lives from cardiac arrest.

Team Performance	Definitions/Notes
Team Roles Defined Pre-Arrival	Compressor, Airway, Monitor, etc.
Team Roles Choreographed	In Pediatrics, include a pre-arrival discussion of dosing and equipment sizing
Compression Fraction, affected by: ¬ Efficient rotation of compressors ¬ Minimization of all pauses in compressions ¬ Prioritization of compressions over advanced airway ¬ Utilization of closed-loop communication	Percentage of ongoing compressions during cardiac arrest, over a period where compressions are indicated

Table 2. Team Performance Metrics

The importance of pre-planning

Pre-arrival role determination is critical for all arrests, and all patients should receive the same high level of CPR irrespective of their age. While adult pre-planning is characteristically non-verbal, performance on pediatric calls will benefit from an intentional pre-arrival discussion that explicitly verbalizes equipment size, defibrillation values, and medication volumes.

Why is HP-CPR important?

HP-CPR is strongly associated with improved survival and is common to communities that save the most lives from cardiac arrest.[10, 11, 12, 13] Unfortunately, CPR usually doesn't meet performance recommendations in both adult and pediatric cases.[11, 12, 36, 37, 38, 39, 40] Achieving HP-CPR holds the promise of improved survival.

In this section of the toolkit, you will find information about the training, quality improvement, and leadership elements needed to build a culture of excellence and transform your EMS agency into a "High-Performance CPR System."

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Orchestrating the Resuscitation to Improve CPR Performance in a Large, Multiagency EMS System

Austin-Travis County EMS System, Austin, Texas

In the City of Austin and Travis County, Texas, leaders of the EMS system knew they had room for improvement. The survival rate from non-traumatic cardiac arrests was good, but not as good as they felt it could be. So they set out to engineer the process and maximize CPR quality while minimizing interruptions to chest compressions.

In 2010, the Austin-Travis County Office of the Medical Director led the implementation of High-Performance CPR—what they called a "pit crew" model—as one of several methods for improving cardiac arrest survival. The choreographed approach was designed to minimize interruptions in CPR. One key would be for every cardiac arrest to look the same, with responders knowing exactly what to do and where to do it before they even arrived on scene. That can be a challenge in any system, but especially one where 14 different agencies respond; Austin-Travis County is served by a single EMS transport agency and 13 fire departments that provide first response. Since Austin-Travis County EMS worked cardiac arrests with each of the 13 fire departments, having one unified way of treating these patients made the most sense. That meant training more than 1500 firefighters and nearly 400 paramedics.

"The model allows us to train and practice CPR in an organized, efficient manner that replicates the way we will actually perform on scene," says Austin Fire Department Battalion Chief Tom Vocke. In addition to training, the agencies all adopted standardized clinical guidelines, checklists, and equipment.

"The advent of pit crew CPR has given us a framework that improves patient care by offering a consistent and reliable approach for the treatment of prehospital cardiac arrest," says Patrick Murphy, an EMS commander with Austin-Travis County EMS.

The initial implementation of the pit crew model was just one part of a process of improvement that never really ends as new evidence and performance data become available.

"High-Performance CPR and resuscitation efforts in general are an ongoing journey," explains Louis Gonzales, a quality and patient safety specialist in the Austin-Travis County Office of the Medical Director. "There is never an end and it is often difficult to tease out whether quantitative results are attributable to any specific effort."

For example, early on they identified the need to change compressors after one minute, rather than two, to achieve the target compression performance. Repeated training, emphasis on key choreography aspects of pit crew CPR and the introduction of real-time compression feedback and ventilation timing devices have become essential to the system's ongoing improvement of its response to cardiac arrest.

"We have made great strides forward through analysis, modifications to clinical guidelines and continuous training," says Mark Escott, MD, medical director for the City of Austin-Travis County EMS System. "Our constant pursuit of excellence continues to enhance survival from cardiac arrest in our community," Escott says.

The Commitment to Act: Challenges and Perspectives

The Science–Implementation Gap

A large gap exists between knowledge of the science of CPR quality and the ideal implementation, leading to large numbers of preventable deaths from cardiac arrest. Historically, attention has appropriately focused on addressing the barriers to the technical skill and application of HP-CPR. The barriers in moving from knowledge to implementing scientific guidelines of CPR and best practices extend beyond a focus on improvement of CPR skills alone. Effective implementation of CPR quality improvement initiatives requires broader strategies that address organizational, operational, cultural, and leadership barriers.[44] These barriers are clearly intertwined, as are the possible approaches to overcome these barriers.

Eisenberg et al. defined ten actions required for implementing cardiac arrest survival improvements within a community. These implementation actions include:

- Select program or programs to implement.
- Form a team or advisory board.
- Determine how to make it happen in your community.
- Set specific goals.
- Establish performance standards.

- Achieve buy-in from agency personnel.
- Consider a pilot program.
- Communicate progress within the agency.
- Communicate with the public and EMS personnel.
- Support, advocate, celebrate.[45]

Barriers to Implementation

Several of these steps directly address common organizational, leadership, and cultural barriers to implementing High-Performance CPR improvement strategies within an EMS organization.[46] Such barriers are not exclusive to EMS. Implementation barriers include:

Leadership

- Misalignment of CPR quality with organizational vision, mission, values, and goals
  → The organization's strategic plan does not clearly lead staff towards a vision of excellence and quality.
- A top-down-only culture
  → Decisions are made by leadership with little to no inclusion, input or influence from those staff closest to the work being improved. This is in contrast to the high reliability organization principle of deference to expertise.
- Lack of engagement and support by the organization's leadership and medical director
  → Without leadership support and active involvement, staff may not see value in engaging in improvement efforts, believing instead that such efforts will simply meet resistance.
- Lack of receptivity toward changes in practices
  → Leadership may not recognize or see the need for HP-CPR or CPR improvement at all. They may believe current CPR performance is adequate or of superior quality.

- Lack of a clearly defined plan for improvement
  - → Leaders may desire to improve CPR performance but do not utilize staff and all available resources to create a plan for improvement.
- Ineffective or absent communication and feedback to field staff
  - → Most EMS providers desire feedback about their performance but don't receive it. When improvement plans are created, they may not be openly communicated to staff who will then be responsible for implementing.

Cultural

- A blame-focused performance improvement culture
  - → An individualistic culture to improving performance focuses on blame. In turn, staff are fearful, leading to a lack of desire to engage in improvement efforts or share ideas.
- Focus on individual-performance-causes only rather than including systems and teams
  - → An individualistic culture fails to consider the impact of teamwork and how other factors outside of the individual's control impact CPR performance.
- Lack of accountability
  - → Focusing on blame rather than encouraging accountability creates an emotional toll on staff. Without accountability, staff and systems lack awareness of CPR performance. Accountability acknowledges human fallibility and seeks to build respect, trust, and a desire to meet performance expectations.
- Lack of engagement of field staff in improvement efforts
  - → Without a bottom-up approach, the full value of employee input, engagement, and acceptance is not reached. If staff are not actively engaged in the process of CPR improvement, they are less likely to champion defined improvement efforts or to accept them at all.
- Resistance to change
  - → Staff and management expected to simply accept change as dictated to them are less likely to accept or promote the changes. The human aspect of change often begins with resistance, and EMS personnel are not at all immune to such feelings of resistance.
- Lack of recognition of potential harm caused by suboptimal CPR quality
  - → Culture is local and thus develops locally. Staff may not see the value of CPR quality or may not recognize the potential harm caused by suboptimal CPR, resulting in the development of a local cultural belief that CPR quality is adequate and not an important opportunity for improvement.

Operational & Organizational

- Costs of training, staff, equipment, and/or devices
  - → Organizations may attempt to implement many improvements and changes at once requiring significant financial and human resources, thus risking failure.
- Lack of staff resources for training and performance review
  - → Staff resource limitations are common in EMS organizations. Alternative approaches to training and case reviews may not be adequately explored.
- Competing priorities and/or limited capacities
  - → Leadership and staff may feel overwhelmed with the increasing number of priorities facing the organization. Reimbursement, personnel shortages, fatigue, personal safety, and other clinical quality concerns are among the important and competing priorities. This risks an HP-CPR program not being implemented.

- Lack of investment in performance measurement, monitoring, and feedback mechanisms
  → Organizations may not adequately explore methods for real-time and post event performance measurement and feedback.
- Attempt to address all CPR performance weaknesses at once
  → In addition to taxing limited resources, this approach may fail to address the impact of change in one performance aspect on another aspect of resuscitation performance. Large-scale implementation is much more challenging than smaller-scale improvements and at more risk for failed implementation.

Solutions to these challenges

CPR Implementation

Tremendous opportunities to maximize survival in local communities occur through engagement of the leadership of the local EMS agency and the EMS workers (EMTs and paramedics) who provide care at the patient's side. The endorsement by an agency's organizational culture of High-Performance CPR implementation is critical in moving from evidence to action. A recent important success changing the culture of healthcare occurred in the campaign to eliminate central-line associated blood stream infections.[47] Pronovost analyzed the impact of healthcare culture on implementation identifying best practices as well as challenges. Best practices included:

- Focusing on teamwork
- Establishing valid performance measures
- Summarizing best evidence into checklists
- Providing clinicians with continuous feedback on established measures

Pronovost reported that all healthcare culture is local. Similarly, all EMS care is local; important gains can be accomplished by achieving buy-in from the boots-on-the-ground EMS providers.[48]

Poor CPR a Preventable Harm

"Poor-quality CPR should be considered a preventable harm."[49] One important solution addressing the preventable harm is implementing High-Performance CPR in an EMS organization. Successful teaching changes behavior and represents the true definition of learning; in order to change behavior throughout the EMS agency, a best practice is to engage the culture of the organization. The publication, "Strategy for a National EMS Culture of Safety," identifies "Just Culture" as a solution to the cultural resistance to implementation. Elements of "Just Culture" include an organizational environment that sets expectations that individuals report mistakes which then evaluates risks leading to errors. The focus on risk, rather than negative outcomes, while addressing system factors, allows modification of these factors in a collaborative way, without blame or punishment. Similarly, this culture supports sharing with the worker valid performance data based upon established measures; this represents an additional way that the leadership can show support and respect for the care delivered by the EMS worker.

Bottom-up Implementation

There is an opportunity for improvement by working within the culture of the EMS organization. One promising method of implementation of High-Performance CPR involves beginning the change from the "bottom up," giving the information to select EMS workers, and having them adapt the techniques to their team work processes. In this way, the workers have buy-in/ownership of the implementation. Optimal selection of the company or crew best able to undertake this pilot implementation can hinge, in part, on how much of an "early adopter" culture exists in the crew. It is likely that the crew selected have previously piloted rollouts of other new policies or equipment in their department.

Similar to the hospital implementation of reducing infections from central lines, adapting the hospital implementation process steps to work for a department intent on rolling this best practice out across a shift and eventually the entire

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department. At each phase of the rollout, crews pilot the HP-CPR. When the incremental pilot implementation delivers success, it develops more workers supporting the culture of change. Gradually, more supporters replace disbelievers until the believers outnumber those who do not believe in the program. When a critical mass of believers exists in a department, outnumbering the non-believers, change in the culture can occur.

