National Cardiac Arrest Audit Report

St Elsewhere Hospital

01 April 2015 to 31 March 2016

(n = 97)

Date of report: 18/10/2016

ncaa@icnarc.org

Supported by Resuscitation Council (UK) and Intensive Care National Audit & Research Centre (ICNARC)
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1. NCAA and your NCAA Report

About the National Cardiac Arrest Audit (NCAA)

The National Cardiac Arrest Audit (NCAA) is the national, clinical, comparative audit for in-hospital cardiac arrest. The purpose of NCAA is to promote local performance management through the provision of timely, validated comparative data to participating hospitals. NCAA is a joint initiative between the Resuscitation Council (UK) and ICNARC (Intensive Care National Audit & Research Centre).

NCAA monitors and reports on the incidence of, and outcome from, in-hospital cardiac arrests and aims to identify and foster improvements, where necessary, in the prevention, care delivery and outcome from cardiac arrest.

Your hospital collects and enters data according to the NCAA data collection scope and dataset specification. The NCAA dataset was developed to ensure that all hospitals collect the same standardised data, so that accurate comparisons can be made.

NCAA is listed as a national clinical audit in the Department of Health’s Quality Accounts. The National Confidential Enquiry into Patient Outcome and Death (NCEPOD) Report on in-hospital cardiac arrest procedures, ‘Time to Intervene?’ (2012), stated: “...Each Trust/hospital should collect structured information on patients who have a cardiac arrest. The National Cardiac Arrest Audit collects such data and hospitals are encouraged to participate...”.

About your NCAA Report

The NCAA Report provides you with an overview of the completeness of your data (for data your hospital has reported), and for in-hospital cardiac arrests attended by the team (i.e. pre-hospital arrests are excluded); analyses of activity and outcome; stratified analyses (drawing comparisons between your hospital and NCAA data); basic, anonymised comparative analyses (non-risk adjusted), risk-adjusted comparative analyses, and identifies unexpected non-survivors.

The multivariable statistical risk model (developed upon NCAA achieving a sufficient sample size) and the risk-adjusted analyses allow fair comparisons of outcomes between participating hospitals to be made for the first time.

Cumulative NCAA Reports are produced quarterly (based on the financial year) and are available on the secure NCAA online system (for registered NCAA users at your hospital only):

- Q1 (April - end of June)
- Q1+Q2 (April - end of September)
- Q1+Q2+Q3 (April - end of December)
- Q1+Q2+Q3+Q4 (April - end of March)
2. How to use your NCAA Report

The NCAA Report marks the beginning of your local performance management/quality improvement process. We encourage you to disseminate the information in this Report to relevant staff in your department, as well as to colleagues in your hospital, Trust, etc. in order to promote wider discussion.

**WHO to share your NCAA Report with:**

- Resuscitation Committee and Chair, and Regional Resuscitation Officer Representative
- Resuscitation Team, staff in your department, and other staff involved with the NCAA data collection and validation process
- Resuscitation trainers/course director(s) - to use as a training and education tool (including Junior Doctor Resuscitation induction) and promote discussion
- Clinical teams at your hospital that feed into the patient journey e.g. nursing, outreach, general ward, critical care, surgical staff, Allied Health Professionals, etc.
- Senior managers (with responsibility for service development and business planning), doctors, nurses, clinical matrons, and clinical and quality improvement leads
- Relevant departments within your hospital/Trust e.g. audit, clinical audit, governance, management, critical care, medical emergency teams, medical directorates, etc.
- Trust Executives and Directors e.g. Trust Chief Executive, Medical Director, Director of Nursing, Non-Executive Director in your Trust responsible for Resuscitation Policy
- Relevant Boards e.g. Trust and Quality Board
- Relevant groups/committees at your hospital/Trust e.g. Patient group, Patient safety, Clinical Quality/Governance/Effectiveness group, Clinical Risk, Mortality, Deteriorating patient, etc.
- External stakeholders on a regional or national level e.g. CQC, NHSLA, C QUIN, CQEG, etc.

**HOW to share/disseminate your NCAA Report:**

- Raise at relevant meetings (monthly/quarterly/yearly), such as:
  - Resuscitation Team or Staff meetings;
  - Resuscitation Committee and Regional Resuscitation Officer meetings;
  - Management meetings; and
  - Service development and Business planning meetings.
- Why not add ‘NCAA Report-review and learn’ as a standing item on relevant meeting agendas?
- Provide a presentation/hold a seminar at relevant meetings (monthly/quarterly/yearly)
- Resuscitation Committee and Chair to share key results/quick reference summary section, locally
- Save NCAA Report electronically on your shared drive for colleagues to access
- Email NCAA Report/key results or quick reference summary section to colleagues
- Include key points/results from quick reference summary section in any local newsletters or intranet
- Display key results on your staff notice board or performance boards in common areas

**WHAT to reflect upon in your NCAA Report:**

- Consider the suggested questions at the beginning of each section, as a basis for your discussion
- Identify and discuss any areas of concern, areas for improvement, and training options
- Identify trends or any areas of interest (for further analysis)
- Agree targets for improvement for the next quarter and year (and put an action plan in place)
- Identify cardiac arrests attended by the team to review in greater detail
- Use your data to support any Root Cause Analysis (RCA)
- Discuss areas of success, identify reason, and feedback to relevant teams locally
- Collate any questions/feedback for the NCAA Team
While interpreting the data within your NCAA Report, it is important to consider the suggested questions for local use at the beginning of each section (within the shaded grey box). These questions can form the basis for local discussion/further investigation. Considering each question will help you to maximise the value of your NCAA Report in order to feed into your local performance management/quality improvement process.

The principles of quality improvement include:

- understanding the problem, focussing on what the data tell you;
- understanding the processes and systems within your hospital;
- analysing the demand, capacity and flows of the service;
- choosing the tools to bring about change, including leadership and clinical engagement, plus staff and patient participation; and
- evaluating and measuring the impact of a change

The brief checklist provided at the end of this Report outlines some suggested next steps in order to bring about the implementation of change.

A quick reference summary providing key analyses within the NCAA Report is available at the end of the Report.

Please note: If sharing or presenting NCAA results/data, you must acknowledge the scope of data collection, the period it relates to and how many team visit records it is based upon (sample size).
3. About the data in this Report

Scope of data collection

NCAA data are collected for all individuals (excluding neonates) receiving chest compression(s) and/or defibrillation and attended by the hospital-based Resuscitation Team (or equivalent) in response to a 2222 call - these team visits are referred to, in this Report, as cardiac arrests attended by the team.

Data collection/validation method

Your data have been validated both at the point of entry onto the secure NCAA online data entry system and centrally at ICNARC. Data are checked for completeness and illogicalities.

Numbers this Report is based on

Reported numbers of admissions to your hospital, 2222 calls, cardiac arrests attended by the team (where location of arrest is in-hospital and pre-hospital, and in-hospital only) and individuals (in relation to in-hospital arrests only) covered by this Report are presented below.

<table>
<thead>
<tr>
<th>Period</th>
<th>Total number of admissions to your hospital*</th>
<th>Total number of 2222 calls solely for cardiac arrest</th>
<th>Total number of reported cardiac arrests attended by the team that met the scope of NCAA</th>
<th>Total number of reported cardiac arrests attended by the team that met the scope of NCAA (in-hospital only)</th>
<th>Number of individuals (in-hospital only)</th>
</tr>
</thead>
<tbody>
<tr>
<td>01/04/2015 - 31/03/2016</td>
<td>103,238</td>
<td>.</td>
<td>97</td>
<td>79</td>
<td>79</td>
</tr>
</tbody>
</table>

Note:
*Total includes elective, non-elective and day cases
+Total includes arrests and fire
Suggested questions for local use

While interpreting the data in this section, it is important that the following specific questions are considered in order to maximise the use of your NCAA Report and bring about the implementation of change and quality improvement locally.

- Are the number and rate of cardiac arrests attended by the team as expected for your hospital?
- Are data being collected according to the current NCAA data collection scope (see ‘Scope of Data Collection - Decision Flow’ in your NCAA Data Collection Manual)?
- Are all cardiac arrests attended by the team being captured and entered/reported by your hospital?
- How might data capture or the collection of NCAA data be improved locally?
- How might you share tips for capturing data with other NCAA participating hospitals that may be experiencing difficulty?
Number and rate of cardiac arrests

These graphs present the following data for your hospital (for the period that this Report covers):
- the reported number of in-hospital and pre-hospital cardiac arrests attended by the team;
- the rate of in-hospital and pre-hospital cardiac arrests attended by the team against your denominator data for EITHER Total number of 2222 calls solely for cardiac arrest OR Total number of 2222 calls (depending on denominator data collected by your hospital); and
- the rate of in-hospital cardiac arrests attended by the team (i.e. pre-hospital arrests are excluded) against your denominator data for Total number of admissions to your hospital.
Note:
*Total includes elective, non-elective and day cases
*Total includes arrests and fire

**Graphical presentation**

In the first graph in this section, data for in-hospital cardiac arrests attended by the team are presented in red and pre-hospital cardiac arrests attended by the team are presented in blue, for your hospital for the period that this Report covers.

