CPR LifeLinks
911 and EMS united to save more lives

CPR LifeLinks is a national initiative that encourages local collaboration between 911 and EMS to improve out-of-hospital cardiac arrest survival rates by improving care in the first links in the “chain of survival,” early 911 access/intervention and early (and effective) CPR.

The CPR LifeLinks Implementation Toolkit

Find resources and a practical roadmap for how:

➢ Any 911 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 911 and EMS can collaborate, working together to strengthen the chain of survival.

DRAFT VERSION 1.0 | 2018
RELEASED FOR PUBLIC FEEDBACK
# Table of Contents

## INTRODUCTION

### PART 1: TELECOMMUNICATOR CPR (T-CPR)

- Section 1: Overview
- Section 2: The Commitment to Act: Challenges and Perspectives
- Section 3: AHA T-CPR Program and Performance Recommendations
- Section 4: Protocols
- Section 5: Telecommunicator Training
- Section 6: Achieving a T-CPR Culture of Excellence

### Appendices

- Appendix 1: The Physiology of Out-of-Hospital Cardiac Arrest (OHCA)
- Appendix 2: When to Do Conventional CPR (CPR with Compressions Rescue Breathing)
- Appendix 3: Critical Incident Stress Management
- Appendix 4: History of T-CPR
- Appendix 5: T-CPR Resources

## PART 2: HIGH PERFORMANCE CPR (HP-CPR)

- Section 1: Overview
- Section 2: The Commitment to Act: Challenges and Perspectives
- Section 3: Performance Recommendations
- Section 4: Common CPR Quality Issues
- Section 5: Training
- Section 6: Achieving an HP-CPR Culture of Excellence

### Appendices

- Appendix 1: Barriers to HP-CPR Implementation
- Appendix 2: Chest Compressions
- Appendix 3: Ventilation
- Appendix 4: Minimally Interrupted Cardiac Resuscitation (MICR)
- Appendix 5: Defibrillation
- Appendix 6: Termination of Resuscitation
- Appendix 7: Transition to Automated Chest Compression Devices
- Appendix 8: HP-CPR Resources

## PART 3: ABOUT THE INITIATIVE—PARTICIPANTS IN THE EXPERT PANELS AND THE PROCESS FOR CREATING THE TOOLKIT
INTRODUCTION

CPR LifeLinks: 911 and EMS United to Save More Lives

Imagine this scene: Margaret, a 47-year-old mother, 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 is lying on the floor, not moving. She kneels next to her and yells, “Mom, are you OK?” There is no response. Jennifer frantically dials 911.

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 your Mom breathing normally?” he asks. “I can’t tell,” Jennifer says, “she’s gasping.” Andy can hear noises faintly in the background and from his training quickly recognizes they are agonal breaths, a sign that the arrest occurred very recently. “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 to do 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 – indeed, one of the firefighters had trained him in compression-only CPR a few months before, a key component of telecommunicator CPR.

The firefighters have been trained in high-performance CPR and know how critical this intervention is for survival. Paramedics arrive and work seamlessly. After several shock attempts and rounds of CPR, Margaret regains a pulse and starts to breath 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 come together with Andy and the firefighters and paramedics at the 911 center, a gathering arranged by leaders to celebrate the life saved. Although they are part of the same team, Andy doesn’t see the firefighters and paramedics often, but these opportunities to celebrate the lives they save empower them all in their work.

#  #  #
Out-of-hospital cardiac arrest (OHCA), the sudden failure of all electrical and mechanical activity in 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. In its absence, the patient is, in all likelihood, dead when professional rescuers arrive. Indeed, the chance a patient lives falls by about 7-10% per minute without CPR.\textsuperscript{1,2}

While many factors contribute to survival, years of study show the profound impact of two interventions: Telecommunicator Cardiopulmonary Resuscitation (T-CPR) and High-Performance CPR (HP-CPR) by Emergency Medical Service (EMS) responders.

TCPR, where bystanders perform pre-arrival 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. In this way, these links in the chain are really a single, continuous effort to restore circulation as soon as possible. We know that much of the OHCA battle is won or lost in the initial minutes at the scene of 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. To help achieve this goal, the National Highway Traffic Safety Administration created CPR LifeLinks, a national initiative encouraging local 911 and EMS systems to collaborate on improving care in the first links in the "chain of survival:" early T-CPR and high performance CPR.

As the case study from Bend, Oregon shows (editor’s note: to be inserted following public comment phase), \textit{collaboration saves lives}.

The CPR LifeLinks Implementation Toolkit provides resources and a practical roadmap for implementing telecommunicator CPR and high performance CPR. The process for developing the Toolkit and the people behind it are summarized in PART 3 of this document.

\textbf{Imagine 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 sports stadium! And think of the many thousands of family members and friends given additional time with their loved ones.

\textbf{How Does Your Community Measure Up?}

Survival rates vary \textbf{five-fold} from one city to another. Unfortunately, where you live affects \textit{if} you live. Why the tremendous disparity? 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?
Figure 1: (to be inserted following public comment phase). The Chain of Survival represents an integrated system of OHCA care. A bystander’s prompt 9-1-1 call enables early T-CPR (the second link), which increases the chance that HP CPR (the third link) restores circulation.

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 dissolve them. We address these challenges in PART 1, Section 2 and PART 2, Section 2 of this document.

EMS systems that implement and carefully measure T-CPR and HP-CPR consistently save the most lives.

Measurement is essential to optimize care and makes a huge difference in saving lives. Systems may face challenges implementing all aspects of these programs, but they should take and build on small steps in their immediate grasp. 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.”

T-CPR & HP-CPR Cultures of Excellence: Earning It Every Day
OHCA tests 911 Centers and EMS care more than any other time-sensitive medical condition and is an accepted benchmark for a system’s overall performance. Agencies that seek a culture of excellence will save lives and realize additional health 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. It incorporates a team effort where individuals appreciate their roles and confidently reach for success. It is built on leadership that insists on accountability and continuous quality improvement (CQI).

Leaders orchestrate the effort. They must communicate “the OHCA story” in a way that fosters true engagement from PSAP and EMS personnel. The story is about much more than the incidence and outcome statistics of a major public health problem: 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” become suddenly
real. Meeting survivors as described in the vignette above, frontline providers are truly inspired to engage the challenges and change required to optimize care.

Leaders also realize that “We cannot improve what we do not measure.” They require the truth about the care their agencies provide. They insist on measuring key performance indicators and comparing the results to recommended standards, engaging 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. Their agency comes to view poor CPR and failure to provide CPR as a preventable harm. It identifies gaps between evidence-based best practices and actual performance, defines a plan to narrow it, and provides examples of success in other systems.

All members of the team are 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 35 and 69.*
PART 1: TELEPHONE CPR

1. OVERVIEW

What is Telephone CPR?
Telecommunicator CPR (T-CPR) or Dispatcher-Assisted CPR, is 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
- coach callers to perform continuous CPR until professional rescuers assume care.

TCPR has been linked to improved patient outcomes across the world and is extremely cost-effective: providing it requires almost no capital expense.

Purpose: The purpose of Part 1 of this document to help you start and/or improve this life-saving program in your 9-1-1 center. It covers:

- The American Heart Association Recommendations for TCPR.
- TCPR Protocols
- TCPR Training
- TCPR culture of excellence

The Three Steps of TCPR: A Brief Overview

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 can arrive and assume care. This section gives an overview of the opportunities and challenges inherent in each of these “three phases” of TCPR.

