



ANZICS
Centre for Outcome
and Resource Evaluation

Report of the
Australian and
New Zealand
Paediatric
Intensive Care
Registry

2009

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Many of the participating hospitals and people listed below have been associated with the Registry for many years and we thank them for their continued active support. As the Registry continues to grow with additional sites each year, we also thank those newer sites for contributions which help to present a more comprehensive picture of paediatric admissions to intensive care in Australia and New Zealand.

In addition to those listed, we also give our thanks to the many other individuals who are involved in the data collection, collation, cleaning, and submission of data to the Registry.

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Foreword

“Well, there's a question as to what sort of information is important in the world, what sort of information can achieve reform. And there's a lot of information. So information that organizations are spending economic effort into concealing, that's a really good signal that when the information gets out, there's a hope of it doing some good.”

Julian Assange

Never before has the role of information held such currency in world events. The decision by US corporations and the US government to try to shut down the WikiLeaks phenomenon will no doubt be ineffective as the public's thirst for information shows no signs of abating. And while the role of whistleblowers in today's society has achieved a certain notoriety, the importance of freedom of information in medicine cannot be underestimated. After the disaster of the Bristol Royal Infirmary in the 1990's, free availability of outcome data in cardiac surgery has almost become *de rigueur* in many parts of the world.

In the field of paediatric intensive care, collection and publication of information on outcome data has been an important development in ensuring quality of care and outcomes.

The ANZPIC Registry has collected data from 24 intensive care units caring for children in Australia and New Zealand in 2009. This is an enormous achievement and credit and thanks must go to both the Registry staff and the data collectors at each centre who put a vast amount of extra work in ensuring good data capture.

The Registry is currently working towards gaining consensus to include identification of each intensive care unit in future reports; another sign of the further demystification of outcome data. While the primary benefit of outcome data is quality assurance there are several other benefits-potential for research, workforce issues and demographic information.

On behalf of ANZICS I would like to thank Tony Slater and Jan Alexander for their continued efforts, for which we are all grateful.

Simon Erickson FRACP FJFICM
Paediatric Chair
ANZICS Executive

I. Introduction

I.1 History of the Australian and New Zealand Paediatric Intensive Care Registry

The Paediatric Study Group (PSG) of the Australian and New Zealand Intensive Care Society (ANZICS) established the Australian and New Zealand Paediatric Intensive Care (ANZPIC) Registry in 1997. The aims of the Registry are:

- To describe paediatric intensive care practices and outcomes in Australia and New Zealand.
- To provide contributing units with efficacy and efficiency reports that compare performance in their units against national and international standards.
- To facilitate research in paediatric intensive care.

This report is the ninth Annual Report describing paediatric intensive care practices and outcomes within Paediatric Intensive Care Units (PICUs) across Australia and New Zealand. Data collected from twenty-four intensive care units (ICUs) (eight PICUs, sixteen general ICUs), during the 2009 calendar year was used to generate this report. The geographical depiction of the location of contributing sites is shown below in Figure 1.1.1.

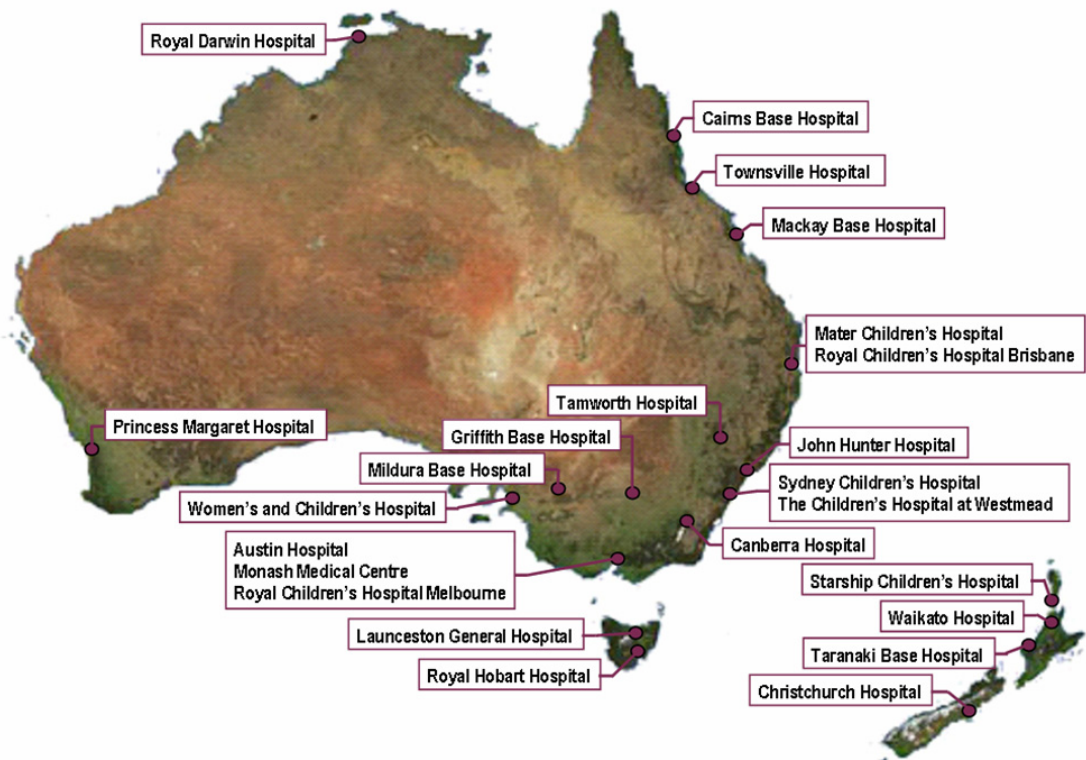


Figure 1.1.1 Location of all sites contributing to the 2009 data collection

The eight PICUs are tertiary referral centres for children requiring intensive care and are based in university affiliated children's hospitals. Data on all patients admitted to these eight units have been included; their age ranges from birth to young adulthood (16 years).

Fifteen general ICUs admitting predominantly adults, and one combined NICU/PICU, also contributed data on their paediatric admissions (patients < 16 years of age). These ICUs are based in metropolitan or regional hospitals in Australia and New Zealand. Griffith Base Hospital, Mackay Base Hospital and Taranaki Base Hospital all provided data to the ANZPIC Registry for the first time in 2009. The Prince Charles Hospital PICU, a contributor since the establishment of the ANZPIC Registry, no longer appears as a separate site after its paediatric cardiac services relocated to the Mater Children's Hospital in 2008. Table 1.1.1 lists the contributing hospitals.

Table 1.1.1 Hospitals contributing to the ANZPIC Registry in 2009

Hospital	State	ICU Type
Austin Hospital	VIC	Metropolitan
Cairns Base Hospital	QLD	Regional
The Canberra Hospital	ACT	Metropolitan
Children's Hospital at Westmead	NSW	PICU
Christchurch Hospital	NZ	Metropolitan
Griffith Base Hospital	NSW	Regional
John Hunter Hospital	NSW	Regional
Launceston Hospital	TAS	Regional
Mackay Base Hospital	QLD	Regional
Mater Children's Hospital	QLD	PICU
Mildura Base Hospital	VIC	Regional
Monash Medical Centre	VIC	Metropolitan
Princess Margaret Hospital	WA	PICU
Royal Children's Hospital - Brisbane	QLD	PICU
Royal Children's Hospital - Melbourne	VIC	PICU
Royal Darwin Hospital	NT	Metropolitan
Royal Hobart Hospital	TAS	Metropolitan (NICU/PICU)
Starship Children's Hospital	NZ	PICU
Sydney Children's Hospital	NSW	PICU
Tamworth Hospital	NSW	Regional
Taranaki Base Hospital	NZ	Regional
Townsville Hospital	QLD	Regional
Waikato Hospital	NZ	Regional
Women's & Children's Hospital	SA	PICU

Introduction continued

1.2 ICU Classification

Table 1.2.1 defines the ICU classifications used by the ANZPIC Registry.

Table 1.2.1 ICU Classifications

Classification	Description
PICU	Paediatric, tertiary referral intensive care units based in a capital city
Metropolitan	All other general intensive care units in capital cities
Regional	General intensive care units outside a capital city

2. Data Set

2.1 Data set

The minimum data set analysed for this report includes 54 variables; their definitions are described in Appendix 1. Information collected for the minimum data set includes demographic data, the diagnosis directly responsible for ICU admission, as well as underlying and additional diagnoses. Additionally, physiological variables measured at the time of first face to face contact between the patient and the doctor from the ICU (or a specialist retrieval team), the ICU outcome, hospital outcome, and the length of stay are recorded. All participating units collect the minimum data set. All variables are routinely measured or recorded in the patients' medical record. Due to software restrictions, many contributing general (i.e. non-paediatric) ICUs were not able to collect the five additional cardiac-related fields in their 2009 data as these additions had not been programmed into their electronic data collection tool. However, given that these general units do not admit any paediatric cardiac surgery patients, the lack of data from these sites had no impact on the RACHS calculations.

2.2 Data collection

Data are collected in the hospitals by either completion of the specific ANZPIC Registry Data Collection form, or by incorporating the ANZPIC Registry data items into the local clinical information system. Participating hospitals maintain unit specific databases and submit electronic copies of the de-identified data in a predefined format to the ANZPIC Registry every six months. Some of the paediatric units use an ANZPIC Registry-supplied Access Database for data entry, while the remaining units have incorporated the ANZPIC Registry data fields into their unit specific databases.

In 2004, a paediatric component was added to the Australasian Outcome Research Tool for Intensive Care (AORTIC), software developed by the ANZICS Adult Patient Database (APD). This has allowed the general units already using AORTIC to collect and submit data on any paediatric admissions. In AORTIC, a paediatric admission is defined as a child less than sixteen years of age at hospital admission.

2.3 Data verification

Missing, inconsistent, or unusual data are identified and flagged at the time of submission to the Registry. This initial filtering is performed automatically, and consists of both logic and range checks. Error reports are sent to each site, and the data is cleaned and resubmitted to the Registry before being approved and uploaded into the main database. All data queries must be resolved before the uploading is performed.

As part of ensuring the integrity and uniformity of all Registry data, site audits need to be routinely performed. All PICUs were audited in 2008, and again in 2010. The audit process uses a sample of 50 records, randomly extracted and stratified by the PIM2 risk of death. This ensures that the random sample includes patients with a representative range of mortality risk.

Data Set continued

An independent data collector from another PICU then re-extracts information from hospital medical records and uses database software to compare the two sources of data. Comparison reports are then centrally generated and sent to each site. These reports included measures of agreement on all fields required for the calculation of PIM2, as well as Bland-Altman plots (2) displaying the agreement between the PIM2 risk of death calculated from the original and re-extracted data. Sites are requested to provide feedback on their reports.

2.4 Registry Data Limitations

Limitations to the Registry data are related to the data collection process, the small population of paediatric patients admitted to ICUs in Australia and New Zealand, and the outcome measures used to assess unit performance.

Not all participating units have designated data managers. In the remaining ICUs, data is collected by a range of staff, including administrative staff, clinical nurses and senior medical staff. It has been noted previously that data collection errors are more common in units where a greater number of staff are involved with the collection of data compared to units who have dedicated data collectors/managers. Study days are organised by the Registry and held annually for site staff in an effort to ensure consistency and accuracy of data submissions.

One other limitation is the lack of physiological measurements for many admissions. The usual explanation for physiological measurements not being available is that the performance of invasive measurements was not considered necessary for patient care. Physiological testing is not performed solely for the purposes of data collection.

2.5 Data Completeness

Table 2.5.1 provides a data completeness summary for the majority of fields within the registry for the 8,340 admission records in 2009. These fields are a subset of all fields submitted and are the ones which are expected to be completed for all admissions, irrespective of treatment given. Other fields such as Intubation hours, Systolic BP, and Death Mode, are not relevant to every patient, and therefore it is not intended that these fields are completed for all records. Therefore these fields have been displayed separately in Table 2.5.2. A data dictionary for all registry fields collected can be found in Appendix 2.

Table 2.5.1 Summary of fields where data collection for all patients is intended, 2009.

Field Name	Maximum Possible Responses	Number of Valid Responses	% Complete
DOB	8340	8340	100.0
WT	8340	8340	100.0
POST	7227 ¹	7225	100.0
HADM_SC	8340	8340	100.0
RETRIEV	8340	8340	100.0
IADM_SC	8340	8340	100.0
PREV_AD	8340	8340	100.0
ADM_DT	8340	8340	100.0
DIS_DT	8340	8340	100.0
PDX	8340	8340	100.0
UDX	8340	7933	95.1
RS_HR124	8340	8340	100.0
OUTCOME	8340	8340	100.0
PIM_UC	8340	8340	100.0
HADM_DT	8340	7787	93.4
HDIS_DT	8340	7763	93.1
HOSP_OUT	8340	7785	93.3
1ST_CONT	8340	8319	99.7
PIM_VAL	8340	8339	100.0
PUPILS	8340	8340	100.0
PIM_LR	8340	8340	100.0
ELECTIVE	8340	8340	100.0
RECOVERY	8340	8340	100.0
BYPASS	8340	8340	100.0
CVVH	8340	8340	100.0
HD	8340	8340	100.0
PD	8340	8340	100.0
PF	8340	8340	100.0
HFO	8340	7989	100.0
INO	8340	8340	100.0
ECMO	8340	8340	100.0
VAD	8340	8330	100.0
ICPM	8340	8340	100.0
IND_STATUS	7354 ²	7354	100.0
GESTATION	7867 ³	7773	98.8
NC_STAN	7867 ³	7725	98.2
CP_SOP	7867 ³	7729	98.2
AD_STAN	7867 ³	7722	98.2
CARDIAC	7867 ³	7627	96.9
INOTROPES	7867 ³	7399	94.1

¹Applicable to Australian sites only²Most NZ sites not collecting this field³Field not recorded in software for some non-cardiac sites

Data Set continued

Table 2.5.2 Summary of fields where data collection for all patients is not intended, 2009.

Field Name	Maximum Possible Responses	Number of Measureable Responses	% Complete	Explanation
SBPA	8340	7479	89.7	for the remaining responses, this measurement was either not recorded, or not recorded within the first hour of ICU admission
PO2A	8340	3403	40.8	
FIO2A	8340	4440	53.2	
BEA	8340	4051	48.6	
DEATH_MODE	234	230	98.3	this information relates only to those patients that died (234) and those that had a limitation of therapy order (90)
ECM	234	232	99.1	
LIMIT	234	232	99.1	
LIMIT_D	90	90	100.0	
ORG_DON	234	230	98.3	only those recording intubation or respiratory support times are included
Intub_hrs	8340	4236	50.8	
RS_hrs	7217 ¹	4172	57.8	

¹ One site does not collect information on respiratory support hours

3. Demographics

3.1 Population

From 2008 onwards, the ANZPIC Registry has based reporting figures on patients discharged from ICU during each calendar year. This facilitates the collection of more complete episode information and greater accuracy in the reporting of bed usage. The term “admissions” has been used in this report in the context of ICU admission episodes, and refers to patients discharged from ICU during the 2009 calendar year.

For 2009, the ANZPIC Registry received data from 8,340 paediatric admissions to 24 ICUs in Australia and New Zealand. As a comparison, in 2007, the ANZPIC Registry received data from 8,086 admissions to 22 ICUs, and in 2008, 8,356 admissions to 23 ICUs.

Each year a number of children are admitted to general ICUs in Australia and New Zealand that are not contributing to the ANZPIC Registry. In 2009 the number of children admitted to these units was estimated to be 6% (7), and represents many ICUs that admit very small numbers of paediatric patients who are often transferred to larger units.

Admissions by region of residence are displayed in Table 3.1.1. Note that the postcodes of patients admitted to ICUs were used to assign a home state, irrespective of their admission hospital. Overseas admissions ($N=64$) were excluded, as was missing data ($N=3$). The child population (<16 yrs) for each state or territory was obtained from the Australian Bureau of Statistics (ABS) Australian Demographic Statistics (3), and Statistics New Zealand (4).

In 2009, the admission rate for paediatric ICU episodes was 1.52 per 1,000 children. The ANZPIC Registry admission rate is slightly higher than the rate recorded by the Paediatric Intensive Care Audit Network (PICANet) in the UK (1.44 in 2009) (5).

The admission rate varied across jurisdictions, from 1.02 per 1,000 for the ACT to 2.09 for the Northern Territory, with the admission rate for males (1.70 per 1,000) being higher than that for females (1.34 per 1,000).

Demographics continued

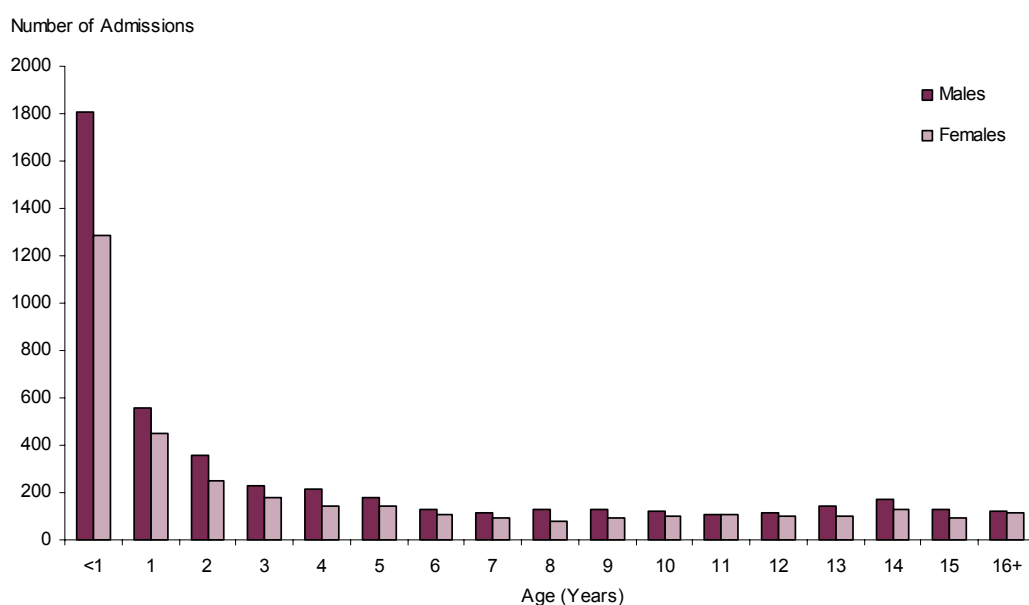
Table 3.1.1 Regional admission rate (per 1,000 population) and sex-specific admission rate to ANZPIC Registry hospitals in 2009.

Region	Population <16yrs	Admission Rate	Male Admissions Frequency (Rate)	Female Admissions Frequency (Rate)
ACT	69,389	1.02	36 (1.02)	35 (1.02)
NSW	1,435,925	1.58	1319 (1.79)	955 (1.36)
NT	56,102	2.09	58 (2.01)	59 (2.17)
QLD	947,692	1.82	936 (1.92)	787 (1.71)
SA	312,167	1.87	316 (1.98)	267 (1.75)
TAS	104,547	2.25	153 (2.85)	82 (1.61)
VIC	1,078,588	1.30	854 (1.54)	547 (1.04)
WA	468,961	1.61	449 (1.86)	307 (1.35)
NZ	953,400	1.17	604 (1.24)	509 (1.10)
Total	5,426,771	1.52	4725 (1.70)	3548 (1.34)

3.2 Age

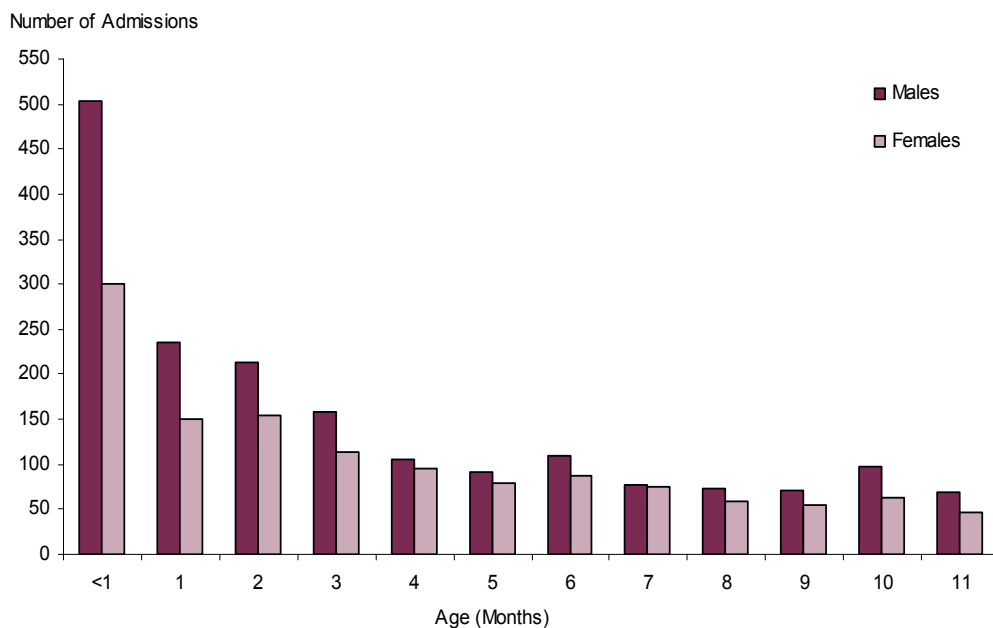
As in previous years, the majority of admissions to ICU in 2009 were for children less than 5 years of age (65.7%), with infants < 12 months of age making up more than half this group (56.4%) and 37.1% of all ICU admissions. A greater number of males were admitted (57.1%) than females (42.9%) across all ages, as illustrated in figure 3.2.1. Figure 3.2.2 displays the admission numbers for patients under one year of age. Over 26% of infants admitted less than one year old were neonates (< 28 days old). All of these figures are consistent with previous years' data.

