NENA Telecommunicator Cardiopulmonary Resuscitation (T-CPR) Standard

Abstract: Standard requirements for PSAP operations to ensure 9-1-1 telecommunicators provide consistent, effective cardiopulmonary resuscitation (CPR) instructions when a 9-1-1 caller is reporting a possible cardiac arrest.

NENA Telecommunicator Cardiopulmonary Resuscitation (T-CPR) Standard

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1 Executive Overview

Out-of-hospital cardiac arrest (OHCA) is a leading cause of death and disability in the United States (U.S.). Of the more than 350,000 adult OHCA that occur each year in the U.S., only 10% survive to hospital discharge, with many survivors experiencing some degree of neurologic disability precluding independent living. While other time-sensitive medical conditions (trauma, STEMI, stroke) are bolstered by mature systems of care, tremendously wide variations, approaching 500%, in both OHCA treatment and outcomes have been consistently described throughout North America.

OHCA is unique, as survival is highly dependent on the performance of the entire system of care, which includes critical actions by layperson bystanders, medical dispatch, emergency medical service (EMS) personnel, and hospital staff. Layperson bystanders are particularly important, as they are often the first to recognize and interact with OHCA victims. Recognition of OHCA with subsequent activation of EMS response and immediate, high-quality cardiopulmonary resuscitation (CPR) are the first two links in the chain of survival from OHCA. While EMS is frequently accessed, most OHCA victims do not receive bystander CPR. Instead, they wait on average five minutes until professional EMS arrives.

As first responders, public safety telecommunicators play an essential role in saving lives by confirming OHCA, ensuring the appropriate EMS response, and providing pre-arrival instructions. In the setting of OHCA, these telecommunicator CPR (T-CPR) instructions, provide *just-in-time* CPR training, and include, if known, the location of the closest available automated external defibrillator. Transforming layperson bystanders into rescuers with rapid and efficient T-CPR instructions is essential as every minute of untreated cardiac arrest decreases the likelihood of survival by 10%.

Despite the intuitive impact of T-CPR upon OHCA survival, less than half of the emergency communications centers, or ECCs, in the United States routinely provide T-CPR instructions. Of those ECCs that do, only a minority provide instructions consistent with current guidelines or have any quality improvement program to monitor performance metrics.

The cost of providing and maintaining a T-CPR program, the perception of the ECC's scope of practice, liability, and public relations concerns are frequently cited as obstacles to T-CPR implementation. These challenges can be overcome with formal medical direction and supervision as suggested by the National Association of State Emergency Medical Services Directors (NASEMSD), the American Society for Testing and Materials (ASTM), the National Institutes of Health (NIH), the National Highway Traffic Safety Administration (NHTSA), and the American Heart Association (AHA), to name just a few.

An active, engaged medical director can provide qualified and licensed oversight of emergency medical dispatch (EMD) including T-CPR and other medically relevant pre-

arrival instructions. In addition, medical directors can educate local public officials, simultaneously addressing the misconception that T-CPR is beyond the ECC's scope of practice and advocating for resources to implement and sustain T-CPR programs.

Quality T-CPR allays public relations exposure from media release of dispatch recordings by reassuring citizens that municipal resources are focused on saving lives. Life-threatening injuries from inappropriately directed or incorrectly performed T-CPR are quite rare. Furthermore, all 50 states and the District of Columbia have Good Samaritan laws mitigating legal liability from mistakenly performed bystander CPR. The perceived risks to providing T-CPR pale in comparison to the preventable deaths that OHCA causes in communities without it.

Telecommunicators, or TCs, as first responders and public safety personnel, must be trained and empowered to provide T-CPR, ensuring that the initial links of the Chain of survival are as strong as they can be. The single most important strategy to improve bystander CPR frequency and quality, and thereby survival from OHCA, is for ECCs to embrace T-CPR as the standard of care.

The information in this standard will provide ECC and pre-hospital system leaders with a roadmap to building a sustainable T-CPR program that addresses the resuscitation knowledge, skills, and abilities of telecommunicators. This document also contains minimum T-CPR performance standards ECCs should strive to meet to improve survival rates from OHCA.

Table of Contents

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Document Number	Approval Date	Reason For Issue/Reissue
NENA-STA-041.1-2022	03/17/2022	Initial Document

2 T-CPR Program Overview

The T-CPR program described in this standard consists of three major components:

- T-CPR Programmatic Requirements
- Required Knowledge, Skills, and Abilities
- Key Performance Indicators

The next three sections in the document will go into detail on what is required for each of these components. Some ECCs currently have an established program that addresses all these requirements, other ECCs don't have a program at all, and the rest of the ECCs will fall somewhere in between. All ECCs should compare their existing operations with this standard and take whatever steps are possible to work toward improving compliance with all of the requirements in this standard so that more OHCA victims survive.

3 T-CPR Programmatic Requirements

Cardiac arrest is a low-frequency, high-risk emergency. These calls are some of the most time-critical emergencies an ECC will respond to. This section provides ECC leaders with guidance on the minimum standards for developing and maintaining a T-CPR program, including minimum performance, training, and quality improvement requirements.

3.1 Leadership Engagement and Support

Successful T-CPR programs have a foundation of strong engagement and support from ECC leadership and leaders of all stakeholder agencies, such as fire departments, law enforcement agencies, and emergency medical service agencies. Leadership's commitment to T-CPR program goals, staff accountability, and timely feedback for consistent improvement are crucial inside the ECC.

3.2 Collaboration

Work with field responders to share information and collaborate on OHCA call processes, information, and outcomes, fostering continuous improvement, and increased understanding of agents' roles in the chain of survival. Regularly including ECC staff in after-action reports for training and quality improvement purposes may increase understanding and improve OHCA outcomes. Hospitals, the EMS system, and ECCs should work together to determine patient impact and what improvements can be made to improve OCHA outcomes.