Step 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 will discuss protocols in more detail in Section 4. In many cases, identification is challenging and requires application of the strategies and tactics discussed in Section 4. For now, it should be noted that protocols should allow telecommunicators to quickly identify potential OHCAs and to start CPR instructions without delay.
Step 2. CPR Instructions

After telecommunicators recognize potential OHCAs, they should provide CPR instructions as soon as possible. As we will discuss later, TCPR increases the chance that professional rescuers succeed in restoring 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 their backs for CPR. Other common barriers include a caller’s fear they will hurt the patient when getting them to the floor or when doing compressions. We’ll cover these and other barriers in the Training section.

In 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.

Step 3. 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 compressions rate, depth and recoil (allowing the chest to come all the way up between pumps).

Telecommunicators are the “first first responders.” They form a team with the caller and work together to do CPR until professional rescuers assume care.
2. THE COMMITMENT TO ACT: CHALLENGES AND PERSPECTIVES

A number of practical considerations must be addressed to implement T-CPR. A number of programs can offer useful strategies.

**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 911 calls.

Things to consider:

- OHCA calls are infrequent: OHCA calls represent 1%-2% of all 911 calls and are therefore a small impact on receiving, processing, and dispatching them.

- OHCA calls could be transferred to a designated PSAP: In Minnesota, five PSAPs 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 TCPR instructions transfer suspected OHCA calls to a PSAP that does provide TCPR instructions.

- Some PSAPs transfer OHCA calls to an EMS agency, which provides instructions and coaching to callers. Parts of Michigan and New Hampshire transfer OHCA calls to EMS agencies.

**Challenge 2: Lack of Medical Direction**

Many PSAPs do not have ongoing, active medical oversight. They may not know “where to start” or who to contact to establish it.

Things to consider:

- 9-1-1 collaboration with local EMS agencies may provide a useful model to consider.

- Since 2017, the Alabama 911 Board has partnered with the state’s Department of Public Health’s Office of EMS, whose medical director reviewed and approved statewide EMD protocols, including instructions for TCPR. The medical director has agreed to provide medical oversight for any PSAP using these protocols.
**Challenge 3: Perceived Liability Concerns**

PSAPs may be concerned that implementing TCPR may open them to liabilities.

**Things to consider:**

- Florida passed legislation protecting 9-1-1 agencies and telecommunicators from liability ([editor's note: link will be inserted] relating to injuries resulting from the use of EMD protocols, including protocols for TCPR. [Minnesota](#) has a similar law protecting telecommunicators.

- EMS Medical Directors may provide liability coverage as part of their role in providing medical oversight for TCPR.

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

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

**Challenge 4: Costs**

PSAPs of all sizes face budget constraints and some state laws allow for funding mechanisms

**Things to consider:**

- Florida allows 911 surcharge funds to be used to cover training, certification/recertification, protocol systems, continuing education and labor costs associated with processing 911 calls. ([editor's note: link will be inserted] relating

- A number of states (e.g., Arkansas, Indiana, Maine, Tennessee) provide funding for 911 training, and while not designated specifically for T-CPR training, these funds could include it.

- Maine allows 911 surcharge funds to be used for the payment of EMD costs for all initial training and recertification, EMD software licenses, set up support, annual maintenance fees, and continuing education training. ([editor's note: link will be inserted]

- 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 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 TCPR implementation. Other states may be able to access tobacco tax revenue for similar purposes.

Challenge 5: Charter/Perceived Scope of Practice

Many PSAPs, especially those with a Law Enforcement focus, may think TCPR is beyond their scope of practice.

Things to consider:

- Most consider CPR “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.

Challenge 6: Use of Data

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

Things to consider:

- HIPPA does not prevent hospitals from sharing patient outcomes with 9-1-1 centers and EMS agencies who provide care for the patient.

  US Department of Health & Human Services: Sharing Patient Health Outcomes Information between Hospitals and EMS Agencies for Quality Improvement

  US Department of Health & Human Services: Uses and Disclosures for Treatment, Payment & Health Care Operations

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

- Next Generation 911 Implementation: As PSAPs upgrade existing infrastructure, capabilities will expand far beyond the current “voice only” environment and will be able to receive, process, and share text “calls” to 911, 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 TCPR

- Make the Commitment
- Actively involve appropriate stakeholders and individuals
- Establish roles and responsibilities (including a plan to fund these)
- Establish written/verbal agreement between 9-1-1 and EMS to collaborate on specific tasks
- Establish and execute a plan for implementation
- Include, technical, administrative, operational and training components
- Summarize scientific evidence supporting TCPR into checklists
- Utilize AHA performance measures
- Provide continuous feedback on performance measures to teams

Ten Actions to Achieve Implementation

- Select program or programs to implement
- Form a team or advisory board
- Determine how to make it happen in your community
- Set specific goals
- Create the compelling argument to achieve buy-in from agency personnel
- Know the performance standards
- Consider a pilot program
- Communicate progress within the agency
- Communicate with the public and EMS personnel
- Support, Advocate, Celebrate

3. AMERICAN HEART ASSOCIATION T-CPR PROGRAM & PERFORMANCE RECOMMENDATIONS

In 2017, the American Heart Association published 6 program and 5 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.

(Editor’s Note: Figure 2 will show the six program recommendations. We will discuss the five performance recommendations in connection with TCPR Quality Improvement in Section 6 on pages 36-39.)

Figure 2: American Heart Association TCPR Program Recommendations

Commitment to Telephone-CPR

- The emergency communications center will commit to providing effective T-CPR.
- The dispatch center director must
Train and Provide Continuing Education in T-CPR for all Telecommunicators

- Require initial training for all call takers and dispatchers. 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 which 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. Ideally, there should
Recognition for Outstanding Performance

- Telecommunicator recognition program for outstanding performance in the recognition of cardiac arrest and delivery of T-CPR instructions.

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.

4. PROTOCOLS

Objective: To summarize the “do’s and don’ts” in TCPR protocols.

- TCPR and Comprehensive Pre-Arrival Instructions

The formal process of providing pre-arrival Instructions (PAIs) to medical 9-1-1 callers began in isolated communities in the late 1970s and has evolved to become national standard of care, a public expectation and, in some cases, a legislative mandate.

For example, see:
- Link to Wisconsin legislation information
- Link to Kentucky legislation information

While cardiac arrest patients can benefit greatly from the provision of 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. 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 telephone CPR in your 9-1-1 center.

There are several commercial EMD programs available. Some direct telecommunicators to assess scene safety before beginning the triage process. EMD programs include but are not limited to: the Priority Dispatch, PowerPhone 911, and the APCO EMD program.
Some agencies develop their own protocols under the guidance of a medical director. After confirming the incident address and caller phone number, your protocols, (whatever dispatch system you use) should allow telecommunicators to identify OHCA and start CPR instructions as soon as possible. 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:

TCPR Stage 1: 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 these questions is “no,” then telecommunicators are advised to start CPR instructions without delay. This “No, No, Go!” approach will cast a wide net to maximize OHCA identification and will include patients not in cardiac arrest. Overtriage, however, is necessary in life-threatening emergencies. In suspected trauma, for example, the acceptable rate of overtriage is 25%-50%.xviii

Below is a link to an example of swift OHCA identification through the two-question approach: (Editor’s Note: link to sample audio file will be included in final report)

Protocols should help telecommunicators quickly identify OHCA and start CPR instructions as early in calls as possible
Callers are sometimes confused by the word “conscious.” If a caller seems confused, telecommunicators can follow up by asking if the patient is “awake,” as in this recording:

CR asked if patient was awake when RF

(Editor’s Note: link to sample audio file will be included in final report)

TCPR Stage 2: CPR Instructions

For adults who suddenly collapse, or who are found unconscious and/or not breathing normally, instructions should be for compression-only CPR. For children, instructions should incorporate rescue breathing and chest compressions, since respiratory causes of cardiac arrest are more common in children.

