Australian Resuscitation Outcomes Consortium (Aus-ROC)

A NHMRC Centre of Research Excellence (CRE) in Clinical Research, #1029983

Out-of-hospital cardiac arrest registry (‘Epistry’)

Presented by Prof Judith Finn
on behalf of the Aus-ROC Investigators
20 April 2012
This presentation will..

- Introduce the purpose and structure of the NHMRC Aus-ROC CRE

- Outline the process (and challenges) for the establishment of the Aus-ROC registry (‘epistry’)

- Identify potential studies using the Aus-ROC registry
Out-of-hospital cardiac arrest (OHCA)

• Cardiac arrest (CA) is defined as the sudden cessation of cardiac mechanical activity, confirmed by the absence of a detectable pulse, unresponsiveness and absence of respiration.

• Causes include: acute myocardial infarction (heart attack); drug toxicity; trauma; heart rhythm disorders
Leading Causes of Death in United States
Extrapolated from www.cdc.gov and Nichol JAMA 2008

Condition

- Cancer
- Heart Disease ex OHCA
- OHCA
- Stroke
- Chronic Respiratory Injury
- Injury
- Alzheimer
- Diabetes
- Influenza and Pneumonia
- Renal
- Septicemia

Annual Number of Deaths

G. Nichol slide
# Out-of-hospital cardiac arrest (OHCA) - poor survival outcomes

<table>
<thead>
<tr>
<th></th>
<th>Perth (WA) 2008</th>
<th>Vic 2008</th>
<th>US/Canada(^1)</th>
</tr>
</thead>
<tbody>
<tr>
<td>All arrests (n)</td>
<td>1,058</td>
<td>4,986</td>
<td>19,584</td>
</tr>
<tr>
<td>Rate per 100,000 population (crude)</td>
<td>66.0</td>
<td>93.8</td>
<td>95.7</td>
</tr>
<tr>
<td>Survival EMS assessed</td>
<td>3.6%</td>
<td>5.4%</td>
<td>1.1 to 8.1%</td>
</tr>
<tr>
<td>Survival EMS treated</td>
<td>8.4%</td>
<td>12.4%</td>
<td>3.0 to 16.3%</td>
</tr>
</tbody>
</table>


### Table 4. Incidence and Outcome of EMS-Treated Out-of-Hospital Cardiac Arrest

<table>
<thead>
<tr>
<th>Location</th>
<th>Adjusted Incidence Rate per 100,000</th>
<th>Adjusted Mortality Rate per 100,000</th>
<th>Case-Fatality Rate, %</th>
<th>Survival to Discharge, %</th>
<th>Vital Status Data Missing, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alabama (n = 267)</td>
<td>40.3</td>
<td>36.9</td>
<td>91.7</td>
<td>3.0</td>
<td>5.3</td>
</tr>
<tr>
<td>Dallas (n = 1265)</td>
<td>82.9</td>
<td>77.2</td>
<td>92.6</td>
<td>4.5</td>
<td>2.9</td>
</tr>
<tr>
<td>Iowa (n = 565)</td>
<td>51.3</td>
<td>44.4</td>
<td>86.9</td>
<td>11.0</td>
<td>2.1</td>
</tr>
<tr>
<td>Milwaukee (n = 801)</td>
<td>86.7</td>
<td>78.0</td>
<td>90.1</td>
<td>9.7</td>
<td>0.1</td>
</tr>
<tr>
<td>Ottawa (n = 1836)</td>
<td>45.1</td>
<td>42.3</td>
<td>93.5</td>
<td>5.3</td>
<td>1.2</td>
</tr>
<tr>
<td>Pittsburgh (n = 575)</td>
<td>51.1</td>
<td>47.1</td>
<td>92.3</td>
<td>7.0</td>
<td>0.7</td>
</tr>
<tr>
<td>Portland (n = 793)</td>
<td>47.0</td>
<td>41.0</td>
<td>86.8</td>
<td>10.6</td>
<td>2.5</td>
</tr>
<tr>
<td>Seattle (n = 1170)</td>
<td>74.4</td>
<td>62.3</td>
<td>83.5</td>
<td>16.3</td>
<td>0.2</td>
</tr>
<tr>
<td>Toronto (n = 2992)</td>
<td>57.0</td>
<td>53.6</td>
<td>93.8</td>
<td>5.5</td>
<td>0.2</td>
</tr>
<tr>
<td>Vancouver (n = 1634)</td>
<td>52.8</td>
<td>46.9</td>
<td>88.5</td>
<td>9.7</td>
<td>1.7</td>
</tr>
<tr>
<td>Overall (n = 11,898)</td>
<td>56.0</td>
<td>50.9</td>
<td>90.7</td>
<td>7.9</td>
<td>1.4</td>
</tr>
</tbody>
</table>

*Abbreviation: EMS, emergency medical services.