3.3 Medical Director

Maintain a qualified medical director who meets guidelines set by state and local statutes, 911 Boards, the adopted EMD protocol system, and other standard-setting bodies; this includes qualifications, job descriptions, and expectations. The medical director must understand the duties inherent in EMD direction and support the telecommunicator's role in

the chain of survival. Physician oversight authority is essential, both to issue dispatch protocols for T-CPR and to ensure that protocols are locally relevant and consistent with guidelines as they evolve. The medical director should review Quality Improvement (QI) reports and can help set priorities for ongoing education.

3.4 Training

ECCs should provide T-CPR-specific training to TCs annually. Training may be provided at intervals convenient to the ECCs but should meet a minimum time frame as recommended. Training should be driven by the ECC's specific needs illuminated through a Quality Assurance / Quality Improvement (QA/QI) program, should be contextual, scenario-based, and should focus on vital components of effective T-CPR, such as compression rate, depth, recognition, barriers, delays, and proper use of supportive technology.

3.5 QA/QI program

ECCs shall create/maintain/implement a QA/QI program to govern TC's adherence to EMD protocols and/or best practices for optimal T-CPR outcomes. This program should be non-punitive with an emphasis on just culture and due process, focusing on education and improvement.

The QA/QI program shall set performance benchmarks for minimal performance, ensure review of a statistically significant data set based on the agency-specific call volumes, and provide feedback and training in a timely manner.

The ECC should establish sound medical management processes through a multi-component QA/QI program in conjunction with the physician medical director. Prompt, correct, and appropriate patient care can be enhanced using a standardized approach to quality assurance, especially the component of EMD performance assessment.

3.6 Feedback/ 360-degree Communication

Develop, maintain, or expand communications channels that allow feedback to flow between all stakeholders. The communication channels may reinforce positive behavior, illuminate points of failure in the chain of survival, provide after-action information, and allow call takers/responders to report unusual circumstances to improve future performance. Feedback and communication should be non-punitive and focus on continuous improvement and learning.

3.7 T-CPR Pre-arrival Instructions

ECCs must use recognized and/or Medical Director approved Pre-Arrival Instructions (PAI) to direct proper, evidence-based T-CPR instructions, with the goal of coaching callers through highly effective T-CPR. Whenever possible, ECCs should employ PAIs from a recognized EMD protocol system.

3.8 Interaction of T-CPR protocols/PAIs with Other Agency Directives

Internal agency directives should provide guidance and reduce confusion regarding T-CPR PAI provision and unusual scenarios, such as heavy call volume during emergency times (Emergency Rule policy activation), calls from medical facilities, acceptable alterations/amendments of questioning, and other situations not addressed by EMD protocols. ECCs should work to reduce undue harm and safely provide T-CPR to all callers.

3.9 Coordinating Community Outreach/Engagement

Partner with internal and external stakeholders to develop and strengthen existing public outreach programs and improve citizens' understanding of OHCA, including the importance of quickly initiating CPR, their role in the chain of survival, and tools and technologies available to support the goal of saving lives from OHCA, such as automated external defibrillator (AED) use and citizen alerting applications.

4 Required Knowledge, Skills, and Abilities (KSA) for T-CPR Program Implementation

The following list identifies knowledge, skills, and abilities (KSAs) related to ECC T-CPR performance goals. ECC professionals of all levels must develop KSAs to be proficient in their position; here we focus on KSAs that directly impact T-CPR program and performance, classified by position.

ECCs should use these KSAs to foster strong performance in T-CPR call processing, training, QA/QI, and program implementation. ECCs may use the information to assess one's baseline performance, develop training, address knowledge or skill gaps, enhance the performance cycle, and provide direction for the benchmarking process. Multiple professional standards were used to develop this list, they may be found in the Appendix.

4.1 ECC Leadership Program Implementation KSA List:

4.1.1 Knowledge of current resuscitation guidelines, best practices, and related science and standards

4.1.2 Knowledge of the TC's role in the chain of survival

4.1.3 Knowledge of state/county/local telecommunicator T-CPR legislation, including training and certification requirements

4.1.4 Knowledge of OHCA call-processing liability, including the Duty to Act and community expectations that establish a local standard of care in calls for cardiac arrest

4.1.5 Knowledge of EMD protocol implementation and use

4.1.6 Knowledge of the Medical Director's legal authority, duties, and responsibilities as they relate to the ECC environment

4.1.7 Ability to engage and communicate with the Medical Director for assistance, learning, and improvement

4.1.8 Ability to communicate and work with internal and external stakeholders to achieve high performance T-CPR performance goals

4.1.9 Ability to develop and manage the T-CPR training program, including initial and continuing education, remedial training, and certification maintenance

4.1.10 Ability to foster a culture of excellence and improvement that includes staff mentoring and coaching

4.1.11 Knowledge of, and proficiency in strengths-based feedback techniques and the ability to employ them in the OHCA review process, including recognition of excellent performance

4.1.12 Ability to implement and maintain the T-CPR QA/QI program

4.1.13 Ability to collaborate with internal and external stakeholders to achieve high-performance T-CPR goals

4.1.14 Knowledge of statistically sound methods and processes for gathering data, identifying trends, and reporting call processing statistics

4.1.15 Ability to set agency performance benchmarks and improvement goals based on recommended guidelines and agency performance trends

4.1.16 Knowledge of call processing statistics and call processing impacts on time to first compression

4.1.17 Ability to report performance data and statistics at regular intervals or delegate this duty to appropriate staff

4.1.18 Knowledge of technologies, systems, and processes available to ECCs used to track OHCA data

4.1.19 Ability to develop policies in conjunction with other stakeholders in response to call processing trends, TC informational needs, workflow processes, and barriers as they present themselves

4.1.20 Knowledge of the importance of mental health and wellness before, during, and after high stress calls

4.1.21 Ability to implement agency-appropriate stress management programs, including critical incident stress response

4.1.22 Ability to develop and maintain a continuity-of-operations plan for handling incoming T-CPR calls and transfers in case of technical issues that prohibit call handling by the EMD agency