Figure 3.2.1 ICU admission numbers by age (years) and sex 2009.



Demographics continued

Figure 3.2.2 ICU admission numbers by age (months) and sex, for infants <12 months of age 2009.



4. Admission Characteristics

4.1 ICU Admission Source

In 2009, patients admitted from the operating theatre accounted for 43.5% of all ICU admissions. Direct admissions to ICU from outside the hospital comprised 20.7%, while admissions from the emergency department and other wards comprised 17.8% and 17.6% respectively.

The main source of ICU admission differed between specialist PICUs and general ICUs, with the operating theatre providing the majority (47%) of PICU admissions and the emergency department providing the majority (42.4%) of general ICU paediatric admissions. Comparative admission source data is presented in Table 4.1.1.

Table 4.1.1 Intensive care admission source by ICU type, 2009.

Admission Source	ICU Type	
	PICU (%)	General ICU (%)
Direct ICU Admission	21.2	17.7
Emergency Department	13.8	42.4
Operating Theatre or Recovery	47.0	22.5
Other ICU or NICU	0.4	0.2
Ward	17.6	17.3

Retrievals

A total of 2,011 patients were retrieved via specialist transport teams during 2009. While PICUs and general ICUs reported similar proportions of children admitted to hospital via specialist retrieval teams (23.1% and 30.4% respectively), the pattern of ICU admission source differed for the two groups. As can be seen in Table 4.1.2, the proportion of retrievals that go directly to ICU in designated PICUs (82.6%) is greater than in general ICUs (43.8%), where patients are often retrieved to the hospital's emergency department (32.1%).

Table 4.1.2 Intensive care admission source for retrieved patients, by ICU type, 2009.

Admission Source	ICU Type	
	PICU (%)	General ICU (%)
Direct ICU Admission	82.6	43.8
Emergency Department	5.6	32.1
Operating Theatre or Recovery	7.0	11.4
Other ICU or NICU	0.8	0.0
Ward	4.0	12.8

Admission Characteristics continued

Table 4.1.3 shows the breakdown of retrieved patients who were admitted directly to ICU, by primary diagnostic category (refer to section 4.3 Admission Diagnosis and Appendix III for details). The distribution of patients in each diagnostic category was fairly consistent between PICUs and general ICUs, however designated PICUs received more patients with cardiovascular problems (12%). Overall the majority of the 1,524 retrieved patients admitted directly to ICU were for respiratory-related illness (40.9%).

Table 4.1.3 Direct ICU admission via retrieval, by diagnostic group and ICU type, 2009

Diagnostic Group	ICU Type	
	PICU (%)	General ICU (%)
Cardiovascular (including post-op)	12.0	1.3
Gastrointestinal/Renal	2.6	3.9
Injury	13.6	11.0
Neurological	16.1	18.8
Post-Operative (non-cardiac)	1.6	1.3
Respiratory	39.8	51.3
Miscellaneous	14.4	12.3

The outcome of the ICU stay for retrieved patients also differed between PICUs and general ICUs, as can be seen in Table 4.1.4, where a higher percentage (18.2%) of retrievals to general ICUs were later transferred to another ICU. This reflects the proportion of complex cases needing transfer to specialist PICUs.

Table 4.1.4 Outcome of ICU stay for retrieved patients, by ICU type, 2009.

ICU Outcome	ICU Type	
	PICU (%)	General ICU (%)
Discharged to ward/home	92.8	80.1
Died in ICU	5.1	1.7
Transferred to another ICU	2.1	18.2
Died <24hr post discharge for palliative care	0.1	0.0

4.2 Admission Type

Admissions are classified as either elective or non-elective. An admission is elective if it is (1) booked to follow elective surgery, (2) for an elective ICU procedure, (3) a review of home ventilation, or (4) for elective monitoring. Surgery or an ICU procedure are defined as being elective if they could be postponed for more than six hours without an adverse effect. An unplanned admission that was not expected or foreseeable, is regarded as non-elective.

Admission Characteristics continued

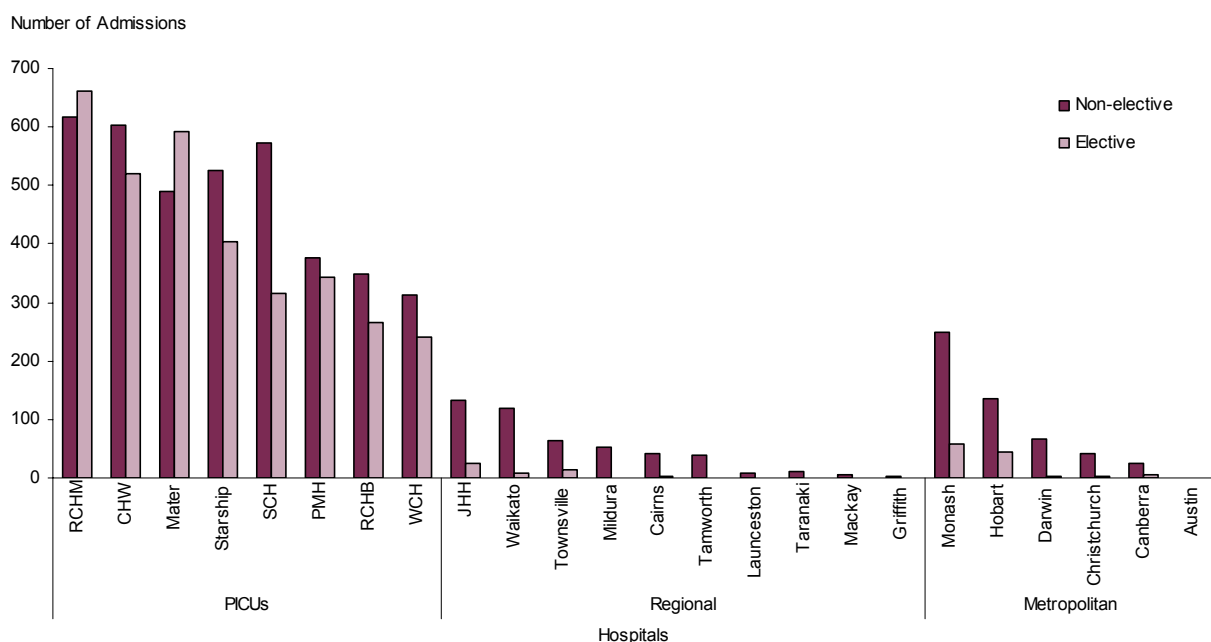
Fifty-eight percent of all ICU admissions in 2009 were non-elective; which is consistent with 2008 figures (Table 4.2.1). Direct ICU admissions accounted for 32.7% of non-elective admissions, with only a small percentage (12.9%) of non-elective admissions coming from other ICUs, NICUs, operating theatre or recovery. In contrast, admissions from the operating theatre or recovery accounted for approximately 86.6% of all elective admissions.

Table 4.2.1 Intensive care admission source by admission classification, 2008 - 2009.

Admission Source	2008		2009	
	Non-elective (%)	Elective (%)	Non-elective (%)	Elective (%)
Direct ICU Admission	19.9	1.6	19.0	1.7
Emergency Department	16.9	0.4	17.1	0.6
Operating Theatre or Recovery	6.6	37.4	7.2	36.3
Other ICU or NICU	0.3	0.3	0.3	0.2
Ward	14.2	2.4	14.5	3.1
Grand Total	57.9	42.1	58.1	41.9

Figure 4.2.1 displays elective and non-elective admissions for each hospital during 2009. While the proportion of elective and non-elective admissions varies considerably between hospitals, for most hospitals non-elective cases outnumber elective cases. However in 2009, the Royal Children's Hospital in Melbourne and the Mater Children's Hospital in Brisbane had a higher proportion of elective cases.

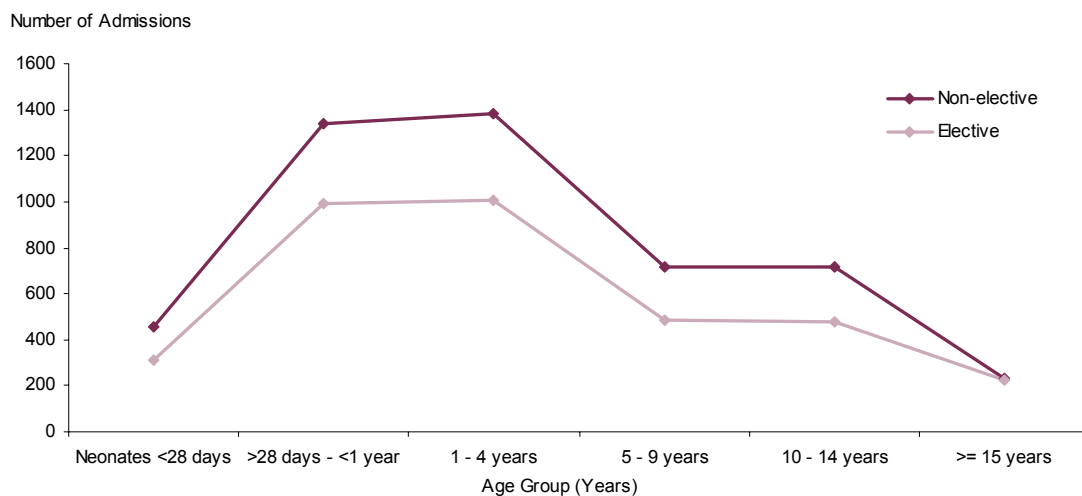
Figure 4.2.1 Elective and non-elective admissions for each hospital, 2009.



Admission Characteristics continued

Figure 4.2.2 displays the elective and non-elective admissions for each age group. The difference between the number of non-elective and elective admissions is greatest for children in the 28 days - 1 year, and 1 - 4 years age groups.

Figure 4.2.2 Elective and non-elective admissions by age, 2009.



4.3 Admission Diagnosis

Diagnosis codes developed by the ANZICS PSG (6) are used to code the principal reason for ICU admission. The underlying diagnosis, and up to five additional diagnoses, can also be assigned for each admission. The ANZPIC Registry diagnosis codes used in 2009 are listed in Appendix II.

For this annual report, the principal reason for ICU admission has been grouped into seven broad diagnostic categories (refer to Appendix III for details). While most post-procedural diagnoses have been coded into one category, all cardiac procedures have been included with other cardiovascular diagnoses in an attempt to provide better information about all cardiac related reasons for admission. Table 4.3.1 gives details of admissions by diagnostic group, and includes a percentage breakdown of PICUs versus general ICUs.

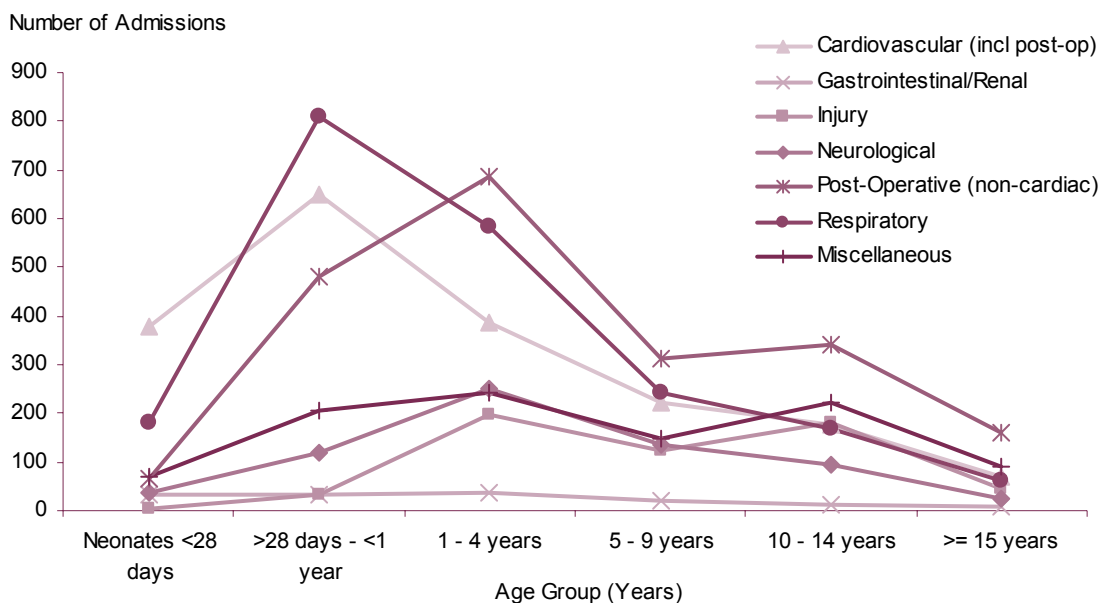
In comparison to previous years, in 2009 there was an increase in respiratory admissions and a decrease in post-operative (non-cardiac) admissions. When considering designated PICUs alone, the post-operative (non-cardiac) group remains the most common diagnostic group, (25.7% of PICU admissions), while the respiratory group comprises the most common diagnostic group in general ICUs (40.4%). Differing trends can be observed when these diagnostic categories are presented by age groups (see Figure 4.3.1). Cardiovascular (33.3%) and respiratory (32.1%) problems were the most commonly occurring diagnostic groups for children under one year of age, while in children 10 years of age and over, the most common diagnostic group was non-cardiac post-operative (30.4%). This too, is consistent with previous years.

Admission Characteristics continued

Table 4.3.1 Number of admissions by diagnostic group and ICU type, 2009.

Diagnostic Group	Frequency	All Admissions (%)	ICU Type	
			PICU (%)	General ICU (%)
Post-Operative (non-cardiac)	2047	24.5	25.7	17.4
Respiratory	2045	24.5	22.0	40.4
Cardiovascular (incl post-op)	1883	22.6	25.9	1.9
Miscellaneous	982	11.8	12.0	10.4
Neurological	659	7.9	7.4	11.3
Injury	580	7.0	5.5	15.8
Gastrointestinal/Renal	144	1.7	1.6	2.7

Figure 4.3.1 Diagnostic categories by age group, 2009.



Tables 4.3.2 and Table 4.3.3 display the 10 most common diagnoses for non-elective and elective admissions to ICU respectively. Also displayed are the median length of stay (LOS) for each diagnosis category. As in 2008, Bronchiolitis (9.9%) was again the most common reason for non-elective admissions to ICU, followed by seizures (8.6%). The most common reason for an elective admission to an ICU also remained the same; Spinal Instrumentation (5.5%). Adenoidectomy and/or Tonsillectomy was again the second most common reason for elective admission (4.3%).

Admission Characteristics continued

Table 4.3.2 Top 10 reasons for non-elective admission to ICU, the percent of all non-elective admissions, and median Length of Stay (LOS) in 2009.

Principal Admission Diagnosis	Frequency	Percent	Median LOS	Mean LOS
Bronchiolitis	479	9.9	2.54	3.60
Seizures	415	8.6	1.00	2.05
Pneumonia or Pneumonitis	300	6.2	3.92	7.58
Asthma	283	5.8	0.79	1.19
Trauma - Head	258	5.3	1.60	3.97
Diabetes Mellitus with Ketoacidosis	200	4.1	0.92	1.06
Respiratory Failure	174	3.6	2.73	6.72
Shock - Septic	134	2.8	2.69	5.05
Sepsis	97	2.0	1.63	3.56
Croup	93	1.9	1.33	2.12

Table 4.3.3 Top 10 reasons for elective admission to ICU, the percent of all elective admissions, and median Length of Stay (LOS) in 2009.

Principal Admission Diagnosis	Frequency	Percent	Median LOS	Mean LOS
Spinal Instrumentation	194	5.5	0.92	1.86
Adenoidectomy and/or Tonsillectomy	149	4.3	0.79	0.73
ICU Procedure (eg. CVC Insertion)	138	3.9	0.25	1.90
VSD Repair	130	3.7	1.15	1.92
ASD Surgery	121	3.5	0.96	1.08
Total Repair of Tetralogy of Fallot	108	3.1	2.83	4.73
General Surgery - Other	100	2.9	0.85	1.49
Cranial Vault Reshaping	84	2.4	0.92	1.08
ENT - Other	76	2.2	0.83	2.17
Fontan Procedure	75	2.1	1.17	2.26

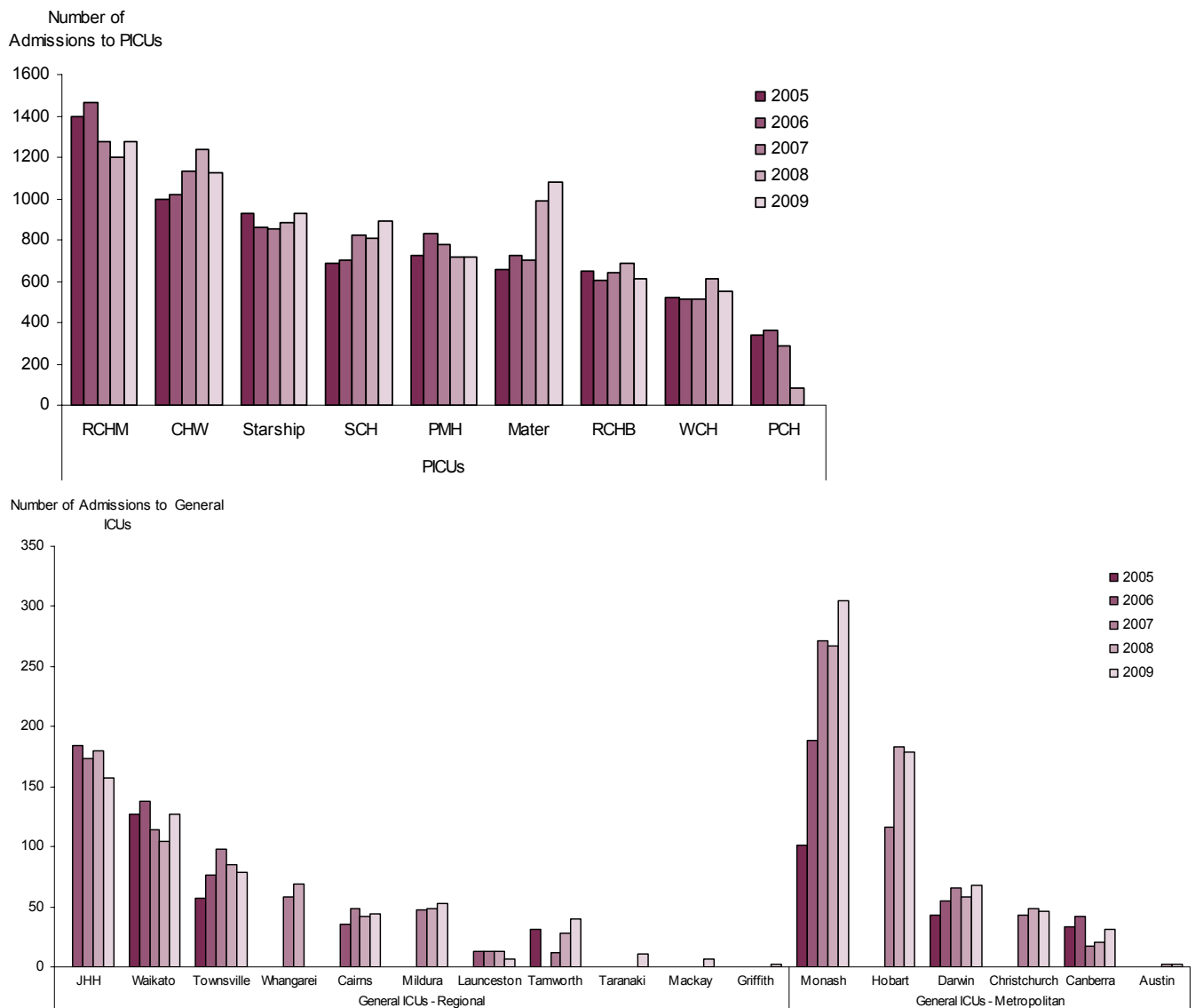
4.4 Other Admission Characteristics

Annual admission numbers per hospital each year since 2005 are displayed in the two parts of Figure 4.4.1 below, where, to assist readability, the specialist paediatric intensive care units are displayed separately to the general ICUs. Taranaki Base Hospital, Mackay Base Hospital and Griffith Base Hospital all provided data to the ANZPIC Registry for the first time in 2009. The relocation of the paediatric cardiac services from the Prince Charles' Hospital (PCH) to the Mater Children's Hospital in Brisbane during 2008 continues to be reflected by the increase of admission numbers for the Mater hospital.

