

# Preliminary insights into data collection processes in New South Wales intensive care units

Karena M Hewson-Conroy and Anthony R Burrell

Given the increasing trend both internationally and within Australia to report critical care outcomes data as a means of indicating the quality of health care delivered to critically ill patients, it is important to know that these data are accurate and reliable. Effort is increasing to address the quality of clinical databases and data collection processes, and the reliability and validity of resulting datasets.

Data quality can be defined as “the extent to which data are valid, reliable, complete, and timely”, and can be affected by many factors, including incomplete or missing data and failure to audit quality.<sup>1</sup> Despite the many potential sources of error,<sup>2-5</sup> the data collected in intensive care units are often assumed to be accurate and high quality. This becomes problematic when potentially flawed data are used to inform major decisions, such as planning and evaluation of intensive care services, and also comparisons between ICUs.<sup>6</sup>

Several authors have identified data quality and integrity as an important consideration in measuring health care performance,<sup>1,7-10</sup> with some producing evidence of variability in outcome measures arising from inaccurate data collection,<sup>4,11,12</sup> missing values,<sup>13</sup> and inter- and intra-observer variability.<sup>6,14,15</sup> A number of strategies for improvement have been proposed, including implementing training programs,<sup>14,16,17</sup> employing dedicated data collectors,<sup>16</sup> conducting data quality audits,<sup>16</sup> and, importantly, providing ICUs with sufficient resources to apply these strategies.<sup>18</sup>

In Australia and New Zealand, ICUs are able to submit data on severity of illness and patient outcomes to the Australian and New Zealand Intensive Care Society (ANZICS) Adult Patient Database (APD).<sup>16</sup> Assessments of the quality of the ANZICS APD were reported in a review article describing the development and implementation of the database.<sup>16</sup> These assessments largely concerned the national dataset, but there were areas of concern at the local level, including limited resources available for data collection and entry, lack of verification of data accuracy and validity, limited training provided to contributing sites and new data collectors, and a lack of dedicated data collectors in ICUs. The authors conceded that the APD's main weakness was in the reliability of data collection.

To gain further insight into the quality of data collected by individual ICUs for submission to the ANZICS APD, a series of investigations in all New South Wales ICUs is planned. As the first stage, we explored the available resources and infrastructure for data collection.

## ABSTRACT

**Objective:** To investigate the resources and infrastructure available for collecting intensive care unit data in New South Wales for submission to the Australian and New Zealand Intensive Care Society (ANZICS) Adult Patient Database (APD).

**Design:** Descriptive cross-sectional survey, part of an annual survey of ICU resources.

**Setting:** All 42 adult ICUs in public hospitals in NSW, March–April 2006.

**Participants:** Nurse unit managers of ICUs.

**Results:** There was variability in who was responsible for data collection and data entry, and who oversaw the data collection process. The time dedicated to these functions also varied greatly and depended on available resources, which were often reported as insufficient. At least 55% of ICUs experienced delays in entering data into a database. Although 65% reported conducting quality checks on data, 30% could not report the frequency of checks; another 30% did not use checks to improve data quality.

**Conclusions:** It appears that NSW ICUs are generally not adequately resourced or organised for collecting data, which could significantly affect the quality of data submitted to the ANZICS APD. Further investigation of data quality is warranted, and a follow-up survey of ICU directors is planned. Until the issue of data quality is adequately addressed, outcomes measurement based on these data should be treated with caution.

