Improving Survival from Out-of-Hospital Cardiac Arrest

Acting on the Call

2018 Update from the Global Resuscitation Alliance
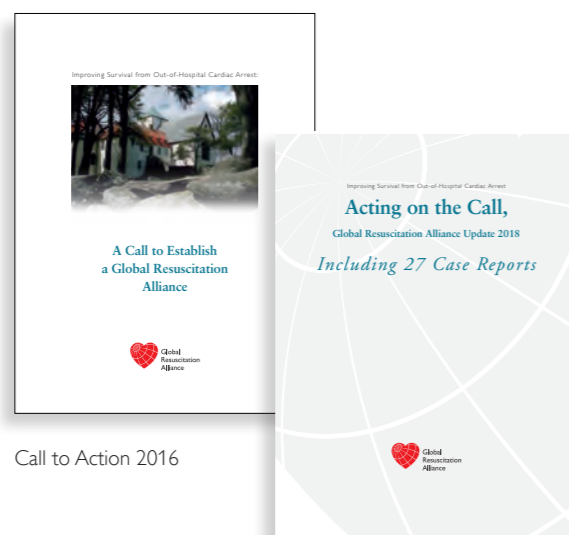
Including 27 Case Reports

Global
Resuscitation
Alliance

The Global Resuscitation Alliance was proposed at a meeting
on how to implement best practices in community resuscitation held
in the Utstein Abbey near Stavanger, Norway on June 6-7, 2015.

The attendees unanimously supported the creation of a Global Resuscitation Alliance (GRA)
and issued a report, "Improving Survival from Out-of-Hospital Cardiac Arrest: A Call to
Establish a Global Resuscitation Alliance". The GRA was formally launched at a follow up
Utstein Meeting held in connection with the EMS2016 Conference in Copenhagen on May
28-29, 2016. The following year the GRA at the EMS2017 Conference held on May 20-21
in Copenhagen the GRA requested an update to the original "A Call to Establish….".

This report updates the original report and has a new title reflecting the countless actions
and global engagement leading toward improvement in cardiac arrest survival.
The new title is "Acting on the Call."

April, 2018

Call to Action 2016

Acting on the Call 2018

*The goal of the Global Resusitation Alliance is to help increase global
survival rates by 50% from 2015 to 2020*

This document calls for action to improve survival from out-of-hospital cardiac arrest.
Two facts stand out. Survival is low across communities and countries, often in the single
digits. Survival is disparate with 15 fold differences between high performing communities
and poorly performing communities. It is an unacceptable reality that where a person lives
determines if he lives. We know that best resuscitation practices can achieve survival rates of
over 50% from ventricular fibrillation cardiac arrest. The GRA calls upon all communities
to implement best resuscitation practices and afford every person a decent chance to survive
cardiac arrest.

This document will be updated periodically to reflect evolving best practices and new knowl-
edge on how best to implement successful resuscitation programs.

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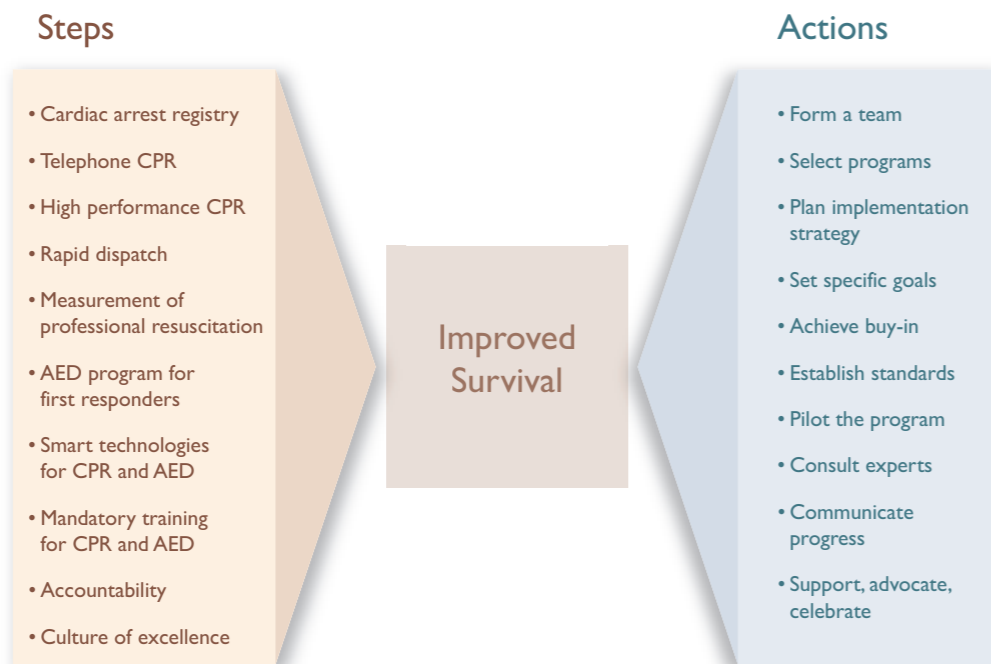## Table of Contents

Case Reports

Acting on the Call - Executive Summary

On June 6-7, 2015 at the Utstein Abbey near Stavanger, Norway, 36 Emergency Medical Services (EMS) leaders, researchers, and experts from throughout the world convened to address the challenge of how to increase community cardiac arrest survival and how to achieve implementation of best practices and worthwhile programs. The attendees called for the establishment of a Global Resuscitation Alliance (GRA) and issued a report laying out ten programs to improve survival and ten steps to achieve successful implementation. The Global Resuscitation Alliance (formally established in 2016 at the EMS2016 Conference) expands internationally the reach and utility of the Resuscitation Academy concept developed in King County, Seattle since 2008. Such a global effort will promote best practices and offer help with implementation to countless communities

Survival from Sudden Cardiac Arrest (SCA) is tragically and unacceptably low. Furthermore, there is 15 fold disparity is survival from ventricular fibrillation cardiac arrest. High-performance communities consistently achieve survival greater than 50%. An estimated 1 million persons die every year from cardiac arrest in high-resource countries. This call to action declares the current situation to be unacceptable.

We believe:
- communities can and must do better.
- based upon current knowledge that with adherence to and implementation of best practices communities can increase survival from cardiac arrest by 50%.
- the Global Resuscitation Alliance will help educate EMS leaders about best practices and provide tools to help improve survival in their communities.

Steps
Actions

- Cardiac arrest registry
- Telephone CPR
- High performance CPR
- Rapid dispatch
- Measurement of professional resuscitation
- AED program for first responders
- Smart technologies for CPR and AED
- Mandatory training for CPR and AED
- Accountability
- Culture of excellence

Improved Survival

- Form a team
- Select programs
- Plan implementation strategy
- Set specific goals
- Achieve buy-in
- Establish standards
- Pilot the program
- Consult experts
- Communicate progress
- Support, advocate, celebrate

The figure summarizes best practice steps and actions described in this report

Timely application of several critical interventions determines the outcome from cardiac arrest and is shown in Table 1. In cardiac arrest the likelihood of surviving declines by approximately 10% for every minute. Thus the intervals from collapse to application of key interventions largely determine the likelihood of survival. These interventions include rapid dispatch, telephone cardiopulmonary resuscitation (T-CPR) (for purposes of this table we consider bystander CPR by trained citizens to be synonymous with T-CPR), EMS at scene, EMS with patient to begin CPR and defibrillation, provision of high performance CPR (HP-CPR), and an aspirational intervention of bystander defibrillation. The time and quality of these interventions define poor, average, and best performing EMS systems.

Poorly performing EMS systems with approximate survival of 10% do not have rapid dispatch, telephone CPR, or HP-CPR. Time to defibrillation is 10 minutes with no or little bystander CPR. Average systems also do not have rapid dispatch but they do have T-CPR (albeit delayed) and HP-CPR. Average survival is 30%. EMS systems with best practices have rapid dispatch, quick deliver of T-CPR instructions, and HP-CPR. Survival is 50%. We believe that defibrillation by a bystander within 21/2 minutes is a future reality and thus we call this intervention aspirational. Though not a reality today, technology for inexpensive consumer AEDs is close at hand. When these consumer AEDs disseminate into homes and apartments, the opportunity for very rapid defibrillation and survival rates of 75% can become a reality.

System factors influencing survival from out-of-hospital cardiac arrest

| EMS System Performance | Current situation | | Future |
(in minutes from cardiac arrest)	Poor	Average	Best	Aspiration
Dispatch activated	2	2	1	1
Ambulance underway	3	3	2	2
Bystander/Telephone-CPR	no	4	2.5	2
Bystander defibrillation	no	no	no	2.5
EMS at scene	7	7	6	6
EMS at patient site	8.5	8.5	7.5	7.5
EMS CPR started	8.5	8.5	-	-
EMS HP-CPR started	no	no	7.5	as needed
EMS defibrillation	10	10	9	as needed
Survival (from VF/VT)	10%	25%	50%	75%

Historical Perspective

In 1990 at the historic Utstein Abbey near Stavanger, Norway, 36 researchers and Emergency Medical Service (EMS) program and medical directors gathered to solve a problem. There was lack of data about cardiac arrest survival, and in the few communities that attempted to measure their performance there was a multiplicity of case definitions with no consistency in calculating survival rates. In short, there were insufficient data and no agreement among the data elements. Those gathered recognized that programmatic advances in cardiac arrest and resuscitation would not progress without uniform data reporting. After the meeting a consensus recommendation on how to report survival data was published in 1991 simultaneously in several leading scientific journals, including Circulation, Resuscitation, and Annals of Emergency Medicine.

This process of defining the essential elements of a cardiac arrest registry came to be known variously as the Utstein method, the Utstein template, the Utstein style, or merely Utstein. Virtually all resuscitation scientists have adopted it, and the original Utstein article remains one of the most cited articles in resuscitation science.

Since the first Utstein meeting in 1990, 20 consensus papers have been issued and 25 meetings held on topics relating to resuscitation and resuscitation research with the original paper updated in 2004 and again in 2014. A total of 488 articles in the medical literature mention Utstein in the title or abstract and approximately 9000 articles refer to Utstein in the text.

In 2015, twenty five years after the first Utstein meeting, 36 resuscitation leaders gathered at Utstein to solve another problem – how best to implement successful strategies in managing cardiac arrest and how to spread the lessons of best practices.

This 25th Anniversary meeting was timely for several reasons:
- There is an understanding of how best practices can achieve dramatic increases in cardiac arrest survival.

- There is better science on the importance of high-performance cardiopulmonary resuscitation (HP-CPR) and Telephone-CPR (T-CPR; also known as Dispatcher-Assisted CPR (DA-CPR) and Telecommunicator CPR).
- There is the emergence of large cardiac arrest registries that provides the platform for measurement and highlights the variability in community survival rates.
- There is better understanding of EMS systems and the characteristics of high performing systems.
- There are now successful strategies to achieve programmatic implementation such as the Resuscitation Academy, which bridges the gap between science and community best practice.
- There is renewed emphasis in the proposed United Nations' (UN) Sustainable Development Goals for 2030 to reduce deaths from non-communicable diseases including the growing problem of prehospital cardiac arrests in low and medium resourced countries.
- Nations with emerging economies will experience dramatic increases in ischemic heart disease and an anticipated need for pragmatic implementation of cost-effective resuscitation practices.

Most of the previous Utstein papers focused on measuring performance including definitions of important variables, and their contribution cannot be overstated. Without comprehensive and precise measurement there can be no improvement. It is now time to turn attention to programmatic improvement. Ideally best practices should become standard of care; thereby leading to dramatic improvements in survival. Best practices are a fluid concept since new therapies and programs begin to define new best practices. Therein lays the power of "measure and improve". Constant measuring enables determination of what needs improving, and will demonstrate if improvement occurs - which can define new best practices. The coming decades should be the era of using measurement to help define and implement best practices. It appears from the literature that it commonly takes 5-10 years before new knowledge and guidelines are generally implemented even after scientific consensus. That process must be speeded up! This requires better understanding of what factors stimulate and what factors hinder implementation of new knowledge and best practices.

The Global Resuscitation Alliance strives to catalyze improvements in survival. The GRA can provide the tools and support for communities to put on local programs modeled after the Resuscitation Academy and thereby promote best practices.

The Utstein process is alive and well. Few endeavors have had such impact globally. The ongoing process, typified by the meeting on implementation, promises yet more advances in resuscitation. Countless individuals directly and indirectly owe their lives to a process begun in an unassuming Abbey outside Stavanger and to the continued efforts of many researchers, scientists, and EMS directors dedicated to advancing resuscitation science and practice. To these individuals and to the hundreds of thousands of first responders, emergency medical technicians, paramedics, emergency telecommunicators, doctors, nurses and all who work so tirelessly to snatch life from the jaws of death, we dedicate this call to action.

Part 1. Cardiac Arrest in the Community

What is Sudden Cardiac Arrest?

No medical emergency is more dramatic than sudden cardiac arrest (SCA). A person at home or in the community suddenly (often with no symptoms) collapses. Pulse and blood pressure are lost instantaneously; consciousness in a matter of seconds. The person is clinically dead, and without intervention this will progress to irreversible biological death within 10 minutes. This cold "statistic" cannot possibly reveal the reality of a vital person engaged in the community, with family, friends, children, and grandchildren, suddenly and so unexpectedly gone.
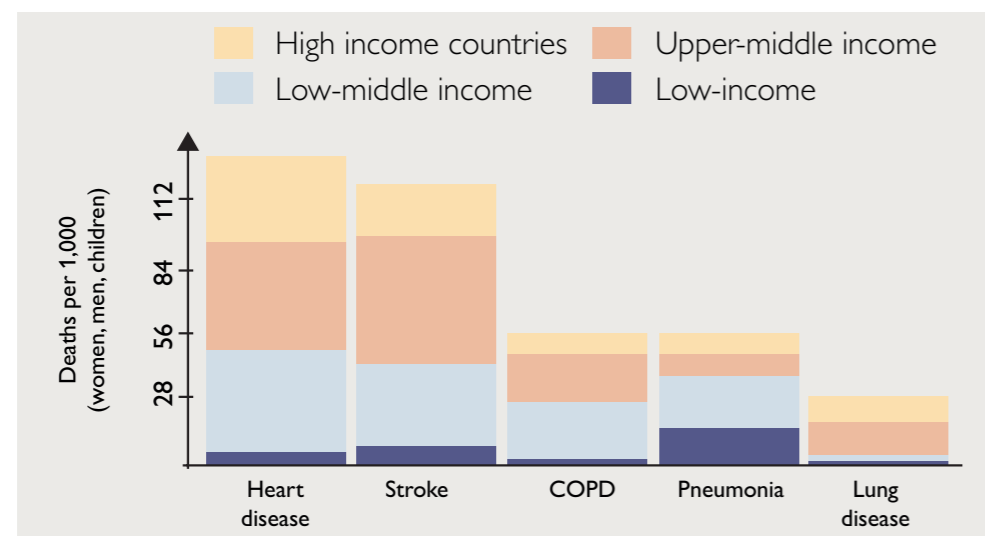
"Resuscitation is ultimately life-affirming. It is an ennobling act that reveals much about our society's value - namely that human life has value."

- A mantra of the Resuscitation Academy

If CPR, defibrillation, and advanced medical care can arrive within this narrow window of time, there is a decent chance for life literally to be snatched from the closing jaws of death. And the sooner help arrives the better the chance of, not only survival, but full neurological recovery.

Magnitude of the Problem

Sudden cardiac arrest is a massive public health problem accounting for approximately ½ million deaths annually in Europe and North America alone. When one factors in the lost years of productive life the public health burden is immense. In developing countries deaths from ischemic heart disease including sudden cardiac arrest will increase dramatically. There is growing awareness that non-communicable diseases (NCDs) are chronic, may be controlled, and not are present over decades of life. Once termed "affluence diseases" it is clear that they are as much a part of developing countries as they are of developed countries.

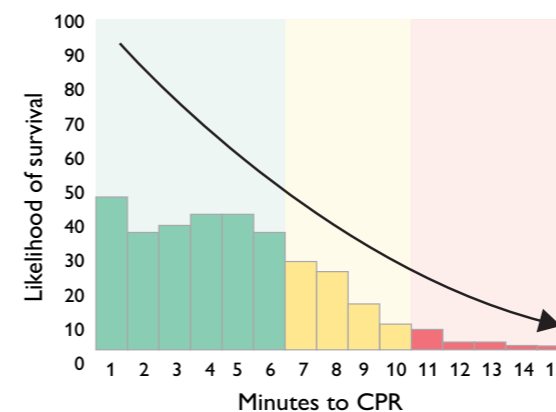**Greatest killer among non-communicable diseases worldwide**

Source: WHO, Fact sheet: The Top Ten Causes of Death. Online: who.int/mediacentre/factsheets/fs310/en

Profile of Sudden Cardiac Arrest

The typical age for cardiac arrest is mid 60s but it can occur in children and young adults. Approximately 70% occur at home. 20% in public settings and 10% in nursing or assisted living settings . Whereas about 50% are witnessed by a bystander, the percentage which receive bystander CPR varies greatly from 10% to 75% in various communities.

Key Interventions: CPR and Defibrillation

Physicians speak of the natural history of disease. For many diseases such as cancer or congestive heart failure the time from diagnosis to death is measured in months or years. The term "natural" implies survival time without therapy. With therapy one hopes the remaining lifetime is considerably lengthened. The same concept applies to sudden cardiac arrest except its natural history is measured in minutes Many researchers cite 10% per minute as the fall in probability of survival following cardiac arrest assuming no interventions.

Thus in 10 minutes clinical death will turn to biological death with no chance of survival. However, the delivery of CPR and defibrillation alters the slope of death and considerably lengthens the history of the "disease," affording a chance at survival.

How do CPR and Defibrillation Work?

CPR maintains a small flow of blood to the vital organs, particularly the heart and brain. Up to 30% of normal blood flow can be achieved with good quality manual CPR. This can allow the heart muscle to contract when a normal heart rhythm is restored, and reduces the rate of brain damage.

Defibrillation works by depolarizing all the heart muscle simultaneously and allows for a normal cardiac pacemaker function to return. Depending on the recurrence or refractoriness of ventricular fibrillation, repeated shocks may be required. The relationship between CPR and defibrillation is complex, but the sooner both are provided the better the outcome. We know today that bystander CPR will double the survival rate and very early use of an AED can lead to survival rates as high as 75% in witnessed cardiac arrests.

Determinants of survival

Whether an individual survives cardiac arrest is a function of circumstances and many factors conveniently grouped into patient , event, and system factors. Patient

factors include age and underlying medical conditions. Event factors such as whether the cardiac arrest was witnessed or the rhythm associated with the arrest play a large role. Patient and event factors are not alterable by the responding EMS personnel. What can be altered, however, are the configuration and quality of the system attempting resuscitation.

Types of EMS systems

One Resuscitation Academy mantra is, "If you've seen one EMS system you've seen one EMS system." No two EMS systems are identical and each has its own strengths and challenges. Nevertheless, there are some common themes. First an EMS response is activated by citizens calling an emergency phone number. The emergency tele-communicator or dispatcher is responsible for sending the correct level of help and offering instant instructions in CPR when cardiac arrest is present. Next one or two emergency vehicles (or helicopter emergency services) staffed with EMTs, paramedics or physicians (or some combination) respond.

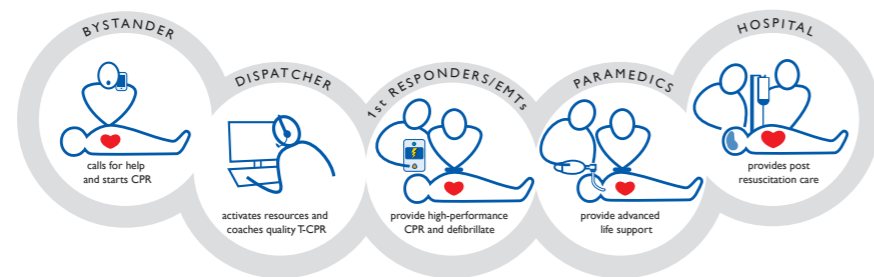At the scene basic and/or advanced life support is provided with variable quality.

"If you've seen one EMS system, you've seen one EMS system."

- A mantra of the Resuscitation Academy

If the patient is successfully resuscitated post-resuscitative care is provided at the scene and continued at the designated hospital following transportation.

For unsuccessful resuscitations the patient may be declared dead at the scene though some systems may require transportation to the hospital to be declared dead.