Overall admission numbers for 2009 are comparable to those recorded for 2008, as the number of admissions from individual ICUs remains relatively stable from year to year. Over 13% of ICU admissions are actually readmissions of the same patients during the year, with 9.2% of those readmissions being within the same hospital episode of care.

Admission Characteristics continued

Figure 4.4.1 Number of patients admitted to ICUs (PICUs and general ICUs) participating in the ANZPIC Registry by ICU classification, 2005-2009.



The proportion of children ventilated during ICU admission is considered a simple indicator of admission threshold. The number of admissions in each ICU and the proportion of ventilated admissions are displayed in table 4.4.1. The Royal Children’s Hospital in Melbourne and Starship Children’s Hospital in Auckland reported the highest ventilation rates for PICUs, which is reflective of their cardiac caseloads.

Patients were ventilated in 57.8% of all admissions during 2009. This is a slight increase from 2008 figures (55.5%).

Admission Characteristics continued

Table 4.4.1 Number of admissions and ventilated patients by unit in 2009.

Hospital	Admissions	Frequency Ventilated	% Ventilated
Royal Children's Hospital - Melbourne	1277	1011	79.2
Children's Hospital at Westmead	1123	<i>not recorded</i>	
Mater Children's Hospital	1080	592	54.8
Starship Children's Hospital	929	710	76.4
Sydney Children's Hospital	888	585	65.9
Princess Margaret Hospital	718	287	40.0
Royal Children's Hospital - Brisbane	614	255	41.5
Women's & Children's Hospital	553	214	38.7
Monash Medical Centre	305	86	28.2
Royal Hobart Hospital	179	97	54.2
John Hunter Hospital	157	90	57.3
Waikato Hospital	127	73	57.5
Townsville Hospital	79	30	38.0
Royal Darwin Hospital	68	23	33.8
Mildura Hospital	53	24	45.3
Christchurch	46	33	71.7
Cairns Base Hospital	44	21	47.7
Tamworth Hospital	40	3	7.5
Canberra Hospital	31	20	64.5
Taranaki Base Hospital	11	11	100.0
Launceston Hospital	7	3	42.9
Mackay Base Hospital	7	0	0.0
Austin Hospital	2	0	0.0
Griffith Base Hospital	2	0	0.0

In Figures 4.4.2 and 4.4.3, the monthly admission numbers by diagnostic group, and monthly admission numbers by age group, are displayed for the 2008-2009 period. In the first figure, an increase in admissions for respiratory related conditions is apparent during the winter months. This pattern is reinforced by data presented in the second figure, where many of the respiratory admissions during the winter months are for children less than one year old. A comparison over two years shows the pattern repeating over time.

Admission Characteristics continued

Figure 4.4.2 Monthly admission numbers by diagnostic group, 2008—2009.

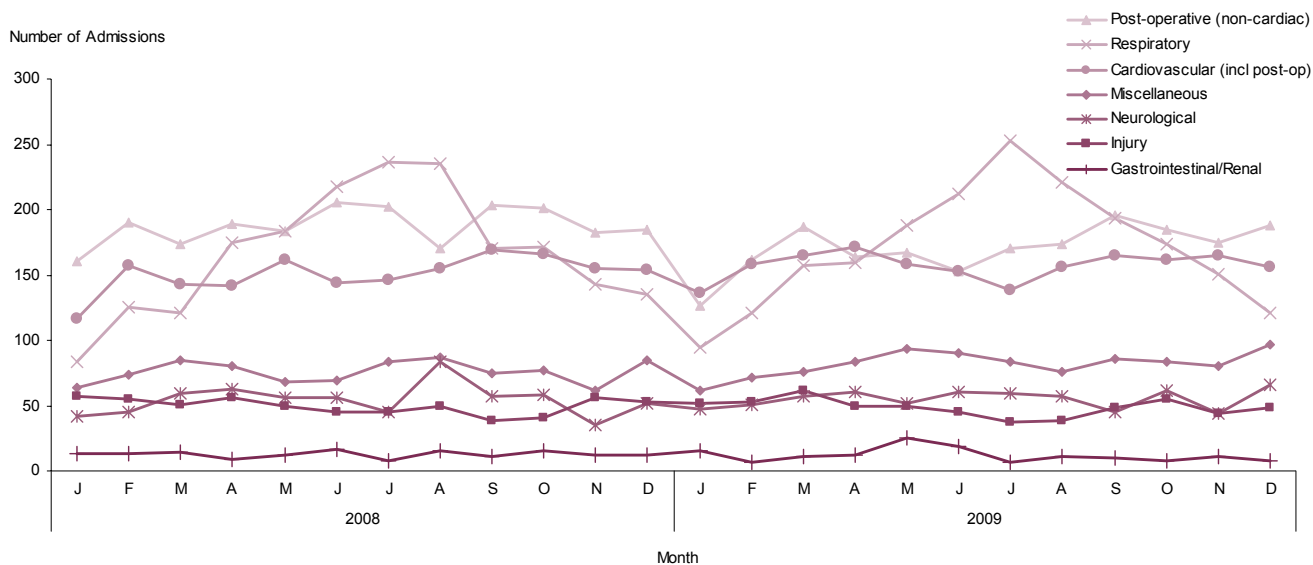
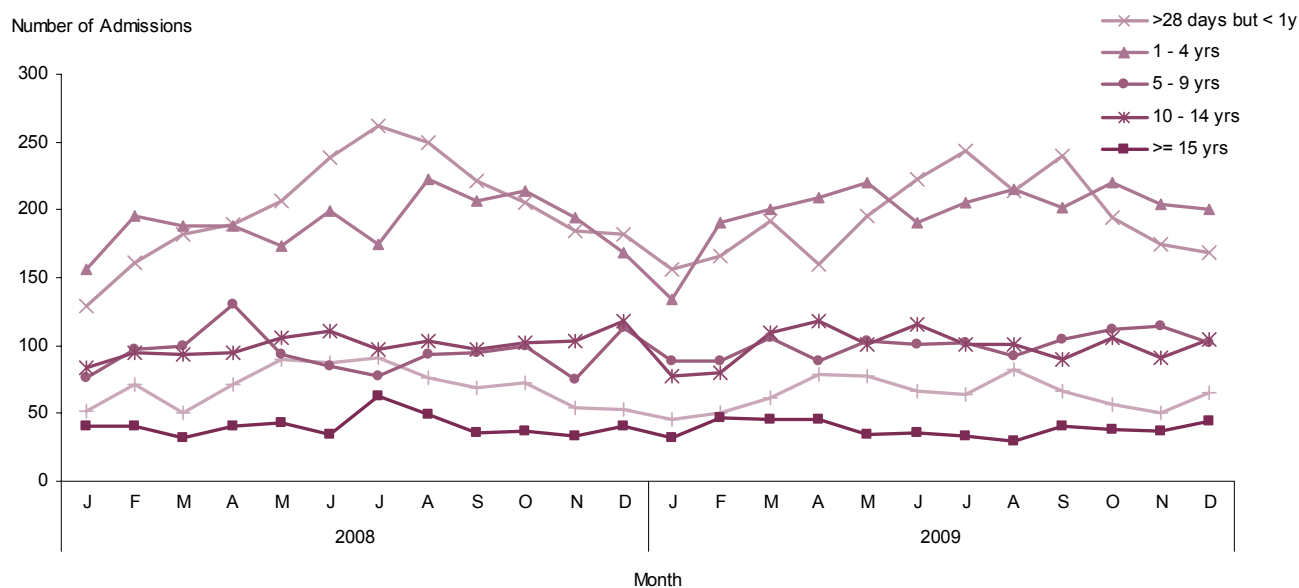


Figure 4.4.3 Monthly admission numbers by age, 2008—2009.



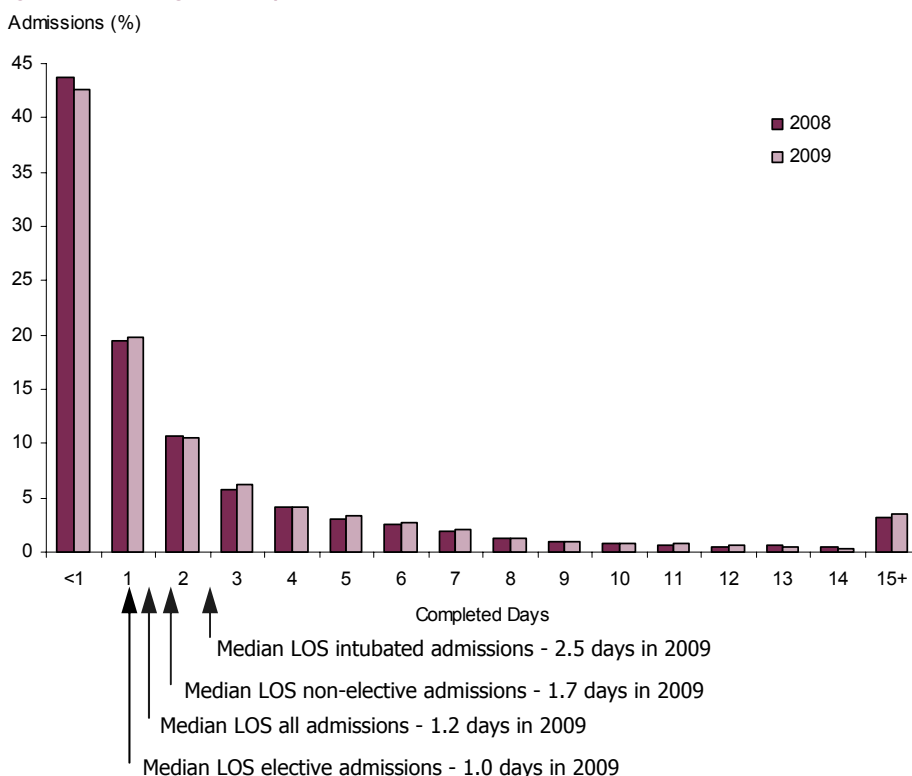
5. Length of Stay & Occupied Bed Days

5.1 Median Length of Stay (survivors only)

Length of Stay (LOS) is defined as the difference between discharge date and time, and admission date and time. The LOS data analysed in this report is only for patients surviving ICU and who were not transferred to another facility. The ICU LOS is positively skewed with the majority (62.4%) of patients staying less than two days. Length of stay patterns are consistent with those in 2008 (see Figure 5.1.1).

The median LOS was used to compare the LOS across groups. The median LOS was used as the measure of central tendency as the mean LOS is disproportionately influenced by prolonged admissions. For example, in 2009, 3.7% of patients had a length of stay greater than 14 days. These included 1.1% of patients who stayed longer than 28 days and occupied 19.8% of bed days. Three patients stayed in ICU longer than six months, occupying 2.8% of bed days.

Figure 5.1.1 Length of stay distribution in 2008 - 2009.



Paediatric ICU LOS in Australia and New Zealand (ANZ) contrasts with that reported by PICANet in the UK, with 42.6% of admissions in ANZ staying less than 24 hours, and 29.3% of admissions in the UK in 2009. The UK data also had a higher percentage of patients staying in ICU beyond one week (see Table 5.1.1).

Length of Stay & Occupied Bed Days continued

Table 5.1.1 Comparison of ICU LOS between Australia & New Zealand, and the United Kingdom in 2009.

LOS	ANZPIC Registry		PICANet	
	Frequency	%	Frequency	%
<1hr	4	0.0	22	0.2
1 - <4hrs	152	1.9	1207	2.5
4 - <12hrs	689	8.5	3498	7.1
12 - <24hrs	2610	32.2	9560	19.5
1 - <3days	2450	30.2	15910	32.5
3 - <7 days	1326	16.4	10826	22.1
7+ days	875	10.8	7859	16.0

The median LOS varied depending on ICU classification (Figure 5.1.2), with PICUs having the longest stay (1.36), versus Metropolitan hospitals (1.05), and Regional hospitals (0.99). Expectedly, LOS varied amongst admission type (Table 5.1.2). The median LOS for intubated patients was 2.5 days, compared to 0.92 days for non-intubated patients. Non-elective admissions had a greater median LOS (1.67) compared to elective admissions (1.04). The Interquartile Range (IQR) is also shown for each of these measurements.

Figure 5.1.2 Median LOS and Interquartile Range (IQR) for all hospitals by ICU classification in 2009.

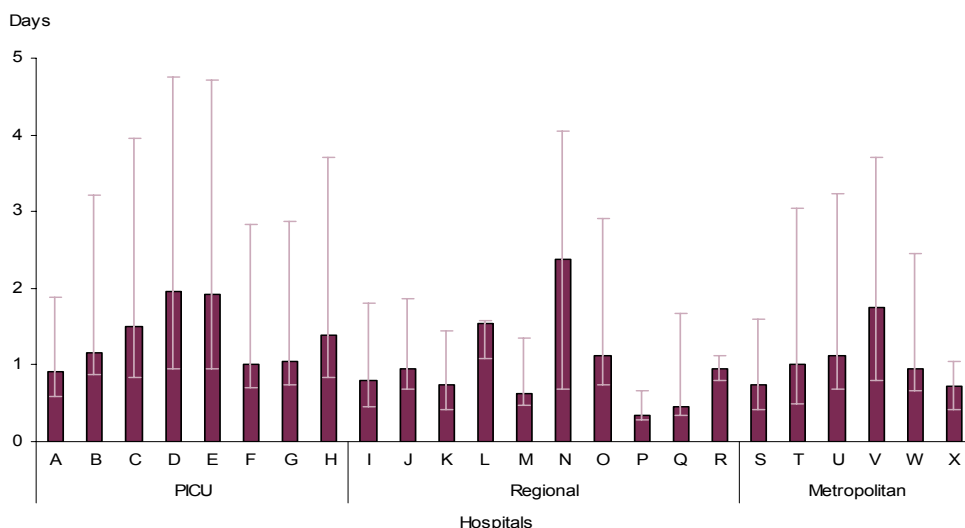


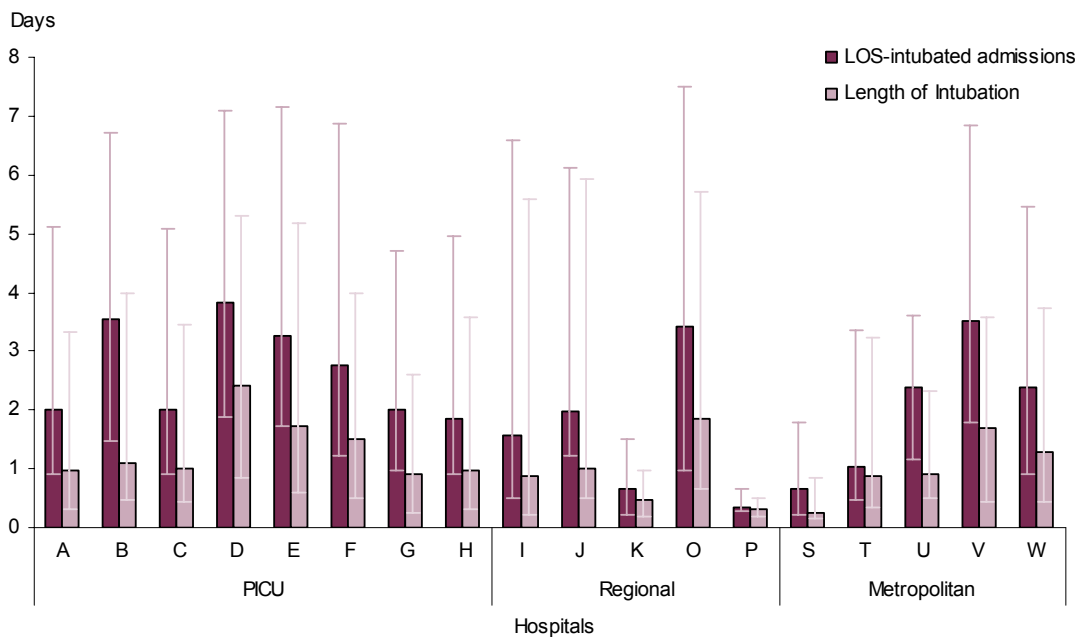
Table 5.1.2 Mean & Median LOS, IQR, and percent of occupied bed days (OBD) by admission type, 2009.

	Mean LOS	Median LOS	IQR	OBD (%)
All admissions	3.50	1.29	0.8 - 3.5	100.0
Elective admissions	2.77	1.04	0.8 - 2.7	33.7
Non-elective admissions	4.06	1.67	0.8 - 4.0	66.3
Intubated admissions	5.25	2.50	1.0 - 5.8	74.3
Non-intubated admissions	1.79	0.92	0.6 - 1.8	25.7

Length of Stay & Occupied Bed Days continued

Figure 5.1.3 displays the median LOS for intubated patients, and the median duration of intubation, for hospitals with intubated patients. Hospitals with <10 intubated admissions have been excluded ($N = 4$) from this figure.

Figure 5.1.3 Median LOS and IQR for intubated admissions in each hospital, by ICU classification in 2009



The LOS for each diagnostic group is summarised in Table 5.1.3. As in 2008, the longest median LOS was observed in the gastrointestinal/renal diagnostic group (2.06 days), followed by the respiratory diagnostic group (2.04 days).

Table 5.1.3 Mean & Median LOS, IQR, and percent of OBD by principal diagnostic group, 2009.

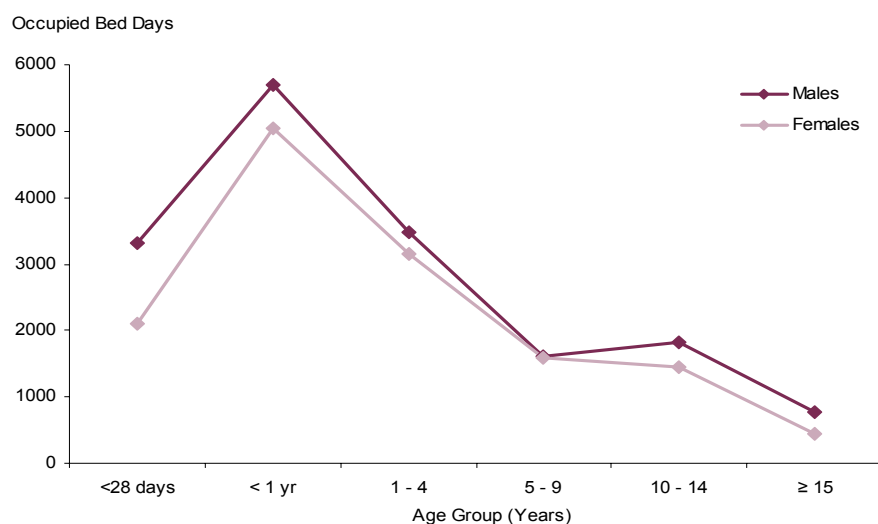
Diagnostic Group	Mean LOS	Median LOS	IQR	OBD (%)
Cardiovascular (including post-op)	3.60	1.83	1.0 - 3.9	23.2
Gastrointestinal/Renal	4.42	2.06	0.9 - 5.0	2.2
Injury	3.34	1.06	0.6 - 3.5	6.5
Miscellaneous	3.55	1.25	0.6 - 3.3	11.4
Neurological	2.59	1.13	0.7 - 2.7	5.7
Post-Operative (non-cardiac)	2.11	0.92	0.8 - 1.8	15.1
Respiratory	5.11	2.04	0.9 - 4.9	35.9

Length of Stay & Occupied Bed Days continued

5.2 Occupied Bed Days

Occupied Bed Days (OBD) in this report are based on all ICU admissions, including those patients who were transferred or died. There were a total of 30,469 OBD in 2009, with children aged > 28 days but less than one year occupying 35.3% of ICU bed days (Figure 5.2.1). Intubated admissions utilised 74.3% of bed days, while non-elective admissions utilised 66.3% of bed days (Table 5.1.2).

