Singapore's Out-of-Hospital Cardiac Arrest Data Report (2011-2022)



UNIT FOR PRE-HOSPITAL EMERGENCY CARE
UPEC
SINGAPORE

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Executive Summary

In this seventh report of yearly out-of-hospital cardiac arrest (OHCA) data we present 12 years' worth of OHCA case burden, response rates, and outcomes. Several goals in the prehospital environment continue to be achieved, and we have made remarkable progress over the last decade in the face of crossing the 4,000-case mark for the first time. Notably, we are delighted to share that this report includes the highest rate of bystander AED (BAED) reported for Singapore. Nevertheless, we continue to set targets and boldly address the challenges ahead to attain them. Our BAED should be set at exceeding 20%. Anyone can learn to use an AED, and our partners at SCDF have embarked on an ambitious task over the years to install these devices nearby where you live. Moreover, Singapore has launched a pilot study on the use of personal AEDs (pAED) that are assigned to community first responders (CFR) with the hope that they will arrive on scene faster without a need to retrieve a wall-mounted AED and apply the pAED early before SCDF paramedics arrive on scene. Also, the 2022 data reflect encouraging resilience and bounce back since COVID-19. Highlights for this reporting period include:

- In 2022, the number of OHCA incidents increased from 3637 in 2021 to **4057**. This increase is largely due to the growing proportion of the elderly population in Singapore. We need to pay attention to vulnerable groups which have higher OHCA burden, including our Malay and Indian communities, and certain districts with higher incidence reflected in the previous year's report.
- The bystander cardiopulmonary resuscitation (BCPR) rates increased from 59.4**%** in 2021 to **62.0%** in 2022.
- AEDs applied/used rates rose from 9.5% in 2021 to **14.0%** in 2022. The Bystander AED use rate is a critical indicator to watch because early use of AEDs can more than double the survival rate.[1]
- In 2022, the Return of Spontaneous Circulation (ROSC) at scene/*en route* rate increased to **9.9%** compared to 8.5% in 2021, breaking 3 years of decreasing rates. ROSC is another important indicator to monitor because it is an initial, but unstable, state of recovery.

[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.

- Post resuscitation and in-hospital care can also be improved through better data collection, quality improvement and increasing access to life saving advanced therapies.
- The overall number of people who survived-to-discharge in 2022 was **167** compared to 140 in 2021. Also, the overall OHCA survival-to-discharge rate increased to **4.9%** in 2022 from 3.8% in 2021.
- Utstein survival rose to **20.5%** in 2022, from 19.9% in 2021. The Utstein survival rate is an internationally accepted benchmark that measures survival among cases where conditions allowed for an intervention (e.g., the collapse was witnessed and there was a shockable heart rhythm). We use it to monitor how well we are doing with our overall efforts to improve the entire chain-of-survival.
- Of those patients who survived an OHCA in 2022, **80.2%** did so with good-to-moderate neurological function compared to 79.3% in 2021. Survival-to-discharge with good-to-moderate neurological functioning is the gold standard for OHCA survival. While our survival rates have fluctuated, those who are surviving, survive well.

Training the public in CPR and AED use remains a priority to move the important progress indicators in the right direction. Over **80%** of cardiac arrests in 2022 occurred at home. Generally, these cases are often witnessed by a family member in the same household who will have the earliest opportunity to respond. With AEDs increasingly available in HDB blocks and now the piloting of smaller, lighter, personal AEDs (pAEDs), it remains important that we amplify the importance of being prepared with knowledge and skills and be willing to rapidly use one.

We urge every able person to register with the myResponder phone app so that each of us are prepared to help in the earliest stage of an OHCA and use an AED. A study involving the advanced CPRcard™ system to help community responders during an emergency is still ongoing and has space for community members to participate. This CPRcard study ("TCPR Link") will equip myResponders / community first responders (CFR) with a device and training to work with an SCDF dispatcher in a meaningful way that enhances the teamwork between them before ambulance arrival. I invite you to participate by contacting UPEC or Singapore Heart Foundation or the SG Red Cross who will be able to direct you appropriately. Again, the critical element for Singapore's response to OHCA is getting CPR/AED trained and becoming a registered myResponder app user.

Resuscitation and survival are dependent on many factors but the most critical is that we have a positive attitude towards making a difference. We remain steadfast in our mission and expect to see a sustained improvement in the key OHCA performance indicators. Let us collectively continue to focus on increasing the quality of early CPR, increasing AED use, high-performance EMS

resuscitation and excellent post-resuscitation care to improve survival with good neurological outcomes.

Finally, Dr Benjamin Leong Sieu-Hon is the new Clinical Director for the Unit for Prehospital Emergency Care. Ben has been a member of UPEC from its audacious beginnings. Ben will provide the Executive Summary for subsequent reports to you. A quick message from Ben below:

"Dear Colleagues and Friends:

Out of Hospital Cardiac Arrest is the emergency of emergencies. It requires a rapid, coordinated and integrated response spanning from the community to the Emergency Medical Services, the emergency departments and the hospitals to achieve good outcomes for our patients.

The annual OHCA report is a key piece of work under the Unit for Prehospital Emergency Care and represents the "vital signs" of OHCA outcomes in Singapore. This continues to reflect the ongoing efforts by all parties working closely together to save more lives in Singapore."

Yours in service,

Prof. Marcus E.H. Ong

Senior Consultant and Distinguished Senior Clinician

Dept of Emergency Medicine, Singapore General Hospital

Provost's Chair and Director Health Services Research & Population Health (HSRPH)

Director, Prehospital and Emergency Research Center (PERC)

Duke-NUS Medical School

Head, Health Services Research Center (HSRC), SingHealth Services

Director, Data and Analytics, Unit for Prehospital Emergency Care (UPEC)

Senior Consultant, Ministry of Health, Hospital Services Division

Chairman, Pan Asian Resuscitation Outcomes Study (PAROS)

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Clinical Director, Unit for Prehospital Emergency Care

