Kedjan som räddar liv 2.0

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Shareholder CAARS AB
Research grant from the Swedish heart lung foundation

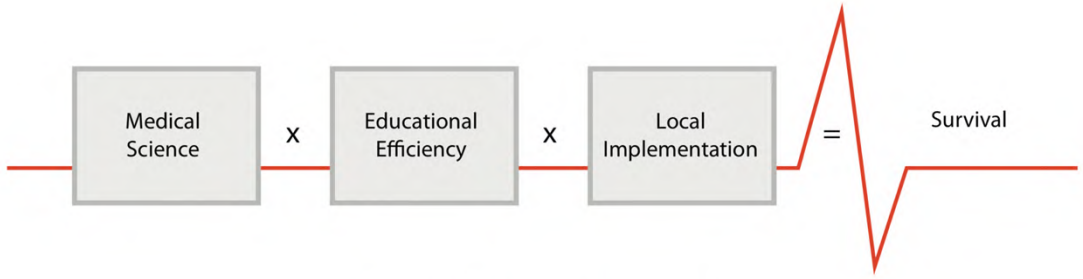

Fig. 1. The Utstein formula for survival.

Överlevnad är beroende av solid vetenskap och evidensbaserade riktlinjer samt effektiva utbildningsinsatser och lokal implementation.

Åtgärder som utförs vid hjärtstopp som kan leda till överlevnad är samlade i kedjan som räddar liv.

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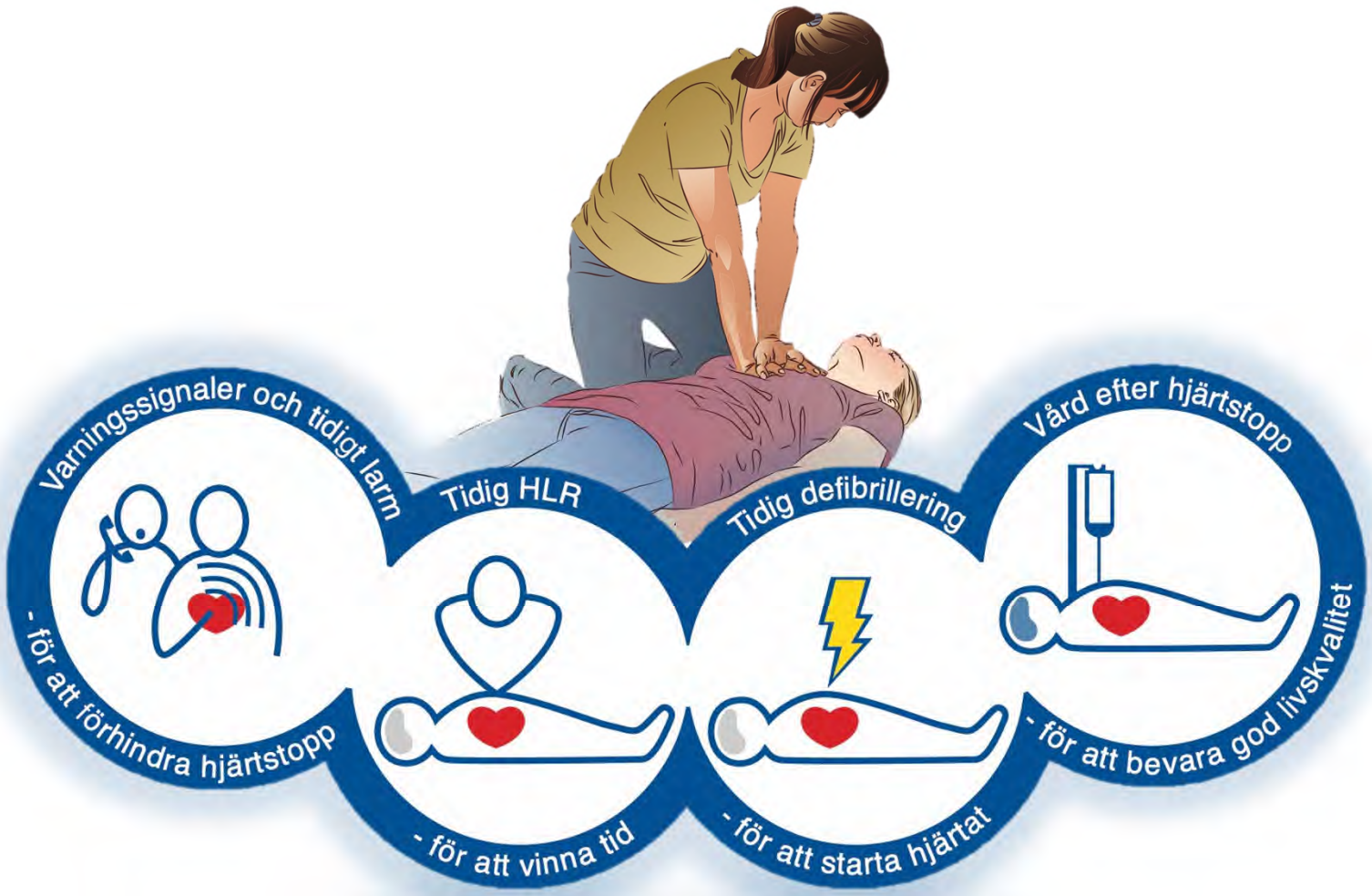