*All rates were unequal across sites at P < .001.

### Table 5. Incidence and Outcome of Ventricular Fibrillation

<table>
<thead>
<tr>
<th>Location</th>
<th>Adjusted Incidence Rate per 100,000</th>
<th>Adjusted Mortality Rate per 100,000</th>
<th>Case-Fatality Rate, %</th>
<th>Survival to Discharge, %</th>
<th>Vital Status Data Missing, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alabama (n = 65)</td>
<td>9.9</td>
<td>8.8</td>
<td>89.2</td>
<td>7.7</td>
<td>3.1</td>
</tr>
<tr>
<td>Dallas (n = 195)</td>
<td>12.8</td>
<td>10.7</td>
<td>82.7</td>
<td>9.5</td>
<td>7.9</td>
</tr>
<tr>
<td>Iowa (n = 135)</td>
<td>12.4</td>
<td>8.9</td>
<td>72.9</td>
<td>22.7</td>
<td>4.4</td>
</tr>
<tr>
<td>Milwaukee (n = 165)</td>
<td>18.7</td>
<td>13.7</td>
<td>74.0</td>
<td>26.0</td>
<td>0</td>
</tr>
<tr>
<td>Ottawa (n = 429)</td>
<td>10.4</td>
<td>8.6</td>
<td>83.1</td>
<td>14.8</td>
<td>2.1</td>
</tr>
<tr>
<td>Pittsburgh (n = 102)</td>
<td>9.3</td>
<td>7.2</td>
<td>77.5</td>
<td>21.5</td>
<td>1.0</td>
</tr>
<tr>
<td>Portland (n = 249)</td>
<td>15.1</td>
<td>11.3</td>
<td>73.9</td>
<td>22.5</td>
<td>3.6</td>
</tr>
<tr>
<td>Seattle (n = 297)</td>
<td>19.0</td>
<td>11.5</td>
<td>59.8</td>
<td>39.9</td>
<td>0.3</td>
</tr>
<tr>
<td>Toronto (n = 614)</td>
<td>11.4</td>
<td>9.5</td>
<td>83.0</td>
<td>15.7</td>
<td>1.3</td>
</tr>
<tr>
<td>Vancouver (n = 478)</td>
<td>15.2</td>
<td>10.9</td>
<td>71.7</td>
<td>25.0</td>
<td>3.3</td>
</tr>
<tr>
<td>Overall (n = 2729)</td>
<td>12.8</td>
<td>9.8</td>
<td>76.5</td>
<td>21.0</td>
<td>2.5</td>
</tr>
</tbody>
</table>

*All rates were unequal across sites at P < .001.
Differences in survival in OHCA..

- Different definitions ie different numerators and denominators
- Different case-mix eg age, pathophysiology
- Better prehospital and inhospital (post-resuscitation) clinical care
- Better organisation of local emergency medical services
Framework for developing a programme of research in resuscitation.
The NHMRC objective of funding CREs is to:

- support the conduct and development of innovative, high quality, collaborative research;
- ensure effective *translation* of research into health policy and / or practice;
- foster and build *capacity* in the health and medical research workforce; and
- provide opportunities to expand and improve collaborations between research teams.
Australian Resuscitation Outcomes Consortium (Aus-ROC)

• to promote and conduct multicentre clinical research in the area of pre-hospital cardiopulmonary arrest, modelled on (and in collaboration with) the highly successful North American (United States and Canada) Resuscitation Outcomes Consortium.
Resuscitation Outcomes Consortium

ROC is a clinical trial network focusing on research in the area of pre-hospital cardiopulmonary arrest and severe traumatic injury.

