



Drönare vid drunkning

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Hjärtstopp utanför sjukhus

Årligen rapporteras ca 6000 fall av hjärtstopp utanför sjukhus till det Svenska HLR-registret, 30-dagars överlevnaden är 10%. *Gräsner et al. Eureka One. Resuscitation 2016.*

Drunkning där HLR-behandling påbörjats har under 2014-2019 årligen omfattat 46-80 fall. Överlevnaden är även i denna grupp ca 10%. *Svenska HLR-registrets årsrapport 2020*



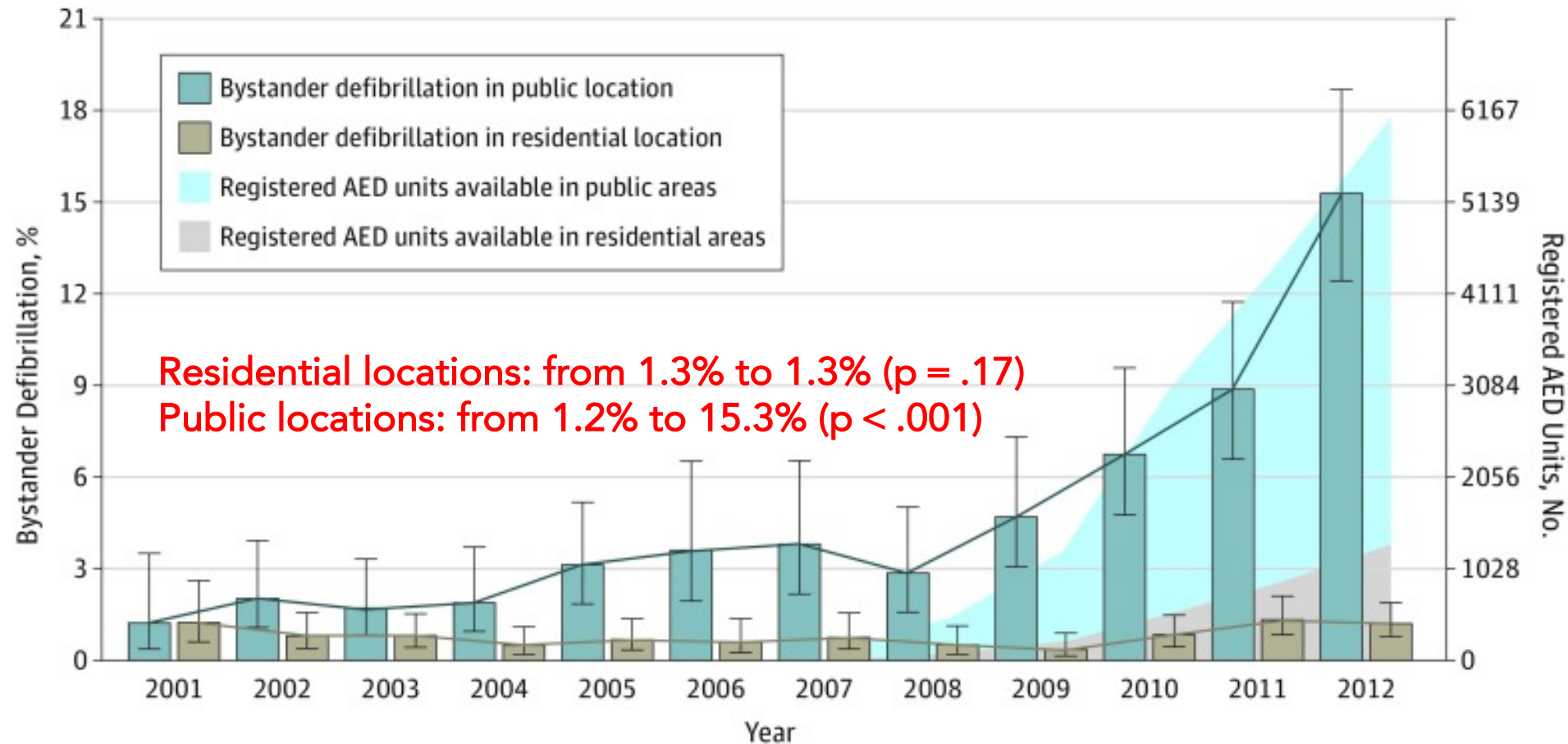




Bystander Defibrillation for Out-of-Hospital Cardiac Arrest in Public vs Residential Locations

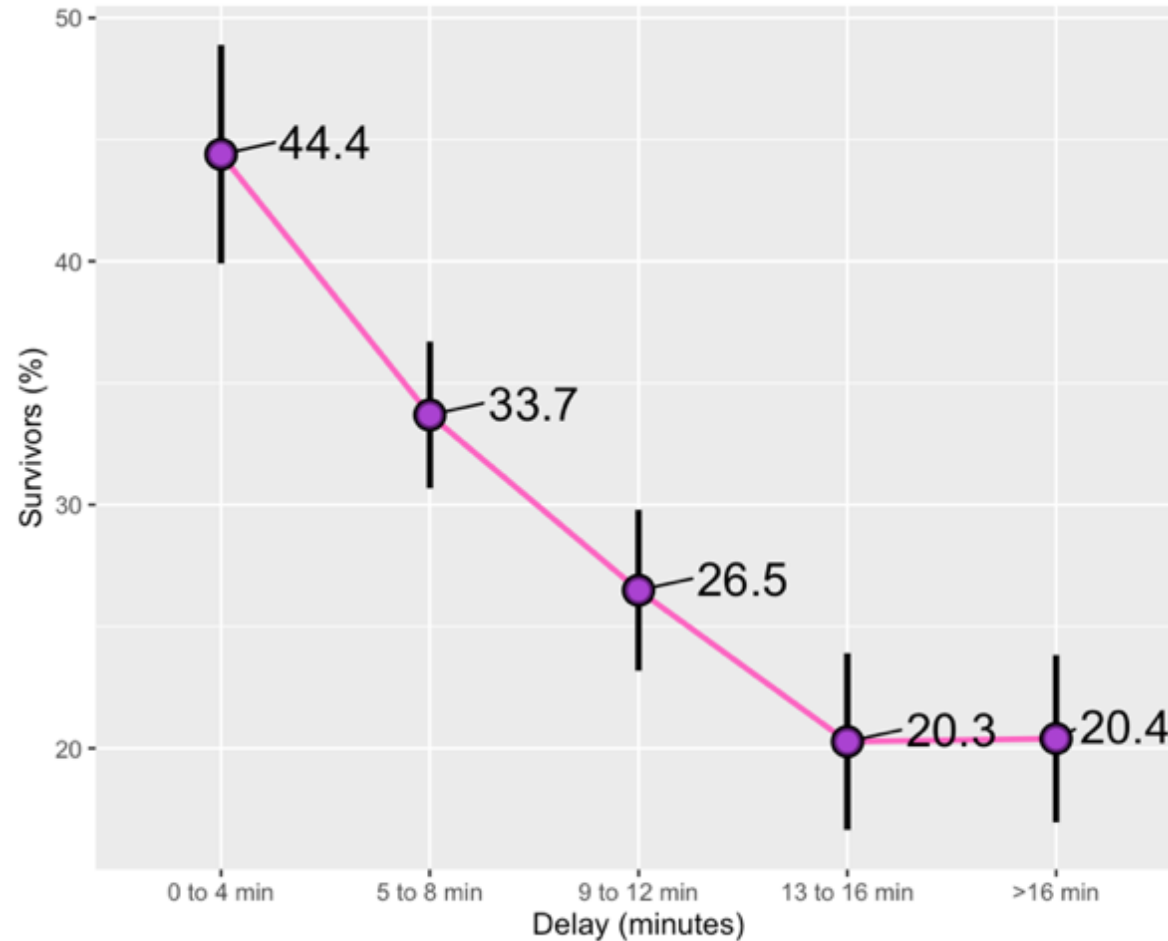
Hansen SM et al. JAMA Cardiol. 2017 May; 2(5): 507–514.