The Chain of Survival

A metaphor used to describe the sequence of therapeutic interventions for cardiac arrest is the Chain of Survival. Successful treatment of cardiac arrest and particularly ventricular fibrillation is associated with an EMS systems ability to deliver care quickly. The chain of survival, with its four pre-hospitals links of early access, early CPR, early defibrillation, early advanced care, illustrates the most critical elements of addressing sudden cardiac arrest.
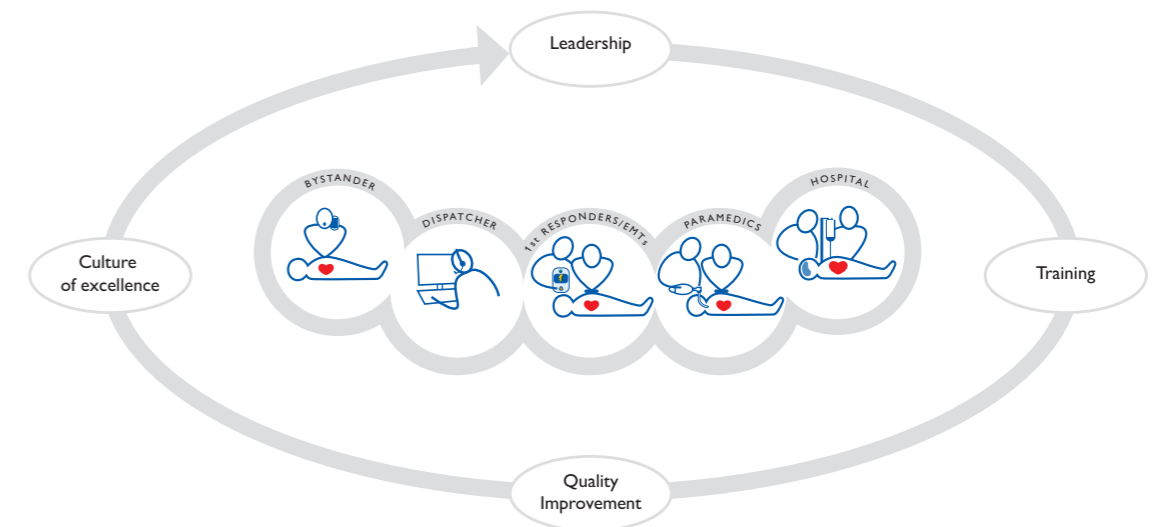

Every EMS system already incorporates some if not all of these system factors at least to some degree – but even these factors, although necessary, are not sufficient. After all, a sports team can have great individual players but still lose every game. What else, then, is needed?

The Enhanced Chain of Survival (the "frame of survival")

To fully understand success or lack of success we need to address qualitative factors that also determine system performance. These are far more difficult to measure or score, but are just as important as the measurable metrics. The links in the chain cannot stay connected unless embedded in a context of strong medical and administrative leadership, continuous medical QI, a culture of excellence, and stellar training and continuing education for all personnel.

These four elements literally frame, surround, and embed the core links of care. They are the frame of survival. Together the chain of survival and frame of survival characterize the constituents of emergency medical services. Together they nurture, sustain, and define a high-quality EMS system. Just as important to the success of a champion sports team that starts with excellent players are sustained practice, superb managing and coaching, continuous review and fine-tuning, and team spirit. In sum, the frame surrounding the chain of survival can be reduced to a single word: accountability.

These important additional dimensions of the chain of survival are also reflected in the Utstein Formula for Survival, stipulating that chances of survival are very much determined by the efficiency (quality) of the education and the local implementation.

The Utstein Formula for Survival

$$\boxed{\text{Medical Science}} \times \boxed{\text{Educational Efficiency}} \times \boxed{\text{Local Implementation}} = \text{Survival}$$

Accountability

Accountability is a keyword in healthcare. It is about individuals being responsible for a set of activities and answering for their actions. Part of the challenge in pre-hospital cardiac resuscitation is that the multiple domains of accountability spread across multiple stakeholders (e.g. emergency dispatch centers, EMS systems, and ambulance services, hospitals, public health departments).
As such no one entity "owns" the cardiac resuscitation process and its outcomes. Ultimately the public must be at the center of all decisions made by the EMS system concerning cardiac resuscitation systems of care. This accountability, achieved through leadership, quality improvement, training, and excellence holds the chain of survival in place and ensures that its links are as strong as they need to be. An EMS system that cannot be accountable to the citizens it serves will at best be mediocre.

All links in the chain of survival are responsible for working closely with the EMS system and its governance to fulfill this mission for the community.

Disparity in Community Cardiac Arrest Survival Rates

The great disparity in survival across communities is illustrated by contemporary registries that have enabled consortia of communities or countries to measure care and outcome. In 2009, a consortium of 11 communities in the US and Canada with survival rates ranging from 3% to 16% established a cardiac arrest registry in order to conduct prospective research studies. These outcome differences are largely attributable to differences in community implementation of best practice. The Cardiac Arrest to Enhance Survival (CARES) registry currently includes a self - selected - but very diverse - cohort of EMS systems representing 20% of the US population. Communities reporting over 100 cardiac arrests a year had survival rates from 4% to 30% from all cardiac arrest rhythms in 2013. The Pan-Asian Resuscitation Outcomes Study (PAROS) reported survival rates, which varied greatly between developing and developed countries (0.5% in Malaysia and 8.5% in Seoul for EMS-assessed, out of hospital cardiac arrest with all rhythms).

If we exclude specific outliers, North American, Asian, and European systems report their own performance with a 24-fold variance in all-rhythm survival from 1.1% to 26.1%. For a community with 500 CA per 1 million inhabitants, the survival would then range from 5 (1.1 %) to 130 survivors (26.1%). Importantly the survival variability indicates real opportunities to improve care and save lives.
It is particularly noteworthy that among patients who are employed at the time of their cardiac arrest, most return to work with the same income and functional status as before the SCA.

Part 2. Global Resuscitation Alliance

The Need for a Global Resuscitation Alliance

Seattle/King County EMS has worked for over 40 years to improve survival from OHCA and is considered among the best in the world with survival rate among the highest or even the highest in the world. In 2008 EMS leaders in Seattle/King County created the Resuscitation Academy (RA) to share best practices in their system with other communities to learn, adapt and implement. To date, they have offered 22 (mostly two-day) academies with > 800 attendees, most from Seattle, the US Pacific Northwest and another dozen states with a handful of attendees from Europe, Australia, and Asia.

The intention is to enable implementation of best practices involving community-based resuscitation of out-of-hospital cardiac arrest.
The RA provides a practical road map to apply scientific principles across a range of communities, and has had substantial appeal. Attendees have implemented effective programs in their communities, leading to important survival improvements.

The Global Resuscitation Alliance is committed to the measurement and quality improvement (QI) strategy fundamental to the RA.
The Alliance will develope curriculum and resources, host RA forums, train and establish other RA sites as part of a global network, and facilitate community participation in an Utstein-style registry.
The GRA will engage communities in Europe, Asia, Australia/New Zealand and will reach out to communities in South America, Africa and the Middle East.
The GRA will work in partnership

About the Resuscitation Academy:

The **Resuscitation Academy** began in 2008 with the goal to improve cardiac arrest survival. Its tag line is "Improving cardiac arrest survival, one community at a time." The Resuscitation Academy forum is dynamic and engaging to include didactic lectures, demonstrations, hands-on breakout sessions, and user-friendly workshops. However such a forum can be complemented by a how-to guide to spell out the details of how to implement the various programs we were talking about. The **Resuscitation Academy Tool Kits** were developed to do just this. They provide a how-to guide for setting up various programs within local communities. But even with tool kits, local community implementation can be challenging. Often the key to success lies at the local level where local community resources must be mobilized to focus on specific challenges to implementation.

The Resuscitation Academy is a joint program of Seattle Medic One and King County Emergency Medical Services and is offered tuition-free with attendees coming from throughout the country (and world). The modest class size allows for a two-way exchange of Information - the faculty provides evidence-based information and tools to improve cardiac arrest survival and the attendees share the real-life challenges they face.
Every community has a different constellation of culture, leadership, resources, and opportunity. Above all, the faculty has learned that change is very challenging, and one should never assume that just because someone comes along with a good idea that it will be embraced and implemented. Impediments to change, whether they stem from habit, inertia, malaise, or lack of resources, will overwhelm the best of intentions. We have also learned that no system will transform itself overnight. Change is not only difficult, it occurs slowly – tiny step by tiny step.

with the RA to include North American communities in the global network. How could such a common condition as out-of-hospital cardiac arrest with an established science have such disparate outcomes? Addressing this could translate to tens of thousands of lives saved worldwide. The RA goal was to overlay traditional resuscitation guidelines with the science of implementation and best practices, often termed "quality improvement" or "QI" to create a new resource that could provide communities with operational strategies to put scientific principles into programmatic action. Most importantly RA distilled the best practices into 10 steps, each of which would add to the momentum of improved survival. The steps were further divided into low and high hanging fruit.

Regionally, the RA has motivated the entire State of Washington - with a population of 7 million – to engage in the "measure and improve" strategy espoused by the RA. As highlighted by the Utstein 2015 Implementation Conference, there is an increasing appreciation that the RA model can be a prime means to positively affect resuscitation care on a community level.

Resuscitation Academy Flexibility

The RA format is flexible and designed to meet the needs of the attendees with the properly sized curriculum. Thus while the typical course designed for EMS leaders and medical directors lasts two days, some have been as short as one-half day. Some RAs focus on a particular step among the 10 steps. Training EMS officers to teach high-performance CPR in their agencies is typically a 6 hour course; training emergency dispatchers in dispatcher CPR a 4 hour course. RAs can also be targeted to different geographic areas from an agency or local region to a nation, and courses have been offered for groups of 20 or as many as 100.

Resuscitation Academy Impact

Measurement is core to successful implementation because it provides objective assessment of performance and highlights opportunities for improvement. A true testament to a community's progress is its commitment to cardiac arrest surveillance and measurement. The RA therefore insists that attendees commit to measure care and outcome consistent with the Utstein template and gauge how subsequent programmatic efforts impact care. Improvements have translated to a measurable increase in survival with hundreds of additional lives saved over the course of the RA's efforts. Survey of RA participants indicates a substantial effort to implement programmatic improvements,

Table 2. Survey of RA participants 2008 - 2013

Program	Before Academy	After Academy
Cardiac arrest registry	31 %	88 %
Telephone CPR	46 %	83 %
HP CPR	17 %	76 %
Police AED	34 %	48 %
Public Access AED	58 %	76 %
Public CPR Training	77 %	91%

Over 90% of Washington State's population is covered by the state's cardiac arrest registry, enabling true population-based, rigorous assessment of care and outcome, for which there has been a corresponding and steady progress (Table 3).

Table 3. Washington State Care and Outcome for Cardiac Arrest

Metric	Utstein Group according to year					
	2011	2012	2013	2014	2015	2016
Bystander CPR[1]	62 %	68 %	72 %	75 %	71 %	76 %
Citizen PAD use	6 %	6 %	7 %	10 %	9 %	8 %
Police PAD	1 %	2 %	4 %	3 %	3 %	4 %
Angiography[2]	37 %	51 %	65 %	69 %	65 %	72 %
Survival to discharge	36 %	43 %	45 %	46 %	45 %	46 %
Neuro Intact Survival	32 %	37 %	40 %	43 %	42 %	44 %

[1] *Among cases that arrest before EMS arrival*
[2] *Among those admitted to hospital*

Resuscitation Academy Building Blocks

The RA provide attendees with knowledge, tools, skills, and motivation to improve cardiac arrest survival in their communities. To achieve this goal, the RA provides core content on the science of resuscitation, community-based resuscitation programs, and key strategies for quality improvement. The media and modes of learning are dynamic and include lectures, demonstrations, hands-on practice, debates, and case-based workshops. With no singular format or timeline, the RA must be tailored to its expressed purpose. The faculty is charged with engaging the attendees on their terms and appreciating their challenges. Conversely, the RA recommends attendance of community resuscitation stakeholders with the real means and authority to affect change.

The RA translates scientific principles into community-based programs and provides the key context to implement these in a sustainable manner. The strategy highlights 10 programs to advance a community's efforts, supported by 10 actions that incorporate concepts of leadership, teamwork, and planning, which collectively help achieve implementation. Grounded in the science of implementation, these process actions enable real-world actions across a broad range of communities.

How to Achieve Best Practices

The following discussion aims to put the links of the chain of survival into practical and effective community programs. 10 programmatic steps are separated into low and high hanging fruits with the lower hanging ones likely to have the biggest impact

for the fewest resources. Clearly we urge that the lower hanging be implemented first. As communities might be in different stages of implementation of specific steps already, this must be carefully evaluated on the local level.
The 10 steps are described in more detail in Part 3.

What is the RA model?
A typical RA has several aims and responsibilities, including:
- Selection of attendees
- Duration and focus – past RAs have typically been 1-2 days.
- Attendee commitment to establish a registry.
- Attendee commitment to undertake a project in their home communities
- Should be Tuition Free (or cost recovery only) with volunteer RA faculty and trainers
- Emphasis on measure and improve as a guiding principle
- Emphasis on 10 programmatic steps
- Emphasis on ongoing QI with feedback to the providers and no disciplinary use of data
- Sharing of all training material and tool kits on many of the 10 steps
- Assistance (including help with faculty) in putting on an RA in other communities

What is Quality Improvement?

Quality improvement is at the core of system improvement. QI can be undertaken at the macro and micro level. At the macro level it refers to the cardiac arrest registry and measurement of outcomes and key response intervals. At the micro level it refers to performance standards. Data should never be used for disciplinary purposes but to improve care. Furthermore, we believe QI data should be shared with EMS and telecommunicator personnel as well as the community.

Performance Standards

While there are few performance standards in EMS, they are metrics to judge system performance and identify areas in need of improvement. Examples of such standards are detailed throughout this report, and are listed under each step in Part 3.
The RA stresses performance standards particularly for telephone and high performance CPR.

Potential of the Global Resuscitation Alliance (GRA)

The RA addresses an important gap in resuscitation. It enables translation of resuscitation science into best practice through successful implementation of community-based programs. The proof-of-concept model developed in Seattle-King County has been duplicated throughout the US and, through the efforts of the GRA, in other regions of the world.

Mission
To advance resuscitation through the RA model by accelerating community implementation of effective programs through a QI strategy to measure and improve.
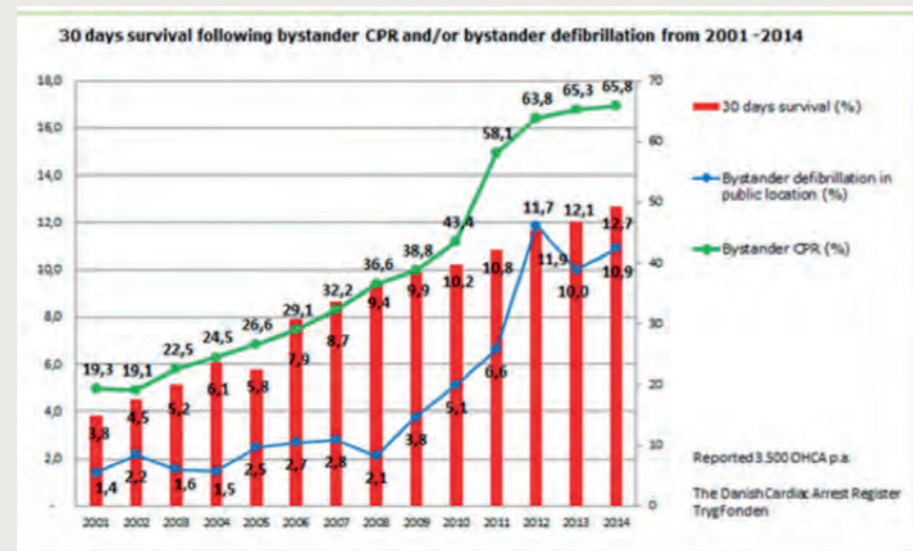
Goals
The GRA will:
- Establish an international network of EMS agencies committed to improving cardiac arrest survival
- Promote the 10 programs to improve cardiac arrest survival
- Promote the 10 actions to achieve successful implementation
- Engage communities to measure and improve as evidenced by participation in an Utstein style registry
- Provide a regular and repeated GRA forum for community stakeholders interested in offering regional and local Resuscitation Academies.
- Develop a geographically diverse, continental GRA network. The GRA network will share common curriculum materials, assure high-quality faculty, and provide a central resource for communities looking to establish a local RA. Ultimately this train-the-trainer process will provide for an increasing number of high-quality GRA forums that can appeal across the spectrum of community size, demographics, culture, or resources.
- Develop, refine, and translate common teaching and training materials used to support the GRA model.
- Provide regular communication and collaboration with organizations sponsoring the GRA to include annual reporting.
- Develop evaluation measures to track these deliverables and thus determine the success and impact of the GRA. In addition to evaluating itself the GRA will provide tools for individual communities within the GRA network to evaluate its own performance.
- Uphold the ethos of the Resuscitation Academy; specifically its message and commitment to promote science based quality programs driven by the desire to improve cardiac arrest survival.

The above goals define the main mission of the GRA as a catalyst, coordinator, and facilitator. This does not preclude the GRA directly sponsoring or co-sponsoring local meetings in various communities.

Administrative Structure and Key Personnel

The Global Resuscitation Academy will provide coordinated infrastructure including human and material resources to develop, refine, and disseminate the RA model. Key structure will include respective continental principal investigators, a Steering Committee comprised of strategic participants in the Global Resuscitation Alliance, and key operational coordinator personnel. The administrative structure will include a full or part time GRA secretariat and designated continental coordinaors.

Case Report 1: Tripling Survival from OHCA in Denmark

Percent survivors and bystanders CPR after OHCA

Denmark has become a prime example of implementing best resuscitation practice in Europe, and has achieved a remarkable tripling of survival from pre-hospital cardiac arrest over the past ten years. Since 2006, a national school Cardiopulmonary Resuscitation (CPR) training program has been underway, sponsored by Trygfonden, a national Danish foundation. 17,000 Automated External Defibrillators (AEDs) have been placed in the community.

The National Danish (Utstein) Out-of-Hospital Cardiac Registry has documented tripling of survival. The increase in bystander CPR from 19% to over 65% is considered to be a main contributor to this.

The percentage of survivors returning to work increased significantly, along with improved survival. Of 30-day survivors employed before the arrest, 76.6% returned to work. (Circulation. 2015;131:1682-1690. DOI: 10.1161/CIRCULATIONAHA.114.011366.) Not only did the number of survivors increase during the years but also the percentage of favourable neurological outcome improved. There is a clear correlation to early bystander CPR and use of AED. (N Engl J Med 2017;376:1737-47. DOI: 10.1056/NEJMoa1601891) Resuscitation Academy has been established as a national collaboration and all EMS systems have committed themselves to the goal of the GRA and implementation of the 10 programs to improve survival.

In 2017 the HeartRunner app was introduced in Copenhagen to activate volunteer laypersons trained in CPR and AED use to respond to cardiac arrests in their neighbourhood. 16,000 citizens joined the system within the first two months.
When receiving a suspected cardiac arrest call, the dispatcher alerts immediately all Heart-Runners that at that time find themselves within 300 m distance from the location of the caller. Any Heartrunner able to respond can then confirm this on the app and will receive exact address and directions on a map on their mobile phone. The dispatcher is also able to inform the responder of all AEDs available within the same 300 m radius with the push of a button.

Case Report 2:
The European Restart a Heart day goes global

The European Restart a Heart Day was launched in 2013 and is now implemented in most European countries. Every 16th of October, national resuscitation councils across Europe hold various national events to champion the goals of Restart a Heart Day. European publics are taught about CPR and use of AED and told that "you can save a life!"

This initiative attracted support from the European Parliament and led Members of the European Parliament in June 2012 to pass a Written Declaration calling for European countries to establish a European Cardiac Arrest Awareness Week europarl.europa.eu The declaration emphasized the importance of equal access to CPR and encouraged member states to establish public access defibrillation programs and increase the availability of Automated External Defibrillator (AED) to European publics.

A common theme for the Restart a Heart Day has been: Kids save lives. And this has been followed by at statement on the importance of teaching children to do CPR. This statement was prepared by the ERC, the International Liaison Committee on Resuscitation and various important societies and later endorsed by the WHO.

In the UK the Restart a Heart day set an impressive new record in 2017 with training of 195,000 school children that day. The initiative has also spread to Australia, Japan and other countries.

In October 2018, the very first global edition of Restart a Heart will take place. Under the motto of All Citizens of the World Can Save A Life, ERC will join forces with ILCOR and resuscitation organisations all across the world to create awareness and teach CPR everywhere!

