

National Health Performance Authority

Technical Supplement:

Time patients spent in emergency departments in 2011–12



National Health Performance Authority

NATIONAL HEALTH PERFORMANCE AUTHORITY

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Paper-based publications

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Please note: This Technical Supplement relates only to the reports *Hospital Performance: Time patients spent in emergency departments in 2011–12* (published December 2012) and *Hospital Performance: Time patients spent in emergency departments in 2012 and 2013, Update* (published May 2014). Data and methods have since been revised. See www.myhospitals.gov.au for the most up-to-date results and methods.

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About the Authority

The National Health Performance Authority has been set up as an independent agency under the *National Health Reform Act 2011*. It commenced full operations in 2012.

Under the terms of the Act, the Authority will monitor, and report on, the performance of Local Hospital Networks, public and private hospitals, primary healthcare organisations and other bodies that provide healthcare services.

The Authority's reports will give all Australians access to timely and impartial information that fairly compares their local healthcare organisations against peer organisations and against national standards.

The reports will let people see, often for the first time, how their local healthcare organisations measure up against comparable organisations across Australia.

The Authority's activities are also guided by a document known as the Performance and Accountability Framework agreed by the Council of Australian Governments (COAG). The framework contains nearly 50 indicators that will form the basis for the Authority's performance reports.

The Authority publishes most performance data through the MyHospitals website, and releases reports on a quarterly basis. The Authority's role includes reporting on the performance of these healthcare organisations against the 48 measures in order to identify both high-performing Local Hospital Networks, Medicare Locals and hospitals (so effective practices can be shared), and Local Hospital

Networks and Medicare Locals that perform poorly (so that steps can be taken to address problems).

The Performance Authority consists of a Chairman, a Deputy Chairman and five other members, appointed for up to five years. Members of the Performance Authority are:

- Ms Patricia Faulkner AO (Chairman)
- Mr John Walsh AM (Deputy Chairman)
- Dr David Filby PSM
- Prof Michael Reid
- Prof Bryant Stokes AM RFD
- Prof Paul Torzillo AM
- Prof Claire Jackson (acting member)

The conclusions in this report are those of the Authority. No official endorsement from any Minister, department of health or healthcare organisation is intended or should be inferred.

Summary

This technical supplement summarises methods used to calculate descriptive statistics and performance indicators presented in *Hospital Performance: Time patients spent in emergency departments in 2011–12*. Due to the complexity of the methods used, this supplement is targeted at individuals with technical expertise in the creation of health information.

Hospital Performance: Time patients spent in emergency departments in 2011–12 publishes statistics relevant to the four-hour National Emergency Access Target (NEAT) for Australian public hospitals. For each emergency department (ED), the Authority has published the following statistics:

- Percentage of all patients departing ED within four hours of arrival
- Time until most admitted patients (90%) departed ED.

This work required an assessment and refinement of public hospital peer groups to support fair comparisons between hospital EDs for the purpose of reporting NEAT.

The National Health Performance Authority (the Authority) identified five peer groups to support comparisons between hospital EDs, as well as an extra group of specialist hospitals not similar enough to other hospitals or to one another to allow comparisons.

An important finding of this work is that the type of peer group hospital in which an ED is located is highly associated with, or predictive of, the length of time in ED as measured using the four-hour NEAT. This finding suggests that the four-hour NEAT indicator is highly associated with whole-of-hospital flow of patients.

See [page 6](#) for the methods the Authority used to identify peer public hospitals and [Appendix 1](#) for a list of hospitals in each peer group.

This supplement presents the following results for each of the five distinct peer groups:

- Percentage of all patients departing ED within four hours of arrival with disaggregation for:
 - » admitted patients
 - » discharged patients
- Time until most admitted patients (90%) departed ED.
- Peer performance (presentations-weighted averages).

For each of these results, the public hospitals in the highest and lowest performing decile (10%) in each peer group have been highlighted ([see Appendix 2](#)).

Measures of time spent in ED

The Hospital Performance: Time patients spent in emergency departments in 2011–12 report presents information about the time patients spent in the ED, displayed in multiple formats to facilitate understanding of the comparable performance of public hospitals across Australia:

1. The percentage of patients who departed ED within four hours of arrival (NEAT)
2. The length of time until most (90%) of patients who were subsequently admitted to hospital took to depart ED.

