



ANZICS Submission to the Consultation Paper on the Pricing Framework for Australian Public Hospital Services 2024–25

The Australian and New Zealand Intensive Care
Society (ANZICS)

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Context

Currently, IHACPA includes an ICU adjustment in the National Efficient Price (NEP) based on the following criteria: a minimum of 24,000 hours of ICU activity with 20% of that inclusive of mechanical ventilation.

With the present consultation, “IHACPA will review the ICU adjustment including the eligibility criteria to be listed as a specified ICU, the underlying drivers of cost variation across different types of ICUs, the materiality of the variation and whether it is unavoidable.”

Overview

In the following document, ANZICS aims to:

1. Identify potential issues related to the present ICU adjustment model
2. Provide information about potential sources of data to inform future criteria
3. Provide provisional examples of the numbers and types of ICUs which might meet potential future criteria

Executive Summary

ANZICS utilises key information sources to gain insights into ICUs in Australia and New Zealand, including:

- ANZICS Adult Patient Database: A comprehensive repository with over 3.5 million patient episodes, providing ICU performance assessments and reports to units and health departments.
- ANZICS Critical Care Resources (CCR) survey: An annual survey that collects data on critical care resources, aiding in planning and research.
- Australian and New Zealand Paediatric Intensive Care Registry (ANZPICR): Collects data from specialised PICUs and selected general ICUs, contributing to pediatric ICU care and research.
- Critical Health Resources Information System (CHRIS): Provides daily updates on ICU patient numbers, resource requirements, and COVID-19 cases for efficient resource allocation.

ANZICS proposes initiatives to enhance funding decisions for ICUs, which include:

- Joint analysis with IHACPA of ICU data
- Exploration of additional eligibility criteria parameters
- Regular refinement dialogues

Currently, ICU adjustments are limited to mechanical ventilation and admission volumes. ANZICS suggests considering additional measures to better align eligibility criteria with ICU complexities and cost structures, such as:

- Renal Replacement Therapy
- Use of Vasoactive Medications
- Extracorporeal Membrane Oxygenation

Accurately capturing costs in smaller rural and remote ICUs, as well as the provision of care outside the ICU, is crucial.

Collaboration between ANZICS and IHACPA can optimise resource allocation and enhance the quality of care in ICUs, resulting in tangible benefits for patient outcomes

Background information

Relevant observations about Intensive Care practice from data available to ANZICS

Using our clinical registries, we have looked at the number of ICUs in Australia reporting to ANZICS which meet specific criteria in 2018/19 and 2021/22. Tables 1, 2 and 3.

- Previous work undertaken by ANZICS to measure ICU costs within Australia, using a ‘top-down’ approach, indicated that the mean cost per patient bed-day was \$4375 in 2013/14. This was similar to costs estimated by IHPA. The ANZICS study also suggested that daily costs were higher in smaller ICUs with lower occupancy, such as rural/regional ICUs, compared to larger tertiary ICUs. (Hicks, P. *et al.* (2019) ‘The financial cost of intensive care in Australia: A multicentre registry study’, *Medical Journal of Australia*, 211(7), pp. 324–325. doi:10.5694/mja2.50309.)
- In keeping with best clinical practice, there has been a decrease in the use and duration of invasive mechanical ventilation. At the same time, there has been an increase in the use of non-invasive ventilation, renal replacement therapy and ECMO. These are resource-intensive therapies which can only be delivered in an ICU.
- With reference to Tables 1 and 2, in the 2018/19 period, there were 169 Intensive Care Units (ICUs) in Australia that reported to the Australian and New Zealand Intensive Care Society (ANZICS). Of these, 140 (82.8%) were ICUs that had operational hours greater than 24,000 in the year. This data demonstrates that most ICUs operated for more than 24,000 hours regardless of location or nature in 2018/19.
- In the 2021/22 period, 178 Intensive Care Units (ICUs) in Australia reported to the Australian and New Zealand Intensive Care Society (ANZICS). Among these, 148 ICUs (83.1%) had operational hours greater than 24,000 in that year. This data indicates that similar to the 2018/19 period, most ICUs, regardless of their location or category, operated for more than 24,000 hours in the year 2021/22. Notably, there was a significant increase in the proportion of metropolitan ICUs operating for more than 24,000 hours, from 90.6% in 2018/19 to 97.0% in 2021/22.

