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The ANZPIC Registry diagnostic codes: a system for coding reasons for admitting children to intensive care

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Abstract *Objective:* To describe the uniform diagnostic coding system used in Australia and New Zealand to code reasons for admitting children to intensive care, and to highlight the benefits of a uniform approach. *Design:* International, multicentre, observational study. *Setting:* A registry of children admitted to intensive care in Australia and New Zealand. *Patients:* The records of 19,249 children admitted to intensive care between 1997 and 2000 were analysed. *Measurements and results:* The system was designed empirically using expert consensus. The principal diagnosis or main reason for intensive care admission and up to five associated diagnoses are coded. The system has four levels of coding: non-operative or post-procedural admission, diagnostic group,

specific condition, and for injury and infection the aetiological factor. The main reason for intensive care admission was coded in all patient records, however, for 11.1% of records the code was limited to diagnostic group with the specific condition coded as "other diagnosis". Two or more diagnoses were coded in 61% of records. The most frequent reason for admission was asthma. *Conclusions:* The major advantage of the system is that units in the region use the same method of coding. A uniform international approach to coding reasons for admitting children to intensive care is needed.

Keywords Paediatric · Intensive care · Diagnosis · Diagnosis-related groups

Introduction

An essential component of systems used to describe populations of children admitted to intensive care is a method of recording and classifying diagnoses and reasons for admission. A method of coding reasons for admission is used in most paediatric intensive care units, however, to our knowledge none of the ICU-specific methods are published and there is little uniformity. If comparisons of intensive care workload and outcome are made between units, regions, or countries, ICUs should use the same diagnostic classification system as well as the same system of estimating mortality risk.

In Australia and New Zealand a uniform approach to diagnostic coding was arrived at by consensus when the

Australian and New Zealand Paediatric Intensive Care Registry (ANZPIC Registry) was established in 1997. In this report we describe the coding system, highlight the benefits of a uniform approach, and promote the need to develop a uniform international approach to coding diagnosis and reasons for admitting children to intensive care.

Materials and methods

During the design phase of the ANZPIC Registry, the diagnostic coding systems in use in the region were reviewed. Questionnaires were used to obtain expert opinion and a consensus meeting was held in October 1996. This process identified the following system requirements: (a) to be simple enough to be used accurately at the

bedside by intensive care physicians and nurses, (b) to specify the main reason for intensive care admission and to allow a number of associated conditions to be coded in addition, (c) to enable the common conditions in intensive care to be coded specifically and uncommon conditions to be classified under diagnostic groups, (d) to enable coding of the common procedures leading to admission when recovery from the procedure is the main reason for admission, and (e) to enable coding of aetiological factors for injury and infection.

The ANZPIC Registry diagnostic codes are listed in Appendix 1 (these can be downloaded in PDF and spreadsheet format from <http://www.anzics.com.au/paed/index.htm>). The instructions for using the ANZPIC registry diagnostic codes are:

1. Code the reason most directly responsible for ICU admission as the *principal diagnosis*.
2. Code up to five *associated diagnoses*.
3. For patients admitted primarily for recovery after a procedure use a *post-procedural diagnosis* for *principal diagnosis*.
4. For patients having an operative procedure during the admission code the *post-procedural diagnosis* as an *associated diagnosis*.
5. Do not use *injury mechanism* or *infection* codes for the *principal diagnosis* (e.g. for respiratory syncytial virus bronchiolitis code bronchiolitis as the *principal diagnosis* and respiratory syncytial virus as an *associated diagnosis*).
6. If new information (e.g. 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.

The following examples illustrate how we use the system. In example 1, a child with leukaemia and chemotherapy-induced neutropenia requires admission to intensive care for management of *Escherichia coli* septic shock. The principal diagnosis is "shock, septic" (832) and the associated diagnoses are "leukaemia or lymphoma" (821), "neutropenia" (823), and *E. coli* (730). In example 2, a pedestrian is struck by a car and sustains a severe head injury with raised intracranial pressure. The principal diagnosis is "trauma, head" (117) and the associated diagnoses are "MVA pedestrian" (156) and "intracranial hypertension" (316). If this patient is admitted to intensive care from the operating theatre following insertion of an intracranial pressure monitor, the principal diagnosis should still be coded as "trauma, head" rather than "ICP monitor or ventricular drain insertion". In this situation recovery from the procedure is not the main reason for intensive care admission.