An example/potential impact of how this cultural shift can reverse expectations is evident when the prevailing cultural attitude is despair and a feeling that the EMS workers, though joining the profession to help and to save lives, are not making an impact in their care of cardiac arrest. Following the pilot and culture change, their attitude is "flipped;" when evaluating that subset of cardiac arrest patients with a witnessed arrest and a shockable rhythm, they now believe they should accomplish return of circulation. In practice, after successful implementation, it is not unusual for return of spontaneous circulation rates to approach 60–65%. Thus, success occurs in the majority and they focus on the approximate 1/3 for whom they did not succeed. When they do not accomplish ROSC they review their performance feedback on that case, praising what they did well, but being very single-minded when evaluating what they could improve next time to succeed at saving a life.

Top-Down Implementation

To pilot a bottom-up implementation for High-Performance CPR has the benefit of engaging the workers and recruiting their support for the change. There are clear benefits as well for pilot implementation from the leadership above.[50] This can occur in many ways and at different times. Most simply, communication and vision from the top can be crucial in setting the pilot up to succeed. Another model that can succeed synergistically is, following buy-in and engagement from the pilot crew, sharing the HP-CPR protocol from the top down while extolling the benefit of the field contribution and "boots on the ground" rollout. An additional method, if the HP-CPR protocol is already in place, can occur after success of the pilot. In this situation, despite a critical mass of personnel who support the change, there may still exist a quarter to a third of the agency that have yet to accept the change. In this situation, release of a HP-CPR order can help complete and cement the change. Once the collaborative order is out, supported by the majority of the department, field-level managers and supervisors can engage those workers not implementing the pilot by emphasizing that now there is a requirement to implement. Much larger implementations are also possible, from a state or national level.[51] In these cases, leadership and support from the top (e.g., setting a strategy, gaining approval of elected officials, publicizing implementation through social media and publishing an HP-CPR protocol to ensure consistency in local rollouts) are crucial to success.

Action Steps for Overcoming Barriers

Essential to the successful implementation of High-Performance CPR initiatives are practical actions overcoming the above listed barriers. Although all are vital, these actions may be implemented in phases particularly when an organization has limited financial and/or staffing resources.

Leadership

The active involvement of leadership in quality improvement efforts encourages involvement at other levels of the organization.[52] Though a top-down implementation alone is not necessarily ideal, the organization's leadership including the medical director should:

1. Foster openness to quality improvement and change through a culture of respect and inclusion (ACHE, 2017).
2. Ensure clinical quality including CPR quality initiatives are both aligned with and a part of the organization's vision, mission, values, and goals.[53]

3. Support and demonstrate active engagement in CPR quality improvement initiatives at all levels of leadership, management, and staff.

4. Formulate a clear plan for implementing, monitoring, and improving HP-CPR within the organization consistent with Eisenberg's ten steps.

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5. Ensure inclusion of all levels of staff in planning and implementing CPR quality improvements.[54]

6. Inspire and encourage both top-down and bottom-up approaches to defining performance improvement opportunities and creating improvement solutions. Seek to incorporate the high reliability principle of deference to expertise by fully utilizing input and ideas from staff closest to the resuscitation work.

7. Establish effective communication and feedback mechanisms and share CPR quality improvement efforts and results with all levels of the organization.

Cultural

1. Consider adopting a just culture or learning culture while seeking to eliminate blame.
2. Adopt an improvement culture that focuses on systems and teams rather than solely on individuals.

3. Seek accountability by defining performance expectations, monitoring performance, and sharing actual CPR performance with staff for the purposes of improvement rather than finding fault.

4. Engage staff closest to the field resuscitation work in the development and testing of improvement initiatives.

5. Foster a culture that recognizes suboptimal CPR quality as preventable harm to patients. Through education, communication, and celebration of successes, demonstrate the value of CPR quality.

Operational & Organizational

1. Create a plan that utilizes a phased-in approach of multiple improvements over time.
2. Prioritize the organization's priorities in a manner that is consistent with the strategic plan and illustrates to leadership, management, and staff the value placed on CPR quality improvement.

3. Implement in small increments (baby steps) to both minimize the initial financial impact and the burden on staff. Utilize a PDCA/PDSA approach to evaluate how well a small change or set of changes improves performance.

4. Utilize small-change improvements to create champions who will then spread the message of success to others.

5. Identify simple, low-cost solutions to measuring, monitoring, and improving CPR performance. For example, small, low-cost, battery-operated metronomes may be easily found at music stores. Alternatively, a metronome app can be downloaded to any smartphone and used to boost team performance by helping EMTs find and stay in the "sweet spot" for survival when delivering chest compressions.

6. Plan for larger-scale CPR quality measurement, monitoring, and feedback devices in future budgets rather than attempting to implement all at once when financial resources are limited. For example, consider incorporating CPR performance devices in future capital purchases of AEDs or similar cardiac monitoring devices.
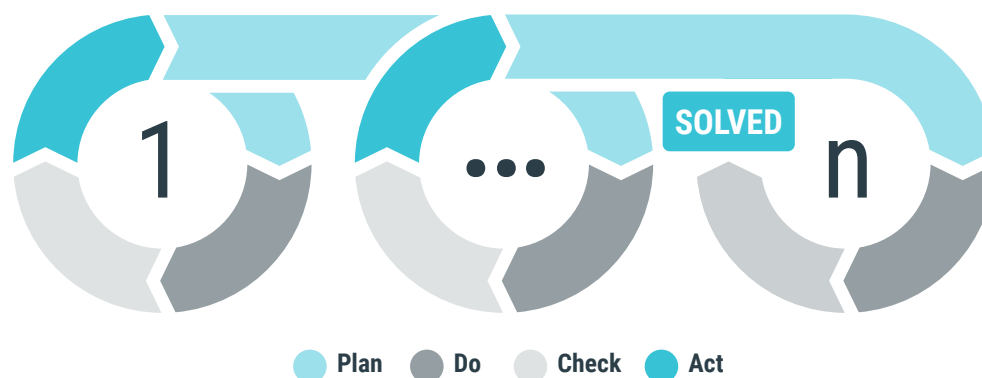

Plan Do Check Act

Figure 5.

Performance Recommendations

This section incorporates the latest American Heart Association performance recommendations to address significant components of adult CPR and pediatric CPR.

Adult CPR

Chest compressions should achieve proper depth, rate, recoil, and fraction. Controlled ventilations should achieve proper rates and volume. Table 3 summarizes performance recommendations for each of these components. It includes common errors, their possible effects, and key points for providers.

Compression fraction, the percentage of time compressions are performed during a resuscitation, should be at least 60%, but should be **as high as possible**. High-performing systems achieve compression fraction of 90% or higher.

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Significant Components of Adult CPR

	Performance Recommendations	Common Errors & Causes	Possible Effects of Common Errors	Key Points for Providers
Chest compression depth	¬ At least 2 inches ¬ No more than 2.4 inches ¬ Approx 5–6 cm	¬ Too shallow ¬ Too deep ¬ Fatigue	▼ coronary perfusion pressure ▼ cerebral perfusion pressure ¬ Potential injuries	"Push hard, but not too hard"
Chest compression rate	¬ 100–120 per minute	¬ Too slow ¬ Too fast ¬ Fatigue	▲ intrathoracic pressure ▼ coronary perfusion pressure ▼ cerebral perfusion pressure	"Push fast & monitor the compression rate"
Chest recoil	¬ Allow complete chest recoil after each compression	¬ Failure to allow full chest recoil ¬ Leaning ¬ Fatigue	▲ intrathoracic pressure ▼ coronary perfusion pressure ▼ venous return ▼ survival	"Allow complete chest recoil"
"Compression fraction"	¬ Minimize ALL interruptions to CPR ¬ Pauses < 10 seconds ¬ At least 60%, **but as high as possible** ¬ High-performing systems achieve compression fraction of 90% or higher	**Prolonged periods of no CPR:** ¬ AED analysis & charging ¬ Pulse checks ¬ Changing rescuer roles ¬ Advanced airway mgmt. ¬ Logistics around defibrillation ¬ Ineffective team coordination	▼ defibrillation success ▼ return of spontaneous circulation (ROSC) ▼ survival	"Minimize interruptions to chest compressions"
Ventilation	¬ 10 breaths per minute ¬ 1 second per breath ¬ Minimal chest rise ¬ Tidal volume 500–600 ml per breath	¬ Excessive ventilation rate ¬ Prolonged ventilation duration ¬ Excessive tidal volume	▲ intrathoracic pressure ▼ coronary perfusion pressure ▼ survival	"Don't overventilate," offer controlled ventilations

Table 3. Hemodynamically & Neurologically Significant Components of Adult CPR

Pediatric vs. Adult CPR

HP-CPR is also the foundation of pediatric resuscitation. Performance on pediatric calls will benefit from an intentional pre-arrival discussion that explicitly verbalizes equipment size, defibrillation values, and medication doses and volumes.

	Pediatric	**Adult**
Likely Arrest Etiology	Respiratory	Cardiac
Rescue Breathing Instructions (T-CPR)	Yes	No
Sniffing Position Technique	Elevate the shoulder	Elevate the head
Compression Depth	1/3 AP Diameter of Chest ¬ Infant (4 cm) ¬ Children (5 cm)	5–6 cm 2–2.4 in
Compressions: Ventilation *Two-person rescue*	15:2	Variable by Agency Continuous vs. 30:2

Table 4. Differences in Pediatric and Adult CPR

For more information on the latest AHA guidelines, please visit the following links:

Adult CPR	**LEARN MORE** 🌐
Pediatric CPR	**LEARN MORE** 🌐

2.4 Common CPR Quality Issues

Recognition of CPR quality issues and their causes is an essential step toward improving performance.

In general, there are four common challenges:

- Avoiding delays, pauses, and interruptions in CPR
- Optimizing compression technique

- Managing chaos
- Managing the effects of airway and ventilation techniques

Avoiding delays, pauses, and interruptions in CPR

Avoiding delays in starting CPR is critical. Delays result when:

- **EMS providers fail to recognize the patient is in cardiac arrest** (often because the patient is gasping, having seizure-like movements, or is "too young" to be in cardiac arrest).
- **The patient must be moved** (e.g., from a small bathroom to the hallway, outside the bathroom, or to a location safe for providers) in order to provide HP-CPR.

With strict compliance, patients in cardiac arrest should not be moved until return of spontaneous circulation (ROSC) has been obtained, unless it is impossible to provide HP-CPR in the current location. Patient movement should be kept to a minimum.

After CPR is started, lengthy pauses in compressions can occur for a number of reasons including: the need to move the patient, switching chest compressors, pulse checks, rhythm analysis, defibrillation, vascular access, airway management, team disorganization, lack of predetermined role coordination, and failed communication. HP-CPR minimizes these pauses and interruptions.

