DOCTOR OF PHILOSOPHY THESIS

A Web-enabled National Multi-Centre Study of Nurse Skill Matching to Patient Acuity and Risk in Intensive Care

Department of Population Health and Clinical Practice
Discipline of Nursing

The University of Adelaide

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Submitted in fulfilment of the requirements for the Degree of Doctor of Philosophy

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STUDENT DECLARATION

I certify that this thesis entitled:

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To Pete, Tom, Will, Mum, Jude, Bill, Maree, Olivia and the Rischbieth family - for your unconditional love, support and patience.

To my darling Dad who saw me begin this journey before sadly passing away on September 4, 2004. I love you and miss you. You are embedded in my heart.

Those who knew him loved him

Nor while they live can they forget

His fine spirit

His wisdom in counsel

His kindness to those in need

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PUBLICATIONS

- Bailey S., Rischbieth A. Ethics in Critical Care In ***ACCCN Critical Care Nursing in Australia and New Zealand 2006*** Ed. Elliot, Aitken, Chaboyer, Elsevier Marrickville.
- Rischbieth A. Skill matching to patient acuity in intensive care: a risk management mandate, ***Journal of Nursing Management*** 2006 Jul; 14(5):397-404.
- Rischbieth A., Blythe D. Ethical Intensive Care Research: Development of an Ethics Handbook ***Critical Care and Resuscitation*** 2005 Dec; 7(4):310-21.
- Rischbieth A. Development and evaluation of a Web-enabled communication platform for a national intensive care nurse skill-matching to patient acuity study. Nursing abstracts from the 2nd Conference of the World Federation of Critical Care Nurses. ***Connect: the World of Critical Care Nursing***; Volume: 4; Issue: 2; 2005.
- Rischbieth A., Blythe D. ***Ethics Handbook for Researchers*** 1st Edition 2005 ANZICS CTG Melbourne.

FREE PAPER / ORAL PRESENTATIONS

The World Federation of Societies of Intensive and Critical Care Medicine
Quadrennial World Congress – Buenos Aires, Argentina - August 2005
Development of a web-enabled communication for a National Intensive Care Skill Matching Study.
**This presentation was named in the top 5 nursing presentations at the World Congress*

The Royal College of Nursing (RCNA) Annual Conference - Adelaide July 2005.
Use of an 'e' approach for a National Intensive Care Skill Matching Study.

GLOSSARY AND ABBREVIATIONS

Operational definitions in this research

For the purpose of this research, the definitions of an *ICU Nurse Unit Manager (NUM)* included the titles of: Nurse Unit Manager (NUM), Clinical Manager (CM), Clinical Nurse Consultant (CNC), Unit Manager (UM), and Clinical Service Manager (CSM). All study NUM participants were referred to as *NUMs* during this study, regardless of their official title as it was determined that their management roles encompassed the required knowledge for this research.

The definition of *ICU Shift Leader Nurse* is one who has a key role in the decision-making processes to determine nurse skill-mix and nurse-patient care allocation at the beginning, and or during, a nursing shift in the Level III ICU. It is recognised that SLNs is likely to be Registered Nurses (RN) from different employment classifications, (i.e. RN1, RN2, RN3, RN4) ICU Nurse Managers were invited to identify the SLNs within their ICU using the above criteria.

Glossary

Accountable: being held responsible.

Accreditation: being granted recognition for meeting designated standards for structure, process and outcome.

Acuity: average workload per occupied bed, commonly used as a nursing benchmark; the degree of severity of a patient's condition and/or situation.

Admitted patient: a patient who undergoes a hospital's formal admission process to receive treatment and/or care.

Adverse event: an incident in which harm resulted to a person receiving health care.

Adverse reaction: an adverse event where the correct process was followed for the context in which the event occurred but unexpected and unpreventable harm resulted. (For example, an adverse drug reaction will be said to have occurred when the right drug was used for the correct indication in the right dose given by the right route, but the patient suffered unexpected and unpreventable harm. Adverse reactions can also result from some diagnostic tests, therapeutic interventions or devices.)

Available (Open) Bed: bed in use or immediately available for use by admitted patients as required. In ICU this refers to a bed with mechanical ventilation and advanced life support capability that is fully staffed and funded.

Average length of stay: the average number of patient days for admitted patient episodes. Patients admitted and separated on the same day are allocated a length of stay of 1 day.

Bed Days (Patient Days): total number of days for all patients who were admitted to the ICU for an episode of care. Calculated as the difference between the separation date and admission date. Same day patients are allocated a length of stay of one day.

Bed Occupancy: the number of patients in a ward expressed as a percentage of bed numbers.

Benchmark: a criterion against which something is measured.

Blame: to hold at fault (implies culpability).

Bottom-up workforce planning methods: staffing levels calculated using factors known to influence a nurse's workload. These could be the number of stroke patients or the number of first-day post-operative patients in the ward.

Casemix: the range and types of patients (the mix of cases) treated by a hospital or other health service. Casemix classifications in Australia (such as AR-DRGs) provide a way of describing and comparing hospitals and other services for management purposes.

Circumstance: all the factors connected with or influencing an event, agent or person/s.

Complexity: the degree to which a patient's condition and/or situation is characterized or Influenced by a range of variables (e.g., multiple medical diagnoses, impaired decision-making ability, challenging family dynamics).

Critical Care Qualification: a post-registration award at a minimum of certificate level obtained by successful completion of an accredited critical care education program (minimum 6 months duration) at a hospital or tertiary institution.

Demand: refers to that created by patients requiring a calculated nurse labour requirement.

Direct care: hands-on care by nurses; for example recording mechanical ventilation clinical parameters in ICU

Disease: a physiological or psychological dysfunction.

Empirical data: information collected systematically, for example observation.

Error: unintentionally being wrong in conduct or judgment. Errors may occur by doing the wrong thing (commission) or by failing to do the right thing (omission).

Establishment: an agreed level of staffing for a ward, unit, hospital, etc. The number of nurses working in the hospital is called the nursing establishment.

Event: something that happens to or with a person.

Full Time Equivalent (FTE/EFT): the number of paid hours expressed as a ratio of the agreed or award hours for a full time employee (e.g. 35 hours per week of paid employment). Because a high proportion of nurses work part-time, the use of the population-standardised headcount is limited as an indicator of nurse supply. It is more appropriate to assess the supply of labour through full-time equivalent (FTE) nurse numbers, which are adjusted for the number of hours worked. The concept of a full-time equivalent depends on what may reasonably be regarded as a full-time job. FTE calculations in this publication are based on the standard full-time working week (may vary from 35-38 hours per week in Australia). Staffing categories include:
- Registered nurses
- Enrolled nurses
- Student nurses

Harm: harm includes disease, injury, suffering, disability and death.

Hazard: *a* circumstance or agent that can lead to harm, damage or loss.

Health: a state of complete physical, mental and social wellbeing and not merely the absence of disease or infirmity.

Health care: services provided to individuals or communities to promote, maintain, monitor, or restore health. Health care is not limited to medical care and includes self-care.

Health care incident: an event or circumstance during health care which could have, or did, result in unintended or unnecessary harm to a person and/or a complaint, loss or damage.

Health care outcome: the health status of an individual, a group of people or a population which is wholly or partially attributable to an action, agent or circumstance.

High Dependency Unit: a discrete unit within the hospital, able to supply critical care expertise at less *(Step Down Unit)* intensive resource levels, providing a level of care that falls between the general ward level and the intensive care unit.

Hospital: *a* health care facility established under Commonwealth, state or territory legislation as a hospital or a free-standing day procedure unit and authorized to provide treatment and/or care to patients.

Iatrogenic: arising from or associated with health care rather than an underlying disease or injury.

Incident: an event or circumstance which could have resulted, or did result, in unintended or unnecessary harm to a person and/or a complaint, loss or damage.

Injury: damage to tissues caused by an agent or circumstance.

Indirect care: individual but remote patient care that is one step removed from the bedside, for example writing a nursing report about a patient.

Intensive Care Specialist: a medical practitioner who has been specifically trained in intensive care (Intensivist) medicine. Intensive care specialists are formally certified in intensive care by completing the training requirements of the JFICM.

Invasive (mechanical) Ventilation: ventilatory support via oral/nasal intubation or tracheostomy tube.

Length of stay: the length of stay of an overnight patient is calculated by subtracting the date the patient is admitted from the date of separation and deducting days the patient was on leave. A same day patient is allocated a length of stay of one day.

Liability: responsibility for an action according to the law or in a legal sense.

National health data dictionary (NHDD): *a* publication that contains a core set of uniform definitions relating to the full range of health services and a range of population parameters.

Loss: any negative consequence, including financial.

Monitor: to check, supervise, observe critically, or record the progress of an activity, action or system on a regular basis in order to identify and/or track change.

Near miss: *a*n incident that did not cause harm.

Negligence (civil or criminal): an incident causing harm, damage or loss as the result of doing something wrong or failing to provide a reasonable level of care in a circumstance in which one has a duty of care.

Nosocomial: pertaining to or originating in a hospital (synonymous with "hospital-acquired").

Nurses: nurses are classified into two broad categories: registered nurses (usually with a degree), who make up the majority of all nurses, and enrolled nurses (usually a certificate or advanced diploma). Although the level of expertise varies within these groups, in general, registered nurses perform more complex medical procedures and hold more responsibility than do enrolled nurses.

Nursing Staff Mix: the combination and number of regulated and unregulated persons providing direct and indirect nursing care to clients in all settings where regulated nursing groups.

Nursing Workload: the amount of time, and mental and physical energy that nurses devote to various work-related activities and to direct patient care

Outcome: the status of an individual, a group of people or a population which is wholly or partially attributable to an action, agent or circumstance.

Patient days: the total number of days for patients who were admitted for an episode of care and who separated during a specified reference period. A patient who is admitted and separated on the same day is allocated one patient day.

Patient dependency: a measuring and classification system consisting of two or more categories arranged in a hierarchical manner that indicate the amount of care patients receive from nursing staff.

Patient outcomes: the observable events/results of nursing interventions or the care environment on patients. The focus is on attempting to determine whether the level of nursing staff was related to the number and/or frequency of adverse events.

Preventable: accepted by the community as potentially avoidable in the particular set of circumstances.

Performance indicator: a statistic or other unit of information/measure that reflects, directly or indirectly, the extent to which an anticipated outcome is achieved or the quality of processes leading to that outcome.

Private hospital: *a* privately owned and operated institution, catering for patients who are treated by a doctor of their own choice. Patients are charged fees for accommodation and other services provided by the hospital and relevant medical and paramedical.

Public hospital: a hospital controlled by a state or territory health authority. Public hospitals offer free diagnostic services, treatment, care and accommodation to all eligible patients.

Quality (degree of): the extent to which a service or product produces a desired outcome or outcomes.

Quality of health care (degree of): the extent to which a health cares service or product produces a desired outcome or outcomes.

Reliability: the strength a research instrument has in terms of consistency.

Remoteness Area A classification of the remoteness of a location using the Australian Standard Geographical Classification Remoteness Structure, based on the Accessibility /Remoteness Index of Australia (ARIA) which measures the remoteness of a point based on the physical road distance to the nearest urban centre.

Risk: the chance of something happening that will have a negative impact. It is measured in terms of consequences and likelihood.

Risk management: in health care, designing and implementing a program of activities to identify and avoid or minimise risks to patients, employees, visitors and the institution; to minimise financial losses (including legal liability) that might arise consequentially.

Root cause analysis: a systematic process whereby the factors which contributed to an incident are identified.

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Safety: freedom from hazard.

Satisfaction: the perception that the expected care that is being given is at least adequate and safe. Satisfaction is looked at in terms of the patient and the nursing staff.

Scope of Practice: the range of services that a professional group is authorised to provide. Both legislation and education determine the scope of practice of a professional group, and they are obliged to practice in accordance with their professional code of ethics and set of professional standards.

Stakeholder: those people and organizations who may affect, be affected by, or perceive themselves to be affected by, a decision or activity.

Standard: agreed attributes and processes designed to ensure that a product, service or method will perform consistently at a designated level.

Skill mix: the different types of practitioners making up the ward's establishment. Nurse managers strive to achieve the ideal mix; one that maintains or improves the quality of care at the least cost.

Staffing levels: the actual or ideal number of nurses working in a ward or department expressed in full time equivalents (FTEs).

Supply: refers to the supply of nurses and where they come from.

System failure: A fault, breakdown or dysfunction within an organisation's operational methods, processes or infrastructure.

System improvement: The result or outcome of the culture, processes and structures that are directed towards the prevention of system failure and the improvement in safety and quality.

Top-down methods: staffing levels calculated using predetermined formulas compiled from widespread health care data; for example the number of nurses per occupied bed.

Validity: evidence that a research instrument measures what it is supposed to measure, for example a patient classification instrument is an accurate measure of a patient's dependence on the nursing staff.

Variability: the degree to which a client's condition or situation changes or is likely to change.

Variables: literally anything that is allowed to vary, for example, bed occupancy.

Ventilator Bed: a physical ICU bed plus ventilator.

Ventilation: the process of respiratory support: Invasive- whereby a patient is intubated (oral / nasal / tracheostomy) and mechanically ventilated; Non-invasive – ventilatory support such as CPAP/BiPAP.

Ventilator Hours: the number of hours a patient is intubated (oral / nasal / tracheostomy) and ventilated but not weaned from invasive mechanical ventilatory support.

Abbreviations

ACHS	Australian Council on Healthcare Standards
AE	adverse event
AORTIC	Australasian Outcomes Research Tool for Intensive Care
APACHE	acute physiology and chronic health evaluation
CDSS	clinical decision support system
EQ-5D	Euroquol 5D
FTE (EFT)	Full Time Equivalent
HDU	High Dependency Unit
ICU	Intensive Care Unit
ICU/CCU	Integrated Intensive Care / Coronary Care Unit / High Dependency Unit
JFICM	Joint Faculty of Intensive Care Medicine
MODS	multiple organ dysfunction syndrome
NAS	nursing activities scale
QOL	quality of life
RCA	root cause analysis
SAC	safety assessment coding
SAPS	simplified acute physiology score
SOFA	sepsis -related/sequential organ failure assessment
TISS	therapeutic intervention scoring system

References

ABS (Australian Bureau of Statistics) 2004a. Private hospitals Australia 2002–03. ABS cat. no. 4390.0. Canberra: ABS.

ABS 2004b. Census of population and housing: socio-economic indexes for areas (SEIFA), Australia—technical paper. ABS cat. no. 2039.0.55.001. Canberra: ABS.

ABS 2005. Private hospitals Australia 2003–04. ABS cat. no. 4390.0. Canberra: ABS.

AIHW (Australian Institute of Health and Welfare) 1997a. Australian hospital statistics, 1993–95: an overview. AIHW cat. no. HSE 2. Health Services Series no. 9. Canberra: AIHW.

AIHW 1997b. Australian hospital statistics 1995–96. AIHW cat. no. HSE 3. Health Services Series no. 10. Canberra: AIHW.

AIHW 1998. Australian hospital statistics 1996–97. AIHW cat. no. HSE 5. Health Services Series no. 11. Canberra: AIHW.

AIHW 1999. Australian hospital statistics, 1997–98. AIHW cat. no. HSE 6. Health Services Series no. 12. Canberra: AIHW.

AIHW 2000. Australian hospital statistics 1998–99. AIHW cat. no. HSE 11. Health Services Series no. 15. Canberra: AIHW.

AIHW 2001a. Australian hospital statistics, 1999–00. AIHW cat. no. HSE 14. Health Services Series no. 17. Canberra: AIHW.

AIHW 2001b. Expenditures on health services for Aboriginal and Torres Strait Islander people 1998–99. AIHW cat. no. IHW 7. Canberra: AIHW and DHAC.

AIHW 2002. Australian hospital statistics, 2000–01. AIHW cat. no. HSE 20. Health Services Series no. 19. Canberra: AIHW.

AIHW 2003. Australian hospital statistics, 2001–02. AIHW cat. no. HSE 25. Health Services Series no. 20. Canberra: AIHW.

AIHW 2004a. Australian hospital statistics 2002–03. AIHW cat. no. HSE 32. Health Services Series no. 22. Canberra: AIHW.

AIHW 2004b. National health data dictionary, version 12.0 supplement. AIHW cat. no. HWI 72. Canberra: AIHW.

AIHW 2005a. Australian hospital statistics 2003–04. AIHW cat. no. HSE 37. Health Services Series no. 23. Canberra: AIHW.

AIHW 2005b. Mental health services in Australia 2003–04. Canberra: AIHW (Mental Health Series no. 8). Canberra: AIHW.

AIHW 2005c. Health expenditure Australia 2003–04. AIHW cat. no. HWE 32. Health and Welfare Expenditure Series no. 25. Canberra: AIHW.

AIHW 2005d. Improving the quality of Indigenous identification in hospital separations data. AIHW cat. no. HSE 101. Health Services Series no. 25. Canberra: AIHW.

Runciman MJA Volume 184 Number 10 • 15 May 2006.
National health data dictionary version 12 and version 12 supplement (NHDC 2003, AIHW 2004b). www.aihw.gov.au.

ABSTRACT

A web-enabled national multi-centre study of nurse skill matching to patient acuity and risk in intensive care

Background

Although there is substantive literature regarding nurse staffing utilisation models, there is a little evidence about the decision-making process involved in the matching of nurse skill levels to patient acuity.

Aim

This study aimed to identify tools, systems and processes that inform nurse skill-assessment and nurse-to-patient allocation decisions in Adult Level III Australian ICUs, and to develop a Nurse Skill Matching Decision-Support Framework that could be incorporated within an ICU risk management system.

Method

Data were collected primarily through a web-enabled survey questionnaire. Nursing Unit Managers (NUMs), and Shift Leader Nurses (SLNs) responsible for key staffing decisions were recruited from all of the 58 Adult Level III Australian ICUs. A high response (86.20%) was achieved. Data method triangulation using quantitative and qualitative data informed the study findings.

Findings

Key staffing problems related to nurse supply, emergency admissions and unpredictability of admission type; lack of nurse skill assessment and inadequate skill mix; budget constraints; student/junior staff; supervision and support, and staff conflict. Suggested solutions included skill database/list creation; control of patient admissions; and attention to detail in skill mix formulae. Autonomy and support for staffing decisions, adequate clinical resources and improved communication were sought.

Discussion

An inextricable link exists between staffing decisions and patient safety, outcome and risk, in the ICU. Staffing systems and associated decisions are complex and multi-factorial, making single-facet staffing models inherently limited. This study highlighted a broad culture of frustration with most current staffing systems in Australian ICUs. Evidence of potential clinical compromise and risk exposure resulting from poor skill matching to patient acuity was found, this being compounded by a skill shortage, lack of skill assessment, budget constraints and a lack of trust of shift leader decisions by managers. A Staffing Decision Support Framework is recommended for further development and potential use in ICUs.

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CHAPTER 1 INTRODUCTION

1.1. Introduction

Nursing workload is one of the most important determinants of patient safety and quality of care. This is true in all types of clinical setting, but perhaps especially so in intensive care units (ICUs). ICUs are, by definition, high-acuity areas. Nurses in ICU must continuously respond to the needs of patients and their families in addition to interacting with the highly intense emotional aspects of life in an ICU, and to the constant fluctuations in the clinical status of patients. Good communication skills are essential when dealing with relatives and family dynamics at a time of high emotional stress. Technology is an integral part of this environment and ICU nurses need the skill and knowledge to use complex equipment with accuracy and adeptness. Multiple therapies for patients are often concurrent and require simultaneous vigilance by the attending bedside nurse. Supervision and guidance from senior colleagues is expected. In addition, there is the management of emergency admissions. Ethical and social issues can also be complex and require sensitive handling.

As a nurse manager for over ten years in a busy, high-acuity intensive care unit, this researcher was aware of the variety of experiences and dynamic events. Two shifts were rarely the same; events being influenced by many factors, emergencies and the mix of staff and patients on any given shift. Because most ICU patients are not admitted in elective circumstances, planning can be difficult and this presents its own set of challenges as budget and organisational targets must be met. However, despite having a strong focus on institution-specific nursing workforce indicators to measure nurse labour and cost, there appeared to be far less emphasis on attaining, assessing, and allocating the right skill-mix for the relevant patient acuity in the researcher's ICU. It appeared to be the view of many senior colleagues, particularly in the administrative areas, that a 'nurse was a nurse was a nurse'. This meant that the focus was not on the attributes and skills of the nurse or nurses, but more on the numerical value (in nurse labour terms) that was represented by the staff.

This philosophy was unsettling despite the fact it was not a new concept. Indeed, many of the available nursing workload measurement tools were numerically based. Coupled with sustained and endemic nurse shortages, there appeared to be a lack of strategies or systematic processes in ICUs to assess accurately the skill level of both the employed ICU nurse and that of other nursing staff that moved in and out in transient fashion through nursing agency deployment and assorted casual contracts. The focus appeared to be always on the numbers, not on the quality of the staff. This raised alarm bells over time as there were many nursing shifts where patient care was potentially compromised by limitations in the capabilities of the available staff to safely deal with the acuity of particular patients.

The system or process of allocation of nurses to patient care varied, largely subject to the preferences of the person doing the allocating, based on individual ideas about 'how it could best be done', thus contributing to the milieu of strategies. These could range from 'allocating the most skilled nurse to the sickest patient' to 'winging it' and just allocating staff in a somewhat 'ad-hoc' manner, particularly if the nurse's skills and experience were unknown to the ICU at the time. This ad hoc approach was inappropriate, given that ICU nurses deliver some of the most complex therapies to the sickest and most vulnerable patients and, therefore, to where the risk of error is potentially high. It was unclear why limited attention was focused on systems that could address the issue of skill assessment and subsequent nurse -to -patient allocation practices. Historically, most ICUs have developed their own in-house ad-hoc systems, but most remained thwarted by the similar workforce- and budget-related numerical indicators that seemed to be the managerial priority.

Although one national professional college has suggested that a certain skill level is required in ICUs, there continues to be an ongoing debate in Australia and internationally regarding the use and role of less skilled health workers in ICUs. The Australian College of Critical Care Nurses (ACCCN) recommend:

> The introduction of non-registered nurses to provide direct patient care in Australian intensive care units is considered inappropriate, problematic and hazardous.[1] (p. 2).

It is reasonable that a certain level of knowledge and training is a minimal requirement to work safely in the ICU setting and, if nurses were 'in training' in the ICU, they required close supervision and support. This stance is well supported by consistent position statements from professional critical care nursing bodies such as ACCCN, The British Association of Critical Care Nurses (BACCN), and the World Federation of Intensive and Critical Care Nurses (WFICCN).[2-4] However, management strategies and key performance indicators (KPI's) appear to be at cross purposes with this view. For most Nurse Unit

(ICU) Managers, the primary workforce indicator was commonly 'Nursing Hours per Patient Day' (NHpPD), which was always a fixed determinant within the annual budget process and cycle.

In most ICUs there was a predetermined formula that calculates final NHpPD figures, with these daily data summarised in table and or graph formats as indicators of a Unit manager's individual performance. Not infrequently these two goals are difficult to reconcile and appear to be counter to the other's objectives. This challenged the researcher's thinking; not the NHpPD calculation itself because there is an understandable fiscal context, but as the sole facet of nurse staffing measurement, it did not make sense. There appeared to be many other dynamic contributing facets that were considered unimportant, and often either negated or dismissed even when they provided very useful data and context to the shift's activities and clinical events.

The experience of this researcher was that, during periods of perceived low nurse-skill availability the number of adverse events increased, as did sick leave. Stressed senior nurses expressed difficulty in having to be responsible for and to supervise too many less skilled staff who had to provide care to the most critically ill and unstable patients. This was compounded by nursing shifts where a number of unknown agency nurses were deployed to the ICU and allocated patients on the assumption that they would not have been sent by the agency unless they were capable of the level of care required. At times, these nurses were excellent and fitted well into the team. But there were many times when there was substantial risk exposure to patients if nurses working out of their scope of practice were deployed to our ICU. This seemed to be unfair to the agency nurse, unfair to the permanent nurses expected to supervise and assist, and unsafe for patients who were at risk of a potential adverse outcome or prolonged length of stay.

Frequently NHpPD numerical endpoints did not reflect the complexities of many of the shifts in any given week. Like any ICU the workload is high in terms of patient acuity, complex therapy delivery with highly technical equipment, and unpredictable patient demand. This is especially true in hospitals where an emergency department is active 24 hours a day, significantly influencing hospital and therefore also the ICU admissions. Furthermore there were some nursing shifts where skill mix was inadequate and/or unknown (due to agency nurse deployment), and where the 'matching' of those skills to patient allocation was variable, both in terms of the intent of the shift leader and the patients' outcomes. In the researcher's ICU, the nurse who was the shift or team leader was deemed the most appropriate and experienced person to make decisions regarding how many nurses were needed and how they should be allocated to patients. However often they did not have all the appropriate information at hand making these decisions challenging.

1.2. Nurse skill mix and nurse staffing decisions

Despite the researcher's personal view that the shift leader nurses should be given autonomy in their staffing decisions, other views were expressed by senior management that reflected their ardent belief that this was not the place for nurse autonomy, and that the ICU manager should hold both the role and responsibility for nurse staffing decisions. This did not sit well from a personal philosophical standpoint. If a shift/team leader nurse was considered responsible enough to manage all admissions and therapies, troubleshoot equipment and technical issues, co-ordinate emergencies especially after hours when managers were absent, it seemed logical and appropriate that they be trusted to make key important staffing decisions. Yet in many instances their staffing decisions were overruled by managers external to the direct ICU environment.

In relation to NHpPD, the researcher was curious to know whether other ICUs had similar experiences with skill mix and staffing decisions and staffing practice issues. Anecdotally, in conversations through critical care networks this appeared to be the case; however an increased understanding from an evidence-based perspective was desired.

An early look at the literature indicated there were many articles about nurse utilisation and patient outcome, and various methodological challenges associated with those relationships, but nothing about *how* staffing decisions were informed and by whom. There appeared to be a myriad of staffing models which were almost all based on various numerical formulae. It is appropriate to ascertain both current practices and determine what is the different staffing –related problems exist. The use of other models or systems that include shift variables would be of benefit to the staffing debate at a local, national and international level.

1.3. Nurse skill assessment in ICU

In the ICU, it is usually known which staff have formal critical care qualifications, who are 'in-training', and who are not formally qualified. The difficulty lies in quantifying skill level and the varying degrees of ICU experience, and expertise. It is particularly difficult to ascertain the skill sets of agency nurses, especially if they were arriving for work 'new' to a particular ICU. Quick questions to the nurse such as "Have you worked in ICU before?", "Can you look after patients with ventilation, renal dialysis, heart balloon pump machines etc?" and "Have you seen and or operated this particular equipment before?", seemed inadequate, and yet there was little alternative. Again this raises the issue of potential unsafe care for patients when allocating nurses about who little was known of their skills and capabilities.

With no other information at hand, the shift leader would makes what they perceive to be the most relevant nurse-to-patient allocation decisions. Suffice to say that these decisions invariably worked out for the better, but at times they were perhaps poorly-informed, when the allocated nurse subsequently struggled to manage the patient care to which he or she had been allocated. A revision process of the nurse-to-patient allocations with possible swapping of nurses to different patients may be necessary mid-way during the shift which then leads to other supervision issues.

An anomaly in this situation is where agency nurses are assigned to an ICU is paid significantly more than if they were deployed to work in a ward area. The local, national and international shortage of critical care staff meant that qualified ICU nurses were at times a rare commodity. Some agency nurses overtly stated that they had told the agency they 'worked in ICU' so they could be sent to one which gave them greater remuneration. Whilst this was in a minority of cases, it was a worrying element and potentially exposed the nurse, the patient and the ICU to less safe patient care and higher risk of adverse event or prolonged ICU length of stay.

1.4. Understanding the context of the research

The staffing issue seemed more than a cyclical phenomenon related solely to a lack of enough ICU nurses worldwide, but appeared to be a more complex myriad of nursing workforce issues. A new concept that has been developed by the researcher is that of 'skill-matching'. Simply put, it reflects the variety of considerations necessary to inform staffing decisions that match the available skill of nurses with the acuity of the ICU patients of the day.

If the result of poor skill matching decisions resulted in an adverse event, an increased length of stay, a clinical complication, or increased mortality, then the 'true cost' of poorly-informed staffing decisions may be far greater than could be quantified using existing single formula (NHpPD) calculations.

Although the principles of responsible health care apply to all health sectors, speciality services to care for the critically ill in the ICU have additional complex clinical, operational and governance requirements. These are both challenging and costly.[5] Escalating biomedical, technological and therapeutic advances and associated rising costs, combined with increasing patient acuity and consumer expectation, compounds the intensive care delivery challenge.[6-8]

Numerical-based nurse utilisation models are often used to calculate staffing requirement,[9] including fiscal targets sets as 'key performance indicators' (KPI's) that must be met. Failure to do so may be perceived to equate to 'poor management' and or 'non-compliance' by those deemed responsible.

To argue the case that there are inherent limitations of these types of staffing models (for example, a nurse labour utilisation/nursing hours based scenario is presented. There are 2 different nursing hours' models - A and B. Both equate to the same finite budgeted total nursing hours although the manner in which they are calculated differs. The two models presented here could reasonably be used to quantify nurse labour.

Staffing Model A: 1:1 Standard Nurse/Patient Ratio = 26 hours

- Clinical Coordinator 1 = 1.3 hours
- Resource Nurse = 60% qual 1:6 = 4.3 hours

Budgeted total = <u>31.6 Hours NHpPD</u>

Staffing Model B:

- All staff nurse hours are counted; no supernumerary allowances.

Budgeted total = <u>31.6 Hours NHpPD</u>

It could be considered that if both Manager A and Manager B achieved these nursing hour targets, (e.g. less than 31.6 hours NHpPD) they would be seen to be a 'good and compliant manager'. The utilisation of staff in hours appears identical, but what are the likely hidden contributing factors? Closer scrutiny of the 2 scenarios in the ICU clinical setting within a single 24 hours illustrates the complexities in the following scenario:

What of the 'mix' and the 'match' in each model?

Clinical scenario A: Manager A using Model A, has a high percentage of junior (in-training) nurses in ICU an old physical ICU layout not conducive to direct observation, and 3 agency nurses who's skills are unknown as they arrived for their shift with no prior information forwarded by the agency. There are 3 critical patients in the Emergency Dept waiting to be admitted to the ICU. One nurse has gone home sick and there are no supportive personnel (transport orderlies and no supernumerary staff). There was a ward clerk on the am shift who has since gone home. Two patients need to start complex therapies but there are not enough skilled nurses who know how to set them up and manage them, so they are delayed. Two of the three agency nurses are unfamiliar with the ventilators used in this ICU. No other staff are available from another area or from any agency. There is a patient who needs an urgent diagnostic scan in the radiology dept. The patient is critical and needs to go now. There are only 2 qualified ICU nurses on duty. The cardiac arrest pager beeps requiring one nurse to leave the ICU as part of the emergency response team. The inherent risks in this shift are numerous and variable and require judicious management on the part of the responsible shift/team leader. Despite this, a medication error occurs and there are delays in removing a breathing tube until another staff member is available to assist. The allocated nurse is unfamiliar with this procedure.

All three shifts in the 24 hours have been similar. With no support staff and full beds, the nursing hours are calculated at 31.0 NHpPD for this 24 hour day. The budget target has been met. However, the actual and the perceived risk exposure to some or all of those patients of either an adverse event or a poor outcome are unknown.

In this scenario, delays in treatment could have been a distinct possibility. In addition, poor supervision due to not enough qualified staff meant ventilator management could have been sub-optimal and titration of critical life-saving medication unclear. Even, best-case scenario, if the day ended with no 'adverse events', what were the 'near-misses' and potential for catastrophic outcome? The question of how to appropriately distinguish and discern the shifts that posed greater patient risks from others that may be deemed 'safer' is difficult in itself. The separate but equally important task of quantifying the distinctions in objective data provides an even greater challenge.

Clinical Scenario B: Manager B using Model B has an entirely different shift yet the same final NHpPD data. In this scenario, there are plenty of qualified staff, no emergencies, and critical but stable patients with no sudden deterioration or complex therapy changes. Junior (in-training) nurses are allocated stable patients, with a qualified nurse in the bed area next to them for support and education. There are two agency nurses both of whom have worked in the ICU previously and are familiar with the equipment and Unit protocols. No adverse events or incidents are reported.

These two brief scenarios demonstrate the same nursing hour utilisation overall (in A and B), yet it is evident that there is a likely completely different impact of level of patient risk and potentially impact on outcome. Identical data points on a 'key performance indicator' (KPI) graph or data table may even reflect that the KPI target has been achieved. However no data were available that could highlight and expose the entirely different 'behind the scene' critical sequence of events. It would be reasonable to assume that virtually all hospitals and their ICUs record any adverse events; however it appears unlikely that any data was collected on detailed staffing decision information, let alone the complex events of the shift, or risk analysis at the outset of the shift.

If challenged, hospital executive managers who set the KPIs are likely to routinely state that 'budgets should not get in the way of clinical care'. However the reality is there appears that they do have an impact every day. There is an innate conflict with savings (less resources) versus spending (more resources); with the main aim a balance of the two without clinical compromise. The bottom line is the need to think and be smarter in staffing management and skill matching with limited resources. Promotion of flexibility and autonomy in staffing decisions is likely to yield benefits but there is no current profile of staffing practices across a range of ICUs.

1.5. Overview of background literature

When the literature was broadly scanned initially there were, as already noted, many papers discussing 'patient dependency' models and various labour force calculations (such as NHpPD). There was little emphasis on 'nurse skill level assessment' or 'allocation to care' considerations or practices. There were rare insights into other ICU staffing practices and very limited discussion on the link between staffing and patient risk per se.

Research on nurse staffing has changed in recent years. In the 1990s, there was insufficient evidence to determine whether nurse staffing changes were detrimental. More recent research shows that nurse staffing is crucial, with evidence suggesting that an increase in nurse staffing is related to decreases in risk-adjusted mortality, nosocomial infection rates, thrombosis and pulmonary complications in surgical patients, pressure ulcers, readmission rates, and failure to rescue. These outcomes may be referred to as nurse-sensitive; that is, affected by the quality of nursing intervention[10,11] and this evidence is discussed further in Chapter 2.

Understanding patient risk

Clinical governance including risk management has become a key focus of governance and management in all organisations. It is of particular relevance in health care organisations because of increasing concern about quality and error in clinical practice and the emergence of funding and capital arrangements that make the identification and management of risk a central task. As clinical governance has grown in importance systematic tools for identifying, quantifying, managing and monitoring risk have emerged.[12]

Risk management is the process of measuring, or assessing risk and then developing strategies to manage the risk.[13] In general, the strategies employed include transferring the risk to another party, avoiding the risk, reducing the negative affect of the risk, and accepting some or all of the consequences of a particular risk. The premise behind risk management is to formalise thinking about situations that might put a staff member or patient in a difficult and or hazardous position, and then decide if that measured level of risk is worth taking. For several years, adverse events have been a subject of interest in Australia, as elsewhere in the world, not least because of uncertainty about how often they occur, and their impact.

The recently (2001) established Australian Council for Safety and Quality in Health Care has a charter to lead national efforts to promote systematic improvements in the safety and quality of health care in Australia. In its action plan for 2001, "the Council identified four priority areas, one of which is better use of data and information throughout the system to support safer patient care".[14] (p. iiii) This researcher supports this objective which aligns with her personal view in that more information is needed to be in a position to improve patient safety and reduce adverse events. An increased understanding from research was needed in order to understand the association between nurse skill, nurse staffing decisions and patient risk.

Chapter 2 presents a detailed *Literature Review*. This is followed by the *Research Design* in Chapter 3 which includes development of the research question, the methodology, method and conduct of the research. The *Analysis and Results* Chapter 4 is next which includes data analysis of both the quantitative and qualitative data. Finally, Chapter 5 presents the *Discussion* following the study's findings. Recommendations and a Conclusion close this chapter. *Appendices, References* and *Publications* follow the end of Chapter 5.

1.6. Summary

This chapter has presented the background of the intensive care environment and intensive care nursing. It described the impetus for this research and consideration of the complex issues that surround nurse staffing in the ICU. Many years of personal clinical and managerial experience in the ICU setting gave insights and, combined with the broad reading of some of the literature, informed the way forward. Preliminary contextual information was also provided regarding the intensive care unit (ICU) environment and patient risk.

Finally a brief overview of the Chapters to follow has been provided.

The research was conducted over three years by a sole researcher undertaking a full-time doctoral (PhD) candidature.

CHAPTER 2 LITERATURE REVIEW

2.1. Introduction

This chapter presents a review of the relevant contemporary literature that informed the research. The purpose of this review was two-fold: to identify the scope of literature; and to critique the relevant literature regarding nurse skill mix and staffing practices, and their association with outcome and risk in the Intensive Care Unit (ICU) setting.

2.2. Literature search

The literature review was conducted in 2004. The intensive care speciality is extremely dynamic with rapid advances in technology, research and practice, hence presentation of contemporary literature was considered appropriate. In this review contemporary literature was defined as a 6 year period from 1998-2004. On the relatively few occasions where pre-2004 literature has been included in the review, the researcher considered it either seminal work or important early conceptual information.

Search strategy

The search strategy gathered information from electronic databases, the World Wide Web including Google® Scholar, government reports, regulatory nursing professional bodies, and published media and free press. The predominant electronic database searches were:

- The Cumulative Index Nursing and Allied Health Literature (CINAHL);
- Medline; and
- The Biomedical Reference Collection Corporate Edition (1998-2004).

A full list of all the electronic resources and specific search strategies can be found in Appendix C. Subject headings used in the searches included the following terms:

nurse staffing
nurse staffing AND skill mix
nurse staffing AND nurse skill
skill mix AND decision-making
nurse staffing AND patient outcomes
nurse staffing AND adverse events
nurse staffing AND patient safety
nurse staffing AND risk
workload measurement

nurse staffing models

2.3. Literature review framework

From the broad overview of the literature, five key issues emerged which focussed the review:

1. Nurse labour (including shortage, casual and agency nurse labour)
2. Nurse skill and Risk management in ICU (including patient safety; risk and harm, and agency nurses)
3. Workforce (staffing) indicators, definitions and workload
4. Outcome measurements in ICU
5. Skill matching to patient acuity.

Issue 1: Nurse Labour (including shortage, casual and agency nurse labour)

Responsible health care delivery in the ICU necessitates a strong focus on cost management and accountability, resource efficiency, and tangible improvements in patient outcomes.[15] The largest health care resource requiring judicious management is that of nursing labour. Nursing staff budgets constitute approximately 50-75% of the total costs in an ICU.[16,17] By the very nature of delivering specialised care, ICUs are high-end users of nurses and nursing hours. Because of the high cost there is inevitable focus on reducing cost and nurse labour is more often than not at the forefront of those debates.

Morbidity and mortality rates in ICUs vary widely between institutions and countries.[18] Although some of this variation is due to case mix (for example, the mix of age, acute severity, co-morbidity, surgical status and reason for admission), a significant variation in hospital mortality is observed even after adjusting for differences in case mix.[15,19,20] this wide variation in the organisation and delivery of intensive care makes it important to understand the impact of organisational factors that impact on ICU outcomes. One cause of this variation is related to the micro system of the ICUs with nurse labour and nursing workload identified as important aspects of that micro system[21].

Given the intensive use and high cost of nurses in an ICU, it makes good sense that with market-driven health care policies, nursing labour costs should be appropriately scrutinised. However, nursing labour costs in ICUs (just as in other specialties) may be viewed as prime targets for easy cost-cutting, with some providers seeing nursing labour as a readily expendable item that is enticing as it can offer quick savings.[22] It is appropriate to challenge the rationale of some of these cost-cutting strategies, indeed, a number of studies suggest that adherence to adequate nurse staffing and organisational support for nursing holds the key to quality of patient care delivery and outcomes, diminished nursing job dissatisfaction and burnout, and improvements in nursing retention.[6,23,24]

Reducing labour costs, for example by reducing nurse-patient ratios or nursing hours per patient day, may risk significant negative effects including increased nursing sick leave, burnout and attrition, and may affect patient outcomes.[22] Any benefit gained in a cost cutting exercise may be negated in losses from staff leave and turnover, adding costs to other financial 'line items' creating an effect that may be misinterpreted. This effect may be further compounded by expensive long-term inefficiencies associated with adverse patient events, complications, readmissions and increased length of stay (LOS). Rationale for these poorer patient outcomes may be inappropriately attributed and masked by the short-term lure of an improved financial position by reducing nurse numbers and/or experience levels. The evidence about the real effect of nursing staff skill mix decisions on patient outcome with direct causality relationships is difficult and complex to demonstrate, predominantly due to problems inherent in research design and methods of measurement.[9,25]

Numerous models for calculating nursing labour have been adopted with varying levels of perceived success.[9,24,26,27] Estimation of appropriate nursing allocation/supply is often conducted using a midnight census approach.[9] This is considered a snapshot view of an intensive care activity position, yet this model fails to account for, or capture, other activities within the intensive care service provision, including cardiac arrest calls, medical emergency calls, transporting to the operating theatre or radiology department or other facilities, and new admissions. It also fails to account for complex therapy delivery to critically ill patients who may require two or three nurses at one time; perhaps for extended periods (such as renal dialysis, complex medication and ventilation strategies). Volpatti, Leathley, Walley, and Dodek compared the correlation between midnight census and actual nurse supply with the correlation between time-weighted supply and actual nurse supply.[28] They concluded that time-weighted nursing demand is a better predictor than midnight census of required nursing supply in the ICU because of the significant fluctuations in patient admissions and transfers.[28]

Clarke noted that it is also problematic to compare intensive care staffing requirements between countries, for example Australia and the United States, given the significant differences in both countries regarding culture, constituency, service provision, and use of more technicians and unregistered personnel.[22] These differences between ICUs is reflected well in the MERIT study in Australia.[29] A cluster randomised study of twenty-three Australian ICUs examined the effect of implementation of a MET (Medical Emergency Team) on three primary outcomes.[29] Their premise was that patients with cardiac arrests or who die in general wards have often received delayed or inadequate care. They investigated whether the medical emergency team (MET) system could reduce the incidence of cardiac arrests, unplanned admissions to intensive care units (ICU), and deaths. Their analysis and discussion demonstrated distinct differences between hospitals and ICUs in almost everything from patient case mix, to culture, to staffing patterns and organisational structure. The investigators argued that this makes comparisons across ICU settings (for MERIT and other cluster studies) complex and generalisability can be difficult. However, the very nature of a small heterogeneous cohort (the ICU patients) dictates a requirement for ICU research studies to be multi-centred and collaborative to achieve recruitment targets and adequately powered trials.

Policy-makers, however, remain focused on benchmarking across ICUs and hospitals with little acknowledgement of the marked limitations of these comparisons.[29] The same analogy could be inferred with staffing decision models that attempt to generalise across multiple ICU settings. Aiken, Clarke, and Sloane, suggested that not enough attention was being given to examining the relationship between the organisation of nursing care and patient outcomes.[30]

Nurse shortage and casual nurse labour

Competition for existing nurses is strong between countries eagerly vying for their employment in an era of global shortage of nurses. An ageing nurse population compounds the problem in Australia, as elsewhere, in addition to insufficient numbers of new nursing student recruits against projected need.[16,31] The ageing of the employed nursing labor force continues, with the average age increasing from 42.2 years in 2001 to 43.1 years in 2003.[32]

Governments are beginning to take notice as nurse shortage concerns are echoed globally. Having reached crisis point in most countries, the damaging implications for future health care provision is a disturbing reality.[33] Whilst governments of the day expect achievable, measurable results and meaningful outcomes without clinical compromise, the fact that these objectives are more difficult to achieve with less nurses and higher health costs, makes the urgency for solutions paramount.

There is a consistent trend towards a concept coined in some literature 'casualisation', where there is a trend for nurses to seek more flexible and fluid employment options. These may include casual positions in one or more institutions, permanent part-time work and or nursing agency work.[31,34] This casualisation factor of the nursing workforce means labour costs rise significantly as health care providers struggle to source enough nurses for their needs as the workforce is less quantifiable and lacks stability. Statistics from the Australian Institute of Health and Welfare (AIHW) 7th biennial report demonstrated an increased shift from full-time to part-time work.[31] In 2003, the AIHW reported the proportion of nurses working part-time increased between 1997 (52.0%) and 2001 (53.3%).[35] The authors noted this as a reflection of a desired lifestyle change and possibly some personal burnout experienced by nurses. In one single Australian state report, a dip in both the nurse rate and the full time equivalent (FTE) rate and the gap between the two measures widened, having peaked in 1999 as proportions of part-time nurses in that state (those working less than 38 hours per week) increased.[36]

High staff turnover and burnout rates in ICU nurses have been demonstrated as occurring since the 1980s[6,37] and supported in studies by Taylor, and Considine.[23,24] Subsequently overall hours worked have decreased, and although a minimal decrease in actual numbers of nurses noted, the increase in ICU bed availability has risen with resulting increased demand in the ICU setting.[16,38] In 2003, there were 236,645 nurses employed in nursing in Australia. Of these, 189,071 were registered nurses and 47,574 were enrolled nurses. Of all employed nurses, 20,434 (8.6%) were males and 216,210 (91.4%) were females. Registered nurses worked an average of 32.8 hours per week, while enrolled nurses worked 31.2 hours representing a downward trend.[32]

The findings from a number of nursing labour force studies support the proposition that the shortage of nurses in Australia is likely to continue.[16,36,39] In Australia, the overall increase in number of employed nurses was accompanied by an increase in the proportion of nurses working part-time, and a decrease in average hours worked per week.[17]

The nursing workforce average age increased from 39.5 years to 41.6 years.[34,40] The gender imbalance in the nursing workforce continued despite a 17.7% increase in the number of male nurses between 1993 and 1999. However females made up over 90% of the nursing workforce. An overall increase in workload (as measured by hospital separations) from 5.3 million separations in 1995-96 to 6.0 million separations in 1999-2000 was also reported.[34]

Zimmerman identified one of the factors affecting the critical care nursing labour as the external opportunities in other fields[41] with increasing numbers of nurses known to take varying periods of extended leave (2,500 in 1993 to 3,500 in 1999).[31] Other studies have attributed personal reasons (including family and maternal commitments, personal stress, workload stress and unsociable hours), inflexible rosters and/or managers, lack of job promotions, and desire for career change, as contributing factors for leaving the intensive care nursing workforce.[6,23].

An understanding of the size and impact of the global nurse shortage is important because there is a risk that managers may feel pressured to consider a range of staffing solutions that may not concur with their usual standards and philosophies when a nurse 'supply–rich' environment exists. A report for the International Council of Nurses by Buchan and Calman noted that skill mix and staff mix varies among organisations, systems and countries, and there is no single 'optimal' mix of nurses and other staff to which all can aspire.[42] In addition, many countries, particularly in Africa, Asia and Central/South America, are struggling to provide a minimum level of nurse staffing. Even in countries with low nurse:population ratios, there is often a maldistribution of available nurses and this exacerbates the shortage impact.[42]

A shortage of nurses, whilst a cyclical phenomenon in some institutions, may also impact significantly on day-to-day nurse-to-patient allocation decisions, with choices about which nurse should care for which patient/s taking on a potentially riskier profile. Dwindling numbers of ICU nurses, in particular those with specialist qualifications relative to the high demand, compounds the existing significant workload pressure on those who remain in employment.[43] Shortages in critical care are likely to be caused by a decreased pool of potential new entrants (in this case, new graduate and recently graduated nurses) and an increased rate of attrition from the workforce.[16] Future demand for critical care services, and thus requirements for critical care nurses, is expected to increase with population growth and ageing. In addition, with the anticipated expansion of services (in terms of bed and patient numbers), increased productivity of critical care nurses is to be expected particularly given the likely technological advances.[16]

Janiszewski-Goodin conducted a literature review for the period 1999-2001 in relation to the USA and this study confirmed a serious nursing shortage in that country.[44] She identified four main factors as the major contributors to this shortage: the ageing workforce; declining enrolment; the changing work climate; and the poor image of nursing. Solutions offered were: exploring recruitment efforts; exploring retention efforts; improving the image of nursing; and supporting legislation that helps rectify the shortage. Reports across the world have reported virtually identical contributing factors suggesting the problem is endemic across much of the world.[17,44-46]

In Australia, concerns for the critical care nurse shortage warranted a Commonwealth Government investigation to examine it and identify potential solutions in an Australian context. This report was the Australian Health Workforce Advisory Committee (AHWAC) Critical Care Nursing Workforce Study 2001-2011.[16] Strikingly similar themes emerged both in identification of contributing factors to the Australian shortage, and in the solutions and strategies mooted to address the crisis, when compared to the United States situation.[44] In both countries, and in Europe, concerns were so high that they have been brought to the attention of governments at the highest levels for urgent consideration. [33,45] Overseas recruitment is being adopted by many countries as a 'stopgap' approach but is arguably unsustainable and prohibitive for developing countries. In addition, ethical questions arise regarding the inappropriate targeting of nurses from countries with already over-burdened health care systems.[47]

De Raeve provided a European perspective.[45] Contributing factors and suggested solutions cited by De Raeve are strikingly similar to the debates underway in Australia.[45] Moreover, the European Commission has been particularly concerned with the problem of competition between countries in the recruitment of nurses. They point out the current situation of 'robbing Peter to pay Paul', where countries are recruiting from each other and often taking the more experienced nurses who are the backbone needed in their own health systems for the future. De Raeve's concern is that the potentially damaging consequences of overseas recruitment need to be considered carefully in any strategy to tackle the global shortage.[45] Such was the degree of concern that:

> The Standing Committee of Nurses of the EU (PCN) has brought it to the attention of the European Commission, the European Parliament and the Council of Europe. Importantly, particular attention has been drawn to the actual and potential problems of competitive recruitment for scarce nursing resources and, therefore, the need for an ethical stance in the EU in relation to nurse recruitment (p. 254).[45]

De Raeve called for countries to be assisted and encouraged to collate comparable quality workforce data, including guidelines for data aggregation, and initiation of qualitative and quantitative workforce analysis research to inform the workforce debate and future policy development.[45] Tierney noted that Australia, the United Kingdom, the United States and Europe have clear agreement as to the required solutions to address the nursing shortage, namely adequate *recruitment*, and effective *retention*. However she also notes the distinction between 'shortage of nurses', and 'shortage of nursing', and suggests they are not the same thing[33]. This is a reasonable view as there is a difference between 'nurse shortage' (that is, of nurse labour) and a 'shortage of nursing' which refers more to the practice of nursing. It suggests a degree of mindfulness when terms are articulated or discussed to ensure they are contextually appropriate.

Numerous studies have examined the rationale for the shortages as well as putting forward strategies to target recruitment and retention of nurses. For example, Seago, Ash, Spetz, Coffman, and Grumbach examined characteristics of acute-care hospitals (which included an ICU) in the United States and reported nurse shortages that ascertained environmental, patient and institutional predictors.[48] They found that although some characteristics under the direct control of hospitals, such as nursing care delivery model, are associated with nurse shortage, shortage is also strongly associated with broader population characteristics.[48]

Diehl-Oplinger and Kaminski reported how one nursing shortage was successfully addressed by development of an internal intensive care 'innovative preceptor program' used in an Pennsylvania, United States.[49] Other strategies identified to address the continuing nursing crisis include creating a culture of retention, improving nursing education infrastructure and establishing financial incentives for investing in nursing. The view that attrition from critical care practice remains a problem gained momentum and additional support from many labour force studies.[16,50,51]

Nursing workforce shortages are also linked with the potential for compromised patient care. An analysis of the Australian Incident Monitoring Study data for Australian ICUs demonstrated that a nursing staff shortage may lead to compromised quality of care.[52] The two main causes of nursing staff shortage they identified were inappropriate staffing for current patient load (responsible for 81% of incidents) and an inability to respond to increased unit activity (19% of incidents). Insufficient nursing staff was found to be associated with the occurrence of the following incidents: drug administration or documentation problems; inadequate patient supervision; incorrect mechanical ventilator or specific equipment setup; and self-extubation. All of these would be considered significant errors or deficiencies in the ICU. In addition, undesirable patient outcomes associated with insufficient nursing staff include major physiological change, patient or relative dissatisfaction, and physical injury. An undesirable patient outcome was reported in 37% of incidents associated with insufficient nursing staff.[52]

Issue 2: Nurse Skill and Risk management in ICU

To provide effective, quality intensive care, critical care nurses must possess the relevant specialist nursing knowledge and skills. It is recognised internationally that the required knowledge and skill are beyond the scope of undergraduate nursing education programs, and require specialist postgraduate training. The 1993 "*International Madrid Declaration on the Preparation of Critical Care Nurses*" mandates that nurses working in critical care units must have access to post-registration programs.[53] This is consistent with the Australian Council of Health Care Standards *Guidelines for Intensive Care Units*, which currently recommends that the majority of nurses working in the intensive care environment should have an appropriate post-registration qualification.[54]

The Australian College of Critical Care Nurses (ACCCN) Position Statement on Intensive Care Nursing Staffing recommends that the optimum level of qualified critical care nurses (CCRNs) in an ICU should be a minimum standard component of 50% of an ICU's total employed staff. [3] This position statement does, however, have some limitations in that the recommended optimal range of qualified nurses (between 50 and 75% or greater) appears as an overall value. It provides no additional guidance or clarification as to the recommended percentage of qualified CCRNs on any given shift. It is also unclear whether any derived requirement of qualified should be differentiated, for example on a day shift as opposed to a night shift. However, this may have been considered an operational issue for each ICU. Nor is there any direction within the Statement whether those percentages equate to full-time equivalent RNs (FTEs) or headcount.[3] Despite some of these limitations in scope, it does provide a national guide useful for benchmarking and research purposes, subject to the challenges in collection of the relevant data.

There is evidence to suggest that an ICU staffed by experienced, qualified nurses is likely to produce more favourable patient health outcomes than an ICU staffed with junior, less qualified and inexperienced nurses.[22,52,55] A number of early studies suggested more registered nurses could reduce morbidity and mortality rates, decrease length of stay and lower readmission rates.[56-58]

Other studies report that where there is a high percentage of registered nurses (RNs) delivering patient care, there have been demonstrated cost savings, reduced length of stay and improved productivity. This outweighs any anticipated cost savings from the introduction of less skilled caregivers.[59] Helt and Jelinek found an approximate 5% savings in productivity while increasing their RN ratios[60] Although conducted in a non-critical care setting, they found length of stay decreased, quality of care improved and all of this was achieved in a setting of rising acuity.[60]

Tourangeau's study looked at nursing-related determinants of 30-day mortality for hospitalised patients.[61] She described one risk-adjustment method useful for minimizing threats to internal validity that stem from the impact on the outcomes under investigation from patients' own characteristics and their associated risks. Mortality was the outcome used to illustrate the risk-adjustment approach. She suggested a two-step approach to outcomes research for this reason. The first step included risk-adjusting outcomes for patient characteristics by developing standard mortality rates. In the second step these risk-adjusted standard rates can be used as dependent variables in outcomes analytic models. In her 2003 study, risk adjustment resulted in changes in both absolute values and rank ordering of hospital mortality rates compared to crude rates.[61] The sample consisted of 75 acute-care hospitals in the province of Ontario, Canada. To develop hospital mortality rates, 46,941 patients (discharged from these hospitals) who had a diagnosis of acute myocardial infarction, stroke, pneumonia, or septicaemia were included. To develop hospital-level nursing predictor variables, 3,998 responses to the Ontario Registered Nurse Survey of Hospital Characteristics were also included. Again, although not critical care specific, the findings support a relationship between lower 30-day mortality and 3 predictors: a richer registered nurse skill mix; more years of experience on the clinical unit; and reported larger number of nurses on shifts.[61]

A number of other studies related to RN staffing effects on patient outcomes have attempted to use patient mortality as an outcome measure. Blegen, Goode, and Reed found that a high proportion of RN staff (i.e. up to 87.5 per cent of all nursing staff being RNs), was associated with low patient mortality.[62] Another important, although older study examined patient mortality compared Magnet versus non-Magnet hospitals in the United States (US) in relation to 30-day mortality rates.[63]

This is considered seminal work as the Magnet concept subsequently became accepted as the 'gold standard' reflecting organisational best practice. The results of this study showed that Magnet hospitals had fewer patient deaths per patients discharged than non-Magnet hospitals. The label "magnet hospitals" originally was given to a group of hospitals in the US that were able to successfully recruit and retain professional nurses during a national nursing shortage in the early 1980s. The Magnet Recognition Program® (administered by the American Nurses Credentialing Center (ANCC)), bestows national recognition (accreditation) to health care organisations that demonstrate sustained nursing care and positive organisational culture.[64] The ANCC then monitors each organisation's compliance over time with Magnet Recognition Program standards.

Studies of Magnet hospitals illuminated the leadership characteristics and professional practice attributes of nurses within these organisations.[64] However, in Aiken's study, the mortality findings should be considered with some degree of caution, given that deaths occur infrequently and the cause can be the result of poor care and or overwhelming disease. Both these factors make detecting statistically significant differences difficult. Despite some limitations, however, the Magnet model is internationally regarded as a gold standard in hospital care delivery and outcome with a strong focus on work environmental factors.[30,65]

Cultural mapping is also considered an organisational improvement strategy. Schein's organisational culture mapping model identified three levels of culture: visible organisational structures and processes which are difficult to decipher; espoused values goals, philosophies, strategies or espoused justifications, often in written documents, mission statements; and basic assumptions subconscious, taken for granted beliefs, values, perceptions, thoughts and feelings, which make up the unwritten rules within subcultures.[66]

More recent culture mapping has been visible in Australian in commercially available staff survey products. One business, Best Practice Australia has been contracted to survey over 80,000 nurses across over 70 Australian hospitals (http://www.bestpracticeadvice.com). This reflects the elevation in significance of the influence of culture and organizational factors at both Unit and organisational levels. The company claim to have developed strong capabilities in diagnosing: Type of Culture; Workforce attraction, retention, satisfaction and turnover factors; Employee perceptions, values and behaviours; and Leadership practices. They assert there are 5 types of organisational culture: Blame, Reaction, Consolidation, Reaction and Success. The culture sought by organisations is one of 'Success' which essentially mimics the Magnet model of a positive and inclusive organisational approach, whilst a culture of 'Blame' is seen at the most negative end of the culture continuum. For example, a culture of success includes attributes such as: 'Large numbers of employees are optimistic about the organisation's future; there is a strong sense of success and achievement; employees are very positive and proactive about tackling problems; there is a "can do" mentality. This type of culture is very close-knit, very cohesive, and very focused'. At the opposite end of the continuum is the Culture of Blame. The attributes of this culture include: 'Large numbers of employees are openly pessimistic about the organisation's future; it is common to hear "communication is poor", "there is no leadership", or "morale is bad"; there is a "them and us" mentality; there is an automatic assumption that management will always have a hidden agenda, and there is an automatic assumption that, no matter how bad it is, it just can't be changed' (www.bestpracticeadvice.com.au).

The fact that so many hospitals and nurses have participated in these surveys reflects its increased level of priority in organisational improvement (see Appendix R).

Both the British Association of Critical Care Nurses (BACCN) and the Staffing Position Statement of the ACCCN colleges cite evidence from the literature to support their stance on recommending only registered nurses in ICUs.[3,4] De Raeve[45] and Morrison[55] also concur with this stance and believe clinical care and outcomes are compromised by using a less than a full RN staff compliment workforce in ICU and that any perceived labour cost benefits could be negated by increased adverse events and poorer patient outcomes. In addition, added pressure for the more experienced nurses to supervise their less experienced ICU counterparts may cause job dissatisfaction if there are too many 'juniors' to supervise on any one shift.

Simmons estimated that of the 5 million patients admitted to ICUs in the United States in 2002, about 10% would die and many would incur preventable adverse events. [67] Programs targeted at reducing adverse events and iatrogenic complications have been shown to reduce both intensive care costs and improve patient outcome.[67,68] For example, best practice evidence-based nursing initiatives that range from the simple and inexpensive, such as hand-washing by health professional staff, to bed head elevation in mechanically ventilated patients, and using advanced electronic monitoring. Such measures over the last few years have been grouped together in an effort to educate nurses on the evidence base of easy to implement care, by considering group strategies to improve outcome.[69]

McGillis Hall found RNs experience high levels of role conflict despite the type of staff mix model they work in; that nurses' job satisfaction is influenced by the type of staff mix model employed on the patient care unit; that nurses' perception of quality care differ with the type of staff mix model utilised; and that bed capacity may be a determinant of the staff mix model utilised on patient care units.[70] In a study by Bratt, Kelber, Broome, and Lostocco[71], job stress, group cohesion, job satisfaction, nurse-physician collaboration, and nursing leadership behaviours explained 52% of the variance in organizational work satisfaction. Dealing with patients' families was the most frequently cited job stressor.

The value of expertise and intuition

Nursing attributes that potentially decrease risk and help contribute towards patient recovery including 'being proactive and coping with the unpredictable'.[26] The proactive nature of nursing care is recognised as a less visible process than the goals of patient management that may be decided on the ward round.[26] Complex activities include manipulation of vasoactive drugs, colloid infusions and the actions taken to wean patients from the ventilator. Fundamental to this activity is the possession of knowledge both theoretical and patient centred; experience of the specialty, together with exposure to the unpredictable nature of critical illness.[26] Coping with the unpredictable demands flexibility on the part of the nurse so that care and management can be constantly reprioritized is a common attribute of the critical care nurse.[26]

Both the context of care and the attributes of nurses are significant contributors in reducing the risk of deterioration of the patient's clinical condition. 'Coping with the unpredictable', demanded flexibility on the nurse's part so that care and management could be regularly re-prioritised.[26,72] Ball and McElligot's study demonstrated that flexibility was apparent in the nurses' response to changing patient-related situations.[26] They cited examples such as, prompt reaction to emergency admissions, a willingness to participate in the transfer of patients, and reprioritising and supporting colleagues. Furthermore they showed that if the nursing resource was stretched due to contextual (organisational factors such as geographical layout, decreased skill mix, increased patient dependency and unit activity), then the ability to provide proactive nursing care became task orientated, progress of the patient was hindered, nurses failed to appreciate the cues given by patients which indicated deterioration, and coping was ineffective.[26] In addition, emotional tension began to surface when the nursing resource was diminished as there was little time to provide emotional support for both relatives and colleagues.

Importantly, they showed that very experienced nurses could demonstrate these characteristics. They were more resilient to pressure than those who were less knowledgeable and experienced. It is likely that in these circumstances nurses are more prone to error, critical incidents increase and patients take longer to recover.[26,73]. More recently several government reports in the United Kingdom called for the increased flexibility of nurses in relation to patient:nurse ratios.[39,74]

Expertise in critical care nursing is seen as invaluable and an important part of achieving quality care for patients by nursing professional bodies.[3,75] However, the increasing use of clinical guidelines and care protocols to direct care in some countries[76] raised concerns about the value afforded to expert practice.[77,78] This was essentially driven by concerns over the quality of care provision following publicity surrounding certain cases, where care fell short of quality standards (e.g. The Bristol Inquiry in the United Kingdom).[79]

Although the use of clinical guidelines may be intended to promote more equal standards of care, some argue that they may detract from nurses using their expertise in clinical decision-making. The recommended use of clinical guidelines and care protocols comes with an understood caveat that these are not intended to replace, but to complement, use of expert clinical judgment and consideration of individual patient need. It is appropriate to consider how expert nurses' contribution to high quality care in intensive care practice can be articulated.

The level of patient acuity in the ICU requires that critical care nurses maintain a high level of clinical expertise.[3,54,80,81] In terms of expertise and specialised practice, it is important to differentiate between s*kill level, experience* and *qualifications.* Because these *concepts* are distinct, they should not be assumed to be one and the same when assessing nurse skill and scope of practice. Although distinct in their own right they are also intertwined within staffing considerations. Lookinland and Crenshaw describe 'expert skill level' as encompassing critical thinking, technical skills and interpersonal skills.[81] Their view was that maintenance of expertise improves patient outcomes and this translates into institutional savings, reduced length of stay and readmissions. They also suggest a theory-based career advancement plan that can encourage and reward clinical competence.

Benner's early work (1984) was important in developing the concept of expertise in nursing.[82] Benner viewed expertise as embedded in practice and considers holistic care rather than the ability to proficiently conduct a series of tasks the hallmark of expertise. Further adapted from the work of Dreyfus and Dreyfus[83], Benner attempted to provide a framework upon which a model of skill acquisition for nursing practice could be used to guide nurses to attain the status of expert. The strength of Benner's model is the emphasis it places on holistic clinical practice, promoting holistic nursing as being more significant than task allocation.[84] She considers the expert to be able to accurately 'zero in' on the problem without wasteful consideration on alternative, unfruitful diagnoses and solutions. She describes the expert performance as fluid, flexible, highly proficient where they are no longer aware of features and rules. Benner and Tanner drew upon six key aspects of intuitive judgment devised from Dreyfus and Dreyfus: pattern recognition; similarity recognition; common-sense understanding; skilled know-how; sense of salience; and deliberative rationality.[85] They suggested these aspects culminate in identifying those traits commonly seen in expert intuitive practice. Consequently, nurses base their clinical judgments on 'gut feelings' or 'there was something not quite right' when deciding what action needed to be taken before any ensuing clinical changes became apparent.[83,85]

This has been referred to by Pyles and Stern as "falling out of pattern"[86] (p. 52). In the ICU context for example, an expert ICU nurse may decide that a patient is not ready for weaning from mechanical ventilation. The ICU protocol on weaning (breathing spontaneously without machine support) may suggest that weaning should commence as the patient's clinical and respiratory parameters fit within those of the weaning algorithm. However, an intuitive feeling regarding the patient may make an expert nurse either delay this or follow a more cautious reduction in ventilation than the protocol suggests. This type of expert decision-making is done rapidly and constantly; arguably subconsciously at times. These types of intuitive feelings, if acted upon, may enable early intervention and thus prevent severe deterioration in the patient's condition and potentially impact on their longer term outcome. However, such intuition is difficult to quantify or demonstrate which is potentially problematic in a world where the cost of any resource, including expert nurses, must be justified and is regularly challenged. Radwin[87] and Rolfe[88] see this combination of tacit, experiential and theoretical knowledge as producing best practice. Indeed, it seems reasonable that this applies both to bedside clinical decisions as well as administrative and organisational decisions in the ICU including staffing decisions.

McCutcheon and Pincombe researched the role of intuition as an important tool in nursing and decision-making.[89] They found intuition not to be some mystical power without a rational basis or explanation, but more a product of the synergy of multi-factorial interaction. Their study suggested that a somatic response associated with moments of intuition is a secondary consequence of the interaction and trajectory of effects of knowledge, experience and expertise. Their data also revealed that the nurse's environment could either support use of intuition or indeed suppress it, (i.e. validate or inhibit its use). Participants observed that there was a mechanism by which the information from an intuitive event was fed back into the individual's knowledge, experience and expertise, whether they acted on their intuition or not. Such feedback from an event was considered to add to their knowledge, experience or expertise.[89](p. 346).

Dowding and Thompson appear to be critical of Benner's concept because it is not a quantifiable definition.[90] More importantly, in the current climate where both cost effectiveness and clinical effectiveness are critical, if expertise in nursing is to be valued, nurses must be able to articulate and debate the nature and value of their expertise.[91]

Woolery suggests that expertise results in performing expert actions without conscious awareness of the knowledge being used.[92] It is therefore reasonable to assert (as Meerabeau cites[93]) that nursing experts have moved 'beyond knowledge alone' and have the ability to rapidly and accurately assimilate knowledge with the salient points of a situation. They can also act appropriately on these without consciously working through the alternatives and the rationale for their decision. This assimilating evidence from a variety of sources, and applying it appropriately to individual care situations is central to the concept of evidence-based practice as described by Sackett[94] and DiCenso.[95]

Not only have researchers suggested a positive association between nurse staffing levels and patient outcomes such as mortality,[65,96] but Aiken[65] and Elixhauser, Steiner and Fraser,[97] have suggested that staff expertise contributed to patient outcomes such as mortality. It has also been reported that quality of care as an index of nursing tasks left undone was an important predictor of unmet patient needs.[98] Aiken argued that higher nurse education levels lower mortality.[99] Other studies reported that nursing education exerted a positive influence on selected nurse and patient outcomes but these studies did not examine the effect on mortality.[100,101]

Use of evidence-based practice is one vital component of clinical expertise, but the contribution and value placed on individual expertise should not be underestimated. [102] The difficulty lies in quantifying that process, making assignment of a measurable value of that expertise almost impossible. Nevertheless, the same principles apply in staffing decision-making where this expertise is almost always utilised but may not be considered valuable. With expertise having an association with outcome it should also be considered within in a risk management context.

Patient safety in ICUs

Research on patient safety and clinical errors reveals that serious circumstances and adverse events that may result from those errors occur frequently in ICUs.[103-105] Bracco and Favre conducted a prospective observational study of consecutive patients admitted over a 1 year period to an 11-bed multidisciplinary ICU in order to identify critical patient incidents and their associated risk factors.[106] The authors developed a list of 105 critical incidents.[106] After a critical incident had been identified, it was analysed and its root cause was coded as equipment-related, patient-related or human-related. For example, if the cause was related to a technical equipment failure, it was classified as equipment-related. The number of critical incidents detected during the study period (1 year) was 777. Thirty-one percent of these incidents were human-related. In addition, they found that human errors prolonged ICU stay for the study group by 425 patient days over a 1-year period.[106]

Of several studies that have examined various types of errors in ICUs, Giraud, Dhainaut, Vaxelaire, Joseph, Journois, Bleichner, Sollet, Chevret, and Monsallier,[107] conducted a prospective, observational study to examine iatrogenic complications and to identify factors that predispose the occurrence of these complications. With the premise that an iatrogenic complication was an adverse event that was independent of the patient's underlying disease, data were collected from a total of 382 patients over 400 consecutive admissions. Iatrogenic complications were noted in 31% of admissions with the risk of mortality among patients with iatrogenic complications significantly higher than that of patients without iatrogenic complications. Forty-four percent of all iatrogenic complications were associated with either human errors (insufficient surveillance, inadequate experience) or equipment-related problems (equipment failure, inadequate equipment). The relationship of the occurrence of iatrogenic complications with prognostic indices, nursing workload, and length of stay was examined.[107] Although a slightly older study, the example above highlights the error possibilities within an intensive care environment and adds weight to the argument that a critical link between nurse staffing decisions and patient safety in the ICU.