To assess the use of the system we reviewed 19,249 patient records submitted to the ANZPIC Registry between 1997 and 2000. Eleven intensive care units submitted data. One unit continued to use a local system of diagnostic classification and map the local codes to the ANZPIC codes before submission. Records from this unit were excluded. The frequency of use of each of the diagnostic codes was calculated and the number of diagnoses per patient tabulated.

Results

A principal diagnosis had been coded in all the records that we reviewed. There were two diagnoses coded in 61% of the cases, three in 29%, four in 13%, five in 6%, and six in 3%. Table 1 lists the ten most frequent principal diagnoses. Within each diagnostic group there is a code for "other diagnosis" for conditions that cannot be otherwise classified. A total of 2,133 (11.1%) patient records had one of the "other diagnoses" used to code the principal diagnosis.

Table 1 The ten most frequent reasons for admitting children to intensive care

Diagnosis	Number (%)	Deaths (%)
Asthma	883 (4.6)	4 (0.5)
Seizures	862 (4.5)	19 (2.2)
Bronchiolitis	855 (4.4)	6 (0.7)
Trauma, head	837 (4.3)	106 (12.7)
ICU procedure	837 (4.3)	2 (0.2)
Ventricular septal defect repair	534 (2.8)	3 (0.6)
Spinal instrumentation	420 (2.2)	1 (0.2)
Pneumonia or pneumonitis	406 (2.1)	29 (7.1)
Ingestion	364 (1.9)	1 (0.3)
Atrial septal defect repair	347 (1.8)	1 (0.3)

Discussion

In this report we describe the uniform method used to classify diagnoses and reasons for admitting children to intensive care in Australia and New Zealand. Even though diagnostic classification systems are used in nearly all intensive care units, there is little uniformity and very little has been published in the field. Young et al. [1] recently described the ICNARC coding method, a five-tiered system specific to intensive care units and high-dependency units that was developed in the United Kingdom. The system was derived from data collected during the APACHE II study in the United Kingdom [2], and the applicability of the system to paediatric intensive care is unknown. The tenth edition of the International Classification of Disease (ICD 10) is commonly used to code hospital admission data, however, the applicability of ICD 10 to intensive care is limited. It is not user friendly for ICU staff collecting clinical data at the bedside, and the majority of conditions are not relevant to ICU.

The extremes in approach to coding reasons for admission to intensive care are to code only the primary organ system failing, on the one hand, or to code all possible conditions presenting on the other hand. Any system between the extremes inevitably requires compromise between simplicity of use and the amount of detail. Apart from ease of use, another major benefit of a simple system is that compliance and accuracy are likely to be enhanced. Although there are 370 codes in our system, they are printed on one double-sided A4 page for ease of use. Coders familiar with the system are able to code most admissions in less than 1 minute.

The ANZPIC codes have four levels of classification: non-operative and post-procedural admission, diagnostic group, specific condition and, for injury and infection, aetiological factor. Specific procedures, listed by organ system, are used for patients admitted for recovery after a procedure. An alternative approach is to code the underlying condition (e.g. ventricular septal defect) with a separate flag for post-operative admission. This ap-

proach, however, would not differentiate, for example, between patients admitted after pulmonary artery banding and patients admitted after complete repair of a ventricular septal defect. In many circumstances the procedure as well as the underlying condition influence mortality risk and workload. For this reason we designed the system to allow coding of specific procedures.

The advantage of the system is that it is relatively simple and user friendly. There are obvious limitations resulting from the need to limit the number of possible conditions. The analysis of the registry data indicated that all patient records could be classified by operative status and diagnostic group. Eleven percent of patients had "other diagnosis" used for the primary reason for intensive care admission, indicating that these children had specific conditions not included in the coding system. Future refinement of the system will require more detailed analysis of this group of patients. To validate the system further it will be important to assess inter-observer agreement in coding. This will address a limitation of this report.

A number of benefits have been obtained from using a common system of coding diagnosis in our region. Explanatory power has been added to comparisons of unit outcome and length of stay. Ad hoc questions have been answered, for example, the incidence and outcome of invasive pneumococcal disease in children admitted to intensive care. The coding also enabled a detailed analysis of the relationship between the reason for admission and adjusted mortality risk. This analysis was central to the revision of the paediatric index of mortality reported elsewhere in this edition [3].