- Totally 18 688 patients with OHCA in Denmark between 2001-2012 (67.8% men):



Adjusted 30 days survival in relation to EMS delay – shockable rhythm - Sweden 2008-2017, n= 25,596 cases, Swedish OHCA-register data

(B) Adjusted 30-days survival: shockable rhythm



Model predictors: age, sex, place of arrest, calendar year, EMS delay



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Simulation and education

National coverage of out-of-hospital cardiac arrests using automated external defibrillator-equipped drones — A geographical information system analysis

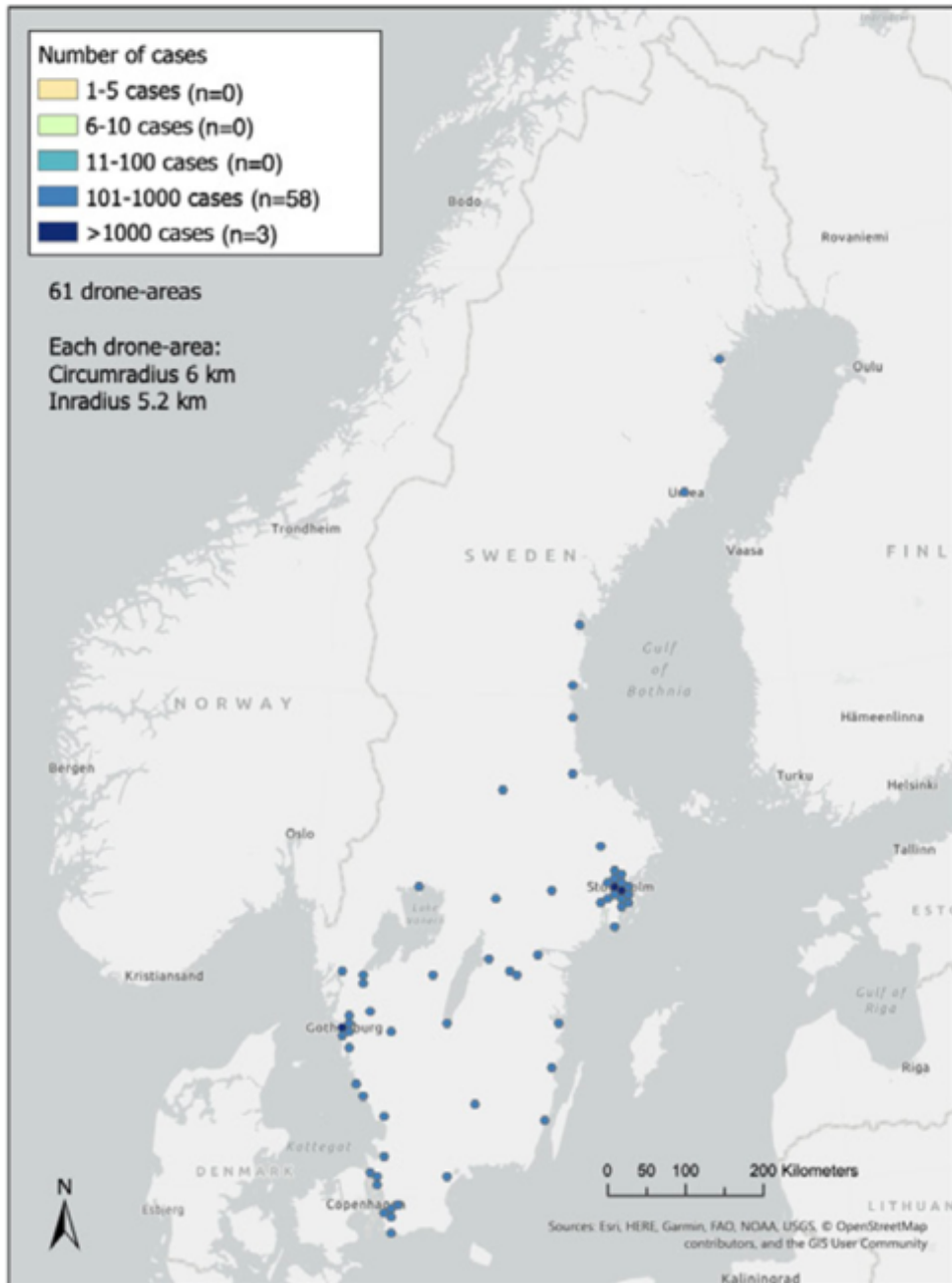
S. Schierbeck^{a,}, A. Nord^a, L. Svensson^a, A. Rawshani^b, J. Hollenberg^a, M. Ringh^a, S. Forsberg^a, P. Nordberg^a, F. Hilding^c, A. Claesson^a*

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High incidence areas



Methods: retrospective observational study of OHCA between 2010-2018. Spatial analyses of optimal drone placement using (GIS)-analyses covering high-incidence areas (>100 OHCA)

Results: 39,246 OHCA were included. To reach all OHCA in high-incidence areas with AEDs delivered by drone or ambulance within eight minutes...