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.”

TCPR Stage 3: CPR Coaching

Protocols should provide scripting for continuous, supportive CPR coaching after CPR is started. Two studies show that TCPR is as effective in saving lives as bystander CPR without telecommunicator instructions. 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”
  - “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.
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 on page 20.

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

Lastly, protocols should reflect the latest science investigating elements of, and barriers to, the TCPR process. A listing of TCPR scientific publications can be found here.

5. TELECOMMUNICATOR TRAINING

Objective: To implement comprehensive telecommunicator training and continuing education programs.

Initial training should require no less than 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”. The circle has five segments addressed below:

1. Know the Recommendations/Learn the Basics

AHA’s TCPR Program and Performance Recommendations lay out the vision and methods for optimizing OHCA outcomes. Please see pages 11-12 and 36-39.

2. Practice CPR Skills
Telecommunicators should practice continuous compressions on a training mannequin 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 establish empathy with callers and their efforts to 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.
- If a PSAP does not have training mannequins, it can usually borrow them from an EMS agency it dispatches for.
- EMS agencies can provide in-person CPR instruction.
- Several short videos freely available on the internet can supplement CPR instruction. One example is available here.

3. Master 3 Stages of TCPR

Telecommunicators who understand how CPR works will have a basic medical foundation on which to master the 3 stages of TCPR. 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 “VF” rhythm noted on page 1), 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 for two reasons:

1. Chest compressions generate blood flow to the heart, brain and vital organs while professional rescuers rush 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, are the patients we have the best chance of saving.

For more detail on the physiology of how CPR works, please see Appendix 1 pages 40-41.

Telecommunicators can profoundly increase rates of bystander CPR by instructing 9-1-1 callers to start CPR after identifying OHCA. Instructions should be for compression-only CPR for adults who suddenly collapse or who are found unconscious and/or not breathing normally. The blood flow compressions generate drops sharply with even short pauses in compressions, as shown at the link below. For this reason, bystanders rescuing adults should not stop compressions to give rescue breaths (unless the arrest stems from a respiratory cause such as drowning).

For children, instructions should include both compressions and rescue breaths since respiratory causes of cardiac arrest are more common in children.

How to process the 9-1-1 Call: The Three Stages of TCPR

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. This assumption can help foster the “aggressive” mindset sometimes needed to identify OHCA. That is, it helps us prepare for success.

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

Of the five links (See Section 1), telecommunicators directly influence the first four. Telecommunicators:

1. receive the 9-1-1 call.
2. triage the patient and identify OHCA.
3. provide telephone CPR instructions to the caller.
4. rapidly dispatch professional rescuers with AEDs

Editor’s Note: Related Sidebar content
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 re-emphasizing several points:

- The role telecommunicators play is understood and appreciated now as never before. 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.”
- Telephone CPR is as effective in saving lives as standard CPR (Wu, Viereck, Ro)
- Telephone CPR is often more common than bystander CPR without telecommunicator instructions (Wu, Viereck, Ro, Hardeland)
- In many places, survivors are twice as likely to have received TCPR than CPR without telecommunicator assistance. [Wu, Viereck, Ro]
- 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 (Berdowski)
- The two-question model is highly effective in identifying cardiac arrest
Some overtriage will happen, but CPR on a person not in cardiac arrest is not dangerous [Rea].

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.

The Three Stages of TCPR

The “Three Stages” of TCPR can serve as the spine of your telecommunicator education program. Again, these steps are: Stage 1 - Identifying OHCA, Stage 2 – CPR Instructions, Stage 3 – CPR Coaching.

Stage 1: Identifying OHCA

Identifying cardiac arrest is the first vital step in the TCPR process. One study found that patients were over three times more likely to survive if telecommunicators simply recognized their arrest during the emergency call.xix

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. Consider the following audio example:

Here, before we even confirm the incident location, the caller has told us that his wife (an adult) has collapsed in the back yard. All we need to ask, then, is whether she is breathing normally. If not, then 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?

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

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.

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 also “no,” then telecommunicators should start CPR instructions without delay.

In a perfect world, callers would provide clear, concise, “yes” and “no” answers to these questions. In the real world, of course, their answers are often unclear even when patients are in cardiac arrest. Consider this compilation of recordings:

(Editor’s Note: link to sample audio file will be included in final report)

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.

- Common barriers and tactics for assessing patient consciousness

  **Barrier 1: 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. Consider the following audio recording:

  (Editor’s Note: link to sample audio file will be included in final report)

  **Tactic 1: Be Assertive**
  
  Telecommunicators should use plain language and a persistent, assertive tone when needed to focus a caller’s attention. Note the tone the telecommunicator used in the recording and her success in getting the caller focused.

  **Barrier 2: The caller does not understand the word “conscious.”**
  
  Callers are not always clear what “conscious” means.
Tactic 2: 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?”

Barrier 3: 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 3: Shake and shout

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

Barrier 4: Agonal Breathing

If the patient is reported unconscious, the telecommunicator should ask if the patient is breathing normally. About 40% of OHCA patients exhibit abnormal, agonal breathing (or “gasp ing”) when EMS arrives [REF].

Agonal breathing is 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. It is completely ineffective. It is typically slower than regular breathing and presents in a variety of ways. Here are a few examples of what agonal breaths can sound like over the phone:

![Agonal 1.wav](#) ![Agonal 2.mp3](#) ![Agonal 3.mp3](#)

(Editor’s Note: link to sample audio file will be included in final report)

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 TCPR process. Yet patients with agonal breathing have a greater chance of surviving than...
patients without it because agonal breathing is linked to residual oxygen in the brain. It is therefore imperative that training programs address how telecommunicators can recognize agonal breathing.

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

Figure 2: Frequency of terms callers use to describe abnormal breathing

These audio recordings provide a few examples of such descriptions:
“Gasping” is the most common term used to describe abnormal breathing

(Editor’s Note: link to sample audio file will be included in final report)

Tactic 4: 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:

(Editor’s Note: link to sample audio file will be included in final report)

If telecommunicators hear neither breathing nor agonal respirations, they should conclude the patient is not breathing normally. Background noise in the PSAP, it should be noted, can make it hard for telecommunicators to listen for breathing.

Tactic 4a: Ask the caller to observe the patient’s chest, watching for it to rise and fall normally and rhythmically.

If telecommunicators are unclear 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 (eg, rib fractures) to adults not in cardiac arrest was just 2%.xxi 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 5: Caller is a health care professional

Telecommunicators should not make assumptions about the competency of callers or veer away from protocols call simply because a caller is a health care professional.

Tactic 5: Treat all callers the same, even if they are health care professionals. Assess consciousness and breathing according to your protocol and, when indicated, start CPR instructions.