Percentage of *all patients* departing ED within four hours of arrival (NEAT)

The percentage of patients departing ED within four hours of arrival is reported for all 134 Australian hospitals listed in **Appendix 1**. The methods for calculation of NEAT can be found in **Box 1 on page 4** of this supplement.

These results are reported across Australia using a hospital peer classification system refined by the Authority for the purposes of reporting the NEAT indicator in a comparable fashion (see **page 6** for more information).

Percentage of *admitted patients* departing ED within four hours of arrival

These data are calculated in an identical manner to the NEAT indicator with the exception that only patients with the following *episode end status* are included in the numerator and the denominator:

Value	Description
1	Admitted to this hospital

Percentage of *discharged patients* departing ED within four hours of arrival

These data are calculated in an identical manner to the NEAT indicator with the exception that only patients with the following *episode end status* are included in the numerator and the denominator:

Value	Description
2	Non-admitted patient emergency department service episode completed—departed without being admitted or referred to another hospital
3	Non-admitted patient emergency department service episode completed—referred to another hospital for admission
4	Did not wait to be attended by a health care professional
5	Left at own risk after being attended by a health care professional but before the non-admitted patient emergency department service episode was completed
6	Died in emergency department as a non-admitted patient
7	Dead on arrival, emergency department clinician certified the death of the patient

Time until most admitted patients (90%) departed

The time until most admitted patients departed ED is measured at the 90th percentile. It provides a measure of the distribution of time spent in ED for those patients subsequently admitted from ED to the same hospital; the 10% of patients who stayed longest in ED took equal to or longer than this time to depart ED.

The methods for calculation of this indicator can be found in **Box 2 on page 5** of this supplement.

Peer Performance

Peer performance is reported for each peer group for both measures discussed above. Peer performance figures are presentations-weighted averages calculated using presentations-level data for all hospitals in a peer group.

Data source

The report uses data from the National Non-admitted Patient Emergency Department Care Database (NNAPEDCD) for the 2011–12 financial year, which was extracted 5 November 2012. This data collection is held by the Australian Institute of Health and Welfare (AIHW).

According to AIHW, the NNAPEDCD is *'a compilation of electronic records of non-admitted patient service episodes from emergency departments of selected public hospitals. Each state and territory health authority determines which hospitals in their jurisdictions submit data to the collection'*.¹

The NNAPEDCD is compiled by AIHW from data supplied by Australian state and territory health authorities. This data collection commenced on 1st July 2003, with each collection period covering a financial year.

For more information on the NNAPEDCD, please see the AIHW's data quality statement at: www.aihw.gov.au/publication-detail/?id=10737423042

1. Australian Institute of Health and Welfare - viewed online 7 November 2012. www.aihw.gov.au/publication-detail/?id=10737423042

Box 1: Percentage of patients departing ED within four hours of arrival (NEAT)²

Description: The percentage of all ED presentations where the time from presentation to physical departure, i.e. the length of the ED stay, is within four hours. It is calculated for public hospital EDs and measured against progressively increasing targets for states and territories with the objective of 90% of all patients departing ED within four hours of arrival by 2015.

Data source: Data are sourced from the NNAPEDCD (2011–2012), extracted 5 November 2012.

Numerator: Number of presentations where ED stay length is less than or equal to four hours. ED stay length is calculated by subtracting presentation time and presentation date from physical departure time and physical departure date.

Denominator: Number of ED presentations with a physical departure date/time contained within the reporting period.

Computation:

$100 \times (\text{Numerator} \div \text{Denominator})$

Additional notes:

Presentation time is the earliest recorded time of either the commencement of the clerical registration or the start of the triage process.

Patients who were **not admitted** use the time the patient's ED non-admitted clinical care ended in place of the physical departure time.

Patients recorded as **did not wait or left at their own risk** use the time the patient leaves ED or was first noticed as having left in place of the physical departure time.

