



# VOLUNTEER RESPONDERS: INCREASING SURVIVAL RATES OF CARDIAC ARREST INCIDENTS

EENA WEBINAR NOVEMBER 8, 2023

DAVID FREDMAN & MADS CHRISTIAN TOFTE GREGERS



# CONFLICT OF INTEREST

- David Fredman RN, PhD
- Member of EENA Tech&Ops committee
- Member of the Swedish CPR council
- Co-founder and operations manager of Hearrunner Sweden

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## OUT OF HOSPITAL CARDIAC ARREST

- OHCA kills 1000 people every day around the world
- Over 340 000 die every year in Europe



# CARDIAC ARREST

- Common and Lethal
- The dramatic ones occur in public



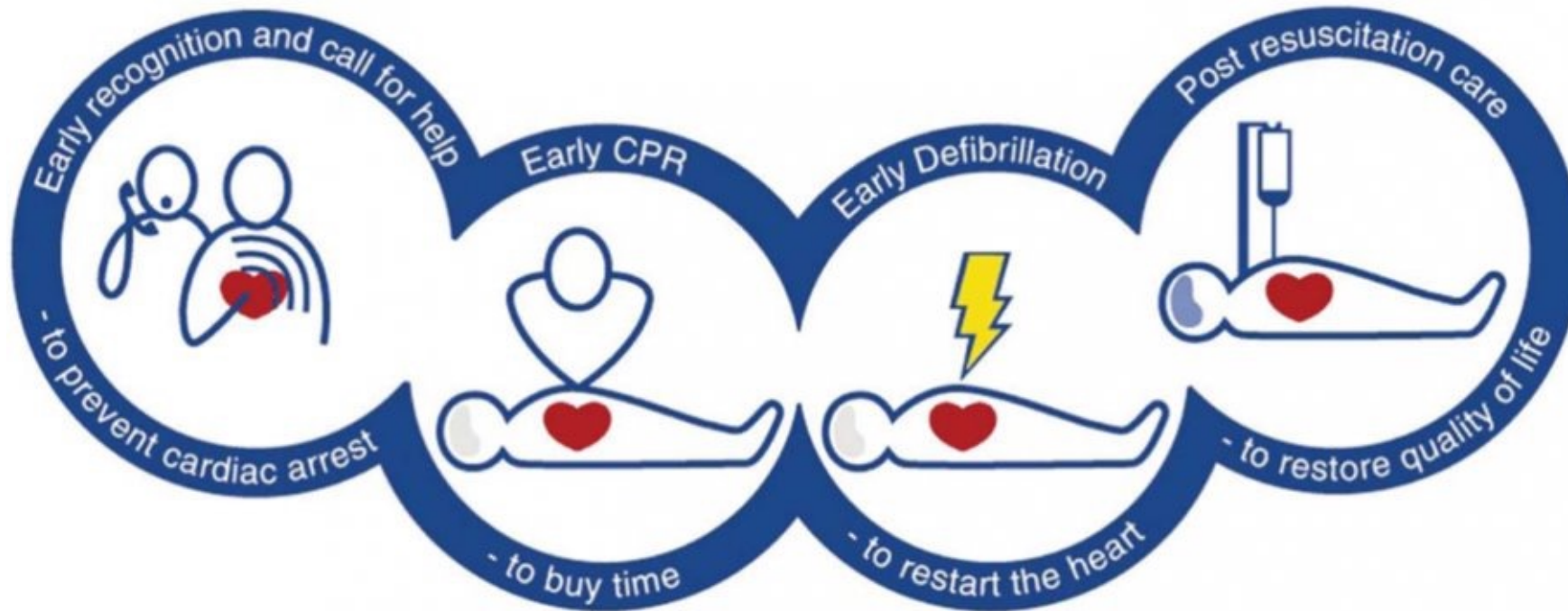


# CARDIAC ARREST

- 65-80% happen at home
- Majority of victims are male
- Less than 10% survive
- Survival is dependent on early CPR and AED use

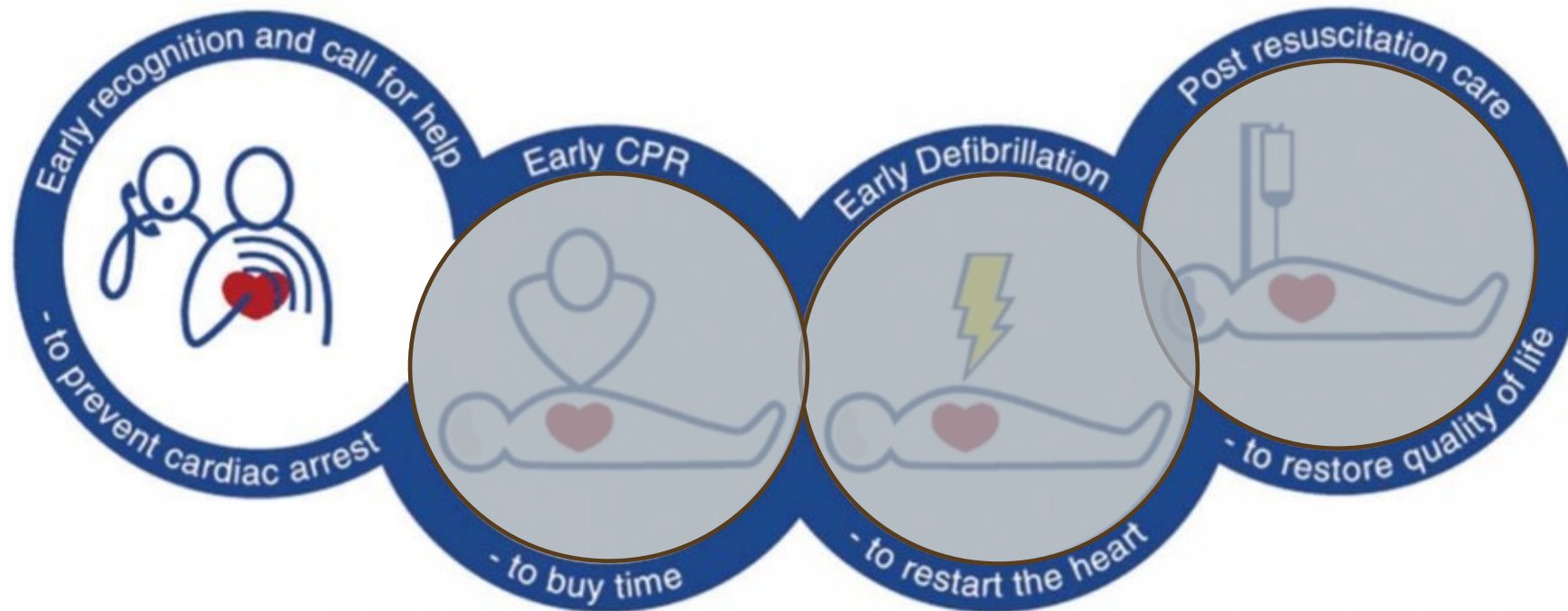


# THE CHAIN OF SURVIVAL



# THE CHAIN OF SURVIVAL

## EARLY RECOGNITION AND CALL FOR HELP





# EARLY RECOGNITION AND CALL FOR HELP

- Proper identification of symptoms of cardiac arrest grants for fast onset of resuscitation
- Two questions:
  - Is the person responding? Is the person breathing?