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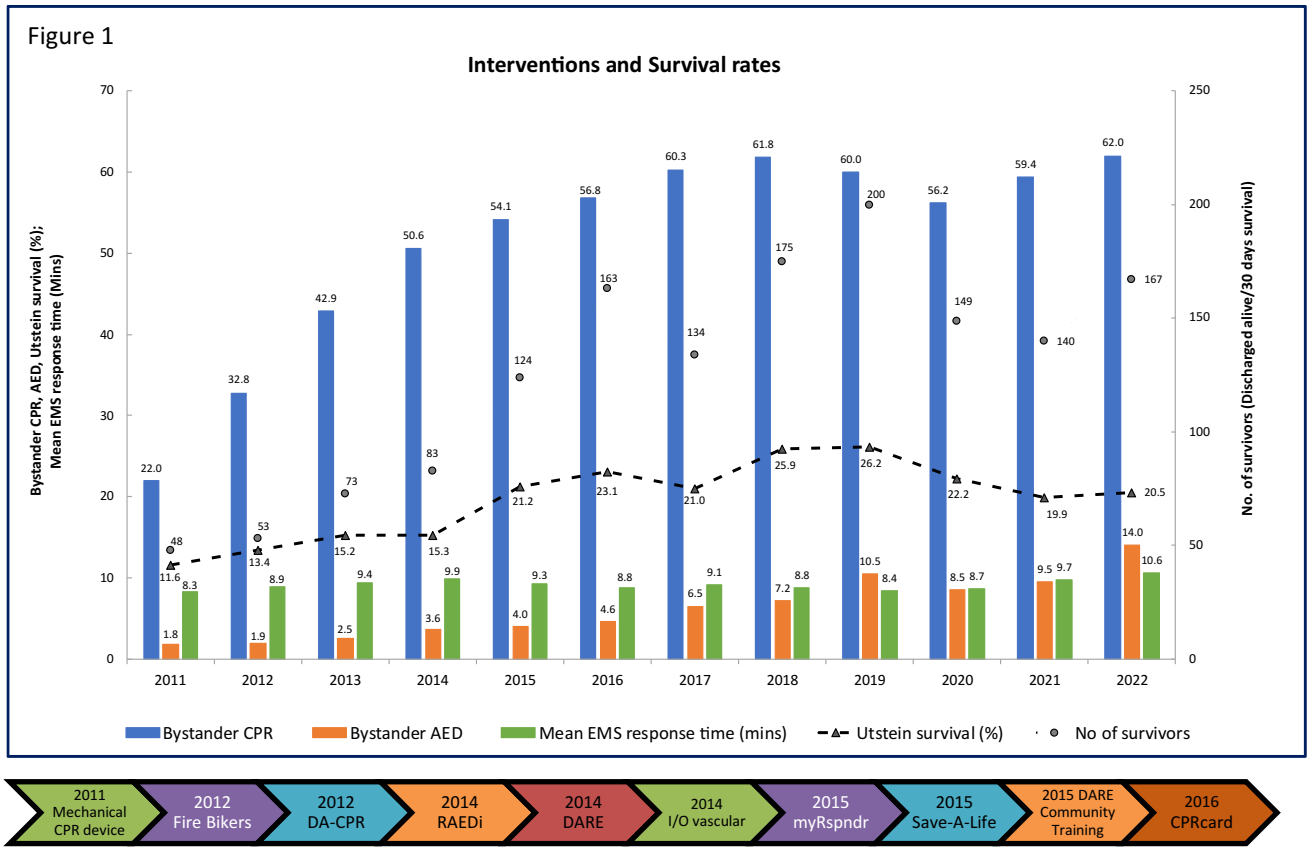
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Singapore Civil Defence Force	(Former CMO) COL (Dr) Colin Tan (Former CMO) Dr Hong Dehan Maj Joey Tay Ai Meng Cpt Shirleen Ho WO2 Low Pey Yun WO2 Shahid Ahmad Bin Mohamed SCDF EMS Dispatchers
National University Hospital	Dr Benjamin Leong Sieu-Hon Dr Lim Shir Lynn Ms Woo Kai Lee
Changi General Hospital	Dr Gan Han Nee Dr Tiah Ling
Tan Tock Seng Hospital	Dr Michael Chia Yih Chong Dr Sarah Tan En Mei Dr Lee Yue Yen
Singapore General Hospital	Prof Marcus Ong Eng Hock Mr Iylia Afiq Muhammad
Khoo Teck Puat Hospital	Dr Desmond Mao Renhao
Ng Teng Fong General Hospital	Dr Ng Wei Ming Dr Tay Wei Ling
KK Women's and Children's Hospital	Clin Assoc Prof Tham Lai Peng Ms Sameema Nisa D/O Haja Mohideen Ms Fatin Insyirah Binte Fadil Ms Audrey Qia Qing Qing
Sengkang General Hospital	Dr Nausheen Edwin Doctor Dr Low Shun Yee
Unit for Pre-hospital Emergency Care	Dr Gayathri Nadarajan Dr Ivan Chua Si Yong Dr Poongkulali Anaikatti Dr Goh E Shaun, Woodlands Hospital All Medical Dispatcher Specialists
Singapore Heart Foundation	Mr Teng Chuin How, Mr Kenneth See, Mr Lim Kiat, and other SHF colleagues

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The Big Picture – Fruits of sustained, collective efforts

Figure 1

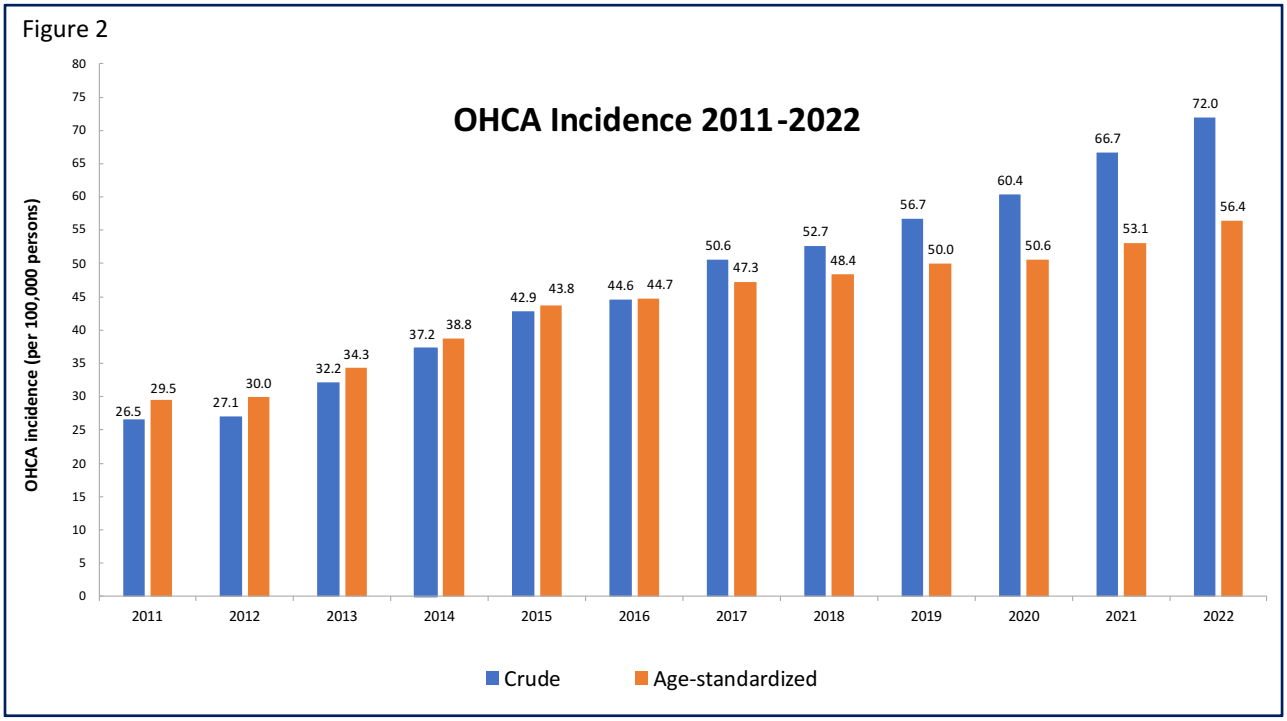


- This is a high-level view of the prehospital response to out-of-hospital cardiac arrest (OHCA) in Singapore over 12 years.

- The reader should note the overview of:
  - Implemented protocols, technologies, and programmes,
  - community CPR and AED response rates,
  - average SCDF response times for OHCA cases, and
  - key survival metrics and measures.

Incidence of OHCA

Figure 2



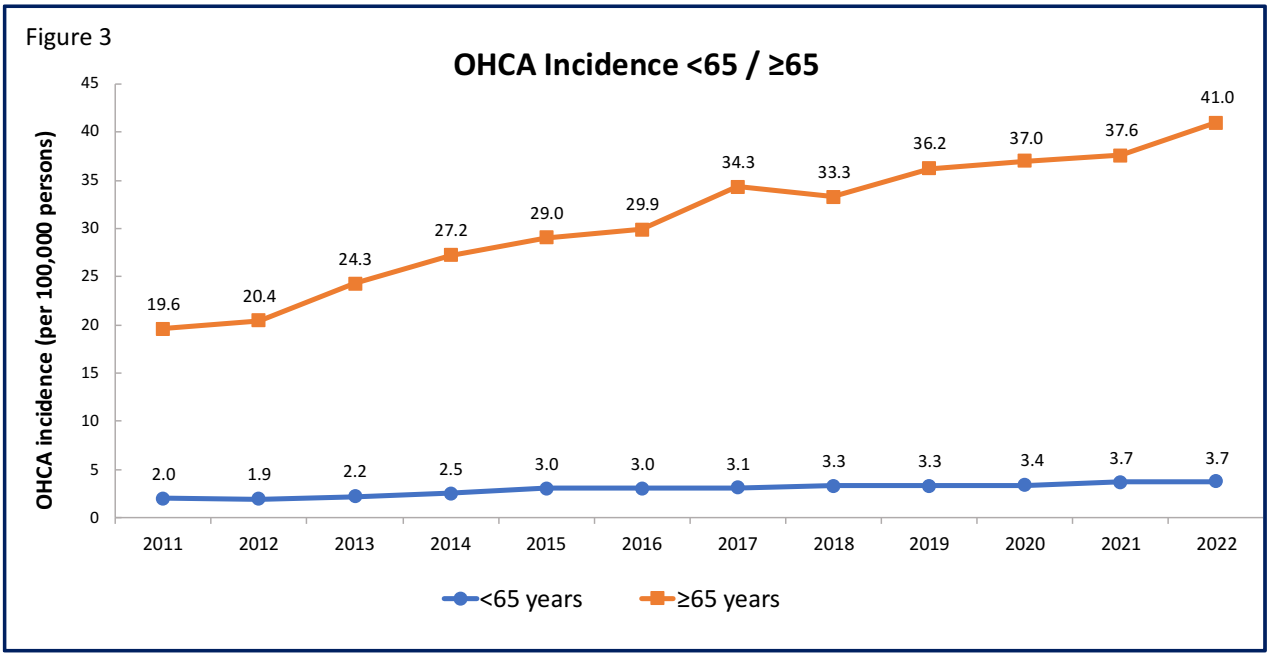
- Crude[2] incidence increased to **72.0 per 100,000** persons in 2022 from 66.7 per 100,000 persons in 2021.