In the second and third graphs above, the rate of cardiac arrests attended by the team is plotted by a red data point. The average for your hospital for the period that this Report covers is plotted by a dashed black line.

The vertical grey line through each red data point represents the 95% CI (confidence interval).

**95% CI (confidence interval)**

Rates plotted are displayed with a 95% confidence interval (CI) shown as the vertical line through each data point (see image to the left).

- Values (i.e. rates) plotted for your hospital data are estimates of the true underlying value because they are based on a certain sized sample of data. The true value will most likely lie somewhere along the vertical line of the CI.

A large sample of data (i.e. a high number of cardiac arrests attended by the team) provides a more accurate estimate of the value (rate). As the sample size increases, the precision with which a result can be calculated increases. Hence, the CI will become a narrower (shorter) vertical line.

Inversely, a small sample of data (i.e. few cardiac arrests attended by the team) provides a less accurate estimate of the value (rate). As the sample size decreases, the precision with which a result can be calculated decreases. Hence, the CI will become a wider (longer) vertical line.

The CI, therefore, gives an indication of how accurately the value (rate) has been estimated.

A 95% CI is shown which means that 95% of the time, we would expect the true value (rate) to lie along the vertical line i.e. we are 95% confident that the true value lies within this range.

---

Now review suggested questions for local use at the beginning of this section!
Rate of in-hospital cardiac arrests

The following graph presents the reported number of in-hospital cardiac arrests attended by the team (i.e. pre-hospital arrests are excluded) per 1,000 hospital admissions for adult, acute hospitals in NCAA.

Note that interpretation of these data is subject to:

- the inclusion of the most recent twelve months of validated data for all adult, acute hospitals participating in NCAA;
- the inclusion of hospitals with at least five in-hospital cardiac arrests attended by the team;
- an assumption that all hospitals are capturing the numerator and denominator data accurately; and
- variation across hospitals of types of admissions included in denominator data.

Graphical presentation

In the graph above, data for your hospital are presented in red, and data for other hospitals are presented in blue (for the period that this Report covers).

Data points plotted are displayed with a 95% confidence interval (CI) shown as the vertical line through each data point (see image to the left).

The values plotted are an estimate of the true underlying value because they are based on a certain sized sample of data. The true value will most likely lie somewhere along the vertical line of the CI.

A large sample of data provides a more accurate estimate of the value. Hence, the CI will become a narrower (shorter) vertical line. The CI, therefore, gives an indication of how accurately the value has been estimated. A 95% CI means that 95% of the time we would expect the true value to lie along the vertical line.

Note: These data are not risk adjusted
Rate of cardiac arrests - ward

The following graph presents the reported number of in-hospital cardiac arrests attended by the team where the location of arrest was ward per 1,000 hospital admissions for adult, acute hospitals in NCAA.

Note that interpretation of these data is subject to:

- the inclusion of the most recent twelve months of validated data for all adult, acute hospitals participating in NCAA;
- the inclusion of hospitals with at least five in-hospital cardiac arrests attended by the team;
- an assumption that all hospitals are capturing the numerator and denominator data accurately; and
- variation across hospitals of types of admissions included in denominator data.

Graphical presentation

In the graph above, data for your hospital are presented in red, and data for other hospitals are presented in blue (for the period that this Report covers).

Data points plotted are displayed with a 95% confidence interval (CI) shown as the vertical line through each data point (see image to the left).

The values plotted are an estimate of the true underlying value because they are based on a certain sized sample of data. The true value will most likely lie somewhere along the vertical line of the CI.

A large sample of data provides a more accurate estimate of the value. Hence, the CI will become a narrower (shorter) vertical line. The CI, therefore, gives an indication of how accurately the value has been estimated. A 95% CI means that 95% of the time we would expect the true value to lie along the vertical line.

Note: These data are not risk adjusted
4. Data completeness

This section provides you with an overview of the completeness of all your NCAA data for all reported cardiac arrests attended by the team (in-hospital & pre-hospital). The following graph illustrates how complete data are for each field in the NCAA dataset.

These are displayed in the following groupings:

- patient characteristics and hospital admission;
- call and team visit/arrest; and
- post-arrest location and outcome.

On the graph, a red bar indicates where data are incomplete (less than 100%) for a given field and a blue bar indicates where data are complete (100%).

On the beginning of each bar, the number of complete team visit records (i.e. cardiac arrests attended by the team), relative to the number required to be complete, is presented. For example, 10/13 means 10 out of 13 team visit records had complete data for this dataset field.

For definitions of the dataset fields in this section, refer to the current NCAA Data Collection Manual.

Suggested questions for local use

While interpreting these data on data completeness, it is important that the following specific questions are considered in order to maximise the use of your NCAA Report and bring about the implementation of change and quality improvement locally.

- Is your hospital fully collecting every field in the NCAA dataset?
- How could your hospital:
  - improve the quality of data collection?
  - increase the speed of data collection/entry?
  - reduce the number of validation queries?
  - increase the speed of processing validation queries?
Data completeness

- NHS Number*: 96/97
- Date of birth: 97/97
- Sex: 97/97
- Ethnicity**: 97/97
- Date of admission to/attendance at/visit to your hospital: 97/97
- Reason for admission to/attendance at/visit to your hospital: 97/97
- Date of 2222 call: 97/97
- Time of 2222 call: 97/97
- Location of arrest: 97/97
- Status at team arrival: 97/97
- Presenting/first documented rhythm***: 93/97
- Reason resuscitation stopped at end of team visit: 97/97
- Duration of resuscitation: 85/97
- Transient post−arrest location: 41/41
- Post−arrest location: 41/41
- Status at discharge from your hospital^: 32/32
- Date of discharge from your hospital: 21/21
- CPC at discharge from your hospital^^: 18/18
- Date of death: 76/76
- Time of death: 76/76

Completeness (%) © NCAA 2016
Footnotes relating to the completeness graph on previous page:

* \( n = 2 \) team visit records where individual was recorded as a "Non-UK patient" (these are considered as complete data)

** \( n = 0 \) team visit records where individual had ethnicity recorded as "Not stated" (these are considered as incomplete data)

*** \( n = 4 \) team visit records where individual had presenting/first documented rhythm recorded as "Unknown" (these are considered as incomplete data)

** n = 4 team visit records where individual had presenting/first documented rhythm recorded as "Never determined" (these are considered as complete data)

^ \( n = 0 \) team visit records where individual is recorded as "patient still in your hospital" (excluded from the denominator)

^^ \( n = 3 \) team visit records where individual is recorded as sedated (excluded from the denominator)

Now review suggested questions for local use at the beginning of this section!

Note: From this point in the Report, all analyses are for in-hospital cardiac arrests attended by the team only. i.e. where the location of the arrest is pre-hospital, these data are excluded.
5. Activity

Activity analyses for in-hospital cardiac arrests attended by the team (i.e. pre-hospital arrests are excluded) are presented for your hospital and are compared against NCAA for adult, acute hospitals, for the period that this Report covers.

Trended analyses on activity for your hospital are presented against NCAA data for adult, acute hospitals by quarter/six month periods/year (dependent on the sample size of data for your hospital).

Graphs are presented under the following headings:

- patient characteristics;
- cardiac arrests attended by the team;
- location of arrest;
- status at team arrival; and
- presenting/first documented rhythm.

Graphical presentation

Data for your hospital are plotted on each graph in red, and NCAA plotted in blue.

On each bar graph, cardiac arrests attended by the team for each category are presented as a percentage on the y axis (vertical) and as the number on the top of each bar.

On each trended graph, the y axis (vertical) presents one of the following:

- percentage of cardiac arrests attended by the team;
- mean values;
- number of cardiac arrests attended by the team; or
- rate.

For trended graphs, the sample size for each period (i.e. quarter/six month/year) for your hospital is presented just above the x axis (horizontal). This can provide an indication of the accuracy of the data plotted (i.e. a larger sample size can mean a more accurate data point).

Note: Trended graphs will be missing data points if a quarter/six month period/year is incomplete, either because that period contains unvalidated data or data was not submitted during that period.
Patient characteristics

Suggested questions for local use

While interpreting these data on patient characteristics, it is important that the following specific questions are considered in order to maximise the use of your NCAA Report and bring about the implementation of change and quality improvement locally.

- Are there any trends in patient characteristics for your hospital?
- How might patient characteristics be affecting the care you deliver?
- How does seasonal variation affect patient characteristics?
- How could these data on patient characteristics be used for planning Resuscitation Team responses and wider service planning at your hospital?
Sex

Sex (males) - trended
Age

Note: n = 0 estimated age (included)

Mean age - trended

Mean age is calculated by summing the ages of the individuals for each cardiac arrest attended by the team and dividing by the number of cardiac arrests attended by the team.
Age by sex

Note: n = 0 estimated age (included)

Reason for admission to/attendance at/visit to your hospital

Now review suggested questions for local use at the beginning of this section!
Cardiac arrests attended by the team

Suggested questions for local use

While interpreting these data on cardiac arrests attended by the team, it is important that the following specific questions are considered in order to maximise the use of your NCAA Report and bring about the implementation of change and quality improvement locally.