Mission

The mission of the Resuscitation Consortium is to provide infrastructure and project support for clinical trials and other outcome-oriented research in the areas of cardiopulmonary arrest and severe traumatic injury that will rapidly lead to evidence-based change in clinical practice. The focus on pre-hospital and early hospitalization interventions recognizes the critical importance of this time frame and early congruence between the emergency cardiac and trauma populations. ROC Investigators will conduct collaborative trials of variable size and duration (equally directed towards the cardiac and trauma populations), leveraging the combined power of the member institutions and promoting the rapid translation of promising scientific and clinical advances for the public good.

Press Releases

2012/01/26: NIH Launches Trials to Evaluate CPR and Drugs After Sudden Cardiac Arrest
2009/11/20: Effect of Real-time CPR Feedback
2009/11/06: Study on Resuscitation Methods for Cardiac Arrest (PRIMED) Halted
2009/05/12: Study of Concentrated Saline for Traumatic Brain Injury Halted
2009/03/26: Study of Concentrated Saline for Shock Halted
2006/03/24: NHLBI Announces Formation and Funding of ROC

https://roc.uwctc.org
Participants

Participating Sites

Regional Clinical Centers
- Dallas/Fort Worth Center for Resuscitation Research
- The Milwaukee Resuscitation Research Center
- Ottawa Ontario RCC
- British Columbia RCC
- Pittsburgh Resuscitation Network
- Oregon Health & Sciences University - Portland Resuscitation Outcomes Consortium
- Seattle-King County Center for Resuscitation Research at the University of Washington
- Alabama Resuscitation Center
- Toronto Regional RESusCitation RESearch ouUt of hospital NETwork
- UCSD/San Diego Resuscitation Research Center

Satellite Centers
- Memphis Resuscitation Research Center
- San Francisco Clinical Center
- Cincinnati Clinical Center
- Houston Clinical Center
- Houston Clinical Coordinating Center
- Houston Data Coordinating Center
- Toronto Sunnybrook Clinical Center
- Baltimore Clinical Center
- Tucson Clinical Center
- Los Angeles Clinical Center
www.ilcor.org
Aus-ROC specific aims

- undertake large multi-centre clinical trials (*initially*) across three jurisdictions.
- establish an Australia-wide OHCA ‘epistry’ (epidemiologic registry) to monitor and report on the population-based effects of changes in pre-hospital resuscitation policy and practice.
- examine system-based strategies to improve the efficiency and effectiveness of pre-hospital emergency care for OHCA in urban and rural environments.
- build capacity in pre-hospital emergency care research across Australia through graduate research and post-doctoral training.
Chief Investigators
• Prof Peter Cameron
  Monash DEPM
• Prof Ian Jacobs
  UWA/SJA(WA)
• A/Prof Stephen Bernard
  Monash DEPM
• Prof Judith Finn
  UWA/ Monash DEPM
• Dr Karen Smith
  AV / Monash DEPM
• Prof Peter Thompson
  UWA
• Prof Andrew Tonkin
  Monash DEPM

Associate Investigators
• Prof Hugh Grantham
  Flinders Uni / SAAS
• A/Prof Peter Morley
  Melbourne Uni
• A/Prof Tony Walker
  AV
• Prof Antonio Celenza
  UWA
• Dr Teresa Williams
  UWA
• Prof Andrew Forbes
  Monash DEPM
• Prof Graham Nichol
  Uni of Washington / ROC
• Medical Director
• Prof Gavin Perkins
  Warwick Uni
Proposed Program of Research
Focus on 4 key areas

1. Reducing the time to definitive care
   - *medical dispatch*
   - *Public Access Defibrillation*

2. Intra-arrest clinical intervention research
   - *clinical trials eg ‘RINSE’*

3. Post-resuscitation Care
   - *intensive care management*

4. **Cardiac Arrest Outcomes Research**
   - *cardiac arrest ‘epistry’*
Aus-ROC CRE funding