**NO – NO – GO!**

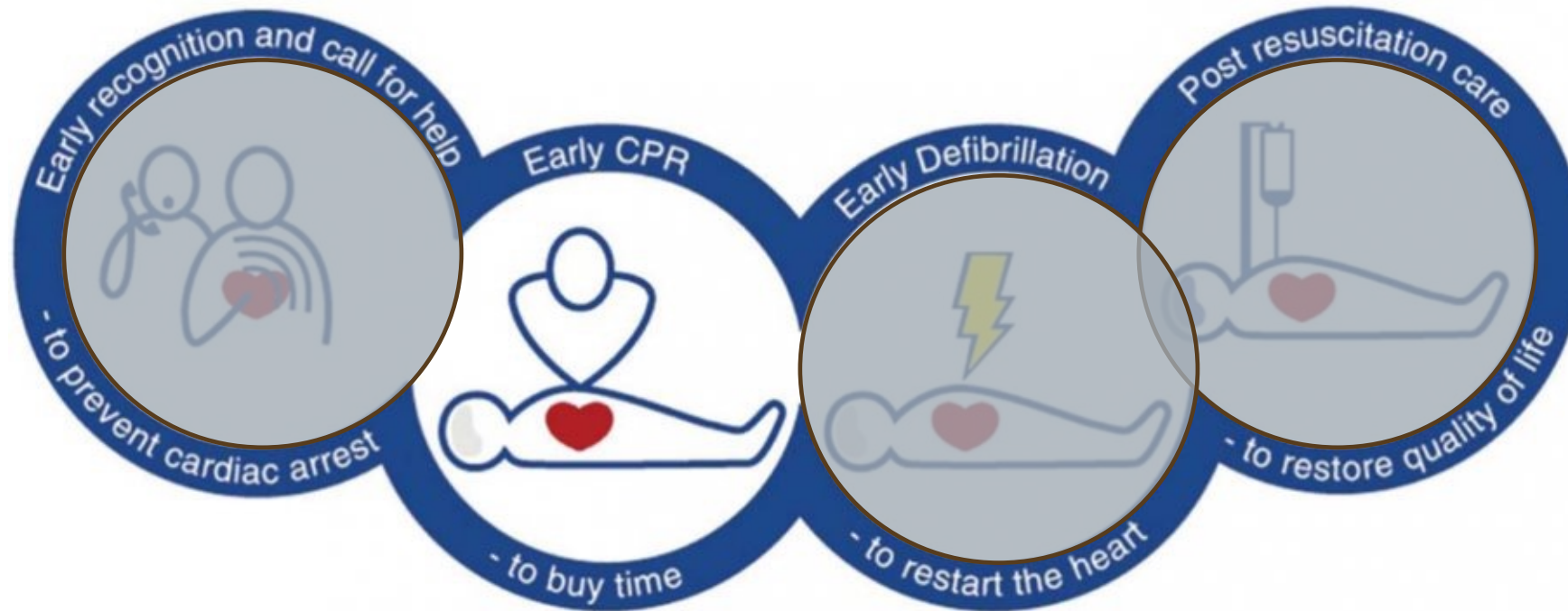


# EARLY RECOGNITION AND CALL FOR HELP

- Proper identification of symptoms of cardiac arrest grants for fast onset of resuscitation
- Two questions:
  - Is the person responding? Is the person breathing
- NO – NO – GO!
- Always call 112 to start the process and get help!

# THE CHAIN OF SURVIVAL

## EARLY CPR – TO BUY TIME



# EARLY CPR – TO BUY TIME

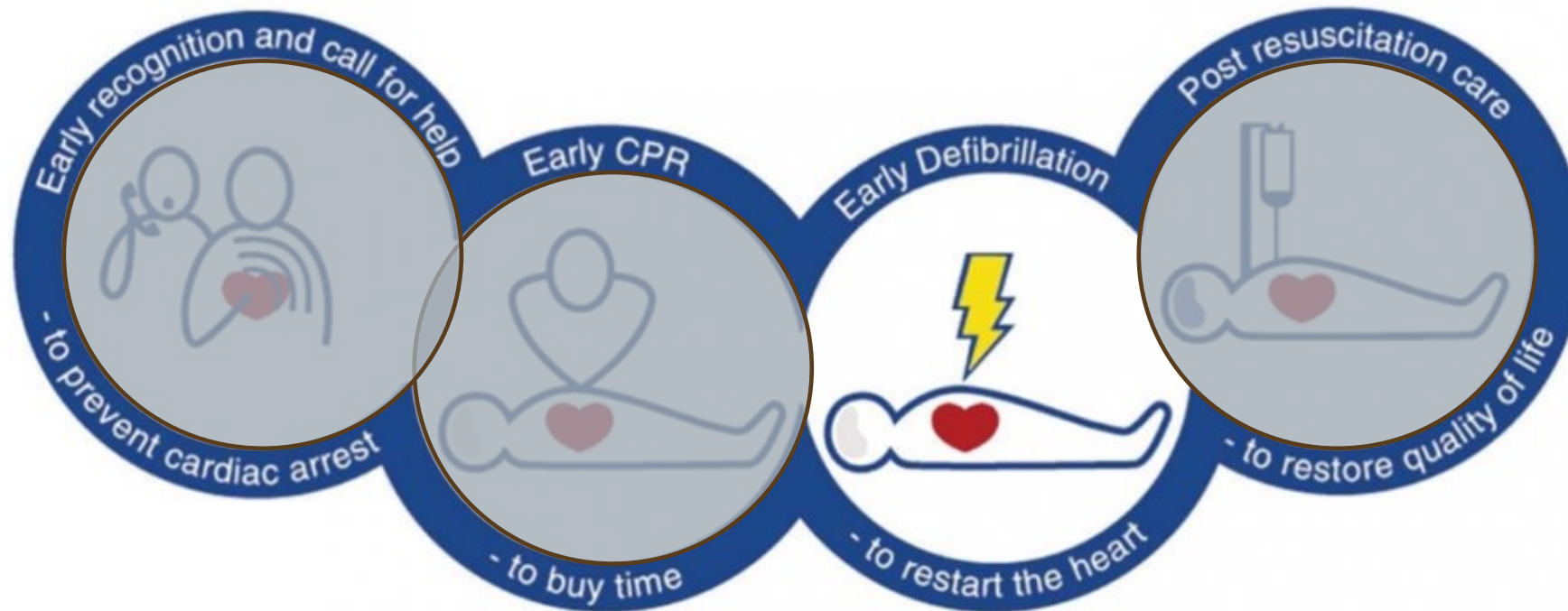
- CPR = cardiopulmonary resuscitation
- Assisted circulation through rhythmic compressions of the chest to circulate blood
  - prevents brain damage
  - keeps heart cells oxygenated to make them receptive to electrical shock
- Learn CPR to be better at it!
- Hands only or use the 30 compressions/2 rescue breaths technique
- Dispatchers can coach you in CPR



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# THE CHAIN OF SURVIVAL

## EARLY DEFIBRILLATION - TO RESTART THE HEART



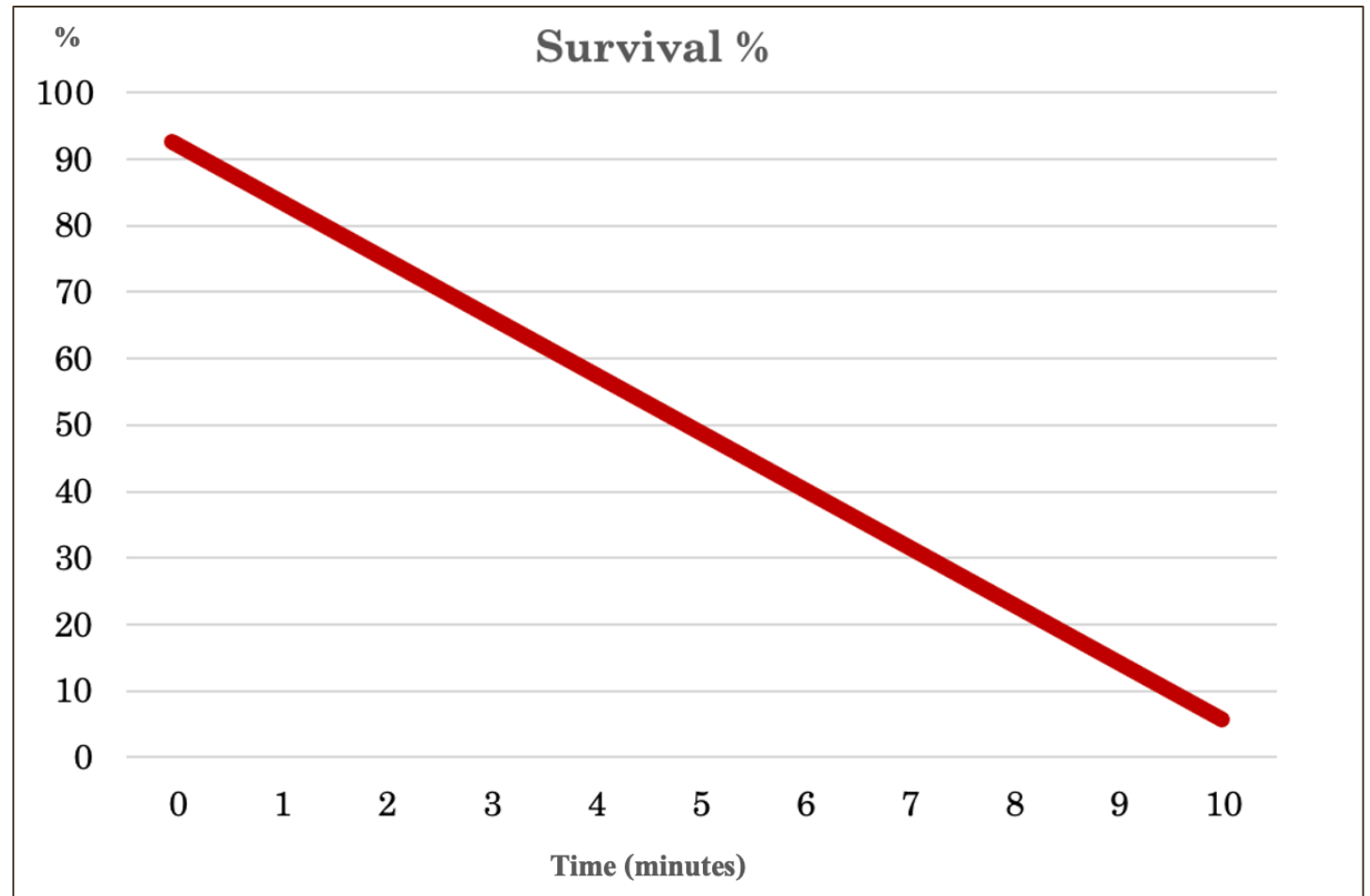


# EARLY DEFIBRILLATION - TO RESTART THE HEART

- An AED (= Automated External Defibrillator) can restore the electric currents in the heart
- Only two rhythms are receptive for defibrillation VF (ventricular fibrillation) & pVT (pulseless ventricular tachycardia)
- Usually VF/pVT are present within the first minutes after collapse
- The faster the better!
- Studies show that 70 survival is obtainable if an AED is used in the first minutes
- Perform CPR until an AED is present - the heart cells need oxygen to be receptive to the electric shock