Figure 5.2.1 Occupied Bed Days by age group and sex, 2009.



Patients who stayed in ICU longer than 28 days (1.3%) occupied a total of 6,588 (21.62%) bed days. Table 5.2.1 displays the admission diagnosis categories for patients who stayed longer than 28 days. Diagnoses associated with a requirement for long term respiratory support occupied the greatest number of bed days, comprising 53.1% of all stays longer than 28 days, and 11.5% of total OBDs in 2009. Three of these long stay patients had H1N1 (swine flu).

Table 5.2.1 Admission diagnoses and occupied bed days for long stay patients (> 28 days), 2009.

Diagnostic Group	Number of patients	Bed days	OBD (%)
Cardiovascular (including post-op)	23	1300.5	19.7
Gastrointestinal/Renal	2	88.1	1.3
Injury	3	125.6	1.9
Miscellaneous	14	837.5	12.7
Neurological	4	140.5	2.1
Post-Operative (non-cardiac)	11	599.6	9.1
Respiratory	50	3496.2	53.1

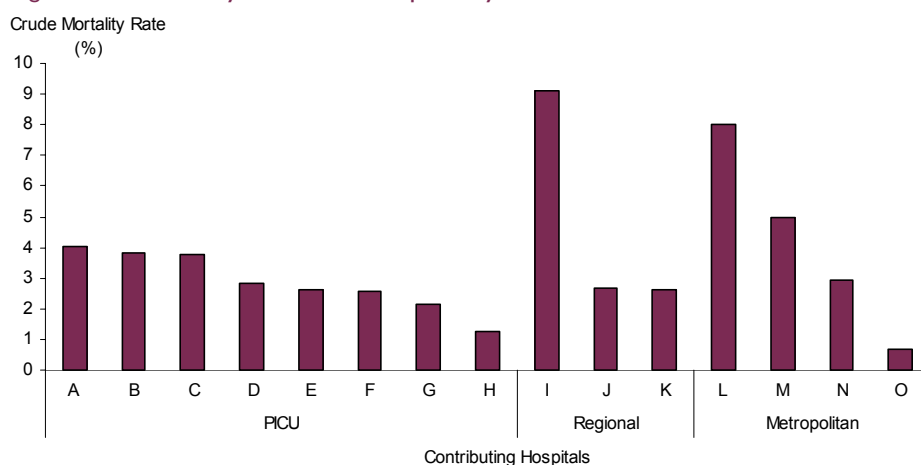
6. Mortality

6.1 Mortality Rates

The ANZPIC Registry collected data on ICU outcome and hospital outcome from all participating units. In 2009, 234 patients died in ICU or within 24 hours of discharge from ICU for palliative care. The crude mortality rate was 2.8% (Males 2.8%, Females 2.9%). This rate is lower than observed in previous years. For example, over the past five years annual rates have ranged from 2.9% to 3.6%.

The crude mortality rates for each unit are shown in Figure 6.1.1. Hospitals that recorded <2 deaths were excluded (N=9). To ensure confidentiality of contributing sites, the hospital codes used in this section are not the same codes used in earlier sections. Crude mortality rates vary with ICU classification, with PICUs recording an average of 2.9%, regional hospitals 4.8% and metropolitan hospitals 4.1%.

Figure 6.1.1 Mortality rate for 18 hospitals by ICU classification in 2009.



The highest age specific mortality rate was for neonates <28 days (5.2%). The mortality rates in the other age groups ranged from 2.3 - 2.8% (Table 6.1.1).

Table 6.1.1 Age specific mortality rates, 2009.

Age Group	Admissions	Deaths	% of Deaths	Age Specific Mortality (95% CI)
Neonates <28 days	765	40	17.1	5.2 (3.7-6.8)
>28 days - <1 year	2327	66	28.2	2.8 (2.2-3.5)
1 - 4 years	2390	56	23.9	2.3 (1.7-2.9)
5 - 9 years	1202	28	12	2.3 (1.5-3.2)
10 - 14 years	1194	32	13.7	2.7 (1.8-3.6)
>= 15 years	462	12	5.1	2.6 (1.1-4.0)

Mortality continued

6.2 Diagnosis Specific Mortality

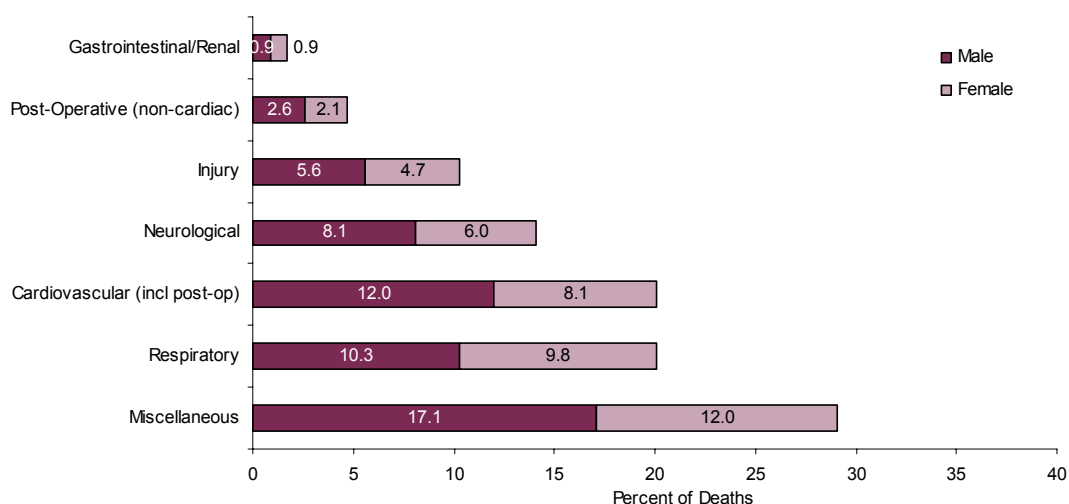
Mortality rates for diagnostic groups in 2009 were lower than or comparable to those in 2008. The greatest reductions were observed in the gastrointestinal/renal diagnostic category (7.4% in 2008 to 3.1% in 2009), and the miscellaneous category (9.0% in 2008 to 7.6% in 2009) (Table 4.3.1).

Table 6.2.1 Mortality rates by diagnostic category, 2008-2009.

Diagnostic Group	2008			2009		
	Admissions	Deaths	Mortality Rate (95% CI)	Admissions	Deaths	Mortality Rate (95% CI)
Post-Operative (non-cardiac)	2245	9	0.4 (0.1 - 0.7)	2047	11	0.5 (0.2 - 0.9)
Respiratory	1996	50	2.6 (1.9 - 3.4)	2045	47	2.4 (1.7 - 3.1)
Cardiovascular (including post-op)	1809	42	2.5 (1.7 - 3.2)	1883	47	2.6 (1.9 - 3.4)
Miscellaneous	908	73	9.0 (7.0 - 11.0)	982	68	7.6 (5.8 - 9.3)
Neurological	651	35	5.8 (3.9 - 7.7)	659	33	5.3 (3.6 - 7.1)
Injury	596	26	4.8 (3.0 - 6.6)	580	24	4.5 (2.7 - 6.3)
Gastrointestinal/Renal	151	10	7.4 (3.0 - 11.8)	144	4	3.1 (0.1 - 6.0)

Over 29% of all deaths had a principal diagnosis in the miscellaneous category. Within this category, 39.7% of deaths were for children who had been admitted due to an out of hospital cardiac arrest. Other diagnoses in the miscellaneous category leading to death include in-hospital cardiac arrest (16.2%) and septic shock (also 16.2%). Cardiac arrest, both in and out of hospital, was the principle diagnosis for 38 (16.2%) of all 234 deaths. Head trauma was the principle diagnosis for 16 (6.8%) deaths, while the proportion of deaths with a principle diagnosis of septic shock reduced from 8.6% (2008) to 4.7% (2009). Figure 6.2.1 depicts the proportion of deaths in each diagnostic category, by gender, in 2009. The mortality rates for males were greater than or equal to female mortality rates in all diagnostic categories.

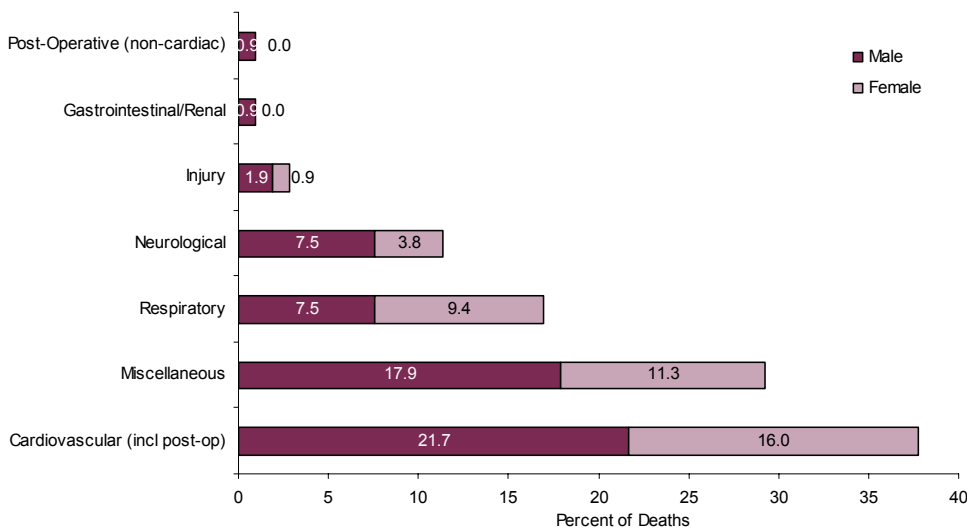
Figure 6.2.1 Diagnostic categories of patients not surviving ICU, by sex in 2009.



Mortality continued

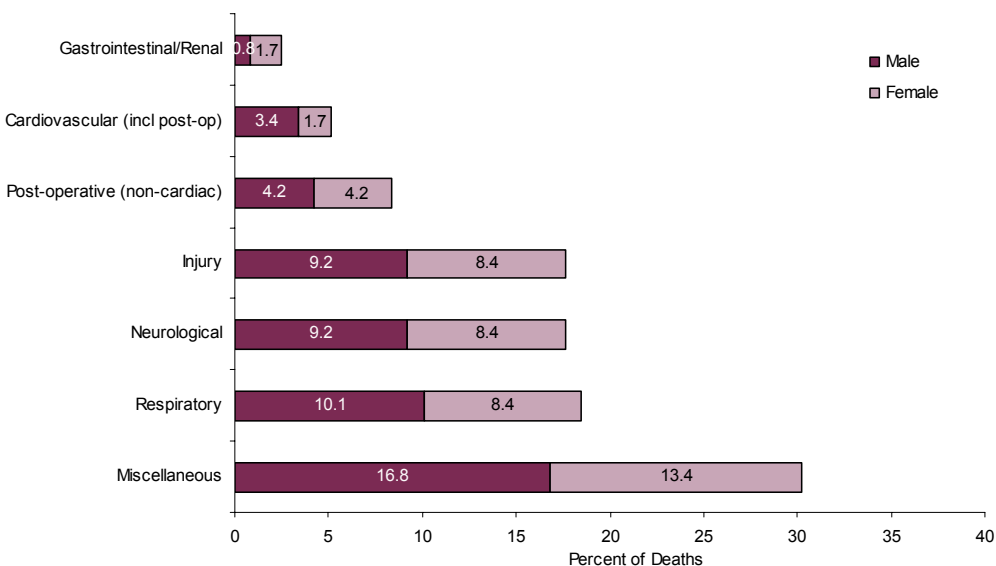
The proportion of deaths in specific diagnosis groups varied across age groups. The highest proportion of deaths among infants less than one year old was recorded in the cardiovascular post-op category (37.7%), of which 65% were congenital cardiovascular conditions and repair (Figure 6.2.2).

Figure 6.2.2 Diagnostic categories of patients aged < 1 year not surviving ICU, by sex, 2009.



In 2009 the highest proportion of deaths for the 1 - 15 year age group was the miscellaneous category (30.3%), with out of hospital cardiac arrest comprising 44.4% of deaths in this category, and 13.4% of deaths overall in this age group. A further 10.9% of deaths in this age group were children admitted with head trauma.

Figure 6.2.3 Diagnostic categories of patients aged 1 - 15 years not surviving ICU, by sex, 2009.



Mortality continued

6.3 Paediatric Cardiac Surgery (PCS)

Since 2007, the ANZPIC Registry has collected data to enable the calculation of a RACHS (risk adjustment for congenital heart surgery) (9) score for patients in ICU who had undergone cardiac surgery. In Australia, the majority of paediatric cardiac surgery (PCS) is performed at the Royal Children's Hospital in Melbourne, the Children's Hospital at Westmead, the Sydney Children's Hospital, the Princess Margaret Hospital in Perth, and, from April 2008 onwards, the Mater Hospital in Brisbane (previously performed at the Prince Charles' Hospital in Brisbane). In New Zealand, this surgery is performed at the Starship Hospital in Auckland.

RACHS allocates cardiac procedures into six risk categories. Table 6.3.1 gives a breakdown of the number of cardiac procedures recorded, listed in RACHS risk category order. As up to six procedures can be recorded for each admission, the numbers in the table represent total procedures, not admissions.

In 2009 a total of 2,322 paediatric cardiac surgical procedures were performed. RACHS categories 1, 2 and 3 accounted for 16.2%, 34.5% and 28.8% of all paediatric cardiac surgery respectively. The most commonly performed procedure was ASD surgery (including ASD secundum, sinus venosus ASD, patent foramen ovale closure), at 8.8% of all paediatric cardiac surgery, followed by VSD repair (7.2%).

A summary of cardiac surgery mortality is given in Table 6.3.2. If more than one procedure was performed at a single operation or during the ICU episode, the case was classified based on the procedure with the highest RACHS category.

In 2009 there were 1,556 children admitted to PICU following cardiac surgery or receiving cardiac surgery during their ICU admission. There were 34 deaths during their hospitalisation (including six after ICU discharge), giving a crude mortality of 2.2%, which was between the 2007 rate (1.7%) and the 2008 rate (2.7%). As expected, the mortality varied with surgical complexity (Table 6.3.2).

Analysis of RACHS data for 2007 to 2009 is being carried out to generate a calibrated model for the Australian and New Zealand region.

Table 6.3.2 Mortality in cardiac surgery cases, 2009.

	Number of cases	% of total	Number of Deaths	Unadjusted mortality rate (%)
Total	1556	100	34	2.2
Highest RACHS category for patient				
1	214	13.8	1	0.5
2	570	36.6	6	1.1
3	572	36.8	10	1.7
4	168	10.8	10	6.0
5	2	0.1	1	50.0
6	30	1.9	6	20.0

Table 6.3.1 Occurrences of cardiac surgical procedures, 2009.

RACHS Category	Procedure	Frequency
1	Aortopexy	2
	ASD surgery (including ASD secundum, sinus venosus ASD, patent foramen ovale closure)	204
	Coarction repair >30d of age	55
	Partially anomalous pulmonary venous connection surgery	33
	PDA surgery >30d of age	82
	Total	376
2	Aortic valvotomy - valvuloplasty >30d of age	47
	ASD and VSD repair	73
	ASD primum repair	27
	Coarction repair =30d of age	41
	Common atrium closure	1
	Glenn shunt	86
	Pulmonary outflow tract augmentation	31
	Pulmonary valve replacement	21
	Pulmonary valvotomy - valvuloplasty	21
	Repair of AP window	5
	Repair of pulmonary artery stenosis	40
	Repair of total anomalous pulmonary veins >30d of age	12
	Repair of unspecified septal defect	1
	Right ventricular infundibulectomy	10
	Subaortic stenosis resection	46
	Total repair of tetralogy of Fallot	118
	Transection of pulmonary artery	1
	Vascular ring surgery	15
	VSD closure and pulmonary artery band removal	19
VSD closure and pulmonary valvotomy or infundibular resection	17	
VSD repair	168	
	Total	800
3	Annuloplasty	10
	Aortic valve replacement	30
	Aortoplasty (not arch)	10
	Arterial switch operation	58
	Atrial switch operation	2
	Excision of intracardiac tumour	2
	Fontan procedure	81
	Left ventricular outflow tract patch	5
	Left ventricular to pulmonary artery conduit	1
	Mitral valve replacement	18
	Mitral valvotomy - valvuloplasty	74
	Pulmonary artery banding	49
	Repair of anomalous coronary artery repair without intrapulmonary tunnel	1
	Repair of coarction and VSD closure	9
	Repair of cor triatriatum	9
	Repair of double-outlet right ventricle with or without repair of right ventricular obstruction	6
	Repair of tetralogy of Fallot with pulmonary atresia	10
	Repair of transitional or complete atrioventricular canal with or without valve replacement	61
	Right ventricular to pulmonary artery conduit	56
	Ross procedure	9
Semilunar valve closure, aortic or pulmonary	1	
Systemic to pulmonary artery shunt	108	
Tricuspid valve replacement	1	
Tricuspid valve repositioning for Ebstein anomaly >30d of age	3	
Tricuspid valvotomy - valvuloplasty	50	
Ventriculomyotomy	5	
	Total	669
4	Aortic valvotomy - valvuloplasty =30d of age	6
	Arterial switch operation with repair of sub PS	1
	Arterial switch operation with VSD closure	31
	Atrial septectomy	33
	Complex anomaly (single ventricle) repair by VSD enlargement	1
	Double switch	8
	Hypoplastic or interrupted arch repair with VSD closure	21
	Hypoplastic or interrupted arch repair without VSD closure	26
	Konno procedure	2
	Repair of transposition-VSD sub PS (Rastelli)	9
	Total repair of anomalous pulmonary veins =30d of age	19
	Transverse arch graft	4
	Truncus arteriosus repair	13
Unifocalization for tetralogy of Fallot - pulmonary atresia	12	
	Total	186
5	Truncus arteriosus and interrupted arch repair	2
6	Damus-Kaye-Stansel procedure	5
	Stage 1 repair of hypoplastic left heart syndrome (Norwood)	22
	Stage 1 repair of nonhypoplastic left heart syndrome conditions	5
	Total	32
Unclassified	Cardiac Surgery Closed – Other	66
	Cardiac Surgery Open – Other	64
	PA Plasty or Repair	17
	Pacemaker insertion/replacement	49
	PDA surgery = 30 days	53
	Transplant – Heart	8
	Total	257

Mortality continued

6.4 Risk Adjusted Mortality (PIM2)

Risk adjusted standardised mortality ratios (SMR) were calculated for each unit contributing to the ANZPIC Registry. The SMR is the ratio of the number of deaths observed in a given population to the number of deaths predicted for that population. A logistic regression model is used to calculate the expected number of deaths for the population. The Paediatric Index of Mortality, PIM2 (1), is the model used by the ANZPIC Registry for this purpose.

Risk adjusted mortality prediction models drift in calibration over time. This has occurred with PIM2 risk of death where the SMR for all patient records in the Registry for 2009 was 0.65 (95% CI 0.57-0.74). To overcome this drift in calibration the model was recalibrated before the production of the 2008 Annual Report using patient records for 2007 and 2008 only and the recalibrated version, PIM2-ANZ08, has been applied to the 2009 data in this report. The variable definitions have not changed from the variable definitions used for PIM2. The recalibration results in new variable coefficients and has resulted in the Registry SMR for 2009 being 0.91 (95% CI 0.80-1.01). In this report we have included results using both PIM2 and PIM2-ANZ08. The PIM2 results allow comparison over time against the standard that has been used since 2003. The PIM2-ANZ08 results allow comparison against the standard of care in Australia and New Zealand in more recent years.

Figure 6.4.1 displays the SMRs with 95% confidence intervals for PIM2 and PIM2-ANZ08 for eight PICUs in 2009. The metropolitan and regional hospitals were excluded from Figure 6.4.1 as they recorded less than ten deaths in the year. For all eight PICUs, the 95% confidence interval of the SMRs using PIM2-ANZ08 included the number 1.0, which indicates that for those units, the observed outcome was not significantly different from the expected outcome. Two sites had PIM2 SMRs significantly less than expected, but this is not remarkable given the low Registry SMR.