• Postdoctoral Fellows
  – 2 Vic; 1 WA; 1 SA
• PhD students
  – 2 Vic; 2 WA; 1 SA
• Part-time Director (Judith Finn)
• Part-time Executive Officer (Mimi Morgan)
• Direct research costs
  – No specific project funding**
The primary goal of the ROC Epistry Database working group is to develop the rationale and methods for a standard reliable and valid epidemiologic databank of out of hospital cardiac arrest and life threatening trauma cases with in-hospital outcomes after 5 years enabling the identification of best practices via observational study and mega trials with the ultimate goal of improving resuscitation success defined as survival to hospital discharge rates across ROC centers.
ROC Epistry Publications 2010-2011
https://roc.uwctc.org/tiki/roc-pub-publications

- Socioeconomic status and incidence of sudden cardiac arrest.
- Cardiac arrest survival did not increase in the Resuscitation Outcomes Consortium after implementation of the 2005 AHA CPR and ECC guidelines.
- Ventricular tachyarrhythmias after cardiac arrest in public versus at home.
- A geospatial assessment of transport distance and survival to discharge in out of hospital cardiac arrest patients: Implications for resuscitation centers.
- Survival after application of automatic external defibrillators before arrival of the emergency medical system: evaluation in the resuscitation outcomes consortium population of 21 million.
- Receiving hospital characteristics associated with survival after out-of-hospital cardiac arrest.
- Predicting survival after out-of-hospital cardiac arrest: role of the Utstein data elements.
- Out-of-hospital cardiac arrest frequency and survival: evidence for temporal variability.
Aus-ROC ‘Epistry’

Bring together core data elements from the cardiac arrest registries of:

• Victorian Ambulance (AV)
  – since 1999 (rural and metro)

• St John Ambulance (WA)
  – since 1996 (metro only)
  – linkage to ED+HMD+DEA

• South Australian Ambulance Service (SAAS)
  – developing since 2009
Aus-ROC Epistry Aims

1. Establish a comprehensive ongoing data infrastructure to facilitate the design, implementation and interpretation of Aus-ROC trials.

2. Define the incidence and outcome of out-of-hospital cardiac arrest, including quality of life after hospital discharge.

3. Describe the relationships between resuscitation performance and EMS structure, adjusting for episode-specific factors.

4. Evaluate the relationships between outcome and patient, EMS, regional, and periodic factors.
Cardiac arrest and cardiopulmonary resuscitation outcome reports: update and simplification of the Utstein templates for resuscitation registries. A statement for healthcare professionals from a task force of the international liaison committee on resuscitation (American Heart Association, European Resuscitation Council, Australian Resuscitation Council, New Zealand Resuscitation Council, Heart and Stroke Foundation of Canada, InterAmerican Heart Foundation, Resuscitation Council of Southern Africa) *


*Pediatric Critical Care Fellowship, Children’s Hospital of Philadelphia, Department of Anesthesia and Critical Care, 34th St. and Civic Center Blvd. Sixth Floor, Room 6120C, Philadelphia, Pa 19104-4309, USA

Received 27 September 2004; accepted 27 September 2004
2.4. Bystander CPR

Bystander CPR is cardiopulmonary resuscitation performed by a person who is not responding as part of an organized emergency response system. Physicians, nurses, and paramedics may be described as performing byystander CPR, if they are not part of the organized emergency response system involved in the victim's resuscitation.

2.5. Cardiac arrest

Cardiac arrest is the cessation of cardiac mechanical activity as confirmed by the absence of signs of circulation. If an EMS provider or physician did not witness the cardiac arrest, he/she may be uncertain as to whether a cardiac arrest actually occurred.

2.6. Cause of arrest

An arrest is presumed to be cardiac if no cause for arrest is present, or if cardiac arrest is confirmed by the arrest of a patient.

2.7. Chest compressions

Chest compressions are performed by an individual or a mechanical device during CPR in an attempt to restore spontaneous circulation.

2.8. CPR

Cardiopulmonary resuscitation is an attempt to restore spontaneous circulation by performing chest compressions with or without ventilation.

2.9. Date of arrest

The date of arrest is the date the event was known to occur or the date on which the victim was found. Date of arrest should be recorded in a conventional format that is consistent for the region (e.g., YYYY-MM-DD or DD-MM-YYYY or MM-DD-YYYY).

2.10. Date of birth

If the victim's date of birth is known, the date should be recorded in an acceptable format. If the date of birth is not known, but the victim's age is known, age should be recorded. If the victim's age is not known, age should be estimated and recorded.