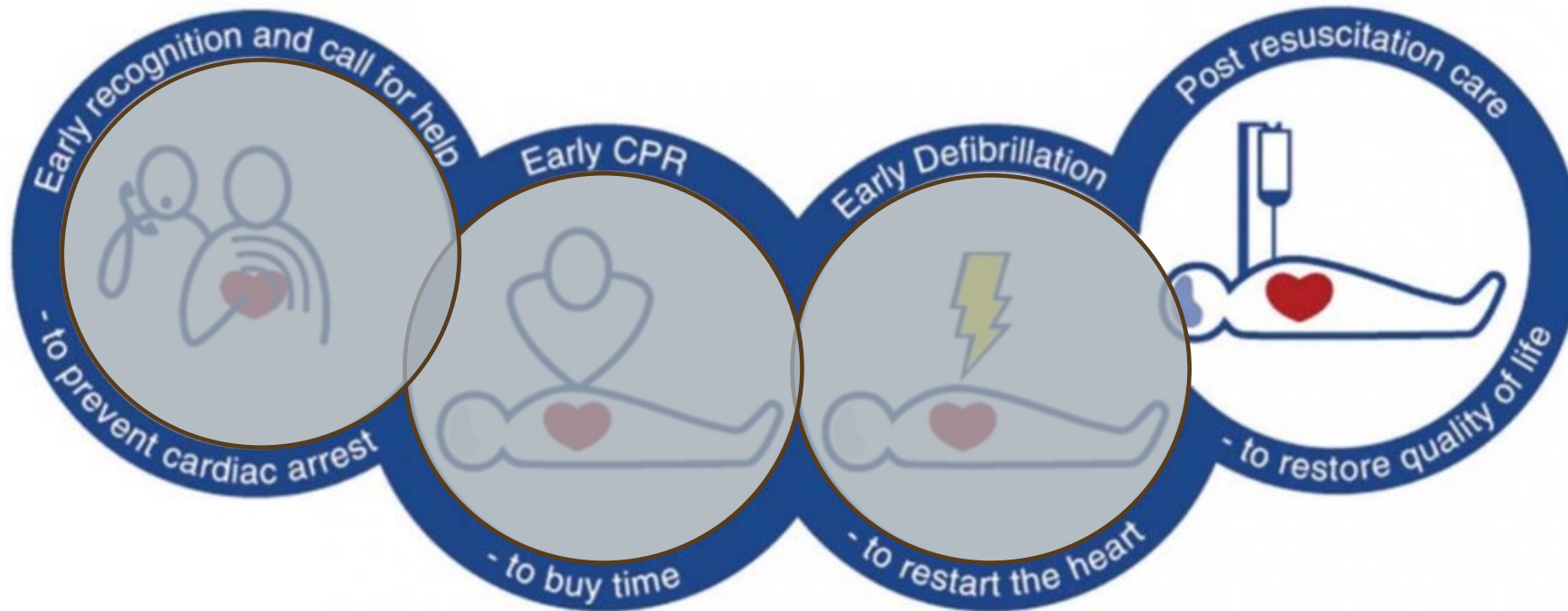
# TIME IS CRUCIAL

- In cardiac arrest, every minute without CPR or use of an AED reduce the chance of survival by 7-10%



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# THE CHAIN OF SURVIVAL POST RESUSCITATION CARE - TO RESTORE QUALITY OF LIFE