Figure 6.4.1 Standardised mortality rates (based on PIM2 & PIM2-ANZ08) with 95% confidence intervals for eight PICUs in 2009.

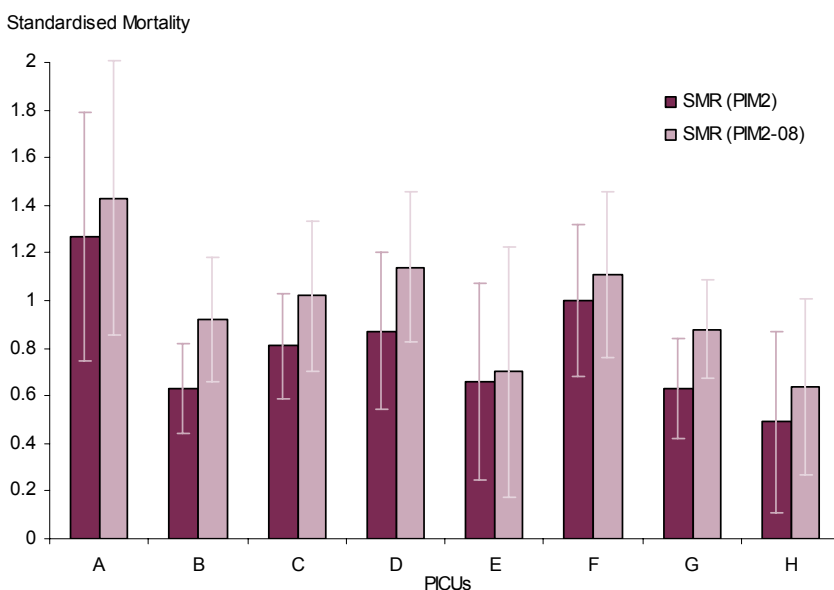


Figure 6.4.2 illustrates the distribution of PIM2-ANZ08 mortality risk for patients submitted to the Registry. The majority of children admitted to ICU have a low risk of mortality.

Figure 6.4.2 Number of admissions and vital status at discharge by PIM2-ANZ08 mortality risk category, 2009.

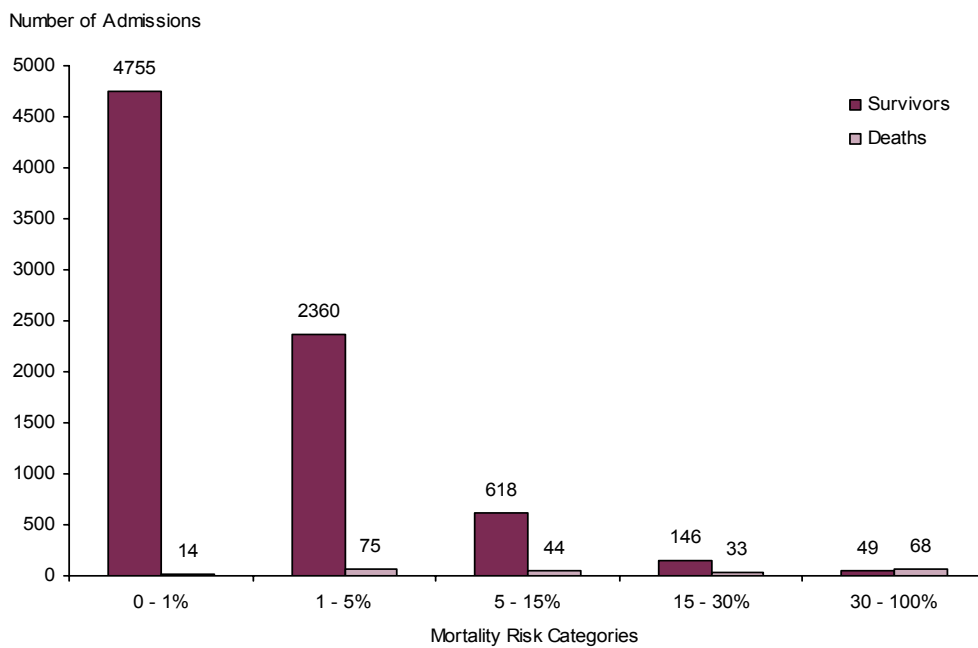
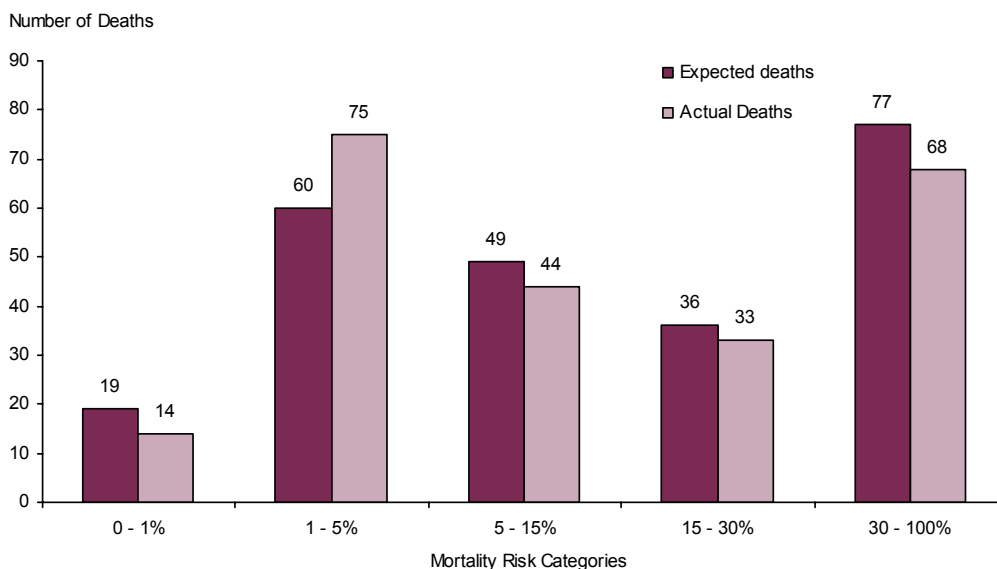


Figure 6.4.3 compares the observed deaths to the expected number of deaths using PIM2-ANZ08 risk of death in the five mortality risk categories.

Figure 6.4.3 Observed vs Expected number of deaths by PIM2-ANZ08 mortality risk category in 2009.



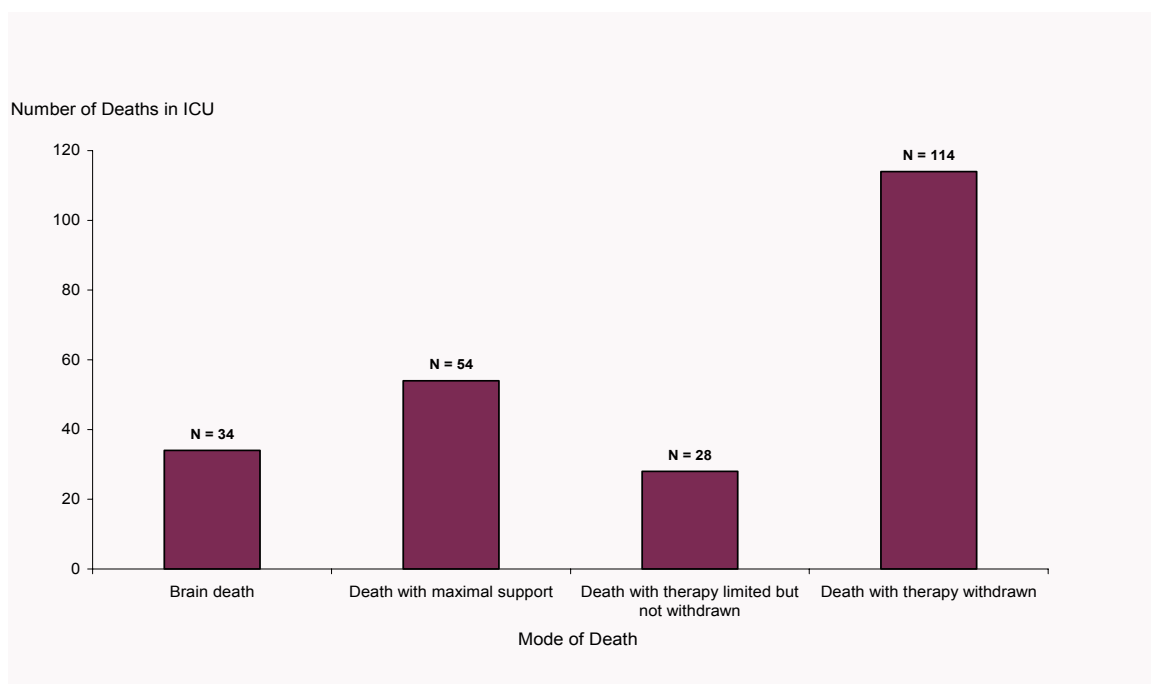
Mortality continued

6.5 Mode of Death and Organ Donation

In 2005, the minimum data set was expanded to collect additional information for patients who died in ICUs. These fields include information on organ donation and the level of intervention in place at the time of death, and have been summarized in annual reports since then.

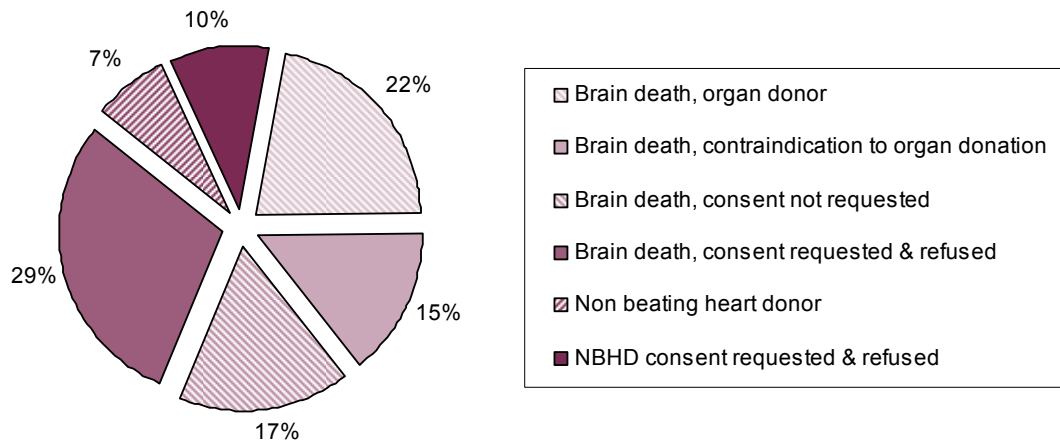
Figure 6.5.1 summarizes the mode of death and level of intervention in place for the 234 patients who died in 2009. Sixty-one percent (142) of the deaths occurred after therapy was limited or withdrawn.

Figure 6.5.1 Mode of death for all patients who died in ICU in 2009.



When considering organ donation from the children who had died, the majority of deaths (189) were in patients where brain death was not present and were not considered for non-beating heart donors (NBHD). Where brain death was diagnosed (n=34), organ donation was contraindicated for 6 of the patients, and not requested in 7 cases. Of the remaining patients, consent for organ donation was requested in 21 cases and consent obtained in 9 of those cases. In addition to the patients meeting brain death criteria, consent for NBHD was requested in 7 patients and consented in 3 of those cases. Figure 6.5.2 summarizes the response to organ donation for the 41 patients where organ donation was considered.

Figure 6.5.2 Organ donation responses for the 41 deaths in ICU with brain death or potential non-beating heart donation, in 2009.



7. Monitoring Performance of Paediatric Intensive Care

7. Monitoring Performance of Paediatric Intensive Care

In order to assess PICU performance and benchmark performance between units, it is necessary to have methods to adjust outcome based on patient risk factors. Methods for risk adjusting mortality have been available for many years. The funnel plots (Figures 7.3.1 and 7.3.2) and the sequential control charts (Figures 7.4.1 to 7.4.8) represent the results of analysis of risk adjusted mortality. These figures were constructed using the recalibrated PIM2 model (PIM2-ANZ08).

As well as considering risk adjusted mortality, new methods of assessing variation in patient outcomes amongst units have been developed using risk adjusted PICU length of stay (LOS) and length of respiratory support (LORS), as well as a visual representation of unit efficiency. These new methods, discussed in sections 7.1 and 7.2, were applied to Registry data in the 2008 Annual Report, and have been generated again using 2009 data.

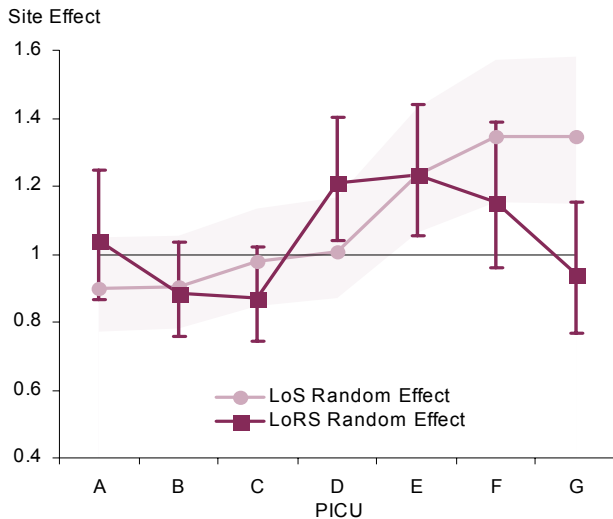
7.1 Risk adjusted Length of Stay and Length of Respiratory Support

A gamma regression model of LOS and a lognormal regression model of LORS were constructed using all patient records in the Registry for 2009 (10,13). Both models included the unit the patient was managed in as a random effect. Therefore, for each unit, a '*site effect*' was generated and this represents the risk adjusted mean LOS and mean LORS relative to the population overall. For example, a site effect of 1.2 for LOS indicates that the risk adjusted mean LOS for that ICU was 1.2 times the risk adjusted mean LOS for the Registry overall. Units where the 95% confidence interval for the site effect did not include one were considered significant.

Figure 7.1.1 illustrates the results of the analysis for seven PICUs in 2009; one PICU was excluded from the analysis as the unit did not collect data on LORS. The figure illustrates that units E, F and G had significantly longer risk adjusted LOS than the population overall. The prolonged LOS in units F and G was not associated in either unit with prolonged LORS suggesting that in these units administrative factors were more likely than clinical factors to be influencing LOS. Administrative factors potentially associated with prolonged LOS include ICU exit block or step down facilities provided within the ICU. Unit D had a risk adjusted mean LORS that was significantly longer than the population overall, however this was not associated with prolonged LOS.

Monitoring Performance of Paediatric Intensive Care continued

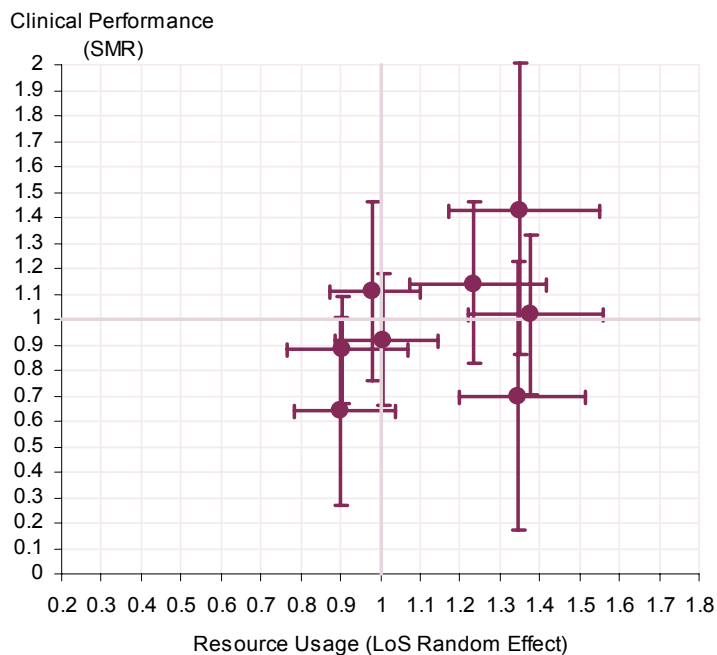
Figure 7.1.1 Risk adjusted mean Length of Stay and Length of Respiratory Support for PICUs in 2009.



7.2 PICU Efficiency

Efficiency in healthcare is a measure of both the effectiveness and cost of care. For intensive care, a unit can be considered efficient if optimum clinical outcomes are achieved with low resource use. Figure 7.2.1, a modified Rapoport-Teres plot, provides a simple visual representation of PICU efficiency. The standardised mortality rate (SMR) serves as an indicator of intensive care clinical performance, while the site effect for mean length of stay (LOS) provides a marker of resource use. When considered together, the plot illustrates efficiency (11). 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 (top left).

Figure 7.2.1 Rapoport-Teres plot of efficiency for PICUs, in 2009.



Monitoring Performance of Paediatric Intensive Care continued

7.3 Risk adjusted mortality

Funnel plots (Figures 7.3.1 and 7.3.2) have been used as an alternative graphical representation of the SMRs for each site. As a comparative report, the funnel plot compares a unit's SMR against the SMRs of all units within the Registry. This plot can identify potential outliers, as they will fall outside the control lines. Figure 7.3.1 represents values from each site in 2009, while Figure 7.3.2 combines their data for 2008 and 2009. Both PICUs and general ICUs are represented on the funnel plots. No outliers were identified using this method.

Figure 7.3.1 Funnel plot representation of PIM2-ANZ08 SMRs for contributing sites in 2009.

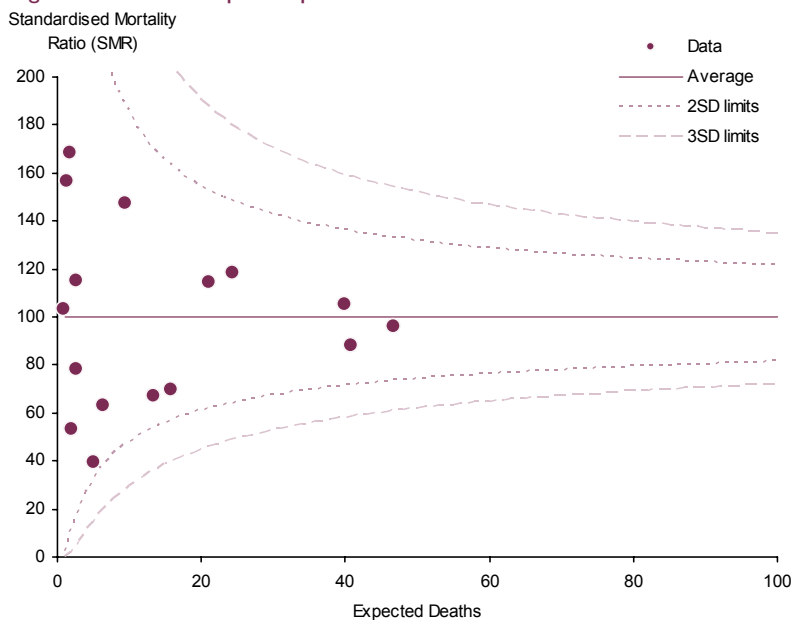
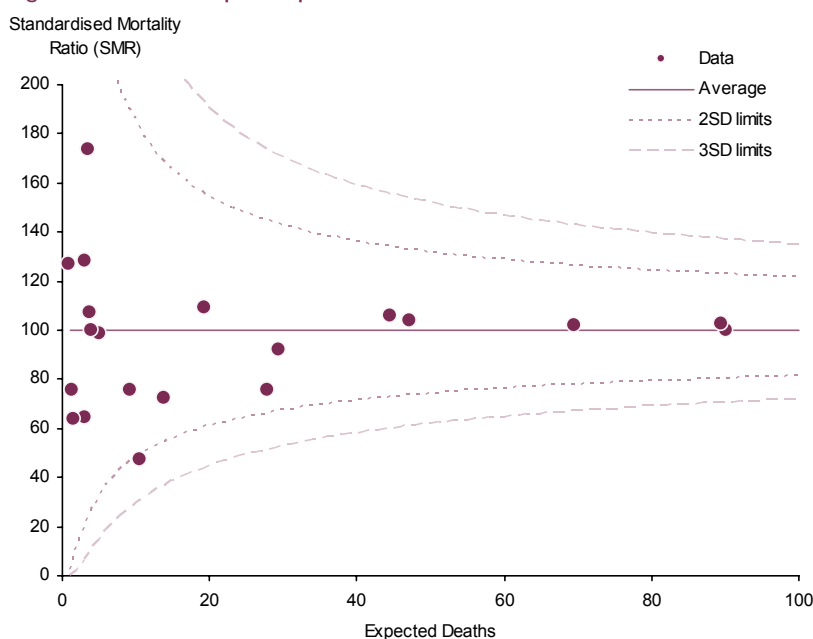


Figure 7.3.2 Funnel plot representation of PIM2-ANZ08 SMRs for sites using combined 2008 and 2009 data.



