Singapore's Out-of-Hospital Cardiac Arrest Data Report (2011-2018)

UPEC
UNIT FOR PRE-HOSPITAL EMERGENCY CARE
• SINGAPORE •
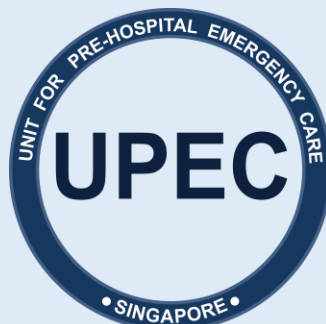
Executive Summary

In this third annual report, we added 2017 and 2018 data along with new measures we will be monitoring. Highlights for this reporting are:

- In 2017, the number of out-of-hospital cardiac arrests (OHCA) increased from 2503 in 2016 to **2841** in 2017 and further increased to **2972** in 2018. These increases are due to the growing proportion of the elderly population in Singapore. Age is a major risk factor for cardiac arrest.

- The bystander CPR rates increased from 56.8% in 2016 to **60.3%** in 2017 and increased further to **61.8%** in 2018.

- Automated External Defibrillators (AED) use (applied) rates increased from 4.6% in 2016 to **6.5%** in 2017 and increased further to **7.2%** in 2018. Bystander AED use is a critical indicator to watch because early application of AEDs can more than double the survival rate. [1]

- In 2018, the Return of Spontaneous Circulation (ROSC) at scene/*en route* rate increased to **13.1%** from **11.9%** in 2017 and **12.5%** in 2016. ROSC is another important indicator to monitor because it is an initial, but unstable, state of recovery.

- The overall number of people who survived-to-discharge increased to **175** in 2018 compared to **163** in 2016 and **134** in 2017. The overall OHCA survival-to-discharge rate was 5.9% in 2018 compared to 6.5% in 2016 and 4.7% in 2017.

- Utstein survival increased to **25.9%** in 2018 compared to **21%** in 2017 and 23.4% in 2016. The Utstein survival rate is an internationally accepted benchmark measure. We use it to monitor how well we are doing with our overall efforts to improve the entire chain of survival.

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[1] Holmberg MJ, Vognsen M, Andersen MS, Donnino MW, Andersen LW. Bystander automated external defibrillator use and clinical outcomes after out-of-hospital cardiac arrest: A systematic review and meta-analysis. Resuscitation. 2017 Nov 1;120:77-87.

- Of those patients who survived an OHCA in 2018, **67.4%** did so with good-to-moderate neurological outcomes compared to **71.8**% in 2017 and 67.7% in 2016. Survival-to-discharge with good-to-moderate neurological functioning is the gold standard for OHCA survival.

On many of the key indicators, we are making steady progress. We continue to see an increasing incidence of out-of-hospital cardiac arrest in Singapore, but it is encouraging to see sustained improvements in our bystander CPR rates, public defibrillation and survival outcomes. Training the public in CPR/AED use will continue with increased intensity and creativity as we steer a course through the COVID-19 pandemic. The public should remain aware that 70% of cardiac arrests occur in the home and are witnessed by a family member in the same household who will have the earliest opportunity to respond. With AEDs increasingly available in HDBs and elsewhere nationwide, it is important we remain prepared with knowledge of AED locations and the skills to retrieve and use one immediately. Chances for a shockable rhythm are greatest when the collapse is first observed or discovered thus making the AED's therapeutic shock more effective.

The progress we have made with our increased bystander CPR and AED use rates and survival rates must be sustained while we further strengthen the chain-of-survival and address remaining gaps. This progress and these continued efforts to improve are all happening while we are challenged with an increasing number of OHCA cases in Singapore. Let us press on to give cardiac arrest victims the very best chance of a good quality survival!

Sincerely,

Prof. Marcus E.H. Ong

UPEC

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> *"We continue to see an increasing incidence of out-of-hospital cardiac arrest in Singapore, but it is encouraging to see sustained improvements in our bystander CPR rates, public defibrillation and survival outcomes..... Let us press on to give cardiac arrest victims the very best chance of a good quality survival!"*

The Big Picture – Fruit of sustained, collective efforts

Figure 1

Overview

Timeline:
- 2011 Mechanical CPR device
- 2012 Fire Bikers Scheme
- 2012 DA-CPR
- 2014 RAEDi
- 2014 DARE
- 2014 I/O vascular
- 2015 myRspndr
- 2015 Save-A-Life
- 2015 DARE Community Training
- 2016 DARE with CPRcard

