ANZICS

ANZICS core

Australian and New Zealand Intensive Care Society

Centre for Outcome and Resource Evaluation

Annual Report 2013/14

Acknowledgments

ANZICS CORE would like to extend their appreciation to the doctors, nurses, ward clerks, data managers and data collectors who have contributed to the CORE Data Registries. Without this support, CORE Registries could not continue to provide information for the range of quality and research activities undertaken by the intensive care clinical community to improve patient outcomes.

Many thanks to all who have contributed to the development of this report.

The data included in this report are drawn from the four ICU Registries managed by ANZICS CORE to provide a complete picture of ICU performance for the 2013/14 reporting period.

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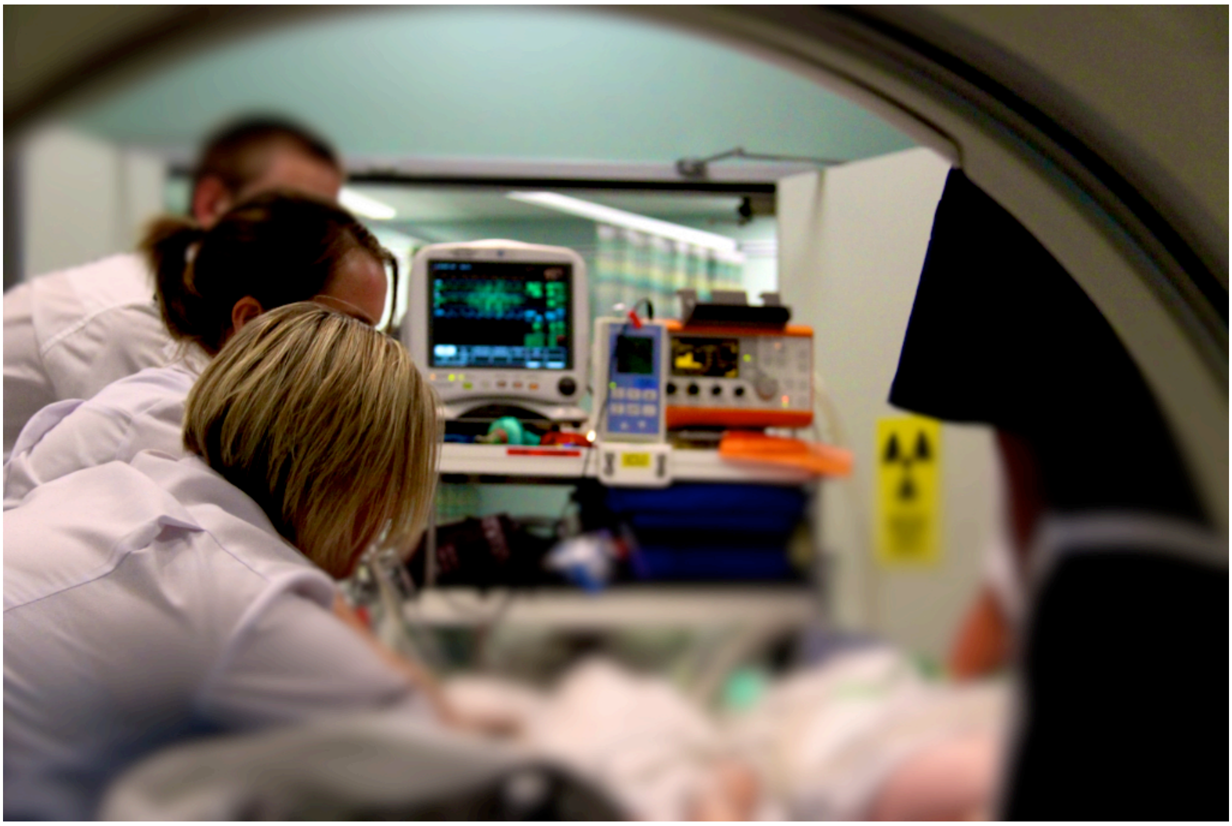

OUR AIMS

To guide best clinical practice and improve the quality of intensive care in Australia and New Zealand.

To host innovative registries that engage with the intensive care community to promote improvements in critical care outcomes through benchmarking, monitoring, education and support of research activities.

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Foreword from the ANZICS CORE Chair

Did you know that you have approximately a one in two chance of being admitted as a patient to an Intensive Care Unit (ICU)?

This is a true estimate of your life time risk of needing an ICU admission. Thankfully nine out of ten of you will leave ICU alive and these survival statistics have been improving progressively over time – findings highlighted this year through a high profile publication in the Journal of the American Medical Association. This is a testament to the high quality of care in Australian and New Zealand ICUs today. This report details the excellent outcomes and practices of Intensive Care medicine in Australia and New Zealand and provides an insight into changes over the past 5 years.

Many organisations and individuals have supported CORE's activities in recent years. Notable amongst these are the Australian Commission on Safety and Quality in Health Care and the Chief Medical Officer of Australia, Professor Chris Baggoley. Thanks go to all jurisdictional health departments for their on-going funding and support, and to the Intensive Care community, in particular those of you who collect data within the ICUs. Without you, this report would not happen and the benchmarking of ICU outcomes through the ANZICS CORE Registry program would not be possible.

The 2013/14 year has seen significant developments at CORE, with large scale IT projects undertaken to improve reporting to units and the development of a new risk adjustment model (The ANZ Risk of Death - ANZROD). In addition, this year saw Tony Slater stand down from his position at the head of the ANZ Paediatric Intensive Care Registry to take on a new challenge as the Director of the Lady Cilento Children's Hospital ICU in Brisbane. Over the past 15 years, he and Jan Alexander have transformed a small database into an internationally recognised Paediatric Intensive Care Registry which is unique throughout the world.

This report is the result of the work of many individuals. My personal thanks go to the staff at CORE whose work efforts are unparalleled, whose enthusiasm seems unstoppable and who contribute to the outcomes of patients in a way which is equally as important as every person who works within an ICU. Thanks also to Sue, Peter and Johnny, my colleagues on the CORE management committee for their constant support and ideas.

And finally to Tony Slater, thank you for all your work over the past years. This report is dedicated to you.

Thank you,

Associate Professor David Pilcher
Intensivist, The Alfred Hospital
Chair, ANZICS CORE

About ANZICS CORE

CORE hosts and manages 4 registries to which contributing ICUs across Australia and New Zealand submit de-identified data.

- The Adult Patient Database (APD) collects data on admissions to adult ICUs.
- The Australian and New Zealand Paediatric Intensive Care (ANZPIC) Registry collects data on children admitted to specialist Paediatric Intensive Care Units (PICUs) and those patients under the age of 16 who are treated at a number of adult units that look after critically ill children.
- The Critical Care Resources (CCR) Registry collects data through an annual survey on ICU infrastructure, staffing and processes.
- The Central Line Associated Blood Stream Infection (CLABSI) Registry collects data related to central line infections in Australian ICUs.

CORE is unique in that it offers an overview of ICU performance and resources across regional, state, federal and international jurisdictions. ANZICS CORE provides ICU Registry Services to Oman, India, and Hong Kong.

The data collected is used to monitor, benchmark and report on intensive care performance providing bi-national and jurisdictional comparison of outcomes and individual units based reports. Jurisdictional data review committees have access to reports relevant to their jurisdictions providing information about Intensive Care Services across their respective health systems and the performance of ICUs under their jurisdiction.

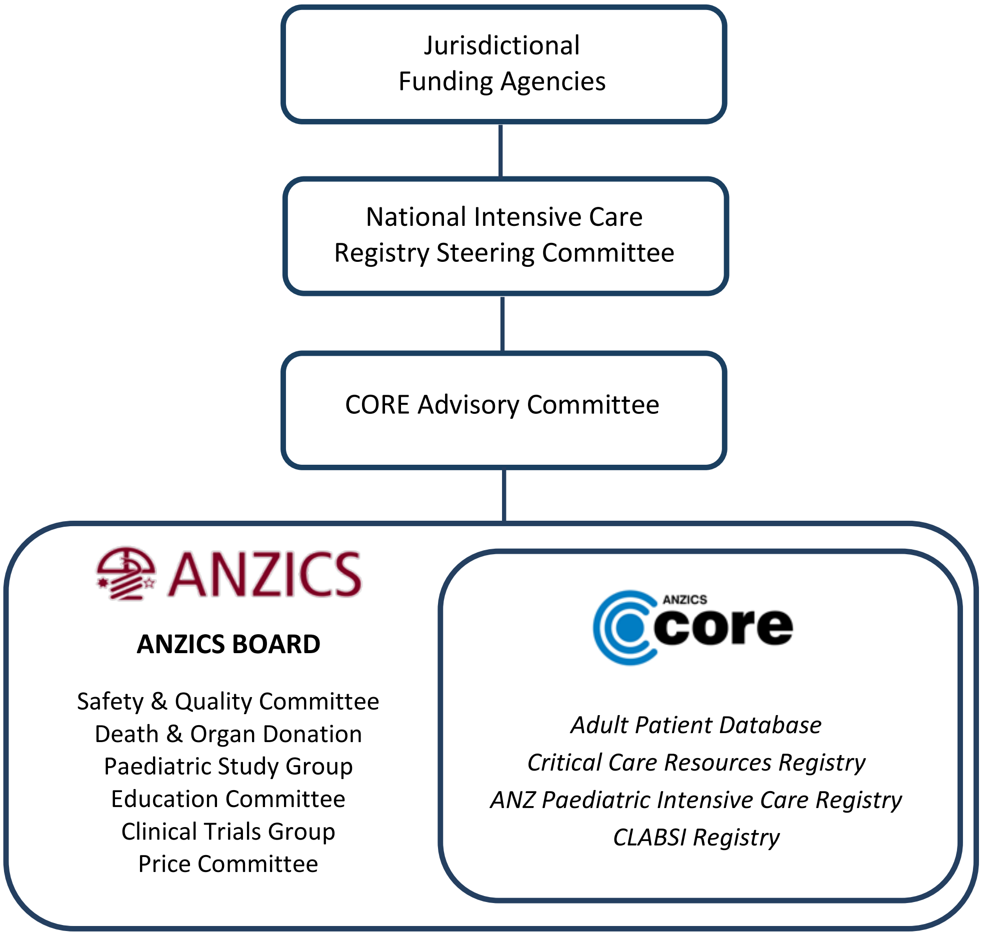
Our Strategic Objectives

- To benchmark and monitor ICUs activity, performance and patient outcomes
- To provide timely and relevant information to clinicians, the public, policy makers, health care providers and funders
- To work with the intensive care community to prioritise activities to improve care of the critically ill
- To develop activities of CORE through local, national and international collaboration

How we achieve these objectives

- Collecting, analysing and publishing data submitted from contributing ICUs
- Providing a mechanism for reporting of intensive care outcomes
- Striving for compatibility with other national databases, including those held by the Australian Institute of Health and Welfare
- Being a source of data for intensive care research activities
- Promoting research activities to gain a greater understanding of critical illness, its management and outcome

Organisational Structure of CORE



CORE committees

- The National Intensive Care Registry Steering Committee (NICRSC) provides national oversight of CORE with representation from key funders
- The CORE Advisory Committee provides general oversight and direction for CORE's activities
- The ANZPIC Registry Clinical Advisory Committee reviews unit-identified data and provides strategic direction to the ANZPIC Registry
- The CORE Management Committee provides operational guidance for CORE's activities

Our Achievements and Future Directions

CORE Enterprise Reporting System (CERS)

In 2013, CERS (a jurisdictionally funded project), entered its "build phase". CERS incorporates a new central data warehouse, which incorporates all CORE registries within the same infrastructure, and a new web-based reporting system to provide improved reports to submitting ICUs, health departments, and private hospital ownership groups. Implementation of the new database and reporting system provides sites with dynamic reporting – the ability to filter reports based on time period and patient group. CERS has been designed to capture both minimum and maximum datasets providing capability to extract data from ICU clinical information systems as they become implemented across jurisdictions.

The future benefits include the:

- capacity for intermittent data collection to measure specific quality and safety outcomes
- ability to support clinical trials
- ability to collect more in-depth data to measure practice variation and outcomes.

Improving data linkage across clinical & health administration datasets

The absence of personal identifiers from data submitted to CORE limits the ability to link data between clinical registries. Currently there is no method to follow up outcomes of patients who have been discharged from hospital, or to identify a patient in the CORE data as the same individual in another dataset such as the National Death Index to monitor long term outcomes.