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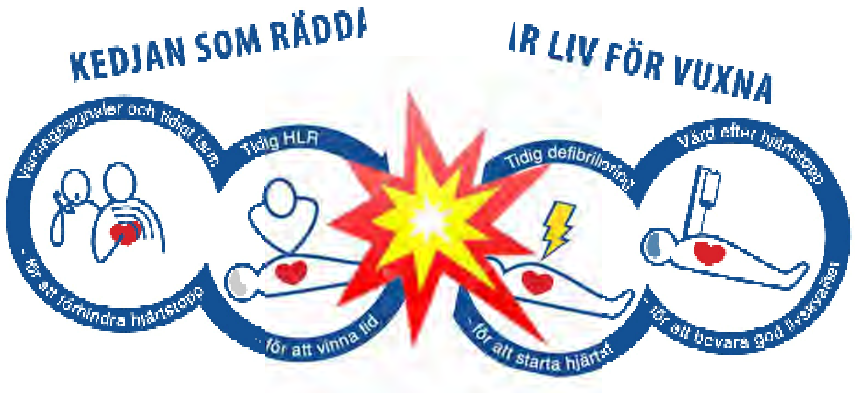
Mål

Att kedjan som räddar liv skall fungera varje gång…
…inte bara på grund av tur.

År 2020 rapporterades 5897 hjärtstopp utanför sjukhus till Svenska HLR-registret.

Kedjan fungerade i 592 fall (10%) men brast 5305 gånger (90%).

Svenska HLR-registret årsrapport 2021



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Deakin et al. och Svenska HLR-registrets årsrapport 2021:

Ca xx,xxx st? ***5897 st*** ***30 dagars överlevnad: 592 st (10,5%)***

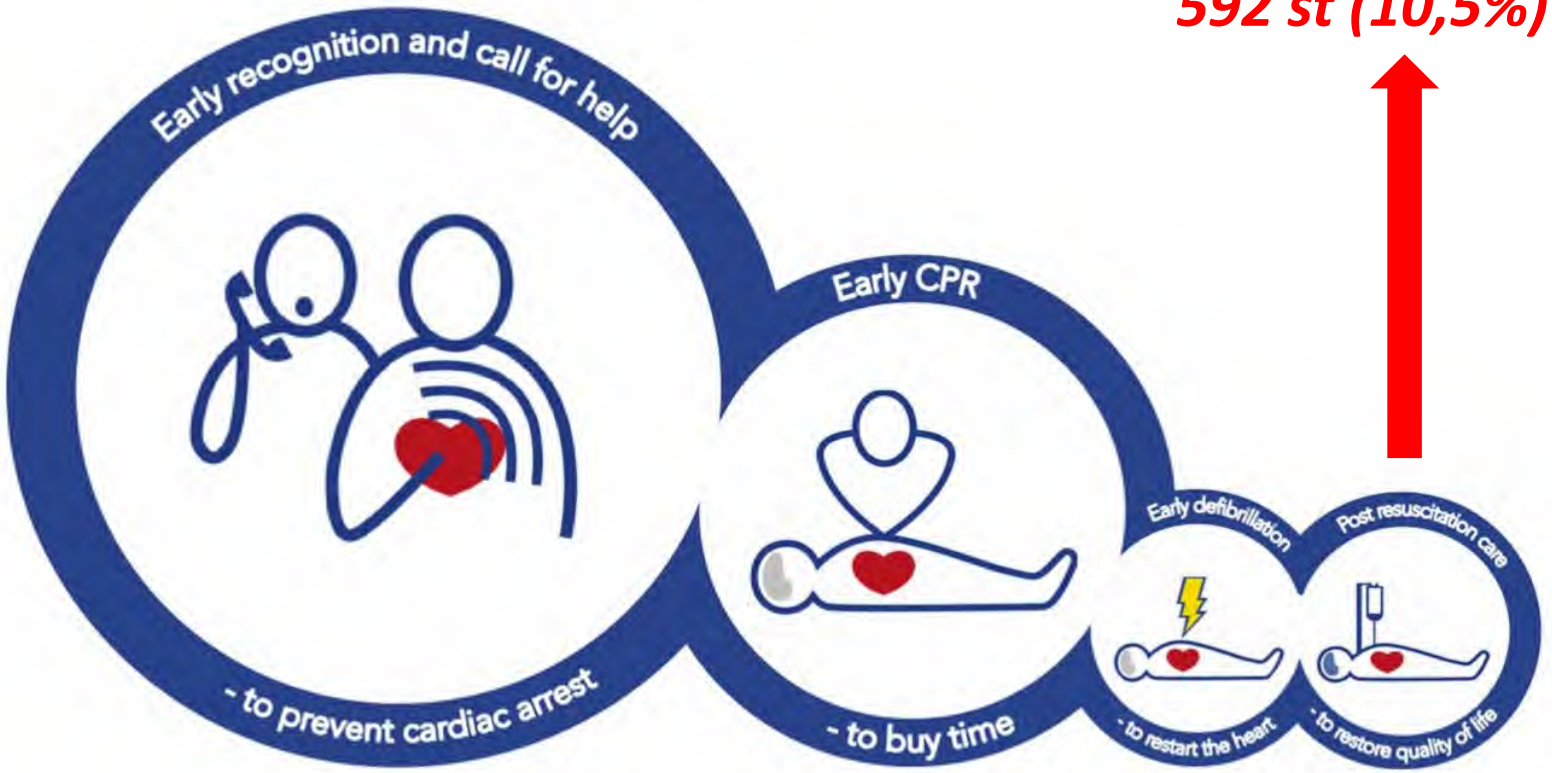

Fig. 1. Chain of survival for out-of-hospital cardiac arrest (Area ratios 1.0, 0.47, 0.12, 0.12).

Deakin CD. The chain of survival: Not all links are equal. Resuscitation. 2018 May;126:80-82

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Available online at www.sciencedirect.com

Resuscitation

journal homepage: www.elsevier.com/locate/resuscitation

EUROPEAN RESUSCITATION COUNCIL

European Resuscitation Council Guidelines 2021: Systems saving lives

Federico Semeraro[a,], Robert Greif[b], Bernd W Böttiger[c], Roman Burkart[d], Diana Cimpoesu[e], Marios Georgiou[f], Joyce Yeung[g], Freddy Lippert[h], Andrew S Lockey[i], Theresa M. Olasveengen[j], Giuseppe Ristagno[k], Joachim Schlieber[l], Sebastian Schnaubelt[m], Andrea Scapigliati[n], Koenraad G Monsieurs[o]*