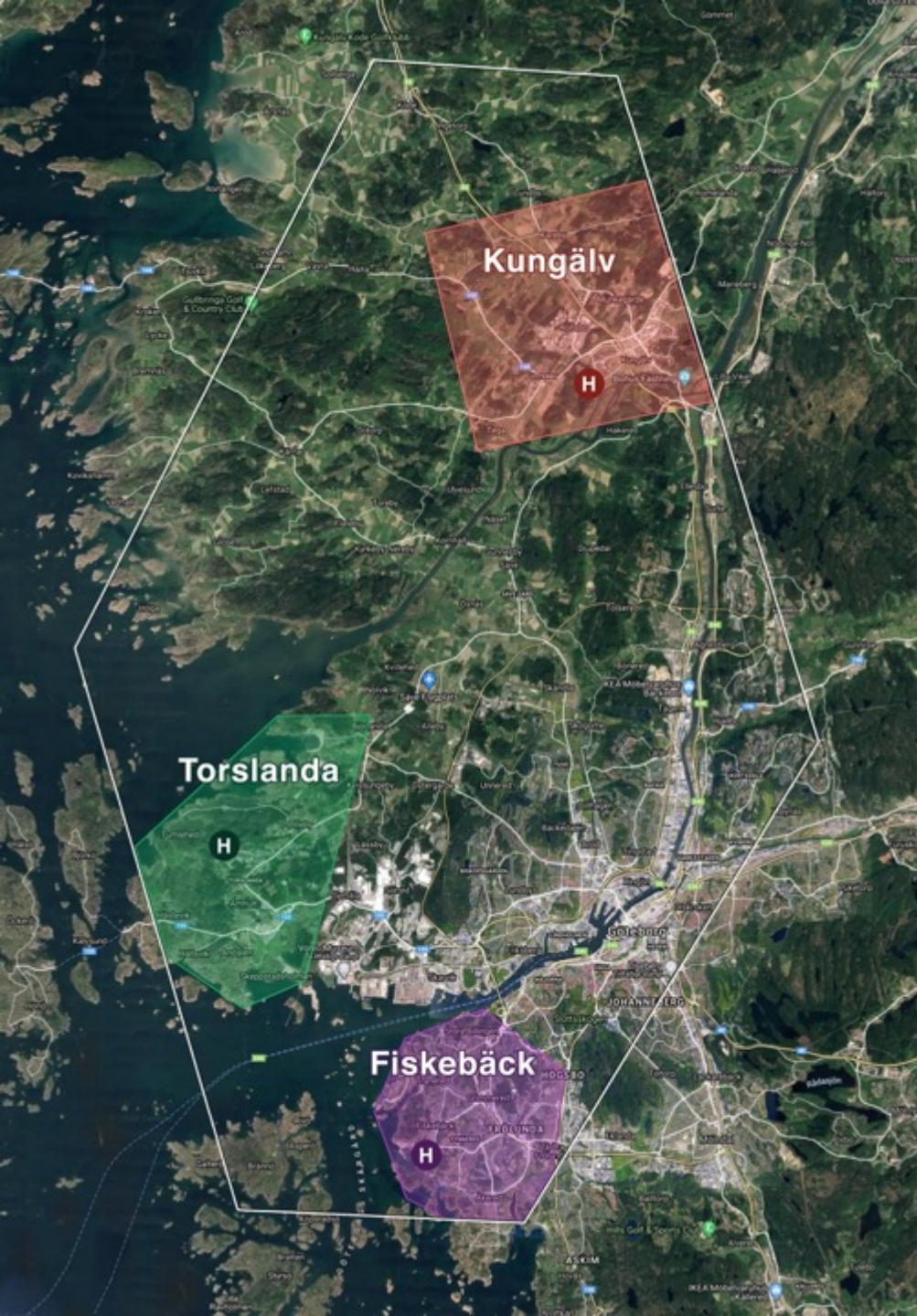
...61 drone systems would be needed.

Feasibility study 2020

n=3 automated drone-systems were integrated with EMS and deployed for AED-delivery to cases of real-life suspected OHCA.

Göteborg, Sweden, covering about 80,000 residents







Mission Control Centre





CLINICAL RESEARCH STUDY

**Automated External Defibrillators Delivered by Drones to
Patients With Suspected Out-of-Hospital Cardiac Arrest**

Schierbeck et al.