More patients leave hospital alive after admission to ICU than ever before but increasing numbers of patients are also discharged to chronic care and rehabilitation facilities. Data linkage is seen as a priority for CORE to enable inclusion of non-mortality measures e.g. functional outcomes and measure of survival beyond the hospital stay. A number of demonstration projects are in progress within jurisdictions where linked data sets are available to develop internal processes to manage data linkage activities, whilst protecting the integrity, privacy and confidentiality of patient information.

Publications based on CORE Registry Data

Below are a few examples of significant publications generated based on CORE Registry data;

JAMA The Journal of the American Medical Association

Research

Original Investigation | CARING FOR THE CRITICALLY ILL PATIENT

Mortality Related to Severe Sepsis and Septic Shock Among Critically Ill Patients in Australia and New Zealand, 2000-2012

Kirsi-Maija Kaukonen, MD, PhD, EDIC; Michael Bailey, PhD; Satoshi Suzuki, MD; David Pilcher, FCICM; Rinaldo Bellomo, MD, PhD

Pediatric Critical Care Medicine

Paediatric Index of Mortality 3: An Updated Model for Predicting Mortality in Pediatric Intensive Care*

Lahn Straney, PhD[1]; Archie Clements, PhD[2]; Roger C. Parslow, BSc, MSc, PhD[3]; Gale Pearson, MBBS, MRCP, FRCPCH, Dip Math[4]; Frank Shann, MD, FRACP, FCICM[5]; Jan Alexander[6]; Anthony Slater, FRACP, FCICM[6,7]; for the ANZICS Paediatric Study Group and the Paediatric Intensive Care Audit Network

Intensive Care Med (2014) 40:1528–1535
DOI 10.1007/s00134-014-3438-x

ORIGINAL

Dashiell Gantner
KJ Farley
Michael Bailey
Sue Huckson
Peter Hicks
David Pilcher

Mortality related to after-hours discharge from intensive care in Australia and New Zealand, 2005–2012

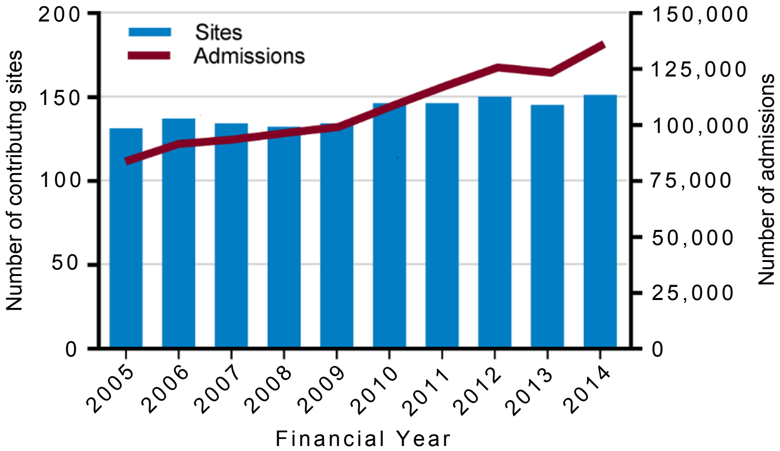
The CORE Registries

Adult Patient Database

Data from more than 1.6 million individual ICU episodes of care are held by the APD, making this one of the largest repositories of ICU patient information in the world.

Figure 1 shows the growth in admissions and contributing sites over the last 10 years.

Figure 1: Contributions to the APD



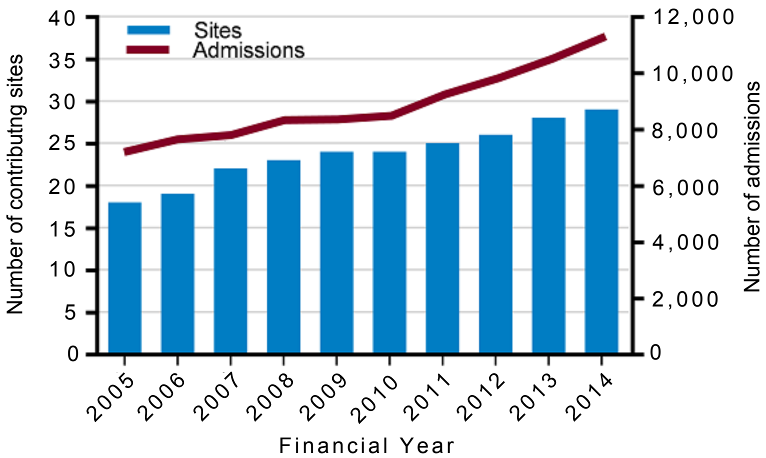
Source: APD

Australian and New Zealand Paediatric Intensive Care (ANZPIC) Registry

The ANZPIC Registry holds data from more than 143,000 paediatric admissions to intensive care.

Figure 2 shows the continued increase in annual paediatric admissions to intensive care and in the number of units submitting data to the ANZPIC Registry.

Figure 2: Contributions to the ANZPICR



Source: ANZPIC Registry

The CORE Registries

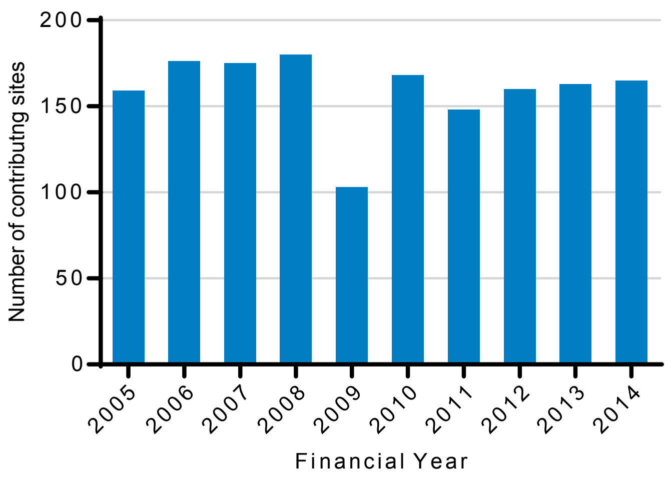
Critical Care Resources (CCR) Registry

The annual CCR Survey collects data related to workforce, resources and activity.

Figure 3 shows contributions to the CCR since 2005.

Note in 2009 a survey was undertaken to capture information related to the H1N1 pandemic which resulted in a reduction of sites contributing to CCR.

Figure 3: Contributions to the CCR Registry



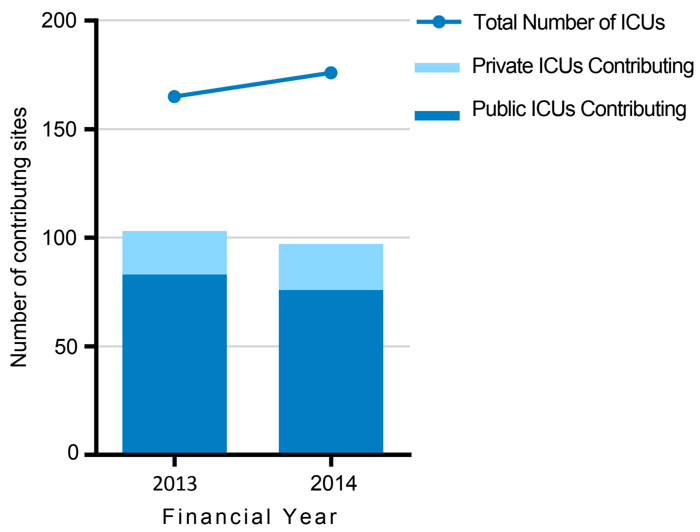
Source: CCR Registry

Central Line Associated Bloodstream Infection (CLABSI) Registry

The CLABSI Surveillance Program was launched in July 2012 as a collaboration between ANZICS and the ACSQHC to monitor the rate of CLABSI in Australian ICUs and PICUs.

Figure 4 shows contribution to the CLABSI Registry for 2012/13 and 2013/14.

Figure 4: Contributions to the CLABSI Registry



Source: CLABSI Registry

Summary of Intensive Care Activity

Who is contributing to CORE?

Of the **207** ICUs across Australia and New Zealand:

- 75.7% Australian and 56.7% New Zealand ICUs contributed to the APD
- 97.4% of all adult tertiary ICUs contributed to the APD
- 79.7% of ICUs contributed to the CCR
- 100% of PICUs and 20 mixed adult/paediatric sites contributed to the ANZPICR
- 55.7% of ICUs submitted data to the CLABSI Registry

Clinical outcomes for adult patients

- Observed hospital mortality in adult patients was 8.6% in Australia and 9.8% in New Zealand[*]
- Predicted risk of death in hospital for adult patients was estimated to be 12% (APACHE III-J mortality prediction algorithm)[*]

Clinical outcomes for paediatric patients

- The paediatric observed hospital mortality was 3.4%[#]
- The paediatric observed ICU mortality was 2.2%, compared with a predicted mortality (PIM3-anz13 mortality prediction model) of 2.3%[#]

ICU activity and resources

- **167,353** ICU admissions across 163 Australian and New Zealand ICUs (including PICUs)[^]
- **2293** adult and paediatric ICU beds across Australia and New Zealand[^]
- **8.63** ICU beds per 100,000 population in Australia
- **5.90** ICU beds per 100,000 population in New Zealand

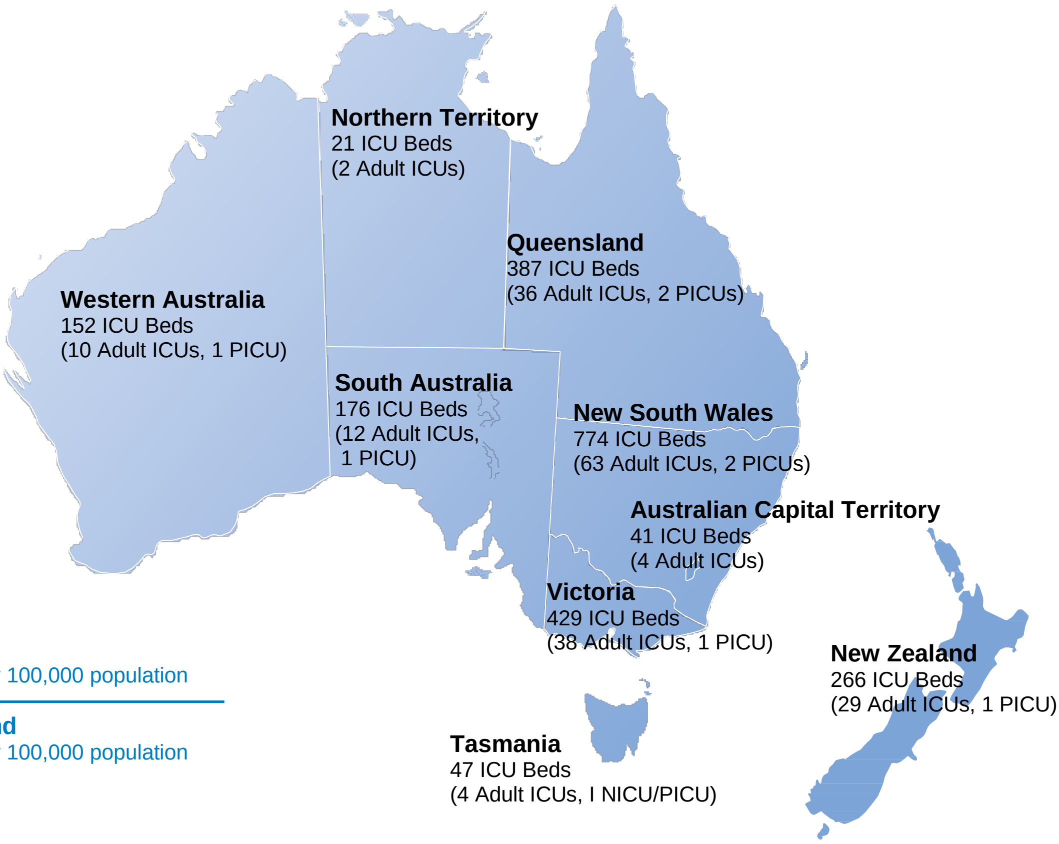
ICU staffing

- **1137** senior medical positions at 154 units were employed in a total of 699.2 FTE positions[^]
- **90.3%** of senior medical staff were Intensivists[^]
- **11,000** registered nurse positions at 160 units were employed in 8,815.3 FTE positions[^]
- **53.9%** of registered nurses at 138 units trained in critical care nursing[^]

**APD, #ANZPIC Registry, ^CCR Registry*

Profile of Intensive Care Services

Figure 5: A profile of all ICUs across Australia and New Zealand



Source: CCR Registry and follow-up of sites by phone to obtain remaining bed numbers not reported.