Optimizing Compression Technique

Optimal compressions achieve target rate and depth and allow complete recoil.

The following can help realize them:

- Compressors should receive real-time feedback regarding compression rate, depth, and recoil. In the absence of a device suitable for this purpose, the team leader must provide real-time feedback to the compressor.
- The team leader should assess compression quality and continuity and should direct the rotation of compressors at least every two minutes and/or during rhythm analysis.
- A metronome or similar rate-measuring device should always be used to help the compressor maintain the target rate. There are multiple free metronome apps available for personal wireless devices.

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Managing Chaos

Resuscitation usually takes place in an environment filled with complex distractions. Team choreography, including strong leadership from a designated code commander with priority task checklists, clear definitions of individual roles, closed-loop communication, and equipment organization will help team members "stay in their lanes" and minimize chaos.

Here are some tips for managing common scene challenges:

- A good rule of thumb as you enter the scene of a cardiac arrest is to "take your own pulse first." Take a moment to ground yourself and be mindful of the critical tasks you are about to perform. Think about giving that patient and his or her family your very best that day.

- If a resuscitation team can assign someone to communicate with loved ones during the resuscitation there can be positive results, regardless of the outcome.[41] There is no need to usher family members out of the room — we now know that engaging family during a resuscitation can be an important part of their understanding and healing. However, if family members are disruptive or interfere with the resuscitation, efforts should be made to calm them or to temporarily escort them from the space.

- Pets, poor lighting, and loud noise can distract rescue efforts. Have pets placed in another room with the door closed. Turn on lights and turn off radios, televisions or other noise-making devices if it's easy and helps focus.

- Re-arrest may occur en route to the hospital and considerations such as time/distance from definitive care, crew safety (e.g., being out of safety belts), and factors preventing High-Performance CPR need to be determined and addressed through department policies and training. Optimally, the crew should stop the transport and re-prioritize high-quality resuscitation. This will help to deliver ideal compressions and promote crew safety. Based on resource availability, the role of mechanical compression devices should be considered if compressions are to be performed during transport.

Managing the Effects of Airway and Ventilation Techniques

Ventilation remains an essential component of CPR. The challenge is to integrate the tasks of ventilation with compressions so interruptions to compressions are prevented or minimized and compression quality isn't compromised.

Interruptions may be unintentionally lengthened by attempts to reposition the airway, reposition the mask, or synchronize ventilations to compressions. Additionally, attempts to manage the airway through placement of an advanced airway may lead to lengthy interruptions of chest compressions. Team distractions on the airway device can also hinder the effectiveness of chest compressions.

The following are tips to help integrate ventilations and airway management into CPR performance:

- Clinical interventions such as endotracheal intubation, supraglottic airway placement, or venous access should be performed such that they do not interfere with compressions.

- When effective ventilation is achieved using a non-invasive technique, consider delaying or deferring placement of an invasive airway management device. However, if necessary, consider placement of an advanced airway after ROSC and before moving the patient. Optimal bag valve mask (BVM) ventilations are difficult to ensure when moving patients.

- Preplanning should define the conditions under which repeated attempts at airway device placement should occur, or if they should occur at all. High-quality compressions should never be interrupted to place an advanced airway.

- Ideally, two people perform bag and mask ventilation. One person should maintain an effective mask seal and appropriate airway position. The other person should operate the bag with care to ensure that the proper tidal volume is delivered.

- Use a nasal pharyngeal airway (NPA) or oral pharyngeal airway (OPA) to increase optimal ventilations. NPAs and OPAs can be used simultaneously. A nasal cannula can also be applied during BVM ventilation to increase oxygen delivery.

- Use a timing feedback device, deliver ventilations every 10–15 compressions, or have an observer time the frequency of ventilations delivered.

- Consider use of volume or pressure-limiting strategies (e.g., pediatric bag for adult patient or volume or pressure limiting devices) to prevent over-inflation.

- ☑ During manual rhythm analysis, assessment of the underlying electrical activity, including shockable, organized, or absence of activity, should be determined within 3–5 seconds.

- ☑ When a manual defibrillator is used, the device should be charged prior to stopping compressions to assess the rhythm.

- ☑ Once the shock decision is made, CPR must be immediately resumed or the shock delivered with CPR following immediately.

- ☑ During the charge sequence of the AED, the compressor should resume high-quality compressions until the "deliver shock" message is given if the AED allows this practice without interrupting analysis or charging sequences. This may not be possible with some AED models. Some models detect motion, which can alter the decision and halt the charge sequence.

- ☑ During AED rhythm or manual rhythm analysis, as well as following defibrillation, the compressor should be in place with hands hovering over the chest to immediately resume compressions. Prior to shock, patient clearing should be no longer than 2 seconds to avoid lengthy pauses in compressions.

- ☑ One confirmation of high-quality CPR may be the presence of a pulse during compressions. Assessment of a pulse during compressions just prior to a planned rhythm and pulse check will allow for rapid assessment of a pulse without CPR.

- ☑ Ideally, the use of continuous EtCO2 may be used to confirm adequate ventilation, assess the quality of compressions, and provide evidence of ROSC.

- ☑ Complete chest recoil is imperative. Feedback devices can be used or compressors can train with the practice of having another provider slide a piece of paper under their hands at complete recoil to ensure complete chest expansion.

- ☑ Providers should be vigilant about the potential for re-arrest after initial ROSC, during patient packaging, or in transport. Frequent assessment/documentation of continued ROSC through EtCO2, SpO2, and perfusing rhythms confirmed with a pulse should be incorporated into post-ROSC protocols. Providers should discuss actions to take upon re-arrest and how to best initiate high-quality CPR and affect resuscitation.

- ☑ Manage the sense of futility associated with OHCA through frequent training and debriefing. Identification of barriers in starting/resuming CPR, as well as sharing resuscitation outcomes with data review, will promote crew buy-in. Recognizing the value of one's efforts minimizes the bias associated with perceived futility in cardiac arrest resuscitation efforts.

Summary

Practical and well-planned actions, vigorous training, and quality-improvement metrics will lead to dramatically improved resuscitation practices. Using the performance metrics described earlier, an agency can determine where the greatest resuscitation deficits lie and identify strategies for improvement. High-Performance CPR should remain the primary focus as a means to improve resuscitative outcomes. Optimal care involves more than just technical and clinical skills, however — the best providers respond with a mindfulness that helps them do their very best under whatever circumstances they may encounter.

2.5 Training

As noted previously, HP-CPR is the foundation of successful resuscitation and is the most important EMS therapy in treating OHCA. Other interventions, such as advanced airway management and drug administration, should never interrupt CPR or compromise chest compression quality.

HP-CPR is not complex, but it isn't easy. Professional rescuers may think they're achieving recommended performance measures, but often they are not. Proper training is the foundation for success and should be mostly "hands-on" and measured for quality. Cognitive training should be no more than 20% of the total training time. Retraining should occur at least every 6 months, but more frequent retraining is better. Repetition is the mother of all mastery. At the end of the day, High-Performance CPR is something that happens on your hands and knees, so it's a good idea to have padding to kneel on when you train.

The pages that follow summarize the things you'll need to keep in mind and have on hand.

Preparing for HP-CPR Training

Class Time	Audience
At least 4 hours	¬ EMTs ¬ Paramedics ¬ Training Officers ¬ Nurses ¬ Respiratory Therapists ¬ Nurse Practitioners ¬ Physician Assistants ¬ Agency Medical Director ¬ Industry stakeholders

CPR**LifeLinks**

Equipment/supplies

The training environment is very important in promoting mastery.

**Here's a list of things you'll need to optimize the learning experience**:

- Class agenda
- Sign-in sheet
- Name badges
- Classroom with plenty of open floor space
- Chairs

- 1 manikin (CPR quality feedback or high-fidelity preferred) for every 6 students
- Defibrillators (or AEDs)
- Defibrillator training pads (Use the same equipment you would use on a call whenever possible.)

- Electrical outlets
- Computer
- PowerPoint projector (or TV monitor)
- Snacks
- Evaluation forms

What Does High-Performance CPR Training Look Like?

- ☑ **Simple**: to facilitate accomplishment of course objectives
- ☑ **Consistent**: to reduce variability that deviates from the intended course agenda
- ☑ **Contextual**: can be applied practically in a real-world setting
- ☑ **Hands-on**: to meet psychomotor and non-technical / leadership skill performance objectives

- ☑ **Practice to Mastery**: to ensure repetitive performance of key skills coupled with rigorous assessment and informative feedback in a controlled setting based on clearly defined objectives
- ☑ **Debriefing**: to allow learners the opportunity to reflect on their performance
- ☑ **Assessment**: to ensure achievement of competence based on clear and measurable learning objectives
- ☑ **Course Evaluation**: to help drive continuous quality improvement

Classroom setup

The classroom should be set up with resuscitation pods to encourage participation and practice.
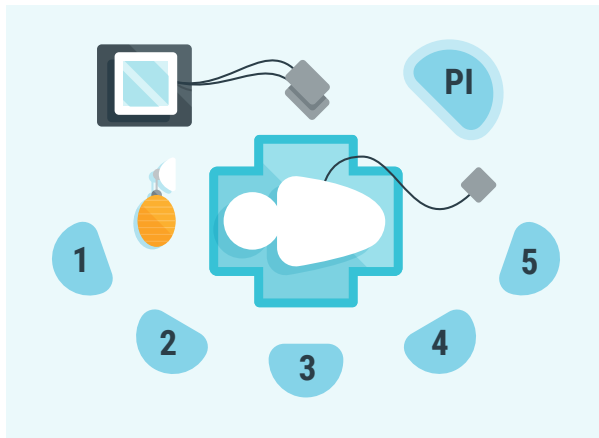
Resuscitation Pods

- Each "pod" consists of chairs in semicircle around a manikin
- Each pod also needs a defibrillator (or AED) with training pads and a bag-valve-mask (BVM)
- Each resuscitation pod should have a "pod instructor" (PI)
- Maximum student-to-manikin ratio of 6:1
- High-fidelity manikins are preferred; monitor/defib/ AED with CPR feedback also preferred

Figure 1. Resuscitation pod set up for 5 students and 1 pod instructor (PI)

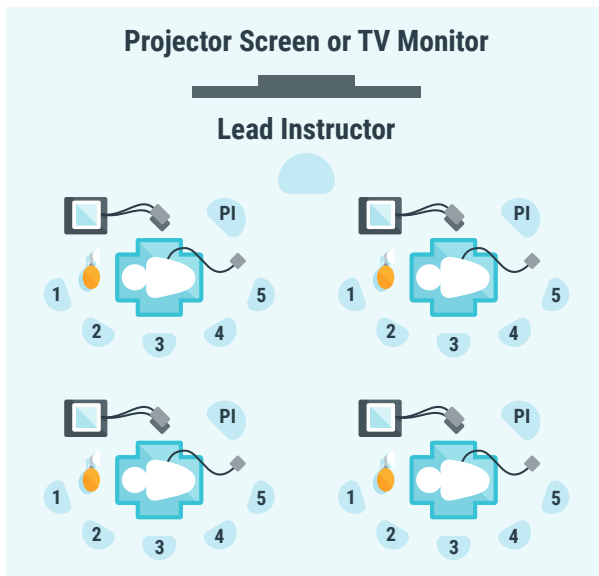**Projector Screen or TV Monitor**

Lead Instructor

Figure 2. Classroom set up with 4 resuscitation pods (20 students)

Other Considerations

- The ideal HP-CPR classroom is modular and scalable.
- The class is conducted by a lead instructor who coordinates content delivery and manages time.
- If there are a sufficient number of manikins, defibrillators, BVMs, and pod instructors, a single classroom might have 5 or 6 pods (or even 10 or more).
- Remove the tables! There should be no physical barriers between the students and the manikin.
- Use a single metronome so the class doesn't get confused.