- The age-standardised incidence[3], which allows for comparisons with other locales, increased slightly to **56.4 per 100,000** in 2022 compared to 53.1 per 100,000 in 2021.

[2] "Crude" and "Overall" have the same meaning in this report.

[3] Age-standardized incidence figures were derived by applying the WHO World Standard (2000-2025) Population Index. World Health Organization 2001. All age-adjusted incidence rates in this report were recalculated using this index.

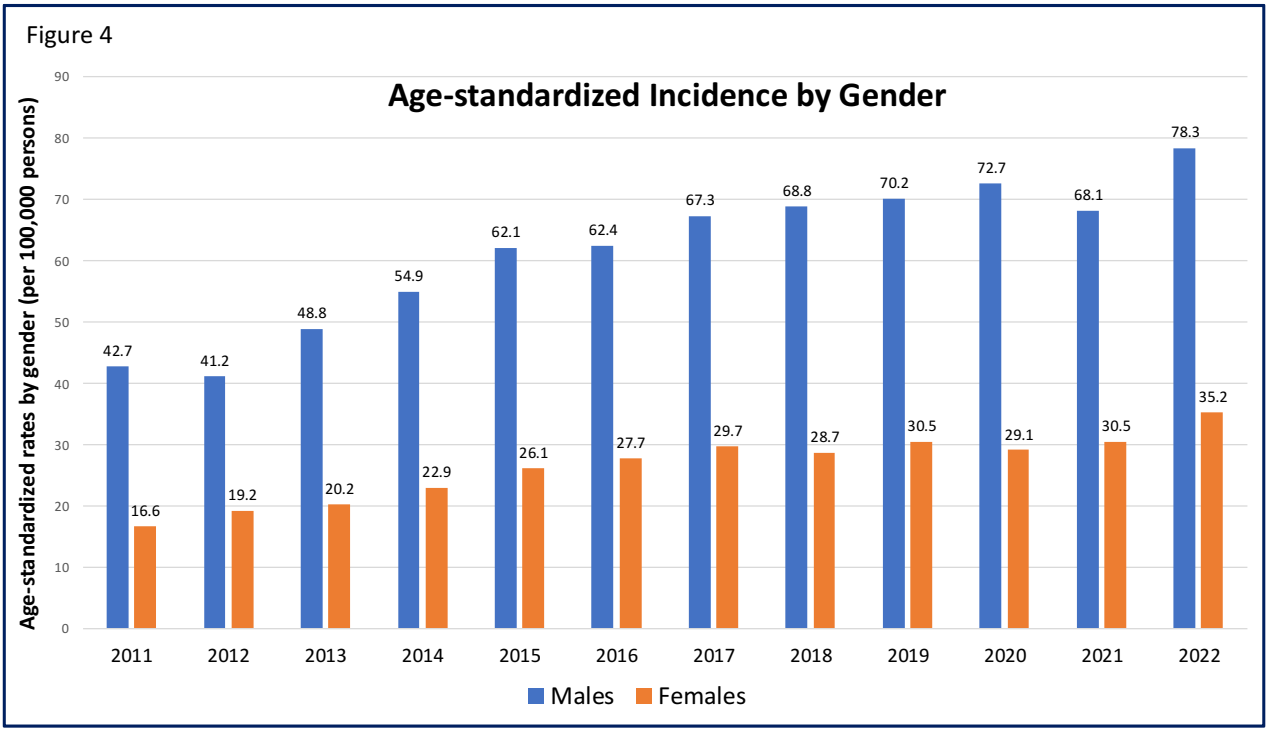
Figure 3



- The incidence among those aged 65 years and older increased slightly to **41.0 per 100,000** persons in 2022 compared to 37.6 per 100,000 persons in 2021.

- For those aged 64 or younger, the rate remained steady at **3.7 per 100,000** persons in 2022, which was the same rate for 2021.

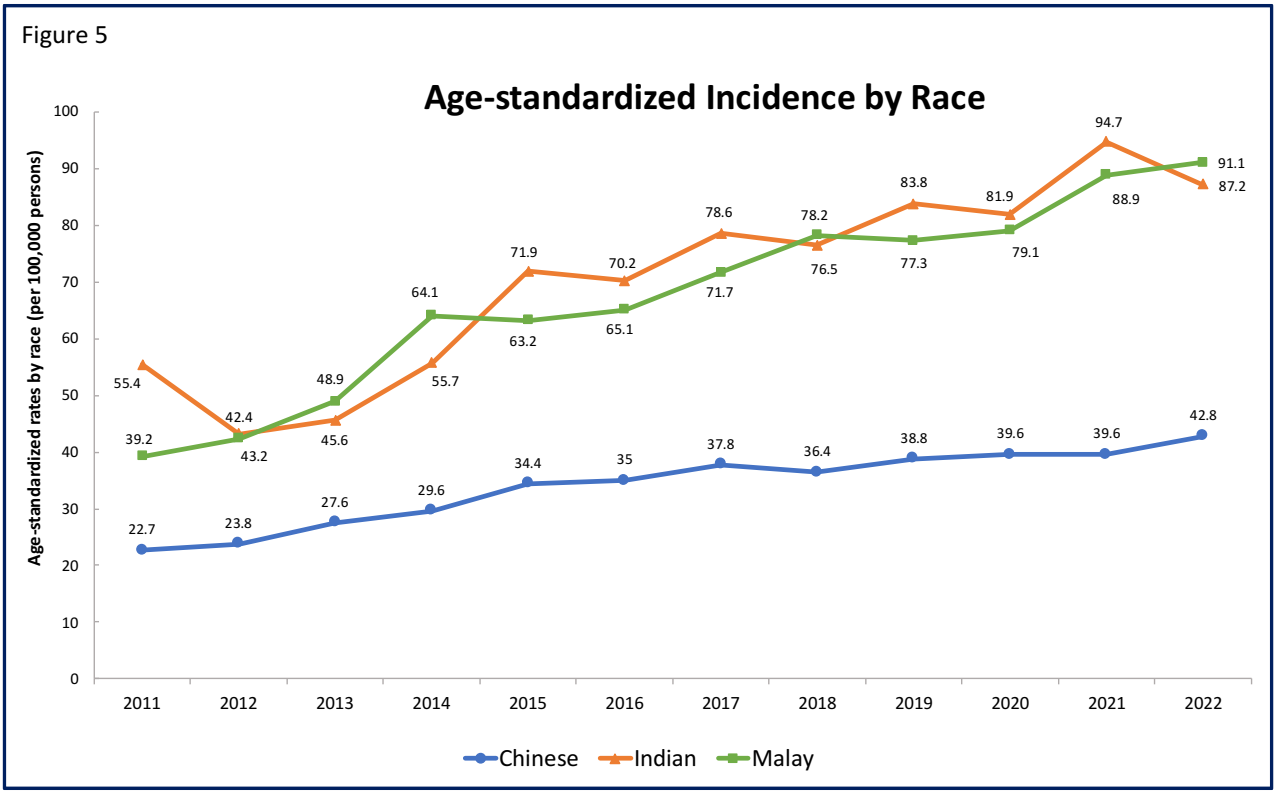
Figure 4



- Age-standardized incidence among males increased to **78.3 per 100,000** persons in 2022 compared to 68.1 per 100,000 persons in 2021.

- Age-standardized incidence among females increased to **35.2 per 100,000** persons in 2022, up from 30.5 per 100,000 persons in 2021.