4.2 Telecommunicator KSAs

4.2.1 Knowledge of sudden cardiac arrest (SCA) and OHCA definitions

4.2.2 Knowledge of call handling techniques to improve OHCA recognition and time to first compression

4.2.3 Ability to navigate to T-CPR pre-arrival instructions in a timely manner.

4.2.4 Ability to efficiently use CAD and supporting technologies to obtain location information to avoid delays in creating a call for service

4.2.5 Ability to meet recommended benchmarks for OHCA intervention

4.2.6 Ability to properly use EMD protocols to process OCHA calls

4.2.7 Knowledge of EMD protocol and pre-arrival pathways for cardiac arrest and T-CPR (e.g., infant, child, and adult CPR pathways)

4.2.8 Ability to utilize EMD protocol to provide age-appropriate T-CPR pre-arrival instructions

4.2.9 Ability to recognize OHCA, including atypical presentations (e.g., pre-cardiac seizure, fall)

4.2.10 Ability to recognize and apply appropriate EMD pre-arrival instructions in a multiple lay rescuer scenario

4.2.11 Ability to utilize EMD protocols and pre-arrival pathways for conditions requiring ventilations

4.2.12 Ability to recognize agonal or ineffective breathing

4.2.13 Knowledge of local AED locations and availability

4.2.14 Knowledge of AED use and instructions

4.2.15 In a multiple rescuer scenario, ability to coach the lay rescuer in AED retrieval, set-up, and use that does not interrupt the delivery of CPR

4.2.16 Knowledge of requirements for delivery of high-quality CPR, including compression rate, depth, recoil, ventilations, and minimizing interruptions

4.2.17 Ability to coach lay rescuers in the delivery of high-quality CPR

4.2.18 Knowledge of QA/QI process, performance standards, and expectations used in QA review

4.2.19 Ability to apply QA feedback to improve OHCA outcomes in future calls

4.2.20 Ability to use sound call processing techniques to safely reduce call transfer times whenever possible

4.2.21 Ability to use effective caller management techniques, such as actively listening, empathy, and repetitive persistence, to improve caller cooperation, and subsequently, patient outcomes

4.2.22 Able to identify and overcome barriers to effective CPR provision

4.2.23 Ability to deliver T-CPR instructions over a variety of communication mediums, such as TTY, text to 911, RTT, or language translation service

4.2.24 Knowledge of agency's employee assistance programs or peer support programs to aid in self-care and support mental health and wellness

4.2.25 Knowledge of potential liability and adverse outcomes associated with deviating from EMD protocols and/or agency call processing directives

4.2.26 Ability to obtain and maintain any required telecommunicator certifications, including CPR and/or T-CPR credentials as mandated by agency or state requirements

4.3 Medical Director KSAs

4.3.1 Knowledge of the medical director role as it relates to ECC operations and EMD, including legal authority, duties and responsibilities, and chain-of-command

4.3.2 Ability to fulfill all expectations defined by agency agreement, state, and local regulations

4.3.3 Knowledge of ECC operations and response jurisdiction

4.3.4 Knowledge of EMS system resources and capabilities

4.3.5 Ability to serve as a liaison between ECC and medical professionals, such as EMS providers and other medical directors within the system

4.3.6 Ability to collaborate with EMS providers and other medical directors within the system to create continuity in CPR delivery and patient care

4.3.7 Knowledge of certification and minimum qualification requirements of ECC's public safety telecommunicators and/or emergency medical dispatchers

4.3.8 Knowledge of local and state EMD and T-CPR requirements, best practices, and evolving science

4.3.9 Knowledge of the philosophy of remote medical interrogation and the provision of pre-arrival instructions

4.3.10 Knowledge of agency protocols used by telecommunicators to manage cardiac arrest and provide pre-arrival medical care, including T-CPR

4.3.11 Ability to assist in the selection of the EMD program that best suits the ECCs operational needs

4.3.12 Ability to create, review, and approve specific medical treatment protocols to be used by ECC telecommunicators when managing cardiac arrest emergencies

4.3.13 Knowledge of dispatch prioritization in EMD for assigning the appropriate level of care, including urgency and type of response

4.3.14 Knowledge of the non-medical aspects of cardiac arrest call flow, such as how calls are routed to the ECC, and what technology is utilized in these calls

4.3.15 Ability to participate in assigned EMD and T-CPR program activities, such as QA/QI, policy development, and training

4.3.16 Ability to proactively provide direction to the ECC on how to handle situations not addressed within the protocol. As an example, provide direction on temporary protocol modifications in response to unusual or novel occurrences

4.3.17 Ability to assess risk management exposure relating to T-CPR activities and provide mitigation recommendations

4.4 Training Coordinator KSAs

4.4.1 Ability to implement a T-CPR training program, including initial and continuing education, remedial training, and certification maintenance

4.4.2 Ability to identify and communicate trends to identify training needs

4.4.3 Knowledge of, and proficiency in, strengths-based feedback techniques

4.4.4 Knowledge of agency T-CPR performance goals and standards

5 T-CPR Key Performance Indicators

This section lists best-practice Key Performance Indicators (KPIs) related to T-CPR performance and essential timestamps for rapid response. These KPIs evolved from established industry standards, like the Program and Performance Recommendations for T-CPR published by the AHA, as well as documented research, high-performing agency data, and other professional information and committee expertise.

Clearly defined KPIs allow ECCs to engage in benchmarking; the process of measuring performance against established standards and the performance of similar high-performing organizations. This process is one tool ECCs use to increase OHCA survival rates. While performance metrics are essential to measurement and benchmarking, each agency should focus on continuous process improvement over simply meeting the numeric goals.