The GRA Steering Committee will include a representative from each of the sponsoring agencies, the continental principal investigators, and the secretariat. The final composition of the Steering Committee may evolve based on input from the sponsors or as the Global Resuscitation Alliance matures. The Steering Committee will have oversight responsibility and have authority to guide the effort. The Committee will serve as an important resource as the Alliance seeks to be efficient with limited resources to maximize the Global Alliance's impact.

The duties of the secretariat will include overall management and organization of the GRA. The secretariat is responsible for helping design and implement global strategies and coordinating regular conference communications across the 4 continents. The secretariat will work to establishes consistent standards for the regional Resuscitation Academies and RA supporting materials. The secretariat will

communicates with sponsors and is responsible for cultivating approaches to achieve sustainability.

The continental coordinators are responsible for the day-to-day implementation of local and regional RA activities including development of faculty, planning of specific RA forums, and working with community stakeholders to assure RA partici- pation and follow-up efforts. The continental coordinators are responsible to the continental principal investigator(s). Each continent may develop a specific structure that will most efficiently advance the Global Resuscitation Alliance mission.

Part 3. 10 Programs to Improve Community Survival Rates

This section details the specific elements of an EMS program we believe comprise best practices. We believe that survival from VF in many communities can reach 50 percent with implementation of best practices. Some communities are already near this level, and a handful exceeds this rate. Progress can be variable and requires persis- tence and determination. Improvement may not occur immediately or dramatically, but we guarantee that steady efforts which continually strive to achieve best practices will improve outcome.

We present these best practices as 10 programs to achieve improvement.

Ten Programs to Improve Cardiac Arrest Survival

1. Establish a cardiac arrest registry
2. Begin Telephone-CPR with ongoing training and QI
3. Begin high-performance EMS CPR with ongoing training and QI
4. Begin rapid dispatch
5. Measure professional resuscitation using the defibrillator recording (and voice if possible)
6. Begin an AED program for first responders, including police officers, guards, and other security personnel.
7. Use smart technologies to extend CPR and public access defibrillation programs to notify volunteer bystanders who can respond to nearby arrest to provide early CPR and defibrillation
8. Make CPR and AED training mandatory in schools and the community
9. Work toward accountability – submit annual reports to the community
10. Work toward a culture of excellence

Step 1: Establish a Cardiac Arrest Registry

RA truism: Measure, Improve, Measure, Improve …

The most important mantra at the Resuscitation Academy is "measure, improve, measure, improve …,"; the bedrock upon which all programmatic change springs forth. A cardiac arrest registry is the essence of measurement. Continuous measurement will determine if implementing changes cause improvements and will identify further steps for improvement. And so on…

Resuscitation is an excellent performance benchmark for the entire EMS system, as it tests all its aspects. It requires coordination, expert judgment, technical skills, effective communication, and timeliness. If cardiac arrest is well managed, it is quite likely that the EMS manages other medical emergencies well. The registry measures all aspects related to the care, not only whether the patient lives or dies. Was bystander CPR performed? Telephone CPR instructions provided? The quality of CPR? Unacceptable pauses in CPR? Successful airway management? Given enough cardiac arrests, a profile begins to emerge of where the system is succeeding and where improvement is needed.

The registry is core and must not be threatened with funding cuts or elimination during lean times. It must have sufficient resources and full support of medical and administrative directors. Necessary resources include staff time for gathering electronic or paper information from ambulances, dispatch center, AEDs, hospital records, and ideally death certificates. While small communities will not have the volume to justify full-time dedicated staff, several small communities can join together to establish a registry. In the US, Emory University has established, with endorsement from the Centers for Disease Control and Prevention, a national cardiac arrest registry: The Cardiac Arrest Registry to Enhance Survival (myCARES.net). As of 2014, 21 states participate; 10 with entire statewide programs. EMS systems and local hospitals submit data via a web-based system. CARES has overcome what has been a major obstacle in most well intentioned US based registries, namely obtaining outcome data from hospitals. Participation in CARES is voluntary, and all the participants receive summaries of their own community as well as a national summary.

"A registry measures more than whether the patient lives or dies, but all aspects related to the care."

CARES can be customized for the needs of the local community, and provides templates so communities can review their statistics in any way they wish.
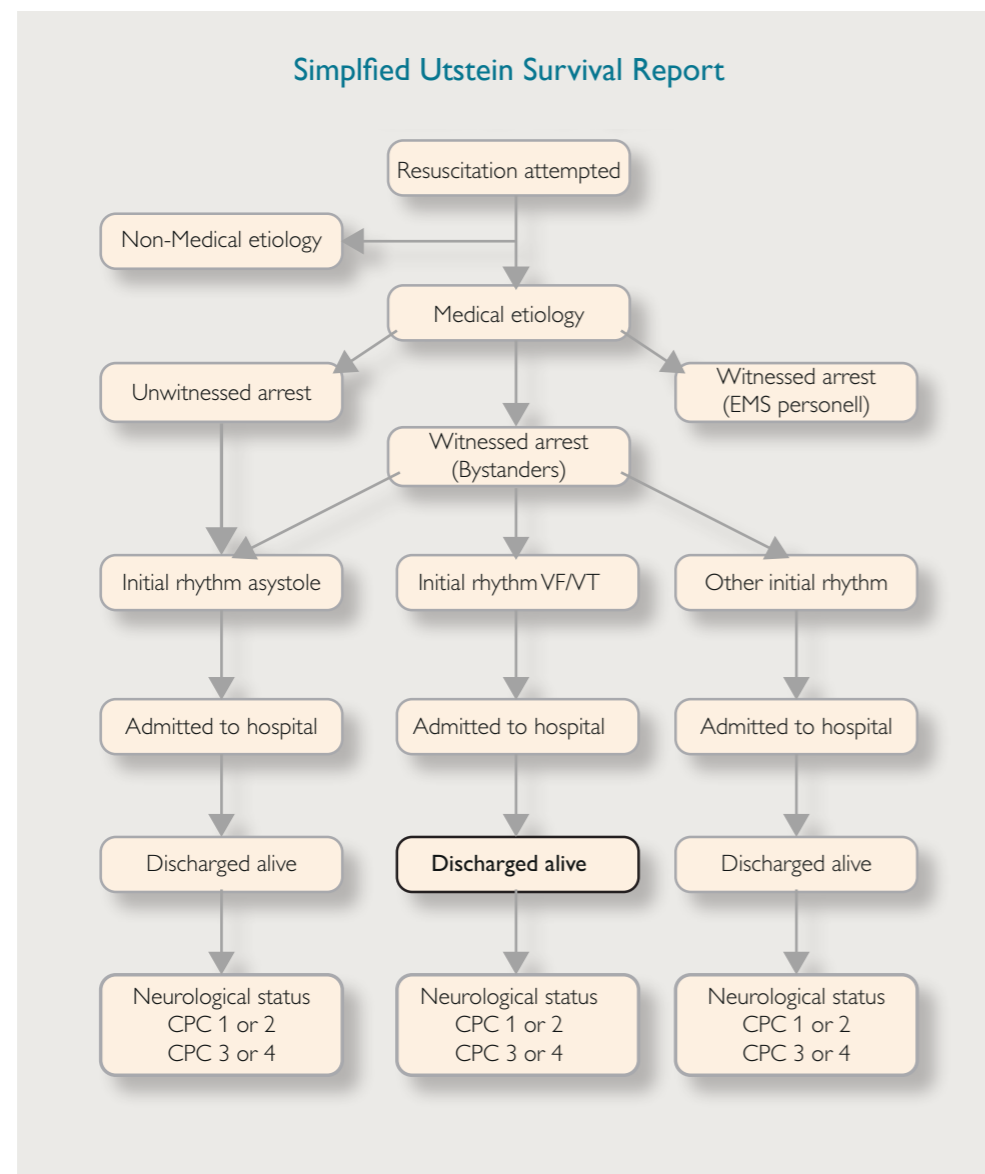
Agencies unable to participate in a national registry, such as CARES in the US, should create their own. One simple-to-use freestanding registry, CATS (Cardiac Arrest Tracking System) may be downloaded at Resuscitationacademy.org for free. It collects only essential variables including 14 event and 3 outcome variables and a data dictionary. It allows any EMS system to monitor its own performance and track changes in survival over time. CATS records information in an Access data base, and thus should be readily available within most organizations. It displays data in an Utstein template and can be exported to Excel to allow for customized displays.

In Asia, nationwide OHCA registries started in 2000. Since the Japan Utstein Project began in 2006, the national fire department of Japan has registered hundreds of

thousands of OHCAs. The Korean national OHCA registry, administered by the Korea Centers for Disease Control and Prevention, has collected approximately 30,000 OHCAs every year since 2006. The Pan-Asian Resuscitation Outcomes Study (PAROS) reported 66,786 cases from 12 cities in seven countries from 2012-2013, and their phase 2 study started in 2014 aiming to increase bystander CPR rate with telephone CPR. Other well-established national cardiac arrest registries exist in Sweden and Denmark. In 2013 the Norwegian government made cardiac arrest a reportable disease with a compulsory and consent-free national registry for all EMS systems and hospitals. The European Resuscitation Council is currently establishing a pan-European registry based upon regional input from many European regions in the EuReCa-project.

Performance Goals:
Collect all cardiac arrest case data in a database and prepare reports to share internally

Simplfied Utstein Survival Report

Case Report 3: How to resuscitate a cardiac arrest registry (Norway)

The Norwegian Cardiac Arrest Registry collected Utstein style data from out-of-hospital cardiac arrests from 2001 and in-hospital cardiac arrests from 2004. In 2009 data collection was suspended, and the registry needed a complete resuscitation! Some of the lessons learned in this process include:

Organizational:
1. National organization needs national collaboration, and someone must take the lead; Norwegian National Competence Unit for Prehospital Emergency Medicine (NAKOS) hosted the project, and representatives from all academic hospitals in Norway joined the steering committee to oversee the resuscitation. Human factors favoring collaboration, sharing, and trust among partners are essential.
2. Political support not only by politicians; NAKOS and the steering committee worked with Oslo University Hospital and all levels in the Norwegian health bureaucracy for local and national support.
3. Cardiac arrest as a reportable disease! We achieved resuscitation of our registry and cardiac arrest is now included in the short list of reportable diseases in Norway, and as such registration is now mandatory. By this elegant solution previous concerns about consent and access to data are replaced by requirements for high security IT-solutions.

Resources:
1. Seed funding can be vital! Early funding came from diverse sources. Academic staff contributed time and resources – from themselves and their institutions, without intentions of ever being repaid!
2. Stable funding must be realistic and cover salaries AND expenses! This is a continuous challenge, especially so when costs for digital infrastructure are beyond the registry's control.
3. Local ownership to data stimulates local allocation of resources! In our model each hospital/EMS owns their local registry within the national registry – they have full access to local data and based on local processes, they can add supplementary data elements for their own quality assurance purposes, within the same legal framework. On the flip-side; mandatory registration without central funding makes it possible for hospital administrators to use cardiac arrest reporting as part of their struggle for resources.

The way forward:
Our registry received a national status for reportable disease in 2013, and the participating EMS-organizations and covered proportion of the Norwegian population are steadily increasing. By 2015 we expect 13 of 19 EMS-services covering 78 % of Norwegian population.

Case Report 4:
Measuring the quality of life of OHCA survivors after discharge from hospital

The Victorian Ambulance Cardiac Arrest Registry (VACAR), Victoria, Australia is a clinical quality registry which collects data for all out-of-hospital cardiac arrests (OHCA) attended by emergency medical services (EMS) in Victoria, Australia. Victoria has a population of more than 6 million people, over 4 million of whom reside in the capital city of Melbourne. VACAR commenced in 1999 in alignment with the Utstein template and to date, over 90,000 records have been recorded. The registry is used to measure/monitor OHCA outcomes, drive clinical improvement within the state-wide ambulance service (Ambulance Victoria), and also supports a comprehensive research program which is recognised internationally.

Problem to be solved/background
The 2015 update to the Utstein template recommended the use of validated measurements tools to assess health-related quality of life post-OHCA. Additionally, the American Heart Association recommends that future cardiac arrest clinical trials focus on assessing neurocognitive impairment and the quality of life of survivors. However, few OHCA registries internationally routinely measure the long-term quality of life of survivors. Currently, the most commonly reported outcome measures include survival to hospital discharge or 30-day survival.

Description of project/program
Acknowledging the importance of understanding the quality of life of OHCA survivors after discharge from hospital, the VACAR commenced 12-month patient follow-up. For OHCA survivors arresting since 2010, the VACAR has conducted quality of life telephone interviews 12 months post-arrest. Responders answer questions related to residential and work status, respond to two generic health-related quality of life tools (12 Item Short Form Health Survey [SF-12] and EuroQol-5D [EQ-5D]), and also respond to a functional recovery measurement instrument (Glasgow Outcome Scale-Extended [GOSE]).

Results
In 2014, the VACAR group published the 12-month outcomes of patients arresting between 2010 and 2012. With 697 responders, this was the largest study at the time to assess the quality of life of OHCA survivors. Most (55.6%) respondents reported a good functional recovery according to the GOSE, and patients reported similar results to the standard Australian population in terms of the SF-12 mental component.
As at June 2017, a total of 1,624 OHCA survivors had responded to the 12-month follow-up since commencement, a response rate of 83%. The proportion of responders reporting a good functional recovery had risen to 62.2%, and the median EQ-5D index score was 0.85 (IQR 0.73-1).
Importantly however, a recent study by the VACAR group assessed the validity and measurement properties of these three generic tools in the OHCA population. The study demonstrated that, whilst the SF-12 and GOSE may be useful in OHCA survivors, the EQ-5D demonstrated high ceiling effects and more work is needed to assess its interpretability.

Challenges
Loss-to-follow-up and compliance rates are a challenge for all studies involving patient follow-up. VACAR tries to mitigate this by accessing contact information from numerous sources, including the ambulance patient care record, hospitals and patient accounts. The state death registry is also searched. Participation rates are increased by sending a letter detailing the call in the weeks prior to phone contact. A maximum of five attempts are made to contact patients.

Additional plans
The VACAR plans to collaborate with experts in neuropsychology to understand the aspects of health that are most important to OHCA survivors during the trajectory of their recovery. In a planned study, patients and their partners or loved-ones will be asked to complete a series of psychological assessments at three and six months post-arrest. The aim of this study will be to assess the neurocognitive and psychological outcomes of survivors, as well as the psychosocial needs of their partners, following OHCA.

Case Report 5: The South Australia Ambulance Service Cardiac Arrest Registry

Brief summary
The first step on the road to improving cardiac arrest survival is the establishment of a Cardiac Arrest Registry (CAR).
With this in mind, SA Ambulance Service (SAAS) resolved to examine historical data collected on all out-of-hospital cardiac arrests (OHCA) attended in South Australia (SA).

Until recently, the information gathered as part of an ongoing key performance indicator and prospective observational study, had not been examined under the requirements of the updated Utstein Resuscitation Registry Template for OHCAs.
The review was directed by the 1st mantra for the 10 step program – Measure and Improve.

SAAS is the sole provider of emergency medical services (EMS) in South Australia, a state which covers some 983,482 square kilometres.

Problem to be solved/background
SAAS has collected data on OHCAs it has attended since 2002. Paramedics (EMS personnel) enter data on paper patient care records, which is later transferred to Excel spreadsheets, stored according to SA Health guidelines and sanctioned by the Human Research Ethics Committee (HREC).
Initially intended for quality assurance and various sector and government reporting, the data elements were based on early Utstein styles. The reports tell an important but small story, and only minimally encompass core elements of the 2014 updated Utstein Resuscitation Registry Templates for OHCA. Only survival to hospital handover information was available, no details on survival to discharge. Data was not routinely linked to other vital internal data such as the Medical Priority Dispatch System (MPDS).

Few published findings enabled SAAS to benchmark outcomes against other EMS services.

Description of project/program

SAAS-CAR: 4 steps
1. Review historical SAAS OHCA data collection process
2. Retrospectively review current data set
3. Establish external collaborations, partnerships and integrate SAAS-CAR within SAAS
4. Ensure business continuity and future planning

Results

The review of the historical OHCA data collection process incorporated significant improvements for prospectively collecting data. We updated our patient care records to incorporate the core Utstein data elements and linked them to the computer aided dispatch system (SACAD) and hospital discharge records. We can now determine if patients were discharged alive or if they died in hospital. A basic data dictionary was also developed and data stored on a secured server.
The data set for 2002-2009 was discarded due fragmentation and inconsistent quality. Data from June 2009 to June 2016 – 12,644 OHCAs – was retained and now forms the basis for measurement and improvement.
A continuing collaboration with the Australian Resuscitation Consortium (Aus-ROC) and focus on improving OHCA survival has helped guide our progress.
SAAS-CAR is firmly integrated into our clinical performance and improvement processes and is expected to not only measure, but better our survival rates.

Challenges

We picked the low-hanging fruit but it wasn't always within easy reach.
Business continuity and future planning has been difficult in the context of high demand for services, where patient care is foremost. However, due to the importance of the registry, SAAS is determined to maintain it and use the data internally and externally to promote survival from OHCA.
A research fellow will work with us to continue the process.

Additional plans

We have measured and improved our registry but we still have a way to go. We plan to publish an annual report, develop a steering committee and obtain funding.

Brief summary

The Victorian Ambulance Cardiac Arrest Registry (VACAR), Victoria, Australia clinical quality registry collects data for all out-of-hospital cardiac arrests (OHCA) attended by emergency medical services (EMS) in Victoria, Australia. Victoria has a population of more than 6 million people, over 4 million of whom reside in the capital city of Melbourne. VACAR commenced in 1999 in alignment with the Utstein template and to date, over 90,000 patient cardiac arrests have been recorded. The registry is used to measure/monitor OHCA outcomes, drive clinical improvement within the state-wide ambulance service (Ambulance Victoria), and also supports a comprehensive research program.
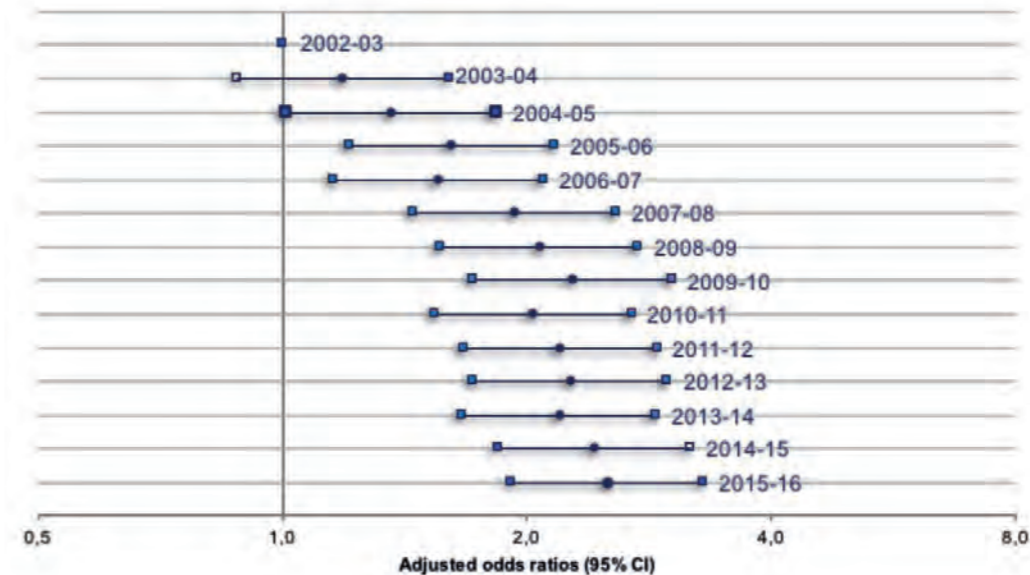
Problem to be solved/background

Finite government and Ambulance Victoria (AV) funding has meant that decisions regarding pre-hospital basic life support initiatives would be ideally based on modelling of the potential impacts. This allows for return on investment to be quantified and informs government and organisational priorities. In addition, initiatives should be monitored and measured to ascertain their impact on survival from OHCA post implementation.

