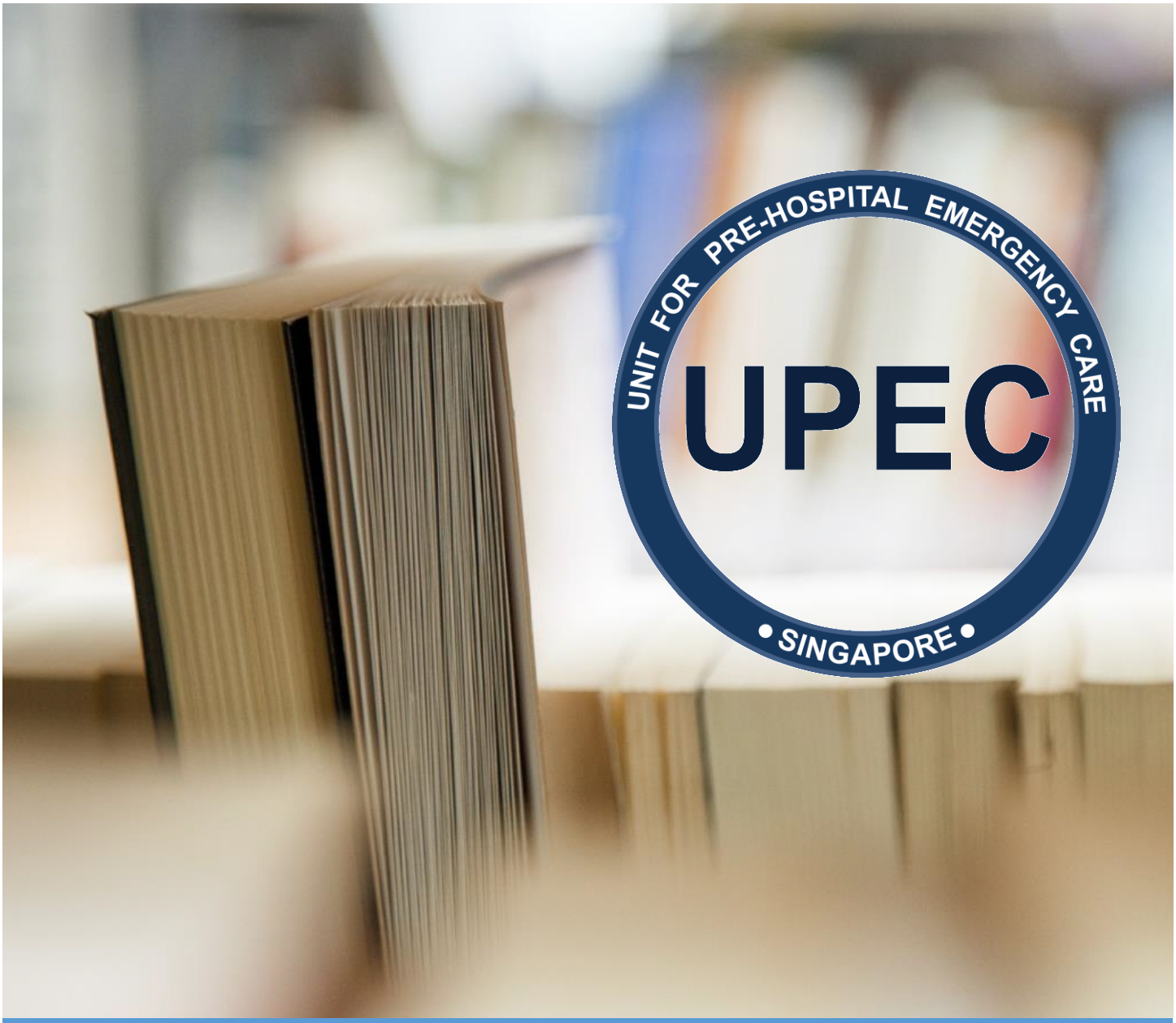


2011-2015 Singapore Out-of-Hospital Cardiac Arrest Registry Report

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ACKNOWLEDGEMENTS

OHCA data collection was supported by National Medical Research Council Singapore Clinician Scientist Award grants.