We acknowledge that the system is imperfect, and that there is potential for further improvement. Nevertheless, a pragmatic approach requires compromise and a perfect system is probably not a realistic goal. We believe the benefits obtained from using a uniform system across two countries outweigh the imperfections. For international comparisons of paediatric intensive care, similar reasoning can be applied. Consensus is required on a uniform international approach to coding diagnosis and reasons for admitting children to intensive care. The specifics of the system itself are less important than the agreement to use a uniform method. Until such a system is developed, we recommend that intensive care units consider using the system described here or, alternatively, investigate the feasibility of mapping the diagnostic codes in the system that they are using to the codes in this system. This will be particularly worthwhile for units planning to collaborate internationally with assessment of intensive care outcome using PIM2 [3]. We intend to update the system periodically. A number of minor modifications have occurred since the system was first designed. We welcome suggested improvements, particularly if modification would enhance the applicability of the system to other countries.

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Diagnostic codes used by the Australian and New Zealand Paediatric Intensive Care (ANZPIC) Registry

Injury

- 100: Injury, other
- 101: Anaphylaxis
- 102: Burns
- 103: Carbon monoxide poisoning
- 104: Drug toxicity, iatrogenic
- 105: Electrocutation
- 106: Envenomation
- 107: Hanging or strangulation
- 108: Hyperthermia
- 109: Hypothermia
- 110: Immersion (near drowning)
- 111: Ingestion
- 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
- 201: Absent pulmonary valve
- 202: Anomalous coronary artery
- 203: Aortic insufficiency
- 204: Aortic stenosis
- 224: AP window
- 205: Atrial septal defect
- 225: Arteriovenous malformation
- 206: AVSD (atrioventricular canal)
- 207: Coarctation
- 208: Cortriatriatum
- 226: Double-outlet right ventricle
- 209: Ebstein's anomaly
- 210: Hypoplastic left heart syndrome
- 211: Interrupted or hypoplastic aortic arch
- 227: Left ventricular outflow obstruction
- 212: Mitral insufficiency
- 213: Mitral stenosis
- 214: Patent ductus arteriosus
- 215: Pulmonary atresia or stenosis
- 228: Pulmonary insufficiency
- 229: Right ventricular 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 arteriosus
- 223: Ventricular septal defect

Cardiovascular, acquired

- 250: Cardiovascular, acquired, other
- 251: Cardiac failure
- 252: Cardiac tumour
- 253: Cardiomyopathy
- 254: Dysrhythmia, supraventricular
- 255: Dysrhythmia, ventricular
- 256: Endocarditis
- 257: Hypertension, pulmonary
- 258: Hypertension, systemic
- 259: Kawasaki's disease
- 260: Pericardial effusion or tamponade
- 263: Previous heart lung transplant
- 264: Previous heart transplant
- 261: Vascular thrombosis
- 262: Vasculitis

Neurological

- 300: Neurological, other
- 301: Botulism
- 302: Brain abscess
- 303: Brain arteriovenous malformation
- 304: Brain death
- 305: Brain infarction or stroke

- 306: Brain tumour
- 324: Cerebral aneurysm
- 307: CSF shunt malfunction or infection
- 308: Encephalitis
- 309: Encephalopathy, acute, hypoxic ischaemic
- 310: Encephalopathy, acute, other
- 311: Encephalopathy, chronic degenerative (e.g. Leigh's syndrome)
- 312: Encephalopathy, chronic static (e.g. cerebral palsy)
- 313: Guillain-Barré syndrome
- 314: Hydrocephalus
- 315: Intracranial haemorrhage, spontaneous
- 316: Intracranial hypertension (raised intracranial pressure)
- 317: Meningitis
- 318: Meningomyelocoele 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
- 404: Laryngotracheobronchitis (croup)
- 405: Obstructive sleep apnoea
- 406: Pierre Robin syndrome
- 407: Retropharyngeal abscess
- 413: Subglottic haemangioma
- 408: Subglottic stenosis
- 409: Tracheitis
- 410: Upper airway obstruction, other
- 411: Upper respiratory infection, other
- 412: Vocal cord paresis

Respiratory, lower airway

- 430: Lower airway, other
- 431: Asthma
- 432: Bronchiolitis
- 433: Chronic lung disease (including bronchopulmonary dysplasia)
- 434: Malacia, trachea and/or bronchi
- 435: Mediastinal mass
- 436: Stenosis, trachea and/or bronchi
- 437: Tracheo-oesophageal fistula
- 438: Vascular ring

Respiratory, other

- 450: Respiratory, other
- 451: Air leak syndrome

- 452: Apnoea, central
- 453: Acute respiratory distress syndrome
- 454: Aspiration
- 455: Chylothorax
- 456: Congenital diaphragmatic hernia
- 457: Congenital lung anomaly
- 458: Cystic fibrosis
- 459: Empyema
- 460: Hyaline membrane disease
- 461: Hypoventilation, central
- 469: Lower respiratory infection, other
- 462: Lung abscess
- 463: Meconium aspiration syndrome
- 470: Pertussis syndrome
- 464: Pleural effusion
- 465: Pneumonia or pneumonitis
- 471: Previous lung transplant
- 466: Pulmonary hypoplasia
- 467: Pulmonary oedema
- 468: Respiratory failure
- 472: Transient tachypnoea of the newborn