Figure 5



Incidence among:

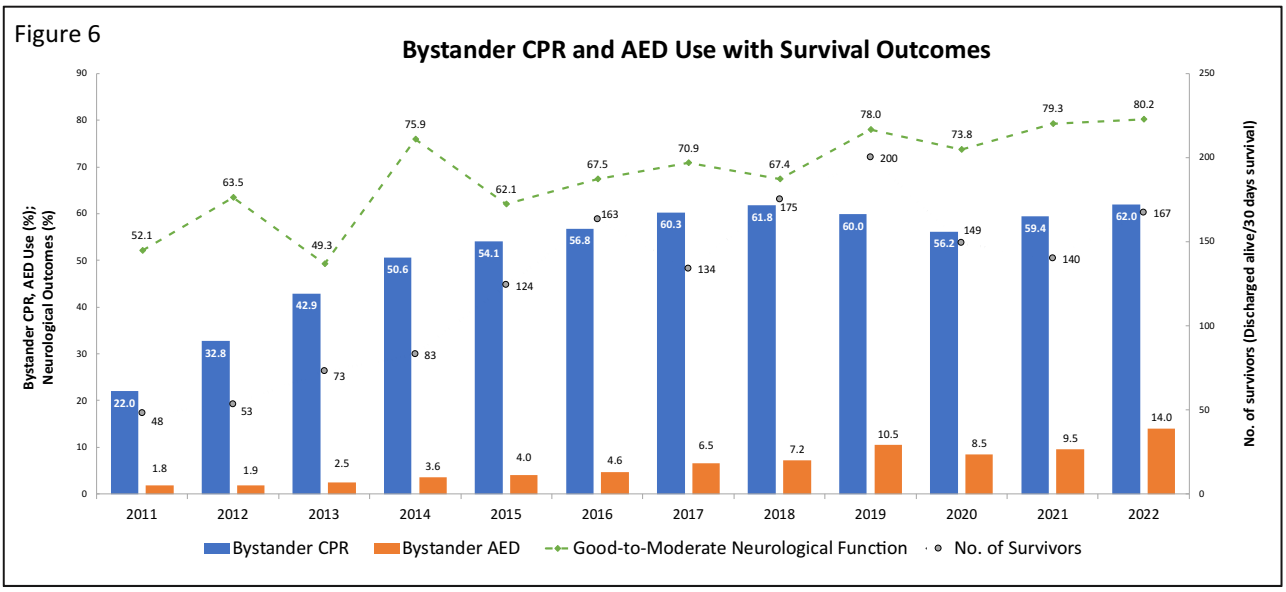
- Chinese increased slightly to **42.8 per 100,000** persons in 2022, compared to 39.6 per 100,000 persons in 2021.

- Indians dropped to **87.2 per 100,000** persons in 2022, down from 94.7 per 100,000 persons in 2021.

- Malays increased slightly to **91.1 per 100,000** persons in 2022, up from 88.9 per 100,000 persons in 2021.

Bystander CPR and AED use

Figure 6



- Bystander CPR increased to **62.0%** in 2022 up from 59.4% in 2021.

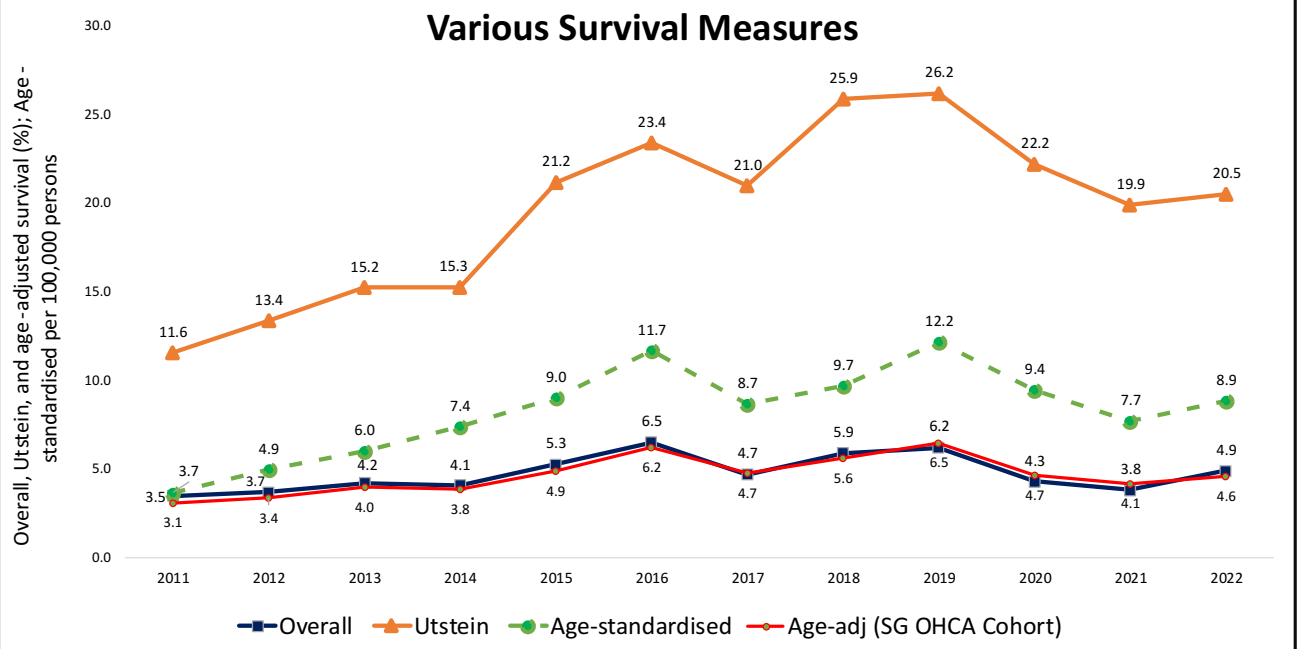
- Automated External Defibrillators (AED) applied/use rate jumped up to **14.0%** in 2022, from 9.5% in 2021.

- The number of survivors climbed to **167** in 2022 from 140 in 2021.

Various 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, i.e., "potentially survivable". As a subset of the overall OHCA cases, reported Utstein survival rates are larger percentages than overall survival rates.*

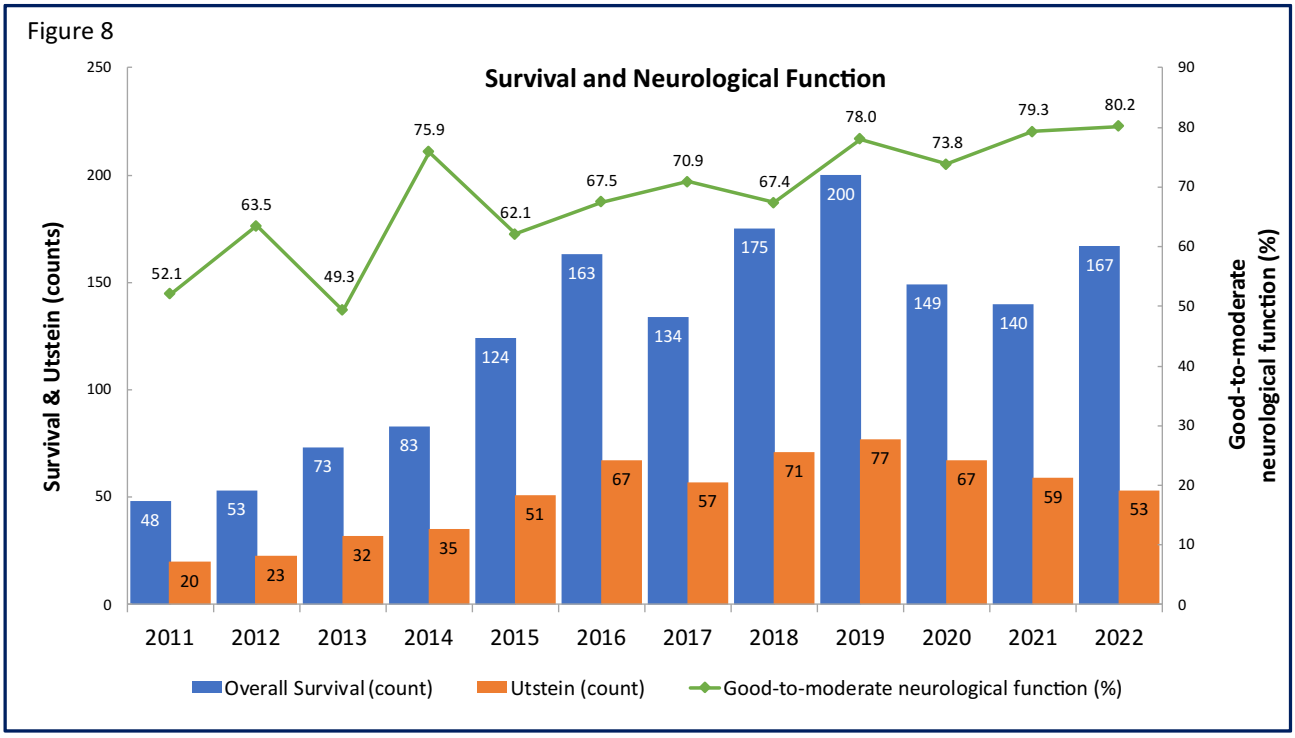
Figure 7



- Overall OHCA survival rate increased slightly to **4.9%** in 2022 from 3.8% in 2021.
- Utstein survival rate increased somewhat to **20.5%** in 2022 from 19.9% in 2021.
- Age-standardized survival increased to **8.9 per 100,000 persons** from 7.7 in 2021.
- **(NEW)** SG OHCA Cohort age-adjusted rate rose slightly to **4.6%** in 2022 from 4.1% in 2021.[4]

[4] Age-adjusted (OHCA cohort) survival was directly age-standardized using the pooled age distribution of OHCA cases across years 2011–2022 as the standard population. Rationale for measure: Older people are less likely to survive a cardiac arrest, so a year with more older patients can look worse even if care did not change. To make a

Figure 8



- Neurological function is measured using 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.