Incidence rates of OHCA

Figure 2

OHCA Incidence 2011-2018
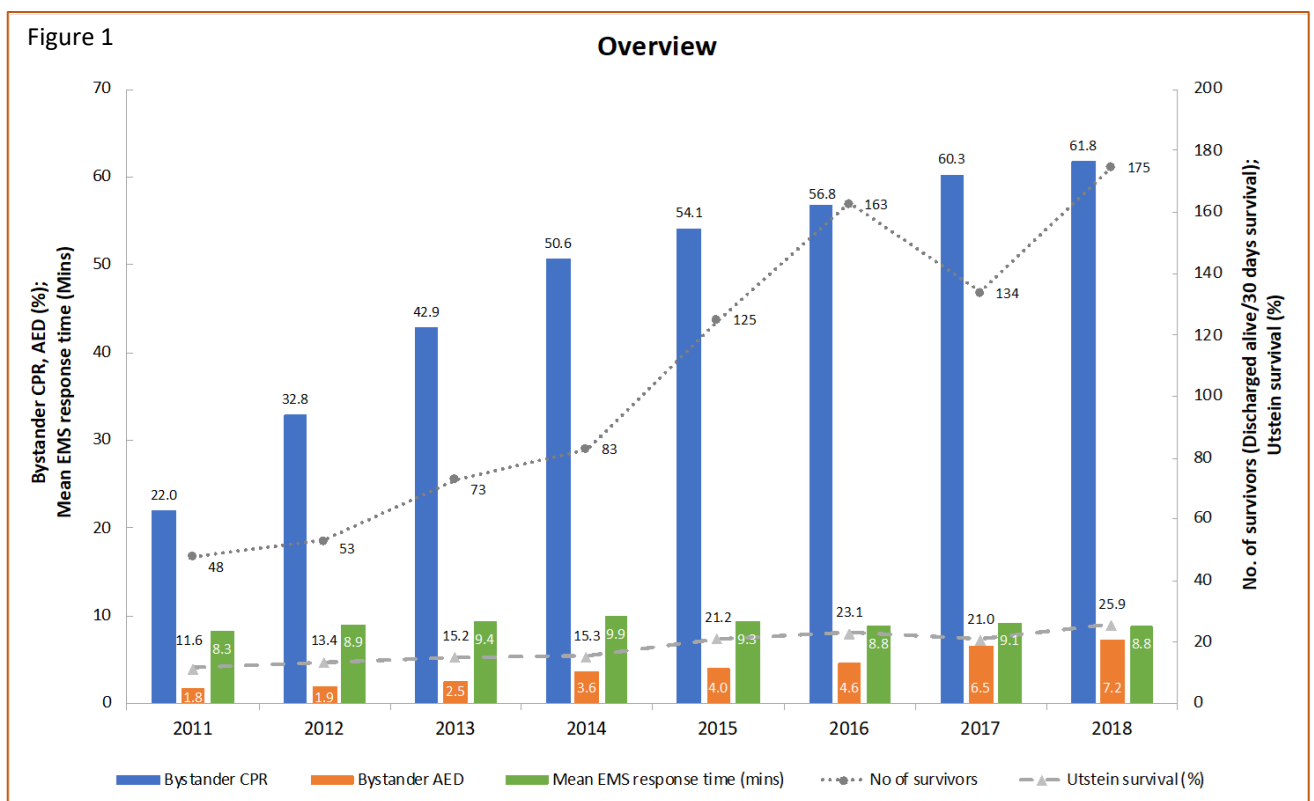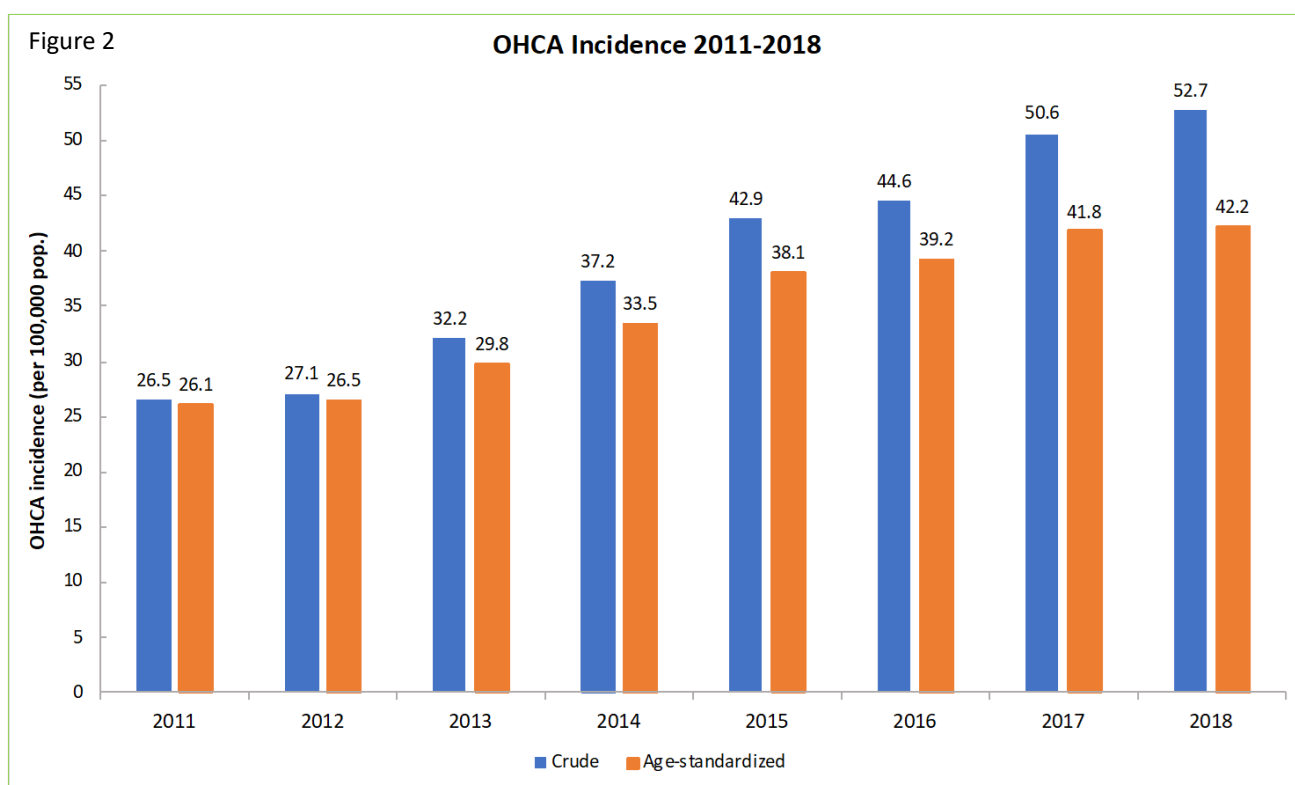
- Crude incidence rate increased to **50.6 per 100,000** population in 2017 from 44.6 in 2016. In 2018, this rate further increased to **52.7 per 100,000** population.

- The age-standardised rate, which allows for comparisons with other locales, increased to **41.8 per 100,000** in 2017 from 39.2 in 2016, and further up to **42.2 per 100,000** in 2018.