Monitoring Performance of Paediatric Intensive Care continued

7.4 Sequential Control Charts (CUSUMS)

CUSUM charts (8) have been constructed for the eight PICUs for the years 2008 and 2009 combined (Figures 7.4.1 - 7.4.8). To construct the risk adjusted Cumulative sum charts, the PIM2-ANZ08 model was used. Therefore these charts test for 'out-of-control' signals where the loss of control is defined as doubling or halving of the odds of death in the test PICU relative to all paediatric patients admitted to intensive care in Australia and New Zealand during 2008 and 2009 that were reported to the Registry.

The upper chart in each figure represents the cumulative excess deaths. The darker line represents the cumulative number of excess deaths - relative to the number of deaths predicted by PIM2-ANZ08. The lighter line represents the cumulative number of excess deaths without adjustment for mortality risk, using an expected crude mortality of 3.34%, and illustrates the effect of risk adjustment. The lower chart represents sequential probability ratio testing for an increase or decrease in the odds of death.

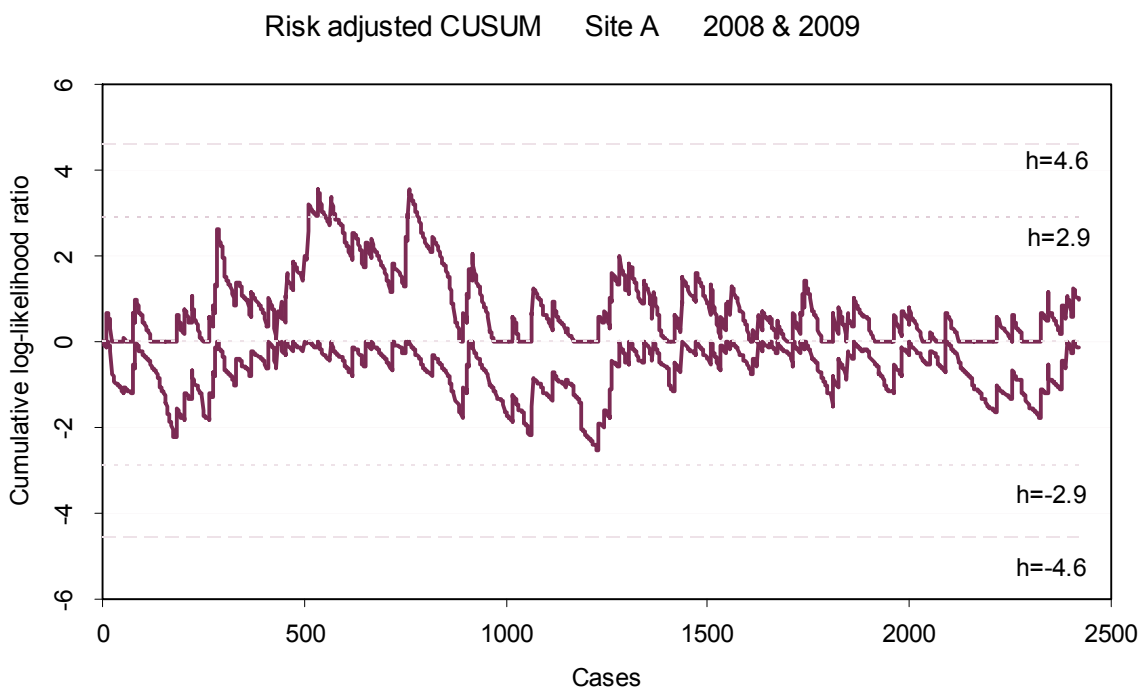
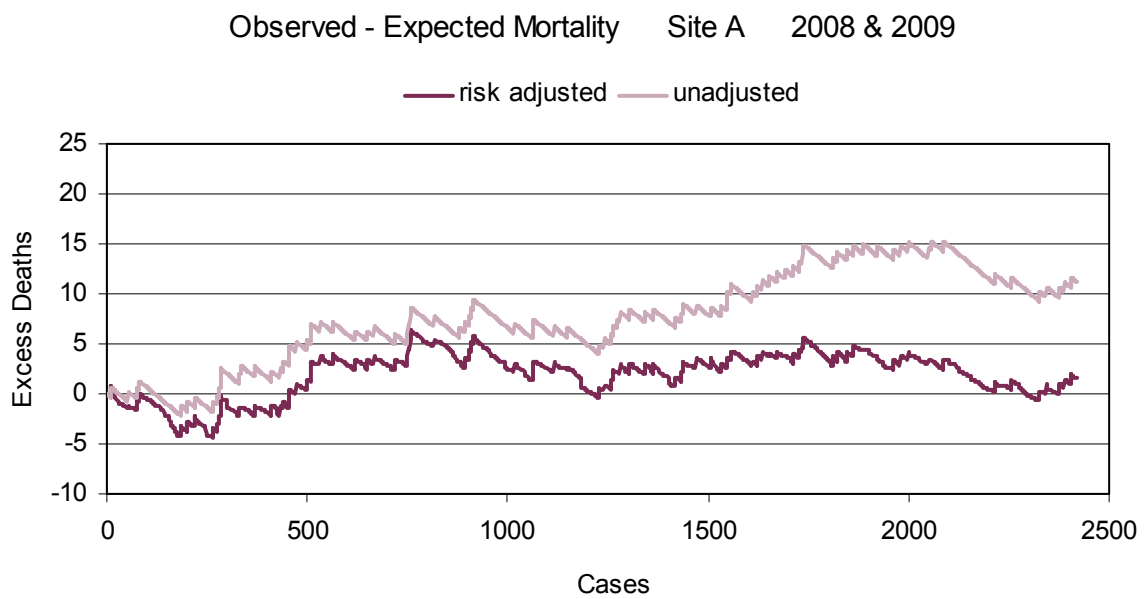
For both charts the x axis represents each admission to ICU in sequence for the two year period 2008 - 2009. The y axis in the upper chart represents the cumulative excess deaths that have occurred relative to the number of deaths predicted. The y axis in the lower chart represents 'process control' where the process is the cumulative observed outcome relative to that predicted by PIM2-ANZ08. The chart is designed to test two hypotheses; Hypothesis A (HA) that the odds of deaths in the unit have doubled relative to the population used to derive PIM2-ANZ08, and Hypothesis B (HB) that the odds of death in the unit have halved relative to the PIM2-ANZ08 population.

If the upper line crosses the control limits, HA is accepted, whereas if the lower line crosses the control limits HB is accepted. The control limits of ± 2.9 and ± 4.6 are set arbitrarily. Conceptually the control limits correspond to the hypotheses being accepted at $\alpha = \beta = 0.05$ (± 2.9) or at $\alpha = \beta = 0.01$ (± 4.6). It should be noted, however, that the resetting of the chart and repeated testing mean that the thresholds no longer represent true probabilities, but become more pragmatic thresholds for deciding if the process is in or out of control. For a more detailed explanation of the methods of constructing these charts and their interpretation see reference (8).

For the two year period there were no alarms signalled at the higher threshold (4.6) by the charts for all of the PICUs (Figures 7.4.1 - 7.4.8). Four units (A, C, F and G) crossed the lower alarm threshold (2.9) during the two year period. This can be interpreted as an early warning signal that the process was 'out of control'. In all four units the plots returned to the 'in control' zone. Therefore these early warning signals are likely to represent chance clustering of cases rather than confirmed 'out of control' processes. While it is important that any signal is investigated, it should be remembered that the expected frequency of false alarms from this method of sequential probability ratio testing has been estimated to be once in every 800 to 1800 cases (8).

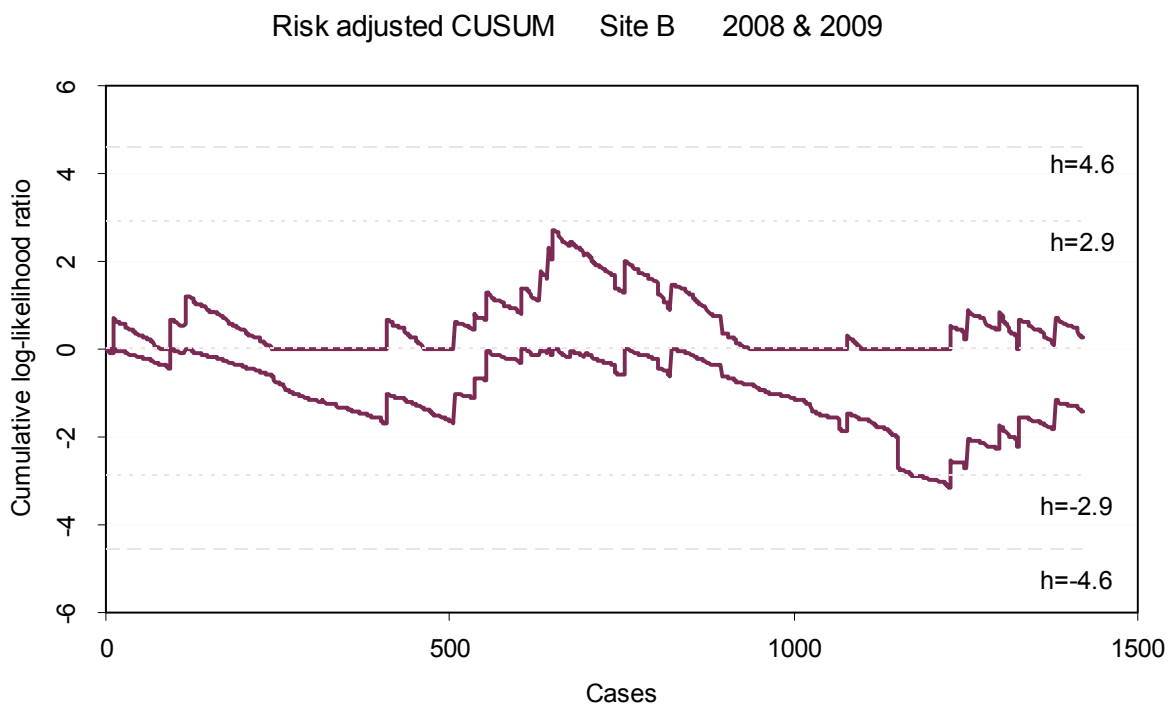
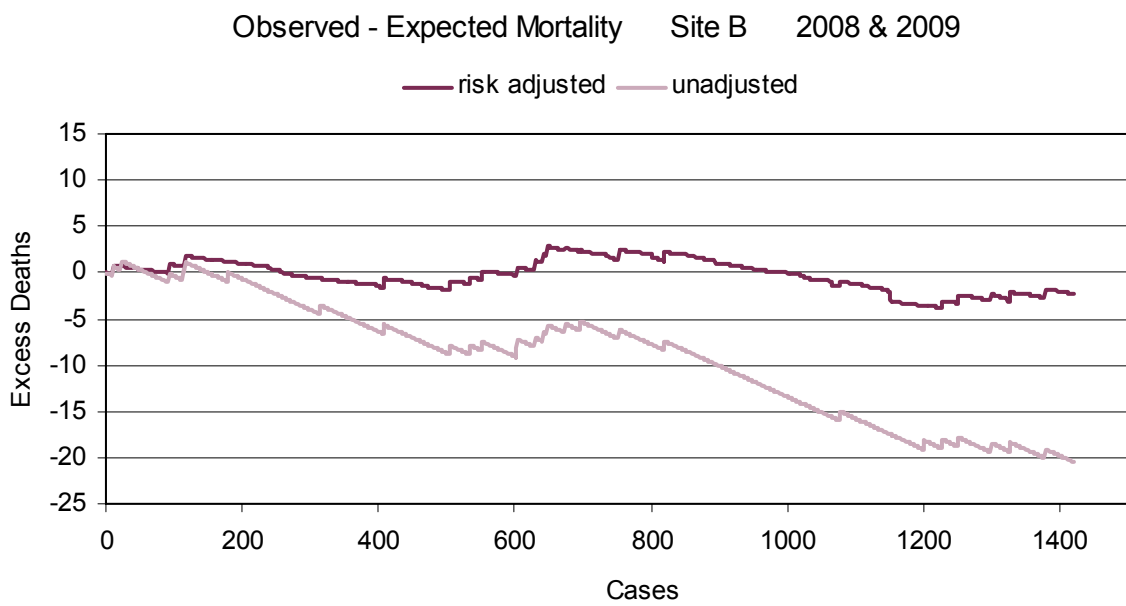
Monitoring Performance of Paediatric Intensive Care continued

Figure 7.4.1 Sequential cumulative sum control chart for doubling and halving the odds of death for PICU A, 2008 - 2009.



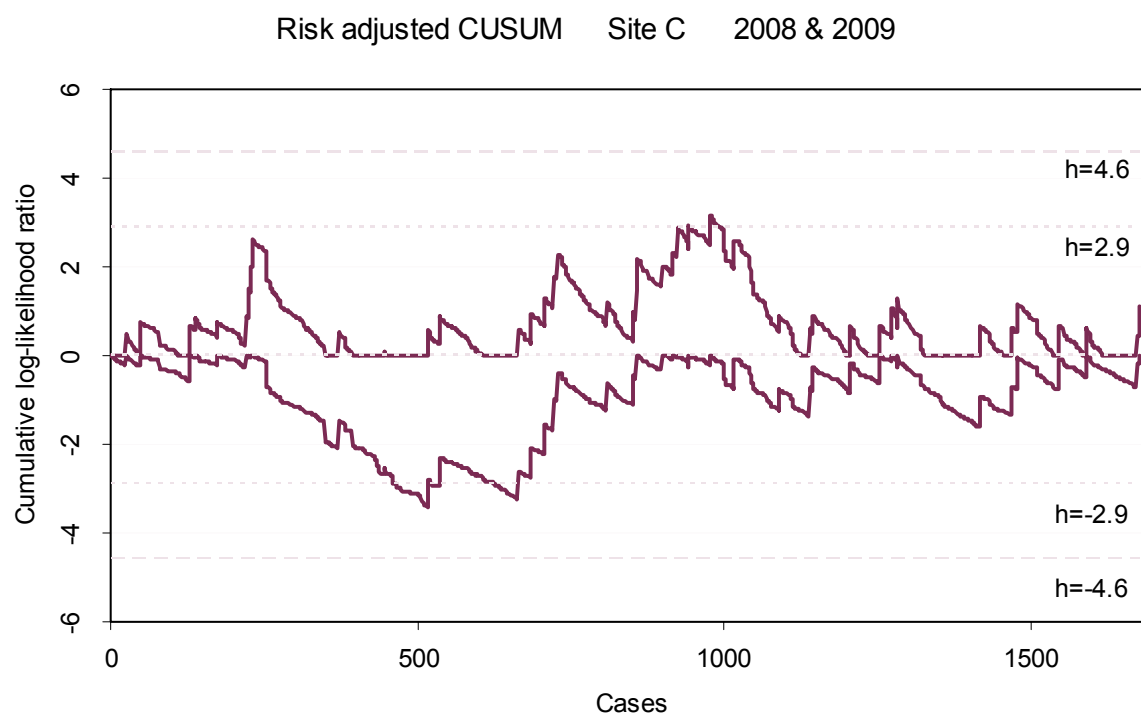
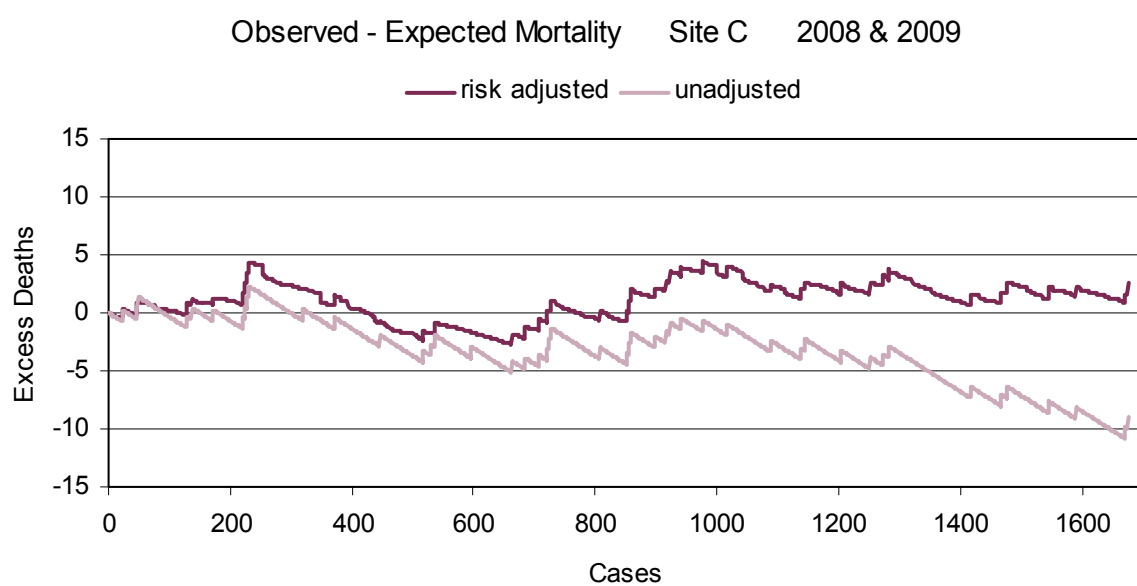
Monitoring Performance of Paediatric Intensive Care continued

Figure 7.4.1 Sequential cumulative sum control chart for doubling and halving the odds of death for PICU B, 2008 - 2009.



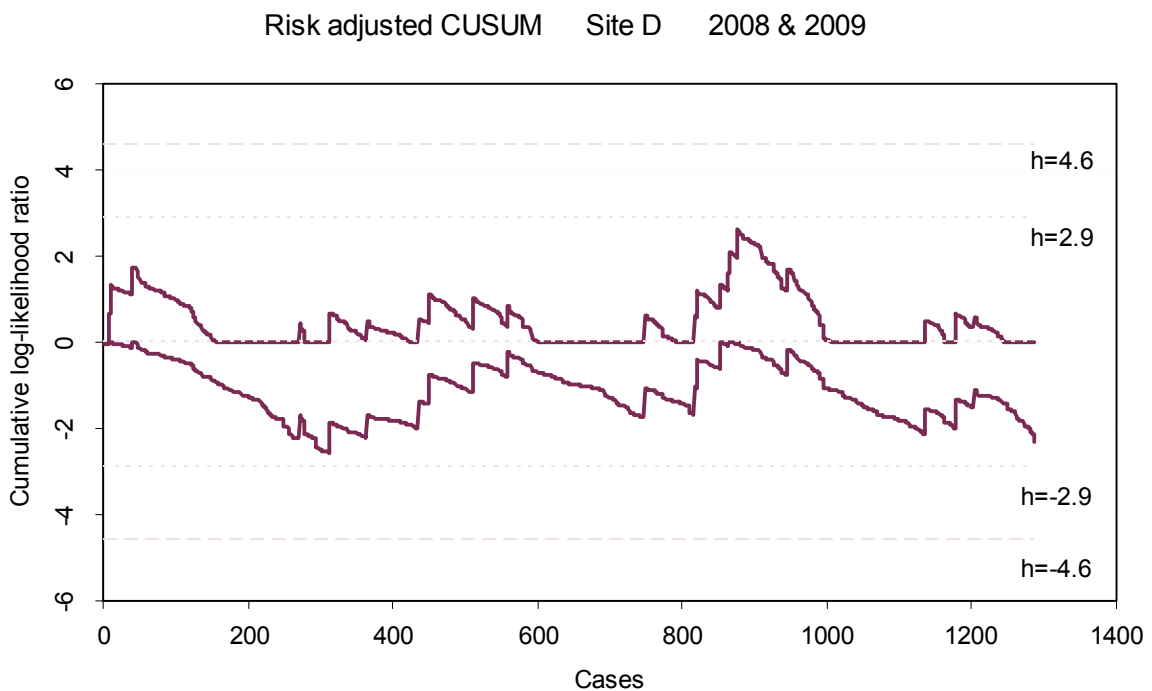
Monitoring Performance of Paediatric Intensive Care continued

Figure 7.4.1 Sequential cumulative sum control chart for doubling and halving the odds of death for PICU C, 2008 - 2009.