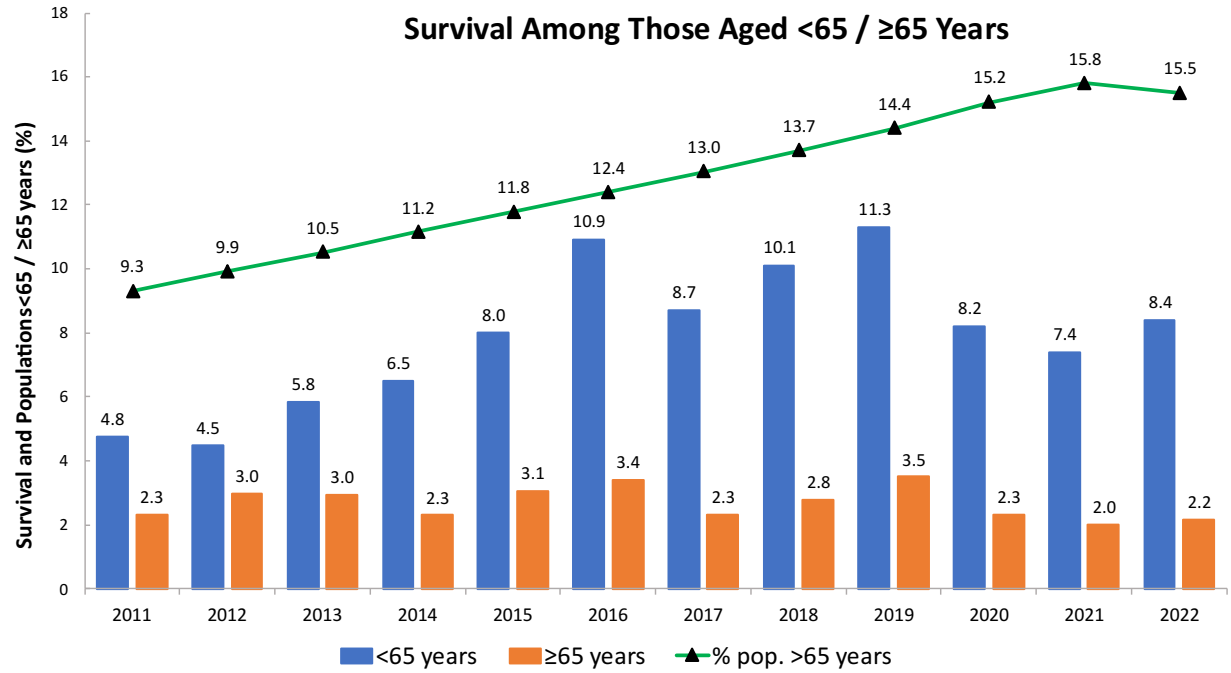
- Patients who survive OHCA are assigned a CPC score of 1 to 4 with CPC 1 being the best outcome.

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

- The rate of survivors with good-to-moderate neurological function increased slightly to **80.2%** in 2022, compared to 79.3% in 2021.

fair comparison, we recalculated each year's survival rate as if the mix of patient ages stayed the same every year, using the combined age mix of all cardiac arrest cases from 2011–2022 as the benchmark. This shows how survival is really trending, without the effect of year-to-year changes in patients' ages.

Figure 9



- Survival among those younger than age 65 increased to **8.4%** in 2022 from 7.4% in 2021.

- Among those aged 65 and older, the survival rate remained steady at **2.2%** in 2022, compared to 2.0% in 2021.

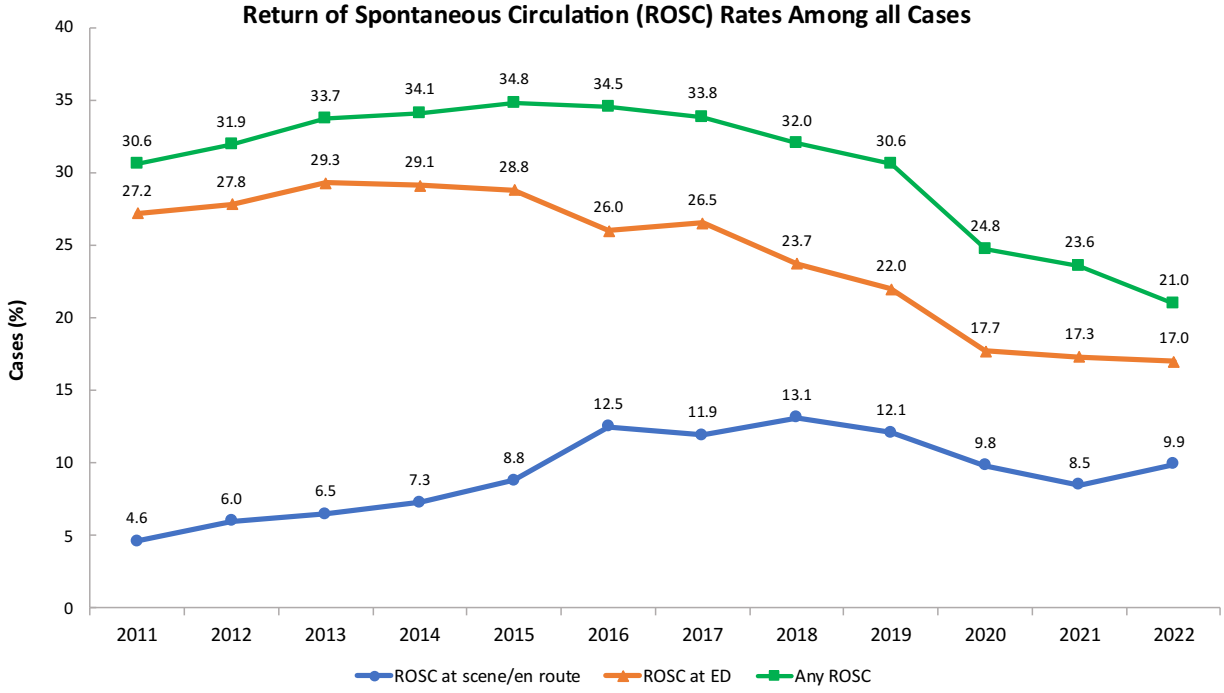
- The proportion of Singaporean residents[5] aged 65 and above had steadily increased year over year. In 2022 this age group made up **15.5%** of the population. In 2021, those aged 65 and above made up 15.8%.[6]

[5] Singapore residents comprise both citizens and permanent residents. From 2003 onwards, data excludes residents who are overseas for a continuous period of 12 months or longer as at the reference period.

[6] Population data set was accessed from the SingStat website of the Department of Statistics (DOS), a department of the Ministry of Trade and Industry in the Government of Singapore. This document reflects population data for 2011-2022 obtained from **https://tablebuilder.singstat.gov.sg/table/TS/M810011#!** Last accessed on July 29, 2026.

Return of spontaneous circulation (ROSC)

Figure 10



- Return of Spontaneous Circulation (ROSC) is an important indicator to monitor because it is an initial, but unstable state of recovery.

- In 2022, the ROSC at scene/en route rate increased to **9.9%**, up from 8.5% in 2021. This represents the long-sought reversal of the three-year trend of decreasing rates. Improvement in this metric is one indicator of the effectiveness of the prehospital community response to OHCA.