- Are there any trends in the number/rate/incidence of cardiac arrests attended by the team?
- How does seasonal variation affect cardiac arrests attended by the team?
- How could these data on cardiac arrests attended by the team be used for planning Resuscitation Team responses and wider service planning at your hospital?
Number of cardiac arrests attended by the team - trended

Rate of cardiac arrests attended by the team per 1000 hospital admissions - trended

*Total includes elective, non-elective and day cases
Day of week of cardiac arrests attended by the team

Day of week/hour of day of cardiac arrests attended by the team

Weekday: Monday 08:00-Saturday 07:59. Weekend: Saturday 08:00-Monday 07:59
Hour of day of cardiac arrests attended by the team

<table>
<thead>
<tr>
<th>Hour of Day</th>
<th>Your Hospital</th>
<th>NCAA</th>
</tr>
</thead>
<tbody>
<tr>
<td>08:00-10:59</td>
<td>11</td>
<td>13</td>
</tr>
<tr>
<td>11:00-13:59</td>
<td>13</td>
<td>14</td>
</tr>
<tr>
<td>14:00-16:59</td>
<td>7</td>
<td>11</td>
</tr>
<tr>
<td>17:00-19:59</td>
<td>8</td>
<td>9</td>
</tr>
<tr>
<td>20:00-22:59</td>
<td>9</td>
<td>6</td>
</tr>
<tr>
<td>23:00-01:59</td>
<td>11</td>
<td>6</td>
</tr>
<tr>
<td>02:00-04:59</td>
<td>6</td>
<td>14</td>
</tr>
<tr>
<td>05:00-07:59</td>
<td>14</td>
<td>14</td>
</tr>
</tbody>
</table>

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Day of week/hour of day of cardiac arrests attended by the team - trended

Weekday: Monday 08:00-Saturday 07:59. Weekend: Saturday 08:00-Monday 07:59
Number of days from admission to cardiac arrests attended by the team

Mean number of days from admission to cardiac arrests attended by the team - trended

Mean number of days is calculated by summing the number of days for each cardiac arrest attended by the team and dividing by the number of cardiac arrests attended by the team.

Now review suggested questions for local use at the beginning of this section!
Location of arrest

Suggested questions for local use

While interpreting these data on location of arrest, it is important that the following specific questions are considered in order to maximise the use of your NCAA Report and bring about the implementation of change and quality improvement locally.

- Are there any trends in the location of cardiac arrests attended by the team and reason for admission to your hospital?
- How could these data on location of cardiac arrests attended by the team be used for planning Resuscitation Team responses and wider service planning at your hospital?
Location of arrest

![Graph showing location of arrests](Image)

Ward arrests by reason for admission to/attendance at/visit to your hospital

![Graph showing reasons for admissions](Image)

Note: The above graph only includes reported cardiac arrests attended by the team where location of arrest is ward.

Now review suggested questions for local use at the beginning of this section!
Suggested questions for local use

While interpreting these data on status at team arrival, it is important that the following specific questions are considered in order to maximise the use of your NCAA Report and bring about the implementation of change and quality improvement locally.

- Are there trends in status at team arrival for cardiac arrests attended by the team?
- How could these data on status at team arrival be used for planning Resuscitation Team responses?
- How could these data on status at team arrival be used for wider service planning at your hospital?

Status at team arrival

![Graph showing status at team arrival]

© NCAA 2016
Status at team arrival - trended

Now review suggested questions for local use at the beginning of this section!
Presenting/first documented rhythm

Suggested questions for local use

While interpreting these data on presenting/first documented rhythm, it is important that the following specific questions are considered in order to maximise the use of your NCAA Report and bring about the implementation of change and quality improvement locally.

- Are there any trends in the presenting/first documented rhythm for cardiac arrests attended by the team?
- How could these data on presenting/first documented rhythm be used for planning Resuscitation Team responses and wider service planning at your hospital?
- What patterns are present in your activity data?

Presenting/first documented rhythm

[Bar chart showing percentage of cardiac arrests attended by the team for different rhythms]
Now review suggested questions for local use at the beginning of this section!
6. Outcome

Analyses on outcome for in-hospital cardiac arrests attended by the team (i.e. pre-hospital arrests are excluded) are presented for your hospital and are compared against NCAA data for adult, acute hospitals, for the period that this Report covers.

Trended analyses on activity for your hospital are presented against NCAA data for adult, acute hospitals by quarter/six month periods/year (dependent on the sample size of data for your hospital).

Graphs are grouped and presented under the following headings:

- reason resuscitation stopped;
- post-arrest location;
- status at hospital discharge (from your hospital); and
- CPC at discharge (from your hospital).

Graphical presentation

Data for your hospital are plotted on each graph in red, and NCAA plotted in blue.

On each bar graph, cardiac arrests attended by the team/number of individuals for each category are presented as a percentage on the y axis (vertical) and as a number on the top of each bar.

On each trended graph, the y axis (vertical) presents one of the following:

- percentage of cardiac arrests attended by the team; or
- percentage of individuals.

For trended graphs, the sample size for each period (i.e. quarter/six month/year) for your hospital is presented just above the x axis (horizontal). This can provide an indication of the accuracy of the data point (i.e. a larger sample size can mean a more accurate data point).

Note: Trended graphs will be missing data points if a quarter/six month period/year is incomplete, either because that period contains unvalidated data or data was not submitted during that period.

Suggested questions for local use

While interpreting these data on outcome, it is important that the following specific questions are considered in order to maximise the use of your NCAA Report and bring about the implementation of change and quality improvement locally.

- Are there any unexpected mortalities or unexpected survivors?
- Is there a need to identify and review any specific cardiac arrests attended by the team?
- How could these data be used for planning Resuscitation Team responses?
Outcome flow

Number of individuals 79

Reason resuscitation stopped

Dead 41 (51.9%)
Alive 38 (48.1%)
Missing 0 (0.0%)

Status at discharge from your hospital

Dead 59 (74.7%)
Survival to hospital discharge 20 (25.3%)
Patient still in your hospital 0 (0.0%)
Missing 0 (0.0%)

Note: All percentages shown in this flow are calculated from the overall number of individuals.
Reason resuscitation stopped

Reason resuscitation stopped at end of team visit

![Bar chart showing % cardiac arrests attended by the team.](chart.png)

© NCAA 2016
Reason resuscitation stopped at end of team visit (Alive - ROSC>20mins) - trended

Note: NCAA comparator data are not plotted as these data are not risk adjusted

Reason resuscitation stopped at end of team visit (Dead - DNAR) - trended
Reason resuscitation stopped at end of team visit for shockable - VF/VT

Reason resuscitation stopped at end of team visit for non-shockable - asystole
Reason resuscitation stopped at end of team visit for non-shockable - PEA

Reason resuscitation stopped at end of team visit for non-shockable - bradycardia
Reason resuscitation stopped at end of team visit by weekday 08:00-19:59

Weekday: Monday 08:00-Saturday 07:59

Reason resuscitation stopped at end of team visit by weekday 20:00-07:59

Weekday: Monday 08:00-Saturday 07:59
Reason resuscitation stopped at end of team visit by weekend 08:00-19:59

Weekend: Saturday 08:00-Monday 07:59

Reason resuscitation stopped at end of team visit by weekend 20:00-07:59

Weekend: Saturday 08:00-Monday 07:59
Duration of resuscitation

Duration of resuscitation (Alive - ROSC > 20mins)

Duration of resuscitation (Dead)

St Elsewhere Hospital (01/04/2015 - 31/03/2016) / Doc. Version 5
Potential non-arrests

Potential non-arrests based on the following criteria: presenting/first documented rhythm “Never determined”, duration of resuscitation less than or equal to 1 minute and reason resuscitation stopped “Alive - ROSC > 20 minutes”.

<table>
<thead>
<tr>
<th>Team visit number</th>
<th>Date of team visit</th>
</tr>
</thead>
<tbody>
<tr>
<td>20150027</td>
<td>13/11/2015</td>
</tr>
<tr>
<td>20160002</td>
<td>08/01/2016</td>
</tr>
</tbody>
</table>
Post-arrest location

Post-arrest location (ICU or ICU/HDU) - trended
Status at hospital discharge

Status at hospital discharge (Alive) - trended

Note: NCAA comparator data are not plotted as these data are not risk adjusted
n = 0 individuals recorded as “patient still in your hospital” (excluded)
Status at hospital discharge by presenting/first documented rhythm

Note: n = 0 individuals recorded as “patient still in your hospital” (excluded)
Status at hospital discharge by day of week/hour of day of 2222 call

Weekday: Monday 08:00-Saturday 07:59. Weekend: Saturday 08:00-Monday 07:59
Note: n = 0 individuals recorded as “patient still in your hospital” (excluded)
CPC at hospital discharge

CPC at discharge from your hospital: Adult survivors

Note: n = 0 individuals recorded as "patient still in your hospital" (excluded)
     n = 2 individuals sedated on discharge from your hospital (excluded)

Favourable CPC at discharge from your hospital: Adult survivors - trended

Favourable neurological outcome is CPC 1 or 2 for adults

Note: n = 0 individuals recorded as “patient still in your hospital” (excluded)
     n = 2 individuals sedated on discharge from your hospital (excluded)
CPC at discharge from your hospital: Paediatric survivors (aged less than 16)