Crit Care Resusc 2008; 10: 301–305

## Methods

The study was a cross-sectional questionnaire-based survey conducted in March–April 2006. A series of questions on ICU data collection and quality (Table 1) were asked of all 42 adult ICUs in NSW public hospitals as part of an annual survey of ICU resources, including staffing, bed numbers and services offered. Respondents were asked to reply to all questions in the present tense. The questionnaire was emailed to the nurse unit manager (NUM) or acting NUM of each ICU, who either completed and returned it electronically, or responded to the questions by telephone. Participation in the survey was voluntary, although follow-up by

**Table 1. Survey questions on data collection and quality for the ANZICS Adult Patient Database**

Question	Response format	Response rate
Do you collect data for the ANZICS Adult Patient Database (APD)?*	Yes/ No	97%
If yes, how often do you submit data to the ANZICS APD?	Open response	74%
What is the position of the person who collects the data?	Director/ Nurse (clinical)/ Nurse (research)/ Data Manager/ Research Officer/ Specialist/ Registrar/ Resident/ Administrative Officer/ Other (specify)	97%
How much time is dedicated to data collection?	Open response	65%
Comments?	Open response	na
What is the position of the person who enters the data?	Nurse (clinical)/ Nurse (research)/ Data Manager/ Research Officer/ Specialist/ Registrar/ Resident/ Administrative Officer/ Other (specify)	97%
How much time is dedicated to data entry?	Open response	68%
Comments?	Open response	na
What is the position of the person who oversees the data collection process?	Data Manager/ Nursing Unit Manager/ Senior Physician/ Director/ Other (specify)	90%
Comments?	Open response	na
How are the data collected (frequency, timing, use of forms)?	Open response	87%
Do you experience delays in entering the data into a database?	Yes/ No	84%
If yes, what is the average estimated time that elapses before data are entered post patient discharge?	Open response	94%
How often do you run quality checks on your data?	Open response	77%
Do these checks lead to further inquiries that aim to improve data accuracy and completeness?	Open response	65%
General comments	Open response	na

na = not applicable (comments optional). \* Sample size (n) = 38 for the first question and n = 31 for subsequent questions.

email a month later was necessary to obtain a timely response.

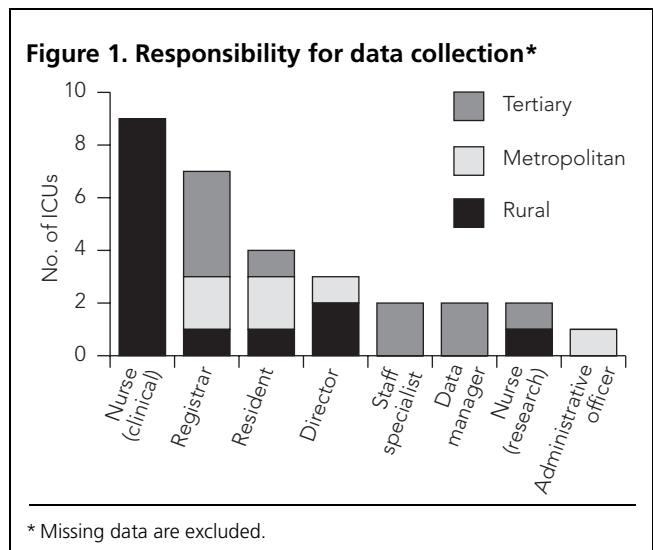
Survey data were entered manually into SPSS statistical software (SPSS Inc, Chicago, Ill, USA), and descriptive statistics were used. Open-ended questions and comments were analysed thematically. This study was recognised as a quality assurance project by the lead Sydney West Area Health Service (Nepean) Human Research Ethics Committee (HREC) on behalf of all NSW Area Health Service HRECs.