Summary

Stage 1 barriers and tactics can be summarized as follows:

<table>
<thead>
<tr>
<th>Barrier</th>
<th>Tactic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Caller emotional distress</td>
<td>Be assertive</td>
</tr>
<tr>
<td>Caller does not understand “conscious”</td>
<td>Rephrase the question (e.g., “Is he awake?”)</td>
</tr>
<tr>
<td>Open eyes, seizure-like movements</td>
<td>Shake and shout</td>
</tr>
<tr>
<td>Agonal breathing</td>
<td>Ask to hear patient’s breathing; look to see if chest rises and falls normally and rhythmically</td>
</tr>
</tbody>
</table>

Stage 2: CPR Instructions

After telecommunicators recognize potential OHCA, they should provide 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.

There are many reasons why callers may hesitate, or even refuse, to perform CPR. They may lack of 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.

Telecommunicators can help overcome each of these barriers.

Barrier 1: Caller hesitates or refuses instructions

Tactic 1: 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 which will increase the caller’s confidence to perform CPR.

**Barrier 2: Patient Positioning**

Perhaps the most challenging barrier to starting instructions is patient positioning. CPR should be done with patients flat on their back 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. Consider this example:

![Unable to move patient](patient.mp3)

(Editor’s Note: link to sample audio file will be included in final report)

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.\textsuperscript{xxii}
Tactic 2: Get help

Callers in emotional distress may not think to get help from people (eg, a family member) 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 person present.

Tactic 2a: Sheet drag

If the patient is on a bed, telecommunicators can advise callers to grab and drag the sheet they’re lying on off the bed.

Tactic 2b: 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 [Langlais].

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 2: Fear of hurting patients when getting them to the floor

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

Tactic 2: Reassure the Caller

While the caller’s concern is understandable, reassure them they will not hurt the patient and continue with directions to move the patient to the floor.
Summary: Step 2 barriers can be summarized in the following table

<table>
<thead>
<tr>
<th>Barrier</th>
<th>Tactic</th>
</tr>
</thead>
<tbody>
<tr>
<td>Caller refuses instructions</td>
<td>Be decisive</td>
</tr>
<tr>
<td>Patient positioning</td>
<td>Get help</td>
</tr>
<tr>
<td></td>
<td>Sheet drag</td>
</tr>
<tr>
<td></td>
<td>Assist and assure</td>
</tr>
<tr>
<td>Fear of hurting patient</td>
<td>Reassure the Caller</td>
</tr>
</tbody>
</table>

- **Compression-only CPR Instructions**

In the vast majority of adult OHCAs, telecommunicators should provide instructions for compression-only CPR (NOTE: In a small minority of cases, OHCAs may stem from an obvious respiratory cause such as drowning. In these cases, telecommunicators should provide instructions for conventional CPR, or CPR with compressions and rescue breaths. Please see Appendix 2 for more on conventional CPR.) 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 3 key components in lay rescuer chest compressions: compression rate, compression depth, and recoil.

- **Compression Rate**
  
  - A rate of 100 – 120 compressions per minute (cpm) is optimal
  
  - Metronomes are inexpensive. Several free metronome desktop and smartphone applications are available.
  
  - To confirm that the caller has begun compressions, and to ensure they are 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 duration of the call. The goal with asking the caller to count out loud is to ensure compliance with instructions and to confirm that the caller is delivering compressions at the appropriate rate. Once that has been established, the telecommunicator may take over counting for the caller.

- **Compression Depth**
  
  - Evidence suggests that proper CPR compression depth is associated with survival. A depth of 2” 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 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.

Stage 3: Continuous CPR Coaching after CPR has started

- The Problem with Pauses in Chest Compressions

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 3 seconds for blood pressure to fall to zero. Once chest compressions have begun, it is very important telecommunicators not distract callers (by asking unnecessary questions, for example) and lead them to pause their compressions.

Telecommunicators should help callers create and maintain proper compression rate. Metronomes, freely available for desktops and smart phone apps, can help. Following their beat, telecommunicators can set the rate and have callers take over the counting. This allows the telecommunicator to monitor the rate and 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 the Protocols section on page 15.

Continuous CPR coaching may explain studies finding that telephone CPR is as closely associated with improved patient outcomes as bystander CPR is.\textsuperscript{vii xxiv}

---

Metronomes are freely available and can help guide the rate of chest compressions

---
Telecommunicators can assist rescuers already doing CPR when a 9-1-1 call is received. Telecommunicators should ask callers to bring the phone near the patient and to count out the compression rate. Whether the person doing CPR is a lay or professional rescuer (e.g., a nurse in a medical facility or nursing home), telecommunicators can have a positive impact on CPR quality through coaching.

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

(Editor's Note: link to sample audio file will be included in final report)

**Additional considerations (Sidebar Content)**

- 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 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 (when appropriate)
  - 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 dispatch help.
  - Telecommunicators should notify EMS that CPR is in progress when lay rescuers start compressions. This directly affects the mindset of
responders on route to the scene, particularly if the call starts as a “Chest Pain” or “Cardiac Incident” complaint.

4. Simulate TCPR

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 field 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 TCPR protocols to choose from given the situation the “caller” describes.

Simulations should encompass each of the Three Stages of TCPR. 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.

TCPR 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. Telecommunicators should process at least 10 OHCA calls per year, either real or simulated.

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, not punish. While not strictly part of TCPR training, measurement should be central to a telecommunicator’s continuing education. It provides essential feedback that can take three broad forms:

- Standardized process reports to share with staff on overall performance on key TCPR measures. These measures shed light on collective strengths and weaknesses and are detailed in the TCPR Quality Improvement section 36-39.

A free reporting template is available [here](#).

- Standardized audio reviews of individual telecommunicator performance on OHCA calls. These reviews can be conducted by supervisors, peers, or by the telecommunicators who processed the call themselves. PSAPs should try to conduct these reviews within a week and no longer than a month from the call. In general, the sooner a review occurs, the more effective it is.

Free standardized review form is available [here](#) and [here](#).

- Real-time feedback on call handling as telecommunicators process OHCA calls.

### Other Topics to Consider (Sidebar Content)

- There should be 2 to 3 hours of continuing education annually. Learning sessions should be frequent and fairly short. We recommend 30 to 45-minute increments at least quarterly throughout the year. In addition to reviewing standard process reports or 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. These include:

    - Patient’s with DNR/POLST orders
    - Patient’s on ventilators
    - Post-Op patients
    - Obvious DOA
    - 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 (and perhaps most severely, PAIs for TCPR) exposes telecommunicators to acutely stressful circumstances that sometimes call for immediate debriefing and support. Continuing education sessions are a chance to point telecommunicators to mental health resilience and support resources. For more on Critical Incident Stress Management, please see Appendix 3, page 47

6. ACHIEVING A TCPR CULTURE OF EXCELLENCE

We described the importance of leadership, accountability, and continuous quality improvement in creating a “culture of excellence” on page 3. In this section, we note:

- how PSAP leaders can build necessary bridges between stakeholders across the Chain of Survival
- recommended elements of TCPR CQI
- 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. The committee can help celebrate successes and advise executive stakeholders of unmet needs. Committee members should include:

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

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

- Medical Director/Oversight executive
- PSAP QI representative
- PSAP agency Director
- EMS agency QI representative
- EMS Chief
- Emergency Room Clinical Manager
- Hospital QI representative
The PSAP and EMS QI 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.