Patient safety: risk and harm

Patient safety to avoid risk and harm is an essential component of risk management, quality improvement and clinical governance. Risk management in health care is akin to that in industry: an essential component of best practice systems.[108-111] Critical to the notion of risk in health care is the belief that outcome-focused, safe, quality health care delivery is the primary objective.[110,111] This includes systems and processes incorporating (amongst other strategies), adverse event prevention, detection, investigation, documentation, and review; especially in the ICU where complex therapies are delivered to the most critically ill and therefore 'at risk' patients.[108,110,112] Healthcare is a risky business, as noted by Standards Australia International:

> Simply being a patient in an acute care hospital in Australia carries, on average, a 200-fold greater risk of dying from the care process than being in traffic and a 2000-fold greater risk than working in the chemical industry.[113] (p.109)

In Australia, the Joint Standards Australia/Standards New Zealand Committee OB/7 on Risk Management recommends the AS/NZS 4360:1999 as a bi-national guiding Standard for Risk Management.[13] (See Appendix D). Whilst the Standard specifies the elements of the risk management process, it is generic and independent of any specific industry or economic sector. It goes further to recommend that the design and implementation of any risk management system will be influenced by the varying needs of an organisation, its particular objectives, its products and services, and the processes and specific practices employed.

It provides a generic framework for establishing the context, identification, analysis, evaluation, treatment, monitoring and communication of risk. It defines risk management as an iterative process consisting of well-defined steps which, taken in sequence, support better decision-making by contributing to a greater insight into risks and their impacts.[13] (p. iii) (see Appendix D)

Integrated risk management is a cost effective, long-term investment that can provide savings in efficiency as well as mitigate future medico-legal and workers' compensation exposures.[113] It provides objective and evidence based recommendations which, if applied systematically can maximise opportunities and minimise exposures within the health industry.[113] One example by Williams of such a health industry model, interweaves corporate governance, clinical governance, and integration opportunities.[113] Within the clinical governance component are the expected considerations such as: 'clinical practice guidelines', 'adverse events/medico-legal', 'ethics and research', and 'clinical outcomes and indicators'.[113] However the model falls short in that it lacks a 'place' for the significant impact and risk consideration of staffing decisions, whether in an ICU or other healthcare unit where nurses care for patients.

What appears to be general consensus is that it should be an integral part of good management practice and be embedded with an organisation's culture.[13,114] In the UK, the National Health Service (NHS) developed the 'Safecode' software tool (with the University of Strathclyde) and a methodological approach to set priorities for investing in risk treatment options despite limited budget constraints. Their model suggests there are 'trade offs' in the 'costs' and 'benefits' of investing in competing risk treatments, and suggest a priority system be adopted when 'risk treatment exceed available budgets'. This would seem a reasonable and practicable approach. In another case study, a number of 'risks' are given attributed 'weights' [113]. 'Staff requirements' are given a weighting of '50' and 'clinical care' is assigned '80' relative weights.[113] The theory is the risk is measured 'before' and 'after' a particular 'risk treatment' is implemented with presumed risk reduction in the 'after' ranking. However there is no mention of the variables within staffing related risks (such as skill) apart from 2 overall broad categories; 'clinical care' and 'staffing requirements'[113].

Although not specifically noted as 'risk-related' some research studies have identified approaches to managing the degree to which patients are exposed in the absence of skilled, experienced and knowledgeable nurses in the area of critical care[115-117], in hospitals generally[65] and within the multidisciplinary team.[118] However Grap suggests that when managing risk in an ICU environment, nursing care delivery is one of a number of overall contributing factors that warrant consideration.[119] Contributing factors to inappropriate and hazardous care delivery (with associated risk exposure implications) include, nurses working out of their scope of practice in the ICU; nurses receiving inadequate orientation and workplace training; a lack of adequate clinical and educational support systems in place; a lack of underpinning knowledge of critical care nursing and therapies; and working in an unsafe ICU environment.[52,55] The risks associated with inappropriate care delivery may be minimised by systems that inform managers about the nurse skill level in their ICU.

The relationship between nurse skill level and risk exposure is evident yet this relationship is poorly articulated with research more concentrated on outcomes rather than the inherent risk relationship that is the sequelae that occurs with less skilled nurses. For example, if workforce allocation decisions are based on inadequate information, inadequate understanding of the issues and processes, or inappropriate or lack of dedicated decision-making systems, then risk is increased. Traditionally, because ICU has a minimum of one nurse to one patient on mechanical ventilation, the impact of poor decisions about nurse-to-patient allocation may be particularly significant. These include an increased risk of harm to patients (e.g. a medication or therapy delivery error) and for staff (e.g. a body fluid splash/exposure incident or cross-infection breach).

Tarnow-Mordi, Hau, Warden, and Shearer examined the relationship between mortality rates and the workload of hospital staff in one adult ICU in the United Kingdom.[118] Measures of workload for a specific patient's stay included occupancy per shift, peak occupancy, ICU nursing requirement per shift, ICU nursing requirement during patient's first shift, ICU occupancy during patient's first shift, the ratio of occupied to appropriately staffed beds per shift, and the ICU nursing requirement per occupied bed per shift. Results showed that patients exposed to high ICU nursing workload were more likely to die than those exposed to low ICU nursing workload. The three measures of workload most strongly associated with mortality were average nursing requirement per occupied bed per shift, peak occupancy, and the ratio of occupied-to-appropriately staffed beds. Explanations for the association between high workload and mortality included insufficient time for clinical procedures to be done appropriately, inadequate training or supervision, errors, overcrowding and consequently nosocomial infections, limited availability of equipment, and premature discharge from the ICU.[118]

More recent progress in the development of instruments that explore the concept of risk with the provision of skilled, experienced and knowledgeable nurses have been explored by Ball and McGillot.[26] In this study *risk* was divided into *'actual' and 'potential'*, and was deemed to be the possibility of misfortune or loss being incurred. *Managing* was associated with being in charge of the intensive care unit. Those staff managed the critical care units were noted as the Nurses in Charge (NICs). It was felt that they were aware of the individual abilities of nurses and managed this proactively. For example, if a junior nurse requested a complex patient, then provision was made to reduce risk by allocating a more senior nurse to care for the patient in the adjacent bed area or the junior nurse's mentor was allocated to work with the same patient. A patient was thought to be at greater risk if the appropriate level of nurse was not available, or could not be allocated to them.[26]

The participants in Ball and McElligot's study identified further problems related to scoring within the risk assessment instrument. Many NICs thought that their knowledge of the patient would differ depending on how many shifts they had worked. The implication of this was that if consecutive shifts had been worked the NIC would know the patient better and allocation of a certain level of nurse might differ from that made by a NIC who had been on 'days off' and relied on the 'handover report' to make a judgement. Therefore, the nurses involved in determining the reliability of the instrument may have been influenced by how well they knew the patient. In regards to their decision-making, NICs were asked only one broad question: "what factors do you take into account when you are considering the skill mix available for a particular shift?"

The diverse data elements were formulated into four categories for the prototype risk assessment instrument.[26] Although this work is encouraging in its acknowledgement of risk, its reliability and validity is yet to be established. They reported only 51.7% reliability from the pilot instrument test. Divergence in regards to measuring nurse skill level was also found including four occasions whereby the nurses involved in testing reliability scored levels as diverse as novice, advanced beginner and competent for the same patients.[26] In addition are the separate issues of staff compliance if an instrument is viewed as 'adding to their already heavy workload'. This makes design and application of such tools even more challenging.

Patient safety in Australia

Health system safety has recently become an urgent issue in many industrialised nations, notably, UK, Canada, Australia and USA. These countries have all engaged in safety initiatives such as patient safety agencies, adverse event reporting and learning systems, and the use of safety performance indicators.[120] The position in Australia in regards to patient safety policy is as follows. The Commonwealth Department of Health funded, in 1994, the Quality in Australian Health Care Study (QAHCS) to detail the degree of adverse events in Australian hospitals; modeled on the Harvard Medical Practice Study in the US.[121,122] The QAHCS in June 1995 showed that 16.6% of admissions had adverse events of which 51% could be preventable.[123] This publication attracted much attention, immediately resulting in the National Taskforce on Quality in Australian Health Care which recommended increased funding and establishment of a national organization for safety and quality of care. The subsequent formation in October 1996 of a National Expert

Advisory Group on Safety and Quality in Australian Healthcare led to the establishment of the Australian Council for Safety and Quality in Health Care (ACSQHC) in 2000.[124] It coordinates the national safety action. Other national safety efforts include the Australian Patient Safety Foundation (APSF) which developed the Australian Incident Monitoring System.[104,125,126]

Adverse events

A number of definitions of adverse events exist. Brennan and Leape noted an adverse event to be, 'an injury caused by medical management rather than by the underlying disease or condition of the patient'.[127] In the United States Institute of Medicine's 2000 report *To err is human,* an adverse event is described as an injury resulting from a medical intervention.[128] The Australian Patient Safety Foundation suggest it is 'unintended or unnecessary harm or suffering arising from any aspect of health care management'.[129] The term is synonymous with the term 'iatrogenic harm', with 'iatrogenic' meaning arising from health care, rather than from the patient's underlying disease or injury. Importantly, these definitions encompass adverse events that could be regarded as preventable and harm that would not be regarded as currently preventable. Adverse events, which may occur in up to 17% of hospital admissions, cost the Australian health care system in excess of $867 million per year in additional hospital bed days alone.[17] The total medical costs of these events exceeds $2 billion per year.[129] Furthermore, the total life-time cost of such preventable injury exceeds $6 billion per year. In addition a heavy toll is exacted on both those who are harmed and the carers themselves by such events.[104,113]

Runciman suggests that as much as half of this burden on society may be removed within 5-10 years if investments are made in a systematic approach to the problem. He also recommends that healthcare be treated as the complex system that it is, with the development, application of classifications and approaches to system failure and human error, learning lessons from other industries (e.g. aviation, off-shore drilling).[104,113]

In a study set in a medical ICU, Tissot and Cornette detected 132 (6.6%) medication preparation and administration errors in a total of 2009 observed events.[130] For 6 hours every day, two observers (pharmacy residents) observed two randomly selected nurses administering medication to patients. Based on their observations, the researchers classified errors into 6 categories: wrong drug preparation, wrong administration technique, dose error, physicochemical incompatibility errors occurring at simultaneous administration of two or more medicines via the same route, wrong rate, and wrong time. They also identified 10 possible causes of medication errors, including high nursing workload and fatigue.[130]

Nursing workload and risk

Research by Aiken which studied greater than 11,000 nurses, found that for every one patient-per-nurse increase in nursing workload, there was a 7% increase in risk of death within 30 days for an individual patient (after controlling for all the hospital and patient variables).[6] In addition, they found a parallel increase of 7% in risk of death for patients (who had complications) for every '1 patient per nurse increase' in average workload. There were also 23% and 15% increases respectively in the risks of nurse burnout and job dissatisfaction for every additional patient per nurse. Patient deaths after surgery were also lowest in hospitals where nurses care for fewer patients on average and have higher levels of education. Five per 1000 fewer surgical patients of the types studied were expected to die in hospitals with 4:1 versus 8:1 average nurse to patient ratios. If all patients treated in hospitals at 4:1 vs. 8:1 nurse:patient ratios they projected up to 20,000 fewer deaths.[6]

Furthermore single facet approaches measuring 'workload' or 'dependency', however ill defined, do not address or take into account the element of risk exposure associated with the care and management of the critically ill by nurses.[131,132] The ICU environment is unique in that the critical care nurse has a constant bedside presence, whereas all other members of the multidisciplinary team are present only on an intermittent basis. It seems reasonable then that the impact of nurses' care and nurses' decisions influence (both positively and negatively) patient outcome.

Cho, Ketefian, Barkauskas, and Smith, studied the effects of nurse staffing on adverse events, morbidity, mortality and medical costs across 232 hospitals and 124,204 patients in acute care Californian hospitals in the United States.[68] Significant relationships were found between nurse staffing and adverse events in that an increase of 1 hour worked by registered nurses (RNs) per patient day was associated with an 8.9% decrease in the odds of pneumonia occurring, and a 10% increase in RN proportion was associated with a 9.5% decrease in odds of pneumonia occurring; that is, more RNs meant less chance of getting pneumonia. The occurrence of each adverse event was associated with a significantly prolonged length of stay and increased medical costs. Patients who had pneumonia, wound infection or sepsis had a greater probability of death during hospitalisation. Of note is that nursing hours, i.e. labour time utilisation as a single facet measurement, (in the absence of comment on the skill mix level assessment) was used in this study.[68] However, as mentioned previously, demonstration of causality in relationships between nursing care and outcome is difficult given the significant number of variables, concurrent complex therapies and challenging research methodological approaches.

Morrison, Beckmann, Durie, Carless and Gillies comment that minimal accurate data are available on the effect on nursing staff inexperience (NSI) on the occurrence of incidents in the intensive care environment.[55] However, the Australian Incident Monitoring Study (AIMS-ICU), an anonymous voluntary incident reporting system, demonstrated the ability to help identify problems in which NSI may be implicated. NSI may be an incident itself or contribute to an occurrence of other incidents. In their study, incidents associated with NSI were identified and their effect on patient quality of care estimated, 735 reports covering 1,472 incidents were identified as relating to NSI. Of these 282 were described in the narrative section, and 453 had NSI selected as a contributing factor by the reporter. Major categories for the 1472 incidents included airway and ventilation, drugs and therapeutics, patient environment, unit management and procedures, lines and equipment. An undesirable major adverse event was selected in 20% of reports.[55] NSI can have a negative impact on quality of care, as demonstrated by the occurrence and outcome of incidents related to inexperience. The authors noted that errors are more likely to occur when NSI is combined with staff shortage, inadequate supervision and high unit activity.[55]

This research highlights that safe patient care requires issues of nursing staff experience to be considered, importantly, in the debate about ICU resource allocation. A stratified analysis of the NSI information within the incident reporting system could provide further insights. One of the limitations of the work by Beckmann and Morrison is that there is no ability to discern which NSI staff members are regularly employed, casual or agency nurses.[52,55] It is not unreasonable that if a nurse has never worked at a particular site or perhaps had training in the specific equipment then immediate issues of skill concern are valid.

Heavy workloads and insufficient staffing are cited by nurses as contributors to poor quality care, job dissatisfaction, and turnover.[6] When nurses leave, their departures result in considerable cost to the health care organisation, especially when organisations are forced to rely on agency staff to fill vacancies. Moreover, the costs are repetitive, with organisations renewing contracts until a permanent employee is recruited. Risk exposure to harm may result from workforce instability. More desirable options involve the prevention of nursing turnover in the first place and the avoidance of agency staff as fillers until a permanent employee can be hired. The use of agency staff often is supplemented by a variety of other strategies designed to maintain sufficient numbers of staff.[133]

Agency nurses

Agency nurses may be defined as those who:

> Have their working life organised by a private contractor, known generally as an agency, to carry out work within any number of hospitals within any one working week.[134] (p. 140).

Agency nursing work refers to the nursing services provided by agency nurses employed on a casual contracted basis. The agency and casual workforce issues are not well described in the literature. Although there are a few studies, most date pre 1994; using agency nurses as participants to describe their experiences. Only one study involved research that involved the nursing agency providers themselves (and nurse managers).[133] There is no literature regarding the impact of agency nurses in ICUs. Yet (anecdotally) in many Australian ICUs this staffing resource may be proportionally a high number within the total staff count, and may well influence the level of skill and consequent level of risk. However, an understanding of how their level of skill is assessed is unknown.

Amongst the few contemporary studies post-1995[135,136] is a recent study by Manias who conducted structured interviews with 10 agency nurses in one Australian state regarding agency-nursing work in terms of the perceptions and experiences of agency nurses.[135] The findings revealed that the primary reason for nurses engaging in agency-nursing work was for the flexibility it offered.[135] While agency nurses described a commitment to professionalism, the findings emphasise the need to establish effective communication networks between agency nurses, nursing agencies and hospital institutions to facilitate discussion of issues such as appropriate notification of shift availability, appropriate assignment of work and recognition of the agency nurse as a valuable member of the health care team.[135]

Further work by Manias, Aitken, Peerson, Parker, and Wong researched the views of hospital managers and the agency providers (as opposed to the agency nurses in the previous study).[133] They found that recruitment and retention of nurses were matters of crucial concern for hospital nursing managers, and that nursing agencies compete with hospitals for available qualified nurses by offering flexible working conditions, choice of deployment and premium salaries. A significant issue that emerged was the allocation of nursing staff. Hospital managers were primarily concerned with maintaining adequate numbers of nursing staff. For the agency providers however a major concern was the inappropriate allocation of their staff. They highlighted the importance of agency nurses having speciality qualifications in particular areas, such as intensive care and coronary care, and the need to match their skills and expertise with the specific setting. The consensus view was that close attention to matching a nurse's abilities and experience to the work setting helps to establish mutually beneficial relationships between the agency nurse, hospital and referring agency.[133] However, an Australian government Senate Community Affairs Committee conceded that it is not always possible to determine the calibre and skills of agency staff until they start work.[137] This reflects a fundamental issue regarding the challenges in awareness of determinants of agency skill.

Reports from Australian hospitals and professional organizations to the Committee also indicated that agency nurse use increased the administrative workload of permanent nurses as they attempted to supervise and orientate these temporary nurses. The increased workload tended to be an ongoing issue because successive agency nurses needed to be orientated to the clinical setting, which further impacted on quality of care.[137]

Another significant issue of the study by Manias concerned the professionalism of agency nurses. While hospital managers confirmed the general quality of care delivered by agency nurses, there were concerns raised about their lack of familiarity with institutional policies and protocols, inability to follow role models demonstrating exemplary practice, and difficulty in dealing with sensitive patient issues.[133] Increased exposure of patients' to risk of either an adverse event or prolonged hospitalisation appears obvious if agency nurses are confronted with unfamiliar equipment, protocols and practices that are beyond their scope of practice. This appears further compounded by the agency nurses' varying skill levels which may not be well articulated.

Other studies noted that agency nursing has appealed to many nurses who wish to work in flexible hours for various reasons, including family obligations, educational commitments, variety and autonomy.[134,136] Bloom, Alexander, and Nuchols concluded that the advantages of using agencies, such as decreased managerial time needed to secure shift coverage by permanent nurses, are small and in fact, any possible savings were likely to be offset by the lack of productivity of agency staff as a result of their lack of organization-specific knowledge. [136]

Schubert interviewed four agency nurses about professional relationships with their current agency and the processes of agency-nursing work.[139] In contrast to Bates (1998) later work, Schubert's exploratory study (although a small sample of only 4 nurses) provided some understanding of nurses' experiences of agency-nursing work. Nurses identified control over work scheduling as a major reason for undertaking agency-nursing work and reflects the importance of flexibility as personal consideration. However, they also indicated a lack of professional autonomy and isolation in their practice. Issues such as access to continuing education and the maintenance of clinical skills were identified as problems associated with their practice.[139] Although an older study, its findings are strikingly similar to Manias research 8 years later. It too back then raised concern over the agency nurses ability to maintain skill levels and attain new knowledge and gives strength to the argument for the need for permanently employed nurse colleagues to have a better understanding of agency nurses skill-sets. It also supported the need for agencies to provide staff development.

When asked about the appropriateness of allocated ward areas, participants in Schubert's study believed they asserted their concerns if their area deployment was unsuitable, although changes could not always be accommodated.[139] Although most of the time participants indicated they felt satisfied about their ward allocation, the initial ward allocated may have been changed by the agency or the hospital. Despite their expressions of assertiveness, such changes caused enormous anxiety for participants if they felt compelled to work in inappropriate settings. Participants felt able to self-regulate and refuse to work in particular work settings if these placements were viewed as unsuitable to their skill level. Despite their perceived assertiveness, participants were extremely anxious if they felt compelled to work in inappropriate settings.[139] Furthermore, in order to obtain the goodwill of the agency, temporary workers could feel obliged to accept assignments that do not necessarily suit them and this could expose them to activities outside their scope of practice with increased potential for adverse events.

Bates reported an additional problem in that agency nurses had few opportunities to access the necessary information from medical records because of constant interruptions, a lack of familiarity with the ward environment, and the immediacy of patient needs. Task completion could be difficult when information, either oral or written, is not always readily accessible. As a result, agency nurses may feel compelled to develop a rapid problem solving or 'quick fix' response to completing tasks and addressing patient problems.[134]

In view of the complex nature of clinical work, agency nurses depend on support from the health care professionals with whom they are working. If this support is not provided agency nurses may experience professional isolation and deliver poor patient care.[137] Problems occur when registered nurses lack knowledge and understanding of the equipment used. These problems related to patients and their care includes both physical and emotional harm.[137] In studies exploring medical device education the percentage of registered nurses having used a medical device that caused patient harm ranged from 9.4% (n = 331) to 13% (n = 139).[140] The nature of the harm ranged from contributing to death to bruised skin. Experiences of increased stress use of equipment in direct patient care ranged upwards of 49.7% in the same study.[140] Reasons most frequently cited by agency nurses in a similar study included being 'unsure how to use the device' and 'fear of harming the patient'.[141]

Issue 3: Workforce indicators, terminology and workload

Staffing terminology

The term staffing may refer to provision of: licensed personnel, assistive/ancillary personnel, and staff in hospitals. There are many ways to measure nurse staffing, i.e. decisions on number (volume) and allocation to patient acuity (severity of illness). These include: nurse-to-patient ratios; hours per patient day (HpPD); full-time equivalent employment (FTE); and skill mix.[9] In addition there is wide variation within HpPD in any one country (including Australia) in patient acuity/patient classification/dependency systems, in fixed ratios, in formula-based ratios, in skill-mix requirements. Inputs might include number of patients, acuity of illness. Output is the designated/deemed 'appropriate' staffing levels. There are many widely marketed systems, home-grown systems and hybrid systems.[9] The two scenarios described previously demonstrate the inherent limitations of such systems to decide nurse staffing.

Nursing activity nomenclature currently in use is broad. For example, 'workload' and dependency' are commonly associated with the activity of nurses in critical care.[9,142]. A number of instruments exist which profess to measure workload and or dependency, but lack validity because they frequently fail to: include indirect nursing activity (for example, supervision of less experienced); incorporate the expertise and knowledge of nurses (that is, not to assume a nurse is a nurse is a nurse). They also fail to account for the degree of risk particular patients pose (e.g. the complexity of intervention/therapy, or the vulnerability of the patient and understanding of deterioration).[142] These instruments have been used to evaluate the work of nurses specifically[9,143] and the multidisciplinary team in general.[144] However, the differences in terminology can lead to misinterpretation across the health sector.

Furthermore, there is no standard/uniform nursing workforce minimum data-set in Australia and this which prevents useful and accurate comparisons. This is compounded by the fact that fundamental workforce language/nomenclature is not well articulated nationally. It is a problem highlighted in the Australian Health Workforce Advisory Council (AHWAC) report titled *Critical Care Nurse Workforce in Australia 2001-2011.*[16] AHWAC note there has been some difficulty in seeking consensus as to what should be included in any minimum data-set development, with this question essentially unresolved.[16] The World Federation of Critical Care Nurses (2004) draft *'Position Statement on the Provision of Critical Care Nursing Workforce'* aims to inform/assist critical care nursing associations, health services, governments and interested parties in the development and provision of appropriate critical care nursing workforce requirements.[2] Although a positive strategy addressing workforce consensus issues, the question arises as to how nurses who make staffing decisions influence the risk exposure of their patients by fully informed decisions. However, if they do not possess consistent and comprehensive staffing information, how can comparative staffing data be acquired if the premise on which it is purported to be measured is flawed by inconsistencies and gaps? Therefore, how feasible is it to measure, let alone manage, patient risk that may be associated with poor staffing decisions?

An additional positive strategy to address the issue of workforce consensus is through collaboration between the Australian College of Critical Care Nurses (ACCCN) and the Australian and New Zealand Intensive Care Society (ANZICS) Adult Patient Database (APD) with updated workforce information now included in their Annual Critical Care Resource (ARCCCR) survey.[38] Formal uses for that collected data are emerging and research projects are likely to be encouraged once adequate response rates are confirmed. Access to the data from the survey is by permission from ANZICS APD.[38] Nevertheless, whilst administrative information systems may assist managers to improve cost containment and resource management of their ICUs, measurement of impact and effect on outcome cannot be truly known without rigorous evaluations.[145]

Scoring systems for nurse labour requirements

Some hospitals use intervention-based scoring systems as an appropriate way to measure nurse labour and skill requirements. Pirret found that the therapeutic intervention scoring system (TISS) was an effective triage tool for differentiating between intensive care unit (ICU) and high dependency (HDU) patients and identifying nursing skill requirements to care for the respective ICU and HDU patient groups.[146] The primary objective of TISS is to ensure patient care requirements do not exceed nursing skill level. Again, however, it is worth noting that in this study, their skill level referred to nursing ratios as opposed to any assessment of level of individual nurse skills. Therefore it is not possible to show any effect of skill level in this study. It is more about the association between specific numbers of nursing hours and TISS.[147] (see Appendix E)

Mark, Salyer and Wan examined nurses' perceptions of staffing adequacy.[148] They examined the impact of hospital characteristics, nursing unit characteristics, nurse characteristics and patient characteristics on nurses' perceptions of staffing adequacy; testing three different models. In their study perceptions of staffing adequacy were influenced significantly by: firstly, the hospital's case mix and growth in hospital admissions; secondly, by the number of beds in the ICU; and thirdly, by patient acuity. Further, current perceptions of staffing adequacy were significantly affected by prior perceptions. They suggested potential interventions for administrators that may ameliorate some of the negative influences on nurses' perceptions of staffing adequacy.[148]

In a systematic review of physician staffing patterns and clinical outcomes in critically ill patients, Pronovost concluded that high-intensity versus low-intensity ICU physician staffing is associated with reduced hospital (16 of 17 studies) and ICU mortality (14 of 15 studies), and hospital (10 of 13 studies) and ICU (14 of 18 studies) length of stay.[149] Whilst these data are not necessarily generalisable to nursing, they provide additional useful insight into the relationship between health professional skill and patient outcome.

Understanding ICU Workloads

Nursing workload is one of the most important determinants of patient safety and quality of care in ICUs. ICU practice is characterized by its regularly high workload situations.[6,37,118,150] Nurses in ICU must continuously respond to the needs of patients and their families in addition to routinely interacting with highly intense emotional aspects of life and responding to constant fluctuations in patient clinical status.

There are inherent and significant limitations in the current methods of selecting and applying strategies to estimate the size and mix of nursing teams. In a comprehensive review by Hurst in the United Kingdom, he summarized these methods and models into five categories: Professional Judgment Approach; Nurses per Occupied Bed Method; Acuity-Quality Method; Timed-Task/Activity Approaches; and Regression-Based Systems. Hurst notes that there are problems in that the systems may be more suitable for long-term, not short-term application, and that prediction and accuracy is dependent on a number of factors that are often neither measured nor even considered.[9]

Fixed, specific nurse-to-patient ratios, (for example, 1:1 nurse:patient in ICU) are often mandated and yet minimum staffing can even become average staffing.[151] Formula-based ratios are also problematic. Nurse workload is a function of registered nurse staff expertise, patient acuity, work intensity, available support staff, doctor availability, and the physical layout of the ICU and its environs.[9,142] Yet it is imperative to question how simplistic numerical formulas can factor in these multi-factorial imperatives? Furthermore, the 'how' and 'when' a 'review of ratios and or formulas used should occur is unknown.

Various measures have been developed to determine nursing requirements and resource allocation in the ICU. They are intended as tools to estimate workload based on the condition of the patient and are often referred to colloquially as dependency tools (see Appendices B and E). They emerged in the 1970s because of a desire to determine severity of illness and cost-effectiveness in the intensive care unit. In the following decades, the need for more specific tools for assessing nursing workload brought the development of scoring systems more focused on nursing activities.

The most widely used measure has been the TISS-Therapeutic Intervention Scoring System by Cullen in 1974.[152] It is based on 57 therapeutic procedures and was designed to assess the severity of illness in the ICU. Each intervention scores 1 to 4. Patients are grouped in 5 classes. Despite not being validated and therefore abandoned, this scoring system did initiate the idea of the 'patient points managed per nurse' approach. The TISS update was expanded by Keene in 1983.[153] The therapeutic procedures were increased to 76, with the assumption that a single nurse could manage 40/50 points per day. Although again not validated, it became the most used tool to assess complexity of treatment and nurse/patient ratio.[153] However, many of these items are obsolete and frequently relate to the severity of illness rather than to specific nursing interventions.

TISS 28 was elaborated by Miranda, de Rijk, and Schaufeli to address two criticisms: 1- Scoring with TISS-76 was time consuming, and 2 - Users found filling out TISS-76 instrument 'cumbersome and boring',[147] It represented a simplified and updated version of the original TISS. The authors believed that a single nurse could 'deal with 46 points over the 24 hours'. Another new index, the Nine Equivalents of Nursing Manpower use Score (NEMS) and was elaborated by Miranda in 1997; derived from TISS and TISS28.[143] Only 9 items, related to specific organ support, nursing and diagnostic/therapeutic interventions inside or outside the ICU, are considered. These items were weighted by multivariate analysis, obtaining a score comparable to the TISS28 score. Under this system, each nurse would theoretically be able to deal with 45-50 points per day.[143]

Another tool, OMEGA, described 86 therapeutic interventions, grouped in 3 categories, measured at the end of ICU stay, represented a measure of global workload and use of resources.[154] In summary, many scoring systems have been proposed to describe nursing workload, both directly or through severity and complexity of treatment (TISS, TISS 28, NAS and NEMS). However these systems are inherently limited and should be considered as just one of the many decision variables used for workforce planning at an operational level, rather than a complete decision solution (see Appendix E).

In an earlier nursing workload study by Giraud et al. using the OMEGA system, they also measured nursing workload subjectively in order to take into account non-objectively measurable factors, such as fatigue, experience and availability of help from others/peers within the ICU.[107] At the end of each 12-hour shift, nurses were asked to rate the level of their workload using the following four categories: 1 = minor, 2 = normal, 3 = heavy, 4 = excessive. Although limitations exist with this type of self-reporting, the results demonstrated that nurses rated their workload as "excessive", 302 times (4.7%), "heavy", 1494 times (23.3%), "normal", 4263 times (66.5%) and "minor", 349 times (5.4%). The authors then used a Kruskal—Wallis test to determine the association between the occurrence of iatrogenic complications, nursing workload and length of stay. Results revealed that the frequency of iatrogenic complications was positively associated with both the subjectively rated nursing workload and OMEGA scores. Length of stay was also found to be significantly higher for patients who developed iatrogenic complications than for patients who did not.[107] It is noteworthy that a number of these older systems remain in use today despite their limitations; perhaps considered as a 'better than nothing' approach. In addition Giraud's study also supports the relationship to risk as described previously. Appendix E shows a summary of a number of nursing workload measurement instruments highlighting the many and varied approaches available internationally with little consensus in the literature as to the 'best' instrument and system.

Research also shows that high workload is one of the most important job stressors among ICU nurses.[6,37,155] Malacrida, Bomio, Matathia, Suter, and Perrez, studied the quality and frequency of stressors in an ICU environment by using two different data collection methods: firstly, the Nursing Stress Scale (NSS) questionnaire; and secondly, a computer-aided self-observation method developed specifically by the authors. In the computer-aided self-observation method, 16 ICU nurses were asked to record their experiences on a computer placed in the ICU, immediately after having experienced a stressful event. These same 16 ICU nurses and 31 other nurses working at the same hospital were then asked to complete the NSS questionnaire. Results obtained by both data collection methods showed that the most important stressors for nurses concerned death and high workload. In this study, staffing and rostering/scheduling problems, not having sufficient time to complete nursing tasks and not having sufficient time to provide emotional support to patients were all considered as workload-related problems.[155]

In addition to research on working conditions and stress, there is considerable evidence that working conditions and job satisfaction are related in nursing.[156,157] Behavioural consequences of job dissatisfaction in nursing, such as low morale, absenteeism, turnover, and poor job performance, potentially can threaten patient care quality and organizational effectiveness.[158] Several nursing studies have examined the outcomes or consequences of job satisfaction. Studies have found positive associations between job satisfaction and job performance[159], and patient satisfaction and quality of care.[160]

Other researchers supported the premise that high workload appears to be related to suboptimal patient care.[6] High workload can affect a care provider's decision to perform various procedures and interventions[161] and may lead to reduced patient satisfaction.[162] High workload may also lead to poor nurse to patient communication[163], impaired nurse-physician collaboration, nurse burnout and job dissatisfaction.[6]

Issue 4: Outcome measurement in ICU

Acuity / severity of illness scoring in intensive care

Intensive Care Units are areas of high resource utilisation[18] with some 100,000 patients admitted to ICUs in Australia each year; 15% of these will die in ICU and a further 10% will die before leaving hospital.[31] To date, outcome measures for critically ill patients admitted to a general ICU have included a variety of methods and variables (see Appendix E).

Predominant severity of illness scoring systems include calculation of the Acute Physiology and Chronic Health Evaluation (APACHE) II and APACHE III scores and hospital mortality probabilities;[164,165] the Simplified Acute Physiology Score (SAPS) II which was developed and validated from a large sample of surgical and medical patients to provide a method to convert the score to a probability of hospital mortality and associated mortality probability;[166] and the Mortality Probability Model (MPM) II probabilities.[167]

Outcome scoring systems in intensive care are promoted as adjuncts to clinical decision-making with their predictive validity and accuracy of prognostic estimates being widely debated. Overall, despite recognised limitations in almost all intensive care scoring systems, there is a consensus that these scoring systems are only as good as the quality of the databases and data entry.[168,169]

An understanding of these measures is necessary to inform the relationship potential and impact of staffing decisions. Clinical information in the intensive care setting is essential for clinical care and to inform staffing decisions. A myriad of clinical data is collected and documented in a range of locations including patient medical records, paper-based or automated bedside clinical information systems (CIS), hand-held devices, unit-specific and/or hospital-wide information systems, and approved external databases.

Nurse-sensitive outcomes

Increasingly, legislators, health funding bodies, and the public demand proof of quality patient care[17]. Regulatory and accrediting bodies such as the Joint Commission on Accreditation of Healthcare Organizations (JCAHO) (USA) and Medicare (Australia) as well as professional groups are moving healthcare toward data-driven and evidence-based practice. As a result, the relationships between patient safety and appropriate staffing levels are a key area of inquiry (http://www.jointcommission.org/PatientSafety/NationalPatientSafetyGoals).

JCAHO's Risk Assessment and Failure Mode and Effects Analysis (FMEA) processes have been adopted and adapted by many institutions as a useful framework. The quality movement has undergone another evolution, moving toward a systematic 'performance improvement' framework. The JCACHO framework focuses on 11 key functions that are inherent to managing care and services in a long-term care facility. Monitoring performance in each of these areas will assist facilities in identifying areas of high-level performance and areas needing improvement. The emphasis is more on system-wide evaluation and design, rather than on a 'who dropped the ball' approach. More and more is being written about the role of sentinel events in risk management. When an event like this occurs, performance improvement calls for the conducting of a 'root cause analysis. The organisation looks at all its systems and processes to identify what went wrong and how to prevent it from happening in the future. The process of risk-based decision making can be broken down relatively easily into a few formal basic steps such as identification/characterisation, analysis, assessment, management, and decision-making. However, each step in 'risk assessment' is heavily dependent on its specific cultural and regulatory context.

Evidence indicates that hospital nursing characteristics including nurse staffing contribute to patient outcomes. The term 'nurse-sensitive outcomes' has emerged in recent years as researchers grapple with the desire to understand the relationship between the interventions and care delivered by nurses and the impact that has on patient outcome. Due to the difficulty in demonstrating causality here, a number of specific measurable outcomes have been used in these types of studies. Key outcomes that have been identified as associated with nurse staffing are: urinary tract infections, pneumonia, length of stay, upper gastrointestinal bleeding, shock, and failure to rescue.[10,11]

Whiteman, Kim, Davidson, Wolf, and Wang described and compared rates of specific indicators within and between 3 types of specialty units (ICU, intermediate care, and general medical-surgical).[11] They found that central line associated blood infections and restraint application duration rates accounted for the largest variance between units, while falls and pressure ulcers accounted for moderate variance. There were no appreciable differences between units for the other outcome measures. This study suggested that some outcomes are more specialty-sensitive than others and provide better information when they are reported for a specific homogenous group rather than diluted with other patient results. The authors recommended continued exploration of methodology for risk adjustment in nurse-sensitive outcomes.[11]

Aiken surveyed nurses about their staffing and work environment in Pennsylvania (USA) in surveys linked to discharge data.[6] Poor nurse staffing was associated with higher 30-day mortality and failure to rescue. Needleman and Buerhaus have also argued that despite the difficulties investigators face (e.g., with data limitations, measurement and methododology problems), many studies have been published that provide compelling, if not yet conclusive evidence of the contribution of nurse staffing to mortality and other important patient outcomes.[96,170]

The previous studies cited have generally been premised on single-level models that predict, for example, that fewer hours of nursing care per patient, or lower levels of nursing education contribute to increased mortality, complications and failure to rescue (death due to in-hospital complications). Estabrooks argued that such studies may either under- or overestimate the contribution of hospital nursing characteristics to patient outcomes, and that the use of hierarchical or multilevel modeling provides more robust estimates.[171] He studied the relative effects and importance of nurse education and skill mix, continuity of care, and quality of work environment in predicting 30-day mortality after adjusting for institutional factors and individual patients' characteristics. This was a cross-sectional analysis of outcome data for 18,142 patients discharged from 49 acute care hospitals in Alberta, Canada, for diagnoses of acute myocardial infarction, congestive heart failure, chronic obstructive pulmonary disease, pneumonia, or stroke between April 1998, and March 1999. Mortality data were linked to patient demographic and co-morbidity factors, institutional characteristics, and hospital nursing characteristics derived from a survey of all registered nurses working in acute care hospitals using multilevel analysis. After adjusting for important individual patient characteristics and co-morbidities, and other institutional characteristics, significant hospital nursing variables that were associated with lower patient mortality among hospitals were: higher nurse education levels, a richer skill mix of nursing staff, better nurse-physician relationships, and lower casual and temporary employment.[171]

Hospitals with a higher proportion of registered nurses, (that is, higher RN-to-non-RN ratios) were associated with lower rates of 30-day patient mortality or 0.83 [95% ci (0.73, 0.96)]. In the same model, hospitals with a higher proportion of casual and temporary nurses were associated with higher rates of 30-day patient mortality, or 1.26 [95% ci (1.09, 1.47)]. These findings would appear to support strategies which improve the work environment for providers, with deliberate focus on the work environment to improve patient and system outcomes.[171]

The complexity of variables involved in measuring the relationship between nurse staffing and outcome, makes causality (of any RN or other workforce) difficult to establish. However, in critical care, there is an increasing volume of evidence that there is a correlation between registered nurses and patient outcome in intensive care. Two studies that are frequently cited in the nurse staffing literature demonstrated this relationship in that registered nurses caring for more than two patients at night increased the risk of post-operative pulmonary (pneumonia and re-intubation) and infectious (septicaemia) complications in oesophagectomy[172] and hepatectomy patients.[117]

Pronovost, Dang, Dorman, Lipsett, Garrett, Jenkles, Bass demonstrated similar results. In their study all regression coefficients remained unchanged suggesting that the presence of registered nurses in intensive care had an independent effect[173]. Hospital mortality was also reduced in patients where nurses were seen to have a higher level of autonomy, decentralised decision-making and lower level of task differentiation[174]. Earlier studies did not demonstrate the same association.[168,175] However, both these studies had smaller sample groups and the earliest did not use risk adjustment to increase analytic sensitivity.[175]

Yang examined the relationships between nurse staffing and adverse patient occurrences while controlling for patient acuity at the unit level.[10] Nurse staffing variables included daily average hours of care, ratios of RNs to patient census, workload index, and skill mix. The five patient outcomes variables included patient falls, pressure ulcers, respiratory tract infections, urinary tract infections, and patient/family complaints. Data were gathered from hospital statistics, incident reports, infection control records, and hospital satisfaction surveys. Lower adverse patient occurrences were more consistently related to a higher proportion of RNs. Workload alone was a powerful predictor of the 5 adverse patient outcomes.[10]

Outcome research limitations

The outcome research has some limitations. For example the data on hospitals do not recognise different staffing on different units. Studies at the individual nursing unit level involve primary data collection and are costly. Single-year studies cannot prove a causal relationship. No study actually identifies an ideal staffing ratio with many sources that inform nurse staffing data.

Issue 5: Nurse skill-matching to patient acuity

The evidence base specifically related to skill assessment and matching to patient acuity is limited. There have been two main areas of research which can inform policy and practice: skill mix within nursing and skill mix between nurses and doctors but no research that explores how nurses decide to match the skill that they have despite the scoring systems and dependency models that exist. Decisions on the best mix of staff and skills are a key element in dealing with staffing problems yet the literature is predominantly focused on single facet labour utilisation models and offers little illumination on the practical and potentially complex issues facing those who make key staffing decisions. Achieving a balance of skill mix, both in number of staff and mix of expertise, experience and exposure (to therapies and complex cases) is a predominant staffing challenge facing nurse managers; equally so in the ICU.[26] This challenge has both quantitative and qualitative dimensions and requires assessment of the relative effectiveness of different mixes of staff and how they are then matched to patient acuity.[42]

2.4. Synopsis of key literature

A synopsis of key literature is presented here under related headings using the five identified issues that framed this review.

1. Nurse labour (including shortage, casual and agency nurse labour)

- Shortages Of Registered Nurses Nationally Including Critical Care Nurses.[176]
- At a conservative estimate of AUD$3110 Per Day, ICU treatment is a very costly component of hospital care.[16,32]
- A world-wide concern with patient safety; escalating health costs, corresponding lack of funding and shortage of nurses (nationally and internationally). [120]
- Agency nurses experience stress in unfamiliar work settings with unfamiliar equipment and protocols, and both managers and agency providers desire to understand their skill sets before their deployment.[133,135]

2. Nurse skill and Risk management in ICU (including patient safety; risk and harm, and agency nurses)

- Evidence shows that patient outcomes are related to RN staffing.[171]
- Improved outcomes have been directly linked to RN competencies related to accurate diagnosis, critical thinking and problem-solving capabilities, innovative timely interventions, leadership capabilities and supervisory skills.[99,150]
- Single-year studies cannot prove a causal relationship although they demonstrate important trends. No study actually has identified an ideal nurse staffing ratio. There are many sources and models for nurse staffing data.[9]

- For every one patient-per-nurse increase in nursing workloads, 7% increase in risk of death within 30 days for an individual patient after controlling for hospital and patient variables. A parallel increase of 7% in risk of death for patients with complications for every 1 patient per nurse increase in average workload in a hospital. 23% and 15% increases in the risks of burnout and job dissatisfaction for nurses in hospitals for every additional patient per nurse.[6]
- RNs experience high levels of role conflict despite the type of staff mix model they work in; nurses' job satisfaction is influenced by the type of staff mix model employed on their patient care unit; nurses' perception of quality care may differ with the type of staff mix model utilised; and bed capacity may be a determinant of the staff mix model utilised on patient care units.[150]
- Skill mix should be examined through the identification of care needs of a specific patient population and then used to determine the required skills of staff.[72,142]
- In the context of the critical care unit, in terms of geographical layout, unit activity, case mix and skill mix of nurses, had a major effect on the ability of nurses to contribute to the recovery of the critically ill. The effectiveness of the nursing resource appeared to be a function of knowledge (theoretical and patient related), experience and exposure. Nurses who were unused to a particular environment were not seen to be as effective as those who were.[26]
- Another important factor absent from the workload equation is the degree of risk critically ill patients are placed in if direct observation cannot be achieved because the nurse has to provide direct care to another patient.[26]
- The concept and importance of nurse staffing related risk is emerging despite with limited research to date.[142,177]
- The risk of mortality may increase as a function of peak occupancy, average nursing requirement per occupied bed and ratio of occupied to appropriately staffed beds.[118]
- Patient:nurse ratios have been linked with complications[116], post abdominal aortic aneurysm repair[173], post hepatectomy[117] and post esophagectomy[172], and Whitman has also identified an increased risk of central line infection rates, pressure sore incidence, falls and physical restraint application where nurse staffing levels are reduced.[73]

3. Workforce (staffing) indicators, terminology, workload

- Significant Changes In Workforce Composition.[176,178]
- Traditionally, the 'gold standard' associated with the care of individual critically ill people has been one patient to one nurse.[151] In high dependency it has been generally accepted that one nurse is able to care for two patients.[132] However, the increasing need for 'flexibility' led to the utilisation of various workload tools that sought to capture the work of the nurse through an appraisal of the patient-related tasks undertaken. The validity of these tools is however questionable.[143,144]
- Staffing decisions should be modified depending upon the nurses' experience, the organization's characteristics and the quality of collaboration between all levels of staff within the organization.[26,142]
- Current nursing workload tools and patient:nurse ratios have been seen to lack validity because they do not appraise the context in which care is delivered, define all nurses as equal and concentrate on activity rather than the effect nurses can have on the outcome of the critically ill.[26,177]

4. Outcome measurements in ICU

- Despite recognised limitations in almost all intensive care scoring systems, there is a consensus that these scoring systems are only as good as the quality of the databases and data entry.[168,169]
- Many scoring systems have been proposed to describe nursing workload, both directly or through severity and complexity of treatment (TISS, TISS 28, NAS and NEMS).[179]

5. Skill matching to patient acuity

- Patient acuity in hospitals is increasing.[51,180]
- Achieving a balance of skill mix, both in number of staff and mix of expertise, experience and exposure (to therapies and complex cases) is a predominant staffing challenge facing nurse managers; equally so in the ICU. This challenge has both quantitative and qualitative dimensions and requires assessment of the relative effectiveness of different mixes of staff and how they are then matched to patient acuity.[42]

Limitations are associated with some outcome studies, key amongst these were issues around the adequacy of the predicted mortality measures[118], low response rates[6], the use of administrative databases for research purposes[116,117,172,173], and the robustness of risk adjustment methods.[73] However, despite the limitations, together they combine to demonstrate growing evidence that complications and even perhaps mortality increase when the nursing resource is diminished.

2.5. Gaps in the literature

This review highlighted the following gaps in the literature:

1. Due attention and emphasis has not been given to the specifics of the key relationship between risk and staffing despite significant literature on adverse events and effects of poor skill mix on outcome. In addition, there are inherent and significant limitations of many current methods of selecting and applying methods for estimating the size and mix of nursing team, with non-consensus and a plethora of models (see Appendices B and E).
2. Ball's 2003 and 2004 research into risk assessment within staffing decisions is positive but with yet to be validated tool. Systems to calculate staffing numbers and staffing mix (Hurst, 2003) demonstrate a fundamentally narrow spectrum and therefore are likely to be inherently flawed if used as sole staffing tools.[9] They fail to address the matching of available skill to patient need with no systematic, logical or evidence-based approach taken.
3. There is a lack of consensus in determining cost effective nurse staffing requirements based on skill level and lack of identification of both skill mix assessment and staffing decision determinants in ICUs.
4. There is a general lack of uniform, reliable and available data on nurse staffing decision-making, preventing the issue from being better understood.
5. There is a need to facilitate the collection of more accurate and reliable staffing data. The literature fails to adequately address the area of skill mix assessment and skill matching to patient acuity despite describing a number of acuity systems.
6. While many studies demonstrate a link between nurse staffing and better patient outcomes, research provides limited data to guide optimal staffing and required skill levels. Implications for managers include the realities of budget allocation and adequate staff, the pros and cons of legislated staffing levels, and the challenge of finding new approaches to ensure safe patient care with limited resources.
7. Despite ever increasing emphasis on patient safety, no national study has identified the nurse staffing decision making process; the decision-makers, what informs their decisions

when assessing available nurse skill and subsequently allocating nurses to required patient care; and how they assess nurse skill in the ICU.

2.6. Summary

This literature review presented contemporary literature (1998-2004) that informed the research in addition to some pre-1998 literature that was considered seminal work in the context of the topis reviewed. There were five key issues that emerged and formed the framework of the review: nurse labour (including shortage, casualisation, and agency nurse labour); nurse skill and risk management in ICU; workforce (staffing) indicators and planning; outcome measurements in ICU; and skill matching to patient acuity.

Historically, invalidated, imprecise measurements have been used with some studies being criticised for methodological weakness, including poor sampling, failure to stratify casemix and acuity, inadequate control groups and differing treatment/intervention protocols. The evidence for relationships between nurse staffing and patient outcomes is increasing. However, issues that remain challenging for improving this evidence include clarity of definitions, data sources, instrumentation, data collection methodology, analytic strategies, risk adjustment and stratification, and patient populations. Despite these limitations there is a growing body of evidence that deficits in skill and or matching are likely to have a negative impact on patient outcomes.

It would seem that staffing models should be based on criteria that are multi-factorial and reflect the needs of the current patient populations and the nursing personnel available in the health care settings including in each ICU. This researcher suggests that an evaluative staffing decision-support framework for nursing staff mix decision-making could benefit nurses, employers and patients. To inform the way forward, evidence is first needed to describe the current staffing practices, profile and problems encountered by those who make these critical decisions. This would involve a national description of staffing decision-making profile in high acuity ICUs; to gain knowledge directly from those at the ICU coalface who make critical staffing decisions (both regarding nurse volume and nurse-to-patient allocation) every day. These data could then be used to inform both the contemporary staffing debate, and the development of a comprehensive staffing decision-support framework; constructed for potential application at ICU operational level. Incorporated into such a dedicated nursing decision support system, it may also provide additional benefit as a risk management strategy to reduce risk of adverse events from staffing and ICU shift related matters.

CHAPTER 3 RESEARCH DESIGN

3.1. Introduction

This chapter describes the research design from both theoretical and practical perspectives. It is divided into three sections:

1) Research question development and purpose. This section includes both the concept and the application of research question development in this research. It then presents the study's purpose and aims, having taking into consideration important research design considerations within the intensive care unit (ICU) setting.

2) Research design (methodology). Within this section the theoretical and conceptual underpinning of the research is presented including the rationale for the application of survey.

3) Research conduct (method). The research conduct is presented in this section and describes the specific use of survey, and details the conduct of the research including specific research logistics and implementation. It also includes a step-by-step account using graphics from the study's web-enabled platform. This allows the reader to follow the path of a research participant, and to reflect on how the research proceeded. This structure highlights the associated attention to rigour throughout the study conduct.

Methodology and Method

In this research the term *methodology* refers to the theoretical framework that guided the researcher and this is encompassed within 'research design' - section 2. The *method* is the umbrella term used for the procedures or processes used to conduct the study and collect data, and this is encompassed in 'research conduct' - section 3. These definitions have been applied by other researchers in seeking to clarify the properties of paradigm methodology and method.[181-183] This empirical study required a down to earth, practical, user-friendly, and reductionist approach. It drew upon both quantitative and qualitative data collection to elicit the rich information required to answer the research questions, using triangulation to achieve this data richness.

3.2. Research question development and purpose

Research questions frequently develop from observation of clinical practice and evolve from focused consideration. Developing a research question includes considering a number of factors such as: preliminary question/topic of interest; population and concepts of interest; reviewing the literature; articulation of the actual problem; and whether the problem is important. These processes should be done before the research question is refined. Research questions may address important clinical issues and should pass the 'so what' or 'significance' test.

Significance of the research question situates the proposed study in its context, provides the rationale for the study, and answers the question: why is the study important? It also implies how the findings will improve knowledge and hopefully patient outcomes. Furthermore, 'Significance Statements' can be used to describe the problem's scope, identify gaps in knowledge, why the study needs to be done, and the potential impact of study findings.[184] Research question development requires an understanding that asking the right research question requires a process. That process is: an initial question emerges from clinical practice; a literature review highlights and substantiates the problem; and the potential significance of the research is eluded by asking the right question.[184]

The research question in this research

The identified gaps in the literature review in Chapter 2 formed the basis for the research question development and informed the purpose of the study. Due attention and emphasis has not been given to the key relationship between risk and staffing despite significant literature on adverse events and effects of poor skill mix on outcome, with inherent limitations in many current methods of selecting and applying methods for estimating the size and mix of nursing teams. They are likely to be inherently flawed if used as sole staffing tools and fail to address the matching of available skill to patient need. There is a lack of consensus in identification of both skill mix assessment and staffing decision determinants in ICUs, including the casual/agency nurse workforce. There is a general lack of uniform, reliable and available data on nurse staffing decision-making preventing the issue from being better understood. While many studies demonstrate a link between nurse staffing and better patient outcomes, research provides limited data to guide optimal staffing and required skill levels. Implications for managers include the realities of budget allocation and adequate staff, the pros and cons of legislated staffing levels, and the challenge of finding new approaches to ensure safe patient care with limited resources.

Despite ever increasing emphasis on patient safety, no national study has identified and described specific nurse staffing decision-making processes, or identified the decision-makers, or identified what informs their decisions when assessing available nurse skill and subsequent allocation of nurses to required patient care.

Two research questions were identified:-

1. What are the tools, systems and processes that inform nurse skill-assessment and nurse-to-patient acuity allocation staffing decisions and practices in Adult Level III Australian intensive care units (ICUs)?

2. Would data from the first question be useful in development of an evidence-based dedicated ICU Nurse Skill Matching Decision-Support Framework (DSF) that could be incorporated within an ICU's risk management system?

A national study of nurse staffing decision-making practices and processes in Australian ICUs was required to answer the first research question, and to inform the decision-support framework development within the second research question. To elicit such broad and comprehensive information on a national scale, a research design was needed that combined different but complementary data methods and data sources.

Qualitative and quantitative approaches have their place within the nursing discipline as each offers different opportunities to generate new knowledge.[184] The research question guided the researcher's decision as to whether the approach should be qualitative, quantitative or both. In this study, both were considered to add value, breadth and depth; to add richness to the data findings. This positioned the research design as a multi-centre study within the positivist paradigm, underpinned by the technique of triangulation using survey as the method.

3.3. Research design considerations in an ICU setting

Prior to considering the most appropriate methodology and method, an understanding of research design in the context of the ICU setting was paramount to inform the researcher's decision. Notwithstanding that research design is a critical component of any research activity, additional challenges exist in designing any research within an intensive care environment. They include limitations in sample size, recruitment capabilities and often the impact of a number of concurrent studies at any one time given limited opportunities in the ICU cohort.[25] In parallel, (as is the case for all research), meticulous planning is required including pilot evaluation of potential data collection instruments and attention to detail in all design aspects and phases of the research conduct itself.

Although the patient throughput is high in most ICUs, the relatively small population of both staff and patients in any single ICU limits research design options, particularly if a sub-set of this cohort is required.[25,185] The same principle applies if the research involves staff rather than patient participants. This needed to be taken into account in this research and its implications fully understood when considering placing this research in a setting already typically saturated with research activity. Concurrent research activities are often resource intensive for staff members who may have investigator and or participant roles across a number of studies in the one ICU.[186] This may further restrict their opportunity or willingness to participate in further research.

These limitations informed the researcher's decision to consider multi-centre research as both a useful and appropriate framework for intensive care-specific research activities. Multi-centre research can add rigour by its ability to generalise findings; provided that recruitment is not biased or flawed. However, it is complex to construct, requires significant co-ordination, effective communication, and attention to detail in planning and conduct.[185] The benefit of multi-centre design in this research was to ascertain nurse staffing decision-making practices from all Australian ICUs so that it was likely to produce generalisable results; subject to achieving an adequate response rate.

Given the lack of literature regarding specific staffing decision-making practices in Australian ICUs, data collection beyond one or even a few ICUs was essential to gauge a national perspective in this study adding more support to the multi-centre approach. A single state or single sector (public or private) study would not have sufficed if a national description or 'map' was sought. In considering the data required to address the research questions, at least four essential broad data components were needed. Within each of these broader components, various additional data elements would also be required. The four broad topics were: 1. Skill assessment; 2. Skill matching to patient acuity; 3. Nursing Hours; and 4. Nurse workforce.

It was likely that both skill assessment, and skill matching to patient acuity (patient allocation) data would not be linear representations, but considered as both separate and collective contributing factors within staffing decision-making. Nursing hours were likely to be factored from a range of numerical dependency models, whilst nurse workforce issues would encompass factors such as casualisation, agency and shortage. The relative presence or absence of these multi-factorial contributing factors was thought to enable a more informed approach to assessment of nursing staff-related risk. The necessity of identifying these components of staffing decision-making staffing practices was akin to a rigorous evidence-based mapping exercise.

3.4. The purpose and aims

The research questions informed the study's purpose. The purpose, which was to describe a national (Australian) profile of nurse staffing decision systems and practices in adult ICUs, and their relationship to risk, was divided into 2 study aims:

1. To describe the tools, systems & processes that inform nurse skill-assessment and nurse to patient allocation staffing decision practices in Adult Level III Australian ICUs.

2. To develop an 'ICU Nurse Skill Matching Decision-Support Framework' informed by the Aim 1 data that could be incorporated within an ICU risk management system.

3.5. Research design (methodology)

The study overview

An overview of the research design in this large multi-centre study is provided here for the reader (see Appendix K). A combined data source and data methods approach (triangulation), using survey, elicited both qualitative and quantitative data elements from all Australian adult ICUs; informed by two groups of respondents. Firstly, from Nurse Unit

Managers (NUMs) and secondly, from Shift Leader Nurses (SLNs). NUMs in Australian ICUs were identified by the researcher to be senior managers who have diverse roles and responsibilities across clinical, financial, educational, patient advocacy, technology and ethical perspectives.[27] SLNs were identified by the researcher as leaders of a nursing shift (or shifts) who were expected to, lead in the clinical environment, be role models, advocate for the NUM in his/her absence, and manage and troubleshoot all shift events. This substantive SLN multi-tasking role also included making key staffing decisions which was the inclusion criteria for SLN participation in the study. In consideration of the diversity of both registered nurse classification levels and the four key nurse staffing concepts described earlier, both data methods and data source triangulation appropriately encompassed the required datasets.

Regarding the survey used in this study, quantitative data were required in most questions in both the NUM and the SLN questionnaires. Where there was likely to be empirical, readily defined and measurable endpoints, a quantitative element fitted. This was evident in the collection of demographic data including each ICU unit profile. It allowed important data analysis in comparisons across ICUs, between staff within each ICU, across other ICUs, and across ICU types. Data related to volume, classification and qualifications of staff were all required as was quantitative data on nursing hours and full-time equivalent status. Content thematic analysis (the qualitative component) of some questions within the surveys added data richness. In addition, because it is common practice in many ICUs for shift leader nurses to make key decisions regarding their staffing needs, it was considered essential to collect data from both NUMs and SLNs in each ICU. Acquisition of data from only one of these sources would have provided only one perspective.

3.6. Triangulation

The method of survey was used in this research, underpinned by the technique of triangulation. Triangulation as a strategy was considered appropriate to gauge a national understanding of staffing decision-making practices. It was envisaged that there would be a requirement for qualitative elements in the data collection in addition to descriptive and demographic data.

A detailed discussion is presented of triangulation including its advantages, disadvantages and application. The rationale for and credibility of qualitative and quantitative components within triangulation is included followed by a detailed discussion of the survey method.

Triangulation combines research strategies (qualitative and quantitative) to facilitate a multi-dimensional view of the area (phenomenon) of interest.[187-189] It increases the opportunities for interpretation because of to the reality of data richness; enhancing the ability to confirm findings across layers of complexity and completeness. Shih suggested there are two purposes of triangulation; purpose of confirmation and purpose of completeness.[190] Thurmond suggested that researchers use triangulation if it can contribute to understanding the phenomenon, but there is also an obligation on the researcher to articulate why it is being used and how it enhances the study.[191]

The term triangulation is derived from the social sciences, particularly surveying and navigation. Triangulation refers to the principle that if two points are known, they can be used to plot a third point so that a triangle is created. It was used as a metaphor by Campbell and Fiske in psychological research to describe several methods to measure a single construct or hypothesis.[192] Decades later, Denzin argued that triangulation is the use of several methodologies to investigate the same phenomenon and includes several data sources, investigators, theories and units of analysis.[193] Others described it as a combination of two or more data sources, investigators, methodological approaches, theoretical perspectives[194,195] or analytical triangulation within the same study.[194] These combinations result in data triangulation, investigator triangulation, methods triangulation, theoretical triangulation[195,196] or analytical triangulation.[194]

Advocates of triangulation, including Flick, recognise that research methods are not neutral tools which will produce the same result regardless of the method, and also assert that triangulation addresses this problem.[197] Triangulation allows the researcher to develop a complex picture of the phenomenon being studied, which might otherwise be unavailable if only one method were used.[198] The intent of using triangulation is to decrease, negate, or counterbalance the deficiency of a single strategy, thereby adding support to the findings.

Triangulation uses multiple methods or perspectives to collect and interpret data about a phenomenon, in order to obtain an accurate representation of its reality.[199] Foss and Ellefsen support this view, suggesting that it is possible to combine methods without violating basic paradigmatic assumptions.[200] This seems reasonable given that the complexity and diversity of reality can be illustrated by combining data methods, adding new perspectives to the phenomenon being studied. Foss and Ellefsen further suggest that different types of knowledge should not be seen as ranked, but as equally valid and necessary to obtain a richer and comprehensive picture, with no single method able to capture the whole and complex reality of a phenomenon.[200] Furthermore, a combination of several methods provides an opportunity to explore different types of knowledge such as that between broad general knowledge and a deeper insight; and macro and micro levels in individuals' interactions; and knowledge about individual intentions and meanings.[200] The possibility that a combination of perspectives (gained by using more than one data method) in staffing decision-making is crucial to understand staffing phenomena is therefore a welcome one. Mutual confirmation among various approaches has been discussed by Campbell,[192] and other researchers have since refined this theme of mutual confirmation through triangulation.[189,201-203]

Use of data methods triangulation

In adopting the triangulation data collection method in this research, there is recognition that qualitative and quantitative data provide different, non-competing knowledge and that different sets of knowledge have equal importance and weight. Although findings originating from different data collection methods can represent worthwhile challenges, this process provides a richer and perhaps more authentic description.[200]

Studies using quantitative data can be generalised beyond the sample, whereas the strength of studies using qualitative data is in the detection of effects that reflect reality.[204] Single approach research designs may be problematic in that there is a possibility that insufficient or inadequate data may not allow interpretation to support a claim or construct. In this research, given that the objective was to ascertain ICU nurse skill-assessment and skill allocation (matching) to acuity decision-making practices, triangulation of both data methods and data sources was considered the most appropriate technique in bringing to bear the relevant mix of points of view in a number of data formats. The ability to generalise the results is determined by the data's completeness from as many representative viewpoints as possible. Jick referred to this conceptually as the 'goal of completeness'.[203]

Jick defined this as the search for elements of elaboration, illustration, enchantment, illustrated understanding and clarification of the result.[203]. Fielding and Fielding[205], and Murphy,[202] have also linked the term triangulation to this goal of completeness. In their view, multiple methods, sources, theories and investigators can be combined to reveal the varied dimensions of the given nursing phenomenon being studied.[202,205] In this research, the goal of completeness is the end-point of the enquiry into the national ICU staffing practices, with its richness in information coming from more than one data source and more than one data method.

Advantages of triangulation

The advantages of triangulation include confidence in research data, creating innovative ways to understand a phenomenon, revealing unique findings, challenging or integrating theories, and providing a clearer understanding of the problem; and some or all of these may pertain to each type of triangulation.[200,202] Of the 5 types of triangulation, data methods and data sources were used in this research. The advantage of data triangulation is the nature and amount of data generated for interpretation as it is likely to be diverse and rich, and adding value to the picture.[206] Lincoln asserts that within the same paradigm, mixing data-collection methods is sensible.[181] Methods triangulation can also occur by combining qualitative and quantitative approaches in a single study and this was the approach taken in this study, particularly within the survey instrument design.[181,207]

Blending elements of one with the other is possible and allows the best representation of both views.[181] Although some argue that paradigms differ epistemologically and ontologically, the counter-argument is that the approaches are similar in their objectives, scope and nature of inquiry across methods and paradigms.[208]

Qualitative data may assist to explain success of interventions when solely numerical data fails to provide an answer.[199] Hence methods triangulation has the potential to expose unique differences or meaningful information that may have remained undiscovered with the use of only one data collection technique or approach in a study. Similarly, quantitative data can enhance understanding by revealing 'outliers' or unique cases.[209] Hinds also asserts that qualitative and quantitative methods, "increase the ability to rule out rival explanations of observed change and reduces skepticism of change-related findings".[210] (p.

442) As an example, in this research, qualitative data was required to elicit nurse staffing problems and suggested solutions by the responding SLNs.

Disadvantages of triangulation

Data triangulation can generate huge amounts of data that pose a significant problem for researchers because of the impact on resource use and time. This may, on occasion, lead to false interpretations of the phenomenon being studied.[211] Difficulties may also arise from trying to 'fit' qualitative data into a quantitative mould even though they were never designed for cross-purposes.[212] At the paradigmatic level, Polit and Hungler caution about various barriers that might impede use of methods triangulation, including difficulty in meshing numerical and narrative data, increased expense of multi-method research, and lack of expertise by the researcher in either method.[199] In methods triangulation, the primary method must be rigorous and sustainable in its own right, while the additional method contributes to the research strength and should be equally rigorous and sustainable.[213] In this research, all of the above cautionary considerations were taken into account by the researcher.

Overall the disadvantages of triangulation include: difficulty in managing large amounts of data; increased time required in comparison to single strategies; conflicts within the theoretical frameworks; lack of understanding regarding why triangulation was used; and potential disharmony based on investigator biases. In this research these have been either managed or negated by definitive strategies within the research design. These included use of a web-based platform, comprehensive third-party data management systems and blinding of the investigator to any data identifiers.

Multiple methods do not compensate for a poorly designed and poorly conducted study hence the rigorous approach taken in the design and conduct of this research.[205,214] Inaccuracies of data from one approach may not lessen inaccuracies of the other. Researchers should not be tempted to hope that weaknesses in one approach might be offset by the strengths of the other. A 'more is better' attitude may result in diluting the possible effectiveness of triangulation.[191] In addition, researchers should not expect multiple sources of data to necessarily confirm one another.[190] Rather, the expectation is one whereby each source adds a piece to the overall puzzle.

Application of triangulation in this research

Multiple strategies were selected in this research because of their ability to comprehensively and diversely investigate ICU staffing practices, rather than counterbalancing strengths and or weaknesses. The technique of triangulation underpinned the data collection in this research. This information was necessary to understand what informed, and how ICU shift leader nurses made, nurse staffing decisions. Use of survey incorporating two questionnaires as the data collection instruments from two differing data sources - Shift Leader Nurses (SLNs) and Nurse Unit Managers (NUMs) in participating ICUs. Both quantitative and qualitative data was collected and analysed. (Level III ICUs are defined later in this chapter). The researcher was mindful that in order for a study to be conducted without error, it must be replicable, and reliably measure the things it purports to measure, and enable generalisability. All Level III Australian ICUs were identified to participate in this research because they manage high acuity patients using complex therapy delivery. Staffing issues in these ICUs are complex and challenging given their activity demands.

In this research it was concluded that the combination of qualitative and quantitative data would add richness and breadth to the inquiry given they brought different elements to inform the research question. The implementation and research conduct phases of this research are presented later in this chapter.

Rigour

Decision (audit) trails

Well developed strategies and attention to detail are critical to maintaining a rigorous approach in both research design and conduct. Whilst more commonly used in qualitative studies, decision-audit trails were considered by the researcher to be useful across both the quantitative and qualitative components of this study. Audit trails have been suggested by some writers as a useful strategy in managing rigour.[215,216] White emphasised the importance of a clear research decision trail and although her study used a hermeneutic approach, the same principles apply in terms of clarity and transparency in design thinking in other research methods.[215] Koch and White both subscribe to the view that qualitative data can be considered particularly if added effort is placed on the associated rigour in acquiring that data.[215,216] This thesis adopted this principle throughout.

Both Koch and White reiterate, and this researcher concurs, that every decision taken by a researcher should be a reasoned one, and that it reflect the theoretical framework of the methodology employed and be made explicit to others.[215,216] The detail in implementation of this study is explained and its place justified throughout this chapter so that a clear decision trail in both thinking and action can be followed.

Qualitative data

Parallel with the different data source considerations was the use of different data gathering techniques and data types. Both quantitative and qualitative data were considered essential to ascertain as much information as possible in order to answer the two research questions. Some would say research that focuses on collecting purely qualitative data may be regarded as a 'soft option', lacking in scientific rigour and readily open to possible bias and even fraud.[217] However, Baker (1992) notes that this may be because the decision trail is not adequately set out and hence many studies suffer from 'method slurring'.[218] Patton states:

> It is important to acknowledge at the outset that particular philosophical underpinnings or theoretical orientations and special purposes for qualitative inquiry will generate different criteria for judging quality and credibility. [219] (p. 543)

In contrast to quantitative data, qualitative data evolves from qualitative methods that focus on interpreting people's thoughts and behaviours.[220] Qualitative data can contribute description and understanding to questions in a way that quantitative data can not.[199]

Choosing the most suitable and appropriate method for collecting data depends on a number of factors, such as the nature of the questions, available resources, time constraints and known information on the sampling frame.[221] In this research, the inquiry's qualitative aspect was incorporated into the SLN questionnaire. Textual narrative was sought to inform knowledge and detail about the decision-making systems being used by the SLNs, including problems they had encountered and their suggested solutions. This data was essential to understand the experiential component of the SLN staffing-related decisions in the ICU. A copy of both data collection instruments (NUM and SLN questionnaires) is found in Appendix F.

Qualitative methods are recognised and valued in nursing research.[193,222,223] The work of Koch heralded a new era in acceptance of qualitative studies and their place in research to address increasing numbers of research questions that were unable to be answered using empirical approaches.[216] Although this research did not use a qualitative method it did contain qualitative components within the data collection and analysis; providing data richness in its contribution to the entire study.

In relation to using the same criteria and terminology as quantitative studies, a solution is best summarised by Leinenger:

> We must develop and use criteria that fit the qualitative paradigm, rather than use quantitative criteria for qualitative studies. It is awkward and inappropriate to re-language quantitative terms.[224] (p. 47)

Rather than researchers taking a defensive position, some researchers have put these principles into practice by providing additional practical guidance and application. The Joanna Briggs Institute (JBI) developed and recommends specific criteria to measure qualitative rigour. JBI recommend its 'Notari Textual Critical Appraisal Instrument' when assessing validity of qualitative research.[102] The checklist includes criteria with which to assess rigour within six single questions. These were considered useful by the researcher to inform in part the qualitative aspects of the research design; a type of reflective tool. Although this Notari system is predominantly used in the design and conduct of systematic reviews where synthesis of a number of studies is the goal, the philosophical underpinning sits well with this researcher when considering the rigour of its qualitative components in the surveys.[102] The Notari six questions are:

1. Is the source of opinion identified?
2. Does the source of opinion have standing in the field?
3. Are the interests of patients the central focus of the opinion?
4. Is the opinion's basis in logic/experience clearly argued?
5. Is there reference to the extant literature/evidence and is any incongruence with it logically defended?
6. Is the opinion supported by peers?[102]

In this research, when the Notari instrument was applied to the 'validity' of the qualitative data components within this research, it receives a 'yes' to all questions. This provided the researcher with a useful tool which provided added reassurance and justification for the research design and use of both quantitative and qualitative data.

3.7. Use of Survey

In the context of this research, the term 'survey' refers to the method whereby questionnaires were used to obtain data from the chosen sample. In the literature, the term has mixed connotations with some text referring to the term as a method and others more colloquially as a tool. This researcher has used it as the method; however it is useful to understand the history of survey and related contexts.