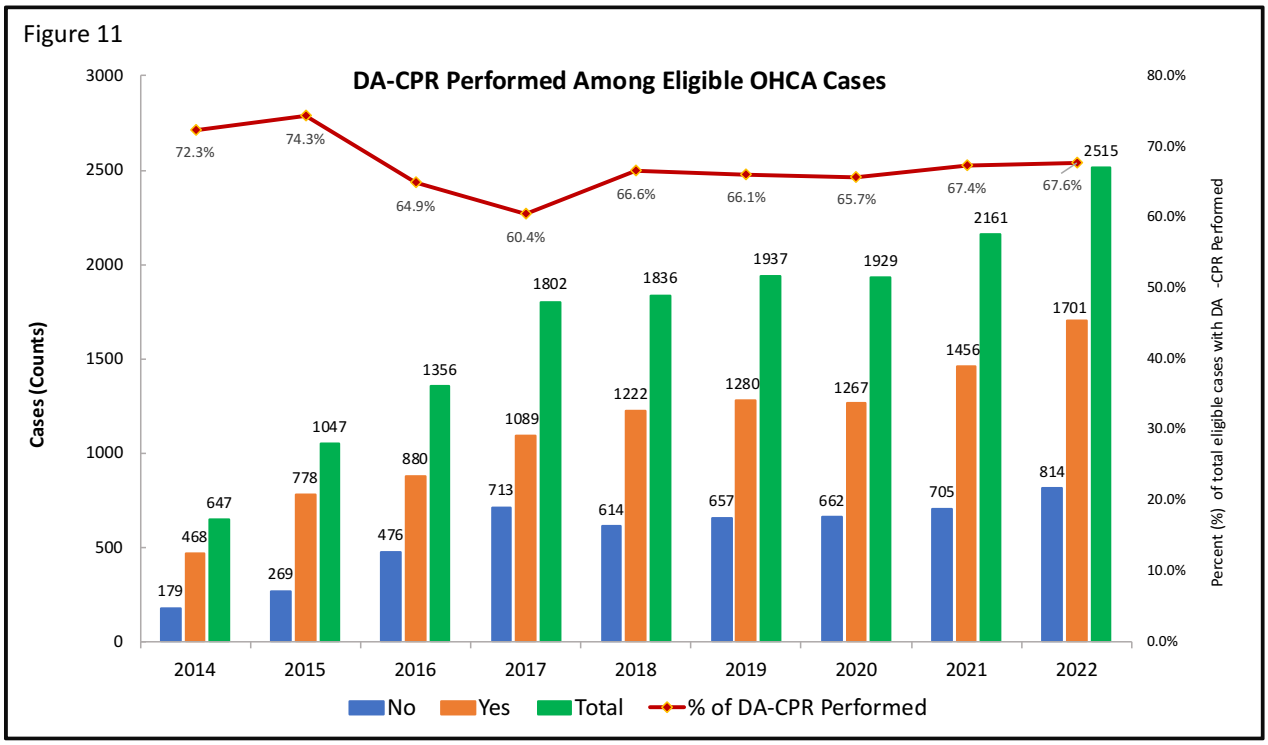
- In 2022, ROSC achieved in the emergency department remained steady at **17.0%** compared to 17.3% in 2021.

- The rate of ROSC achieved at any point dropped to **21.0%**[7] in 2022 compared to 23.6% in 2021.

[7] We believe this to be an anomaly resulting from missing Emerg. Dept. ROSC data for this report.

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

Figure 11



- This chart shows the number of DA-CPR cases where: 1) no DA-CPR was performed, 2) where DA-CPR was performed, and 3) the total eligible cases.

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

- In 2022, the rate of DA-CPR performed remained steady. **1701 (67.6%) out of 2515** eligible cases involved DA-CPR compared to 1456 (67.4%) out of 2161 eligible cases in 2021.

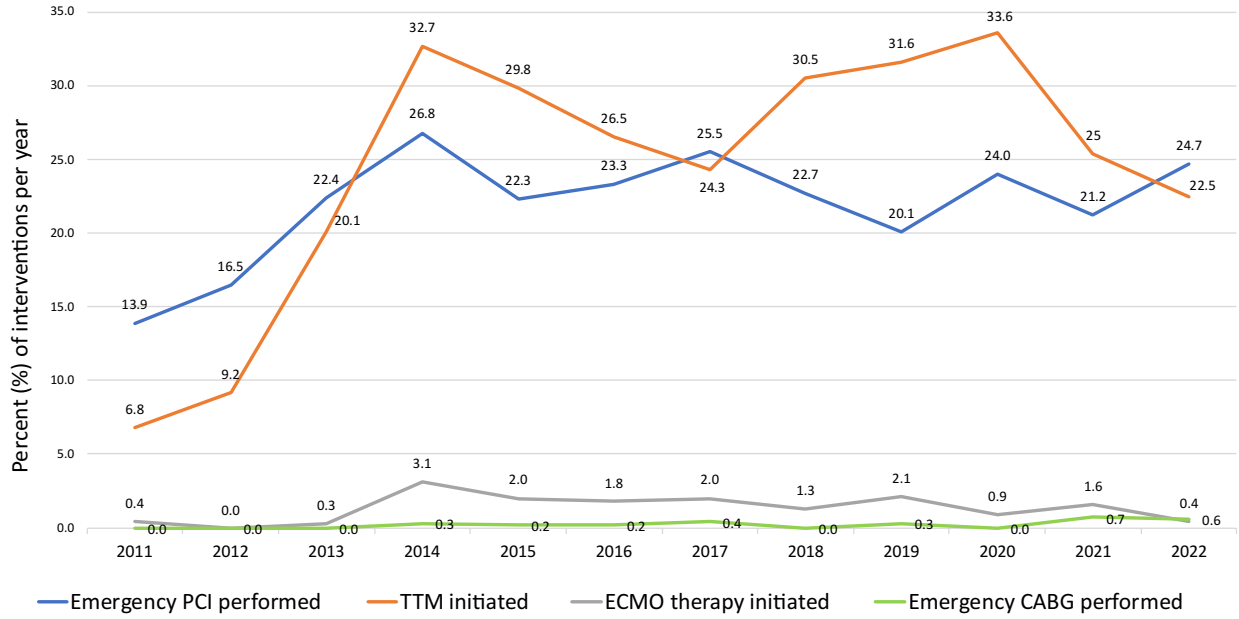
- DA-CPR would not have been done if callers could not move the patient; refused to start CPR; or if SCDF arrived before dispatcher instructions began. Other reasons include caller declined instructions (e.g., already knew how to do CPR/AED); left or hung-up phone before dispatcher instructions were given; no one answered upon call back; caller too distraught; change in patient status; caller not with patient; patient cold and hard.[8]

[8] 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.

Post-resuscitation interventions for OHCA

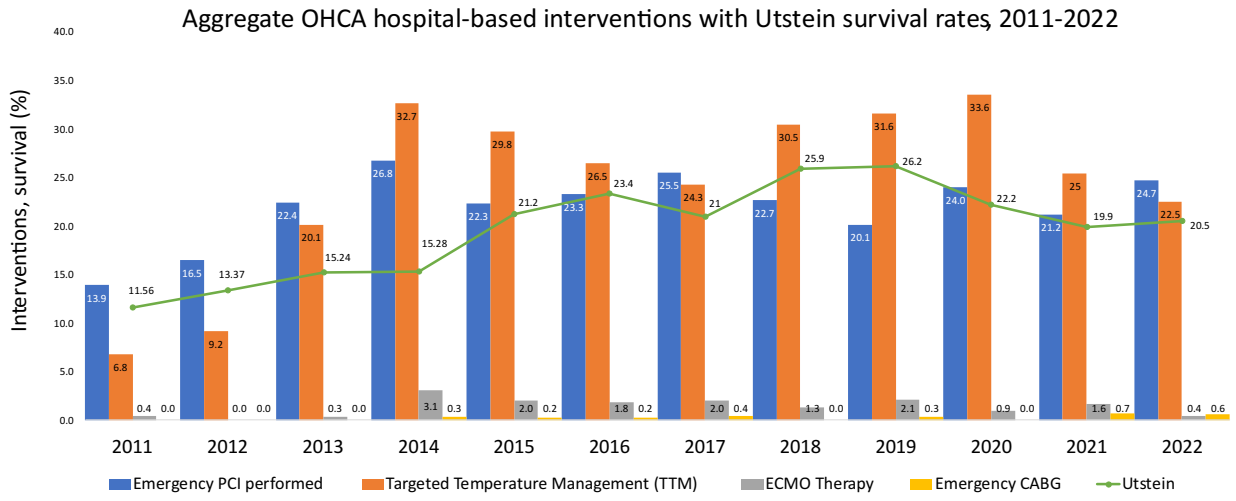
Post-resuscitation interventions are an important link in the chain of survival. We continue to include these measures in our reporting, but this year reflects a change in our thinking about what the denominator should be. The new denominator now reflects cases who "survived to admission" instead of using "all cases". All rates from 2011 onward have been adjusted.