- **Recommended Elements of TCPR CQI**

CQI is, by definition, ongoing and devoted to measuring and improving care. Importantly, it is meant to support and encourage telecommunicators in their work, not punish them.

Measuring TCPR process and patient outcomes is central to assessing quality of care. It sheds light on deficiencies and inspires improvement in both process and outcomes. Please see page 33 for the different forms CQI can take as part of continuing education.

Figure: 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.

- **TCPR Quality Improvement: Evaluating OHCA audio recordings for benchmarks/barriers**
Ideally, PSAPs can capture and evaluate all OHCA calls in the region they serve. There are an estimated 55 OHCAs per 100,000 people.xxvi xxvii

Below is a summary of the 5 AHA-recommended performance metrics for TCPR. These metrics should serve as the basis of your TCPR QI program. For more information on these recommendations, please see:
https://cpr.heart.org/AHAEC/CPRAandECC/ResuscitationScience/TelephoneCPR/MeettheTaskforce/UCM_492699_T-CPR-Taskforce.jsp

- **Recommendation 1: Percentage of total OHCA Cases Correctly Identified by Telecommunicators**
  - **Definition:** Telecommunicator recognized / total OHCA (confirmed by EMS impression)
  - **Numerator:** Number of QI reviewed EMS confirmed OHCA with recognition noted. (Reminder: the numerator is the top number in a fraction. For example, in the fraction ¼, the numerator is 1 and the denominator is 4.)
  - **Denominator:** EMS confirmed OHCA
  - 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.
  - **Performance Goal 75%**

- **Recommendation 2: Percentage of Recognizable OHCA Cases Correctly Identified by Telecommunicators**
  - **Definition:** Telecommunicator recognition / 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:**
    - 3rd Party calls
    - Hang Up
    - Hysterical/Extreme Emotion
    - CPR in progress
    - Language barrier
    - Other circumstances supervisor deems “unidentifiable”
o **Performance Goal**: 95%

**Recommendation 3: Percentage of Call Taker Recognized OHCA Receiving T-CPR**

- Definition: Number of telecommunicator recognized OHCA cases receiving call-taker directed T-CPR / number of QI reviewed EMS-confirmed OHCA with recognition noted where call taker directed T-CPR is performed.

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

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

- Exclusions from denominator:
  - Caller is unable to physically perform CPR (i.e., caller not with 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**: 75%

**Recommendation 4: Median Time Interval Between 911 Call and OHCA Recognition**

- Definition: Median amount of time in second between 911 call connected and OHCA recognition.

- **Benchmark**: < 120 seconds (less than 60 second from address acquisition to telecommunicator recognition of OHCA.)

**Recommendation 5: Median Time Interval Between 911 Call and First TCPR Directed Compression**

- Definition: Median amount of time in seconds between 911 call connected and first CPR compression directed by telecommunicator

- **Benchmark**: < 180 seconds (less than 120 seconds from address acquisition to first CPR compression directed by the telecommunicator)

- **Additional considerations**
• Frequency of barriers to TCPR

  It is helpful to track how often you identify particular barriers to TCPR. 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.

  • A data collection template, dictionary and video tutorial are available at https://mycares.net/

  • A QI reporting template is available at https://azdhs.gov/preparedness/emergency-medical-services-trauma-system/save-hearts-az-registry-education/index.php#dispatchers-quality-improvemet

• 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. Have PSAP staff met 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
APPENDICES

Appendix 1: The Physiology of OHCA

Sometimes in cardiac arrest, the ventricles, or lower chambers of the heart, cease to contract normally and begin to quiver or “fibrillate.” This is known as ventricular fibrillation (VF). In other cases, pumping becomes weak or absent and the person looses consciousness while the electrocardiogram present itself from almost normal to a flat line (asystole)

A normal heart rhythm looks like this on an electrocardiogram:

![Normal heart rhythm](image1.png)

VF looks like this:

![VF rhythm](image2.png)

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 – that is, because they are “shockable” – these patients are more likely to survive than patients found with non-shockable rhythms.

VF decays in a matter of minutes into asystole, a non-shockable waveform that looks like this on an electrocardiogram:

![Asystole waveform](image3.png)

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 are included, explains why overall OHCA survival is so low.
Chest compressions prolong and even “energize” the VF waveform. Consider this graphic:

The first panel shows a VF waveform at 1 min with no CPR. The second panel shows the waveform at 2 minutes with no CPR. The third shows the waveform at 13 min after 3 min of CPR. The waveform in third panel resembles the waveform in the first panel, shortly after arrest onset. This “newly energized” waveform explains why compressions increase the chance professional rescuers succeed in defibrillating the heart.

Appendix 2: Conventional CPR (CPR with compressions and rescue breaths)

- When?
  - Conventional CPR instructions should be provided for instances when cardiac arrest is secondary to respiratory arrest or oxygen deprivation, such as:
    - 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 compared to adult cardiac arrest. For this reason, instructions for these patients will still include instructions for ventilations.

- Compression to Ventilation Rate
  - When appropriate, the following compression to ventilation rate should be applied (single rescuer scenario):
    - Neonate/Newborn 3:1
    - Infants [mention: on table or floor, 1 day – 1 year] 30:2
Appendix 3: 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 your employees. You must care for your most valuable resource, your telecommunicators. Training that offers insight and awareness about critical incident stress, including available resources, such as EAPs, peer support groups, or department chaplains should be included in this curriculum.

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 TCPR) can expose those involved to acutely challenging and stressful situations. The impacts of secondary psychological trauma include in emotional duress experienced by the telecommunicator. The non-visual nature of the work can on one hand provide a psychological buffer but can also increase the impact on the telecommunicator as they try to visualize the scene. In addition, the auditory component becomes highly accentuated for the Telecommunicator and has a stronger potential for compounding vulnerabilities to secondary 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 trauma treatment with evidence-based solutions such as EMDR (Eye Movement Desensitization Reprocessing) should be established as early as possible for assisting the 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 (https://911wellness.com/) and the National Emergency Number Association (NENA) Standard on 9-1-1 Acute/Traumatic and Chronic Stress Management NENA-STA-002.1-2013.
Appendix 4: History of Telephone CPR

Paramedic medical responses for out of hospital cardiac 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 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, UT fire department. These protocols contained specific questions, instructions, and response codes to aid callers and prioritize responses. A formal training program for emergency medical dispatchers was introduced in Utah in 1979. In 1978, a Medical Advisory Flip File was adopted in the state of Illinois.

In the early 1980’s, a number of places throughout the country, including King County, WA, Aurora, CO, and Salt Lake City, UT began using scripted instructions to address cardiac arrest, and other major problems like choking and childbirth.

The King County group trained dispatchers to recognize cardiac arrest over the phone and to provide scripted instructions to the caller. The scripted instructions were pilot 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 both callers with no prior training as well as refresh 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 dispatchers. 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 pre-arrival instructions, when provided by properly trained emergency medical dispatchers, 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 re enforced 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 telephone CPR, identified barriers to delivering instructions, helped refine the instructions, and shortened the time from call to beginning chest compression. 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 bystander instructions.