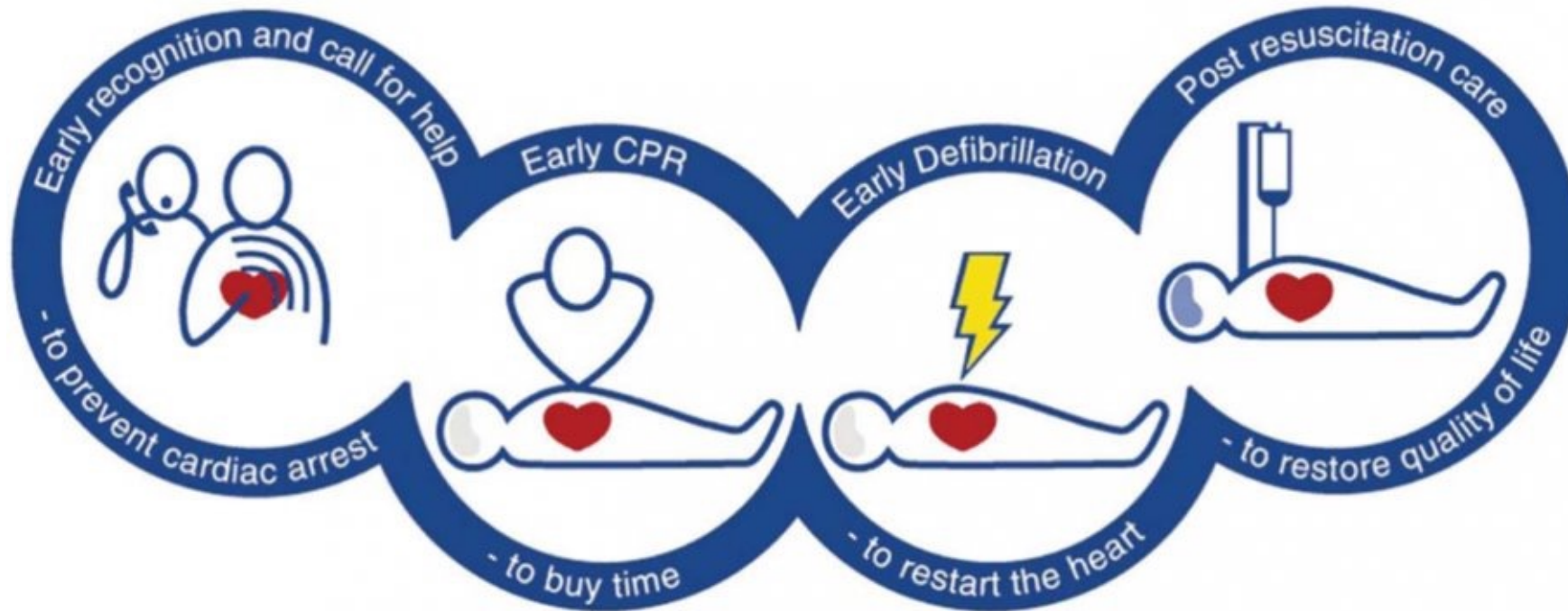




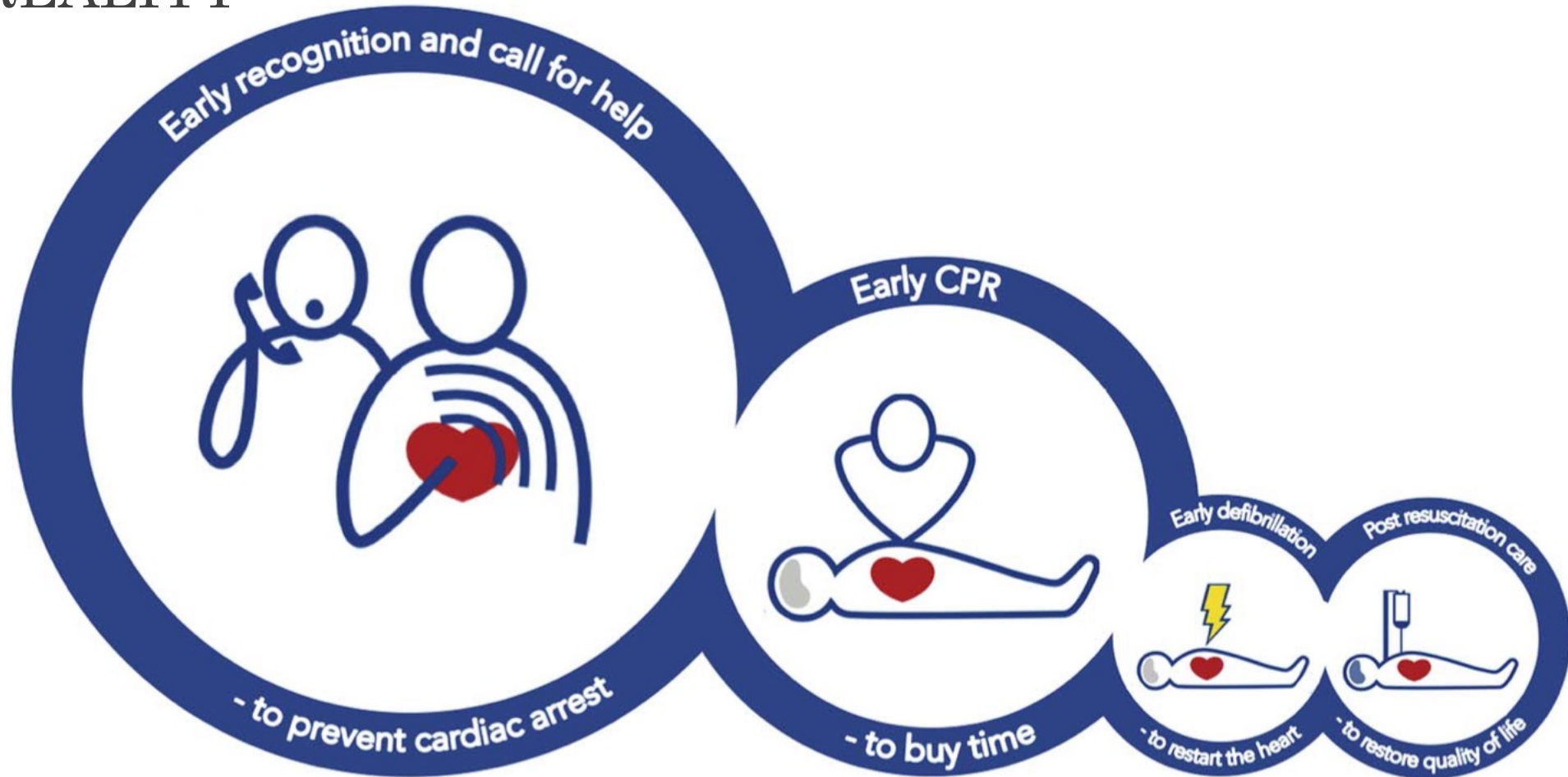
# POST RESUSCITATION CARE - TO RESTORE QUALITY OF LIFE

- Treat the reason for the cardiac arrest
  - CAT lab/Angioplasty to restore oxygenation to the heart
- Intensive care
  - Induced hypothermia to prevent brain damage
- Consistent, effective and sustainable post-cardiac arrest care is important for survivors and their families
- Many survivors can go back to normal life

# THE CHAIN OF SURVIVAL

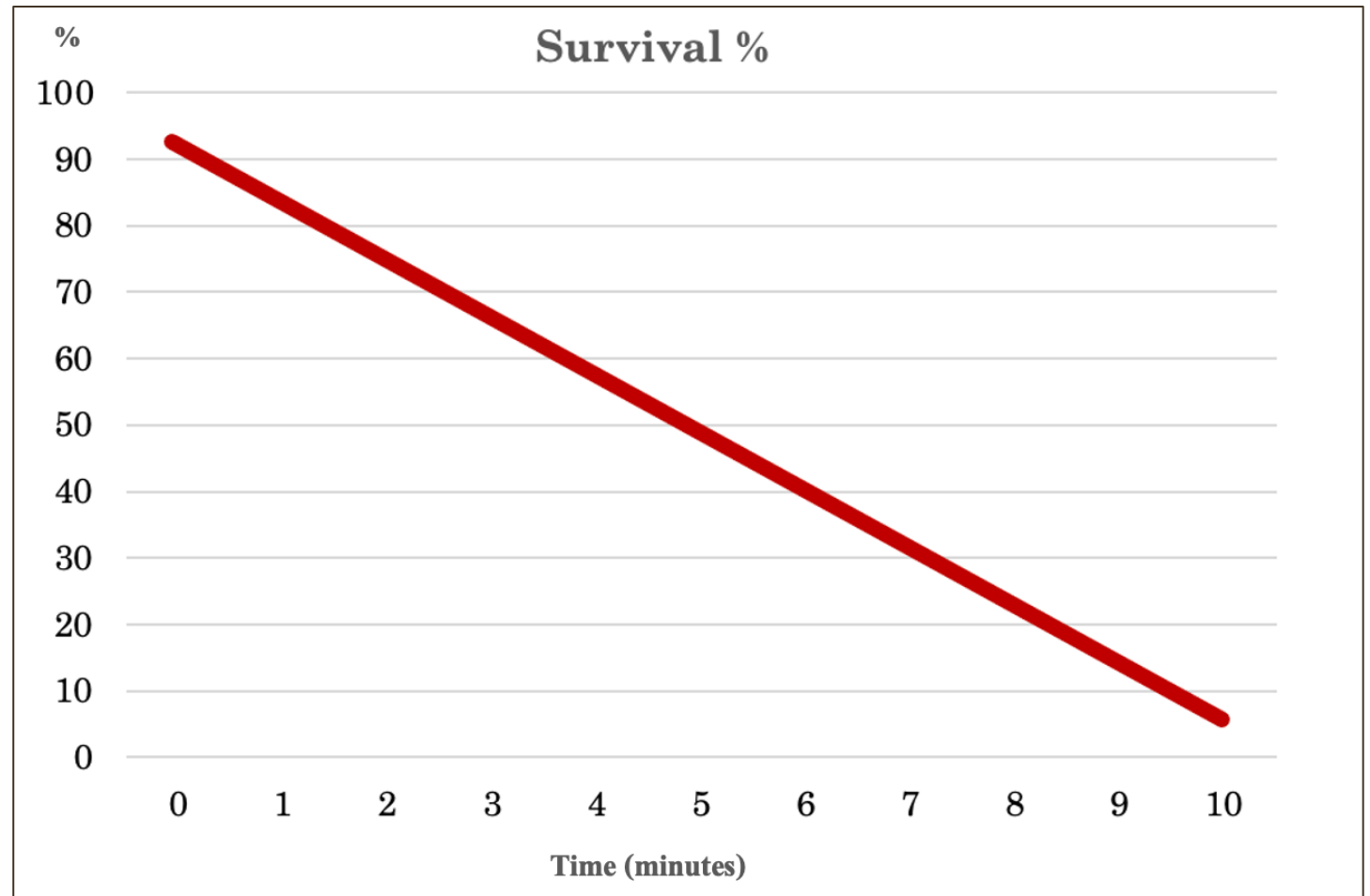


# THE CHAIN OF SURVIVAL ...IN REALITY



# TIME IS CRUCIAL

- In cardiac arrest, every minute without CPR or use of an AED reduce the chance of survival by 7-10%







THIS CAN CHANGE!  
THIS MUST CHANGE!

# EUROPEAN RESUSCITATION COUNCIL 2021 CPR GUIDELINES

SYSTEMS SAVING LIVES GL 2021

## 5 TOP MESSAGES



### 1. RAISE AWARENESS ABOUT CPR AND DEFIBRILLATION

- Train as many citizens as possible
- Engage with World Restart a Heart Day
- Develop new and innovative systems and policies that will save more lives

### 2. USE TECHNOLOGY TO ENGAGE COMMUNITIES

- Implement technologies to alert first responders to cardiac arrests through smartphone apps / text messages
- Develop communities of first responders to help save lives
- Map and share the locations of public access defibrillators



## ... LONG AGO IN A LAND FAR AWAY

- An idea was born ...
- ... before smartphones and GPS technologies in every device

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... LONG AGO IN A LAND FAR AWAY

*What if it's possible to alert motivated  
and educated volunteers of a cardiac  
arrest nearby ...?*



## ... LONG AGO IN A LAND FAR AWAY

- Many believed this was nuts!
- Research proved the benefits and perseverance paid off

# RESEARCH PAVED THE WAY TO PROVE THE BENEFITS


*The* NEW ENGLAND JOURNAL *of* MEDICINE

ORIGINAL ARTICLE

## Mobile-Phone Dispatch of Laypersons for CPR in Out-of-Hospital Cardiac Arrest

Mattias Ringh, M.D., Mårten Rosenqvist, M.D., Ph.D., Jacob Hollenberg, M.D., Ph.D.,  
Martin Jonsson, B.Sc., David Fredman, R.N., Per Nordberg, M.D.,  
Hans Järnbert-Pettersson, Ph.D., Ingela Hasselqvist-Ax, R.N., Gabriel Riva, M.D.,  
and Leif Svensson, M.D., Ph.D.




 **Journal of the American College of Cardiology**  
 Volume 76, Issue 1, 7 July 2020, Pages 43-53

Original Investigation

## Smartphone Activation of Citizen Responders to Facilitate Defibrillation in Out-of-Hospital Cardiac Arrest

Linn Andelius MD<sup>a</sup>, Carolina Malta Hansen MD, PhD<sup>a</sup>, Lena Karlsson MD, PhD<sup>a, b</sup>, Christian Torp-Pedersen MD, DSc<sup>a</sup>, Lars Køber MD, DSc<sup>f</sup>, Helle Collatz Christensen MD, PhD<sup>a</sup>, Stig Gunnar H. Gislason MD, PhD<sup>b</sup>, Fredrik Folke MD, PhD<sup>a, b</sup>

 **Resuscitation**  
 Volume 152, July 2020, Pages 16-25

Review

## Enhancing citizens response to out-of-hospital cardiac arrest: A systematic review of mobile-phone systems to alert citizens as first responders

Tommaso Scquizzato<sup>a, b</sup>, Ottavia Pallanch<sup>a</sup>, Alessandro Belletti<sup>a</sup>, Antonio Frontera<sup>c</sup>, Luca Cabrini<sup>d</sup>, Alberto Zangrillo<sup>a, b</sup>, Giovanni Landoni<sup>a, b</sup>

 **Resuscitation**  
 Volume 147, 1 February 2020, Pages 57-64

Clinical paper

## Mobile phone-based alerting of CPR-trained volunteers simultaneously with the ambulance can reduce the resuscitation-free interval and improve outcome after out-of-hospital cardiac arrest: A German, population-based cohort study


Ralf Stroop<sup>a, 1</sup>, Thoralf Kerner<sup>b, 1</sup>, Bernd Strickmann<sup>c</sup>, Mario Hensel<sup>d</sup>