Population was 23,490,736 for Australia and 4,509,900 for New Zealand.

http://www.abs.gov.au/AUSSTATS/abs@.nsf/Lookup/3101.0Main+Features1Jun%202014?OpenDocument
http://www.stats.govt.nz/browse_for_stats/population/estimates_and_projections/NationalPopulationEstimates_HOTPAt30Jun14.aspx

Figure 5 shows all available ICU and PICU beds in Australia and New Zealand based on CCR data and follow up of all non-contributing sites. Non-contributing sites are predominantly smaller rural and private ICUs that admit a small number of ICU patients compared with other sites that contribute data to CORE.

Table 1 outlines the number of available beds, total admissions and occupancy rate in Australia and New Zealand for the 2013/14 reporting period based on data submitted to the APD, CCR and ANZPIC Registry.

Table 1: Bed numbers, admissions and occupancy

	Australia	New Zealand	Total
Available Beds	2,027 (n=177)	266 (n=30)	2,293 (n=207)
Total Admissions	149,690 (n=140)	17,663 (n=23)	167,353 (n=163)
Occupancy Rate	75.78% (n=129)	60.53% (n=21)	74.01% (n=150)

Source: CCR Registry, n=number of sites reporting data to CCR and non-reporting sites followed up through phone contact.

Auditing and Benchmarking ICU Outcomes

The Standard Mortality Ratio (SMR) is commonly used as a key indicator of quality and safety to monitor and benchmark ICU performance. The SMR is a ratio of the actual number of deaths divided by the predicted number of deaths at each ICU. The predicted number of deaths in adult ICUs is derived from the APACHE III-J calculation tool, whilst the ANZPIC Registry uses the PIM3 tool to calculate the paediatric SMR**.**

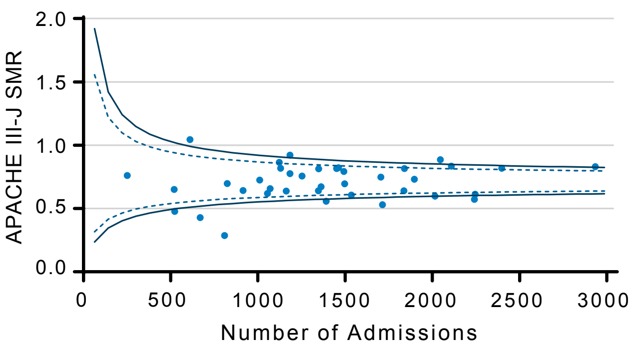
ANZICS CORE will introduce a new prediction model - ANZROD, the Australian and New Zealand Risk of Death Model, in late 2014. This model is based on APACHE III-J but has been developed using Australian and New Zealand patient data from the APD. The contributions of each element within the model have been recalibrated to ensure an SMR of 1, and some additional elements have been added. This model will be regularly recalibrated so that the SMR remains at 1 in the years to come.

Adult Intensive Care

To identify units with outcomes that are potentially significantly different to their peer group, SMRs are presented on a funnel plot. The SMR for each site is plotted against the number of admissions for that site for the reporting period. Control lines, taking the shape of a funnel, are based on the mean SMR of the group. Figure 6 shows the 2013/14 funnel plots for each APD hospital classification.

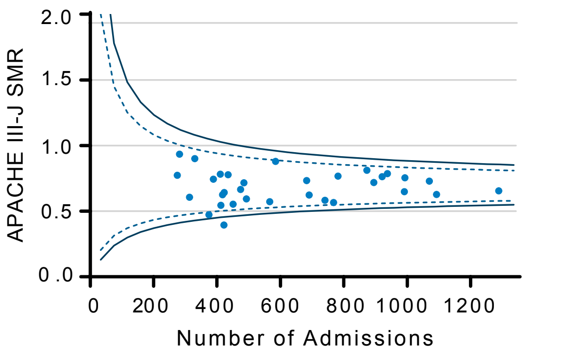
Figure 6: APACHE III-J SMR funnel plots

Tertiary Hospitals



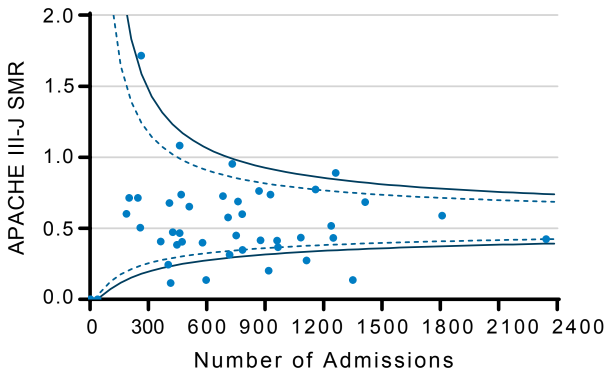
Source: APD

Metropolitan Hospitals



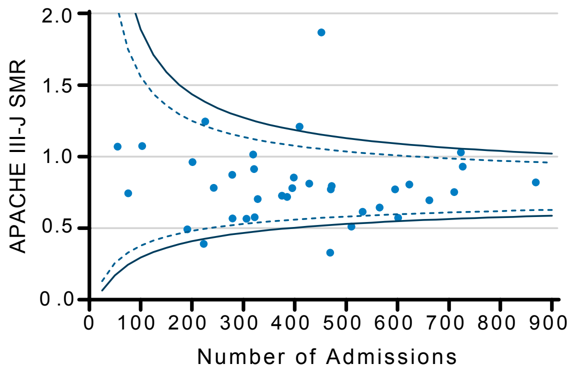
Source: APD

Private Hospitals



Source: APD

Rural Hospitals

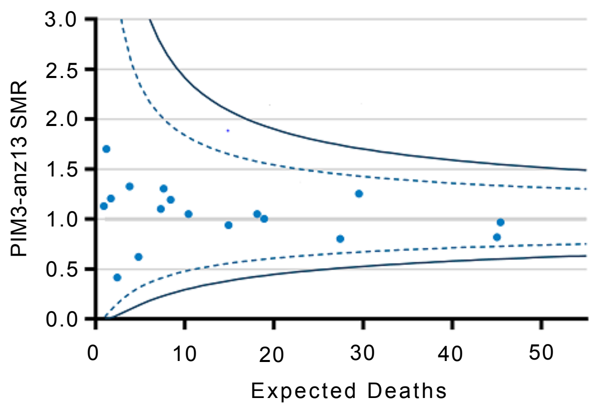


Source: APD

Auditing and Benchmarking ICU Outcomes

Paediatric Intensive Care

Figure 7: PIM3-anz13 SMR funnel plot



Source: ANZPIC Registry

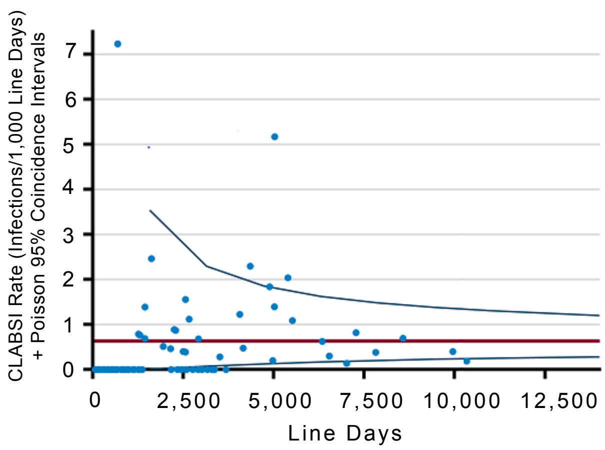
Figure 7 shows the SMR for each unit contributing to the ANZPIC Registry in 2013/14. The prediction model used was PIM3-anz13, control lines are set as ± 2 and 3 standard deviations around an SMR of 1.

Potential outliers are those sites that fall outside the control lines.

Expected deaths has been used on the x-axis to minimise the potential to identify units.

CLABSI Registry

Figure 8: CLABSI funnel plot



Source: CLABSI Registry

Figure 8 is based on data submitted for 2013/14 from 98 Australian sites showing the CLABSI rate against the number of line days.

Auditing and Benchmarking ICU Outcomes

Identifying Outliers

CORE undertakes risk-adjusted peer group comparisons of ICUs throughout Australia and New Zealand. The identification of 'Outlier' units is central in the benchmarking of ICU performance. Outliers are those sites that sit above or below the 95-99% confidence intervals on the funnel plots.

Identification of Outliers

- **Adult Patient Database** – quarterly review of 12 month risk-adjusted mortality funnel plots for each hospital peer group classification
- **Australian and New Zealand Paediatric Intensive Care Registry –** six monthly review of 12 month risk-adjusted mortality funnel plots
- The ICU director and jurisdictional/regional data review body are notified when an ICU is identified as a potential outlier and alerted that additional analysis will proceed.

Where no jurisdictional/regional data review body exists, the ANZICS regional representative and local health department will also be contacted directly.

Outlier Analysis – Data Analysis Principles

- Do data quality issues contribute to or explain the high SMR?
- Does case mix contribute to or explain the high SMR?
- Are there hospital processes or resource issues which contribute to or explain a higher SMR?

Review of Analysis

- ANZICS CORE staff prepare a report for the Outlier Working Group.
- The report is reviewed by the Outlier Working Group
- The Outlier Working Group agrees findings and finalises the report
- The report is provided simultaneously to ICU director, hospital CEO and jurisdictional/regional data review committee.

All reports are produced and provided confidentially. Further dissemination of the report is at the discretion of the hospital in question and its local governance body.

Supporting high quality data

Poor data quality often contributes to sites being identified as a potential outlier. To support submission of high quality data to the registries that is compliant and reliable CORE has a number of processes in place including:

Standardised data collection tools

- Validation checks incorporated in the AORTIC data collection software

Validation of submitted data

- Secondary validation of data submitted through the CORE enterprise database and reporting system (CERS)

Training for data collectors and clinicians

- Regular workshops and clinician seminars held around Australia and New Zealand

Data audit program

- Identify causes of variation and bias in the data collection
- Assess the inter-observer reliability of the Risk of Death calculations and disease severity scores (APACHE scores for APD and PIM scores for the ANZPIC Registry).

Critical Care Activity and Resources

This section provides an overview of key changes in activity and bed numbers as reported in the 2013/14 CCR survey and comparisons over 5 years from sites that have consistently submitted data over this period. Comparisons from year to year are complex as some units do not submit or complete a full survey each year. When making comparisons over a number of years, units with incomplete data are excluded. There may be a bias towards the larger units who are more likely to have complete data every year. As a result the percentage change from 2012/13 to 2013/14 for a single item, may differ between a 2 or 5 year selection of units. For 2013/14, 165 of 207 (80%) units submitted a survey. Bed information was obtained from all units.

Beds

2013/14 saw a 2.6% increase in available beds (data over 2 years from 204 units).

- 15 units decreased the number of available beds (total decrease 28, range 1-6 per unit)
- 39 units increased the number of available beds (total increase 85, range 1-5, median 2)
- 150 units had no change
- The overall increase was 57 beds.

Regional and hospital classification differences

- Queensland had the largest increase of 7.8% (28 beds) followed by Victoria (14 beds) and Western Australia (9 beds).
- The increase in beds was proportionally higher for tertiary and rural units.

The 5 year bed trend is shown in Figure 9.

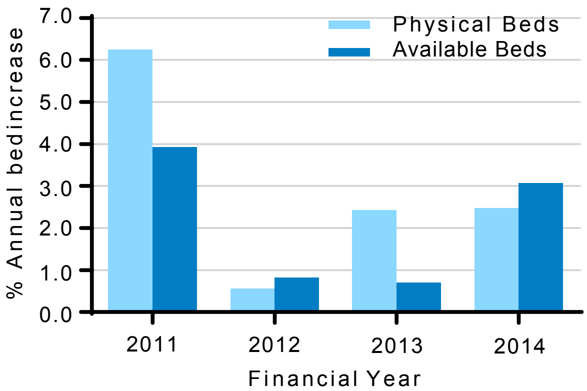
5 year summary

When bed numbers were analysed over a 5 year period in relation to admissions and patient days, there were 103 units with complete data for these measures.