Patients who **died in the ED** or were certified **dead on arrival** use the time the body was removed from ED. If an ED physician certified the death of the patient outside the ED, then use the time the patient was certified dead.

Performance by states and territories against NEAT is measured against the schedule of progressively increasing targets with the objective of 90% of all patients leaving ED within four hours by 2015. Further detail can be found in the *National Health Reform Agreement – National Partnership Agreement on Improving Public Hospital Services*, Schedule C (Table C5).

Invalid records are excluded from the numerator and denominator. Invalid records are records for which:

- Length of stay < 0
- Presentation or triage date or time are missing
- Physical departure date or time are missing.

2. This specification is also used by the Australian Institute of Health and Welfare for publication in *Australian Hospital Statistics* and for calculating NEAT under the *National Partnership Agreement on Improving Public Hospital Services*.

Box 2: Time until most admitted patients (90%) departed ED³

Description: The time taken until 90% of admitted patients left the ED. This indicator includes all patients attending a public hospital ED who were subsequently admitted to the same hospital and measures the total time from presentation until departure at the 90th percentile.

Data source: Data are sourced from the NNAPEDCD 2011–12, extracted on 5 November 2012.

Computation: This indicator is time in ED from arrival to departure (in hours and minutes) at 90th percentile for ED presentations with an *episode end status* of 1: *Admitted to this hospital* (either short stay unit, hospital-in-the-home or non-emergency department hospital ward).

Calculation of time in ED: Time in ED from arrival to departure is calculated by subtracting presentations time and date from physical departure time and date respectively, consistent with the business rules included in the NAPEDC National Minimum Data Set 2011–12.

Calculation of 90th percentile: The 90th percentile is calculated using an empirical distribution function with averaging in SAS^{®4}. Using this method, observations are sorted in ascending order.

The calculation is:

$n \times p = i + f$ (where i is an integer and f is the fractional part of $n \times p$).

where

n is the number of observations and
 p is the percentile value divided by 100.

If $n \times p$ is an integer, then the percentile value will correspond to the average of the values for the i^{th} and $(i+1)^{\text{th}}$ observations.

If $n \times p$ is not an integer, then the percentile value will correspond to the value for the $(i+1)^{\text{th}}$ observation.

For example, if there were 100 observations admitted to the hospital, the 90th percentile will correspond to the average time for the 90th and 91st observations.

If there were 101 observations, the 90th percentile will correspond to the time for the 91st observation.

The 90th percentiles have been rounded to the nearest whole number of minutes.

Additional notes:

Admitted patients are those with an *episode end status* = 1.

Presentation time is the earliest recorded time of either the commencement of the clerical registration or the start of the triage process.

Invalid records are excluded from the numerator and denominator. Invalid records are records for which:

- Length of stay < 0
- Presentation or triage date or time are missing
- Physical departure date or time are missing.

3. This specification is also used by the Australian Institute of Health and Welfare for publication in *Australian Hospital Statistics*.
4. SAS[®] Institute Inc. 2010. *Base SAS[®] 9.2 Procedures Guide: Statistical Procedures, Third Edition*, Cary, NC: SAS Institute Inc.

Fair comparisons of hospitals and their EDs

Peer groups

Decision

NEAT performance reporting will use the AIHW Revision 1 method for peer classification. The analysis resulted in the following groups being defined:

- Major metropolitan hospitals
- Major regional hospitals
- Large metropolitan hospitals
- Large regional hospitals
- Medium hospitals.

Further work on the impact of adjustment on hospital results is being conducted by the Authority. This analysis will determine the difference between adjusted and non-adjusted relative performance of individual hospitals within their peer group and inform our approach to standardisation.