Coordination

- One of the main objectives is to break down HP-CPR into its component skills (e.g., compression skills) and to master each skill.
- The pod instructor can assign individual roles based on the student's chair number. For example, "In this evolution, #1 will be monitor, #2 will be chest compressions, and #3 will be airway."
- When the evolution is complete, the students return to their assigned chairs so the Lead Instructor can see that the pod is ready for the next evolution.

CPR**LifeLinks**

Circle of Learning

The High-Performance CPR Circle of Learning illustrates that High-Performance CPR is a continuous process intended to transform actual performance during emergencies.

HP-CPR starts in the classroom but is meant for the street/hospital. It is designed to give professional rescuers the knowledge and skills they need to work together at a very high level.
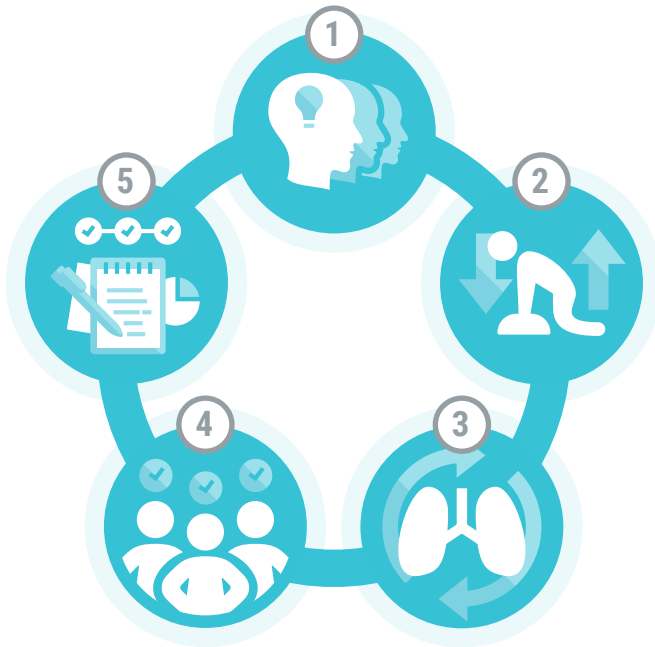
SEGMENT ONE
Know the Recommendations

SEGMENT TWO
Master Rate, Depth & Recoil

SEGMENT THREE
Don't Over-Ventilate

SEGMENT FOUR
Optimize Teamwork – Minimize Pauses

SEGMENT FIVE
Measure & Improve

SEGMENT ONE
Know the Recommendations

Evidence-based guidelines (see Tables 3 and 4) tell us what to do. High-quality training shows us how to do it. The very best training includes the "why" — understanding the basic science of HP-CPR provides context that motivates performance and helps professional rescuers remember the critical steps of HP-CPR during actual resuscitation attempts.

Adult learners like to know the reason they are being asked to perform in a particular way. Professional rescuers want to do a good job. If they're compressing too fast, not allowing full recoil, or over-ventilating, it's not intentional.
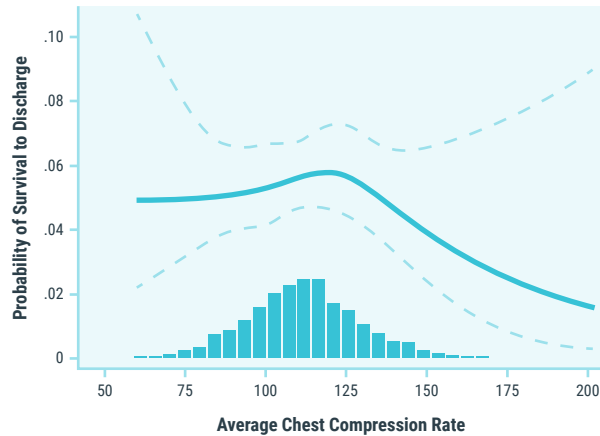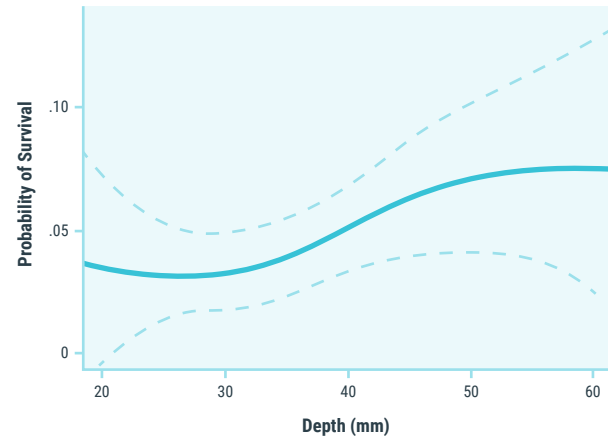
Master Rate, Depth & Recoil

A good chest compression has three important qualities: rate, depth, and recoil. Survival depends on maximizing the effectiveness of all three.
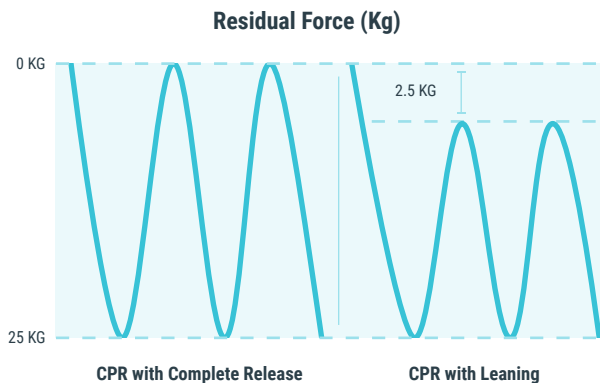
Rate: 100–120   **Depth:** 2.0–2.4 in (5–6 cm/50–60 mm)   **Recoil:** Avoid Leaning

Figure 3. The relationship between chest compression rates and outcomes from cardiac arrest. *Circulation* 2012;125(24):3004–3012

Figure 4. What is the Role of Chest Compression Depth during Out-of-Hospital Cardiac Arrest Resuscitation? *Crit Care Med* 2012 Apr;40(4):1192-1198

Figure 5. The prevalence of chest compression leaning during in-hospital cardio-pulmonary resuscitation. *Resuscitation* 2011 Aug; 82(8):1019-1024

Figure 6. One way to ensure full recoil is to allow the heel of your hand to come all the way off the chest during the upstroke. **You should be able to swipe a credit card between the heel of your hand and the chest**.

To achieve proper chest compression mechanics, do the following:

- Position knees close to side of patient.
- Position shoulders directly over patient's chest.
- Lock your elbows.
- Push with the heel of your hand.
- Completely release off chest between compressions.
- Don't lean on the chest.

In addition to compression rate, depth, and recoil, compression fraction (the percentage of time compressions are being performed during a resuscitation) also impacts survival — that's why we want to keep interruptions to a minimum. Compressions should be performed at least 60% of the time, *but the higher the fraction, the better.*

For more on compression skills, please see Appendix 3.7, page 74.

Don't Over-Ventilate

The tendency is to over-ventilate. Ventilations should be controlled.

Keep these things in mind:

- Don't squeeze the bag too often.
- Squeeze just enough to see chest gently rise.
- Allow full release of the bag.
- Ideally, two people manage ventilation. One assures a proper seal over the mouth and nose. The other provides controlled ventilations.

Why are uncontrolled ventilations bad? Positive pressure ventilations increase intrathoracic pressure, which decreases blood return to the heart and lowers cardiac output during CPR.

Note: Some BVMs are "smart bags" that limit flow and may prevent excessive airway pressures, volume, and rate. Use of a timing light for ventilations may also help.

SEGMENT FOUR
Optimize Teamwork – Minimize Pauses

Once each individual has learned how to perform consistently excellent chest compressions and ventilations, it's time to combine these skills and work together as a team. **Never pause CPR longer than 10 seconds**.

Keep in mind that standardized equipment placement during a resuscitation makes consistent performance much easier.

Communication between team members must be clear.

Before You Get There

Everyone needs to know their individual assignment before they arrive on scene. They also need to know the shared priorities and goals that make up team "choreography." Knowing this helps to avoid duplication and prevents gaps in the performance of critical tasks. Some systems may find that an assignment given at the beginning of the shift is best ("Today you are compressor 1"). Other systems may prefer other methods (e.g., "'Left Rear Seat' is always compressor 1"). By whatever means, everyone needs to know their position and responsibilities when they arrive.

Positions and responsibilities will vary from one agency to another. Here's one way of breaking them down:

Position 1: Monitor/AED

- Places monitor at 45-degree angle to left shoulder (monitor can be set back a few feet from working area)
- Checks pulse and announces "no pulse, begin CPR"
- Attaches capnography circuit to monitor
- Extends pads and coordinates placement with rescuer in Position 2 (chest compressions)
- Changes monitor to pediatric mode if applicable
- When appropriate pre-charges the monitor and manages peri-shock pause

Position 2: Chest Compressions

- "Hovers" during pulse check
- Performs compressions at correct rate, depth, and recoil
- Accepts feedback from crew members about compression quality
- Coordinates pad placement with rescuer in Position 1 (monitor/AED)
- Counts out loud "13, 14, 15" or "28, 29, 30" to prompt rescuer in Position 3 to give breaths
- Waits two full seconds for airway position to give breaths and continues compressions
- Helps keep track of 2-minute cycle
- Stops compressions and remains clear when Monitor/AED position announces "stop CPR" at the beginning of the peri-shock pause

Position 3: Airway

- Announces "I've got airway"
- Selects the correct size BVM and attaches capnography between mask and bag
- Announces "ready for 15:2" or "ready for 30:2"
- Reminds Position 2 rescuer to count last three compressions out loud
- Delivers ventilations correctly (just enough to produce chest rise with full release between ventilations)
- Manages the patient's airway as necessary

Position 4: Timekeeper/Assistant

- Starts metronome and acts as timekeeper
- Turns on oxygen and connects BVM to oxygen at 15 LPM
- Selects correct-sized oropharyngeal airway (OPA) for the rescuer on the airway
- Deploys and tests suction unit
- Reminds rescuer on monitor to pre-charge at 1 minute 45 seconds into the cycle

When You Get There

There are a few things to size up when you arrive on scene:

- Is the scene safe for the team?
- Is anyone already doing CPR?