In 2013/14 there was a 3.2% increase in available beds, a 6.0% increase in admissions and a 2.3% increase in patient days. The increase in admissions was out of step with the increase in patient days. However, this complements the 2.6% increase in admissions and 7.0% increase in patient days in 2010/11 (Figure 10).

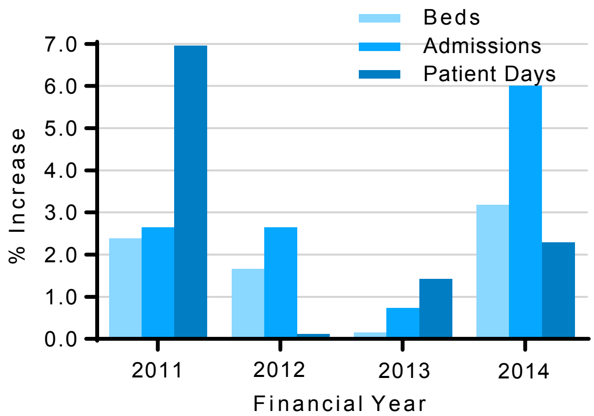
The average annual increase over 5 years has been 1.9% in available beds, 3.1% in admissions and 2.8% in patient days.

Figure 9: Physical and available beds – 5yr trend



Source: CCR Registry (n=103)

Figure 10: Available beds, admissions and patient days – 5yr trend



Source: CCR Registry (n=103)

Critical Care Activity and Resources

Admissions

There was a 7.3% increase in admissions in 2013/14 (from 148 units with data over two years). One third of units had a decrease and two thirds had an increase (range -28% to 74%). Tertiary and metropolitan units had the same percentage increase, with private units higher and rural units lower.

Analysis by jurisdictions is difficult as some jurisdictions have small numbers of units and large biases from missing data. The larger jurisdictions (NSW, VIC, QLD) had more units to review and increases of 5-8%.

Looking at changes in unit admissions over 5 years there was a 5.2%, 2.5%, -0.3% and 6.9% increase each year (based on 120 units). This averages to 3.1% but it is hard to identify why there is such variation over the past two years.

Patient Days

There was a 3.4% increase in patient days in 2013/14 (from 125 units with data over two years). This increase was predominantly in the private units (12%) and least in the tertiary units (1.9%). This increase is lower than the 7% increase in admissions. One third of units had a decrease in patient days and two thirds had an increase. The range was -23% to 85%.

Over 5 years the percent annual change has been 6.9%, 0.1%, 1.4% and 2.3% averaging 2.8% (103 units). The difference between the 3.4% change for a 1 year sample, and 2.3% change for the 5 year sample represents the bias from the higher proportion of Tertiary units in the 5 year sample.

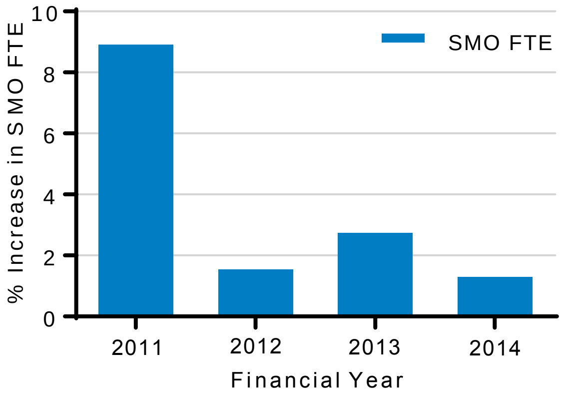
Nursing Staffing

Nursing Full Time Equivalents (FTE) over the last 5 years have increased by 7.3% (averaging 1.8% each year) which was proportional to the increase in activity in those units, so that the median RN FTE per 1000 patient days has not changed. Nursing vacancies have fallen slightly over the past three years and the vacancy rate for 2013/14 is 4.8%.

Senior Medical Officer Staffing

The Senior Medical Officer (SMO) workforce has increased over the last 5 years with a rise in the total FTE of 15.1% (averaging 3.7% each year). Figure 11 shows the % increase in SMO FTE each year (data from 103 sites over 5 years).

Figure 11: Senior Medical Officer FTE – 5yr trend



Source: CCR Registry (103 units)

The median unit SMO FTE per 1000 patient days has not changed. Most notable is the continued fall in the SMO vacancy rate from 9.2% 5 years ago to 2.8%. The actual number of vacant positions for 2013/14 was 17 FTE (at the time of the survey).

Variation in Practice

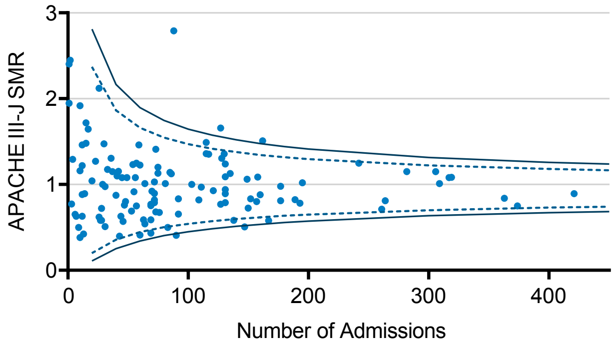
Variation in outcomes

Improvements in practice can be best achieved by identifying variation in outcomes. This variation is more prevalent for some conditions than others. The funnel plots in Figure 12 show the SMRs for four different common diagnostic groups of patients admitted to tertiary ICUs over the most recent 5 year period.

Within each diagnostic group, there are units which appear to have better or worse outcomes (i.e. are 'outside the funnels') than the majority of ICUs in Australia and New Zealand.

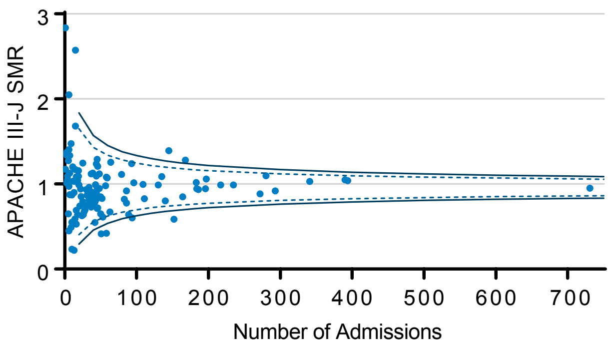
Figure 12: Mean SMR for various diagnostic groups – 5yr trend

Chronic obstructive pulmonary disease group 5 yr



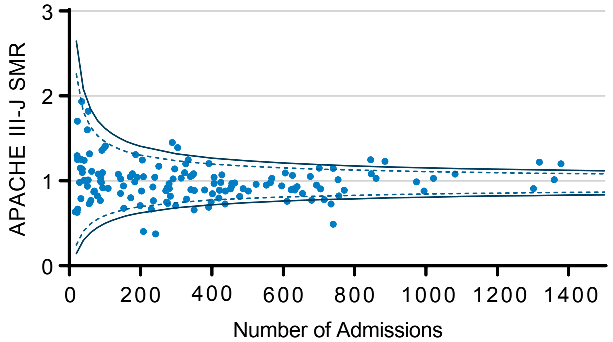
Source: APD

Stroke group 5yr



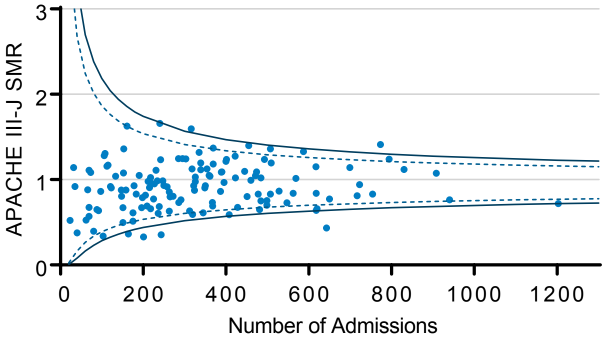
Source: APD

Infectious diseases group 5yr



Source: APD

Gastro-intestinal malignancy group 5yr



Source: APD

Variation in Practice

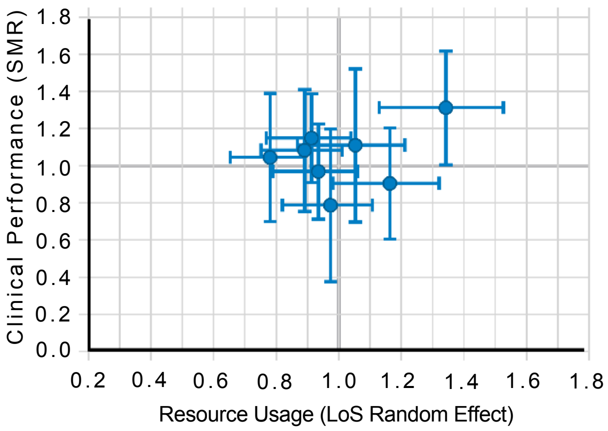
Variation in efficiency

An ICU can be considered efficient if optimum clinical outcomes are achieved with low resource use.

The modified Rapoport-Teres plot (Figure 13) uses the SMR as an indicator of clinical performance, while a risk-adjusted length of stay (LoS) model provides a marker of resource use[1]. When considered together the plot illustrates efficiency.

The quadrants of the plot can be designated as most efficient (bottom left), least efficient (top right), effective but at the expense of high resource use (bottom right), and poor performance with lower resource use (top left).

Figure 13: ANZPICR Rapoport-Teres plot of efficiency



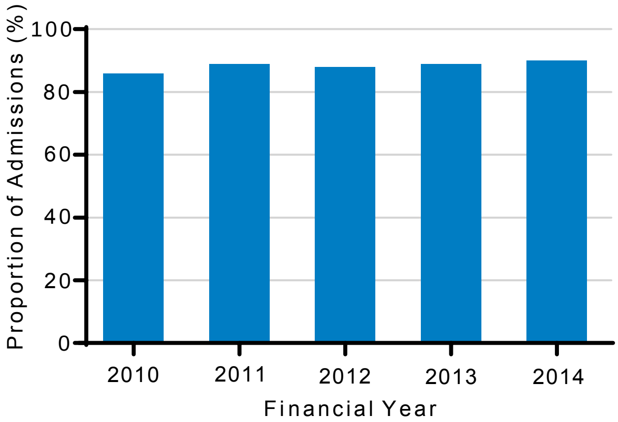
Source: ANZPIC Registry

Provision of VTE Prophylaxis

Registry data provides an opportunity to measure variation in practice and demonstrates where best practice has been sustained over time.

Although provision of VTE prophylaxis has been reported to be 58%[2] across the health sector, the rate of VTE prophylaxis in ICUs remains consistently greater than 80% (Figure 14).

Figure 14: VTE prophylaxis within 24 hours of admission



Source: APD

[1] Straney L, Clements A, Alexander J, Slater A, for the ANZICS Paediatric Study Group (2010) Measuring Efficiency in Australian and New Zealand Paediatric Intensive Care Units. Intensive Care Medicine, 36(8): 1410-1416.

[2] Runciman WB, Hunt TD, Hannaford NA, Hibbert PD, Westbrook JI, Coiera EW, et al. CareTrack: assessing the appropriateness of health care delivery in Australia. Med J Aust [Internet] 2012.

Variation in Practice

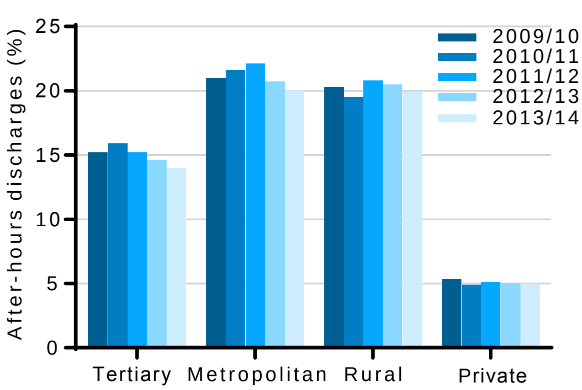
After hours discharge

There has been minimal change in rates of after-hours discharge across all hospital classifications from 2010 to 2014. The variation in after-hours discharge remains markedly different between public and private sector ICUs (Figure 15).

