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High-Performance Cardiopulmonary Resuscitation:

The implementation of an interventional bundle of education and feedback provision to improve patient outcomes.

SITUATION

The crude incidence of Out of Hospital Cardiac Arrest (OHCA) in Victoria slowly increases each year with Ambulance Victoria (AV) servicing a population of approximately 6.64 million people. In 2020-2021, the unadjusted incidence of all OHCA's in Victoria was 104 events per 100,000 population (1, 2). The survival to hospital discharge rates for OHCA presenting in a shockable rhythm is reported annually by AV's Victorian Ambulance Cardiac Arrest Registry (VACAR), and was determined to be, on average, 33.6% between 2016 and 2021 (1). AV introduced a High-Performance Cardiopulmonary Resuscitation (HPCPR) intervention bundle in October 2018 as growing evidence emerged of the potential impact that variation in emergency medical services (EMS) CPR performance could have on patient outcomes (3).

INTERVENTION

AV's HPCPR intervention bundle consists of:

- (i) the introduction of a checklist and a designated team leader to streamline resuscitation efforts;
- (ii) resuscitation choreography dictating team member roles, equipment placing, and intervention timing;
- (iii) on-screen rhythm analysis and defibrillations provided in manual mode with pre-emptive charging of the monitor whilst continuing chest compressions to eliminate unnecessary pauses;
- (iv) pulse checks conducted only for potentially perfusing rhythms;
- (v) CPR quality guided by the use of real-time CPR feedback pads, and;
- (vi) post-event TPR's (2).

A four-month educational period between 1st February 2019 and 31st January 2020 saw over 5000 paramedics trained in four hours of didactic education, scenario-based training, and online learning modules. Reporting was implemented shortly thereafter (2, 3). TPRs are created and sent to staff ideally within 7-14 days of an OHCA by a dedicated Resuscitation Officer who reviews online ZOLL defibrillator records and patient care reports, comparing performance against benchmarks from the preceding 12 months. A TPR is generated for every OHCA incident managed by EMS, except for cases where the duration of CPR was less than 2 minutes, patients are under the age of ≤ 11 years, traumatic OHCA's and patients with 'Not for Resuscitation' orders (2).

TPRs contain 19 metrics (see table 1) considered to be measurable and modifiable aspects reflecting resuscitation quality. The reports are used to foster a positive culture of self-improvement and recognition of quality resuscitation efforts (2).

THEME	METRICS
Early Recognition	1 - Arrival at patient to placement of defibrillation pads (mins). 2 - Compressions underway during pad placement (y/n). 3 - Identification of arrest rhythm on paramedic arrival (y/n).
Quality CPR	4 - Compressions at target depth (%). 5 - Compressions at target rate (%). 6 - Total compressions in target (%). 7 - Compression fraction (%). 8 - Average recoil velocity (%).
Defibrillation	9 - Arrival at patient to first defibrillation or disarm (mins). 10 - Average length of pause before a defibrillation (secs). 11 - Average length of pause after a defibrillation (secs).
Advanced Interventions	12 - Arrival at patient to insertion of iGel (mins). 13 - Arrival of sufficient crews to first bolus adrenaline (mins). 14 - Arrival of sufficient crews to first bolus amiodarone (mins).
Post-resuscitation care	15 - Adequate duration of resuscitation before termination (y/n). 16 - Intubation with first-pass success (y/n). 17 - Time between sustained ROSC and 12-lead ECG (mins). 18 - Blood pressure \geq 100mmHg on hospital arrival (y/n). 19 - Transport to 24-hour PCI facility if applicable (y/n).

The creation of TPR's as a part of a broader HPCPR cardiac arrest improvement strategy bundle is underpinned by the Global Resuscitation Alliance (GRA) Ten Programs, primarily addressing numbers; three, five, nine and ten (4).

ESTIMATED LIFESAVING IMPACT

Current published international literature supports the implementation of similar debriefing programs, real-time feedback and training refreshers with several demonstrating not only improved quality of OHCA management but direct patient effects such as improved survival to hospital discharge with good neurological outcomes (2, 3, 5-8).

REPORT LIFESAVING IMPACT

Whilst Covid-19 influenced overall EMS performance, the HPCPR bundle has been successfully implemented with TPR's continuing to be created and dispersed. After adjustment for arrest factors and temporal trends, there was a significant increase in the level of monthly survival to hospital discharge (AOR 1.50; 95% CI: 1.10, 2.04; $p = 0.01$), event survival (AOR 1.34; 95% CI: 1.09, 1.65; $p = 0.006$) and return of spontaneous circulation (AOR 1.38; 95% CI: 1.14, 1.65; $p = 0.001$). On average the intervention resulted in 8.7 (95% CI: 3.2, 14.1) additional survivors per million population (3). 8- Average recoil velocity (%).

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