Figure 3

OHCA Incidence <65 / ≥65
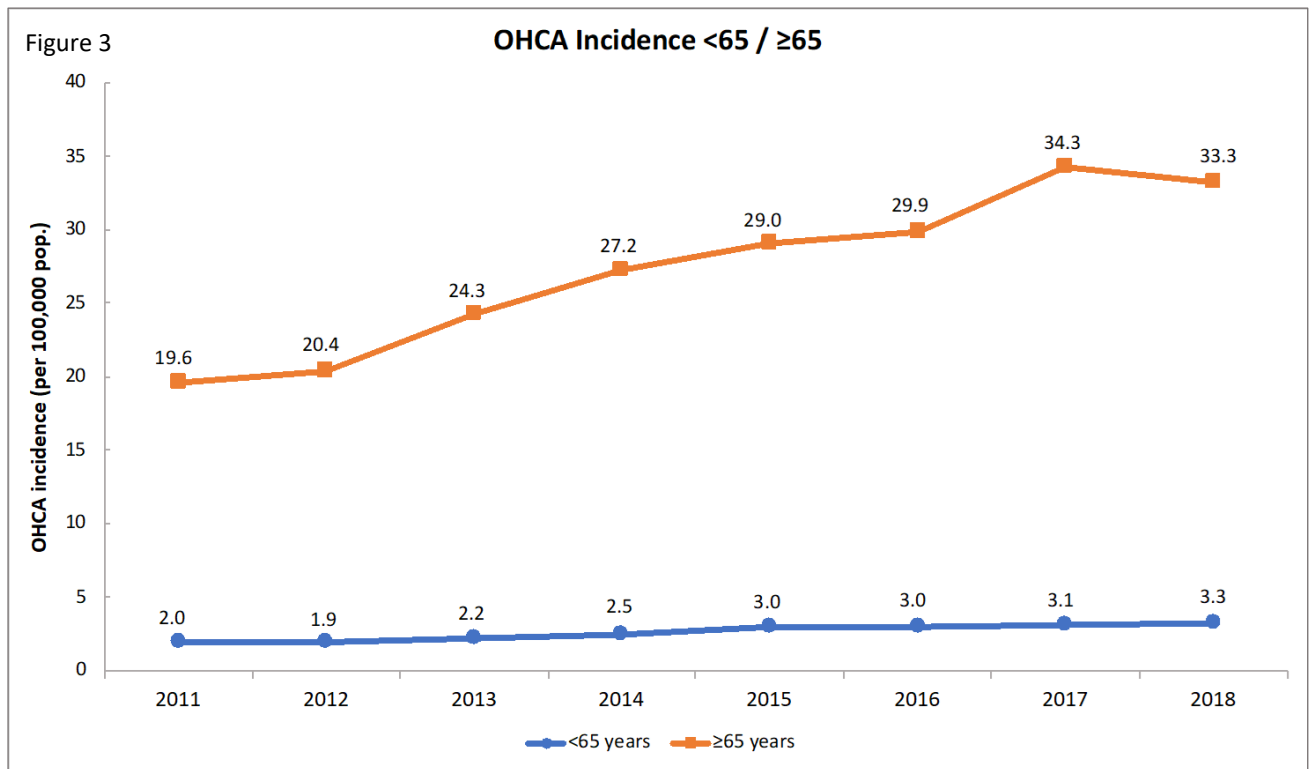
- The incidence rate among those aged 64 or younger increased slightly to **3.1 per 100,000** in 2017 and increased further to **3.3 per 100,000** population in 2018. While this rate remains low, there is a gradual increase.

- For those aged 65 and older, this rate increased to **34.3 per 100,000** in 2017 compared to 29.9 in 2016 and dropped slightly to **33.3 per 100,000** in 2018.

Figure 4

Incidence Rates by Gender
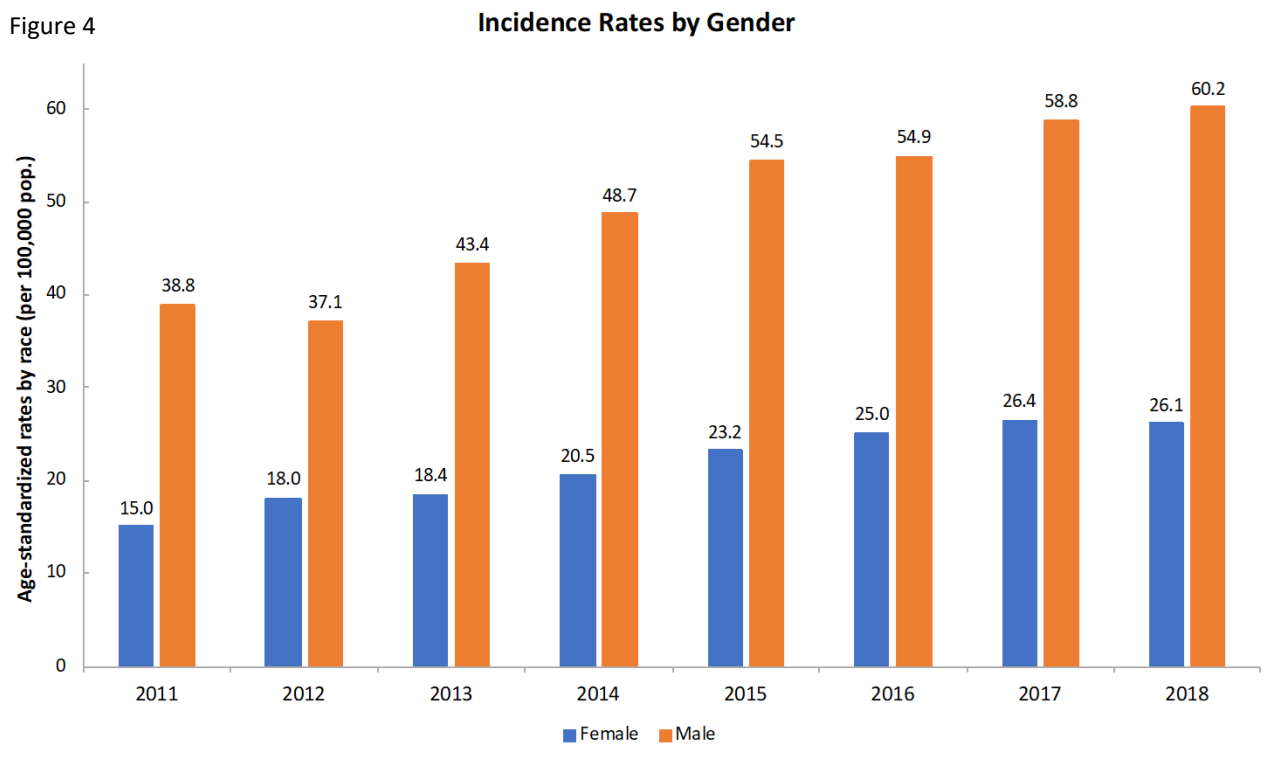
- Incidence rate among females increased to **26.4 per 100,000** in 2017 from 25.0 in 2016. In 2018, this rate dipped slightly to **26.1 per 100,00**.

- Incidence among males increased to **58.8 per 100,000** in 2017 from 54.9 in 2016 and increased further to **60.2 per 100,000** in 2018.