ICU after-hours discharge is associated with an increased risk of death.[3,4,5]

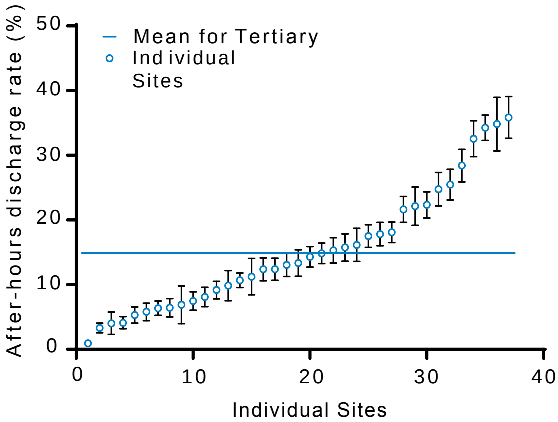
Figure 16 shows the variation of after-hours discharge across the 37 Tertiary ICUs from 0.9% to 35.9% with the mean of 14.9%.

Figure 15: Patients discharged between 6pm and 6am



Source: APD

Figure 16: Variation in after-hours discharge by tertiary sites 2013/14



Source: APD

[3] Gantner D, Farley K, Bailey M, Huckson S, Hicks P, Pilcher D. Mortality related to after-hours discharge from intensive care in Australia and New Zealand, 2005-2012. Intensive Care Med. 2014 Oct; 40(10):1528–35.

[4] Pilcher DV, Duke GJ, George C, Bailey MJ, Hart G. After-hours discharge from intensive care increases the risk of readmission and death. Anaesth Intensive Care. 2007 Aug; 35(4):477-85.

[5] Goldfrad C, Rowan K. Consequences of discharges from intensive care at night. Lancet. 2000 Apr 1; 355(9210):1138-42.

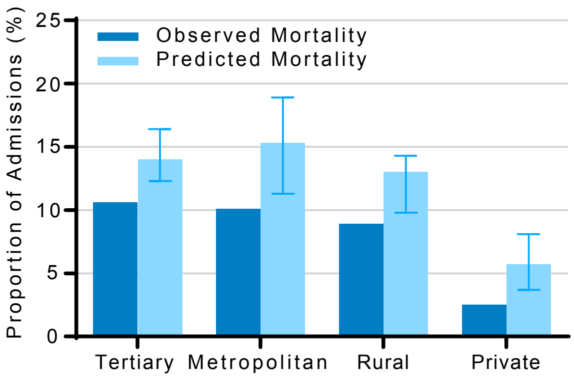
Characteristics by Hospital Classification

Adult Intensive Care Units

Observed and predicted mortality

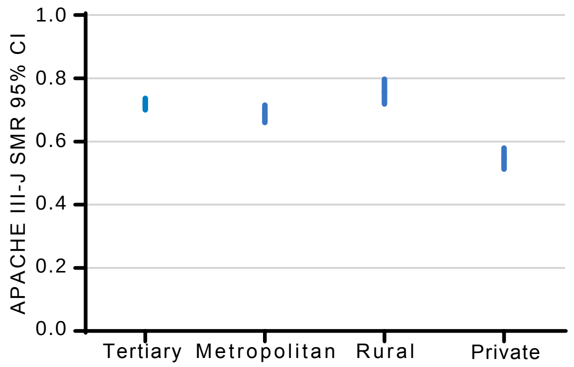
Private hospitals had the lowest observed mortality across hospital classifications (Figure 17). Private hospitals had a higher proportion of elective surgical admissions that had a planned admission to ICU, and an associated lower risk of death (Figure 18).

Figure 17: Observed and predicted hospital mortality



Source: APD

Figure 18: APACHE III-J SMR 95% confidence intervals for ICUs by hospital classification



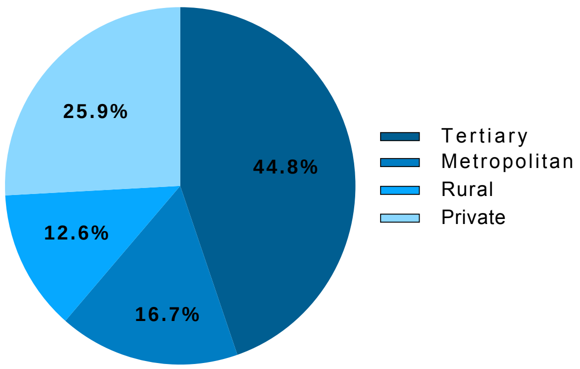
Source: APD

Admissions

The demographics and outcomes of patients admitted to adult ICUs in Australia and New Zealand are reported according to hospital classification. This allows hospitals with similar services and diagnostic case mix to be compared with peer hospitals (Figure 19).

Hospitals are classified as tertiary, metropolitan, rural/regional or private. These classifications are based on hospital location and level of care provided.

Figure 19: Admissions to adult ICUs by hospital classification



Source: APD

Characteristics by Hospital Classification

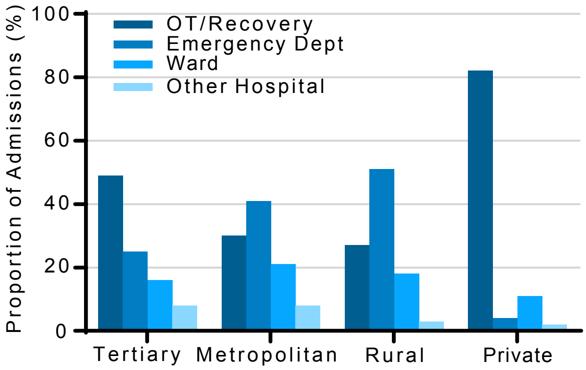
Admission source

Private ICUs had a much higher proportion of patients admitted from operating theatres or recovery - the majority were planned admissions following elective surgery.

Metropolitan and rural hospitals had the largest proportion of ICU admissions from emergency departments, followed by tertiary hospitals.

Of the public hospitals (tertiary, metropolitan and rural), tertiary hospitals had the highest proportion of ICU admissions from operating room and recovery (Figure 20).

Figure 20: Source of admission by hospital classification

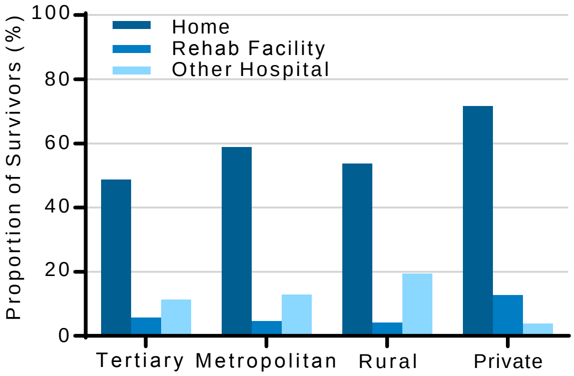


Source: APD, OT - Operating Theatre

Discharge destination

There was some variation in discharge destination between the hospital classifications, with rural hospitals tending to transfer a higher percentage of patients to other hospitals. Private ICUs had a higher percentage of patients discharged to rehabilitation facilities (Figure 21).

Figure 21: Destination on discharge from hospital following ICU admission, by hospital classification



Source: APD

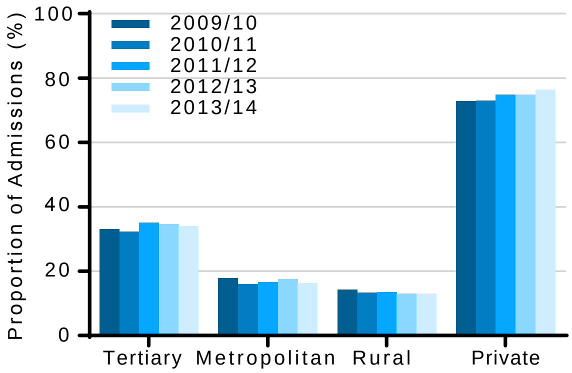
Changes Over Time

Adult admission to ICUs

Type of admissions by hospital classification

The rate of elective surgical cases admitted as planned admissions to intensive care units remains relatively unchanged, with the exception of the private sector where there has been a small but consistent increase over time (Figure 22).

Figure 22: Elective surgical planned admission by hospital classification – 5yr trend

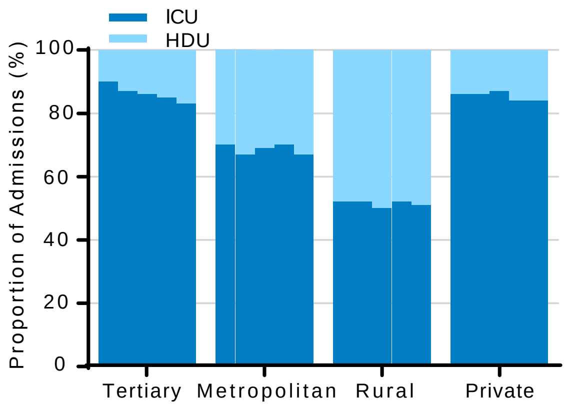


Source: APD

Comparison of ICU and HDU admissions

Tertiary ICUs have shown a steady decline in ICU admissions and a subsequent increase in HDU admissions compared to other hospital classifications. Distribution of ICU and HDU admissions has remained relatively consistent across all other hospital classifications (Figure 23).

Figure 23: Changes in care type across hospital classifications – 5yr trend



Source: APD

Ventilation

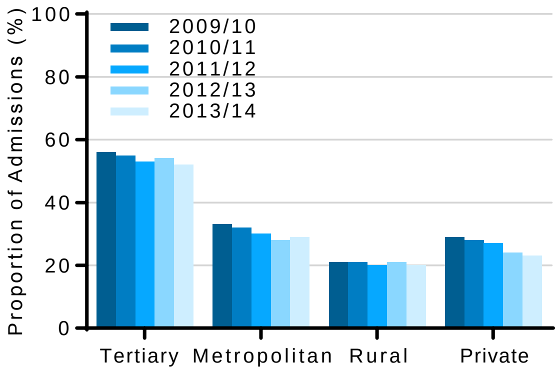
The APD considers a patient to be mechanically ventilated if the patient was invasively ventilated at the time the highest-scoring arterial blood gas was taken during the first 24 hours of ICU admission, based on the APACHE III-J scoring system.

Note that patients requiring mechanical ventilation after the first 24 hours of ICU admission are not represented in this data.

The greatest change in ventilation has occurred in the private sector, where the rate has consistently decreased from 2010 to 2014.

Figure 24 shows that more than 50% of admissions to tertiary units are ventilated, understandable based on the case mix and higher acuity of patients compared with other hospital classifications.

Figure 24: Invasive ventilation across hospital classification – 5yr trend



Source: APD

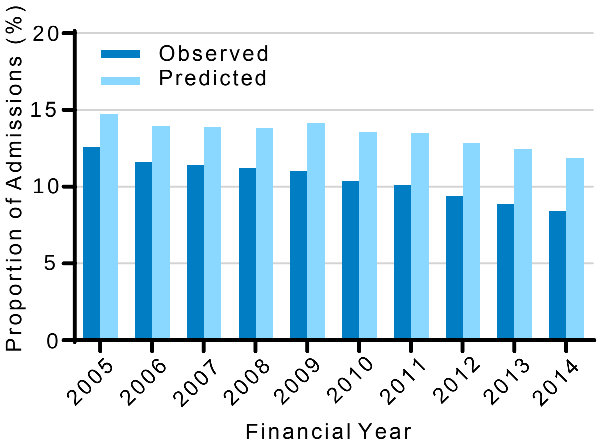
Changes Over Time

Observed and Predicted Mortality

Both observed and predicted mortality have declined over the past decade. The decline in predicted mortality has been as a result of an increase in the number of elective surgical cases, HDU cases and non-ventilated patients being admitted to ICUs.

Patients admitted in the 2013/14 period had a much higher chance of survival than patients admitted during the 2004/05 period, for the same severity of illness or APACHE score (Figure 25).

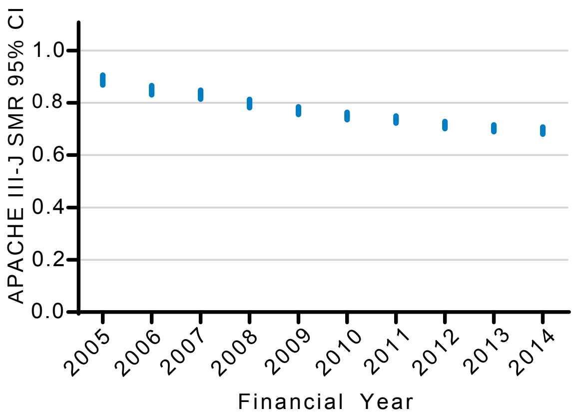
Figure 25: Observed and predicted hospital mortality – 10yr trend



Source: APD

Improvements in clinical processes, changes in case mix and increasing numbers of low risk patients are considered to have contributed to the decline in the SMR since 2004 (Figure 26).