Cochrane Database of Systematic Reviews | Review - Intervention

### Community first responders for out-of-hospital cardiac arrest in adults and children

✉ Tomas Barry, Maeve C Doheny, Siobhán Masterson, Niall Conroy, Jan Klimas, Ricardo Segurado, Mary Codd,  
 Authors' declarations of interest

Version published: 19 July 2019 | Version history  
<https://doi.org/10.1002/14651858.CD012764.pub2>

 **Resuscitation**  
 Volume 85, Issue 11, November 2014, Pages 1444-1449

Clinical paper

## Local lay rescuers with AEDs, alerted by text messages, contribute to early defibrillation in a Dutch out-of-hospital cardiac arrest dispatch system ☆


Jolande A. Zijlstra<sup>a, 1</sup>, Remy Stieglis<sup>a, 1</sup>, Frank Riedijk<sup>b</sup>, Martin Smeekes<sup>b</sup>, Wim E. van der Worp<sup>c</sup>, Rudolph W. Koster<sup>a</sup>

 **Resuscitation Plus**  
 Volume 16, December 2023, 100486

Clinical paper

## Technology activated community first responders in Singapore: Real-world delivery & outcome trends

Fahad Javaid Siddiqui<sup>a</sup>, Stephanie Fook-Chong<sup>b</sup>, Nur Shahidah<sup>b, c</sup>, Colin K Tan<sup>d</sup>, Jijun Wei<sup>e</sup>, Wei Ming Ng<sup>f</sup>, Dennis Quah<sup>g</sup>, Yih Yng Ng<sup>h, i</sup>, Benjamin SH Leong<sup>j</sup>, Marcus EH Ong<sup>k</sup>


 **Resuscitation**  
 Volume 126, May 2018, Pages 160-165

Clinical paper

## A smartphone application for dispatch of lay responders to out-of-hospital cardiac arrests


Ellinor Berglund<sup>a</sup>, Andreas Claesson<sup>a</sup>, Per Nordberg<sup>a</sup>, Therese Djärv<sup>a</sup>, Peter Lundgren<sup>b, c</sup>, Fredrik Folke<sup>d</sup>, Sune Forsberg<sup>e, f</sup>, Gabriel Riva<sup>a</sup>, Mattias Ringh<sup>a</sup>

- In July 2023, a publication with over 9 500 patients proved dramatically increases 30-day survival when volunteers were alerted to cardiac arrest





Journal of the American College of Cardiology

Volume 82, Issue 3, 18 July 2023, Pages 200-210

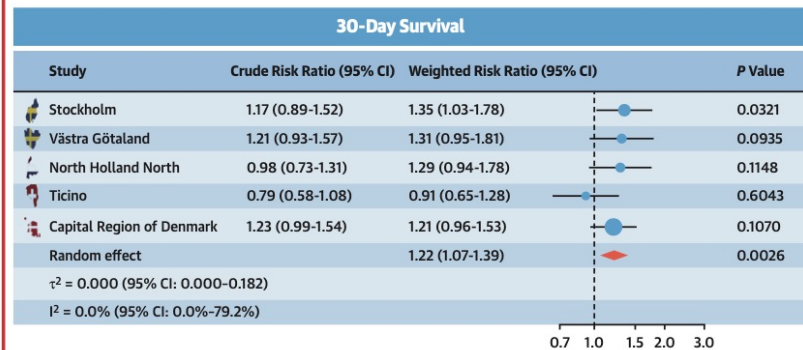
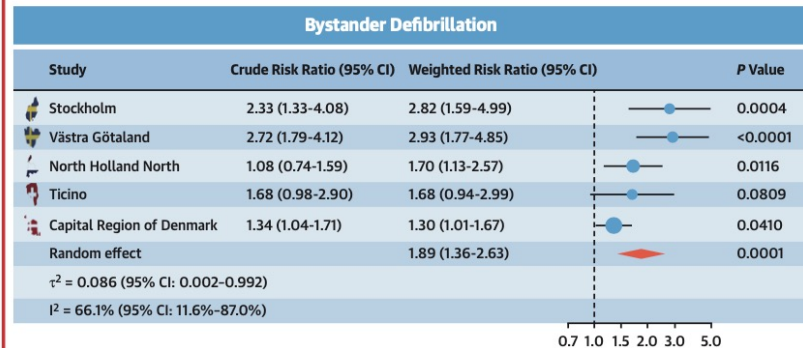
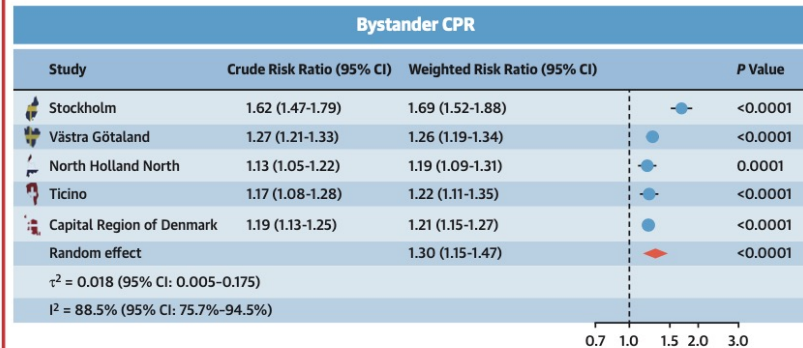


Original Investigation

## Dispatch of Volunteer Responders to Out-of-Hospital Cardiac Arrests

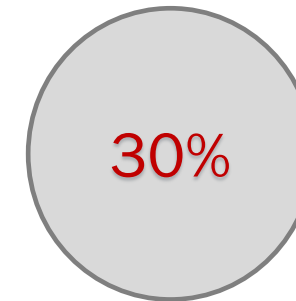
Martin Jonsson PhD<sup>a\*</sup>  , Ellinor Berglund PhD<sup>a\*</sup>, Enrico Baldi MD, PhD<sup>b,c</sup>,  
Maria Luce Caputo MD, PhD<sup>d</sup>, Angelo Auricchio MD, PhD<sup>d</sup>, Marieke T. Blom PhD<sup>e,f</sup>,  
Hanno L. Tan MD, PhD<sup>e</sup>, Remy Stieglis MS<sup>e</sup>, Linn Andelius MD, PhD<sup>g</sup>, Fredrik Folke MD, PhD<sup>g,h,i</sup>,  
Jacob Hollenberg MD, PhD<sup>a</sup>, Leif Svensson MD, PhD<sup>j</sup>, Mattias Ringh MD, PhD<sup>a</sup>,  
ESCAPE-NET Investigators

**CENTRAL ILLUSTRATION** Study Outcomes

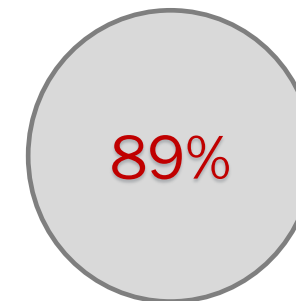


Jonsson M, et al. J Am Coll Cardiol. 2023;82(3):200-210.

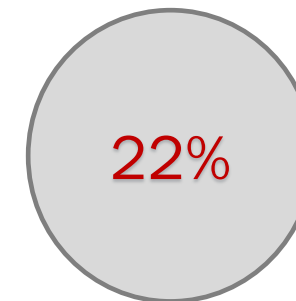
The figure illustrates the differences in risk ratios and 95% CIs for each study outcomes (bystander cardiopulmonary resuscitation [CPR], bystander defibrillation, and 30-day survival) and study site after inverse probability treatment weighting. Pooled random effect estimates for all study sites are presented as a red diamond. The size of the circles represents the weight from each study site.



Increase in CPR



Increased defibrillation



30-day survival

# VOLUNTEER RESPONDER SYSTEMS

- An estimation is that 50% of the countries in Europe have a system alerting volunteers in place at some level
- Generally, they rely on the same idea, alerting volunteers to increase engagement and survival in OHCA
- Denmark was to my knowledge the first European country to have a national unified system alerting volunteer responders in 2020
- Great success!