Figure 5 — Incidence Rates by Race
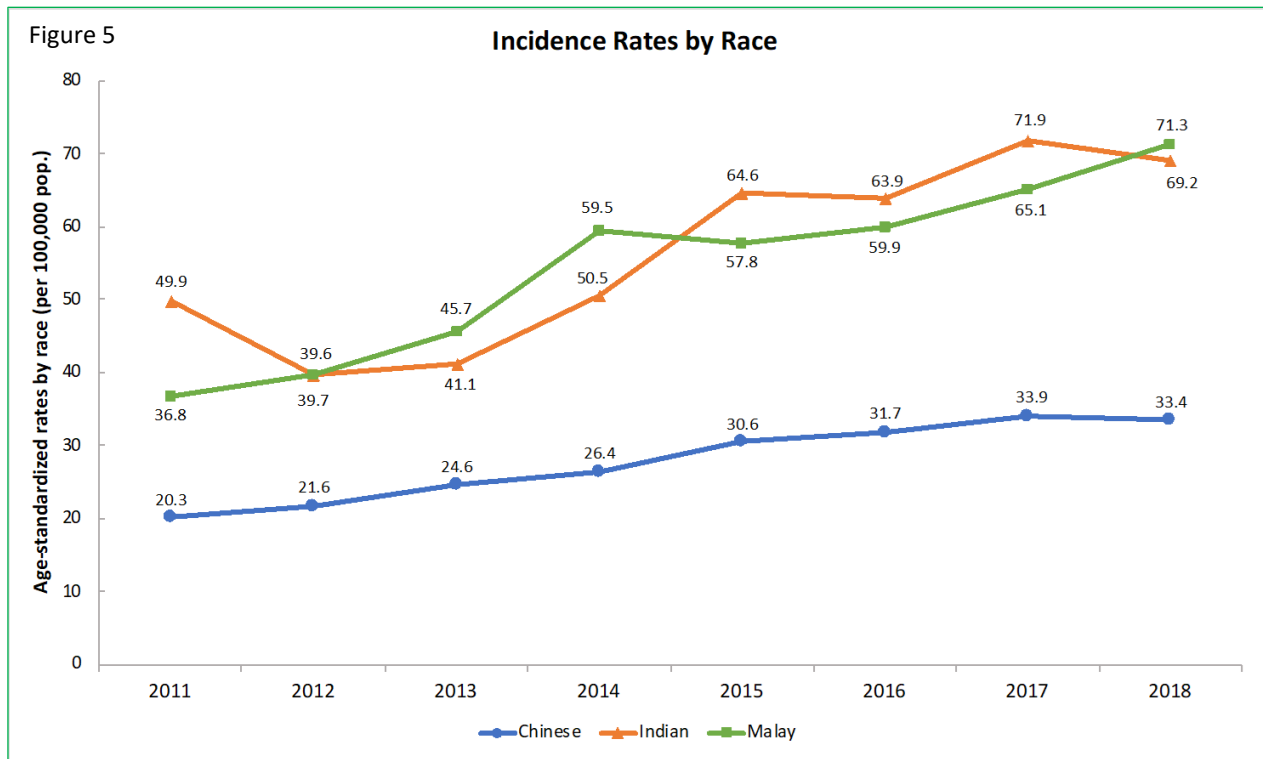
- Chinese increased to **33.9 per 100,000** in 2017 from 31.7 in 2016 and dropped to **33.4 per 100,000** in 2018.

- Indians increased to **71.9 per 100,000** in 2017 from 63.9 in 2016 dropped to **69.2 per 100,000** in 2018.

- Malays increased to **65.1 per 100,000** in 2017 from 59.9 in 2016 and increased further to **71.3 per 100,00** in 2018.

Bystander CPR and AED use

Figure 6

Bystander CPR and AED Use with Survival Outcomes
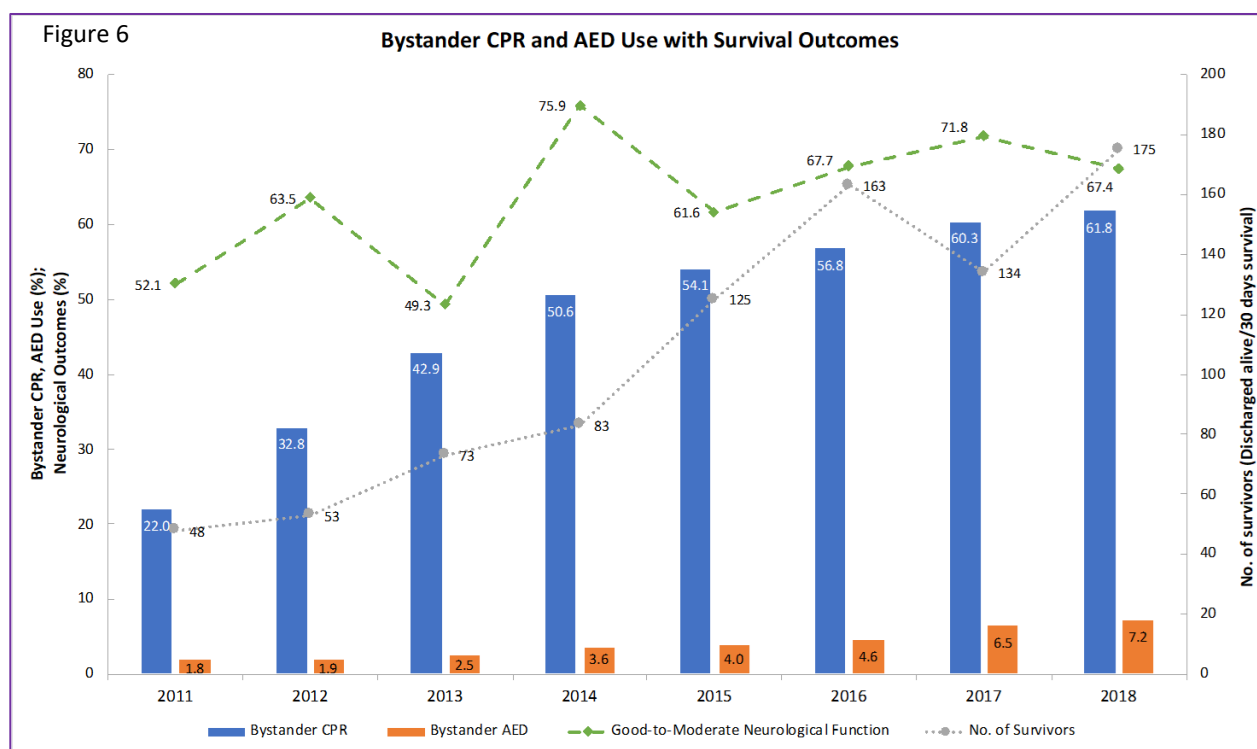
- Bystander CPR rate increased to **60.3**% in 2017 from 56.8% in 2016. In 2018 the rate increased to **61.8%**.

- Automated External Defibrillators (AED) use (applied) rate increased in 2017 to **6.5**% from 4.6% in 2016. In 2018, the AED use rate increased to **7.2%**.

- Collective efforts have resulted in **134 survivors** in 2017, down from 163 in 2016. However, this count jumped up to **175 survivors** in 2018.

- The proportion of survivors with good neurological function increased to **71.8**% in 2017 from 67.7% in 2016. However, the rate dropped to **67.4%** in 2018.