How technology can help:

EMS systems should consider the use of technology such as:

- Artificial intelligence to recognize cardiac arrest
- Video communication to communicate with bystanders
- Smartphones to dispatch first responders
- Drones to deliver AEDs to the site of cardiac arrest

Möjligheter att optimera kedjan som räddar liv

1. Utbilda så många som möjligt i HLR
2. Utbilda och utvärdera T-HLR på larmcentral
3. AI för att identifiera hjärtstopp
4. Smartwatch för HLR-kvalitet, detektering, larm
5. Smartphones för utlarmning av frivilliga
6. Hjärtstartarregister / PAD
7. IVPA, first responders
8. Drönare för leverans av hjärtstartare

Cardiac arrest centres
Tidig kylning
Temperaturkontroll
Fysiologisk målstyrning
Cirkulationsstöd / ECMO

Illustrationer: Laerdal A/S

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1. Utbilda så många som möjligt i HLR

- Kids save lives
- Skola, arbetsplats, föreningsliv
- Feedback- device/dockor rekommenderas integrerade i utbildningspaket
- ”Big data” för att designa bättre utbildningsprogram?

2. Utbilda och utvärdera T-HLR på larmcentral

1. Kontinuerligt kvalitetsuppföljning utifrån AHA performance indicators:

- Andel identifierade. (Mål: 95% av de som är identifierbara)
- Tid till identifiering. (Mål: Median 60 sekunder)
- Tid till start T-HLR. (Mål: Median 90 sekunder)

2. Träning av larmoperatörer i T-HLR

- Regelbunden HLR utbildning med parvis scenarioträning
- Avlyssning av egna OHCA-samtal under handledning
- AI-baserade telefonscenarier?

3. Audiovisuell feedback från mobiltelefon/smartklocka till operatör för ökad HLR-kvalitet?

Illustration: Jenny Johansson

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Förbättrad identifiering av hjärtstopp

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" (ie, seizure, drug overdose, etc)

FALSE-NEGATIVE (FN) RATE
UNDER-CALL:
1. Unidentified but identifiable *(opportunity)*
2. Unidentifiable for reasonable exclusion:
   - Third party
   - Language barrier
   - Hysteria, etc

HJÄRTSTOPP IDENTIFIERAT

T-HLR INITIERAT

AMBULANS-BEHANDLAT

"SANT POSITIVA"

Illustration: American Heart Association: cpr.heart.org

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Mål vid telefon-HLR för larmcentraler