- The total number of ICUs in Australia reporting to ANZICS increased from 169 in 2018/19 to 178 in 2021/22, indicating a growth in the number of intensive care facilities and the proportion of units submitting data over the years.
- The proportion of ICUs with more than 24,000 hours of operation and over 20% of those hours on ventilators significantly increased from 31.0% in 2018/19 to 38.6% in 2021/22.
- The data suggests that the percentage of ICUs with over 24,000 hours and more than 20% of patients ventilated also increased from 52.7% in 2018/19 to 59.6% in 2021/22.
- The data suggest a higher prevalence of ventilator usage in Metropolitan and Tertiary ICUs compared to Rural/Regional and Private ICUs.
- The percentage of ICUs with over 24,000 hours and more than 20% of patients undergoing ventilation, non-invasive ventilation (NIV), renal replacement therapy (RRT), extracorporeal membrane oxygenation (ECMO), or receiving vasoactive agents also increased over the years.
- All Metropolitan and Tertiary ICUs reported over 24,000 hours and more than 20% of patients undergoing ventilation, NIV, RRT, ECMO, or receiving vasoactive agents in 2021/22.
- If applied to ANZICS data from hospitals reporting in 2021/22, the present IHACPA criteria would result in fewer hospitals being eligible for the ICU adjustment despite an increase in demand for ICU services overall. (Table 3). In detail, 79 ICUs (74%) meet the criteria of having more than 24,000 hours and more than 20% of hours ventilated based on IHACPA data, while 58 ICUs (57.4%) meet the same criteria according to ANZICS data.

Advantages and limitations of ventilator hours

Ventilator hours as a measure in ICU can be informative as it directly correlates with the intensity of patient care. Patients on ventilators require more resources, including personnel time, equipment, and supplies, which can significantly increase the cost of care. Therefore, the use of ventilator hours can provide a basis for allocating resources and adjusting for variations in patient complexity within a funding model. However, it is important to

acknowledge potential limitations associated with using ventilator hours as a primary measure:

1. **Variability in Practice:** Different ICUs may have variations in their practice regarding the use of non-invasive ventilation prior to decision to intubate or extubate a patient. Relying solely on (invasive) ventilator hours may not account for these differences and could lead to misleading comparisons.
2. **Patient Complexity:** Using ventilator hours does not fully capture the complexity and acuity of the patient's condition. An increasing number of patients are being managed in intensive care units without ventilators. Many of these non-mechanically ventilated patients have similar or sometimes greater care needs than an otherwise straightforward invasively ventilated patient and often require more nursing supervision.
3. **Incentive:** There is a risk that using ventilator hours as the main criterion could inadvertently incentivise longer ventilation times, which may not always align with optimal patient care.
4. **Non-Ventilated ICU Care:** Other intensive forms of care provided in the ICU, such as extracorporeal membrane oxygenation (ECMO), renal replacement therapy (RRT), complex inhalational therapy (e.g. inhaled nitric oxide or prostacyclin), or vasoactive medication can significantly impact patient outcomes and resource utilisation.

Considering these limitations, it is essential to use a comprehensive approach that takes into account various factors, including patient acuity, complexity, and the range of intensive care interventions provided, to ensure accurate assessments and comparisons among ICUs.

Overall, while ventilator hours can be a useful measure, it might be beneficial to consider it in conjunction with other criteria to more accurately represent the broad spectrum of care delivered in ICUs. These could include measures such as ICU length of stay, patient acuity scores, or specific high-cost, high-intensity interventions such as those mentioned above.

Furthermore, relying solely on mechanical ventilation as a patient-level measure does not capture the costs associated with ICU services that manage patients not admitted to the ICU. These services include rapid response teams, ICU liaison, and retrieval. These components are crucial in providing critical care expertise and support outside the traditional ICU setting.

Therefore, it is important to consider the broader scope of ICU services and associated costs beyond mechanical ventilation when evaluating the overall cost and value of ICU care.

Consultation Questions

To inform the review of the ICU adjustment, what available evidence demonstrates the underlying drivers of cost variation for complex ICUs?

Determining the cost variation in complex Intensive Care Units (ICUs) is a multifaceted issue influenced by several factors. The underlying drivers of cost variation can include the following:

1. **Patient Characteristics:** Patient characteristics such as age, severity of illness, presence of comorbidities, and primary diagnosis all significantly influence the cost of care in ICUs. For example, patients with more severe conditions or multiple comorbidities generally require more resources, which can increase costs.
2. **Treatment Complexity:** The complexity of the treatments administered can considerably impact costs. For instance, the use of high-cost procedures such as mechanical ventilation, non-invasive ventilation (NIV), renal replacement therapy (RRT), extracorporeal membrane oxygenation (ECMO), or administration of vasoactive drugs can all contribute to higher ICU costs.
3. **Length of Stay:** The duration of a patient's stay in the ICU is another critical factor. More extended stays can lead to higher costs due to the continuous need for intensive care services, medical supplies, and medications.
4. **Staffing:** Staffing costs, including wages for physicians, nurses, and other healthcare professionals, also contribute to the total cost. High nurse-to-patient ratios, essential for providing high-quality ICU care, can increase staffing costs.
5. **Geographic Variation:** Geographic location can influence the costs due to regional differences in wages, cost of living, and the availability of resources.
6. **Hospital Characteristics:** Hospital characteristics such as size, teaching status, availability of specialised services, and whether the hospital is urban or rural can influence ICU costs.

7. **Technology and Equipment:** The cost and maintenance of advanced medical equipment also contribute to the overall cost of running an ICU.

Research and data analysis can help identify and quantify these cost drivers. For instance, studies that compare costs across ICUs with different patient populations, treatment modalities, or hospital characteristics can provide valuable insights. Similarly, patient-level cost data, which captures the cost of individual patient encounters, can help identify the specific treatments or patient characteristics that most strongly influence costs. Therefore, a review of the ICU adjustment could consider these factors.

To inform the review of the ICU adjustment, what additional or alternative measures, other than mechanical ventilation hours, should IHACPA consider for inclusion in the eligibility criteria for a specified ICU?

The Independent Health and Aged Care Pricing Authority (IHACPA) could consider the following criteria when setting eligibility for specific ICU adjustments:

1. **The proportion of Patients Ventilated either through mechanical ventilation or non-invasive ventilation (NIV):** The percentage of patients ventilated (either through mechanical ventilation or non-invasive ventilation (NIV)) could be an alternative or additional measure to ventilation hours. As per the data, this measure seems to vary significantly across ICUs and might better capture the complexity of care.
2. **Use of Renal Replacement Therapy (RRT):** The use of RRT, which is a therapy that replaces the normal blood-filtering function of the kidneys, could be an indicator of ICU complexity. This measure also shows variations across different types of ICUs.
3. **Use of Vasoactive Medications:** The administration of vasoactive medications, which are used to stabilise blood pressure or heart rate, could also indicate ICU complexity. The data suggests significant variation in the use of these medications across ICUs.
4. **Use of Extracorporeal Membrane Oxygenation (ECMO):** ECMO, a treatment that uses a pump to circulate blood through an artificial lung back into the bloodstream, is often used for the sickest patients and could serve as an indicator of ICU complexity.

5. **Use of other complex therapies/interventions/monitoring:**
- a) Prone positioning while mechanically ventilated
 - b) Complex blood purification, e.g. plasma exchange
 - c) Complex inhalational therapies, e.g. inhaled nitric oxide or prostacyclin
 - d) Repeated patient transfers, e.g. moving ventilated patients between the radiology suite, operating room, cardiac catheterisation laboratory etc.
 - e) Complex monitoring, e.g. continuous intracranial pressure monitoring, lumbar drains, pulmonary artery catheter monitoring
6. **Location and Type of ICU:** The data suggest differences in patient complexity and service provision between rural/regional, metropolitan, tertiary, and private ICUs. The IHACPA might consider these differences when determining eligibility for specific ICU adjustments. ANZICS proposes that all ICUs meeting jurisdictional role delineation requirements be considered for the ICU adjustment, regardless of specific ICU hours or other quantitative measures. We also suggest that the ICU adjustment should be appropriately modified to account for the complexity and case-mix of each ICU. This approach takes into account the higher marginal costs associated with providing ICU services in smaller rural and remote hospitals.

By considering jurisdictional role delineation requirements as the primary criterion for inclusion in the ICU adjustment, this approach acknowledges the importance of ensuring equitable access to funding for all ICUs, irrespective of their size or location. At the same time, by incorporating complexity and case-mix adjustments, we can accurately reflect the unique challenges and resource needs of different ICUs, promoting fair and targeted funding allocations. ANZICS believes this approach achieves the optimal balance between ensuring access to funding for all qualifying ICUs and recognising each ICU's specific characteristics and requirements. By appropriately modifying the ICU adjustment based on complexity and case mix, we can optimise resource allocation and support the delivery of high-quality ICU care across diverse healthcare settings.

It is important to note that the above measures reflect the volume and intensity of care provided in ICUs. They could be used individually or in combination to capture ICU complexity better and inform the review of the ICU adjustment. Prior to implementing any changes, the

IHACPA might decide to further investigate the relationship between these measures and ICU costs to ensure that the new eligibility criteria align with the underlying cost structures of ICUs.