Description of project/program

Data from VACAR has been used extensively to inform government investment and organisational initiatives. This includes:
- Government allocation of funding for CPR programs, fire fighter first responders, community response teams and public access defibrillation programs has been informed by VACAR modelling to demonstrate likely survival benefits from initiatives

Adjusted odds ratios (95% CI)

- VACAR data has been used to prioritise locations for the roll-out of fire first responders and PAD sites, including the density of cardiac arrests and the modelled response time saving
- VACAR data has been used to monitor the impact of initiatives such as moving to a rural CAD system, implementing fire first responders, rolling out a CPR awareness program and implementing a PAD program in key locations (1).
- VACAR data has also been used to monitor changes in treatment protocols (2,3) and in the impact of changing dispatcher instructions (4) and to measure the impact of a public awareness campaign for heart attack symptoms on the incidence of cardiac arrest (5)
- VACAR has also been used to support a large research program, including reducing the cost of clinical trials

Results
The use of VACAR data to inform and monitor operational initiatives and government funding decisions has been pivotal in improving survival from OHCA in Victoria. The latest VACAR Annual Report (publically available) shows that the risk adjusted odds of survival to hospital discharge for patients presenting in a shockable rhythm has tripled in 2015/16 compared to 2002/03 (AOR 3.3, 95% CI 2.4- 4.5) (6).

Challenges
Maintaining registry quality data requires significant organisational support and re-sourcing. Demonstrating value can significantly assist in preserving government and board buy in. This is also facilitated by the incorporation of key cardiac arrest KPIs in the ambulance service's annual agreement with the Health Minister.

Additional plans
AV will continue to extensively use VACAR data to make evidence based decisions and to monitor the impact of initiatives. Future plans include informing the roll-out and benefit of dispatching lay responders via the Goodsam application, informing paramedic reaccreditation and training through monitoring of exposure to OHCA (7), targeting areas of high OHCA incidence with low bystander participation (8) and to reduce disparity in OHCA outcomes across regions through risk adjusted identification of outliers.

Step 2: Begin Telephone CPR with Ongoing Training and QI

RA Truism: Every call is a cardiac arrest until proven otherwise.

Dispatchers are critical in the first link in the chain of survival.* They must identify cardiac arrest to provide Telephone CPR(T-CPR) guidance or identify close-by AEDs and should be considered the team leader for a resuscitation effort until EMS arrives at the scene. Many emergency dispatch centers have protocols in place, but frequently fail to offer T-CPR. Determining the presence of cardiac arrest and providing T-CPR can be difficult and stressful.

It is far easier simply to reassure the caller that help is on the way, but the center whose culture supports its dispatchers to assertively identify potential arrest and offer T-CPR is a center that has the chain of survival firmly in its grasp. This kind of culture only exists if someone is responsible for teaching T-CPR and monitoring the program. It requires listening to cardiac arrest call recordings and giving feedback both to individual dispatchers and the entire staff. It is important to review calls where cardiac arrest was recognized/not recognized and in which instructions were provided/not provided (good examples or potential for improvements).

"Assertive" describes a useful mindset for dispatchers when fielding possible cardiac arrest calls. A take-charge attitude that moves ahead with CPR instructions, when there is reasonable likelihood that cardiac arrest is present, is needed for success. An overly cautious dispatcher holding back in the face of uncertainty, will seldom initiate or will at least delay implementation of T-CPR.

Any successful T-CPR program requires training with continuing education. In King County "every call is a cardiac arrest until proven otherwise" is a step specific mantra for T-CPR. Though only 1 percent of the calls will actually be a cardiac arrest, this expectation primes the dispatcher to always ask the two screening questions (unless the caller is the patient) as quickly as possible:

Is the patient conscious (awake)?
Is the patient breathing normally?

If the answer is no to both, the dispatcher immediately begins CPR instructions; thus, giving us the teaching aid "No, No, then Go."

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* Some larger systems have dedicated personnel for providing T-CPR distinct from the actual dispatchers but the term "dispatcher" will be used here for both

Dispatchers learn the significance of agonal respirations and how to recognize them. CPR instructions are particularly important in patients with agonal respirations, since they are the ones most likely to be resuscitated and discharged from the hospital. Agonal breathing is present in approximately 60 percent of patients with bystander-witnessed VF cardiac arrest, and often confuses the caller and/or dispatcher into thinking the patient is not in cardiac arrest.

Recognizing agonal breathing remains a challenge, and is the focus of considerable research. In terms of training and motivation, an emergency dispatch center should do whatever is necessary to ensure a 75 percent rate of offering T-CPR in cases of cardiac arrest. This will require a sponsor – someone who takes charge of the desired change, has the authority to direct supporting efforts, and establishes training, professional expectations, and ongoing audits to see that the change is fully implemented. Once dispatchers realize how vital they are to the chain of survival and see concrete evidence of their success, they become the staunchest advocates of T-CPR.

Performance Goals:

Quality of dispatcher-assisted CPR is measured by reviewing every call of cardiac arrest with the following elements:

Every call is a cardiac arrest until proven otherwise.

- Cardiac arrest recognized within median one minute in 75% of all EMS treated cardiac arrest.
- The two basic questions asked in 100% of reviewed cases:
  a. Is the patient conscious (awake)?
  b. Is the patient breathing normally?
- Agonal respirations (if present) recognized in 90% of cases?
- T-CPR instructions offered in 75% of cases of EMS treated, and provided in 50% of all EMS treated cardiac arrests (excluding calls in which bystanders perform CPR at the time of the call)
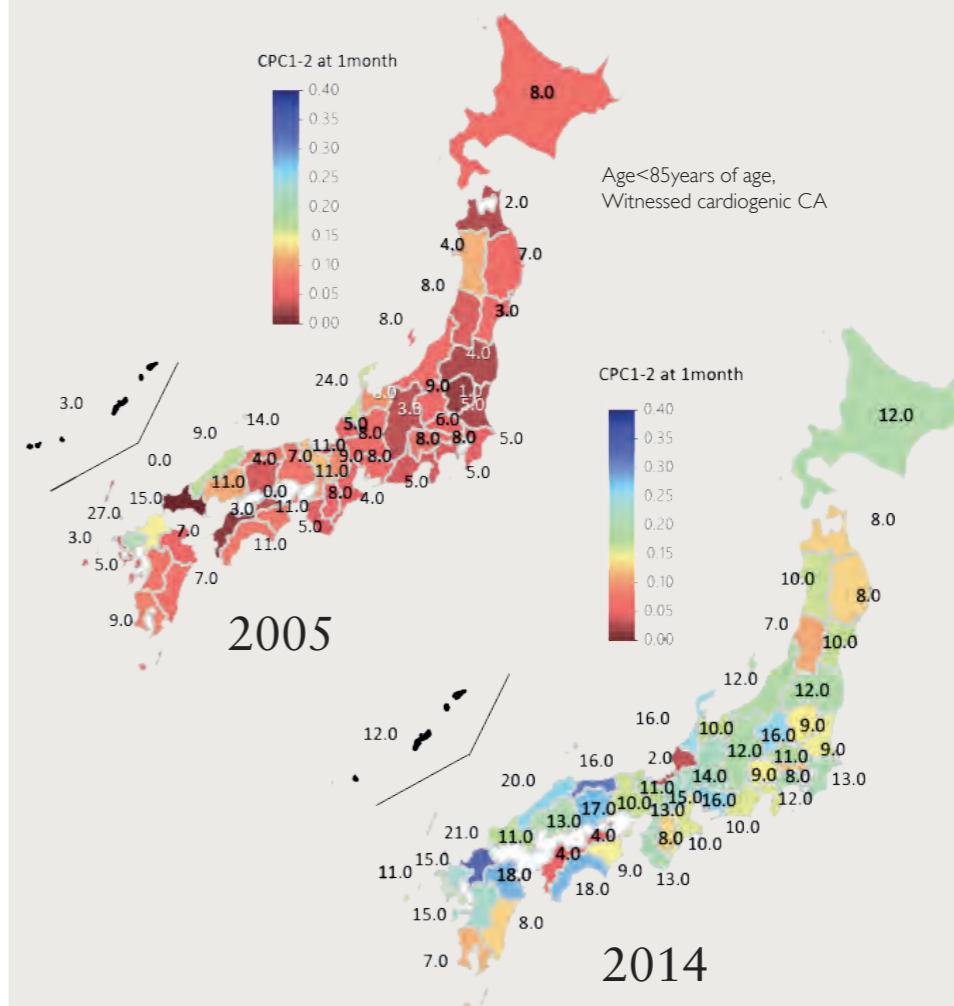- First compression started within median two minutes

Both the American Heart Association and the European Resuscitation Council in their new 2015 guidelines strongly endorse, including the importance of asking the two identifying questions, special training in the recognition of agonal respirations, and a vigorous ongoing QI program. Note in the instructions below that there are no instructions to "bare" the chest. Studies in King County demonstrated using simulated cardiac arrests that instruction to "bare the chest" delayed the onset of CPR by 30 seconds and did not improve hand position or CPR quality.

Case Report 7: Tripling of survival in Japan over 10 years

In Japan, a national Utstein based registry for all OHCA was established in 2005. Around 130,000 cases have been registered every year, totaling over 1.3 million cases by end of 2017. Over 100 research papers have been published based on the registry.

The survival rate of witnessed cardiogenic cardiac arrest improved from 3.3% in 2005 to 7.2% in 2014. The improvement is primarily attributed to an increase in bystander CPR from 38.6% to 50.9% and increased AED utilization. Adjusted odds ratio for survival to discharge with CPC1-2 2.24 (CI: 1.93–2.61) for bystander defibrillation compared with EMS defibrillation.

The National Utstein Database shows more than tripling of survival from 2005 - 20014. The map below shows the improvement by prefecture. Such regional comparison has been shown to stimulate actions by the local governments to improve OHCA outcome according to 10 steps for survivals

Created by: Hiroshi Takyu, Takahiro Hara, Genki Hoshino, Shota Tanaka, Ryo Sagisaka, Hideharu Tanaka,

Case Report 8:
Telephone CPR (T-CPR) Program Recommendations and Performance Measures

In 2017 the American Heart Association issued important recommendations on T-CPR including performance standards

http://cpr.heart.org/AHAECC/CPRAndECC/ResuscitationScience/
UCM_477526_CPR-Emergency -Medical-Dispatcher-CPR-Instructions.jsp

Sudden cardiac arrest (SCA) is the sudden, unexpected loss of heart function, breathing and consciousness, and is commonly the result of an electrical disturbance in the heart. Each year an estimated 350,000 cardiac arrest events occur in the United States in an out-of-hospital environment. Almost all of these events result in a call for help to 911. Without quick intervention in the form of cardiopulmonary resuscitation (CPR) and defibrillation, death from SCA is certain.

Telecommunicators are the true, first responders and a critical link in the cardiac arrest chain of survival. It is the telecommunicator, in partnership with the caller, who has the opportunity to identify a patient in cardiac arrest, providing the initial level of care by delivering telephone CPR (T-CPR) instructions to the caller, and quickly dispatching the appropriate level of help. It is through these actions that the telecommunicator can make the difference between life and death. It is important to emphasize that the telecommunicator and the caller form a unique team in which the expertise of the telecommunicator and the willingness of the caller to provide T-CPR represents the best opportunity to improve survival form SCA.

The information below outlines the minimal acceptable standards for timely and high-quality delivery of T-CPR instructions by emergency telecommunicators. Where possible, these processes should occur in parallel, rather than in series, to minimize the overall time interval from 911 call to T-CPR as much as possible.

Every emergency dispatch center in the nation should be aware of the following:
• The provision of T-CPR instruction for virtually all cardiac arrests is a standard of care.
• Meeting this standard requires training, ongoing training, and continuous quality improvement.
• Meeting this standard saves lives.
• Not meeting this standard results in deaths that are preventable.

PROGRAM RECOMMENDATIONS

TELECOMMUNICATOR IDENTIFIED OHCA, T-CPR INITIATED

OHCA IDENTIFIED & T-CPR PERFORMED — TRUE POSITIVE — Goal is to maximize this space
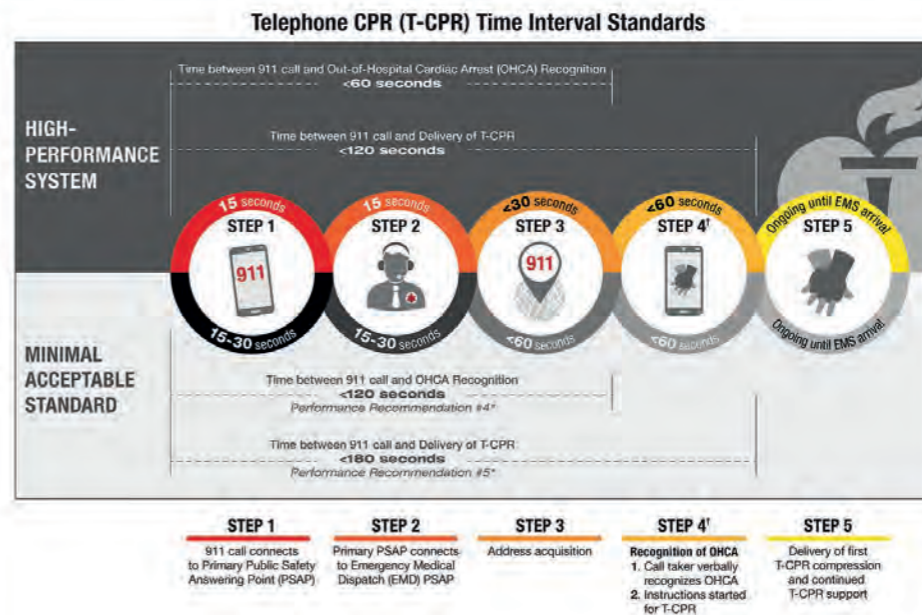
PARAMEDIC IMPRESSION = OHCA

FALSE POSITIVE (FP) RATE
OVER-CALL: Telecommunicator suspects/identifies cardiac arrest and T-CPR instruction given; EMS impression of patient found to have other than "cardiac arrest" (i.e. seizure, drug overdose, etc.)

FALSE NEGATIVE (FN) RATE
UNDER-CALL:
1. Unidentified but identifiable (opportunity)
2. Unidentifiable for reasonable exclusion:
— 3rd party
— Language Barrier
— Hysteria, etc.

1. Commitment to T-CPR
   • The emergency communications center will commit to providing effective T-CPR.
   • The dispatch center director must provide leadership and hold the staff accountable for implementation.
2. Train and Provide Continuing Education in T-CPR for all Telecommunicators
3. Conduct Ongoing Quality Improvement (QI) for all Calls in which a Cardiac Arrest is Confirmed by EMS Personnel and in which Resuscitation is Attempted
4. Connection to EMS Agency
5. Designated Medical Director
6. Recognition for Outstanding Performance

PERFORMANCE MEASURES

Telephone CPR (T-CPR) Time Interval Standards

*These recommended performance intervals should be as short as possible as described in the "High-Performance System"
#'s provided are minimal acceptable performance
†As soon as a medical emergency is recognized, dispatch of the 1st due EMS response should occur in parallel with other EMD processes and within 30 seconds of address acquisition

1. Percentage of Total Out-of-Hospital Cardiac Arrest (OHCA) Cases Correctly Identified by Public Safety Answering Point (PSAP)
   • Definition: telecommunicator recognized / total OHCA (confirmed by EMS impression)
   • Numerator: # of QI reviewed EMS confirmed OHCA with recognition noted
   • Denominator: EMS confirmed OHCA
   • Performance Goal: 75%
2. Percentage of OHCA Cases Correctly Identified by PSAP that were Recognizable
3. Percentage of Call-Taker Recognized OHCA Receiving T-CPR
4. Median Time Between 911 Call and OHCA Recognition
5. Median Time Between 911 Call and First T-CPR Directed Compression

BARRIERS TO IMPLEMENTATION

Several system barriers can slow the implementation of telephone CPR (T-CPR) programs. These include, but are not limited to, a public safety answering point's (PSAPs) chartered or perceived scope of practice, organizational culture, fear of liability, public relations concerns, and budget constraints.

Formal medical direction and supervision is essential. An active, engaged physician provides qualified oversight of emergency medical dispatch (EMD), the T-CPR protocol, and quality improvement practices. Through active involvement, the medical director can support and implement T-CPR programs by communicating their importance to elected public officials. Furthermore, they can educate local decision-makers to overcome the widely-held misconception that T-CPR instructions are beyond the scope of practice of the PSAP.

The provision of such instructions is, in fact, the standard of care vetted by experts in resuscitation science and practice. Providing T-CPR instructions is the single most effective method for improving bystander CPR rates. Furthermore, scientific investigations suggest adult patients who mistakenly receive chest compressions (ie, they are not in cardiac arrest) suffer injury only in 1 in 50 cases. Those injuries were all chest wall injuries and no internal organ injuries occurred.
(See White et. al. Circulation 2009)

The authors of the current recommendations are unaware of any lawsuits filed against 911 centers in connection with T-CPR and suggest that 911 centers are more likely to face liability for not providing CPR instructions in cases of confirmed out-of-hospital cardiac arrest (OHCA). Furthermore, they suggest that concern of poor publicity from publicly released 911 recordings are vastly overstated in light of the very real benefits of providing T-CPR to OHCA victims.

Local budgets are a perennial barrier to quality-improvement practice. T-CPR process measurement is time- and labor-intensive. An accurate representation of call-taker performance, however, can be gleaned by evaluating a subset of OHCA calls. 911 centers must define a sustainable fraction of calls to evaluate through time to improve the quality of care they provide in their communities.

The Evolution of Telephone CPR

Telephone CPR can both increase the number of bystanders that start CPR and increase the quality of the CPR performance. It is therefore expected that Telephone CPR will evolve in the coming years with opportunities to include information about the process of telephone CPR in lay CPR training. Particularly important is information about how to interact with the dispatcher. The next few years may also see standardized training in telephone CPR and some certification for dispatchers and recognition of dispatch centers, which adhere to standards of training and QI. Many learning principles of low dose high frequency training apply to telephone CPR training. There is a need for a quality training program which is generic for all types of dispatch systems. As performance standards become widely accepted centers will be able to benchmark their performance.

Perhaps in the 3-5 year time frame we may see active involvement of the dispatcher in the resuscitation. For example, the dispatcher may receive data feeds from the scene (for example, video feeds to allow the dispatcher to see the CPR quality live). Such information would allow the dispatcher to adjust the instructions to achieve higher quality CPR. The key concept here, whether for the present or for the future is that the dispatcher is a member of the team. The message is "We can help you, you are not alone." This builds a CPR team.

Adult CPR Instructions

I've notified the dispatcher, talking to me won't cause a delay.
Follow my instructions:
If caller does not understand, say something like this:
- We need to help the heart work
- (If caller asks, confirm that they will be doing CPR)

Get them on their back on the floor. *(Confirm position if doubt that patient is on floor.) If caller does not understand, say something like this:*
- Lay them down
- On the ground
- Face up

Kneel by their side.
If caller does not understand, say something like this:
- Get down on the floor
- Next to/close to/near them

Put your hand on the center of their chest, right between the nipples, and put your other hand on top of that hand.
If caller does not understand, say something like this:
- Middle of the chest
- Between the breasts
- Use palm/heel/bottom of your hand

With straight arms push down as hard as you can, just like you're pumping the chest. Let's start: push, push, push, push, 1, 2, 3, 4, 1, 2, 3, 4, 1, 2, 3, 4 … Push and count out loud: 1, 2, 3, 4, 1, 2, 3, 4, 1, 2, 3, 4 … Keep going! Do not pause.
Count with the caller! When it sounds like caller is confident counting, stop counting to listen

Telephone CPR can easily be simulated in CPR training, both for lay people and for dispatchers. One person act as the dispatcher – reading from the local protocol while the other act as a caller. This picture is from a PAROS Telephone CPR training in Singapore.

Case report 9:
Improve Bystander CPR in Seoul, South Korea with Dispatcher-Assisted CPR

The Challenge: To improve bystander CPR rate through implementation of dispatcher-assisted CPR (DA-CPR)

The gap between the knowledge and practice of bystander CPR remains as a challenge in providing early CPR before EMS arrival among OHCA patients. In order to increase bystander CPR rate, the dispatcher-assisted CPR (DA-CPR) system was implemented in Seoul, South Korea in 2011 where primary call dispatchers (PCDs), first in line to respond to emergency calls, asked two key questions to all callers to detect possible cardiac arrest cases, which then were transferred to medical call dispatcher (MCDs), who provided pre-arrival CPR instruction to the caller. A strong quality assurance program supplemented the implementation including establishment of the DA-CPR Registry for monitoring and feedback purposes, and monthly supervisory monitoring where 10% of DA-CPR recordings were audited by medical directors. Through the system, we aimed to achieve increased bystander CPR rates and in turn improved patient outcomes.

The Result: Significant improvement in survival with good neurological recovery Prior to 2011, the bystander rate in Korea was estimated around 6-9%. Bystander CPR increased to 46.5% by the end of 2013 where 33.3% received bystander CPR with dispatcher assistance. The likelihood of patients who received DA-CPR and had the arrest in public locations surviving with good neurological outcomes was observed to have nearly doubled.