If someone is already doing CPR, your team leader should judge the CPR quality and relieve the person doing CPR. Details about the quality of CPR should be documented and passed along to the rest of the team and hospital staff, if appropriate, as they may impact decisions about how long to resuscitate and can affect the hospital providers' early impression of the patient's chance of survival.

- Is the patient in cardiac arrest?

Initial patient assessment should take no more than 10 seconds. Remember, "if there's doubt, there is no doubt" — if you're not sure whether there's a pulse, start CPR. Don't get fooled by agonal breathing. We sometimes mistake it for signs of life and this delays CPR. Training should include how to recognize agonal breathing.

Here are some examples of what it can sound like:	LISTEN 🔊	LISTEN 🔊	LISTEN 🔊

- Is there enough room for the crew?

We need enough space to do HP-CPR. You may need to move the patient or clear furniture. Remember, however, that as a rule, patients should not be moved until ROSC has been obtained. Only move the patient if necessary!

- If there is apparent trauma, is it really the cause of cardiac arrest?

Be suspicious of "trauma" cardiac arrests. If an event seems unlikely to cause cardiac arrest (a minor motor vehicle accident, for example), it may have resulted from cardiac arrest. Again, if there's doubt, there is no doubt — start resuscitation.

- Place defibrillator pads as early as possible. If good CPR is in progress when you arrive, consider checking rhythm right away.

Types of CPR Delivery

Standard CPR

The most common method of ventilation of adults during cardiac arrest is to deliver 2 breaths for every 30 chest compressions, which is referred to as "30 to 2."

Without proper training it is not uncommon for crews to pause 5 or 6 seconds to provide 2 breaths! Manikins are often hard to ventilate — the chest doesn't rise the way we think it should, for example. This can lead us to deliver too much air and waste precious time during actual cardiac arrests. With HP-CPR the delay for ventilations should be only about 3 seconds: one second to deliver the breath, one second of passive expiration, one second to deliver the second breath. Then continue with 30 compressions.

The rescuer on airway is responsible for delivering the breaths during this short pause. The rescuer on chest compressions should start again after 3 seconds whether the breaths have gone in or not.

This helps prevent the steep decline in coronary and cerebral perfusion pressure associated with excessive delays. Continue holding the mask on the face to deliver passive oxygenation during compressions.
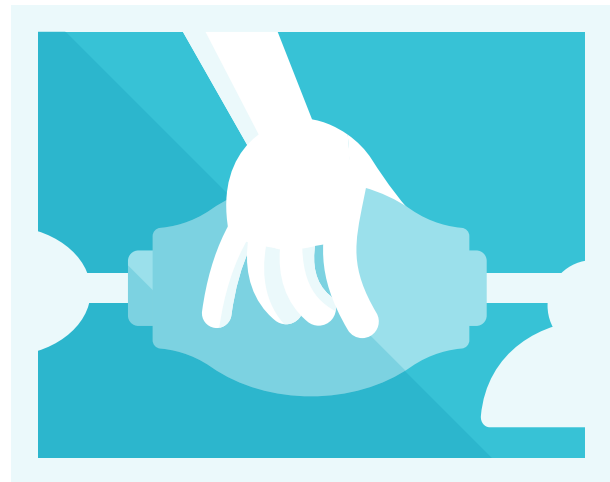
Consider holding the BVM by the end or using a thumb and 2 or 3 fingers to ventilate. This is sometimes called *"pinky-up"* or *"princess"* ventilations.

BLS Continuous

Some systems provide continuous chest compressions and interpose one small breath every tenth compression. This requires practice but can be done without an advanced airway in place.

Passive Oxygenation

Some systems perform 3 cycles (or more) of continuous chest compressions with passive oxygen administration for adult, witnessed cardiac arrest. This is sometimes referred to as Minimally Interrupted Cardiac Resuscitation (MICR).

Regardless of which compression/ventilation strategy is used the same advice applies — be the best you can be at that method!

Defibrillation

Once students can perform chest compressions and ventilations together as a team, defibrillation is added.

There are logical reasons for resuscitation teams to interrupt CPR, including to perform rhythm checks, to defibrillate, or to switch out the rescuer on chest compressions. **We should train to combine these interruptions into the same (short!) interval to minimize pauses and delays in CPR**.

The term "peri-shock pause" is used to describe the length of time during which CPR is interrupted to perform defibrillation. Keep the hands-off-chest time during rhythm check and compressor change to 10 seconds or less — highly functioning crews can limit this to 2 or 3 seconds.
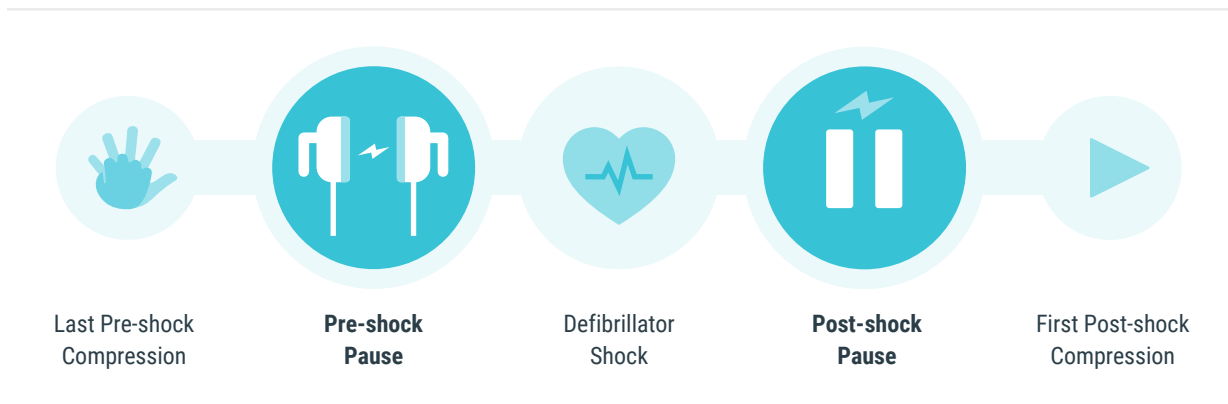
Anatomy of a Peri-shock Pause

| Last Pre-shock Compression | **Pre-shock Pause** | Defibrillator Shock | **Post-shock Pause** | First Post-shock Compression |

Figure 7. Anatomy of a Peri-shock Pause

Peri-shock Pause: Efficiently Managing the Peri-shock Pause.	
David: (Compressor)	*"We're at 1:30 – 30 seconds!"*
Team Leader:	*"Okay. Whose next on compressions?"*
Susan:	*"I am!"* (Susan gets into place to take over compressions.) …
Team Leader:	*"Ok, we're now at 1:45. I'm pre-charging the defibrillator – everyone but David clear the patient."*
	BEEP—BEEEP-BEEEEP-BEEEEEEP—BEEEEEEEEEEP
Team Leader:	*"Okay, stop CPR."* (Beginning of peri-shock pause.) (David clears out of the way and is replaced by Susan.)
Team Leader:	*"We have VF on the monitor. Shocking."* (Shock is delivered. Alarm stops.)
Team Leader:	*"Continue CPR."* (Susan starts chest compressions. End of peri-shock pause.)

Table 5. Efficiently Managing the Peri-shock Pause

CPR**LifeLinks**

Find the femoral pulse during compressions — your fingers will be in the perfect place to assess whether there's a pulse during the peri-shock pause.

One of the ways we can minimize hands-off time is to pre-charge the defibrillator at the 1:45 mark of each cycle. The compressor should call out time (from the monitor) to keep the team in sync. A crewmember should locate the compression pulse in the groin and maintain contact with that point when compressions are paused.

Chest compressions should not be interrupted during the pre-charge. However, it should alert the team that it's time to switch out the rescuer on chest compressions. For more on defibrillation, please see Appendix 3.8, page 75.

Scenario-Based Simulations

Simulation training helps teams and individuals hone their proficiency in realistic conditions. Providers must train in teams with other providers so that they can function as a unit, just as they must do in real-life resuscitation attempts. The amount of training time varies based on rescuers' backgrounds and skill levels, and the frequency with which they perform CPR in the field.

Here are some scenarios you can use in training:

One: Witnessed with no bystander CPR
67-year-old male collapses while playing tennis. He is unconscious with gasping respirations. Skin color is gray-blue. On EMS arrival the patient is found in the recovery position. Initial assessment reveals no pulse.

Two: Witnessed with bystander CPR
21-year-old college soccer player collapses on the field and is determined to have suffered out-of-hospital cardiac arrest by the athletic trainer. Someone has reportedly been sent to the school to retrieve the AED but it has not yet arrived. High-quality CPR is being performed by the athletic trainer and an off-duty nurse.

Three: Unwitnessed
38-year-old female found by her roommate unconscious in the bathroom. She is reportedly a recovering addict. The scene is safe. Bystander CPR is being performed by a law enforcement officer at the time of EMS arrival. It is a small bathroom.

Four: Pediatric
5-year-old male discovered missing by parents. Found floating in backyard pool. Child is pulled out of the swimming pool. The patient's father is performing CPR on EMS arrival. The mother is screaming. The hospital is 5 minutes away.

Five: Special situation
58-year-old female is a restrained operator of a motor vehicle involved in a minor motor vehicle collision. She is unconscious and slumped forward. Skin color is blue. The scene is safe. A bystander placed the vehicle in park and turned off the ignition. The patient does not appear to be breathing.

CPR**LifeLinks**

> Each member of the team should function in every role until mastery. Consistently excellent CPR delivery is what High-Performance CPR is all about.

Measure & Improve

High-Performance CPR is about improving patient outcomes. Once members of your team are proficient in HP-CPR practice, they must start to use the skills during actual emergencies.

Through team debriefings and analysis of CPR performance with defibrillator data (software that measures things like CPR fraction and peri-shock pauses), you can identify opportunities for improvement that can in turn be incorporated into the next iteration of your HP-CPR class. The process never ends!

Additional Considerations for Training

While optimizing CPR skills and teamwork are the core of HP-CPR training, training should also help professional rescuers identify return of spontaneous circulation, provide appropriate post-resuscitation care, and transition to mechanical CPR.

Identifying Return of Spontaneous Circulation (ROSC):

- Sudden rise in EtCO2
- Organized rhythm on the monitor
- Improvement in skin color
- Consistent SpO2 pulse oxymetry plethysmograph waveform
- Patient movement or respiratory effort
- Confirmed with a pulse check

Post-Resuscitation Care

- Anticipate re-arrest. Be prepared to resume HP-CPR.
- Obtain a full set of vital signs, including pulse oximetry.
- Be prepared to treat post-arrest hypotension.
- Acquire a 12-lead ECG and activate cardiac cath lab if STEMI.

Transition to Mechanical CPR

- Have a plan!
- Measure application time.
- Practice, practice, practice, and practice some more. Crews have to be well-versed in mechanical CPR device application. Applying these devices can eat up a significant amount of time before we realize it. Have someone count out loud and keep the hands-off-chest time for application of the device to 10 seconds or less.
- For more on the transition to Mechanical CPR, please see Appendix 3.9, page 77.