The modern survey can be traced back to ancient forms of the census. A census includes information on characteristics of the entire population in a territory/place. It is based on what people tell 'officials' or what 'officials' observe.[213] Survey research is non-experimental research in which information regarding its activities, beliefs, preferences, and attitudes of people is gathered via direct questioning.[213,225] This type of research may collect information on a number of variables within a population. This information could refer to prevalence, distribution and interrelationships, as examples. Survey is also used to collect information on people's actions, intentions, knowledge, attitudes and opinions, as was the case in this research.

Survey may be criticised as an insubstantial method of research because there are issues regarding their reliability and validity.[204] These issues can be compounded by poor response rates and the subsequent inability to generalise the findings from the sample surveyed to the entire population. However, survey is used for valid reasons across a number of stakeholders including retail, advertising companies, and social and health-related research. They are, according to Neuman , "appropriate for research questions about self-reported beliefs or behaviours".[184] (p. 273)

Asking the right questions, sampling from the correct population, working with a reliable sample, and clean data entry are all critical to the reliability and quality of the end product. This important premise was adopted in this research with the stated features demonstrated within the research design: asking the right questions; sampling from the correct population; working with a reliable sample; and clean data entry.[199] This process is evident in this research within the detail of the research conduct in the latter part of this chapter.

Survey data are predominantly self-reported whereby respondents answer researchers' questions. The mode of this data collection can be via personal interviews and/or distribution of questionnaires, with the latter chosen for this study. The key premise for survey content is that the item must be written or presented so that the intent of the question and the nature of the information sought are clear to the respondent. According to Polit,

> Each item must ask one question, be grammatically correct, free of jargon and value-laden terms, not open to alternative interpretations, and written in language understandable to the respondents.[225] (p. 284)

Pilot studies are useful to determine this in the absence of a previously validated tool. The intended instrument can be tested in a similar population as was done in this research.

The descriptive design of research using survey, can be used to identify relationships between variables and describe features of sample groups as well as provide an accurate picture and discover new meanings.[226,227] According to Bradburn, survey "like other scientific and technical tools, can be well made or poorly made and can be used in inappropriate or inappropriate ways".[228] (p. 37) Survey data are typically summarised in the form of charts, graphs or tables and analysed with statistics.

Advantages of survey

Self-administered questionnaires using survey, that is, those answered independently by the respondents, are considered economical.[213] They may not, however, be appropriate for certain types of populations, for example the elderly, children, cognitively impaired.[213,225] Survey can utilise is highly flexible document which can be applied to many populations. It can focus on a wide range of topics with information able to be used for many purposes. The researcher does not manipulate a situation or condition to see how people react; he or she simply records answers from many people who have been asked the same questions.[184,213]

Disadvantages of survey

Establishing reliability and validity can be difficult using survey, despite the fact that they are able to broadly ascertain responses from many subjects over large populations spread over a wide geographical area.[226] Less administrative resources are required for a survey making them a cost-effective option and they are a common choice in almost all marketing and quality structures within business. However, there is a risk of poor response rates with survey and this may affect generalisability.[198] Survey information may be regarded as relatively superficial and is therefore suited to extensive rather than intensive analysis.[225] There is also risk of incomplete data, misinterpretation, and mischievous answering.

Web-based survey

The Internet or the World Wide Web (www), as a worldwide computer network, has enabled people using computers connected to the Internet to communicate with each other. This phenomenal development of cyber communities where people with common interests can readily communicate transcends geographical boundaries.[229] Computer-mediated communication (CMC) is the term used for the 'direct use of computers in a text-based communication process'.[230] (p.2) This approach enabled participants and researchers to read, reply, print, forward or file extended messages that have been electronically transmitted.[230]

Attempts have been made to identify common standards of etiquette for users of the Internet and these standards should be given the same considerations in research conducted over the Internet.[230] These standards were termed 'net'iquette' and refer to a set of conventions that structure online communications or behaviour.[231] Access to the Internet did not become widespread until the late 1990s. For example in 1994, only 3% of the United States population had email access compared to 75% a decade later.[184] This researcher chose to use web-based surveys to, enhance recruitment, facilitate timeliness in responses, avoid data entry transcription errors and duplication, protect participant identity, and allow the data to be managed more efficiently. The following advantages and disadvantages of specifically web-based surveys were considered carefully with the benefits outweighing the perceived negatives.

Advantages of web-based survey

Web-based survey methods are fast, inexpensive, allow flexible design and can even incorporate audio, video and visual images. Efficiencies can all but eliminate paper, postage, mail-out, and data entry costs as well as overcoming geographical boundaries. Labour can be reduced significantly[232] and for multi-centre studies, a large number of participants can access a web-based system at any given time, subject to personal access (and consideration of protective firewall systems). These flexibility options have advantages in recruitment and in data instrument delivery and collection and were considered advantageous for this research.

Disadvantages of web-based survey

A variety of complex issues arise in cyberspace. These include ethical difficulties in acquisition of consent, who has access to contact databases for the questionnaire delivery, and the consideration that "temporal, special and sensory components of human interaction and communication are altered".[233] (p. 543) Three distinct disadvantages are: coverage, privacy and verification, and design issues. The first, coverage, involves sampling and unequal access, e.g. to the Internet. This study addressed this issue with follow-up hard copy access for those ICUs where IT access was restricted or unavailable. Respondent privacy and protection can be addressed with secure websites and coded access as was the case here. This technological gate-keeping restricting access more than once by each respondent in this research is not entirely true. One could access IT many times but once a person had completed the questionnaire and submitted it then the person could not do so again. A consistent format with drop-down boxes is recommended in design issue considerations. Visual appearance (regarding fonts and graphics) should be simplified for easy reading and consistency. It is also useful to make it easy for respondents to move back and forth across questions.[232] This was factored into this web-based data instrument design and delivery.

Avoiding bias in use of survey

Adopting principles of writing good questions will assist in improving the study's rigour, thus avoiding bias and facilitating meaningful answers.[184] Avoiding emotional language and prestige bias is done by using neutral language. Words have implicit connotative as well as denotative meanings. Likewise, titles, positions in society, etc. carry prestige status and words with emotional connotations can sway how people 'hear' and answer survey related questions. Avoidance of ambiguity including double-barrelled questions is important. If two answers are linked together, it makes the respondent's answer ambiguous. Leading questions should also be avoided. Respondents should feel that all answers are legitimate and that it is not possible to identify a potential 'answer' that the researcher may want. A 'leading' or 'loaded' question is one that leads the respondent to choose one response over another by its wording.[184,199]

Questions that are beyond a respondent's expected capabilities should also be avoided. By asking something that few respondents will know the answer can frustrate respondents and result in poor quality answers. False premises should be avoided. This can occur if a question is phrased with a premise that the respondent(s) may not agree, and then go on to ask a question about it. Respondents who disagree with the premise may be frustrated and unsure how to answer. A better question will explicitly ask the respondent to assume the premise is true, and then it asks for a preference.

Double-negatives can be confusing and are grammatically incorrect in ordinary language. An example may be 'disagreeing with not doing something'. Another consideration is to avoid overlapping or unbalanced response categories. Response categories should be made mutually exclusive, exhaustive, and balanced. 'Exhaustive' means that every respondent has a choice; a place to go. Response categories should also be kept balanced. Unless there is a specific purpose for doing otherwise, it is better to offer respondents equal polar opposites at the end of a continuum as is commonly the case with Likert Scales. Finally, it is vital to avoid jargon, slang, abbreviations, and vagueness so that bias and poor quality responses are avoided.[184,199]

Survey design

In designing a survey it is essential to consider the methods that will be used for data analysis. In determining the methods to be used, two criteria should apply.[213] Firstly, what is the question one is interested in being answered? Secondly, is the type of data available to answer that question? The type of data collected and the questions to be answered determine the data instrument and choice of statistical technique to be used for data analysis. Five broad survey design principles were adopted in this study:

1. Content - does it need to be collected? and

2. Analysis - consider data analysis process as questions are designed; and
3. Presentation – is the question being asked correctly and clearly? and
4. Methodology - how can problems be minimised or avoided? Consider potential problems and their solutions early in design phase; and
5. Keep it 'simple and systematic'.[213]

Following this, with each part of the design phase, broad consideration of how the data might be analysed is critical, and two criteria were applied. First, the researcher considered what was the question being asked, and second, was the type of data available to answer that question and how could that be rigorously analysed? In addition, specific attention to detail in regards to awareness of potential bias and how to reduce it in the survey design is important.[213]

Because respondents have different reading and writing capabilities, this needed to be taken into account when selecting the optimal data collection instrument. Registered nurses in Australia are educated at tertiary level and are required to have a mature English writing and comprehension grounding. In addition, any overseas nurses who may be an ICU shift leader would have been required to undertake an entry English test prior to Nurses Board registration. In this research there was confidence that all participants would be able to answer the survey questionnaire format due to the context of the study and the level of expertise required to be employed in the study locations (i.e. the ICUs).

3.8. Sampling

Sampling is the process of recruiting suitable participants and/or settings for inclusion in the research. It is an important consideration because how sampling is undertaken can influence the integrity, results and outcomes of the research if a poor or inappropriate sampling procedure is employed. Frequently, for reasons of expediency, cost and feasibility, data are collected from a sample rather than a whole population. Where a representative sample is possible then this should be pursued. This gives the smallest possible sample from which results can be generalized.[213]

Sampling may allow selection of a representative portion of a designated population. Although individuals constitute a common element, other elements such as places or objects can form the basis of a sample or population. Sometimes the sampling element (or sets of elements known as a sampling unit) represents the same thing. On other occasions it is more efficient to use a larger unit than a single element for sampling purposes. In this research the ICUs are considered to be the sampling unit although other individual respondents are involved.

The purpose of sampling is to increase the study's efficiency and effectiveness, without compromising its integrity. The foremost criterion in evaluating a sample is its representativeness.[199,213] Because it is usually difficult to access an entire population, the researcher must use sampling strategies that minimize or control for sample bias. A population is a well-defined set that has certain specific properties hence the basic unit of the population must be clearly defined.[199] This is because the findings' generalisability will be a function of the population criteria. Furthermore, the population descriptors that provide the basis for eligibility criteria should be evident in the sample. That is, the population characteristics and the sample should be congruent.[225] To be suitable for inclusion, participants need to have certain characteristics and meet certain requirements or criteria. The elements that need to be included are commonly referred to as the inclusion criteria. The three main types of sampling are convenience, purposive and snowball sampling.[199,213]

Variation between samples

Even if the researcher ensures that every member of a population has a known and usually an equal, chance of being included in a sample, it does not follow that a series of samples drawn from one population and fulfilling this criterion will be identical. They will show chance variations from one to another, and the variation may be slight or considerable. Thus the variation between samples depends partly on the amount of variation in the population from which they are drawn. Furthermore, it is a matter of common observation that a small sample is a much less certain guide to the population from which it was drawn than a large sample. In other words, the more members of a population that are included in a sample the more chance that sample will have of accurately representing the population, provided a random process is used to construct the sample. A consequence of this is that, if two or more samples are drawn from a population, the larger they are the more likely they are to resemble each other - again provided that a random technique is followed. Thus the variation between samples depends partly also on the size of the sample.

However, in this research it was not appropriate to take a random sample as all ICUs could be included. For valid generalisations to be made a sample needs to be in some way representative of the population as a whole. For this reason the first stage in a report is to describe the sample, say by age, sex, and disease status, so that other readers can decide if it is representative of the type of patients they encounter.

Convenience samples

Convenience samples are those that recruit anyone who meets the inclusion criteria as is the case in this research.[213] In this study, Level III Australian ICUs were identified to participate in this research given their high patient acuity status. The study was therefore framed to include the most complex ICUs. That was not to say that Level 1 and Level II ICUs could not potentially add additional data, however if they too had been included, there would have been over 200 participating Units and this would have been outside the scope of this study given the time and resource constraints of a single researcher. Level III ICU data would provide a substantive understanding of staffing decisions and influences in the highest patient acuity ICU environment.

Convenience sampling is also called incidental or accidental sampling, and makes use of the most readily accessible individuals or units as subjects in a study. Often the advantage of convenience sample is that it may be easier for the researcher to obtain participants (subjects).[213] The only concern is obtaining a sufficient number who meet the designated inclusion criteria of the study. All Level 3 ICUs in the public or private sector across all states were included in this sample. The only inclusion criterion was that they be classified a Level 3 unit as per the Joint Faculty of Intensive Care Medicine (JFICM) intensive care unit criteria. JFICM criteria are clearly defined and as such the ICUs can be categorized in a systematic structural manner.[234]

The major disadvantage of a convenience sample is that the risk of bias is greater than in any other type of sample. The bias problem exists because convenience samples tend to be self-selecting, i.e. the researcher ends up obtaining information only from the people who choose to participate,[225] for example those who choose to return a questionnaire that is sent to them. To address the amount of potential bias, it is useful to ask three questions: first, what motivated some and not others to participate?; second, how representative of the population are those that participate?; and third, what kind of data may have been obtained if the non-participants had also participated?[213] These questions are encompassed in a discussion below regarding selection bias.

Multi-centre sampling

Multi-centre research can add rigour by its ability to generalise findings (increased external validity) provided that recruitment is not biased or flawed. However, it is often complex to construct, requires significant co-ordination, effective communication, and attention to detail in planning and conduct.[25,185] This researcher needed to use a multi-centre approach to maximise generalisability and to produce a national mapping of nurse staffing decision-making practices. Single state or single sector (public or private) would not suffice if a national profile was to be ascertained.

Problems with non-random samples

In general it is more difficult in health-related research to achieve the ideal of a random sample and researchers may be limited to what is realistically available, that is, a convenience sample. In order to be able to make generalisations it is important to investigate whether biases could have crept in, meaning the participants available are not typical. Common biases are: hospital participants are not the same as ones seen in the community; volunteers are not typical of non-volunteers; and participants who return questionnaires differ from those who do not.[213]

In order to persuade the reader that the participants included are typical it is important that the researcher give as much detail as possible at the beginning of the selection process and some demographic data such as age, sex, social class and response rate. The researcher has addressed this for this study in the section on Recruitment.

Sample size

If a study is too small it will not be able to answer the question posed. It could also be deemed unethical because participants may be put at risk (if an interventional clinical study) with no apparent benefit. However, studies should not be too large because resources would be wasted if fewer participants would have sufficed. In the context of this study (and within the confines of a PhD), resources were limited, but in order to recruit as many participants as possible all were invited to participate using an innovative web-based platform specifically designed and purpose built to facilitate the data collection and overcome a number of logistical hurdles that face multi-centre researchers.

Selection bias

Selection bias occurs when the subjects studied are not representative of the target population about which conclusions are to be drawn.[235] It is a problem in research designs without random assignment of participants, and is a reflection of internal validity of the research. It occurs when more subjects in one group have a characteristic that affects the dependent variable. Ideally to minimize election bias, random assignment of participants is optimal if comparing two or more groups.[235] The possibility of selection bias should always be considered when defining a study sample. In this research it would have been too difficult to randomize responses from all SLNs because their participation relied on the NUMs corresponding with them to seek their interest in completing the survey. Had this researcher tried to impose a randomisation technique and associated logistics from each NUM, it is likely the NUM would have been less inclined so this was considered a risk not worth taking. Furthermore, when responses are incomplete, the scope for bias must be assessed. This understanding was taken into account when designing questions so that the rationale for not answering a question could be elicited. This provided data which was useful in the analysis of questions, which may have otherwise had blank or missing fields.

Measurement error

It is important to assess the quality of measurements. Sometimes a reliable standard is available against which the validity of a survey method can be assessed. More often, however, there is no distinct reference standard. In practice, therefore, validity may have to be assessed indirectly. One clear available method is to pilot the survey (in the absence of a pre-validated data instrument).[213] This strategy was adopted in this research and is described further into the chapter.

Design considerations for e approach for data delivery and management

In this research an innovative electronic or 'e' approach to data instrument delivery and data management was considered, designed and implemented. However, an apriori understanding of the design considerations was required. A fundamental objective in adopting a web-enabled approach was to facilitate a data collection system that would be user-friendly and cause minimal disruption to NUMs who considered whether or not their

ICU would participate. Given this researcher's personal knowledge (from her won experience) that senior managers are very busy professionals, it was considered that ease of using the data collection tool would maximise participation. Furthermore, data integrity, identity protection and rigorous data management system were imperative in this research and the e-survey approach facilitated this capability.

Advantages of a web-based e system

There are significant advantages in using electronic data collection. Direct data entry eliminates the need for secondary data entry and potential transcription error, and is resource efficient in terms of time, labour, cost, and very attractive where there is a single researcher. There is a more likely bias reduction as data entry is blinded. Real time entry allows tracking progress any time and this was a significant advantage to facilitate follow-up of those that had not responded. This was an important consideration to optimise the response rate, and was undertaken by sending the email content for a 'reminder', which was then forwarded by the independent data manager. Secure / restricted access was essential and this was achieved by initiating a number of password protected firewalls. The database was constructed to ensure it interfaced directly with statistical packages. This facility was in-built in the database design features and made possible the production of reports and queries. The researcher could at any time request a report or query and this would be provided in a de-identified manner maintaining confidentiality. Adequate server space (capacity) was critical and this was negotiated to allow access to substantial server space.

Disadvantages

There are some important disadvantages that required consideration in the design of this research. One key disadvantage is that these systems are usually costly and reliant on technology systems. There is a risk of fault/breakdown with or without data loss. The researcher may have limited IT knowledge, which then requires collaboration and trust in others. There are limitations of end-users (respondents) in terms of access, capability, compliance, and there is the potential for a high aggravation factor if the system is poorly designed and / or fails to work.

Before deciding on the final web-based design, a range of data collection modes of delivery were considered. These are listed below with the rationale noted in italics and the preferred options noted in red:

1. Paper report form - 2nd option *used only after web-based data receipt was optimized;*
2. Single versus double data entry – *the latter resource-intensive with increased transcription error risk;*
3. Incorporating data from external database – *selected to merge essential Adult Patient Database demographic data*[38];
4. Fax-based – *logistically problematic, especially after business hours. Risk of faxes being lost or not received;*
5. Data acquisition from optical images – *not a requirement in this study;*
6. Personal digital assistant - *not a feasible option for national study;*
7. Tablet (wireless assistant) - *not a feasible option for national study;*
8. Remote data entry (via an 'e' electronic approach) - 1st option; and
9. Direct upload of data (via an 'e' electronic approach) – 1st option.

Options 1, 8 and 9 were selected as the most appropriate for this study. They provided a combination of an *e* based delivery in addition to a system for subsequent follow-up using a hard copy mail-back option. This was thought to provide the most flexible and achievable result in allowing flexibility of response, and for maximising the overall response rate. Quantitative and qualitative data would be collected from the two (NUM & SLN) data instruments. All analysis would be performed using SAS version 9.1 (SAS Institute, Cary, NC, USA) in both the pilot and main study, except the content analysis of the qualitative data which would be conducted using a systematic manual approach.

The advantages of this e approach in this research outweighed the disadvantages. There were 4 key advantages: first, ease of use either on-site in their ICU or from any external computer with internet access; second, a reduction in bias as the researcher remained at a distance and was blinded to the institutions and participants; third, the ability to send a reminder in a quick and timely manner; and fourth, a web-based database platform linked to a statistical software package. This facilitated running interim reports that were used for follow-up purposes to maximise the response rate.

Rationale for Piloting

Piloting assists with the rigour of a study in that it allows the tool, sample and logistics to be tested with any subsequent modifications made without affecting the primary study. A pilot is essentially a small-scale version or trial run for a major study. Whatever method of data collection is adopted, it is usually worth testing it in a pilot survey before embarking on the main study.[213,235] Early identification of practical problems reduces the likelihood of flaws in design and subsequent difficulties. This was a desirable focus for this study with a key element a pilot study of the data collection tools before commencing the multi-centre national study. The details of how the pilot in this research was conducted are presented further into the chapter.

Recruitment considerations

A key consideration regarding recruitment options for this study was the limitations of this single researcher's available resources. These included time, available information technology, and financial capacity to complete the study within the designated three year timeframe. The ability to ascertain all the required data in a timely manner without comprising the study design's rigour was a critical factor. These considerations were a key driver in the researcher's decision to adopt an innovative web-enabled platform. The platform facilitated recruitment, electronic data collection and management whilst maintaining a rigorous approach and provided an opportunity for optimal recruitment of all Australian Level III ICUs.

In addition to the electronic web-based survey method delivery, the researcher believed response rates would be enhanced by offering (with pre-paid express postal return) postal survey delivery as an alternative option for participants who may not wish to participate electronically. There is a reasonable body of literature that informs on how to increase response rates for mailed questionnaires.[184,232,236] Brehm found that with advance contact of potential participants, the response rate improved.[236] In this research, the researcher made preliminary contact with all NUMs three months prior to the scheduled study commencement date. In a meta-analysis of 115 articles on mail survey responses taken from 25 journals published between 1940 and 1988, there was demonstrable improvement in response rate by the use of cover letters, questionnaires of four pages or less, a return pre-paid envelope, and a small monetary reward.[237] The first three of those strategies were adopted in this research but the researcher deliberately chose not to include any monetary or other 'in-kind' participant incentive; ensuring there would be no perception or otherwise of coercion. The detail of the three phases of recruitment used in this study is presented further into this chapter.

ICU Classification: The Levels system

To provide a homogeneous setting for the recruitment, Level III ICUs were chosen for this research. To illustrate the rationale for this decision in this research setting context, it is both useful and important to understand the meaning and relevance of the formalised ICU 'Level' system. This system is a form of accreditation in Australia, and provides some delineation of ICU activity within Australian hospitals. The system is described here followed by the related ICU characteristics.

In Australia, the attributes of an ICU are determined by the type and number of critically ill patients, and the provision of resources, staffing and support services. These are outlined in the Minimum Standards for Intensive Care Units. Policy Document IC-1 (Faculty of Intensive Care, Australian and New Zealand College of Anaesthetists.[234] Australian ICU facilities are divided into three categories or levels: Level I, Level II and Level III. This is based upon their care delivery and service provision with Level III able to provide the most comprehensive level of intensive care services. For the purposes of this study, only Level III ICUs were invited to participate because they provided the most complex intensive care service delivery, were likely to use the most nursing labour, and had common attributes and patient casemix.[15,234] This provided a homogenous setting for the study with increased potential for generalisability of the study findings.

The Australian and New Zealand Intensive Care Society (ANZICS) Adult Patient Database (APD) manages large amounts of data across all ICUs.[38] They were therefore the appropriate professional body to be approached by the researcher to ascertain the most current details of the number, location, and contact details of existing Level III ICUs. The APD receives data submissions from ICUs throughout Australia, New Zealand and Hong Kong and the criterion for a Level III ICU is a national standard set by The Joint Faculty of Intensive Care.[234] Nurse staffing decisions in Level III ICUs are likely to be complex and multi-factorial. An understanding of the more specific characteristics of a Level III ICU provides a useful contextual perspective and highlights the complexities of such an environment.

Characteristics of Level III Adult ICUs

A Level III ICU is a tertiary referral unit for intensive care patients; able to provide the highest level of care including complex multi-system life support for an indefinite period. It must be capable of providing mechanical ventilation, extra-corporeal renal support services and invasive cardiovascular monitoring for an indefinite period. It should have extensive back-up laboratory and clinical service facilities. All patients admitted to the Unit must be referred for management to the attending intensive care specialist. A Level III ICU should be a self-contained area, with easy access to the emergency department, operating theatres and organ imaging. Level III ICUs have defined admission, discharge and referral policies, at least six staffed and equipped beds, more than 350 mechanically ventilated patients per annum, and medical director who is recognised by the Joint Specialist Advisory Committee in Intensive Care as a specialist in intensive care medicine. Level III ICUs must have sufficient supporting specialist(s) so that consultant support is always available to the unit's medical staff. In addition to the attending specialist, at least one registered medical practitioner with an appropriate level of experience should be exclusively rostered and present in the Unit at all times.[234]

In Australian Level III ICUs there is a minimum ratio of 1:1 (one nurse for every one mechanically ventilated patient) as the usual standard nurse to patient ratio and on occasion may have nursing staff available to greater than 1:1 ratio for patients requiring multiple concurrent complex therapy management. This standard dates back to 1967.[151] However there is no recommendation as to the required skill mix apart from the broad Australian College of Critical Care Nurses (ACCCN) recommendation of greater than 50%

ICU qualified nurses should be on staff in Level III ICUs.[3] In charge of the ICU is a nurse with a post-registration qualification in intensive care or in the clinical specialty of the Unit. The majority of nursing staff must also have a post-registration qualification in intensive care or in the specialty of the Unit. All nursing staff in the Unit responsible for direct patient care should be registered nurses. There is a nurse educator, a formal nursing educational program and twenty-four hour access to pharmacy, pathology, operating theatres and tertiary level imaging services, and appropriate access to physiotherapy and other allied health services.[234]

This understanding of these Level III ICU characteristics contextualises the research and gives support to its choice as the most appropriate setting to gauge the national status regarding nurse skill mix and staffing decision data.

Limitations of the ICU Level classification system

The ICU levels should be viewed with a small degree of caution. For example, casemix, morbidity and mortality data and severity of illness scores do not form part of the analysis and so little is known about accurate patient acuity. Additionally, casemix data may not reflect ICU admission diagnoses, as diagnostic data currently available from the AIHW does not adequately capture ICU admissions.[38,238] Moreover, the specified time lines in the standards may be difficult to apply in some settings, particularly ICUs located in rural and remote regions. The levels are self-reported. It is therefore possible that a small number of ICUs over or under estimate the ICU level when objective criteria for infrastructure, throughput, and staffing and research activities are applied. Despite objective definitions, respondents may not answer objectively. However despite these limitations, the ICU Levels system remains the only recognised national benchmark and hence the most appropriate for this research.[234]

3.9. Data collection Instruments: questionnaire design

When designing research using survey as a method, a good questionnaire forms an 'integrated whole'[184] in which questions flow logically and systematically. Limited introductory remarks and instructions are included for clarification purposes, and each variable is measured with one or more questions. Neuman suggests two key principles to keep in mind: to "avoid confusion and keep the respondent's perspective in mind".[184] (p. 277) Good survey questions both give the researcher valid and reliable measures and help respondents feel that they understand the question and that their answers are considered meaningful.

As stated previously, two separate questionnaires were developed to target the two respective data sources; Nursing Unit Managers (NUMs) and Shift Leader Nurses (SLNs). The NUM questionnaire including specific question content required to elicit demographic information and nursing workforce utilisation (both agency and employed ICU nurses). The questions were constructed to build a profile of nursing workforce indicators within each ICU. Categories were used in the answer options within 3 of the 10 questions in the interest of facilitating answers in a practicable timely manner. Open and closed questions were incorporated into the two questionnaires.

Likert Scales were used to respond to statements or questions. Likert Scales are an example of a fixed-response item, on which respondents indicate their answer. Likert Scales are commonly constructed as 4-point, 5-point, 7-point or 10-point. In this research a 5-point Likert Scale was chosen and used consistently throughout.[239,240] Questions were structured to elicit binary, categorical and iterative answers. The NUM Questionnaire sought to gain information on the participating ICU profile in terms of number of ventilator (an ICU size determinant) beds, size, occupancy and employed nursing workforce.

Predominantly binary and categorical answers were sought with the researcher mindful that NUMs are busy people with significant portfolios who would be more likely to answer a questionnaire where the answers were readily at hand. That said there was a small iterative element to allow for optional comment to a couple of questions. Specific information regarding casemix, location, etc. was not requested as this was formerly elicited and matched from the ANZICS Adult Patient Database (APD) data.[38] This strategy reduced the number of required questions and was thought to optimise response rates by not asking repetitious questions that the ICU would have been asked as regular contributors to the APD national dataset. Because the participating ICUs were classified using the JFICM criteria (the national standard), the researcher could be confident that this information would be valid and accurate.[234]

The SLN questionnaire sought personal demographic data concerning age, gender, qualifications, employment classification and years in the role. There were also questions asking for identification and descriptions of ICU nurse skill-assessment systems, processes, tools, and nurse-patient allocation practices within their ICU. Some questions focused on identification of agency nurse skills and associated patient allocation practices, in order to compare differences on how agency nurse skills and employed nurse skills are determined by the SLNs. This information was provided in a range of formats including, but not limited to: descriptive and / or narrative information, electronic tools, documents/proformas, nursing dependency models, nurse competency/skill assessment tools and guidelines. The length of the predominant nursing shift (e.g. 12 hours or 8 hours or other) worked by the SLN was recorded as it may reflect an independent influence on skill matching decision-making practices. Well defined principles in the design of questionnaire format are critical. In this research, 'what to collect?' was considered just as important as 'how to collect it?'

A number of key criteria and principles should be considered to optimise a questionnaire format and all of these were adopted in this research.[213,239,240] Data collected should obtain the required data/answer to the question(s) and achieve a balance between too much and not enough. Aggravation and frustration of participants should be avoided. Each question should be constructed to obtain a single piece of information. Where additional iterative comment was warranted, this was structured separately at the end of the relevant question. Where there was likely to be more than one alternative answer to a single question (as in a number of the SLN questions), a coding scheme with associated 'look-up tables' was developed (see Appendix L).

A unique identifier, that is, a study number, was placed on every page. Taken into consideration were the following: objective measurements and Likert Scales would be used wherever possible; categories/ranges clearly stipulated (unless continuous variable required), for example 10-20%; and standard definitions used and coded wherever possible. Furthermore, data duplication should be avoided. The question format should be identical in the electronic *e* version and hard copy.[213] In terms of question structure in this research, open, closed and a combined open/closed format was used in the question structure because it enabled a variety and depth of information to be obtained.[239,240]

Application of questionnaire design elements in this research

The NUM survey ascertained ICU-specific demographic data (cross-referenced to the APD data to confirm concordance), and staffing profile data:

- Name and type of ICU (de-identified and coded by data manager);
- Type of admission casemix (i.e. cardiac, general ICU, neuro, trauma);
- Number of agency hours worked for the 2003/2004 financial year;
- Number of currently 'open' ICU beds;
- ICU bed occupancy for 2003/2004 financial year;
- *Current* total employed Full Time Equivalent nurses (FTEs);
- *Current* percentage of qualified ICU nurses (CCRNs);
- The total annual nurse labour costs spent on non-agency labour (i.e. total of FT, PPT, & Casual nurses);
- The total number of agency hours worked; and
- Number of Shift Leader Nurses on current roster.

The second questionnaire concerns data collected from the SLNs in all ICUs (see Appendix F). It contained 20 questions including 4 that had 2 parts; 'a' and 'b'. There were questions that elicited information on the decision-making processes and systems undertaken by SLNs, which involve assessing available nursing skill, and allocating nurses and their skills to patient acuity and required care in the ICU. Information on qualifications, length of ICU experience and types of shifts worked, was also sought. A 5 point Likert Scale plus an option for 'unsure' format was used for 6 questions all using identical nomenclature (for consistency and clarity purposes) in the answer options.[213,239,240] The options were: "*always*", "*often*", "*sometimes*", "*rarely*", and "*never*". *Unsure* was also included. Limitations of Likert scales are that they can be perceived to bring about forced choice. Some suggest there be an 'undecided' category to reduce the forced choice perception and *unsure* would equate to that in these 6 questions.[239,240]

Data analysis and data integrity

The starting point for computer analysis of quantitative data is data coding and entry. In addition, once the data have been entered, further checks should be made to ensure that all codes are valid and to look for any internal inconsistencies (such as a date of admission to hospital being earlier than the subject's date of birth).[213] Data integrity in this research was checked by using random checks which elicited a low query rate of < 1%. Statistical analysis would only be attempted when the data set was considered as 'clean' as possible.[213,241]

All of the quantitative data collected from the NUM and SLN questionnaires were to be analysed using statistical software: SAS version 9.1 (SAS Institute, Cary, NC, USA) in both the pilot and main study, with the exception of the content analysis of the qualitative data which would be conducted using a systematic manual approach. To summarise the data, descriptive statistical analysis were to be performed including measures of central tendency, frequency distribution, and variability. Using linear or logistic multivariate analysis as appropriate, associations would be examined between key responses and respondent characteristics. The selection of the most appropriate statistical tests would be based upon factors including whether a parametric test was justified, the levels of measurement were used, and how many groups were to be compared. A thematic content analysis would be conducted on the collected qualitative narrative data from the last 3 questions in the SLN questionnaire. Initially, basic analyses would be generated to provide an overview of the information collected and to provide a framework in which to 'summarise, organise, interpret, and communicate' the data in a numerical manner.[199] These statistics could include frequency distributions (percentages), measures of central tendency (mode, median, mean), measures of variability (range, standard deviation), and where appropriate, basic correlations (Pearson product). Parametric tests were to be applied as they use summary (parameters) characteristics such as mean and standard deviation to compare groups.[213] Some data was transformed from continuous to categorical variables.

3.10. Thematic data analysis

Where short textual narrative data was provided in response to some questions, this was to be presented with the context of the data analysis of the related question in the questionnaire. As they were likely to be brief notations, the researcher planned not perform detailed qualitative analysis, but instead to include this information in the presentation of the specific question data analysis. However, there would be three questions that required qualitative data responses and they would require a more detailed thematic analysis.

Within this study's qualitative dataset, the search for themes involved not only the discovery of commonalities across participants but also a search for natural variation.

Thematic analysis is an iterative and recursive process with more detailed classifications as required, whereby themes are ordered into a comprehensive structure reflecting the listed comments made by respondents. Throughout the sorting and resorting, the references to origin and location are be tracked to the themes revealing patterns and clusters of similar data. The clustering helps make more sense of the complex information collected. The core of the technique was iterative sorting and classification of data. The sorting brought similar information together, allowing the researcher to see relationships that are otherwise not evident. The iterative component allowed progressive refinement of structure as additional categories became evident. A theme, as defined by DeSantis and Ugarriza (2000) is:

> An abstract entity that brings meaning and identity to a current experience and its variant manifestations. As such, a theme captures and unifies the nature or basis of the experience into a meaningful whole.[242] (p.362)

Themes would emerge from the data and be developed within categories. Potential patterns in participant subsets would also be investigated. The entire dataset would be read, then a classification and indexing system created using coded broad themes which would eventually be recoded and reduced down into the key themes.[213]

A variety of procedures exist to organise, manage and analyse qualitative data. Data management files were established to keep a systematic, accurate record of the qualitative data as analysis proceeded. Although computer software is commercially available for this process, a manual method involving development of conceptual files and a subsequent content analysis on the three narrative SLN questionnaire items was chosen for this study. These files were developed in MSWord and Excel with space for making notes about the process, added to the side column.

A file was created for each potential category as they emerged, with each relevant SLN response then copied into the relevant file to create a thorough database for each theme. While labour intensive, this manual indexing allowed the researcher to gain an intimate knowledge of the available data. In addition the de-identified data was managed allowed accurate cross-checks to affirm location of raw data narrative quotations. Any direct quotes used in the analyses were managed and reported according to their relevant location within the raw dataset, represented as the Excel line item number followed by a slash, then the de-identified SLN participant number. The analysis searched for recurring regularities or themes. Codes were defined as they developed with properties assigned and notes made on their relationship to other codes. A bibliographic file kept notes and records of particularly relevant references with hyperlinks into bibliographic software (EndNote®) for easy retrieval. The data files helped the researcher work actively with the data and become very familiar with it.

3.11. Ethical Considerations

Respect for ethical codes is a requirement for all researchers involved in study involving people. Ethics and ethical principles extend to all aspects of human activity and govern interactions in the conduct of human research.[243] It was imperative that the researcher understood the complexities of privacy principles and practice and the use of information to ensure this research complied with local, state and federal regulations and legislative requirements. This ensured the ethical integrity of the study in addition to being another feature of this study's rigour.

In Australia, medical research is performed in accordance with guidelines issued by the NHMRC. The NHMRC has statutory backing and Human Research Ethics Committees (HRECs) are bound to consider research proposals in accordance with NHMRC and Australian Human Ethics Committee (AHEC)-recommended processes and procedures. These recommendations are set out in the NHMRC *National Statement on Ethical Conduct in Research Involving Humans (National Statement)* and in the NHMRC *Human Research Ethics Handbook.*[243,244]

This research was guided by both the above-mentioned *National Statement* and *The World Medical Association Declaration of Helsinki: Ethical principles for medical research involving human subjects.*[243,245] The ethical considerations for research within ICUs are complex with no single piece of encompassing legislation across Australia. Considerations also apply for research involving ICU staff, not only when involving patients in ICU research studies. This is because many ICUs are already involved in a number of concurrent clinical research studies. On the positive side ICUs usually promulgate a positive research culture which may mean they tend to be more accepting of conducting and participating in research.

Research governance issues present as a myriad of complex arrangements in legal and jurisdictional governance, in particular regarding consent and privacy. With the finite number of Australian Level III ICUs and staff sensitive to their limitations in the number of studies they can concurrently commit to, the researcher notified the ICUs 3 months in advance of this study. This forewarning and designated timing of the study was a strategy to maximise recruitment opportunities. From an ethics perspective, although this research was not an interventional study, the researcher needed to be mindful of the potential burden placed on participating ICUs. It also added weight to the decision to choose an *e* approach as the preferred mode of delivery as the researcher believed this could optimise the response rate when combined with a hard copy option.

Application of ethical principles in this research

In this research, the researcher recognised that the purpose of ethical principles and guidelines is twofold, as with any research involving humans:

- Protection of the rights and welfare of research participants.
- Facilitation of research that is designed to contribute to knowledge, and be of benefit to the researcher's community and/or to humankind.

Respect for person's states that individuals should be treated as autonomous agents; and that individuals with diminished autonomy are entitled to protection. In this study, individual nurses are treated as autonomous agents contributing knowledge on a voluntary basis free of any coercion.

Beneficence is the principle that it is ethical to act in a way that secures the well-being of another person; which incorporates the two actions of doing no harm, and maximising possible benefits while minimising possible harms. In this study, there was no conceivable risk of harm to the participants.

Justice requires that there is a fair distribution of the benefits and burdens of participation in research within a population; and for any given participant, a balance of burdens and benefits. In this study, there are no risks to participants. The duration of time being demanded of the nurses and participating ICUs was not considered onerous and an approximation of this time was included in the consent form.

Integrity, described as the "guiding value", requires that the researcher be committed to the search for knowledge and to the principles of ethical research, conduct, and results dissemination. In this study, the researcher's integrity is demonstrated by her clinical, management, academic history and background knowledge of the research question topic.

In the researcher's submission to the relevant Human Research Ethics Committees, the researcher ensured ethical integrity and followed guidelines to: find the relevant HREC(s), submit on time, submit in the correct format, submit a team effort, submit with good science, submit with careful attention to consent and participant information, submit comprehensive information, and ask for help.[243,246,247]

Ethics approval

Both the University of Adelaide Department of Clinical Nursing Research and Higher Degrees (RAHDS) Committee, and the Royal Adelaide Hospital Research Ethics Committee granted initial approval (See Appendix G). No other hospitals requested ethics approval but two hospitals asked the researcher to send a letter to their hospital executive team seeking permission for release of data. One was granted by letter and the other by email (see Appendix H. Criteria for ethical approval in multi-centre studies varies widely as does the associated debate. Because of the inherent interpretative nature of the *National Statement*, coupled with the self-regulating position of HRECs, it is not uncommon to find disparate opinion between ethics committees that may result in approval by some but not by others. This phenomenon is not exclusive to Australia or NZ and is well noted in the UK and Canada.[247] NHMRC and AHEC believe it is the responsibility of individual HRECs to make approval decisions independently, or elect to accept another HREC's approval and conduct an 'expedited review'.[243]

When is ethics approval required?

It was important in this research for the researcher to understand when ethics approval is required particularly given the multi-centre approach. If ethics approval had been required from the Ethics Committee of each individual site it is likely that the study would not have been able to be conducted within the time, scope and resources of the researcher. The *National Statement* suggests it is the responsibility of each institution to develop criteria to classify which of its activities are reviewable by an HREC and which are not.[243] To assist researchers and HREC members as to when ethical review is warranted, the NHMRC sought broad consultation and published a guiding document: *When does quality assurance require independent ethical review*?[248] In this guide, a process of asking 9 specific questions is recommended to inform decision-making regarding whether an ethical review is required. If *all* 9 questions are answered in the negative, no HREC consideration is required. If one or possibly two are answered 'yes', then the proposal may only require expedited review. If yes is answered to a number of questions, a full review is usually warranted. Using these guidelines, when these 9 questions were applied to this study, no ethical review was warranted. The researcher, however, accepted that there may have been some institutions that would request a full review. None did so however one ICU would only participate if approval was granted by their Director of Nursing (see Appendix H).

Privacy

Alignment between health service provider needs and expectations, and those of the consumer about what will be done with personal information, is the guiding principle here. In health and medical research, sensitive information may be required to be collected from patients and staff to answer specific research questions in the interests of research into health improvement.[249] Both private and public hospital ICUs were included in this research, hence an understanding of privacy legislation was considered important.[250] However because there was no personal health information sourced the privacy issues related to the staff in the participating institutions and their individual consent.

Confidentiality

Personal information data identification

Where identifiers may be needed initially for participant linkages, the data must be de-identified as soon as possible while still allowing the aims of the project to be achieved. If the information needs to be re-identified in the future, any codes should be stored securely and separately from study data and the data are referred to as 'potentially identifiable (coded, re-identifiable)'. Where identifiers are removed permanently, these data are referred to as 'de-identified (not re-identifiable, anonymous)'.[247] Ethical checklists are considered useful for researchers to assist with submission to HRECs. This ensures that a rigorous approach has been used and ensures all information is available within the submitted proposal. In this research, such an ethical checklist was followed prior to submission to the two HRECs.[246,251]

This study involved no patient intervention and all personal information was confidentiality maintained, de-identified, and blinded to the researcher. Participation in this study was voluntary. All questionnaires were individually coded. It was imperative to demonstrate to the researcher's attention to detail in the confidentiality aspect of the participants data handling, especially as some of the narrative comments were likely to be sensitive. It was equally important to the richness of the data that the participants felt comfortable with the confidentiality process and would therefore be more likely to comment anonymously.

Confidentiality of sensitive data

When using surveys to collect data, researchers use a number of techniques to increase honest answers to questions about sensitive topics.[240,243] In this study this related to questions regarding specific staffing problem experiences, which may be considered sensitive in nature. One technique is to establish a comfortable setting before asking the questions. This was done in this study by detailed information given to all potential participants regarding data confidentiality and how their answers would be protected, used and or disclosed. The use of individual password codes to access the study questionnaires was a reassurance that identity would be protected. In addition, the data was managed by an external professional data management group and therefore participants were reassured their individual answers were blinded to the researcher. NUMs were asked to display the pre-paid envelope so that staff could place their stapled questionnaire directly.

The questioning format affects how respondents answer questions. Studies show that survey formats permitting greater respondent anonymity such as self-administered questionnaires or web-based surveys (as was used in this study), increase the likelihood of honest responses over other formats that involve personal interaction with another individual, for example face-to-face or telephone interviews.[240,249,252]

Consent

Participation was on the basis of informed consent. It was explained to all participants in the cover letter that their consent was given by choosing to return the questionnaire. Each staff member used the personal code allocated when returning the questionnaire (see Appendix Q). These codes were distributed in a small sealed envelope by the ICU nurse managers who had been asked to identify which nurses perform shift leadership duties in their ICU. On the card within the envelope were the researcher's contact details and the web-based platform manager should the participant have any queries. They were given an opportunity to discuss the study with someone external to the study such as a friend, relative, or the chairperson of the ethics committee. Written consent from the ANZICS Adult Patient Database was obtained to access demographic data about Level III ICUs in Australia[38] (see Appendix I).

Participant information

To ensure that participating ICUs were informed before they chose whether to participate, two forms of participant information sheet were distributed. Firstly, a more detailed sheet about the study; and secondly, a brief 'flyer' type document with an abridged version (see Appendix J). This was done to provide broad coverage in all ICUs as some were likely to want more information/detail, and others less and short and succinct sufficed. Both achieved the purpose of informing them of the nature and purpose of ICSMS and their involvement. It also provided assurances that their information was not identifiable to the researcher. Participants were informed that they could have withdrawn from the study at any time, although for practical purposes this would likely mean that the questionnaire was not completed and / or submitted. The researcher's name and contact details were provided in case further information or feedback was required.

Data storage and protection

All hard copy data were collected and stored in a locked filing cabinet in the University of Adelaide's Department of Public Health Data Management Analysis Unit (DMAC) manager's office. It will be kept here for 5 years. *The Joint NHMRC and AVCC Statement and Guidelines on Research Practice (1997)* recommend a minimum of 5 years from publication date, and a minimum of 15 years for data derived from clinical research.[253] Electronic data was stored with password protection by DMAC.

3.12. Synopsis of the research design

A synopsis of the research design chapter so far is provided here before the next section provides a detailed discussion of the implementation and conduct phases of the research. The theoretical and conceptual underpinning of a triangulated research design for this research has been discussed including rationale, advantages, disadvantages and principles of its application. This predominantly quantitative study sits within a positivist paradigm using survey as the method, underpinned by data source and data method triangulation. The survey consisted of two questionnaires completed by participating NUMs and SLNs in Level III Australian ICUs in the public and private sectors. These were delivered using both an innovative purpose-built electronic web-based platform, and via mailed hard copy using identically constructed versions. This optimised the response rate.

The questionnaires contained both quantitative and qualitative data. Computer software analysis was performed on the quantitative data and the qualitative data was managed and analysed using a manual systematic process. The ethical considerations involved in design of any research involving people required a comprehensive understanding and was paramount to inform the direction, structure and rigour of the research. These important ethical principles and how they were applied have been articulated.

The next section of this chapter presents the application of the research design: the method of survey underpinned by triangulation, in its detailed implementation phases of the research incorporating the specific steps of the research conduct.

3.13. Research Conduct

Application of the research method: implementation and conduct

This section describes in detail the research method implementation used in this study. To illustrate and emphasize the important role of the web-based delivery and data management platform, this section of the chapter includes a number of key images from the web-based communication platform. This will assist the reader in visualising the practical aspects of the design and conduct of the research. Included is a Summary ICSMS Flow Chart that illustrates the study implementation phases (see Appendix K).

Recruitment Phases

This sub-section focuses on the management of the recruitment process. For the purposes of this study, only Level III ICUs were invited to participate because these ICUs provide the most complex intensive care service delivery, use the most nursing labour, and have common attributes and patient casemix. This provided a homogenous setting for the study and therefore provided potential for generalisability across public and private sectors.

There were three phases to the recruitment process. In *Phase One* a formal application was made to the Australian and New Zealand Intensive Care Society (ANZICS) to access the Adult Patient Database (APD) to obtain demographic data and contact details of all Australian Level III ICUs. This required completion of an application form including information on how the data was to be used, which had to align with their policy information on use and disclosure of their owned data. A small administration fee of $22 was paid (see Appendix I). The data was forwarded by ANZICS in a timely manner to the researcher as requested in an Excel spreadsheet and contained all 58 ICUs and their contact details. Although these contact details are in the public domain as they are listed hospitals, the researcher would not have been able to ascertain (independently of ANZICS) which hospitals had Level III ICUs.

Once the researcher had the contact data, *Phase Two* commenced. Early telephone contact was made to each and every Level III ICU Nurse Unit Manager in November 2004. The purpose was twofold: first, to introduce the researcher; and second, to outline the nature and purpose of the study and inviting them to participate in the study. This was done to raise the study's existence and profile early and permission for subsequent follow-up contact by electronic mail was sought at the same time. In addition, the email contacts and clarification of the correct syntax were confirmed at this time which was paramount. *Phase Two* was completed in November 2004 and the final participant database of 58 ICUs was finalised. The final recruitment phase was *Phase Three* and this consisted of follow-up contact by letter and email to the ICU Nurse Unit Managers with a written explanation of the nature and purpose of the study. It also provided them with a participant information sheet and individual codes to access the web-based system. This provided more detail on the study involvement, expectations and time commitment required if they chose to participate. Each NUM was asked to identify SLNs in their ICU. When the study commenced, the SLNs would be asked to answer Questionnaire 2, which specifically related to shift leader decision-making about staffing (see Appendix K).

Building the web-enabled platform to facilitate the e delivery mode

A number of issues were considered in the decision-making process regarding required data management. They included: accuracy, speed, initial costs, ongoing costs, security, flexibility, and regulatory considerations. Mindful of the various advantages and disadvantages described, an on-line electronic web-enabled delivery platform was considered to be the best option. The University of Adelaide Department of Public Health Data Management and Analysis Centre (DMAC), which has expertise in managing large data collections, managed the data. Because DMAC is an external experienced data management group, the potential bias was reduced.

Simplicity in design, delivery and operation of the platform was critical to this study. Credibility and profile of the researcher was also deemed an important factor to demonstrate the researcher's integrity.[243]

In addition, to give added credibility, an identity, and contemporary relevance, a small photo of an ICU nurse at the bedside showing a ventilator formed the study banner/logo/identity as its Intensive Care Nurse Skill Matching Study (ICSMS) national identity. It was also intended to create a level of comfort, integrity, and association for ICU nurses, as it represented a common symbolic picture of an ICU nurse's attentive bedside presence (particularly using one of the latest model ventilators in the picture/graphic). It was hoped that these intentions were achieved and although unable to be measured, there was an ICU participation response rate of 86.29% in the study which was considered a positive outcome.

This banner formed the heading of the title web-page and in associated study flyers and correspondence as it was important that it became synonymous with the National Intensive Care Nurse Skill Matching Study (ICSMS). The only other graphic was the University of Adelaide's logo, which was intended to add integrity in that most university-supported research goes through significant rigorous processes, and reinforced the well-designed and credible nature of this study to potential participants.

Technological specifications of the web-enabled platform

The ICSMS website was built using a combination of technologies to optimise content delivery, interactivity and data integrity. Data was stored and accessed using Microsoft SQL Server 2000. The site was driven by HTML and Java, using both Java Server Pages (JSP) and Class/Servlet technology. An ODBC database with Microsoft Access front end was created to collect and store data. Web-based and subsequent follow-up mail-back options were utilised to allow maximum flexibility in responses. Quantitative and qualitative data were collected from the two data instruments that were linked into the site. Descriptive analyses were performed using SAS V9.1 (SAS Institute Inc., Cary, NC, USA) in both the pilot and main study.

The researcher allocated time and consideration to the development of the NUM and SLN survey questionnaires. Their development occurred over a two month period (October/November, 2004) with advice sought from experienced senior biostatistics and information technology personnel who had significant expertise in survey design and construction. This assistance was invaluable and was aligned in the design subsequent application of the data collection instruments into the building of the web-enabled platform.

Functionality of the web-enabled platform incorporated the following: The initial automated email to the NUMs included a 'welcome' and 'appreciation of their participation' message, a brief overview of the purpose of the study, and clear succinct instructions for the participant (the NUM in the first instance). Individual usernames and passwords with a facility to allow 30 minutes to answer the questionnaire before it would be automatically timed out. This allowed for the possibility that the NUM may either: a) be called away, or b) have to go elsewhere seeking information to answer some questions (possibly Q4 and Q5). Once the questionnaire was '*submitted*' and then the answers *'confirmed by a green tick on screen'* it could not be redone by that user. This provided added protection and rigour to the data in that no one else could submit under another user's log-in. An asterisk was attached to the questions requiring specific number answers rather than the drop-down format of categorical choices that were part of the other questions. A prompt came up on the screen in the event a participant had omitted answering any questions or if their answers were incomplete. The prompt specified where the omissions were and directed the user to return and complete them, then *submit* again.

The researcher was mindful of the potential access restrictions regarding Intellectual Property (IP) protection at hospital IT systems. It was impossible to forecast if and how any restrictions (firewalls, etc.) might impact on this research. In fact this did present some difficulty as the research process unfolded. This was, however, adequately addressed by the subsequent follow-up of a hard copy/paper-based mode of delivery with identical questions to those on the web-based platform (see Appendix F).

Instructions to web users within the platform

A number of instructions were given as the participant moved through the web-based platform. There were: *page-specific* instructions; simple *how to respond* instructions; *what to do if information is unavailable; what to do next; use of prompts*. The problem of too many instructions was avoided by using clear, simple and plain language consistently. Instructions were couched in the positive rather than negative as a form of positive encouragement and feedback during the process. There may be some participants whose computer literacy skills were limited and this was taken into account during all the design and implementation phases.

Data Management

Data storage / protection

Attention to detail was addressed in every aspect of the data management phase, including security and stable storage. This included the use of version numbers to facilitate tracking, and master copies of data collection instruments being securely stored. Identifying information was kept separate with DMAC. Database information included explanations of files, format and data dictionary listing variables, variable names, and coding rules were created, filed and safely stored (see Appendix Q).

Database management strategies

All respondents were given personal access codes and this prevented anyone from answering the surveys more than once. This was because in the web-based system, a block was built into the system that automatically prevented site access once it had already been answered once. Access was timed with 30 minutes allowed to complete the questionnaire. If it was not completed in that time, say, the NUM had to do other tasks, it would *log off* after 30 minutes but allow access again at any time to return to complete the questionnaire(s). A detailed research conduct sequence is presented further into this chapter including copies of web page graphics to make it easier for the reader to follow.

Coding records and a data log were created to record modifications, and data cleaning (see Appendix L). Data cleaning involves consistency checks being done, including query resolution. The database was backed up on one of the large university servers and locked for final analysis once the cleaning and query resolution were completed. The codes were entered into the data file within a statistical analytic software program SAS V9.1 (SAS Institute Inc., Cary, NC, USA). It was recommended that where possible that a coding scheme should consist of numbers rather than alphabetical characters, and this was achieved in the coding scheme. It is also useful to establish and adhere to all the possible responses and have a code assigned to each. The specific logistical and operational detail of the questionnaire including distribution and delivery is discussed later in this chapter. Statistical analysis was undertaken using a variety of statistical tests depending on the measurement scales of the data, distribution of variables and stratification requirements. Further detail of this process is shown in Chapter 4.

Pilot of the data collection instrument and web-based platform

A key element of the questionnaire was the need to pilot both it and the web-enabled communication system before commencing the national study. As mentioned earlier, pilots are considered a sign of a study's rigour in that it allows the tool, sample and logistics to be tested with any subsequent modifications able to be made without affecting the primary study.[213,240] For the pilot a single Australian state was chosen because it was the researcher's place of residence. Ease of participant identification (so as to avoid contamination of the main study) and timeliness made this feasible. This was also considered representative of the Level III ICU sample as the selected pilot participants had recently worked in such an environment. The pilot sample was selected so as not to contaminate the recruitment of participants by using experienced critical care RNs and ex-ICU nurse managers but who were no longer working in ICU. The researcher also believed that the pilot participants would provide internal validity, constructive critical comment on both the question content and construction of the pilot instruments. Another goal was also to test both modes of delivery; the dedicated web-enabled platform (interfaced with the study database); and the hard copy printed versions of the identical questions. Furthermore, the researcher aimed to evaluate the readability, content, understanding of the questions, time taken to completion, and whether the pilot participant concurred with the researcher in understanding and eliciting the required information.

The SLN pilot participants were a small sample of experienced critical care qualified nurses (CCRNs) with more than 5 years' experience in Level III ICUs within the preceding 12 months but who were no longer employed in one. The NUM pilot participants were those CCRNs who had also worked as NUMs even if only in an acting capacity. These participants were viewed as having enough knowledge and understanding of the question content and able to answer the survey questions. They were identified through personal knowledge by the researcher of those CCRNs who fulfilled these criteria. All pilot participants were personally contacted by telephone and verbal consent to participate was gained. Since the pilot participants could not be linked to a specific NUM because they all no longer worked in an ICU (although this could be done in the full survey), the initial email contact containing dedicated username and log-in codes was undertaken by the data management personnel to each NUM and SLN. The researcher's strong background in intensive care provided good insights into the best approach on how to maximise involvement in this research. Given the busy and diverse workload of ICU managers and clinicians and therefore significant demands on their time, the design, promotion, recruitment needs and delivery of the study tools had to be undertaken and completed in good time.

The pilot was conducted over a two-week period. There were 6 NUMs and 5 SLNs who participated. This was considered reasonable in the interests of resource constraints and timeliness of the study scope. Because both the hard copy format and electronic (web-enabled) submission options were piloted, additional information on the submission format could be ascertained. Pilot participants were given a brief *'Study Information Sheet'* attached as a Word document in the contact email. Feedback was also sought as to the usefulness of this text. The two questionnaires were piloted for reasons of timeliness, practicality and to ascertain if the answers reflected the information being sought. The hard copy questionnaires were identical in question content and were distributed in person by the researcher with a request to provide a rapid response.

Pilot analysis

Data from the pilot were analysed using SAS software. This included brief descriptive analysis and a thematic analysis of some questions. The database within the platform provided unformatted data with associated look-up tables to allow data analysis using statistical software. The pilot results identified intensive care nurse skill assessment criteria and systems, patient acuity assessment, and skill-matching practices in ICU, including systems to quantify agency nurse skill level. Results demonstrated positive outcomes in participant anonymity and security, functionality, timeliness of data entry and analysis, clarity of questions, ease of point-of-access, and ability for both electronic and hard copy data submission.

Following the pilot evaluation, the following modifications were made:

- an increase in size of the "log-out" icon;
- an increase in spaces for number data entry in Questions 6 and 7 to accommodate up to seven figure sums for 'nursing hours';
- clarity of number/letter allocation in allocated log-in username/codes;
- clarification and amendments to NUM database contact details;
- personalised emails within generic NUM email notices;
- additional question (Q.10) included in NUM survey regarding number of SLNs on current roster;
- addition of some text/comment boxes under some questions to seek further data;
- removal of some data 'choices' in drop-down cases for some questions deemed not relevant or useful; and
- minor rewording of some questions to improve clarity.

The final version of the modified web-enabled communication platform and data collection questionnaires for the ICSMS was shaped by pilot conduct and data analysis. ICSMS commenced shortly afterwards in March 2005.

All 58 ICU NUMs said during the researcher's initial telephone contact that they anticipated that most staff could and would access the Internet within their ICUs in order to respond electronically to the survey. An option of data collection via printed hard copy was made available if the NUM reported difficulty with Internet access. In the event of this occurring the hard copies were posted in express postal envelopes (and included a pre-paid return express envelope) directly to DMAC with data entry conducted by two senior staff members with over 10 years experience in data entry.

Study implementation

Figure 3 below is a National Intensive Care Skill Matching Study (ICSMS Flow Chart) that summarises the study.

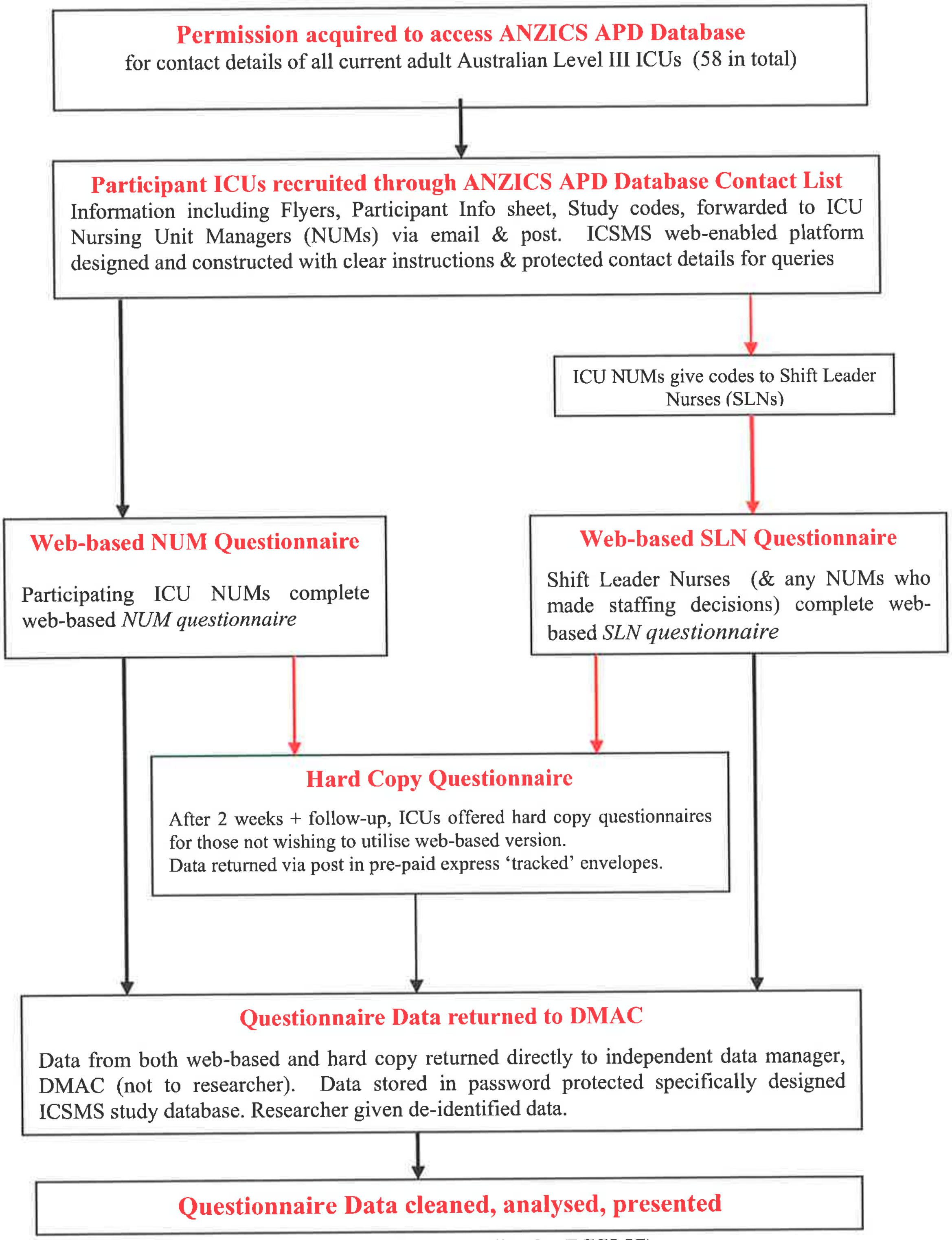
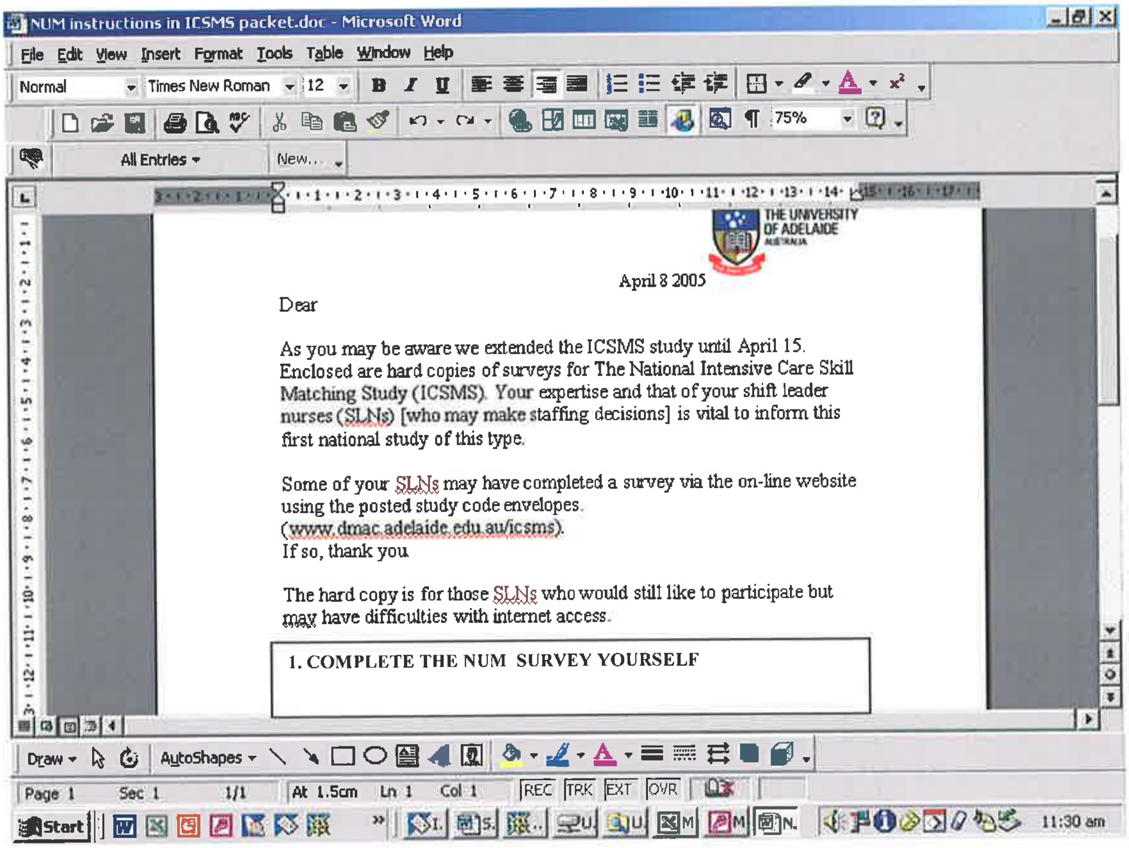


Figure 3-1 National Intensive Care Skill Matching Study (ICSMS)

Study conduct in detail

The following section includes graphic copies of the exact 'screen dumps' from the website with accompanying explanations describe the step-by-step implementation. It illustrates both the look, format and some of the key design elements of the web-based system and process and enables the reader to follow the path of a research participant in the ICSMS study.



THE UNIVERSITY OF ADELAIDE AUSTRALIA

April 8 2005

Dear

As you may be aware we extended the ICSMS study until April 15. Enclosed are hard copies of surveys for The National Intensive Care Skill Matching Study (ICSMS). Your expertise and that of your shift leader nurses (SLNs) [who may make staffing decisions] is vital to inform this first national study of this type.

Some of your SLNs may have completed a survey via the on-line website using the posted study code envelopes. (www.dmac.adelaide.edu.au/icsms). If so, thank you

The hard copy is for those SLNs who would still like to participate but may have difficulties with internet access.

1. COMPLETE THE NUM SURVEY YOURSELF

Figure 3-2 Example of correspondence sent to each participating ICU

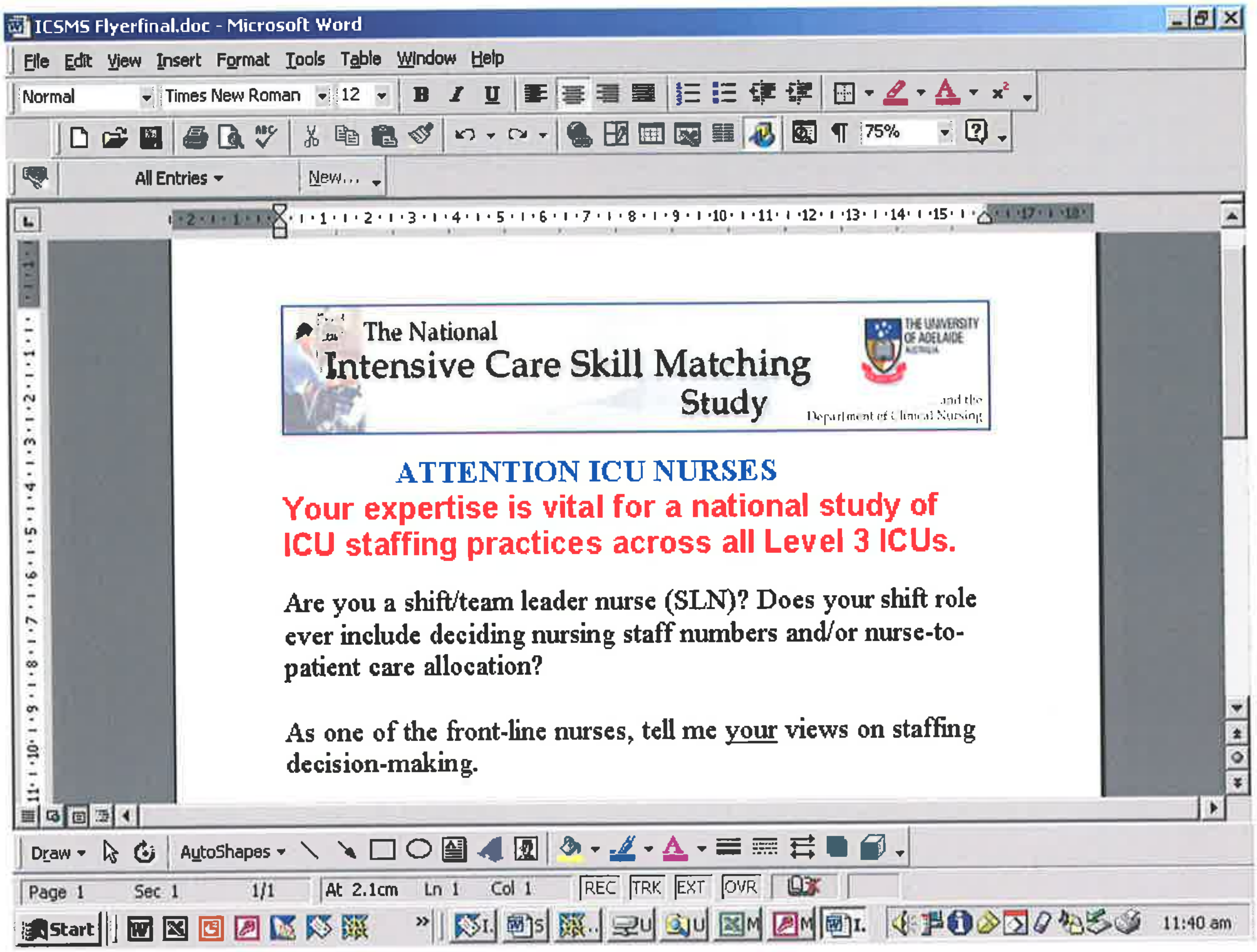


Figure 3-3 Study 'flyer' to recruit ICU shift leader nurses

Figures 3-2 and 3-3 shows correspondence forwarded by both post and email (see also Appendix J).

Each participating ICU was sent an email and directed to the ICSMS website and Front Page. A welcome message and detailed instructions were provided before respondents answered the questionnaire(s). Below in Figure 3-4 is a pilot example, hence the researcher's name in this instance.

