



A member of the  
**Global  
Resuscitation  
Alliance**



# Using Defibrillator Data to Measure Human Factors & Technical Performance

## SITUATION

St John WA (SJWA) provides ambulance services across a vast land mass approximately 2.5 million km<sup>2</sup> in area. Western Australia (WA) has a population of approximately 2.66 million, the majority of whom reside within the Perth metropolitan and South-West areas of the state.

SJWA attended to 2698 OHCA cases in the calendar year 2020 (01 January – 31 December), a slight decrease on 2019 (n=2722). Most cases (n=2660) were adults (16 years and above) compared to those aged under 16 years of age (n=38). Of all OHCA cases, 69.2% were recorded by paramedics as male and 30.8% as female.

The crude incidence for adults was 125.8 per 100,000 population, compared to children at 6.9 per 100,000. These are both slightly lower than the rates observed in 2019 (128.9/100,000 for adults; 7.6/100,000 for children).

The total number of patients who survived OHCA at 30 days in 2020 was 128 (124 adults and 4 children). This represents 11.8% of the 1086 OHCA patients who had resuscitation attempted. Arriving at ED with a pulse (ROSC at ED) was a prognostically favourable indicator and arguably a barometer of prehospital performance. Of the 1086 resuscitation attempted cases, 224 patients had ROSC at ED (20.6%).

## INTERVENTION(S)

Aligning to Program 5: Measuring Professional Resuscitation Using the Defibrillator Recording, St John Ambulance Western Australia (SJWA) implemented a structured, review of voice and data captured from the Corpuls Cardiac Monitor:

Drivers for implementation were to link technical and human factor indicators as a means to measure and improve resuscitation efficiency and effectiveness. A range of data is collected as outlined in the table following.

<i>Human Factor Data</i>	<i>Technical Data</i>
<ul style="list-style-type: none"> <li>• Paramedic witnessed or not OHCA</li> <li>• Clinical back-up</li> <li>• Cause of arrest</li> <li>• CPR prior to arrival / AED use</li> <li>• Working space</li> <li>• Co-ordination and leadership</li> <li>• Compressor distraction</li> <li>• Use of taught standardised phrases</li> <li>• Compressor swaps</li> <li>• Response to CPR meter feedback</li> <li>• Approach to ventilation</li> <li>• Use of mechanical CPR device</li> <li>• Application of patient history</li> <li>• Destination discussion</li> <li>• Critical thinking</li> <li>• Teaching case or not</li> </ul>	<ul style="list-style-type: none"> <li>• Date / Time</li> <li>• Crew and crew mix</li> <li>• Resuscitation duration</li> <li>• Number of compression periods</li> <li>• Time until first compression</li> <li>• Initial rhythm</li> <li>• Monitor mode (AED / manual)</li> <li>• CPR duration</li> <li>• Sum of compression times and pauses</li> <li>• Compression fraction</li> <li>• Number of compressions</li> <li>• Number of shocks</li> <li>• Longest pause in compressions</li> <li>• Number of pauses &gt; 10 seconds</li> <li>• Pre/Post/Per-shock pause length(s)</li> <li>• CPR depth (average, median, st. dev)</li> <li>• CPR rate (average, median, st. dev)</li> <li>• Number of compressions too shallow/slow</li> </ul>

SJWA funds a full-time OHCA Improvement Specialist and this individual is responsible for reviewing OHCA recordings. The value of this element of improvement is balanced against other initiatives. The primary barrier to be overcome was workforce reluctance to this new mode of audit and quality assurance. Reporting occurs monthly to the Chief Executive Officer, and anonymised reports are provided to various areas of the organisation to inform response, education, and clinical decision making.

## ESTIMATE LIFESAVING IMPACT

Various elements of the literature, combined with the audit review elements demonstrate the potential to improve OHCA outcomes. Three examples are provided below.

**Audit Element** – Overall Resuscitation Improvement Program: Linking the audit elements to an overall OHCA improvement program (strategic plan) improves the opportunity for survival (Nehme, et al., 2021). After removing the non-significant temporal trend, there was a 33% increase (AOR 1.33; 95% CI: 1.11, 1.58;  $p=0.002$ ) in the risk-adjusted odds of survival over the 12-month intervention period from a structured program equating to an additional 8.7 survivors per million population. If replicated in WA this would equate to an additional 23 survivors per annum.

**Audit Element** – Time to First Compression / Defibrillation & Receipt of Bystander CPR: Rapid dispatch to OHCA has been shown to improve patient survival (Gnesin, et al., 2021). Bystander defibrillation increased the chances of survival to 30-days by an odds ratio of 2.6. Response times within 1-minute were also more likely to survive. If SJWA can improve response times to less than 1-minute for 75% of its OHCA patients, then it would mean 814 would improve their opportunity for survival by 2.6.

**Audit Element** – Decision Making on OHCA Patient Destination: Admission to a hospital with specialist services improves the chances of survival (von Vopelius-Feldt, Perkins, & Bengert, 2021) Admission to a hospital with 24/7 PPCI availability or high-volume was associated with an absolute improvement in survival to hospital discharge of 2.5% and 2.8% respectively. The association between admission to an OHCA centre and improved rates of survival was mainly seen in patients with OHCA due to shockable rhythms, with no or minimal potential benefit for patients with OHCA and asystole as first presenting rhythm. If SJWA was able to increase its survivor rate by 2.5% it would increase the number of survivors from 128 to 155.

## REPORT LIFESAVING IMPACT

Audio review has not yet, in isolation, shown improvements in cardiac arrest outcomes as it was only commenced in 2020. As with many other healthcare and ambulance systems, 2020 proved to be a year of coping with new challenges and learning to adapt to revised methods of delivering ambulance care in the midst of a Covid-19 pandemic. Intermittent periods of restriction, lockdown and community uncertainty were a reality, and this had some impact on service delivery at times. Despite these circumstances, we observed that the effect on patient survival and other important variables such as Bystander CPR rates and AED use remained fairly robust in comparison to other jurisdictions that reported a contrasting picture.

## References

- Gnesin, F., Møller, A., Mills, E., Zyliftari, N., Jensen, B., Bøggild, H., . . . Torp-Pedersen, C. (2021). Rapid dispatch for out-of-hospital cardiac arrest is associated with improved survival. *Resuscitation*, 176-183. doi:<https://doi.org/10.1016/j.resuscitation.2021.03.015>
- Nehme, Z., Ball, J., Stephenson, M., Walker, T., Stub, D., & Smith, K. (2021). Effect of a resuscitation quality improvement programme on outcomes from out-of-hospital cardiac arrest. *Resuscitation*, 236-244. doi:<https://doi.org/10.1016/j.resuscitation.2021.03.007>
- Von Vopelius-Feldt, J., Perkins, G. D., & Bengert, J. (2021). Association between admission to a cardiac arrest centre and survival to hospital discharge for adults following out-of-hospital cardiac arrest: A multi-centre observational study. *Resuscitation*, 118-125. doi:<https://doi.org/10.1016/j.resuscitation.2021.01.024>