

'Cardiac Arrest' – The CPR Song

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INTRODUCTION

Out-of-hospital cardiac arrest (OHCA) is a major public health problem. The exact incidence of sudden cardiac arrest is unknown but is estimated to be between 180,000-450,000 in the US.¹ Only 8–11% of people that are treated by EMS survive in the United States.² Survival rates in the US according to CARES (Cardiac Arrest Registry to Advance Survival) 2021 were 9.1%³ (The 2021 dataset represented about 51% of US population).

Novel strategies are needed to improve outcomes from OHCA. One such intervention is proposed and discussed in this article – the utilization of an instructional Cardio-Pulmonary Resuscitation (CPR) Song – titled 'Cardiac Arrest',⁴ with the intent to positively influence bystander CPR rates in the lay public. (<https://www.youtube.com/watch?v=e0il2tqaGAU>)

THE CHAIN OF SURVIVAL

The key to effective treatment of cardiac arrest is a strategy called the "Chain of Survival".⁵

The components include:

- Recognition of cardiac arrest and activation of the emergency response system
- Early cardiopulmonary resuscitation (CPR) with an emphasis on chest compressions
- Rapid defibrillation
- Advanced resuscitation by Emergency Medical Services and other healthcare providers
- Post-cardiac arrest care
- Recovery (including additional treatment, observation, rehabilitation, and psychological support)

The first 3 components are very time sensitive, and outcomes rapidly decline if treatment is not provided promptly. Moreover, there is a higher likelihood of presence of a lay-person rather than a medically trained person at the time and place of a cardiac arrest. Neurologically intact survival decreases by 7–10% for every minute that a person with OHCA goes without CPR and defibrillation.^{6,7} Not all links in this chain of survival are equal. Data from the NHS in England indicate that the biggest 'drop' in survival occurs in the first link.⁸ Survival to hospital admission as per CARES

2021 data is only 24.7%.³ Some well-established factors that improve survival include bystander CPR, early defibrillation and early advanced cardiac care.

EARLY INTERVENTION AND BYSTANDER CPR

Bystander CPR may more than double survival rates. In a Japanese study from 2012 by S. Nakahara et al,⁹ increased bystander CPR rates from 2005–2012 (from 38.6% to 50.9%) more than doubled the neurologically intact survival (from 3.3% to 8.2%). A European study¹⁰ that included data from 27 countries showed a bystander CPR rate of 47.40% (range 6.3–78%). In the US, as per 2021 CARES data,³ the survival to discharge rate for patients receiving bystander CPR was significantly higher than that of patients who did not receive bystander CPR (11.2% vs 6.7%, $p < 0.0001$).

Bystander CPR rates in the US greatly vary between states and urban/rural setting and are between 10–65%.¹¹ In the states participating in the CARES registry (Currently 30 states participate within the US) the bystander CPR rate in 2021 was 40.2%.

For comparison, in the state of Rhode Island, the bystander CPR rate was 20%.¹² Though membership in the CARES registry improves outcomes, the state of Rhode Island does not participate in the CARES registry due to financial barriers.¹³

EFFORTS TO IMPROVE BYSTANDER CPR

In the first few minutes after cardiac arrest, it is more likely that the patient will be surrounded by lay persons not trained to do CPR. It is estimated that only about 2.4% of the US population undergoes CPR training annually.¹⁴ Several other modalities have been tried and have, to varying degrees, proven to be useful early interventions in the first 3 links in the chain of survival. These include CPR kiosks in public locations,¹⁵ mass trainings of large number of people, instructional role-playing games, virtual reality programs,^{16,17} and 1- to 8-minute-long video instructions for compression only CPR.¹⁸ Additionally, to address the challenge of early appropriate intervention by bystanders and improving CPR training, several leading organizations have programs targeting such goals. World Health Organization's "Kids Save Lives",¹⁹ American Heart Association had a goal of training 20 million people per year in CPR by 2020 and

“All Citizens of the World Could Save a Life”²⁰ are some such initiatives. Despite all the efforts, bystander CPR rates remain low and there remains much opportunity for novel strategies for improvement.