Figure 26: APACHE III-J SMR (95% CI) – 10yr trend

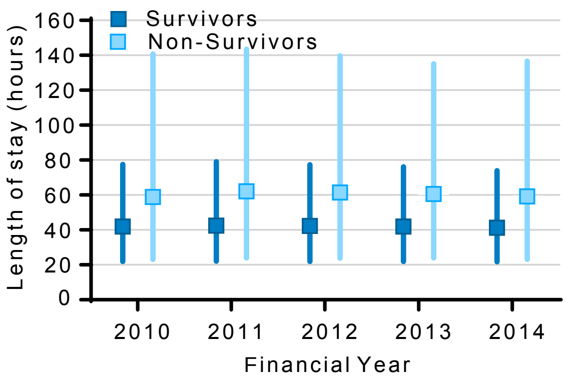


Source: APD

ICU length of stay

Despite the increase in lower acuity patients admitted across all hospital classifications, there has been no change in the ICU length of stay for survivors and non-survivors from 2010 to 2014 (Figure 27).

Figure 27: Length of stay for ICU survivors and non-survivors (median and IQR) – 5yr trend



Source: APD

Rate of Readmission

There has been minimal change in the overall rate of readmission to ICU from 2010 to 2014. Patients who require readmission to ICU have a higher mortality than other ICU admissions[6].

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[6] Renton J, Pilcher DV, Santamaria JD, Stow P, Bailey M, Hart G, et al. Factors associated with increased risk of readmission to intensive care in Australia. Intensive Care Med. 2011 Nov; 37(11):1800–8.

Changes Over Time

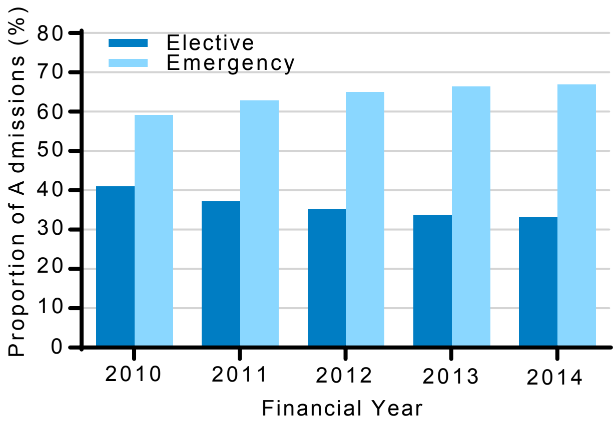
Paediatric admissions to ICUs

Elective and non-elective admissions

The rate of elective admissions continued to decrease, with a corresponding increase in emergency admissions (Figure 28).

An ANZPIC Registry admission is classed as elective when planned or foreseen. Unexpected admissions after elective surgery are not considered to be elective admissions.

Figure 28: Elective and emergency paediatric admissions to ICU – 5yr trend

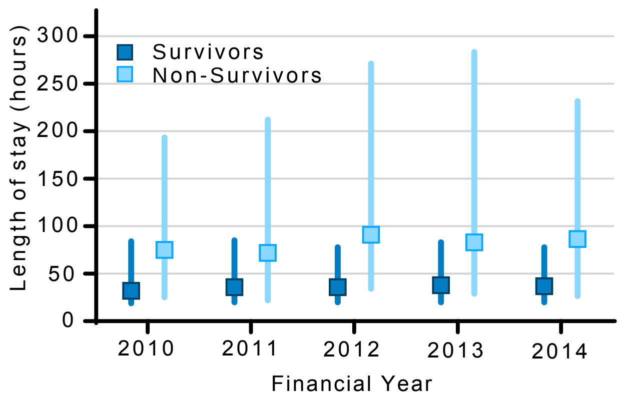


Source: ANZPIC Registry

Length of stay

Both ICU survivors and non-survivors showed minimal change in median length of stay over the 5 year period (Figure 29).

Figure 29: Paediatric ICU survivors and non-survivors length of stay (median and IQR) – 5yr trend



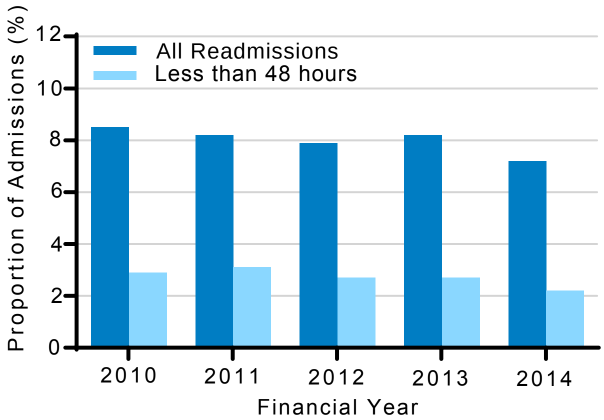
Source: ANZPIC Registry

Rate of Readmission

A slight downward trend was noted in the rate of readmission within 48 hours post-ICU discharge from 2010 to 2013 (Figure 30).

Readmissions included planned and unplanned readmissions.

Figure 30: Paediatric Readmissions to ICU – 5yr trend



Source: ANZPIC Registry

CORE Supporting Research

CORE supports a number of research projects through a formal information request process and through collaboration with a wide range of research groups and individual researchers. Requests for data are encouraged from all ANZICS members and others interested in research related to improving care and quality outcomes for intensive care medicine in Australia and New Zealand.

Providing a secure platform for researchers

ANZICS CORE established a partnership with the SAX institute to utilise the Secure Unified Researcher Environment (SURE) in 2014. SURE is Australia's only remote-access data research laboratory for analysing routinely collected health data. The SURE facility will support researchers using CORE data for major data linkage projects and projects involving large data sets to ensure data security.

Research collaborations are funded independently from the main quality assurance and benchmarking activities of CORE. Future data linkage projects to review long term outcomes are planned and will be curated within SURE.

Current Projects

Measuring change in practice

- Outcome and trends for patients with cirrhosis in ICU
- Outcomes and epidemiology of the immunosuppressed in ICU
- Trends and outcomes for cardiac arrest in Australian and New Zealand ICUs
- Changes in after-hours discharge practices from ICUs
- Outcome and trends for patients with sepsis admitted to Australian ICUs
- Glycaemic control in Australia and New Zealand before and after the NICE-SUGAR trial.

Identifying practice gaps

- Impact of hyperoxia in patients undergoing cardiac surgery
- Relationship between sodium and mortality after admission to ICU
- Effect of hospital admission time definition on Emergency Department waiting times.

Developing tools to predict ICU outcomes

- Data Linkage with the Australian and New Zealand Cardiothoracic Registry to identify risk change as a marker for cardiac surgical performance
- The effect of Body Mass Index on Outcome after ICU admission.

CORE Supporting Research

Collaborations

Data linkage project

A collaboration between CORE, the Tasmanian Department of Health and Human Services and clinicians to:

- Identify linkage possibilities with de-identified and identified data
- Analyse long-term mortality rates for Tasmanian ICU patients after hospital discharge
- Assess the role of critical illness and utility of severity of illness scores in post-hospital mortality
- Learn from the process to expedite future data linkage projects in other jurisdictions.

Clinical trials groups

CORE continues to have strong links with clinical trials groups such as The ANZIC-Research Centre at Monash University and The George Institute. CORE supports studies undertaken by these groups to provide background information for funding applications, the planning of interventional studies and facilitate the use of registry data to identify practice variation and quality care.

Publications

Requests for data to support various aspects of research is encouraged and considered important to further the body of knowledge that will lead to improved patient outcomes for critically ill patients in Australia and New Zealand.

Quality of Care Research

Kaukonen K-M, Bailey M, Suzuki S, Pilcher D, Bellomo R. Mortality related to severe sepsis and septic shock among critically ill patients in Australia and New Zealand, 2000-2012. JAMA. 2014 Apr 2;311(13):1308–16.

Schneider AG, Eastwood GM, Bellomo R, Bailey M, Lipcsey M, Pilcher D, et al. Arterial carbon dioxide tension and outcome in patients admitted to the intensive care unit after cardiac arrest. Resuscitation. 2013 Jul;84(7):927–34.

Kaukonen K-M, Bailey M, Pilcher D, Orford N, Finfer S, Bellomo R. Glycaemic control in Australia and New Zealand before and after the NICE-SUGAR trial: a translational study. Crit Care. 2013 Oct 2;17(5):R215.

Cheng AC, Woolnough E, Worth LJ, Pilcher DV. How should we interpret hospital infection statistics? Med J Aust. 2013 Dec 16;199(11):735–6.

Ihle JF, Bernard S, Bailey MJ, Pilcher DV, Smith K, Scheinkestel CD. Hyperoxia in the intensive care unit and outcome after out-of-hospital ventricular fibrillation cardiac arrest. Crit Care Resusc. 2013 Sep;15(3):186–90.

Pilcher D, Paul E, Bailey M, Huckson S. The Australian and New Zealand Risk of Death (ANZROD) model: getting mortality prediction right for intensive care units. Crit Care Resusc. 2014 Mar;16(1):3–4.

Moore EC, Pilcher DV, Bailey MJ, Stephens H, Cleland H. The Burns Evaluation and Mortality Study (BEAMS): predicting deaths in Australian and New Zealand burn patients admitted to intensive care with burns. J Trauma Acute Care Surg. 2013 Aug;75(2):298–303.

Health Services Research

Kasza J, Moran JL, Solomon PJ, ANZICS-Australian New Zealand Intensive Care Society Centre for Outcome and Resource Evaluation-CORE. Evaluating the performance of Australian and New Zealand intensive care units in 2009 and 2010. Stat Med. 2013 Sep 20;32(21):3720–36.

Hobday LK, Thorley BR, Alexander J, Aitken T, Massey PD, Cretikos M, et al. Potential for the Australian and New Zealand paediatric intensive care registry to enhance acute flaccid paralysis surveillance in Australia: a data-linkage study. BMC Infect Dis. 2013 Aug 21;13(1):384.

Registry Science Research

Solomon PJ, Moran JL, Kasza J. Identifying unusual performance in Australian and New Zealand intensive care units from 2000 to 2010. BMC Med Res Methodol. 2014 Apr 22;14(1):53.

Pilcher D, Paul E, Bailey M, Huckson S. The Australian and New Zealand Risk of Death (ANZROD) model: getting mortality prediction right for intensive care units. Crit Care Resusc. 2014 Mar;16(1):3–4.

Straney L, Clements A, Parslow RC, Pearson G, Shann F, Alexander J, et al. Paediatric index of mortality 3: an updated model for predicting mortality in pediatric intensive care*. Pediatr Crit Care Med. 2013 Sep;14(7):673–8.

Appendix 1 – Contributing Sites and Admissions

Table 2: Contributing ICUs and admissions reported to the APD

	Australia		New Zealand	
Hospital Classification	**Number of Hospitals**	**Number of ICU Admissions**	**Number of Hospitals**	**Number of ICU Admissions**
Tertiary	31	52,122	7	8,894
Metropolitan	29	20,990	3	1,846
Rural/Regional	31	15,976	5	1,246
Private	43	35,202	2	62
Total	134	124,290	17	12,048

Source: APD

Table 3: Contributing ICUs and admissions reported to the ANZPIC Registry

ICU Classification	Australian Contributing Sites	New Zealand Contributing Sites	Total Admission Numbers
PICU	7	1	9,169
NICU/PICU	1	-	
ICU	14	6	2,153
Total	22	7	11,322

Data Source: ANZPIC Registry, NICU – Neonatal Intensive Care Unit

Table 4: Contributing ICUs and admissions reported to the CCR

	Australia		New Zealand	
Hospital Classification	**Number of Hospitals**	**Number of ICU Admissions**	**Number of Hospitals**	**Number of ICU Admissions**
Tertiary	31	59,061	6	8,716
Metropolitan	23	18,778	4	2,470
Rural/Regional	33	21,546	10	5,192
Private	47	43,914	2	193
PICU	6	6,391	1	1,092
Total	140	149,690	23	17,663

Source: CCR Registry

Appendix 2 – Profile of CORE Registry Data

Table 5: Characteristics for admissions to adult ICUs from APD

	Australia	New Zealand	Australia and New Zealand
Patient Characteristics			
Total Admissions	123,564	11,974	135,538
Median Age in years	64.7 (49.9-75.2)	62.0 (45.6-73.0)	64.5 (49.6-75.0)
Male	57.5%	60.8%	57.8%
Planned Admissions after Elective Surgery	39.6%	37.9%	39.4%
Invasive Ventilation in first 24 Hours of ICU	35.7%	45.5%	36.6%
Total Ventilation (invasive and non-invasive) over ICU admission^	44.9%	49.6%	45.4%
Length of Stay in ICU in days	1.8 (0.9-3.4)	1.2 (0.8-2.7)	1.7 (0.9-3.3)
After-Hours Discharges to Ward (1800 – 0600)	13.8%	9.2%	13.4%
Readmissions	4.7%	3.5%	4.6%
Source of Admission			
Ward	15.5%	16.7%	15.7%
Operating Theatre/Recovery	51.7%	51.1%	51.7%
Emergency Department	25.7%	26.7%	25.8%
Other Hospital	6.0%	3.5%	5.8%
Severity of Illness – Scores			
Median APACHE III-J Score	44 (31-61)	46 (33-62)	45 (32-62)
Median APACHE II Score	14 (10-19)	14 (10-19)	14 (10-19)
Severity of Illness – APACHE III-J Predicted Risk of Death			
Mean Predicted Risk of Death	12.4%	12.5%	12.4%
Median Predicted Risk of Death (IQR)	3.95% (1.2-13.6)	3.90% (1.2-13.9)	3.95% (1.2-13.7)
Outcomes			
ICU Mortality	5.5%	7.3%	5.6%
Hospital Mortality	8.6%	9.8%	8.7%
APACHE III-J SMR (95% CI)	0.68 (0.67-0.70)	0.81 (0.77-0.86)	0.70 (0.68-0.71)
Survivors (admitted to hospital from home) discharged home	75.8%	73.3%	75.5%
Survivors (admitted to hospital from home) discharged to a chronic care facility	9.4%	7.2%	9.2%

Source: APD unless indicated (^) then CCR Registry.