2.6 Achieving an HP-CPR Culture of Excellence

The importance of leadership, accountability and continuous quality improvement in creating a "culture of excellence" were addressed briefly on pages 5-7. This section addresses how EMS leaders can build necessary bridges between stakeholders across the Chain of Survival, specific elements of EMS CQI, and additional steps EMS agencies can take toward a culture of excellence.

Building Bridges

EMS leaders can move toward a culture of excellence by connecting essential players across the spectrum of OHCA care. They can foster accountability and cooperation between their agencies, PSAPs, and hospitals by convening review committees to evaluate OHCA events, outcomes, and opportunities to improve care. The committees can help celebrate successes and advise executive stakeholders of unmet needs. Committee members should include:

- EMS agency and First Responder operational (paramedic, EMS Lieutenant, etc.) representatives
- EMS agency and First Responder CQI representatives
- PSAP operational telecommunicator representative

- PSAP CQI representative
- Medical Director/Oversight representative
- Hospital Emergency Room operational (RN, paramedic) representative
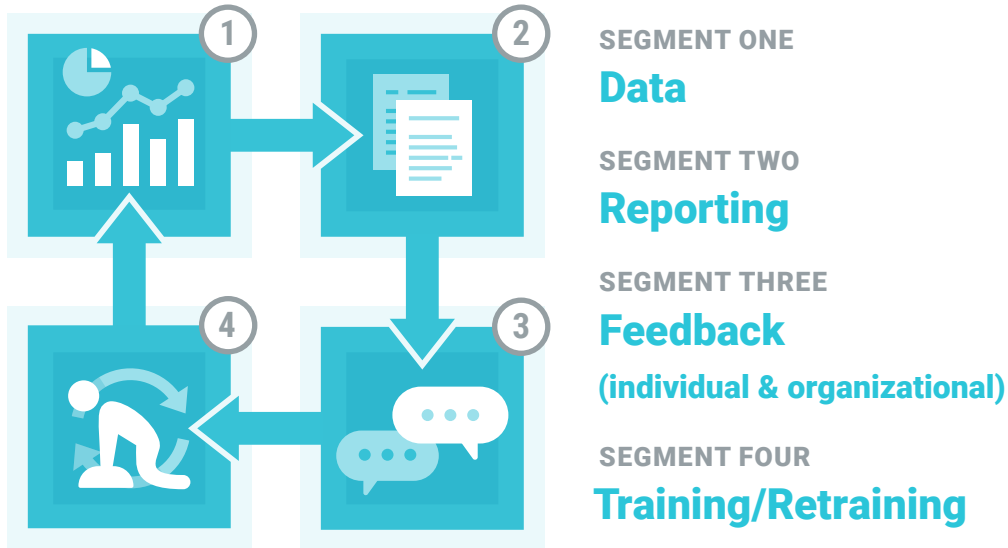- Hospital CQI representative

Leaders can also convene executive committees to oversee policy resource direction. An executive committee could include:

- Medical Director/Oversight executive
- EMS agency and First Responder CQI representatives
- EMS and First Responder Chiefs

- PSAP CQI representative
- PSAP Director
- Emergency Room Clinical Manager
- Hospital CQI representative

The PSAP CQI and EMS CQI representatives should participate in both the review and executive committees. This not only gives executives an opportunity to learn from the operational perspective; it also indirectly provides a sense of empowerment and a voice to the "front line" 9-1-1 and EMS personnel. The executive committee can assess recommendations from the review committee, approve policy, and provide resources to improve OHCA care and outcomes.

CPR**LifeLinks**

Specific Elements of Continuous Quality Improvement

CQI is, by definition, ongoing and devoted to finding ways to improve outcomes. It includes standardized reporting on overall system performance that highlights collective strengths and weakness as well as debriefings during which personnel discuss the events they participate in and see how their team's performance compares with the standards cited in Section 2.2.

SEGMENT ONE
Data

SEGMENT TWO
Reporting

SEGMENT THREE
Feedback
(individual & organizational)

SEGMENT FOUR
Training/Retraining

Figure 8: A model for CQI. Data collection, reporting, and feedback to individual providers can help agencies refine their regular trainings in an ongoing effort to enhance OHCA care.

Standardized Reporting

Measuring and reporting health outcomes are central to assessing the quality of care for all conditions and cardiac arrest is no different. It is often said that "We cannot improve something we do not measure." Measurement sheds light on quality of care and can inspire improvements in both process and outcomes.

Many EMS functions are hard to measure accurately. Cardiac resuscitation, however, and particularly resuscitation of witnessed OHCA patients in shockable rhythms when EMS arrive, is relatively easy to measure.

Data collection tools that can be used to generate reports on overall staff performance:	**LEARN MORE** 🌐
Data dictionary and standard template for patient outcome reports:	**LEARN MORE** 🌐

Debriefing

Allowing personnel to share their experience after resuscitation attempts can provide insights that improve CPR and can help rescuers better process these events. OHCA case review among team members, then, provides the platform for constructive and non-punitive communication that can identify challenges and/or best practices and in turn inform future efforts.

In this setting, debriefing refers to a dedicated dialogue after a cardiac arrest event in which individual actions and overall team performance are openly reviewed. This technique can be extremely helpful for realizing High-Performance CPR. Debriefing is most effective if performed while the resuscitation is fresh in the rescuer's thoughts.

There are two types of resuscitation debriefing techniques: "hot" debriefing and "cold" debriefing.

"Hot" Debriefing

Hot debriefing entails a collective discussion by team members immediately following the resuscitation attempt. Usually, objective CPR performance data are not readily available, so the team focuses on its overall reaction to the event, what went well, and areas for improvement. This approach is usually easily adaptable for OHCA resuscitations, as it can entail a simple "group huddle" among providers. This style of "hot" debriefing is useful for discussing emotional responses to difficult situations in addition to teamwork evaluation. However, without actual CPR process data (e.g., chest compression depth, rate, pauses, etc.), it is unlikely to have a significant impact on CPR performance itself.

"Cold" Debriefing

Cold debriefing occurs a few days after the resuscitation attempt. It has some benefits over hot debriefing. First, as get-togethers take place days (ideally a few days but not weeks later) after the resuscitation attempt, CPR performance data can be downloaded, evaluated, and utilized in the debriefing session. This pause between event and debriefing also gives providers the opportunity to reflect on the resuscitation event. Second, in contrast to hot debriefing, cold debriefing can be made accessible to all team members, thus permitting providers to learn from each other in a more structured and regularly scheduled debriefing session.

Debriefing Structure

Structured debriefings allow for guided discussions regarding performance and future improvements in a safe environment for providers. The Gather-Analyze-Summarize (GAS) model consists of three phases.[42] Initially, the team is asked to provide their emotional reactions to the OHCA event. This allows for acknowledgment and expression of emotions and defuses providers prior to learning and reflection.[42] Pediatric OHCAs are particularly emotionally difficult for the majority of providers; this initial "Gather" phase recognizes the impact emotions have on processing events and subsequent learning.

In the "Analyze" phase, discussion of specific actions or events takes place. Defibrillator recordings are utilized in this phase, if available. Providers are able to articulate their thought processes behind decisions, and the facilitator leading the debriefing guides providers' analysis of their performance.[43] Avoid extensive lectures or placing blame; it is assumed that providers are making decisions to the best of their ability.[43]

Finally, the "Summarize" phase allows for review of key points. Providers are asked to reflect on things they would do differently in the future, and crucial takeaway messages from the debriefing are highlighted.[42] Any last questions are addressed during this phase as well.

Tools Utilize in Debriefing

Many defibrillator manufacturers provide software that enable objective assessment of some CPR metrics. These metrics can be provided in a static summary manner or presented in a real-time manner by "playing" the defibrillator recording, enabling the crew to observe the case second-by-second.

CPR performance can be analyzed using the defibrillator recording, and individual providers can be debriefed on both quality and consistency of compressions. In addition to individual performance, the defibrillator recording can serve as a tool to evaluate team leader effectiveness and team dynamics during the resuscitation. Team leaders are ultimately responsible for identifying the quality of ongoing CPR; analyzing defibrillator data can highlight successful leadership strategies and offer areas of improvement in team dynamics.

Additional steps to foster a culture of excellence

- Commit resources to create or use existing OHCA registries and measure OHCA care.
- Meet with frontline EMS providers and groups to explain goals and get feedback.
- Meet with affiliated organizations (telecommunications, hospitals, lay advocacy groups).
- Support learning opportunities involving resuscitation (internal focus on resuscitation/attending Resuscitation Academies).
- Commit to a training schedule (regular CPR practice).
- Create and maintain a performance dashboard (key indicator report on an ongoing/cyclical basis).
- Share annual performance reports with external and internal stakeholders.
- Acknowledge success (e.g., organizing survivor celebrations).
- Support resilience (e.g., chaplain program, Employee Assistance Programs, peer support groups).

Many free web-based resources supporting resilience are available. Here are a few:

Journal of EMS article on coping with stress	**LEARN MORE** 🌐
Traumatology article on paramedic resilience	**LEARN MORE** 🌐
EMS World article on harnessing stress at work	**LEARN MORE** 🌐
Peer support resources	**LEARN MORE** 🌐

APPENDICES

The Physiology of OHCA
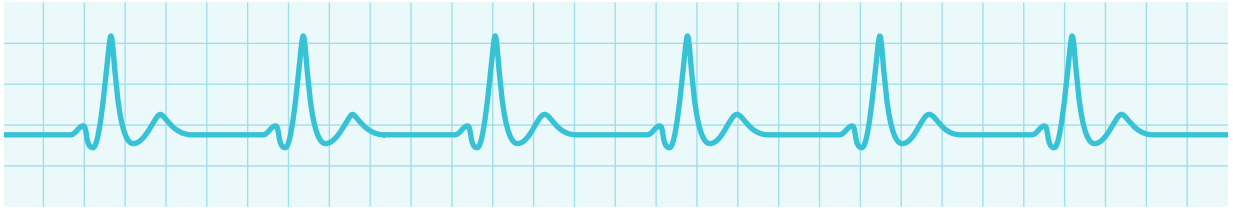
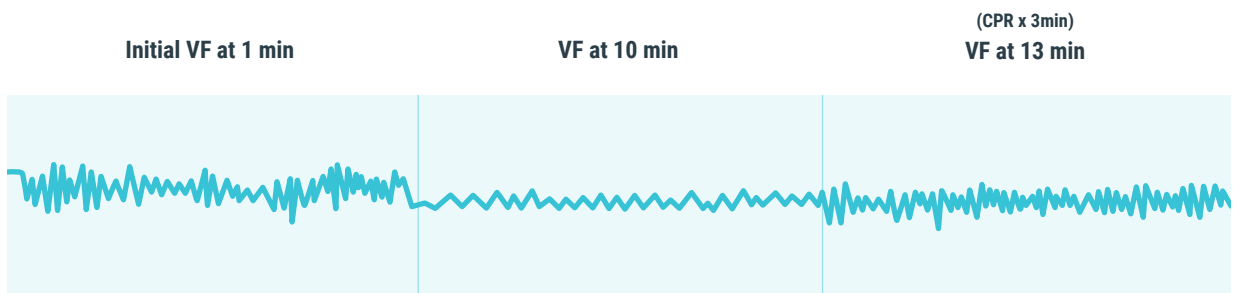**Figure 1.** A normal heart rhythm looks like this on an electrocardiogram.