Center for Resuscitation Science Karolinska Institutet, Sweden 2020

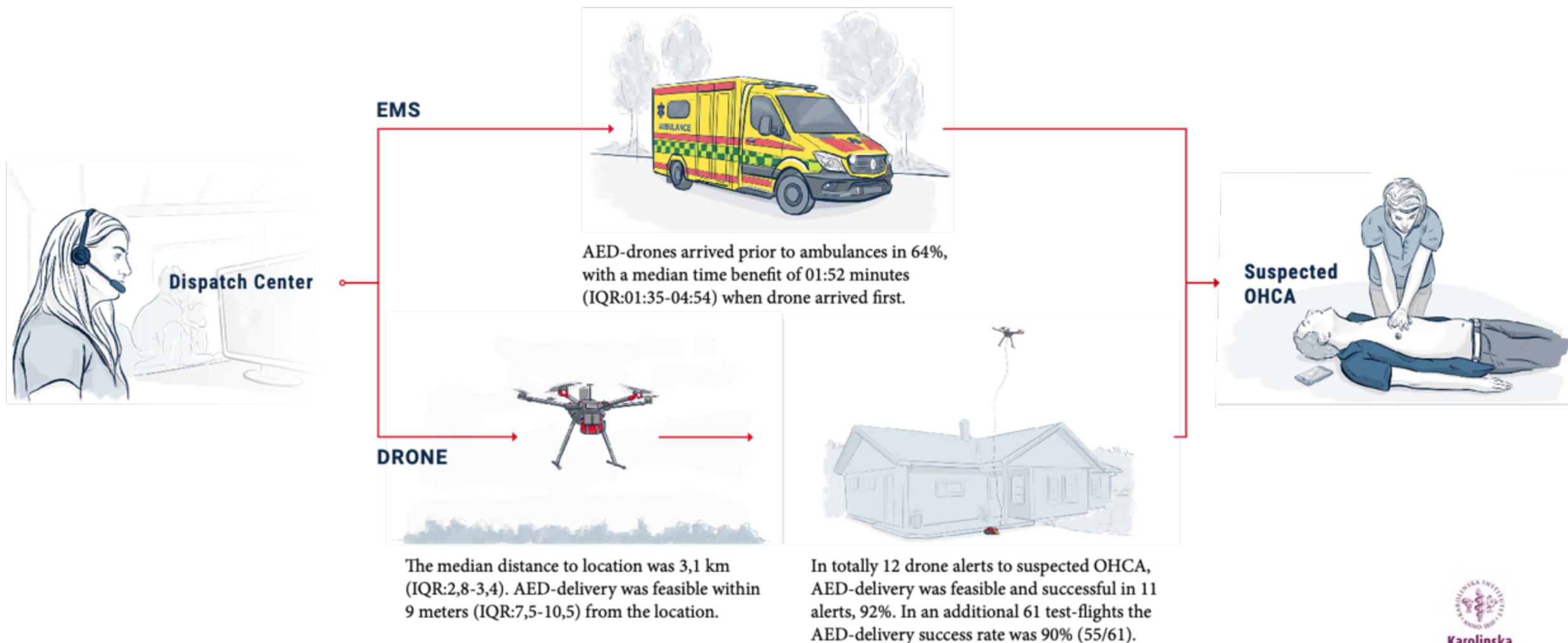
Automated external defibrillators delivered by drones to patients with suspected out-of-hospital cardiac arrest

Sofia Schierbeck ¹, **Jacob Hollenberg** ¹, **Anette Nord** ¹, **Leif Svensson**¹,
Per Nordberg¹, **Mattias Ringh**¹, **Sune Forsberg**¹, **Peter Lundgren** ^{2,3,4},
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Automated External Defibrillators delivered by drones to patients with suspected Out-of-Hospital Cardiac Arrest

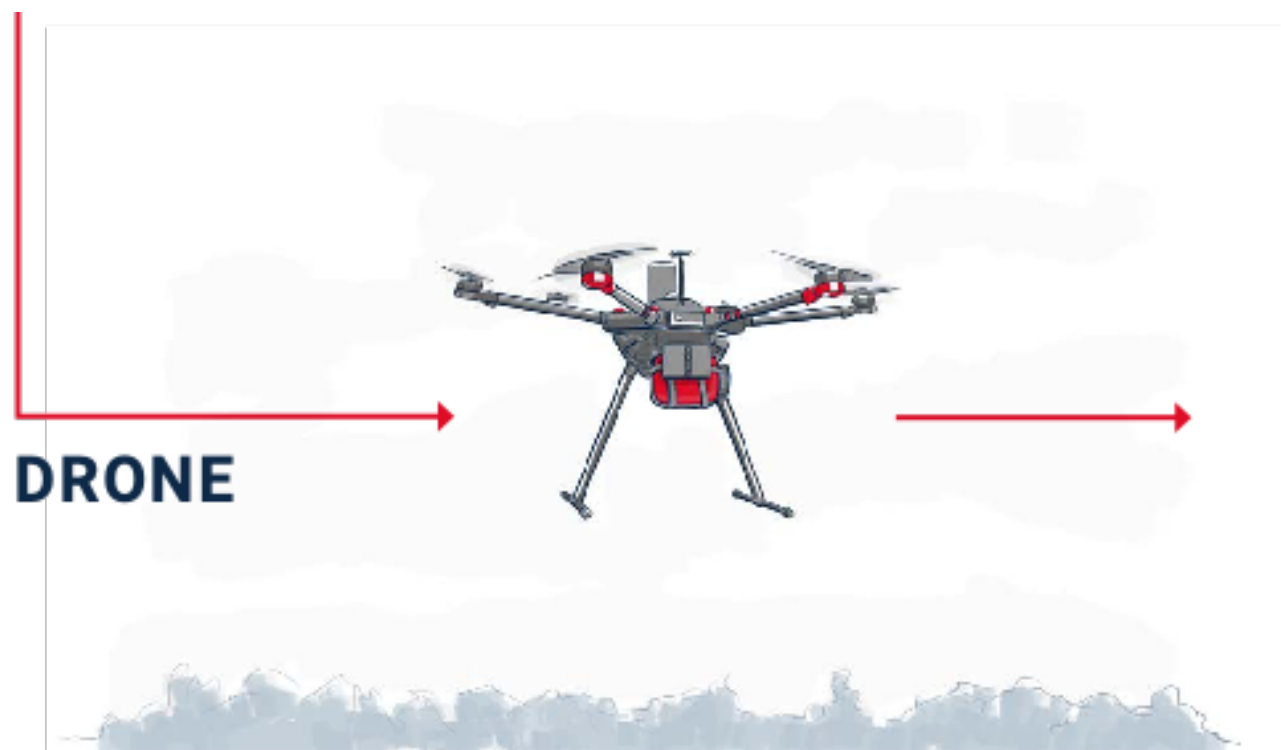




In totally 12 drone alerts to suspected OHCA, AED-delivery was feasible and successful in 11 alerts, 92%. In an additional 61 test-flights the AED-delivery success rate was 90% (55/61).



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.



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.



Figure 1. Fiskebäck service area with example of no-fly zones marked in red.