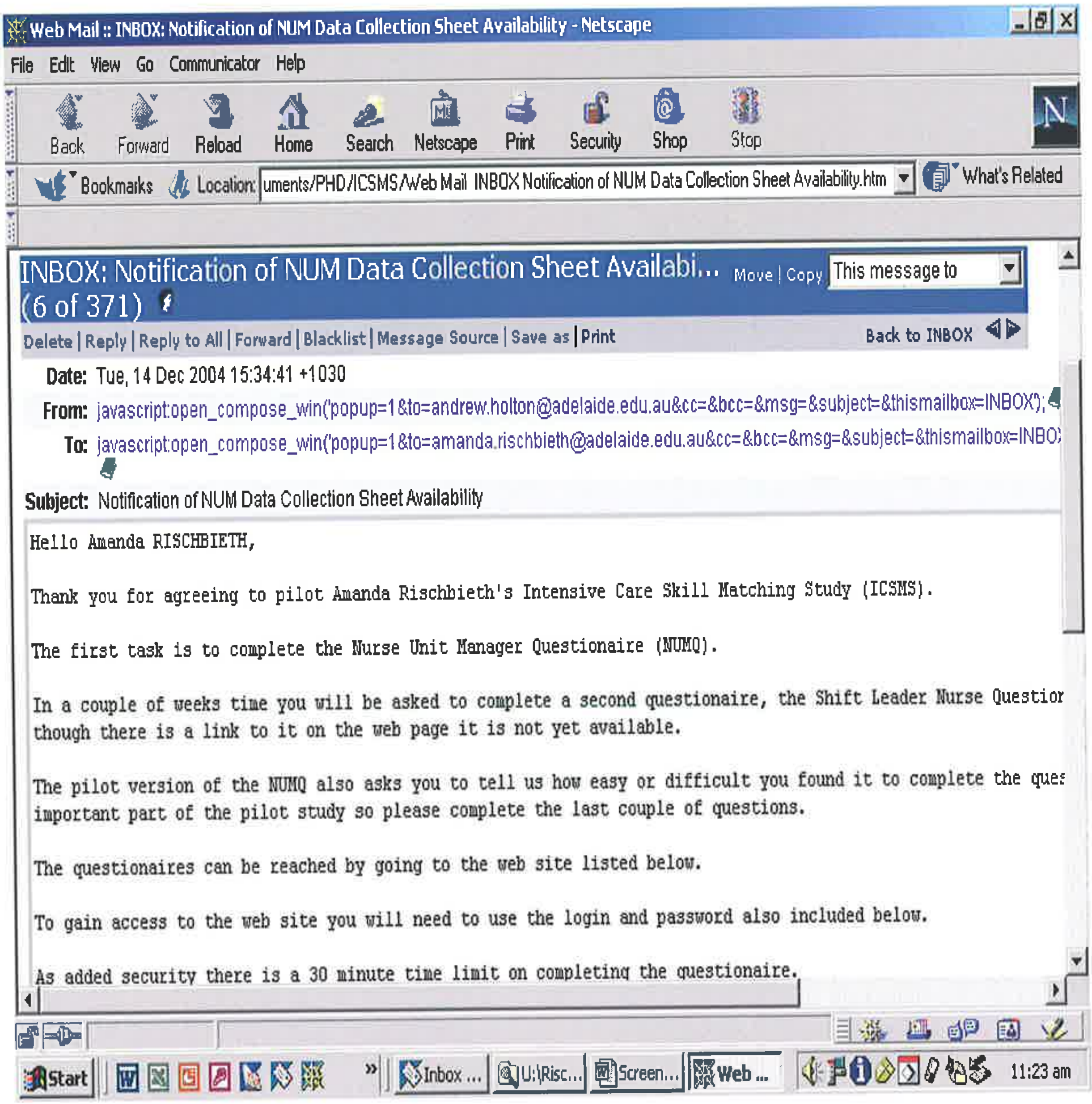


Figure 3-4 Pilot example of Welcome Message and Instructions

All ICUs received individual codes and as many as required. NUMs were asked to give code cards (each sealed in an individual envelope) to the SLNs. The 'code cards' contained a website ICSMS access code and the researcher's contact details should queries arise. For generic queries about the study the researcher answered these promptly. For specific questions concerning the web-enabled system, participants were given direct contact to the DMAC website advisor. Below in Figure 3-5 is an example of some SLN ICSMS codes to demonstrate that they were not identifiable (see example of a code-card distributed to potential participants) (see Appendix Q).

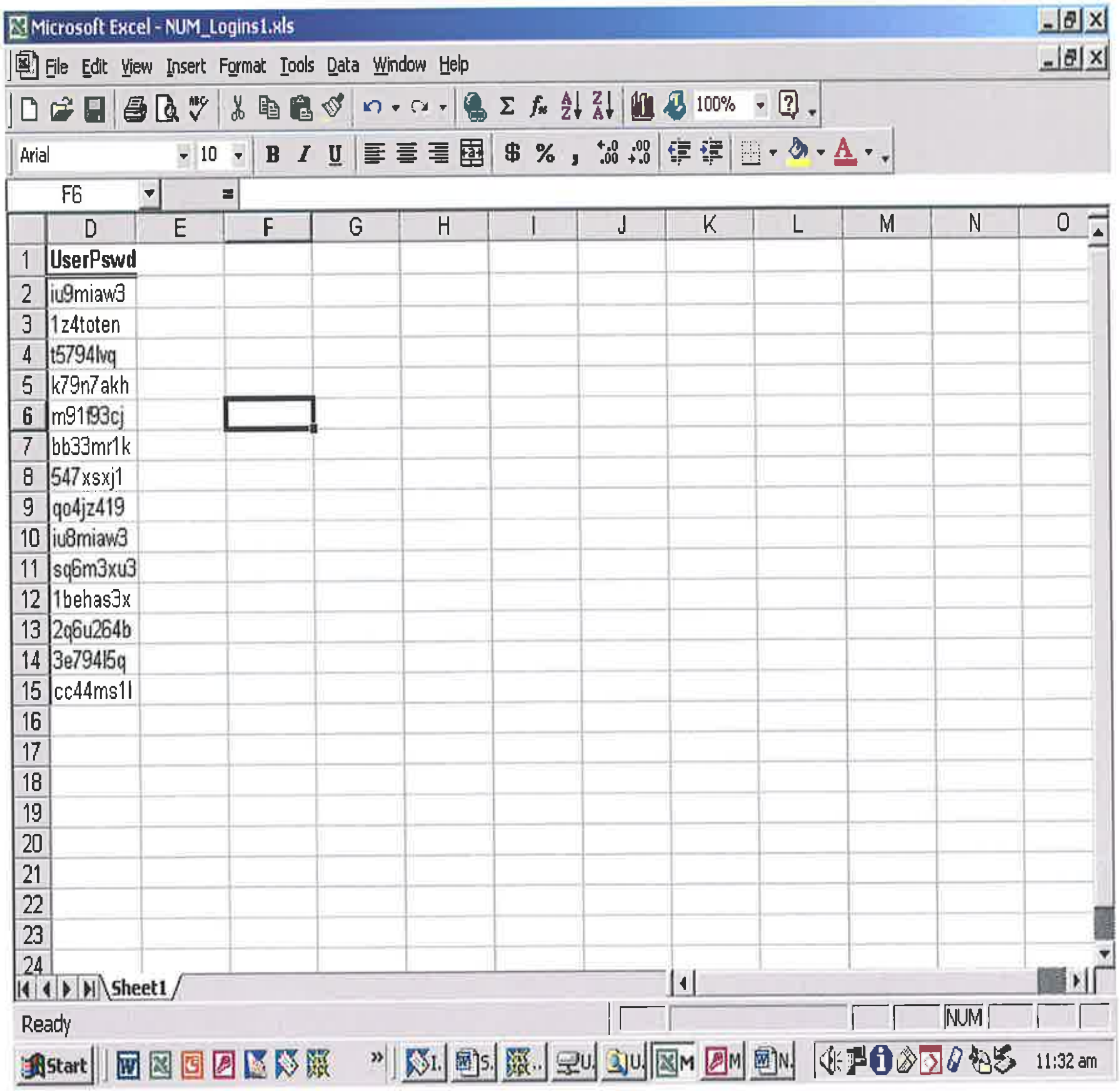


Figure 3-5 Examples of SLN ICSMS codes

Once at the ICSMS website Front Page, there was simple but important information. In addition to clearly showing where to 'log-in', there was a note regarding the most appropriate and relevant Internet browser versions to ensure the site's smooth functionality. Those participants who may not have had a browser option were offered a hard copy questionnaire delivery option. At the top of the page was the website ‘banner’ designed to give a simple and credible identity to the study, while the DMAC was acknowledged at the bottom of the page, as shown in Figure 3-6 and 3-7. This reminded participants that this was a national study and may have had some degree of impact on response rate.

Figure 3-6 ICSMS Banner

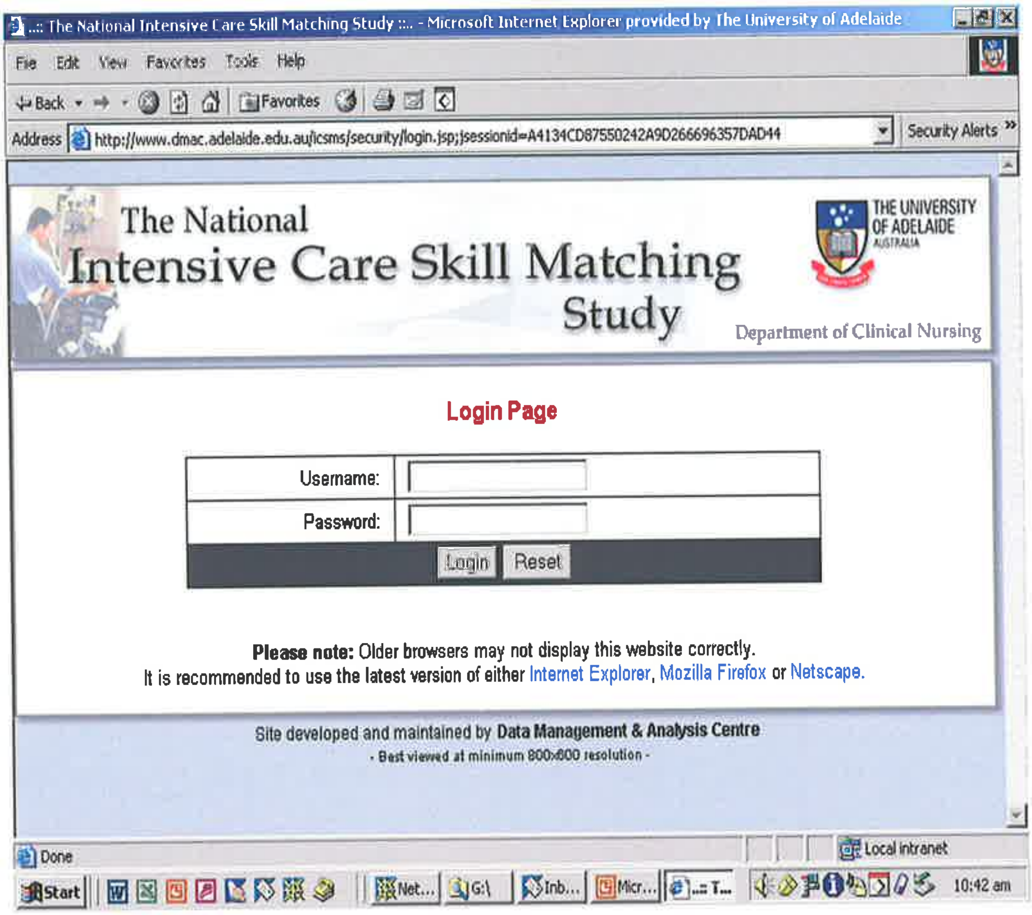


Figure 3-7 ICSMS Log-in Page

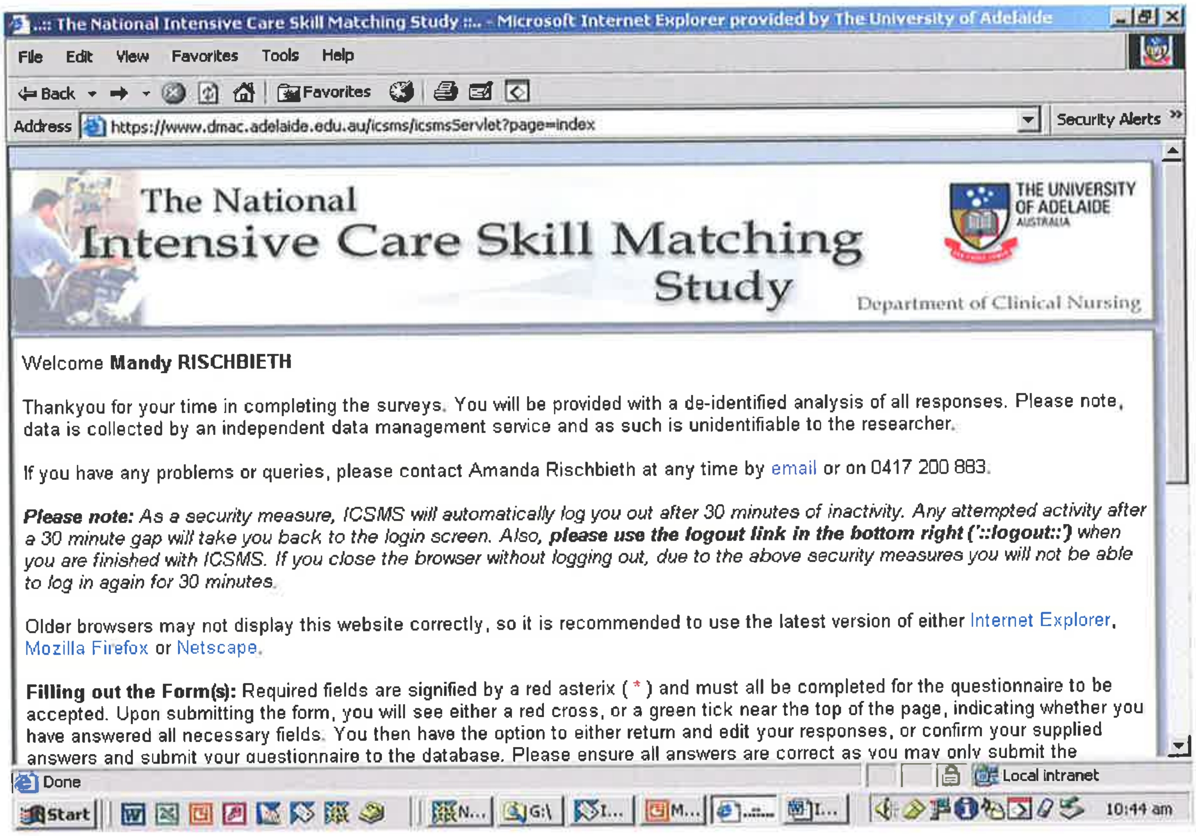


Figure 3-8 Welcome Message and Instructions once logged in

Once logged in to the ICSMS site, a welcome message was displayed followed by simple, clear instructions on how to proceed. In addition, there was another reminder of the researcher's contact details and an important statement about a 'time-out' feature as well as an instruction to actively 'log-out' once the questionnaire was complete. This was required so that the site was not overwhelmed by users at the one time and hence became more manageable. The purpose of this design function was to allow enough time to complete the questionnaire (30 minutes) but that should the participant get called away to another task, the site would automatically log them out. This did not preclude them from revisiting the site at a later time as their code was 're-usable' only when the questionnaire was 'completed', 'submitted' and 'accepted'. The immediate 10 minutes after a 'log-out' marked a period where a log-in could not reoccur and this was purely a design security feature.

The lower section of the Welcome page presented instructions regarding answering the questions in the two data collection sheets and emphasised that questions marked with a red asterisk (*), required a definitive data entry/answer. 'User' and 'Hospital' details were displayed but were only sighted by the individual respondent once their code had been entered. A brightly coloured blue 'log-out' icon was displayed to facilitate the correct log-out process.

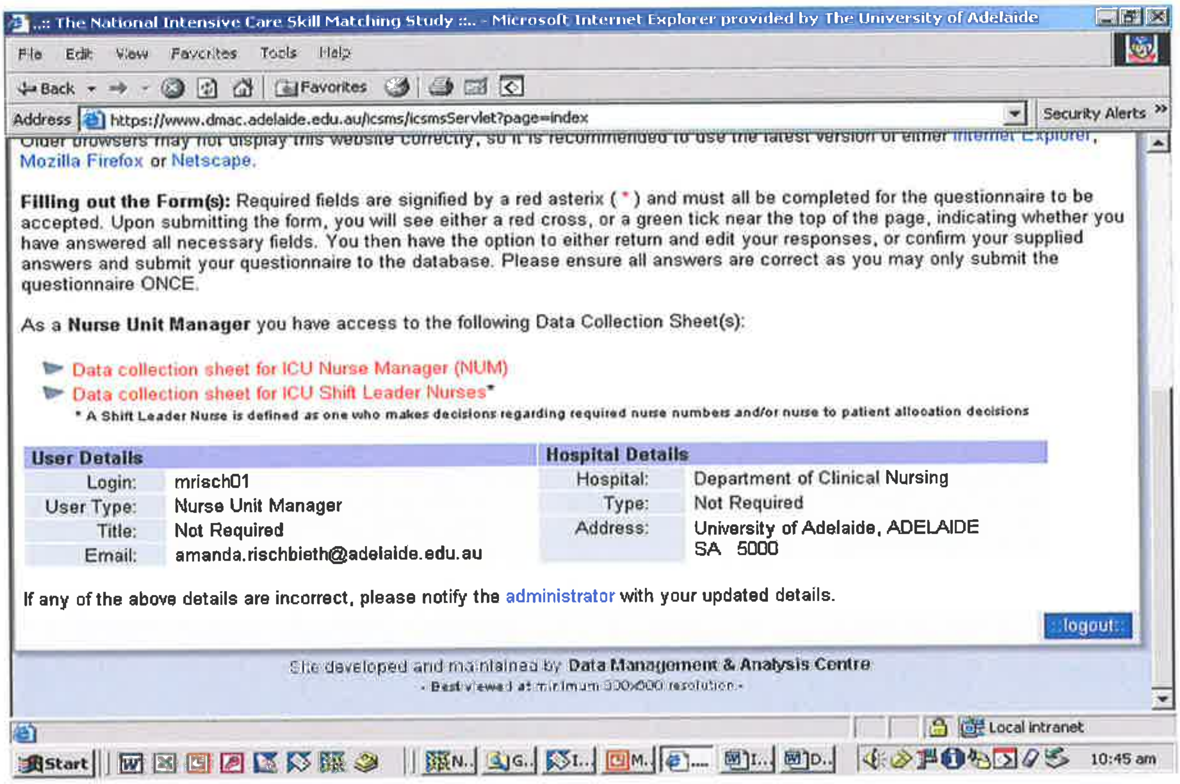


Figure 3-9 Log Out

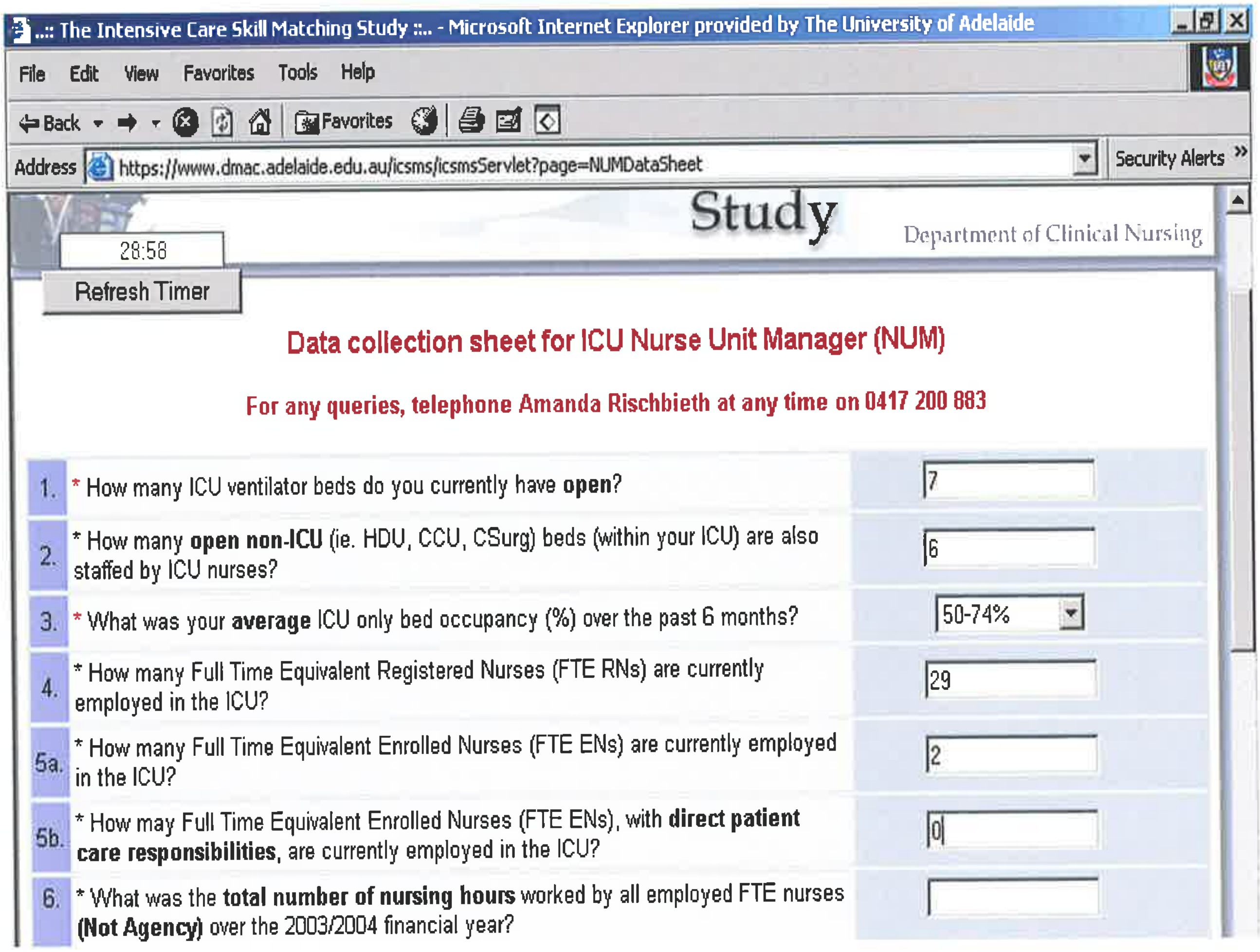


Figure 3-10 NUM Data Collection Sheet Page containing the NUM

Red asterisks can be seen in Figure 3-11 Drop-down answer selection was made available for a number of questions, particularly for categorical data (see also look-up tables that correlated with these). Once again the researcher's contact was readily available. In the top far left hand corner, a 'timer' was displayed. This showed the run down of the clock from a 30 minute start (a security measure). The second half of the same page (as the person scrolled down) shows that the timer remains within sight as the last questions are answered. Three simple clear choices are then given: '*Submit*', '*Reset*' or '*Clear Answers*'. The other alternative was to 'log-out' by pressing the blue icon, for example, if the respondent had to go elsewhere and was not in a position to check through answers and '*Submit*' then and there (see below).

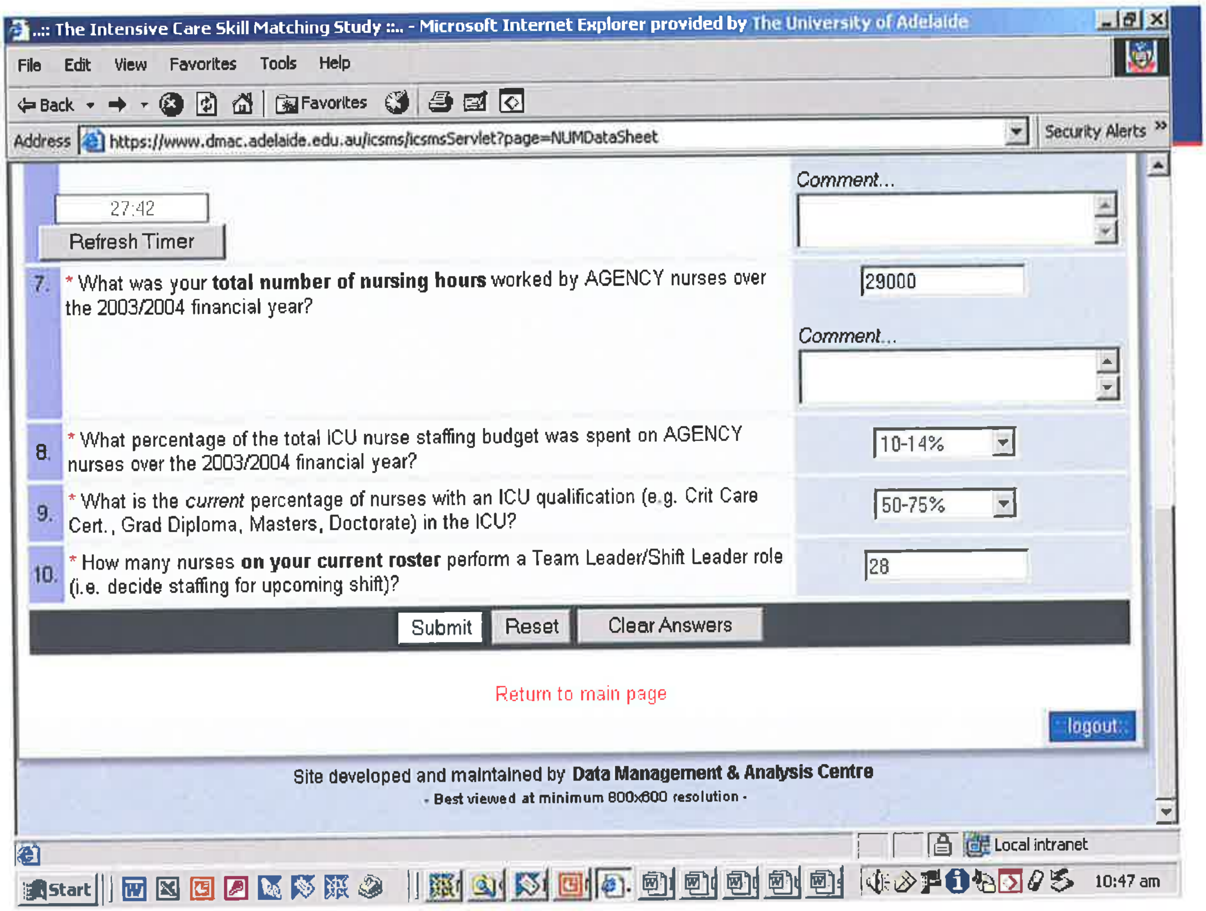


Figure 3-11 Lower Half of NUM Data Collection Web-page

Once the Submit icon was pressed the next page would appear with the answers all in red for the respondent to check through. If a participant noticed an error in their data entry, the '*Edit Responses*' icon could be pressed so that an answer could be corrected. If the respondent was happy with the answers, the '*Confirm*' icon was pressed.

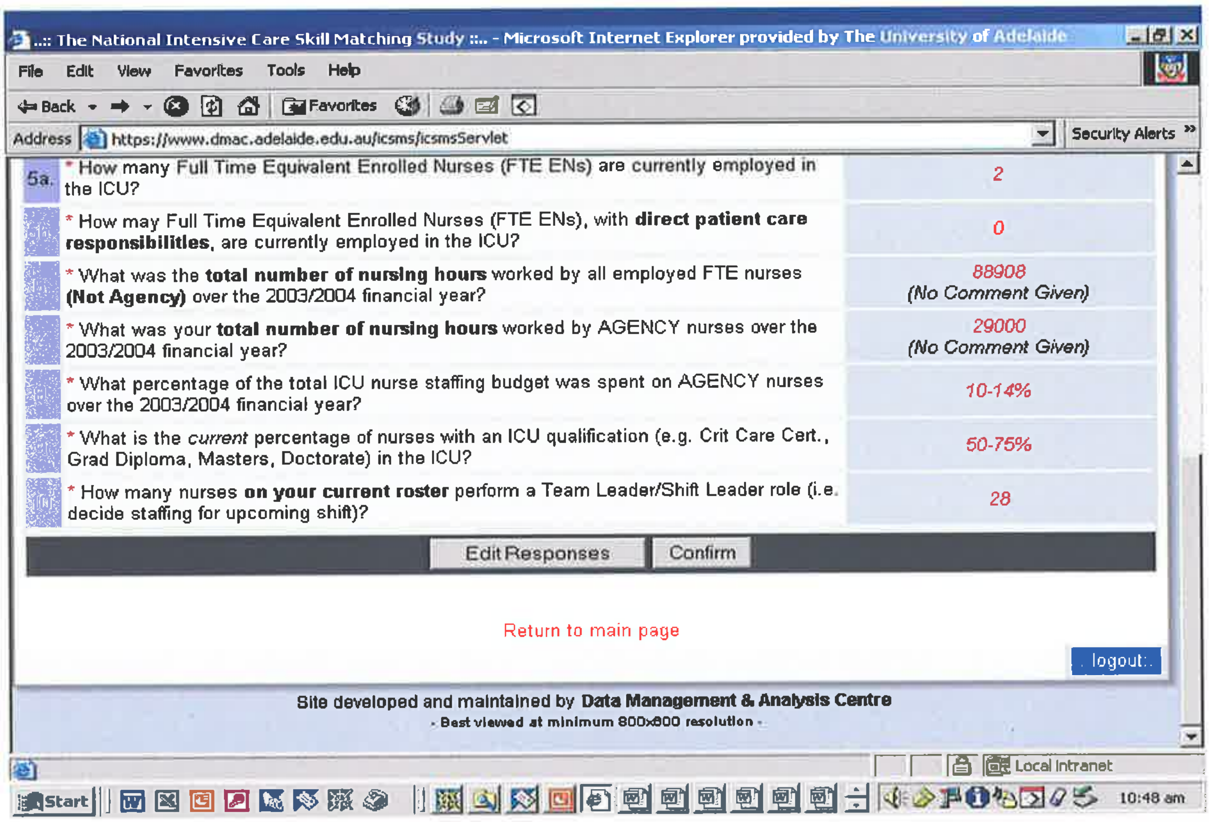


Figure 3-12 Final data Check/Edit Opportunity

Once the '*Confirm*' icon was pressed, the next page to appear was a confirmation page with a large Green tick and a thank you. If an error was noted or a field was missing, for example, the same page appeared but with a red X, a request to return and complete the missing fields was automatically displayed. Any such missing data was specified so that the respondent did not have to go through the entire data sheet, only those questions needing review.

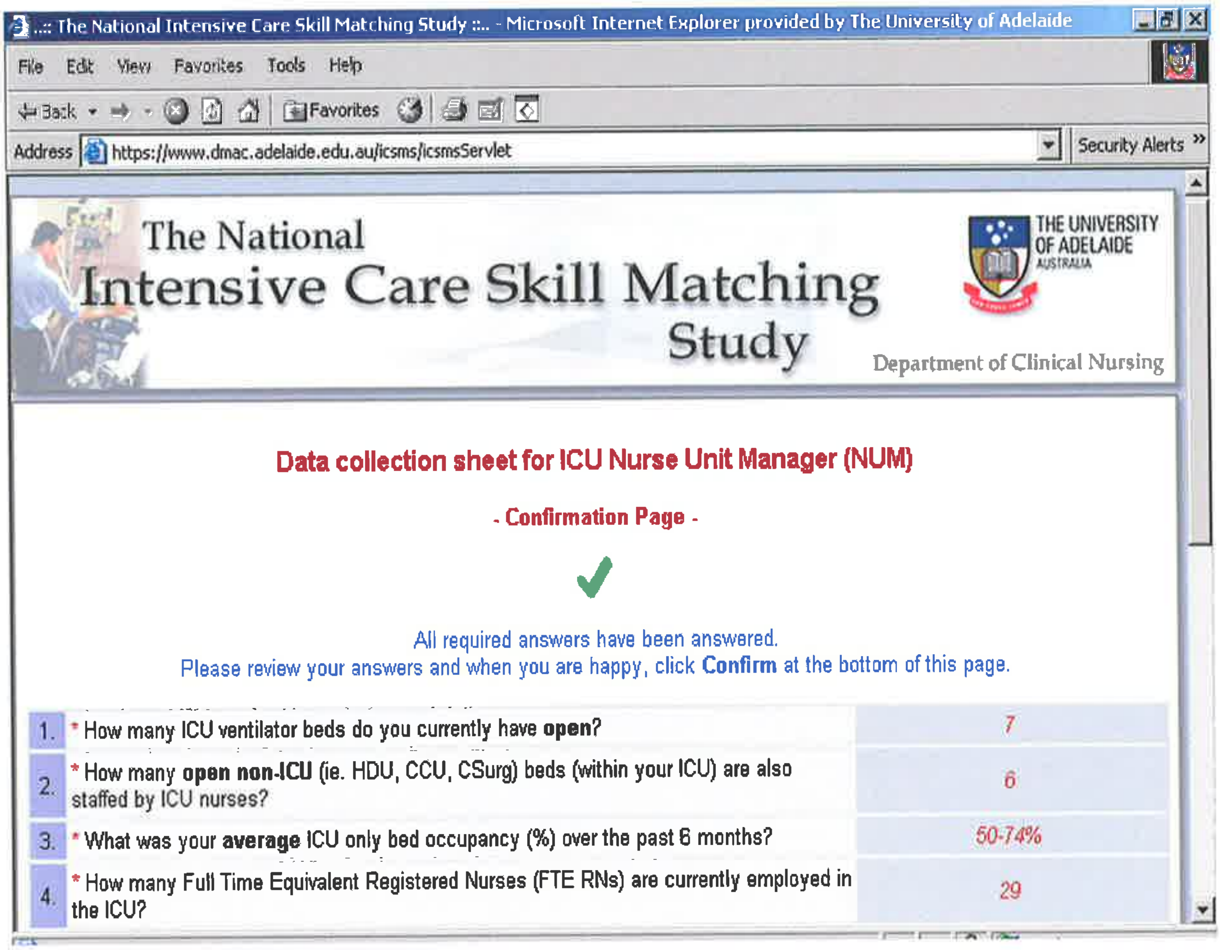


Figure 3-13 Confirmation (of data acceptance)

Once the Confirmation page was acknowledged a thank you page (Figure 3-15) appeared and the respondent could then log-out.

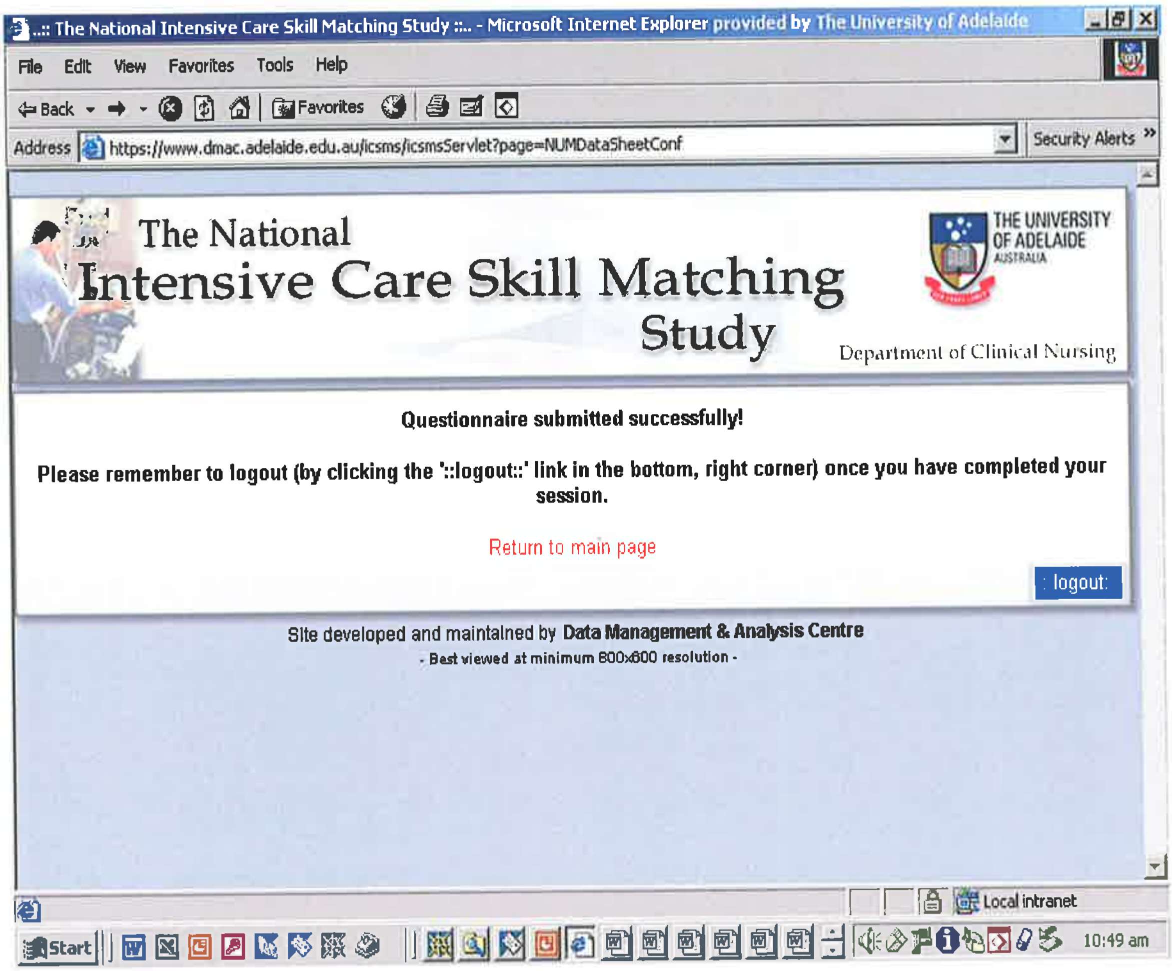


Figure 3-14 Data (Questionnaire) Submitted Successfully Page

If anyone else tried to re-enter the site with the same code this page would be displayed. However, there was a brief message stating: "*If you feel this is a mistake, or you would like to redo the questionnaire, please contact the administrator*" (i.e. DMAC as a direct email link). This provided the data with more integrity in that even after all the checks (as described) along the process were done, there was a final opportunity to query the data manager who could (if required) delete an erroneous sheet and allow the person to do it again.

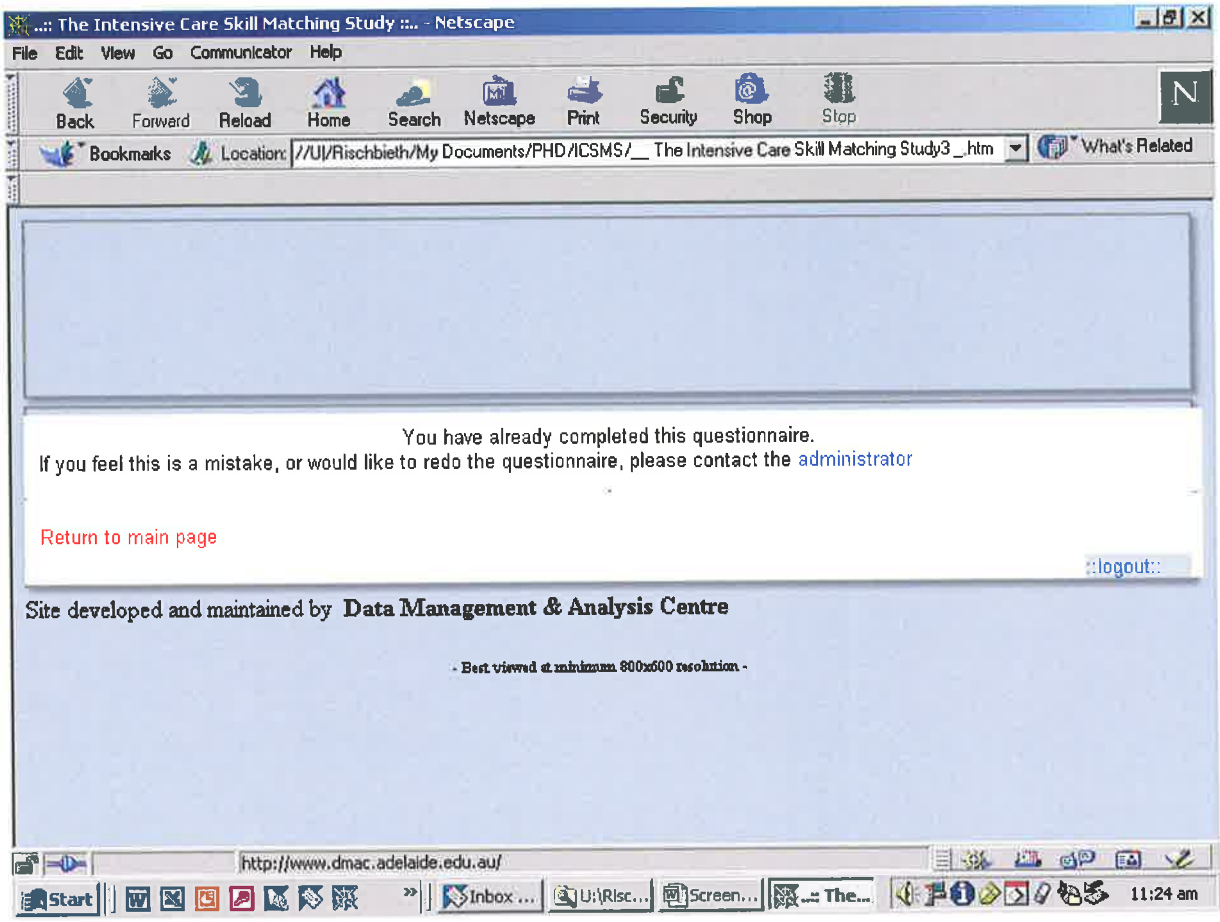
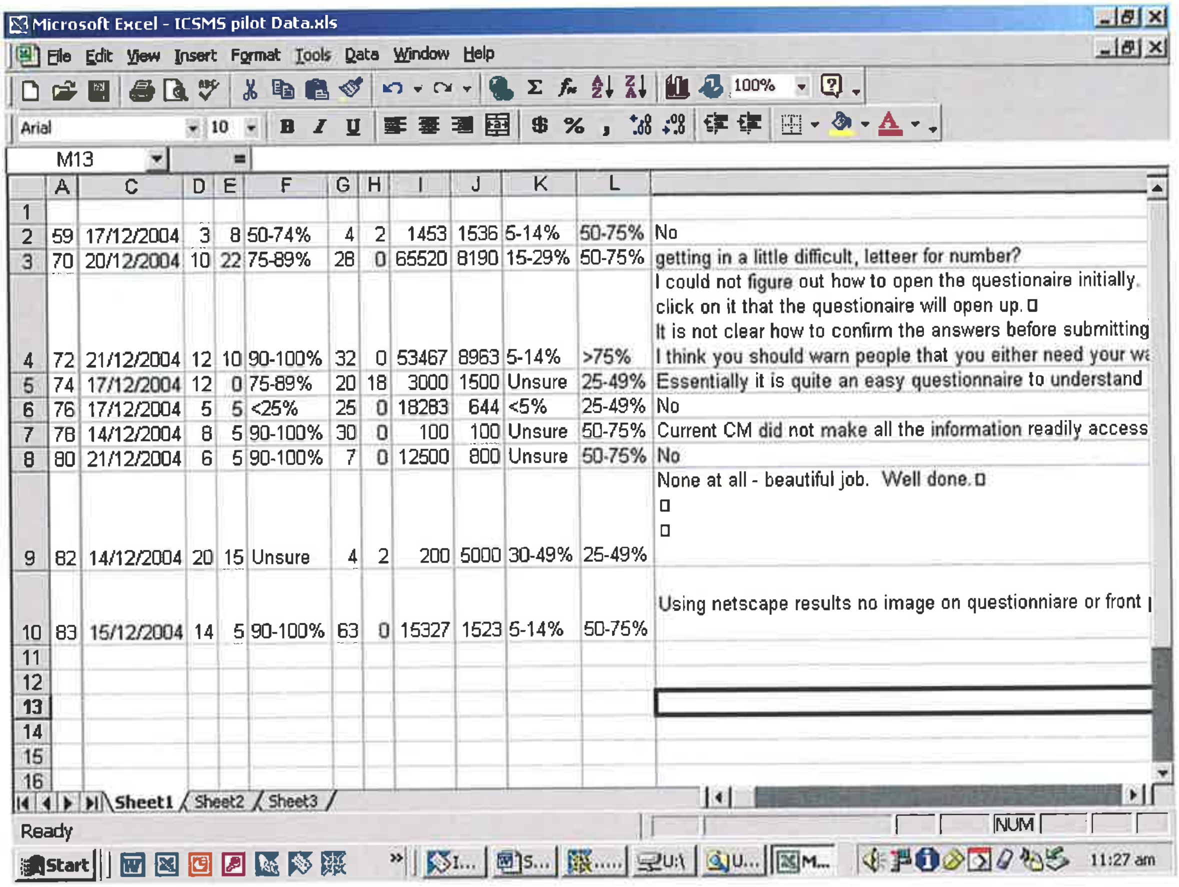


Figure 3-15 Protection against Multiple Entry

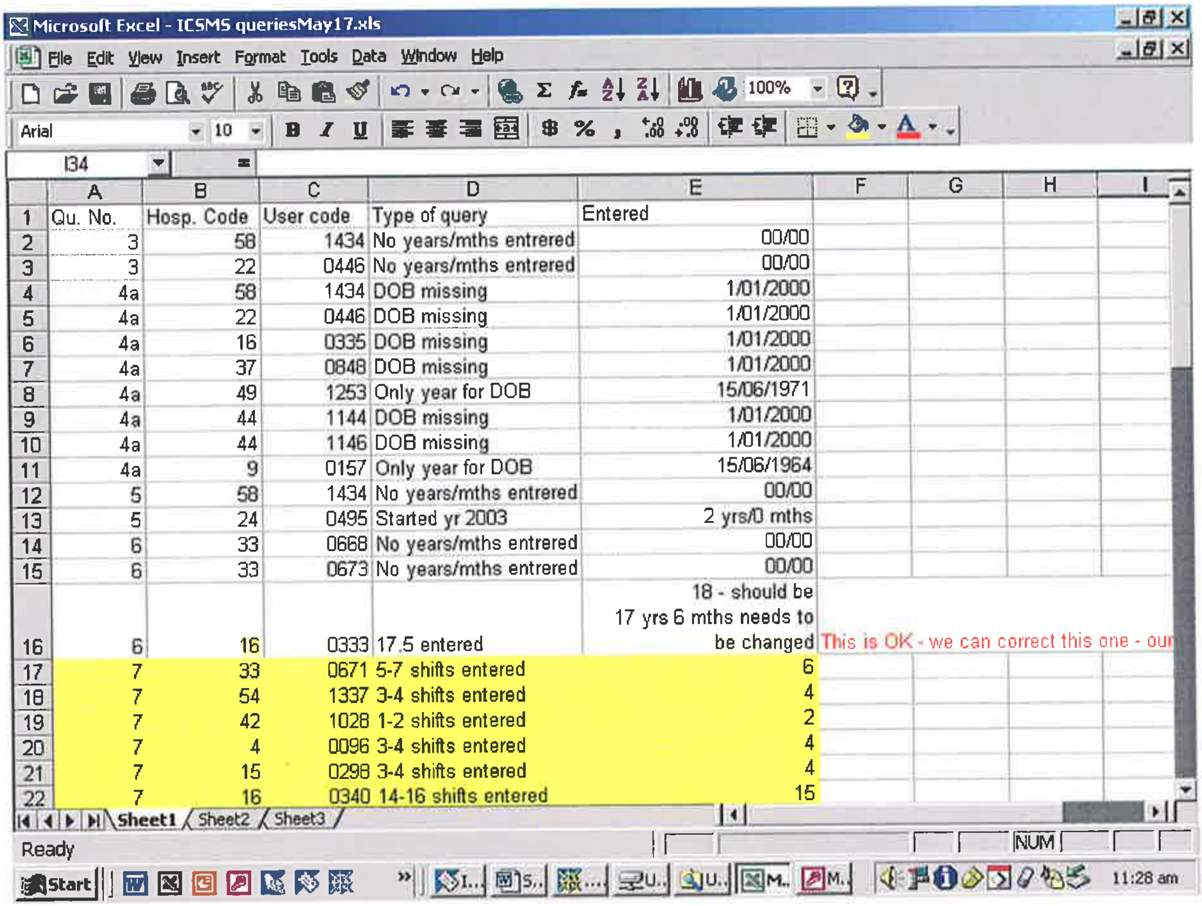
The process for the SLN Data Collection Sheet was identical to that previously described.



	A	C	D	E	F	G	H	I	J	K	L	
1												
2	59	17/12/2004	3	8	50-74%	4	2	1453	1536	5-14%	50-75%	No
3	70	20/12/2004	10	22	75-89%	28	0	65520	8190	15-29%	50-75%	getting in a little difficult, letteer for number?
4	72	21/12/2004	12	10	90-100%	32	0	53467	8963	5-14%	>75%	I could not figure out how to open the questionaire initially. click on it that the questionaire will open up. It is not clear how to confirm the answers before submitting I think you should warn people that you either need your wa
5	74	17/12/2004	12	0	75-89%	20	18	3000	1500	Unsure	25-49%	Essentially it is quite an easy questionnaire to understand
6	76	17/12/2004	5	5	<25%	25	0	18283	644	<5%	25-49%	No
7	78	14/12/2004	8	5	90-100%	30	0	100	100	Unsure	50-75%	Current CM did not make all the information readily access
8	80	21/12/2004	6	5	90-100%	7	0	12500	800	Unsure	50-75%	No
9	82	14/12/2004	20	15	Unsure	4	2	200	5000	30-49%	25-49%	None at all - beautiful job. Well done.
10	83	15/12/2004	14	5	90-100%	63	0	15327	1523	5-14%	50-75%	Using netscape results no image on questionniare or front

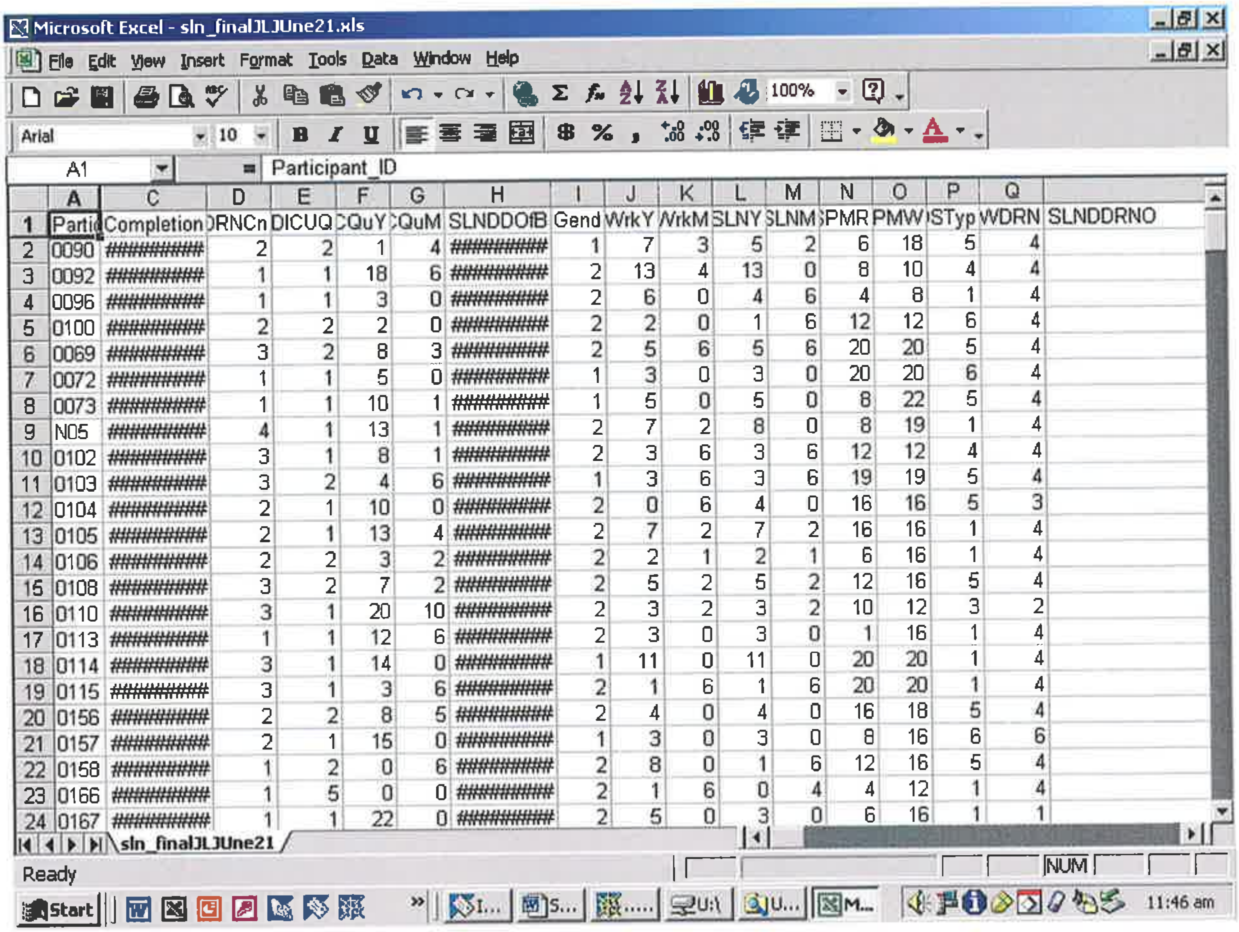
Figure 3-16 Example of Pilot Data

During the pilot for the data collection sheets and the '*e*' delivery communication platform, information was sought regarding the functionality, user friendliness and question content, understanding and time taken to completion. The queries that were created in the resultant pilot dataset informed the minor modifications that were subsequently made to the web-based system (Figure 3-17).



Qu. No.	Hosp. Code	User code	Type of query	Entered	
3	58	1434	No years/mths entrered	00/00	
3	22	0446	No years/mths entrered	00/00	
4a	58	1434	DOB missing	1/01/2000	
4a	22	0446	DOB missing	1/01/2000	
4a	16	0335	DOB missing	1/01/2000	
4a	37	0848	DOB missing	1/01/2000	
4a	49	1253	Only year for DOB	15/06/1971	
4a	44	1144	DOB missing	1/01/2000	
4a	44	1146	DOB missing	1/01/2000	
4a	9	0157	Only year for DOB	15/06/1964	
5	58	1434	No years/mths entrered	00/00	
5	24	0495	Started yr 2003	2 yrs/0 mths	
6	33	0668	No years/mths entrered	00/00	
6	33	0673	No years/mths entrered	00/00	
6	16	0333	17.5 entered	18 - should be 17 yrs 6 mths needs to be changed	This is OK - we can correct this one - our
7	33	0671	5-7 shifts entered	6	
7	54	1337	3-4 shifts entered	4	
7	42	1028	1-2 shifts entered	2	
7	4	0096	3-4 shifts entered	4	
7	15	0298	3-4 shifts entered	4	
7	16	0340	14-16 shifts entered	15	

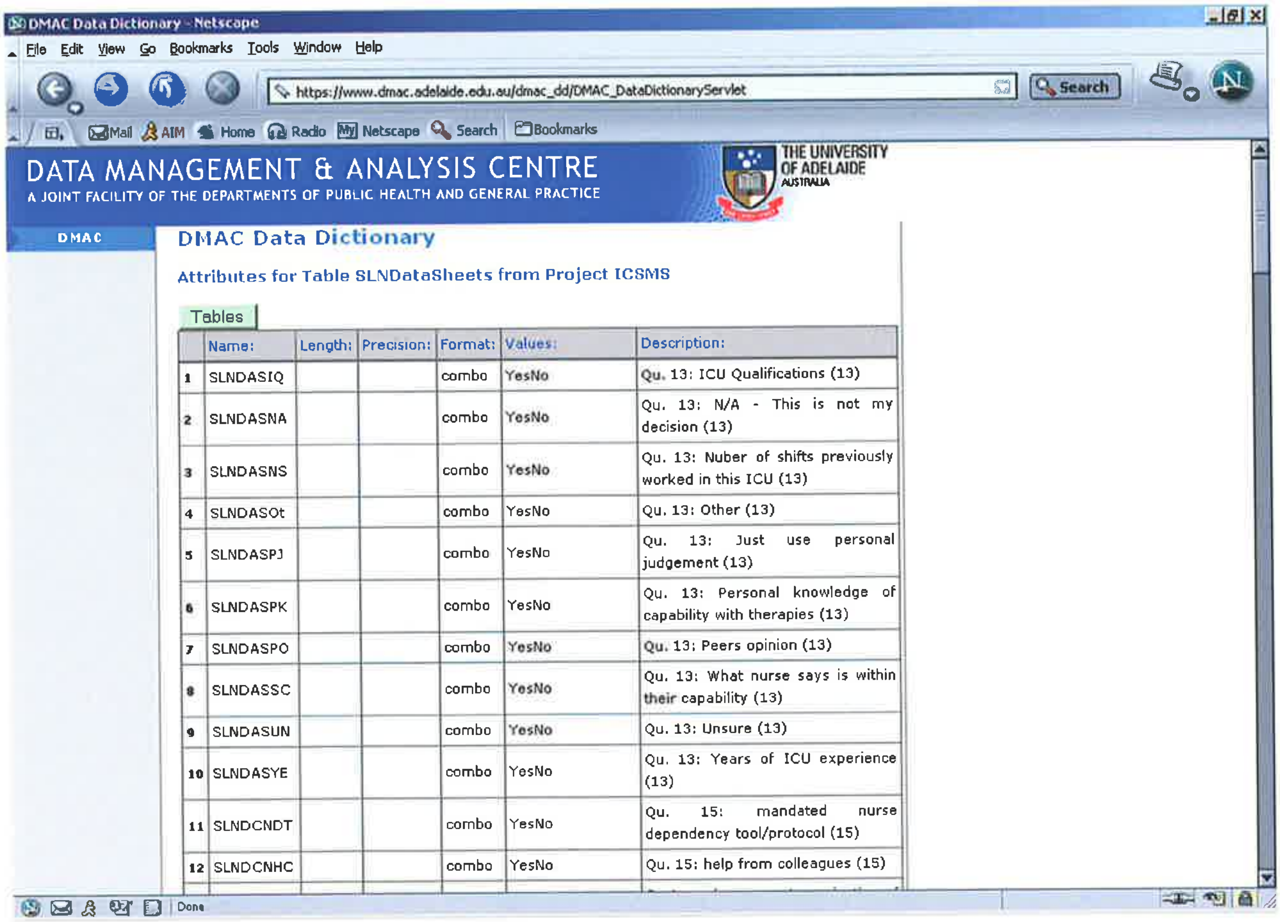
Figure 3-17 Example of Data Queries



	A	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	
1	Parti	Completion	RNCn	DICUQ	QuY	QuM	SLNDDOfB	Gend	WrkY	WrkM	SLNY	SLNM	PMR	PMW	STyp	WDRN	SLNDDRNO
2	0090	##########	2	2	1	4	##########	1	7	3	5	2	6	18	5	4	
3	0092	##########	1	1	18	6	##########	2	13	4	13	0	8	10	4	4	
4	0096	##########	1	1	3	0	##########	2	6	0	4	6	4	8	1	4	
5	0100	##########	2	2	2	0	##########	2	2	0	1	6	12	12	6	4	
6	0069	##########	3	2	8	3	##########	2	5	6	5	6	20	20	5	4	
7	0072	##########	1	1	5	0	##########	1	3	0	3	0	20	20	6	4	
8	0073	##########	1	1	10	1	##########	1	5	0	5	0	8	22	5	4	
9	N05	##########	4	1	13	1	##########	2	7	2	8	0	8	19	1	4	
10	0102	##########	3	1	8	1	##########	2	3	6	3	6	12	12	4	4	
11	0103	##########	3	2	4	6	##########	1	3	6	3	6	19	19	5	4	
12	0104	##########	2	1	10	0	##########	2	0	6	4	0	16	16	5	3	
13	0105	##########	2	1	13	4	##########	2	7	2	7	2	16	16	1	4	
14	0106	##########	2	2	3	2	##########	2	2	1	2	1	6	16	1	4	
15	0108	##########	3	2	7	2	##########	2	5	2	5	2	12	16	5	4	
16	0110	##########	3	1	20	10	##########	2	3	2	3	2	10	12	3	2	
17	0113	##########	1	1	12	6	##########	2	3	0	3	0	1	16	1	4	
18	0114	##########	3	1	14	0	##########	1	11	0	11	0	20	20	1	4	
19	0115	##########	3	1	3	6	##########	2	1	6	1	6	20	20	1	4	
20	0156	##########	2	2	8	5	##########	2	4	0	4	0	16	18	5	4	
21	0157	##########	2	1	15	0	##########	1	3	0	3	0	8	16	6	6	
22	0158	##########	1	2	0	6	##########	2	8	0	1	6	12	16	5	4	
23	0166	##########	1	5	0	0	##########	2	1	6	0	4	4	12	1	4	
24	0167	##########	1	1	22	0	##########	2	5	0	3	0	6	16	1	1	

Figure 3-18 Example of De-identified data from main study

A DMAC Data Dictionary with Attributes for Table SLN Datasheets from project ICSMS was created by DMAC personnel (illustrated below in Figure 3-20). This attributed the designated data codes to each question and provided a means of cross-referencing during data analysis.



DMAC Data Dictionary - Netscape

DATA MANAGEMENT & ANALYSIS CENTRE

A JOINT FACILITY OF THE DEPARTMENTS OF PUBLIC HEALTH AND GENERAL PRACTICE

THE UNIVERSITY OF ADELAIDE AUSTRALIA

DMAC

DMAC Data Dictionary

Attributes for Table SLNDataSheets from Project ICSMS

Tables

	Name:	Length:	Precision:	Format:	Values:	Description:
1	SLNDASIQ			combo	YesNo	Qu. 13: ICU Qualifications (13)
2	SLNDASNA			combo	YesNo	Qu. 13: N/A - This is not my decision (13)
3	SLNDASNS			combo	YesNo	Qu. 13: Nuber of shifts previously worked in this ICU (13)
4	SLNDASOt			combo	YesNo	Qu. 13: Other (13)
5	SLNDASPJ			combo	YesNo	Qu. 13: Just use personal judgement (13)
6	SLNDASPK			combo	YesNo	Qu. 13: Personal knowledge of capability with therapies (13)
7	SLNDASPO			combo	YesNo	Qu. 13: Peers opinion (13)
8	SLNDASSC			combo	YesNo	Qu. 13: What nurse says is within their capability (13)
9	SLNDASUN			combo	YesNo	Qu. 13: Unsure (13)
10	SLNDASYE			combo	YesNo	Qu. 13: Years of ICU experience (13)
11	SLNDCNDT			combo	YesNo	Qu. 15: mandated nurse dependency tool/protocol (15)
12	SLNDCNHC			combo	YesNo	Qu. 15: help from colleagues (15)

Figure 3-19 Data Dictionary

3.14. Summary

A combined data source and data methods approach (triangulation) using survey, elicited both qualitative and quantitative data elements from all Australian adult ICUs; informed by two groups of respondents (NUMS and SLNs). Substantive qualitative data was required in three of the SLN questionnaire questions with minor brief qualitative elements included as clarifying information within some other questions. In this large multi-centre study, the data allowed stratifications and analysis across ICUs, by Australian state, sector, area, type, size, location, occupancy. Other data related to volume, classification and qualifications of staff, shift types, nursing hours and full-time equivalent employment status. A content thematic analysis (the qualitative component) was conducted of selected questions within the surveys which added data richness.

Attention to detail in both pilot and ICSMS in all aspects of the study design and conduct in the interests of scientific rigour, ethical integrity, and in data collection and management was paramount. Recruitment and response rate was optimised, confidentiality of participants was maintained, and data was cleaned, stored and analysed. The study results are presented in the next chapter.

CHAPTER 4 ANALYSIS & RESULTS

4.1. Introduction

In this chapter, the data analysis and results are presented, with response information discussed first including data on non-responders. This is followed by an overview of the data analysis in which the main results are presented in two sections: the ICU staffing profile data (NUMs and SLNs), and, the thematic analysis of the qualitative data.

4.2. Data response

At the beginning of the study, a total of 58 Level III ICUs were operational in Australia. All of these 58 Level III ICUs were invited to participate, and 50 (86.20%) consented. Of these 50 participating ICUs, there was a 92% (n = 46) response rate from Nurse Unit Managers (NUMs) to the NUM questionnaire, and 317 Shift Leader Nurses (SLNs) from the 50 participating ICUs completed the SLN questionnaire. The response rate to the SLN questionnaire was worked out by making an estimate based on each NUM's answer to the question, "How many nurses on your current roster make staffing decisions? (i.e. shift leader nurses)" on the NUM questionnaire (see Appendix F). Based on these results, the SLN questionnaire response rate was estimated as 66.89%, equalling an average of 6.34 SLNs per ICU. This was considered a good response rate, given that some ICUs use a small number of SLNs to repeatedly perform the shift leader role, while other ICUs utilise a broader range of nursing staff to perform as SLN. In addition, the recruitment of SLNs was carried out by NUMs rather than directly by the researcher which may have impacted on their participation. There were 9 NUMs (19.56%) who completed both an NUM and SLN questionnaire (as was requested if an NUM's "shift role ever included deciding nurse numbers and/or nurse-to-patient allocation decisions").

Non-responders

The design of this research, which incorporated significant efforts to protect the privacy of those SLNs approached to take part in the study and made follow-up attempts impossible, meant that it was difficult to discover why non-responding SLNs chose not to participate. However, of the 8 ICUs that chose not to participate, there was spontaneous feedback from 7 NUMs as to their reasons for not participating. These included being 'too busy' (n = 3), 'already taking part in a number of other research projects' (n = 2), 'moving to a new ICU' (n = 1); and 'usual NUM on leave – don't wish to commit' (n = 1).

4.3. Statistical analysis

All quantitative data analyses in both the pilot and main study were performed using SAS version 9.1 (SAS Institute, Cary, NC, USA). Initially, basic analyses were generated to provide an overview of the information collected and to provide a framework in which to 'summarise, organise, interpret, and communicate' the data in a numerical manner.[254]

To summarise the data, descriptive statistical analysis were performed including measures of central tendency, frequency distribution, and variability. Using linear or logistic multivariate analysis, associations were examined between key responses and respondent characteristics. Selection of the most appropriate statistical tests was based upon factors including whether a parametric test was justified, the levels of measurement used, and how many groups were to be compared. Using a systematic manual approach, thematic content analysis was carried out on the qualitative data gathered predominantly from the last 3 questions in the SLN questionnaire. Where there were small amounts of qualitative data related to other specific questions, this was presented beside the quantitative analysis in order to retain the context.

Data collection overview

In this research, NUMs were asked to complete one questionnaire (NUM questionnaire) while SLNs completed another (SLN questionnaire). The questionnaires are shown in Appendix F. The NUM questionnaire contained 10 questions which predominantly related to ICU-specific demographic and staffing profile data. NUMs were asked to also complete an SLN Questionnaire if their *"shift role ever included deciding nurse numbers and/or nurse-to-patient allocation decisions"* (i.e. if they ever had an active role in nurse staffing decisions in their ICU)

The SLN questionnaire contained 22 questions (5 of those questions contained two parts) and was designed primarily to elicit information on the decision-making processes and systems used by SLNs in their role as shift leader, including determining and assessing available nursing skill and allocating nurse-to-patient acuity and care in the ICU. Basic demographic data was also sought, including age, gender, qualifications, employment classification, years in SLN role, and use of any ICU nurse skill-assessment systems, processes, tools, and nurse-patient allocation practices. Other SLN questionnaire items focused on agency nurse skill identification systems, associated patient allocation practices, and staffing problems and solutions.

The data analysis and results presentation framework

An outline of the data analysis presented in this chapter is presented in Table 4-1. The different sections of the analyses presented in this chapter follow the sequence of steps in this outline to assist the reader to understand the systematic data analysis approach. The key findings are presented through free text, tables, and figures. For the NUM data analysis, only the 46 ICUs from which the NUMs had completed a NUM survey were analysed, making a 'total' NUM ICU dataset of 46. The SLN data was collected from a total of 50 ICUs; however, the total used for the SLN analyses was 317 – the total number of SLNs who completed the SLN questionnaire. In the framework below, the data source for each section (NUM questionnaire or SLN questionnaire) is shown in brackets in red.

Table 4-1 ICSMS Data Analysis and Results Presentation Framework

ICU Characteristics/Demographics (NUM questionnaire)

▪ *ICU size and size by state*
▪ *ICU location*
    ▪ *State*
    ▪ *Metropolitan, remote, rural location*
▪ *ICU type*
    ▪ *Public or private hospital*
    ▪ *ICU case-mix*
▪ *ICU occupancy*

ICU Staffing Data (NUM questionnaire)
▪ *ICU qualifications (overall ICU profile)* ▪ *RN distribution* ▪ *EN distribution* ▪ *Hours worked by RNs vs. agency nurses* ▪ *Costs of RNs vs. agency nurses*
The Shift Leaders (SLN questionnaire)
▪ *Number of shift leaders (from NUM data)* ▪ *SLN profile*   ▪ *Classification, qualification, age, gender, length of service*

▪ *Shift leader experience and shift profile*
SLN Staffing Decisions (SLN questionnaire)
▪ *Who makes staffing decisions* ▪ *Nurse numbers* ▪ *Nurse-to-patient allocation* ▪ *Who should make staffing decisions* ▪ *Nurse numbers* ▪ *Nurse-pt allocation* ▪ *What information is required for nurse skill assessment* ▪ *How are shift nurse numbers calculated? What are the identified tools/systems, and how accurate are they?* ▪ *Adequacy of available information prior to staffing decisions* ▪ *Agency nurses* ▪ *Required skills specified* ▪ *Information usually requested* ▪ *Frequency that skill criteria is matched* ▪ *Frequency that agency feedback is given*
Problems & Solutions (SLN questionnaire)
▪ *Nurse number decision themes* ▪ *Nurse allocation decision themes* ▪ *SLN staffing solutions*

During the data analysis, codes were created to ensure alignment with the raw data and to facilitate cross reference checks and ensure clarity. The final presented results do not include a number of tables and figures that were considered by the researcher to offer limited contribution, however these have all been archived should the data be required at another time. Hence the code initials relate to groups of data analysis. In the presentation of the Tables and Figures in this chapter, the codes remained for consistency and accuracy using a systematic process (see Table 4-2). The blue coloured codes in within the figure and table captions align with the legend in Table 4-2.

Some of the data are presented using both graphs and tables whereas other data may use one of these presentation types. Each question on the questionnaires had a code created for spreadsheet management (see Appendix P).

Table 4-2 Table and Figure codes – Legend

Table & Figure codes	Raw data source
NT	NUM data
T	NUM data
SLN	SLN data
SND	SLN data
SLND	SLN data
SQ	SLN data
MO	SLN thematic data

4.4. The Results

ICU Characteristics / Demographics

ICU Size and Size by Australian State

NUMs were asked how many open ventilator (open vent) beds were in their ICU, and this raw data was collapsed into 3 categories to reflect 'ICU size': small (1-8 beds), medium (9-16 beds), and large (17+ beds) ICUs (Figure NT1a). These categories were selected as they align with commonly used terms, and given that there was no defined national standards on ICU categorisation determinants, this was considered appropriate by the researcher. As can be seen in Table NT1, there were 5 'small' ICUs, 12 'medium' ICUs, and 29 'large' ICUs across all Australian States who participated via their NUMs and or SLNs.