Conclusion

ANZICS acknowledges the instrumental role played by the Independent Health and Aged Care Pricing Authority (IHACPA) in determining and implementing the National Efficient Price for public hospital services. We recognise that the ICU classification criteria have significant implications for hospital funding and care.

Given the substantial impact of these determinants, we at ANZICS see a unique opportunity to enhance our partnership with IHACPA. Such an initiative can facilitate the exchange of valuable insights, aiding the development of more refined, context-specific funding decisions.

1. **Joint scrutiny and interpretation of ICU Data:** ANZICS suggests collaborating with IHACPA to thoroughly analyse and interpret the ICU data collected by ANZICS. This collaborative effort will focus on identifying and understanding the factors contributing to cost differences in advanced ICUs. By jointly examining the data, we can gain valuable insights into the drivers of ICU costs and work towards developing a more comprehensive understanding of ICU funding requirements.
2. **Exploration of Additional Parameters:** ANZICS recommends exploring the inclusion of additional or alternative parameters to complement mechanical ventilation hours in the ICU classification eligibility criteria. This exploration could involve the establishment of a joint working group or the initiation of cooperative research ventures. By considering a broader range of factors, we can ensure that the ICU funding model captures the complexity and diversity of care provided by ICU services, leading to more accurate and fair funding allocations.

3. Frequent Dialogues and Feedback Sessions: ANZICS advocates for regular dialogues and feedback sessions between ANZICS and IHACPA. This ongoing communication will facilitate continuous refinement of the ICU funding model in alignment with evolving trends and new data. By maintaining an open and collaborative dialogue, we can address emerging challenges, incorporate new insights, and make necessary adjustments to the funding model to optimise patient care and resource allocation in ICUs.

By implementing these proposed steps, ANZICS aims to strengthen the partnership with IHACPA, promote knowledge sharing, and drive meaningful improvements in ICU funding and patient care.

In addition to the above, ANZICS acknowledges that certain specific data points, such as Continuous Renal Replacement Therapy (CRRT), vasoactive drugs, and non-invasive ventilation, may not be readily accessible to health departments. This could potentially limit the scope of information available for analysis and decision-making. Thus, part of our collaborative efforts could include exploring ways to improve data accessibility and transparency.

By working together, ANZICS and IHACPA can identify potential obstacles to data access and devise strategies to overcome them. This may involve streamlining data collection processes, establishing data-sharing agreements, or implementing technological solutions to facilitate data exchange. Improving data accessibility will enable a more comprehensive and robust analysis of ICU services, leading to more informed ICU classifications and funding decisions.

Appendix 1 - Current approach to determining ICU adjustment level and deduct associated costs (National Pricing Model 2022–23. Technical Specifications, March 2022)

The Technical Specifications for the National Pricing Model 2022-23, which were updated in March 2022, analyse patient-level cost data for instances in hospitals with eligible Intensive Care Units (ICUs) or Paediatric ICUs (PICUs). This data is then used to calculate an average cost per ICU hour. Eligible ICUs and PICUs are those located within hospitals that report over 24,000 ICU hours and have more than 20% of those hours attributed to the use of mechanical ventilation. The specific hospitals with eligible ICUs and/or PICUs can be found in Appendix D of the National Efficient Price Determination 2022-23. The study incorporates 94,567 separations, encompassing ICU hours and costs from institutions with qualifying ICUs/PICUs.

The cost of an ICU hour for each state/territory was determined through linear regressions. Influential observations were excluded using Difference in Fits (DFFITS) statistics. A national ICU rate of \$250 per hour was established by calculating the weighted mean of hourly ICU costs across all states.

For eligible episodes, the ICU adjustment is calculated using the estimated ICU cost per hour and the recorded total number of ICU hours. This adjustment is subtracted from the in-scope costs used for modelling the same-day payment AR-DRG, short-stay outlier, inlier, and long-stay outlier costs, along with the associated adjustments. However, this amount is added back for the ICU adjustment. Entire ICU days are also subtracted from the length of stay for each eligible episode. According to the National Efficient Price Determination 2022-23, Appendix D, 84 Intensive Care Units (ICUs) in Australia meet the criteria outlined by IHACPA. These ICUs have accumulated more than 24,000 ICU hours, with at least 20% involving ventilated patients. The distribution of these ICUs across different states and territories is as follows:

- New South Wales (NSW): 26 adult ICUs and two paediatric ICUs.
- Victoria (VIC): 16 adult ICUs and one paediatric ICU.
- Queensland (QLD): 18 adult ICUs and one paediatric ICU.
- South Australia (SA): 5 adult ICUs.