Evidence

To facilitate fair comparisons between hospitals, the Authority investigated existing and revised hospital peer classifications for NEAT reporting. The following groups for analysis and reporting were investigated:

- ED role delineation using the Australasian College for Emergency Medicine (ACEM)⁵ role delineation framework

- ED role delineation by the Independent Hospital Pricing Authority (IHPA)⁶
- Public hospitals peer groups by AIHW⁷
- Revision 1 of AIHW public hospitals peer groups with the following amendments:
 - » Separation of Principal Referral (A1) hospitals into metropolitan and regional locations using Australian Standard Geographical Classification (ASGC) Remoteness Area, 2006
 - » Exclusion of specialist women's and children's hospitals (A2)
 - » Exclusion of specialist eye or eye and ear hospitals
 - » Exclusion of hospitals with EDs with <20,000 presentations in 2011–12.
- Revision 2 of AIHW public hospitals peer groups with the following amendments:
 - » Separation of Principal Referral (A1) hospitals into metropolitan and regional locations using Australian Standard Geographical Classification (ASGC) Remoteness Area, 2006
 - » Combination of Large Regional (B2) and Medium (C1) hospitals
 - » Exclusion of specialist women's and children's hospitals (A2)
 - » Exclusion of specialist eye or eye and ear hospitals
 - » Exclusion of hospitals with EDs with <20,000 presentations in 2011–12.

5. Australasian College for Emergency Medicine – viewed online 1 October 2012 [http://www.acem.org.au/media/S12_Role_delineation_formatted_August_2004.pdf]. Role delineations for EDs that had not been assigned by ACEM were assigned by the Authority using a data driven method.

6. Independent Hospital Pricing Authority – viewed online 1 October 2012 [[http://www.ihoa.gov.au/internet/ihoa/publishing.nsf/content/704A9BE19D2BBB90CA257A4000199523/\\$File/IHPA%20Three%20Year%20Data%20Plan.pdf](http://www.ihoa.gov.au/internet/ihoa/publishing.nsf/content/704A9BE19D2BBB90CA257A4000199523/$File/IHPA%20Three%20Year%20Data%20Plan.pdf)]

7. Australian Institute of Health and Welfare – viewed online 1 October 2012. [<http://www.aihw.gov.au/publication-detail/?id=10737421633&tab=2>]

In order to determine the type of peer group classification to use to support fair comparisons between hospitals in relation to time spent in EDs, an analysis was undertaken to determine which peer group classification was most related to, or predictive of, relative performance. This analysis is best done using ‘goodness of fit’ statistics.

A goodness of fit statistic (R^2 values) was calculated for each peer group classification option to identify the optimal peer classification.

R^2 was calculated using the following formula:

$$R^2 = 1 - \frac{\sum_{i=1}^k \sum_{j=1}^{n_i} (y_{ij} - \bar{y}_i)^2}{\sum_{i=1}^k \sum_{j=1}^{n_i} (y_{ij} - \bar{y})^2} = \frac{\sum_{i=1}^k n_i (\bar{y}_i - \bar{y})^2}{\sum_{i=1}^k \sum_{j=1}^{n_i} (y_{ij} - \bar{y})^2}$$

where

k is the number of groups in the classification;

n_i is the number of hospitals in the i^{th} group;

y_{ij} is the percentage of NEAT for the j^{th} hospital in the i^{th} group;

\bar{y}_i is the average percentage of NEAT for the i^{th} group;

\bar{y} is the average percentage of NEAT for all hospitals.

Table 1 shows R^2 for each peer classification option. It can be seen from **Table 1** that AIHW Revision 1 and AIHW Revision 2 have the largest R^2 value (48%), demonstrating the greatest variation between the hospital groups within the classification and the least variation between hospitals in the groups within the classification. At this point of development,

for reporting the NEAT indicator, R^2 is used to understand and quantify the variation between the hospital groups for each approach to peer group classification, as well as the variation within the hospital groups within the classification. During this analysis, hospitals with fewer than 20,000 presentations in 2011–12 were excluded. The rationale was to allow fair comparison of methods and because ACEM has not assigned an ED role delineation to any ED with fewer than 20,000 presentations.

AIHW Revision 1 was the preferred option as it has an equally high R^2 value but with greater flexibility around reporting as the large regional hospitals and medium hospitals peer groups are not combined. AIHW revision 1 includes 122 peer-grouped hospitals. These hospitals and their peer groups are listed in **Appendix 1**.

Table 1: R² values for peer classification options

Peer classification option	AGEM	IHPA	AIHW	AIHW Revision 1	AIHW Revision 2
R ² value	20.3%	21.7%	40.6%	48.1%	48.1%

Source: National Non-admitted Patient Emergency Department Care Database 2011–12, data extracted 5 November 2012.