Figure 12



- The graph shows the aggregated rates for each of the four post-OHCA hospital interventions from 2011-2022.
- Only public hospitals are included.
- Of the four hospital interventions charted, **Targeted Temperature Management (TTM)** and **Percutaneous Coronary Intervention (PCI)** are the most used treatments.
- Rates of PCI performed have increased while the other charted interventions dipped.

Figure 13



- This graph shows an overlay of the Utstein rate of survival atop the four aggregated hospital interventions.

- Utstein survival rates reflect cases that were witnessed and had a shockable rhythm. These are the cases that early intervention likely had a role in successfully resuscitating.

- Several parameters are overlaid here for convenience, however no conclusions regarding temporality, causal associations or clinical significance should be drawn.

ANNEX A

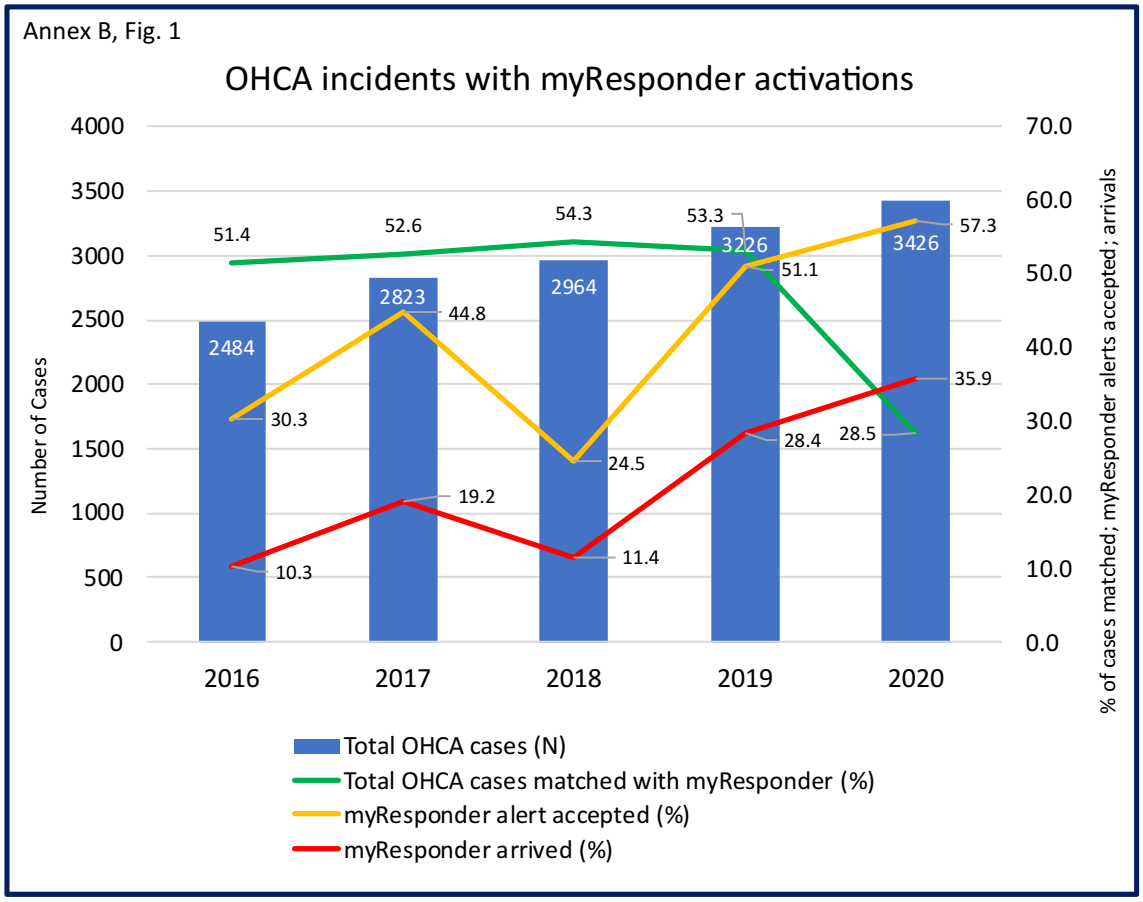
OHCA Results Table, 2011-2022

	2011 n=1377	2012 n=1440	2013 n=1736	2014 n=2037	2015 n=2372	2016 n=2503	2017 n=2841	2018 n=2972	2019 n=3233	2020 n=3432	2021 n=3637	2022 n=4,058***
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)	69.1 (71.0)	69.9 (72.0)	70.0 (73.0)	70.6 (73.0)
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)	1209 (37.4)	1244 (36.2)	1363 (37.5)	1566 (38.6)
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)	2024 (62.6)	2188 (63.8)	2274 (62.5)	2491 (61.4)
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)	2390 (73.9)	2570 (74.9)	2888 (79.4)	3246 (80.0)
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)	260 (8.0)	318 (9.3)	246 (6.8)	315 (7.8)
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)	514 (15.9)	484 (14.1)	503 (13.8)	496 (12.2)
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)	1937 (60.0)	1929 (56.2)	2161 (59.4)	2515 (62.0)
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)	849 (67.1)	831 (64.2)	959 (66.1)	1213 (70.6)
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)	1088 (65.1)	1098 (60.4)	1200 (63.1)	1302 (65.0)
* DA-CPR performed	-	54 (18.6)	252 (34.0)	468 (72.3)	778 (74.3)	880 (64.9)	1089 (60.4)	1222 (66.6)	1280 (66.1)	1267 (65.7)	1456 (67.4)	1701 (67.9)
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)	505 (39.9)	500 (38.6)	582 (40.0)	741 (43.1)
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)	775 (46.4)	767 (42.2)	874 (45.9)	961 (48.0)
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)	340 (10.5)	291 (8.5)	347 (9.5)	569 (14.0)
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)	700 (21.6)	783 (22.8)	938 (25.8)	1072 (26.4)
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)	106 (3.3)	133 (3.9)	145 (4.0)	184 (4.5)
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)	460 (14.2)	378 (11.0)	368 (10.1)	462 (11.4)
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)	296 (9.2)	319 (9.3)	284 (7.8)	338 (8.3)
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)	1671 (51.7)	1819 (53.0)	1902 (52.3)	2002 (49.3)
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)	503 (15.6)	516 (15.0)	456 (12.5)	446 (11.0)
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)	2717 (84.0)	2908 (84.7)	3181 (87.5)	3560 (87.7) *52 missing data
Outcomes (%)												
ROSC at scene	63 (4.6)	86 (6.0)	113 (6.5)	148 (7.3)	209 (8.8)	312 (12.5)	339 (11.9)	389 (13.1)	392 (12.1)	335 (9.8)	309 (8.5)	403 (9.9) *66 missing data
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)	712 (22.0)	608 (17.7)	630 (17.3)	571/3367 (17.0)