Survival rates: Overall, Utstein, age-standardised, and those aged </≥65 years

Utstein rates *are a reporting of OHCA cases that were witnessed, had a shockable heart rhythm, and were caused by some heart problem, i.e. not trauma. These are the cases where resuscitation efforts (CPR+AED) have the highest success rates. As a subset of the overall OHCA cases, reported Utstein survival rates are larger percentages than overall survival rates.*

Figure 7
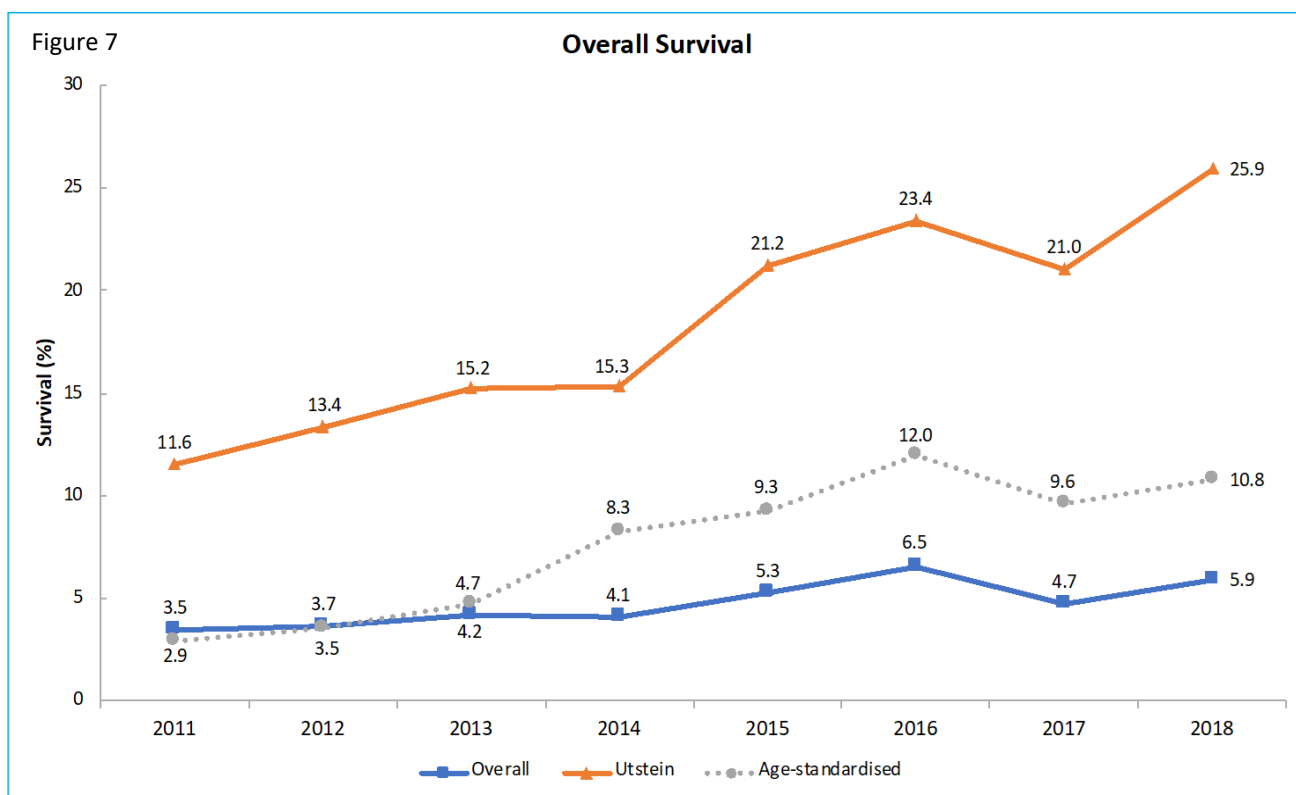
Overall Survival

- Overall survival rate decreased to **4.7**% in 2017 from 6.5% in 2016. In 2018, the rate increased to **5.9%**.

- Utstein survival rate decreased to **21**% in 2017 from 23.4% in 2016. In 2018, this rate increased to **25.9%**.

- Age-standardized survival rate decreased to **9.6**% in 2017 from 12.0% in 2016. In 2018 this rate ticked up to **10.8 %**.

Figure 8 — Survival and Neurological Function
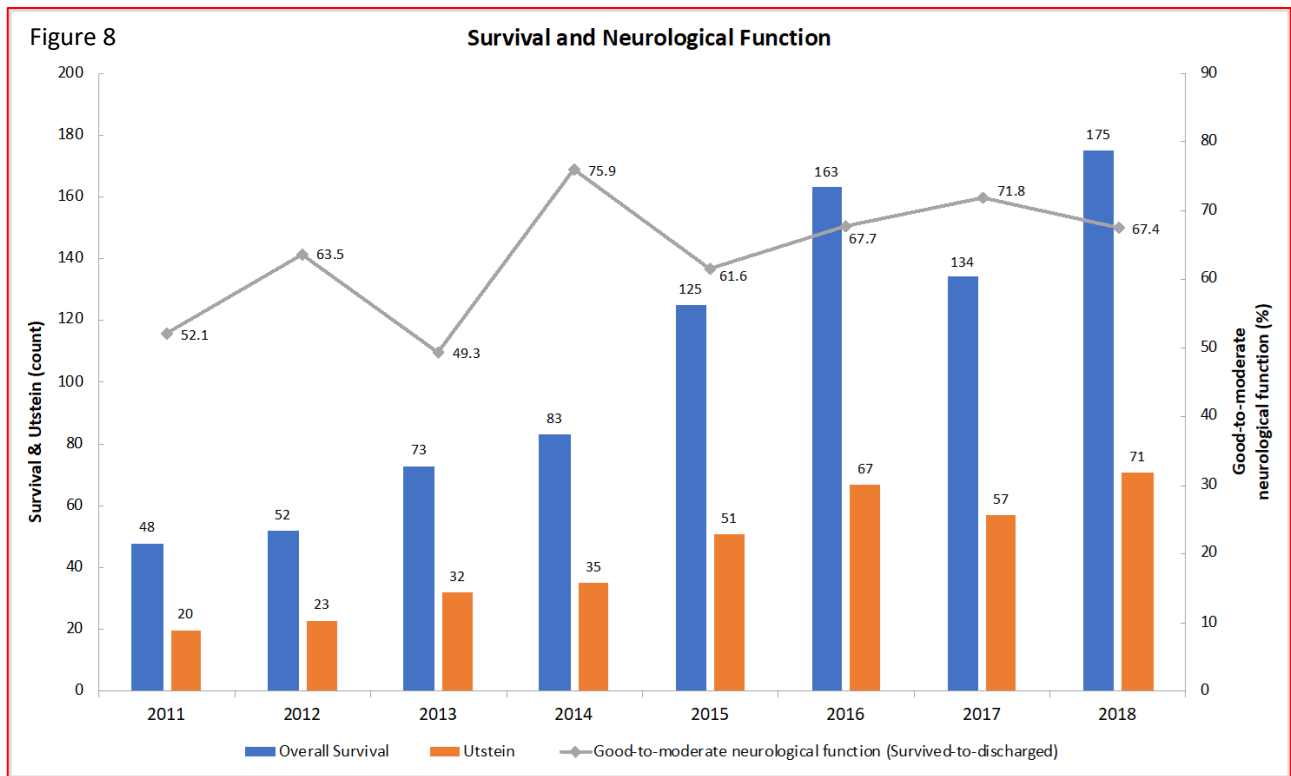
- The rate of survivors with good-to-moderate neurological outcomes continued to improve since 2015 with 67.7% in 2016 and **71.8**% in 2017. However, in 2018 the rate dropped back down to **67.4%**.