Biggest Obstacle to Implementation: Detection of cardiac arrest case by the primary call dispatcher at the dispatch center. In order for dispatcher-assisted CPR instruction to be initiated, calls detected as cardiac arrest cases must be forwarded to medical call dispatcher by the primary call dispatcher. Therefore, it was important to provide standardized and simplified protocol for OHCA detection as well as hold regular training sessions. Approximately 1/4 of cases were detected in 2011, calling for ongoing efforts. We held monthly educational meetings where registry-based statistics were reported and respective feedback was provided to all MCDs and PCDs. Additionally, OHCA cases whose arrests occurred in private locations did not significantly benefit from the DA-CPR system, calling for further actions in educating home bystanders.

Case Report 10: Telephone CPR in Arizona

Challenge: To increase the rate of Telephone CPR (T-CPR) and reduce the time to first chest compression 9-1-1 agencies in Arizona. T-CPR has been shown to increase rates of bystander CPR (BCPR) and is associated with improved survival from cardiac arrest. We aimed to increase the rate of T-CPR and reduce the time from call-receipt to first chest compression at three agencies that collectively serve approximately two-thirds of the state population.

We implemented a bundle of care at these agencies. It included a guideline-based T-CPR protocol, T-CPR training modules and system quality-improvement reports and case-level feedback to individual providers. In an effort to increase and speed OHCA

recognition, the protocol directs telecommunicators to ask two questions as early in suspected OHCA calls as possible: (1) "Is the patient conscious?" and (2) "Is the patient breathing normally?" Live and web-based trainings emphasized the importance of dispatcher assertiveness and identification of agonal breathing

Result: The rate of T-CPR increased from 44% to 62% and the time to first chest compression 178 seconds to 155 seconds after program implementation. Data from nine 9-1-1 centers indicated adjusted survival ORs of 1.6 and 1.4 for patients receiving BCPR and T-CPR before EMS arrived, respectively, vs. patients who did not receive CPR.

Biggest Obstacle to Implementation: The biggest obstacles to implementation was convincing agencies that there was a problem in the first place. When proposing our program, management would respond that their agency was already doing T-CPR. This essentially meant they had protocols in place for suspected OHCA calls and didn't see any real need to make adjustments. We emphasized that TCPR was not an either/or proposition and that known variation in T-CPR performance meant improvement was possible. We focused on demonstrating program value at a single agency. We offered to listen to audio recordings and provide reports on baseline and post implementation measures. These documented significant process improvements that underscored our case, made the agency the known local leader in T-CPR and helped in bringing the other the agencies to partner with us.

Case Report 11: Telephone CPR in Singapore

STATEMENT OF PROBLEM: Singapore's out-of-hospital cardiac arrest (OHCA) survival rate is 3.0%. The current literature suggests a strong relationship between higher OHCA survival rates and increased bystander cardiopulmonary resuscitation (BCPR) rates. However in Singapore, bystander CPR rates are at around 20% and has remained there for many years.

INTERVENTION: We instituted a Telephone CPR programme that provides callers with CPR coaching before an ambulance arrives on scene. All emergency call-takers are trained to coach a caller in CPR, and are further assisted by four medical nurses in the EMS call centre who work in shifts to provide 24-hour supplemental medical assistance. Singapore, being a small national-state, has only one call centre which made it easier to implement and streamline the programme.

OUTCOMES: BCPR rates increased from 20% to 40% since this implementation. The rate of patients who attained return of spontaneous circulation (ROSC) increased significantly by 6%. Other improvements included better survival to admission and higher rate of good functional recovery.

QUALITY CONTROL: The dispatchers regularly receive feedback on the handling of a case, and the dispatch nurses and physicians review all cardiac arrest call-recordings for training purposes.

CHALLENGES: Barriers still exist preventing higher rates of T-CPR. Some callers are resistant to perform T-CPR due to lack of knowledge, and fears. As such, we have launched a community initiative to train residents and make them aware of what steps to take if they witness a cardiac arrest, with the long-term view of increasing BCPR for improved OHCA patient outcomes.

Case Report 12: Begin Telephone-CPR with ongoing training and QI

Brief Summary:
In 2015, Australian Capital Territory Ambulance Service (ACTAS) commenced a program to improve the recognition of potential cardiac arrests over the phone and reduce the time to telephone-CPR (T-CPR). The program has increased accuracy and decreased time to recognition.

Problem to be solved:
It is challenging to rapidly and accurately identify out-of-hospital cardiac arrest over the phone. Increasing the rate of recognition and reducing the time to recognition may improve survival.

Description of project:
Prior to 2015, ACTAS call-takers would ask callers if the patient was "conscious" and "breathing" to determine cardiac arrest. Analysis of historical calls indicated that callers responded inconsistently to the word "conscious", particularly if the patient had their eyes open. Callers would also state the patient was breathing if they were making any kind of respiratory effort, including agonal respiration. It was apparent that this was a stressful situation for the caller and the language used by the call-takers was affecting the caller's understanding of the questions.
In 2015, ACTAS changed the questions asked at the beginning of every E000 call. The aim was to ask simple, unambiguous questions that could be clearly answered as "yes" or "no" even by those under severe stress. The new questions were:
1. "Is the patient awake and talking?"
2. "Is the patient breathing normally?"
If the answers to these questions were both "no" or uncertain, then all call takers would commence instruction in CPR. This change was preceded by extensive face-to-face training for call-takers.
Once implemented, every cardiac arrest patient attended by ACTAS paramedics was identified from the electronic health record. Additionally, every call where T-CPR was initiated was identified and reviewed. Feedback was provided to call-takers following every incident in which T-CPR was provided. Call-takers received positive feedback and were encourage to continue to provide T-CPR, even if the patient was not in cardiac arrest on paramedic arrival. The continual message was that T-CPR is good and cannot harm the patient. "Better to perform CPR on someone who doesn't need it, then not perform it on someone who does."

"Is the patient conscious?" ⟶ "Is the patient awake and talking?"

"Is the patient breathing?" ⟶ "Is the patient breathing normally?"

Results:
In the first 13 months of implementation, 100% of patients in cardiac arrest were identified over the phone. However, 61% of patients thought to be in cardiac arrest were not actually when paramedics arrived. The most common presentations for patients not in cardiac arrest were seizures or drug overdose. No patient harm was reported for those patients receiving CPR incorrectly.

Following this another study was conducted in 2017 to determine if this improvement was sustained. On this second audit, ACTAS call-takers correctly identified 98% of cardiac arrest patients. The missed cases were attributed to the call taker not asking the 2 questions or varying the wording of the questions. In 2017, 75% of T-CPR cases were not in cardiac arrest on paramedic arrival. Again, no patient harm was reported. From the time the call is answered to initiation of T-CPR was less than 60 seconds on 50% of cases. There were no calls where it took longer than 2 minutes from call answer to initiate T-CPR.

Challenges:
There were several challenges we faced during this project. Changing the questioning of the call takers to stop using word "conscious" took some time. Additionally, the importance of the word "normally" in the breathing question has been emphasised. All call takers continue to receive feedback on every cardiac arrest case, which is demanding on the QA staff but found to be critical in maintaining standards. Despite this, the number of false positives remains high and we are continuing to investigate ways of reducing this, without reducing accuracy.

Additional Plans:
The key challenge moving forward is to maintain call-taker support in the face of false positives. We plan on increasing feedback, but this will place increasing demands on QA staff so we are reviewing feedback mechanisms to improve quality and efficiency. We also need to consider additional support for non-English speaking persons and the hearing impaired to ensure consistency of service across the community.

Step 3: Begin High-performance CPR with Ongoing Training and QI RA truism: Performance Not Protocol

Not only is the time interval from collapse to onset of CPR predictive of survival; the quality of CPR is just as important. We have seen a dramatic increase in survival after initiating high-performance CPR training for EMS personnel in 2005. Resuscitations can go on for 50 or 60 minutes with a pharmacy of medications and 10 defibrillatory shocks, resulting in a patient who survives with excellent neurological recovery. It is as though the onset of high-performance CPR suspends death and gives a better opportunity for the defibrillatory shocks and medications to provide collective benefit.

High-performance CPR is as much a construct as a measurable skill, saying that letter perfect CPR is the goal of all resuscitations. This can be achieved by training with automated feedback via the manikin on individual skills or from a facilitator in team simulation combined with review of real events. Ongoing QI programs should provide performance feedback to the involved personnel following every cardiac arrest. Most defibrillators allow digital downloads following the resuscitation with measurements of CPR percentage and quality. This near instant download allows for QI and team feedback to be provided as close to the case as possible when it is clearly most effective.

Elements of High-Performance CPR include:

- Correct hand position
- Compression rate of 100-120 beats per minute
- Depth of compression of 2 inches (5-6 cm)
- Full recoil on the upstroke
- 50:50 duty cycles
- Ventilations of one second each
- Minimal interruptions of CPR (no pause to exceed 10 seconds)
- Intubation and IV start without pausing chest compressions

High-performance CPR is high quality team performance. It is also called the "dance of resuscitation", the "CPR ballet" or "pit-stop approach to CPR". Observing well-trained rescuers engaged in high-performance CPR is indeed like watching a well-choreographed dance where the members rotate roles with minimal interruptions. Like professional race car pit crews, each team member knows exactly what to do and does it with the minimal wastage of time and effort. With fewer rescuers the responsibilities must be aggregated. Ideally one person should be the "team captain" with a meta-view of the situation and provide direction when needed to the crew.

Performance Goals:
- Chest compressions given >90% of the available time
- Rate 100-120 compressions per minute
- Depth (if measurable) 5 cm
- Full recoil on the upstroke
- Pre-charging defibrillator prior to rhythm assessment
- CPR immediate after shock
- No pause in CPR greater than 10 seconds
- Intubation and IV start without stopping CPR
- Hold cardiac arrest training drills monthly or quarterly

Case report 13:
Improve EMS CPR in King County, Washington with High-Performance CPR

The Challenge: Improve the quality of CPR by EMS personnel.
Ongoing QI identified a problem, which we felt needed improvement. For many years, the quality of CPR has been measured with voice recording and CPR detection devices. This ongoing QI identified many cardiac arrest events with pauses in chest compression, incorrect rate of compression, and long intervals to intubate the patient.

Annual survival from witnessed VF cardiac arrest from 1995-2004 ranged from 30% to 35%. As a result of this information we changed our CPR protocols in January, 2005 to achieve the following:
- No pause in CPR greater than 10 seconds
- Training to insure proper rate, depth, and full recoil
- Shock immediately followed by CPR
- Pre-charging the defibrillator prior to assessment
- No stacked shocks
- Intubation with ongoing CPR
- Training to integrate EMTs with paramedics
- Quality of CPR is owned by the EMTs
- Paramedics are responsible for advanced procedures

The Result: Dramatic improvement in survival
Discharged Survival improved 50% in the first year following the new training and this rate has been maintained. Survival is now above 50% (and one year we reached 62%).
Biggest Obstacle to Implementation: Massive training requirement
In our EMS system we have 2500 EMTs who all needed training in what we term High-Performance CPR. With 30 EMS agencies in our system this was a big challenge but one that was achieved with the help on online instruction and hands-on instruction by the training officers in every EMS agency. We also provided information on the science of CPR and why the changes were so important. When the EMTs realized the reasons for the metrics of CPR (rate, depth, full recoil, no pauses) the need for quality CPR sold itself. We also provided feedback to every department in terms of how well they were achieving high-performance CPR.

Case Report 14: The Big Problem in the Big Apple

The Problem: In 1994, the first report of cardiac arrest survival in New York City (NYC) found that survival among witnessed out-of-hospital cardiac arrests (OOHCAs) presenting with ventricular fibrillation (VF) was 5.3%.

Challenge: Focus on OOHCA treatments that will improve survival for patients presenting in VF.

Change: From 2004 - 2010, the following changes were implemented in the NYC EMS system specific to OOHCA:
- chest compressions-only instruction given to untrained bystanders by Fire Department of New York (FDNY) dispatchers
- retraining of all firefighters (i.e. certified first responders), EMTs and paramedics in CPR with a focus on compression rate, depth and recoil
- CO_2 confirmation of advanced airway placement
- use of vasopressin as the preferred first-line vasopressor agent
- use of alternative airways for the management of all difficult airways
- use of IO access
- role of "resuscitation leader" in the form of mandated response by an EMS Officer to all cardiac arrests
- elimination of "stacked shocks"
- use of adult AEDs for pediatric patients when needed
- use of VF waveform analysis in AED algorithms

Result: A study published in 2013 that focused on OOHCA patients presenting in VF in NYC found that survival to hospital discharge had more than tripled since that first report nearly 20 years ago (5.3% --> 16.6%).

Next Steps: The FDNY is implementing technologies among CFRs, EMTs and paramedics that will allow for the assessment of CPR performance characteristics (depth, rate, release, duty cycle, interruptions). Given the >10,000 personnel employed at those levels, both the initial training in proper CPR mechanics and the quality assurance mechanisms necessary to provide feedback on individual resuscitation performance present significant challenges. Furthermore, while short-term measures of survival (i.e. return of spontaneous circulation, or ROSC) are maintained by the FDNY, on-going issues prevent the universal collection of data from NYC hospitals regarding the long-term survival of these patients.

Step 4:
Begin Rapid Dispatch with Ongoing Training and QI

Rapid dispatch improves survival: No, no, go

With rapid dispatch, the closest vehicle is dispatched within seconds, specific medical emergencies are reported to the dispatcher. It occurs even while additional information is being gathered from the caller. If it is immediately clear that more resources are needed, more vehicles can be rapidly dispatched.

Motorcycle response in London

Dispatch centers/EMS systems in a community must have a clear list of incidents/symptoms initiating rapid dispatch, and carefully measure time intervals from first ring into the alarm center to dispatch, here named "dispatch time". The US National Fire Protection Association (NFPA) sets a standard of 60 seconds for critical events, King County manages 15 seconds or less, especially when the address is auto populated into the dispatcher CAD (computer aided dispatch) system.

The first mention of a critical symptom mandates immediate dispatch. Centers that prioritize a rigid, predefined protocol over rapid dispatch do their communities a disservice and in the case of cardiac arrest delay life-saving therapy.

Symptoms Triggering Rapid Dispatch:
- Unconscious
- Difficulty breathing
- Stroke symptoms
- Chest pain
- Seizure
- Major trauma
- Diabetic hypoglycemia

Rapid dispatch applies to tiered-response as well as single response EMS systems. Dispatch protocols requiring full information before even sending the first rescue vehicle, may be an acceptable procedure for the majority of calls, but speed is of the essence in a life-or-death situation, and in those cases protocols must be short-circuited. In Seattle and King County, in addition to hearing key words or phrases from callers, dispatcher must use common sense and initiate rapid response whenever a caller otherwise conveys the likelihood of a critical event. In King County rapid dispatch is used in approximately 30 percent of EMS calls, and we believe it saves 30-60 seconds for the most critical medical emergencies.

With survival falling about 10 percent for every minute of delay in CPR and defibrillation, rapid dispatch can add 5-10 percent to a community's survival rate without additional staffing or resources.
All EMS dispatch centers must have protocols authorized by medical directors.

Medical expertise is necessary to provide pre-arrival instructions, determine the urgency of the callers' complaints, and how quickly units must be dispatched. The logical person to fill this roll is the EMS medical director, but in many communities they are not involved, a bizarre disconnect between the patient and the EMS system. Performance Goals:

- Regular review of adherence to protocol
- Determination of need for rapid dispatch within 30 seconds or less
- Regular feedback to telecommunicators
- Frequent training on all-caller Interview

The above four steps (described on pages 22 - 45 are the ones we consider to be the easiest to implement and likely to have the largest immediate impact on community survival rate. It is important to note that Telephone-CPR, High Performance-CPR, and Rapid Dispatch require ongoing training and QI to be sustainable.

This, however, does not diminish the importance of the subsequent steps

Step 5:
Measure professional resuscitation using the defibrillator recording

RA Truism: It's not complicated, but it's not easy

In Seattle and King County every cardiac arrest has a digital record created in part from the defibrillator. This includes second-by-second information about cardiac rhythm and CPR, synchronized with digital voice recording. Personnel may fear that the records may be used for disciplinary purposes. It is only intended to accurately reconstruct the events, and these thousands of voice and ECG recordings have never been used for disciplinary action. Voice recordings combined with the patient's cardiac rhythm makes the event vivid. When was the defibrillator attached, when were ventilations given. Sequence and timing of events become clear and reason for delays can be deduced (e.g. the dog was growling at the EMT, the patient was moved from the bathroom, the oxygen tank ran out etc). Post-event digital readout of compressions, ventilations, heart rhythm, and timing of shocks is clearly useful, but nothing beats a voice recording.

Some communities have experience with video recordings. One channel can track chest compressions. Voice and ECG recordings provide beneficial QI and teaching material when shared with the personnel, who want to do better next time. In one recording the paramedic asked the EMT to stop CPR so he could intubate. After 65 seconds with no CPR the paramedic asked the EMT to resume chest compression. When reviewed with the paramedic, he could not believe how long the pause was. He will do better the next time. There is nothing like a real event to grab your attention – to make one breathe a sigh of relief when things go well and to cringe when they don't.

Performance Goals
1. Collect and review defibrillator data and voice recordings for cardiac arrests
2. Document verbalization of event details, interventions and CPR metrics
3. Timely feedback to EMS personnel

Step 6:
Begin an AED program for first responders, including police officers, guards, and other security personnel.

RA Truism: Protect and serve includes saving lives

Public safety or other first-responders with CPR skills and AED training have the potential to increase survival rates from cardiac arrest, but their role has been modest and inconsistent. Some communities embracing police defibrillation have seen dramatic improvements in survival, most notably in Rochester, Minnesota.

There are many issues in a police defibrillation program involving leadership support and buy-in from the rank and file, support from fire department and/or EMS agency, initial and ongoing training costs, cost of AEDs, supervision, QI, and integration with EMS dispatching. Police AED programs in Bellevue and Kent, two cities in suburban King County, Washington each with approximately 100,000 residents, in 2010 contributed to successful resuscitation of a handful of lives; and we believe further training (both for police and dispatchers) will lead to even more success.

A few critical lessons might help other communities as they embark on police defibrillation. There must be total police and EMS agency support, and every police officer should be taught in person (not only with video or web based training). Secondly, the training message must be simple: "If the person does not respond and is not breathing normally, attach the AED. Let it analyze and then follow its prompts." We teach the police to provide chest compression only, and we do not use voice recordings for police AEDs. Both are a huge relief relief to police officers. The police must be dispatched simultaneously with the first responding EMS agency. This is perhaps the most challenging issue in achieving a successful police defibrillation program. Our goal is for police to be dispatched only for true cardiac arrest events. It frequently takes some seconds (or longer) to confirm an arrest (remember

that the EMS unit has already been dispatched under rapid dispatch). When the dispatcher waits to confirm cardiac arrest before dispatching police, the EMS will have had enough of a jump start to arrive before police in many instances. How to send police quickly, but not over send, is a challenge we continue to work on.

Performance Goals for Police or other First Responders:
- Review all cardiac arrest calls for potential involvement
- Provide feedback; AED used properly? Patient outcome
- Ensure annual training on AED use and hands-only CPR

Case Report 15: Police Defibrillation in King County Washington

Challenge: Convince the King County Sheriff Department to train and equip their officers with AEDs. The goal would was for police vehicles to arrive at the scene of a cardiac arrest prior to EMS personnel

Results: The Sheriffs Department serves a population of over 100,000. We started the program with 20 AEDs and asked for volunteers among the police officers. An internal champion for the program provided all training and the county EMS medical director authorized the program and provided written protocols. The police provided chest compression only CPR and there were no voice recordings made of the resuscitation. There was a surplus of volunteers. In the first year there were over a dozen cardiac arrests in which the police officer arrived prior to EMS and in 4 instances the patients received a defibrillatory shock by the police and three of these patients survived.

Challenges: The biggest challenge was providing an AED for every vehicle. But since the program began with volunteer police officers, it quickly sold itself, so by the end of the first year additional funds were allocated to equip additional volunteers with AEDs.

Several million AEDs have been placed as part of AED-Public Access programs. They come most often to use when placed at busy airports and train stations. In Japan AEDs have also been integrated with vending machines.

Case Report 16: Reduce response times and time to defibrillation in Melbourne

Challenge: An audit in 1995 of ambulance case records in Melbourne (capital city of Victoria, Australia) showed mean ambulance response to out-of-hospital cardiac arrest (OHCA) patients was 9.4 minutes. More than 50% of patients were defibrillated >10 minutes after onset of ventricular fibrillation (VF).

