MJA
The Medical Journal of Australia

Supporting Information

Supplementary methods, tables, and figures

This appendix was part of the submitted manuscript and has been peer reviewed.
It is posted as supplied by the authors.

Appendix to: Hicks P, Huckson S, Fenny E, et al. The financial cost of intensive care in Australia: a multicentre registry study. *Med J Aust* 2019; doi: 10.5694/mja2.50309.

Methods: supplementary details

Of the 79 ICUs that provided some information on costs, analysis was limited to the 36 that ICUs that included medical and nursing staff costs in reported total ICU expenditure. An available bed was defined as a physical bed space with equipment that is staffed and available for use every day. The cost per patient-day was calculated by dividing the total expenditure for an ICU by the total number of patient-days reported by the ICU. Costs per bed were calculated by dividing the total expenditure for an ICU by the number of reported available beds. All costs were in Australian dollars. Total national operational cost was extrapolated from the mean cost per bed for each ICU category, multiplied by the total number of beds in each ICU category, and compared with national health care costs reported by the Australian Institute of Health and Welfare.

Costs per patient bed-day in Australia were compared with those in selected other countries by firstly converting costs to international dollars using purchase price parity and secondly adjusting for inflation according to consumer price index changes for each country. The international dollar is a hypothetical currency for translating and comparing costs in different countries that applies a common reference point, the purchasing power of the US dollar in the United States.

Analyses were performed in Stata 14 (StataCorp). Data are expressed as percentages with numbers, means with standard deviations, or medians with interquartile ranges (IQRs) as appropriate, depending on the type and distribution of data. Linear regression was used to assess associations between cost and independent variables; $P < 0.05$ (2-sided) was deemed statistically significant. The Australian and New Zealand Intensive Care Society Centre for Outcome and Resources Evaluation (ANZICS CORE) Critical Care Resources Registry (CCR), is a declared quality assurance activity under the *Health Insurance (Quality Assurance Confidentiality) Amendment Act 1992*. The study was conducted and reported according to the Consolidated Health Economic Evaluation Reporting Standards (CHEERS), http://www.equator-network.org/wp-content/uploads/2013/04/Revised-CHEERS-Checklist-Oct13.pdf (viewed March 2019).

Table 1. Cost block questions from the Critical Care Resources (CCR) survey for the financial year 2013/14

Item	Amount ($)	Included in the ICU budget? (yes/no)
Total ICU budget		
Medical specialist staff		
Medical non-specialist staff		
Nursing staff		
Allied health staff		
Other staff		
Blood products		
Fluids		
Nutrition products		
Disposable equipment		
Pharmacy (drugs)		
Laboratory		
Radiology		
Blood gas analysis		
Other services		

Table 2. Characteristics of intensive care units (ICUs) contributing cost data to the ANZICS Critical Care Resources Survey, 2013/14

	All ICUs	Tertiary	Metropolitan	Rural/regional	Private	*P*
ICUs (response rate)	36 (20%)	15 (36%)	5 (15%)	12 (30%)	4 (6%)	
Available ICU beds	500	339	46	86	29	
Median (IQR)	11 (6–21)	21 (16–31)	8 (6–13)	6 (5–9)	5 (5–10)	< 0.001
ICU admissions	41 927	29 436	3739	6434	2318	
Median (IQR)	798 (512–1887)	1939 (1341–2239)	527 (463–1155)	543 (469–770)	540 (429–730)	< 0.001
Occupancy (IQR)	81% (65–89%)	86% (81–91%)	64% (63–77%)	66% (59–89%)	66% (45–99%)	0.05
Services provided						
General medical	36	15	5	12	4	
General surgical	36	15	5	12	4	
Cardiothoracic	17	14	0	0	3	
Neurosurgical	14	13	0	0	1	
Trauma	10	10	0	0	0	
Combined*	9	9	0	0	0	

IQR = interquartile range. * Services offering all five service types.

Table 3. Comparison of intensive care units (ICUs) that contributed or did not contribute survey data, financial year 2013/14

	Contributing ICUs	Non-contributing ICUs	*P*
Number of ICUs	36	148	
Available ICU beds, median (IQR)	11 (6–21)	10 (6–14)	0.18
ICU admissions, median (IQR)	798 (512–1887)	774 (483–1960)	0.18
Occupancy (IQR)	81% (65–89%)	72% (55–84%)	0.15

IQR = interquartile range.

Table 4. Estimated total national annual cost per intensive care unit (ICU) bed (Australian dollars)

Classification	ICU beds*	Mean annual cost (standard deviation)	Extrapolated total cost
Tertiary	813	922 995 (372 650)	750 394 935
Metropolitan	306	1 198 453 (269 569)	366 726 618
Rural/regional	280	1 279 072 (244 759)	358 140 160
Private	628	1 025 168 (468 336)	643 805 504
Total	*2027*		*2 119 067 217*

* Source: Australian and New Zealand Intensive Care Society Centre for Outcome and Resources Evaluation. Annual report 2013/14. Melbourne: ANZICS, 2014. https://www.anzics.com.au/wp-content/uploads/2018/08/ANZICS-CORE-Annual-Report-2013-14.pdf (viewed Apr 2019).