Legend:

Readmissions are reported as the proportion of patients discharged alive from their first ICU admission who have one or more readmissions to ICU within the same hospital stay.

Please see Appendix 4 for an explanation of the scoring systems used by CORE.

Appendix 2 – Profile of CORE Registry data

Table 6: Top 5 admission diagnoses for patients admitted to adult ICUs

Australia	Number	Percentage
CABG Surgery	8,251	6.6%
Orthopaedic Surgery	5,572	4.5%
GI Surgery for Neoplasm	5,102	4.1%
Valvular Heart Surgery	4,666	3.8%
Drug Overdose	4,364	3.5%
New Zealand	**Number**	**Percentage**
CABG Surgery	1,379	11.4%
Valvular Heart Surgery	859	7.1%
Sepsis, other than urinary	394	3.3%
Drug Overdose	367	3.0%
GI Surgery for Neoplasm	353	2.9%

Source: APD

Table 7: Medical and nursing workforce in adult units

	Australia	New Zealand	Total
Total Senior Medical Officer FTE	589.4 (n=132)	100.8 (n=22)	690.2 (n=154)
Total Registrars FTE	964.9 (n=104)	103.5 (n=12)	1068.4 (n=116)
Total Registered Nurse FTE	76456 (n=136)	892 (n=23)	8537.6 (n=159)
Senior Medical Officer Vacancy	2.6% (n=100)	4.1% (n=20)	2.8% (n=120)
Registered Nurse Vacancy	5.0% (n=126)	3.1% (n=21)	4.8% (n=147)
Proportion Intensivists	95.1% (n=127)	53.8% (n=20)	89.6% (n=147)
Proportion CICM Registrars	55.1% (n=113)	32.9% (n=19)	52.9% (n=132)
Proportion Critical Care Nurses	56.1% (n=113)	46.9% (n=20)	55.2% (n=133)

Source: CCR Registry, n= number of contributing units.

Appendix 2 – Profile of CORE Registry data

Table 8: Admission characteristics for paediatric admissions

	Australia	New Zealand	Total
Patient Characteristics			
Total Admissions	9,630 (n=22)	1,692 (n=7)	11,322 (n=29)
Median Age in Months	23.4 (5.2 – 90.5)	18.7 (3.9 – 72.9)	22.7 (5.0 – 87.5)
Males	57.8%	58.0%	57.8%
Patients with Elective Admissions	34.5%	25.4%	33.2%
Ventilated in First Hour of ICU Admission	39.1%	50.5%	40.8%
Ventilated Overall	46.8%	59.1%	48.6%
Length of Stay in ICU in Days	1.6 (0.8 – 3.7)	1.3 (0.8 – 3.0)	1.5 (0.8 – 3.4)
After-Hours Discharges to Ward (18:00 – 06:00)	10.5%	5.6%	9.8%
Readmissions	7.2%	7.0%	7.2%
Severity of Illness – Predicted Risk of Death			
Mean PIM3 Predicted Risk of Death	2.1%	3.2%	2.3%
Median PIM3 Predicted Risk of Death	0.4% (0.2 – 1.6%)	0.6% (0.2 – 2.2%)	0.4% (0.2 – 1.6%)
Outcomes			
ICU Mortality	2.1%	3.0%	2.2%
Hospital Mortality	3.2%	4.4%	3.4%
PIM3-anz SMR (95% CI)	0.98 (0.87 – 1.10)	0.94 (0.72 – 1.16)	0.97 (0.87 – 1.08)

Source: ANZPIC Registry, n=number of contributing units.

***Legend**:*

All continuous values are reported as medians and interquartile range (IQR) unless stated. Categorical values are reported as proportions.

Readmissions are reported as the proportion of patients discharged alive from their first ICU admission who have one or more readmissions to ICU within the same hospital stay.

Please see Appendix 4 for an explanation of the mortality prediction scoring systems used by CORE.

Table 9: Top 5 admission diagnoses for paediatric patients

Australia	Number	Percentage
Bronchiolitis	1,143	11.9%
Seizures	470	4.9%
Pneumonia or Pneumonitis	431	4.5%
Asthma	399	4.1%
Adenoidectomy and/or Tonsillectomy	222	2.3%
New Zealand	**Number**	**Percentage**
Bronchiolitis	241	14.2%
Seizures	112	6.6%
Asthma	107	6.3%
Pneumonia or Pneumonitis	82	4.8%
Head Trauma	73	4.3%

Source: ANZPIC Registry

Appendix 2 – Profile of CORE Registry data

Table 10: Medical and nursing workforce in paediatric units

	Australia & New Zealand
Total Senior Medical Officer FTE	44.5 (n=7)
Total Registrars FTE	110.5 (n=6)
Total Registered Nurse FTE	641.5 (n=6)
Senior Medical Officer Vacancy	2.6% (n=5)
Registered Nurse Vacancy	4.9% (n=5)
Proportion Intensivists	100% (n=7)
Proportion CICM Registrars	46.2% (n=7)
Proportion Critical Care Nurses	35.1% (n=5)

Source: CCR Registry, n= number of contributing units. Australia and New Zealand data combined to avoid identification of sites.

Appendix 3 – Sites Contributing to CORE Registries

Australian Capital Territory	APD	CCR	ANZPICR	CLABSI
Calvary Hospital	✓	✓		
Calvary John James Hospital		✓		✓
Canberra Hospital	✓	✓	✓	✓
National Capital Private Hospital	✓	✓		
New South Wales	**APD**	**CCR**	**ANZPICR**	**CLABSI**
Armidale Rural Referral Hospital		✓		✓
Bankstown-Lidcombe Hospital	✓	✓		✓
Bathurst Base Hospital		✓		✓
Bega District Hospital				✓
Blacktown Hospital	✓			✓
Bowral Hospital		✓		
Broken Hill Base Hospital & Health Service				✓
Calvary Health Care Riverina		✓		✓
Calvary Mater Newcastle	✓	✓		✓
Campbelltown Hospital	✓	✓		
Canterbury Hospital		✓		✓
Coffs Harbour Health Campus	✓			✓
Concord Hospital	✓	✓		✓
Dalcross Adventist Hospital		✓		
Dubbo Base Hospital		✓		✓
Fairfield Hospital				✓
Figtree Private Hospital		✓		
Gosford Hospital	✓	✓		✓
Gosford Private Hospital	✓	✓		
Goulburn Base Hospital	✓	✓		✓
Grafton Base Hospital				
Griffith Base Hospital	✓	✓	✓	✓
Hornsby Ku-ring-gai Hospital	✓	✓		✓
John Hunter Hospital	✓	✓	✓	✓
Lake Macquarie Private Hospital		✓		
Lismore Base Hospital	✓	✓		✓
Liverpool Hospital	✓	✓		✓
Macquarie University Hospital	✓	✓		
Maitland Hospital		✓		
Manly Hospital & Community Health	✓	✓		✓
Manning Rural Referral Hospital	✓	✓		✓
Mater Private Hospital, Sydney	✓	✓		✓
Mona Vale Hospital				✓
Nepean Hospital	✓	✓		✓
Nepean Private Hospital^		✓		
Newcastle Private Hospital	✓	✓		
North Shore Private Hospital	✓	✓		
Norwest Private Hospital	✓	✓		
Orange Base Hospital		✓		✓
Port Macquarie Base Hospital	✓			✓
Prince of Wales Hospital		✓		✓

Appendix 3 – Sites Contributing to CORE Registries

New South Wales	APD	CCR	ANZPIC	CLABSI
Prince of Wales Private Hospital	✓	✓		
Royal North Shore Hospital	✓	✓		✓
Royal Prince Alfred Hospital		✓		✓
Shoalhaven Hospital	✓	✓		✓
St George Hospital	✓	✓		✓
St George Hospital (ICU 2)	✓	✓		
St George Private Hospital	✓			
St Vincent's Hospital	✓	✓		✓
St Vincent's Private Hospital	✓	✓		✓
Strathfield Private Hospital		✓		
Sutherland Hospital & Community Health Services	✓	✓		✓
Sydney Adventist Hospital	✓	✓		
Sydney Children's Hospital		✓	✓ (PICU)	✓
Tamworth Base Hospital	✓	✓	✓	✓
The Children's Hospital at Westmead		✓	✓ (PICU)	✓
Tweed Heads District Hospital	✓	✓		✓
Wagga Wagga Base Hospital	✓	✓		✓
Westmead Hospital	✓	✓		✓
Westmead Private Hospital	✓	✓		
Wollongong Hospital	✓	✓		✓
Wyong Hospital	✓	✓		
Queensland	**APD**	**CCR**	**ANZPIC**	**CLABSI**
Allamanda Private Hospital	✓	✓		
Brisbane Private Hospital	✓	✓		
Bundaberg Base Hospital	✓	✓		
Caboolture Hospital	✓	✓		
Cairns Base Hospital	✓	✓	✓	✓
Gold Coast University Hospital	✓	✓	✓	
Hervey Bay Hospital	✓	✓		
Holy Spirit Northside Hospital	✓	✓		✓
Ipswich Hospital	✓	✓		
John Flynn Private Hospital	✓	✓		
Logan Hospital	✓	✓		
Mackay Base Hospital	✓	✓	✓	
Mater Adults Hospital, Brisbane	✓	✓		
Mater Children's Hospital, Brisbane		✓	✓(PICU)	
Mater Private Hospital, Brisbane	✓	✓		
Mater Private Hospital, Townsville	✓			
Mount Isa Hospital	✓	✓		
Nambour General Hospital	✓	✓		
Noosa Hospital	✓	✓		
Pindara Private Hospital	✓			
Princess Alexandra Hospital	✓	✓		✓
Queen Elizabeth II Jubilee Hospital	✓	✓		
Redcliffe Hospital	✓	✓		
Robina Hospital	✓	✓		