Note: n = 0 individuals recorded as "patient still in your hospital" (excluded)
n = 0 individuals sedated on discharge from your hospital (excluded)

Favourable CPC at discharge from your hospital: Paediatric survivors (aged less than 16) - trended

Favourable neurological outcome is CPC 1, 2 or 3 for paediatrics

Note: n = 0 individuals recorded as "patient still in your hospital" (excluded)
n = 0 individuals sedated on discharge from your hospital (excluded)
CPC at discharge from your hospital by presenting/first documented rhythm of first 2222 call: Adults

Note:  
- n = 0 individuals recorded as "patient still in your hospital" (excluded)  
- n = 2 individuals sedated on discharge from your hospital (excluded)
CPC at discharge from your hospital by day of week/hour of day of first 2222 call: Adults

Weekday: Monday 08:00-Saturday 07:59. Weekend: Saturday 08:00-Monday 07:59

Note: n = 0 individuals recorded as "patient still in your hospital" (excluded)

n = 2 individuals sedated on discharge from your hospital (excluded)

Now review suggested questions for local use at the beginning of this section!
7. Stratified analyses

This section provides you with a stratified overview of in-hospital cardiac arrests attended by the team for your hospital (i.e. pre-hospital arrests are excluded), against NCAA data for all adult, acute hospitals, for the period that this Report covers.

Stratified analyses provide grouped comparisons on specific outcome variables, including:

i. reason resuscitation stopped at end of team visit (Alive - ROSC>20 minutes) - reported as a percentage of cardiac arrests attended by the team;
ii. survival to hospital discharge - reported as a percentage of individuals; and
iii. favourable neurological outcome (CPC 1 or 2 for adults, and CPC 1, 2 or 3 for paediatrics) at discharge from your hospital - reported as a percentage of individuals.

Stratified graphs for the outcomes listed above are presented under the following headings:

- age;
- day of week/hour of day of cardiac arrest attended by the team;
- location of arrest; and
- presenting/first documented rhythm.

Graphical presentation

Data for your hospital are plotted on each graph in red, and NCAA plotted in blue.

For each graph, the number of cardiac arrests attended by the team/individuals in each category for your hospital (for the period that this Report covers), is presented just above the x axis (horizontal).

Data points plotted are displayed with a 95% confidence interval (CI) shown as the vertical line through each data point (see image to left).

The values plotted are an estimate of the true underlying value because they are based on a certain sized sample of data. The true value will most likely lie somewhere along the vertical line of the CI.

A large sample of data provides a more accurate estimate of the value. Hence, the CI will become a narrower (shorter) vertical line. The CI, therefore, gives an indication of how accurately the value has been estimated. A 95% CI means that 95% of the time, we would expect the true value to lie along the vertical line.

Note: where there are fewer than five cardiac arrests attended by the team/individuals in a category for your hospital, data are not plotted.
Suggested questions for local use

While interpreting the data in this section, it is important that the following specific questions are considered in order to maximise the use of your NCAA Report and bring about the implementation of change and quality improvement locally.

- How does your hospital compare with NCAA in terms of age; day of week/hour of day of cardiac arrest attended by the team; location of arrest; and presenting/first documented rhythm, for each outcome:
  - reason resuscitation stopped at end of team visit (Alive - ROSC>20 minutes);
  - survival to hospital discharge; and
  - favourable neurological outcome at discharge from your hospital.
- How could these stratified data be used for planning Resuscitation Team responses?
- How could these stratified data be used for wider service planning at your hospital?
Favourable neurological outcome is CPC 1 or 2 for adults, and CPC 1, 2 or 3 for paediatrics.

Note:  
- n = 2 individuals sedated on discharge from your hospital (excluded)
- n = 0 individuals alive, not sedated and missing CPC at discharge from your hospital (excluded)
- n = 0 individuals recorded as "patient still in your hospital" (excluded)
Outcomes by day of week/hour of day of cardiac arrest attended by the team

Favourable neurological outcome is CPC 1 or 2 for adults, and CPC 1, 2 or 3 for paediatrics.

Weekday: Monday 08:00-Saturday 07:59. Weekend: Saturday 08:00-Monday 07:59

Note:
- n = 2 individuals sedated on discharge from your hospital (excluded)
- n = 0 individuals alive, not sedated and missing CPC at discharge from your hospital (excluded)
- n = 0 individuals recorded as "patient still in your hospital" (excluded)
For the graphs in this section, data for location of arrest have been grouped. Definitions of the categories on each graph:

- **Presentation at hospital**: Emergency department, emergency admissions unit (or equivalent), clinic, non-clinical area
- **In-hospital location**: Ward, obstetrics area, other intermediate care area, other internal location
- **Treatment area**: Theatre & recovery, imaging department, cardiac catheter laboratory, specialist treatment area
- **Critical/coronary care unit**: ICU or ICU/HDU, HDU, PICU, PHDU, CCU
Favourable neurological outcome is CPC 1 or 2 for adults, and CPC 1, 2 or 3 for paediatrics.

Note:
- \( n = 2 \) individuals sedated on discharge from your hospital (excluded)
- \( n = 0 \) individuals alive, not sedated and missing CPC at discharge from your hospital (excluded)
- \( n = 0 \) individuals recorded as "patient still in your hospital" (excluded)
Outcomes by presenting/first documented rhythm

i) Alive – ROSC>20 minutes (% cardiac arrests attended by the team)

ii) Survival to hospital discharge (% individuals)

iii) Favourable neurological outcome (% individuals)

Favourable neurological outcome is CPC 1 or 2 for adults, and CPC 1, 2 or 3 for paediatrics.

Note:  
- n = 1 individuals sedated on discharge from your hospital (excluded)
- n = 0 individuals alive, not sedated and missing CPC at discharge from your hospital (excluded)
- n = 0 individuals recorded as “patient still in your hospital” (excluded)

Now review suggested questions for local use at the beginning of this section!
This section provides you with basic comparative analyses on resuscitation outcomes for in-hospital cardiac arrests attended by the team for your hospital (i.e. pre-hospital arrests are excluded). These are not risk adjusted. Your hospital is compared with other adult, acute hospitals participating in NCAA.

The outcomes included in this section are survival to hospital discharge (reported as a percentage of individuals), by:

- shockable presenting/first documented rhythm; and
- non-shockable presenting/first documented rhythm.

**Suggested questions for local use**

While interpreting these non-risk adjusted comparative data, it is important that the following specific questions are considered in order to maximise the use of your NCAA Report and bring about the implementation of change and quality improvement locally.

- How do your non-risk adjusted outcomes compare with other NCAA participating hospitals?
- What other factors (e.g. age, etc.) might be causing the variation seen?
Survival to hospital discharge by shockable presenting/first documented rhythm

The graph above shows the survival to hospital discharge by shockable presenting/first documented rhythm, plotted against number of individuals, at your hospital (for the period that this Report covers) and other NCAA hospitals with at least five eligible individuals (for the most recent twelve months of validated data).

- **Red data point** = survival to hospital discharge by shockable presenting/first documented rhythm, for **your hospital**
- **Blue data points** = survival to hospital discharge by shockable presenting/first documented rhythm, for **other NCAA hospitals**

The percentage of individuals with a shockable presenting/first documented rhythm surviving to hospital discharge is presented on the y axis (vertical). The sample size (of the number of individuals) for hospitals is presented on the x axis (horizontal). This can provide an indication of the accuracy of the data point (i.e. a larger sample size can mean a more accurate data point). The level of accuracy is indicated by the funnel lines on the graph.

**Standard deviation (SD) funnel lines**

Standard deviation (SD) funnel lines on the graph are wider at lower sample sizes (i.e. fewer individuals) given the greater imprecision with small numbers, and narrower at higher sample sizes (i.e. higher number of individuals). Data points for higher sample sizes indicate a more accurate value.

If variation between hospitals is random (i.e. variation of results between hospitals is acceptable) then on average 95% of data points should lie within 2 SD (dashed funnel lines) and 99.8% should lie within 3 SD (solid funnel lines). Where data points lie outside of the funnel lines, this indicates that the variation of the results is **significant**.

**Note:** These data are not risk adjusted.
Survival to hospital discharge by non-shockable presenting/first documented rhythm

Graphical presentation

The graph above shows the survival to hospital discharge by non-shockable presenting/first documented rhythm, plotted against number of individuals, at your hospital (for the period that this Report covers) and other NCAA hospitals with at least five eligible individuals (for the most recent twelve months of validated data).

- **Red data point** = survival to hospital discharge by non-shockable presenting/first documented rhythm, for your hospital
- **Blue data points** = survival to hospital discharge by non-shockable presenting/first documented rhythm, for other NCAA hospitals

The percentage of individuals with a non-shockable presenting/first documented rhythm surviving to hospital discharge is presented on the y axis (vertical). The sample size (of the number of individuals) for hospitals is presented on the x axis (horizontal). This can provide an indication of the accuracy of the data point (i.e. a larger sample size can mean a more accurate data point). The level of accuracy is indicated by the funnel lines on the graph.