**Results**

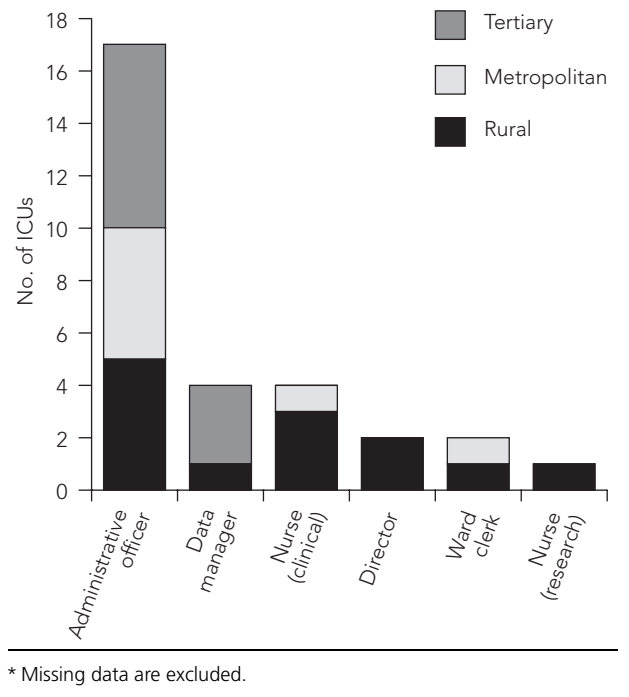
Survey responses were received from 38 of the 42 ICUs (90%); of these, 31 (82%) collected data for the ANZICS APD (10 tertiary, 7 metropolitan and 14 rural ICUs). Response rates to individual questions ranged from 65% to 97% (Table 1). Eighteen (58%) of the 31 contributing ICUs submitted data quarterly to ANZICS, three (10%) ICUs submitted data biannually, one (3%) annually, one rural unit had recently stopped submitting data, and the respondent was uncertain when it would recommence, and the remainder (26%) did not respond.

**Data collection**

The positions of people whose responsibility it was to collect the data varied between ICUs, although there appeared to be similarities within each level of ICU (Figure 1). Overall, the



**Figure 2. Responsibility for data entry into a database\***



two most frequently cited positions were clinical nurse (9 ICUs) and registrar (7). Dedicated data managers or research nurses collected data in three tertiary ICUs and one rural ICU. Medical staff (ranging from resident through to director) were mostly responsible for collecting data at both metropolitan (83%) and tertiary (70%) ICUs. At rural ICUs, on the other hand, most data collectors were clinical nurses (64%).

Across all three levels of ICU (tertiary, metropolitan or rural), the time allocated for data collection depended on the position of the person whose role it was to collect the data and the resources dedicated by the unit. For directors, this was "nil", and for other medical staff data were to be collected during their allocated shift, with no specific time designated. For the clinical nurses (all in rural ICUs), the time ranged from "no specific amount of time" to 16 hours per week.

**Data entry**

Data were entered into a database predominantly by administrative officers (Figure 2), but also by data managers in tertiary ICUs, and by clinical nurses in rural ICUs. The amount of time allocated for data entry varied greatly, with tertiary ICUs seeming to allocate more time than rural ICUs. Three tertiary ICUs had data managers who entered data as part of their role, whereas a single data manager was shared across a former NSW Area Health Service that included four rural ICUs.

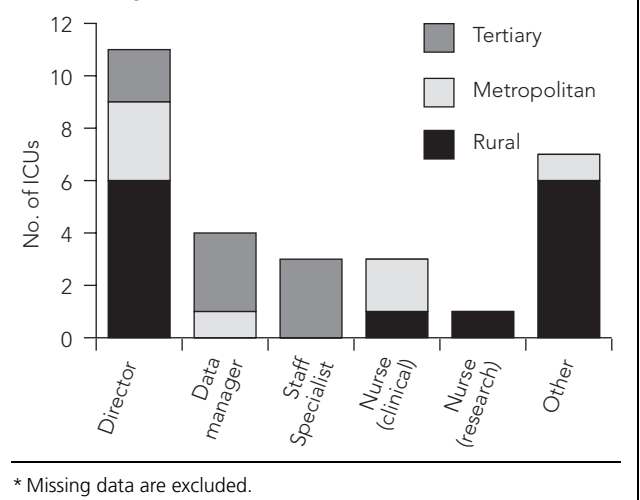
**Data management**

Those who oversaw the data collection process were predominantly directors (38%) and data managers (14%). Clinical and research nurses also had this role in metropolitan and rural ICUs, as did staff specialists in tertiary ICUs (Figure 3). For the rural ICUs that indicated "other" positions, one was the director of clinical services at an area health service level, two were nurse unit managers, and another two said no-one oversaw the data collection process.