National awareness of telephone 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. The Resuscitation Academy since its inception in 2008 actively promoted telephone CPR as an effective step in improving community survival rates. In 2015 the Institute of Medicine recommended NHTSA take the lead to promote telephone CPR and in 2017 the American Heart Association issued telephone CPR program guidelines and performance goals. Most recently, several more states have adopted or are considering legislation requiring training in telephone CPR for emergency telecommunicators.

Appendix 5. TCPR resources

The following links provide additional TCPR training and CQI support:

http://www.resuscitationacademy.org/

http://cprlinktolife.com/

https://mycares.net/
PART 2: HIGH-PERFORMANCE CPR (HP-CPR)

1. OVERVIEW

○ What is HP-CPR?

- HP-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 all successful resuscitation and is the most important 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:

○ Table 1: Individual and Team Performance Metrics

<table>
<thead>
<tr>
<th>Individual Performance</th>
<th>Definitions / Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Compression Rate</td>
<td>Number of compressions per minute</td>
</tr>
<tr>
<td>Compression Depth</td>
<td>Depth of each compression</td>
</tr>
<tr>
<td>Chest Recoil</td>
<td>Full recoil of compressor’s hands off the chest</td>
</tr>
<tr>
<td>Ventilation Rate</td>
<td>Number of ventilations per minute</td>
</tr>
<tr>
<td>Ventilation Volume</td>
<td>Volume of each positive pressure ventilation</td>
</tr>
<tr>
<td>Real-time CPR performance feedback</td>
<td>Use of feedback or prompt devices that enhance real-time performance (e.g. Metronome, puck)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Team Performance</th>
<th>Definitions / Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Team Roles Defined Pre-Arrival</td>
<td>Compressor, Airway, Monitor etc.</td>
</tr>
<tr>
<td>Team Roles Choreographed</td>
<td>In Pediatrics, include a pre-arrival discussion of dosing and equipment sizing</td>
</tr>
<tr>
<td>Compression Fraction</td>
<td>Percentage of ongoing compressions during cardiac arrest, over a period where compressions are indicated</td>
</tr>
</tbody>
</table>

- Efficient rotation of compressors
- Minimization of all pauses in compressions
- Prioritization of compressions over
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. Unfortunately, CPR usually doesn’t meet performance recommendations in both adult and pediatric cases. Adoption of HP-CPR holds the promise of improved survival.

What is the purpose of Part 2: HP-CPR?

The purpose of this section is to present 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.”
Chest compressions should achieve proper depth, rate, recoil, and fraction. Controlled ventilations should achieve proper rates and volume. Table 2 summarizes performance recommendations for each of these components. It includes common errors, their possible effects, and key points for providers.

<table>
<thead>
<tr>
<th>Significant Components of Adult CPR</th>
<th>Performance Recommendations</th>
<th>Common Errors &amp; Causes</th>
<th>Possible Effects of Common Errors</th>
<th>Key Points for Providers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chest compression depth</td>
<td>• At least 2 inches</td>
<td>• Too shallow</td>
<td>• ↓ coronary perfusion pressure</td>
<td>“Push hard, but not too hard”</td>
</tr>
<tr>
<td></td>
<td>• No more than 2.4 inches</td>
<td>• Too deep</td>
<td>• ↓ cerebral perfusion pressure</td>
<td></td>
</tr>
<tr>
<td></td>
<td>• Approx 5 – 6 cm</td>
<td>• Fatigue</td>
<td>• Potential injuries</td>
<td></td>
</tr>
<tr>
<td>Chest compression rate</td>
<td>• 100 – 120 per minute</td>
<td>• Too slow</td>
<td>• ↑ intrathoracic pressure</td>
<td>“Push fast &amp; monitor the compression rate”</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Too fast</td>
<td>• ↓ coronary perfusion pressure</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Fatigue</td>
<td>• ↓ cerebral perfusion pressure</td>
<td></td>
</tr>
<tr>
<td>Chest recoil</td>
<td>• Allow complete chest recoil after each compression</td>
<td>• Failure to allow full chest recoil</td>
<td>• ↑ intrathoracic pressure</td>
<td>“Allow complete chest recoil”</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Leaning</td>
<td>• ↓ coronary perfusion pressure</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Fatigue</td>
<td>• ↓ venous return</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>• ↓ survival</td>
<td></td>
</tr>
</tbody>
</table>

Table 2: Recommendations for Adult CPR

Hemodynamically & Neurologically
**Compression fraction**

- Minimize ALL interruptions to CPR
- Pauses < 10 seconds
- At least 60%, **but as high as possible**

**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

---

**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**

---

Compression fraction, the percentage of time compressions are being performed during a resuscitation, should be **as high as possible**. The recommended 60% represents the *minimum fraction*
As noted above, performance on pediatric calls will benefit from an intentional pre-arrival discussion that explicitly verbalizes equipment size, defibrillation values, and medication volumes.

### Differences in Pediatric and Adult CPR

<table>
<thead>
<tr>
<th></th>
<th>Pediatric</th>
<th>Adult</th>
</tr>
</thead>
<tbody>
<tr>
<td>Likely Arrest Etiology</td>
<td>Respiratory</td>
<td>Cardiac</td>
</tr>
<tr>
<td>Rescue Breathing Instructions (TCPR)</td>
<td>Yes</td>
<td>No</td>
</tr>
<tr>
<td>Sniffing Position Technique</td>
<td>Elevate the Shoulder</td>
<td>Elevate the Head</td>
</tr>
<tr>
<td>Compression Depth</td>
<td>1/3 AP Diameter of Chest Infant (4 cm), Children (5 cm)</td>
<td>5 – 6 cm 2 – 2.4 in</td>
</tr>
</tbody>
</table>
| Compressions : Ventilation 2-person rescue | 15:2                             | Variable by Agency
                                                             Continuous vs. 30:2 |

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

- Rescue Breathing Instructions
- Adult chest compression depth
- Compression Depth
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, the patient should not be moved until ROSC has been obtained unless it is impossible to provide high-quality CPR in the current location. Patient movement should be kept to a minimum.

After CPR is started, HP-CPR minimizes pauses and interruptions. Lengthy pauses in compressions 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.

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 direct 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.

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. The following are common scene challenges along with tips for managing them.

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. 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 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 ensure delivery of ideal compressions as well as 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.

Other tips and best practices useful in addressing CPR quality issues include:
o During manual rhythm analysis, assessment of the underlying electrical activity, including shockable, organized or absence of activity, should be determined within 3-5 seconds.

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

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

o 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.

o 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.

o 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.

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

o Complete chest recoil is imperative. Feedback devices may 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 insure complete chest expansion.

o 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 effect resuscitation.

o 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 data gathered on previously-discussed performance metrics, 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.

5. TRAINING

So far, the document has addressed:

- performance recommendations for HP-CPR
- common CPR quality issues and tips for eliminating or reducing them.

We now turn to training. As noted previously, **HP-CPR is the foundation of all successful resuscitation and is the most important 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.

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

**Preparation**

**Class Time**

- At least 4 hours

**Audience**

- EMTs
- Paramedics
- Training Officers
- Nurses
- Respiratory Therapists
What You’ll Need

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

Resuscitation Pods

• Each “pod” consists of chairs in semi-circle 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

Figure 1. Resuscitation pod set up for 5 students and 1 pod instructor (PI)
• High fidelity manikins are preferred; monitor/defib/AED with CPR feedback also preferred

Classroom Setup

• 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 our main objectives is to break down HP-CPR into its component skills (e.g., compression skills) and master each. Then we move on to the next skill.
• The PI 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

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.