- Neurological outcome is measured by use of the Cerebral Performance Categories (CPC) scale.

- The score tells us about the survivor's neurological status and is an indication of how well survivors are recovering.

- Patients who survived are assigned a CPC score of 1 to 4, with CPC 1 being the best outcome.

- Good-to-moderate entails a CPC score of 1 or 2.

Figure 9 — Survival by Age <65 / ≥65 years
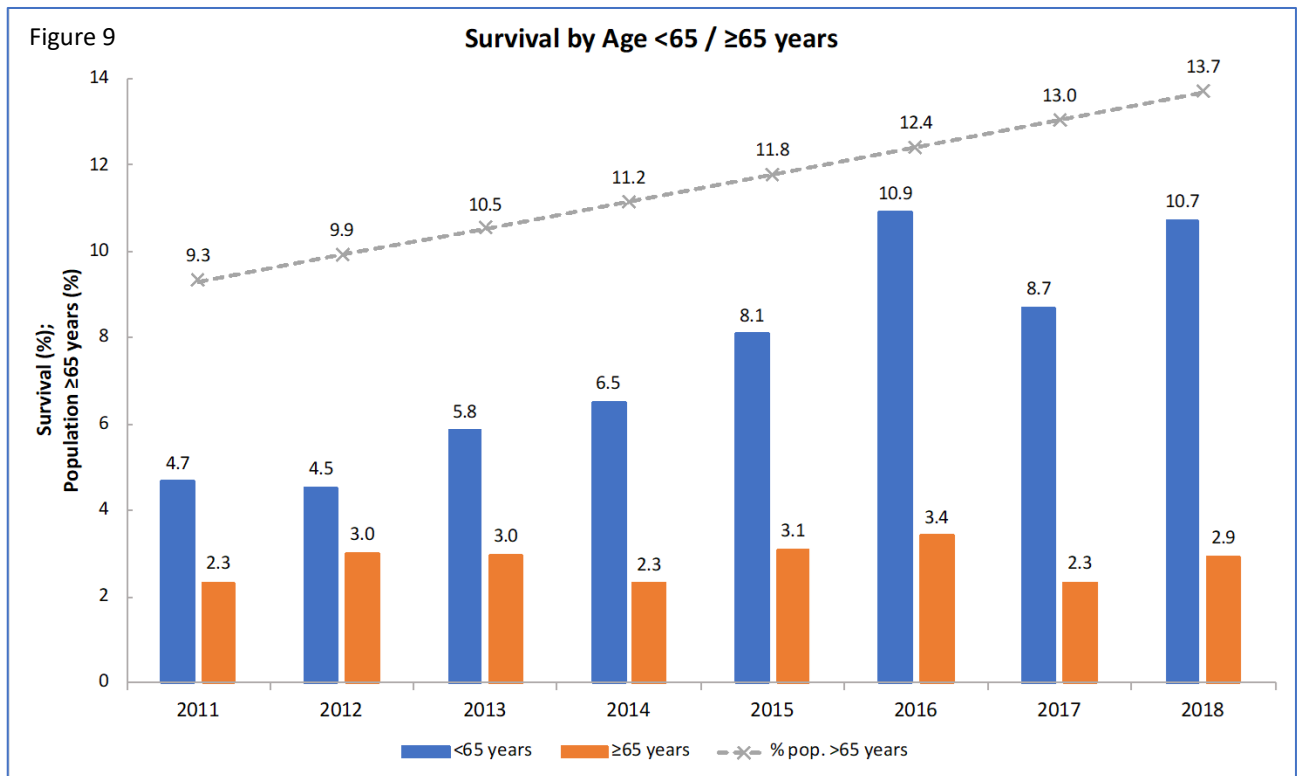
- Survival among those younger than age 65 decreased to **8.7**% in 2017 from 10.9% in 2016. In 2018, the rate of survival among this group jumped up to **10.7**%.

- Among those aged 65 and older, the rate decreased to **2.3**% in 2017 from 3.4% in 2016. But in 2018, survival among those aged 65 and older increased to **2.9%**.

- Singapore's proportion of those aged 65 and above steadily increased year over year, and in 2017 they made up **13**% of the population. In 2018, those aged 65 and above made up **13.7%**.