The following KPIs can be measured at several levels within the ECC. Individual TC and entire ECC data are vital measurements; ECC leadership may identify other useful sample categories (such as shift, time of day, or geographical location). ECC Leadership should be familiar with professionally accepted QA/QI program elements, such as those provided by organizations responsible for protocol creation or the NENA/APCO QA/QI standard.

Further information on the benchmarking process, and a guide to data analysis can be found in the Appendix and the Resource and Tool Kit.

5.1 Frequency of OHCA Recognition

5.1.1 **KPI:** Percentage of total OHCA cases correctly identified by ECC

5.1.2 Number of telecommunicator-recognized OHCA out of all EMS confirmed OHCA cases.

5.1.2.1 Performance Metric: Telecommunicator recognized OHCAs ÷ total EMS-confirmed OHCAs

5.1.2.2 Performance Goal: ≥ 75%

5.1.3 **KPI:** Percentage of OHCA cases correctly identified by PSAP that were recognizable

5.1.3.1 Performance Metric: Telecommunicator-recognized OHCAs ÷ number of cases deemed identifiable (through QI)

5.1.3.2 Performance Goal: ≥ 95%

5.2 Percentage of Telecommunicator-Recognized OHCAs Receiving T-CPR

5.2.1 **KPI:** Number of telecommunicator-recognized OHCA cases that received T-CPR

5.2.1.1 Performance Metric: Number of telecommunicator-recognized OHCA cases receiving telecommunicator-directed T-CPR ÷ number of telecommunicator-recognized OHCA cases.

5.2.1.2 Performance Goal: ≥ 75%

5.3 T-CPR Performance Times

5.3.1 **KPI:** Median time to address acquisition

5.3.1.1 Performance metric: Time (in seconds) from call received to verification of dispatchable location

5.3.1.2 Performance Goal: <30 seconds

5.3.2 **KPI:** Time to 1st unit dispatched

5.3.2.1 Performance Metric: Time (in seconds) from call received to 1st unit alerted

5.3.2.2 Performance Goal: <60 seconds

5.3.3 **KPI:** Median time Between 9-1-1 Call and OHCA Recognition

5.3.3.1 Performance Metric: Time (in seconds) from call received time to OHCA recognition.

5.3.3.2 Performance Goal: <90 seconds

5.3.4 **KPI:** Median time between 9 1 1 call and first T-CPR-directed compression

5.3.4.1 Performance Metric: Time (in seconds) from call received time to delivery of 1st T-CPR directed compression to the patient.

5.3.4.2 Performance Goal: <150 seconds

6 Operations Impacts Summary

The purpose of this standard is to provide pre-hospital systems and ECC leadership a roadmap on how to develop and sustain a T-CPR program that will help to improve survival from OHCA. It may be difficult for some ECCs to adopt all aspects of this standard at once. Some progress towards T-CPR quality improvement is better than none, so do not be afraid to start small. Work to grow your T-CPR program iteratively and as resources allow.
To improve survival from out-of-hospital cardiac arrest, it takes an entire system working together. You are encouraged to reach out to your system partners, including your EMS and hospital systems, to see what resources or assistance they may provide to you as you work to develop your T-CPR program and adopt this standard in your ECC.

7 Abbreviations, Terms, and Definitions

See the NENA Knowledge Base for a Glossary of terms and abbreviations used in NENA documents. Abbreviations and terms used in this document are listed below with their definitions.

Term or Abbreviation (Expansion)	Definition / Description
AED (Automatic External Defibrillator)	A portable defibrillator designed to be automated such that it can be used by persons without substantial medical training who are responding to a cardiac emergency.
CAD (Computer Aided Dispatch)	A computer-based system which aids PSAP Telecommunicators by automating selected dispatching and record keeping activities.

CISM (Critical Incident Stress Management)	A form of psychological "first aid" and represents a powerful, yet cost-effective approach to crisis response. CISM is a comprehensive, integrative, multicomponent crisis intervention system. Interventions range from pre-crisis, acute crisis, to the post-crisis phase. CISM is also considered comprehensive in that it consists of interventions which may be applied to individuals, small functional groups, large groups, families, organizations, and even communities. Interventions include stress management education, stress resistance, and crisis mitigation training for both individuals and organizations. Disasters or large-scale incidents, as well as, school and community disasters may require Rest, Information, and Transition Services (RITS), Crisis Management Briefings ("town meetings"), and staff advisement. Other components include one-on-one crisis intervention/counseling, family crisis intervention, as well as, organizational consultation. Follow-up and referral mechanisms are available for assessment and treatment, if necessary. References Mitchell, J. T. & Everly, G.S. (in press). CISM and CISD: Evolution, effects and outcomes. In B. Raphael & J. Wilson (Eds.). Psychological Debriefing. Everly, G.S. & Mitchell, J.T. (1997). Critical Incident Stress Management (CISM):A New Era and Standard of Care in Crisis Intervention . Ellicott City, MD: Chevron. Everly, 0., Flannery, R., & Mitchell, J. (in press). CISM: A review of literature. Aggression and Violent Behavior: A Review Journal.

ECC (Emergency Communications Center)	A facility that is designated to receive requests for emergency assistance, including but not limited to 9-1-1 calls, and staffed to perform one or more of the following functions: • Determine the location where an emergency response is being requested. • Interrogate callers to identify, assess, prioritize, and classify requests for emergency assistance and other gathered information. • Determine the appropriate emergency response required. • Assess the available emergency response resources that are, or will be, available in the time required. • Dispatch appropriate emergency response providers. • Transfer or exchange requests for emergency assistance and other gathered information with other emergency communications centers and emergency response providers. • Analyze and respond to communications received from emergency response providers and coordinate appropriate actions. • Support incident command functions.
EMD (Emergency Medical Dispatch)	A system that enhances services provided by ECC telecommunicators (TC) by allowing the TC to quickly narrow down the caller's type of medical or trauma situation, so as to better dispatch emergency services, and provide quality instruction to the caller before help arrives.
OHCA (Out-of-Hospital Cardiac Arrest)	The loss of mechanical cardiac function and the absence of systemic blood circulation that occurs outside of a hospital setting. Time is crucial, with a lack of perfusion leading to continual cell death; with each second that passes the possibility of a good outcome decreases.
PAD (Public Access Defibrillator)	An AED (Automatic External Defibrillator) that is located in a public location and accessible by anyone in that area.
PAI (Pre-arrival Instructions)	First aid instruction provided by an ECC telecommunicator to a 9-1-1 caller until first responders arrive on scene (See EMD)
STEMI	ST-Segment Elevation Myocardial Infarction
QA/QI (Quality Assurance / Quality Improvement)	The intentional process of making system-level changes in clinical processes with a continuous reassessment to improve the delivery of high-quality prehospital medical care.