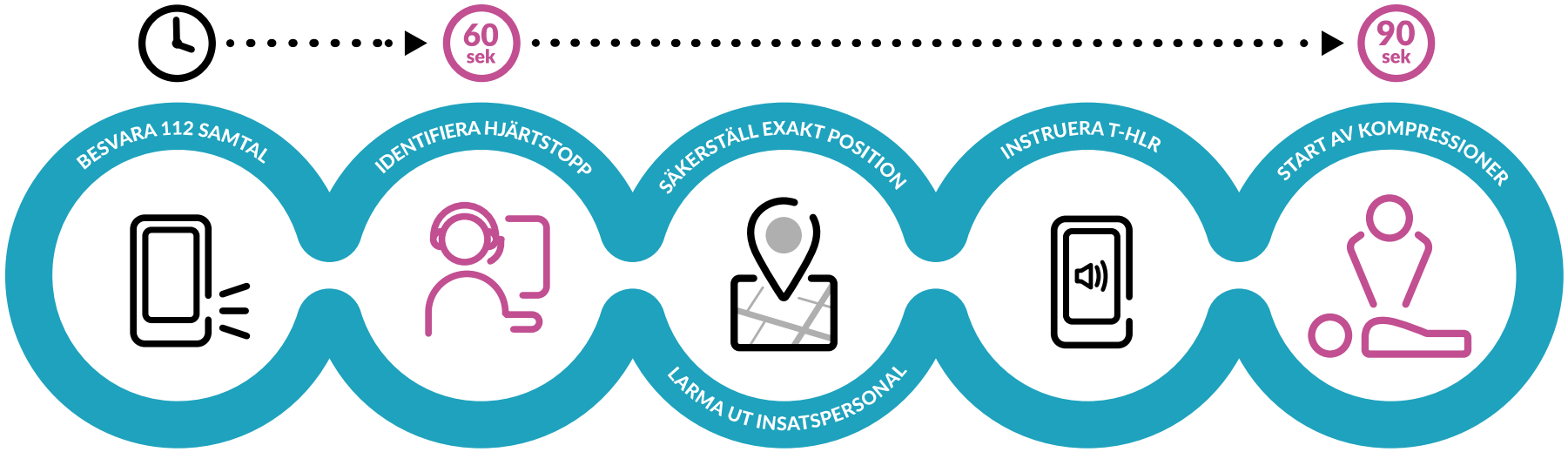

Illustration: Laerdal A/S

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3. AI för att identifiera hjärtstopp

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Clinical paper

Machine learning as a supportive tool to recognize cardiac arrest in emergency calls

Stig Nikolaj Blomberg[a,b,], Fredrik Folke[a,b,c], Annette Kjær Ersbøll[d], Helle Collatz Christensen[e], Christian Torp-Pedersen[e,f], Michael R. Sayre[g], Catherine R. Counts[g], Freddy K. Lippert[a,b]*

Compared with medical dispatchers, the machine learning framework had a significantly higher sensitivity (72.5% vs. 84.1%, $p < 0.001$)

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Clinical paper

Machine learning can support dispatchers to better and faster recognize out-of-hospital cardiac arrest during emergency calls: A retrospective study

Fredrik Byrsell[a,b,], Andreas Claesson[a], Mattias Ringh[a], Leif Svensson[a], Martin Jonsson[a], Per Nordberg[a], Sune Forsberg[a], Jacob Hollenberg[a], Anette Nord[a]*

[a] Department of Medicine, Centre for Resuscitation Science, Karolinska Institutet, Solna, Sweden

[b] SOS Alarm AB, Stockholm, Sweden

The ML recognized 36% (n = 305) within 1 min compared with 25% (n = 213) by dispatchers.

The recognition rate at any time during the call was 86% for ML and 84% for dispatchers.

4. Smartwatch för HLR-kvalitet , detektering, larm,

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European Resuscitation Council Guidelines 2021: Systems saving lives

Federico Semeraro[a,], Robert Greif[b], Bernd W Böttiger[c], Roman Burkart[d], Diana Cimpoesu[e], Marios Georgiou[f], Joyce Yeung[g], Freddy Lippert[h], Andrew S Lockey[i], Theresa M. Olasveengen[j], Giuseppe Ristagno[k], Joachim Schlieber[l], Sebastian Schnaubelt[m], Andrea Scapigliati[n], Koenraad G Monsieurs[o]*

- ”Ubiquitous personal technology (smart phone or watch) may be able to measure and report compression characteristics to help coach CPR”.

PLOS | ONE

RESEARCH ARTICLE

Effectiveness of feedback with a smartwatch for high-quality chest compressions during adult cardiac arrest: A randomized controlled simulation study

Chiwon Ahn[1,2☯], Juncheol Lee[1☯], Jaehoon Oh[1,3]*, Yeongtak Song[3], Youngjoon Chee[4], Tae Ho Lim[1,3], Hyunggoo Kang[1,3], Hyungoo Shin[1]

1 Department of Emergency Medicine, College of Medicine, Hanyang University, Seoul, Korea, 2 Department of Biomedical Engineering, Graduate School of Medicine, Hanyang University, Seoul, Korea, 3 Convergence Technology Center for Disaster Preparedness, Hanyang University, Seoul, Korea, 4 School of Electrical Engineering, University of Ulsan, Ulsan, Korea

☯ These authors contributed equally to this work.
* ojjai@hanmail.net

Resultat:

Andelen korrekta bröstkompressioner i interventionsgruppen var signifikant högre än i kontrollgruppen:

(64.6% ±7.8% vs 43.1% ±28.3%; *p* = 0.02).