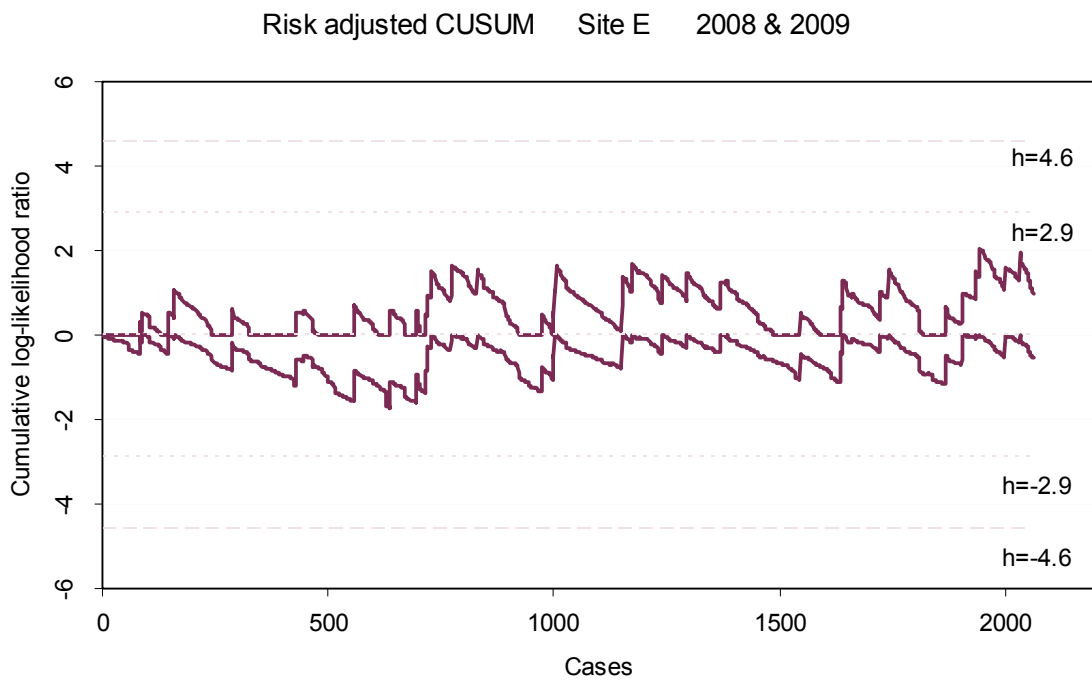
Monitoring Performance of Paediatric Intensive Care continued

Figure 7.4.1 Sequential cumulative sum control chart for doubling and halving the odds of death for PICU D, 2008 - 2009.



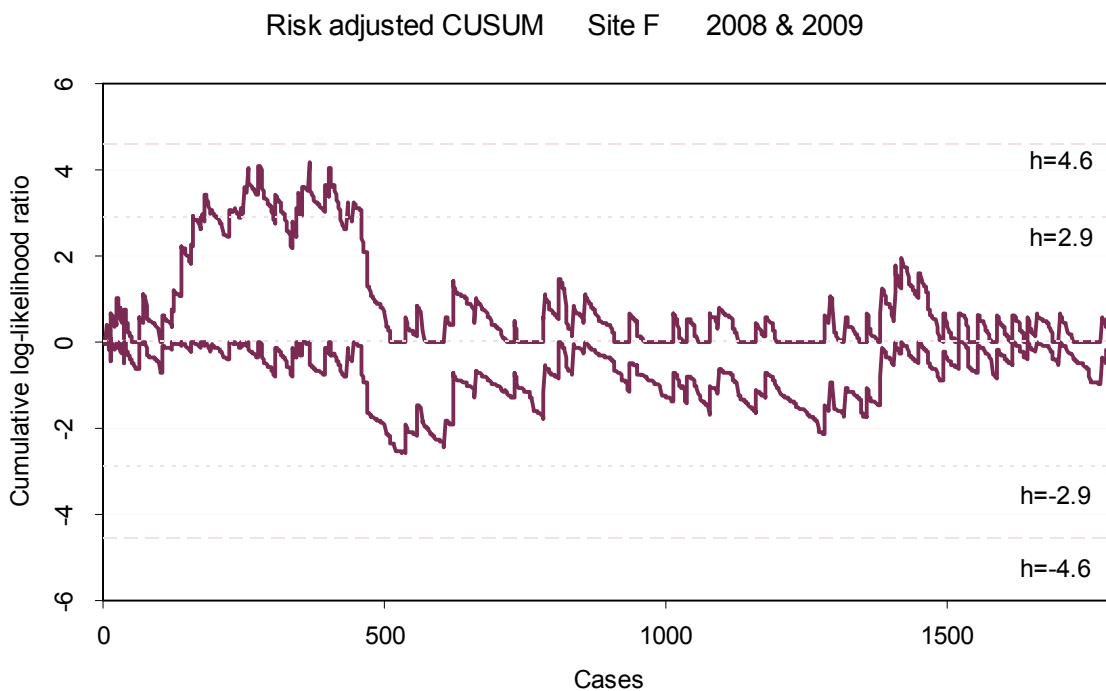
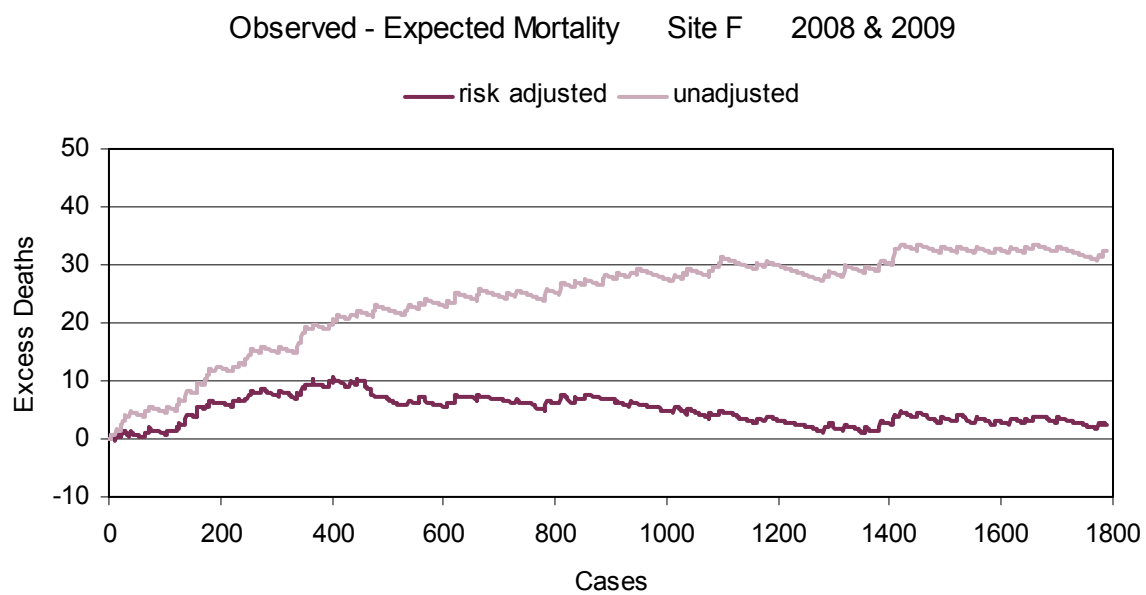
Monitoring Performance of Paediatric Intensive Care continued

Figure 7.4.1 Sequential cumulative sum control chart for doubling and halving the odds of death for PICU E, 2008 - 2009.



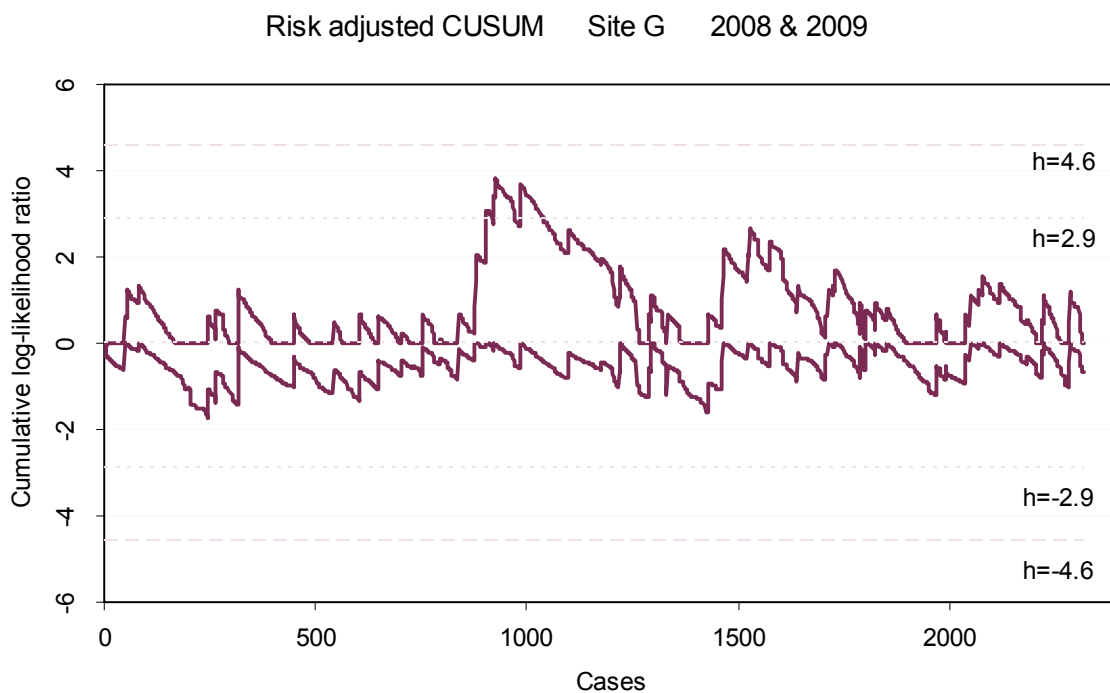
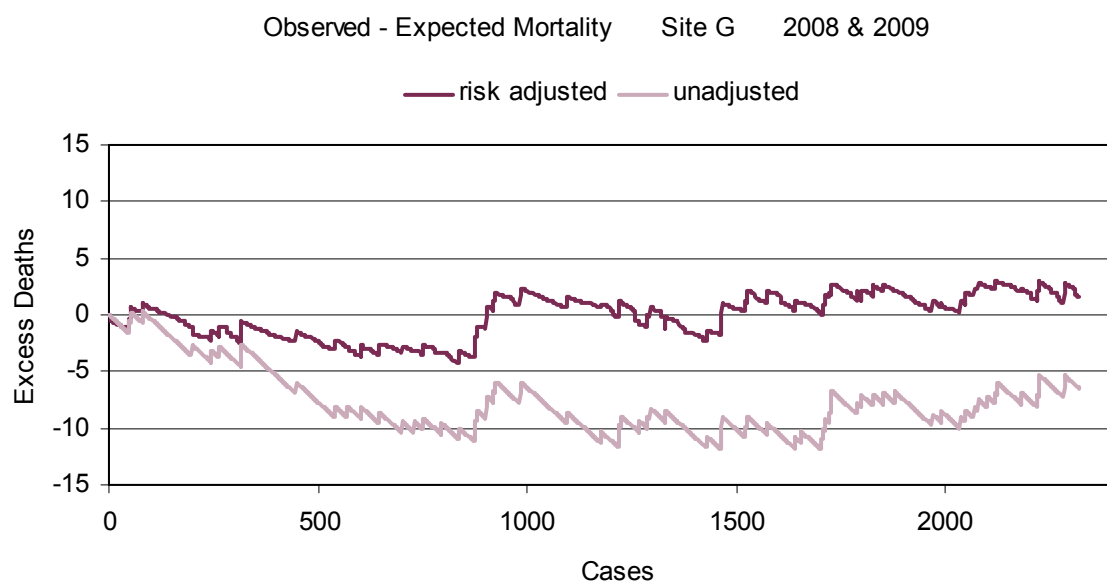
Monitoring Performance of Paediatric Intensive Care continued

Figure 7.4.1 Sequential cumulative sum control chart for doubling and halving the odds of death for PICU F, 2008 - 2009.



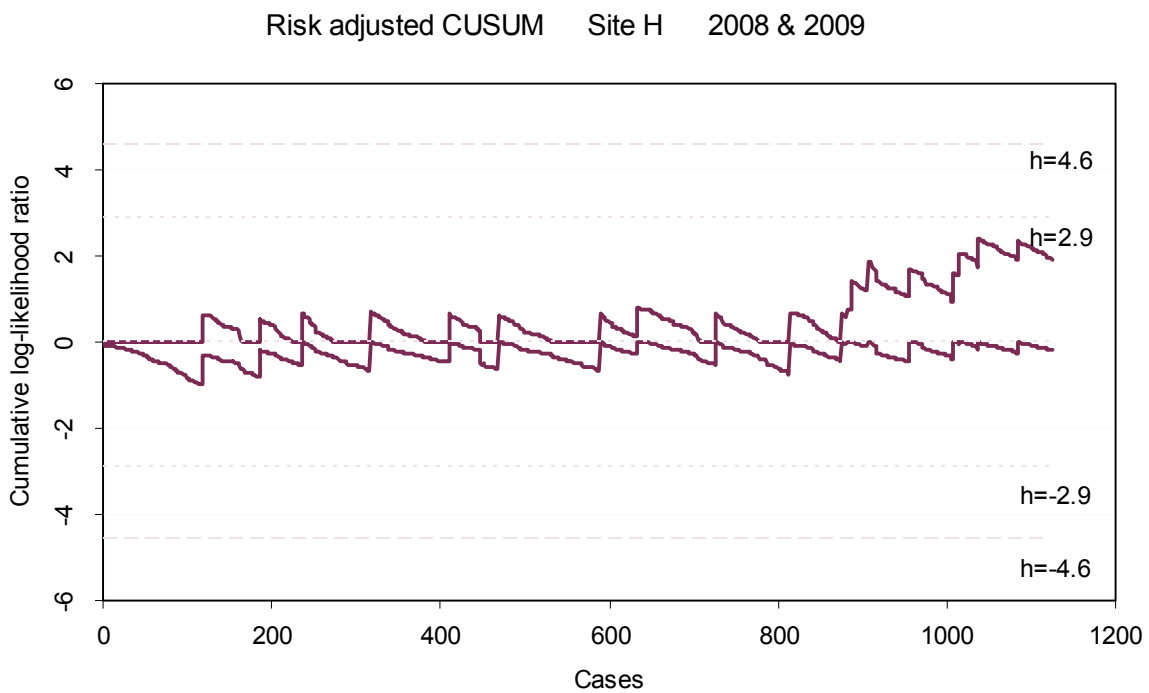
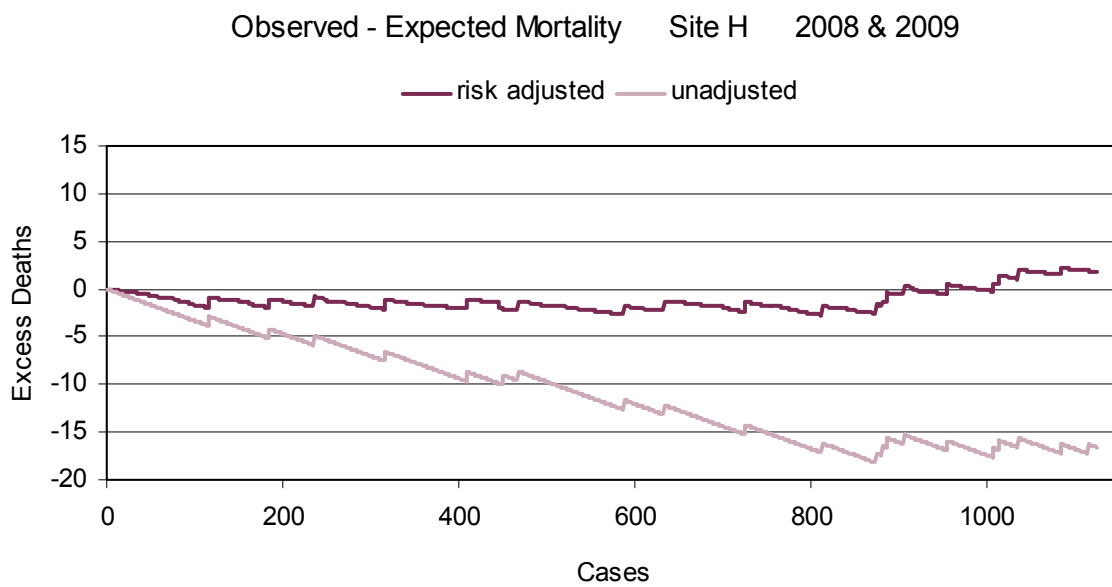
Monitoring Performance of Paediatric Intensive Care continued

Figure 7.4.1 Sequential cumulative sum control chart for doubling and halving the odds of death for PICU G, 2008 - 2009.



Monitoring Performance of Paediatric Intensive Care continued

Figure 7.4.1 Sequential cumulative sum control chart for doubling and halving the odds of death for PICU H, 2008 - 2009.



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Appendix I: Minimum Data Set Variables

Date of Birth (field name DOB)

Date of Birth of the patient (dd/mm/yyyy)

Gender (field name GENDER)

Gender of the patient

- M Male
- F Female

Indigenous Status (field name IND_STATUS)

The indigenous status of the patient, as identified by the patient next of kin

- 0 Not of Aboriginal or Torres Strait Islander (TI) descent
- 1 Aboriginal - of Aboriginal or Torres Strait Islander (TI) descent, who identifies as an Aboriginal or TI, and is accepted as such by the community with which the patient is associated

Weight (field name WT)

The weight of the patient on admission, measured in kilograms (Kg).

Post Code (field name POST)

Post Code of patient's home address.

Hospital Admission Source (field name HADM_SC)

Patient's location prior to admission to the hospital housing the ICU

- 1 Home/scene - admitted from home or the scene of an injury
- 2 Other Hospital - Emergency Department - patient transferred from the emergency department of another hospital
- 3 Other Hospital - OT/Recovery - patient transferred from the operating theatre or recovery room of another hospital
- 4 Other Hospital - ICU/NICU - patient transferred from the intensive care unit or neonatal intensive care unit of another hospital
- 5 Other Hospital - Ward - patient transferred from any other inpatient area of another hospital
- 6 Inborn - patient was born at the hospital housing the ICU

Retrieval (field name RETRIEV)

Describes the mechanism whereby a patient is transported to the hospital by a specialist paediatric ICU transport team or equivalent

- 0 No
- 1 Yes

ICU Admission Source (field name IADM_SC)

Patients location immediately prior to admission to the ICU

- 1 OT/Recovery - patient admitted to ICU from the operating theatre or recovery room.
- 2 Emergency Department - patient admitted to ICU from the emergency department.
- 3 Ward - patient admitted to ICU from any other inpatient area.
- 4 Other ICU/NICU Same Hospital - patient admitted to ICU from another ICU or NICU within the same hospital.
- 5 Direct ICU Admission - patient admitted directly to ICU, for example following a retrieval.

Appendix I: Minimum Data Set Variables

Previous ICU Admission During this Hospital Admission (field name PREV_AD)

Has the patient been previously admitted to intensive care during this episode of care

- 0 No
- 1 Yes - Readmitted within 48 hours post ICU Discharge
- 2 Yes - Readmitted after 48 hours post ICU Discharge

ICU Admission Date and Time (field name ADM_DT)

The date and time on which the patient commenced an episode of ICU care (dd/mm/yyyy hh:mm)

ICU Discharge Date and Time (field name DIS_DT)

The date and time on which the patient completes an episode of ICU care (dd/mm/yyyy hh:mm)

Principal ICU Diagnosis (field name PDX)

Code the diagnosis most directly responsible for the ICU admission. Use the ANZPIC Registry diagnoses codes (Appendix II). For patients admitted primarily for recovery after a procedure, use a Post Procedural Diagnosis for the principal diagnosis. Do not use an infection code or mechanism of injury code for Principal Diagnosis

Principal underlying diagnosis (field name UDX)

The underlying diagnosis which has contributed to the need for ICU admission.

For example, an ex-premature infant with bronchiolitis will have a principal ICU diagnosis of bronchiolitis with an underlying diagnosis of prematurity

Associated Diagnoses (field names ADX1, ADX2, ADX3, ADX4, ADX5)

The presence of any other conditions in addition to that listed as the principal diagnosis (record up to five associated diagnoses). For patients having an operative procedure during the ICU admission, a Post Procedural Diagnosis should be listed as an associated diagnosis.