Renal

- 500: Renal, other
- 501: Haemolytic uraemic syndrome
- 502: Nephrotic and/or nephritic syndrome
- 505: Previous renal transplant
- 503: Renal failure, acute
- 504: Renal failure, chronic
- 506: Urinary tract infection

Gastrointestinal

- 600: Gastrointestinal, other
- 620: Biliary atresia
- 601: Bowel obstruction
- 621: Bowel perforation
- 602: Colitis
- 603: Gastroenteritis
- 604: Gastrointestinal haemorrhage
- 605: Gastroschisis or exomphalos
- 606: Hepatitis
- 622: Hirschsprung's disease
- 607: Intussusception
- 608: Liver disorder, other
- 609: Liver failure, acute
- 610: Liver failure, chronic
- 611: Necrotising enterocolitis
- 623: Neonatal jaundice
- 612: Oesophageal atresia
- 624: Oesophageal foreign body
- 613: Pancreatitis
- 614: Peritonitis
- 625: Portal hypertension
- 626: Previous liver transplant
- 615: Pyloric stenosis
- 616: Short gut syndrome

- 617: Ulcer duodenal
- 618: Ulcer gastric or gastritis
- 619: Varices oesophageal or gastric
- 627: Volvulus

Infection (do not use for principal diagnosis)

- 700: Injection, other
- 701: Adenovirus
- 702: Bacterium, other
- 703: Bacterium, gram negative, other
- 704: Bacterium, gram positive, other
- 705: Candida
- 706: Clostridium
- 707: Cytomegalovirus
- 708: Epstein-Barr virus
- 730: Escherichia coli
- 709: Enterovirus
- 710: Fungus, other
- 711: Haemophilus influenzae type b
- 712: Hepatitis, viral
- 713: Herpes simplex virus
- 714: Human immunodeficiency virus
- 715: Influenza virus
- 731: Klebsiella
- 716: Legionella
- 732: Malaria
- 735: Measles virus
- 717: Meningococcus
- 718: Mycoplasma
- 719: Parainfluenzae virus
- 720: Pertussis
- 721: Pneumococcus
- 722: Pneumocystis carinii
- 733: Pseudomonas
- 723: Rotavirus
- 724: Respiratory syncytial virus
- 725: Salmonella
- 726: Staphylococcus
- 734: Streptococcus group b
- 727: Streptococcus, other
- 728: Varicella
- 729: Virus, other
- 799: No organism identified

Miscellaneous

- 800: Miscellaneous, other
- 801: Acute life threatening event (near miss SIDS)
- 802: Cardiac arrest, in hospital
- 803: Cardiac arrest, out of hospital
- 804: Chromosomal anomaly
- 805: Coagulopathy
- 839: Craniosynostosis
- 806: Dehydration
- 807: Dermatological disorder
- 808: Diabetes insipidus
- 809: Diabetes mellitus with ketoacidosis

- 810: Diabetes mellitus without ketoacidosis
- 811: Electrolyte disorder
- 812: Endocrine disorder
- 813: Gas gangrene
- 847: Haematological disorder
- 814: Home ventilation patient
- 815: Hypoglycaemia
- 816: ICU diagnostic monitoring, elective
- 817: ICU procedure (eg CVC insertion)
- 818: Immunodeficiency, congenital
- 819: Immunosuppression, acquired
- 820: Inborn error of metabolism
- 821: Leukaemia or lymphoma
- 822: Necrotising fasciitis
- 840: Neonate, hydrops fetalis
- 841: Neonate, infant of diabetic mother
- 842: Neonate, intra-uterine growth retardation
- 823: Neutropenia
- 848: Organ donor
- 824: Pancytopenia
- 825: Pheochromocytoma
- 826: Prematurity
- 843: Previous bone marrow transplant
- 827: Respiratory arrest, in hospital
- 828: Respiratory arrest, out of hospital
- 844: Scoliosis
- 829: Sepsis
- 830: Shock, cardiogenic
- 831: Shock, hypovolaemic
- 832: Shock, septic
- 833: Systemic inflammatory response syndrome
- 834: Solid neoplasm, malignant (not lymphoma)
- 835: Solid neoplasm, non malignant
- 836: Syndrome or malformation (not chromosomal)
- 837: Toxic shock syndrome
- 838: Transplant, bone marrow
- 845: Tumor lysis syndrome
- 846: Wound infection