The NEW ENGLAND JOURNAL of MEDICINE

ORIGINAL ARTICLE

Large-Scale Assessment of a Smartwatch to Identify Atrial Fibrillation

Marco V. Perez, M.D., Kenneth W. Mahaffey, M.D., Haley Hedlin, Ph.D., John S. Rumsfeld, M.D., Ph.D., Ariadna Garcia, M.S., Todd Ferris, M.D., Vidhya Balasubramanian, M.S., Andrea M. Russo, M.D., Amol Rajmane, M.D., Lauren Cheung, M.D., Grace Hung, M.S., Justin Lee, M.P.H., Peter Kowey, M.D., Nisha Talati, M.B.A., Divya Nag, Santosh E. Gummidipundi, M.S., Alexis Beatty, M.D., M.A.S., Mellanie True Hills, B.S., Sumbul Desai, M.D., Christopher B. Granger, M.D., Manisha Desai, Ph.D., and Mintu P. Turakhia, M.D., M.A.S., for the Apple Heart Study Investigators*

Photo :Apple inc.

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Metod
Totalt 419,297 personer (>22 år) rekryterades i USA i perioden November 2017, till Augusti 2018.

En Iphone-baserad app användes för att delta i studien samt för att övervaka hjärtrytmen via Apple smartwatch.

Om klockan varnade för oregelbunden puls sändes uppföljande långtids-EKG (7-dagar) ut till deltagaren.

Resultat
Under en övervakningstid av 117 dagar (median) fick 2161 (0.52%) deltagare en varning om oregelbunden puls.

Konklusion
Sannolikheten att få en notifiering om oregelbunden rytm var låg (0,5%). Hos deltagare som fick en notifiering hade 34% FF.

Perez MV et al; Apple Heart Study Investigators. Large-Scale Assessment of a Smartwatch to Identify Atrial Fibrillation. N Engl J Med. 2019 Nov 14;381(20):1909-1917.

Photo :Apple inc.

Vision.. automatiserad detektion och larm vid misstänkt hjärtstopp?

- Tillgänglighet till smartklockor i ökande

- Detektering av VF/VT/Asystoli möjlig ihop med andra sensorer?:
  - Spo2, Puls, Falldetektion samt Ej respons från användare inom x sek.

- Potential att:
  a) ”Bevittna” fler fall omedelbart
  b) Förkorta tid till larm avsevärt

- Risk för:
  a) Överutlarmning
  b) x?

Photo: Montage AC.

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5. Smartphones för utlarmning av frivilliga

Fig. 1 – System saving lives infographic summary.

In line with ILCOR, the ERC recommends that citizens who are near a suspected OHCA event and willing to be engaged/notified by a smartphone app with a mobile positioning system (MPS) or Text Message (TM)-alert system should be notified.

As these technologies become ubiquitous, they will play a greater role in the chain of survival.

Illustration: ERC: erc.edu

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European Heart Journal

ESC
European Society of Cardiology

ACCEPTED MANUSCRIPT

Alert system-supported lay defibrillation and basic life-support for cardiac arrest at home

Remy Stieglis, MSc, Jolande A Zijlstra, PhD, Frank Riedijk, BEng, Martin Smeekes, MD, Wim E van der Worp, BSc, Jan G P Tijssen, PhD, Aeilko H Zwinderman, PhD, Marieke T Blom, PhD, Rudolph W Koster, MD, PhD Author Notes

European Heart Journal, ehab802, https://doi.org/10.1093/eurheartj/ehab802
Published: 14 November 2021 **Article history**

Methods

In residential areas 785 AEDs were placed and 5735 volunteer responders recruited.