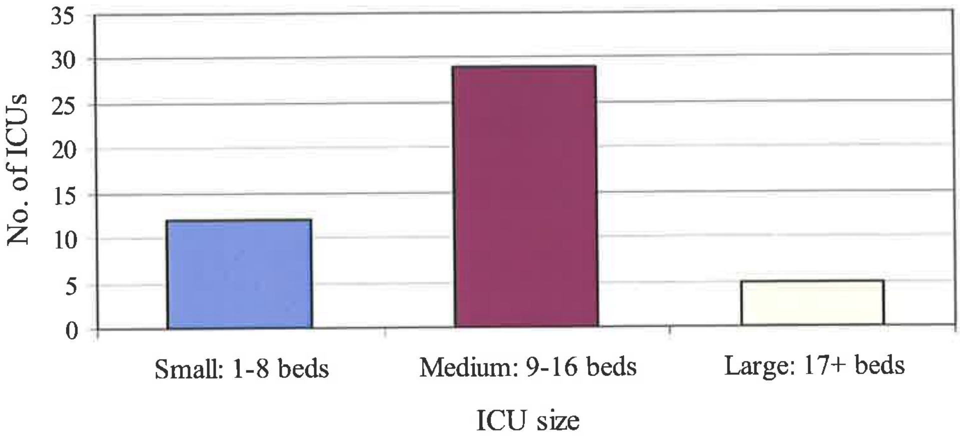


Figure 4-1 ***NT1a*** ***Number of ICUs by Size (number of open vent beds)***

As Table NT1 illustrates, of the 46 Level III ICUs that provided NUM data, 73.91% were located in the 3 most heavily populated ('largest') Australian states: New South Wales, Victoria, and Queensland[255]. All 3 Tasmanian ICUs were small (100%), and Western Australia had the highest number of large ICUs (50%), followed by South Australia (25%) and Victoria (10%).

Table 4-3 ***NT1*** ***Number of small, medium, and large ICUs (by number of open vent beds) in each Australian state***

State	ICU size			Total
	Small: 1-8 beds	Medium: 9-16 beds	Large: 17+ beds	
NSW	3 25%	9 75%	0 0%	12
Victoria	4 40%	5 50%	1 10%	10
Queensland	1 8.33%	10 83.33%	1 8.33%	12
SA	1 25%	2 50%	1 25%	4
WA	0 0%	2 50%	2 50%	4
Tasmania	3 100%	0 0%	0 0%	3
ACT	0 0%	1 100%	0 0%	1
Total	12	29	5	46

ICU Location

NUMs were asked to nominate the location of their ICU according to the Australian and New Zealand Intensive Care Society (APD) data dictionary category definitions for 'rural/regional', 'metropolitan', and 'tertiary/capital city'.[38] Their answers were cross-checked with the known location of their ICU within that database (following relevant permissions being granted to the researcher).[38] As can be seen in Figure NT4, the majority of ICUs (82.61%) were located in a capital city, with fewer in a metropolitan (13.04%) or rural (4.35%) location. This is useful data in the context of providing a national perspective (see Appendix M).

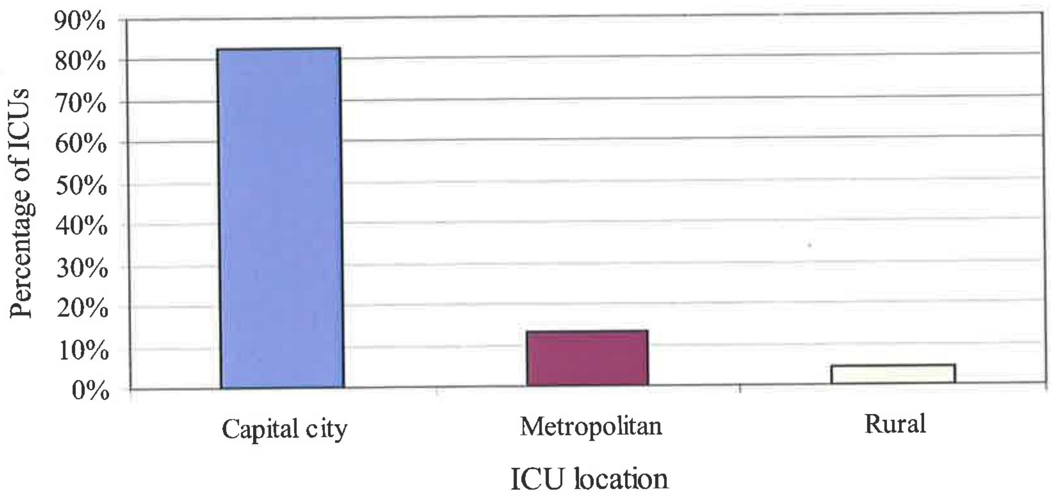


Figure 4-2 NT4 Number of small, medium, and large ICUs (by number of open vent beds) in Australian rural, remote, and metropolitan areas

ICU (Hospital) Type

The type of hospital in which each ICU was located was collected in order to be able to control for different patient profiles for different types of ICU facilities. Each NUM was asked to specify whether their ICU was in either a 'public' or 'private' hospital, with these categories chosen because they exist in both the National Health Data Dictionary, and the National Minimum Dataset Data Dictionary.[50]

As can be seen in Table NT2, there were more than double the number of public hospital ICUs (n = 31; 67.39%) to private hospital ICUs (n = 15; 32.61%) in the sample. This table also displays the distribution of ICU size across private and public sector ICUs, showing that all of the large ICUs in this study were located in public hospitals. Appendix N shows the stratifications and codes used.

Table 4-4 NT2 Number of small, medium, and large ICUs (by number of open vent beds) in public and private hospitals

Hospital type	ICU size			Total
	Small: 1-8 beds	Medium: 9-16 beds	Large: 17+ beds	
Public	7 22.58%	19 61.29%	5 16.13%	31
Private	5 33.33%	10 66.67%	0 0%	15
Total	12	29	5	46

ICU Case-mix

The case-mix of each ICU was categorised as either 'general', combined 'intensive care unit (ICU) and coronary care unit (CCU)', or 'other'. Although the National Intensive Care Adult Patient Database[38] also categorises a number of other unit types, the three categories used in this research were considered adequate for this study. [15,19]

Figure NT3a illustrates the case-mix of each ICU, and shows that the vast majority (91.3%) of all ICUs had a 'general' case-mix, 6.52% had an 'ICU/CCU case-mix', and 2.17% were categorised as having an 'other' case-mix. It should also be noted that while 'general' ICUs may include patients who have undergone cardiac surgeries, cardiology patients are more likely be included as part of a CCU mix.

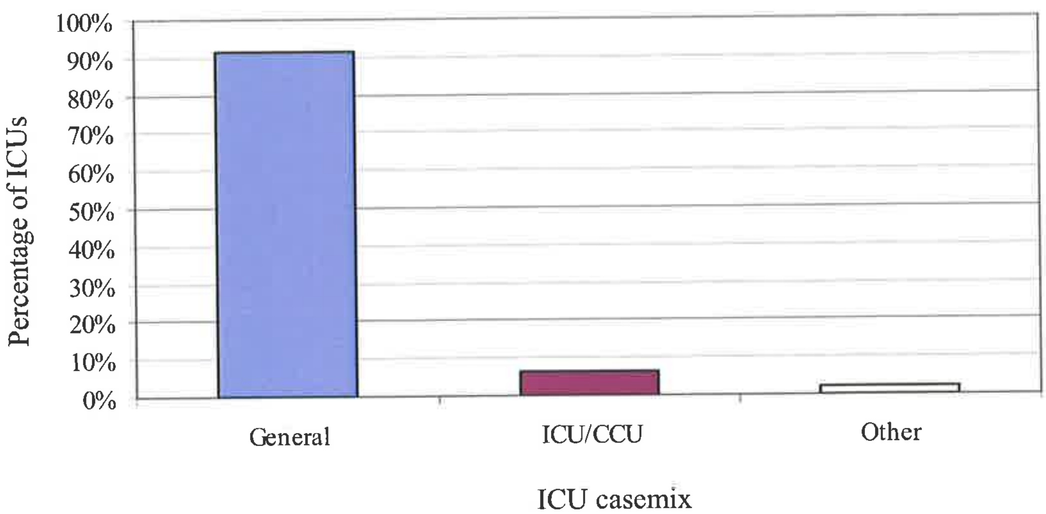


Figure 4-3 NT3a Case-mix of each ICU

The case-mix of small, medium, and large ICUs is shown in Table NT3. Most general case-mix units were medium-sized (66.67%), all (100%) combined ICU/CCUs were categorised as small, and all large ICUs (100%) were general case-mix.

Table 4-5 NT3 Number of small, medium, and large ICUs (by number of open vent beds) by ICU type

ICU type	ICU size			Total
	Small: 1-8 beds	Medium: 9-16 beds	Large: 17+ beds	
General	9 21.43%	28 66.67%	5 11.90%	42
ICU/CCU	3 100%	0 0%	0 0%	3
Other	0 0%	1 100%	0 0%	1
Total	12	29	5	46

Occupancy

The average occupancy of each ICU over the preceding 12 months (2003/2004 financial year) was collected. However, as it was thought that NUMs may not have easy access to the raw data required to answer this question, categorical percentage ranges were offered for responses. This may be considered a limitation, but was a compromise to elicit as large and accurate a response from NUMs as possible. These results show that 65.22% of ICUs had an average occupancy of 75-100%, and only 4.34% of ICUs had an average occupancy of less than 50%, reflecting the busy nature of Australian Level III ICUs.

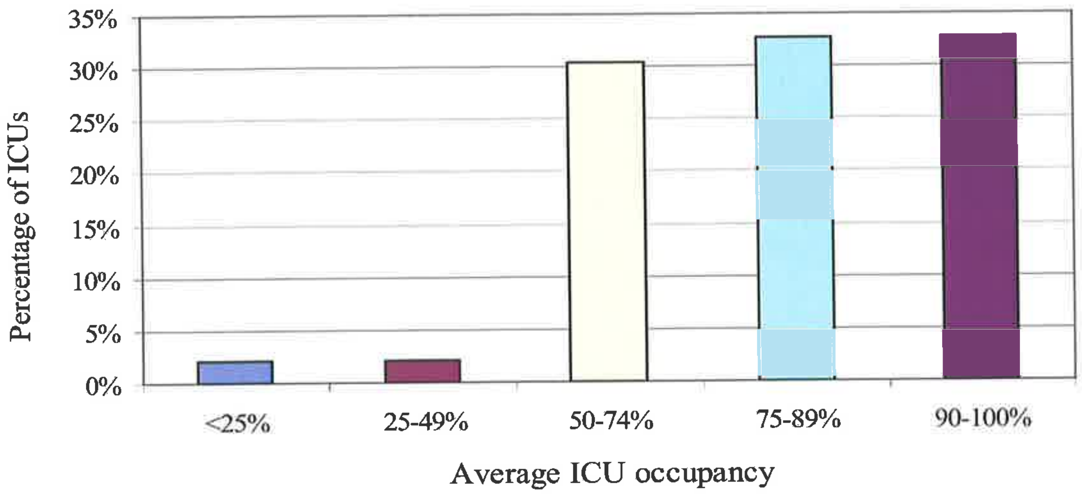


Figure 4-4 ***NT5a*** ***Average occupancy in percentage of ICUs***

The average ICU occupancy in each Australian state is shown below, in Table NT5. ICUs in New South Wales (70%) and Victoria (75%) had similar proportions of ICUs with average occupancies of greater than 75%.

Table 4-6 NT5 Average occupancy of ICUs in each Australian state

State	ICU average occupancy					Total
	<25%	25-49%	50-74%	75-89%	90-100%	
NSW	0 0%	0 0%	3 25%	3 25%	6 50%	12
Victoria	1 10%	0 0%	2 20%	2 20%	5 50%	10
Queensland	0 0%	0 0%	5 41.67%	4 33.33%	3 25%	12
SA	0 0%	0 0%	2 50%	2 50%	0 0%	4
WA	0 0%	0 0%	2 50%	2 50%	0 0%	4
Tasmania	0 0%	1 33.33%	0 0%	2 66.67%	0 0%	3
ACT	0 0%	0 0%	0 0%	0 0%	1 100%	1
Total	1	1	14	15	15	46

Examining the average ICU occupancy in public and private hospitals, Table NT6 illustrates that 87.12% of public ICUs, but just 20% of private ICUs, had a 75-100% occupancy. These data support anecdotal evidence that public hospital ICUs tend to be busier with higher occupancy. There are usually emergency departments in all public hospitals but not all private ones, which is likely to influence admissions. When a chi-square test was performed to examine the relationship between state and the average ICU occupancy, a non-significant result was found ($p > .05$).

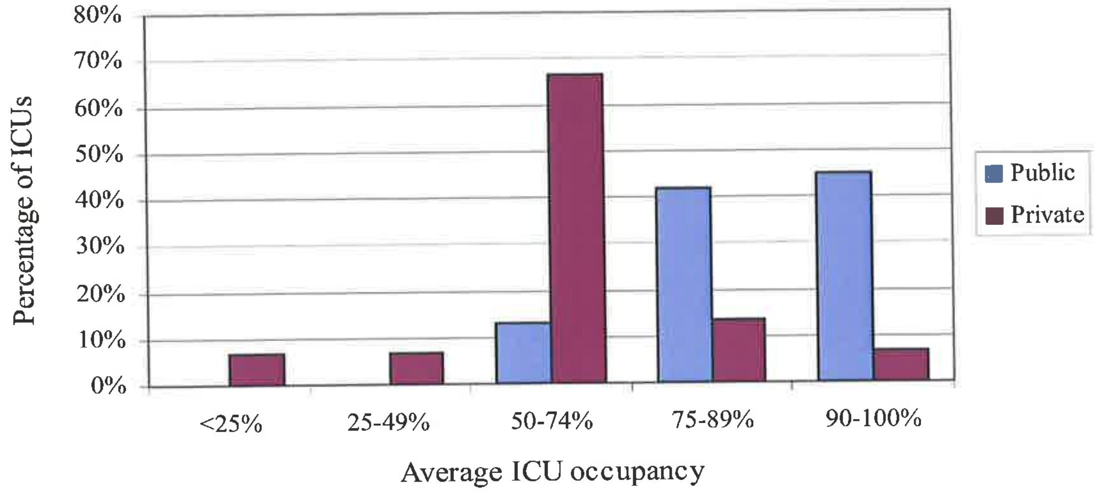


Figure 4-5 NT6 Average ICU occupancy in private and public hospitals

Figure NT7 below shows the average ICU occupancy of general, ICU/CCU, and other case-mix ICUs. General case-mix and ICU/CCU ICUs had the highest average occupancy, with 66.66% of general case-mix and 66.67% of ICU/CCU ICUs having an average occupancy of 75-100%.

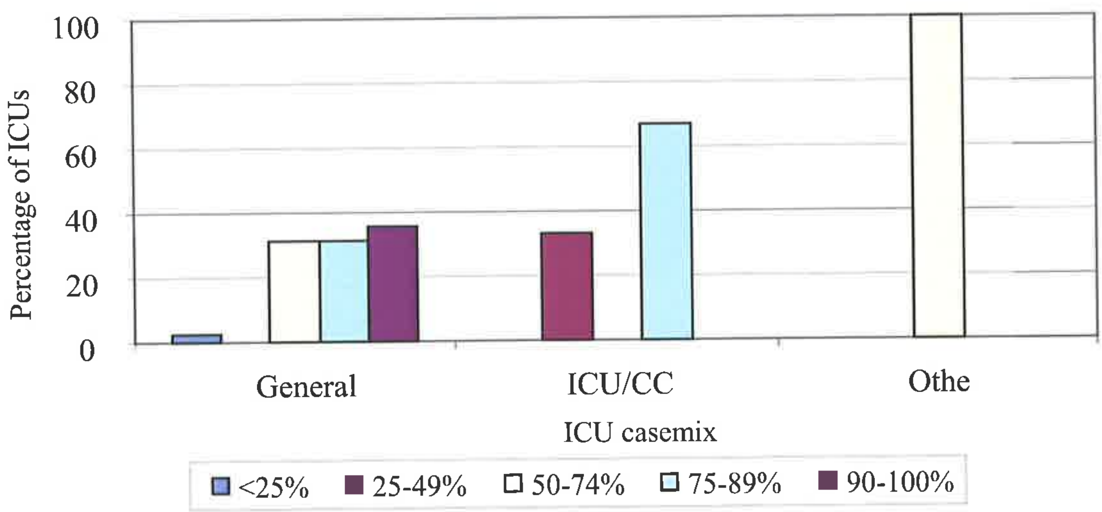


Figure 4-6 NT7 Average ICU occupancy by Casemix

Figure NT8 illustrates the average occupancy of small, medium, and large ICUs. Of the large ICUs, 80% (n = 3) had a reported average occupancy of 75-100%, compared to 65.52% (n = 19) of medium size ICUs, and 58.33% of small ICUs. When a Fishers exact (chi-square) test was conducted to investigate the relationship between ICU size and average occupancy, no significant result was found ($p > .05$).

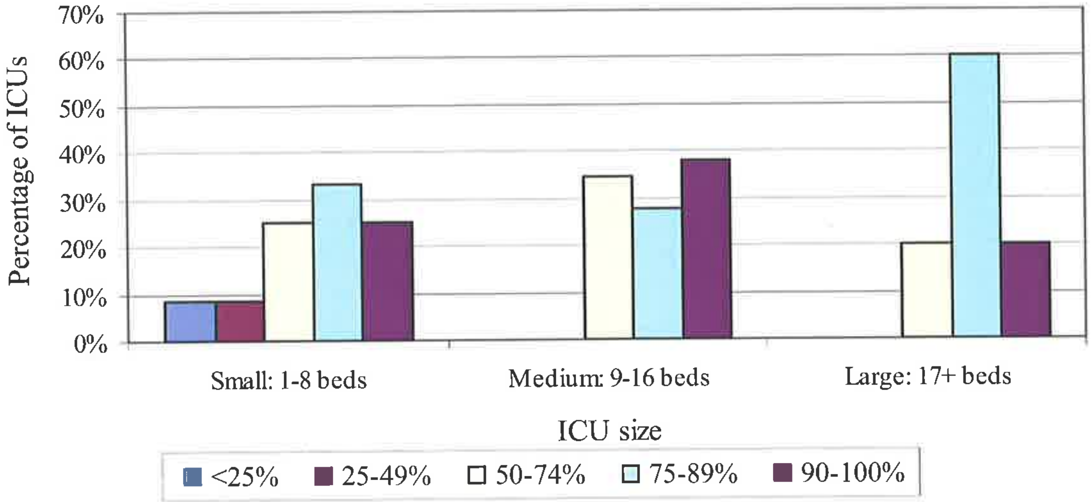


Figure 4-7 NT8 Average ICU occupancy of each size ICU by number of open vent beds

Staffing data

Percentage of nurses with an ICU qualification

NUMs were asked to record the percentage (within pre-defined percentage ranges) of nurses in their ICU who held a formal ICU qualification (Critical Care Certificate, Graduate Diploma in Intensive Care Nursing, Master of Nursing, or Doctor of Nursing). The choice of percentage categories for this question was guided by the Australian College of Critical Care Nurses (ACCCN) Position Statement on Intensive Care Staffing [3] This national data describing the qualifications of ICU nurses in this research is important to examine because the ACCCN recommends that every Level III ICU have a minimum of 50%, and a recommended level of 75%, ICU nurses with an ICU qualification. If a Level III ICU has less than 50% of its staff with specialist qualification, its ability to be given (and maintain) intensive care unit formal accreditation status may be compromised. In Australia, The Joint Faculty of Intensive Care Medicine assesses the accreditation status of ICUs as part of a formal and rigorous process.[3,234]

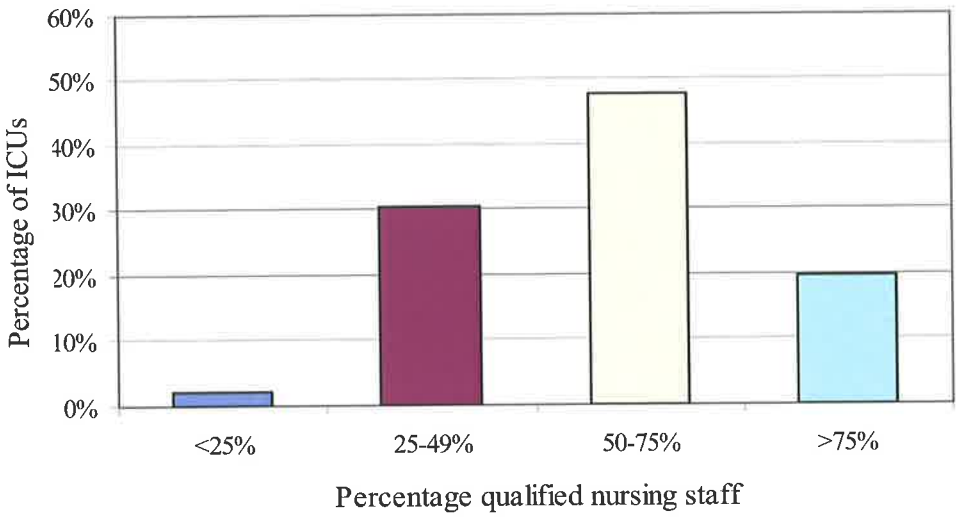


Figure 4-8 NT32a Percentage of ICU-qualified nursing staff in each ICU

As Figure NT32a, above, illustrates, 67.39% of ICUs had 50% or more ICU staff with specialist ICU qualifications (in line with the ACCCN accepted level), and 19.57% of ICUs had 75% or more ICU nurses with specialist qualifications (in line with the recommended ACCCN staffing level). However, 32.61% had fewer than the ACCCN endorsed percentage (50%) of qualified ICU nurses, including one ICU that had fewer than 25% ICU qualified nurses. Table NT32, below, shows that of the Australian states, Victoria had the highest proportion of ICUs with more than 75% qualified nurses (70%).

Table 4-7 NT32 Proportion of nurses with a formal ICU qualification in ICUs in each Australian state

State	Nurses in each ICU who have a formal ICU qualification				Total
	<25%	25-49%	50-75%	>75%	
NSW	0 0%	4 33.33%	8 66.67%	0 0%	12
Victoria	1 10%	0 0%	2 20%	7 70%	10
Queensland	0 0%	5 41.67%	7 58.33%	0 0%	12
SA	0 0%	1 25%	2 50%	1 25%	4
WA	0 0%	2 50%	1 25%	1 25%	4
Tasmania	0 0%	1 33.33%	2 66.67%	0 0%	3
ACT	0 0%	1 100%	0 0%	0 0%	1
Total	1	14	22	9	46

Comparing the proportion of ICU qualified nurses in public and private hospital ICUs, 67.75% of public ICUs and 66.67% of private ICUs had more than 50% of nurses with ICU qualifications, as shown in Figure NT33, where the data from two categories that were over 50%, was aggregated .

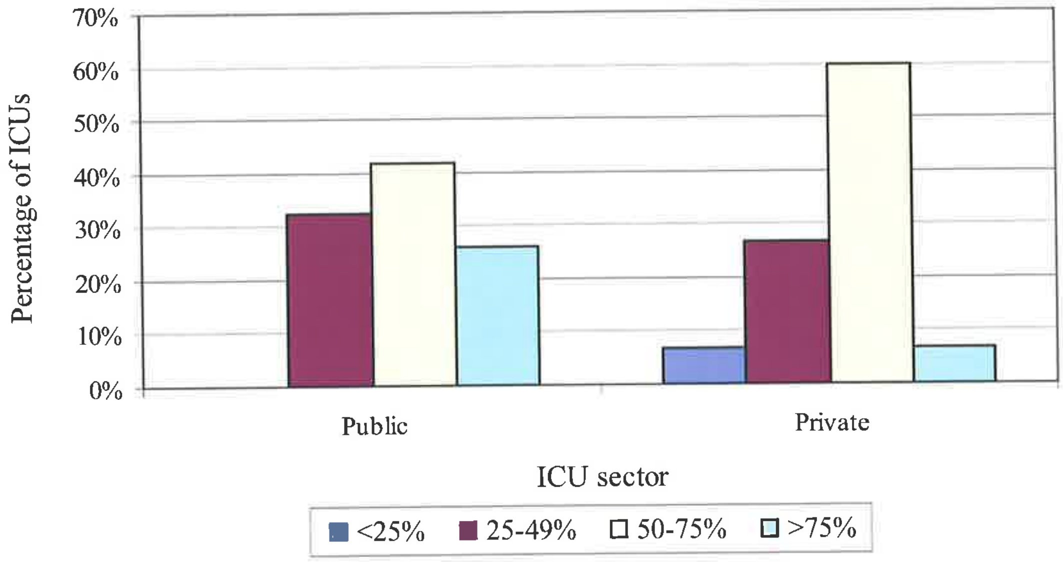


Figure 4-9** NT33 **Percentage of ICU-qualified nurses in private and public ICUs

Figure NT34, below, illustrates the proportion of ICU-qualified nurses in capital city, metropolitan, and rural ICUs. As can be seen, the two rural ICUs in the sample both reported 50% or more nurses being specialist qualified. In capital cities, 34.21% of ICUs had between 25-49% qualified and 2.63% had less than 25% qualified staff (the only ICU in the study to have <25% specialist-qualified nurses).

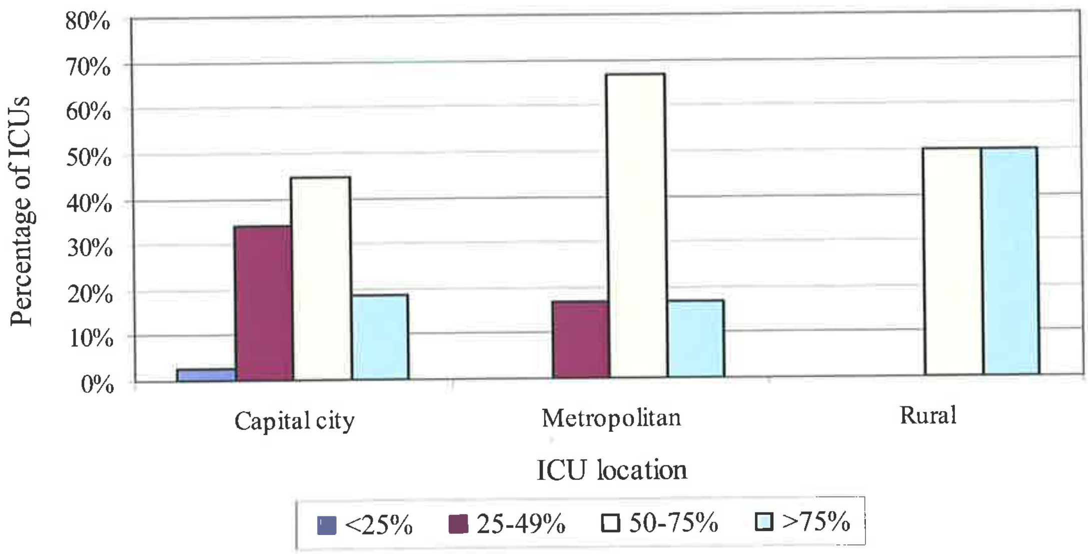


Figure 4-10** NT34 **Percentage of ICU-qualified nurses in Australian remote, rural, and metropolitan ICUs

Examining the average occupancy of each ICU by the proportion of ICU-qualified nurses (as shown in Table NT35), in the ICUs reporting the highest average occupancy level (90-

100%), 73.33% complied with the ACCCN recommended number (50% or more qualified nurses). In the next highest average occupancy level (75-89%), 53.33% complied with the ACCCN recommendation. The categorical data were analysed by a Fisher's exact (chi-square) test; however, no significant relationship ($p > .05$) was found between the percentage of nurses with ICU qualifications and the average ICU occupancy.

Table 4-8 NT35 Average ICU occupancy by percentage of nurses with a formal ICU qualification in each ICU

Average ICU occupancy	Nurses in each ICU with a formal ICU qualification				Total
	<25%	25-49%	50-75%	>75%	
<25%	0 0%	0 0%	0 0%	1 100%	1
25-49%	0 0%	1 100%	0 0%	0 0%	1
50-74%	1 7.14%	2 14.29%	8 57.14%	3 21.43%	14
75-89%	0 0%	7 46.67%	6 40%	2 13.33%	15
90-100%	0 0%	4 26.67%	8 53.33%	3 20%	15
Total	1	14	22	9	46

Table NT36 shows the percentage of nurses with a formal qualification in ICUs of each size, with 75% of the small, 65.51% of the medium, and 60% of the large ICUs complying with the ACCCN endorsed standard of 50% or more qualified nurses per ICU.

Table 4-9 NT36 ICU size by percentage of nurses with a formal ICU qualification in each ICU

ICU size	Nurses in each ICU with a formal ICU qualification				Total
	<25%	25-49%	50-75%	>75%	
Small: 1-8 beds	0 0%	3 25%	6 50%	3 25%	12
Medium: 9-16 beds	1 3.45%	9 31.03%	15 51.72%	4 13.79%	29
Large: 17+ beds	0 0%	2 40%	1 20%	2 40%	5
Total	1	14	22	9	46

The percentage of nurses with a formal ICU qualification in public and private hospital ICUs is displayed below, in Figure NT38. As can be seen, just one private ICU (6.67%) and no public ICUs (0%) had less than 25% qualified nurses. Comparatively, 25.81% of public ICUs and just 6.67% of private ICUs had more than 75% qualified. In the 50-75% category (the ACCCN-endorsed acceptable standard), 60% of private sector ICUs and 41.94% of public hospital ICUs complied. In the 50-100% qualified nurses category (which combines the ACCCN 'acceptable' (greater than 50%) and 'recommended' (greater than 75%) levels), 66.67% of private hospital ICUs, and 67.75% of public ICUs were within the ACCCN standards.[3]

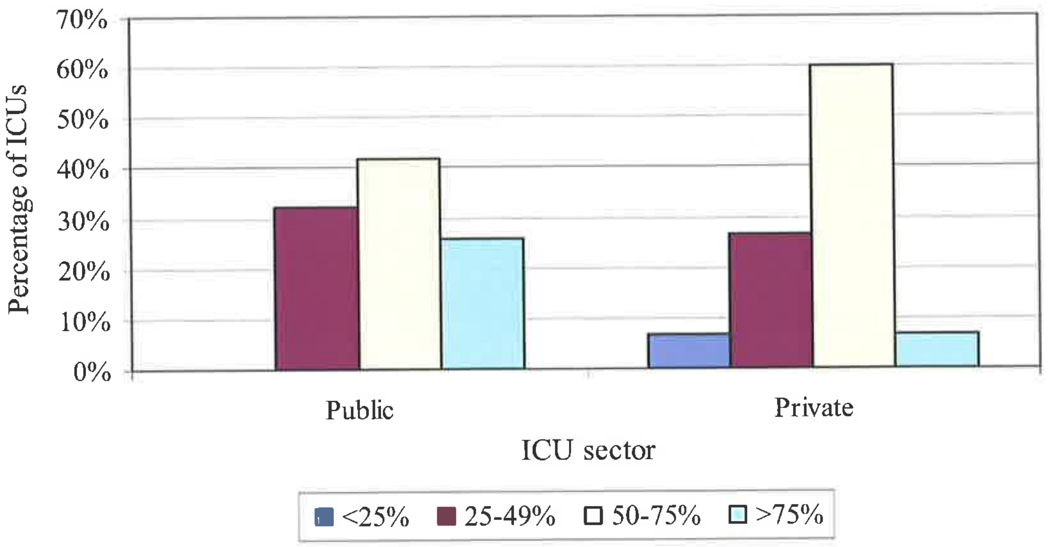


Figure 4-11 NT38 Proportion of nurses with a formal ICU qualification employed in each public and private hospital ICU

RN Distribution

NUMs were asked the number of full-time equivalent (FTE) Registered Nurses (RNs) (refer Glossary) employed in their ICU, in order to gauge the numbers of nurses working across ICUs. This is a data-set which it was believed NUMs would be readily familiar with. It should also be noted that the number of FTE nurses, not the number of employed nurses, was collected, as it allows for more accurate workforce comparisons across ICUs.

The spread of FTE RNs is shown below, in Figure NT10a. A similar number of ICUs employed more than 60 FTE RNs (43.48%) as employed 31-60 FTE RNs (39.13%), and just 4.35% of ICUs employed more than 130 FTE RNs.

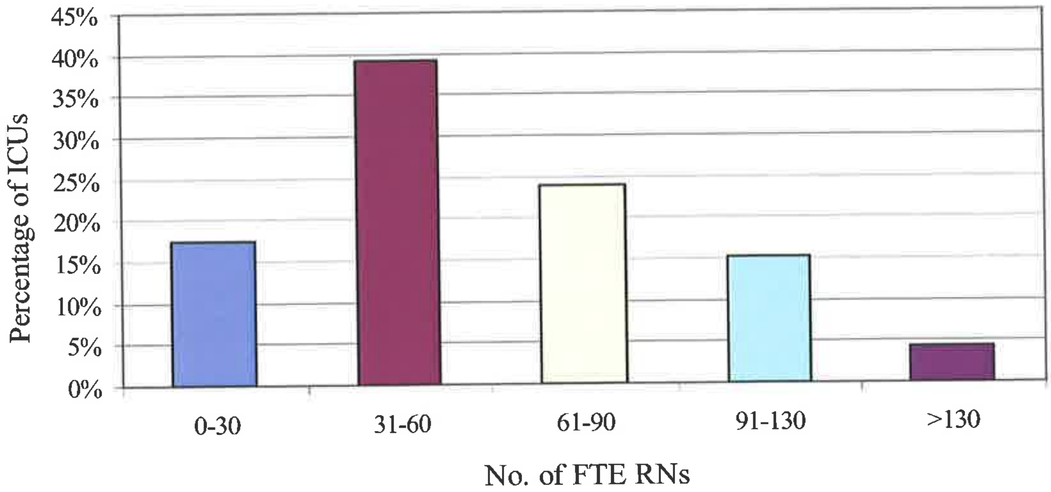


Figure 4-12 NT10a *Number of full-time equivalent registered nurses employed in each ICU*

Comparing RNs in private and public hospital ICUs, 93.33% of private hospital ICUs, and just 38.71% of public hospital ICUs, employed 60 or less FTE RNs. Within the entire sample, 53.33% of ICUs employed 30 or fewer FTE RNs, but all of these ICUs were located within private hospitals (Figure NT11).

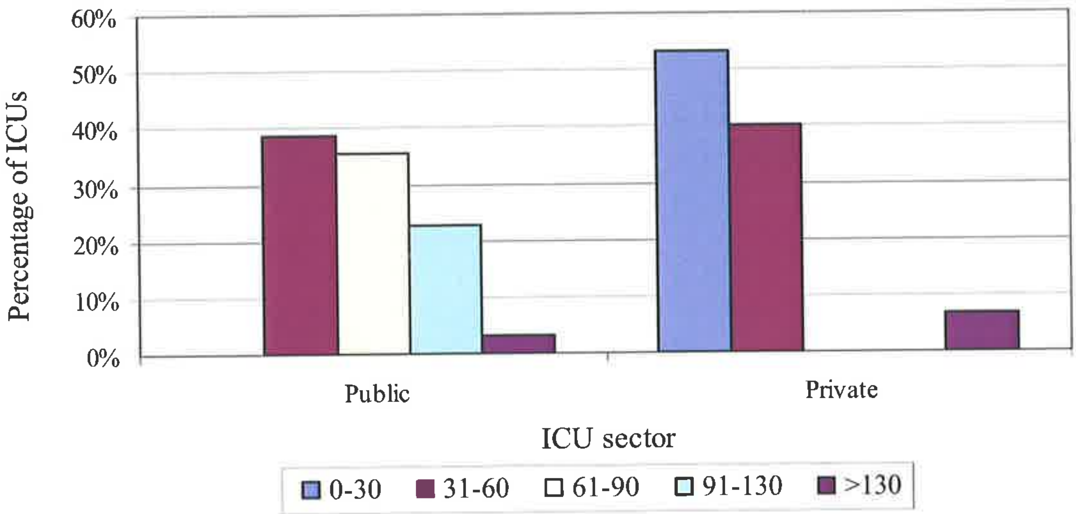


Figure 4-13 NT11 *Number of full-time equivalent registered nurses employed in each public and private hospital ICU*

Figure NT12 shows the correlation between the number of open vent beds and FTE RNs in each ICU (with one private hospital excluded due to a nursing hours outlier that would have skewed the data). The relationship between these two variables was investigated through a Pearson's r correlation, with the strong, positive correlation found indicating that higher numbers of open vent beds in an ICU are associated with higher numbers of FTE RNs ($r = .71$, $p < .0001$).

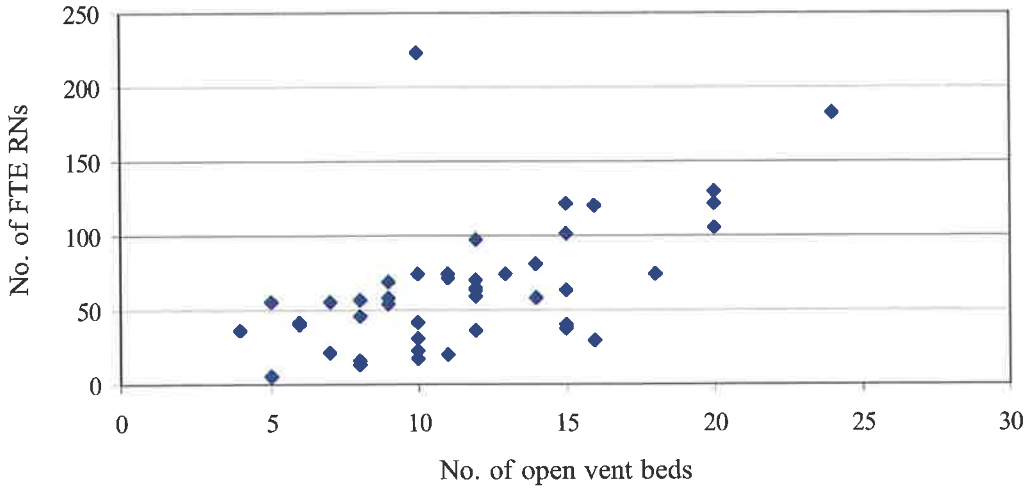


Figure 4-14** NT12 **Number of open vent beds in each ICU by number of FTE registered nurses

When a further two-way between groups analysis of variance was conducted on the number of FTE RNs and average ICU occupancy, no significant effect was found ($p > .05$).

EN Distribution

The number of FTE enrolled nurses (ENs, also known as Division 2 RNs in some states – refer Glossary) employed in each ICU was also gathered in the NUM questionnaire. The data collected showed that the vast majority of ICUs (76.09%) employed no ENs at all, while fewer ICUs employed 1 (10.87%), 2 (8.7%), or 3 (2.17%) ENs. Only 1 ICU (2.17%) employed more than 3 ENs, with that ICU employing 8 ENs (Figure NT13a).

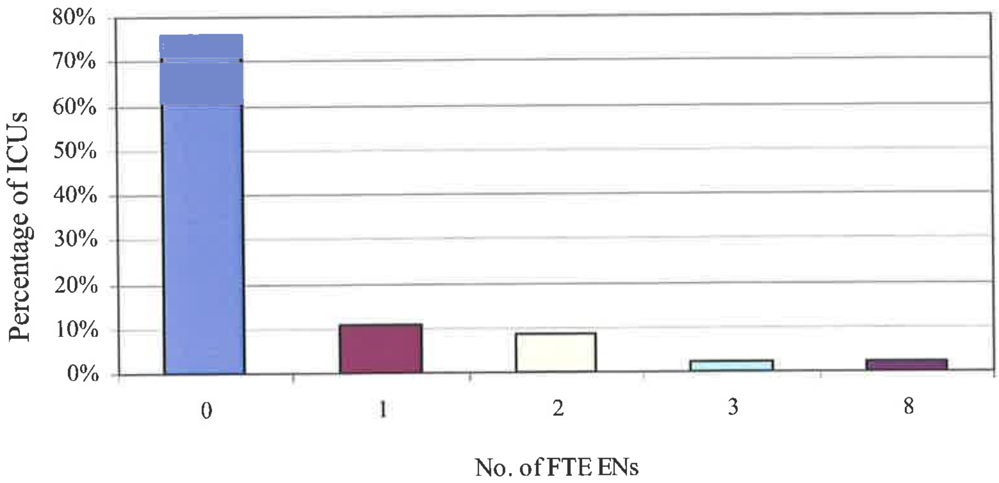


Figure 4-15 NT13a Number of enrolled nurses employed in each ICU

This item on the number of ENs in each ICU in the NUM questionnaire was framed as a broad initial question on overall EN employment in ICUs, while subsequent questions sought greater detail regarding whether employed ENs had any direct patient care duties in their ICU. The initial results indicate that the use of ENs in the overall ICU workforce is generally negligible, and the proportion of ENs to RNs in the vast majority of Australian ICUs is very much in favour of RNs. As illustrated in Table NT13, 9 (90%) of Victorian ICUs, 11 (91.67%) of New South Wales ICUs, 3 (75%) of South Australian and Western Australian ICUs, 2 (66.67%) of Tasmanian ICUs, and 7 (58.33%) of Queensland ICUs did not employ any ENs.

Table 4-10 NT13 Number of full-time equivalent enrolled nurses employed in ICUs located in each Australian state

State	No. of FTE ENs employed in each ICU					Total
	0	1	2	3	8	
NSW	11 91.67%	0 0%	1 8.33%	0 0%	0 0%	12
Victoria	9 90%	0 0%	1 10%	0 0%	0 0%	10
Queensland	7 58.33%	3 25%	1 8.33%	1 8.33%	0 0%	12
SA	3 75%	0 0%	0 0%	0 0%	1 25%	4
WA	3 75%	1 25%	0 0%	0 0%	0 0%	4
Tasmania	2 66.67%	0 0%	1 33.33%	0 0%	0 0%	3
ACT	0 0%	1 100%	0 0%	0 0%	0 0%	1
Total	35	5	4	1	1	46

Examining the number of FTE ENs employed in public and private hospital ICUs, a higher percentage of private hospital ICUs (86.67%) than public hospital ICUs (70.97%) employed no FTE ENs (Figure NT14). The one ICU that employed more than 3 FTE ENs was located within a public hospital.

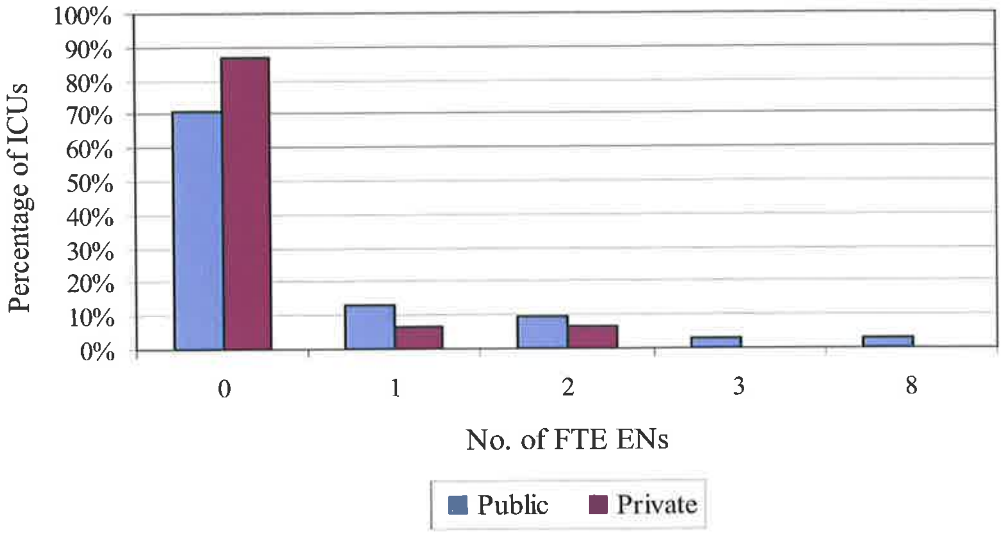


Figure 4-16 NT14 Number of full-time equivalent enrolled nurses employed in public and private hospital ICUs

Table NT15, below, describes the distribution of FTE ENs across different-sized ICUs. Those ICUs that employed no FTE ENs were 40% of large ICUs, 79.31% of medium ICUs, and 83.33% of small ICUs. The only ICU to employed more than 3 FTE ENs was a large ICU.

Table 4-11 NT15 Number of full-time equivalent enrolled nurses employed in different sized ICUs

ICU size	No. of FTE ENs employed in each ICU					Total
	0	1	2	3	8	
Small: 1-8 beds	10 83.33%	0 0%	2 16.67%	0 0%	0 0%	12
Medium: 9-16 beds	23 79.31%	3 10.34%	2 6.90%	1 3.45%	0 0%	29
Large: 17+ beds	2 40%	2 40%	0 0%	0 0%	1 20%	5
Total	35	5	4	1	1	46

As previously mentioned, following the initial question on the number of FTE ENs employed in each hospital, a follow-up question enquired about how many ENs were employed in direct patient care duties (although one NUM did not answer the follow-up).

Table 4-12 NT15a Number of full-time equivalent enrolled nurses working in direct patient care in each ICU in each Australian state

ICU size	No. of FTE ENs working in direct patient care in each ICU			Total
	0	1	2	
NSW	12 100%	0 0%	0 0%	12
Victoria	10 100%	0 0%	0 0%	10
Queensland	11 91.67%	1 8.33%	0 0%	12
SA	3 100%	0 0%	0 0%	3
WA	4 100%	0 0%	0 0%	4
Tasmania	2 66.67%	0 0%	1 33.33%	3
ACT	1 100%	0 0%	0 0%	1
Total	43	1	1	45

As can be seen in Table NT15a (above), the only two ICUs (4.44%) that did utilise ENs in direct patient care were located in Queensland and Tasmania.

Table 4-13 NT16 Number of full-time equivalent enrolled nurses working in direct patient care in each public and private hospital ICU

Hospital type	No. of FTE ENs working in direct patient care in each ICU			Total
	0	1	2	
Public	30 100%	0 0%	0 0%	30
Private	13 86.67%	1 6.67%	1 6.67%	15
Total	43	1	1	45

The two ICUs which did utilise ENs for direct patient care were both located in private hospitals (Table NT16, above) in capital cities (Table NT17, below).

Table 4-14 NT17 Number of full-time equivalent enrolled nurses working in direct patient care in each rural, remote, and metropolitan ICU

Area classification	No. of FTE ENs working in direct patient care in each ICU			Total
	0	1	2	
Capital city	35 94.59%	1 2.7%	1 2.7%	37
Metropolitan	6 100%	0 0%	0 0%	6
Rural	2 100%	0 0%	0 0%	2
Total	43	1	1	45

Hours Worked – RNs vs. Agency Nurses

NUMs were asked the total number of nursing hours worked by all nurses employed in their ICU (excluding agency nurses) over the 2003/2004 financial year, to act as a gauge of nursing labour. This information was collected as continuous data, and was later re-classified into categories. Almost a quarter of all NUMs (23.91%) did not answer this question, and any comments on why they didn't respond were classified into 'unable to answer', 'unsure', or 'no answer' where no comment was provided.

Of the 35 ICUs that provided data to this question, as shown in Figure NT19a, the majority utilised 50,000-100,000 (42.86% of responding ICUs) or 100,001-1,000,000 (28.57% of responding ICUs) nursing hours (RNs and ENs, if employed) in the 2003/2004 financial year.

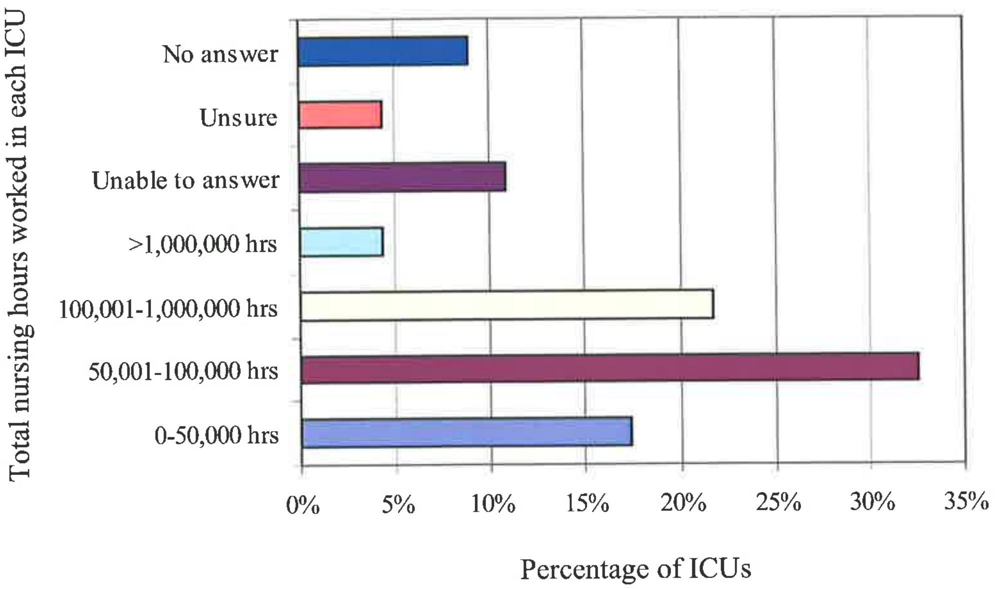


Figure 4-17 NT19a Total number of hours worked by registered and enrolled nurses (excluding agency nurses) over the 2003/2004 financial year

Almost all private ICUs (93.34%) reported using 100,000 or fewer nursing hours in the 12 month period, while the other private ICU (6.67%) did not answer the question. Of public sector ICUs, 29.04% used less than 100,000 or fewer hours, and 32.26% used 100,000 to 1,000,000 hours. Eleven ICUs in total did not provide data on this question, which may reflect sensitivities regarding dissemination of this type of information to external parties (it may be considered commercial-in-confidence) or it may traditionally not be benchmarked. However cautious interpretation is needed here as it is likely that the bed size of each ICU will have an effect.

Table 4-15 NT19 Total number of hours worked by registered and enrolled nurses (excluding agency nurses) over the 2003/2004 financial year in each public and private hospital ICU

Hospital type	Total hours worked by nurses in each ICU over the 2003/2004 financial year							Total
	0-50,000 hours	50,001-100,000 hours	100,001-1,000,000 hours	>1,000,000 hours	Unable to answer	Unsure	No answer	
Public	1 3.23%	8 25.81%	10 32.26%	2 6.45%	4 12.9%	2 6.45%	4 12.9%	31
Private	7 46.67%	7 46.67%	0 0%	0 0%	1 6.67%	0 0%	0 0%	15
Total	8	15	10	2	5	2	4	46

Open Vent Beds	Total hours worked by registered and enrolled nurses (excluding agency nurses) by Open Vent beds over the 2003/2004 financial year							Total
	0-50,000 hours	50,001-100,000 hours	100,001-1,000,000 hours	>1,000,000 hours	Unable to answer	Unsure	No answer	
Small 1-8	3 25.00%	5 41.67%	0 00.00%	0 00.00%	2 16.67%	1 8.33%	1 8.33%	12
Medium 9-16	5 17.24%	10 34.48%	7 24.14%	1 3.45%	3 10.34%	1 3.45%	2 6.90%	29
Large 17+	0 00.00%	0 00.00%	3 60.00%	1 20.00%	0 00.00%	0 00.00%	1 20.00%	5
Total	8	15	10	2	5	2	4	46

Table 4-16a NT19a Total number of hours worked (not agency) by Open Vent Beds over the 2003/2004 financial year

Table NT19a above, reflects increased nursing hours across ICUs with more beds, with 11 ICUs not providing data.

NUMs were also asked about the total number of nursing hours worked by agency nurses employed in their ICU over the 2003/2004 financial year. This was a separate question to the previous one regarding nursing hours worked by registered and enrolled nursing staff. Agency nurse hours worked ranged from 0 to more than 10,000 hours per ICU in the 2003/2004 financial year, demonstrating the level of agency nurse work in Level III ICUs across Australia for the first time in the literature. This information is important in acknowledging the broad range of available, and possibly somewhat unrecognised, skills belonging to agency nurses working in Australian Level III ICUs.

The most common agency hour range was between 5,000 and 10,000 hours as experienced by 12 of the 34 ICUS that provided data to this question.

Table 4-17b ***NT19b*** ***Total number of agency hours worked by Open Vent Beds over the 2003/2004 financial year***

Open Vent Bed	Total hours worked by agency nurses by Open Vent Bed over the 2003/2004 financial year							Total
	0-1,000 hours	1,001-5,000 hours	5,001-10,000 hours	>10,000 hours	Unable to answer	Agency not used	No answer	
Small 1-8	2 16.13%	1 8.33%	4 33.33%	1 8.33%	2 16.67%	2 16.67%	0 00.00%	12
Medium 9-16	3 10.34%	6 20.69%	7 24.14%	6 20.69%	3 10.34%	1 3.45%	1 3.45%	29
Large 17 +	0 00.00%	2 40.00%	1 20.00%	1 20.00%	0 00.00%	0 00.00%	1 20.00%	15
Total	5	9	12	8	5	3	4	46

As Figure NT21 shows, within the 80.43% of NUMs (n = 37) who provided answers on the number of hours worked by agency nurses in their ICU (including ICUs not employing agency nurses), 32.43% utilised 5,001-10,000 agency hours, and 21.62% utilised more than 10,000 hours. Agency nurses were not used by 8.11% of responding ICUs. There were 10.87% of participating NUMs who reported that they were unable to acquire the information required to answer this question.

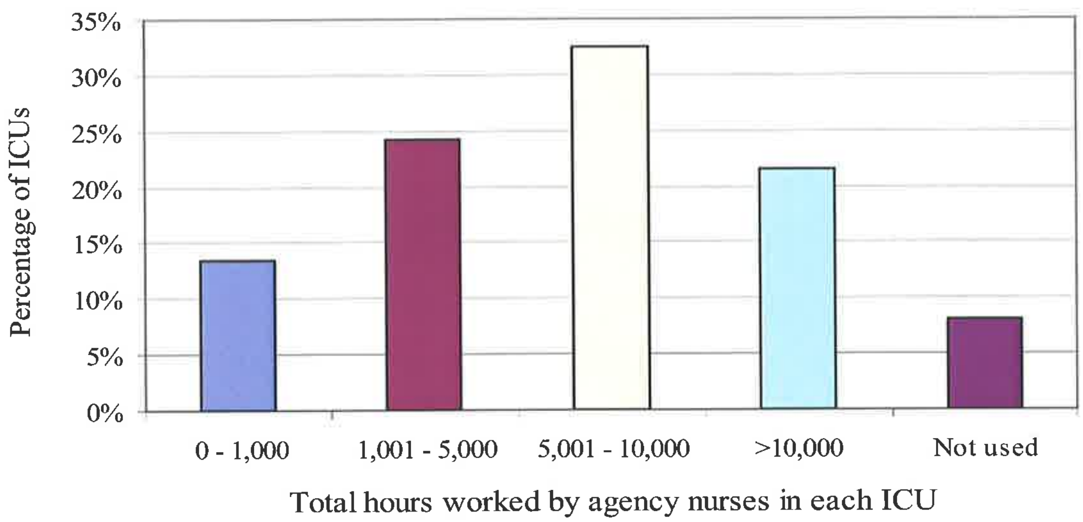


Figure 4-18 ***NT21*** ***Total hours worked by agency nurses in each ICU over 2003/2004 financial year***

Table NT22, below, displays the distribution of total hours worked by agency nurses in ICUs in each Australian state, though 9 of the 46 ICUs did not provide the requested data ('unable to answer' and 'no answer' on Table NT22). Of those ICUs that provided data, 13.51% (n = 5) used 1000 or fewer hours of agency labour over the 12 month period, with 3 of those in located Queensland and one each in Victoria and New South Wales. Of the 21.62% of ICUs (n = 8) that reported the highest agency hours used (more than 10,000), 3 of those were located in Queensland, 2 were in Western Australia and New South Wales, and 1 was in Victoria.

Table 4-18 NT22 Total number of hours worked by agency nurses in each ICU over the 2003/2004 financial year in each Australian state

	Total hours worked by agency nurses in each ICU over the 2003/2004 financial year							
State	0-1,000 hours	1,001-5,000 hours	5,001-10,000 hours	>10,000 hours	Unable to answer	Agency not used	No answer	Total
NSW	1 8.33%	0 0%	4 33.33%	2 16.67%	3 25%	1 8.33%	1 8.33%	12
Victoria	1 10%	5 50%	3 30%	1 10%	0 0%	0 0%	0 0%	10
Queensland	3 25%	3 25%	1 8.33%	3 25%	0 0%	0 0%	2 16.67%	12
SA	0 0%	0 0%	2 50%	0 0%	1 25%	0 0%	1 25%	4
WA	0 0%	0 0%	2 50%	2 50%	0 0%	0 0%	0 0%	4
Tasmania	0 0%	0 0%	0 0%	0 0%	1 33.33%	2 66.67%	0 0%	3
ACT	0 0%	1 100%	0 0%	0 0%	0 0%	0 0%	0 0%	1
Total	5	9	12	8	5	3	4	46

All of the responding ICUs that did not employ any agency nurses were located in public hospitals (12.5% of public ICUs; Table NT23). Over 3 times the number of private hospital ICUs (61.54% of responding) than public hospital ICUs (16.67% of responding) used 5,001-10,000 hours of agency nurses in the 2003/2004 financial year.

Table 4-19 NT23 Total number of hours worked by agency nurses in each ICU over the 2003/2004 financial year in public and private hospitals

Hospital type	Total hours worked by agency nurses in each ICU over the 2003/2004 financial year							Total
	0-1,000 hours	1,001-5,000 hours	5,001-10,000 hours	>10,000 hours	Unable to answer	Agency not used	No answer	
Public	5 16.13%	7 22.58%	4 12.90%	5 16.13%	4 12.90%	3 9.68%	3 9.68%	31
Private	0 0%	2 13.33%	8 53.33%	3 20%	1 6.67%	0 0%	1 6.67%	15
Total	5	9	12	8	5	3	4	46

The number of hours worked by agency nurses in ICUs over the 2003/2004 financial year in capital cities and metropolitan and rural areas is displayed in Table NT24. In rural ICUs (n = 2), agency nurse employment was sparse, with 1 rural ICU using 0-1,000 hours of work by agency nurses, and the other 1 not employing agency nurses at all. Reasons for this may relate to a lack of availability, or could reflect a more stable permanent rural workforce.

Table 4-20 NT24 Total number of hours worked by agency nurses over the 2003/2004 financial year in each rural, remote, and metropolitan ICU

Area	Total hours worked by agency nurses in each ICU over the 2003/2004 financial year							
	0-1,000 hours	1,001-5,000 hours	5,001-10,000 hours	>10,000 hours	Unable to answer	Agency not used	No answer	Total
Capital city	0 0%	7 18.42%	12 31.58%	8 21.05%	5 13.16%	2 5.26%	4 10.53%	38
Metro-politan	4 66.67%	2 33.33%	0 0%	0 0%	0 0%	0 0%	0 0%	6
Rural	1 50%	0 0%	0 0%	0 0%	0 0%	1 50%	0 0%	2
Total	5	9	12	8	5	3	4	46

The FTE nurse hours (excluding agency nurses) in each ICU in the 2003/2004 financial year by agency nurse hours in each ICU for the same time period by public and private hospital ICUs was also analysed. The number of agency nursing hours was analysed as a continuous variable using linear regression to determine whether a statistically significant difference existed between private and public hospitals after adjustment for total nursing hours. After adjustment for total nursing hours there was no statistically significant difference between private and public hospitals and the number of agency nursing hours ($p = 0.3478$, mean difference -3569.45, C.I. (-11156,4017.59)).

The relationship between the total hours of work done by agency nurses in the 2003/2004 financial year and total hours of work done by all other ICU nurses (excluding agency nurses), was also separated out into average ICU occupancy. A Pearson's r correlation, performed to examine the relationship between nursing hours (excluding agency nurses) in each ICU by agency nursing hours for each ICU, found no significant association ($r = -0.26$, $p > .05$), indicating that the number of agency nursing hours is not related to the number of FTE nursing hours.

NUMs were also asked what proportion of their total ICU nursing staff was comprised of agency nurses, and their responses are displayed below, in Figure NT29a. Predefined percentage categories were offered for answers to this question, as it was believed that the exact data on the proportion of agency nurse use may not have been readily available to NUMs. Most ICUs, as one of their recognised performance indicators, aim to have their agency use at less than 10% on a regular basis. Of those that answered (n = 39), the majority of NUMs used less than 5% of their budget on agency nurses (35.89%), with the next most frequent percentages of agency nurses being 15-24% (20.51%), 10-14% (15.38%), and 5-9% (12.82%). The fewest ICUs had more than 25% of their nursing workforce budget comprised of agency nurses.

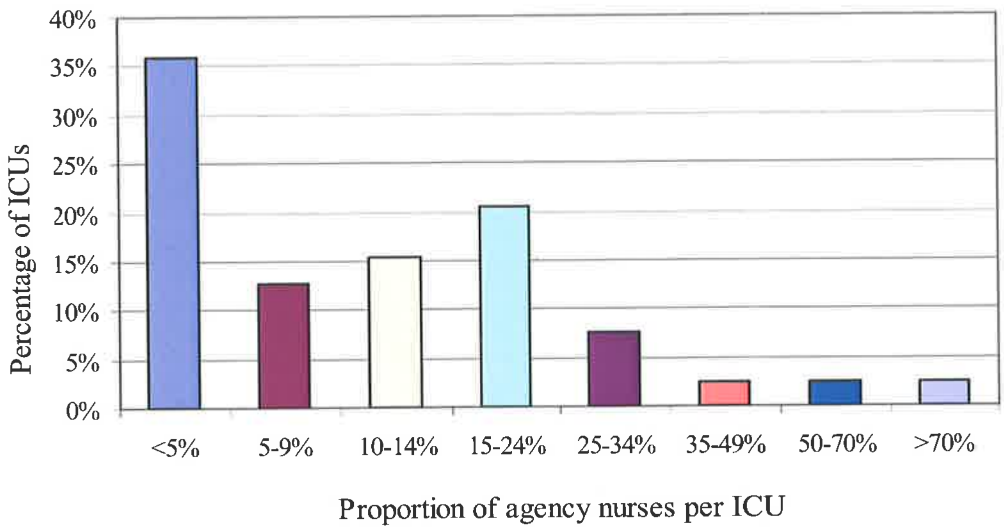


Figure 4-19 NT29a Proportion of agency nurse hours within the total nursing staff of each ICU

Table NT29 illustrates the percentage of the total ICU nurse labour that was spent on agency nurses over the 2003/2004 financial year across each Australian state. Within the two smallest Australian states, 1 ICU in Tasmania utilised 15-24% agency nurses and one was unsure, while the one other Tasmanian ICU and the only responding ACT ICU both reported 5-9% agency nurse use.

Table 4-21 NT29 Proportion of agency nurse hours within the total nursing staff of ICUs in each state

State	Proportion of agency nurses within total nursing staff in each ICU									Total
	<5%	5-9%	10-14%	15-24%	25-34%	35-49%	50-70%	>70%	Unsure	
NSW	1 8.33%	0 0%	4 33.33%	1 8.33%	1 8.33%	1 8.33%	1 8.33%	1 8.33%	2 16.67%	12
VIC	5 50%	2 20%	1 10%	1 10%	0 0%	0 0%	0 0%	0 0%	1 10%	10
QLD	5 41.67%	2 16.67%	1 8.33%	2 16.67%	1 8.33%	0 0%	0 0%	0 0%	1 10%	12
SA	1 25%	0 0%	0 0%	1 25%	0 0%	0 0%	0 0%	0 0%	1 25%	4
WA	1 25%	0 0%	0 0%	1 25%	1 25%	0 0%	0 0%	0 0%	1 25%	4
TAS	1 33.33%	0 0%	0 0%	1 33.33%	0 0%	0 0%	0 0%	0 0%	1 33.33%	3
ACT	0 0%	1 100%	0 0%	0 0%	0 0%	0 0%	0 0%	0 0%	0 0%	1
Total	14	5	6	8	3	1	1	1	7	46

The difference in the proportion of agency nurses within public and private hospital ICUs can be seen below in Table NT30. Within the overall sample, 61.54% of responding public ICUs (excluding 'unsure' responses) used less than 10% agency nurses within their nursing workforce budget, compared to just 23.08% of private ICUs using the same proportion. However, 69.23% of private ICUs used 10-24% agency nurses, versus the 19.23% of public ICUs that used that same proportion. Of the only two ICUs that reported using more than 50% agency nurse labour (5.13% of the total responding ICUs), both were in the public sector. The number of agency nursing hours used in ICUs was analysed (as a continuous variable) using linear regression to determine whether there was a statistically significant difference between private and public hospitals after controlling for the ICU total nursing hours; however, as Table NT30a shows, no significant difference was found between the agency nursing hours used in public and private hospital ICUs ($p > .05$).

Table 4-22 NT30 Proportion of agency nurses within the total nursing staff of public and private hospital ICUs

Hosp type	Proportion of agency nurses within total nursing staff in each ICU									Total
	<5%	5-9%	10-14%	15-24%	25-34%	35-49%	50-70%	>70%	Unsure	
Pub	13 41.94%	3 9.68%	3 9.68%	2 6.45%	3 9.68%	0 0%	1 3.23%	1 3.23%	5 16.13%	31
Priv	1 6.67%	2 13.33%	3 20%	6 40%	0 0%	1 6.67%	0 0%	0 0%	2 13.33%	15
Total	14	5	6	8	3	1	1	1	7	46

Table 4-23 NT30a Linear regression analysing the difference between the agency nursing hours used by public and private ICUs, controlling for total nursing hours used

Hospital type	Mean agency hours used	Pr > | t |
Public	3057.45	0.3478
Private	6626.90	

Comparing the proportion of agency nurses used in ICUs located in capital cities, metropolitan areas, and rural areas, as shown in Table NT31, all of the metropolitan and rural ICUs in this study (100%) employed less than 5% agency nurses within their total ICU nursing workforce. In contrast, the proportion of agency nurses was much more varied between capital city ICUs, ranging from less than 5% to more than 70%.

Table 4-24 NT31 Proportion of agency nurses within the total nursing staff of ICUs in capital cities and metropolitan and rural areas

Area class.	Proportion of agency nurses within total nursing staff in each ICU									Total
	<5%	5-9%	10-14%	15-24%	25-34%	35-49%	50-70%	>70%	Unsure	
Capital City	6 15.79%	5 13.16%	6 15.79%	8 21.05%	3 7.89%	1 2.63%	1 2.63%	1 2.63%	7 18.42%	38
Metro-politan	6 100%	0 0%	0 0%	0 0%	0 0%	0 0%	0 0%	0 0%	0 0%	6
Rural	2 100%	0 0%	0 0%	0 0%	0 0%	0 0%	0 0%	0 0%	0 0%	2
Total	14	5	6	8	3	1	1	1	7	46

Number of Shift Leaders

NUMs were asked to provide the number of employed SLNs in their ICU for two purposes: (a) to allow approximation of the SLN response rate to the SLN questionnaire, and (b) to ascertain the number of Shift Leaders across ICUs by sector and states. One ICU (of 46) did not answer this question. As Figure NT39 shows, of those responding ICUs, just over half (53.33%) reported having 11-20 rostered SLNs, while just 11.11% had more than 30 SLNs, and 13.33% had 6-10 SLNs. However, within those ICUs with fewer SLNs, it may be that the same SLNs are adopting this role over and over again, as opposed to ICUs with greater numbers of SLNs, in which more nurses may be called upon to perform this role less often. Table NT39a below highlights the wide spread of SLNs across ICU size.

Table 4-22a NT39a Number of SLNs rostered in ICUs by Open Vent Beds

Open Vent Beds	No. of SLNs rostered in each ICU				Total
	6-10	11-20	21-30	>30	
Small 1-8	4 33.33%	6 50.00%	2 16.67%	0 00.00%	12
Medium 9-16	2 7.14%	16 57.14%	7 25.00%	3 10.71%	28
Large 17 +	0 00.00%	2 40.00%	1 20.00%	2 40.00%	5
Total	6	24	10	5	45

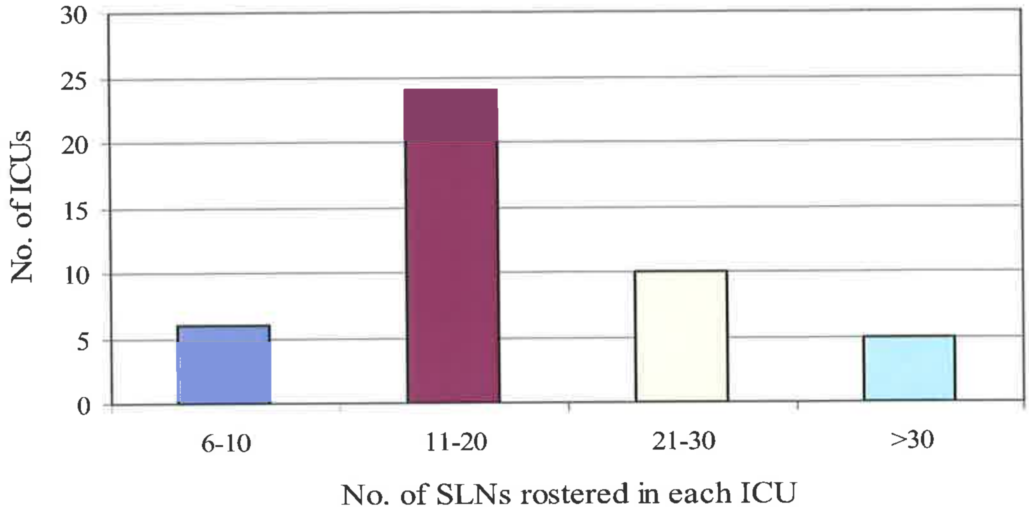


Figure 4-20 NT39 Number of SLNs rostered in ICUs

Table NT39a, below, shows the number of SLNs in ICUs located in each Australian state. While no Victorian or ACT ICU employed more than 20 SLNs, 25% of Queensland ICUs, 45.45% of NSW ICUs, and 75% of both South Australian and Western Australian ICUs all employed more than 20.

