OHCA System of Care – ‘Chain of Survival’
OHCA and Early Defibrillation

► OHCA a significant public health issue in Australia. 30,000 incidents per annum with survival typically 10% or less

► 9% reduction in survival for each minute increase in time to defibrillation (Fridman 2007)

► Early activation of EMS, early bystander CPR and defibrillation as soon as possible after cardiac arrest increases OHCA survival

► Public AED programs have effectively been used in communities with reported survival to discharge rates of 31 – 69% (Hallstrom 2004, Kitamura 2010, Eckstein 2012, Nielsen 2013)

► AED application before EMS arrival increases likelihood of survival to discharge (Weisfeldt 2010, Lijovic 2014)
Victorian OHCA System of Care

- Cardiac Arrest Registry underpinning research and continuous improvement
- Dispatcher assisted Telephone CPR
- 4 Steps for Life CPR & AED training program
- Public Access Defibrillation program
- Automated External Defibrillator Registry
- Firefighter and Community co-responder programs
- Evidence based clinical practice guidelines
- Transport to PCI capable hospital where available
- Annual report and reported KPIs
Public Access Defibrillation (PAD) in Victoria

- Ambulance Victoria has had PAD program since 2002
- 97 AEDs operating across 25 sites with high incidence or risk of OHCA, including airports, zoos, train stations, shopping centres, ferries and recreation centres.
- Significant increase in private AEDs and PAD sites over the past decade. Opt in AED Registry commenced in 2005 (www.registermyaed.com.au) to capture these AEDs and link to Computer Aided Dispatch system.
- Registry currently has over 3,500 AEDs but has some limitations
Clinical paper

Public access defibrillation—Results from the Victorian Ambulance Cardiac Arrest Registry

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On behalf of the Victorian Ambulance Cardiac Arrest Registry Steering Committee

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PAD in Victoria

► From 2002-2013 153 patients first defibrillated by a bystander with public AED
  • Ambulance Victoria maintained PAD site: 25
  • Public event manned by first aid volunteer: 26
  • AED not maintained by Ambulance Victoria: 102

► Most common locations of arrest where individual first defibrillated with a public AED:
  • Melbourne Airport: n=18 (12%)  
  • 2 major sporting venues: n=18 (12%)
  • Casino: n=4 (2.5%)

► Remaining cases (n=113, 74%) defibrillated at other locations across the state

Lijovic et al 2014
<table>
<thead>
<tr>
<th>Location</th>
<th>First shocked by EMS ($n=2117$)</th>
<th>First shocked by bystander with public AED ($n=153$)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Street/car park/public road/public transport</td>
<td>1167 (55%)</td>
<td>33 (22%)</td>
</tr>
<tr>
<td>Recreation/sporting complex</td>
<td>386 (18%)</td>
<td>76 (50%)</td>
</tr>
<tr>
<td>Workplace</td>
<td>296 (14%)</td>
<td>13 (8%)</td>
</tr>
<tr>
<td>Airport</td>
<td>0 (0%)</td>
<td>18 (12%)</td>
</tr>
<tr>
<td>All other public places (e.g. shopping centres)</td>
<td>268 (13%)</td>
<td>13 (8%)</td>
</tr>
</tbody>
</table>

Lijovic et al 2014
<table>
<thead>
<tr>
<th>Population characteristics according to EMS defibrillation and bystander defibrillation.</th>
<th>First shocked by EMS (n = 2117)</th>
<th>First shocked by bystander with public AED (n = 153)</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age, years (median, IQR)</strong></td>
<td>63 (53–74)</td>
<td>63 (52–71)</td>
<td>0.246</td>
</tr>
<tr>
<td>Unknown, n (%)</td>
<td>4 (0.2%)</td>
<td>0 (0%)</td>
<td></td>
</tr>
<tr>
<td><strong>Male gender, n (%)</strong></td>
<td>1860 (88%)</td>
<td>138 (88%)</td>
<td>0.390</td>
</tr>
<tr>
<td><strong>Cardiac precipitating event, n (%)</strong></td>
<td>2058 (97%)</td>
<td>148 (97%)</td>
<td>0.729</td>
</tr>
<tr>
<td>Bystander witnessed, n (%)</td>
<td>1765 (84%)</td>
<td>134 (88%)</td>
<td>0.214</td>
</tr>
<tr>
<td>Unknown, n (%)</td>
<td>10 (0.5%)</td>
<td>0 (0%)</td>
<td></td>
</tr>
<tr>
<td><strong>Bystander CPR, n (%)</strong></td>
<td>1571 (74%)</td>
<td>146 (95%)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td><strong>EMS Response time, minutes (median, IQR)</strong></td>
<td>7.3 (5.8–10.0)</td>
<td>8.0 (6.1–10.9)</td>
<td>0.017</td>
</tr>
<tr>
<td>Unknown, n (%)</td>
<td>38 (2%)</td>
<td>64 (4%)</td>
<td></td>
</tr>
<tr>
<td><strong>Time to first shock, minutes (median, IQR)</strong></td>
<td>10.0 (8.0–13.0)</td>
<td>5.2 (4.0–8.0)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td><strong>Survival to hospital, n (%)</strong></td>
<td>1059 (51%)</td>
<td>99 (66%)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Unknown, n (%)</td>
<td>26 (1%)</td>
<td>2 (1%)</td>
<td></td>
</tr>
<tr>
<td><strong>Survival to hospital discharge, n (%)</strong></td>
<td>637 (31%)</td>
<td>66 (45%)</td>
<td>0.001</td>
</tr>
<tr>
<td>Unknown, n (%)</td>
<td>73 (3%)</td>
<td>6 (4%)</td>
<td></td>
</tr>
</tbody>
</table>