The authors would like to thank the following for data contribution:

Singapore Civil Defence Force	**COL (Dr) Ng Yih Yng** **CPT Joey Tay Ai Meng** **WO1 Doris Low Lian Tien** **WO2 Mohamed Zohri Bin Anwar** **WO2 Siti Zarinah Binte Sarip** **SSN Winston Teo Kok Liang** **SSN Geraldine Goh Shu Yi**
National University Hospital	**Dr Benjamin Leong Sieu-Hon**
Changi General Hospital	**Dr Gan Han Nee** **Dr Tiah Ling**
Tan Tock Seng Hospital	**Dr Michael Chia Yih Chong**
Singapore General Hospital	**A/Prof Marcus Ong Eng Hock** **Dr Nausheen Edwin Doctor**
Khoo Teck Puat Hospital	**Dr Desmond Mao Renhao** **Dr Goh E Shaun**
Ng Teng Fong General Hospital	**Dr Cheah Si Oon** **Adj Asst Prof Rabind Antony Charles**
KK Women and Children Hospital	**A/Prof (Adj) Tham Lai Peng**

The authors wish to acknowledge the enormous efforts by the Singapore PAROS team:

Ms Susan Yap
Ms Nur Shahidah Binte Ahmad
Ms Pek Pin Pin

Suggested cite: White AE, Wah W, Ong MEH. *2011-2015 Singapore Out-of-Hospital Cardiac Arrest Registry Report*. September 2017. Republic of Singapore. Unit for Prehospital Emergency Care. 2017.

Out-of-hospital cardiac arrest (OHCA) in Singapore

Introduction

Out-of-hospital cardiac arrest (OHCA) is a leading cause of death. An estimated 700,000 people yearly across Europe and North America suffered out-of-hospital cardiac arrests, and only an estimated 10% survived.[1] In Singapore, the number of OHCA rose from 1376 in 2011 to 2374 in 2015, highlighting an upward trend of annual OHCA cases. As in Europe and North America, 70% of the OHCA in Singapore occurred in residential areas.

This data report provides an overview of: 1) the burden of OHCA; 2) pre-hospital interventions and other characteristics, and 3) OHCA characteristics and outcomes between 2011 and 2015.

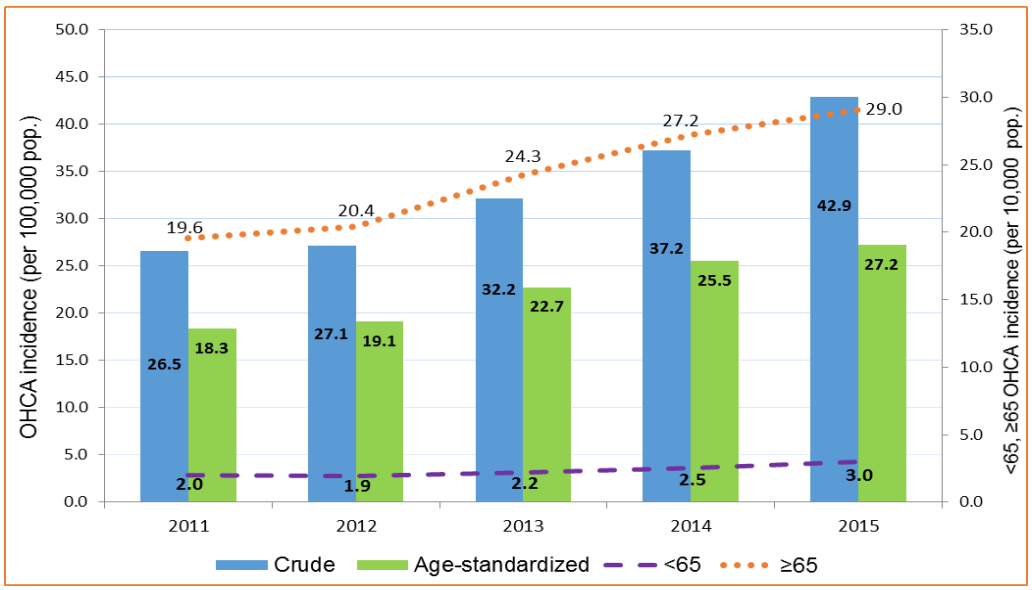
Data sources, collection, management and analysis

OHCA data is drawn from the Pan-Asian Resuscitation Outcomes Study (PAROS) registry. The registry is a prospective multinational OHCA registry established in 2010.[2] The registry aims to improve OHCA outcomes and emergency medical services (EMS) across Asia by collecting data contributions from member nations and using these to contribute to a common evidence-base. The registry data is extracted from dispatch records, ambulance forms, emergency department records, and in-hospital medical records.