Generally in cardiac arrest, the ventricles, or lower chambers of the heart, cease to contract normally and begin to quiver or "fibrillate." This is the VF rhythm we have noted.

This rhythm (and pulseless ventricular tachycardia, or pVT) results in immediate loss of circulation. There is no blood flow to the heart, brain, or vital organs and patients suddenly collapse. They are unconscious and often present with abnormal breathing or brief, seizure-like symptoms. Without immediate medical care, they die within minutes.

Because VF and pVT can be converted to a normal rhythm through defibrillation, however — because they are "shockable" — these patients are more likely to survive than patients found with non-shockable rhythms.

Figure 2. VF looks like this on an electrocardiogram.
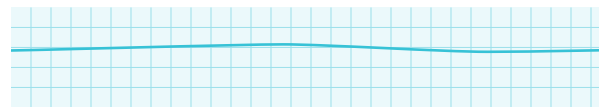
Figure 3. VF decays in a matter of minutes into asystole, a non-shockable waveform that looks like this on an electrocardiogram.
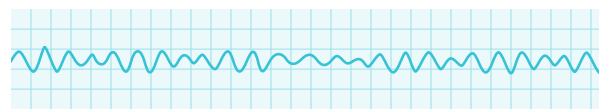
This decay, coupled with EMS response intervals that can be 10 to 15 minutes when the time from 9-1-1 call receipt to arrival at a patient's side is included, explains why overall OHCA survival is so low.

Chest compressions prolong and even "energize" the VF waveform. Consider this graphic:

Initial VF at 1 min   **VF at 10 min**   **(CPR x 3min)**
VF at 13 min

Figure 4. VF waveform over time[34]

The first panel shows a VF waveform at 1 min with no CPR. The second panel shows the waveform at 10 minutes with no CPR. **The third shows the waveform at 13 min after 3 minutes of CPR**. The waveform in the third panel begins to resemble the waveform in the first panel. This "newly energized" waveform may explain why compressions increase the chance professional rescuers succeed in defibrillating the heart.

Conventional CPR (CPR with compressions and rescue breaths)

When should we provide these instructions?

Conventional CPR instructions should be provided in instances when cardiac arrest is secondary to respiratory arrest or oxygen deprivation, such as in:

- Choking
- Drowning
- Hanging

- Smoke inhalation
- Carbon monoxide poisoning
- Drug overdose

Furthermore, a child in cardiac arrest should always receive chest compression plus ventilation instructions. Cardiac arrest in a child is more likely caused by choking or a respiratory event than is cardiac arrest in adults. One study found that chest compressions may be more effective in managing foreign body airway obstructions in unconscious patients than the Heimlich maneuver.[35]

When appropriate, the following compression to ventilation rates should be applied (single rescuer scenario):

Compression to Ventilation Rate	
Neonate/Newborn	→ 3:1
¬ **Infants (1 day–1 year old)** ¬ **Child (1–12 years old)** ¬ **Adults**	→ 30:2

Table 1.

CPR**LifeLinks**

Critical Incident Stress Management

The reality of cardiac arrest calls is that we will lose more people than we save. This can take an emotional toll on telecommunicators. Training should offer insight and awareness about critical incident stress and should address available resources such as Employee Assistance Programs, peer support groups, or department chaplains.

Call centers should provide mental health resilience and support resources for telecommunicators. The provision of pre-arrival medical instructions (and perhaps most severely, instructions for T-CPR) can expose those involved to acutely challenging and stressful situations. The impacts of secondary psychological trauma include emotional duress experienced by the telecommunicator. The non-visual nature of the work can provide a psychological buffer but can also increase the impact on telecommunicators as they try to visualize the scene. In addition, the auditory component becomes highly accentuated for the telecommunicator and has a strong potential for compounding vulnerabilities to secondary, or vicarious, trauma.

If possible, mental health resilience training that includes education about physiological stress reactions and how to best manage these reactions should be provided to telecommunicators prior to their first interaction with a T-CPR situation. In addition, an infrastructure of mental health professionals certified in psychological vicarious trauma treatment with evidence-based solutions such as Eye Movement Desensitization Reprocessing should be established as early as possible to assist telecommunicators if they experience difficulty managing stressors secondary to the provision of T-CPR.

Two resources available for more information are the 9-1-1 Wellness **website** and the National Emergency Number Association (NENA) Standard on 9-1-1 Acute/Traumatic and Chronic Stress Management **NENA-STA-002.1-2013**.

History of Telecommunicator CPR

Paramedic medical responses for OHCA began in the early 1970s and it soon became apparent that a short time from collapse to the onset of CPR was strongly associated with survival. The first community- wide effort to train the general public in CPR started in Seattle in 1973.

Around 1975, a paramedic in Phoenix, Arizona, gave unscripted instructions over the phone to the mother of a non-breathing baby and the child survived. The fire chief then instructed the dispatch center to routinely provide such pre-arrival instructions over the phone; the unscripted program was called "Medical Self Help."

In 1978, scripted protocols were introduced in the Salt Lake City, Utah, fire department. These protocols contained specific questions, instructions, and response codes to aid callers and prioritize responses. A formal training program for emergency medical telecommunicators was introduced in Utah in 1979. In 1978, a Medical Advisory Flip File was adopted in the state of Illinois.

In the early 1980s, a number of places throughout the country, including King County, Washington, Aurora, Colorado, and Salt Lake City, began using scripted instructions to address cardiac arrest, and other major problems such as choking and childbirth.

The King County group trained telecommunicators to recognize cardiac arrest over the phone and to provide scripted instructions to the caller. The scripted instructions were tested to devise the clearest instructions using the fewest words. The program was a success. Rates of bystander CPR increased dramatically and the survival rate from cardiac arrest rose. Within a few years 50% of bystander CPR was solely the result of the telephone instructions. The instructions helped callers with no prior training and refreshed the skills of individuals who had taken a prior CPR course.

In 1983, Utah became the first state to formally require the use of medically approved dispatch protocols and established the first certification program for emergency medical telecommunicators. Shortly thereafter, the United States Department of Transportation (USDOT) issued both a curriculum and a sample protocol based on a combination of the Salt Lake City Protocol, the Illinois Medical Advisory Flip File, and the Utah State curriculum.

In 1989, the National Association of Emergency Medical Services Physicians issued a position paper stating that pre-arrival instructions were a mandatory component of every medical dispatch center and that pre-arrival instructions, when provided by properly trained emergency medical telecommunicators, were safe, effective, and a moral necessity. In 1990, the American Society for Testing and Materials (ASTM), under a mandate from the USDOT, issued a practice standard for emergency medical dispatch. This standard was reinforced in 1994 when ASTM released two more practice standards, one for emergency medical training, certification, and curriculum, and one for management and quality assurance.

Further studies over the past 30 years demonstrated the safety of Telecommunicator CPR, identified barriers to delivering instructions, helped refine the instructions, and shortened the time from call receipt to the start of chest compressions. In 2017 the rate of bystander CPR in Seattle and King County was 75% for cardiac arrest associated with ventricular fibrillation (VF) with approximately half resulting from telecommunicator instructions.

National awareness of Telecommunicator CPR increased as scientific studies demonstrated utility and led to endorsements for the American Heart Association and incorporation of instructions into most emergency center protocols. Since its inception in 2008, the Resuscitation Academy actively promoted Telecommunicator CPR as an effective step in improving community survival rates. In 2015 the Institute of Medicine recommended NHTSA take the lead to promote Telecommunicator CPR, and in 2017, the American Heart Association issued Telecommunicator CPR program guidelines and performance goals. Most recently, several more states have adopted or are considering legislation requiring training in Telecommunicator CPR for emergency telecommunicators.

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3.5 | T-CPR Resources

The following links provide additional T-CPR training and CQI support:

CPR LifeLinks Resource Training Materials, Videos and Case Studies	**LEARN MORE** ⊕
Resuscitation Academy (Seattle)	**LEARN MORE** ⊕
Cardiac Arrest Registry to Enhance Survival	**LEARN MORE** ⊕
Save Hearts in Arizona Registry & Education	**LEARN MORE** ⊕
Milwaukee County Dispatcher Assisted Bystander CPR	**LEARN MORE** ⊕
American Heart Association Program and Performance Recommendations	**LEARN MORE** ⊕
Resuscitation Academy Video (Maryland)	**LEARN MORE** ⊕
International Academies of Emergency Dispatch	**LEARN MORE** ⊕
Annals of Emergency Dispatch & Response	**LEARN MORE** ⊕
Strategies to Improve Cardiac Arrest Survival (Institute of Medicine 2015)	**LEARN MORE** ⊕
Running on Adrenaline and Love: A Survivor story	**LEARN MORE** ⊕

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3.6 Chest Compressions and Ventilation

Chest Compressions

The team approach trains each team member to recognize the "primacy" of the compressor. High- quality compressions are the most important initial intervention. The team should be encouraged to call out and correct any observed deficiency. CPR must be performed to the highest standard with recognition of proper rate and depth and with full release and high compression fraction. To achieve this reliably, training must address the ergonomics of proper CPR regarding the provider's position relative to the patient, hand position, locked extended arms as well as monitoring for signs of fatigue. Real-time cues to improve CPR have been proven effective and include metronomes and devices measuring rate, depth, and release such as accelerometers. Also available are devices that measure the absolute distance between a sensor on either side of the torso and can provide a more accurate compression distance compared to the accelerometer (which measures the sum of the movement, often including the compression of the substrate such as a mattress or stretcher pad).

Ventilation

Ventilation strategies are not as well-defined as compression strategies. All of those who advocate different methods recognize that in non-asphyxial adult OHCA early ventilation is not a high initial priority relative to CPR and early defibrillation. The potential danger of excess ventilation causing decreased CPR cardiac output is a recognized concern. The most common approach is ventilation at 30:2 or continuous interposed ventilation, which has been studied and found equivalent. Airway strategies include bag-valve-mask ventilation and the use of supraglottic airways or endotracheal intubation. When these approaches are used it is mandatory that the procedure does not lead to interruptions in CPR. Some individuals advocate for passive ventilation using face mask oxygen delivery without ventilation for the first two or three cycles of CPR. There are, however, no randomized clinical data to suggest its equivalency or superiority to the use of a bag-valve-mask.

Ventilation parameters:

Rate
Either 30:2 or continuous interposed

Volume
Providers tend to give too large of a tidal volume. Strategies include the "tea cup" (or "princess") approach with compression using only thumb, index, and long fingers to limit the delivered volume or using smaller bags.