2.11. Date of discharge or death

The date of discharge or death is the date on which the patient was discharged from the scene hospital or was certified dead. It should be recorded in an acceptable format.

2.12. Defibrillation attempt before EMS arrival

When a bystander attempts defibrillation, e.g., public access or lay rescuer defibrillation, it is recorded as a defibrillation attempt before EMS arrival. AEDs are increasingly being made available for access by the general public. In patients with an ICD, a shockable rhythm is likely to be triggered by at least one shock by the device before the arrival of EMS personnel. This can be confirmed by analyzing the ICD memory. After extensive discussion, the task force agreed that defibrillation attempts by ICDs are important but difficult for EMS to track. Thus, ICD documentation is optional.

2.13. Drugs

The term "drugs" refers to delivery of any medication (e.g., intravenous calcium, intraosseous needle, or intracardiac tube) during the resuscitation event.

2.14. Emergency medical services

EMS personnel respond to a medical emergency in an official capacity as part of an organized medical response team. By this definition, physicians, nurses, or paramedics who witness a cardiac arrest and initiate CPR but are not part of the organized response team are characterized as bystanders and not part of the EMS system.

2.15. End of event

A resuscitation attempt is deemed to have ended when death is declared or spontaneous circulation is restored and sustained for 20 min or longer. If extracorporeal life support is being provided, the end of event is 20 min after establishment of extracorporeal circulation.

2.16. First monitored rhythm

The first monitored rhythm is the first cardiac rhythm present when the monitor or defibrillator is attached to the patient after a cardiac arrest. If the AED does not have a rhythm display, it may be possible to determine the first monitored rhythm from a data storage card, hard drive, or other device used by the AED to record data. If the AED has no data recording device, the first monitored rhythm should be classified simply as shockable or unshockable. This data point may be updated at a later time if the AED has data download capability.

2.17. Location of arrest

Location of arrest is the specific location where the event occurred or the patient was found. Knowledge of the arrest process is critical to the cardiovascular system's ability to determine how it can optimize its response to reduce response interval. A basic list of predefined locations will facilitate collection. Local factors may make creation of subcategories useful. For example:

- Place of residence: e.g., home, apartment, back yard of a home.
- Public place: e.g., the central city park, shopping center, sports stadium, entertainment center, airport, railway station, church, beach, airport
- Other: hotel room, private office, long-term care nursing facility.

2.18. Neurological outcome at discharge from hospital

Documentation of the patient's neurological status or any specific point in time (e.g., discharge from the hospital, 6 months, or 1 year), however, recording neurological outcome after discharge has been difficult. Survival without higher neurological function is suboptimal, therefore, it is important to attempt to assess neurological outcome at discharge. A simple validated neurological score such as cerebral performance category (CPC) should be recorded if available.

2.19. Patient identifier

A patient identifier is a unique numeric or alpha-numeric sequence that identifies a specific patient and cardiac arrest event. Ideally, the patient identifier should follow the patient from the resuscitation event to hospital discharge (recovery or death). Unfortunately, few systems have the ability to link individual patient care records for the out of hospital, in hospital, and post discharge phases of the event.

2.20. Resuscitation

A resuscitation attempt is defined as the act of attempting to maintain or restore life by establishing and/or maintaining arrest, breathing, and circulation through CPR, defibrillation, and other related emergency care.

2.21. Resuscitation attempt by EMS personnel

When EMS personnel perform CPR, or attempt defibrillation, it is recorded in a resuscitation attempt by EMS personnel.

2.22. Resuscitation not attempted by EMS personnel

EMS personnel may not attempt resuscitation when a do-not-resuscitate (DNR) order exists, a resuscitation attempt is considered futile, or resuscitation is not required (e.g., the patient has no signs of circulation).