**Standard deviation (SD) funnel lines**

Standard deviation (SD) funnel lines on the graph are wider at lower sample sizes (i.e. fewer individuals) given the greater imprecision with small numbers, and narrower at higher sample sizes (i.e. higher number of individuals). Data points for higher sample sizes indicate a more accurate value.

If variation between hospitals is random (i.e. variation of results between hospitals is acceptable) then on average 95% of data points should lie within 2 SD (dashed funnel lines) and 99.8% should lie within 3 SD (solid funnel lines). Where data points lie outside of the funnel lines, this indicates that the variation of the results is **significant**.

**Note:** These data are not risk adjusted.
Note that interpretation of these data is subject to:

• the inclusion of hospitals with data recorded for at least five individuals;
• an assumption that all hospitals are capturing data for presenting/first documented rhythm and outcome at hospital discharge accurately

Clearly, presenting rhythm is not the only determinant of survival and, were other risk factors (e.g. age, etc.) not similar across hospitals, survival rates could vary even within shockable/non-shockable rhythms. It is for this reason that a multivariable statistical risk model has been developed.

**Risk adjusted comparative analyses, allowing fair and true comparisons to be made between participating hospitals, are presented in section 9.**

*Now review suggested questions for local use at the beginning of this section!*
9. Risk adjusted comparative analyses

This section provides you with risk adjusted comparative analyses on resuscitation outcomes for in-hospital cardiac arrests attended by the team (i.e. pre-hospital arrests are excluded) for your hospital.

Your data (for the period that this Report covers) are compared with all other NCAA participating hospitals (for the most recent twelve months of validated data).

Outcome data have been risk adjusted using multivariable statistical risk models developed by NCAA. The observed (i.e. actual) and predicted (as calculated by the NCAA risk model) outcomes are presented in this section and grouped by:

1) ROSC greater than 20 minutes
2) Survival to hospital discharge

Using these analyses, your hospital can fairly compare outcomes and identify whether patient outcomes at your hospital are within the bounds of what is expected compared with NCAA and other NCAA participating hospitals (this assumes that all team visits have been reported by your hospital).

NCAA risk modelling

The purpose of a risk model is to use data from prior to/at the start of an intervention (in this case the intervention of the Resuscitation Team) to predict the likelihood of an outcome. Development of the risk models was dependent on NCAA achieving a sufficient sample size.

NCAA risk models enable fair comparisons to be made between hospitals, whereby differences in the patient/event characteristics (e.g. age, presenting rhythm, etc.) that would be expected to result in differences in outcomes, are taken into account. The models are based on the following predictors -

- Age
- Sex (for outcome ROSC>20 minutes only)
- Length of stay in hospital prior to arrest
- Reason for admission to/attendance at/visit to hospital
- Location of arrest
- Presenting/first documented rhythm
- Interactions between location of arrest and presenting/first documented rhythm

The following are excluded from risk-adjusted comparative analyses:

- Revisits i.e. where an individual has had more than one visit from the hospital-based Resuscitation Team (or equivalent). In these cases, the first team visit is selected for analyses;
- Team visits which are missing outcome data;
- Team visits where the reason resuscitation stopped is recorded as Dead - DNAR; and
- Team visits which are missing one or more of the above predictors.

<table>
<thead>
<tr>
<th>Period</th>
<th>01/04/2015 - 31/03/2016</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total number of reported in-hospital team visits</td>
<td>79</td>
</tr>
<tr>
<td>Team visit exclusions:</td>
<td>ROSC&gt;20mins</td>
</tr>
<tr>
<td>Revisits</td>
<td>0</td>
</tr>
<tr>
<td>Missing outcome</td>
<td>0</td>
</tr>
<tr>
<td>Outcome = Dead - DNAR</td>
<td>5</td>
</tr>
<tr>
<td>Missing predictors</td>
<td>0</td>
</tr>
<tr>
<td>Number of individuals included</td>
<td>74</td>
</tr>
</tbody>
</table>
**Graphical presentation**

Data for your hospital are plotted in red, and other participating hospitals/NCAA data are plotted in blue.

The results are presented by the following types of analyses:

- distribution of the predicted probability;
- calibration plot;
- funnel plot of observed to predicted outcomes;
- trended graph of observed to predicted outcomes (by quarter/six month periods/year, dependent on the sample size of data for your hospital); and
- EWMA (exponentially weighted moving average) plot - note that observed outcome is plotted in red and predicted outcome is plotted in blue.

Note: Trended graphs will be missing data points if a quarter/six month period/year is incomplete, either because that period contains unvalidated data or data was not submitted during that period.

Note that interpretation of these data is subject to:

- an assumption that all hospitals are capturing data for risk factors and outcomes accurately.

**Suggested questions for local use**

While interpreting these risk adjusted comparative data, it is important that the following specific questions are considered in order to maximise the use of your NCAA Report and bring about the implementation of change and quality improvement locally.

- **How do the observed outcomes at your hospital compare against the predicted outcomes at your hospital?**
- **Are there any trends in the observed to predicted (as calculated by the NCAA risk model(s)) outcome for patients at your hospital?**
- **Are there any unexpected results for the observed outcomes at your hospital?**
- **How do your outcomes compare with NCAA/other NCAA participating hospitals?**
- **How might your hospital improve outcomes following cardiac arrests attended by the team?**
- **Have quality improvement interventions at your hospital been successful?**
- **How could these risk adjusted comparative data be used for planning Resuscitation Team responses?**
- **How might you use these data to engage Clinicians, Managers, and Trust Board Members?**
ROSC greater than 20 minutes

Distribution of the predicted probability of ROSC > 20 minutes

The graph above shows the distribution of the predicted probability of ROSC > 20 minutes for individuals at your hospital (for the period that this Report covers) and NCAA (for the most recent twelve months of validated data).

- **Red bars** = predicted probability of ROSC > 20 minutes, for **your hospital**
- **Blue line** = predicted probability of ROSC > 20 minutes, for **NCAA**

The percentage of the predicted probability of ROSC > 20 minutes (calculated by the NCAA risk model) is presented in 5% groupings on the x axis (horizontal), and the percentage of individuals is presented on the y axis (vertical).

The sample size of the number of individuals for your hospital and NCAA is shown in the legend on the graph.

**Questions**

*What is the percentage of individuals (y axis (vertical)) for each 5% grouping of predicted probability of ROSC > 20 minutes (x axis (horizontal)) at your hospital? How does the distribution vary for your hospital?*

- For each 5% grouping of predicted probability of ROSC > 20 minutes (0%- 5%, 5%-10%, 10%-15%, etc.) on the x axis (horizontal), follow the red bar to the top and read the value on the y axis (vertical).
How does the distribution of the predicted probability of ROSC > 20 minutes at your hospital compare to NCAA?

- For each grouping of predicted probability (0%-5%, 5%-10%, 10%-15%, etc.) on the x axis (horizontal), continue in a straight line upwards to the blue line and read the value on the y axis (vertical).
- Compare values (on the y axis (vertical)) for your hospital (red bar) and NCAA (blue line) for the same 5% grouping (x axis (horizontal)) and overall.
**Calibration plot for ROSC > 20 minutes**

![Graphical presentation](image)

**Graphical presentation**

The plot above shows the observed percentage with ROSC > 20 minutes against the predicted percentage with ROSC > 20 minutes, for five equal sized groups (where each group must have at least five team visits) of individuals (patients) at your hospital (for the period that this Report covers) and NCAA (for the most recent twelve months of validated data).

- **Red data points** = observed against the predicted percentage with ROSC > 20 minutes for a group of individuals, for your hospital
- **Blue data points** = observed against the predicted percentage with ROSC > 20 minutes for a group of individuals, for NCAA

The five equal sized groups of individuals are formed by ordering the data for individuals by their predicted probability of ROSC > 20 minutes (low to high) as calculated by the NCAA risk model. These ordered data are then divided into the five equal sized groups (count five data points for your hospital and NCAA on the plot). Note: to be plotted on the calibration plot each group must have at least five team visits.

Each data point plots the observed (i.e. actual) percentage with ROSC > 20 minutes (y axis (vertical)) against the predicted percentage with ROSC > 20 minutes (x axis (horizontal)), for each group of individuals, for your hospital and NCAA.

Data points for NCAA show that the observed percentage is similar to the predicted probability percentage with ROSC > 20 minutes for each group of individuals, which indicates the accuracy of the NCAA risk model for predicting the probability of ROSC > 20 minutes.
Data point lies:

- **ON** the bold grey diagonal line across the plot, this indicates that the observed percentage with ROSC > 20 minutes is equal to the predicted for that group of individuals.
- **ABOVE** (i.e. to the left of) the bold grey diagonal line across the plot, this indicates that the observed percentage with ROSC > 20 minutes is higher than predicted for that group of individuals.
- **BELOW** (i.e. to the right of) the bold grey diagonal line across the plot, this indicates that the observed percentage with ROSC > 20 minutes is lower than predicted for that group of individuals.

Data points plotted for your hospital are displayed with a 95% confidence interval (CI) shown as the vertical line through each data point (see image to the left).