Table 4-25 NT39a Number of SLNs rostered in ICUs in each Australian state

State	No. of SLNs rostered in each ICU				Total
	6-10	11-20	21-30	>30	
NSW	2 18.18%	4 36.36%	5 45.45%	0 0%	11
Victoria	2 20%	8 80%	0 0%	0 0%	10
Queensland	1 8.33%	8 66.67%	1 8.33%	2 16.67%	12
SA	0 0%	1 25%	1 25%	2 50%	4
WA	0 0%	1 25%	2 50%	1 25%	4
Tasmania	1 33.33%	1 33.33%	1 33.33%	0 0%	3
ACT	0 0%	1 100%	0 0%	0 0%	1
Total	6	24	10	5	45

Figure NT43 displays the number of SLNs and FTE RNs in each public and private hospital ICU. Investigation of a possible association between the number of SLNs rostered in each ICU and the number of FTE RNs in each ICU was conducted via a Pearson's r test (excluding one outlier hospital), which found a strong, positive correlation ($r = 0.62$; $p < .0001$). As illustrated in Figure NT43, this finding shows that a greater number of FTE RNs in an ICU is associated with a greater number of individual SLNs rostered in the ICU.

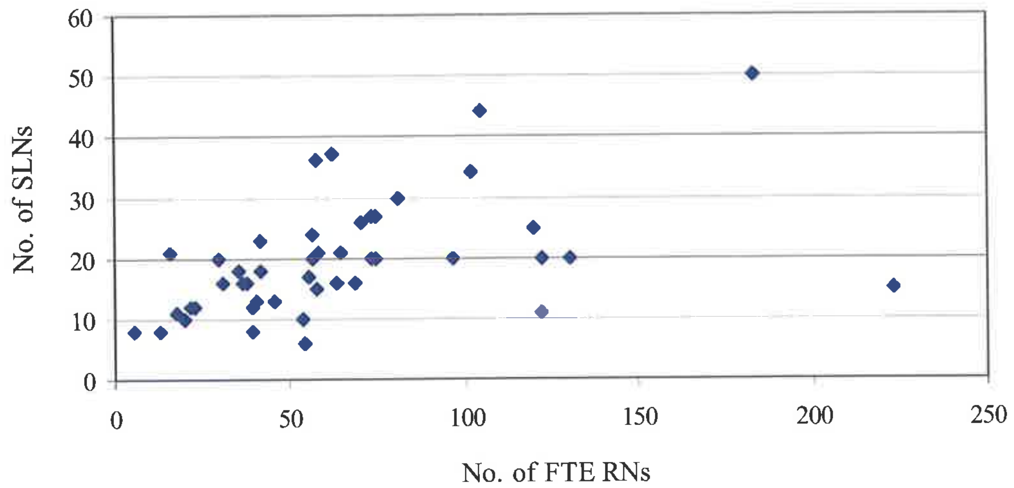


Figure 4-21 NT43 Number of FTE RNs by number of rostered SLNs

The Shift Leaders (SLNs)

In the following shift leader-related analyses, data obtained from 317 SLNs working in 50 ICUs is presented. Although 46 NUMs (1 in each ICU) took part in the study, SLNs from another 4 ICUs also participated, even though their NUM had not completed a NUM questionnaire.

SLN profile

In this section, the characteristics of participating SLNs (n = 317) are presented in regards to their nursing classification, qualifications, age, gender, and length of service.

As shown in Figure T1a, most SLNs (58.1%) were Level 2 RNs, while only 9.84% were RN Classification Level 3 or greater, and 86.35% of SLNs were RN Level 1 or 2 (n = 315). This suggests in the majority of ICUs, a reasonable level of experience is required or expected to be charged with the shift leader and staffing decision-making role and associated responsibilities.

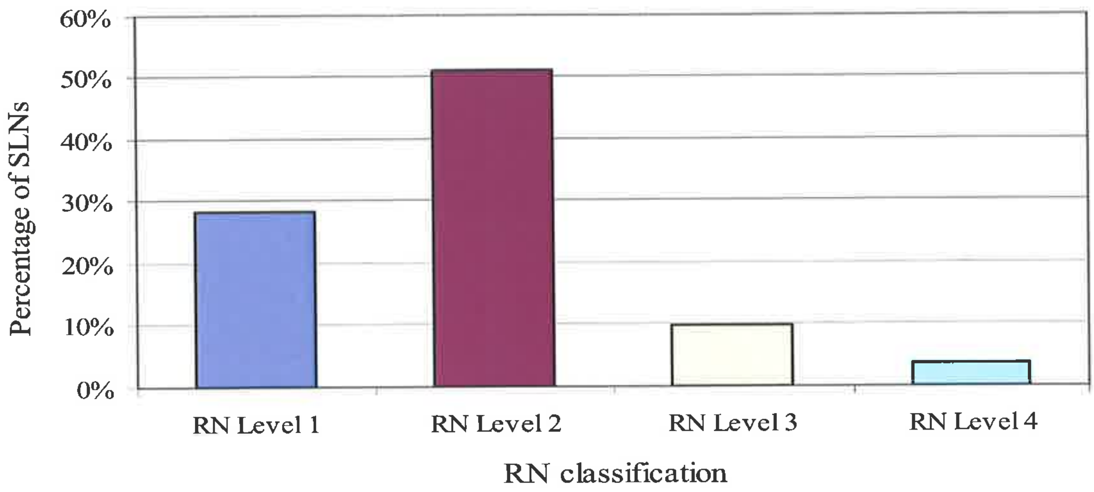


Figure 4-22 T1a RN Classification of each SLN

The Classification of SLNs in ICUs located in each Australian state is presented below in Table SLN1b (n = 315). Across all Australian states, 32.61% to 82.93% of responding SLNs were Level 2 RNs. Senior RNs (Level 4) working as SLNs appeared relatively rare in all states, with proportions ranging from 0% (ACT and WA) to 7.89% (NSW).

Table 4-26 SLN1b Classification of SLNs employed in ICUs located in each Australian state

State	RN classification				Total
	Level 1	Level 2	Level 3 (CNC/ CM/NM)	Level 4 (NUM)	
NSW	24 31.58%	43 56.58%	3 3.95%	6 7.89%	76
Victoria	5 9.62%	26 50%	19 36.54%	2 3.85%	52
Queensland	22 28.57%	51 66.23%	2 2.6%	2 2.6%	77
SA	26 56.52%	15 32.61%	4 8.7%	1 2.17%	46
WA	6 14.63%	34 82.93%	1 2.44%	0 0%	41
Tasmania	5 33.33%	9 60%	0 0%	1 6.67%	15
ACT	0 0%	1 50%	1 50%	0 0%	2
NT	1 16.67%	4 66.67%	1 16.67%	0 0%	6
Total	89	183	31	12	315

Figure SLN2 displays the RN classifications of SLNs working in public and private ICUs, and shows that the private sector had more RN Level 1 SLNs (35.53%) than the public (25.73%), with the inverse relationship present in regards to Level 2 RN SLNs.

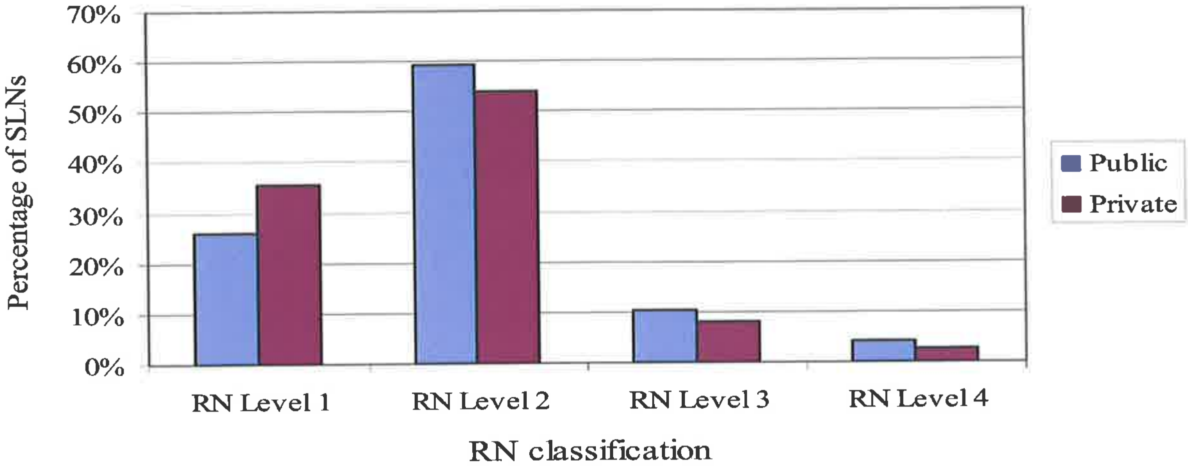


Figure 4-23 SLN2 Classification of SLNs employed in public and private hospital ICUs

Figure T2 (below) illustrates the highest ICU qualification held by SLNs. Of the responding SLNs (in all subsequent related analyses, n = 316), 93.35% held a formal ICU qualification (a Critical Care Certificate, Graduate Diploma or Masters degree).

Despite the fact that SLNs have a significant role in staffing decisions as shift leaders, the remaining 6.65% of SLNs had no recognised ICU qualification. Although this is a relatively low percentage, it is surprising that there are any SLNs without qualifications, given that the shift leader is considered the key resource member of the shift and that many shifts are outside of 'normal working hours' with minimal (if any) support available from senior staff.

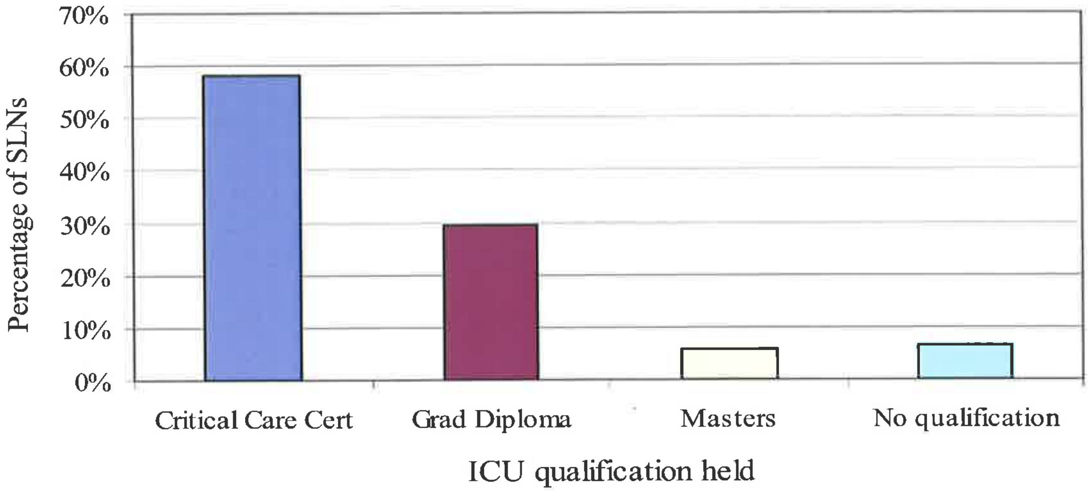


Figure 4-24 T2 Highest recognised ICU qualification held by each SLN

The ICU qualifications of SLNs in each Australian state can be seen in Table SLN3. In the ACT, no SLN had a higher ICU qualification than a Critical Care Certificate, while a Masters degree was held by 13.16% of SLNs in Western Australia, 8.7% in South Australia, 6.67% in Tasmania, and no SLNs (0%) in Victoria, Western Australia, the ACT, and Northern Territory.

Table 4-27 SLN3 Highest recognised qualification held by SLNs employed in ICUs in each Australian state

State	Highest ICU qualification				Total
	Critical care certificate	Graduate diploma	Masters degree	No qualification	
NSW	49 63.64%	17 22.08%	3 3.9%	8 10.39%	77
Victoria	29 55.77%	23 44.23%	0 0%	0 0%	52
Queensland	59 63.16%	13 17.11%	10 13.16%	6 7.89%	76
SA	21 45.65%	21 45.65%	4 8.7%	0 0%	46
WA	26 63.41%	11 26.83%	0 0%	4 9.76%	41
Tasmania	5	6	1	3	15

	33.33%	40%	6.67%	20%	
ACT	2 100%	0 0%	0 0%	0 0%	2
NT	4 66.67%	2 33.33%	0 0%	0 0%	6
Total	184	93	18	21	316

In Table SLN3a the highest qualification held by SLNs in public and private hospital ICUs is shown, with similar percentages of SLNs in each sector holding either a Critical Care Certificate or Graduate Diploma (86.67% in public vs. 90.79% in private).

Table 4-28 SLN3a Highest recognised qualification held by SLNs employed in public and private hospital ICUs

Hospital type	Highest ICU qualification				Total
	Critical care certificate	Graduate diploma	Masters degree	No qualification	
Public	133 55.42%	75 31.25%	13 5.42%	19 7.92%	240
Private	51 67.11%	18 23.68%	5 6.58%	2 2.63%	76
Total	184	93	18	21	316

The data gathered on the highest qualification held by SLNs was then collapsed into two larger categories: those who held a recognised ICU qualification (93.35%; n = 295) and those who didn't (6.65%; n = 21), as shown in Table SLN3b below. The state with the highest percentage of non-qualified SLNs was Tasmania (20%), while NSW (10.39%) and WA (9.76%) had the next highest proportions of non-qualified SLNs. Four states had no SLNs without an ICU qualification.

Table 4-29 SLN3b SLNs with and without any ICU qualification in each Australian state

State	ICU qualification status		Total
	Has ICU qualification	No ICU qualification	
NSW	69 89.61%	8 10.39%	77
Victoria	52 100%	0 0%	52
Queensland	71 92.21%	6 7.79%	77
SA	46 100%	0 0%	46
WA	37 90.24%	4 9.76%	41
Tasmania	12 80%	3 20%	15
ACT	2 100%	0 0%	2
NT	6 100%	0 0%	6
Total	295	21	316

Figure SLN5a, below, shows the distribution of ICU qualified and non-ICU qualified SLNs across public and private sectors. In the private sector, 97.37% held an ICU qualification, compared to 92.08% of SLNs in the public sector.

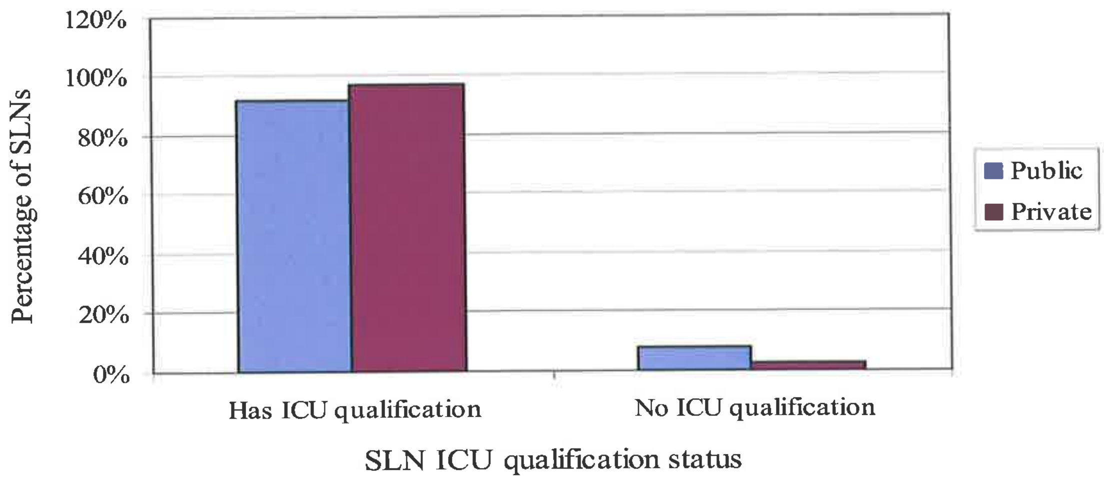


Figure 4-25 SLN5a SLNs with and without any ICU qualification in public and private hospital ICUs

The qualification status of SLNs working in ICUs located in capital cities, metropolitan, and rural areas is shown in Table SLN5b. In rural areas, 18.75% of SLNs had no ICU qualification, compared to 6.77% in metropolitan areas, and 2.04% in capital cities.

Table 4-30 SLN5b Qualification status of SLNs in capital city, metropolitan, and rural ICUs

Area classification	ICU qualification status		Total
	Has ICU qualification	No ICU qualification	
Capital city	234 93.23%	17 6.77%	251
Metropolitan	48 97.96%	1 2.04%	49
Rural	13 81.25%	3 18.75%	16
Total	295	21	316

Figure T3, below, displays the number of years since each SLN's most recent ICU qualification (n = 293). It had been 10 or more years since the most recent qualification of 29.01% of SLNs, while the majority (31.74%) had received their most recent qualification between 5 and less than 10 years ago.

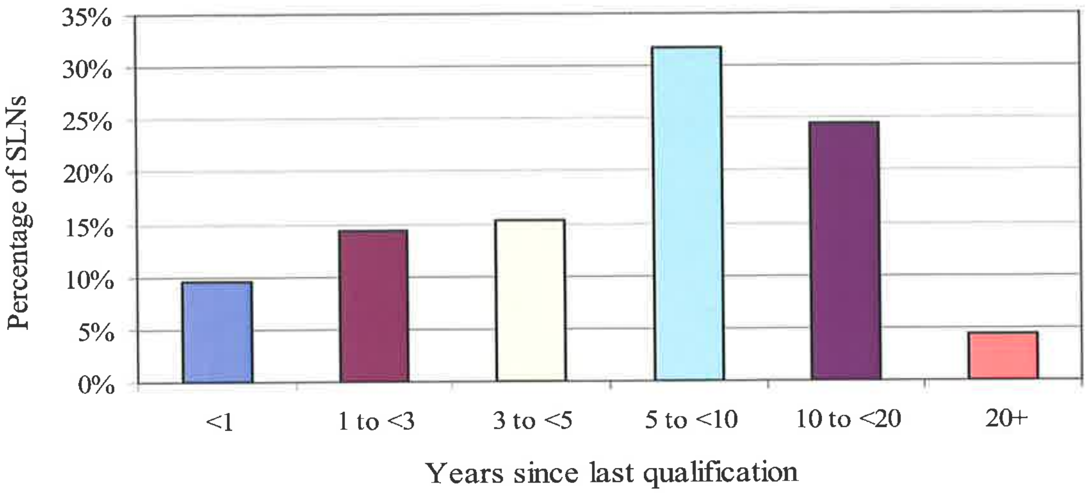


Figure 4-26 T3 Years since each SLN's most recent ICU qualification

The number of years since the most recent ICU qualification of ICU SLNs in each Australian state can be seen in Table SLN6, with similar representation across the states for SLNs whose qualifications had been gained more than 10 years ago.

Table 4-31 SLN6 Number of years since the most recent ICU qualification of ICU SLNs in each Australian state

State	Years since most recent ICU qualification						Total
	<1 year	1 to <3 years	3 to <5 years	5 to <10 years	10 to <20 years	20+ years	
NSW	8 11.59%	15 21.74%	8 11.59%	22 31.88%	14 20.29%	2 2.9%	69
Victoria	0 0%	1 2%	12 24%	14 28%	20 40%	3 6%	50
Queensland	8 11.27%	10 14.08%	12 16.90%	25 35.21%	13 18.31%	3 4.23%	71
SA	4 8.7%	9 19.57%	6 13.04%	13 28.26%	13 28.26%	1 2.17%	46
WA	4 10.81%	7 18.92%	3 8.11%	13 35.14%	8 21.62%	2 5.41%	37
Tasmania	4 33.33%	7 8.92%	3 8.11%	13 35.14%	8 21.62%	2 5.41%	12
ACT	0 0%	0 0%	0 0%	1 50%	1 50%	0 0%	2
NT	0 0%	0 0%	3 50%	2 33.33%	0 0%	1 16.67%	6
Total	28	42	45	93	72	13	293

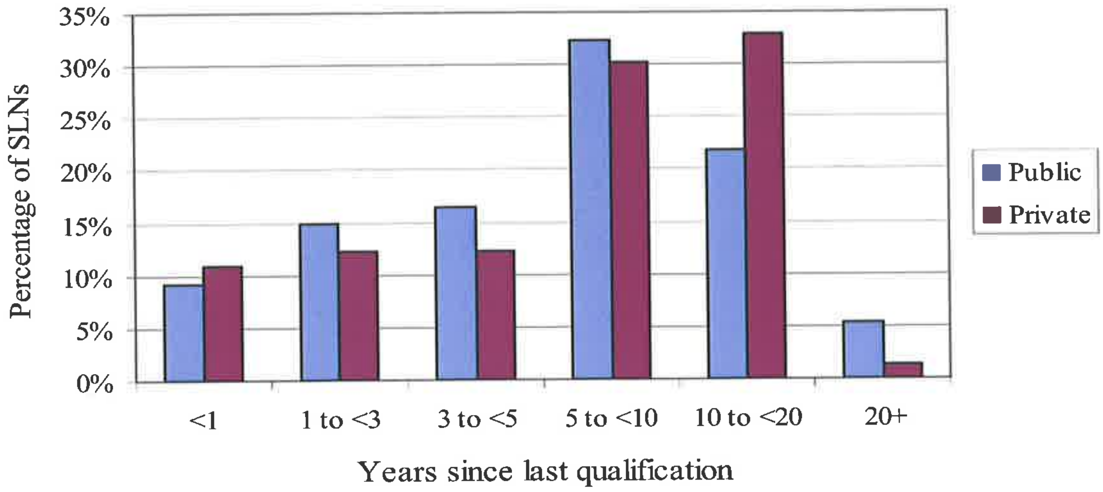


Figure 4-27 ***SLN7*** ***Number of years since the most recent ICU qualification of SLNs in public and private hospital ICUs***

Figure SLN7 displays the number of years since the most recent ICU qualification of public and private ICU SLNs. SLNs whose most recent qualification had been gained 10 to less than 20 years ago, were comprised of 21.82% of public sector ICUs, compared to 32.88% private ICUs. The opposite trend was found in regards to SLNs who had received their most recent qualification more than 20 years ago, with 5.45% of public ICU SLNs and 1.37% of private ICU SLNs fitting into this category. Below, in Figure SLN8, it can be seen that a higher proportion of rural ICUs (38.46%) had SLNs who had received their last qualification 10 to less than 20 years ago, compared to metropolitan (22.92%) and capital city-located SLNs (24.14%).

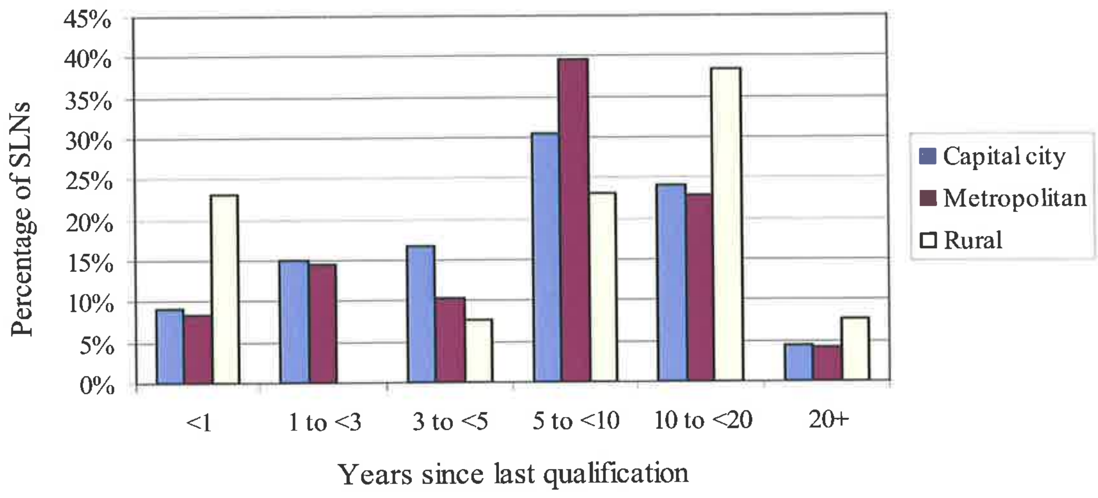


Figure 4-28 SLN8 Number of years since the most recent ICU qualification of SLNs in capital city, metropolitan, and rural ICUs

SLN demographics by Age

The ages of SLNs are displayed in Figure T4 (n = 311). SLNs' ages ranged from less than 24 to greater than 60 years old, with 39.86% of SLNs being aged 40 years or older, and the majority (48.87%) were aged 30 to 39 years. These results appear to support existing literature on ageing nature of the Australian ICU workforce.[16,17,40]

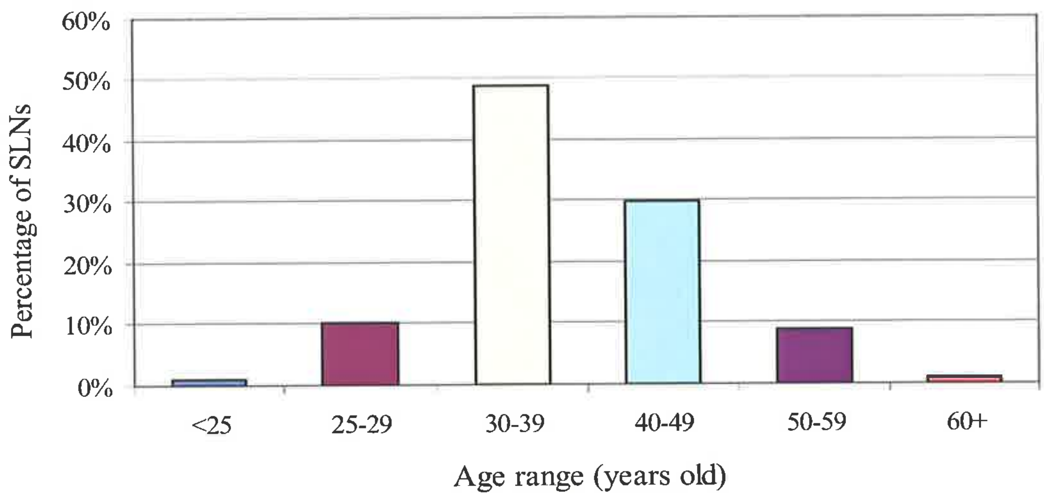


Figure 4-29 T4 Age spread of SLNs

Table SLN14 displays the average age of SLNs in each Australian state, showing that Tasmania had the highest average SLN age of 45.67 years; almost 5 years higher than the next highest average age for SLNs (South Australia, with an average of 40.64 years). The

ACT (34.5 years) and Northern Territory (35.82 years) had the youngest average SLNs in Australia.

Table 4-32 SLN14 Average age of SLNs in each Australian state

	NSW	Vic	QLD	SA	WA	Tas	ACT	NT
No. of SLNs (n)	77	50	77	45	39	15	2	6
Average age	35.94	37.48	39.18	40.64	39.62	45.67	34.50	35.83

The average age of SLNs in the public sector (38.33 years) was similar in comparison to SLNs in the private sector (39.40 years). Examining public and private SLNs by age group (Table SLN12), 38.55% of public hospital SLNs were aged 40 years or older, compared to 44.01% of private hospital SLNs.

Table 4-33 SLN1 Ages of SLNs working in public and private hospital ICUs

Hospital type	SLN ages						Total
	<25 years	25-29 years	30-39 years	40-49 years	50-59 years	60+ years	
Public	0 0%	24 10.17%	121 51.27%	70 29.66%	20 8.47%	1 0.42%	236
Private	3 4%	8 10.67%	31 41.33%	23 30.67%	8 10.67%	2 2.67%	75
Total	3	32	152	93	28	3	311

SLN demographics by gender

Of the 314 SLNs who indicated their gender on the SLN questionnaire, around three quarters (76.75%) were female, and 23.25% were male. Figure SLN16 displays the gender split of SLNs in each Australian state. In the ACT half the responding SLNs were male, followed by Tasmania (33.33% male SLNs), New South Wales (30.26%), and South Australia (28.89%) as the next most highly represented states for male SLNs.

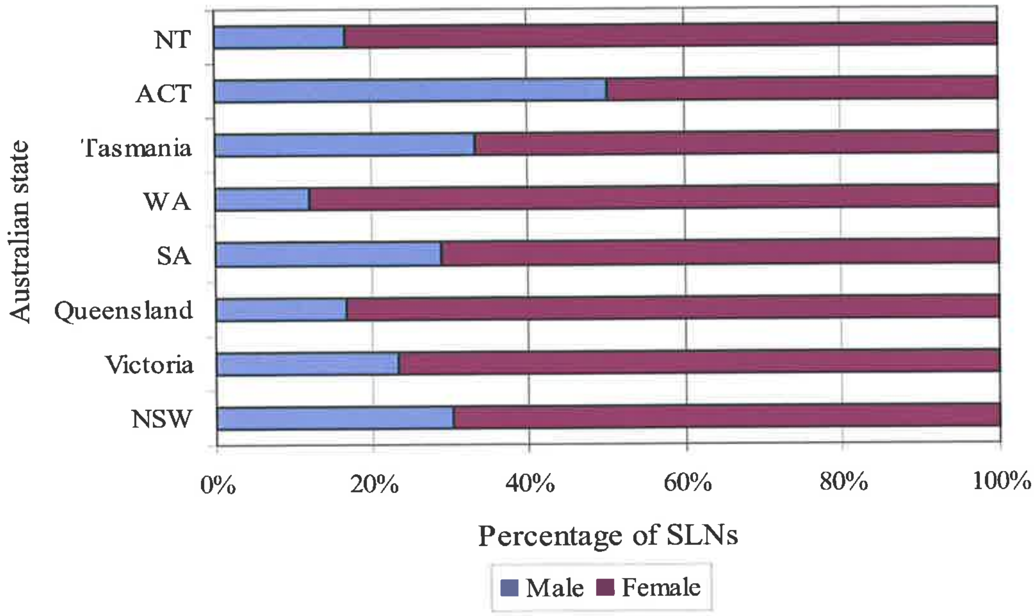


Figure 4-30 SLN16 Gender split of SLNs working in ICUs located in each Australian state

As can be seen in Table SLN17, a higher proportion of male SLNs worked in public hospital ICUs (25.63%) than in private hospital ICUs (15.79%).

Table 4-34 SLN17 Gender split of SLNs working in public and private hospital ICUs

Hospital type	SLN gender		Total
	Male	Female	
Public	61 25.63%	177 74.37%	238
Private	12 15.79%	64 84.21%	76
Total	73	241	314

Figure T5 shows the gender split of SLNs in each age group. As can be seen, there were no male SLNs aged younger than 25 or over 60 years. The highest proportion of male SLNs was in the 50-59 year old age group, where they comprised 35.71% of SLNs.

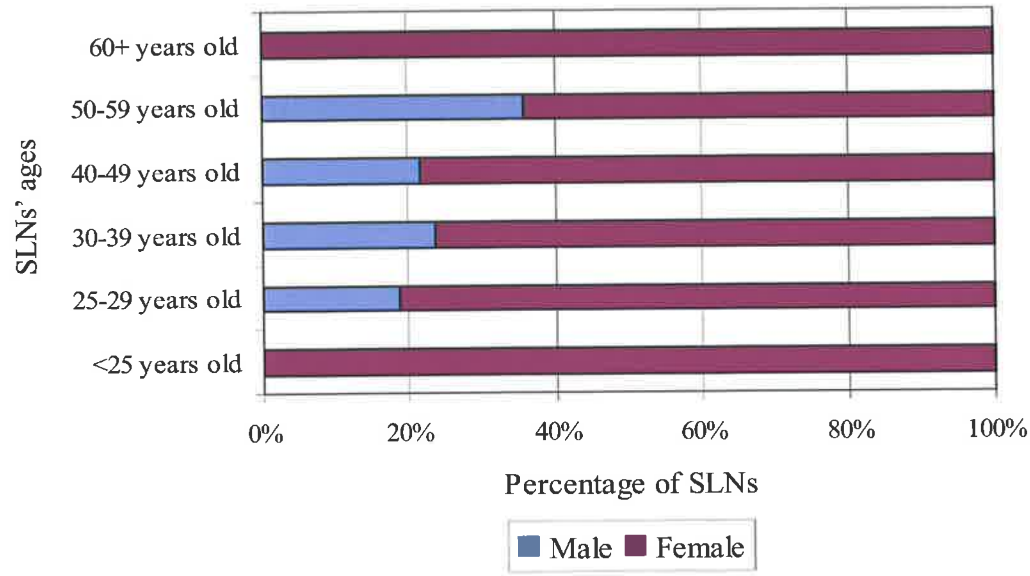
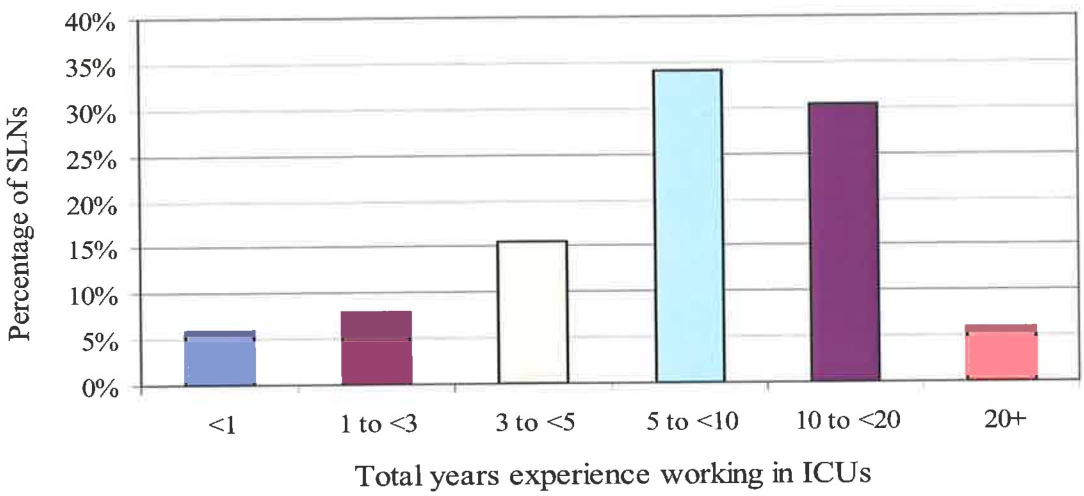


Figure 4-31 T5 Gender split of SLNs in each age group

As Figure T6 displays, the majority of SLNs had either 5 to less than 10 (34.18%), 10 to less than 20 (30.28%), or 3 to less than 5 years (15.51%) experience working in ICUs. Importantly, over 80% of SLNs had 3 or more years of experience working in ICUs, and just 6.01% of SLNs had less than 1 year of ICU experience.



Shift Leader experience

Demographics by Years Worked in Current ICU

SLNs were also asked how many years they had been working in their current employing ICU, and their responses are displayed below, in Figure T7. As can be seen, 31.43% of SLNs had worked in their current employing ICU for less than 3 years, and 12.7% had worked there less than 1 year. As discussed in Chapter 2, these findings may be a reflection of the move toward increased casualisation and a more transient workforce.

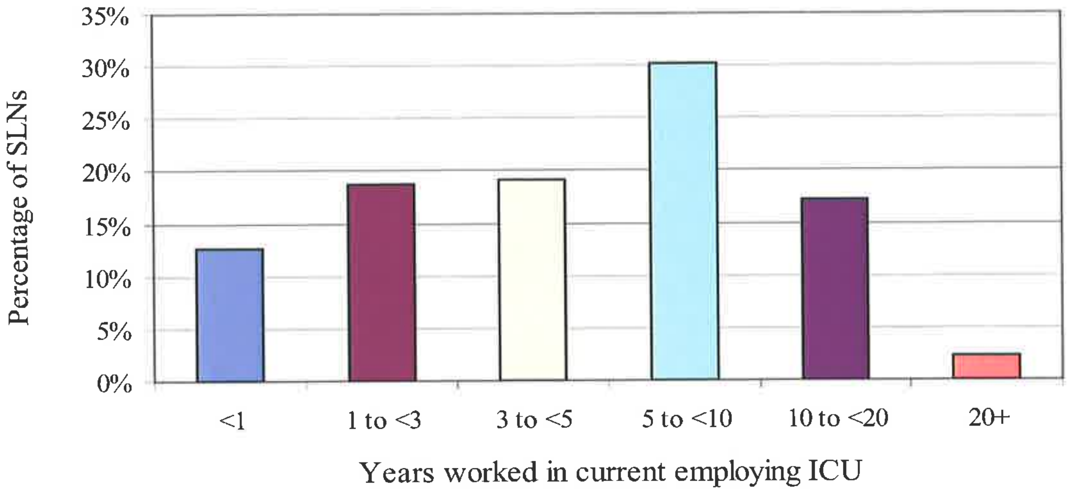


Figure 4-32 T7 Years worked by SLNs in current employing ICU

In the public sector, 4.58% of SLNs had been working in their current ICU for less than one year, compared with 10.53% in the private sector (Table SLN20). Conversely, 3.95% SLNs in private ICUs, and 6.67% of public ICU SLNs, had been working in their current ICU for 20 years or longer.

Table 4-35 SLN20 Years worked by SLNs in current employing public or private hospital ICU

Hospital type	Years worked in current ICU						Total
	<1 year	1 to <3 years	3 to <5 years	5 to <10 years	10 to <20 years	20+ years	
Public	11 4.58%	19 7.92%	37 15.42%	82 34.17%	75 31.25%	16 6.67%	240
Private	8 10.53%	6 7.89%	12 15.79%	26 34.21%	21 27.63%	3 3.95%	76
Total	19	25	49	108	96	19	316

Shifts per month in the Shift Leader role

Figure T8, below, displays the average number of shifts worked in the SLN role per month by each SLN. The vast majority of SLNs (75.39%) worked less than 10 shifts as SLN per month.

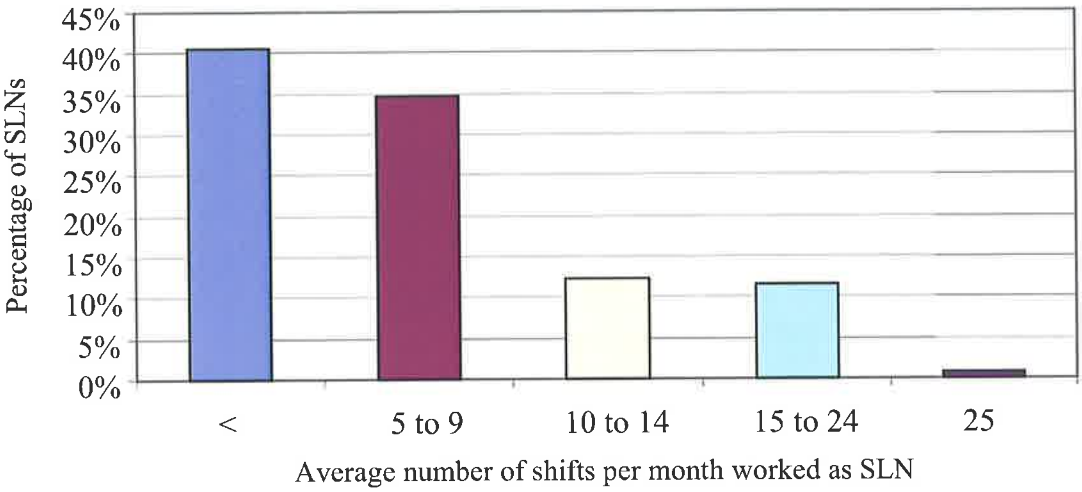


Figure 4-33 T8 Average number of shifts worked per month by SLNs in the SLN role

Table T8a shows the total number of shifts worked (in any role) per month by SLNs. As is displayed, just 1.89% worked 25 or more shifts, while 2.52% of SLNs worked less than 5 shifts. The most common number of shifts worked was 10 to 14 (47.95%) and 15 to 24 (41.64%). This supports the age distribution in the literature.

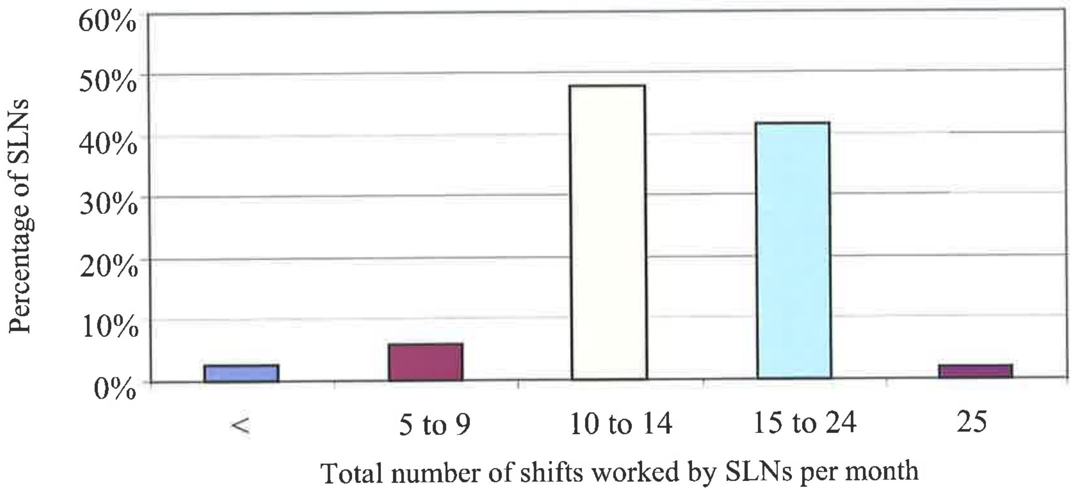


Figure 4-34 T8a Total number of shifts worked per month by SLNs (as shift leader or other)

Demographics by shift type predominantly worked

The shift type most often worked by each SLN can be seen in Figure SQ8, below. The most common shift types involved rotating rosters, with 39.43% working a mix of day and night long shifts, and 26.18% working a mix of day and night long shifts. By far, the fewest SLNs worked mostly short night shifts (0.95%).

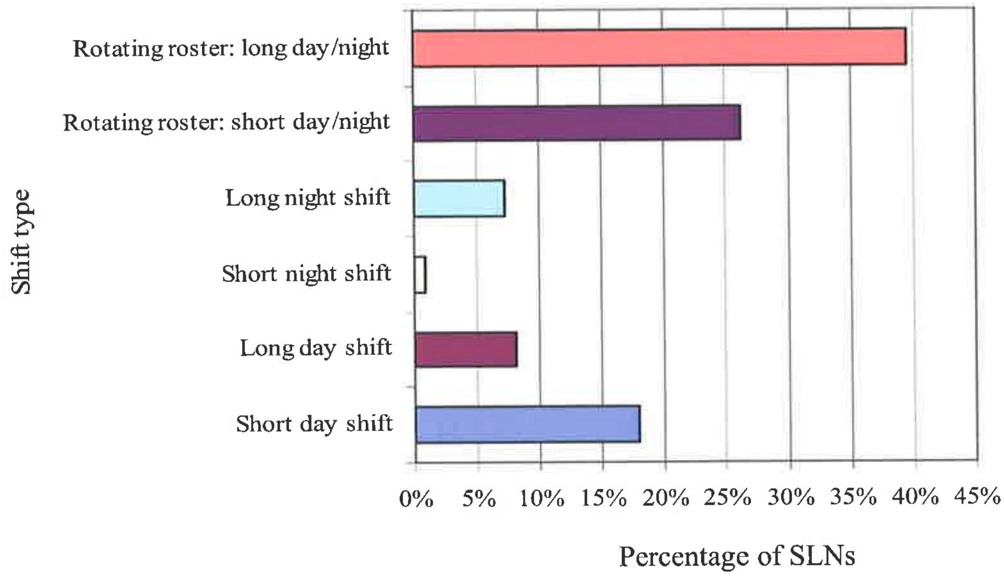


Figure 4-35 SQ8 Total number of shifts worked per month by SLNs (as shift leader or other)

The most common shift type worked by SLNs in each Australian state is shown below in Table SND1. A rotating roster of long day and night shifts was worked by the majority of SLNs in Tasmania (46.67%), Victoria (36.54%), Western Australia (63.41%), and New South Wales (49.35%), while a rotating roster of short day and night shifts was worked by the majority of SLNs in Queensland (42.31%) and South Australia (34.78%).

Table 4-36 SND1 Shift type most commonly worked by SLNs in each Australian state

State	Short day shift	Long day shift	Short night shift	Long night shift	Rotating roster: short day and night	Rotating roster: long day and night	Total
	Shift type most commonly worked by each SLN						
NSW	19 24.68%	7 9.09%	0 0%	5 6.49%	8 10.39%	38 49.35%	77
Victoria	13 25%	3 5.77%	1 1.92%	4 7.69%	12 23.08%	19 36.54%	52
Queensland	8 10.26%	7 8.97%	1 1.28%	6 7.69%	33 42.31%	23 29.49%	78
SA	8 17.39%	6 13.04%	1 2.17%	4 8.7%	16 34.78%	11 23.91%	46
WA	4 9.76%	2 4.88%	0 0%	2 4.88%	7 17.07%	26 63.41%	41
Tasmania	3 20%	0 0%	0 0%	1 6.67%	4 26.67%	7 46.67%	15
ACT	0 0%	1 50%	0 0%	0 0%	1 50%	0 0%	2
NT	2 33.33%	0 0%	0 0%	1 16.67%	2 33.33%	1 16.67%	6
Total	57	26	3	23	83	125	317

Figure SND2 displays the type of shift most commonly worked by SLNs in public and private hospital ICUs. While long day shifts were most commonly worked by 19.74% of private hospital SLNs, they were the most common shift for only 4.56% of public hospital SLNs, and in contrast, just 4.98% of private SLNs, but 14.47% of public SLNs, most commonly worked long night shifts. Almost double the proportion of public ICU SLNs (44.4%) most often worked a rotating roster of day and night long shifts, compared to private ICU SLNs (23.68%).

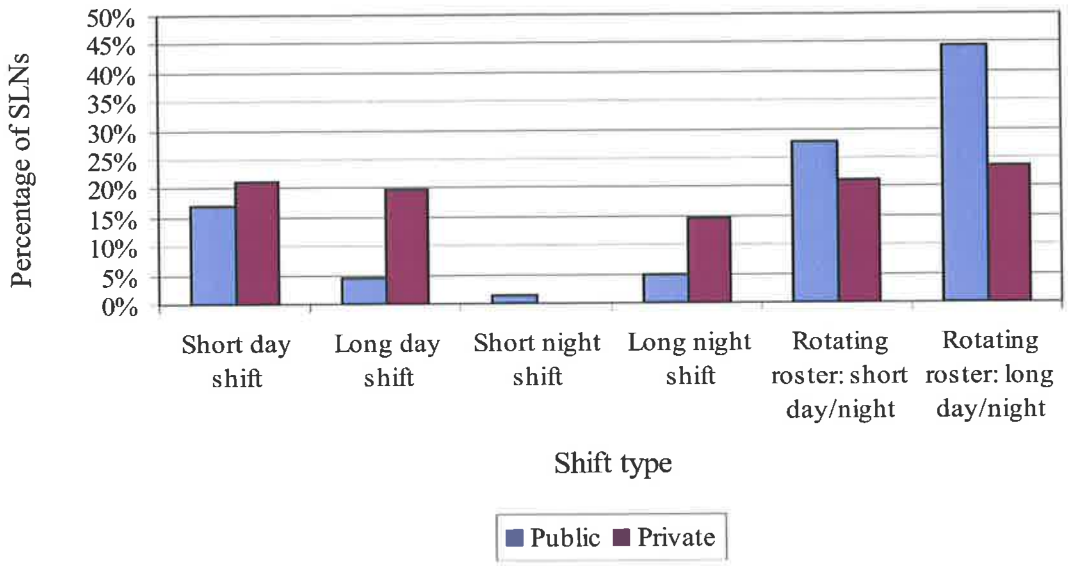


Figure 4-36 SND2 Shift type most commonly worked by SLNs employed in public and private hospital ICUs

In rural areas, 37.5% of SLNs most often worked a rotating roster of long day and night shifts, 25% worked a rotating roster of short day and night shifts, and 25% worked a straight short day shift, as shown in Table SND3. The same pattern was also seen in capital city ICUs, while in metropolitan areas the majority of SLNs (42.86%) worked a rotating roster of short day and night shifts.

Table 4-37 SND3 Shift type most commonly worked by SLNs in capital city, metropolitan, and rural ICUs

Area classification	Shift type most commonly worked by each SLN						Total
	Short day shift	Long day shift	Short night shift	Long night shift	Rotating roster: short day and night	Rotating roster: long day and night	
Capital city	46 18.25%	25 9.92%	2 0.79%	16 6.35%	58 23.02%	105 41.67%	252
Metropolitan	7 14.29%	1 2.04%	1 2.04%	5 10.2%	21 42.86%	14 28.57%	49
Rural	4 25%	0 0%	0 0%	2 12.5%	4 25%	6 37.5%	16
Total	57	26	3	23	83	125	317

Demographics by shift type predominantly worked - combined day/night/rotating

SLNs' responses on the type of shift they most commonly worked (short day shift, long day shift, short night shift, long night shift, long shift rotating roster, or short shift rotating roster) were subsequently collapsed into three categories: day shifts, night shifts, and rotating rosters. Over 60% of SLNs reported most often working combined rotating day/night shifts (Figure SND4). Less than 10% (8.2%) reported night shift as their predominant shift type, supporting the anecdotal view in ICUs that working only night duty is not a popular choice. It is not possible to ascertain from this data if part or all of their shift type components are done by choice (voluntarily) or by hospital mandate.

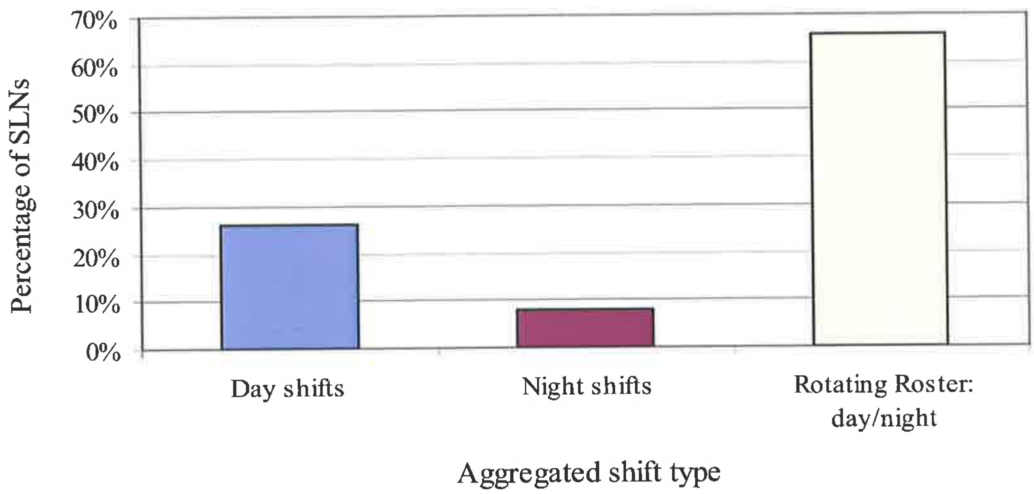


Figure 4-37 SND4 Aggregated shift type most commonly worked by SLNs

The most common collapsed shift types for SLNs in each Australian state are displayed in Figure SND4a. As can be seen, the highest proportion of SLNs working rotating shifts was in Western Australia (80.49%), Tasmania (73.33%), and Queensland (71.79%). The ACT had the highest proportion of day shifts worked by SLNs (50%), though no SLNs (0%) there worked mostly night duty.

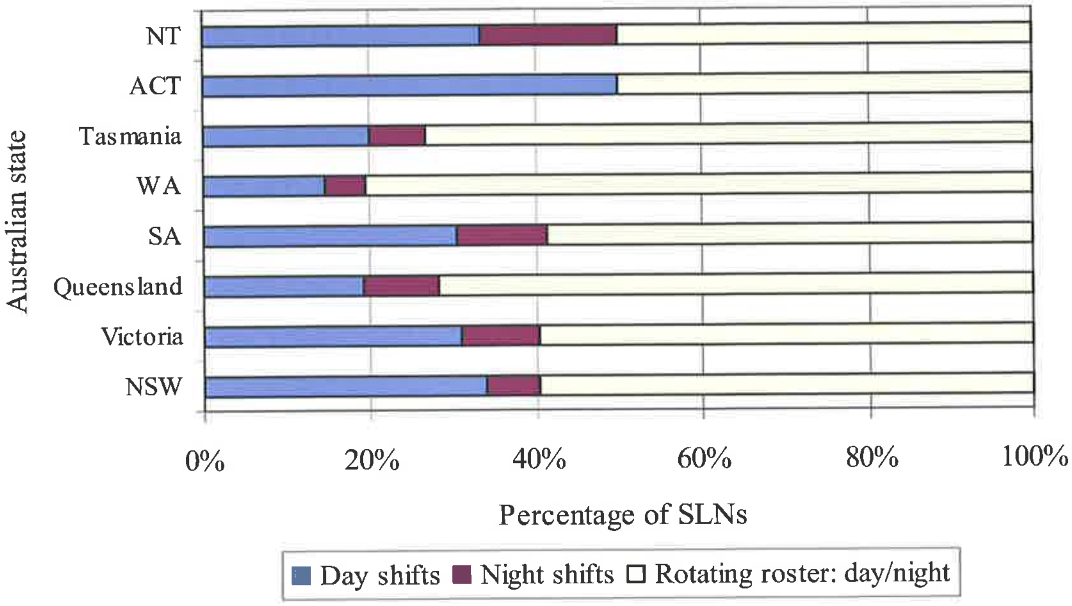


Figure 4-38 SND4a Aggregated shift type most commonly worked by SLNs in each Australian state

As shown in Figure SND5, SLNs in public hospital ICUs were more likely to work a rotating roster (72.2%) compared to private hospital ICUs (44.74%). The lower figure of SLNs in the private sector predominantly working rotating rosters, together with the higher percentage of SLNs in private sector predominantly working day shifts (40.79%) compared to in public hospitals (21.58%), may reflect more flexible rostering practices in private ICUs.

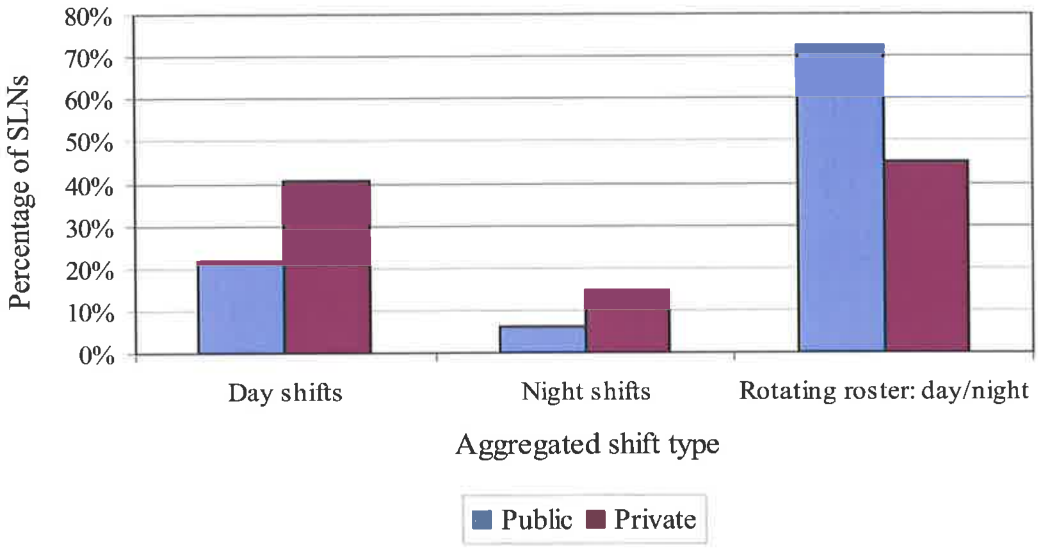


Figure 4-39 SND5 Aggregated shift type most commonly worked by SLNs in public and private ICUs

A more even distribution of shift types across capital city, metropolitan, and rural ICUs is shown in Figure SND6. Across all areas SLNs mainly working a rotating roster was the norm, with the highest proportion found in metropolitan ICUs (71.43%).

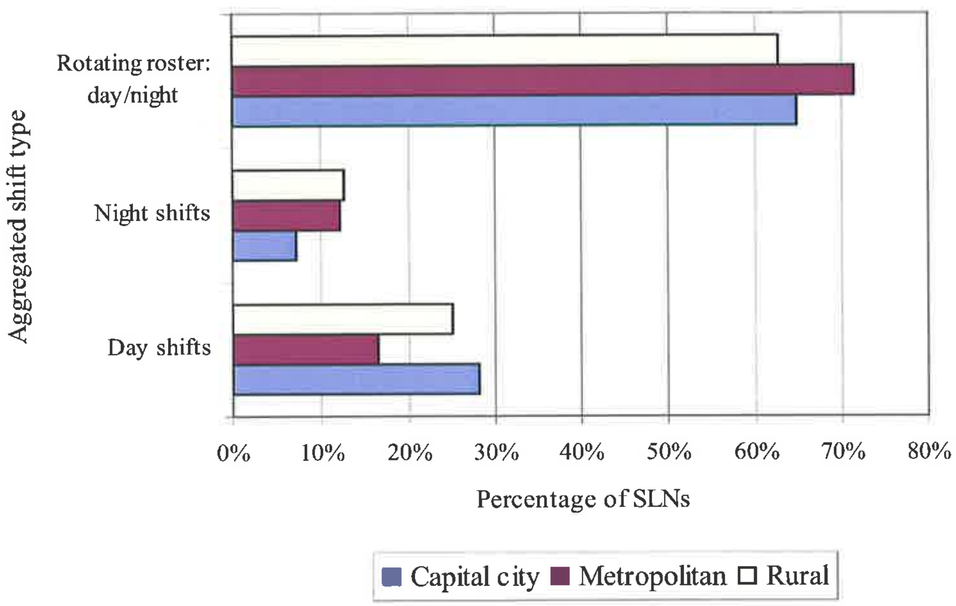


Figure 4-40 SND6 Aggregated shift type most often worked by SLNs in capital city, metropolitan, and rural ICUs

Demographics by shift type predominantly worked - combined short/long

The following two figures (SND7 and SND8) display the distribution of long and short shifts worked by SLNs in each Australian state and in public and private ICUs, data which provides evidence for the practice of working long shifts (anecdotally known as '12 hour shifts') in ICUs, although the substantiation here is only regarding SLNs.

This data appears to demonstrate the degree of flexibility of shift choice (long and short) predominantly worked, though as previously mentioned, it is unknown which are shifts are worked voluntarily and which are mandated. 'Twelve hour shifts' were introduced into Australian ICUs in the late 1990s, mostly as a voluntary option for nurses who preferred the more flexible lifestyle they could offer.[256]

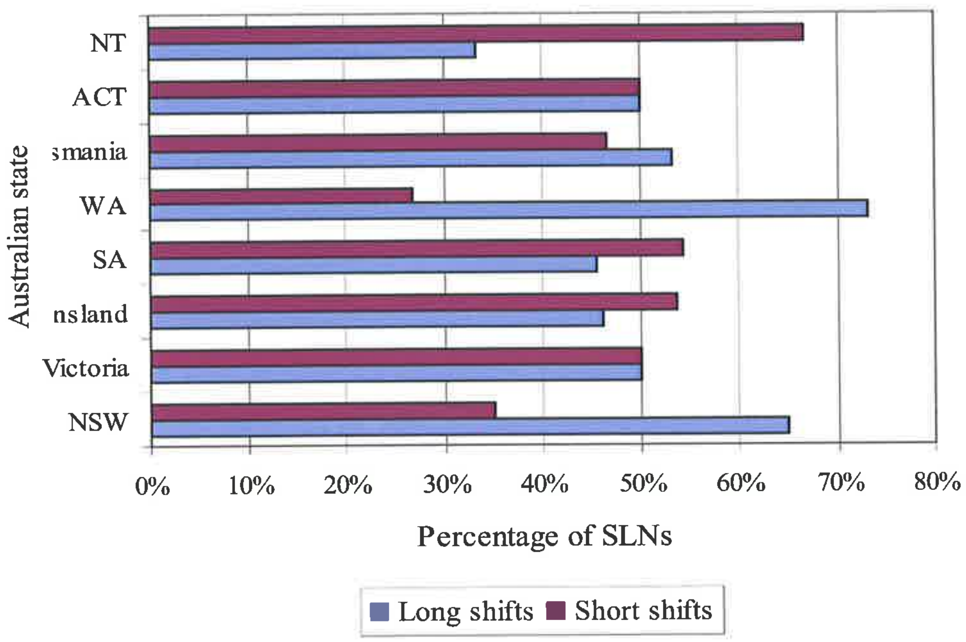


Figure 4-41 SND7 Shift length most commonly worked by SLNs in each Australian state

The data above (Figure SND7) shows that whether SLNs worked more long shifts or more short shifts varied widely between Australian states. In the Northern Territory, South Australia, and Queensland, short shifts were more common for the majority of SLNs, while in Western Australia, Tasmania, and New South Wales, long shifts were more often worked by most SLNs. In the ACT and Victoria, 50% of SLNs worked predominantly short shifts, and 50% worked predominantly long shifts.

Figure SND8 displays the commonality of SLNs in the public and private sector working mainly long or short shifts, with the majority of SLNs in both the public (53.94%) and private sectors (57.89%) working predominantly long shifts.

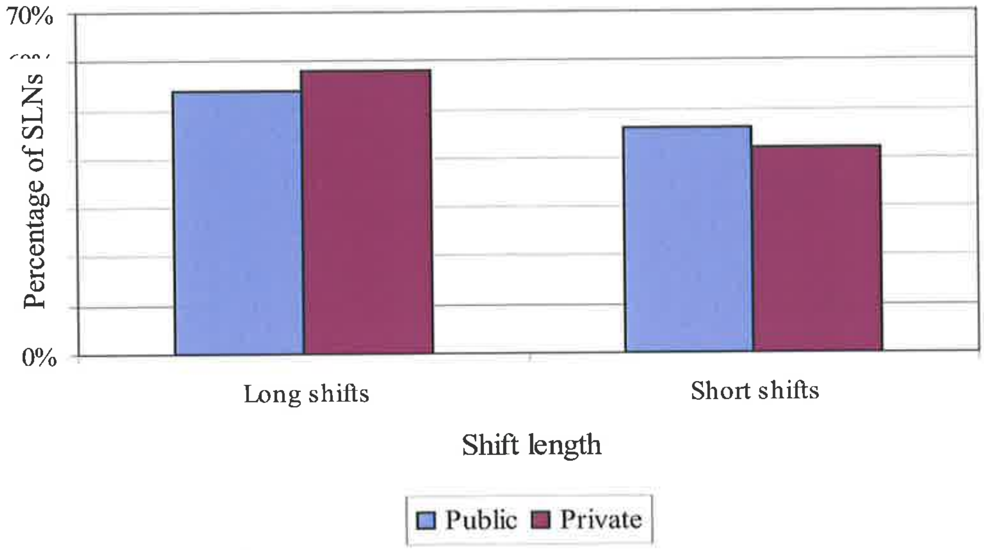


Figure 4-42 SND8 Shift length most commonly worked by SLNs in public and private hospital ICUs

Figure SND9, below, shows the aggregated shift type worked by SLNs in each age group. SLNs in the older age groups worked mostly rotating rosters (which include night duty) with 62.37% of the 40-49 age group, 53.57% of the 50-59 year age group, and 66.67% of the over 60 years age group predominantly working these shifts, while the youngest age group, those less than 25 years old, worked mainly day shifts. Straight night shifts were most commonly worked by those aged 60 years and older (33.33% in that age group), and decreased as the SLNs' ages decreased.

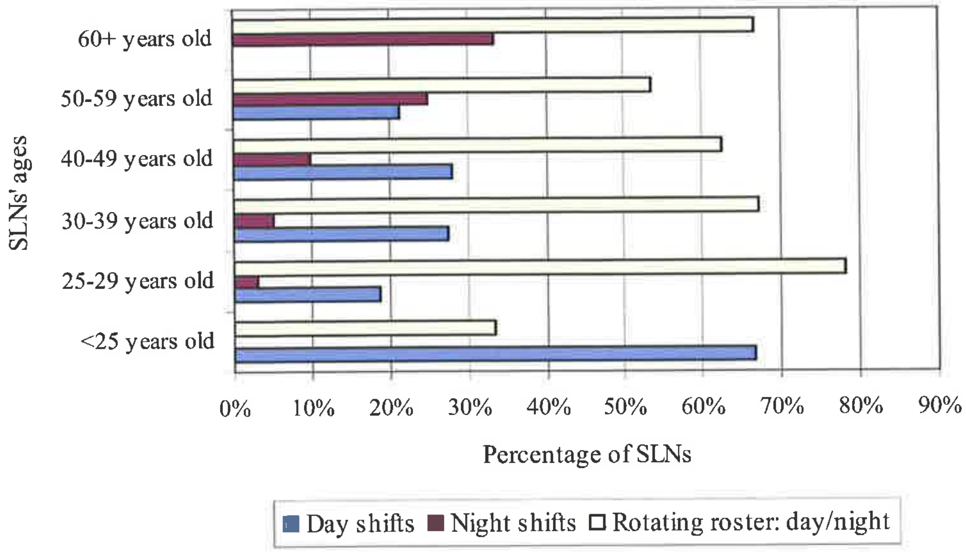


Figure 4-43 SND9 Aggregated shift type most commonly worked by SLNs in each age group

Staffing decisions

In the next section of this chapter, data from the 317 SLN respondents relating to staffing decision making practices in Level III ICUs is presented. To begin, Figure SLND1, below, shows which ICU staff member is chiefly responsible for determining the required number of nurses for the next shift. The majority of SLNs (57.41%) reported that the team or shift leader from the previous shift generally made this decision, while 31.54% of SLNs reported that this decision was made by senior RNs (Classification Level 2 or higher), rather than the shift leader. Alternatively, 5.99% of SLNs noted that the nurse numbers decision was not made by any one particular individual, and just 0.32% of SLNs stated that the new (incoming) shift leader generally made this decision.

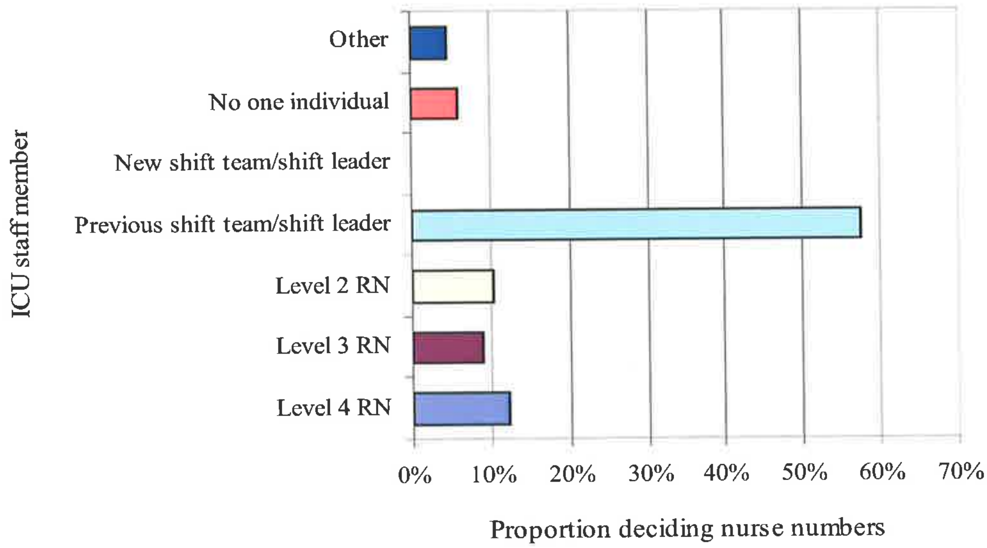


Figure 4-44 SLND1 Staff member who decides nurse numbers for each ICU shift

The following question asked SLNs who they thought should decide on nurse numbers for the next shift, in order to gauge the concurrence between who really did, and who they believed should, make this decision in ICUs. This comparative data-set is shown below in Figure SQ10/SLND1. A higher percentage (63.41%) of SLNs believed that the predominant nurse number decision maker should be the team/shift leader from the previous shift, compared to 57.41% of ICUs in which the previous team/shift leaders actually made this decision. Fewer SLNs (26.5%) thought that Level 2-4 SLNs should decide this issue than actually did (31.54%).

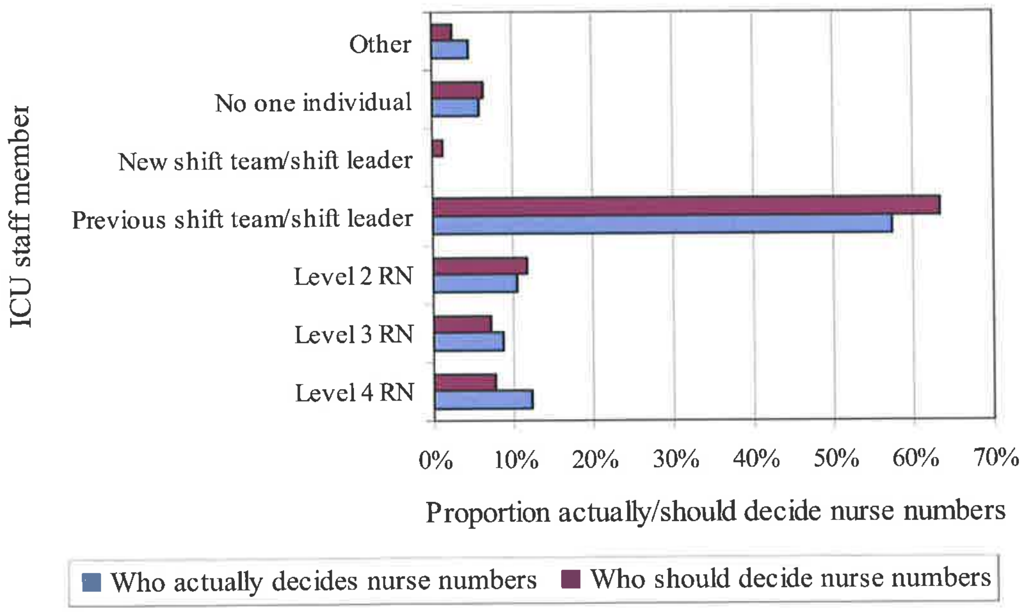


Figure 4-45 SQ10/SLND1 Who actually decides, and who SLNs believe should decide, nurse numbers for the next ICU shift

Table SND11 and Figures SND12 and SND13 display additional stratifications of the ICU staff member who predominantly determines the required nurse numbers for each shift by state, sector, and location. Data from all three affirm that the shift leader nurse/team leader predominantly decides the required shift nurse numbers. The majority of SLNs in every Australian state said the previous shift's team leader decided the required nurse numbers (86.67% in Tasmania, 84.78% in SA, and 74.73% in WA; Table SND11).