8 Recommended Reading and References

[1] National Emergency Number Association. *NENA Master Glossary of 9-1-1 Terminology*. NENA-ADM-000.24-2021. Arlington, VA: NENA, approved June 22, 2021.

[2] Michael Christopher Kurz, MD, MS, FAHA, Bentley J. Bobrow, MD, Julie Buckingham, Jose G. Cabanas, MD, MPH, Mickey Eisenberg, MD, PhD, Peter Fromm, MPH, RN, FAHA, Micah J. Panczyk, Tom Rea, MD, MPH, Kevin Seaman, MD, Christian Vaillancourt, MD, MSc. "Telecommunicator Cardiopulmonary Resuscitation: A Policy Statement from the American Heart Association." *Circulation* 141, Issue 12, 24 March 2020:e686-e700. https://doi.org/10.1161/CIR.0000000000000744.

[3] National Highway Traffic Safety Administration. *CPR LifeLinks Implementation Toolkit.* https://www.911.gov/project_cprlifelinks/

[4] Association of Public-Safety Communications Officials. *Public Safety Communications Center Key Performance Indicators.* APCO 1.117.1-2019. Daytona Beach: APCO, 2019.

9 Appendix

Introduction:

The journey to "high performance" is fluid and never ending, and every agency has a unique starting point in the process of improvement. This appendix provides additional information on the Key Performance Indicator (KPI) benchmarks listed in Section 5, including performance metric definitions and calculations.

Data collection and measurement is a cornerstone of any T-CPR program, as such ECC personnel should familiarize themselves with best practices involving data. Agencies may accidentally use data that is incomplete, includes errors, or represents incorrect data points for the desired analysis.

ECCs should strive to review 100% of all calls with confirmed OHCA. Because of the impact of QA/QI as a training activity and the importance of immediate feedback, reviews should be conducted, and feedback returned to the telecommunicator as close to the occurrence of the call as possible.

Aggregated data collected through QA/QI should be reported annually (at a minimum) to identify trends in T-CPR performance, identify the ECC role in OHCA outcomes if available, and celebrate performance improvement. Reports should be shared to stakeholders throughout the system of care and in the community.

Data reporting must convey statistically meaningful information. Not all statistical information or measures are appropriate for all situations; for instance, reporting a mathematical average may not communicate accurate performance. APCO published ANSI

Standard "Public Safety Communications Center Key Performance Indicators" [4] which describes the process for extracting and analyzing ECC data. Special attention should be paid to the sections that describe how to identify and remove erroneous data.

The KPI performance data contained in this document is necessary to measure and improve the processes that affect OHCA survival. The data may also reveal a gap in policy, procedure, or training that needs to be addressed. For these reasons, ECCs should strive to measure as many benchmarks as possible.

Indeed, the ability to accurately measure and improve processes and outcomes will vary among agencies and is driven by many factors that influence their efforts. ECCs are encouraged to begin with a few benchmarks and investigate efficient ways to gather the needed data; then continue to develop the benchmarking process as resources allow. Listening to the audio of each cardiac arrest call is an excellent way to obtain data for many of the performance metrics listed in this standard.

If ECCs strive for numeric goals rather than an ongoing effort to improve, individuals and teams may focus on the number and bend the rules to achieve that number. Numeric goals miss the overall objectives of process improvement and increased survival rates, especially when punitive measures are used to achieve the targeted number.

Each agency should consider process improvement a tool to increase survival and use the numeric measurements as a method to inform and achieve that goal. In this effort, the authors highly recommend additional quality improvement education for employees who audit, measure, and provide feedback. QA/QI education will hone the statistical significance of benchmarking data and optimize the less tangible, but critical, aspects of feedback and goal orientation.

1. KPI: Total OHCA Cases correctly identified by ECC

Performance Goal Origin: American Heart Association, T-CPR Performance Metrics [2].

Intent: This KPI assesses how often ECC telecommunicators correctly identify OHCA when compared to the number of patients found in cardiac arrest by EMS. The measurement validates the training and performance of telecommunicators in identifying cardiac arrest. It also shows cardiac arrest patients who were not identified during the call taking process, allowing the agency to examine policy, procedure, training, and performance to address issues.

Performance Metric: Telecommunicator recognized OHCAs ÷ total EMS-confirmed OHCAs

Numerator: QI-reviewed and EMS-confirmed OHCAs with recognition noted

- Telecommunicator recognized OHCA includes all calls in which telecommunicators identified cardiac arrest. This number includes every telecommunicator identified cardiac arrest event, regardless of whether T-CPR was provided or declined. It

includes calls in which the telecommunicator encountered a barrier to cardiac arrest identification (e.g., language translation). Inclusion of all calls will help the ECC identify the frequency and types of barriers that exist.

Denominator: Number of EMS-confirmed OHCAs

- Total EMS confirmed OHCA includes all calls which EMS classified as cardiac arrest. It is recognized that in a small number of cases the patient may go into cardiac arrest after EMS arrives. Those calls, in which cardiac arrest had not occurred during the call taking process, may be excluded if the timing of the cardiac arrest can be determined.