To reduce response times and time to defibrillation, the Emergency Medical Response (EMR) pilot program was established in 1998. This involved simultaneous dispatch of Ambulance Victoria (AV) paramedics and fire-fighters (trained in cardiopulmonary resuscitation and equipped with automatic external defibrillators) to suspected OHCA in a pilot area of Melbourne. At 12 months, the mean EMR response time was reduced by 1.6 minutes (95% CI, 1.2–2.0), from 7.5 minutes in a control area with ambulance dispatch only to 5.9 minutes in the EMR pilot area (171 km2). Survival was higher for patients in VF on arrival of the EMR than in the control area (29% vs 18%). Based on the outcomes of the pilot program, in 2000 the EMR program was expanded to include all 47 metropolitan Melbourne serviced by the Metropolitan Fire Brigade (MFB). At 12 months after the expansion, 90th percentile response time was reduced by >1 minute when fire-fighter response times to OHCA were included.

In 2008, AV proposed a trial to extend the EMR model into Country Fire Authority (CFA) areas. The pilot involved five volunteer brigades in outer metropolitan Melbourne. At 24 months, 90th percentile response time was reduced by more than four minutes to EMR eligible events in the CFA pilot area. A further five additional integrated CFA Brigades (with volunteer and career fire-fighters) were included in the program in 2011 At 12 months, the 90th percentile response time to OHCA patients in the expanded CFA pilot area was 12.2 minutes, compared to 14.0 minutes when considering AV response time only, p<0.001. Median time to first shock was reduced by 1 minute when CFA provided first shock compared to AV (10.5 vs 11.5 minutes). Survival of patients first defibrillated by CFA fire-fighters (43%) was double that of patients first defibrillated by AV (21%).

In 2015, in recognition of the success of the EMR program, the Victorian Government committed to expanding the EMR program to all integrated CFA brigades. We anticipate that further expansion of the EMR program in Victoria will further improve response time and increase OHCA survival.

Step 7: Use smart technologies to extend CPR and public access defibrillation programs to notify volunteer bystanders who can respond to nearby arrest to provide early CPR and defibrillation

RA Truism: Cardiac arrest response is a team effort

In the past five years numerous innovative pilot programs have demonstrated the utility of using smart technology to alert volunteer responders of a nearby cardiac arrest and/or signify the location of the closest AED. The potential is a volunteer rescuer arriving at the scene prior to EMS thereby increasing the probability of success. Several European pilot programs have demonstrated utility with this concept. These are some immediate response programs:

- Register publicly-accessible AEDs with the EMS system and telecommunicator center and when possible notify the caller of a nearby AED.
- Using a smart phone app, volunteers register on a cardiac arrest notification alert system. In the US the PulsePoint app is designed for this. When EMS is dispatched, the app notifies nearby volunteers and can display the location of nearby AEDs. The US system is currently limited to arrests in public places, which limits its utility.
- Volunteers agree to have an AED with them most times, and are notified when EMS is dispatched to a cardiac arrest. These volunteers could be the general public or limited to medically related volunteers including lifeguards, etc. The telecommunicator could notify the caller that a volunteer responder is traveling to the scene.

Greater Copenhagen has a register of 5.100 AEDs in Greater Copenhagens. The location of any AED less than 180 seconds transport from the site of call automatically comes up on the dispatcher screen (red dots in middle screen).

Real time video transmission of bystander CPR may help the dispatcher improve coaching

Performance Goals:

- Measure percentage of cardiac arrests with defibrillator placement as a result of public access defibrillation or a digital notification system
- Measure the percentage of population volunteering to participate in immediate response program.
- Measure time from call to arrival at scene for immediate community responders
- Measure survival rate for VF when immediate community responder provides CPR and/or defibrillation

Name of Program and location
DARE (Dispatcher-Assisted first REsponder) program

Brief Summary
The DARE (Dispatcher-Assisted first REsponder) program in Singapore was rolled out in 2014 with the aim to encourage more people to perform cardiopulmonary resuscitation (CPR) and use an automated external defibrillator (AED) when they encounter cardiac arrest victims.

Problem to be solved/ background
Immediate CPR and defibrillation are the most critical therapies for patients in cardiac arrest with ventricular fibrillation, and the AED shock should be delivered within the first few minutes of arrest. However, lack of training and confidence in resuscitation have been barriers to bystander CPR and AED usage, leading to inadvertent delays.
Description of program
Unlike a 4-hour CPR and AED certification course, the DARE programme is a simplified 1-hour hands-on session. The curriculum comprises both a scenario-based video followed by a hands-on practice sequence. Participants will learn to dial 995, stay on the line with the medical dispatcher, perform CPR as directed, and use an AED with voice prompts.

Result
Since the launch of the programme in April 2014, we have observed a steady increase in the national bystander CPR rate from 42.8% in 2013 to 54.1% in 2015 and bystander AED rates from 2.5% in 2013 to 4.1% in 2015. This has resulted in an improved Utstein survival rate from 15.2% in 2013 to 21.3% in 2015. The overall survival rates also improved from 4.2% in 2013 to 5.3% in 2015, with the age-adjusted survival rates being 7.3% in 2015. A big contributor to improved survival has been the DARE programme.

Challenges
The challenge ahead is to extend the coverage of the DARE programme to rest of the community in order to further improve bystander CPR and AED rates.
Additional plans
As part of national initiatives, other projects have been initiated, including a national AED registry, dispatcher assisted CPR program and the MyResponder phone app which alerts registered users within 400m of cardiac arrest victim to respond and initiate resuscitation in order to improve the survival rate of Out-of-Hospital Cardiac Arrest (OHCA). The app also indicates where the nearest AED is located, and has also involved volunteer taxi drivers equipped with AEDs.

URL of the program
More information on the DARE programme is available at http://www.myheart.org.sg/article/heart-safe-singapore/dare-programme/about/682
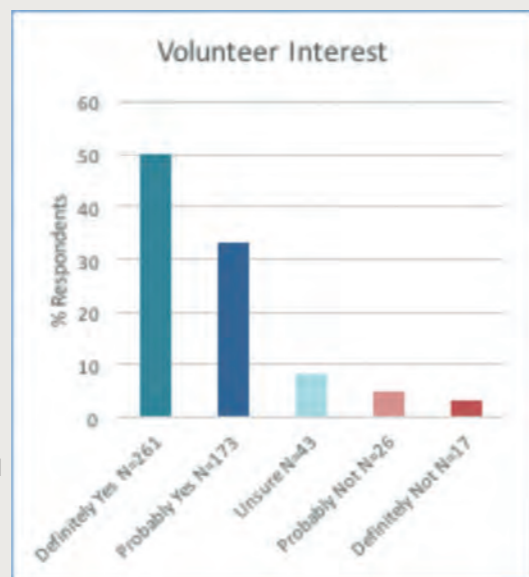
Case Report 18: Verified Responder: Several US Communities

Numerous smart phone apps are now available to alert laypersons of a nearby OHCA. ILCOR ad AHA have each recognized that these apps present important opportunities to improve bystander CPR rates as well as decrease the time to defibrillation by AED application prior to the arrival of professional responders. To date however, this strategy has largely been restricted to cardiac arrests that occur during awake hours and in public settings. As a consequence, only about 10% of cardiac arrests can potentially benefit from this innovative approach. GoodSAM, HeartRunner, and other programs in Europe and Asia are evaluating notifications for both public and private locations, greatly increasing the potential benefit.

The Verified Responder program is a novel strategy and the first in the United States that enlists off-duty professional responders who volunteer to respond to proximal cardiac arrests via smart phone app (PulsePoint platform), potentially during all hours and to both public and private settings. Each Verified Responder will also be equipped with a dedicated AED. This strategy provides an expanded application of a promising approach that can potentially overcome the current limitations due to OHCA location. The professional qualifications provide the requisite criterion to empower this volunteer group to potentially respond to provide CPR and defibrillation to all cardiac arrests in the community.

Goal:
1. Measure level of interest (and potential barriers) from health care and public safety professionals for this program in the Washington State where a program such as this is not available.
   Initial interest was measured through a targeted survey of professional responders and public safety professionals and volunteers where is was found that 83.3% of respondents were interested in volunteering for such a program. Of those interested, 89.3% would respond to both public and private locations.

2. Implement program in communities
   Five high performing communities have implemented the Verified Responder program in 2017. A total of 550 volunteers signed up and were assigned dedicated AEDs, covering a population of over 1.2 million people and roughly 700 square miles.

3. Evaluate program
   Evaluation is ongoing. Data from cardiac arrest events, cardiac arrest registries, PulsePoint, and surveys post activation is currently being collected for evaluation.

PulsePoint identifies location of the arrest and the location of a verified responder within a quarter-mile radius

Case Report 19:
Shockingly Simple – Restart a Heart campaign in King County, WA

The Challenge: It is well documented that quick action with an Automated External Defibrillator (AED) can saves lives, however it is challenging to encourage residents and members of the business community to purchase and register AEDs with EMS authorities. The Shockingly Simple – Restart a Heart Campaign is a marketing/media campaign designed to engage with business leaders and large employers to increase AED awareness, persuade businesses and large organizations to purchase AEDs for their worksite/marketplace, and register them with the King County PAD Registry. The campaign was designed to boost the regions efforts to increase the number of AEDs in the community, improve the ability to locate and use them during cardiac arrest and increase registration. AED registration allows 911 dispatchers to refer a caller to the nearest AED when needed. Registration is also required by WA RCW 70.54.310.)

The Result: The Shockingly Simple – Restart a Heart Campaign was launched in June 2012 with a distinctive logo and tagline, new web pages, media coverage, participation in high visibility sporting events, an informational toolkit and a promotional display which was used at public events. Registered AEDs were tagged with a highly visible "I am Registered" sticker in order to assist the community in locating non-registered AEDs. Fire departments were encouraged to allow fire inspectors to identify unregistered AEDs as a part of their routine inspections. Promotional materials were given to municipalities within King County to promote the Shockingly Simple campaign at public events in their communities. The campaign resulted in 13 media stories, 8 stories in association newsletters, 550 Prezi views on Vimeo in the first 3 months, and 22,136 website views in the first year, with a high of 3,348 views in June, the month of the campaign launch. Seventy different businesses registered 256 new AEDs in the months following the campaign launch. The King County PAD Registry currently contains the location of over 3,000 AEDs.

Biggest Obstacle to Implementation: Public awareness campaigns can be costly and the message can be difficult to sustain. The cost of media buys is expensive, therefore we tried to acquire as much 'earned media' as possible by staging media events of interest. Participation in community events and staffing displays is labor intensive. Use of volunteers is encouraged.

Case Report 20: Saving 200 more lives from OHCA in Norway;

Norway has a long tradition for CPR and first aid training, and a high bystander CPR rate. However, when comparing the national OHCA registries in Norway and Denmark, it turned out that although both countries report a little over 15% survival based on the Utstein template, for similar sized populations, 200 more OHCA victims were saved per year in Denmark. The explanation of this apparent paradox is a considerably higher proportion of attempted resuscitations in Denmark, 700 per m population compared to about 500 in Norway.

The Norwegian minister of health took personal interest in these findings and co-hosted in February 2017with the Laerdal Foundation a full day workshop at the Utstein Abbey, with participation of over 30 stakeholders from all relevant first aid and emergency medicine organizations in the country. The workshop agreed to start a national program focusing on training in CPR and first aid at all stages of life (lifelong learning), improved communication between bystanders and the Emergency Medical Dispatch Center (EMDC), increased use of additional resources (e.g. first responders) and increased use of the National Cardiac Arrest registry in system improvements.

By April 2018, over 20 organizations, representing both public and private partners, as well as all relevant NGOs, have enthusiastically joined this initiative. New measures include a stepwise approach for training all school children in first aid and CPR through grade 1-10, a national AED registry and a smartphone app that automatically transmit the callers GPS position to the dispatch center, saving time to dispatch of the ambulance and initiation of telephone-CPR

Most of the funding of the campaign has been provided by a generous grant of over 6 million Euros from the Gjensidige Foundation, the main owner of the largest insurance company in Norway. The campaign is coordinated by the Norwegian Directorate of Health, supported by a strategy document and an advisory board.

Future plans
In the years to come, the campaign aims at establishing more systematic training of high-school pupils, healthcare workers and minorities in accordance with the lifelong learning goal. Other projects relate to follow up and support of bystanders who perform CPR on OHCA victims and expanding the campaign to other time-critical events where the public can contribute to increased survival and prevent permanent damage to patients (stroke, myocardial infarction and severe traumas).

Health minister Bent Høie opens the national concensus meeting at Utstein Abbey

Case Report 21: Improving the out-of-hospital cardiac arrest patient by empowering the first responder in Belgium.

We investigated the location, 24/7 availability and maintenance of the Belgian public access defibrillators (PAD). Secondly we validated the feasibility of an application that strengthens the chain of survival. At present, timely deployment of an AED in Belgium is a matter of being at the right place, at the right time: nationwide training programs for the public cannot integrate a bystander-driven PAD strategy. Therefore our group developed a four pillar plan.

1. Goal
The ERC Guidelines 2015 highlight the critical importance of the interactions between the emergency medical dispatcher, the bystander who provides CPR and the timely deployment of an AED. Our study group analyzed the possibility to implement an application that draws these elements together, in order to improve survival after an OHCA in Belgium.

2. Methods
We investigated datasheets of the mobile emergency team from 2010 to 2015 to examine the use of PADs before their arrival. A structured telephone survey of the AED database maintained by the MoH was conducted and captured three key questions: current PAD location, availability 24/7 and whether a certificate of maintenance was available.
Secondly, we carried out a modified Delphi approach with participants from the 5 major stakeholders: the bystander, EMS provider, Government, EMD center and patient. a systematic search as performed to identify commercial available alerting systems for community first responders and defined their essential components. Data were plotted using Tableau 9.1.2. software.

3. Results.
An average of 10.924 OHCA was observed annually and survival rate was 7%. An AED was only used in 0,40% by bystanders before arrival of the ambulance. We noted that in rural area coverage is limited (Fig. 2). In addition a telephone survey of 570 PADs (10,1%) was conducted. Only 361 (63,0%) of the addresses matched with the officially registered data. 20,4% of the PADs were 24/7 available. Equally important, we found that availability was mostly associated with commercial or other dedicated opening hours. Of all the PAD owners, 367 (88,2%) had purchased a maintenance contract at the selling company.
The essential components of commercial alerting systems for community first responders are a PAD database, volunteer database and communication system for dispatching and guidance. At present there are no such systems implemented in Belgium. However, Belgian EMD centers are compatible and the general public is eager to use innovative approaches.

4. Conclusion
Recently our Belgian Healthcare Knowledge Centre (KCE) published a report about static AED's for opportunistic use by bystanders. We both highlight the lack of Belgian data on current PAD location, 24/7 availability, maintenance status and their use. This creates a significant delay in the development and launching of first responder applications for cardiac arrest in Belgium. PAD use prior to arrival of the ambulance is still rare. This weak link in the chain of survival needs strengthening.

5. The way forward

Future perspectives include a nationwide plan based on four pillars: i) an intelligent database for PADs and volunteer registry, ii) harmonization of reanimation education and training, iii) civilians as the extra tier in EMS, and iv) continuous quality improvement through scientific analysis and feedback.
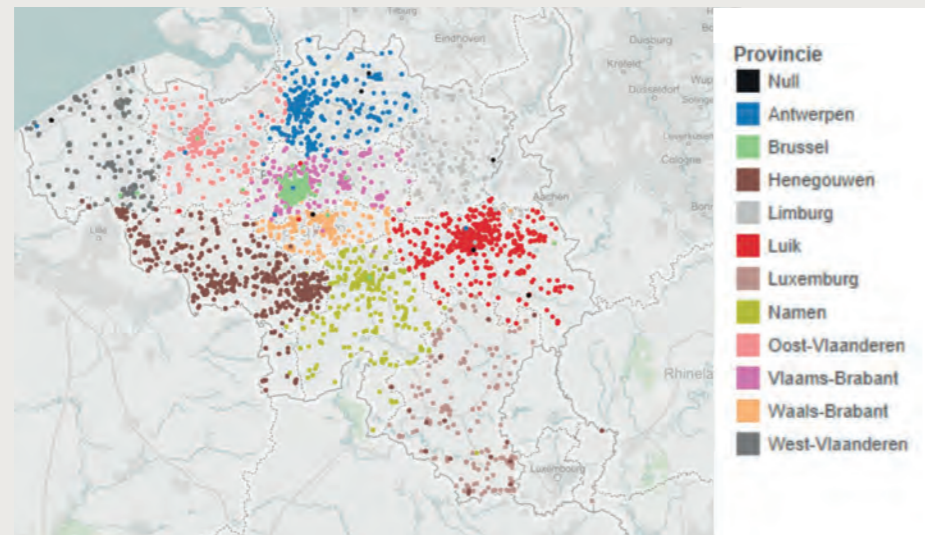

Figure 1: Localization of public-access defibrillators in Belgium. Each colour indicates another province.

Figure 2: Four pillar plan to improve the out-of-hospital cardiac arrest patient in Belgium.

Step 8: Make CPR and AED training Mandatory in School and the Community

RA Truism: It takes a system (including kids!) to save a victim

Mandatory training in CPR/AED has been part of the school curriculum in Norway for many years and in Denmark for 10 years. In the United States, 27 states have enacted legislation for mandatory high school CPR/AED training. This is a step in the right direction, but we must work toward communities in which all adults are trained in CPR and aware of AEDs and how to use them. A population universally trained in CPR has the potential to double survival rates. How to bring this about is a challenge. It could be argued that since CPR can occur any place in the community, anyone who works with public contact should be required to have CPR training. Simple curricula, many of which are on line or smart phone based, exist to provide the basics of CPR and AED use in the work place. Other curricula exist for lay persons in the home setting.

Seoul Metropolitan City has collaborated with Laerdal Medical to develop a new training program for home bystander CPR directed by the dispatcher (called dispatch-basic life support, DA-BLS) and implemented the new training program in four counties (2 million total population) in 2015 (Home Education and Resuscitation Outcomes Study, HEROS). The DA-BLS training program includes T-CPR in the curriculum in addition to standard BLS training program. It is a video-based, one-hour training program targeted for potential home bystanders, especially women and elderly.

Performance Goals:
- Train 100% of high school students in CPR prior to graduation
- Train 100% of public employees in CPR

Case Report 22: Well underway to training 5 million in CPR in the UK by 2020

By end 2017, over 65 % of secondary schools in the UK have joined the **British Heart Foundation (BHF) Nation of Lifesavers programme** and have received their free Call Push Rescue kits which allow a classroom of pupils to learn CPR at a time. Since the programme began in October 2014, over 2 million school pupils have been trained in CPR using this DVD-led training model. As a result of such a far-reaching programme, we are hearing of young people who now have the confidence to help in an emergency. Sarah Salami, a school pupil from South London, saved her Dad's life after he collapsed at home in May 2016. Sarah, who had learnt CPR at school just a few weeks earlier recognised the signs of cardiac arrest, dialled 999 and performed CPR for 10 minutes until the ambulance arrived.

Biggest Obstacle to Implementation: CPR is not mandatory in UK secondary schools, so there is a need for strong   engagement of teachers, pupils and parents. whilst continuing to campaign for CPR to be mandatory.

The BHF have also supported their corporate partners to invest in CPR training in the workplace for their employees. One partner seized the initiative and trained 16, 000 of their staff in 10 days with 11 lives saved to date as a result. The BHF also provides a part-funding defibrillator scheme helping local communities throughout the UK to purchase a public-access defibrillator. Also included is a free Call Push Rescue kit to train members of their community in CPR helping to strengthen the chain of survival.

The BHF has set an ambitious target to train 5 million people by 2020. Thanks to the school programme along with workplace and community training they had reached over 3 million by Oct 2017.

Alongside a successful marketing campaign, the BHF have invested in a programme of engagement to ensure schools continue to train their pupils in CPR year on year. Campaigns include **European Restart a Heart Day** 2017 which saw the BHF joining forces in collaboration with RC (UK), St John Ambulance, British Red Cross and all Ambulance Service Trusts across the UK to provide the resource which allowed 195,000 pupils to be trained in schools on the day.
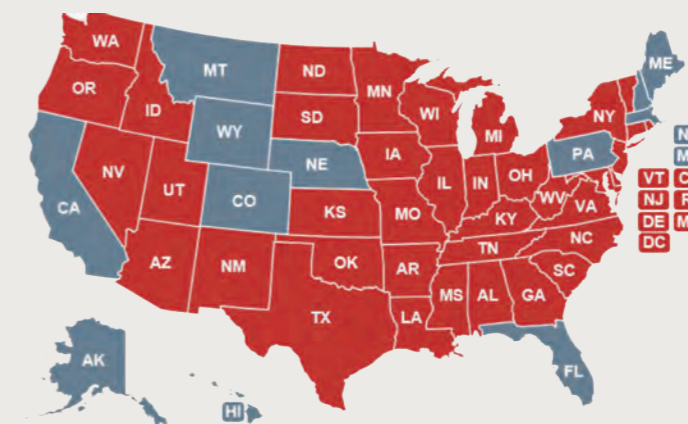

Case Report 23: School CPR Training is gaining momentum

5 European countries have introduced legislation mandating CPR training in schools, and 16 other countries have recommended this be done.