Seventeen respondents (55%) indicated they experienced delays in entering data into a database. Rural ICUs tended to experience the longest delays overall (ranging from weeks to several years), but both metropolitan and tertiary ICUs also reported delays of up to 1 month and "several" months, respectively. With regard to the frequency of conducting quality checks on the data collected, responses (Figure 4) ranged from weekly (3 ICUs) to rarely/never (4). After including other responses, such as "regularly" and "occasionally", 20 (65%) respondents conducted some form of quality checks on their data; 13 (65%) of these ICUs conducted checks at least quarterly, but six (30%) did not report the frequency of checks. Of those who indicated that quality checks were done, 70% (14) said these checks led to further enquiries that aimed to improve data quality (ie, accuracy and completeness).

Comparison of responses from ICUs with data managers suggested there was no single model for the role of data manager. Responsibilities ranged from data collection alone, to data entry or overseeing of the data collection process, or a combination of these roles. Interestingly, ICUs still experienced delays in data entry despite having data managers: all rural ICUs with data managers experienced delays, and at least three tertiary ICUs experienced delays of up to 6 weeks.

**Figure 3. Responsibility for overseeing the data collection process\***



Further, the presence of data managers did not guarantee that quality checks were performed on the data collected. The single metropolitan ICU with a data manager never conducted quality checks on data, and two tertiary ICUs appeared uncertain whether quality checks were done. Of the nine ICUs with data managers who specified that checks were done, seven also indicated that the checks led to further enquiries that aimed to improve data quality.

#### Data collection processes

Our exploration of the processes for collecting data found that most ICUs (77%) used paper forms, six ICUs collected data either daily or in real time, and four rural ICUs obtained their data via retrospective medical record review (two indicated this was done monthly). Respondent comments highlighted that data collection was time intensive, and that a dedicated data manager was required to perform this function. Rural ICUs displayed the most strain with regard to the data collection process. Some of the identified barriers to efficient data collection were:

- insufficient resources allocated to the data collection process overall;
- staff turnover, with frequent secondments and the constant need to train staff;
- no involvement of medical staff in the data collection process (one rural ICU); and
- limited time for data collection and data entry, as clinical duties took priority.

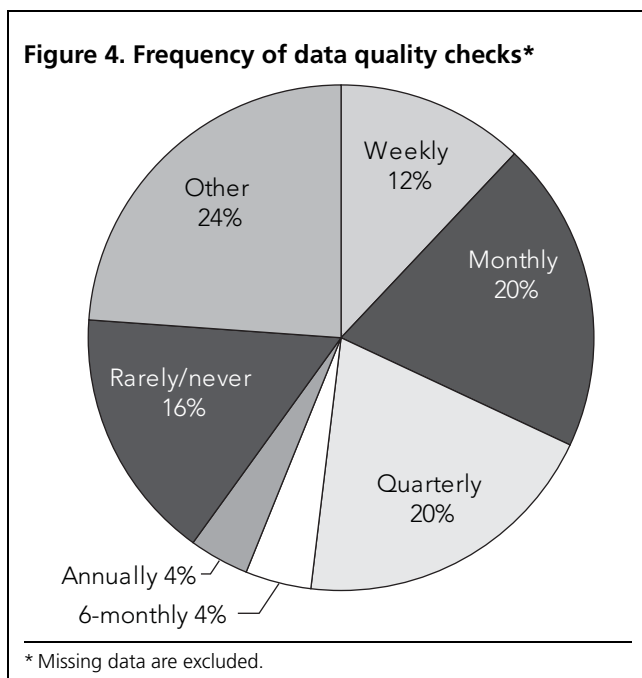
#### Discussion

This investigation shows the diversity of approaches to data collection in NSW ICUs. In general, there was little consistency in the positions of personnel given the responsibility of data collection, data entry, and overseeing the data collection process. These roles were variously filled by medical, nursing, administrative and data management personnel. The amount of time dedicated to these functions varied greatly and depended on the positions of the people who were doing the work and the available resources of the ICU, which were often reported as inadequate.