These data points plotted are an estimate of the true underlying value because it is based on a certain sized sample of data. The true value will most likely lie somewhere along the vertical line of the CI.

A large sample of data provides a more accurate estimate of the value. Hence, the CI will become a narrower (shorter) vertical line. The CI, therefore, gives an indication of how accurately the value has been estimated. A 95% CI means that 95% of the time, we would expect the true value to lie along the vertical line.

The sample size of the number of individuals for your hospital and NCAA is shown in the legend on the graph.

Questions

*Is the observed percentage with ROSC > 20 minutes higher or lower than the predicted percentage with ROSC > 20 minutes for each equal sized group of individuals at your hospital? What could be the reason(s) for any differences?*

- For each data point (i.e. each equal sized group of individuals) for your hospital (red), read the value on the x axis (horizontal) for the predicted percentage with ROSC > 20 minutes and then the value on the y axis (vertical) for the observed percentage with ROSC > 20 minutes.
- Compare the value for the predicted and observed percentage with ROSC > 20 minutes for each data point for your hospital.

*For each equal sized group of individuals, how does the observed percentage with ROSC > 20 minutes against the predicted percentage with ROSC > 20 minutes at your hospital compare to NCAA?*

- Read the values for each data point for your hospital (red) as per the steps above and compare this against the data point for NCAA (blue).
Funnel plot of observed to predicted ROSC > 20 minutes

Graphical presentation

The plot above shows the ratio of observed to predicted ROSC > 20 minutes plotted against number of individuals, for your hospital (for the period that this Report covers) and other NCAA hospitals with at least ten eligible individuals (for the most recent twelve months of validated data).

- **Red data point** = ratio of observed to predicted ROSC > 20 minutes, for your hospital
- **Blue data points** = ratio of observed to predicted ROSC > 20 minutes, for other NCAA hospitals

The ratio of observed (i.e. actual) to predicted ROSC > 20 minutes is presented on the y axis (vertical). It is calculated by dividing the number of individuals with ROSC > 20 minutes (i.e. observed) by the number of individuals predicted (as calculated by the NCAA risk model) to have ROSC > 20 minutes.

Explanations of ratios (y axis (vertical)) in relation to where a data point sits on the plot:

- **Ratio is 1.0** - observed ROSC > 20 minutes is equal to the predicted ROSC > 20 minutes i.e. the number of individuals to have ROSC > 20 minutes was the same as predicted
- **Ratio is greater than 1.0** - observed ROSC > 20 minutes is higher than the predicted ROSC > 20 minutes i.e. more individuals had ROSC > 20 minutes than predicted
- **Ratio is less than 1.0** - observed ROSC > 20 minutes is lower than the predicted ROSC > 20 minutes i.e. less individuals had ROSC > 20 minutes than predicted

---

<table>
<thead>
<tr>
<th>Your hospital</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of individuals</td>
<td>74</td>
</tr>
<tr>
<td>Number of individuals with observed ROSC &gt; 20 minutes</td>
<td>38</td>
</tr>
<tr>
<td>Number of individuals with predicted ROSC &gt; 20 minutes</td>
<td>35.0</td>
</tr>
<tr>
<td>Ratio of observed to predicted ROSC &gt; 20 minutes</td>
<td>1.09</td>
</tr>
<tr>
<td>95% confidence interval</td>
<td>(0.85,1.32)</td>
</tr>
</tbody>
</table>

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The sample size (of the number of individuals) for hospitals is presented on the x axis (horizontal). This can provide an indication of the accuracy of the data point (i.e. a larger sample size can mean a more accurate data point). The level of accuracy is indicated by the funnel lines on the plot.

**Standard deviation (SD) funnel lines**

Standard deviation (SD) funnel lines on the plot are wider at lower sample sizes (i.e. fewer individuals) given the greater imprecision with small numbers, and narrower at higher sample sizes (i.e. higher number of individuals). Data points for higher sample sizes indicate a more accurate value.

If variation between hospitals is random (i.e. variation of results between hospitals is acceptable) then on average 95% of data points should lie within 2 SD (dashed funnel lines) and 99.8% should lie within 3 SD (solid funnel lines). Where data points lie outside of the funnel lines, this indicates that the variation of the results is **significant**.

**Values presented in the table**

The exact ratio for the observed to predicted ROSC > 20 minutes for your hospital is presented in the table. Data points are estimates, therefore 95% confidence interval values are also provided in the table indicating the range of values likely to contain the true value.

**Questions**

*What is the ratio for the observed ROSC > 20 minutes to the predicted ROSC > 20 minutes for your hospital?*

- Read the ratio for your hospital (red data point) on the y axis (vertical).
  - Note: the exact ratio for your hospital is specified in the table beneath the graph. Ratios are explained earlier in this section.
- As data points are estimates, the 95% confidence interval values provided in the table, indicate the range of values likely to contain the true value for your hospital.

*Where does the red data point for your hospital lie within the funnel, and how does it compare to other NCAA hospitals (blue data points)?*

Data point lies:

- **WITHIN** funnel lines - observed ROSC > 20 minutes is **not significantly different** from predicted.
- **ABOVE** funnel lines - observed ROSC > 20 minutes is **significantly higher** than predicted.
- **BELOW** funnel lines - observed ROSC > 20 minutes is **significantly lower** than predicted.
Trend of observed to predicted ROSC > 20 minutes

Graphical presentation

The graph above shows the trend over time by quarter for the ratio of observed to predicted ROSC > 20 minutes, at your hospital and NCAA.

- **Red data points and line** = ratio of observed to predicted ROSC > 20 minutes, for your hospital
- **Blue line** = ratio of observed to predicted ROSC > 20 minutes, for NCAA

The ratio of observed (i.e. actual) to predicted ROSC > 20 minutes is presented on the y axis (vertical). It is calculated by dividing the number of individuals with ROSC > 20 minutes (i.e. observed) by the number of individuals predicted (as calculated by the NCAA risk model) to have ROSC > 20 minutes.

Explanations of ratios (y axis (vertical)):

- **Ratio is 1.0** - observed ROSC > 20 minutes is equal to the predicted ROSC > 20 minutes i.e. the number of individuals to have ROSC > 20 minutes was the same as predicted
- **Ratio is greater than 1.0** - observed ROSC > 20 minutes is higher than the predicted ROSC > 20 minutes i.e. more individuals had ROSC > 20 minutes than predicted
- **Ratio is less than 1.0** - observed ROSC > 20 minutes is lower than the predicted ROSC > 20 minutes i.e. less individuals had ROSC > 20 minutes than predicted

Periods of data over time (by quarter) are presented on the x axis (horizontal). The sample size for each period for your hospital is presented just above the x axis (horizontal). This can provide an indication of the accuracy of the data point (i.e. a larger sample size can mean a more accurate data point).

The grey shaded area of the graph represents the 95% confidence interval (CI). Each data point plotted for your hospital is an estimate of the true underlying value because it is based on a certain sized sample of data. The true value will most likely lie somewhere within the shaded area.
A large sample of data provides a more accurate estimate of the value. Hence, the shaded area will become a narrower. The CI, therefore, gives an indication of how accurately the value has been estimated.

Questions

Is the ratio of the observed (i.e. actual) to the predicted ROSC > 20 minutes at your hospital greater, less than, or equal to 1.0, over time? Can you see any trend or variation? What could be the reason(s) for this?

- Read the ratio for each red data point for your hospital on the y axis (vertical). Ratios are explained earlier in this section.
- As data points are estimates, the 95% confidence interval values provided in the table, indicate the range of values likely to contain the true value for your hospital.
**EWMA plot for ROSC > 20 minutes**

The EWMA (exponentially weighted moving average) plot above shows the observed and predicted ROSC > 20 minutes for consecutive individuals at your hospital, for the period that this Report covers and historically.

- **Red line** = average observed (i.e. actual) percentage with ROSC > 20 minutes, for your hospital
- **Blue line** = average predicted percentage with ROSC > 20 minutes, for your hospital

Values plotted are averages for the observed percentage with ROSC > 20 minutes at your hospital and predicted (as calculated by the NCAA risk model) percentage with ROSC > 20 minutes for your hospital. Both are presented on the y axis (vertical).

Consecutive individuals are shown on the x axis (horizontal). As the sample size increases with each consecutive (additional) individual reported by your hospital, the EWMA sequentially plots the updated values. Consecutive individuals are ‘exponentially weighted’ - giving a larger weighting in favour of the most recent individuals, smoothing the appearance of the lines.

The vertical black line indicates the start of the period that this Report covers. Values plotted before the vertical black line show historical data for your hospital.

**2 SD and 3 SD**

The blue shaded areas of the plot (graph) represent 2 and 3 standard deviations (SD) above and below the predicted line (blue).