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In the USA, The American Heart Association is working to pass state laws that will assure all students are trained in life-saving CPR before they graduate from high school. By end 2017 38 states had passed legislation to introduce school CPR training, and more than 2 million students now receive school CPR training every year.

Case Report 24: Japan: EMS response at major sports events

Marathons

Impressive survival rates have been achieved through well organized EMS response to marathons in Tokyo. Over the past eight years there has been 37 cardiac arrest cases ; an incident rate of 2.0 in full marathon and 2.5 in half-marathons per 100,000 participants..20 cases were given defibrillation and 17 cases were not. CPC1-2 survival rate at one-month was 95.0 % (19/20 cases) when defibrillation was administered, versus 47.1 % (8/17 cases) with no AED. Statistically significant difference between the cases where both bystander CPR and PAD were delivered and the cases where the only bystander CPR took place without PAD (95.0 % vs. 47.1%; p < 0.05

Tokyo marathon medical support system
Goal: CPR performed within 1 minute and shock delivered within 3minutes

GPS dispatch   Medical control

AED support every 1.5 -2km   On foot BLS+AED every 1 km   Physician runner

Preparations for the 2020 Tokyo Olympics

Planning for response to medical emergencies at the 2020 Tokyo Olympic and Paralympic Summer Games are well underway. The Japan AED Foundation is now proceeding the "Cardiac arrest Zero Campaign" to aim no deaths from cardiac arrest occurred at any of the sports events. The main focus is on high-risk sports where cardiac arrest has occurred with relatively higher frequency in the past, such as Marathon, Swimming, Soccer, Baseball, Gymnastics, Golf, Basketball, Karate, Judo, and Kendo. The EMS response system is being planned in close collaboration with the respective sports association.

The plan is to train over 80,000 volunteers in BLS/AED skills as part of the Sports Medical Support System. The CPR training will be using the "CPR Classroom" system which in pilot tests has proved to be a cost- and time efficient method to train large numbers of people to perform good quality CPR

Case Report 25: St John New Zealand

The St John New Zealand ambulance service covers a population of just over 4 million people and attends greater than 4,000 cardiac arrests annually. In 2013 the St John New Zealand Out-of-Hospital Cardiac Arrest Registry was established giving St John the ability to collect data and ultimately report on outcomes from out-of-hospital cardiac arrest for the first time.

Challenge: The difficulty in reporting on technical data was to produce a document that explained to experts and lay people, the clinical outcomes from cardiac arrest. The report also had to be appealing and generate interest from our own staff, key stakeholders and the public. Moreover, as the intent was to engender accountability St John needed to compare our outcomes against other similar services.

Intervention: The challenge of making the report appealing and readable to a wide audience was met through incorporation of infographics and pictures to bring a reader's focus on key results. The requirement for accountability was met through engagement with international collaborators seeking permission to use results from their services alongside the results from St John. In addition, comparisons were made to results already in the public domain. This side-by-side accountability, although not perfectly aligned in some instances, gives direction and impetus for making improvements.

Results: In 2014 St John produced its first Out-of-Hospital Cardiac Arrest Registry Annual Report. Alongside the report posters and media releases were generated which highlighted what St John were doing well and where improvements could be made. This was well received by our staff, key stakeholders and public alike. More recently other services are also adopting the use of infographics in their report.

Additional plans: Moving forward the focus is on strengthening communications through consistent publications utilizing further improved infographics and incorporation of the 10-Steps within annual reports to increase goal-directed accountability.

The St John Out-of-Hospital Cardiac Arrest Registry Annual Reports are publicly available through this link: http://www.stjohn.org.nz/News--Info/ Our-Performance/Cardiac-Arrest-Annual-Report/

Executive summary

5 people a day
(approx) are treated for an out-of-hospital cardiac arrest in New Zealand (nearly 2000 per year)
32% female, 68% male

60%
of patients had bystander CPR performed

6%

The median time in which a St John ambulance reaches a patient is 7 minutes in urban communities and 11 minutes in rural and remote communities

of patients that had a cardiac arrest in public were defibrillated with a public access defibrillator

70%
of events were co-responded to and attended by the New Zealand Fire Service

29%
of patients survived the event (had a pulse on arrival at hospital)

16% of patients survived to hospital discharge

Response to all-cause, out-of-hospital cardiac arrest in adults where a resuscitation attempt was made by the responding EAS

Step 9: Work toward accountability – submit annual reports to the community

RA Truism: Share the Knowledge

An annual EMS performance report is the best way to declare accountability to the community. A system that is transparent in its performance wants to improve and respects the citizens it serves by sharing vital information. This radical idea will undoubtedly raise eyebrows among EMS directors, but why should a system collecting cardiac arrest data and having comparison data from peer communities hide the information? Sharing such important information is a way of being accountable. The information can be used to promote the organization if results are positive. If results are not positive, then the information should be used to motivate stakeholders including community leaders and politicians to invest in efforts to improve.

Performance Goals:

1. Publish annual report internally or externally including major metrics for cardiac arrest patients, response factors, program features

Key Elements in the Report Card could include the following:

a. Total population
b. Total number of worked cardiac arrests
c. Utstein survival (discharged survival from witnessed VF)
d. Survival from all rhythms
e. Percent of all arrests that are witnessed cardiac arrests
f. Percent of all arrests that have bystander CPR
g. Percent of bystander CPR due to dispatcher CPR
h. PADs registered with the EMS system
i. Number of cardiac arrests in which a PAD was applied prior to EMS arrival
j. Number of first responder or police responses to cardiac arrest and number of defibrillations prior to arrival of EMS personnel

Step 10: Work toward a Culture of Excellence

RA Truism: Everyone in VF survives

Creating and nurturing a culture of excellence is perhaps the most difficult step. What it is? An implicit awareness perceived by most or all members of the organization that high expectations and high performance define the standard of care. It requires leadership with a determined vision, ideally shared by the administrative and medical director. They need to meet regularly – perhaps weekly – to jointly administer and plan all aspects of the EMS programs and establish a long-term plan to create and maintain a culture of excellence. Many will argue that creating a

culture of excellence is extremely challenging. Nevertheless, a culture of excellence, hard though it may be to define or measure, is probably a key factor separating great systems from those that are merely satisfactory.

Administrative and medical leadership together must enhance training and continuing education and make medical QI the means of constant improvement. Excellence also requires buy-in from the extended EMS family of personnel. When EMS providers recognize the presence of sincere, mission-driven leadership, as opposed to lip service, they respond to the positive culture and contribute to it as well.

A culture of excellence can be achieved in any organizational model, but we believe it can more easily be accomplished in a medical based model. What is meant by a medical model? It is a system in which a medical director plays a large role in determining and supervising the quality of medical care, being responsible for the following seven areas:

- Protocols for dispatchers, EMTs, and paramedics
- Medical supervision online and offline
- Evidence-based practice
- Ongoing medical QI
- Training and continuing education
- Controlled substance policies
- Medical discipline

There is an eighth optional area of responsibility, namely, ongoing research studies. Continuous studies (to push the envelope of knowledge) create a sense of being part of a larger enterprise and helps foster a desire to contribute new evidence-based knowledge to the world of EMS. These studies do not have to be randomized clinical trials or be published in peer-reviewed journals. Small-scale projects can still make a contribution, and sharing the findings with the personnel can be rewarding and help to achieve a sense of pride.

A culture of excellence also demands ongoing quality improvement. The medical director, with the support of the administrative director, is responsible for conducting QI audits. The cultural norm says we (all of us who provide care) are measuring how we perform in order to perform even better. Medical QI can involve any aspect of EMS care. As it relates to cardiac arrest, the substrate for continuous QI is the cardiac arrest registry. Without QI, the cardiac arrest registry is just a collection of facts. With QI, the registry becomes the basis for improvement.

QI can occur at the macro system level or micro level (system components) or even individual resuscitations. At the system level one should be able to determine survival rates. For the micro level, QI bores down to system components:
What is the average time to CPR? Defibrillation?
What percentage of arrests have bystander CPR? Telephone CPR?
What is the average time to deliver CPR instructions?

Every link and every sub link in the chain of survival can be studied; the number of possible QI projects is limited only by resources and by the accuracy of the registry data. An EMS system should never become complacent. There are always opportunities for improvement, and continuous QI is the way to bring it about.

Improving skills among paramedics, EMTs, and telecommunicators is yet another way to work toward a culture of excellence. Skills improve with a combination of training, continuing education, and actual performance. In Seattle and King County, paramedics are required to perform 12 intubations and 36 IVs every year to maintain certification. Staffing correlates directly with opportunities to perform critical skills, and there are strong advocates for various types of staffing in EMS programs. Seattle and King County utilize a tiered response system and paramedics are sent only to the most serious calls. Thus, they are able to maintain critical skill such as endotracheal intubation. In other systems, a paramedic is sent to all EMS calls. These programs assume that service is thereby improved, since every call, regardless of the seriousness of the emergency, will have a paramedic in attendance. A consequence may be less opportunity for any single paramedic to perform critical skills and gain proficiency. Others send out physicians to the most serious calls. There are advocates for each approach. The responsibility of the Medical Director is to understand the relative strengths and weaknesses given the staffing model and help design the best strategy for his or her community.

Emergency telecommunicators are also members of the EMS team, mobilizing the responding units and initiating T-CPR. Their training, practice and skill review are as important to positive outcomes as are high-performance CPR and defibrillation. A highly trained dispatcher can increase the likelihood of the patient's survival, both with rapid dispatch and by offering T-CPR instructions.
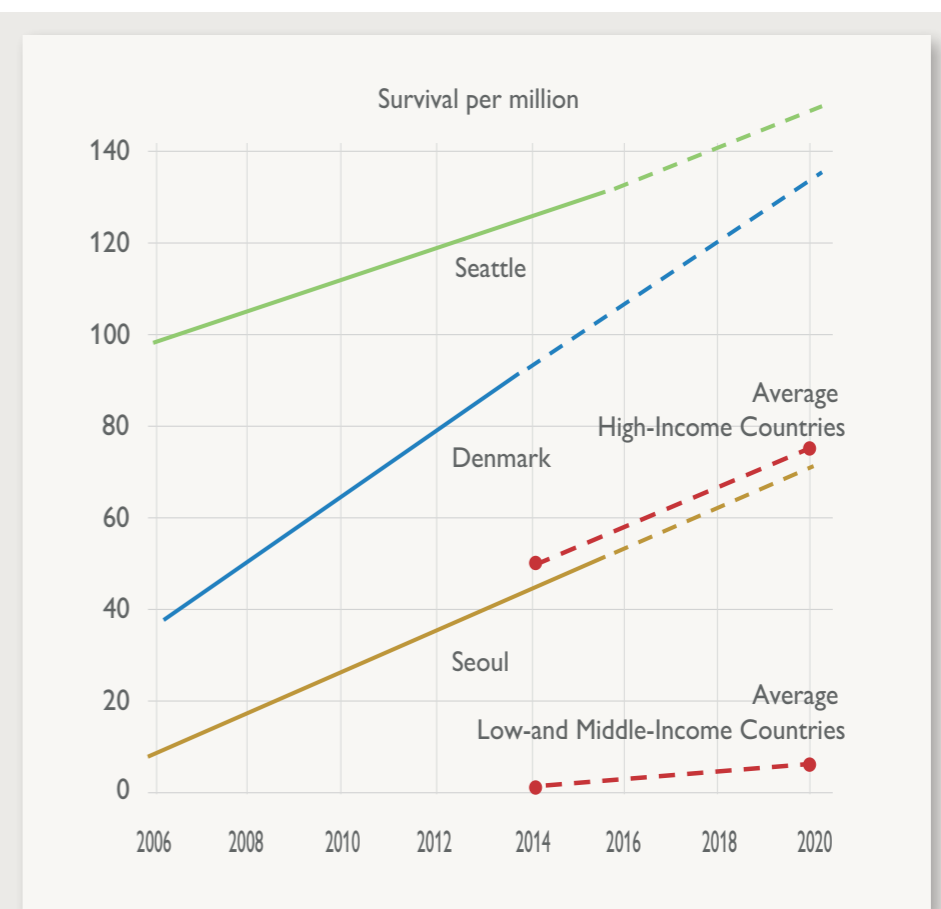
Performance Goals:
1. Convene leadership meetings once a month

> *"We would tear our department apart and rebuild it step by step, if we thought we were losing 4 to 6 citizens per year that should have been rescued from fires. So, when we know that we can save 4 to 6 additional people every year from cardiac arrest--are we as an agency going to step up and put the same energy into saving these CPR patients? Whether it is a person dying in a house fire or a person dying from cardiac arrest—to the family—dead is dead, and equally tragic, so why would we spend any less effort saving these patients?"*
>
> - Russ McCallion, Assistant Chief EMS & Training Divisions
> East Pierce Fire and Rescue, Washington

2. Analyze data in partnership with operations and medical director
3. Use data to inform training and protocols

Case Report 26: Impressive Increases in Survival

The graph shows survival from out-of-hospital cardiac arrest in Seattle, Denmark, and Seoul, leading EMS systems in their respective world regions, for the periods from 2006 through to 2014-16. The three systems are all founding members of the Global Resuscitation Alliance (GRA) and focus on adopting best EMS practice for improving survival.

Their results are impressive, showing almost doubling of survival in Seoul and tripling of survival in Denmark over ten years. The dotted lines indicate a further 50% increase of these survival numbers by 2020 by continuing the trends.

Several studies indicate that the average survival from cardiac arrest among EMS systems in high-income countries may be at a similar level as in Seoul, i.e. around 50 per million population (/m). Assuming these EMS systems adapt the GRA ten best practice steps, survival could increase 50%, i.e. to around 75/m in 2020. This is the goal set by the GRA, and would amount to 35,000 additional survivors per year.

In low- and middle-income countries, where 82% of the global population live, the situation is dramatically different. Very few witnesses of a cardiac arrest are trained to recognize and respond to such an emergency, the dispatch systems are not well established, and the ambulances (if at all available) typically arrive too late and with poorly-trained and poorly-equipped personnel. As a result, current survival may be as low as 1/m. By modest implementation of best practice, an increase in survival from 1 to 6/m by 2020 should be achievable, saving another 35,000 lives per year.

Part 4. 10 Actions to Achieve Implementation

To quote a cliché, "Good ideas are a dime a dozen." Without successful implementation good ideas will wither on the vine. The Utstein Formula for Survival, noted on page 11, stresses the importance of local implementation. Successful implementation, however, is difficult. The chain of survival metaphor contains important concepts that can contribute to survival, but implementing a community system of sudden cardiac arrest (SCA) survival requires understanding the strengths and limitations within a particular community. Communities have uniquely established operational processes, programs and personnel each with their own work styles, values, attitudes, guiding standards and protocols. One should always be aware of the community context when proposing new programs or policies.

> **Toolkits:**
>
> CARES Toolkit
> Community Foundation Toolkit
> Community PAD Toolkit
> DA CPR Toolkit
> End of Life Toolkit
> HP CPR Toolkit
> Police Defibrillation Toolkit
> Community CPR Toolkit

Prior to implementation of any program there has to be an awareness of the program's scope and the granular details of what is required. The Resuscitation Academy Tool Kits were developed to provide this information. They are how-to guides for setting up various programs within local communities, but even with tool kits, local community implementation can be challenging. Often the key to success lies at the local level where local community resources must be mobilized to focus on specific challenges to implementation.

We realize how hard it can be for local communities to decide what program or programs should be implemented. We think more attention must be focused on careful decision-making, the challenges of implementation, and the need to mobilize local community resources. Thus Part 4 tries to shine a beacon on the difficult topic of how to achieve successful implementation.

What does it takes communities to successfully implement the programs of the Resuscitation Academy. The question is also gaining attention at the national level – the American Heart Association recently published a consensus statement in 2011 appropriately called "Implementation strategies for improving survival after out-of-hospital cardiac arrest in the United States." Why does community A embrace these recommendations and transform their system and why does community B, given the same information, do very little to improve resuscitation? What is the secret sauce? Definitive answers are elusive, though there is no end to possible explanations. Is it individual charisma? Is it leadership? Is it complementary personalities? Is it legislative mandates

> "Thoughtful implementation will facilitate meaningful change."

(funded or not)? Is it adequate resources? Certainly some or all of these may provide part of the explanation. Common sense says that an effective leader can be a catalyst for change but such individuals are relatively rare and often the changes evaporate when that individual leaves or retires. Thoughtful implementation will facilitate meaningful change. (summarize and reference implementation paper in Resuscitation)

The following actions are practical aids as you strive to achieve successful and lasting programmatic improvements. Some or all may be useful to you.

> ### Actions for Successful Implementation of Resuscitation Programs
>
> 1. Select program or programs to implement
> 2. Form a team or advisory board
> 3. Determine how to make it happen in your community
> 4. Set specific goals
> 5. Achieve buy-in from agency personnel
> 6. Establish performance standards
> 7. Consider a pilot program
> 8. Communicate progress within the agency
> 9. Communicate with the public and EMS personnel
> 10. Support, Advocate, Celebrate

1. Select the program to implement

Initial energies should be devoted to implementing the core components typically easiest to implement and offering a high likelihood of immediate and dramatic improvements in results (the low hanging fruits). But how to choose which to implement first? Participation in a cardiac arrest registry is mandatory. If there is no state or country registry option, begin your own free-standing registry. While it cannot make cross-community comparisons, you can track your survival rate and other variables over time.

The next step to identify the best choice for programmatic implementation for your community can be to calculate an impact score. This approach has some subjectivity but enables a constructive way to think about which programs might be best. The equation is as follows:

The following table of six programs is an example of how every program has an associated survival impact, challenges of implementation and cost. It is meant as an example and each community should consider their own challenges. Though one can debate our "scoring" of the survival impact we try to indicate the relative importance of T-CPR, HP-CPR, and rapid dispatch relative to other interventions.

Table 4 : Typical program costs, challenges and impact

Program	Cost	Implementation Challenges	Survival Impact
T-CPR	Small	Small	Large
HP-CPR	Small	Small	Large
Rapid dispatch	Small	Small	Large
Record reus.	Modest	Small	Modest
Police defibrillation	Large	Large	Small
CPR/AED Mandatory	Modest	Modest	Modest

2. Form a team or advisory board

A team or advisory board can be immensely useful depending on the scope of the program you select. For small focused programs (such as beginning rapid dispatch) a large advisory board may not be required. For a larger program involving multiple constituencies or agencies a board can give support, guidance, and help achieve buy-in. We believe a team effort with shared vision is often the most important ingredient in the sauce of implementation. The vision can be as simple as improving survival from out of hospital cardiac arrest. The team or advisory board or steering committee (or whatever term you use), should ideally be led or co-led by: the EMS director (or fire chief or chief of EMS operations); the medical director with a core group consisting of the dispatch director; the head of personnel training; the QI officer (if one exists); a representative of the local hospital (or local hospital association); ideally a political leader (mayor or council member); and a citizen. This core group may be ad hoc or formal (in other words commissioned by the mayor or council with formal appointments), and all it takes is one enthusiastic and determined individual to catalyze the initiative. One person must be accountable to the board, keep everyone on task and maintaining forward momentum. The staff person should be thought of as the site coordinator who works on behalf of the advisory board.

3. Determine how to make it happen in your community.

Every program must be customized to the local system and its strengths. There is no one pattern. Rochester, Minnesota, has a completely different EMS system from Seattle and King County. And yet both achieve high survival rates proving that there is no ONE system. Each EMS leader must mobilize and strategize based on what is possible locally. Some stakeholders may be more or less motivated. Or the structure of the system may make a particular program challenging to implement. In one community, police response to cardiac arrest may be straightforward because of leadership and logistics while in another community such a program may have real leadership or design challenges. We recommend that the planning team or advisory group discuss goals and objectives for each area of change and decide which ones to focus on in which order. Optimally all areas must work together to achieve maximum survival rates, but this is a long-term process and must be carefully and strategically planned to achieve long-term success.