Several findings deserve highlighting. First, although the position of the person responsible for data collection varied between ICUs, there were some similarities within levels of ICU. Medical staff were predominantly responsible for data collection in metropolitan and tertiary ICUs, whereas clinical nurses had this role in rural ICUs. Data entry was treated as more of an administrative role and, although the positions of those entering data varied, administrative officers and data managers fulfilled this role in most ICUs.

Rural ICUs displayed the most strain with regard to the data collection process. This has important implications for future decisions on where resources should be directed to improve the data collection process in NSW. Further, over half the ICUs, including those with data managers, experienced delays in entering data into a database. Delays affect the timeliness of data submission to the APD and subsequent reporting. Data integrity also becomes an issue, with quality checks unlikely to occur when there is pressure to process a backlog of ICU data forms. Although 65% of respondents reported conducting some form of quality checks on their data, 30% could not report the actual frequency of these checks, and another 30% indicated the checks did not lead to further enquiries that sought to improve data quality. Furthermore, the existence of data managers did not guarantee that data quality processes were performed. This could be due to lack of dedicated time and insufficient resources.

Even without additional funding or resources, there are strategies that ICUs can use to help improve the quality of their data. Providing rigorous training that follows strict guidelines and data definitions to data collectors has been shown to increase data accuracy<sup>17</sup> and reduce interobserver variability in APACHE II scoring.<sup>14</sup> The expertise of data collectors has also been shown to make a difference, with senior clinical staff and experienced research coordinators producing higher APACHE II scores than junior clinical staff.<sup>6,18</sup> One of these studies — in an Australian tertiary hospital ICU<sup>18</sup> — also showed an impact of the expertise of data collectors on predicted risk of death and standardised mortality ratio (SMR).



Despite the work to date, it is currently not known whether data quality has a significant impact on the Australian and New Zealand ICU data repository and the outcomes data it produces. For this reason, the ANZICS Centre for Outcome and Resource Evaluation (CORE) is currently assessing the quality of the data at 20 ICUs across Victoria and NSW through an audit conducted by trained data collectors (S Chavan, Data Quality and Education Officer, ANZICS CORE, personal communication). Original APACHE II score and predicted risk of death will be compared with re-abstracted values from the audit to determine whether any differences in outcome were attributable to the quality of data collected.

In addition, the NSW Intensive Care Coordination and Monitoring Unit (ICCMU) is planning further investigation into the quality of data collected in NSW ICUs. A survey currently underway seeks to explore data quality in more depth and to gain insights into ICU directors' perspectives on outcome measurement and the impact data quality has on this. Further studies of the relationship between data quality and the infrastructure for data collection would also be valuable in determining the most efficient data collection model for ICUs.

This study had some limitations. First, all responses were self-reported and were not independently verified. Second, respondents were asked numerous questions, of which this subsurvey was only a part. The burden may have led to missing data, limiting our findings. Reducing the number of open-response questions in future surveys might improve response rates to individual questions and the quantification of results (eg, time spent on data collection and data entry). Third, this survey provides only a snapshot. Resources and infrastructure in any health care setting are variable, but no significant changes have been reported to or evidenced by the NSW ICCMU since completion of the survey.

This study revealed that ICUs are not necessarily resourced or structured adequately for collecting data. Unstructured, ad-hoc and inconsistent data collection processes, along with inadequate staffing, have the potential to significantly affect the quality of data submitted to the ANZICS APD. Delays in data entry and a lack of quality checks on data indicate a less than desirable system that may be fraught with error and inconsistencies. Further investigation into the quality of data collected in NSW ICUs is warranted, and a follow-up survey of ICU directors is planned. Until the issue of data quality is adequately addressed, any performance measurement based on these data should be treated with caution.