Table 5. National intensive care unit costs in Australia as proportion of gross domestic product (GDP) and national health care costs

	Total expenditure*	Intensive care costs	ICU costs (proportion)
Gross domestic product	$1 450 000 million	$2 119 million	0.15%
All health care expenditure (government and private)	$154 633 million	$2 119 million	1.4%
Government health expenditure (state and federal)	$104 800 million	$1 475 million	1.5%
Government public hospital expenditure (state and federal)	$45 723 million	$1 475 million	3.4%

* Source: Australian Institute of Health and Welfare. Health expenditure Australia 2013–14 (Cat. no. HWE 63; Health and welfare expenditure series no. 54). Canberra: AIHW, 2015.

Table 6. Intensive care unit (ICU) costs, by component

Cost component (number reporting)*	Proportion of total costs, median (IQR)
Total staff costs	82% (79–84%)
Senior medical staff (27)	15% (11–20%)
All medical staff (27)	26% (24–32%)
Nursing staff (26)	53% (49–57%)
Non-clinical staff (23)	2% (1–2%)
Consumables (30)	13% (8–17%)
Drugs (30)	4% (3–6%)
Laboratory (13)	3% (1–4%)
Radiology (5)	1% (1–2%)
Fluids (10)	1% (0–1%)

IQR = interquartile range.

* Thirty-six ICUs supplied data, but not all provided information for each component. The number in parentheses is the number of ICUs that provided information for each component.

Table 7. Mean intensive care costs per patient-day, by country

	International dollar	Australian dollar	US dollar	Euro	British pound
Currency conversion according to purchase price parity index, 2013					
Australia (2013/14)	3373	4375*	4716	3693	4716
France (1999)	1188	1102	1445	1132*	1332
Germany (2003)	917	850	1117	874*	1030
United Kingdom (2003)	3070	3351	3070	2624	2228*
United States (2005–2010)	4527	4880	4527*	3545	3351
Currency conversions according to exchange rates, 2013					
Australia (2013/14)	3373	4375*	3373	3214	2448
France (1999)	1188	1540	1188	1132*	862
Germany (2003)	917	1189	917	874*	665
United Kingdom (2003)	3070	3982	3070	2925	2228*
United States (2005–2010)	4527	5872	4527*	4313	3286

* Original source estimates. Sources:

France: Negrini D, Sheppard L, Mills GH, et al. International Programme for Resource Use in Critical Care (IPOC): a methodology and initial results of cost and provision in four European countries. Acta Anaesthesiol Scand 2006; 50: 72-79.

Germany: Moerer O, Plock E, Mgbor U, et al. A German national prevalence study on the cost of intensive care: an evaluation from 51 intensive care units. Crit Care 2007; 11: R69.

United Kingdom: Ridley S, Morris S. Cost effectiveness of adult intensive care in the UK. Anaesthesia 2007; 62 547-554.

United States: Halpern NA, Pastores SM. Critical care medicine in the United States 2000–2005: an analysis of bed numbers, occupancy rates, payer mix, and costs. Crit Care Med 2010; 38: 65-71.

Figure 1. Annual cost per intensive care unit (ICU) bed, by number of available ICU beds (36 ICUs)