4. Set specific goals

This planning group must be realistic. They will need to consider community characteristics and the pace of change that the community will support. No system will be transformed overnight, and attainable goals should be achieved by prioritizing low-hanging fruits. Progress will likely be slow and iterative (step by step). The more you can help the planning group set achievable goals the better, especially in the early days where early successes might help motivate others to join. Once on the path to improvement there is no stopping that community.

Each step your planning and advisory group selects, needs its own goals. Whenever possible, provide explicit benchmarks including a timeline i.e. "Complete training of the EMS agency by March 1". If appropriate, share these goals with leaders and frontline personnel to achieve buy-in and help motivate performance. If progress is slow, reassess and invite others to provide input for how to refine the plan and its goals as part of program implementation.

5. Achieve buy-in from agency personnel

Leadership can't achieve much without support of agency personnel. The leaders must share and sell their vision outlining the importance of the proposed programs. Change can be very hard and the reasons for push back and resistance are numerous. Change may be perceived as unwelcome worsening of work conditions, or a misguided counterproductive effort because leadership does not understand field dynamics. Early discussions, careful listening, and being attentive to concerns among all the personnel can help achieve buy-in.

A presentation or materials might help explain the reasons for programmatic change. Highlighted goals of improved patient care and outcome can win over skeptical individuals to the effort. Another approach is to invite influential skeptics to help with decisions. This can transform a skeptic into a champion while also making for a better logistical approach. Buy-in is essential and you will need to extend yourself to make personal connections with those stakeholders who provide the logistical and leadership traction that will be required for implementation.

6. Establish performance standards

Earlier in this guide, we listed possible performance standards for telephone CPR and high-performance CPR. When you begin a new program, let everyone know what the standards are and why they matter. Then provide the training and support to meet these standards. Consistent (and timely) feedback is also part of the equation. A 2011 consensus paper from the American Heart Association calls for specific benchmarks and quality improvement goals for out-of-hospital cardiac arrest. These goals span the spectrum from medical leadership to dispatch to EMS to hospital care. Whether one agrees with the specific goals is in some way less important than the fact that performance standards are becoming part of the national dialogue on how to improve survival rates. The following are possible standards for an urban or suburban EMS system and are meant to complement the 10 specific steps at the

beginning of this guide. Note how the standards are weighted toward bystander CPR (whether by a trained person or as a result of dispatcher assistance) and the rapid delivery of CPR and defibrillation standards that will surely lead to improved survival. One might consider different standards depending on community and EMS characteristics. These standards provide an excellent basis to try to improve care. Highlighting cases with success or contrasting difficult cases helps cement the standards as a worthwhile effort.

Examples of Performance Standards:

- Bystander CPR in more than 60% of witnessed cardiac arrests Telecommunicator-CPR
  - o T-CPR in more than 50% of all cardiac arrests (excluding arrests when T-CPR cannot be provided EMS Response
  - o Less than 5 minutes between pickup of the call and the arrival of EMTs (designated first responders) at the patient's side more than 90% of the time
  - o Less than 10 minutes between pick-up of the call to 911 and the arrival of paramedics at the patient's side 90% of the time
- EMS High Performance CPR
  - o Provide performance standards for HP-CPR
  - o Rate of 100-120 compressions / minute
  - o CPR fraction of >90% for 10:1 compression: ventilation (or >80% for 30:2)
  - o Full recoil
  - o No pause in CPR > 10 seconds
  - o One second breaths
  - o No over ventilation (300-400 ml of air)
  - o Intubation and IV start with no stopping chest compressions
- Medical Review
  - o Use of the defibrillator recording to provide resuscitation review
  - o Physician review of each cardiac arrest
- Community survival rate - Discharged from hospital of 50% for patients with witnessed VF

7. Consider a pilot program

Consider a pilot of the program prior to full implementation. This could be implementation of a segment of the overall plan. Pilot program success should motivate even doubters and naysayers and provide credibility to your planning group with the rest of the community. A pilot program is a great way for everyone to gain experience with the program and work out the bugs as well as recalibrate goals and expectations. The pilot should be time-limited and include all stakeholders when you review the results and refine the larger implementation plan.

8. Get a little help from your friends

Seek help. Help can come from many sources. One obvious source is the Global Resuscitation Alliance. It is intended to share programs and resources and, most of all, provide support and encouragement to other communities-- particular communities which know their system needs improving but aren't sure exactly what to do or how to proceed.

9. Communicate to the public and to EMS personnel

It is important to share data and QI information with everyone in the EMS program, with elected officials and the public. Communicating directly to the public via press release of public forums is a way to be accountable to the community served. It also communicates to everyone (within the agency and the general public) that the EMS agency takes its performance seriously. Make sure to highlight areas in which you have created successes. Some success will convince community leaders that you have good ideas and provide the leverage to address other areas where you have not been yet achieved success. If small numbers lead to too much variability, then consider rolling averages that combine years to give a more reliable picture of your efforts.

10. Support, Celebrate, and Advocate

SUPPORT - Approximately 40,000 people survive SCA in the United States annually. For many survivors and their families, leaving the hospital after experiencing a sudden cardiac arrest can be unsettling. For instance, many survivors receive an implantable cardioverter defibrillator (ICD) to prevent future fatal arrhythmias and may have concerns related to the device and what activities are safe.

Partner with local hospitals and other advocacy groups to develop a cardiac arrest survivor forum for patients and families and, when possible, share resources with family members of surviving patients. In addition, grief support and resources may also be shared with families of the many victims who do not survive. Often times, it is these family members who go on to become community champions and advocates for improved survival.

Survivors also commonly deal with memory loss or delayed recall. Forgetfulness and/or a reduced ability to comprehend or problem-solve can lead to increased stress, anxiety, anger and depression. These issues can be managed. Making sure survivors and their families have the support and connections they need to local and online resources as part of the community's chain of survival.

CELEBRATE - Throw a party. Invite officials, the public, employees, and especially survivors. Let everyone know when the survival rate increases and next steps to continue the success. Such a celebration contributes to the culture of the agency and publicly pronounces the commitment to doing everything possible for cardiac arrest patients.

ADVOCATE - Survivors play an integral role in educating the public about sudden cardiac arrest. Sharing survivor stories can powerfully influence EMS agencies and hospital providers and can be leveraged to challenge the public to learn CPR and place AEDs in their neighborhoods. Survivors increase awareness of SCA through appearances, media interviews, and fundraisers.

Survivors also take an active role in advocating for policy change at the local, state, and national levels. For example, many states have passed legislation mandating or recommending CPR and AED training in middle and high schools. Survivors, and family members of victims lost to SCA are in most cases behind the scenes driving this important work.

Part 5. Conclusion

Current survival from out of hospital cardiac arrest is unacceptably low and there is wide disparity across communities. We call for action to change this unacceptable situation and urge all communities to embrace the messages of the Global Resuscitation Alliance and the Resuscitation Academy to implement best practices, including the 10 steps to improve cardiac arrest survival.

We fervently believe that community EMS leaders can acquire the knowledge, skills, tools, and motivation to achieve best practices in their communities.

The Global Resuscitation Alliance will also help train and motivate local leadership and provide that leadership with the resources and training materials to offer RAs in their communities. In this sense the Global Resuscitation Alliance is a catalyst to improve resuscitation at the local level. EMS systems that have implemented many of the steps described in this document report significantly improved survival. Shouldn't all communities do the same?
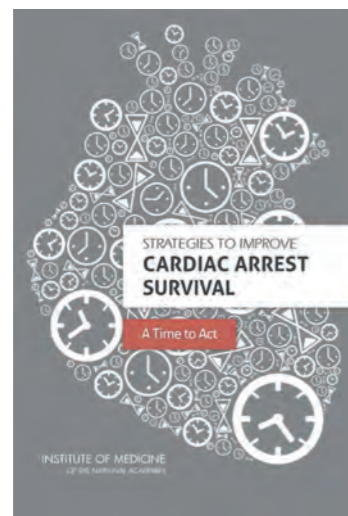
Part 6. Appendix

Recent national and international reports address the challenges of improving cardiac arrest survival and implementing quality programs. These comprehensive reports come from the Institute of Medicine, Resuscitation and the European Resuscitation Council ILCOR report, and the Scottish Government. All three reports were issued in 2015 and all complement and support the recommendations in our Call to Establish a Global Resuscitation Alliance.
Following are very brief summaries or a brief selection of the three reports:

Scotland

A national strategy for Out-of-Hospital Cardiac Arrest (OHCA) was developed in 2015 in a collaboration among a range of stakeholders.

The strategy aims to increase survival rates after OHCA by 10% across the country within five years. Reaching this level of performance would mean around 300 more lives being saved every year compared to recent years. Starting an improvement programme now could result in a total of 1,000 additional lives saved by 2020. The strategy also aims to equip an additional 500,000 people with CPR skills by 2020. Increasing the incidence of bystander CPR is the cornerstone of improving outcomes because prompt bystander CPR can increase the likelihood of survival after OHCA by 2 or 3 times.from cardiac arrest.
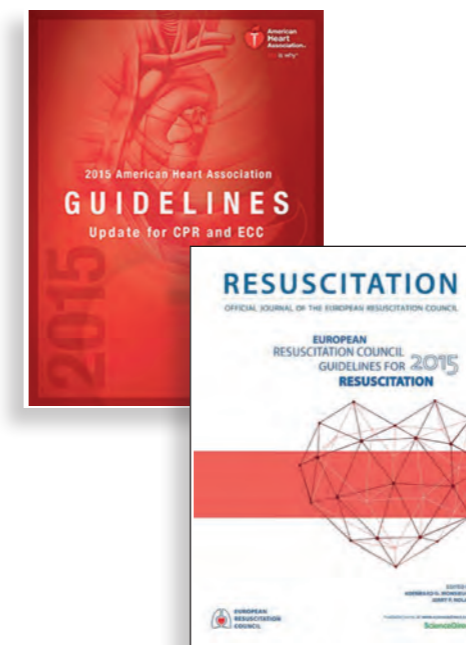
The Institute of Medicine Report on Cardiac Arrest

Community best-practices for resuscitation described above are supported by the US Institute of Medicine issued Strategies to Improve Cardiac Arrest Survival: A Time to Act issued in June 2015. This detailed report was the first time the United States federal government dealt with this topic in such a formal and sanctioned manner.

Key to the report are eight recommendations:
- Establish a national cardiac arrest registry
- Foster a culture of action through public awareness and training
- Enhance the capabilities and performance of emergency medical services (EMS) systems
- Set national accreditation standards related to cardiac arrest for hospitals and health care systems
- Adopt continuous quality improvement programs
- Accelerate research on pathophysiology, new therapies, and translation of science for cardiac arrest
- Accelerate research on the evaluation and adoption of cardiac arrest therapies
- Create a national cardiac arrest collaborative

Although typically more conceptual, many of these Institute of Medicine recommendations track directly to the 10 steps for improving survival from cardiac arrest.

The International Liaison Committee on Resuscitation (ILCOR) was formed in 1992 to provide a forum for discussion and for coordination of resuscitation worldwide. Based on the ILCOR review and consensus on science and treatment, regional resuscitation councils publish their respective guidelines as basis for education and implementation.

The American heart Association and the European Resuscitation Council (ERC) both published their updated 2015 CPR Guidelines on Oct 15.

The excerpt to the right from the executive summary of the 2015 ERC Guidelines, from the October 15 issue of the journal Resuscitation, illustrates how aligned the ten steps suggested by this report are with the most recent science.

Excerpt from the journal Resuscitation October 15 2015

Summary of the changes since the 2010 Guidelines

Adult basic life support and automated external defibrillation

- The ERC Guidelines 2015 highlight the critical importance of the interactions between the emergency medical dispatcher, the bystander who provides CPR and the timely deployment of an AED. An effective, co-ordinated community response that draws these elements together is key to improving survival from out- of-hospital cardiac arrest (Fig. 1.1).
- The emergency medical dispatcher plays an important role in the early diagnosis of cardiac arrest, the provision of dispatcher- assisted CPR (also known as telephone CPR), and the location and dispatch of an AED.
- The bystander who is trained and able should assess the collapsed victim rapidly to determine if the victim is unresponsive and not breathing normally and then immediately alert the emergency services.

Fig. 1.1. *The interactions between the emergency medical dispatcher, the bystander who provides CPR and the timely use of an automated external debrillator are the key ingredients for improving survival from out of hospital cardiac arrest.*

- The victim who is unresponsive and not breathing normally is in cardiac arrest and requires CPR. Bystanders and emergency medical dispatchers should be suspicious of cardiac arrest in any patient presenting with seizures and should carefully assess whether the victim is breathing normally.
- CPR providers should perform chest compressions for all victims in cardiac arrest. CPR providers trained and able to perform rescue breaths should combine chest compressions and rescue breaths. Our confidence in the equivalence between chest compression- only and standard CPR is not sufficient to change current practice.
- High-quality CPR remains essential to improving outcomes. The guidelines on compression depth and rate have not changed. CPR providers should ensure chest compressions of adequate depth (at least 5 cm but no more than 6 cm) with a rate of 100–120 com- pressions min–1. After each compression allow the chest to recoil completely and minimise interruptions in compressions. When providing rescue breaths/ ventilations spend approximately 1 s inflating the chest with sufficient volume to ensure the chest rises visibly. The ratio of chest compressions to ventilations remains 30:2. Do not interrupt chest compressions for more than 10 s to provide ventilations.
- Defibrillation within 3–5 min of collapse can produce survival rates as high as 50–70%. Early defibrillation can be achieved through CPR providers using public access and on-site AEDs. Pub- lic access AED programmes should be actively implemented in public places that have a high density of citizens.

International Liaison Committee for Resuscitation

The International Liaison Committee for Resuscitation (ILCOR) is a global partnership of the 7 major Resuscitation Councils from around the world. ILCOR was formed in 1992 to provide a forum for liaison between principal resuscitation organisations with the shared vision of saving more lives globally through resuscitation.

ILCOR pursues its vision through:

- Rigorous and continuous review of scientific literature focused on resuscitation, cardiac arrest, relevant conditions requiring first aid, related education, implementation strategies and systems of care
- Publishing regular and ongoing consensus on science with treatment recommendations
- Collaborating with others to facilitate knowledge dissemination and exchange, inform effective education and training, implement and share trusted evidence-informed resuscitation practices
- Enhancing capacity through mentorship and fostering the next generation
- Leading the international resuscitation research agenda to address gaps in knowledge and promote funding related to resuscitation and relevant first aid practices
- Encouraging engagement of patients, families and the public as partners in our activities
- Monitoring and report incidence, process of care and outcomes to improve patient care
- Building the foundation to evolve from international to global impact

Since its inception, ILCOR has produced consensus on science and treatment recommendations every 5-6 years, with the fifth set published in October 2015. In addition it has developed key advisory statements on education, targeted temperature management, defibrillation, AED use as well as the standardized reporting for cardiac arrest registries (Utstein style reporting guidelines).

ILCOR is pleased to work with the Global Resuscitation Academy to promote the implementation of best evidence highlighted during the 2015 Consensus on Science and Treatment Recommendations and summarized below.

Gavin Perkins, Vinay Nadkarni, Co-Chairs, ILCOR

ILCOR members: American Heart Association (AHA), European Resuscitation Council (ERC), Heart and Stroke Foundation of Canada (HSFC), Australian and New Zealand Committee on Resuscitation (ANZCOR), Resuscitation Councils of Southern Africa (RCSA), Inter American Heart Foundation (IAHF) and the Resuscitation Council of Asia (RCA).

Ten steps to improve cardiac arrest survival	ILCOR recommendation	ILCOR Reference	Journal Reference
Establish a cardiac arrest registry	Utstein recommendations for reporting Out of Hospital cardiac arrest.		Resuscitation. 2015;96:328-40
Begin Telephone-CPR with ongoing training and QI	We recommend that dispatchers provide chest compression-only CPR instructions to callers for adults with suspected OHCA(strong recommendation, low-quality evidence).	Dispatcher instruction (BLS 359)	Resuscitation. 2015;95:e43-69.
Begin high-performance EMS CPR with ongoing training and QI	We continue to place strong emphasis on the importance of delivering high-quality CPR.	Early, High-Quality CPR	Resuscitation. 2015;95:e43-69.
Measure professional resuscitation using the defibrillator recording *(and voice if possible)*	We recommend data-driven, performance-focused debriefing of rescuers after IHCA in both adults and children (strong recommendation, low-quality evidence). We suggest data-driven, performance-focused debriefing of rescuers after OHCA in both adults and children *(weak recommendation, very-low-quality evidence).*	Debriefing of resuscitation performance (EIT 645)	Resuscitation. 2015;95:e203-24
Use smart technologies to extend CPR and public access defibrillation programs to notify volunteer bystanders who can respond to nearby arrest to provide early CPR and defibrillation	We suggest that individuals in close proximity to a suspected OHCA episodes who are willing and able to perform CPR be notified of the event via technology or social media	Social media technologies (EIT 878)	Resuscitation. 2015;95:e203-24
Make CPR and AED training mandatory in schools and the community	Kids save lives –: Training school children in cardio-pulmonary resuscitation worldwide	WHO endorsed statement	Resuscitation. 2015;94:A5-7.
Work toward accountability – submit annual reports to the community	We suggest the use of performance measurement and quality improvement initiatives in organizations that treat cardiac arrest *(weak recommendation, very-low-quality evidence).*	Measuring performance of resuscitation systems (EIT 640)	Resuscitation. 2015;95:e203-24

Global Resuscitation Alliance - GRA - Mission Statement

Renowned international organizations, emergency medical services, and resuscitation leaders achieved consensus on the establishment of a Global Resuscitation Alliance May 28-29th 2016 in Copenhagen at an international Utstein Meeting. This global network focuses on collaborating to implement best practices to increase survival from sudden cardiac arrest. The participants committed themselves to the ambitious target of increasing survival rates by 50 percent. This agreement, signed in Copenhagen, Denmark and constituting the culmination of years of international effort, is a major and decisive step in global efforts to save more lives from sudden cardiac arrest.

The participants support the establishment, mission, and goals of the Global Resuscitation Alliance and commit themselves to continue this important work.

Support by
Representatives at the International Utstein Meeting on Implementation

EMS systems, ambulance services and relevant organizations:
- North America
  - Seattle by Michael Sayre/Tom Rea/Ann Doll
  - Maryland Resuscitation Academy by Kevin Seaman
- Europe
  - Emergency Medical Services, Copenhagen, Denmark (on behalf of the EMS leadership network in Europe
  - London Ambulance Service, UK by Fionna Moore
  - Scottish Ambulance Service, UK by James Ward /Paul Gowens
  - Emergency Medicine and Services, Helsinki and Uusimaa Region, Finland, by Maaret Castrén
  - Institute for Emergency Medicine, University Hospital Schleswig-Holstein, Germany by Jan-Thorsten Graesner
  - Stavanger University Hospital, Stavanger, Norway by Eldar Søreide/Conrad Bjørshol
- Australia-New Zealand
  - Victoria Ambulance Service, Australia by Tony Walker /Karen Smith
- Asia
  - Seoul EMS Support Network by Sang Do Shin
  - Tokyo EMS by Hideharu Tanaka
  - Singapore EMS by Marcus Ong /Ng Yih Yng
  - GVK Emergency Management and Research Institute India by Ramana Rao

Resuscitation Academies:
- Resuscitation Academy, Seattle (Ann Doll)
- Seoul EMS Resuscitation Academy (SERA) by Sang Do Shin
- Singapore Resuscitation Academy by Marcus Ong / Ng Yih Yng
- Tokyo Resuscitation Academy JFEM by Hideharu Tanaka
- European Resuscitation Academy by Maaret Castrén

Organizations and foundations:
- Laerdal Foundation by Tore Laerdal
- American Heart Association by John Meiners and Russell Griffin
- Norwegian Air Ambulance Foundation by Hans Morten Lossius/Stephen Sollid
- International Federation of Red Cross / Red Crescent by Pascal Cassan
- Hamad International Training Centre, Hamad Medical Corporation, Qatar by Khalid Abdulnoor Saifeldeen
- Pan-Asian Resuscitation Outcomes Study Clinical Research Network by Marcus Ong
- European Registry for Cardiac Arrest (EuReCa) by Jan-Thorsten Graesner
- Norwegian Cardiac Arrest Registry by Jo Kramer-Johansen
- Resuscitation Research Group, Edinburgh, Scotland, by Paul Gowens / Gareth Clegg
- European Resuscitation Council by Maaret Castrén
- International Liaison Committee on Resuscitation (ILCOR) by Judith Finn

Global
Resuscitation
Alliance