CHALLENGES

Some of the factors affecting bystander initiation of early CPR, calling EMS and use of AED, include insufficient training due to 3–4-hour long duration of the classes and high cost of BLS training sessions, the need for trained instructors, lack of awareness of where and how to get training and lack of motivation. Other well-known barriers to CPR performance include fear of causing harm, fear of litigation, complexity of performing mouth-to-mouth rescue breathing, reluctance to make mouth-to-mouth contact, rescuer’s physical limitations, and panic.^{18,21,22,23,24}

‘CARDIAC ARREST’: THE CPR SONG

A potential way to reach the lay public, as a component of a broader health care intervention or as an independent public service message, could be music in the form of a lyrically instructional CPR song. This may be useful from memory by repeated exposure or even by playing actively if feasible, during a cardiac arrest occurrence. The specific intent is to increase bystander CPR rates in the public.

It was theorized that the ideal CPR song ought to include concise, simple and instructional lyrics that are backed by latest evidence and guidelines. Moreover, it may be updated as new evidence comes in.

The song, if set to a tempo of 110 beats per minute (bpm) could enable people to perform chest compressions at the recommended rate (100–120 bpm) and allow for a ±10 bpm margin of error.

Many individuals trained in Basic Life Support (BLS) and Advanced Cardiac Life Support (ACLS), including those working in health care, already utilize various songs and their tempo to guide the rate of initial chest compressions (for example, ‘Stayin’ Alive’ Bee Gees, 1977, which was recorded at 104 bpm). There have been other songs and music videos endorsed by medical organizations including the American Heart Association (AHA) and the British Heart Foundation, but they tend to utilize popular songs (e.g., ‘Stayin’ Alive’) and use their tempo to aid in appropriate chest compression rate (100–120 bpm).^{25,26,27} The CPR song (“Cardiac Arrest”⁴) written by the first author is composed with the specific purpose of delivering the message of early and appropriate intervention for a cardiac arrest. Gender neutral pronouns are used to be more inclusive. The intended outcome is an increase in bystander CPR attempts and where possible, defibrillator use.

The lyrical content of the song is presented in **Figure 1** and the rationale for word selection is provided in **Figure 2**.

Figure 1.

The CPR song: Cardiac Arrest
If you see a person unconscious Ask them “hey, you okay?” If you see that they are not breathing Or breathing strange, don't delay
<i>Cardiac arrest</i> <i>Cardiac arrest</i> <i>You gotta start chest compressions right away</i> <i>Cardiac arrest</i> <i>Cardiac arrest</i>
You gotta call 911 right away If a friend is with you Send them to get a Defibrillator right away
<i>Cardiac arrest...</i>
Put your palms on the center of their chest Push 2 or 3 inches deep Pump to save a life now Keep on pumping with this beat
<i>Cardiac arrest...</i>
If you think they did drugs Give them a narcan Spray in the nostrils, right away
<i>Cardiac arrest...</i>

Figure 2.

AHA Recommendations & Comments on Lyrical Incorporation
Recognize cardiac arrest immediately by checking: 1. Unresponsiveness 2. Absence of normal breathing, such as: a. Apnea b. Gasping for air or “strange breathing”
Lay rescuers recommended <i>not</i> to check a pulse: • Call EMS/911 • Initiate CPR Compression-only CPR; no ventilations Palm placement on the “Center of the chest”; lower half of sternum Fast (100-120/min) Deep (2-2.5 inches) Allow chest wall recoil • Few interruptions in chest compressions as possible
Use of Naloxone Naloxone administration may be considered after initiation of CPR if there is high suspicion of opiate overdose. (~6% OHCA due to drugs)
Do not hyperventilate No mention of avoiding hyperventilation in the lyrics for ease of understanding
Defibrillator • Ask someone to get a defibrillator • Once you have it, use it as soon as possible • Put pads on the chest. Pad placement is usually indicated on the defibrillator kit, if available. • After shock is delivered, immediately resume CPR