Table 4-38 SND11 Staff member who predominantly determines nurse numbers for the next ICU shift in each Australian state

State	Who determines required nurse numbers							Total
	Level 4 RN	Level 3 RN	Level 2 RN	Previous shift leader	New shift leader	No one individ.	Other	
NSW	27 35.06%	6 7.79%	2 2.6%	30 38.96%	0 0%	8 10.39%	4 5.19%	77
Victoria	6 11.54%	7 13.46%	15 28.85%	20 38.46%	0 0%	0 0%	4 7.69%	52
Queensland	4 5.13%	9 11.54%	6 7.69%	46 58.97%	1 1.28%	7 8.97%	5 6.41%	78
SA	2 4.35%	2 4.35%	3 6.52%	39 84.78%	0 0%	0 0%	0 0%	46
WA	0 0%	3 7.32%	5 12.2%	29 70.73%	0 0%	3 7.32%	1 2.44%	41
Tasmania	0 0%	0 0%	1 6.67%	13 86.67%	0 0%	1 6.67%	0 0%	15
ACT	0 0%	1 50%	0 0%	1 50%	0 0%	0 0%	0 0%	2
NT	0 0%	0 0%	1 16.67%	4 66.67%	0 0%	0 0%	1 16.67%	6
Total	39	28	33	182	1	19	15	317

Similar data can be seen below in Figure SND12, across the public and private sectors, with 56.02% of public hospital SLNs and 61.84% of private hospital SLNs also reporting the previous shift's leader as the predominant decision-maker.

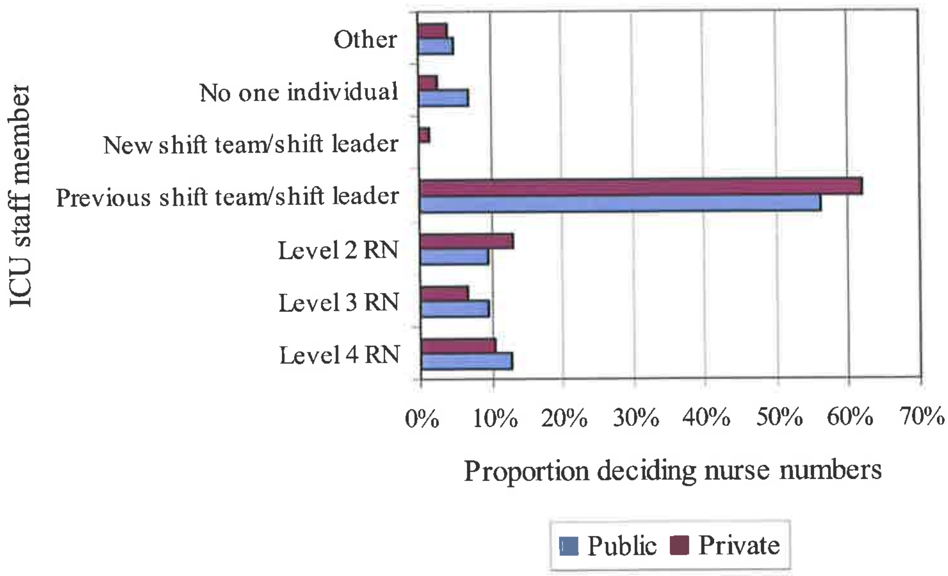


Figure 4-46 SND12 Staff member who predominantly determines nurse numbers for the next shift in public and private hospital ICUs

Similarly, as Figure SND13 shows, in most capital city (56.75%), metropolitan (51.02%), and rural ICUs (87.5%), SLNs reported that the previous shift's team leader made their ICU's nurse number decision.

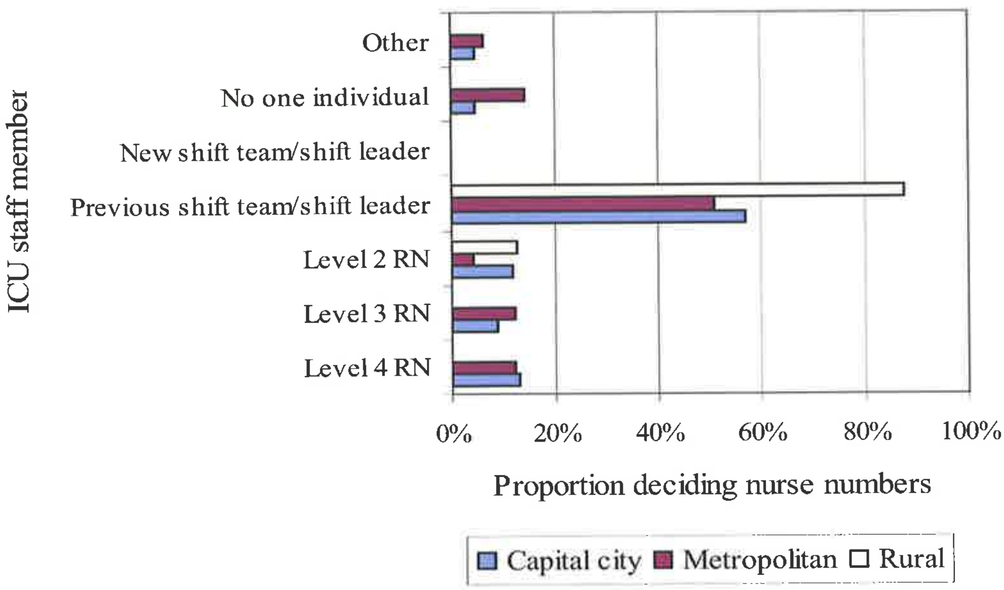


Figure 4-47 SND13 Staff member who predominantly determines nurse numbers for the next shift in capital city, metropolitan, and rural ICUs

SLNs were also asked who predominantly determined the nurse-to-patient allocation for each shift. It was envisaged by the researcher that this decision might possibly be made by the same decision-maker who also decided required nurse numbers for the ICU. As displayed in Figure SQ11, 60.57% of SLNs stated that the outgoing team/shift leader (from the previous shift) makes the nurse-to-patient allocation decision, while the incoming team/shift leader (from the next shift) makes this decision in just 18.3% of SLNs' ICUs. Further, 15.14% of SLNs said that nurse numbers were decided by Level 2-4 RNs who were neither the incoming or outgoing shift leader.

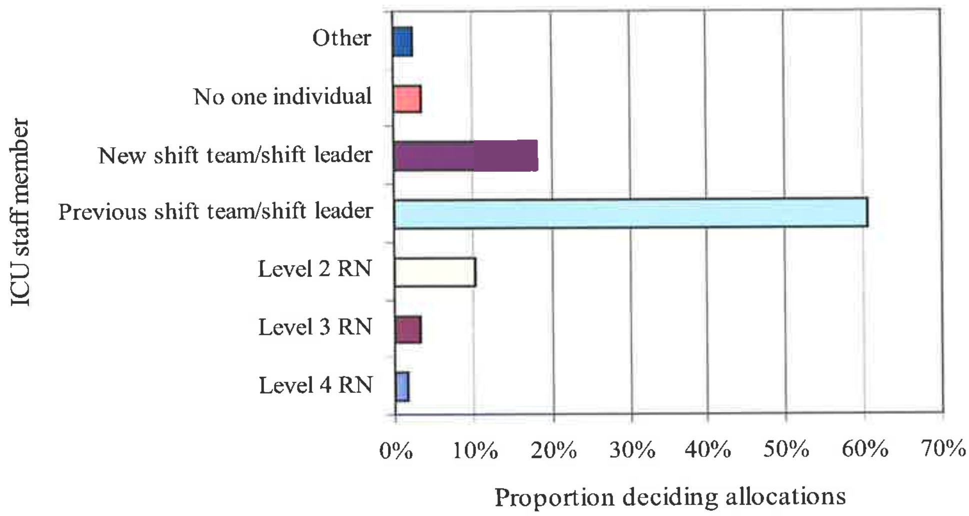


Figure 4-48 SQ11 Staff member who decides nurse-to-patient allocations for each ICU shift

Figure SLND1/SQ11 (below) displays the data collected from SLNs on who actually makes the staffing decisions regarding both nursing numbers and nurse-to-patient allocations for each incoming ICU shift. Almost the same percentage of SLNs reported that both these decisions were being made by the previous shift team/shift leader. As noted earlier (in SQ11), nearly 18.3% of SLNs reported that the incoming shift team/shift leader made the nurse to patient allocation decisions, while only 0.32% of incoming shift team/shift leaders decided nurse numbers. It makes sense that incoming staff would not be involved in nurse number decisions as these would require final decisions before the shift began.

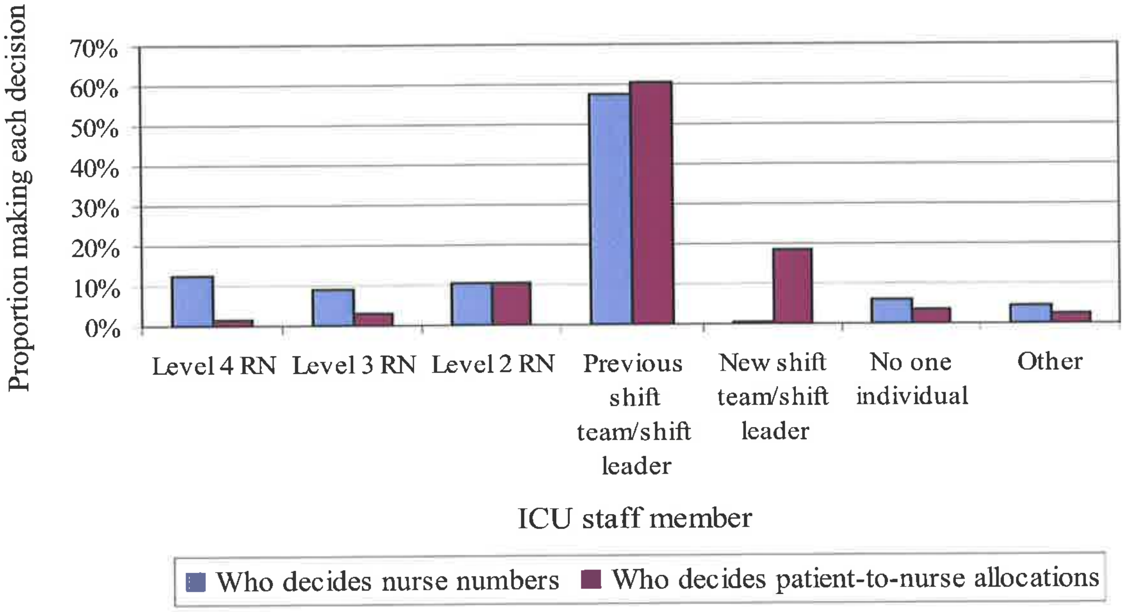


Figure 4-49 SLND1/SQ11 Comparison of the staff member in each ICU who decides nurse numbers and who decides patient-to-nurse allocations

Examining who made the nurse-to-patient allocations in each state (Figure SND14), the previous shift leader made these decisions in the majority of ICUs in South Australia (91.3%), Western Australia (92.68%), Queensland (67.95%), Tasmania (60%) and New South Wales (42.86%).

Most Victorian SLNs (32.69%) reported that in their ICUs this decision was made by a Level 2 RN who was neither the previous nor incoming shift leader, and in the Northern Territory this decision was made most often by the incoming shift/team leader (66.67%).

Table 4-39 SND14 Staff member who predominantly determines patient-to-nurse allocations for the next ICU shift in each Australian state

State	Who determines nurse-to-patient allocations							Total
	Level 4 RN	Level 3 RN	Level 2 RN	Previous shift leader	New shift leader	No one individ.	Other	
NSW	5 6.49%	1 1.30%	3 3.9%	33 42.86%	28 36.36%	7 9.09%	0 0%	77
Victoria	0 0%	6 11.54%	17 32.69%	15 28.85%	11 21.15%	2 3.85%	1 1.92%	52
Queensland	0 0%	3 3.85%	6 7.69%	53 67.95%	11 14.1%	2 2.56%	3 3.85%	78
SA	0 0%	0 0%	3 6.52%	42 91.3%	0 0%	0 0%	1 2.17%	46
WA	0 0%	0 0%	3 7.32%	38 92.68%	0 0%	0 0%	0 0%	41
Tasmania	0 0%	0 0%	0 0%	9 60%	3 20%	0 0%	3 20%	15
ACT	0 0%	0 0%	0 0%	1 50%	1 50%	0 0%	0 0%	2
NT	0 0%	0 0%	1 16.67%	1 16.67%	4 66.67%	0 0%	0 0%	6
Total	5	10	33	192	58	11	8	317

Comparing public and private ICUs, more SLNs in public hospitals (22.41%), than in private hospitals (5.26%), reported that the new (incoming) shift leader generally decided nurse-to-patient allocations (see Figure SND14a). A Fisher's exact (chi-square) test was also performed to examine the difference between nurse-to-patient decision-makers in public and private hospital ICUs, with a significant result found ($p < 0.01$).

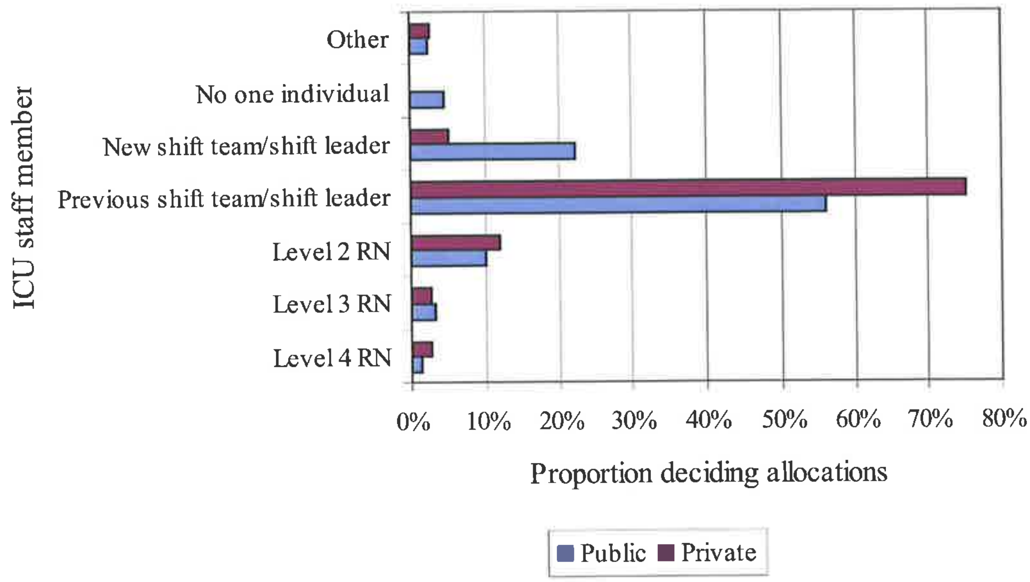


Figure 4-50 SND14a Staff member who predominantly determines patient-to-nurse allocations for the next shift in public and private hospital ICUs

When a (Fisher's exact) chi-square test was performed on the data displayed in Figure SND16, a very weak difference ($p = 0.057$) was found between who SLNs in public and private ICUs believe should make nurse-to-patient allocation decisions.

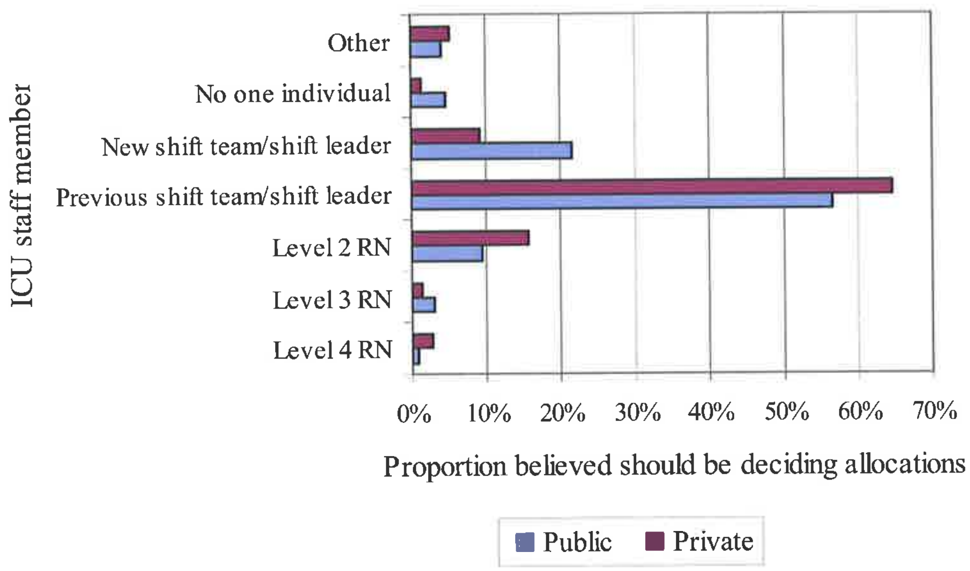


Figure 4-51 SND16 Staff member who SLNs believe should predominantly determine nurse-to-patient allocations for the next shift in public and private hospital ICUs

Figure SND17 shows that in the rural sector, 43.75% of SLNs reported that they believed the previous shift's team/shift leader should predominantly make nurse-to-patient allocation decisions, compared to 59.13% in capital cities. In the rural sector, 31.25% of SLNs reported that patient allocation decisions should be made by the incoming/new team/shift leader, compared to 17.86% in capital cities.

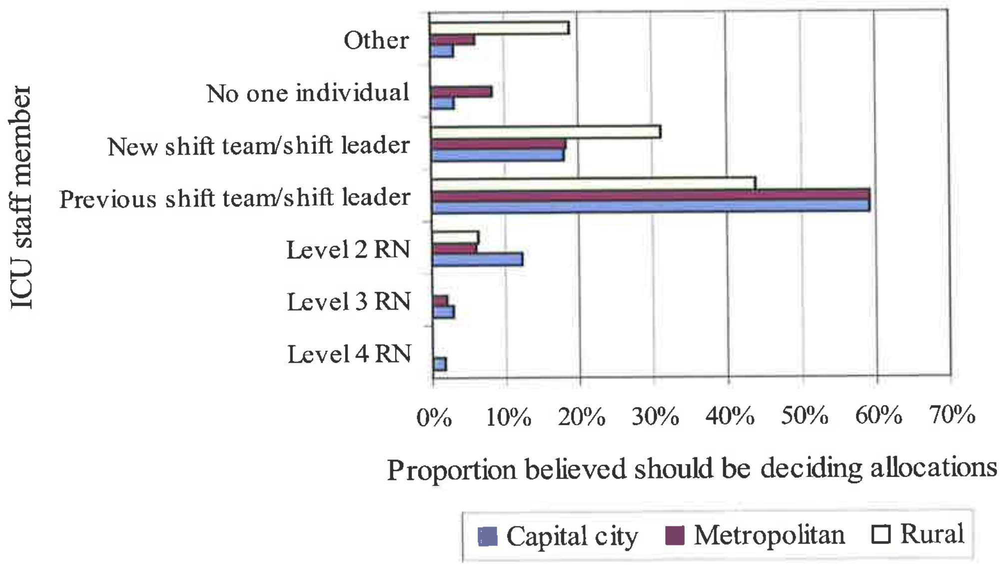


Figure 4-52 SND17 Staff member who SLNs believe should predominantly determines nurse-to-patient allocations for the next shift in capital city, metropolitan, and rural ICUs

When SLNs were asked who they thought <u>should</u> predominantly determine nurse-to-patient allocation for next shift, the vast majority (58.36%) said that the previous shift's shift/team leader should be the one to make this decision, while fewer thought that the new shift/team leader (18.61%) or a non-team leader Level 2 RN (11.04%) should decide this (Figure SQ12).

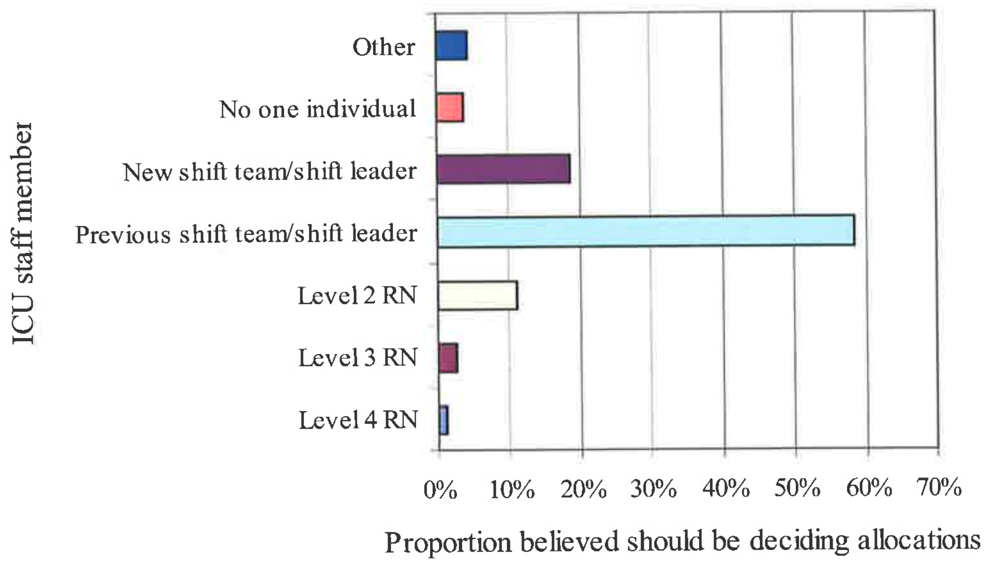


Figure 4-53 SQ12 The staff member who SLNs believe should decide nurse-to-patient allocations for each ICU shift

Figure SQ11/SQ12, below, shows the comparative data collected on who decides nurse-to-patient allocations in each SLN's ICU, and who SLNs believe should really make this decision. For example, 58.36% of SLNs believed that the previous shift's team/shift leader should decide patient allocations, while 60.57% of SLNs worked in ICUs where this was actually the case. Overall, the percentages of who actually decides nurse-to-patient allocation, and who SLNs want to decide them, appeared to be very similar, though unfortunately, it was not feasible to inspect individual responses to check whether SLN's answers to each question matched up.

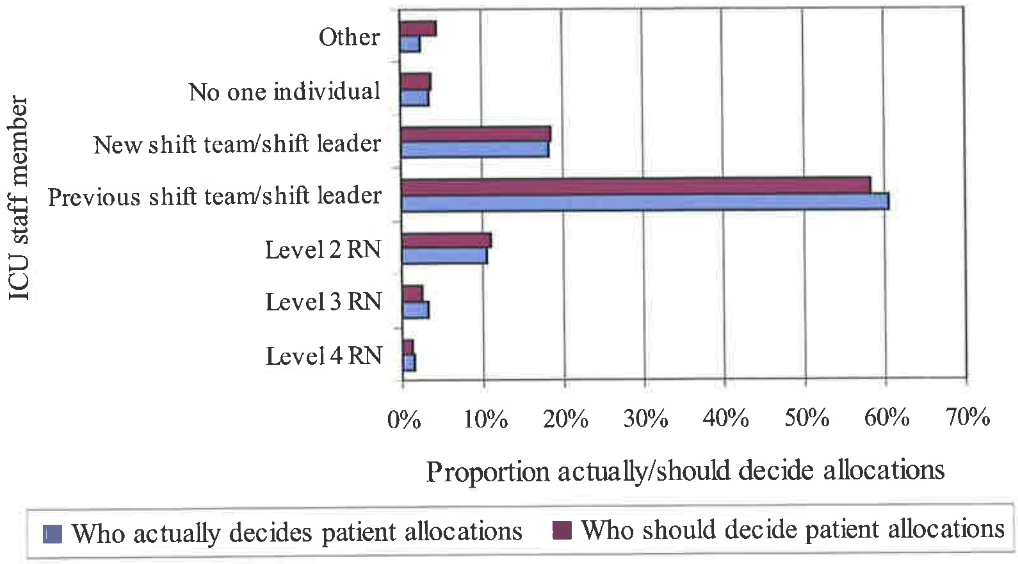


Figure 4-54 SQ11/SQ12 Who actually decides, and who SLNs believe should decide, nurse-to-patient allocations for the next ICU shift

Data were collected from SLNs on what they take into account when assessing the skills of available nurses before making nurse-to-patient allocation decisions, with Figure SQ13a displaying this data. The SLN respondents could record as many of the considerations available to choose from on the questionnaire as they wished. The most common SLN consideration was their *knowledge of each nurse's therapy capabilities* (95.27%), followed by their *years of overall ICU experience* (75.39%), *ICU qualifications* (57.41%), and *number of shifts worked in the SLN's ICU* (51.74%). *Personal judgement* was used by just 0.63% of SLNs. Other cited considerations (totalling 15.77%) were *previous staff allocations*, *educational/preceptor needs across the ICU*, *overall skill mix*, and *available support resources*. Four SLNs specified that they utilised an organisation specific database that their ICU had created to inform these considerations.

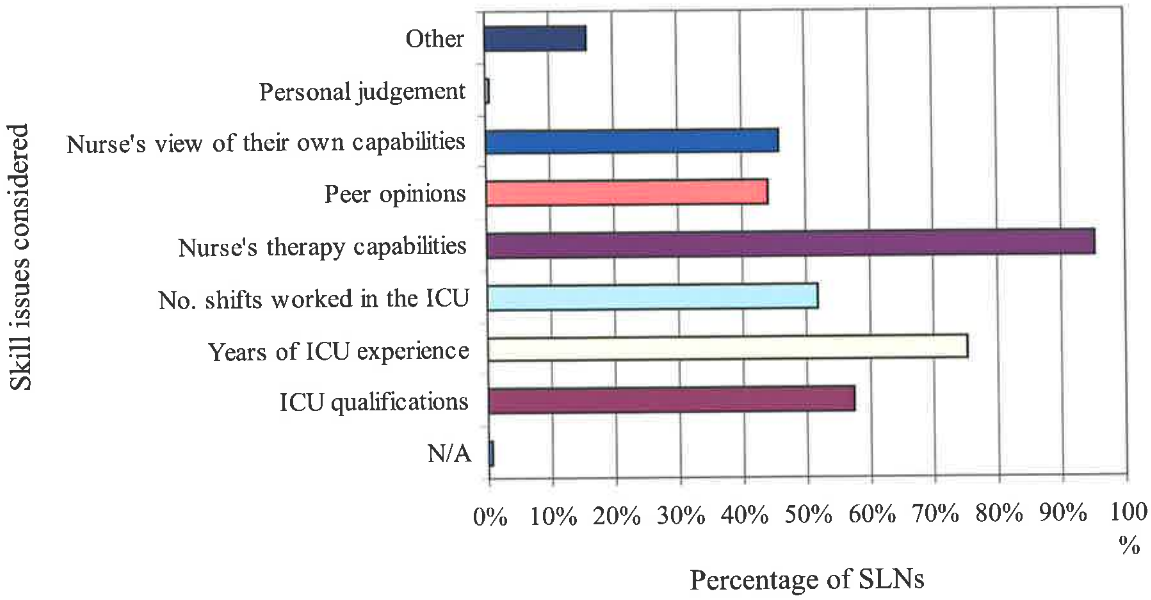


Figure 4-55 SQ13a Issues taken into account by SLNs when assessing available skill prior to making nurse-to-patient allocation decisions

SLNs were asked how often all of the required nursing skill information is available prior to making nurse-to-patient allocation decisions, with answers made on a 6-point Likert scale including an *unsure* option. This data-set is presented below in Figure SQ14 (for all related subsequent data, n = 315). Of those responding SLNs, 11.75% said that the information was *always* available, 54.92% said it was *often* available, and 26.98% said it was available only *sometimes*. Two SLNs (0.63%) said that the required information was *never* available.

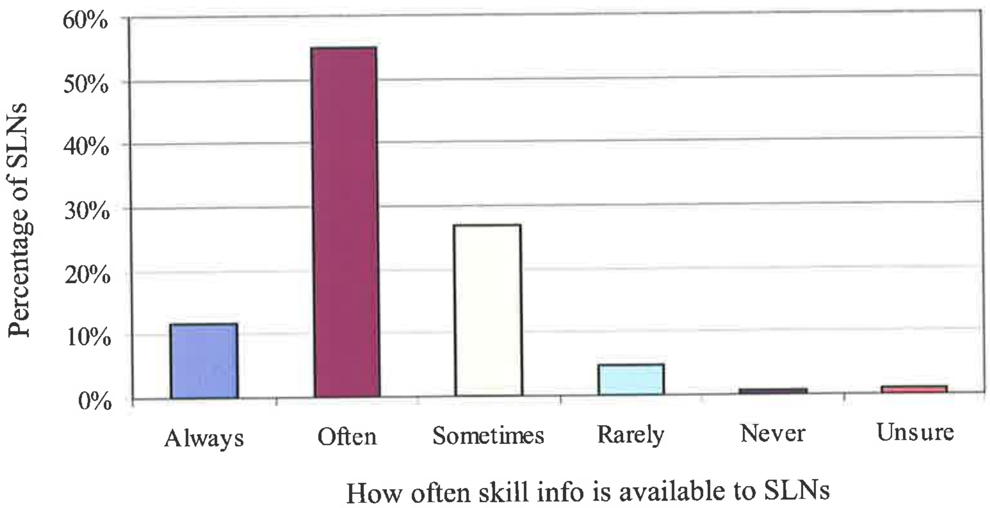


Figure 4-56 ***SQ14*** ***How often the nursing skill information required to make nurse-to-patient allocation decisions is available to SLNs***

Figure SND19 shows how often the nursing skill information required to make patient allocations is available to SLNs in each Australian state. The only two states where this information was *never* available were the Northern Territory (reported by 16.67% of SLNs) and New South Wales (1.32%). Nursing skill information was *always* available to 21.15% of SLNs in Victoria, 20% in Tasmania, and 14.63% in Western Australia.

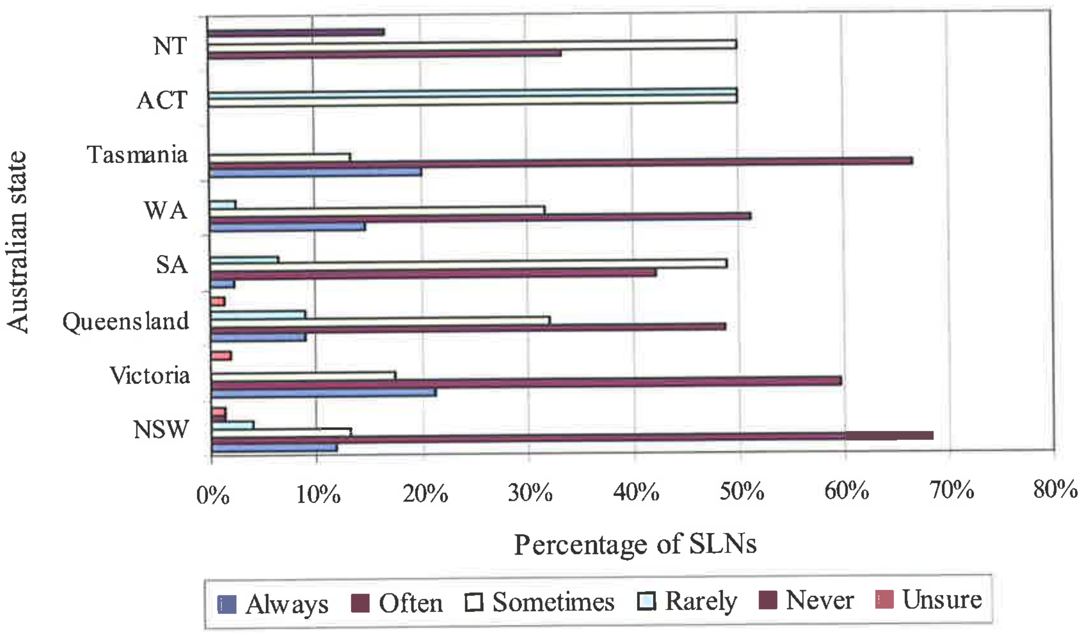


Figure 4-57 ***SND19*** ***How often the nursing skill information required to make nurse-to-patient allocation decisions is available to SLNs in each state***

Figure SND20 shows the same skill data availability data, split into public and private hospital SLNs. There were similar data for both sectors for skill information being *often* available (55% in public ICUs, 54.67% in private ICUs). The information was *sometimes* available for fewer public hospital SLNs (25.42%) than private hospital SLNs (32%), but was *always* available for more public hospital SLNs (14.17%) than private hospital SLNs (4%).

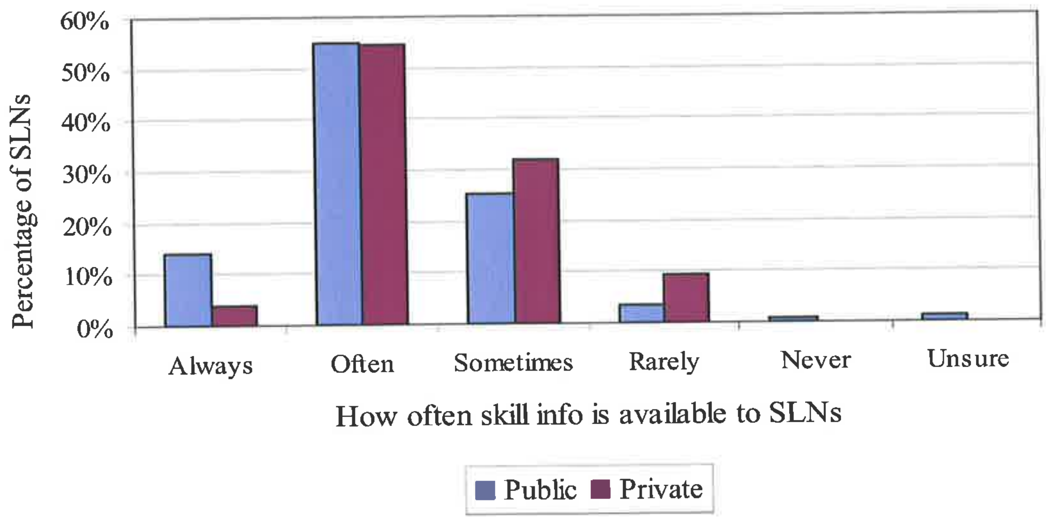


Figure 4-58 ***SND20*** ***How often the nursing skill information required to make nurse-to-patient allocation decisions is available to public and private hospital SLNs***

The nursing skill information availability for SLNs in capital city, metropolitan, and rural ICUs is displayed below, in Figure SND21. Across all areas, the information was most commonly often available, with this applying to 54.8% of SLNs in capital cities, 51.02% of metropolitan SLNs, and 68.75% of rural SLNs. This information was rarely or never available to 6% of capital city SLNs, 4.08% of metropolitan SLNs, and significantly, no rural SLNs.

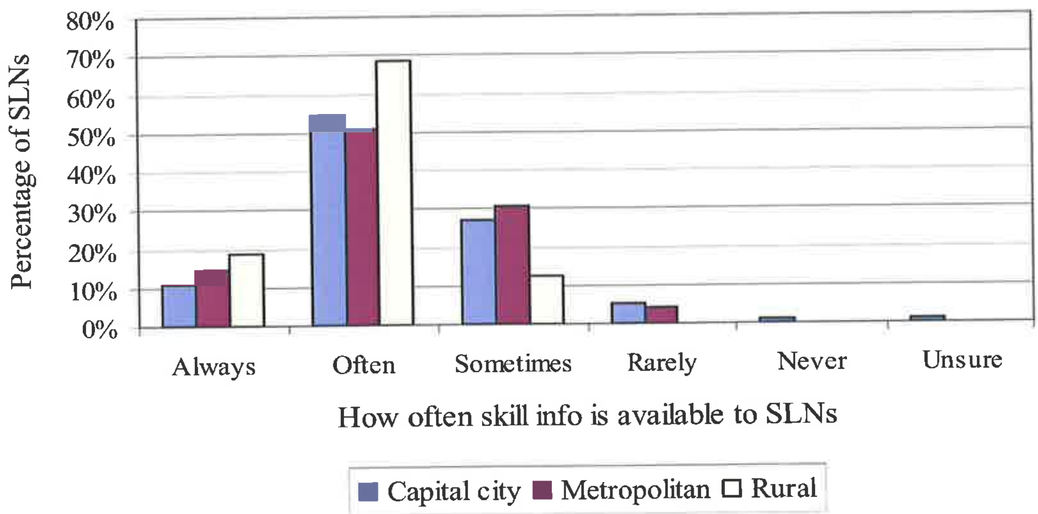


Figure 4-59 ***SND21*** ***How often the nursing skill information required to make nurse-to-patient allocation decisions is available to SLNs in capital city, metropolitan, and rural ICUs***

Figure SQ15a displays the data collected from SLNs' responses on how they calculate the required nurse numbers for each shift (SLNs could select as many of the listed options as applied). The most common way of making this calculation involved the SLN using their personal judgement based on experience (58.68%). In regards to existing pre-calculation system approaches being used to calculate required nurse numbers, 3 options were given: mandated hospital dependency tool (12.62%), mandated hospital nursing ratios (21.45%), and mandated hospital nursing hours (5.05%). Few SLNs said that they used the Excel care (0.63%) and TISS (0.32%) pre-calculation systems in their nurse number decision-making, while 27.13% of SLNs said they utilised the ACCCN Position Statement on Staffing Guidelines[3]. Help from colleagues was noted by 11.36%, and 6.94% reported they used their own system.

When prompted to describe *their own system*, 20 of the 41 SLNs who ticked *Other* gave brief description/notations as free text. Part of this data-set is presented here with the relevant Excel data sheet de-identified codes. For example 'AP' refers to the 'header column' on the SLN Excel datasheet and 'L' refers to the Excel line location of the raw data/quotation. Most descriptions of SLNs' *own systems* referred to their nursing ratios, in which all respondents said they allocated one nurse to one ICU patient, and one nurse to two high dependency patients, as well as having either a team leader or 'clinical resource person'.

Other descriptions can be best summarised within these few examples: *knowledge of intensivist + patient plan* (AP:L5), *what has been taught by hospital* (AP:L32), and *understanding staff abilities, experience and competence* (AP:L132). Interestingly there was 9.46% who said that *although SLN, my manager either does this or checks this,* indicating that despite the fact that they were in charge/leader of the shift, these SLNs were not given autonomy for final staffing decisions.

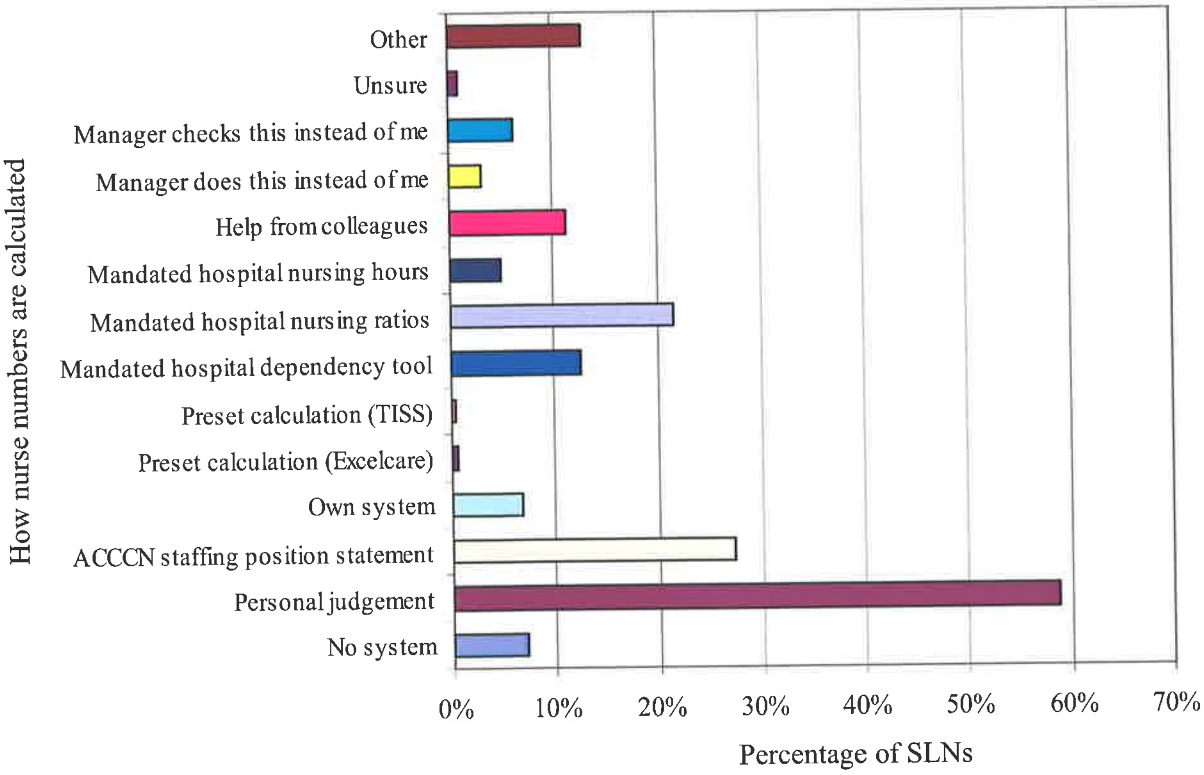


Figure 4-60 SQ15 How SLNs calculate the required nurse numbers for each shift

Using the previous data on how SLNs calculated required nurse numbers for next shift, Figure SND22 displays the data on how many SLNs used a mandated hospital workforce tool (i.e. *mandated hospital dependency tool, mandated hospital nursing ratios*, or *mandated hospital nursing hours*). The use (yes) or non-use (no) of a *mandated hospital workforce tool* reflects the combined data for all SLNs who checked one or more of the 3 'mandated tool' options. Overall, 36.91% of SLNs said that they used at least one mandated tool (Figure SND22a).

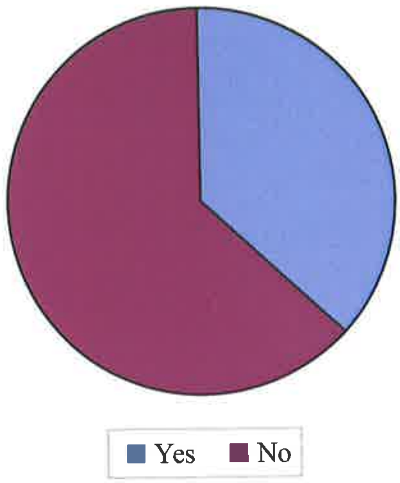


Figure 4-61 ***SND22a*** ***Proportion of SLNs who do ('yes') and do not ('no') use a mandated hospital workforce tool in their nurse number decision-making***

As shown in Figure SND22, the use of a mandated tool to calculate nurse numbers in each state ranged from 19.51% of SLNs in Western Australia, to 66.67% in the Northern Territory.

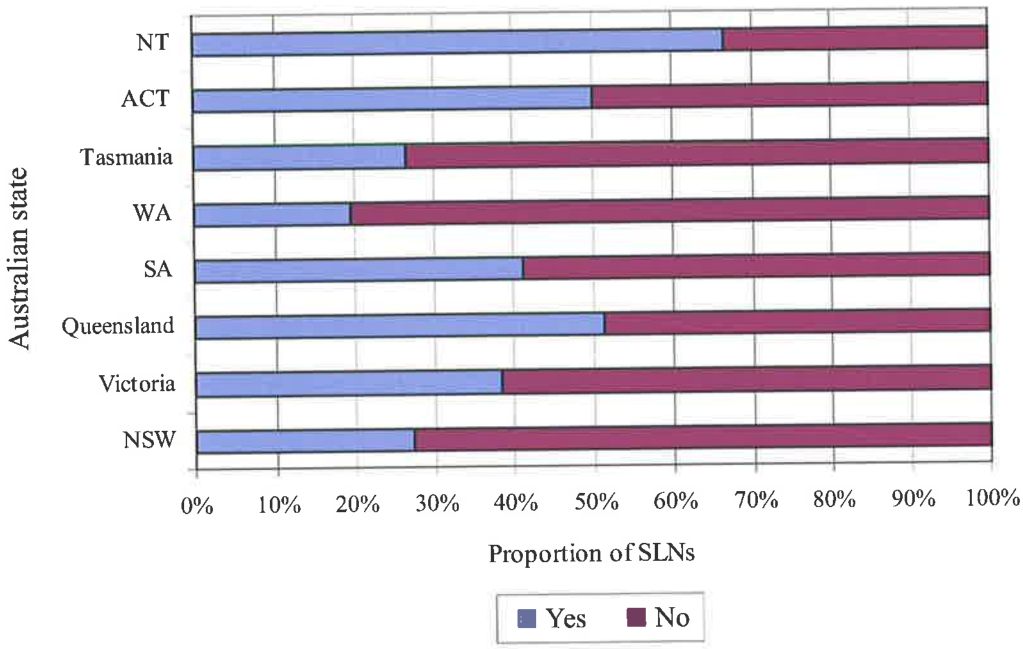


Figure SND22 ***Proportion of SLNs in each Australian state who do ('Yes') or do not ('No') use a mandated hospital workforce tool in calculating the required nurse numbers for each shift***

Data on the use of ACCCN staffing position statement[3] by SLNs for calculation of required nurse numbers for next shift is shown in Figure SND23a. Overall, 27.12% of

SLNs reported that they used the ACCCN position statement when making this calculation.[3]

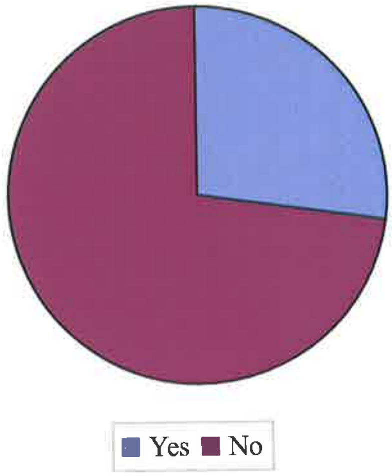


Figure 4-62 ***SND23a*** ***Proportion of SLNs who do ('Yes') and do not ('No') use the ACCCN staffing position statement in their nurse number decision-making***

Examining SLNs' use of the ACCCN statement for nurse number decision-making in each state (Figure SND23), the highest usage was in the ACT (50%) and Tasmania (46.67%).

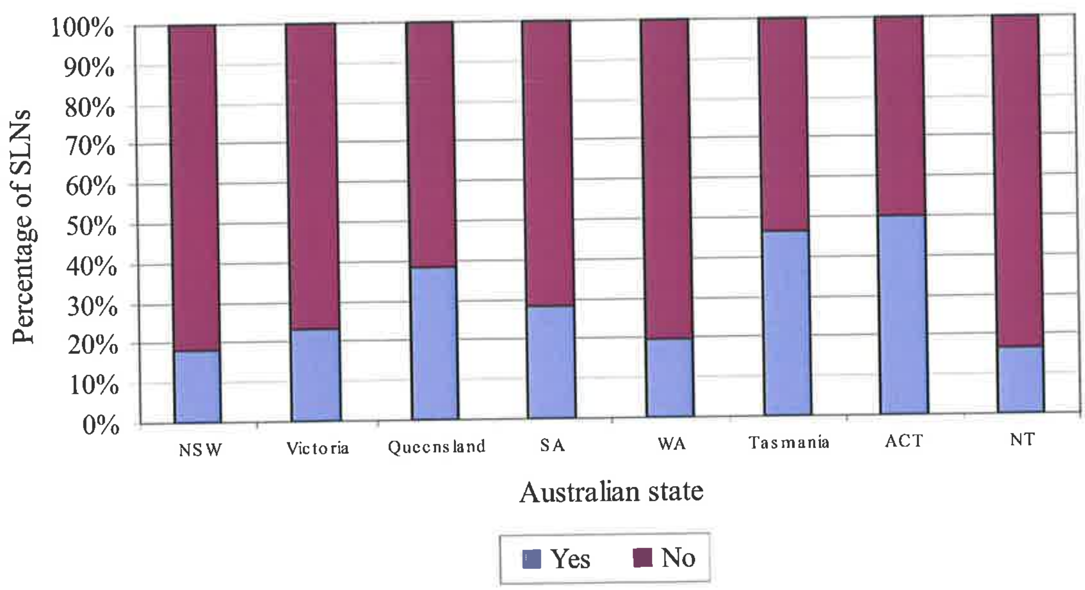


Figure 4-63 ***SND23*** ***Proportion of SLNs in each Australian state who do ('Yes') or do not ('No') use the ACCCN staffing position statement in calculating the required nurse numbers for each shift***

Figure SND24 shows SLNs' use of the ACCCN staffing position statement across public and private sectors, with 29.46% of public hospital SLNs and 19.74% of private hospital

SLNs using the statement. As can be seen in Figure SND25, in rural areas 56.25% of SLNs used the statement, compared to 48.98% in metropolitan areas, and 21.03% in capital cities.

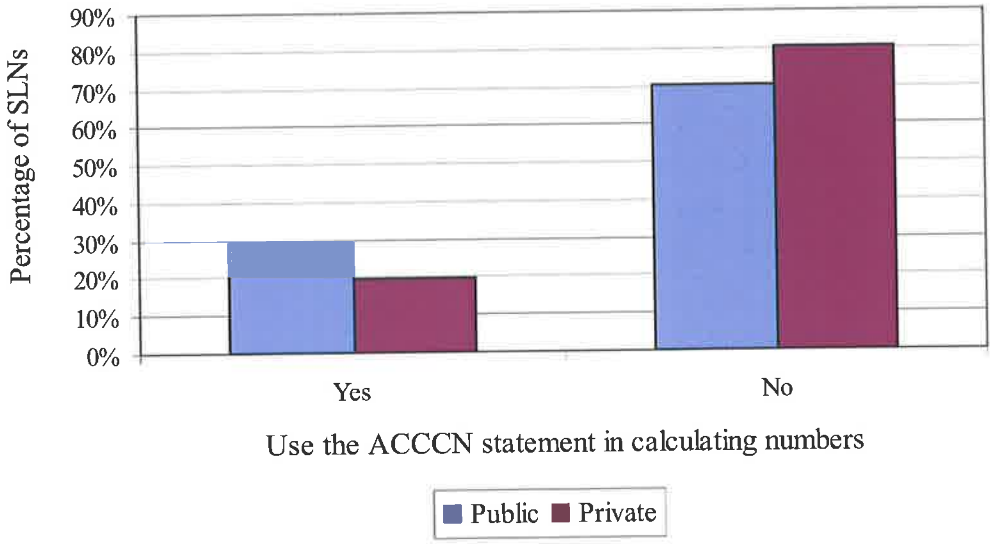


Figure 4-64 ***SND24*** ***Proportion of SLNs in public and private hospital ICUs who do ('Yes') or do not ('No') use the ACCCN staffing position statement in calculating the required nurse numbers for each shift***

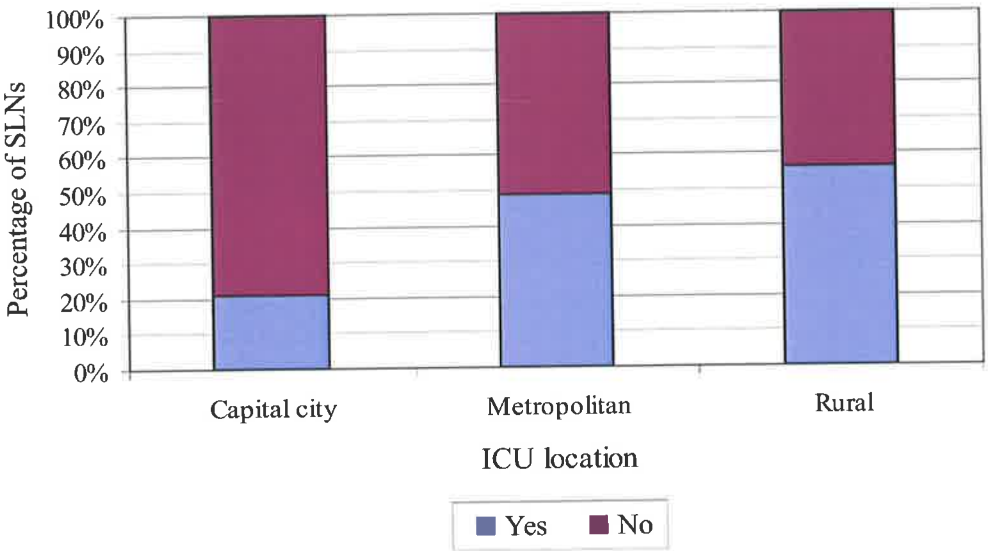


Figure 4-65 ***SND25*** ***Proportion of SLNs in capital city, metropolitan, and rural ICUs who do ('Yes') or do not ('No') use the ACCCN staffing position statement in calculating the required nurse numbers for each shift***

When SLNs were asked whether they believed *their system* that they used to calculate nurse numbers for each shift *gave them an accurate staffing projection*, 88.02% reported that their system worked either *often* or *always* (Figure SND26). This apparent high degree of faith in their own systems is interesting given the separate data citing the many difficulties and other negatives reported by SLNs regarding their staffing problems as presented further into this chapter.

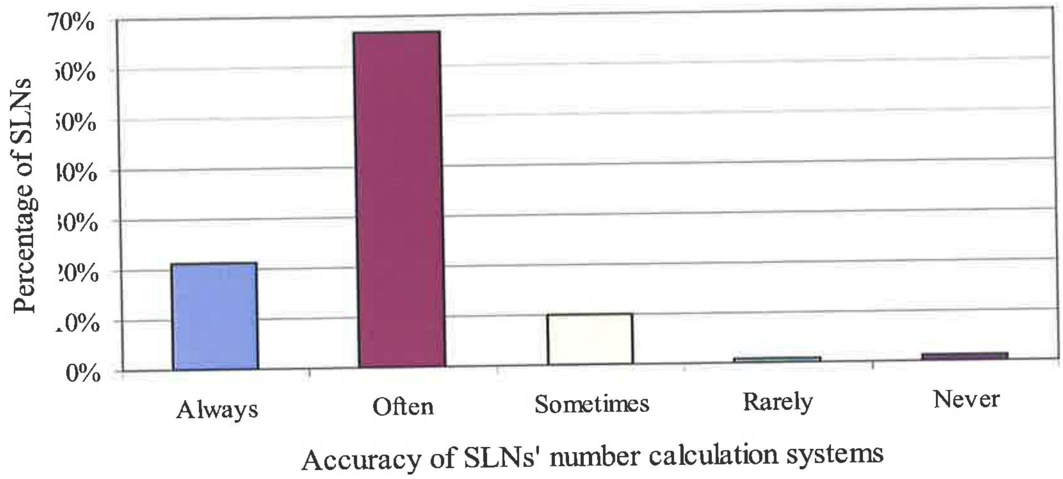


Figure 4-66 ***SND26*** ***How often SLNs' system used to calculate nurse numbers for each shift gives them an accurate staffing projection***

Viewed across sectors (Figure SND27), 91.29% of public hospital SLNs and 77.63% of private hospital SLNs reported that the system they used to calculate nurse numbers always or often gave an accurate staffing projection. SLNs' own systems worked sometimes for fewer SLNs in public ICUs (7.05%) than in private ICUs (19.74%).

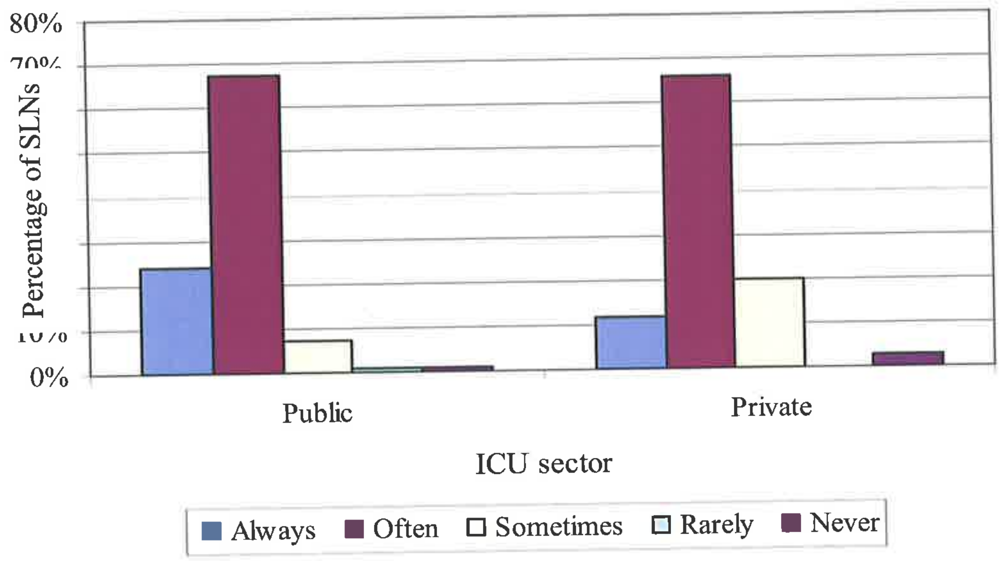


Figure 4-67 SND27 How often the system used by SLNs in public and private hospitals to determine nurse numbers for each shift gives them an accurate staffing projection

As well as looking at nurse number decision-making, SLNs were also asked how they decided nurse-to-patient allocations (Figure SQ16a). As with the earlier question on how SLNs decided nurse numbers, as many of the offered options as applicable could be selected. Of the 317 responding SLNs, 18.3% said they used no system. Using professional judgement from experience was very common (82.02%), followed by decisions depending on whether other support staff are available (58.68%) and SLNs usually allocating the most experienced nurse to the sickest patient (48.9%). Within the data, 29.65% of SLNs used one or more of the three mandated hospital nursing tools, and 34.06% used either the TISS or Excel care preset calculation tools. Help from colleagues was used by 19.87% of SLNs in making nurse-to-patient allocations.

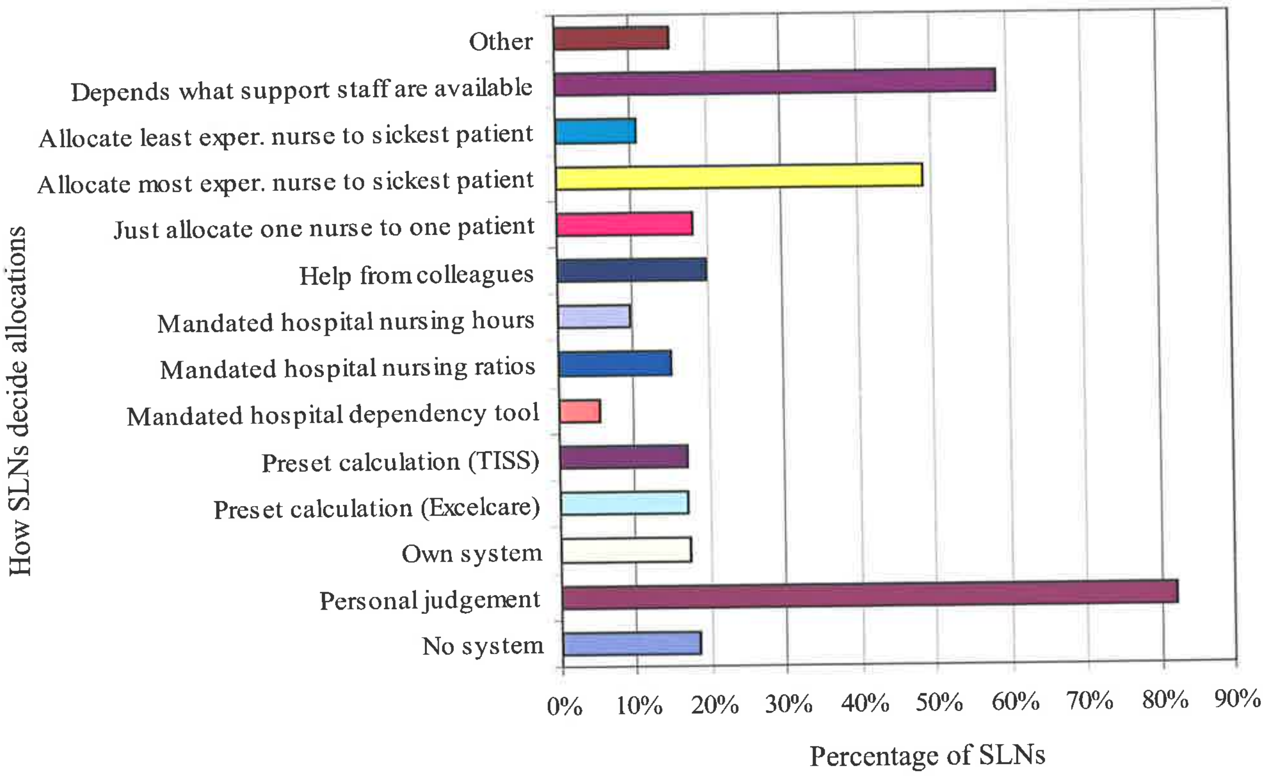


Figure 4-68 SQ16a How SLNs decide the nurse-to-patient allocations for each shift

Data on how SLNs decide both nurse numbers and nurse to patient allocations is presented in the one graph in Figure SQ15a/SQ16a. This illustrates that the three most prevalent factors considered in making nurse number decisions were personal judgement, the ACCCN position statement, and mandated ratios. For nurse to patient allocation decisions, the top three related to personal judgement, the support available, and allocating the most experienced nurse to the sickest patient. This table highlights the multifactorial nature of staffing decision-making by SLNs for both nurse number decisions and nurse-to-patient allocation decisions.

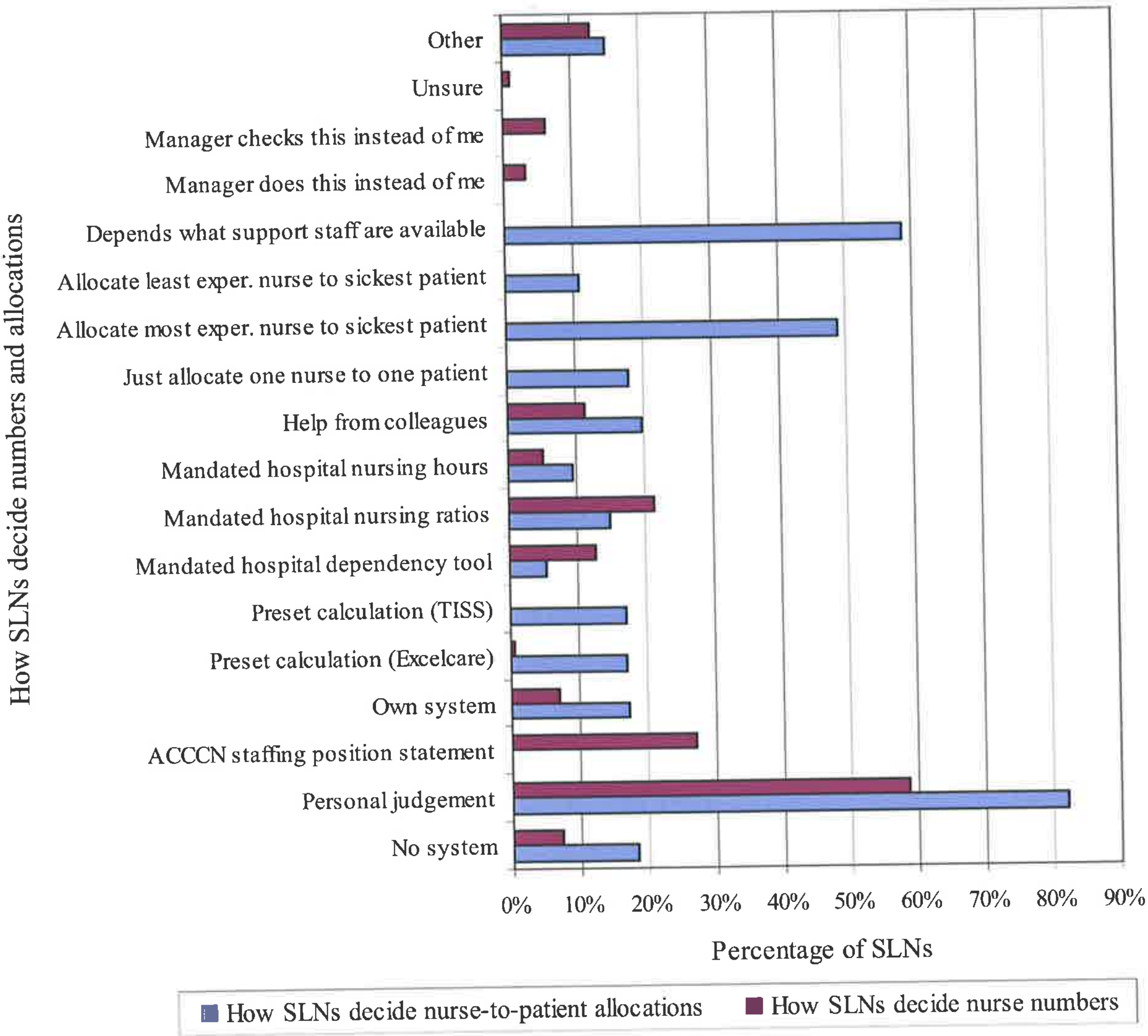


Figure 4-69 SQ15a/SQ16a How SLNs decide the nurse numbers and nurse-to-patient allocations for each shift

As for the previous questions on nurse number decisions, SLNs were asked whether the system they used to determine nurse-to-patient allocations generally gave them accurate information. Of those responding (n = 310 for subsequent related analyses), 89.03% said that it was always or often accurate, while it was sometimes accurate for 9.03%, and rarely or never accurate for 0.97% of SLNs.

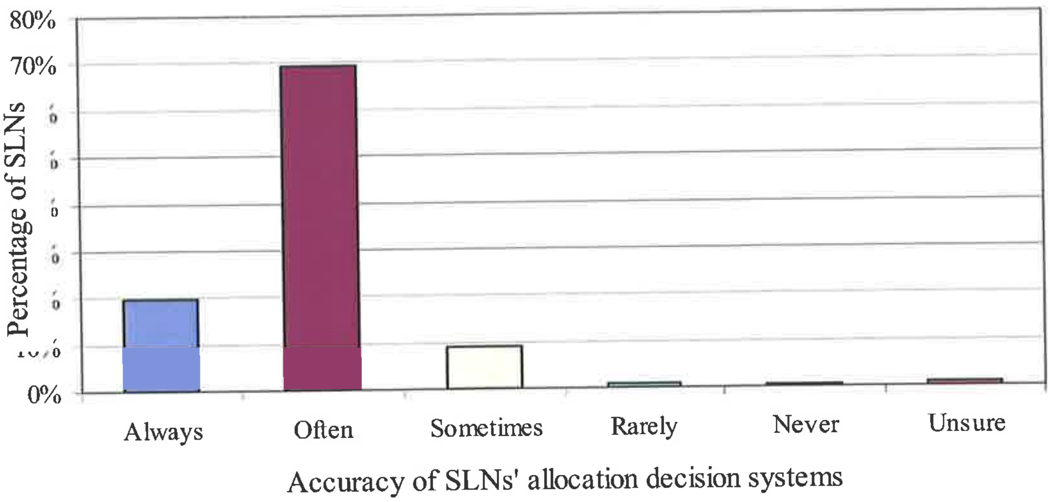


Figure 4-70 SND30a How often SLNs' system used to decide nurse-to-patient allocations for each shift gives them accurate information

When compared across public and private sectors (Figure SND30), no (0%) SLNs in public ICUs, and just 3.95% of private ICU SLNs, reported rarely or never getting accurate information from their chosen system of deciding nurse-to-patient allocations. The majority of SLNs in both sectors reported that their system often provides accurate information (71.79% of public SLNs and 61.84% of private SLNs).

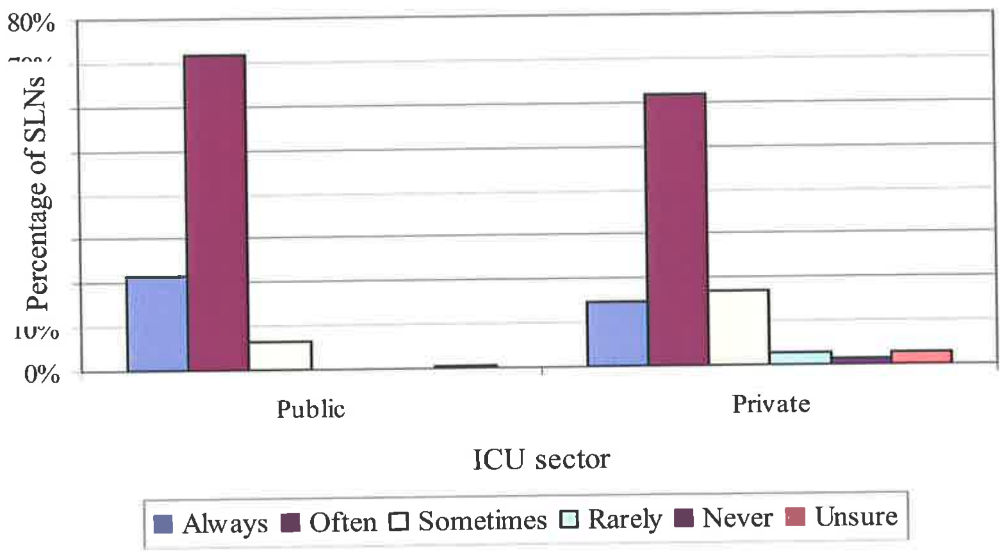


Figure 4-71 SND30 How often the system used by SLNs in public and private hospitals to determine nurse-to-patient allocations for each shift gives them accurate information

Across sectors, similar proportions of SLNs in capital city (88.8%), metropolitan (88.63%), and rural (93.75%) ICUs reported always or often getting accurate information from their system used to decide nurse-to-patient allocations. This data suggests an overall high degree of confidence in SLNs' own patient allocation systems in all sectors, though this is slightly higher in the rural sector than the capital city and metropolitan sectors.

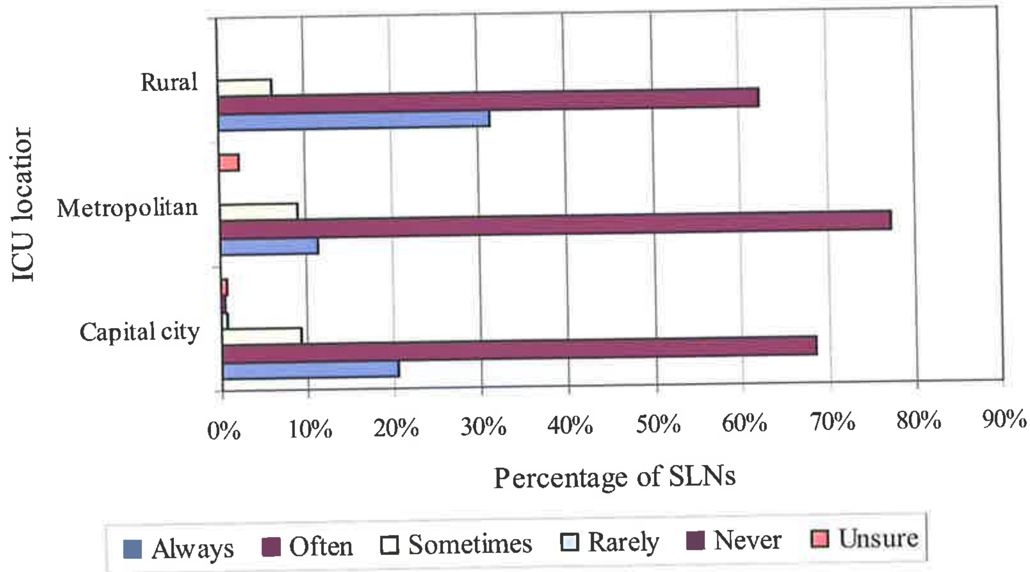


Figure 4-72 ***SND31*** ***How often the system used by SLNs in capital city, metropolitan, and rural ICUs to determine nurse-to-patient allocations for each shift gives them accurate information***

Figure SND30a/SND26a displays a comparison of the accuracy of information gained from the systems SLNs use to decide nurse numbers and nurse-to-patient allocations for each shift. Around 90% of SLNs believed that the system that used often or always provided accurate staffing information for both types of staffing decisions.