An important finding of this work is that the type of peer group hospital in which an emergency department is located is highly related to, or predictive of, the length of time in ED as measured against the four-hour NEAT. That is, from a statistical perspective, half the variation in the performance of hospital EDs on this indicator relates to the type of hospital. One-fifth of the variation relates to the type of ED. This finding suggests that the four-hour NEAT indicator is highly associated with whole-of-hospital flow of patients.

The Authority also investigated the effect of including risk-adjustment for each peer classification option. Based on expert clinical advice and recent literature⁸, triage casemix, the percentage of admitted patents and the percentage of patients transferred to other EDs were identified as factors that may affect NEAT performance.

Table 2 shows R² for each peer classification option as additional casemix variables are added. R² from linear regression models was calculated using the following formula:

$$R^2 = 1 - \frac{\sum_{i=1}^n (y_i - \hat{y}_i)^2}{\sum_{i=1}^n (y_i - \bar{y})^2}$$

where

n is the number of hospitals;

y_i is the percentage of NEAT for the i^{th} hospital;

\hat{y}_i is the estimated percentage of NEAT for the i^{th} hospital from the linear model;

\bar{y} is the average percentage of NEAT for all hospitals.

8. Green J and Hall J (2012.) *The comparability of emergency department waiting time performance data*. Medical Journal of Australia, 197:6 pp345-348.
Eagar K, Dawber J, Masso M, Bird S and Green J (2011) *Emergency Department Performance by States and Territories*. Centre for Health Service Development, University of Wollongong.

Table 2: Goodness of fit (R^2) for peer classification options with incremental casemix investigation

Casemix variables used for analysis	Goodness of fit (R^2)				
	ACEM	IHPA	AIHW	AIHW Revision 1	AIHW Revision 2
Peer classification method only	20%	22%	41%	48%	48%
Peer + percentage of ED patients admitted	43%	41%	49%	52%	52%
Peer + percentage of triage 3+4+5 patients combined	31%	30%	47%	50%	50%
Peer + percentage of triage 3+4+5 patients combined + percentage of ED patients admitted	45%	43%	51%	53%	53%
Peer + percentage of triage 3, 4, 5 (as separate variables)	33%	32%	47%	51%	51%
Peer + percentage of triage 3, 4, 5 (as separate variables) + percentage ED patients admitted	47%	45%	52%	54%	54%
Peer + percentage of triage 3, 4, 5 (as separate variables) + percentage ED patients admitted + percentage ED patients transferred	49%	46%	52%	55%	54%

Note: Addition of the percentage of triage 1 & 2 presentations as variables did not significantly affect goodness of fit so these variables were not included in the analyses.

Source: National Non-admitted Patient Emergency Department Care Database 2011–12, data extracted 5 November 2012.

While addition of casemix adjustment does result in a large improvement for the two ED role delineation classifications and, to a lesser extent, the traditional AIHW peer group classification, there was only a marginal improvement in R^2 observed for the two revised AIHW classifications. In addition, the variables used for risk-adjustment were

found to have a complex relationship with NEAT performance depending on the peer classification of the hospital. Based on these findings, a decision has been made to use the AIHW Revision 1 method for reporting NEAT performance in December 2012 but not to use casemix adjustment until a more detailed assessment has been completed.

Specialist hospitals

Decision

For reporting NEAT, the Authority has used a revised version of the AIHW public hospitals peer classification (Revision 1) that excludes all specialist hospitals, including women's and children's hospitals. Due to the differences of these hospitals with regards to role and casemix, the Authority has not directly compared the specialist hospitals for NEAT performance. Because the Authority will not directly compare these facilities, those with fewer than 20,000 presentations were not excluded.