Drönare inom livräddning

1. **Autonom lokalisation av personer i- och under ytan**

- Indikerar fyndplatsen för räddningspersonal
- Dokumenterar tider och förlopp
- Kortar tid till a) räddning samt b) start av HLR

2. **Levererans av flythjälp**

- Indikerar platsen för räddningspersonal
- Dokumenterar tider och förlopp
- Säkrar personen i ytan



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Simulation and education

Drones may be used to save lives in out of hospital cardiac arrest due to drowning[☆]

A. Claesson^{a,*}, L. Svensson^a, P. Nordberg^a, M. Ringh^a, M. Rosenqvist^a, T. Djarv^a,
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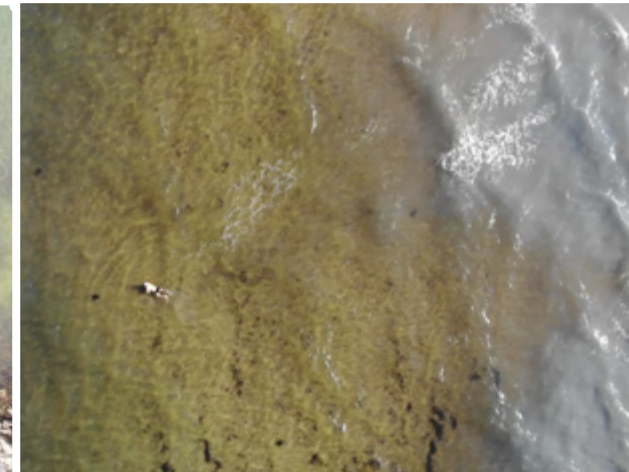
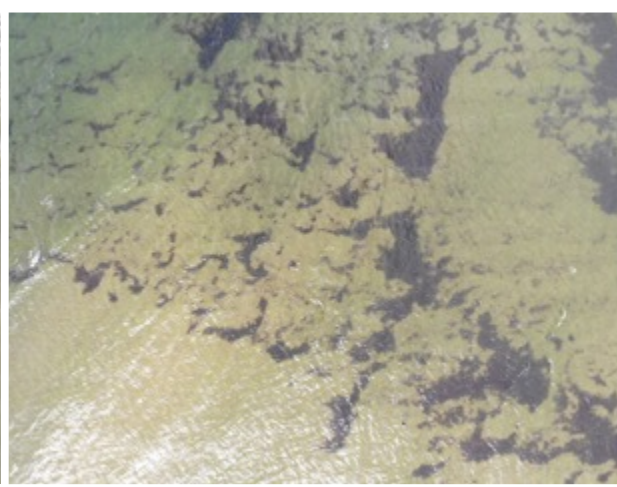
^d Swedish Lifesaving Society, Surf Lifesaving Club Tylösand, Sweden











50 m sidled vs 50 m höjded





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Original Research

Drones for Provision of Flotation Support in Simulated Drowning

Anders Bäckman, RN ¹, Jacob Hollenberg, MD, PhD ², Leif Svensson, MD, PhD ²,
Mattias Ringh, MD ², Per Nordberg, MD, PhD ², Therese Djärv, MD ²,
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Simulation and education

The use of drones and a machine-learning model for recognition of simulated drowning victims—A feasibility study



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Table 1 – Search area coverage with different drone altitudes.

Variable	GSD (cm/px) ^a	Search area dimensions width × height (meters)	Search area coverage (m ²)	Drowning victim area on screen width × height (px) ^b
Drone altitude (meters)				
10	0.46	18.7 × 10.5	196	391 × 109
20	0.92	37.3 × 21	783	196 × 54
30	1.37	55.6 × 31.2	1735	131 × 36
40	1.83	74.2 × 41.7	3094	98 × 27
50	2.29	92.9 × 52.2	4849	79 × 22
60	2.75	111.5 × 62.7	6991	65 × 18
70	3.21	130.2 × 73.2	9531	56 × 16
80	3.66	148.4 × 83.4	12,377	49 × 14
90	4.12	167.1 × 93.9	15,691	44 × 12
100	4.58	185.8 × 104.4	19,398	39 × 11

^a Ground sample distance (GSD) i.e ground area covered by each pixel on screen depending on drone altitude. Calculations based on DJI Mavic Air drone specifications with a 16:9 screen ratio made with online calculator Propelleaero.com.

^b Number of pixels on image containing presumed drowning victim. Calculations based on rectangular area. General area coverage of an adult human sized 180cm × 50cm = 0.9 m².



Table 2 – Machine learning model recognition of n = 200 simulated drowning victim photos.

Variable	Value %	95% CI
Sensitivity, true positives	91	83.6–95.8
Specificity, true negatives	90	82.4–95.1
Drowning victim prevalence	50	42.9–57.1
Victim present (n = 100)		
Number of photos with one (n = 1) object detected (^a 1)	75	
Number of photos with two (n = 2) objects detected (^b)	25	
Human probability object 1 (real victim)-median (IQR)	66 (52–71)	
Human probability object 2 (n = 25 false objects) median (IQR)	40.5 (31–59)	
Victim absent (n = 100)		
Number of photos with one (n = 1) object detected (^b)	10	
Human probability object 1 (false object) median (IQR)	35% (20–46)	

^a Actual submerged victim.

^b Machine learning model recognized a secondary false object.



In Flight (GPS)

GPS

19



5.8G

56%



08:07



Auto ISO	SHUTTER	EV	WB
100	320	+0.0	Auto

SD	CAPACITY
1080P/60	01:40:43

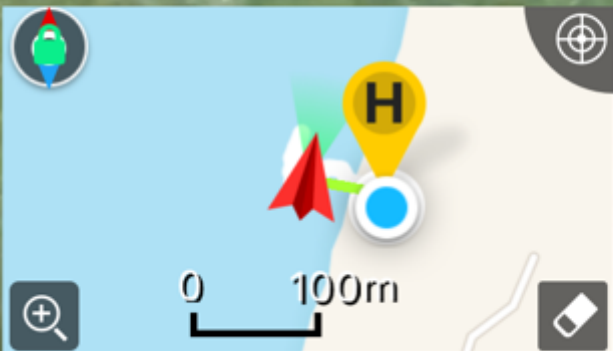
1080P/60



AI-detektion!
Misstänkt drunkning!
 (96% sannolikhet)