Emergency PCI performed	35 (13.9)	41 (16.5)	68 (22.4)	96 (26.8)	101 (22.3)	116 (23.3)	138 (25.5)	125 (22.7)	114 (20.1)	107 (24.0)	95 (21.2)	116 (24.4)
Targeted Temperature Management (TTM) initiated	17 (6.8)	23 (9.2)	61 (20.1)	117 (32.7)	135 (29.8)	132 (26.5)	132 (24.3)	168 (30.5)	179 (31.6)	150 (33.6)	114 (25.4)	107 (22.5)
ECMO Therapy inititaed	1 (0.4)	0 (0.0)	1 (0.3)	11 (3.1)	9 (2.0)	9 (1.8)	11 (2.0)	7 (1.3)	12 (2.1)	4 (0.9)	7 (1.6)	2 (0.4)
Emergency CABG performed	0 (0.0)	0 (0.0)	0 (0.0)	1 (0.3)	1 (0.2)	1 (0.2)	2 (0.4)	0 (0.0)	2 (0.3)	0 (0.0)	3 (0.7)	3 (0.6)
Survival to discharge	48 (3.5)	52 (3.7)	73 (4.2)	83 (4.1)	124 (5.2)	163 (6.5)	134 (4.7)	175 (5.9)	200 (6.2)	149 (4.3)	140 (3.8)	167/3407 (4.9)
Good-to-moderate neurological function (Overall)	25 (1.8)	33 (2.3)	36 (2.1)	63 (3.1)	77 (3.2)	110 (4.4)	95 (3.3)	118 (4.0)	156 (4.8)	110 (3.2)	111 (3.0)	134 (3.3)
** Good-to-moderate neurological function (Survived-to-discharged)	25 (52.1)	33 (63.5)	36 (49.3)	63 (75.9)	77 (62.1)	110 (67.5)	95 (70.9)	118 (67.4)	156 (78.0)	110 (73.8)	111 (79.3)	134 (80.2)
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)	77 (26.2)	67 (22.2)	59 (19.9)	53 (20.5)
Missing hospital outcomes	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	3 (0.1)	1 (0.03)	0 (0.0)	1 (0.03)	1 (0.03)	100 (2.9)
Unknown hospital outcomes	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)	1 (0.03)	0 (0.0)	0 (0.0)	0 (0.0)	0 (0.0)
Non-shockable rhythm bystander witnessed survival	7 (1.2) n = 585	9 (1.7) n = 523	15 (2.3) n = 651	12 (1.5) n = 819	31 (3.1) n = 994	30 (3.2) n = 942	31 (2.4) n = 1306	30 (3.1) n = 966	29 (3.0) n = 955	32 (3.3) n = 974	35 (3.0) n = 1151	47 (3.3) n=1435
Good-to-moderate neurological function (non-shockable rhythm, bystander witnessed overall)	1 (1.7)	6 (1.1)	3 (0.5)	9 (1.1)	16 (1.6)	15 (1.6)	19 (1.4)	16 (1.6)	15 (1.6)	15 (1.5)	23 (2.0)	36 (2.5)
Good-to-moderate neurological function (non-shockable rhythm bystander witnessed survival)	1 (14.3)	6 (66.7)	3 (20.0)	9 (75.0)	16 (51.6)	15 (50.0)	19 (61.3)	16 (53.3)	15 (51.7)	15 (46.9)	23 (65.7)	36 (76.6)
Non-cardiac origin bystander witnessed survival	6 (4.0) n = 148	6 (3.4) n = 176	9 (3.7) n = 242	8 (2.8) n = 287	19 (5.0) n = 378	28 (8.4) n = 331	18 (3.5) n = 508	28 (8.5) n = 329	21 (7.5) n = 279	21 (7.4) n = 284	26 (8.6) n=303	18 (6.5) n = 278
Good-to-moderate neurological function (non-cardiac origin, bystander witnessed overall)	2 (1.3)	4 (2.3)	1 (0.4)	5 (1.7)	12 (3.2)	16 (4.8)	10 (2.0)	15 (4.5)	13 (4.7)	9 (3.2)	14 (4.6)	13 (4.7)
Good-to-moderate neurological function (non-cardiac origin, bystander witnessed survival)	2 (33.3)	4 (66.7)	1 (1.1)	5 (62.5)	12 (63.1)	16 (57.1)	10 (55.5)	15 (53.6)	13 (61.9)	9 (42.9)	14 (53.8)	13 (72.2)
* Calculations based on valid cases.												
**Calculations based on available data.												
***One confirmed case but gender/demographic information unavailable.												

ANNEX B

myResponder Activation Data. Available for 2016-2020.[9]

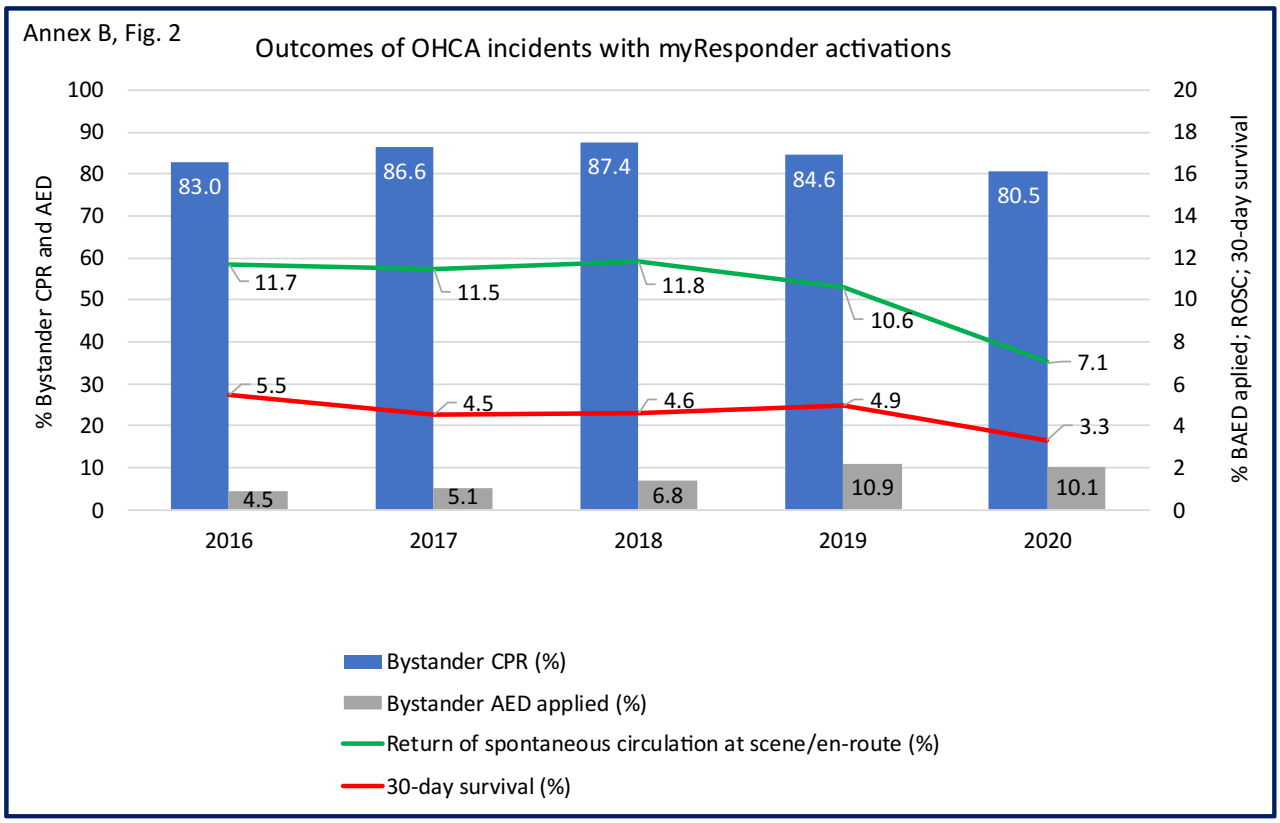


- More than half of all OHCA cases were matched with myResponder volunteers throughout the 5-year report period.

- Alert acceptance increased from 30.3% in 2016 to 57.3% in 2020, almost doubling during report period, with notable gain occurring in 2019.

- The proportion of activated responders arriving at the scene increased substantially from 10.3% in 2016 to 35.9% in 2020, more than tripling during the 5-year period.

[9] Takahashi H, Ain N, Fook-Chong S, Qiao F, Shahidah N, Okada Y, Ng YY, Hong D, Leong BS, Chia MY, Mao DR. Impact of smartphone activated first responders on provision of bystander CPR, bystander AED and outcomes for out-of-hospital cardiac arrest (OHCA). Resuscitation. 2025 Jul 1;212:110645. This study excludes 2020 data impacted by COVID-19. Study's database was used for graphs in this Annex B supplemental material.



- Bystander CPR rates among cases with myResponder activations increased from 83.0% in 2016 to a peak of 87.4% in 2018, remaining above 80% even in 2020 during the COVID-19 pandemic.

- Bystander AED (applied) rates among cases with myResponder activations more than doubled, increasing from 4.5% in 2016 to over 10% by 2019-2020, reflecting growing public access and willingness to use AEDs.

- Return of spontaneous circulation (ROSC) rates among cases with myResponder activations remained relatively stable at around 11-12% between 2016 and 2018, before declining to 7.1% in 2020.

- 30-day survival rates among cases with myResponder activations stayed within the 4.5-5.5% range through 2019, before decreasing to 3.3% in 2020.

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