Other Diagnosis (field name DIAGTEXT)

Where a non-specific "other" diagnosis code has been used (e.g. 450 Respiratory – Other), please record the actual diagnosis (free text).

Total Hours of Intubation During this Admission (field name I_ADHR)

Intubation refers to ETT or Tracheostomy

Total Hours of Respiratory Support During this Admission (field name RS_ADHR)

Respiratory Support refers to ventilation, CPAP, BiPAP or NPV delivered by ETT, Tracheostomy, nasopharyngeal airway, mask, nasal prongs, or Curass (i.e.. any form of mechanical assistance).

Outcome (field name OUTCOME)

The patients destination on completion of the ICU episode of care.

- 1 Discharged to ward (includes transfer to another hospital ward) or home
- 2 Died in ICU
- 3 Transferred to another ICU (includes NICU)
- 4 Still in ICU
- 5 Died within 24 hours after being discharged from ICU to receive palliative care

ICU/NICU Transferred to (field name ICU_TRAN)

Code of the hospital to which the patient is transferred.

Appendix I: Minimum Data Set Variables

Paediatric Index of Mortality (PIM2) Variables

Record the first value of each variable measure at or about the time of first face to face contact between the patient and a doctor from your ICU (or a specialist paediatric retrieval team). Use the first values measured within the period from shortly before first contact to one hour after arrival in your own ICU. The first contact may be in the ICU, the emergency department, another inpatient area of the hospital, or in another hospital (for example on a retrieval). If the variable was not measured record 999.

Elective (field name ELECTIVE)

An ICU admission or an operation is considered elective if it was planned or foreseeable, and could have been postponed for more than six hours without an adverse effect.

- 0 Non-elective - all other admissions.
- 1 Elective - includes booked ICU admission after elective surgery, for an ICU procedure (for example central line insertion), for diagnostic monitoring or review of a home ventilation patient.

Recovery from surgery (field name RECOVERY)

Includes a radiology procedure or cardiac catheter. Do not include patients admitted from the operating theatre where recovery from surgery is not the main reason for ICU admission (for example, a patient with a head injury who is admitted from theatre after insertion of an ICP monitor, in this patient the main reason for ICU admission is the head injury).

- 0 No
- 1 Yes

Admitted following cardiac bypass (field name BYPASS)

(Also code as recovery from surgery.)

- 0 No
- 1 Admitted following cardiac bypass
- 2 Bypass procedure during ICU admission
- 3 Both 1 & 2 apply

Mechanical ventilation (field name RS_HR124)

Record whether the patient was mechanically ventilated within the first hour of admission to ICU. Mechanical ventilation refers to both invasive (ETT or tracheostomy), and non-invasive (nasopharyngeal airway, mask or nasal prongs) methods of augmenting work of breathing. Using conventional mechanical ventilation (CVM), continuous positive airway pressure (CPAP), biphasic positive airway pressure (BiPAP), or negative pressure ventilation (NPV).

- 0 No
- 1 Yes

Systolic Blood Pressure (field name SBPA)

Measure in mmHg. If not measured within one hour of admission record 999.

Pupillary Responses to bright light (field name PUPILS)

Pupillary reactions to bright light are used as an index of brain function. Do not record abnormal findings due to drugs, toxins, or local eye injury.

- 0 All other responses including unknown
- 1 Both fixed and > 3mm

PaO₂ (field name PO2A)

The arterial oxygen tension, mmHg, as measured in an arterial blood gas sample. At time of PaO₂ if oxygen via ETT or headbox (unknown = 999).

Appendix I: Minimum Data Set Variables

Base Excess (field name BEA)

The base excess measured in arterial or capillary blood, in mmol/l. Unknown = 999.

FiO₂ (field name FIO2A)

The fraction of inspired oxygen being delivered to the patient via endotracheal tube (ETT), non-invasive ventilation (NIV), or headbox. Measure at the same time as the PaO₂.

PIM2 Low risk diagnosis (field name PIM_LR)

Specific conditions associated with reduced mortality risk

- 0 None
- 1 Asthma is the main reason for ICU admission.
- 2 Bronchiolitis is the main reason for admission.
- 3 Croup is the main reason for ICU admission.
- 4 Obstructive sleep apnoea (OSA) is the main reason for ICU admission. Include admissions following adenoidectomy &/or tonsillectomy where OSA is the main reason for ICU admission.
- 5 Diabetic keto-acidosis is the main reason for ICU admission.

PIM2 High risk diagnosis (field name PIM_UC)

Specific conditions associated with increased mortality risk

- 0 None
- 1 Cardiac arrest out of hospital - requires either documented absent pulse or the requirement for external cardiac massage (do not include past history of cardiac arrest).
- 2 Severe combined immune deficiency - requires the documented diagnosis of SCID.
- 3 Leukaemia or lymphoma after 1st induction. Include only cases where the admission is related to leukaemia or lymphoma, or the therapy for these conditions.
- 4 Spontaneous cerebral haemorrhage - haemorrhage must be spontaneous (for example, from an aneurysm or AVM). Do not include traumatic cerebral haemorrhage or intracranial haemorrhage that is not intracerebral.
- 5 Cardiomyopathy or myocarditis - requires the documented diagnosis of myocarditis or cardiomyopathy.
- 6 Hypoplastic left heart syndrome - include only cases where a Norwood procedure, or equivalent is required to sustain life.
- 7 HIV infection - requires the document diagnosis of HIV.
- 8 *Code no longer in use (2009 onwards)*
- 9 Neurodegenerative disorder - requires a history of progressive loss of milestones (even if no specific condition has been diagnosed) or a diagnosis where this will inevitably occur.
- 10 Liver failure - acute or chronic, include patients admitted for recovery following liver transplantation for acute or chronic liver failure.
- 11 Cardiac arrest in hospital - preceding ICU admission requires either documented absent pulse or the requirement for external cardiac massage (do not include past history of cardiac arrest)

(End of PIM2 variables)

Place of first face to face contact (field name 1ST_CONT)

Place of first face to face contact between the patient and a doctor from your ICU (or a doctor from a specialist paediatric transport team).

- 1 Your ICU
- 2 In your hospital but outside ICU
- 3 Outside your hospital

Appendix I: Minimum Data Set Variables

First contact (field name PIM_VAL)

Are the values recorded above (i.e. those used in PIM2 calculations) made at or about the time of first face to face contact?

- 0 No
- 1 Yes

Mode of Death (field name DEATH_MODE)

For patients who died, what was the mode of death of patient.

- 1 Brain death
- 2 Death with maximal support
- 3 Death with therapy limited but not withdrawn
- 4 Death with therapy withdrawn

External Cardiac Massage (field name ECM)

For patients who died, was external cardiac massage performed as the terminal event.

- 0 No
- 1 Yes

Limitation of Therapy (field name LIMIT)

For patients who died, was there a limitation of therapy order in the notes.

- 0 No
- 1 Yes

Date of Limitation Order (field name LIMIT_D)

For patients who died and who had a limitation of therapy order in their notes, record the date that the order was documented in the patient's case notes (dd/mm/yyyy). If more than one order, record date of first order; if order preceded ICU admission, record ICU admission date.

Organ Donation (field name ORG_DON)

For patients who died, what was their organ donation status.

- 1 Brain death not present (NBHD not considered)
- 2 Brain death, organ donor
- 3 Brain death, contraindication to organ donation
- 4 Brain death, consent not requested
- 5 Brain death, consent requested and refused
- 6 Non beating heart donor
- 7 Non beating heart donation consent requested and refused

Specific Therapies

To be completed at the time of patient discharge from ICU.

CVVH or CVVHD (field name CVVH)

Specifies whether the patient received renal therapy support in terms of continuous haemodialysis at any time during their admission to ICU.

- 0 No
- 1 Yes

Appendix I: Minimum Data Set Variables

Haemodialysis (field name HD)

Specifies whether the patient received renal therapy support in terms of intermittent haemodialysis at any time during their admission to ICU.

0 No
1 Yes

Peritoneal dialysis (field name PD)

Specifies whether the patient received renal therapy support in terms of peritoneal dialysis at any time during their admission to ICU.

0 No
1 Yes

Plasma filtration (field name PF)

Specifies whether the patient received renal therapy support in terms of plasma filtration at any time during their admission to ICU.

0 No
1 Yes

High frequency oscillation (field name HFO)

Specifies whether the patient received high frequency oscillation (HFO) therapy at any time during their admission to ICU.

0 No
1 Yes

Inhaled nitric oxide (field name INO)

Specifies whether the patient received inhaled nitric oxide therapy at any time during their admission to ICU.

0 No
1 Yes

ECMO (field name ECMO)

Specifies whether the patient received extra corporeal membrane oxygenation (ECMO) therapy at any time during their admission to ICU.

0 No
1 Yes

Ventricular assist device (field name VAD)

Specifies whether the patient received support from a ventricular assist device (VAD) at any time during their admission to ICU.

0 No
1 Yes

ICP Monitoring (field name ICPM)

Specifies whether the patient had an intra cranial pressure monitor inserted at any time during their admission to ICU.

0 No
1 Yes

Appendix I: Minimum Data Set Variables

Inotropes (field name INOTROPES)

Specifies whether the patient received inotrope therapy at any time during their admission to ICU.

- 0 None
- 1 Commenced within 1st hour of admission
- 2 Commenced > 1st hour of admission

Hospital Admission Date and Time (field name HADM_DT)

The date and time on which the patient commenced an episode of hospital care (dd/mm/yyyy hh:mm).

Hospital Discharge Date and Time (field name HDIS_DT)

The date and time on which the patient completes an episode of hospital care (dd/mm/yyyy hh:mm).

Hospital Outcome (field name HOSP_OUT)

The patient's destination on completion of the hospital episode of care.

- 1 Still in hospital
- 2 Died
- 3 Discharged home
- 4 Transferred to a rehabilitation hospital
- 5 Transferred to other hospital—ICU/NICU
- 6 Transferred to other hospital—ward

New fields added in 2007 to enable the calculation of a RACHS (risk adjustment for congenital heart surgery) score -

Gestation (field name GESTATION)

If < 37 completed weeks and < 12 months of age, enter the number of completed weeks of gestation,

If > 37 completed weeks or >12 months of age enter the number 40.

Major Non Cardiac Structural Anomaly (field name NC_STAN)

- 0 No
- 1 Yes

Combination of Cardiac Surgery Procedures at a Single Operation (field name CP_SOP)

- 0 No
- 1 Yes

Antenatal Diagnosis of Major Structural Anomaly (field name AD_STAN)

- 0 No
- 1 Yes

Cardiac Surgery During this Admission (field name CARDIAC)

- 0 No
- 1 Yes

Appendix II: ANZPIC Diagnostic Codes

INJURY

- 100 Injury - Other
- 101 Anaphylaxis
- 102 Burns
- 103 Carbon Monoxide Poisoning
- 104 Drug Toxicity - Iatrogenic
- 105 Electrocution
- 106 Envenomation
- 107 Hanging or Strangulation
- 108 Hyperthermia
- 109 Hypothermia
- 110 Immersion (Near Drowning)
- 111 *Ingestion (code no longer in use)*
- 121 Ingestion - drug
- 122 Ingestion - non drug
- 112 Smoke Inhalation
- 113 Trauma - Other
- 114 Trauma - Abdominal
- 115 Trauma - Chest
- 116 Trauma - Facial
- 117 Trauma - Head
- 118 Trauma - Skeletal
- 119 Trauma - Spinal

INJURY MECHANISM

(DO NOT USE FOR PRINCIPAL DIAGNOSIS)

- 150 Injury Mechanism – Other
- 162 Crush Injury
- 151 Cyclist
- 152 Fall
- 153 Farm Equipment
- 154 Firearm Injury
- 161 Motor Bike Rider / Passenger
- 155 MVA – Passenger
- 156 MVA – Pedestrian
- 157 Non Accidental Injury
- 158 Self Injury
- 159 Sports Injury
- 160 Stab Injury

CARDIOVASCULAR

CONGENITAL

- 200 Cardiovascular - Congenital - Other
- 230 Cardiovascular - Congenital-Post Palliation
- 201 Absent Pulmonary Valve
- 202 Anomalous Coronary Artery
- 203 Aortic Insufficiency
- 204 Aortic Stenosis
- 224 AP Window
- 205 ASD
- 225 AV Malformation

- 226 Double Outlet Right Ventricle
- 209 Ebstein's Anomaly
- 231 Hypoplastic LV (not HLHS)
- 210 Hypoplastic Left Heart Syndrome
- 232 Hypoplastic RV
- 211 Interrupted or Hypoplastic Aortic Arch
- 227 LV Outflow Obstruction
- 233 I-TGA (Levo-Transposition of Great Arteries)
- 212 Mitral Insufficiency
- 213 Mitral Stenosis
- 214 PDA
- 215 Pulmonary Atresia or Stenosis
- 228 Pulmonary Insufficiency
- 229 RV Outflow Obstruction
- 216 Single Ventricle
- 217 TAPVD
- 218 Tetralogy of Fallot
- 219 Transposition of Great Arteries (*d TGA*)
- 220 Tricuspid Atresia or Stenosis
- 221 Tricuspid Insufficiency
- 222 Truncus Arteriosis
- 223 VSD

AQUIRED

- 250 Cardiovascular – Acquired – Other
- 251 Cardiac Failure
- 252 Cardiac Tumour
- 253 Cardiomyopathy/Myocarditis
- 254 Dysrhythmia – Supraventricular
- 255 Dysrhythmia – Ventricular
- 256 Endocarditis
- 257 Hypertension – Pulmonary
- 258 Hypertension – Systemic
- 259 Kawasaki's Disease
- 268 Myocardial Infarction/Ischaemia
- 260 Pericardial Effusion or Tamponade
- 266 Previous Cardiac Surgery
- 263 Previous Heart Lung Transplant
- 264 Previous Heart Transplant
- 267 Pulmonary Embolism
- 265 Rheumatic Heart Disease
- 261 Vascular Thrombosis
- 262 Vasculitis

NEUROLOGICAL

- 300 Neurological – Other
- 328 Arnold Chiari Malformation
- 301 Botulism
- 302 Brain Abscess
- 303 Brain AV Malformation

- 304 Brain Death
- 329 Brain Cyst
- 305 Brain Infarction or Stroke
- 306 Brain Tumour
- 324 Cerebral Aneurysm
- 331 Cerebral Oedema
- 307 CSF Shunt Malfunction or Infection
- 308 Encephalitis
- 309 Encephalopathy, Acute – Hypoxic Ischaemic
- 310 Encephalopathy, Acute – Other
- 311 Encephalopathy, Chronic Degenerative (eg Leigh's Syndrome)
- 312 Encephalopathy, Chronic Static (eg Cerebral Palsy)
- 310 Encephalopathy, Acute – Other
- 311 Encephalopathy, Chronic Degenerative (eg Leigh's Syndrome)
- 312 Encephalopathy, Chronic Static (eg Cerebral Palsy)
- 330 Epilepsy (comorbidity)
- 313 Guillain Barre Syndrome
- 314 Hydrocephalus
- 315 Intracranial Haemorrhage – Spontaneous
- 332 Intracranial Haemorrhage – Traumatic
- 316 Intracranial Hypertension (Raised ICP)
- 317 Meningitis
- 318 Meningocele or Spina Bifida
- 325 Muscular Dystrophy
- 326 Myasthenia Gravis
- 319 Myopathy
- 320 Neuropathy
- 321 Seizures
- 322 Spinal Cord Lesion
- 327 Tetanus
- 323 Venous Sinus Thrombosis

RESPIRATORY

UPPER AIRWAY

- 400 Upper Airway – Other
- 401 Choanal Atresia or Stenosis
- 402 Epiglottitis
- 403 Foreign Body – Inhaled
- 414 Laryngomalacia
- 404 Laryngotracheobronchitis (Croup)
- 405 Obstructive Sleep Apnoea
- 406 Pierre Robin Syndrome
- 407 Retropharyngeal Abscess
- 413 Subglottic Haemangioma
- 408 Subglottic Stenosis

Appendix II: ANZPIC Diagnostic Codes

1927 Common atrium closure	1947 Repair of transitional or complete atrioventricular canal with or without valve replacement	1968 Arterial switch operation with repair of sub PS	
1928 Left ventricular to right atrial shunt repair	1948 Pulmonary artery banding	1969 Repair of truncus arteriosus	
<i>RISK CATEGORY 3</i>			
1929 Aortic valve replacement	1949 Repair of tetralogy of Fallot with pulmonary atresia	1970 Repair of hypoplastic or interrupted arch without VSD closure	
1930 Ross procedure	1950 Repair of cor triatriatum	1971 Repair of hypoplastic or interrupted arch with VSD closure	
1931 Left ventricular outflow tract patch	1951 Systemic to pulmonary artery shunt	1972 Transverse arch graft	
1932 Ventriculomyotomy	1952 Atrial switch operation	1973 Unifocalization for tetralogy of Fallot - pulmonary atresia	
1933 Aortoplasty (not arch repair or graft)	1953 Arterial switch operation	1974 Double switch	
1934 Mitral valvotomy - valvuloplasty	1954 Reimplantation of anomalous pulmonary artery	<i>RISK CATEGORY 5</i>	
1935 Mitral valve replacement	1955 Annuloplasty	1975 Tricuspid valve repositioning for neonatal Ebstein ≤30d of age	
1936 Valvectomy of tricuspid valve	1956 Repair of coarctation and VSD closure	1976 Repair of truncus arteriosus & interrupted arch	
1937 Tricuspid valvotomy - valvuloplasty	1957 Excision of intracardiac tumour	<i>RISK CATEGORY 6</i>	
1938 Tricuspid valve replacement	<i>RISK CATEGORY 4</i>		
1939 Tricuspid valve repositioning for Ebstein anomaly >30d of age	1958 Aortic valvotomy - valvuloplasty ≤30d of age	1977 Stage 1 repair of hypoplastic left heart syndrome (Norwood)	
1940 Repair of anomalous coronary artery without intrapulmonary tunnel	1959 Konno procedure	1978 Stage 1 repair of nonhypoplastic left heart syndrome conditions	
1941 Repair anomalous coronary art. with intrapulmonary tunnel (Takeuchi)	1960 Repair of complex anomaly (single ventricle) by VSD enlargement	1979 Damus-Kaye-Stansel procedure	
1942 Closure of semilunar valve, aortic or pulmonary	1961 Total repair of anomalous pulmonary veins ≤30d of age	<i>UNCLASSIFIED</i>	
1943 Right ventricular to pulmonary artery conduit	1962 Atrial septectomy	1992 Pacemaker Insertion/Replacement	
1944 Left ventricular to pulmonary artery conduit	1963 Repair of transposition-VSD sub PS (Rastelli)	1993 PDA surgery ≤ 30 days	
1945 Repair of double-outlet right ventricle with or without repair of right ventricular obstruction	1964 Atrial switch operation with VSD closure	1994 Transplant – Heart	
1946 Fontan procedure	1965 Atrial switch operation with repair of sub PS	1995 Transplant – Heart Lung	
	1966 Arterial switch operation with pulmonary artery band removal	1996 Transplant – Lung	
	1967 Arterial switch operation with VSD closure	1997 PA Plasty or Repair	
		1998 Cardiac Surgery Closed – Other	
		1999 Cardiac Surgery Open – Other	

Instructions for using the ANZPIC registry diagnostic codes

- Code the reason most directly responsible for ICU admission as the *Principal Diagnosis*.
- Code up to 5 *Associated Diagnoses*.
- For patients admitted primarily for recovery after a procedure, use a *Post Procedural Diagnosis* for *Principal Diagnosis*.
- For patients having an operative procedure during the admission code the *Post Procedural Diagnosis* as an *Associated Diagnosis*.
- Do not use *Injury Mechanism* or *Infection* codes for the *Principal Diagnosis* (eg for RSV bronchiolitis code bronchiolitis as the *Principal Diagnosis* and RSV as an *Associated Diagnosis*).
- If new information (eg a test result) becomes available during the admission that allows more accurate coding, amend the original codes but ensure that the *Principal Diagnosis* still indicates the reason most directly responsible for ICU admission.

Appendix III: Diagnostic Groups used in Annual Report

Diagnostic group	ANZPIC Registry Diagnostic Codes
Cardiovascular (including post-op)	1900-1999, 200-299, 1102,1106,1107
Gastrointestinal/Renal	500-699
Injury	100-199
Neurological	300-399
Post-Operative (non-cardiac)	1300-1899, 1100,1101,1104,1105, 1103, 1108
Respiratory	400-499
Miscellaneous	700-799,800 - 899

Please refer to Appendix II for definitions of diagnostic codes.

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