If variation over time is random then on average 95% of values plotted should lie within 2 SD (dark blue shaded area) and 99.8% should lie within 3 SD (light blue shaded area).
- If the observed ROSC > 20 minutes line (red) is **ABOVE and outside of the blue shaded areas**, this means that the observed percentage with ROSC > 20 minutes for your hospital is **significantly higher** than the predicted percentage with ROSC > 20 minutes.
  *i.e. significantly more individuals achieved ROSC > 20 minutes than predicted.*
- If the observed ROSC >20 minutes line (red) is **BELOW and outside of the blue shaded areas**, this means that observed percentage with ROSC > 20 minutes for your hospital is **significantly lower** than the predicted percentage with ROSC > 20 minutes.
  *i.e. significantly less individuals achieved ROSC > 20 minutes than predicted.*

**Questions**

*What is the average observed percentage with ROSC > 20 minutes at your hospital, at the end of this reporting period? How does this compare to the predicted percentage with ROSC > 20 minutes at your hospital?*

- Read the value plotted at the end of the **red line** on the y axis (vertical).
- Read the value plotted at the end of the **blue line** on the y axis (vertical).
- Compare these values.

*Are there any variations in the average observed percentage with ROSC > 20 minutes against the predicted percentage with ROSC > 20 minutes over time, at your hospital?*

- Assess the differences between value plotted for the **red line** (observed) and the **blue line** (predicted) across the whole graph (i.e. from where the red and blue lines begin).

The significance of the difference between the value plotted for observed and predicted ROSC > 20 minutes is indicated by the 2 and 3 standard deviation (SD) shaded areas (see earlier explanation).
Survival to hospital discharge

Distribution of the predicted probability of survival to hospital discharge

Graphical presentation

The graph above shows the distribution of the predicted probability of survival to hospital discharge for individuals at your hospital (for the period that this Report covers) and NCAA (for the most recent twelve months of validated data).

- **Red bars** = predicted probability of survival to hospital discharge, for **your hospital**
- **Blue line** = predicted probability of survival to hospital discharge, for **NCAA**

The percentage of the predicted probability of survival to hospital discharge (calculated by the NCAA risk model) is presented in 5% groupings on the x axis (horizontal), and the percentage of individuals is presented on the y axis (vertical).

The sample size of the number of individuals for your hospital and NCAA is shown in the legend on the graph.

Questions

What is the percentage of individuals (y axis (vertical)) for each 5% grouping of predicted probability of survival to hospital discharge (x axis (horizontal)) at your hospital? How does the distribution vary for your hospital?

- For each 5% grouping of predicted probability of survival to hospital discharge (0%-5%, 5%-10%, 10%-15%, etc.) on the x axis (horizontal), follow the **red** bar to the top and read the value on the y axis (vertical).
How does the distribution of the predicted probability of survival to hospital discharge at your hospital compare to NCAA?

- For each grouping of predicted probability (0%-5%, 5%-10%, 10%-15%, etc.) on the x axis (horizontal), continue in a straight line upwards to the blue line and read the value on the y axis (vertical)
- Compare values (on the y axis (vertical)) for your hospital (red bar) and NCAA (blue line) for the same 5% grouping (x axis (horizontal)) and overall.
Graphical presentation

The plot above shows the observed percentage of survival to hospital discharge against the predicted percentage of survival to hospital discharge, for five equal sized groups (where each group must have at least five team visits) of individuals (patients) at your hospital (for the period that this Report covers) and NCAA (for the most recent twelve months of validated data).

- **Red data points** = observed against the predicted percentage of survival to hospital discharge for a group of individuals, for your hospital
- **Blue data points** = observed against the predicted percentage of survival to hospital discharge for a group of individuals, for NCAA

The five equal sized groups of individuals are formed by ordering the data for individuals by their predicted probability of survival to hospital discharge (low to high) as calculated by the NCAA risk model. These ordered data are then divided into the five equal sized groups (count five data points for your hospital and NCAA on the plot). Note: to be plotted on the calibration plot each group must have at least five team visits.

Each data point plots the observed (i.e. actual) percentage of survival to hospital discharge (y axis (vertical)) against the predicted percentage of survival to hospital discharge (x axis (horizontal)), for each group of individuals, for your hospital and NCAA.

Data points for NCAA show that the observed percentage is similar to the predicted probability percentage of survival to hospital discharge for each group of individuals, which indicates the accuracy of the NCAA risk model for predicting the probability of survival to hospital discharge.
Data point lies:

- **ON** the bold grey diagonal line across the plot, this indicates that the observed percentage of survival to hospital discharge is **equal** to the predicted for that group of individuals.
- **ABOVE** (i.e. to the left of) the bold grey diagonal line across the plot, this indicates that the observed percentage of survival to hospital discharge is **higher** than predicted for that group of individuals.
- **BELOW** (i.e. to the right of) the bold grey diagonal line across the plot, this indicates that the observed percentage of survival to hospital discharge is **lower** than predicted for that group of individuals.

Data points plotted for your hospital are displayed with a 95% confidence interval (CI) shown as the vertical line through each data point (see image to the left).

These data points plotted are an estimate of the true underlying value because it is based on a certain sized sample of data. The true value will most likely lie somewhere along the vertical line of the CI. A large sample of data provides a more accurate estimate of the value. Hence, the CI will become a narrower (shorter) vertical line. The CI, therefore, gives an indication of how accurately the value has been estimated. A 95% CI means that 95% of the time, we would expect the true value to lie along the vertical line.

The sample size of the number of individuals for your hospital and NCAA is shown in the legend on the graph.

**Questions**

*Is the observed percentage of survival to hospital discharge higher or lower than the predicted percentage of survival to hospital discharge for each equal sized group of individuals at your hospital? What could be the reason(s) for any differences?*

- For each data point (i.e. each equal sized group of individuals) for your hospital (**red**), read the value on the x axis (horizontal) for the predicted percentage of survival to hospital discharge and then the value on the y axis (vertical) for the observed percentage of survival to hospital discharge.
- Compare the value for the predicted and observed percentage of survival to hospital discharge for each data point for your hospital.
- Refer to the table listing unexpected non-survivors at the end of this section

*For each equal sized group of individuals, how does the observed percentage of survival to hospital discharge against the predicted percentage of survival to hospital discharge at your hospital compare to NCAA?*

- Read the values for each data point for your hospital (**red**) as per the steps above and compare this against the data point for NCAA (**blue**).
Funnel plot of observed to predicted survival to hospital discharge

Graphical presentation

The plot above shows the ratio of observed to predicted survival to hospital discharge plotted against number of individuals, for your hospital (for the period that this Report covers) and other NCAA hospitals with at least ten eligible individuals (for the most recent twelve months of validated data).

- Red data point = ratio of observed to predicted survival to hospital discharge, for your hospital
- Blue data points = ratio of observed to predicted survival to hospital discharge, for other NCAA hospitals

The ratio of observed (i.e. actual) to predicted survival to hospital discharge is presented on the y axis (vertical). It is calculated by dividing the number of individuals that survived to hospital discharge (i.e. observed) by the number of individuals predicted (as calculated by the NCAA risk model) to survive to hospital discharge.

Explanations of ratios (y axis (vertical)) in relation to where a data point sits on the plot:

- **Ratio is 1.0** - observed survival to hospital discharge is equal to the predicted survival to hospital discharge i.e. the number of individuals that survived to hospital discharge was the same as predicted
- **Ratio is greater than 1.0** - observed survival to hospital discharge is higher than the predicted survival to hospital discharge i.e. more individuals survived to hospital discharge than predicted
- **Ratio is less than 1.0** - observed survival to hospital discharge is lower than the predicted survival to hospital discharge i.e. less individuals survived to hospital discharge than predicted.

The sample size (of the number of individuals) for hospitals is presented on the x axis (horizontal). This can provide an indication of the accuracy of the data point (i.e. a larger sample size can mean a more accurate data point). The level of accuracy is indicated by the funnel lines on the plot.

**Standard deviation (SD) funnel lines**

Standard deviation (SD) funnel lines on the plot are wider at lower sample sizes (i.e. fewer individuals) given the greater imprecision with small numbers, and narrower at higher sample sizes (i.e. higher number of individuals). Data points for higher sample sizes indicate a more accurate value.

If variation between hospitals is random (i.e. variation of results between hospitals is acceptable) then on average 95% of data points should lie within 2 SD (dashed funnel lines) and 99.8% should lie within 3 SD (solid funnel lines). Where data points lie outside of the funnel lines, this indicates that the variation of the results is **significant**.

**Values presented in the table**

The exact ratio for the observed to predicted survival to hospital discharge for your hospital is presented in the table. Data points are estimates, therefore 95% confidence interval values are also provided in the table indicating the range of values likely to contain the true value.

**Questions**

*What is the ratio for the observed survival to hospital discharge to the predicted survival to hospital discharge for your hospital?*

- Read the ratio for your hospital (red data point) on the y axis (vertical).
  - Note: the exact ratio for your hospital is specified in the table beneath the graph. Ratios are explained earlier in this section.
- As data points are estimates, the 95% confidence interval values provided in the table, indicate the range of values likely to contain the true value for your hospital.

*Where does the red data point for your hospital lie within the funnel, and how does it compare to other NCAA hospitals (blue data points)?*

Data point lies:

- **WITHIN** funnel lines - observed survival to hospital discharge is **not significantly different** from predicted.
- **ABOVE** funnel lines - observed survival to hospital discharge is **significantly higher** than predicted.
- **BELOW** funnel lines - observed survival to hospital discharge is **significantly lower** than predicted.
Trend of observed to predicted survival to hospital discharge

Graphical presentation

The graph above shows the trend over time by quarter for the ratio of observed to predicted survival to hospital discharge, at your hospital and NCAA.