*Note: IQR stands for Interquartile Range.*

*Lijovic et al 2014*
Proportion of cases where AV performed first defibrillation reduced significantly between 2006-2007 and 2015-2016, from 91% to 82% (p<0.001)

Decline has been driven by an almost four-fold increase in the use of public AED by bystanders over the same period (2.8% to 11.0%, p<0.001).

If a bystander provided CPR, a patient was 11 times more likely to have a shockable rhythm.
Where a bystander witnessed the arrest, 4% of patients were first shocked by a bystander.

Proportion of patients presenting in a shockable rhythm was higher amongst bystander witnessed arrests than for all OHCA patients (30% vs 13%).

When an OHCA was witnessed by a bystander, the proportion of patients discharged alive was higher than for all OHCA patients combined (17% vs 11%).

Source: 2015-16 VACAR Annual Report

<table>
<thead>
<tr>
<th>Total events</th>
<th>All OHCA</th>
<th>Bystander witnessed</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>5,899^</td>
<td>1,607</td>
</tr>
<tr>
<td>- Bystander CPR</td>
<td>2141 (36%)</td>
<td>977 (61%)</td>
</tr>
<tr>
<td>- Bystander AED use</td>
<td>72 (1.2%)</td>
<td>65 (4.0%)</td>
</tr>
<tr>
<td>- Shockable rhythm</td>
<td>766 (13%)</td>
<td>485 (30%)</td>
</tr>
<tr>
<td>EMS treated events</td>
<td>2,326</td>
<td>1,167</td>
</tr>
<tr>
<td>- Survived event</td>
<td>634 (27%)</td>
<td>444 (38%)</td>
</tr>
<tr>
<td>- Discharged alive</td>
<td>244 (11%)</td>
<td>192 (17%)</td>
</tr>
</tbody>
</table>

^ Total OHCA events include EMS witnessed events; all other data in the table exclude EMS witnessed events.
Adult survival from all cause cardiac arrest

Source: 2015-16 VACAR Annual Report
Risk adjusted odds of survival (Shockable EMS Rx)
Impact of bystander defibrillation on survival

- Ambulance Victoria: 50% Survived Event, 28% Discharged Alive
- First Responders: 56% Survived Event, 38% Discharged Alive
- Public AED: 76% Survived Event, 55% Discharged Alive

Source: 2015-16 VACAR Annual Report
It’s not without its challenges

- Location of cardiac arrest and AEDs
- Only 20% of AEDs used are on AV Registry
- Lack of agreed standards for public AEDs
- Competing AED locator apps
- Role of ambulance service hasn’t kept up in changing environment

Location of adult cardiac arrest (VACAR 2015-16)
Improving access to bystander CPR and AED

- Disruptive technology is proving a game changer
- SMS and smartphone apps e.g. Goodsam and Pulsepoint
- Connects rescuer to nearest AED and push notification of nearby cardiac arrest
- Successfully operating in many parts of the world and recommended by Global Resuscitation Alliance as a key step to improve survival from OHCA
- True benefit lies in integration with EMS (public versus private locations)
- Ambulance Victoria is introducing an integrated smartphone app to be operational in 2017-18
Acknowledgements

Prof Karen Smith, Prof Stephen Bernard and our researchers and responders

It takes a system to save a life!

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