Post-procedural diagnoses

Miscellaneous/anaesthetic

- 1100: Post-procedure, other
- 1101: Anaesthetic complication
- 1106: Cardiac catheter, balloon septostomy
- 1102: Cardiac catheter, diagnostic
- 1107: Cardiac catheter, interventional
- 1103: Ex-prem, after general anaesthetic
- 1104: Invasive radiology procedure
- 1105: Massive intraoperative transfusion (>1 blood vol)

Cardiac surgery, closed

- 1200: Cardiac surgery, closed, other
- 1201: Coarctation repair

- 1202: PA band
- 1203: Pacemaker insertion or revision
- 1204: Patent ductus arteriosus ligation
- 1205: Systemic-pulmonary shunt
- 1206: Valvotomy, closed

Cardiac surgery, open

- 1230: Cardiac surgery, open, other
- 1231: Aortic arch reconstruction
- 1232: Arterial switch
- 1233: Atrial septal defect repair
- 1234: AVSD repair (atrioventricular canal)
- 1235: Cardiac tumour resection
- 1236: Cavo-pulmonary shunt
- 1252: Conduit repair or replacement
- 1253: Coronary artery repair
- 1237: Fontan
- 1238: Left ventricular outflow reconstruction
- 1254: MAPCA's surgery
- 1239: Norwood stage I
- 1240: PA plasty or repair
- 1241: Right ventricular outflow reconstruction
- 1242: Senning
- 1243: TAPVD repair
- 1244: Tetralogy of Fallot repair
- 1245: Transplant, heart
- 1246: Transplant, heart lung
- 1247: Transplant, lung
- 1248: Truncus repair
- 1249: Valve repair or replacement
- 1250: Valvotomy, open
- 1251: Ventricular septal defect repair

Neurosurgery

- 1300: Neurosurgery, other
- 1301: Craniotomy, anterior fossa
- 1302: Craniotomy, posterior fossa
- 1303: CSF shunt insertion or revision
- 1304: Decompression, cranial
- 1305: Decompression, spinal cord
- 1306: Hemispherectomy or lobectomy
- 1307: ICP monitor or ventricular drain insertion
- 1308: Intracranial haematoma evacuation

Thoracic surgery

- 1400: Thoracic surgery, other
- 1401: Diaphragm plication
- 1402: Diaphragm repair
- 1403: Lung biopsy
- 1404: Lung decortication
- 1405: Oesophageal atresia repair
- 1406: Pneumonectomy or lobectomy
- 1407: Thoracic tumour resection
- 1408: Tracheo-oesophageal fistula repair
- 1409: Tracheopexy

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- Ears, nose, throat surgery
 - 1500: Ears, nose, throat surgery, other
 - 1501: Adenoidectomy and/or tonsillectomy
 - 1502: Choanal atresia repair
 - 1503: Cricoid split
 - 1504: Laryngeal reconstruction
 - 1505: Laryngobronchoscopy
 - 1506: Tracheostomy
- Abdominal/general surgery
- 1600: General surgery, other
 - 1601: Abdominal tumour resection
 - 1602: Appendicectomy
 - 1603: Bladder extrophy repair
 - 1604: Burns surgery
 - 1605: Fundoplication
 - 1606: Gastroschisis or exomphalos repair
 - 1607: Gastrointestinal endoscopy and/or sclerotherapy
 - 1608: Intussusception repair
 - 1609: Kasai
 - 1610: Laparotomy
 - 1615: Laparotomy, bowel obstruction
 - 1616: Laparotomy, bowel perforation
- 1617: Laparotomy, gastrointestinal haemorrhage
 - 1618: Laparotomy, necrotising enterocolitis
 - 1619: Laparotomy, peritonitis
 - 1620: Laparotomy, trauma
 - 1611: Transplant, kidney
 - 1612: Transplant, liver
 - 1613: Transplant, small bowel
 - 1614: Urogenital surgery, other
- Craniofacial surgery
- 1700: Craniofacial surgery, other
 - 1706: Cleft palate repair
 - 1701: Cranial vault reshaping
 - 1702: Dental surgery
 - 1703: Facial cleft repair
 - 1704: Mandibular mobilisation
 - 1705: Midface mobilisation
- Orthopaedic surgery
 - 1800: Orthopaedic surgery, other
 - 1801: Fracture fixation
 - 1802: Spinal instrumentation

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