• Starts in the classroom but meant for the street/hospital
• Designed to give professional rescuers the skills, knowledge, and ability to work together at a very high level.
Know the Recommendations

Evidence-based guidelines (see Tables 2 and 3) tell us what to do. High quality training shows us how to do it. The very best training includes the “why”.

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.

Present an inspiring survivor story from your own EMS system. This isn’t about statistics. It’s about human lives!

Balance explanation of the critical concepts of HP-CPR against training time. GOAL: Consistently excellent hands-on performance.

- At least 80% of High Performance CPR training should be hands on.
- At the end of the day, High Performance CPR is something that happens on your hands and knees! (For this reason, it’s a good idea to have padding to kneel on when you train).

Compression Skills

A good chest compression has 3 important qualities: rate, depth, and recoil. Survival depends on maximizing effectiveness of all three.

- Rate: 100-120
4. Depth: 2.0-2.4 in (5-6 cm/50-60 mm)

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

11. Recoil (Avoid Leaning)

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.

19. In addition, compression fraction (the percentage of time compressions are being performed during a resuscitation) 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.

24. Ventilation Skills
Ventilations should be *controlled*.

Keep these things in mind:

- Don’t squeeze the bag too often
- Squeeze just enough for chest 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, which 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 help also.

For more on ventilation skills, please see Appendix 3, page 79.

**Optimize Teamwork**

Once each individual has learned how to perform consistently excellent chest compressions and perfect ventilations it’s time to combine these skills and work together as a team.

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

**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:
Positions:

• Position 1: Monitor / AED
• Position 2: Chest Compressions
• Position 3: Airway
• Position 4: Timekeeper / Assistant

Responsibilities:

Position 1

• 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 on chest compressions
• Changes monitor to pediatric mode if applicable
• When appropriate pre-charges the monitor and manages peri-shock pause

Position 2

• “Hovers” during pulse check
• Performs CPR at correct rate, depth, and recoil
• Accepts feedback from crew members about CPR quality
• Coordinates pad placement with rescuer on monitor
• Counts out loud “13, 14, 15” or “28, 29, 30” to prompt rescuer on airway to give breaths
• Waits two full seconds for airway position to give breaths and continues compressions
• Helps keep track of 2-minute cycle
• When Monitor/AED position announces “stop CPR” at the beginning of the peri-shock pause this rescuer clears out of the way

Position 3

• Announces “I’ve got airway”
• Selects the correct sized BVM and attaches capnography between mask and bag
• Announces “ready for 15:2” or “ready for 30:2”
• Reminds rescuer on compressions to count last three
• Ventilations are given correctly (just enough to produce chest rise with full release between ventilations)
• Manages the patient’s airway as necessary

**Position 4**
• Starts metronome and acts as timekeeper
• Turns on oxygen and hooks up BVM to oxygen at 15 LPM
• Selects correct sized OPA for the rescuer on the airway
• Deploys and tests suction unit
• If pediatric, takes out **Handtevy book** and determines child’s age
• Reminds rescuer on monitor to pre-charge the capacitor at 1:45 into the cycle

**When You Get There**
There are a few things to size up when you arrive:

- Is the scene safe for the team?
- Is anyone doing CPR?
  - If yes, your team leader should judge the CPR quality and immediately relieve the person doing CPR. The team leader let the team know the CPR quality and enter it into the report because CPR quality can impact decisions about how long to resuscitate and can affect the hospital providers’ early impression of the chance the patient survives.
- 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. Your training should include how to recognize agonal breathing. Here are some examples of what it can sound like:

  ![Waveform](Agonal.1.wav) ![Waveform](Agonal.2.mp3) ![Waveform](Agonal.3.mp3)

(Editor’s Note: link to sample audio file will be included in final report)
Here are some examples of how 9-1-1 callers describe it:

(Editor’s Note: link to sample audio file will be included in final report)

- 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: 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 responsible?
  - 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. If in doubt, there is no doubt – start resuscitation.

- If resources allow, emphasize early application of defibrillator pads. If good CPR is in progress when you arrive, consider early rhythm check.

Types of CPR Delivery:

**Standard CPR**

The most common method of ventilation 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 in real life. With HP-CPR the delay for ventilations should be only about 3 seconds: one second in, one second passive expiration, one second in. 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 precipitous decline in coronary and cerebral perfusion pressure associated with excessive

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.
delays. Continue holding the mask on the face to deliver passive oxygenation during compressions.

**BLS Continuous**

Some systems provide continuous chest compressions and interpose one small breath every 10th compression. This requires practice but can be done without an advanced airway in place.

**Passive Oxygenation**

Some systems perform 3 cycles (some perform more) of continuous chest compressions with passive oxygen administration for adult, witnessed cardiac arrest. This is sometimes referred to as the Minimally Interrupted Cardiac Resuscitation (MICR) protocol. For a sample MICR protocol, please see Appendix 4, page 80.

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 “perishock pause” is used to measure how long we interrupt CPR to perform defibrillation. Keep the hands-off-chest time during rhythm check/compressor change to 10 seconds or less – highly functioning crews can limit this to 2 or 3 seconds.

Perishock pause has two components.

- The pre-shock pause
- The post-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 crew member 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 5, page 80.

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, skill levels, and the frequency with which they perform CPR.

Here are some scenarios you can use in training:

1 - 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.

2 - WITNESSED WITH BYSTANDER CPR

21-year-old college soccer player collapses on the field and is determined to have suffered sudden 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.

3 - 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.

4 - PEDIATRIC

5-year-old male discovered missing by parents. Found floating in back yard 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.

5 - 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.

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

Through team debriefings, analysis of CPR performance with defibrillator data downloads (software that helps measure things like CPR fraction and perishock 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 Information**

**Identifying Return of Spontaneous Circulation (ROSC)**

- Sudden rise in ETCO2
- Organized rhythm on the monitor
- Improvement in skin color
- Consistent SpO2 pleth waveform
- Patient movement or respiratory effort
- Confirmed with a pulse check

**Post-Resuscitation Care**

- Anticipate re-arrest. An orderly exit from the scene may allow more efficient treatment if re-arrest occurs.
- Anticipate BP drop: Know strategy to treatment with BP goals using fluid or pressors
- Minimize lung injury: elevate head of bed to avoid aspiration, limit tidal volumes, place nasogastric tube as necessary
- Use sedation protocol if patient is fighting tube
- Attach pulse oximetry
- Obtain a full set of vital signs including temperature
- Acquire a 12-lead ECG
- Rapid transport and activate cardiac cath lab if 12-lead ECG shows STEMI
- Turn on VF/VT alarm
- Assemble an appropriate transport team (at least 3 in back of ambulance)
- Transport the patient to an appropriate medical facility
- Engage social work/chaplain for the patient/family at the hospital

**Transitioning 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.
6. ACHIEVING AN HP-CPR CULTURE OF EXCELLENCE

We described the importance of leadership, accountability, and continuous quality improvement in creating a “culture of excellence” on page 3. In this section, we note:

- how EMS leaders can build necessary bridges between stakeholders across the Chain of Survival
- specific elements of EMS CQI
- 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 operational (paramedic, EMS Lieutenant, etc) representative
- EMS agency CQI representative
- 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 CQI representative
- EMS Chief
- 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.