**TrygFonden**

**HJERTE  
LØBER**

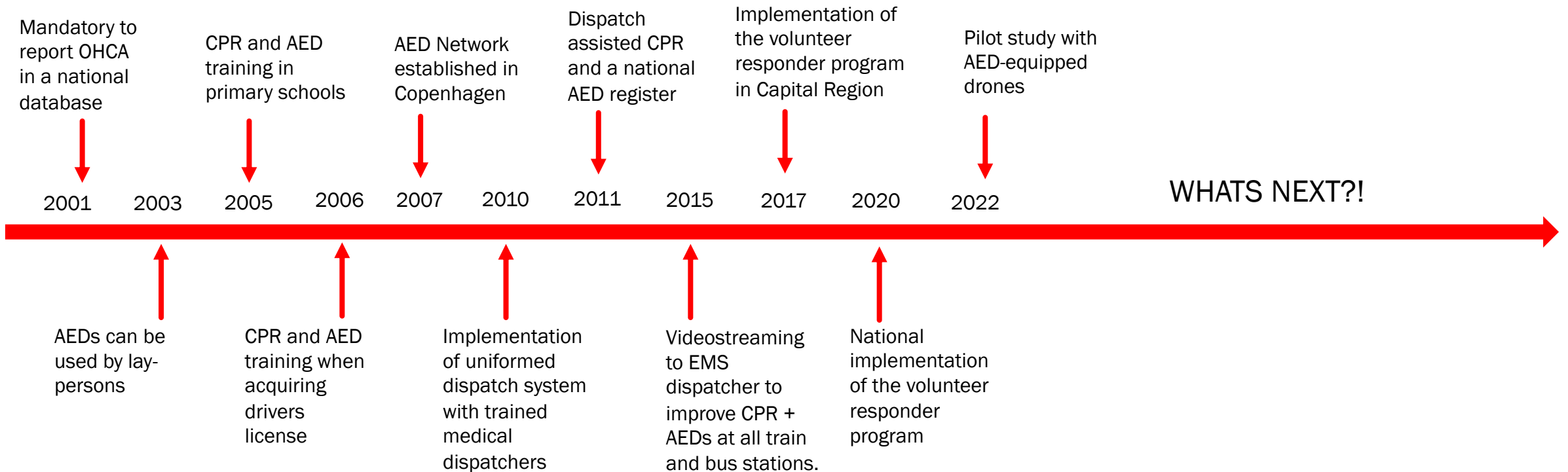


# CONFLICT OF INTEREST

**Mads Gregers M.D. Ph.D.**

- Member of the Danish National Steering Committee of the Volunteer Responder Program
- Medical expert for Oono Medical A/S

# OUT-OF-HOSPITAL CARDIAC ARREST IN DENMARK







### Vidner, der yder livreddende førstehjælp

% af alle indrapporterede hjertestop i DK.



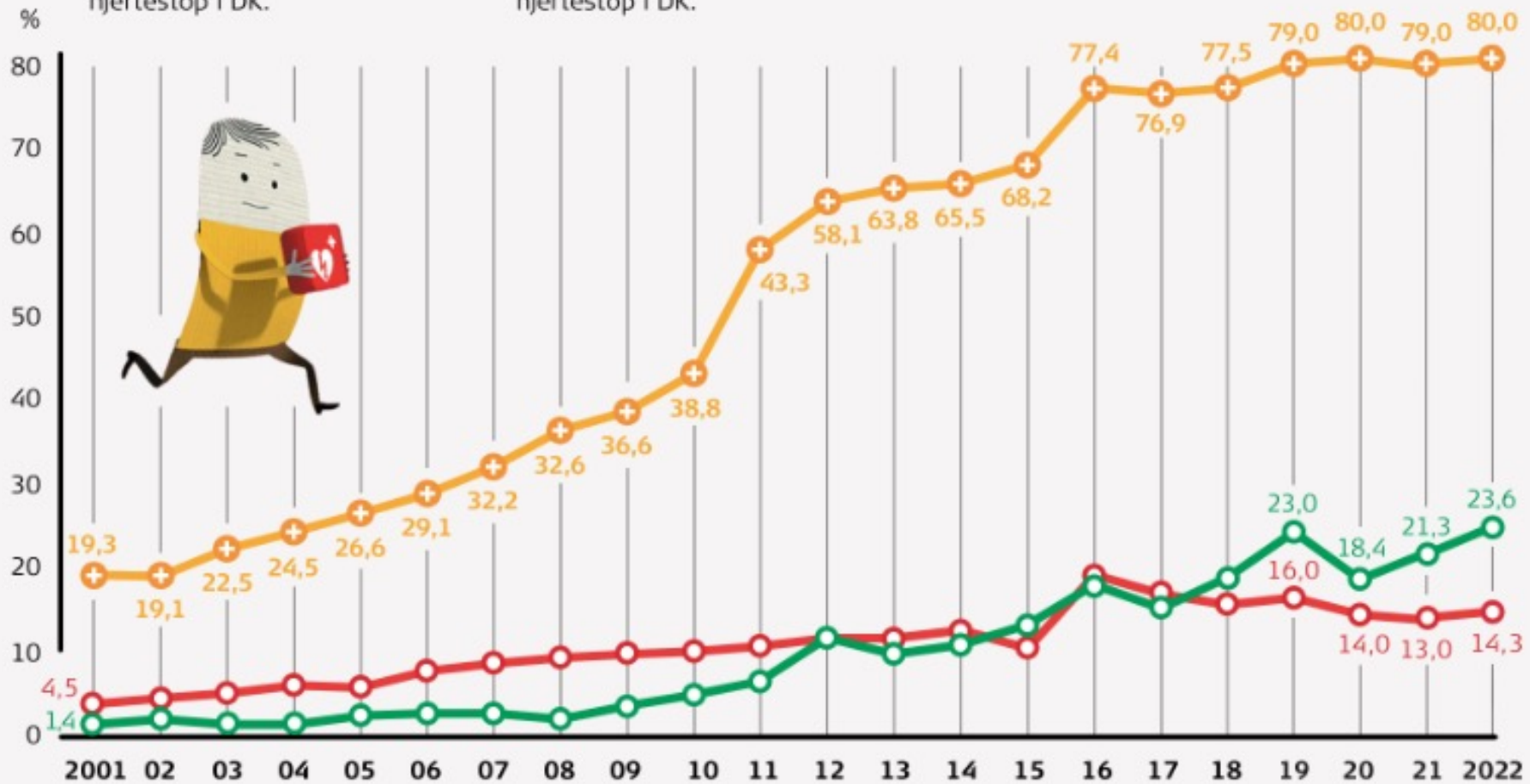
### Brug af hjertestarter i det offentlige rum

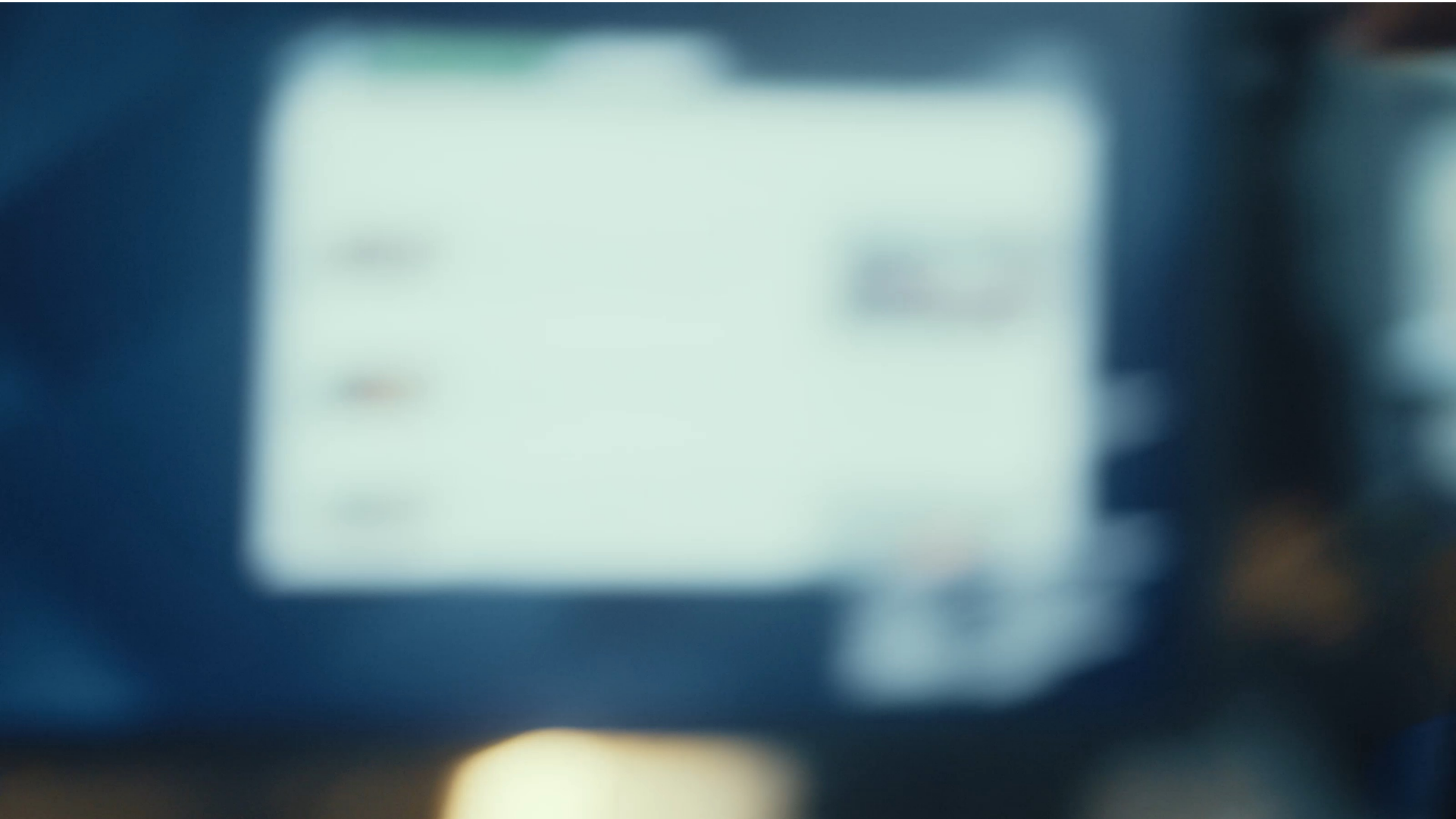
% af alle indrapporterede hjertestop i DK.