Evidence

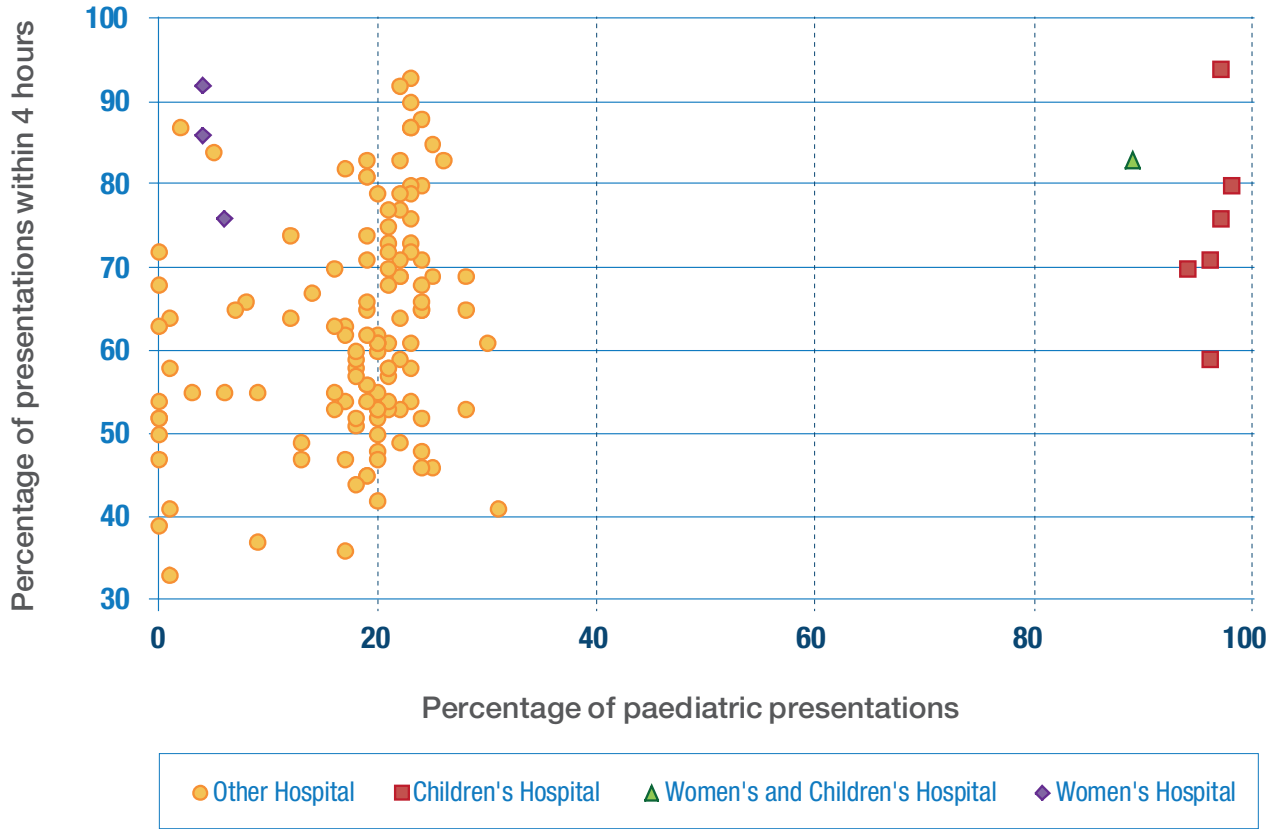
The Authority investigated the effect that the proportion of paediatric presentations to ED might have on NEAT performance. Expert clinicians advised the Authority that the way children are managed in EDs can be different from adults, and that hospitals and jurisdictions may vary with regard to formal and informal policies for managing children in EDs.

Figure 1 presents the percentage of paediatric cases among all ED presentations and performance against the NEAT indicator. The data does not demonstrate a direct relationship between percentage of paediatric patients and NEAT performance but two distinct clusters can be seen. The densest cluster of hospitals has between highest to lowest of presentations defined as paediatric and the largest range of performance against NEAT (highest to lowest). A second cluster of facilities has in excess of 90% presentations defined as paediatric, again demonstrating a wide NEAT distribution—this second cluster is

comprised of the children's hospitals. However, some of the specialist hospitals (women's and others) have very low percentages of paediatric patients and, even after risk adjustment, should not be compared with the children's hospitals.

