A prehospital study of survival outcomes from out-of-hospital cardiac arrest in ST-Elevation myocardial infarction in Queensland (the PRAISE study)

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Dr. Stephen Rashford
Background

- **Study Cohort**
  - resuscitation attempt
  - paramedic witnessed OHCA
  - context of an identified STEMI

- This is a unique sub-set of OHCA patients that present with an reversible cause

- The survival outcomes of these patients has not been previously explored and represents a current knowledge gap
Study Setting

• The Queensland Ambulance Service (QAS) utilises a two-tiered response model

• QAS paramedics are trained in the identification of STEMI and authorised to initiate reperfusion strategies
  - (pPCI)
  - fibrinolysis

• Indications for reperfusion regimes are dependant on proximity to PCI facility when STEMI is identified
  - < 60 minutes = pPCI
  - > 60 minutes = fibrinolysis
STEMI Reperfusion Regime

- **Primary PCI**
  - platelet aggregation inhibitor (ticagrelor)
  - anticoagulant (heparin)

- **Fibrinolysis**
  - platelet aggregation inhibitor (clopidogrel)
  - anticoagulant (enoxaparin)
  - thrombolytic agent (tenecteplase)
QAS Clinical Practice Guidelines

• Prioritises the timely initiation of reperfusion regimes

• In the setting of OHCA, this can occur:
  - prior to deterioration into OHCA
  - intra-arrest (under medical consultation)
  - post achievement of ROSC

• Align with ILCOR & ANZCOR
  - CPR
  - defibrillation (biphasic; 200j)
  - airway adjunct
  - inotropic / antiarrhythmic drugs
Methodology / Study Population

• Retrospective analysis of the QAS Cardiac Arrest Database
• 1st January 2013 – 31st December 2017

Inclusion Criteria

• Aged 18+
• STEMI identified by attending paramedic (≥ 1mm contiguous limb leads & ≥ 2mm in chest leads)
• Subsequently experienced a paramedic-witnessed OHCA

Exclusion Criteria

• Paramedic not definitive in their diagnosis
• Inter-hospital transfers
Primary Outcome / Definition of Survival

‘Survived Event’

- ROSC on arrival at receiving hospital. Defined as the resumption of a perfusing cardiac rhythm and presence of a palpable pulse

‘Survived to Hospital Discharge’

- Alive at the end of their hospital episode of care

- **It is possible for a patient to not survive the event but survive to hospital discharge if successfully resuscitated in-hospital**
Statistical Analysis

• Association between variables and survival were initially analysed using univariate logistic regression

• A relaxed $p$-value criterion of $\leq 0.2$ was used to identify variables to be included in a multivariate logistic model

• All tests were two-sided, with a $p$-value $< 0.05$ considered statistically significant
### Demographic, Clinical & System Characteristics

<table>
<thead>
<tr>
<th>Variable</th>
<th>n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Age</strong></td>
<td></td>
</tr>
<tr>
<td>Median (IQR)</td>
<td>59 (51 - 70)</td>
</tr>
<tr>
<td><strong>Gender</strong></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>215 (74.9)</td>
</tr>
<tr>
<td>Female</td>
<td>72 (25.1)</td>
</tr>
<tr>
<td><strong>Prehospital documented medical history</strong></td>
<td></td>
</tr>
<tr>
<td>Cardiac risk factors</td>
<td>122 (42.5)</td>
</tr>
<tr>
<td>Previous acute myocardial infarction</td>
<td>34 (11.8)</td>
</tr>
<tr>
<td>Previous coronary angioplasty / stent</td>
<td>17 (5.9)</td>
</tr>
<tr>
<td>Prescribed anti-coagulants / anti-platelets</td>
<td>71 (24.7)</td>
</tr>
<tr>
<td>Nil medical history; no prescribed medications</td>
<td>81 (28.2)</td>
</tr>
<tr>
<td><strong>Geographical location of patient attended in</strong></td>
<td></td>
</tr>
<tr>
<td>Metropolitan</td>
<td>180 (62.7)</td>
</tr>
<tr>
<td>Regional</td>
<td>100 (34.8)</td>
</tr>
<tr>
<td>Remote</td>
<td>7 (2.4)</td>
</tr>
<tr>
<td><strong>Clinical Features</strong></td>
<td></td>
</tr>
<tr>
<td>Initial arrest rhythm shockable</td>
<td>240 (83.6)</td>
</tr>
<tr>
<td><strong>System Related Factors</strong></td>
<td></td>
</tr>
<tr>
<td>Critical Care Paramedic attended incident</td>
<td>243 (84.7)</td>
</tr>
<tr>
<td>Received reperfusion medication</td>
<td>147 (51.2)</td>
</tr>
<tr>
<td>Emergency call made inside business hours</td>
<td>87 (30.3)</td>
</tr>
</tbody>
</table>

n = 287
## Factors Associated With Survived Event (Univariate Analysis)