2.23. Return of spontaneous circulation (ROSC)

Signs of return of spontaneous circulation include breathing (more than an occasional gasp), coughing, or movement. For healthcare personnel, signs of ROSC also include evidence of a palpable pulse or a measurable blood pressure. For the purposes of the Utstein registry database, "successful resuscitation" or ROSC, is defined for all rhythms as the restoration of a spontaneous perfusing rhythm that results in more than an occasional gasp,帮扶 palpation, pulsatil, or arterial waveform. Assisted circulation (e.g., extracorporeal support such as extracorporeal membrane oxygenation or intracardiac assist device) should not be considered ROSC until "patient-generated" (i.e., spontaneous) circulation is established. Previous reports focused on outcomes from ventricular fibrillation have varied definitions that "successful defibrillation" is the termination of fibrillation to any rhythm (including asystole) and the termination of fibrillation to organized cardiac rhythm at 5 s after defibrillation (including pulseless electrical activity, PEA). Neither of these definitions are consistent across studies, and the term "ROSC" is intended to represent a brief (approximately 30 s) resuscitation of spontaneous circulation that provides evidence of return of spontaneous circulation and is accompanied by evidence of return of circulatory activity. Consequently, the term "ROSC" is intended to represent a brief (approximately 30 s) resuscitation of spontaneous circulation that provides evidence of return of spontaneous circulation and is accompanied by evidence of return of circulatory activity.

2.24. Sex

Sex (male or female) may be an important risk factor for cardiac arrest and resuscitation intervention.

2.25. Shockable/Nonshockable rhythm

This element refers to the first monitored rhythm, which, when analyzed by the person interpreting the monitor or defibrillator or an AED, was found to be treatable attempt resuscitation (i.e., shockable or nonshockable). In general, shockable cardiac arrest rhythms are further divided into ventricular fibrillation and pulsatile ventricular tachycardia. Nonshockable cardiac arrest rhythms are categorized as either asystole or PEA. Although a very specific definition of asystole is desirable, no consensus agreement was reached on either specific duration (e.g., 30 s) or heart rate (e.g., <5 beats per minute) to define asystole versus brady-PeA. In future iterations of the registry document, further consideration and addition of research resources may be needed to address the importance and implications of this distinction.
Fig. 1. Utstein reporting template for core data elements. ED, emergency department; OR, operating room; CCU/ICU, critical care unit/intensive care unit; and PEA, pulseless electrical activity.
Aus-ROC Epistry
Issues to be considered

- Data ownership
  - perceived loss of control

- Data harmonisation across all 3 States
  - core data items; data definitions; outcomes

- Governance Structures
  - ethics;
  - data transfer / data security

- Data access
  - who / how / fees
Selected research outputs from VACAR.....

Aus-ROC Epistry - extension

- CPR quality (Q-CPR)
- In-hospital management
  - Emergency department data
  - Intensive care unit data
- Long-term outcomes
  - Morbidity
  - Mortality
- Effect of comorbidity on survival outcomes
- Quality of Life
Kaplan Meir Survival Curve
for all OHCA survivors Perth 1996-2010 (n=457)

During study period
n=143  (31%) died

Median survival
11.77 years

Mean survival
9.6 ± sd=0.3 years
95% CI 9.0 to 10.3 years
In Summary

• The Aus-ROC Epistry will bring together core data from (initially) 3 State Ambulance Service cardiac arrest registries

• Provide an opportunity to:
  – Compare processes and survival outcomes
  – Provide infrastructure to plan & monitor trials
  – Generate hypotheses about candidate interventions

• Goal: Improve patient outcomes from OHCA
Louise Owen and daughter – the ‘big picture’

- A ‘typical’ School day as a teacher in Grafton in 1990
- 30 years old mother of one (Grace)
- 26 weeks pregnant
- Sudden Cardiac Arrest
- Alarm raised by students + CPR performed by colleagues
- Defibrillation by Ambulance Officers 8 minutes later
- Transferred to Brisbane Hospital
- Katy born by Caesarian section – 13 weeks premature – but healthy
- Louise continues to be a strong advocate for resuscitation practice, training and research

Photo from [www.surgeons.org/surgical_news](http://www.surgeons.org/surgical_news)
Louise is a cardiac arrest survivor and has over 20 years of CPR training experience.

She is a longstanding advocate of cardiac arrest survival in Australia having survived a cardiac arrest while pregnant with her daughter, also a survivor.

She is the head of training and education for Cardiac Responder.

The Cardiac Arrest Survival Foundation (CASF), a registered charitable fund, aims to reduce the number of needless deaths from cardiac arrest by improving public awareness, reliability and accessibility of AEDs, especially in public spaces and workplaces.