Performance Goal: ≥ 75%

Case Study:

The Anywhere ECC worked with the EMS system's medical director to obtain data on cardiac arrest patients. The EMS records management system identified all EMS calls involving patients in cardiac arrest for the prior six months. The report displayed the CAD system incident number in addition to the date and time the call was dispatched. The Anywhere EMS system had 26 cardiac arrests during this reporting period.

ECC personnel then printed out the CAD incident report for each of these calls. The printouts were used to locate the audio record of each cardiac arrest event. Calls were examined to determine in how many cases the telecommunicator identified that the patient was in cardiac arrest. While this is typically accomplished by listening to the call, less optimal methods may include looking at the incident type (if a specific incident type code is used for cardiac arrest), or by looking to see if there is an entry noting that T-CPR is in progress (or that CPR was declined). Some Emergency Medical Dispatch software systems also provide data that can be used to assess the call.

The Anywhere ECC identified that in 24 of the 26 calls, agency telecommunicators correctly identified that the patient was in cardiac arrest. In cases where the telecommunicator did not identify that the patient was in cardiac arrest, the review of the call audio provided insight into the circumstances.

KPI Calculation:

Evaluation Metric	Example Data
(A) Number of TC recognized OHCAs	**A** = 24
(B) Number of EMS cardiac arrest calls	**B** = 26
A divided by **B** equals the performance	0.92 or 92%
Performance Goal	≥ 75%

Additional Discussion:

If the ECC is unable to obtain EMS patient care data, they may be able to use CAD system data to identify calls in which EMS reported a cardiac arrest (e.g., CPR was in progress). While not optimal, this approach may help identify cases that would be otherwise missed in the QA/QI process (cases not coded as Cardiac Arrest during telecommunicator call processing).

ECCs that provide service to multiple EMS agencies may not be able to obtain cardiac arrest data from all of them. It may be necessary to examine a smaller sample in which cardiac arrest identification is limited to a study of calls from a select group of agencies.

2. KPI: OHCA cases correctly identified by the ECC that were recognizable

Performance Goal Origin: American Heart Association, TCPR Performance Metrics [2].

Intent: This performance measure builds off the prior KPI and assesses how often ECC telecommunicators correctly identify OHCA during a call without barriers (e.g., language translation). This measure provides an indication of the T-CPR program success rate for "base-line" OHCA calls. Base-line calls are those without unusual circumstances that negatively impact the telecommunicator's ability to assess the patient and provide T-CPR instructions.

Performance Metric: Telecommunicator-recognized OHCAs number of cases deemed identifiable

Numerator: QI-reviewed and EMS-confirmed OHCAs with recognition noted

- Telecommunicator recognized barrier-free OHCA includes calls where telecommunicators identified cardiac arrest and did not involve circumstances that would prevent recognition (e.g., third party caller). This number derives from the EMS case count and includes every telecommunicator identified cardiac arrest event, regardless of whether T-CPR was provided or declined.

Denominator: EMS-confirmed OHCAs deemed identifiable through QI

- Total EMS confirmed OHCA includes all calls which EMS classified as cardiac arrest. As mentioned in the prior KPI, it may be possible to exclude calls where the patient went into cardiac arrest after the telecommunicator ended the call.

Exclusions from denominator:

- Third-party call
- Hang up
- Hysteria
- CPR in progress
- Language barrier
- Other circumstances supervisor deems "unidentifiable"

Performance Goal: ≥ 95%

Case Study:

The Anywhere ECC worked with the EMS system's medical director to obtain data on cardiac arrest patients. The EMS records management system identified all EMS calls involving patients in cardiac arrest for the prior six months. The report displayed the CAD system incident number in addition to the date and time the call was dispatched. The Anywhere EMS system had 26 cardiac arrests during this reporting period.

ECC personnel then printed out the CAD incident report for each of these calls. The printouts were used to locate the audio record of each cardiac arrest event. Calls were examined to determine how many cases included barriers that prevented rapid identification of cardiac arrest. Those calls, which were included in the prior KPI, were excluded in this performance metric. That analysis reduced the number of appropriate EMS cases from 26 to 22. The remaining 22 calls were assessed to determine in how many cases the telecommunicator identified that the patient was in cardiac arrest.

The Anywhere ECC identified that in 21 of the 22 calls, agency telecommunicators correctly identified that the patient was in cardiac arrest. In cases where the telecommunicator did not identify that the patient was in cardiac arrest, the review of the call audio would provide insight into the circumstances.

KPI Calculation:

Evaluation Metric	Example Data
(A) Number of TC recognized barrier free OHCAs	**A** = 21
(B) Number of EMS cardiac arrest calls	**B** = 22
A divided by **B** equals the performance	0.954 or 95%
Performance Goal	≥ 95%

Additional Discussion:

When doing analysis that involves smaller sets of numbers it is important to examine the actual number in addition to the percentage calculation. This is especially crucial when reviewing performance data across time. Consider if the ECC in the case study above had 20 cases of correct identification (instead of 21). The resulting performance would change from 95% to 91%. The drop of 4 percentage points might cause someone to infer that a significant performance deficit occurred, even though it only involved a single cardiac arrest emergency.

3. KPI: Percentage of telecommunicator recognized OHCA cases receiving T-CPR

Performance Goal Origin: American Heart Association, TCPR Performance Metrics [2].

Intent: This performance measure assesses how often patients receive CPR chest compressions, directed by the telecommunicator to the lay rescuer, in calls where OHCA has been identified.

Performance Metric: Number of telecommunicator recognized OHCA cases receiving telecommunicator directed T-CPR ÷ number of telecommunicator recognized OHCA cases.

Numerator: Number of QI-reviewed, EMS-confirmed OHCAs with recognition noted when telecommunicator-directed T-CPR is performed

- Number of telecommunicator recognized OHCA cases receiving telecommunicator directed T-CPR. This is the total number of OHCA calls processed by the ECC in which ECC telecommunicators successfully provided T-CPR instructions. It excludes calls in which T-CPR was declined or not provided for other reasons.