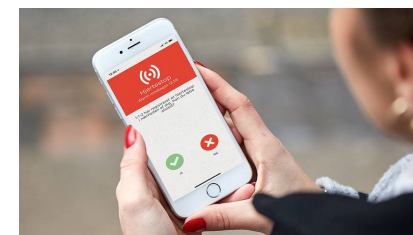
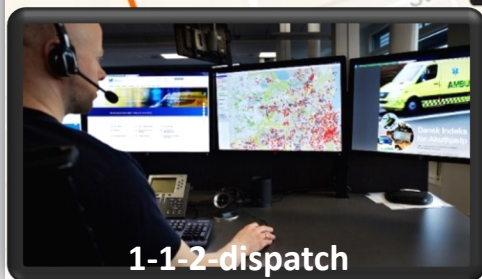
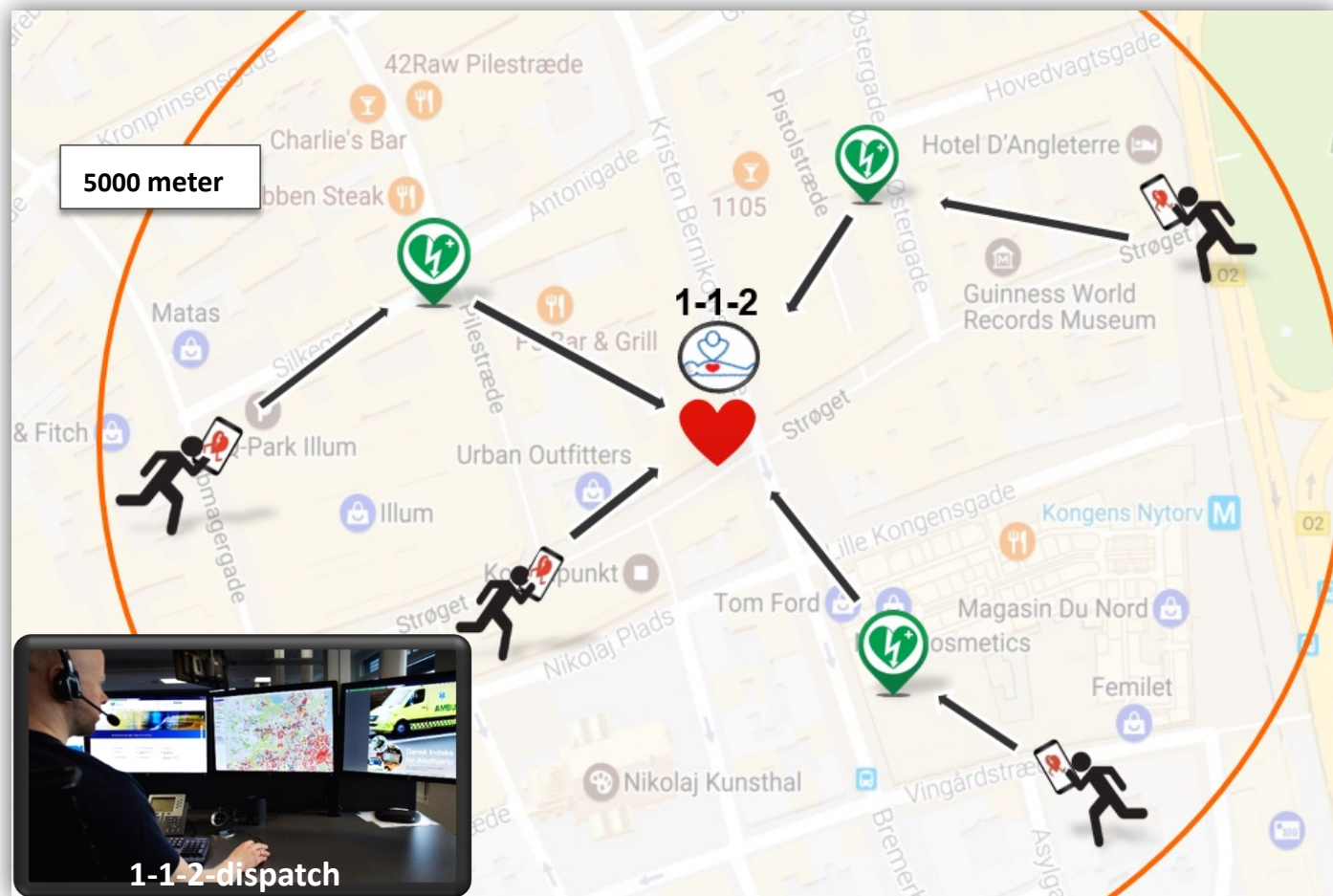
### Overlevende

% af alle indrapporterede hjertestop i DK.