### Author details

Karena M Hewson-Conroy, Research and Quality Manager,<sup>1</sup> and Visiting Associate<sup>2</sup>

Anthony R Burrell, Medical Director,<sup>1</sup> Director Patient Safety,<sup>3</sup> Clinical Lecturer,<sup>4</sup> and Adjunct Professor<sup>2</sup>

1 NSW Intensive Care Coordination and Monitoring Unit, Sydney, NSW.

2 University of Technology, Sydney, NSW.

3 NSW Clinical Excellence Commission, Sydney, NSW.

4 University of Sydney, Sydney, NSW.

Correspondence: hewsonk@wahs.nsw.gov.au

### References

- Loeb J. The current state of performance measurement in health care. *Int J Qual Health Care* 2004; 16 Suppl 1: i5-9.
- Rowan K. The reliability of case mix measurement in intensive care. *Curr Opin Crit Care* 1996; 2: 209-13.
- Goldhill D, Withington P. Mortality predicted by APACHE II. The effect of changes in physiological values and post-ICU hospital mortality. *Anaesthesia* 1996; 51: 719-23.
- Goldhill DR, Sumner A. APACHE II, data accuracy and outcome prediction. *Anaesthesia* 1998; 53: 937-43.
- Ridley S. Uncertainty and scoring systems. *Anaesthesia* 2002; 57: 761-7.
- McHugh GJ. Quality and reliability of data collected in a regional hospital Intensive Care Unit. *Crit Care Resusc* 2004; 6: 258-60.
- Teres D. What is the way forward? The value of limits of severity adjusted mortality for ICU patients. *J Crit Care* 2004; 19: 257-63.
- Moreno R, Matos R. New issues in severity scoring: interfacing the ICU and evaluating it. *Curr Opin Crit Care* 2001; 7: 469-74.
- Polderman KH, Metnitz PGH. Using risk adjustment systems in the ICU: avoid scoring an "own goal". *Intensive Care Med* 2005; 31: 1471-3.
- Fraenkel DJ. Safety and quality in intensive care. *Crit Care Resusc* 2000; 2: 220-6.
- Polderman K, Girbes A, Thijs L, et al. Accuracy and reliability of APACHE II scoring in two intensive care units: problems and pitfalls in the use of APACHE II and suggestions for improvement. *Anaesthesia* 2001; 56: 47-50.
- Chen L, Martin C, Morrison T, Sibbald W. Interobserver variability in data collection of the APACHE II score in teaching and community hospitals. *Crit Care Med* 1999; 27: 1999-2004.
- Afessa B, Keegan MT, Hubmayr RD, et al. Evaluating the performance of an institution using an intensive care unit benchmark. *Mayo Clin Proc* 2005; 80: 174-80.
- Polderman K, Jorna E, Girbes A. Inter-observer variability in APACHE II scoring: effect of strict guidelines and training. *Intensive Care Med* 2001; 27: 1365-9.
- Polderman K, Christiaans H, Wester J, et al. Intra-observer variability in APACHE II scoring. *Intensive Care Med* 2001; 27: 1550-2.
- Stow P, Hart G, Higlett T, et al. Development and implementation of a high-quality clinical database: the Australian and New Zealand Intensive Care Society Adult Patient Database. *J Crit Care* 2006; 21: 133-41.
- Arts DG, Bosman RJ, de Jonge E, et al. Training in data definitions improves quality of intensive care data. *Crit Care* 2003; 7: 179-84.
- Ledoux D, Finfer S, McKinley S. Impact of operator expertise on collection of the APACHE II score and on the derived risk of death and standardized mortality ratio. *Anaesth Intensive Care* 2005; 33: 585-90. □