### Survived Event – 76.6%

<table>
<thead>
<tr>
<th></th>
<th>Survived Event</th>
<th>No ROSC</th>
<th><em>p</em>-value</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Number of cases, n (%)</strong></td>
<td>220 (76.7)</td>
<td>67 (23.3)</td>
<td></td>
</tr>
<tr>
<td><strong>Age, Median, (IQR)</strong></td>
<td>59 (51, 69)</td>
<td>57 (51,70)</td>
<td>0.91</td>
</tr>
<tr>
<td><strong>Gender</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>162 (73.6)</td>
<td>53 (79.1)</td>
<td>0.37</td>
</tr>
<tr>
<td>Female</td>
<td>58 (26.4)</td>
<td>14 (20.9)</td>
<td>0.37</td>
</tr>
<tr>
<td><strong>Past Medical History / Current Medications</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cardiac risk factors</td>
<td>94 (42.7)</td>
<td>28 (41.8)</td>
<td>0.89</td>
</tr>
<tr>
<td>Previous acute myocardial infarction</td>
<td>25 (11.4)</td>
<td>9 (13.4)</td>
<td>0.65</td>
</tr>
<tr>
<td>Previous coronary angioplasty / stent</td>
<td>13 (5.9)</td>
<td>4 (6.0)</td>
<td>0.98</td>
</tr>
<tr>
<td>Prescribed anti-coagulants / anti-platelets</td>
<td>54 (24.5)</td>
<td>17 (25.4)</td>
<td>0.89</td>
</tr>
<tr>
<td>Nil medical history; no prescribed medications</td>
<td>66 (30.0)</td>
<td>15 (22.4)</td>
<td>0.23</td>
</tr>
<tr>
<td><strong>Geographical Location Patient Attended</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Metropolitan</td>
<td>135 (61.4)</td>
<td>45 (67.2)</td>
<td>0.60</td>
</tr>
<tr>
<td>Regional</td>
<td>80 (36.4)</td>
<td>20 (29.9)</td>
<td>0.60</td>
</tr>
<tr>
<td>Remote</td>
<td>5 (2.3)</td>
<td>2 (3.0)</td>
<td>0.60</td>
</tr>
<tr>
<td><strong>Clinical Features</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Initial rhythm shockable</td>
<td>203 (92.3)</td>
<td>37 (55.2)</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td><strong>System-related Factors</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Critical Care Paramedic attended incident</td>
<td>189 (85.9)</td>
<td>54 (80.6)</td>
<td>0.29</td>
</tr>
<tr>
<td>Received reperfusion medication</td>
<td>127 (57.7)</td>
<td>20 (29.9)</td>
<td>&lt;0.01</td>
</tr>
</tbody>
</table>
| Emergency call made inside business hours | 73 (33.2)   | 14 (20.9)| 0.05      

n = 287
### Factors Associated With Survived to Hospital Discharge (Univariate Analysis)

<table>
<thead>
<tr>
<th></th>
<th>Survived Discharge</th>
<th>Died</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of cases, ( n ) (%)</td>
<td>214 (74.6)</td>
<td>73 (25.4)</td>
<td>-</td>
</tr>
<tr>
<td>Age, Median, (IQR)</td>
<td>59 (50, 59)</td>
<td>60 (51.5,74.5)</td>
<td>0.20</td>
</tr>
<tr>
<td>Gender</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>162 (75.7)</td>
<td>53 (72.6)</td>
<td>0.60</td>
</tr>
<tr>
<td>Female</td>
<td>52 (24.3)</td>
<td>20 (27.4)</td>
<td>0.60</td>
</tr>
<tr>
<td>Past Medical History / Current Medications</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cardiac risk factors</td>
<td>86 (40.2)</td>
<td>36 (49.3)</td>
<td>0.17</td>
</tr>
<tr>
<td>Previous acute myocardial infarction</td>
<td>21 (9.8)</td>
<td>13 (17.8)</td>
<td>0.68</td>
</tr>
<tr>
<td>Previous coronary angioplasty / stent</td>
<td>13 (6.1)</td>
<td>4 (5.5)</td>
<td>0.85</td>
</tr>
<tr>
<td>Prescribed anti-coagulants / anti-platelets</td>
<td>50 (23.4)</td>
<td>21 (28.8)</td>
<td>0.36</td>
</tr>
<tr>
<td>Nil medical history; no prescribed medications</td>
<td>68 (31.8)</td>
<td>13 (17.8)</td>
<td>0.02</td>
</tr>
<tr>
<td>Geographical Location Patient Attended</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Metropolitan</td>
<td>134 (62.6)</td>
<td>46 (63.0)</td>
<td>0.98</td>
</tr>
<tr>
<td>Regional</td>
<td>75 (35.0)</td>
<td>25 (34.2)</td>
<td>0.98</td>
</tr>
<tr>
<td>Remote</td>
<td>5 (2.3)</td>
<td>2 (2.7)</td>
<td>0.98</td>
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<td>Clinical Features</td>
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<td>Initial rhythm shockable</td>
<td>202 (94.4)</td>
<td>38 (52.1)</td>
<td>&lt;0.01</td>
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<tr>
<td>System-related Factors</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Critical Care Paramedic attended incident</td>
<td>185 (86.4)</td>
<td>58 (79.5)</td>
<td>0.15</td>
</tr>
<tr>
<td>Received reperfusion medication</td>
<td>130 (60.7)</td>
<td>17 (23.3)</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Emergency call made inside business hours</td>
<td>71 (33.2)</td>
<td>16 (21.9)</td>
<td>0.07</td>
</tr>
</tbody>
</table>