Appendix 3 – Sites Contributing to CORE Registries

Queensland	APD	CCR	ANZPIC	CLABSI
Rockhampton Hospital	✓	✓	✓	✓
Royal Brisbane and Women's Hospital	✓	✓		
Royal Children's Hospital (Brisbane)			✓(PICU)	
St Andrew's Hospital, Toowoomba	✓	✓		
St Andrew's War Memorial Hospital	✓	✓		
St Vincent's Hospital, Toowoomba	✓			✓
Sunshine Coast University Private Hospital		✓		
The Prince Charles Hospital	✓	✓		
The Sunshine Coast Private Hospital	✓	✓		
The Townsville Hospital	✓	✓	✓	
The Townsville Mater Private	✓			
The Wesley Hospital	✓	✓		
Toowoomba Hospital	✓	✓		
South Australia	**APD**	**CCR**	**ANZPIC**	**CLABSI**
Ashford Community Hospital	✓	✓		
Calvary North Adelaide Hospital				✓
Calvary Wakefield Hospital	✓	✓		✓
Flinders Medical Centre	✓	✓		✓
Flinders Private Hospital	✓	✓		
Lyell McEwin Hospital	✓	✓		✓
Modbury Public Hospital	✓			
Repatriation General Hospital	✓			✓
Royal Adelaide Hospital	✓	✓		✓
St Andrew's Hospital	✓	✓		✓
The Memorial Hospital	✓	✓		
The Queen Elizabeth Hospital	✓	✓		✓
Women's and Children's Hospital			✓(PICU)	✓
Victoria	**APD**	**CCR**	**ANZPIC**	**CLABSI**
Albury Base Hospital	✓	✓		✓
Alfred Hospital	✓	✓		✓
Austin Hospital	✓	✓		✓
Ballarat Health Services	✓	✓		✓
Bendigo Health Care Group	✓	✓		✓
Box Hill Hospital	✓			✓
Cabrini Hospital		✓		
Central Gippsland Health Service	✓	✓		
Dandenong Hospital	✓	✓		✓
Epworth Eastern Private Hospital	✓	✓		✓
Epworth Freemasons Hospital	✓	✓		✓
Epworth Hospital	✓	✓		✓
Frankston Hospital	✓	✓		✓
Geelong Hospital	✓	✓		✓
Goulburn Valley Health	✓	✓		✓
John Fawkner Hospital	✓	✓		✓
Knox Private Hospital	✓	✓		
Latrobe Regional Hospital	✓	✓		✓

Appendix 3 – Sites Contributing to CORE Registries

Victoria	APD	CCR	ANZPIC	CLABSI
Maroondah Hospital	✓	✓		✓
Melbourne Private Hospital	✓	✓		
Mildura Base Hospital	✓	✓	✓	
Monash Medical Centre Clayton	✓	✓	✓	✓
Northeast Health Wangaratta	✓	✓		✓
Peninsula Private	✓	✓		
Peter MacCallum Cancer Institute^	✓	✓		✓
Royal Children's Hospital (Melbourne)		✓	✓(PICU)	✓
Royal Melbourne Hospital	✓	✓		✓
South West Healthcare, Warrnambool	✓	✓		✓
St John of God Hospital, Ballarat				✓
St John of God Hospital, Bendigo	✓	✓		✓
St John Of God Hospital, Geelong	✓	✓		✓
St Vincent's Hospital	✓	✓		✓
St Vincent's Mercy Private		✓		✓
The Northern Hospital	✓			✓
The Valley Private Hospital	✓			
Warringal Private Hospital	✓	✓		
Western District Health Service	✓	✓		
Western Hospital	✓			✓
Wimmera Health Care Group	✓	✓		
Western Australia	**APD**	**CCR**	**ANZPIC**	**CLABSI**
Armadale Health Service	✓			
Fremantle Hospital	✓	✓		✓
Joondalup Health Campus	✓	✓		✓
Mount Hospital	✓	✓		
Princess Margaret Hospital for Children		✓	✓(PICU)	
Rockingham General Hospital	✓			✓
Royal Perth Hospital	✓	✓		✓
Sir Charles Gairdner Hospital	✓	✓		✓
St John of God Hospital, Murdoch				✓
St John of God Hospital, Subiaco^	✓	✓		✓
Northern Territory	**APD**	**CCR**	**ANZPIC**	**CLABSI**
Alice Springs Hospital	✓	✓	✓	
Royal Darwin Hospital	✓	✓	✓	✓
Tasmania	**APD**	**CCR**	**ANZPIC**	**CLABSI**
Calvary Hospital, Lenah Valley		✓		
Launceston General Hospital	✓	✓	✓	
North West Regional Hospital		✓		
Royal Hobart Hospital	✓			
Royal Hobart NICU/PICU		✓	✓	

Appendix 3 – Sites Contributing to CORE Registries

New Zealand	APD	CCR	ANZPIC	CLABSI *
Auckland City Hospital – DCCM ICU	✓			
Auckland City Hospital - CV ICU	✓	✓		
Christchurch Hospital	✓	✓	✓	
Dunedin Hospital	✓	✓		
Greymouth Hospital		✓		
Hawkes Bay Hospital	✓	✓		
Hutt Hospital^	✓	✓		
Middlemore Hospital	✓	✓	✓	
Nelson Hospital	✓	✓		
North Shore Hospital		✓		
Palmerston North Hospital		✓		
Rotorua Hospital^	✓	✓		
Southern Cross Hospital, Hamilton	✓	✓		
Southern Cross Hospital, Wellington	✓			
Southland Hospital		✓		
Starship Children's Hospital		✓	✓(PICU)	
Taranaki Base Hospital	✓	✓	✓	
Tauranga Hospital	✓	✓	✓	
Timaru Hospital	✓	✓		
Waikato Hospital	✓	✓	✓	
Wairau Hospital		✓		
Wakefield Hospital		✓		
Wanganui Hospital		✓		
Wellington Hospital	✓	✓		
Whakatane Hospital		✓		
Whangarei Hospital	✓	✓	✓	

**NZ sites had not been recruited to the CLABSI Registry in 2013/14*

^Hutt Hospital ICU and Peter MacCallum Cancer Institute ICU contributed to the APD in 2013/14, however have been excluded from the analysis as data was not available at the time of reporting. Nepean Private ICU & Rotorua ICU contributed to the CCR Registry for the first time in 2013/14, however have been excluded from the analysis as data submitted was incomplete. St John of God Subiaco ICU and Peter MacCallum Cancer Institute were excluded from the analysis as data was submitted to the CCR Registry post-closing date.

Appendix 4 – Scoring Systems

Prognostic models are used to provide case mix-adjusted analysis for comparison between units and as a foundation for research into therapeutic efforts and the economics of care in the ICU. During 2013/14, the APD reported on APACHE II and APACHE III-J prognostic systems. The ANZPIC Registry reports on PIM3. While an estimated APACHE or PIM3 probability of death is calculated for each patient, the aim of APACHE/PIM3 is to estimate the expected mortality for a population (or unit) overall.

All readmission episodes to ICU are excluded from calculation of predicted mortality, observed mortality (ICU and hospital) and Standardised Mortality Ratio (SMR).

APACHE II (2nd revision)

The APACHE II predicted risk of death is calculated using the worst physiological values in the first 24 hours of ICU admission, age, type of admission (planned/unplanned), chronic health status prior to hospital admission, ICU source of admission and diagnostic reason for ICU admission. The exclusion criteria for the APACHE II reports include:

- Length of stay < 8 hours
- Age < 16 years
- Unknown hospital outcome
- Missing or non-valid APACHE II diagnostic codes
- 12 physiological variables required for the APACHE II score calculation are all missing

APACHE III-J (3rd revision, 10th recalibration)

The APACHE III-J predicted risk of death is calculated using the worst physiological values in the first 24 hours, age, pre-ICU length of stay, type of admission (planned/unplanned), chronic health status prior to hospital admission, ICU source of admission and a more specific diagnostic reason for ICU admission (as compared to APACHE II). APACHE III-J takes into account whether Acute Myocardial Infarction (AMI)/heart attack patients have received thrombolytic therapy and also includes cardiac patients, taking into account whether these patients have received multiple grafts. The exclusion criteria for the APACHE III-J reports include:

- Length of stay < 4 hours
- Age < 16 years
- Unknown hospital outcome
- Missing or non-valid APACHE III diagnostic codes
- 16 physiological variables required for the APACHE III-J score calculation are all missing

Paediatric Index of Mortality 3 (PIM3-anz13)

PIM3 is an internationally recognised mortality prediction model for children in intensive care. Data for PIM3 are collected within the first hour of admission, which avoids potential bias from the effects of treatment after admission. The PIM3 model is based on the combined effect of risk factors collected at the time of admission to intensive care. PIM3 is an updated model, developed within ANZ, using a contemporary dataset (2010 & 2011). This dataset comprised more than 53,000 paediatric admissions. The availability of these more recent data, together with reclassification of diagnostic information, and modelling systolic blood pressure as a quadratic, provides better estimates of mortality risk among children admitted to intensive care. The development of the new PIM3 model represents an important collaboration between the ANZPIC Registry and PICANet in the UK and was published in the Pediatric Critical Care Medicine journal in 2013. This annual report is using an ANZ regional calibration of the PIM3 published model, denoted as PIM3-anz13.

Abbreviations

ACSQHC	Australian Commission on Safety and Quality in Health Care
AFP	Acute Flaccid Paralysis
AMI	Acute Myocardial Infarction
ANZICS	Australian and New Zealand Intensive Care Society
ANZIC-RC	Australian and New Zealand Intensive Care Research Centre
ANZPIC	Australian and New Zealand Paediatric Intensive Care
ANZROD	Australian and New Zealand Risk of Death
APACHE	Acute Physiological, Age and Chronic Health Evaluation
APD	Adult Patient Database
CABG	Coronary Artery Bypass Graft
CCR	Critical Care Resources Registry
CERS	CORE Enterprise Reporting System
CI	Confidence Interval
CICM	College of Intensive Care Medicine
CORE	Centre for Outcome and Resource Evaluation
CTG	Clinical Trials Group
FTE	Full Time Equivalent
GI	Gastrointestinal
ICU	Intensive Care Unit
IQR	Interquartile Range
NICU	Neonatal Intensive Care Unit
NICRSC	National Intensive Care Registry Steering Committee
OT	Operating Theatre
PICANet	Paediatric Intensive Care Audit Network
PICU	Paediatric Intensive Care Unit
PIM	Paediatric Index of Mortality
SMR	Standardised Mortality Ratio
VTE	Venous Thromboembolism

Glossary

After-Hours Discharge	Discharge of a patient from ICU between 1800 and 0600.
Available beds	A bed with advanced life support capability that is fully staffed and funded.
Chronic Care Facility	A facility that provides rehabilitative, restorative, and/or ongoing skilled nursing care to patients or residents in need of assistance with activities of daily living. Long-term care facilities include nursing homes, rehabilitation facilities, inpatient behavioural health facilities, and long-term chronic care hospitals.
Critical Care Nurse	A nurse who has completed a post-registration critical care qualification.
Elective Admission	A planned admission to ICU following elective surgery.
Emergency Admission	An unplanned admission to ICU. An admission to the ICU for urgent care or treatment.
Full Time Equivalent	The number of paid hours expressed as a ratio of the agreed hours for a full time employee (> 35 hours per week of paid employment, worked at an individual site).
Hospital Mortality	Proportion of patients with an ICU admission that died in the same hospital admission.
ICU Mortality	Proportion of patients that died in ICU.
Intensivist	Medical practitioners who have completed the CICM certification and training program and attained CICM Fellowship.
Occupancy	The number of patient bed days divided by the number of available beds divided by the number of days in a year.
Observed Mortality	Proportion of patients who died in hospital following a stay in ICU and only includes admissions that meet the criteria for an SMR. *Note: SMR exclusions differ depending on the predictive model being used.*
Predicted Mortality	Proportion of patients predicted (by a disease severity model) to die in hospital following a stay in ICU and only includes patients that meet the criteria for an SMR. *Note: SMR exclusions differ depending on the predictive model being used.*
Readmission	A readmitted ICU patient is a patient who survived ICU and has had at least one readmission, excluding direct transfers to or from ICU/HDU. Readmission includes all readmissions; it is not equivalent to the ACHS indicator ≤ 72 hours.
Registered Nurse	Australia: A nurse who is on the register maintained by the State of Territory nurses board or nursing council to practise nursing in that state or territory. New Zealand: A registered nurse is defined by the Nurses Act 1977 as a nurse whose name is recorded on one of the registers of Nurses.
Registrar	A medical practitioner appointed to a specialist training position.
Senior Medical Officer	A medical practitioner employed or working in a role as a specialist.
Standardised Mortality Ratio	The SMR presents the number of deaths that occur as a proportion of the number of deaths that might be expected based on a disease severity model such as APACHE III-J or PIM3, which aims to take into account confounding factors such as disease severity and age. 'Expected deaths' therefore reflects outcomes that have been achieved internationally across hospitals seen to be delivering best practice treatment. An SMR below 1 represents a lower than expected mortality rate.
Ventilated	Patients provided with continuous support via oral/nasal intubation or tracheostomy by means of a mechanical device that augments or replaces respiratory effort.
VTE Prophylaxis	The administration of pharmacological or non-pharmacological treatment to prevent the formation of a venous thrombo-embolus.

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