Denominator: Number of QI-reviewed, EMS-confirmed OHCAs with recognition noted

- Number of telecommunicator recognized OHCA cases without T-CPR barriers. This number includes all known OHCA cases received by the ECC. It excludes any calls in which barriers existed that would negatively impact the ability of the telecommunicator to provide T-CPR instructions (e.g., language translation difficulty).

Exclusions from denominator:

- CPR is already in progress by lay rescuer
- Caller is unable to physically perform CPR (e.g., call being made from a different location than the OHCA)
- Caller is unable to get the patient into the appropriate position for CPR (e.g., cannot move patient from bed to floor)
- Caller refuses to perform T-CPR
- For safety, T-CPR instructions are not given (e.g., traumatic cause, disaster scenario)
- Caller hangs up
- Other circumstances the supervisor deems valid for why T-CPR could not be performed

Performance Goal: ≥ 75%

Case Study:

The Anywhere ECC identified the receipt of 26 OHCA calls during their regular reporting period.

ECC personnel then printed out the CAD incident report for each of these calls. The printouts were used to locate the audio record of each cardiac arrest event. Calls were examined to determine how many cases included barriers that prevented successful

provision of T-CPR instructions. That analysis reduced the number of appropriate calls from 26 to 24.

The remaining 24 calls were assessed to determine in how many cases the telecommunicator successfully provided T-CPR instructions. The Anywhere ECC identified that in 21 of the 24 calls, agency telecommunicators were successful in providing T-CPR instructions.

ECC personnel reviewed the 3 calls in which T-CPR was not provided to gain insight into the circumstances.

KPI Calculation:

Evaluation Metric	Example Data
(A) Number of TC recognized OHCA calls in which T-CPR instructions were given	**A** = 21
(B) Number of TC recognized OHCA cases without T-CPR barriers	**B** = 24
A divided by **B** equals the performance	0.875 or 88%
Performance Goal	≥ 75%

Additional Discussion:

ECC management should develop a list of approved barriers which are used to exclude specific calls from analysis. The application of a common set of defined barriers will provide consistent analysis across time and reduce the introduction of variance by different ECC personnel. AHA provides a list of examples which may need to be adjusted to meet the unique needs of the ECC.

4. KPI: Median Time to address acquisition

Performance Goal Origin: American Heart Association, TCPR Performance Metrics [2].

Intent: This performance measure is the first of several to assess how quickly ECC telecommunicators meet national benchmarks on OHCA call processing. This metric involves an analysis of the number of seconds that elapse between the answering of a 9-1-1 call reporting OHCA and the receipt of a dispatchable location. The performance metric uses the statistical reference "median" time which is a more mathematically precise way to examine call processing.

Performance Metric: Time to address acquisition is the calculated median value of the individual time intervals associated with all calls received by the ECC which were coded as OHCA.

This performance metric involves the time interval for address acquisition and includes:

- Time call received. This is the time that the 9-1-1 call was answered by the ECC telecommunicator. This timestamp may be automatically captured by the ECC CAD system.
- Time of receipt of dispatchable location. This is the time that a dispatchable location was obtained from the caller. This may also include the entry of a dispatchable location by the telecommunicator who is sending units to a nearby landmark while efforts to confirm the exact location continue. This timestamp may be automatically captured by the ECC CAD system upon address/location geo-verification.

Performance Goal: ≤ 30 seconds

KPI Calculation:

- Identify each incident coded as OHCA
- Print the CAD incident record
- For each incident, determine the time stamp for Time Call Received and Time Dispatchable Address received. This may be done by listening to the OHCA call audio and using a stopwatch or using the automated time stamp in the CAD system or duration timer in the audio file.
- To determine the median time, record the number of seconds that elapsed between these time intervals for each OHCA case. (example: 32 seconds, 17 seconds, 29 seconds)
- Arrange the times in a list with the lowest number at the top and the highest number at the bottom (example: 32 seconds, 29 seconds, 17 seconds)
- If you have an odd number of OHCA cases: select the middle number from the list. In the example above, you would select 29 seconds as the median time for acquisition of a dispatchable location.
- If you have an even number of OHCA cases: select the two numbers that represent the middle. (example: from the list of 32 sec, 29 sec, 22 seconds, 17 seconds, select both "29 sec" and "22 sec"). Add the two numbers together (29 seconds + 22 seconds = 51 seconds). Then divide the result by two (51 seconds divided by 2 = 25.5 seconds). The median time in this example would be 25.5 seconds.

Additional Discussion:

It is recommended that a spreadsheet program be used (example: Microsoft Excel or Google Sheets) to assist with the calculation of the data. Most of the spreadsheet programs can automatically calculate the statistical values listed in this standard, including the median.

If agencies are unable to listen to the OHCA call audio to determine the time stamps, they may attempt to use other time stamps generated by the ECC CAD system or the ECC's

9-1-1 system. It is highly recommended that personnel place test calls to the 9-1-1 system and generate a test incident in CAD to fully understand how time elements are being reported. For example, is "Time 9-1-1 call received" the time that the 9-1-1 call reached the ECC phone switch, or the time that the 9-1-1 call entered the agency's Automatic Call Distribution (ACD) queue, or the time that the 9-1-1 call started ringing at the telecommunicators desk, or the time that the 9-1-1 was answered by a telecommunicator?

The time that a dispatchable location was determined may, or may not, be captured accurately in the CAD system (depending on vendor and agency configuration). There is also the ever-present issue in how telecommunicators use the CAD system software. For example, if a telecommunicator is unable to verify different locations in CAD, they may cancel the event entry window and start a new window. The CAD system may reset the time stamps and show the call as "received" when the new window is opened which would be followed immediately by another time stamp for address verification. For these reasons, it is recommended that ECC personnel listen to the audio of the OHCA call and manually record the time.