Return of spontaneous circulation (ROSC)
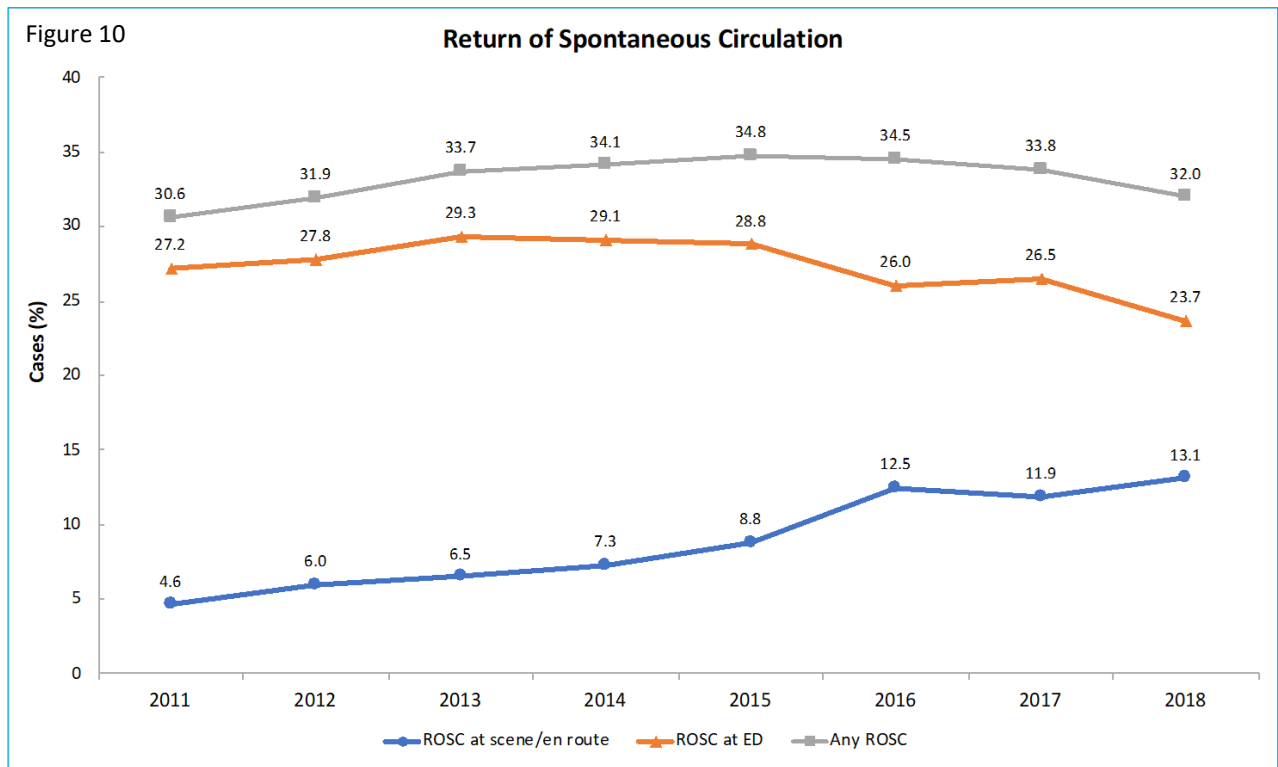
Figure 10

Return of Spontaneous Circulation

- In 2018, the Return of Spontaneous Circulation (ROSC) at scene/en route rate increased to **13.1%** from 11.9% in 2017 and 12.5% in 2016.

- In 2018, ROSC achieved in the emergency department dipped to **23.7%** from **26.5**% in 2017 and 26% in 2016.

- The rate of ROSC achieved at any point dipped slightly to **33.8**% in 2017 compared to 34.5% in 2016. In 2018, the overall ROSC rate dipped to **32.0%**.

- ROSC is another important indicator to monitor because it is an initial, but unstable, state of recovery.

Cases involving Dispatcher-assisted CPR (*Eligible cases only)

Figure 11

Cases with DA-CPR
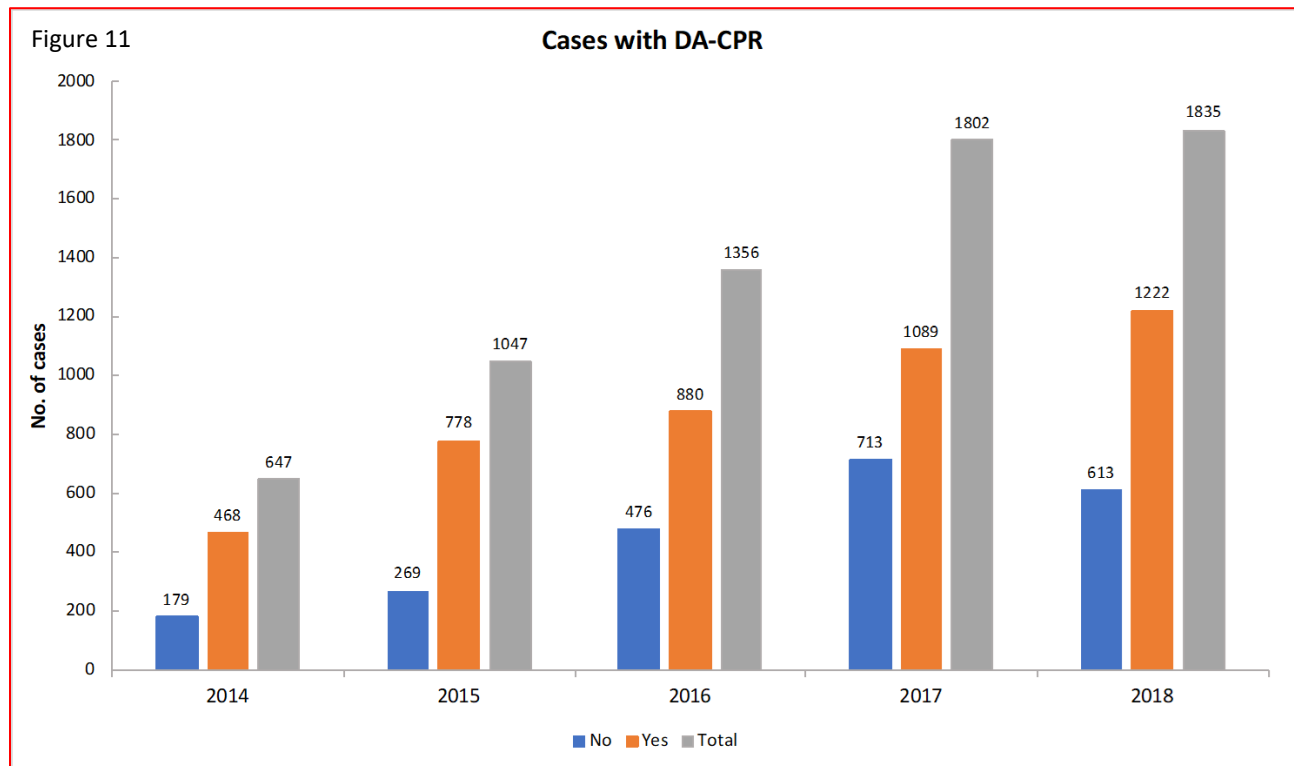
- Chart shows the number of DA-CPR included cases where: 1) no DA-CPR was performed, 2) where DA-CPR was performed, and 3) total eligible cases.

- * Excluded cases are SCDF-witnessed collapses and non-EMS cases.

- In 2017, **1089 out of 1802** eligible cases involved DA-CPR. In 2018, this count increased to **1222 out of 1835** eligible cases involved DA-CPR.

- DA-CPR would not be done if callers could not move the patient; refused to start CPR; or if SCDF arrived before dispatcher instructions began. Other reasons include caller declined instructions (because they already knew how); left or hung up phone before dispatcher instructions were given; no one answered upon call back; caller too distraught; change in patient status; caller not with patient; patient cold and hard.[2]

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[2] Ho AF, Sim ZJ, Shahidah N, Hao Y, Ng YY, Leong BS, Zarinah S, Teo WK, Goh GS, Jaafar H, Ong ME. Barriers to dispatcher-assisted cardiopulmonary resuscitation in Singapore. Resuscitation. 2016 Aug 1;105:149-55.