Conclusion

Introducing volunteer responders directed to AEDs, dispatched by text-message was associated with significantly reduced time to first defibrillation, increased bystander CPR and increased overall survival for OHCA patients in residences found with VF.

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6. Tillgång till hjärtstartare

Figur 1. Antal kontrollerade hjärtstartare vid årsskiftet 2019/2020

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RESUSCITATION 165 (2021) 101 –109

Available online at www.sciencedirect.com

Resuscitation

journal homepage: www.elsevier.com/locate/resuscitation

Review

Out of hospital cardiac arrest: Past, present, and future

Thomas Rea[a], *Peter J. Kudenchuk*[a], *Michael R. Sayre*[b], *Ann Doll*[c], *Mickey Eisenberg*[b,*]

[a] Department of Medicine, University of Washington, United States
[b] Department of Emergency Medicine, University of Washington, United States
[c] Resuscitation Academy, United States

Current AEDs are designed for “industrial use” whereby they are engineered and powered for sustained and repeated high-fidelity operation.

Yet we know that in most public access events, the AED delivers a single shock as this initial shock is either successful or professional response arrives.

https://rapidresponserevival.com

7. IVPA / First responders

More than half of the European countries have at least one region with a first responder system.

First responders (trained and untrained laypersons, firefighters, police officers, and off-duty healthcare professionals) who are near a suspected OHCA…

…should be notified by the dispatch centre through an alerting system implemented with a smartphone app or a text message.

Illustration: Laerdal A/S.

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8. Drönare med AED

ESC European Society of Cardiology

European Heart Journal (2021) **00**, 1–10
doi:10.1093/eurheartj/ehab498

CLINICAL RESEARCH
Clinical trials

Automated external defibrillators delivered by drones to patients with suspected out-of-hospital cardiac arrest

Sofia Schierbeck [1], Jacob Hollenberg [1], Anette Nord [1], Leif Svensson[1], Per Nordberg[1], Mattias Ringh[1], Sune Forsberg[1], Peter Lundgren [2,3,4], Christer Axelsson[2,3], and Andreas Claesson [1]*

[1]Department of Medicine, Centre for Resuscitation Science, Karolinska Institutet, Södersjukhuset Sjukhusbacken 10, Solna, 118 83 Stockholm, Sweden; [2]Institute of Medicine, Sahlgrenska Academy, University of Gothenburg, Arwid Wallgrens backe, 413 46 Gothenburg, Sweden; [3]Prehospen—Centre for Prehospital Research, University of Borås, 501 90 Borås, Sweden; and [4]Department of Cardiology, Region Västra Götaland, Sahlgrenska University Hospital, Blå stråket 5, 413 45 Gothenburg, Sweden

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Graphical abstract, EHJ

Automated External Defibrillators delivered by drones to patients with suspected Out-of-Hospital Cardiac Arrest

Dispatch Center

EMS

AED-drones arrived prior to ambulances in 64%, with a median time benefit of 01:52 minutes (IQR:01:35-04:54) when drone arrived first.

DRONE

The median distance to location was 3,1 km (IQR:2,8-3,4). AED-delivery was feasible within 9 meters (IQR:7,5-10,5) from the location.

In totally 12 drone alerts to suspected OHCA, AED-delivery was feasible and successful in 11 alerts, 92%. In an additional 61 test-flights the AED-delivery success rate was 90% (55/61).

Suspected OHCA

Karolinska Institutet

GIS-data för optimal placering:

Invånare Trollhättan:

~40,000

Responstid, ambulans vs drönare:
9m 39s / 4m 25s

Antal teoretiska hjärtstartarleveranser minst 3 min före ankomst av ambulans:

70%

Kedjan som räddar liv 2.0

Andreas Claesson

Ordförande Svenska HLR-rådet

Leg. Ambulanssjuksköt. / Docent

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Suspected
OHCA
Dispatch Center
AMBULANS
AMBULANCE
AMBULANS