Mid-year population estimates from the Singapore Department of Statistics were used to calculate crude and age-standardized incidence and survival rates of OHCA. Population estimates in the report pertain to resident population (Singapore citizens and permanent residents).

Incidence rates were calculated by dividing the number of OHCA cases by the mid-year population. Age-standardized incidence rates were derived by applying the category-specific incidence rates of each population to the Segi World Standard population.[3] Age-standardised survival rates were calculated by the direct method using the Singapore population as the standard population in the corresponding year.[4, 5]

Incidence rates



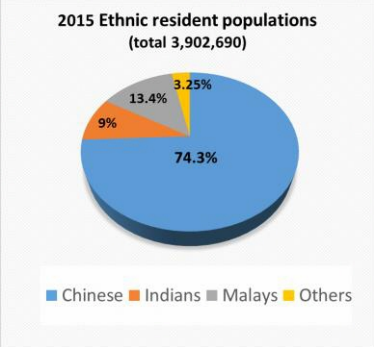
Incidence rate is the frequency rate of new OHCA cases within a period of time. In this chart you will see the rates for 2011 to 2015 expressed as cases-per-100,000; a crude rate; and separate cases-per-10,000 for people at or above age 65, and younger.

Data:

- 2015 age-standardised incidence rates for OHCA was **27.2** per 100,000 population.
- On average, there was a **2.22%** per year increase in the age-standardised OHCA incidence rate year-over-year from 2011 to 2015
- The incidence rate among people below the age of 65 remained relatively low (2.0 per 10,000 pop. in 2011; **3.0** in 2015); but we saw a slight increase over the 5 years reported here.
- For people aged 65 and above, we observed the sharpest increase in rates (19.6 cases per 10,000 pop. in 2011 to **29** in 2015)

Incidence rates by ethnicity and gender

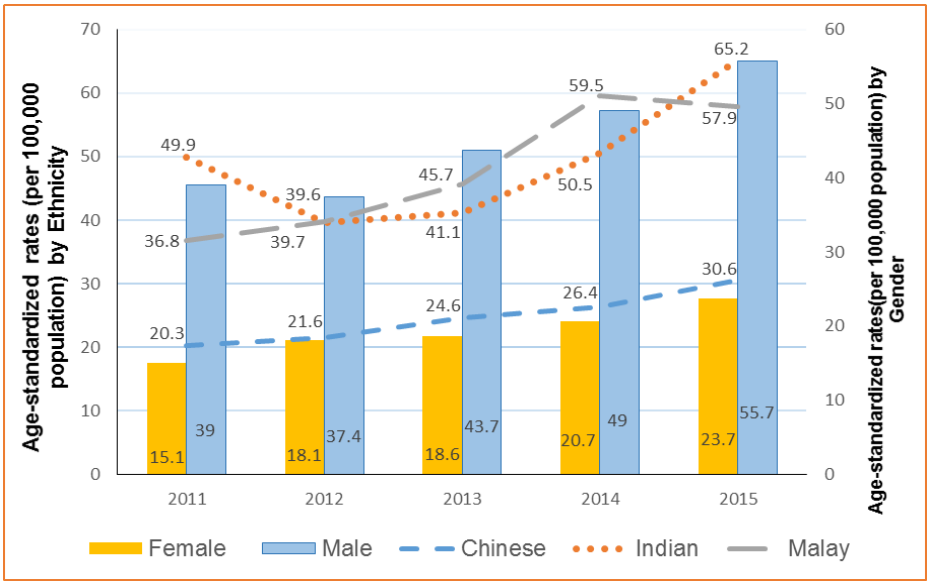
In this section, we report the incidence rates by ethnicity. There are several risk factors that can increase the chance of suffering a cardiac arrest. Some are modifiable and others are not (for example, age or genetics). The modifiable risk factors are influenced by behavioural or lifestyle choices which also account for the variance in risk profile in different groups. Stratifying the data by ethnicity and gender allows us to better see what groups and gender are experiencing a greater health burden. This enables health professionals to see which groups should have targeted interventions and how those targeted interventions are impacting the groups over time.



It is also important to measure and report ethnic data to be able to answer questions from those ethnic groups, and also assure the public that, with their health and welfare in mind, we are collecting and measuring the data. If we do not measure we will lack important information to tailor community interventions. Tailored interventions support efficient use of resources.