1:37



D 59 m

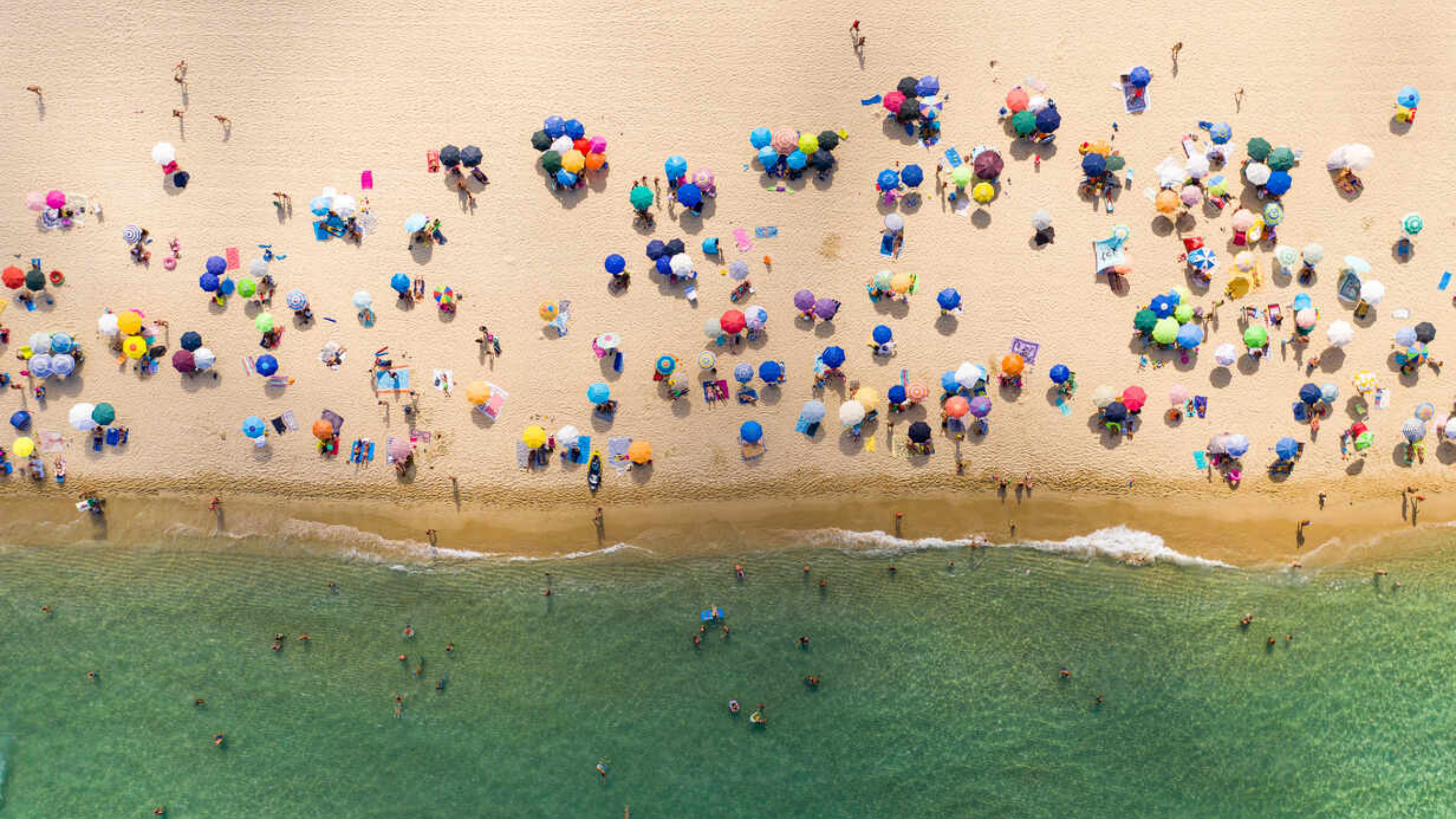
H 47 m

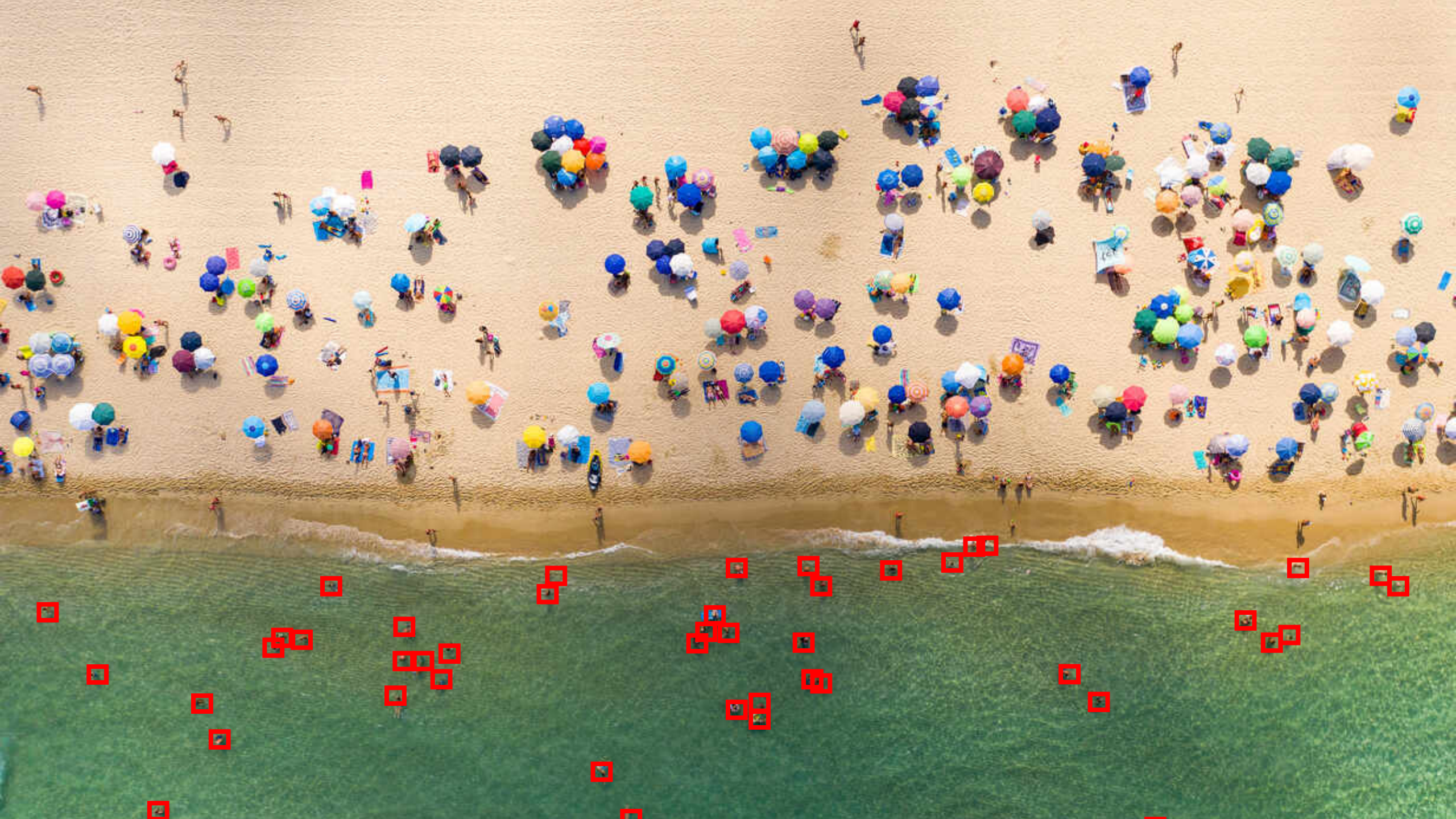
H.S 0.0 m/s

V.S 0.0 m/s

N/A