- Western Australia (WA): 7 adult ICUs and one paediatric ICU.
- Tasmania (TAS): 2 adult ICUs.
- Northern Territory (NT): 2 adult ICUs.
- Australian Capital Territory (ACT): 1 adult ICU.

Specified Intensive Care Units meeting IHACPA criteria (>24,000 ICU hours including at least 20% ventilated – extracted from Appendix D of the National Efficient Price Determination 2022-23:

NSW	Bankstown-Lidcombe Hospital
NSW	Blacktown Hospital
NSW	Calvary Mater Newcastle
NSW	Campbelltown Hospital
NSW	Children’s Hospital Westmead
NSW	Coffs Harbour Health Campus
NSW	Concord Repatriation General Hospital
NSW	Gosford Hospital
NSW	Hornsby Ku-Ring-Gai Hospital
NSW	John Hunter Hospital
NSW	Lismore Base Hospital
NSW	Liverpool Hospital
NSW	Nepean Hospital
NSW	Northern Beaches Hospital
NSW	Orange Base Hospital
NSW	Port Macquarie Base Hospital
NSW	Prince of Wales Hospital
NSW	Royal North Shore Hospital
NSW	Royal Prince Alfred Hospital
NSW	St George Hospital (NSW)
NSW	St Vincent’s Hospital (Darlinghurst)
NSW	Sydney Children’s Hospital
NSW	Tamworth Hospital
NSW	The Sutherland Hospital
NSW	The Tweed Hospital
NSW	Wagga Wagga Base Hospital
NSW	Westmead Hospital
NSW	Wollongong Hospital
Vic	Austin Health - Austin Hospital
Vic	Ballarat Health Services (Base Hospital)
Vic	Barwon Health - Geelong Hospital Campus
Vic	Bendigo Health Care Group - Bendigo Hospital
Vic	Box Hill Hospital
Vic	Dandenong Hospital

Vic	Frankston Hospital
Vic	Maroondah Hospital
Vic	Monash Medical Centre - Clayton Campus
Vic	Peter MacCallum Cancer Centre
Vic	Royal Melbourne Hospital - City Campus
Vic	St Vincent's Hospital (Melbourne) Ltd
Vic	Sunshine Hospital
Vic	The Alfred
Vic	The Northern Hospital
Vic	The Royal Children's Hospital
Vic	The Royal Women's Hospital
Vic	Western Hospital
Qld	Bundaberg Base Hospital
Qld	Caboolture Hospital
Qld	Cairns Base Hospital
Qld	Gold Coast University Hospital
Qld	Hervey Bay Hospital
Qld	Ipswich Hospital
Qld	Logan Hospital
Qld	Mackay Base Hospital
Qld	Mater Adult Hospital
Qld	Princess Alexandra Hospital
Qld	Queen Elizabeth II Jubilee Hospital
Qld	Queensland Children's Hospital
Qld	Redcliffe Hospital
Qld	Robina Hospital
Qld	Rockhampton Hospital
Qld	Royal Brisbane & Women's Hospital
Qld	Sunshine Coast Public University Hospital
Qld	The Prince Charles Hospital
Qld	Toowoomba Hospital
Qld	Townsville University Hospital
SA	Flinders Medical Centre
SA	Lyell McEwin Hospital
SA	Royal Adelaide Hospital
SA	The Queen Elizabeth Hospital
SA	Women's and Children's Hospital
WA	Armadale Kelmscott Memorial Hospital
WA	Bunbury Hospital
WA	Fiona Stanley Hospital
WA	Joondalup Health Campus
WA	Perth Children's Hospital
WA	Rockingham General Hospital
WA	Royal Perth Hospital
WA	Sir Charles Gairdner Hospital
Tas	Launceston General Hospital

Tas	Royal Hobart Hospital
NT	Alice Springs Hospital
NT	Royal Darwin Hospital
ACT	Canberra Hospital and Health Services

Table 3 provides information on the total public Intensive Care Units (ICUs) in each region and the percentage of ICUs meeting specific criteria based on IHACPA and ANZICS data for 2021/22. An interpretation of the table shows:

- ACT: There are two total public ICUs in the ACT. Of these, one ICU (50%) meets the criteria of having more than 24,000 hours and more than 20% of hours ventilated, according to IHACPA and ANZICS data.
- NSW: There are 40 total public ICUs in NSW. Based on IHACPA data, 26 ICUs (65%) meet the criteria of having more than 24,000 hours and more than 20% of hours ventilated. According to ANZICS data, 20 ICUs (52.6%) meet the same criteria.
- NT: There are two total public ICUs in NT, and both ICUs (100%) meet the criteria of having more than 24,000 hours and more than 20% of hours ventilated, according to both IHACPA and ANZICS data.
- QLD: There are 20 total public ICUs in QLD. Based on IHACPA data, 19 ICUs (95%) meet the criteria of having more than 24,000 hours and more than 20% of hours ventilated. According to ANZICS data, 16 ICUs (80%) meet the same criteria.
- SA: There are five total public ICUs in SA, and all (100%) meet the criteria of having more than 24,000 hours and more than 20% of hours ventilated, according to IHACPA data. Based on ANZICS data, three ICUs (75%) meet the same criteria.
- TAS: There are three total public ICUs in TAS. Based on IHACPA data, two ICUs (67%) meet the criteria of having more than 24,000 hours and more than 20% of hours ventilated. According to ANZICS data, two ICUs (66.7%) meet the same criteria.
- VIC: There are 28 total public ICUs in VIC. Based on IHACPA data, 17 ICUs (61%) meet the criteria of having more than 24,000 hours and more than 20% of hours ventilated. According to ANZICS data, 11 ICUs (42.3%) meet the same criteria.
- WA: There are seven total public ICUs in WA, and all (100%) meet the criteria of having more than 24,000 hours and more than 20% of hours ventilated, according to IHACPA data. Based on ANZICS data, three ICUs (50%) meet the same criteria.

Out of the total 107 public ICUs considered, 79 ICUs (74%) meet the criteria of having more than 24,000 hours and more than 20% of hours ventilated, according to IHACPA data. According to ANZICS data, 58 ICUs (57.4%) meet the same criteria. These percentages provide an overview of the proportion of ICUs meeting the specific criteria in each region based on the IHACPA and ANZICS data provided.

Appendix 2 – Background Information

The Australian and New Zealand Intensive Care Society (ANZICS)

The Australian and New Zealand Intensive Care Society (ANZICS) is a not-for-profit organisation that collaborates closely with crucial healthcare stakeholders, including regulatory bodies, government and non-government agencies, and healthcare providers. Through its committees and specialist interest groups, ANZICS supports various activities, including clinical quality registries, clinical research, and implementing health initiatives in areas with limited resources.

The ANZICS Clinical Quality Registry

The ANZICS Clinical Quality Registry (run by the ANZICS Centre for Outcomes and Resource Evaluation) has provided a peer review and quality assurance program for ICUs across Australia and New Zealand since 1992. This program serves for audit and benchmarking services and extends to regional, state, national and international jurisdictions. The data is reported back to the submitting ICUs and jurisdictional funding bodies. The primary objectives of the ICU Registries Program include providing benchmarking reports, identifying and analysing outlier ICUs, conducting data quality training workshops, and assisting researchers in identifying potential improvements in intensive care practices and patient outcomes. Presently 98% of ICUs in Australia submit data to ANZICS. Non-submitting ICUs are small rural/regional or private ICUs. All public metropolitan and tertiary hospital ICUs contribute. The collected data supports research on various Intensive Care topics, including disease patterns, critical care interventions, workforce, outcomes and planning for emerging issues like pandemics or biosecurity threats.

The following four datasets are the major sources of information collected about Australian ICUs:

1. The ANZICS Adult Patient Database

The Adult Patient Database (APD) is a comprehensive compilation of data from over 3.5 million patient episodes, establishing it as one of the world's most extensive repositories of

intensive care data. This database amasses data quarterly from over 98% of ICUs in Australia and 67% of ICUs in New Zealand. The collected data is employed to assess and compare the performance of each contributing unit. Findings are reported back to contributing ICUs and jurisdictional health departments. Reports are also made publicly accessible.

2. The ANZICS Critical Care Resources (CCR) Survey

The Critical Care Resources (CCR) Survey collects data annually pertaining to the availability and usage of critical care resources in Australia and New Zealand, such as the number of beds per ICU, staffing numbers and profiles, occupancy rates, ventilation hours and details related to ICU safety and quality indicators. The data collected is vital for clinicians and policymakers to assist in future planning and health services research. ICUs are also invited to contribute data about the costs of providing services. Approximately half the ICUs provide costing information.