Data:

- Indians comprised 9.09% of the Singaporean population in 2015; Chinese (74.3%); Malay (13.4%); and others (3.25%).[3]
- Indian ethnicity population had the highest age-standardised incidence rate in 2015 (**65.2** per 100,000 pop.) compared to their Chinese (**30.6**) and Malay (**57.9**) counterparts.
- In 2011 and 2015, Indians had higher incidence rates than Malays, whereas between 2012 and 2014, Malays' rates were higher.
- Both genders showed an increase in OHCA incidence rate. Males, overall, had a much higher age-standardised incidence rate in 2015 (**55.7** per 100,000 pop.) compared to females (**23.7**).



Survival rate

In health statistics, survival is generally measured and reported in relation to various points in time. You can look at survival at: 1) admission; 2) 30-days after admission/incident; 3) discharge; and 4) at 5 years after admission/incident depending on the ailment being measured.
Rates report here refer to survival-to-hospital discharge or survival to 30-days post cardiac arrest.

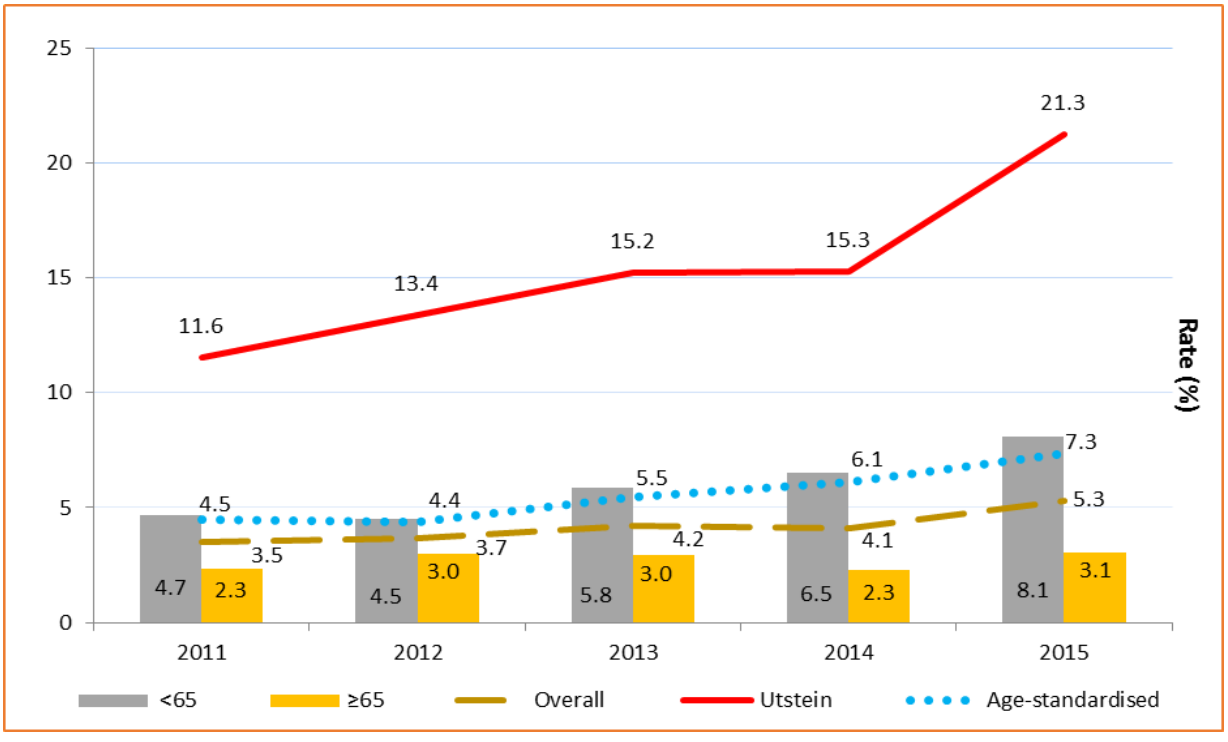
Utstein survival rates are derived by applying a set of specific criteria to OHCA cases to define this sub-group of the overall cases. The criteria includes OHCA cases that were non-traumatic in origin, bystander witnessed, and involved initial shockable heart rhythms (ventricular fibrillation or tachycardia). The criteria is simply an agreed upon convention of measuring which OHCA cases should be the focus of quality improvement efforts and thus a true measure of a country's efforts to improve survival rates. It is the most commonly used benchmark between countries and EMS systems.