SLS, Livräddarna Tylösand
- Räddningar i utström
2012-2016, n=25

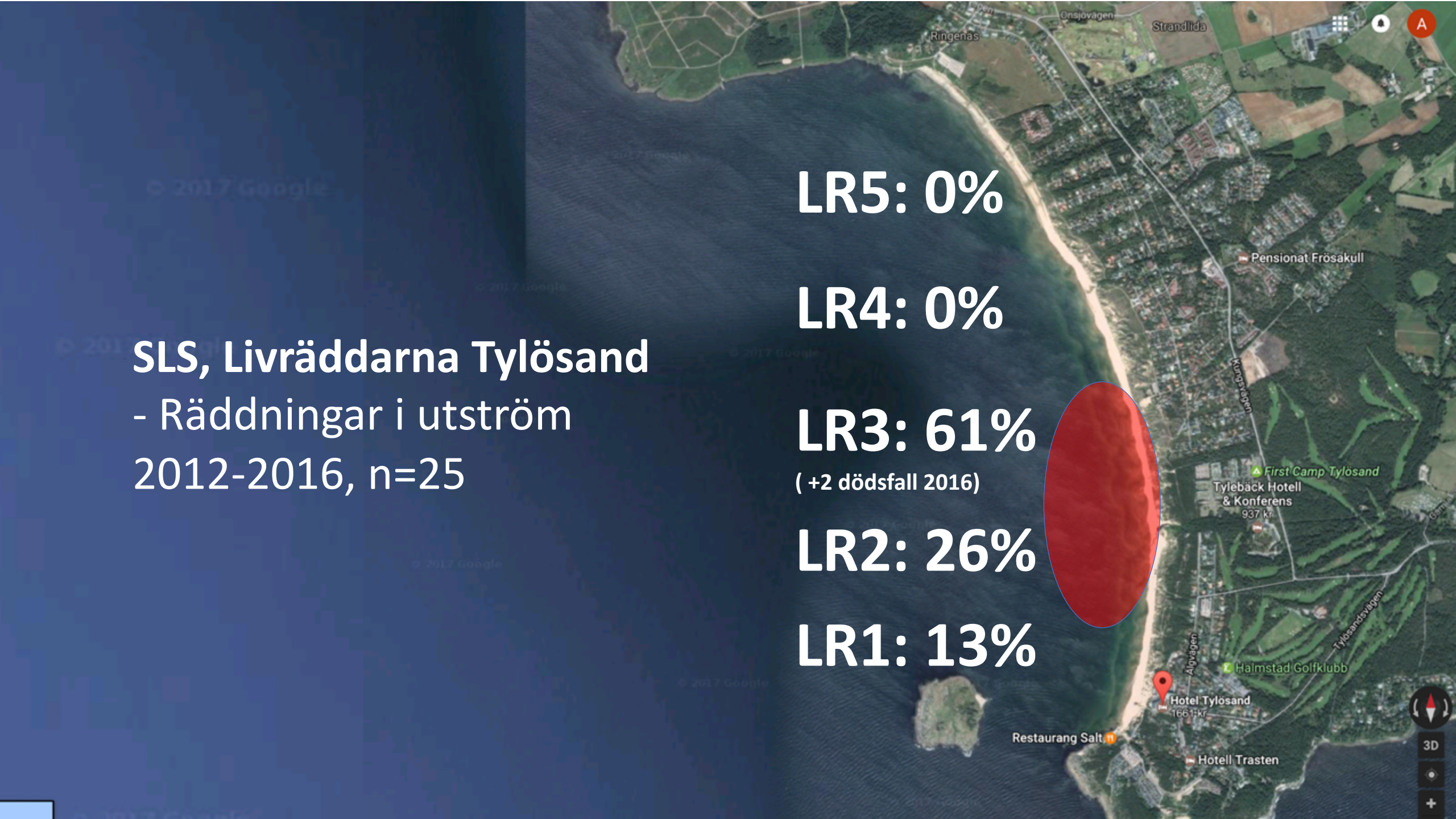
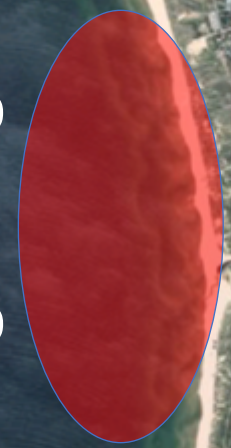
LR5: 0%