3. Australian and New Zealand Paediatric Intensive Care Registry (ANZPICR)

The Australian and New Zealand Paediatric Intensive Care Registry collects data from all specialist Paediatric Intensive Care Units (PICUs) and over 20 general ICUs, which provide care for both adults and children, also contribute data. These include three units in New South Wales, two in Victoria, and one each in Queensland, South Australia, Western Australia, and Tasmania. New Zealand has a single centre, the Starship Children's Hospital in Auckland. Findings are reported back to contributing ICUs and jurisdictional health departments.

4. Critical Health Resources Information System (CHRIS)

The Critical Health Resources Information System (CHRIS) was a federally funded initiative in response to the COVID-19 pandemic. This collaboration was between the Australian Commonwealth Government, ANZICS and Ambulance Victoria. CHRIS provides daily information about the number of patients in every Australian ICU, the number requiring 1:1 ICU nursing, invasive ventilation, non-invasive ventilation, renal replacement therapy, ECMO and the number of patients within each ICU isolated for COVID-19. This gives an almost immediate view of the daily resource requirements for each ICU.

Previous estimates of the costs of ICU in Australia undertaken by ANZICS

ANZICS previously examined the financial costs of providing care in ICUs across Australia, considering variables such as bed number, unit occupancy, and type of ICU (tertiary, metropolitan, rural/regional public hospitals, or private hospitals). The data utilised for this analysis was sourced from the Australian and New Zealand Intensive Care Society (ANZICS) Centre for Outcomes and Resources Evaluation (CORE) Critical Care Resources (CCR) registry. In the 2013/2014 data analysis, 36 ICUs provided complete costing data, comprising about 25% of the total ICU beds in Australia. The finding indicated that the mean cost per patient bed-day was \$4375, with a decreasing trend in costs with an increase in ICU bed numbers and occupancy rates. The estimated total annual operational cost for ICU care in Australia was \$2119 million, accounting for approximately 0.15% of the GDP and 1.4% of total healthcare costs. Staffing costs constituted around 80% of the ICU operational costs. (Hicks, P. *et al.* (2019) 'The financial cost of intensive care in Australia: A multicentre registry study', *Medical Journal of Australia*, 211(7), pp. 324–325. doi:10.5694/mja2.50309.)

Table 1: Number of adult ICUs in Australia reporting to ANZICS which meet specific criteria in 2018/19

	Total (Public)	Rural/regional	Metropolitan	Tertiary	Private
	N=102	N=37	N=32	N=33	N=67
ICUs with >24,000 hrs	89 (87.3%)	31 (83.8%)	29 (90.6%)	29 (87.9%)	51 (76.1%)
ICUs >24K hrs & >20% hrs ventilated ^a	40 (46.0%)	6 (17.6%)	13 (50.0%)	21 (77.8%)	4 (7.3%)
ICUs >24K hrs & >20% patients ventilated	67 (65.7%)	13 (35.1%)	22 (68.8%)	32 (97.0%)	22 (32.8%)
ICUs >24K hrs & (>20% hours OR >20% patients ventilated)	68 (66.7%)	13 (35.1%)	23 (71.9%)	32 (97.0%)	22 (32.8%)
ICUs >24K hrs & >20% pts vent, NIV, RRT, ECMO, vasoactives	93 (91.2%)	29 (78.4%)	31 (96.9%)	33 (100.0%)	41 (61.2%)
ICUs >20% pts ventilated, RRT, ECMO	72 (70.6%)	16 (43.2%)	23 (71.9%)	33 (100.0%)	26 (38.8%)
ICUs >20% pts vent, NIV, RRT, ECMO or vasoactives	93 (91.2%)	29 (78.4%)	31 (96.9%)	33 (100.0%)	41 (61.2%)

a Not all ICUs provided information about hours of ventilation, so the denominators for this row are Rural/regional 35, Metropolitan 26, Tertiary 27, Private 55

Table 2: Number of adult ICUs in Australia reporting to ANZICS which meet specific criteria in 2021/22

	Total (Public)	Rural/regional	Metropolitan	Tertiary	Private
	N=107	N=41	N=33	N=33	N=71
ICUs with >24,000 hrs	96 (89.7%)	34 (82.9%)	32 (97.0%)	30 (90.9%)	52 (73.2%)
ICUs >24K hrs & >20% hrs ventilated ^a	58 (57.4%)	10 (25.6%)	20 (62.5%)	28 (93.3%)	3 (5.3%)
ICUs >24K hrs & >20% patients ventilated	80 (74.8%)	19 (46.3%)	29 (87.9%)	32 (97.0%)	26 (36.6%)
ICUs >24K hrs & (>20% hrs OR >20% patients ventilated)	84 (78.5%)	21 (51.2%)	31 (93.9%)	32 (97.0%)	26 (36.6%)
ICUs >24K hrs & >20% pts vent, NIV, RRT, ECMO, vasoactives	100 (93.5%)	34 (82.9%)	33 (100.0%)	33 (100.0%)	48 (67.6%)
ICUs >20% pts ventilated, RRT, ECMO	85 (79.4%)	21 (51.2%)	31 (93.9%)	33 (100.0%)	29 (40.8%)
ICUs >20% pts vent, NIV, RRT, ECMO or vasoactives	100 (93.5%)	34 (82.9%)	33 (100.0%)	33 (100.0%)	48 (67.6%)