In essence, Utstein criteria seeks to define (identify) only those cases where there was a chance to intervene and resuscitate. Reported Utstein survival rates will be a larger number than reported overall survival rates because the denominator of the Utstein rate is smaller (e.g., 10/100 vs. 10/1,000).

Below we present survival **rates** in several ways: 1) above and below age 65; 2) overall rates; 3) Utstein rates; and 4) the age-standardised rates.

Data:

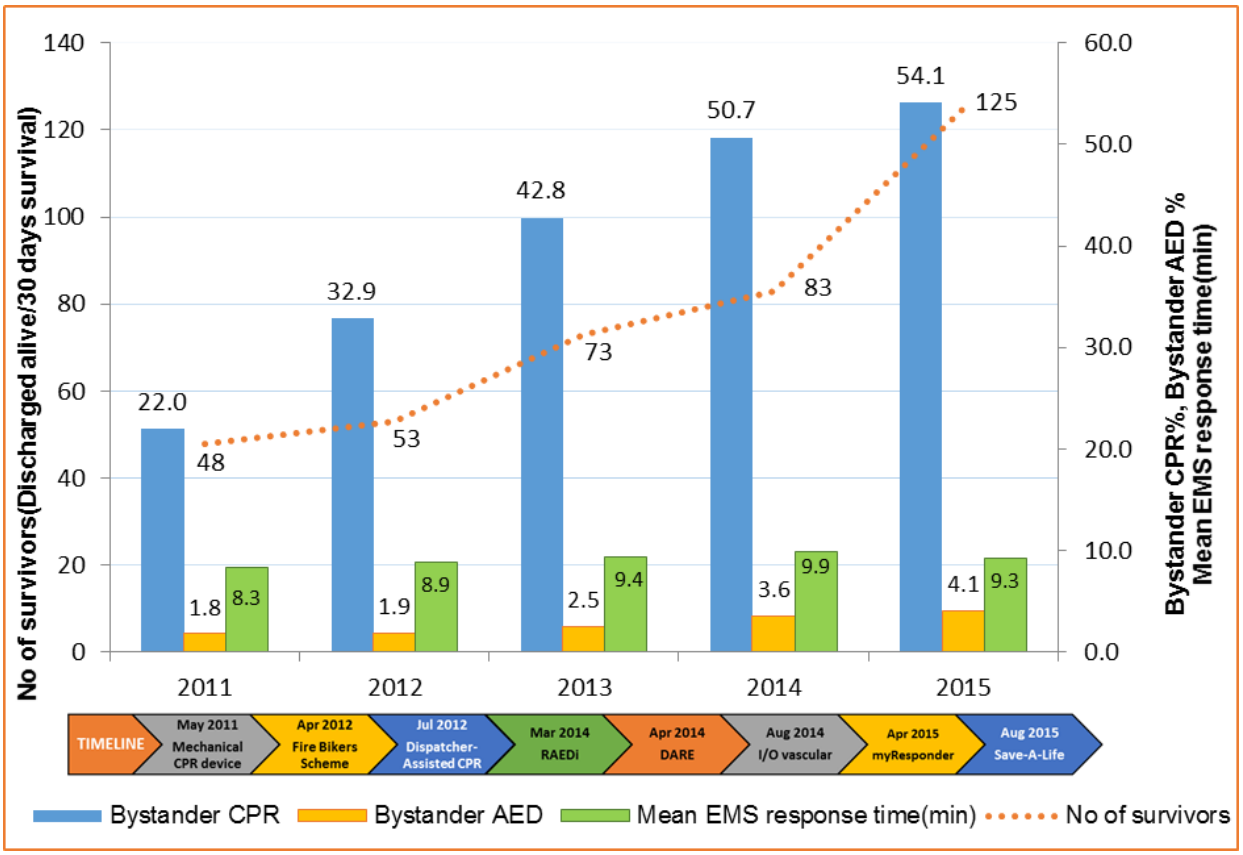
- Overall survival rates improved over the years from 3.5% in 2011 to **5.3%** in 2015.
- Age-standardised survival rates significantly increased from 4.5% in 2011 to **7.3%** in 2015.
- Utstein survival rates nearly doubled from 11.6% in 2011 to **21.3%** in 2015.
- Among younger OHCA (<65) the survival rate nearly doubled from 4.7% to **8.1%** in 2015.
- Survival rates among older OHCA remained consistently low: 2.3% in 2011 to **3.1%** in 2015.