# ACTIVATION OF VOLUNTEER RESPONDERS

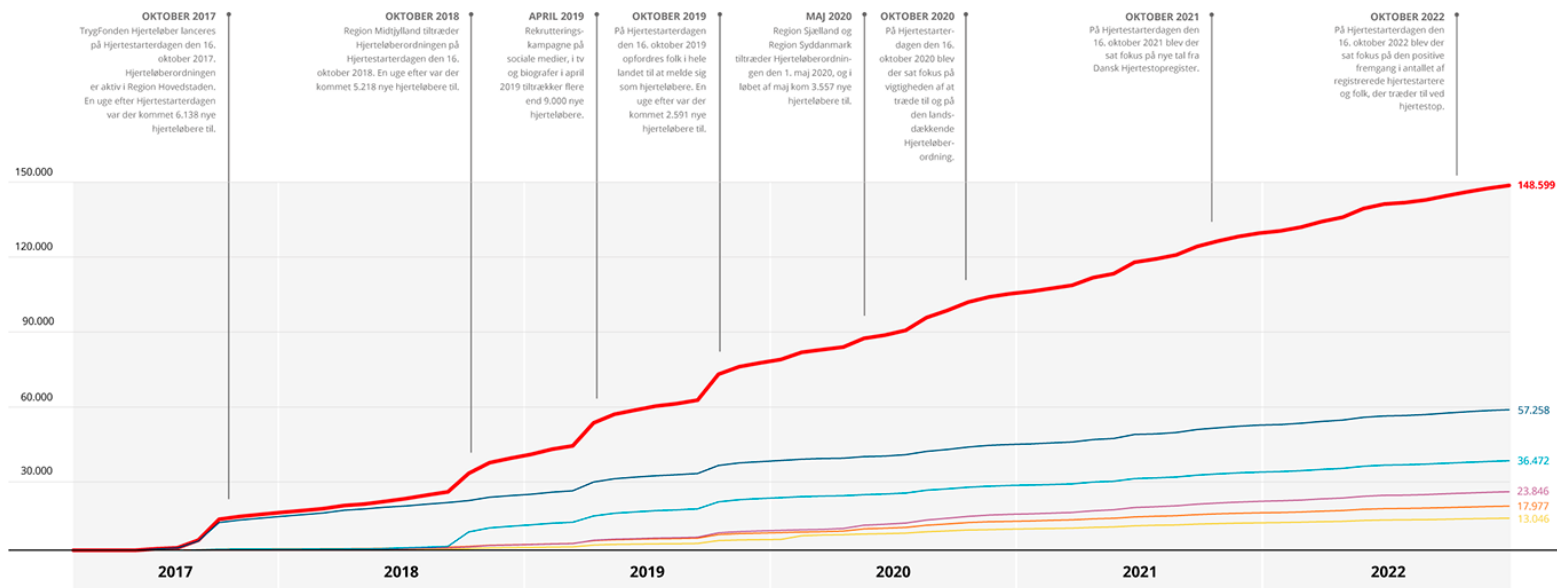


# 152,773 REGISTERED VOLUNTEER RESPONDERS

## 2,608 VOLUNTEERS /100,000 INHABITANTS

### TrygFonden Hjerteløber – Udvikling i antal hjerteløbere 2017-2022

● SAMLET ● REGION HOVEDSTADEN ● REGION MIDTJYLLAND ● REGION SYDDANMARK ● REGION SJÆLLAND ● REGION NORDJYLLAND



Grafen er opdateret med tal pr. 31. december 2022



50:50



24% health care professionals



>95% first aid course



# HOW TO RECRUIT VOLUNTEER RESPONDERS?



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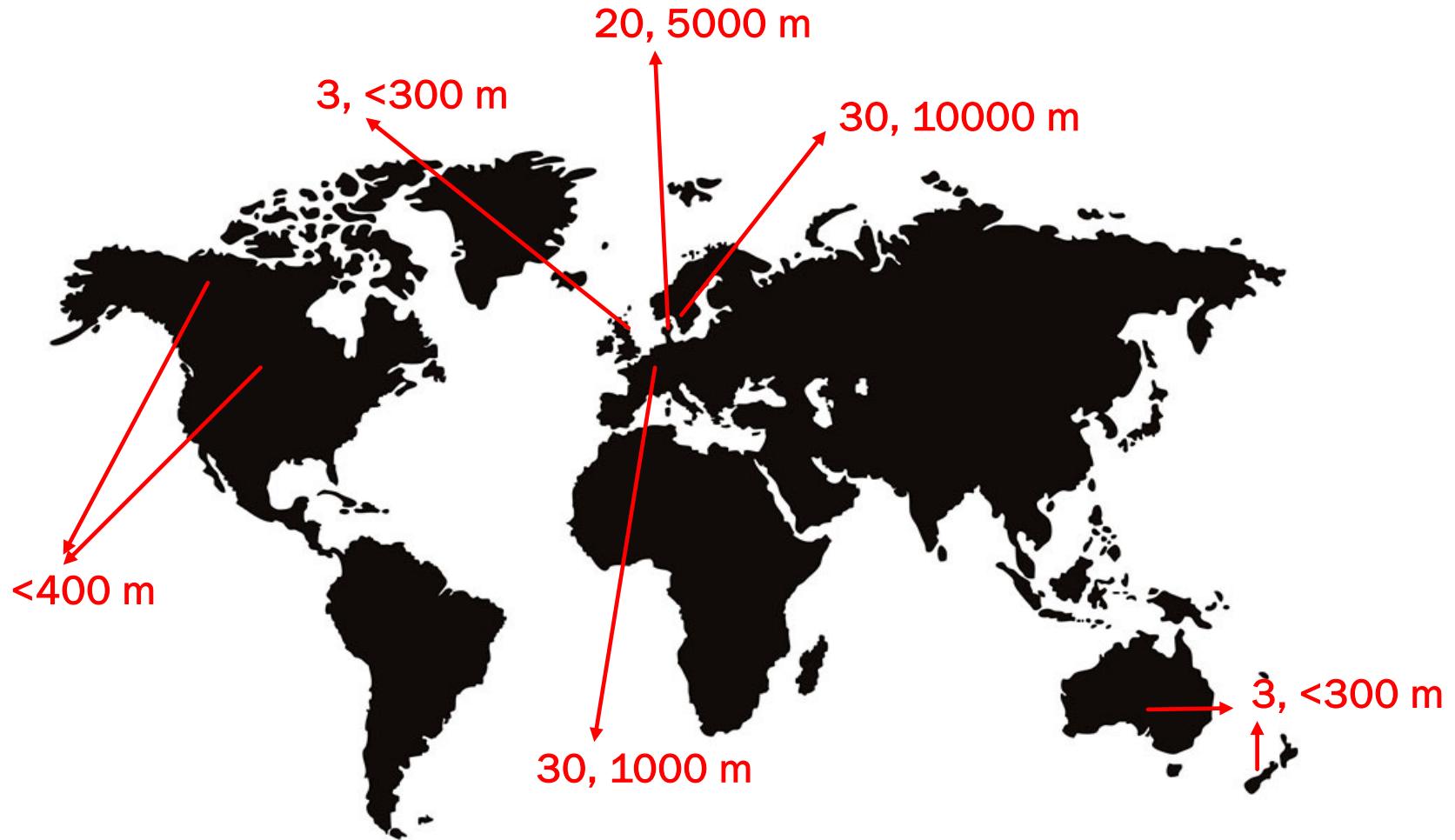
## HOW TO IMPLEMENT A VOLUNTEER RESPONDER SYSTEM?



Many stakeholders!

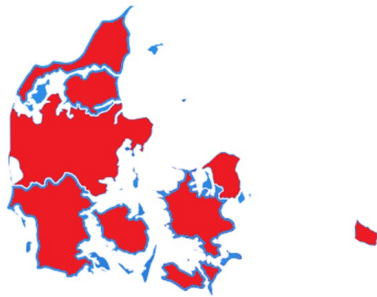


Money...



Volunteer responder programs in the world

# OUR RESULTS



How many react to the alarm?



■ YES ■ NO



≈ 40-45% arrives before the ambulance!

**CENTRAL ILLUSTRATION:** Associations Between Citizen Responders Arriving Before Emergency Medical Services and Bystander Cardiopulmonary Resuscitation and Bystander Defibrillation

| Cardiac Arrest Outcomes                        | N (%)       | Odds Ratio (95% CI) |
|--|-------------|---------------------|
| <b>Bystander cardiopulmonary resuscitation</b> |             |                     |
| Citizen responders arrived first               | 157 (85.3%) | 1.76 (1.07 to 2.91) |
| Emergency medical services arrived first       | 195 (76.8%) | 1.00 (ref)          |
| <b>Bystander defibrillation</b>                |             |                     |
| Citizen responders arrived first               | 39 (21.2%)  | 3.73 (2.04 to 6.84) |
| Emergency medical services arrived first       | 17 (6.7%)   | 1.00 (ref)          |

Odds Ratio, 95% CI

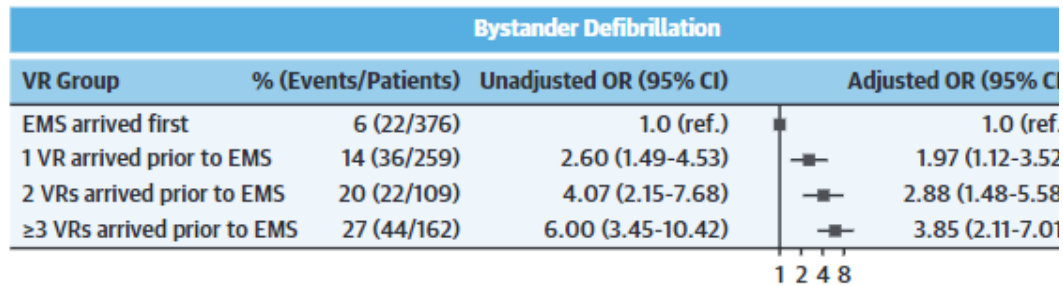
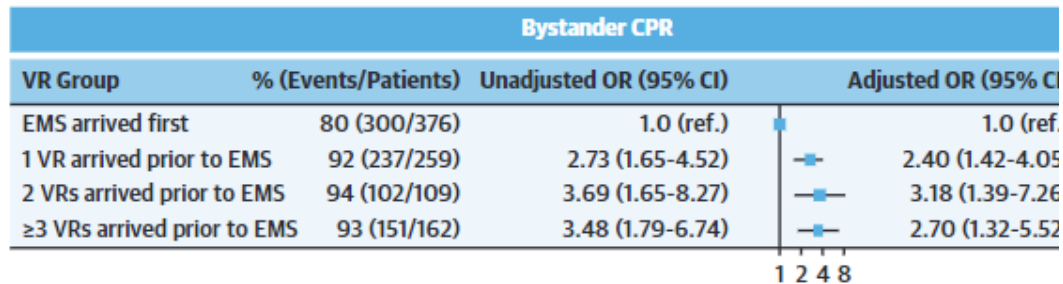
**DEFIBRILLATION TRIPLES!**

Andelius, L. et al. J Am Coll Cardiol. 2020;76(1):43-53.



# OUR RESULTS CONTINUED

**FIGURE 3** Association Between Number of VRs Arriving First and Interventions



Forest plot illustrating both unadjusted and adjusted (for ambulance response time) logistic regression models of bystander interventions according to the number of VRs arriving before the EMS. No corrections for multiple testing were applied. CPR – cardiopulmonary resuscitation; other abbreviations as in Figure 1.

- The number of volunteer responders arriving before the ambulance influences the proportion of patients that are defibrillated by an AED!

A man with dark hair and a beard, wearing a blue t-shirt, is shown from the chest up. He has a questioning or uncertain expression on his face, with his eyebrows slightly furrowed and his mouth turned down at the corners. His hands are held out to his sides, palms up, in a shrugging gesture. The background is a plain, light gray color.

**SURVIVAL AND VOLUNTEER  
RESPONDER PROGRAMS?**


# VOLUNTEER RESPONDER SYSTEMS

ORIGINAL RESEARCH

Open Access

## Smartphone-based dispatch of community first responders to out-of-hospital cardiac arrest - statements from an international consensus conference



Camilla Metelmann<sup>1\*</sup>, Bibiana Metelmann<sup>1†</sup>, Dorothea Kohnen<sup>2</sup>, Peter Brinkrolf<sup>1</sup>, Linn Andelius<sup>3</sup>, Bernd W. Böttiger<sup>4</sup>, Roman Burkart<sup>5</sup>, Klaus Hahnenkamp<sup>1</sup>, Mario Krammel<sup>6,7</sup>, Tore Marks<sup>1</sup>, Michael P. Müller<sup>8</sup>, Stefan Prasse<sup>9</sup>, Remy Stieglis<sup>10</sup>, Bernd Strickmann<sup>11</sup> and Karl Christian Thies<sup>1,12</sup>

- Efforts are made to reach consensus on systematics, safety and data reporting from volunteer responder systems
- We need to understand more to perform better

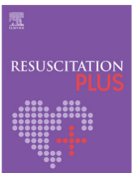
RESUSCITATION PLUS 14 (2023) 100395



Available online at [www.sciencedirect.com](http://www.sciencedirect.com)

## Resuscitation Plus

journal homepage: [www.elsevier.com/locate/resuscitation-plus](http://www.elsevier.com/locate/resuscitation-plus)



Letter to the Editor

**Proposal to increase safety of first responders dispatched to cardiac arrest**





# THANK YOU!

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- <https://eena.org/knowledge-hub/documents/citizen-response-to-cardiac-arrest/>