This reinforces the decision not to casemix adjust NEAT performance until additional research has been conducted. The hospitals making up this specialist group will be reported separately from non-specialist hospitals and are not presented in a way to facilitate comparisons within this group of hospitals.

Figure 1: Percentage of paediatric ED presentations by hospital, 2011–12



Source: National Non-admitted Patient Emergency Department Care Database 2011–12, data extracted 5 November 2012.

Appendix 1: Hospital EDs by peer group

Major metropolitan hospitals

Bankstown Lidcombe Hospital, **NSW**
Blacktown Hospital, **NSW**
Campbelltown Hospital, **NSW**
Concord Hospital, **NSW**
Gosford Hospital, **NSW**
John Hunter Hospital, **NSW**
Liverpool Hospital, **NSW**
Nepean Hospital, **NSW**
Prince of Wales Hospital, **NSW**
Royal North Shore Hospital, **NSW**
Royal Prince Alfred Hospital, **NSW**
St George Hospital, **NSW**
St Vincent's Hospital, **NSW**
Sutherland Hospital, **NSW**
The Tweed Hospital, **NSW**
Westmead Hospital, **NSW**
Wollongong Hospital, **NSW**
Wyong Hospital, **NSW**

Austin Hospital (Heidelberg), **VIC**
Box Hill Hospital, **VIC**
Casey Hospital, **VIC**
Dandenong Campus, **VIC**
Frankston Hospital, **VIC**
Geelong Hospital, **VIC**
Maroondah Hospital (East Ringwood), **VIC**
Monash Medical Centre (Clayton), **VIC**
Royal Melbourne Hospital (Parkville), **VIC**
St Vincent's Hospital (Fitzroy), **VIC**
Sunshine Hospital, **VIC**
The Alfred, **VIC**
The Northern Hospital (Epping), **VIC**
Western Hospital (Footscray), **VIC**

Caboolture Hospital, **QLD**
Gold Coast Hospital, **QLD**
Ipswich Hospital, **QLD**
Logan Hospital, **QLD**
Mater Adult Hospital, **QLD**

Princess Alexandra Hospital, **QLD**
Redcliffe Hospital, **QLD**
Royal Brisbane & Women's Hospital, **QLD**
The Prince Charles Hospital, **QLD**

Fremantle Hospital, **WA**
Joondalup Health Campus (Public), **WA**
Royal Perth Hospital (Wellington Street Campus), **WA**
Sir Charles Gairdner Hospital, **WA**

Flinders Medical Centre, **SA**
Lyell McEwin Hospital, **SA**
Royal Adelaide Hospital, **SA**
The Queen Elizabeth Hospital, **SA**

Calvary Public Hospital, **ACT**
The Canberra Hospital, **ACT**

Major regional hospitals

Coffs Harbour Hospital, **NSW**
Dubbo Hospital, **NSW**
Lismore Hospital, **NSW**
Manning Hospital, **NSW**
Orange Health Service, **NSW**
Port Macquarie Hospital, **NSW**
Shoalhaven Hospital, **NSW**
Tamworth Hospital, **NSW**
Wagga Wagga Hospital, **NSW**

Ballarat Health Services (Base Campus), **VIC**
Goulburn Valley Health (Shepparton), **VIC**
Latrobe Regional Hospital (Traralgon), **VIC**
South West Healthcare (Warrnambool), **VIC**
The Bendigo Hospital, **VIC**

Bundaberg Hospital, **QLD**
Cairns Base Hospital, **QLD**
Mackay Base Hospital, **QLD**
Nambour Hospital, **QLD**

Rockhampton Base Hospital, **QLD**
The Townsville Hospital, **QLD**
Toowoomba Hospital, **QLD**

South West Health Campus, **WA**

Launceston General Hospital, **TAS**
Royal Hobart Hospital, **TAS**

Alice Springs Hospital, **NT**
Royal Darwin Hospital, **NT**

Large metropolitan hospitals

Auburn Hospital, **NSW**
Calvary Mater Newcastle Hospital, **NSW**
Canterbury Hospital, **NSW**
Fairfield Hospital, **NSW**
Hawkesbury Hospital, **NSW**
Hornsby Ku-ring-gai Hospital, **NSW**
Maitland Hospital, **NSW**
Manly Hospital, **NSW**
Mona Vale Hospital, **NSW**
Ryde Hospital, **NSW**
Shellharbour Hospital, **NSW**