a Not all ICUs provided information about hours of ventilation, so the denominators for this row are Rural/regional 39, Metropolitan 32, Tertiary 30, Private 56

Table 3: Adult public ICUs within each jurisdiction – comparison of number of ICUs meeting specific criteria

		IHACPA ^a	ANZICS 2021/22 ^b	ANZICS 2021/22 ^c	ANZICS 2021/22 ^d	ANZICS 2021/22 ^e	ANZICS 2021/22 ^f	ANZICS 2021/22 ^g	ANZICS 2021/22 ^h
	Total public ICUs	ICUs >24K hrs & >20% hrs ventilated	ICUs >24K hrs & >20% hrs ventilated	ICUs with >24,000 hrs	ICUs >24K hrs & >20% pts ventilated	ICUs >24K hrs & (>20% hrs OR >20%pts ventilated)	ICUs >24K hrs & >20% pts vent, NIV, RRT, ECMO, vasoactives	ICUs >20% pts ventilated, RRT, ECMO	ICUs >20% pts vent, NIV, RRT, ECMO or vasoactives
ACT	N=2	1 (50%)	1 (50.0%)	2 (100.0%)	2 (100.0%)	2 (100.0%)	2 (100.0%)	2 (100.0%)	2 (100.0%)
NSW	N=40	26 (65%)	20 (52.6%)	36 (90.0%)	26 (65.0%)	28 (70.0%)	39 (97.5%)	27 (67.5%)	39 (97.5%)
NT	N=2	2 (100%)	2 (100.0%)	2 (100.0%)	1 (50.0%)	2 (100.0%)	2 (100.0%)	2 (100.0%)	2 (100.0%)
QLD	N=20	19 (95%)	16 (80.0%)	18 (90.0%)	18 (90.0%)	19 (95.0%)	19 (95.0%)	19 (95.0%)	19 (95.0%)
SA	N=5	5 (100%)	3 (75.0%)	4 (80.0%)	4 (80.0%)	4 (80.0%)	5 (100.0%)	5 (100.0%)	5 (100.0%)
TAS	N=3	2 (67%)	2 (66.7%)	3 (100.0%)	2 (66.7%)	2 (66.7%)	3 (100.0%)	3 (100.0%)	3 (100.0%)
VIC	N=28	17 (61%)	11 (42.3%)	25 (89.3%)	21 (75.0%)	21 (75.0%)	23 (82.1%)	21 (75.0%)	23 (82.1%)
WA	N=7	7 (100%)	3 (50.0%)	6 (85.7%)	6 (85.7%)	6 (85.7%)	7 (100.0%)	6 (85.7%)	7 (100.0%)
Total	N=107	79 (74%)	58 (57.4%)	96 (89.7%)	80 (74.8%)	84 (78.5%)	100 (93.5%)	85 (79.4%)	100 (93.5%)

a Number of adult ICUs in each region reported by IHACPA as meeting present ICU criteria (as a proportion of total public adult ICUs reporting to ANZICS).

b Number of adult ICUs in each region meeting present IHACPA criteria for consideration as an ICU using presently available data from 2021/22

c Number of adult ICUs in each region with more than 24,000 patient hours in 2021/22

d Number of adult ICUs in each region with more than 24,000 patient hours in 2021/22 and with more than 20% of ventilated patients

e Number of adult ICUs in each region with more than 24,000 patient hours in 2021/22 and with more than 20% of ventilated patients, or >20% ventilation hours

f Number of adult ICUs in each region with more than 24,000 patient hours in 2021/22, with more than 20% of patients receiving one or more of invasive/non-invasive ventilation, renal replacement therapy, intravenous vasopressors or ECMO

g Number of adult ICUs in each region with more than 20% of patients receiving one or more of invasive ventilation, renal replacement therapy or ECMO

h Number of adult ICUs in each region with more than 20% of patients receiving one or more of invasive/non-invasive ventilation, renal replacement therapy, intravenous vasopressors or ECMO