Survived Discharge – 74.6%

\( n = 287 \)
All patients n = 287

Received reperfusion medications 147/287 (51%)

Prior to OHCA
53/147 (36%)

- Prior to OHCA
  - 53/147 (36%)
  - No ROSC
    - 9/53 (17%)
  - Survived event
    - 44/53 (83%)
    - No ROSC
      - 10/12 (83%)
      - Survived event
        - 2/12 (17%)
      - Survived hospital discharge
        - 81/82 (99%)
      - Survived event
        - 47/140 (34%)
        - No ROSC
          - 47/140 (34%)
          - Survived event
            - 93/140 (66%)
            - Survived hospital discharge
              - 85/140 (61%)
    - Survived hospital discharge
      - 2/12 (17%)

After ROSC
82/147 (56%)

- After ROSC
  - 82/147 (56%)
  - No ROSC
    - 1/82 (1%)
    - Survived event
      - 81/82 (99%)
      - Survived hospital discharge
        - 81/82 (99%)
    - Survived hospital discharge
      - 2/12 (17%)

No reperfusion medications
140/287 (49%)

- No reperfusion medications
  - 140/287 (49%)
  - No ROSC
    - 47/140 (34%)
    - Survived event
      - 93/140 (66%)
      - Survived hospital discharge
        - 85/140 (61%)
  - Survived hospital discharge
    - 47/53 (85%)
    - Survived hospital discharge
      - 47/53 (85%)

*These 47 patients included the 44 patients who achieved ROSC on hospital arrival (i.e. survived event), and 3 additional patients who did not ‘survive event’ but had successful resuscitation in-hospital.
Survived Event - Multivariate Regression Model

<table>
<thead>
<tr>
<th>Event Represented</th>
<th>Adjusted OR (95% CI)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emergency call inside business hrs</td>
<td>2.15 (1.02 - 4.55)</td>
<td>0.04</td>
</tr>
<tr>
<td>Reperfusion &amp; adjuvant medications</td>
<td>2.16 (1.14 - 4.10)</td>
<td>0.02</td>
</tr>
<tr>
<td>Initial rhythm shockable</td>
<td>8.65 (4.18 - 17.91)</td>
<td>0.01</td>
</tr>
</tbody>
</table>
Survived to Discharge - Multivariate Regression Model

- **Emergency call inside business hrs**: Reduces odds of survived discharge
- **Reperfusion & adjuvant medications**: Increases odds of survived discharge
- **Initial rhythm shockable**: Reduces odds of survived discharge
- **CCP attended incident**: Increases odds of survived discharge
- **Medical history; prescribed medications**: Reduces odds of survived discharge
- **Cardiac risk factors**: Increases odds of survived discharge

<table>
<thead>
<tr>
<th>Factor</th>
<th>Adjusted OR (95% CI)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emergency call inside hrs</td>
<td>2.14 (0.98 - 4.67)</td>
<td>0.06</td>
</tr>
<tr>
<td>Reperfusion &amp; adjuvant meds</td>
<td>3.18 (1.55 - 6.53)</td>
<td>0.01</td>
</tr>
<tr>
<td>Initial rhythm shockable</td>
<td><strong>14.22 (6.37 - 31.76)</strong></td>
<td>0.01</td>
</tr>
<tr>
<td>CCP attended incident</td>
<td>1.35 (0.60 - 3.05)</td>
<td>0.47</td>
</tr>
<tr>
<td>Medical history; prescribed</td>
<td>0.76 (0.31 - 1.86)</td>
<td>0.54</td>
</tr>
<tr>
<td>Cardiac risk factors</td>
<td>0.89 (0.43 - 1.88)</td>
<td>0.77</td>
</tr>
</tbody>
</table>
Discussion / Implications

• Comparison with prior literature is difficult
  - hospital centric
  - exclude patients did not ‘survive event’

• Previous literature
  - survived event = N/A
  - survived to hospital discharge = 44-86%

• Our findings
  - survived event = 76.7%
  - survived to hospital discharge = 74.6%

• Geographical location and clinical skillset does not impact survival
Discussion / Implications

- This is a highly time-critical cohort

- These patients are highly salvageable and responsive to resuscitative measures

- Administration of reperfusion medication results in a three-fold increase in survival to discharge
Acknowledgements / COI

• We would like acknowledge the high quality care provided by paramedics to the Queensland community

• No potential conflicts of interest associated with this work

• No external grants funded this study

• For further information contact: gas.research@ambulance.qld.gov.au