- **Red data points and line** = ratio of observed to predicted survival to hospital discharge, for your hospital
- **Blue line** = ratio of observed to predicted survival to hospital discharge, for NCAA

The ratio of observed (i.e. actual) to predicted survival to hospital discharge is presented on the y axis (vertical). It is calculated by dividing the number of individuals that survived to hospital discharge (i.e. observed) by the number of individuals predicted (as calculated by the NCAA risk model) to survive to hospital discharge.

Explanations of ratios (y axis (vertical)):

- **Ratio is 1.0** - observed survival to hospital discharge is equal to the predicted survival to hospital discharge i.e. the number of individuals that survived to hospital discharge was the same as predicted
- **Ratio is greater than 1.0** - observed survival to hospital discharge is higher than the predicted survival to hospital discharge i.e. more individuals survived to hospital discharge than predicted
- **Ratio is less than 1.0** - observed survival to hospital discharge is lower than the predicted survival to hospital discharge i.e. less individuals survived to hospital discharge than predicted

Periods of data over time (by quarter) are presented on the x axis (horizontal). The sample size for each period for your hospital is presented just above the x axis (horizontal). This can provide an indication of the accuracy of the data point (i.e. a larger sample size can mean a more accurate data point).
The grey shaded area of the graph represents the 95% confidence interval (CI). Each data point plotted for your hospital is an estimate of the true underlying value because it is based on a certain sized sample of data. The true value will most likely lie somewhere within the shaded area.

A large sample of data provides a more accurate estimate of the value. Hence, the shaded area will become a narrower. The CI, therefore, gives an indication of how accurately the value has been estimated.

Questions

Is the ratio of the observed (i.e. actual) to the predicted survival to hospital discharge at your hospital greater, less than, or equal to 1.0, over time? Can you see any trend or variation? What could be the reason(s) for this?

- Read the ratio for each red data point for your hospital on the y axis (vertical). Ratios are explained earlier in this section.
- As data points are estimates, the 95% confidence interval values provided in the table, indicate the range of values likely to contain the true value for your hospital.
**EWMA plot for survival to hospital discharge**

![EWMA Plot](image)

**Graphical presentation**

The EWMA (exponentially weighted moving average) plot above shows the observed and predicted survival to hospital discharge for consecutive individuals at your hospital, for the period that this Report covers and historically.

- **Red line** = average observed (i.e. actual) percentage survival to hospital discharge, for your hospital
- **Blue line** = average predicted percentage survival to hospital discharge, for your hospital

Values plotted are averages for the observed percentage survival to hospital discharge at your hospital and predicted (as calculated by the NCAA risk model) percentage survival to hospital discharge for your hospital. Both are presented on the y axis (vertical).

Consecutive individuals are shown on the x axis (horizontal). As the sample size increases with each consecutive (additional) individual reported by your hospital, the EWMA sequentially plots the updated values. Consecutive individuals are "exponentially weighted" - giving a larger weighting in favour of the most recent individuals, smoothing the appearance of the lines.

The vertical black line indicates the start of the period that this Report covers. Values plotted before the vertical black line show historical data for your hospital.

**2 SD and 3 SD**

The blue shaded areas of the plot (graph) represent 2 and 3 standard deviations (SD) above and below the predicted line (blue).

If variation over time is random then on average 95% of values plotted should lie within 2 SD (dark blue shaded area) and 99.8% should lie within 3 SD (light blue shaded area).
- If the observed survival to hospital discharge line (red) is **ABOVE and outside of the blue shaded areas**, this means that the observed percentage survival to hospital discharge for your hospital is **significantly higher** than the predicted percentage survival to hospital discharge. 
  *i.e. significantly more individuals survived to hospital discharge than predicted.*

- If the observed survival to hospital discharge line (red) is **BELOW and outside of the blue shaded areas**, this means that observed percentage survival to hospital discharge for your hospital is **significantly lower** than the predicted percentage survival to hospital discharge.
  *i.e. significantly less individuals survived to hospital discharge than predicted.*

**Questions**

What is the average observed percentage survival to hospital discharge at your hospital, at the end of this reporting period? How does this compare to the predicted percentage survival to hospital discharge at your hospital?

- Read the value plotted at the end of the red line on the y axis (vertical).
- Read the value plotted at the end of the blue line on the y axis (vertical).
- Compare these values.

Are there any variations in the average observed percentage for survival to hospital discharge against the predicted percentage to survival to hospital discharge over time, at your hospital?

- Assess the differences between value plotted for the red line (observed) and the blue line (predicted) across the whole graph (i.e. from where the red and blue lines begin).

The significance of the difference between the value plotted for observed and predicted survival to hospital discharge is indicated by the 2 and 3 standard deviation (SD) shaded areas (see earlier explanation).
### Unexpected non-survivors

Hospital non-survivors with a predicted probability of survival to hospital discharge greater than 50%.

<table>
<thead>
<tr>
<th>Team visit number</th>
<th>Predicted probability of survival to hospital discharge</th>
<th>Date of team visit</th>
</tr>
</thead>
<tbody>
<tr>
<td>20150025</td>
<td>64.5</td>
<td>03/11/2015</td>
</tr>
</tbody>
</table>

Now review suggested questions for local use at the beginning of this section!
10. Quick reference summary of your NCAA Report

Selected analyses/data from the NCAA Report (i.e. same graphs for each hospital) are provided below as key analyses for quick reference.

The period of data covered by this Report is **01 April 2015 to 31 March 2016**.

Further analyses and explanation on interpreting these are provided in the relevant sections within the Report.

**Numbers this Report is based on**

See section 3 'About the data in this Report'.

<table>
<thead>
<tr>
<th>Period</th>
<th>Total number of admissions to your hospital*</th>
<th>Total number of 2222 calls solely for cardiac arrest</th>
<th>Total number of reported cardiac arrests attended by the team that met the scope of NCAA (in-hospital only)</th>
<th>Total number of reported cardiac arrests attended by the team that met the scope of NCAA (in-hospital only)</th>
<th>Number of individuals (in-hospital only)</th>
</tr>
</thead>
<tbody>
<tr>
<td>01/04/2015 - 31/03/2016</td>
<td>103,238</td>
<td>.</td>
<td>97</td>
<td>79</td>
<td>79</td>
</tr>
</tbody>
</table>

Note:
*Total includes elective, non-elective and day cases
*Total includes arrests and fire

**Reminder:** the following analyses are for resuscitation outcomes for **in-hospital cardiac arrests** attended by the team (i.e. pre-hospital arrests are excluded) for your hospital.
Rate of cardiac arrests attended by the team per 1000 hospital admissions - trended

See section 5 ‘Activity’ and heading ‘Cardiac arrests attended by the team’.

*Total includes elective, non-elective and day cases
Outcomes flow

See section 6 ‘Outcome’.

Number of individuals 79

Reason resuscitation stopped

- Dead 41 (51.9%)
- Alive 38 (48.1%)
- Missing 0 (0.0%)

Status at discharge from your hospital

- Dead 59 (74.7%)
- Survival to hospital discharge 20 (25.3%)
- Patient still in your hospital 0 (0.0%)
- Missing 0 (0.0%)

Note: All percentages shown in this flow are calculated from the overall number of individuals.
Funnel plot of observed to predicted survival to hospital discharge

See section 9 ‘Risk adjusted comparative analyses’.

![Funnel plot image]

<table>
<thead>
<tr>
<th>Your hospital</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of individuals</td>
</tr>
<tr>
<td>Number of observed survivors to hospital discharge</td>
</tr>
<tr>
<td>Number of predicted survivors to hospital discharge</td>
</tr>
<tr>
<td>Ratio of observed to predicted survival to hospital discharge</td>
</tr>
<tr>
<td>95% confidence interval</td>
</tr>
</tbody>
</table>

Trend of observed to predicted survival to hospital discharge

See section 9 ‘Risk adjusted comparative analyses’.

![Trend plot image]
Checklist for using your NCAA Report

As your NCAA Report marks the beginning of your local performance management/quality improvement process, we encourage you to share the information or key points in this Report with relevant staff at your hospital in order to promote wider discussion.

The checklist below suggests some next steps in order to maximise the value of your NCAA Report:

☑ Have you referred back to section 2 ‘How to use your NCAA Report’?

☑ Have you shared and discussed results/key points with all relevant staff/teams/departments/managers at your Hospital, Directors/Boards/groups at your Trust, and any external stakeholders?

☑ Have you ensured that relevant staff can access this NCAA Report either online (via File Exchange on the secure NCAA online portal) or on a local shared drive?

☑ Have you made the results of your NCAA Report a standing agenda item at relevant meetings?

☑ Have you highlighted areas for possible improvement for the next quarter and forthcoming year, and drawn up an action plan of how to achieve this?

☑ Have you considered feeding your results into local resuscitation training?

☑ Have you shared local successes in the delivery of care?
11. Comments on your NCAA Report

If you have any questions or comments about your NCAA Report, then please email the NCAA team (ncaa@icnarc.org).