EtCO2
The use of EtCO2 can be an adjunct for gauging ventilation. While use of EtCO2 has many benefits and is strongly encouraged, there are no studies that definitively define its use to guide ventilations during cardiopulmonary arrest. Confounding features include the use of sodium bicarbonate and altered V/Q relationships during cardiac arrest.

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3.7 Defibrillation

Ventricular fibrillation progresses from a recognizable high amplitude grouped complexes with a steep r wave that is relatively shock-sensitive to a more disorganized lower amplitude rhythm that becomes shock refractory and ultimately becomes asystole. Chest compressions can improve a deteriorated ventricular fibrillation to one that is more amenable to defibrillation. The best approach is early defibrillation after an initial round of CPR while placing an AED or manual monitor defibrillator. (NOTE: The fraction of patients who are in VF is only between 20–25%. HP-CPR is equally vital for patients with non-shockable rhythms.)

> ## Pulse checks and defibrillation can lead to unnecessary pauses in CPR.

CPR cycles will typically be two minutes. A crucial training component is the timing of the cycle with particular attention to the last 20–30 seconds. During this time the team leader should vocalize that there are 20 seconds until the next pulse check and at that time the defibrillator should be charged. A crewmember should locate the compression pulse in the groin and maintain contact with that point when compressions are paused. Knowing where the pulse should be is a critical timesaving technique. The device should be fully charged at the moment of the pause for pulse check/rhythm check. Shock/no shock should be decided and completed within 5 seconds with immediate resumption of compressions.

While HP-CPR is fundamentally a BLS skill, many cardiac arrests receive ALS care. Consideration must be given in training to the transition to ALS care or the integration of ALS care from the outset.

When ALS is present at the outset, training must be directed to the priorities of care, which are compressions and the placement of a monitor defibrillator or AED. As resources allow, the ALS steps include establishment of IV or IO access, establishment of an airway if desired, and then the use of ALS drugs. When ALS arrives after the initial first responder or BLS care, an organized integration of this level of care in a manner that does not disrupt the ongoing resuscitation should be a specific training point. The specifics of the use and merits of ALS medications is beyond the scope of this document.

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3.8 Termination of Resuscitation

It is important to recognize the potential for life and to recognize futility.

The following factors should be considered:

- Whether the arrest was witnessed
- Whether Asystole was the only rhythm observed
- Time from collapse
- EtC02 (less than 10 mmHg despite HP-CPR)

The decision to abandon resuscitation should involve team members and family members. The team leader should review the challenges that have been faced, any finding suggesting a potential for improved outcome, the duration of the event, and the responses to the interventions. All members should have equal input in voicing concerns about termination or going forward. This should occur before engaging medical control consult if that is required.

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3.9 Transition to Mechanical CPR

Mechanical CPR devices are frequently used in the provision of CPR. The 2015 ECC guidelines state: "The use of mechanical piston devices may be considered in specific settings where the delivery of high-quality manual compressions may be challenging or dangerous for the provider (e.g., limited rescuers available, prolonged CPR, during hypothermic cardiac arrest, in a moving ambulance, in the angiography suite, during preparation for extracorporeal CPR [ECPR]), provided that rescuers strictly limit interruptions in CPR during deployment and removal of the devices" (Class IIb, LOE C-EO). Furthermore, "Manual chest compressions remain the standard of care for the treatment of cardiac arrest, but mechanical piston devices may be a reasonable alternative for use by properly trained personnel" (Class IIb, LOE B-R). This statement reflects the available science. There may be merit in their use but training in the application and use of the device is recognized as a foundational element.

Mechanical CPR is provided by one of two technologies, either compression-band or piston-type devices. The specific method for applying each is different, but application of any device to the patient's torso induces a pause in compressions that would not be present if only HP-CPR were being done. Therefore, the time to apply the device must be the absolute minimum that can be achieved and there must be a perceived benefit that outweighs the potential risk. These benefits may include any of the indications noted above for the use of mechanical CPR. The device risks could include such things as a prolonged pause to apply the device or delaying defibrillation in a witnessed VF arrest. Even if the application is done in a highly competent manner, it is important that this not disrupt the early "choreography" of the resuscitation effort. Priorities should be established and completed as determined by how the team has trained and operational priorities associated with the event. In summary, the use of mechanical CPR should be "high-performance" as well.

Agencies and institutions choosing to use this technology should develop guidelines, training, and process improvement that include:

- A specific protocol describing best practice for the application of the device being used along with scenarios tailored to the expected operational environment of those using the device. Some points to include:

  - └ The indication for mechanical CPR in preference to manual CPR
  - └ Clinical assessment of whether the device is indicated for a given patient (e.g., for size limitations)
  - └ When in the course of the resuscitation to transition from manual to mechanical
  - └ Who directs the transition
  - └ Specific goals for application-related pause
  - └ Device malfunction recognition mandating quick transition back to manual CPR with device troubleshooting done off the patient

- A means for precise measurement of the metrics of the manual-to-mechanical CPR transition as well as ongoing evaluation of the CPR metrics of mechanical CPR to recursively confirm that the goals are being met

- Team training demonstrating and practicing the protocol, confirming timing and competency of all members

- Recurrent training on a frequent basis

- Interfacing with receiving facilities to orient their staff to the device and its use by the agency during the implementation phase with follow-up as necessary to account for attrition and staff changes

- Support for a receiving facility if the resuscitation continues in the emergency department or to another department such as radiology or the cath lab. Additional supplies, e.g., batteries, may be needed, as may technical knowledge.

For more on applying a mechanical CPR device, please see:

HP-CPR with Metronome and transition to the LUCAS device **WATCH ▶**

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3.10 HP-CPR Resources

Additional HP-CPR training and CQI resources can be found at:

CPR LifeLinks Resource Training Materials, Videos and Case Studies	**LEARN MORE** 🌐
High Performance CPR Toolkit	**LEARN MORE** 🌐
The Cardiac Arrest Registry to Enhance Survival (CARES)	**LEARN MORE** 🌐
High Performance CPR University	**LEARN MORE** 🌐
Strategies to Improve Cardiac Arrest Survival (Institute of Medicine 2015)	**LEARN MORE** 🌐
EMS Agenda 2050: Envision the Future	**LEARN MORE** 🌐

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GLOSSARY

Agonal breathing ("gasping")
a form of abnormal breathing common in the first few minutes of out-of-hospital cardiac arrest and often mistaken as a sign of life

Automated External Defibrillator (AED)
a portable device that can deliver electrical shocks that can reestablish an effective heart rhythm during out-of-hospital cardiac arrest

Bag-valve-mask (BVM)
a hand-held device commonly used to provide positive pressure ventilation to patients who are not breathing or not breathing adequately

Chain of Survival
a series of rescue actions that can improve patient outcomes after out-of-hospital cardiac arrest

Chest compression-only CPR
cardiopulmonary resuscitation where only chest compressions are provided

Chest compression rate
the number of chest compressions given per minute

Chest compression depth
how deep providers push when giving chest compressions

Chest compression recoil
how far the chest comes up after a compression

Continuous Quality Improvement (CQI)
the measurement of process metrics and patient outcomes that informs an ongoing effort to optimize performance

Conventional ("standard") CPR
cardiopulmonary resuscitation where both chest compressions and rescue breaths are provided

High-Performance CPR (HP-CPR)
an expertly-performed, choreographed, and measured response consisting of individual and team performance that meet or exceed current performance recommendations

National Highway Traffic Safety Administration (NHTSA)
an agency within the United States Department of Transportation that aims to save lives, prevent injuries, and reduce economic costs due to road traffic crashes

Out-of-hospital cardiac arrest (OHCA)
a severe malfunction or cessation of the electrical and mechanical activity of the heart and a leading cause of death across the world

Pre-Arrival Instructions (PAIs)
directions given to 9-1-1 callers for providing patient care before professional rescuers reach the scene

Public Safety Answering Point (PSAP)
a call center responsible for handling 9-1-1 calls

Return of Spontaneous Circulation (ROSC)
the resumption of effective cardiac activity after cardiac arrest

Telecommunicator
a call-taker or dispatcher

Telecommunicator CPR (T-CPR)
a three-step process where telecommunicators work together with 9-1-1 callers to identify potential OHCA patients, provide callers with pre-arrival CPR instructions, and coach callers to perform continuous CPR until professional rescuers assume care

Ventricular fibrillation (VF)
an arrhythmia where the heart quivers instead of pumping blood, resulting in collapse, loss of consciousness and, if not immediately treated, death

CPRLifeLinks

ABOUT THE INITIATIVE

CPR**LifeLinks**

6.1 CPR LifeLinks

The CPR LifeLinks initiative was created to support 9-1-1 and EMS agencies in their efforts to save more lives from out-of-hospital cardiac arrest (OHCA). Resulting from recommendations by the Institute of Medicine's 2015 report *Strategies to Improve Cardiac Arrest Survival: A Time to Act,* the objectives of this project were to:

- Define best practice recommendations for performing Telecommunicator CPR, as well as, develop training and implementation guidelines that can be customized and implemented by 9-1-1 centers.
- Define best practice recommendations for High-Performance CPR to be used by trained EMS personnel and develop a training curriculum and implementation guide.

Lead by Ben Bobrow, M.D. and Daniel Spaite, M.D., two working committees of physicians, paramedics, medical directors and 9-1-1 PSAP supervisors and trainers collaborated through a variety of in-person and teleconference meetings to create a practical toolkit that serves as a resource for 9-1-1 and EMS agencies interested in improving OHCA responses within their community.

In addition to the clear goal of creating useful resources for CPR improvement programs, the working groups focused significant effort on clarifying the importance of collaboration between 9-1-1 and EMS agencies.

The 16-month project included regular working group meetings and a public comment period to obtain input from the 9-1-1 and EMS communities. The effort resulted in a practical toolkit to help 9-1-1 and EMS agencies create and implement CPRimprovement programs.

The toolkit includes:

- information about the science of cardiac arrest
- tips for engaging leadership support for CPR improvement programs
- recommendations for training and continuous quality improvement efforts
- training tools such as videos and audio recordings of 9-1-1 calls.

It also provides tips to help overcome common challenges and to establish survivor recognition programs, connecting telecommunicators and EMS personnel with the people whose lives they save.

The effort was funded by the **National Highway Traffic Safety Administration's Office of EMS**, the **National 911 Program**, **U.S. Department of Health and Human Services**, **Health Resources and Services Administration**, **Maternal and Child Health Bureau**, **Emergency Medical Services for Children Program**. The toolkit was created with the support of the **University of Arizona's Emergency Medicine Research Center**, the **RedFlash Group**, and **Resurgent Biomedical Consulting**.

CPR**LifeLinks**

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The working committee volunteers, listed on the following page, played a significant role in collating and describing best practices and agency experiences to create this toolkit. Their efforts to share expertise and knowledge, engage with EMS and 9-1-1 communities to gather additional input, and to promote the impact of early, high-quality CPR will help 9-1-1 and EMS agencies nationwide save more lives.

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