Singapore Check List
Ten steps for improving OHCA survival

	Steps	Yes	In-progress	No
1.	**Establish a Cardiac Arrest Registry**	✓		
2.	**Implement Dispatcher-Assisted CPR**	✓		
3.	**Implement High Performance CPR**	✓		
4.	**Implement Rapid Dispatch**	✓		
5.	**Voice Record All Attempted Resuscitations**	✓		
6.	**First Responder Defibrillation**		✓	
7.	**Public Access Defibrillation**	✓		
8.	**Funding and Support for Training and QI**	✓		
9.	**Hypothermia in All Receiving Hospitals**		✓	
10.	**Culture of Excellence (e.g., CQI)**		✓	

Table 1: OHCA Results, 2011-2018

	2011 n=1377	2012 n=1440	2013 n=1736	2014 n=2037	2015 n=2372	2016 n=2503	2017 n=2841	2018 n=2972
Age, Mean (Median)	63.5 (65.0)	64.1 (66.0)	65.9 (65.9)	65.9 (68.0)	65.5 (67.0)	66.0 (69.0)	67.8 (70.0)	68.0 (70.0)
Gender (%)								
Female	442 (32.1)	528 (36.7)	605 (34.9)	721 (35.4)	826 (34.8)	912 (36.4)	1063 (37.4)	1075 (36.2)
Male	935 (67.9)	912 (63.3)	1131 (65.2)	1316 (64.6)	1546 (65.2)	1591 (63.6)	1778 (62.6)	1897 (63.8)
Location Type (%)								
Home residence	985 (71.6)	990 (68.8)	1246 (71.8)	1481 (72.7)	1658 (69.9)	1837 (73.4)	2117 (74.5)	2164 (72.8)
Healthcare facilities	100 (7.3)	102 (7.1)	107 (6.2)	139 (6.8)	157 (6.6)	164 (6.6)	213 (7.5)	227 (7.6)
Public setting	260 (18.9)	308 (21.4)	320 (18.4)	387 (19.0)	458 (19.3)	446 (17.8)	451 (15.9)	501 (16.9)
Bystander Intervention (%)								
Bystander CPR	302 (22.0)	472 (32.8)	744 (42.9)	1031 (50.6)	1284 (54.1)	1422 (56.8)	1714 (60.3)	1836 (61.8)
Bystander CPR - Witnessed arrest	214 (27.6)	304 (42.5)	423 (48.0)	615 (56.8)	779 (61.3)	808 (63.8)	1165 (72.1)	882 (69.9)
Bystander CPR - Not witnessed	88 (18.0)	168 (27.9)	321 (44.8)	416 (52.0)	505 (57.1)	614 (62.3)	549 (56.8)	954 (68.1)
* DA-CPR performed	-	54 (18.6)	252 (34.0)	468 (72.3)	778 (74.3)	880 (64.9)	1089 (60.4)	1222 (66.6)
DA-CPR performed - Witnessed arrest	-	29 (4.1)	129 (16.4)	244 (22.6)	421 (33.1)	450 (35.5)	698 (43.2)	532 (42.2)
DA-CPR performed - Not witnessed	-	25 (4.1)	123 (17.2)	224 (28.0)	357 (40.3)	430 (43.7)	391 (40.4)	690 (49.3)
Bystander AED	25 (1.8)	27 (1.9)	43 (2.5)	73 (3.6)	96 (4.0)	116 (4.6)	185 (6.5)	214 (7.2)
Arrest Witnessed by (%)								
Bystander - Family	481 (34.9)	414 (28.8)	526 (30.3)	729 (35.8)	808 (34.1)	779 (31.1)	1063 (37.4)	714 (24.0)
Bystander - Healthcare professional	65 (4.7)	69 (4.8)	70 (4.0)	79 (3.9)	113 (4.8)	110 (4.4)	201 (7.1)	111 (3.7)
Bystander - Layperson	229 (16.6)	232 (16.1)	284 (16.4)	275 (13.5)	350 (14.8)	377 (15.1)	352 (12.4)	437 (14.7)
EMS/Private Ambulance	112 (8.1)	122 (8.5)	139 (8.0)	154 (7.6)	216 (9.1)	252 (10.1)	258 (9.1)	309 (10.4)
Not witnessed	490 (35.6)	603 (41.9)	717 (41.3)	800 (39.3)	885 (37.3)	985 (39.4)	967 (34.0)	1401 (47.1)

*Calculations based on eligible cases

	2011 n=1377	2012 n=1440	2013 n=1736	2014 n=2037	2015 n=2372	2016 n=2503	2017 n=2841	2018 n=2972
Initial Rhythm (%)								
Shockable rhythm	251 (18.4)	280 (19.7)	304 (17.8)	347 (17.4)	378 (15.9)	435 (17.7)	422 (14.8)	451 (15.2)
Non-shockable rhythm	1114 (80.9)	1144 (80.3)	1405 (82.2)	1651 (82.6)	1941 (81.8)	2021 (82.3)	2360 (83.0)	2481 (83.5)
Outcomes (%)								
ROSC at scene/*en route*	63 (4.6)	86 (6.0)	113 (6.5)	148 (7.3)	209 (8.8)	312 (12.5)	339 (11.9)	389 (13.1)
ROSC at ED	374 (27.2)	400 (27.8)	509 (29.3)	593 (29.1)	684 (28.8)	650 (26.0)	754 (26.5)	704 (23.7)
Survival to admission	251 (18.2)	249 (17.3)	303 (17.5)	358 (17.6)	453 (19.1)	497 (19.9)	542 (19.1)	550 (18.5)
Survival to discharge	48 (3.5)	52 (3.7)	73 (4.2)	83 (4.1)	125 (5.3)	163 (6.5)	134 (4.7)	175 (5.9)
Good-to-moderate neurological function (Overall)	25 (1.8)	33 (2.3)	36 (2.1)	63 (3.1)	77 (3.2)	109 (4.4)	94 (3.3)	118 (4.0)
** Good-to-moderate neurological function (Survived-to-discharged)	25 (52.1)	33 (63.5)	36 (49.3)	63 (75.9)	77 (61.6)	109 (67.7)	94 (71.8)	118 (67.4)
Utstein survival	20 (11.6)	23 (13.4)	32 (15.2)	35 (15.3)	51 (21.2)	67 (23.1)	57 (21.0)	71 (25.9)
Missing hospital outcomes	0 (0)	0 (0)	0 (0)	1 (0.05)	1 (0.04)	1 (0.04)	3 (0.1)	1 (0.03)
Unknown hospital outcomes	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (0.03)

**Calculations based on available data

For more information or data requests:

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