Interventions

By interventions we mean those steps taken to attempt resuscitation. Measures include bystander CPR and AED use; and mean EMS response time. These interventions are those things that we can influence and improve, and therefore must be measured to monitor the results.

Below you will see the reported rates of bystander CPR, bystander AED, mean EMS response time, with the number of survivors (a raw count) layered on. This enables us to see the relationship between interventions and survival (discharged alive and 30-days survival).



Timeline glossary

RAEDI – (Registry for AED Integration) is the national registry for publicly accessible AEDs.
DARE – Dispatcher-assisted first responder programme. Simplified CPR+AED training.
I/O vascular – device that administers adrenaline/epinephrine directly into the bone marrow.
myResponder – phone app the alerts users to possible cardiac arrest and AED locations.
Save-a-life – programme increased public AEDs in high foot traffic areas near where people live.

Data

- Bystander CPR rates climbed from 22% in 2011 to **54.1%** in 2015.
- Bystander AED rates increased from 1.8 in 2011 to **4.1%** in 2015.
- Number of survivors increased from 48 in 2011 to **125** in 2015.
- Average EMS response time (call-received to arrival-at-scene) increased from 8.3 in 2011 to **9.3** in 2015, however this is an improvement compared to 2014.

OHCA Characteristics and Outcomes

	2011 n=1376	2012 n=1440	2013 n=1736	2014 n=2037	2015 n=2374
Age, Mean (Median)	63.5 (65)	64.1 (66)	65.9 (65.9)	65.9 (68)	65.6 (67)
Gender (%)					
Female	442 (32.1)	528 (36.7)	605 (34.9)	721 (35.4)	826 (34.8)
Male	934 (67.9)	912 (63.3)	1131 (65.2)	1316 (64.6)	1548 (65.2)
Location Type (%)					
Home Residence	985 (71.6)	988 (68.6)	1245 (71.7)	1481 (72.7)	1656 (69.8)
Nursing Home	54 (3.9)	54 (3.8)	58 (3.3)	72 (3.5)	83 (3.5)
Public setting	337 (24.4)	398 (27.8)	433 (25)	484 (23.8)	635 (26.8)
Bystander Intervention (%)					
Bystander CPR	302 (22)	473 (32.9)	743 (42.8)	1032 (50.7)	1284 (54.1)
Bystander AED	25 (1.8)	27 (1.9)	43 (2.5)	73 (3.6)	97 (4.1)
Arrest witnessed by (%)					
Bystander - Family	480 (34.9)	414 (28.8)	526 (30.3)	729 (35.8)	809 (34.1)
Bystander - Healthcare professional	65 (4.7)	69 (4.8)	70 (4)	79 (3.9)	113 (4.8)
Bystander - Lay Person	229 (16.6)	232 (16.1)	284 (16.4)	275 (13.5)	350 (14.7)
EMS/Private ambulance	112 (8.1)	122 (8.5)	139 (8)	154 (7.6)	217 (9.1)
Not witnessed	490 (35.6)	603 (41.9)	717 (41.3)	800 (39.3)	885 (37.3)
Initial rhythm (%)					
Shockable rhythm	251 (18.4)	280 (19.7)	304 (17.8)	347 (17.4)	378 (16.3)
Non-shockable rhythm	1113 (81.6)	1144 (80.3)	1405 (82.2)	1651 (82.6)	1943 (83.7)
Outcomes (%)					
ROSC at scene	63 (4.6)	86 (6)	113 (6.5)	148 (7.3)	208 (8.8)
ROSC at ED	52 (3.8)	63 (4.4)	90 (5.2)	103 (5.1)	156 6.6)
Survival to admission	251 (18.2)	249 (17.3)	303 (17.5)	358 (17.6)	453 (19.1)
Survival to discharge	48 (3.5)	53 (3.7)	73 (4.2)	83 (4.1)	125 (5.3)
Good-to-moderate neurological function(Overall)	25 (1.82)	33 (2.29)	36 (2.07)	63 (3.09)	77 (3.24)
Good-to-moderate neurological function(Survived-to-discharge)	25 (52.1)	33 (63.5)	36 (49.3)	63 (75.9)	77 (62.1) *
Utstein survival	20 (11.6)	23 (13.4)	32 (15.2)	35 (15.3)	51 (21.3)
Missing hospital outcomes	0 (0)	0 (0)	0 (0)	1 (0.1)	1 (0.04)

*** Calculation based on the 124 for which we had complete data.**

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November 2017