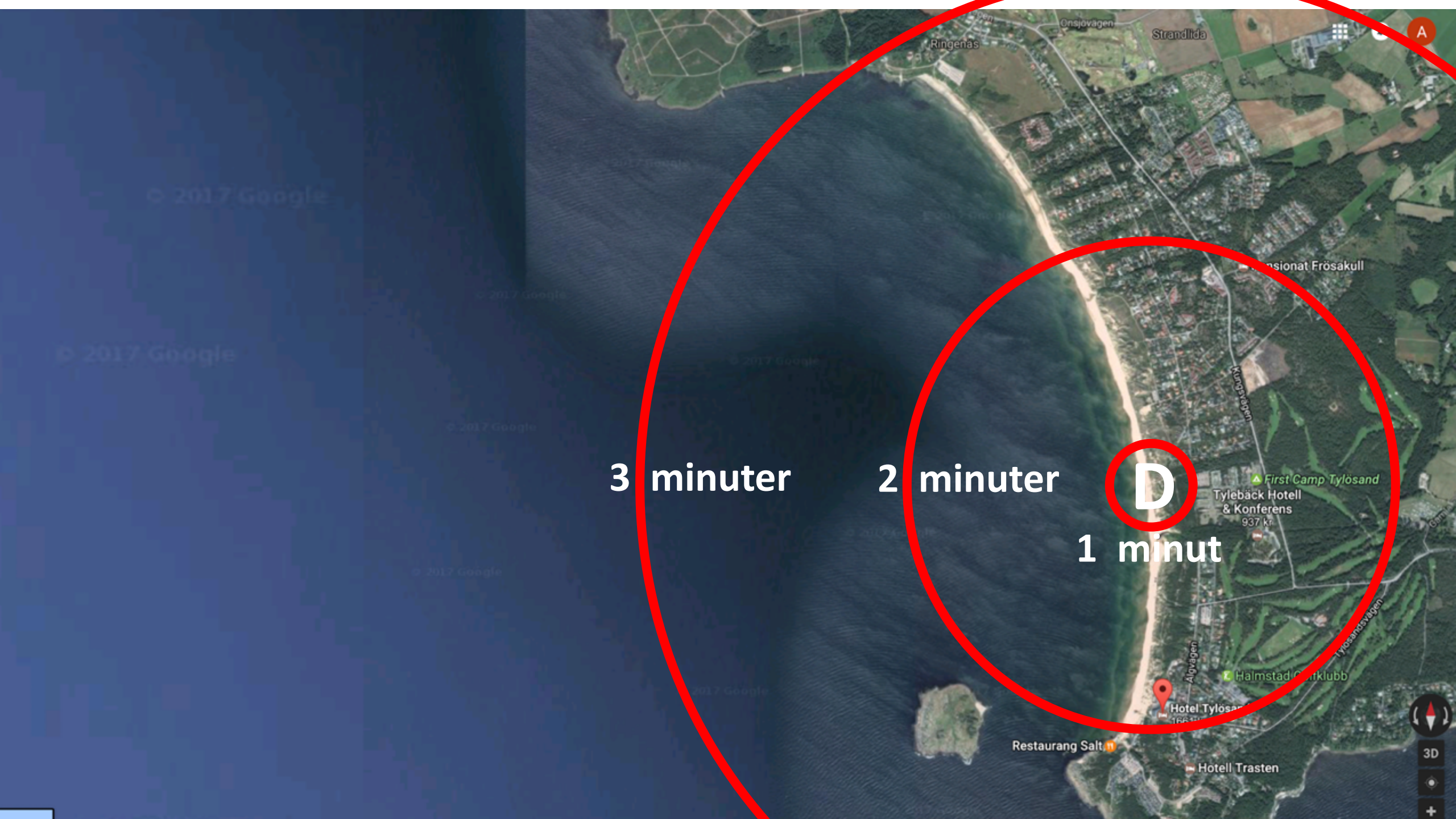
LR4: 0%

LR3: 61%
(+2 dödsfall 2016)

LR2: 26%

LR1: 13%





3 minuter

2 minuter

D

1 minut



Konklusion

Chansen att överleva drunkning är liten efter 10 minuters submersion

Räddningstjänst, ambulans anländer ofta för sent, livräddningskunniga personer på plats avgörande för överlevnaden.

Drönare har potential att rädda liv vid drunkning genom att:

- Placeras på optimala platser vid badplatser för automatiserad utlarmning
- Leverera utrustning t.ex. hjärtstartare
- Lokalisera personer på stranden samt i eller under ytan
- Nyttja AI-stöd för automatiserad lokalisering
- Dokumentera tider och förlopp
- Tidigt tillse flytkraft till personer i ytan

Tack!

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Summer season - 01/12/2009 to 15/07/2015
Santa Catarina State Coast - Total of 1.565.699 interventions by lifeguards

DROWNING CHAIN OF SURVIVAL

A call to action

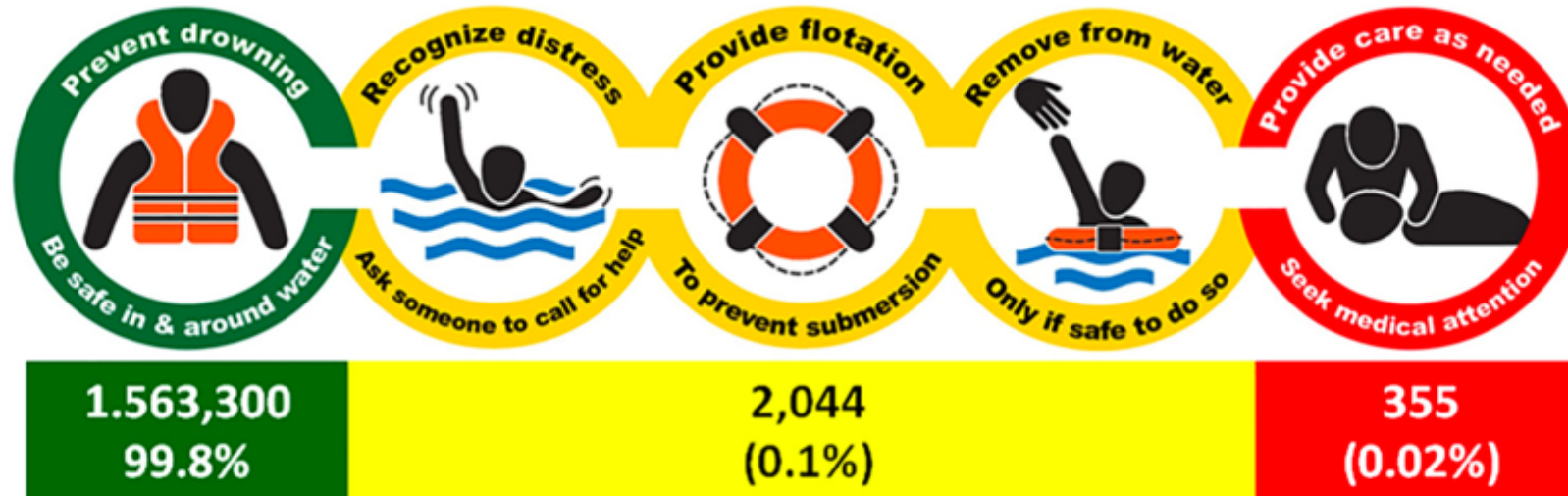


Fig. 2. Frequency of lifeguard interventions (n = 1,565,358) at “praia dos Ingleses” beach in the South of Brazil, State of Santa Catarina as they relate to the three phases of the Drowning Chain of Survival.

Adapted from Szpilman et al. [5].