DISCUSSION & FUTURE DIRECTIONS

There is much room for improvement in making the chain of survival more effective and potentially save lives. The medical field is increasingly complex and though access to information has become much easier due to the information technology and internet revolution, misinformation and conflicting information for the lay persons have emerged as public health challenges. For a public health recommendation to practically become effective and change outcomes in the real-world setting, the communication to laypersons must ideally be clear, easily understandable and uniform across multiple organizations. Communication by the medical community via art and music is underutilized and perhaps a potential avenue to bridge the communication gap between the medical community and the lay public.

Dispatcher-guided CPR or telephone-CPR (tCPR) is a promising way to improve multiple outcomes to varying degrees. A Swedish study by Bång et al²⁸ showed tCPR being offered by dispatchers in less than 30% OHCA cases, and CPR with dispatcher assistance completed in <15% cases (8 in all). Two reviews by Vaillaincourt et al²⁹ in 2011 and Drennan et al³⁰ in 2021 demonstrated dispatcher recognition of OHCA with 70% and 79% sensitivities respectively.

In a prospective, before-after study³¹, tCPR has been associated with decreased time to commence CPR –256 to 212 seconds ($p<0.001$) corresponding with a tCPR rate increase from 43.5% to 52.8% (9.3%) in the same period.

In one systematic review,³² tCPR was associated with increased survival in four studies but with a trend toward decreased survival in one. In a later study³³ by Wu Z et al, survival at hospital discharge as well as favorable functional outcome at hospital discharge were found to be improved compared to no CPR group (multivariate adjusted odds ratio for survival at hospital discharge was 1.64 (95% CI, 1.16–2.30) and for favorable functional outcome at discharge was 1.56 (95% CI, 1.06–2.31) for TCPR). Overall survival in the study remained at 11.5%.

In the above-mentioned study by Bobrow et al,¹⁸ laypersons exposed to even an ultra-brief video (1 minute in length) were more likely to attempt hands-only CPR and showed superior skills compared to untrained laypersons. The effects of brief interventions (1 minute, 5 minutes & 5-minute video + 3-minute practice) were reflected even 3 months later after a single intervention, in increased bystander CPR attempts and quality of CPR.

A recent systematic review by Pellegrino, Vance J and Asselin N³⁴ found trends towards improved CPR metric performance in groups who were exposed to songs during treatment, though this only reached significance when groups were tested at >30 days from initial exposure. Additionally, they suggested that song selection should favor beats per minute closer to the midpoint of the 100–120 ideal range to allow for variation when used as mental metronomes. The tempo of ‘Cardiac Arrest’, consistent with that idea, is set at 110 bpm.

The authors are currently working on a public health intervention using the Intervening Mapping process^{35,36}

where the song is one component of a broader intervention – accompanied by an instructional video, skill exercises, and a social media community support group among others.

Constructs from the Health Belief Model³⁷ and Social Cognitive Theory³⁸ were used in making the song to impact cognitive determinants of behavior. The theoretical methods used include information chunking, repeated exposure and cues with the intent and hope to increase bystander CPR rates in the lay public and thereby attempting to increase survival and neurologically intact survival from OHCA.

An additional advantage of using art forms, including music, to disseminate accurate scientific medical ideas is its cost effectiveness (even in resource poor settings), wider reach in the society, and pan-cultural adaptability. The song can be re-composed in different languages and genres. Moreover, the ideas carried via music and art do not necessarily require high literacy rates in the intended audience, which may be a major determinant in low-resource settings globally.

Fundamental societal structures and relations of individuals within our modern society are rapidly evolving and are being redefined. Though the medical scientific community faces new challenges in disseminating accurate ideas in the public interest, the new landscape brings with it numerous opportunities for novel effective strategies.

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Disclosure

Saud Dhillon, MD, owns the intellectual copyrights to the song "Cardiac Arrest"

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