5. KPI: Time to 1st Unit dispatched

Performance Goal Origin: American Heart Association, TCPR Performance Metrics [2].

Intent: This performance metric involves an analysis of the number of seconds that elapse between the answering of a 9-1-1 call reporting OHCA and dispatch of EMS or other AED equipped first responders. It assesses the ECC's performance with the American Heart Association's "rapid dispatch" recommendations.

Performance Metric: This metric is the median value of the time from call received to 1st unit dispatched for all calls coded as OHCA. If the ECC having jurisdiction did not dispatch the 1st responding unit and is unable to access the dispatch time for that unit(s), they may document the time of their first AED equipped responder in the record.

This performance metric involves the time interval between the call receipt and dispatch of EMS:

- Time call received: This is the time that the 9-1-1 call was answered by the ECC telecommunicator. This timestamp may be automatically captured by the ECC CAD system.
- Time 1st EMS Unit Dispatched: This is the time that the first EMS or AED-equipped first responder is assigned (dispatched) to the OCHA call. This may be the time that the unit is alerted to the call via the ECC station alerting system or the time that the unit is assigned the call via radio dispatch. The timestamp is typically captured by the ECC CAD system automatically.

Performance Goal: < 60 seconds

KPI Calculation:

- Identify each incident that is coded as OHCA
- Print the CAD incident record
- For each incident, determine the time stamp for Time Received and Time First Unit Dispatched. This may be done by listening to the OHCA call audio and using a stopwatch or using the automated time stamp in the CAD system or duration timer in the audio file.
- Record the number of seconds that elapsed between the Call Received and First EMS Unit dispatched for each OHCA case. (Example: 39 seconds, 22 seconds, 24 seconds, etc.)
- To determine the median time, arrange the times in a list with the lowest number at the top and the highest number at the bottom (example: 39 seconds, 24 seconds, 22 seconds)
- If you have an odd number of OHCA cases: select the middle number from the list. In the example above, you would select 24 seconds as the median time for acquisition of a dispatchable location.
- If you have an even number of OHCA cases: select the two numbers that represent the middle two entries. Example: from the list of 39 sec, 29 sec, 25 seconds, 19 seconds, select both "29 sec" and "25 sec". Add the two middle numbers together (29 seconds + 25 seconds = 54 seconds). Then divide the result by two, (54 seconds divided by 2 = 27 seconds). The median time in this example would be 27 seconds.

Additional Discussion:

As noted earlier, it is recommended that a spreadsheet program be used (example: Microsoft Excel or Google Sheets) to assist with the calculation of the data.

If agencies are using CAD system time stamp data, it is highly recommended that several incidents be rigorously evaluated to determine that the "Time first unit dispatched" is accurately captured.

6. KPI: Median Time Between 9-1-1 Call and OHCA Recognition

Performance Goal Origin: American Heart Association, TCPR Performance Metrics [2].

Intent: This performance metric involves an analysis of the median time , reported in seconds, between the time the telecommunicator receives the 9-1-1 call and the point the telecommunicator identifies the cardiac arrest.

The median value measured in this aggregated KPI is the middle number in a sorted, ascending or descending, list of numbers. If there is an odd number of numbers, the median value is the number that is in the middle, with the same amount of numbers below and above.

Performance Metric: Median amount of time in seconds between 9-1-1 call received by the ECC and OHCA recognition.

This performance metric involves the time interval between:

- Time call received: This is the time that the 9-1-1 call was answered by the ECC telecommunicator. This timestamp may be automatically captured by the ECC CAD system.
- Time OHCA is Recognized: This is the time that the TC recognizes that the incident is a cardiac arrest.

Performance Goal: < 90 seconds

KPI Calculation:

- Identify each incident that is coded as OHCA
- Print the CAD incident record
- identify the elapsed time from the point received the call and OHCA was recognized by the TC. This may be done by listening to the OHCA call audio and using a stopwatch or duration timer in the audio file.
- For each call, record the number of seconds that elapsed (Example: 39 seconds, 22 seconds, 24 seconds, etc.)
- Determine the median time for these calls. See prior KPI for guidance on how to calculate the median time.

Additional Discussion:

N/A

7. KPI: Median Time Between 9-1-1 Call and First T-CPR Directed Compression

Performance Goal Origin: American Heart Association, TCPR Performance Metrics, Cardiac Arrest Registry to Enhance Survival [2].

Intent: This performance metric measures the median amount of time in seconds between 9-1-1 call connection and first CPR compression directed by telecommunicator is delivered to the patient.

Performance Metric: Time to first TC directed chest compression is the calculated median value of the individual time intervals associated with all calls received by the ECC which were coded as OHCA. Calls in which bystander CPR is already in progress are excluded from this measurement.

The median value measured in this aggregated KPI is the middle number in a sorted, ascending or descending, list of numbers. If there is an odd number of numbers, the median value is the number that is in the middle, with the same amount of numbers below and above.

This performance metric involves the time interval between:

- Time call received: This is the time that the 9-1-1 call was answered by the ECC telecommunicator. This timestamp may be automatically captured by the ECC CAD system.
- Time of first TC directed chest compression: This time is noted when the first compression is audible or the caller/rescuer indicates he or she has started compressions (i.e. by counting with telecommunicator) has started compressions (i.e. by counting with dispatcher).

Performance Goal: < 150 seconds

KPI Calculation:

- Identify each incident that is coded as OHCA
- Print the CAD incident record
- For each incident, determine if T-CPR was performed. This may be done by listening to the OHCA call audio and using a stopwatch or duration timer in the audio file.
- Record the number of seconds that elapsed between the Call Received and audible evidence of first chest compression being delivered to the patient. (Example: 39 seconds, 22 seconds, 24 seconds, etc.)
- Determine the median time for these calls. See prior KPI for guidance on how to calculate the median time.

Additional Discussion:

N/A

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