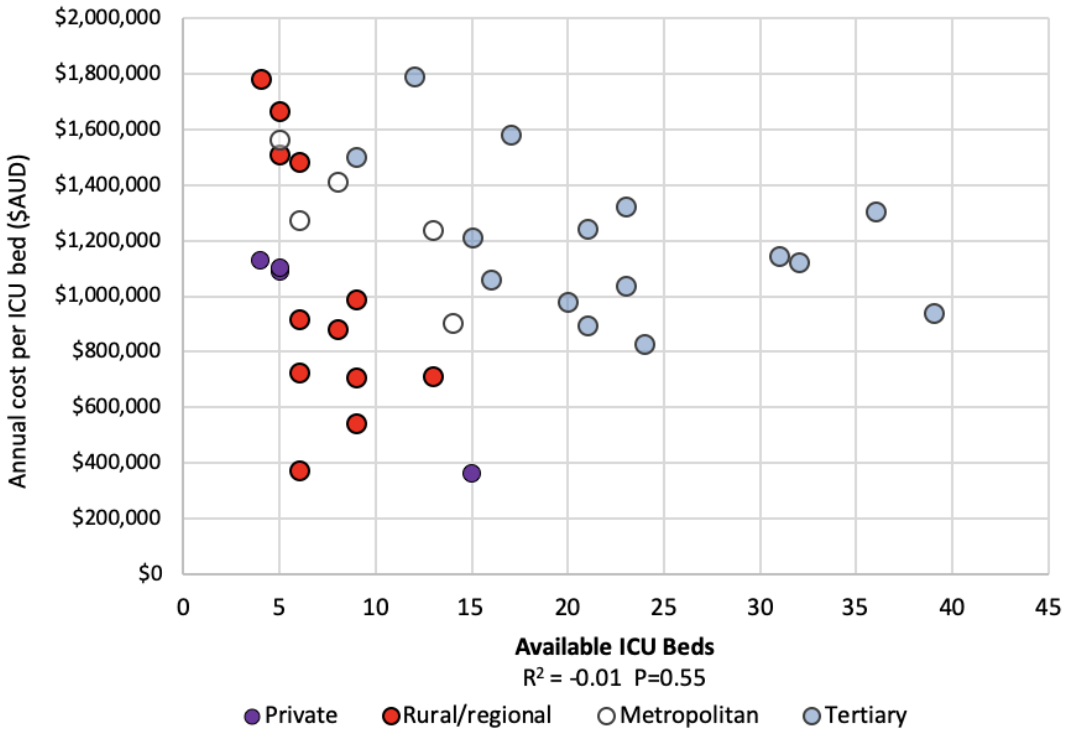

Figure 2. Intensive care unit (ICU) medical staffing costs per patient-day, by number of available ICU beds (32 ICUs)

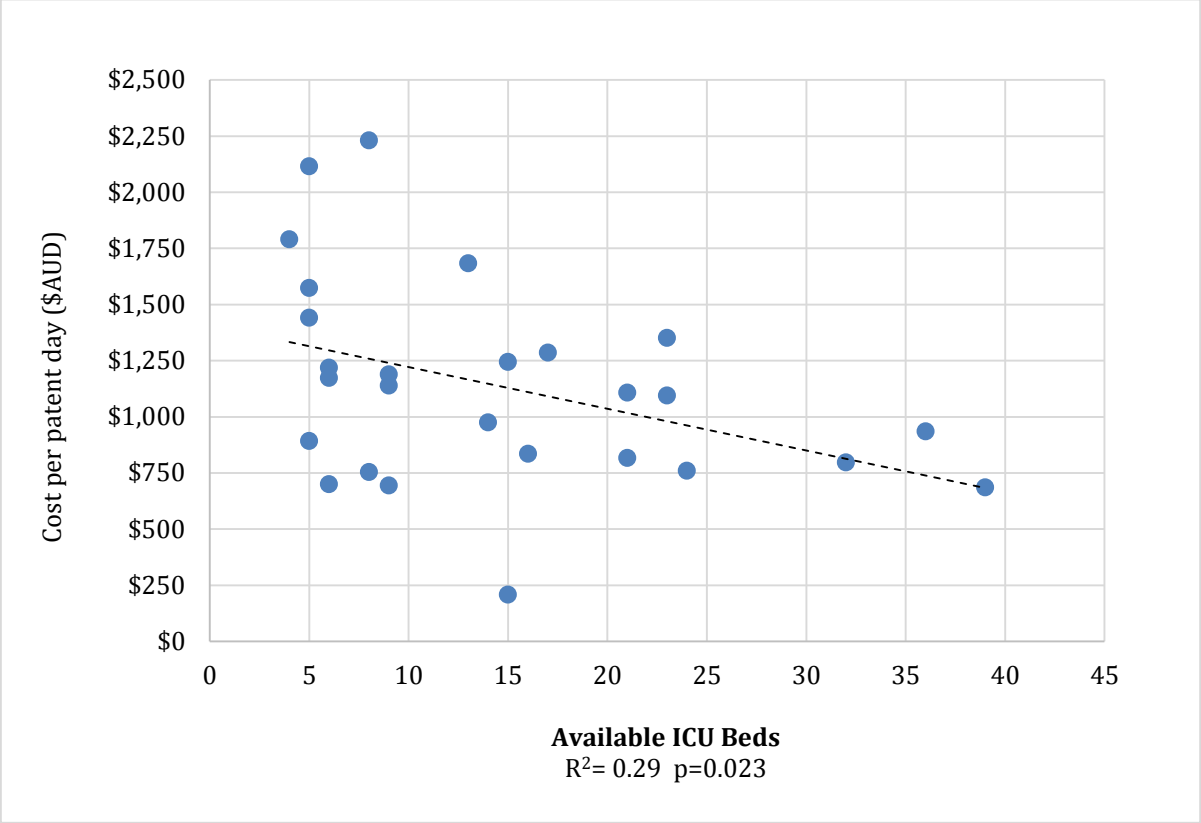

Figure 3. Intensive care unit (ICU) nursing costs per patient-day, by number of available ICU beds (32 ICUs)