Angliss Hospital, **VIC**
Mercy Public Hospital (Werribee), **VIC**
Sandringham Hospital, **VIC**

Queen Elizabeth II Jubilee Hospital, **QLD**
Redland Hospital, **QLD**

Armadale-Kelmscott Memorial Hospital, **WA**
Rockingham General Hospital, **WA**
Swan District Hospital, **WA**

Modbury Hospital, **SA**

Large regional hospitals

Bathurst Hospital, **NSW**
Grafton Base Hospital, **NSW**

Albury Wodonga Health (Albury Campus), **VIC**
Albury Wodonga Health (Wodonga Campus), **VIC**
Mildura Base Hospital, **VIC**
Northeast Health Wangaratta, **VIC**
West Gippsland Healthcare Group (Warragul), **VIC**

Hervey Bay Hospital, **QLD**
Mount Isa Hospital, **QLD**

Albany Hospital, **WA**
Geraldton Hospital, **WA**
Kalgoorlie Hospital, **WA**
Peel Health Campus, **WA**

North West Regional Hospital, **TAS**

Medium hospitals

Belmont Hospital, **NSW**
Broken Hill Hospital, **NSW**
Kempsey Hospital, **NSW**
Mount Druitt Hospital, **NSW**

Rosebud Hospital, **VIC**
Williamstown Hospital, **VIC**

Caloundra Hospital, **QLD**
Gladstone Hospital, **QLD**
Gympie Hospital, **QLD**

Noarlunga Public Hospital, **SA**

Mersey Community Hospital, **TAS**

Un-peered specialist hospitals

The Children's Hospital at Westmead, **NSW**
Sydney Hospital / Sydney Eye Hospital, **NSW**
Sydney Children's Hospital, **NSW**

Mercy Hospital for Women, **VIC**
Royal Children's Hospital (Parkville), **VIC**
Royal Women's Hospital (Carlton), **VIC**
The Royal Victorian Eye & Ear Hospital, **VIC**

Mater Children's Hospital, **QLD**
Royal Children's Hospital, **QLD**

Women's and Children's Hospital, **SA**

Princess Margaret Hospital for Children, **WA**
King Edward Memorial Hospital for
Women, **WA**

Appendix 2: Approach for calculating deciles

The Authority used multiple methods to identify hospitals that were performing higher or lower than most facilities.

Highest and lowest 10% of hospitals in peer groups for percentage of patients departing ED within four hours of arrival

The highest and lowest 10% of hospitals in each peer group were identified using deciles. Deciles are a statistical measure of distribution across an indicator. The Authority reported hospitals in the highest and lowest deciles, by peer group, for each of the following indicators:

- Percentage of *all patients* departing ED within four hours of arrival—National Emergency Access Target (NEAT)
- Percentage of *admitted patients* departing ED within four hours of arrival
- Percentage of *discharged patients* departing ED within four hours of arrival.

For this report, a decile of 1 represents the highest-performing 10% of hospitals against NEAT while a decile of 10 represents the lowest-performing 10% of hospitals for NEAT.

For example, a hospital with the decile being 1 for the percentage of presentations within four hours means that if hospitals in the peer group are sorted by the descending percentage of presentations within four hours, this hospital is in the top 10%.

The Authority uses the data for each hospital and the mean of the corresponding rank for tied data values to assign the decile in SAS^{®7}. The decile was calculated using the following formula:

$$\text{decile} = \text{FLOOR}\left(\frac{\text{rank} * 10}{n + 1}\right)$$

where

FLOOR(x) returns the largest integer that is less than or equal to x;

rank is the value's order rank based on the descending percentage of presentations within four hours (and the mean of the corresponding rank for tied data values);

n is the number of hospitals in the peer group

7. SAS Institute Inc. 2009. Base SAS[®] 9.2 Procedures Guide: Statistical Procedures, Third Edition, Cary, NC: SAS Institute Inc.