*Specific Elements of CQI*

CQI is, by definition, ongoing and devoted to improvement. It can take the form of (1) standardized reporting on overall staff performance that highlights collective strengths and weakness and (2) debriefings where personnel discuss the events they participate in and see how their personal performance compares with the standards cited in Section 2.

Figure: 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 widely held 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 report on overall staff performance can be found here.

A data dictionary and standard template for patient outcome reports can be found here.

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 and 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 their overall reaction to the event and what went well and what could have been improved. 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 teamwork. 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 joined into the debriefing session. This pause between event and debriefing also gives providers the opportunity to reflect on the resuscitation event. Secondly, 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.
The debriefing may incorporate the defibrillator recording given its objective assessment of CPR performance. Many of the 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.

Additional steps agencies can take toward 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 (regularly practice CPR)
- Create and maintain a performance dashboard (key indicator report on an ongoing/ cyclical basis)
- Share (Annual) Performance Report with external and internal stakeholders
- Acknowledge success (for example, organizing survivor celebrations)
- Support resilience (chaplain program, mental health services for personnel)
APPENDICES

Appendix 1: Barriers to HP CPR Implementation

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 require broader strategies that address organizational, operational, cultural and leadership barriers. 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

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. 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 superior.

- 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 fail to 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 uniquely 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

  o 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.

  o 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.

  o 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.

  o 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.

  o 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.

  o Solutions to these challenges

  o CPR Implementation

  o 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.xli
    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

    He 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.xlii
Poor CPR a Preventable Harm

“Poor quality CPR should be considered a preventable harm.” 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, to 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 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, now they believe they should accomplish
return of circulation for all patients. 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, in support for the pilot implementation from the leadership above.\textsuperscript{xlii}
This can occur in many ways and at different times. Most simply, communication and
vision from the top, in announcing support from leadership for the pilot 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 exists a quarter to as much as 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, an
order, to implement. Much larger implementations are also possible, from a state or
national level.\textsuperscript{xiv} In these cases, leadership and support from the top, preceding pilot
rollout, for example, setting a strategy, gaining approval of elected officials, publicizing
implementation through social media and publishing a 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.\textsuperscript{xlvi} 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. xlvii
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.xl
5. Ensure inclusion of all levels of staff in planning and implementing CPR quality improvements.xlviii
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 (Pronovost, Peter J., 2010).
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 simply, 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 EMT’s 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.

Appendix 2: 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, depth, full release and with 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, devices measuring rate,
depth and release such as accelerometers or devices that measure the absolute distance between a
sensor on either side of the torso to provide true compression distance as compared to the
accelerometer that measures the sum of the movement which often includes the compression of the
substrate such as a mattress or stretcher pad.

Appendix 3: 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. Some advocate for
passive ventilation using facemask oxygen delivery without ventilation for the first two or three cycles of
CPR. Observational studies have supported this approach. Airway strategies include passive ventilation,
bag-valve-mask, the use of supraglottic airways or endotracheal intubation. When invasive approaches
are used it is mandatory that the procedure does not lead to interruptions in CPR. In other words,
practitioners of SGA placement or endotracheal tubes must have as a core competency the ability to
reliably placing the devices during active CPR.

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 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.

Appendix 4: Minimally Interrupted Cardiac Resuscitation (MICR)

MICR protocol implementation has been associated with improved survival from OHCA. Here is a sample MICR protocol:

Appendix 5: 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 is 20 seconds until the next pulse check and at that time the defibrillator should be charged. A crew member 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 time-saving 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.

Appendix 6: 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 as only rhythm
- Time from collapse
- EtC02 (less than 10 mmHg despite HP-CPR)

The decision to abandon resuscitation should involve team members and also-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 as well as reasons for going forward. Family should be brought in to the discussion as well. This should occur before engaging medical control consult if that is required.

Appendix 7: Transition to Mechanical CPR

Manual HP CPR and integration with mechanical CPR devices. 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 HPCPR 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 of the “pit crew” 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 includes:

- A specific protocol describing best practice for the application of the device being used that should include 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, for e.g. 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 of 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:

https://anchoragefire.viebit.com/player.php?hash=05hME6lLkd0S

Appendix 8: HP-CPR Resources

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


https://mycares.net/
References


(Editor’s Note: To be included in final document)

Working Committee Rosters:

<table>
<thead>
<tr>
<th>Telephone CPR</th>
<th>High-Performance CPR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Julie Buckingham</td>
<td>Peter Antey, MD</td>
</tr>
<tr>
<td>Mickey Eisenberg, MD, MPH, PhD</td>
<td>EMS Medical Director, Pediatric Emergency Medicine Physician, Florida</td>
</tr>
<tr>
<td>Chris Fischer</td>
<td>Tom Bouthillet, NREMT-P</td>
</tr>
<tr>
<td>Jim Lanier, MPA</td>
<td>Ten Campbell, RN, BSN, CEN, CFRN</td>
</tr>
<tr>
<td>Helge Myklebust</td>
<td>Louis Gonzales, MPH*</td>
</tr>
<tr>
<td>Jason Oko, NR-Paramedic</td>
<td>Clinical Quality &amp; Patient Safety Specialist, Austin/Travis County Office of the Medical Director</td>
</tr>
<tr>
<td>Brett Patterson</td>
<td>Mike Helbox, MICP, NR-P, SEI</td>
</tr>
<tr>
<td>Jamison Peeryhouse, ENP</td>
<td>Director - Emergency Medical Trainers &amp; Consultants, Seattle/King County EMS</td>
</tr>
<tr>
<td>Thomas Rea, MD*</td>
<td>Brian LaCroix, FACPE</td>
</tr>
<tr>
<td>Kevin Seaman, MD</td>
<td>Mike Levy, MD</td>
</tr>
<tr>
<td>Bob Swor, DO</td>
<td>Brent Myers, MD</td>
</tr>
<tr>
<td>Jerry Turk</td>
<td>Thomas Rea, MD</td>
</tr>
<tr>
<td></td>
<td>Kevin Seaman, MD</td>
</tr>
</tbody>
</table>

Emergency Medical Dispatch QI Program Manager, Seattle/King County EMS
Director of Medical QI, Seattle/King County EMS
Public Safety Communication Consultant, Chris Fischer Consulting
Technical Services Division Manager, Alachua County Sheriff’s Office
Director of Strategic Research, Acting CEO, Laerdal Medical
Licensing Agent & EMD Program Coordinator, Maine Emergency Medical Services
Academics & Standards Associate Chair, International Academies of Emergency Dispatch
Training Coordinator, Tennessee Emergency Communications Board
Medical Program Director, Seattle/King County EMS
Medical Director, Maryland Resuscitation Academy
EMS Medical Director, Royal Oak Fire Department
President, PowerPhone
EMS Medical Director, Pediatric Emergency Medicine Physician. Florida
Battalion Chief of EMS, Hilton Head Fire & Rescue
Program Director, Illinois Heart Rescue
Clinical Quality & Patient Safety Specialist, Austin/Travis County Office of the Medical Director
Director - Emergency Medical Trainers & Consultants, Seattle/King County EMS
President / EMS Chief, Allina Health EMS
EMS Medical Director, Anchorage Fire Department and the state of Alaska
President, National Association of EMS Physicians
Medical Program Director, Seattle/King County EMS
Medical Director, Maryland Resuscitation Academy