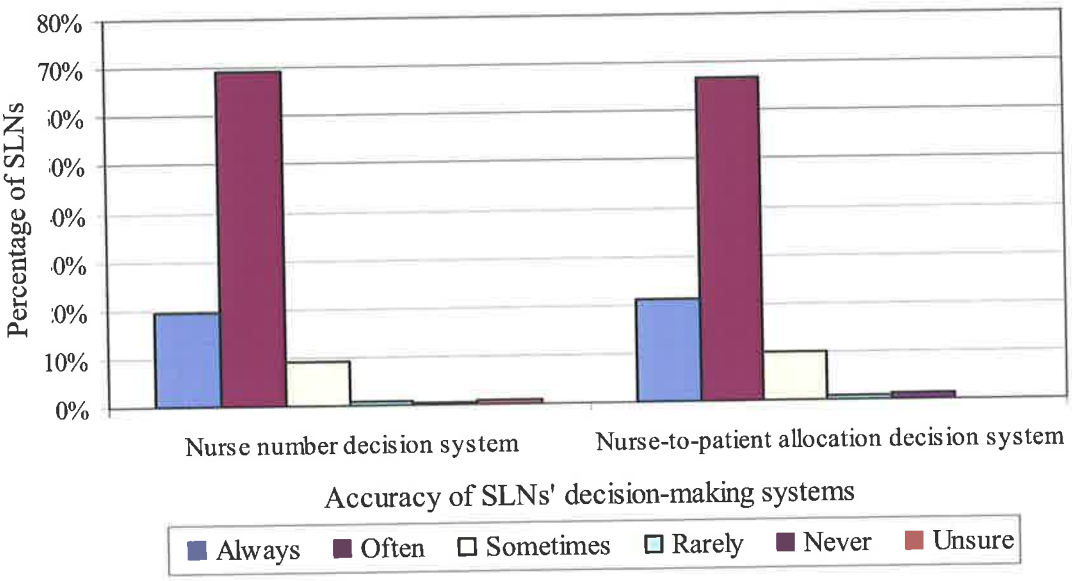


Figure 4-73 SND30a/SND26a Accuracy of information gained from systems SLNs use to decide nurse numbers and nurse-to-patient allocations for each shift

Agency nurses

Agency nurse skill assessment

The following presented data relates to the questions SLNs were asked regarding their assessment of agency nurse skills. Figure SQ17 presents the first part of this data (n = 310) on whether SLNs specify any required skills when they request ICU agency staff. As can be seen, 64.52% of responding SLNs reported they always or often asked the nursing agency for nurses with specific skills, while 4.19% rarely requested specifically skilled nurses, and 8.06% never specified required skills from the agency providers.

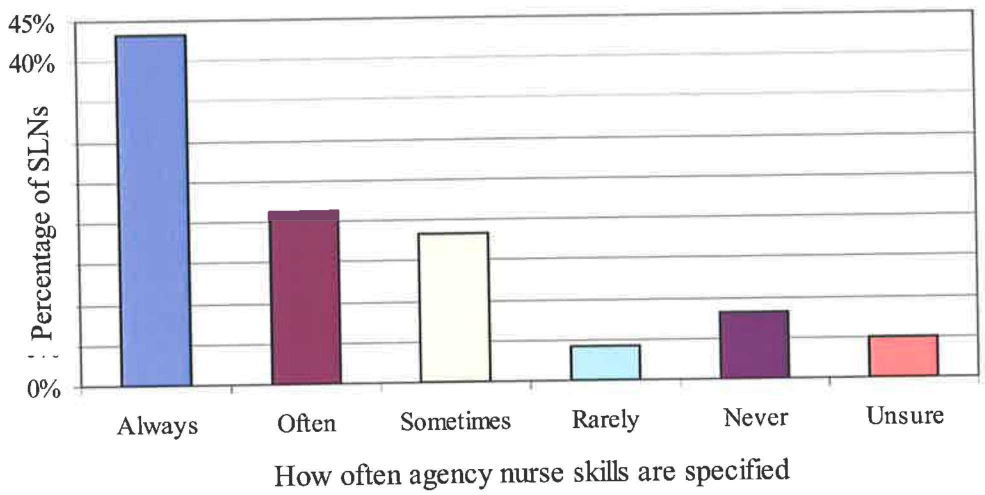


Figure 4-74 SQ17 How often SLNs specify any required skills when requesting ICU agency staff

Investigated by sector, 10.68% of public SLNs, but no (0%) private SLNs, said they *never* asked for any specific skills when requesting agency nurses (Figure SND33, below).

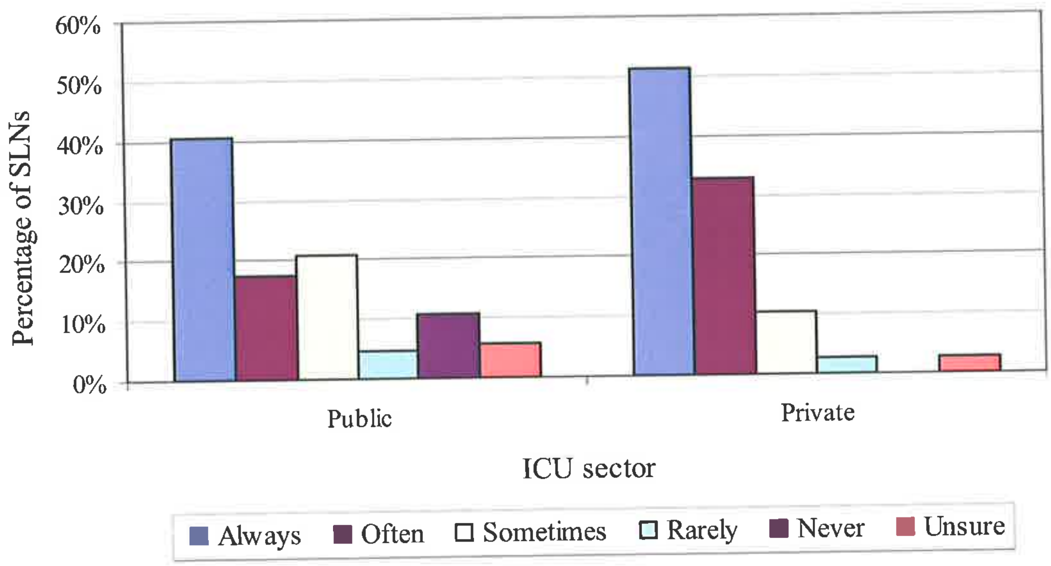


Figure 4-75 SND33 How often SLNs in public and private hospital ICUs specify any required skills when requesting ICU agency staff

Figure SND34, below, displays how often agency nurses with specific skills were requested by SLNs in capital city, metropolitan, and rural ICUs. In rural areas, a much higher proportion of SLNs (56.25%) said that they *rarely* or *never* asked agency nurse providers for specifically skilled nurses, compared to capital city (10.04%) and metropolitan (8.88%) ICU SLNs.

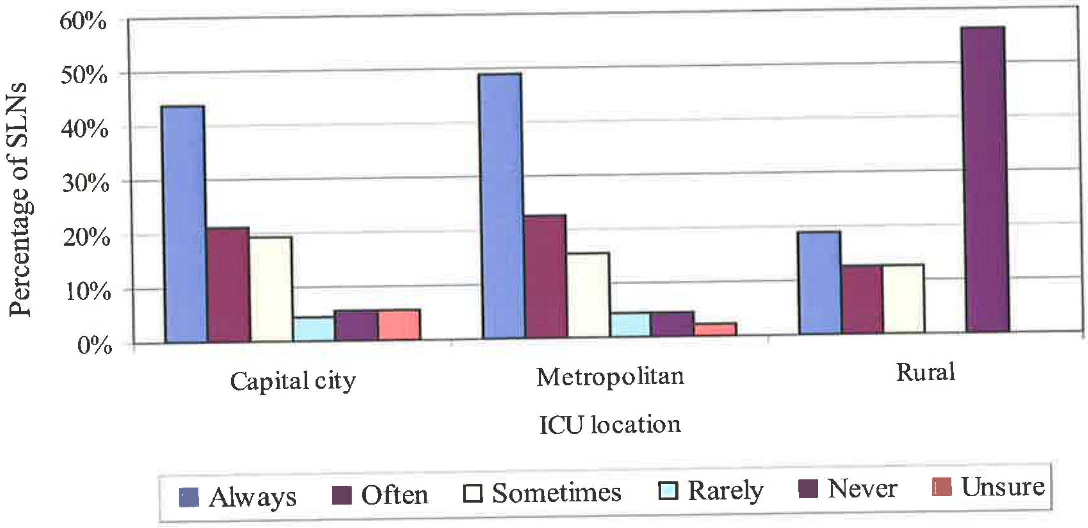


Figure 4-76 SND34 How often SLNs in capital city, metropolitan, and rural ICUs specify any required skills when requesting ICU agency staff

The issue of SLNs' assessment of agency nurse skill was further explored by asking SLNs what specific information they usually requested when ordering/booking an ICU agency nurse (Figure SQ18). Of the responding SLNs (n = 297), 18.78% said that they did not order or book agency nurses. Of those who did, the most common response was that they requested *nothing specific, besides asking for either a vent-comp or non-vent-comp nurse as required* (26.6%). Just 11.78% of SLNs said they asked for *nurses with ICU qualifications*, 3.37% asked for a nurse with a *certain number of years experience*, 6.06% requested a *nurse who had already worked a certain number of shifts in the SLN's ICU. Specific expertise* in one or more types of therapies was requested by 10.09% of SLNs, while only 1.01% mentioned that any specific preset criteria for agency nurses (that were to be deployed in their ICU) had been previously advised to the nursing agency.

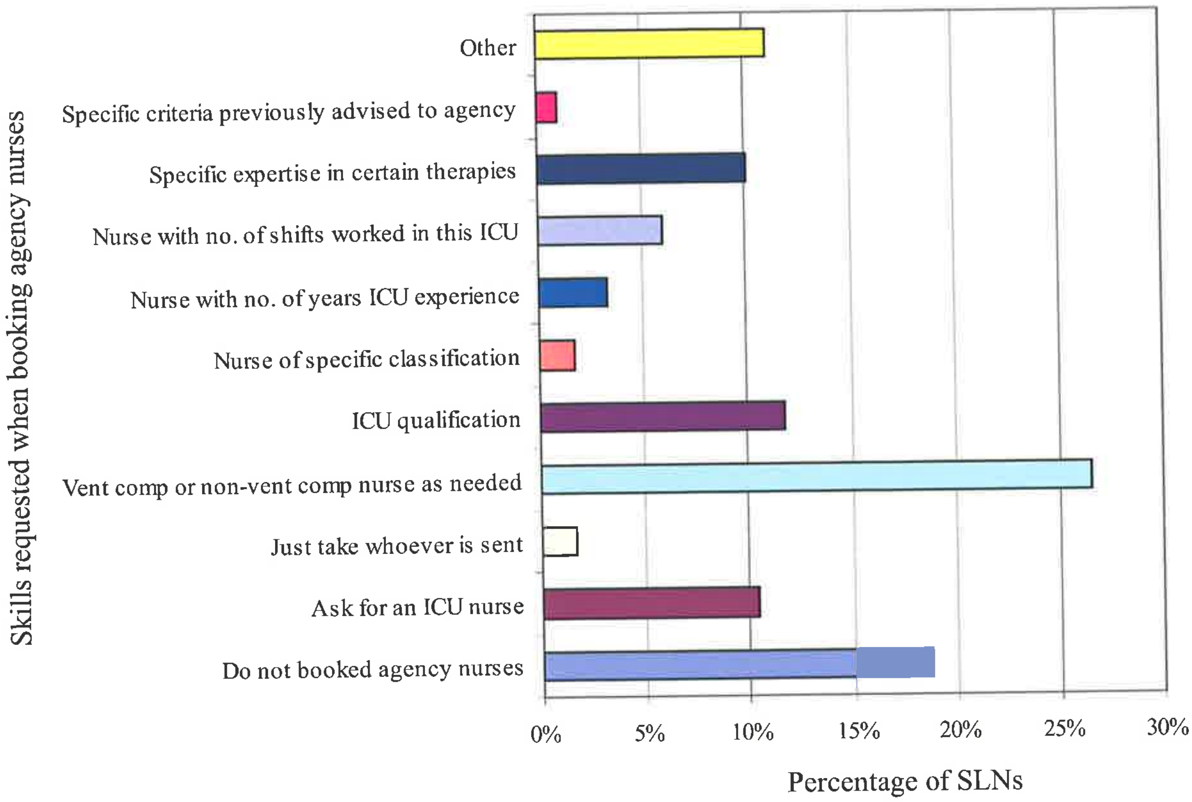


Figure 4-77 SQ18 The required skills that SLNs usually request when ordering an ICU agency nurse

Figure SQ19 shows SLNs' responses (n = 310) on how often requested agency nurses actually meet the skill level criteria required for the ICU shift they were brought in to work. Perhaps not surprising, only 63.87% of SLNs said that agency nurses always or often met the required criteria, and 26.77% said the required criteria were only sometimes met by the agency nurses deployed to their ICU.

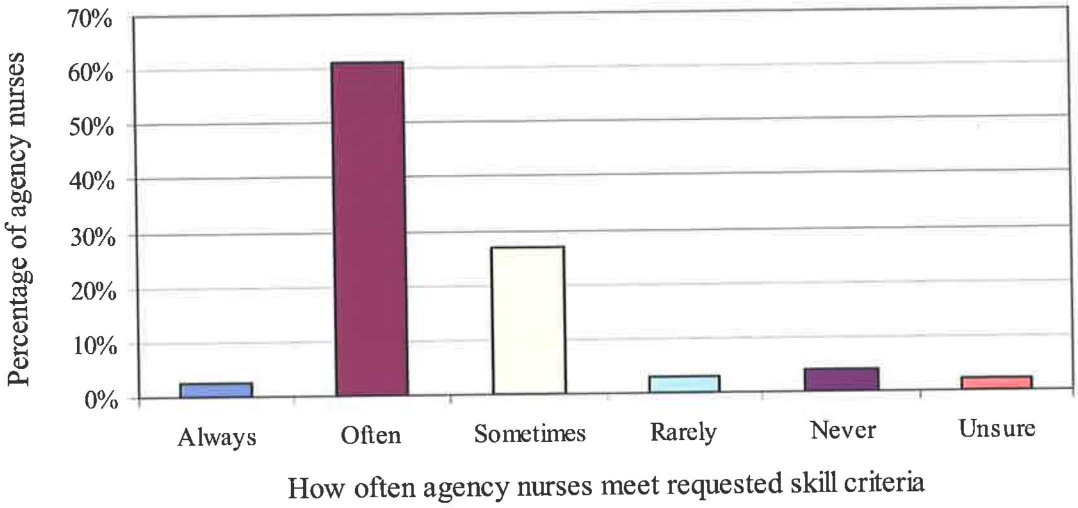


Figure 4-78 SQ19 How often ICU agency staff meet the required skill criteria when requested by SLNs

State-by-state (Figure SND35), the proportion of agency nurses who always or often met the required skill level for their ICU shift ranged from 16.67% in the Northern Territory to 100% in the ACT.

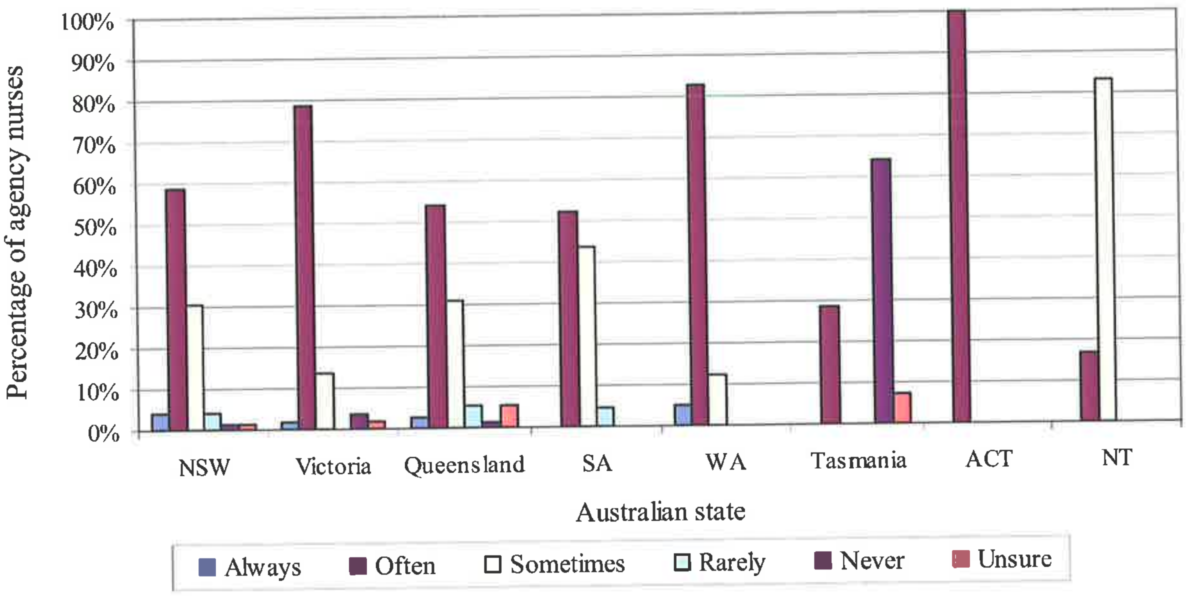


Figure 4-79 SND35 How often ICU agency staff meet the required skill criteria when requested by SLNs in each Australian state

Across sectors (Figure SND36), the proportion of agency nurses who always or often met the skill level required for the ICU shift they were employed for was slightly higher for public hospital SLNs (65.81%) than for private hospital SLNs (57.9%).

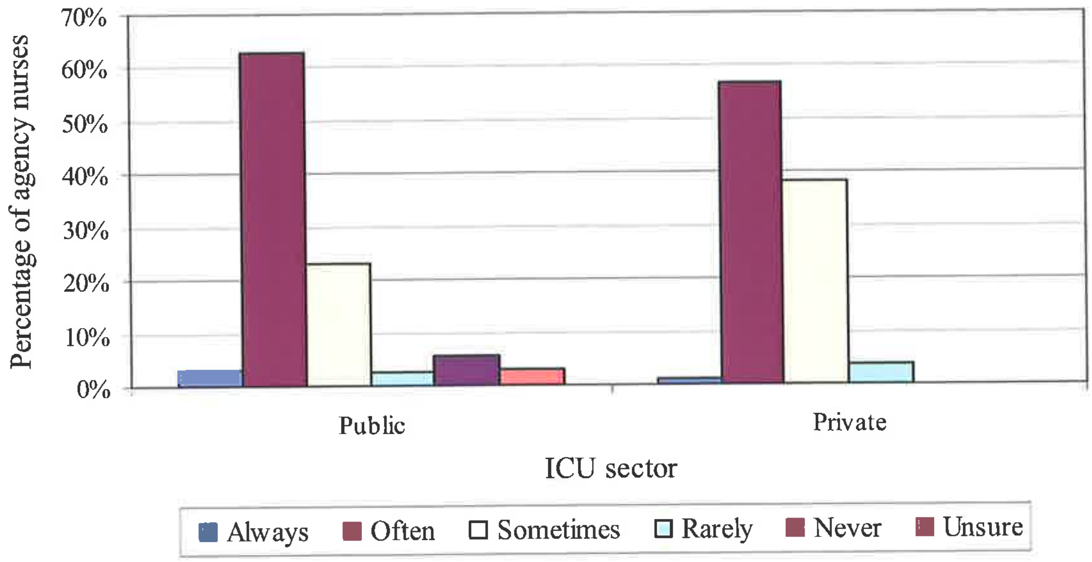


Figure 4-80 SND36 How often ICU agency staff meet the required skill criteria when requested by SLNs in public and private hospitals

Examined across areas in Figure SND37, a much higher proportion of rural SLNs (73.33%) said that agency nurses rarely or never met the skill level criteria required for the ICU shift compared to capital city (2.8%) and metropolitan SLNs (8.89%) respectively.

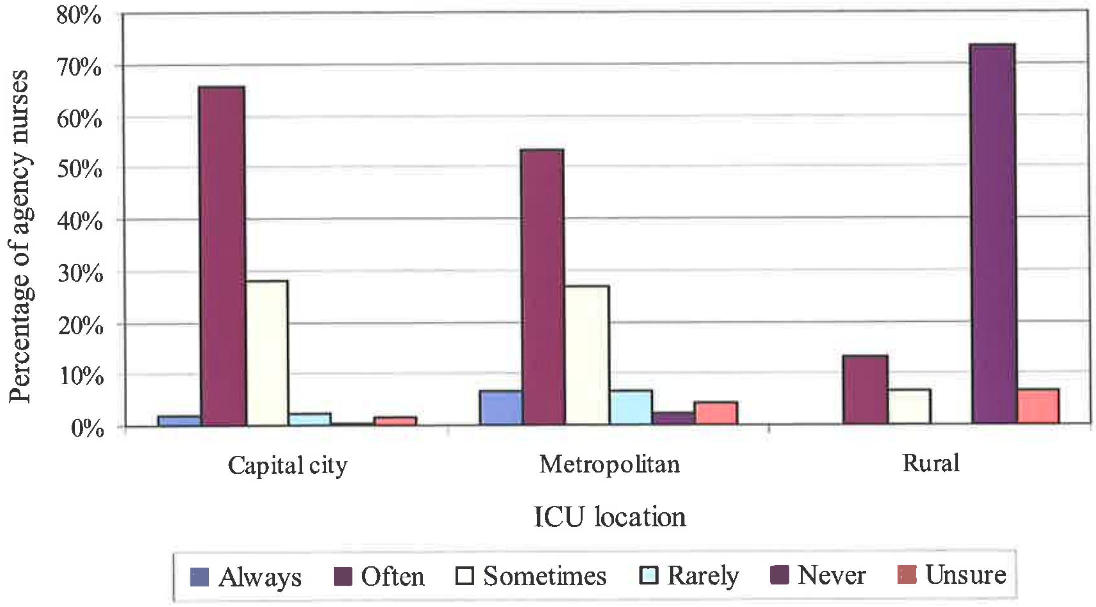


Figure 4-81 SND37 How often ICU agency staff meet the required skill criteria when requested by SLNs in capital city, metropolitan, and rural hospitals

Figure SQ20 displays how often performance feedback was provided to agency nurses after their <u>first shift</u> in each SLN's ICU (n = 309). In total, 24.91% of SLNs said that they *always* or *often* provided feedback to agency nurses after their first shift, while 38.19% *rarely* or *never* provided feedback. Given the data above regarding the low percentage who reported that the required skills were met, it is interesting that a similarly low percentage do not feed this information back to the nurse. This raises the issue that if feedback on skill-levels and performance is not given to agency nurses, particularly when their skills are perceived to be inadequate or needing to be improved. In addition, if the agency is not provided with preset skill criteria for that particular ICU, what mechanisms exist to prevent inappropriately skilled nurses from being sent to work there? There was little difference in the proportion of SLNs providing feedback across private and public sectors, and capital city, metropolitan, and rural areas.

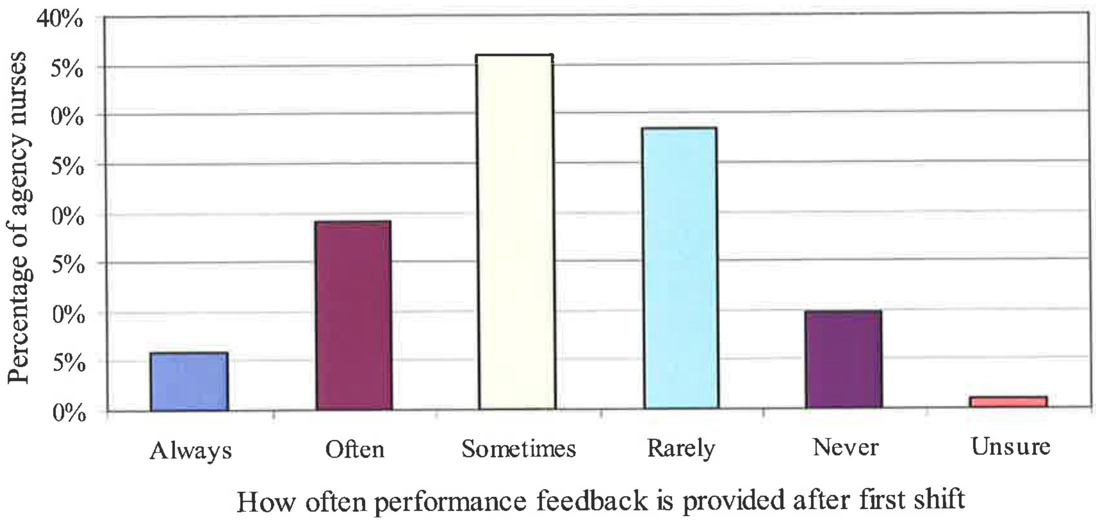


Figure 4-82 SQ20 How often performance feedback is provided to agency nurses after their first shift in the ICU

4.5. Thematic Analysis

Although only 3 open-answer questions were included in the SLN questionnaire, the answers to these few items provided a rich qualitative dataset that could not have been ascertained using only a quantitative design approach.

A variety of procedures exist to organise, manage, and analyse qualitative data, and although computer programs are available for this process, a manual method involving development of conceptual files and a subsequent thematic analysis on the three narrative SLN questionnaire items was chosen for this study. A file was created for each potential category or theme as they emerged, with each relevant SLN response then copied into the relevant file to create an accurate dataset for each theme. Although labour intensive, this manual indexing allowed the researcher to gain an intimate knowledge of all the available data.

The de-identified data-set was managed using an Excel spreadsheet which allowed accurate cross-checks to affirm the location of the original (raw data) narrative quotations. The direct quotes used in these analyses are reported according to their relevant Excel line item number followed by a slash, then the de-identified SLN participant number. For example, L24/95 next to a quotation could be directly cross-referenced to the thematic data Excel spreadsheet to Line 24 and Participant No 95 (of 317 SLNs who responded to the qualitative questions). Other sub-themes are presented.

The analysis began with a search for recurring regularities or themes. Within this study's qualitative data-set, the search for themes involved not only the discovery of commonalities across participants but also a search for natural variation. Themes emerged from the data and developed within categories. Potential patterns in participant subsets were also investigated. In this analysis a 'template analysis style', as described by Polit and Beck was utilised, which involves creating a template (a category and analysis guide for sorting the data), with this initial rudimentary template undergoing constant refinement as the data continues to be examined.[225] The entire dataset was read, then a classification and indexing system was created using coded broad themes which were eventually recoded and reduced down into the key themes.

In addition to these key themes gleaned from the responses to each question, some qualitative data in this section is presented as quasi-statistics. Quasi-statistics involve tabulations of the frequency with which certain themes are recognised in the data.[225] According to Polit and Beck, although frequency tabulations in this context might be considered less precise than quantitative analysis because of the often imprecise enumeration of themes, when integrated, a clearer view of the findings can be ascertained[225]. Polit and Beck's process was adopted by this researcher for the thematic analysis, with the aim of a better understanding of both the intricacies and the bigger picture of the collected data.[225]

Both the researcher and an independent health care professional (who was not related to the study in any other way) verified the coding system undertaken to ensure an inter-rater reliability of 95% or higher. The analysed data were ascertained from the three final questions from the SLN questionnaire, and while they were nominally free-text questions, SLNs were asked to "list" answers rather than using continuous paragraphs of text, to assist with succinct data collection, management, and analysis. The questions asked SLNs to list problems they had encountered in both their decisions regarding the number of required nurses (Question 21a in the SLN questionnaire) and their decisions regarding nurse-to-patient allocations (Q21b), as well as asking them to list their solutions to improve ICU nurse staffing allocation decision-making processes in their ICU (Q22).

Problems identified by SLNs regarding nurse number decisions - Summative Themes

As mentioned, SLNs were asked to list problems encountered whilst making their decisions on how many nurses are needed for next shift. The data from this question was read through many times in order to best understand the intricacies of SLNs' answers. It was then sorted, coded, and condensed into broad themes.

From this analysis, 8 main summative themes were identified as problems in nurse number decision-making: 1. Emergency Admissions, 2. ICU Environment Unpredictability, 3. Budget Constraints, 4. Lack of Skill/Inadequate Skill Mix, 5. Nurse Supply, 6. Lack of Support, 7. Lack of Communication, and 8. Conflict. Figure MO1 illustrates the frequency with which each problem (key theme) was reported by each of the 261 SLNs who responded to the nurse number decision-making question. By examining these frequencies, a clearer picture is gained regarding the commonality of problems.

The four most commonly reported problem themes related to making decisions on nurse numbers were related to nurse supply (noted by 57.85% of responding SLNs), the unpredictable nature of the ICU environment (55.93%), emergency admissions (40.22%), and lack of nurse skill/inadequate skill mix (38.69%). Notably, just 1.91% of responding SLNs stated that they had not encountered any problems.

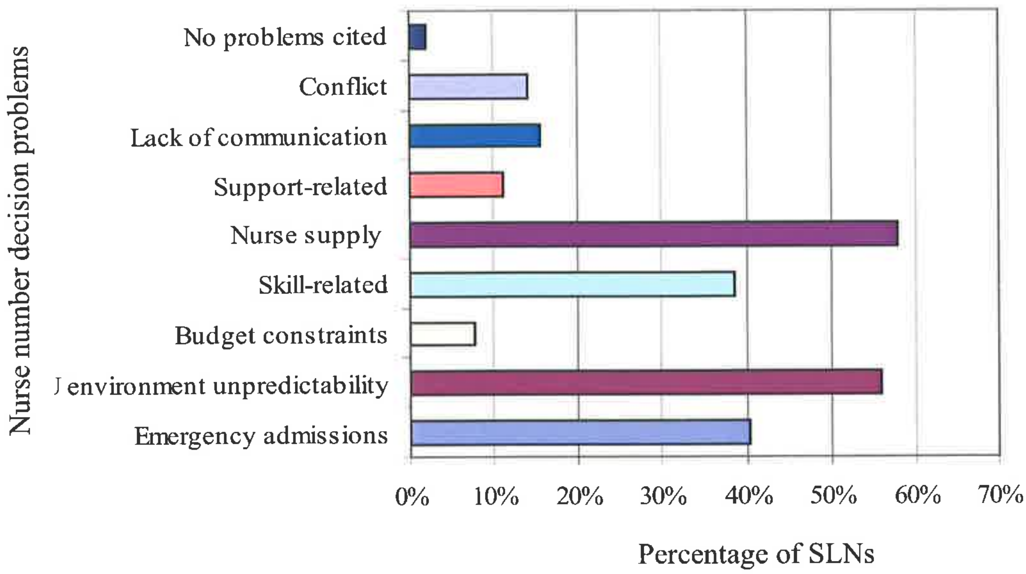


Figure 4-83 MO1 Percentage of SLNs reporting key problems related to nurse number decision-making

This broad range of problems faced by SLNs in nurse number decision-making both highlights the multitude of issues that can affect staffing decision-making, and also lends strength to the argument that simple, linear approaches in staffing models are unlikely to consider all potential influencing factors. This is discussed further in Chapter 5.

1. Emergency Admissions

Within each of the 8 broad themes related to problems in nurse number decision-making, there were a number of sub-themes. Identified sub-themes under the first theme, *Emergency Admissions,* included 'emergency admissions especially at night', 'multiple new admissions', 'unaccepted admissions stretching available staff', 'emergency theatre cases', 'last minute admissions', 'medical staff admitting patients when no staff available to care for patient', 'no on-call for emergency admissions', 'if there is one emergency admission it strains the system and the coordinator has to take a patient load', 'difficult to organise appropriately qualified staff at short notice', 'need crystal ball to estimate new admissions', 'just the usual ICU thing where you sort staffing then hear of 3 new potential admissions', and 'may be multiple beds empty and only one or less available staff for new admissions'. It was evident and not surprising that emergency patients being admitted to the ICU cause difficulty in predicting nurse numbers for any given shift, with 40.22% of responding SLNs reporting this as a problem for their decision-making.

2. ICU Environment Unpredictability

Sub-themes that emerged under theme of *ICU Environment Unpredictability* illustrate the problem of the inherent unpredictability in the ICU setting, including both the condition of the patients already in the ICU, as well as the unpredictable events and changes in demand and acuity that occur during a shift. This unpredictability problem was reported by 55.93% of responding SLNs. Sub-themes related to the unpredictability of the ICU included 'bed-state always variable', 'unknown hospital arrests/trauma calls/medical emergencies from ward', 'patient acuity changes during shift/change in status', unexpected deterioration', 'difficult to predict number ahead', and 'dynamic environment'.

Bed block related problems were cited by a number of others who noted that 'patients can arrive just after staff member was cancelled', 'bed exit-block means patients may stay longer without allocated nurse', 'bed block -more than one admission with no patients able to transfer out', and 'post-op patients dramatically better or worse'.

Issues of turnover and sudden fluctuations in demand for procedures, both inside and outside the ICU, such as diagnostic scans were reported. These included: 'ICU turnover high and patient allocation program doesn't allow for a 'special' even though you need one', 'need for escorts to scans', 'problem if extreme numbers of procedures or codes', 'downsize then get sick call', and 'patients requiring isolation'.

Changes in patient's clinical status caused significant problems. Examples included: 'When doctors admit a patient as HDU 1:2 then they end up 1:1', 'often high dependency (HDU) non-vent patients are very sick/busy/demanding', 'not allowed to staff for what-if cases', 'unpredictable clinical load', 'change in condition close to handover. These sub-themes are rich data that highlight the range of contributing problems related to ICU unpredictability in the staffing decision milieu.

3. Budget Constraints

Budget Constraints was the third identified theme, and although reported by a relatively low percentage of responding SLNs (7.66%), strong feelings emerged from the SLNs regarding budgets and the associated decisions. In parallel, a sub-theme of Lack of Trust also emerged as SLNs showed both frustration and distrust in the impact of what they perceived to be budget constraints. These sub-themes included: 'being overruled by nurse managers'; 'having to account (and justify) for 1:1 sick/ventilated patients'; 'many private hospitals governed by 'work hours' with unrealistic targets'; 'governed by set work hours'; 'pressure to keep numbers low'; 'unrealistic work hour targets', 'tight budget constraints'. There was a sense of not enough funding with 'nursing hours that reflected volume not acuity'; 'not enough funding' and 'restricted by agency policy in having to cancel within certain time or a face monetary penalty'. 'if numbers 'good' manager not concerned with staff mix, staff experience or patient acuity', the lack of trust sub-theme emerged with comments reflecting that 'Trendcare (a nursing dependency tool) is too mean'; and they are 'always having to justify a 'runner' to keep Unit safe and open to admissions'. Having to justify why agency nurse is to be used made them feel guilty. Budget constraints were viewed as a stressful additional consideration for SLNs when making nurse number decisions.

4. Lack of Skill/Inadequate Skill-Mix

The fourth main theme related to problems in nurse number decision-making was *Lack of Skill/Inadequate Skill-Mix*, and was noted by 38.69% of responding SLNs. The data revealed sub-themes including 'lack of skilled staff', 'if not enough senior nurses available, may overstaff if a lot of junior nurses are on', 'nurses not admitting their limitations then getting into trouble', 'junior nurses sent to help but this makes it harder', and 'inappropriate skill of agency nurses'. More frustration with the limitations of Trendcare include that it 'takes no account of skill-mix'. 'Staff are asked to do double/OT shifts because no one else is available, and 'ICU course nurses counted in numbers too early/not ready'. A number of SLNs noted 'the repeated occurrence of being sent 'poor quality/sub-optimal agency nurses', 'unqualified agency nurses', and 'not enough vent-comp nurses' (nurses who are competent to manage ventilated patients).

5. Lack of Supply

Lack of Supply, referring to a lack of available (nurse) supply such as from restrictions in agency provision and inability to replace nurses, was the fifth main theme. This problem was the most frequently reported in relation to problems related to nurse number decision-making, being experienced and reported by 57.85% of SLNs. The sub-themes that emerged within this theme were 'reduced numbers available'; 'short supply'; 'low numbers on roster'. More agency related problems such as: 'agency can't supply'; 'agency not turning up'; 'not enough quality staff'.

Staff reliability and subsequent contingency planning unfolded with 'part-timers required to pick up extra shifts and overtime'; 'problem if staff don't turn up'; 'might end up doubling up patients or having to use unqualified staff (i.e. assistants in nursing)'; 'unable to replace sick leave due to no agency'; 'bank or own staff willing to do extra shifts'; and 'reduced staff numbers'. Difficulties with medical staff 'pushing' to take extra patients when not enough staff or appropriate skill already were problems and contingency planning involved: 'having to reallocate/double up on patients to facilitate care, due to increased workload'; 'required to redeploy staff to meet other ward needs or codes'; 'sometimes a patient requires more than one nurse', 'not having adequate staff despite going through all avenues', and 'when required staff are unavailable unit safety may be compromised'. This evidence of self-reported problems support existing evidence on nurse shortages, and reflect the contemporary and real difficulty in staffing Australian ICUs. It also highlights the risk issue that was discussed in the literature review. If supply and skill are low, risk (of adverse events and poor patient outcome) is likely to be high. In addition are the complexities that this type of working environment impacts on morale, retention and recruitment of ICU qualified and skilled nurses.

The ICU shift leaders clearly appear to struggle in their nurse number decision-making because of nurse shortages and nurse skill issues. Just 2 SLN respondents made any kind of favourable comments regarding nurse number decision-making, including 'if over, used for education' and 'sometimes overstaffed if unexpected transfers/deaths'.

6. Lack of Support

The sixth main theme related to problems in nurse number decision-making was *Lack of Support*, which was reported by 11.11% of SLN respondents. Related to this theme were the sub-themes 'numbers of support nurses variable'; 'availability of relieving staff variable', 'not able to get float nurse'; 'often nil staff available for new admissions'; 'general relief staff not available'; 'agency often can't supply required numbers' 'complexity of supernumerary (extra person not specifically allocated) coordinator'. Direct managers were perceived by some to offer negligible support which was noticed by the SLNs. Comments included: 'underestimated by management'; 'hospital coordinators will only staff as computer tells them, not as I advise them', 'not being given extra float when requested', 'problem when patients are extremely unwell', and 'usually allocated only one admission nurse'; 'managers are not listening'; and 'managers expect coordinators to take patient',

Just one responding SLN made a favourable comment related to support issues, stating that there was 'usually no problems; staffing coordinators trust my decision'. Given that SLNs have diverse responsibilities for all shift management and staff direction, it is surprising that 11.11% of SLNs specifically reported a lack of support in their decision-making role as a problem in deciding the required number of nurses for ICU shifts.

7. Lack of Communication

Lack of Communication was the seventh main theme, and was reported by 15.70% of SLN respondents. There were a small number of sub-themes here including: 'miscommunication regarding granted staff leave makes Unit short staffed'; 'lack of communication from doctors that are accepting new patients, therefore unsure of required numbers'. One SLN noted the "vagaries" of doctors' ward rounds which can dramatically affect nursing numbers'.

8. Conflict

The final major (eighth) theme related to problems with nurse number decision-making was *Conflict*, which was reported by 14.19% of SLN respondents. This was evidenced within the following sub-themes and reflected a more emphatic view of disagreement with management, and also some dispute with their peers. Although it could be argued that some of these also crossed the theme of 'lack of trust' and lack of support', they have been grouped here due to their more emphatic nature.

This was reflected in these sub-themes: 'management often dispute number required'; 'conflict and differing opinions between shift TL and Level III who has no ICU qualification'; 'high sick leave but push to open beds'; 'NUM does not agree with two floats despite this being Unit policy'; 'oncoming shift staff unhappy with staffing'; 'staff complaints when allocated to skill-mix numbers and acuity without maintaining continuity of care'; 'management anger expressed over budget overruns despite this decision made because of increased numbers of acute patients/inadequate skill mix/emergency admissions despite irrefutable need'.

Having to acquire extra numbers through management caused increased tension. 'You often have to push to have your METs covered'; 'convincing management'; 'pressure from management to keep staff numbers low without safety net for emergency admissions'; 'previous AUMs (an RN Classification category) under- or overestimating'. Some cited that there were 'no staff available according to managers, yet staff report not being contacted'. There were 'disagreements over dependence/acuity, with non-vent seen as less needy'. Some thought it 'difficult to sell' to managers, and others 'tried to use ACCCN staffing guideline formula'. Others noted that 'meal breaks were not captured in numbers', and that the 'clinical manager reduced the numbers that have been requested for even if unit very busy'. There was also some crossover here with the *Lack of Trust* parallel sub-theme cited earlier in the discussion on *Budget Constraints* and also some alignment with the theme of *Lack of Support*. Notably, one favourable comment was made in regards to conflict in the ICU (or lack thereof): 'rarely problems, NUM and my ICU very good about required numbers'. At the opposite end of the scale, one SLN just reported despairingly, 'too many gripes'.

Nurse allocation-to-patient decision problems – Summative Themes

Question 21b of the SLN questionnaire asked Shift Leader Nurses to list problems they had encountered in making nurse-to-patient allocation decisions. This was included in the questionnaire as a separate question to the one on nurse number decision-making problems to discern whether or not the problems would be similar, given that both are key decisions made by SLNs. Once shift leaders have made decisions about the required numbers of nurses for the shift, there are separate decision-making processes in place to allocate the designated number of nurses to patients in the ICU. It is the difficulties and problems that SLNs experience in this particular component of staffing decision-making that are the basis for this question and analysis.

Analysis of the data on problems SLNs faced regarding nurse-to-patient allocation decisions revealed some similar themes, as well as some new themes, compared to those themes related to nurse number decision-making. Overall, 9 broad themes were identified in regards to problems in nurse-to-patient allocation decisions: 1. Emergency Admissions, 2. ICU Environment Unpredictability, 3. Lack of Skill/Unknown Skill, 4. Student/Junior Staff Considerations, 5. Supply, 6. Staff Preferences, 7. Allocation Fallout, 8. Supervision and Support, and 9. Conflict. Figure MO2 below presents the frequency with which each of these themes (problems) were cited, and is followed by a more detailed presentation of each of the 'patient-to-nurse allocation problem' themes. Lack of skill or unknown skill was the most common problem cited by SLNs (26.82%), followed closely by problems related to the inherently unpredictable nature of the ICU (23.98%). A total of 4.88% of SLNs stated that they hadn't experienced any problems related to nurse-to-patient allocation decisions.

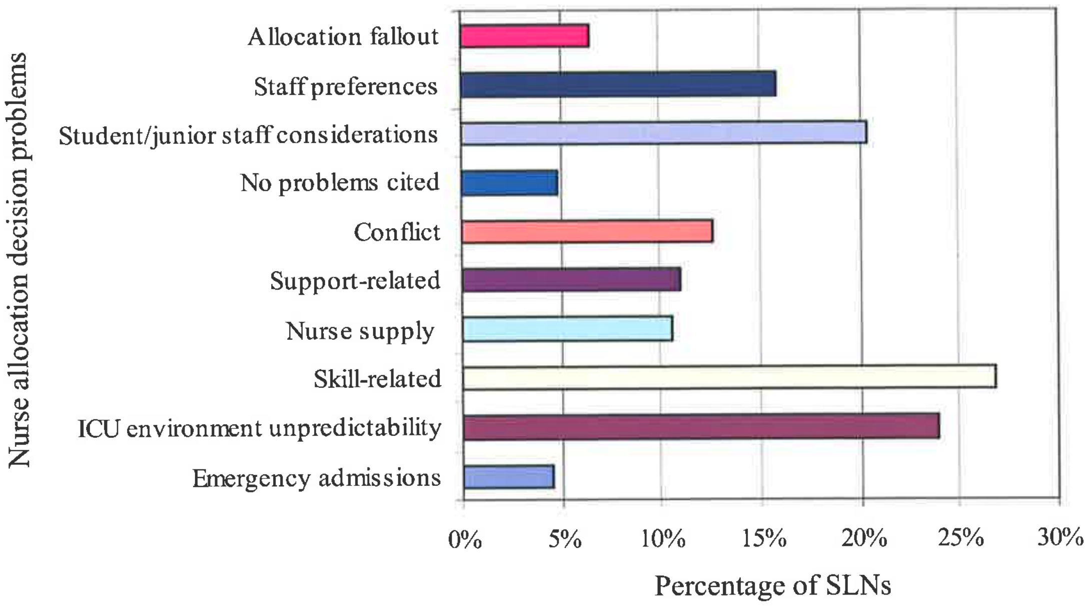


Figure 4-84 MO2 Percentage of SLNs reporting key problems related to nurse-to-patient allocation decisions

1. Emergency Admissions

Under the first theme of *Emergency Admissions*, the emergent sub-themes were not dissimilar to those found under this theme for the previous question. In regards to nurse-to-patient allocation, the sub-themes were 'emergency cases', 'unexpected admissions', and 'difficult to organise appropriately qualified staff at short notice'. This problem was reported by 4.47% of SLNs who answered this question. The smaller representation may reflect that emergency admission factors influence nurse allocation decisions less than they affect required nurse number decisions.

2. ICU Environment Unpredictability

The second main theme, *ICU Environment Unpredictability*, was noted by 23.98% of SLNs as being a problem they had experienced related to making nurse-to-patient allocations. Again, similarities can be seen in the sub-themes in this category for each of the questions. In this case, the sub-themes were 'bed-state always variable', 'unknown hospital arrests/trauma calls', 'patient acuity changes during shift/change in status', 'unexpected deterioration', and 'difficult to predict ahead'.

3. Lack of Skill/Unknown Skill

Lack of Skill/Unknown Skill was again determined to be a main theme, and was the most frequently cited problem related to nurse-to-patient decision-making, noted by 26.82% of SLNs. The sub-themes in this case were 'lack of skilled staff', 'requires change on patient management/condition', 'staff not to expected standard', 'uneven skill mix', not all can cope with change in acuity', 'haven't known staff capabilities', 'too busy to support them', 'nurses not declaring/acknowledging their limitations', 'agency saying they are experienced when they are not', 'staff not to expected standard', 'feeling that nurse not able to cope with their allocated patient', 'not having enough experienced staff to allocate to patients', 'difficult if nurse is new to area', and 'inappropriate skill mix due to poor rostering'.

4. *Student/Junior Staff Considerations*

Student/Junior Staff Considerations was a new main theme, with SLNs experiencing these problems whilst making nurse-to-patient allocation decisions, but not during nurse number decisions. The emergent sub-themes in this category were 'finding appropriate patients for nursing students', 'balancing student needs/wishes with those of senior staff', 'patient deteriorates beyond nurse's skill level and support person is then too busy to help/preceptor', 'allocating junior staff to sick patients without adequate support', 'juniors have time management trouble, others forced to assist when time already limited', 'lots of junior staff, need reliable backup but seniors miss caring for sicker patients', 'junior staff with HDU patient who then becomes ICU patient', and 'mix of students from a number of levels, hard to keep track of where they are each at'. ICUs, like other medical departments, generally have a number of junior staff in them at any given time and clearly their place within the available skill-mix is a significant consideration, and often problem, in deciding which nurses will care for which patients. Of the responding SLNs, 20.32% reported this problem, highlighting it as a reasonably oft-experienced concern in nurse-to-patient allocation decision-making.

5. Supply

Supply was a summative theme again, with 10.56% of SLNs citing this as a problem. The identified supply-related sub-themes were 'reduced numbers available', 'short supply', 'low numbers on roster', 'agency can't supply', 'not enough quality staff', 'part-timers required to pick up extra shifts and overtime', 'sometimes too bottom heavy', and 'lack of senior staff'. There is some overlap in answers within these sub-themes and those in the *Supply* sub-themes related to nurse number decision-making.

6. Staff Preferences

The sixth summative theme was a new one, titled *Staff Preferences*. In nurse-to-patient allocation decision-making, it is likely that there will be some influence, positive and/or negative, exerted on the SLN as they decide which patient(s) each nurse will be allocated responsibility for. The sub-themes related to this theme were 'nurse requests', 'staff unhappy with allocation', 'staff either not wanting same patient too often or wanting same patient for continuity of care', 'staff wanting the most interesting patient', 'never wanting to look after extubated patients', 'trouble maintaining shift consistency between shift allocations', 'fair allocation of HDU patients', 'view by some that sickest patient should have most experienced nurse', 'bad backs restrict allocation options', and 'allocation of pregnant staff'. Whilst these sub-themes may show no real surprises in any workplace where staff wish to exert some influence, it does highlight an added consideration and potential burden for the shift leader when allocating nurses roles and responsibilities. Of responding SLNs, 15.85% reported that they had experienced staff preferences as a problem in nurse-to-patient decision-making.

7. Allocation Fallout

Allocation Fallout was the seventh main theme, and another new one. This theme was related to consequences that occurred, usually later in the shift, because of the SLN's earlier nurse-to-patient allocation decision. Hence, they were considered problems that the SLN had experienced related to their decisions on nurse-to-patient allocation. The sub-themes related to *Allocation Fallout* were 'risk of deskilling critical care qualified nurses in certain therapies', 'personality types of both patients and nurses not realised until later in shift post allocation', and 'relying on colleagues' approval has sometimes led to mismatch in allocations'. This problem was noted by 6.5% of SLNs.

8. Supervision and Support

The theme of *Supervision and Support* was again identified in regards to nurse-to-patient allocation decisions (titled *Lack of Support* in the nurse number decision-making data), though the sub-themes in this case had their own implications related to nurse-to-patient allocation decision-making. Sub-themes were '*s*taff saying they know what they are doing but on checking it is found otherwise', 'numbers of support nurses variable', 'managers are not listening', 'managers expect coordinators to take patient', 'availability of relieving staff variable', 'not able to get float nurse', 'often nil staff available for new admissions', 'complexity of supernumerary (extra person) coordinator underestimated by management', 'general relief staff not available', 'stable patient can deteriorate with unskilled staff member', 'unplanned procedures that the nurse is not managing as patient acuity increases', and 'allocating to challenge someone with support but when it gets busy unable to provide support'. This problem was cited by 10.97% of participating SLNs.

9. Conflict

The final main theme in regards to nurse-to-patient allocation decision-making was *Conflict*, which was the same as a theme related to nurse number decision-making. However, the emphasis in this case is slightly different, as identified in the following sub-themes: 'interference from CNC', 'told relievers are more experienced than they are', 'conflict and differing opinions between shift TL and Level 3 who has no ICU qualification', 'oncoming shift staff unhappy with staffing', 'staff complaints when SLN has been allocated to skill-mix, numbers and acuity without maintaining continuity of care', 'arguments between staff over allocation choices/decisions', 'patient and family complaints regarding allocation', and 'overruled by nurse managers'. The parallel theme of *Lack of Trust* can again be seen in some of these sub-themes. *Conflict* was noted as a problem in nurse-to-patient allocation decision by 12.61% of SLNs.

Comparison: Problems in Nurse Number Decisions vs. Nurse-To-Patient Allocations

Figure MO3 displays comparative data on how often each nurse number decision problem and each nurse-to-patient allocation problem was cited by SLNs. Though frequency analysis is not necessarily a common feature in qualitative data analysis, it is useful in this context to add clarity and richness to the data, adding support to the use of triangulation in this research design (refer Chapter 3). Several problems were faced by SLNs in both nurse number and nurse allocation decisions. For example, emergency admissions were problematic in both decisions, though for many more SLNs during nurse number decisions (40.22%) than nurse-to-patient allocations (4.47%). Nurse supply was also a more common problem when making nurse number decisions (57.85% vs. 10.56%), and the same was found in regards to the unpredictable environment of the ICU (55.93% vs. 23.98%). However, similar percentages of SLNs cited support-related difficulties (11.11%

for nurse numbers, 10.97% for nurse-to-patient allocations) and conflict (14.19% for nurse numbers, 12.6% for allocations) as being problems in both decisions.

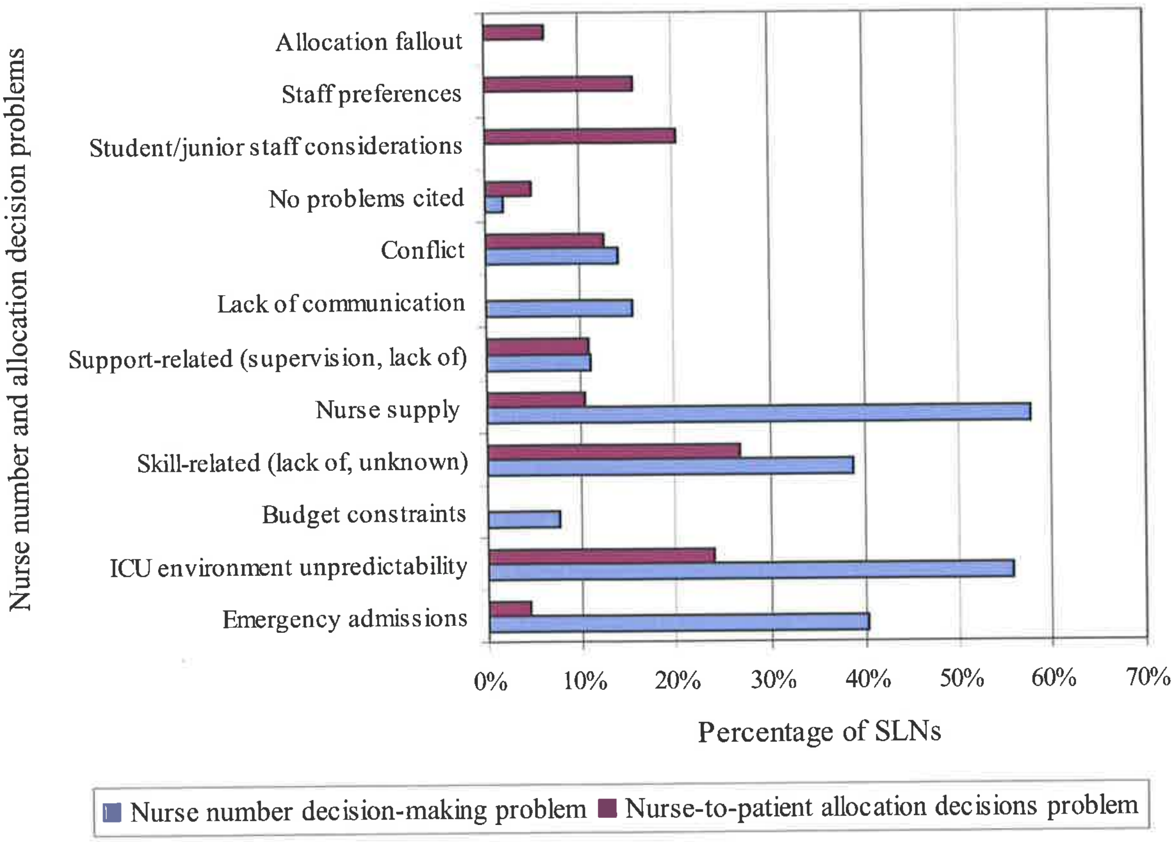


Figure 4-85 MO3 Percentage of SLNs reporting key themes (problems) related to making decisions on nurse-to-patient allocations and nurse numbers

SLN staffing solutions

After providing information on problems they had experienced (related to nurse number decision-making and nurse-to-patient allocation decisions), SLNs were asked to list their 'solutions to improve ICU nurse staffing allocation decision-making processes' in their ICU. Of the 317 participating SLNs, 87 did not provide a response to this question, and another 4 answered with 'nil' or 'none', leaving 71.29% (n = 226) responding SLNs, who offered between one and four staffing solutions. Although the questionnaire instructed SLNs to 'list' their answers, most respondents instead wrote one or two short sentences encompassing their solution(s). As SLNs often offered multiple staffing solutions, the Excel code for each line of raw data may be referenced more than once in this section (because more than one answer was often entered on a line, instead of one solution per line as SLNs were asked to answer), and the total frequency with which the themes are represented in the data is higher than the number of respondents. Where direct quotes from the data are presented in this section, a code/identifier (CRI) and the corresponding Excel line item (ranging from 1-317) are shown in italics to identify the origin of the data. The researcher believed it was important to present examples of the raw data collected in order to retain the emphasis and context of what SLNs 'really' had to say.

Nine distinct themes emerged from SLNs' responses on how they believed staffing allocation processes could be improved in their ICU: 1. No Solution: Despair/No Solution: Status Quo OK, 2. Create Skill Database/List, 3. Restrict/Control Patient Demand/Activity, 4. Skill-Mix Formula Guide, 5. Staff Preferences, 6. Autonomy and Support for Decisions, 7. Adequate Clinical Resources/Increased Supply, 8. Better Communication Between Team Leaders/Attitude, and 9. Improved Conditions for Staff. Figure MO4, below, presents the frequency with which each of these themes (solutions) were cited, and is followed by a more detailed analysis of each of these 'staffing allocation solution' themes. As can be seen, having a skill-mix formula guide to use was the most common solution suggested by responding SLNs (26.54%), followed closely by creating/using a skill database/list (25.22%) and having adequate clinical resources/increased supply (19.02%).

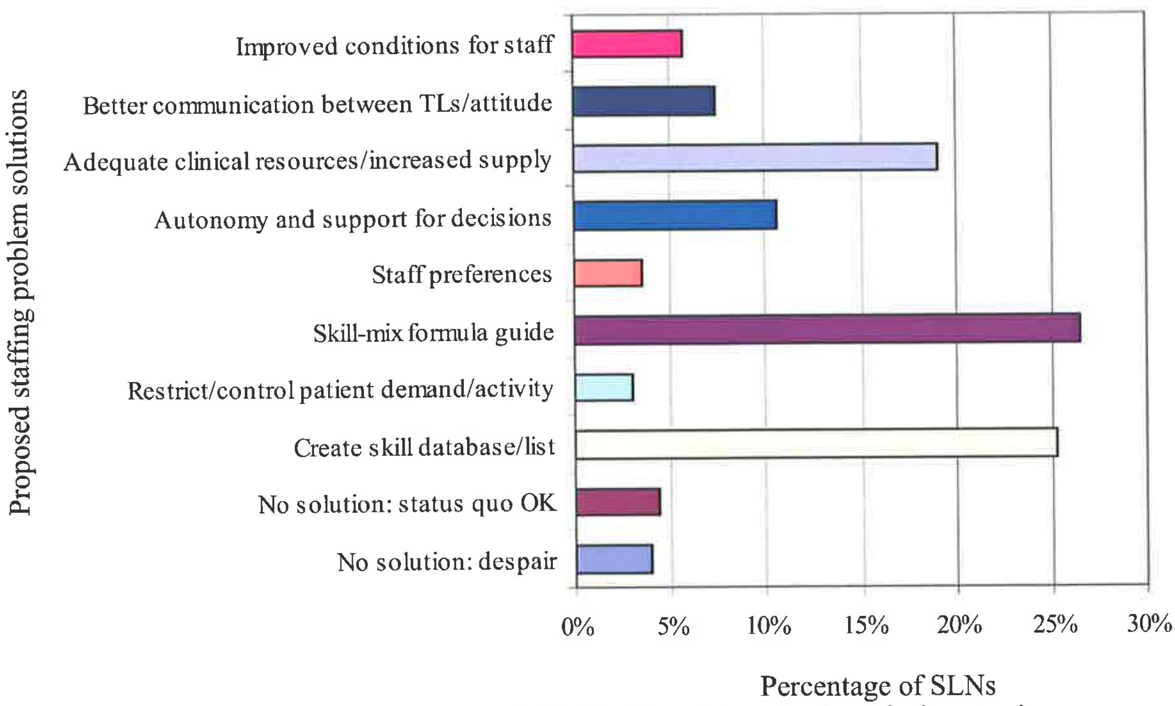


Figure 4-86 MO4 Percentage of SLNs proposing each solution to improve nurse staffing allocation decision-making processes in their ICU

1. No Solution: Despair and No Solution: Status Quo OK

The first staffing solutions theme, of 'no solution' being suggested, combines two very different broad reasons given by SLNs for not giving any solutions: despair regarding the current system, and also the belief that the current processes in the SLN's ICU (the 'status quo') were adequate. Firstly, 3.98% of responding SLNs suggested that there was no solution to their nurse staffing allocation processes, with their answers reflecting varying degrees of despair:

> CRI 1: *Have to take what we can get & allocate as best we can. With nursing shortages, sick leave etc. can't see a solution*

> CRI 54: *I offer no solutions as all the issues that occur are beyond your control*

> CRI 192: *I don't know how you solve a problem when your colleagues don't believe there is a problem.*

> CRI 311: *There is no answer.*

On the other hand, 4.42% of SLNs offered no solutions but suggested that their ICU's 'status quo' was acceptable. One SLN reported that the lack of problems in their ICU was most likely due to a high number of qualified staff, while another stated that they learned from their mistakes. Other related responses included:

> CRI 66: *We have adequate allocation systems in place.*

> CRI 102: *I think our system works quite well, we try to have people on call if the staffing is tight. We just need more permanent, experienced staff.*

> CRI 175: *believe the process works well - frequently understaffed though - due to lack of staff availability.*

> CRI 234: *I think system works pretty well. We can't predict the unexpected it comes with the job, but all in all it usually comes together quite well.*

2. *Create Skill Database/List*

The second most frequently suggested solution by SLNs (25.22%) related to the need for the creation of databases or lists of staff skills to inform their decision-making and staffing planning. A number of SLNs stated that the database should include information not only on skill level but also each staff member's experience, capabilities, knowledge of equipment, previous times they had worked in that ICU, and previous patient allocations they had been given. Four SLNs suggested this information should include a photo of the staff member so that 'a name can be put with the face'. Examples of actual responses falling within this theme include:

CRI 5: *Have an easily accessible profile on staff members so that I could see what kind of experience they need.*

CRI 13: *Documentation of previous allocations.*

CRI 31: *Profiles of all staff and their skill level/experience/capabilities.*

CRI 34: *Photo of all relieving/ new staff so I can put a face to the name on the allocation page. Their level of experience, certificate etc.*

CRI 84: *List showing each staff member's competency in the various pieces of equip/proc. (particularly juniors).*

There was also a specific emphasis in some responses regarding new staff:

CRI 154: *Accurate information regarding skill level of new and relieving staff.*

CRI 230: *Being aware of new staff and their level of skills via staff meetings and introduction of new staff to ICU.*

CRI 256: *New staff - experience, whether ICU trained, previous working environment. Info available so allocation earlier.*

Some SLNs suggested computer-based systems related to nurse competencies and others wanted simple lists of information:

CRI 305: *Computerised system stating nurses competence (i.e. IABP, PA, CVVHD, vent, non vent comp) and who assessed competency.*

CRI 307: *Gathering of own information on individual staff and their work practices and capabilities.*

On a positive note, 1.77% of all responding SLNs stated there was some sort of skill database or list already in use in their ICU.

CRI 52: *Allocation database is an invaluable tool which assists us greatly.*

CRI 49: *We have a nursing allocation database which highlights CNS, RN Division status. Shows last 3 weeks of who staff have cared for, so fairer allocation. Competency folder of staffs ability - competency.*

CRI 91: *We currently use a spreadsheet set-up with all the staffs skill level.*

CRI 218: *We have a file with the learning needs and experience of new staff members and critical care students. We also have a list of staff with midwifery qualifications, ALS competent and cardiothoracic competent.*

The need for a skill database specifically for agency staff because the skill sets of agency staff are often unknown when they arrive for their ICU shift was noted by 7.08% of SLNs. From the data presented earlier in this chapter, it is apparent that this may be due to staff not specifically requesting an agency nurse with the skills they require for the shift, and/or agency providers not supplying this information of their own accord.

CRI 3: *Have a proper list of staff available & their ICU skills i.e. vent comp etc*

CRI 44: *All agencies should provide information on each of their critical care nurses that could potentially be working in the ICU, including their experience, skills and if they've worked here before.*

CRI 279: *Agencies should provide their nurses with a list of their experience and capabilities that I could quickly sight on their arrival to my unit.*

CRI 79: *Accurate prior knowledge of the skill of agency staff.*

CRI 212: *More info from agency staff abilities - if new staff to unit. Occasionally shift leader not informed of extra staff names until very close to onset of shift so unable to allocate appropriately.*

CRI 304: *List of ICU/vent comp. nurses available - updated each time.*

3. Restrict/Control Patient Demand/Activity

The solution least commonly cited by SLNs (3.1%) related to strategies that could be used to restrict or control the patient demand/activity which caused a problem when reduced skill and nurse supply was available.

CRI 9: *Pre-warned is pre-armed. If shift is going to be tight for numbers or skill mix it is then possible to limit numbers of procedures performed and further admissions accepted.*

CRI 79: *Cap beds when staffing levels unsafe.*

CRI 125: *Streamlining processes for ICU referrals to identify potential admissions earlier.*

CRI 147: *Decrease admissions in ICU.*

CRI 178: *Stop admitting pts when ICU is inadequately staffed*

4. Skill-Mix Formula Guide

There were 24.34% of SLNs who listed solutions that related to this theme. They included responses regarding various formulas/guide-related suggestions that they believed would work to improve or enhance how ICU staff skill-mix could be determined and managed. A commonly noted SLN skill-mix 'formula' included senior and junior (or more skilled and less skilled) nurses being strategically allocated to areas/patients in close proximity to each other to encourage support and education:

CRI 87: *Buddy junior and senior staff.*

CRI 34: *Place an experienced nurse next to a novice.*

CRI 149: *Place unskilled staff adjacent to senior, more experienced staff.*

CRI 59: *You still have to expose juniors to sicker pts. But this is dependent* *on skill mix available.*

Other SLNs suggested solutions that were numeric-based, such as ratios, though the variations in these strategies reflect a number of different approaches:

CRI 36: *at least 2-3 senior on haemofiltered or balloon pumped should still require a nursing ratio of 1 to 1, especially when confused. Non-invasively ventilated pts if they are dependent on mask ventilation should be considered as ICU each shift.*

CRI 252: *Protocols on Nurse to Patient ratios...*

CRI 50: *Some HDU pts, though not ventilated, pts.*

CRI 249: *1:1 ratio for post op hearts for at least 24 hrs.*

CRI 149: *Double up stable patients.*

CRI 86: *When the unit has a number of high dependency pts - do not make these 2:1 pt/nurse ratios. Leave some room for unexpected admissions by making some of these pts a 1:1 ratio. When the unit is full with 10-12 pts - having a compulsory float/access nurse.*

CRI 88: *Roster more senior to junior ratio per shift.*

CRI 7: *Standard ratio of ANUM, CNS, trained, untrained staff rostered onto a shift.*

One SLN suggested there should be education on application of the ACCCN Position Statement on Staffing to guide their decisions[3]. The term 'ACCESS nurse' was referred to, which is an acronym from the ACCCN Position Statement that stands for "**A**ssistance, **C**oordination, **C**ontingency (for a late admission on the shift, or staff sick leave mid-shift), **E**ducation (of junior staff, relatives, and others), **S**upervision and **S**upport. These 'ACCESS' nurses work in addition to bedside nurses, clinical coordinator, unit manager, educators and non-nursing support staff.[3]

Use of extra staff in supernumerary (support) roles was a also common solution, and other SLNs just referred to skill mix in more general terms such as 'keep the skill-mix even', 'improved skill on each shift', and 'continually review the staffing requirements throughout the shift'. Other related responses were:

CRI 119: *would like new nurses to be supernumerary for at least 6-12 weeks until competencies achieved.*

CRI 266: *ACCESS nurse to do all the things they do.*

CRI 62: *Don't have too many new or inexperienced nurses on each shift. Never give up your runner to take a pt load, use them as a resource and support for less experienced staff and also to support and help all staff.*

CRI 95: *Keep an open mind + <u>continually review.</u>*

CRI 108: *Re-allocate patients during shift if necessary i.e.: pt gets sicker and is too difficult for nurse to cope and unit is busy. Continue to supervise new and less experienced staff.*

Some SLNs suggested general solutions around 'formalising' and have a more 'structure' in allocation processes, with one suggesting there needed to be performance management of underperforming staff members who fail to carry full load. Another suggested closely monitoring the allocation of obese patients to share the load, and minimise the risk of back injuries occurring. There were mixed opinions regarding solutions that involved specific dependency or acuity measurement tools such as TISS, with 4 SLNs suggesting that TISS was useful, and 1 SLN specifying that they <u>did not</u> use patient dependency computer systems because 'some events can't be predicted'. Other SLNs were less specific about the standards or tools they used, such as the response 'unit based standards and guidelines for coordinators'.

Other SLNs proposed solutions around nurses being required to have ICU qualifications:

CRI 277: *Requirement for permanent ICU staff to have Intensive Care Qualification.*

CRI 74: *Provide ICU trained nurses.*

CRI 130: *Always maintain at least one very competent qualified ICU staff member on the floor to assist with procedures, education, trouble shooting, coverage when T/L absent on breaks etc.*

Five SLNs had solutions for skill-mix problems that specifically related to agency nurses, including:

CRI 125: *Trying to ensure regular agency nurses who know the unit.*

CRI 276: *Only contracting "ITU" trained staff from agency.*

5. Staff Preferences

The fifth main theme (solution) suggested improving nurse staffing allocation decision-making processes in the ICU contained responses from 2.65% of responding SLNs, and was related to staff preferences in sharing roles and choice of patient allocation:

CRI 169: *Encourage people to speak up at allocation time - be pro active about what they need for education etc.*

CRI 241: *Listening to <u>staff requests.</u>*

CRI 262: *allowing staff to have a say in what patient they look after.*

CRI 128 *Interesting pts to be shared around and difficult pts share allocation (e.g. 4-6 hrs each - difficult pts cannot always be tolerated for 12 hr shift).*

CRI 272: *Nurses to state their preferences in certain therapies/or type of pt they wish to look after, Shift leader allocating to look back at shifts previously worked re allocating nurses/pts.*

CRI 120: *Where possible staff are asked for any preferences when leaving, if they are to return again the next day. Students are given both high and low acuity patients so regular staff do not miss out on interesting cases.*

Others debated the benefits and consequences of a preference solution, with most believing it required a balanced and fair approach. Responses revolved around the belief that if staff were allocated their preferences, they may be more likely to stay in the ICU; however, the noted possible downside was that there may be perceptions of favouritism if preferences were given to nurses. The question was raised that it would be difficult, if not impossible, to accommodate all requests, so who should get priority?

6. Autonomy and Support for Decisions

The belief that support from peers and managers, and autonomy in decision-making, might help solve problems in allocation processes was noted by 8.85% of SLNs. Some held stronger opinions on the necessity of these solutions, clearly viewing the lack of support as a key problem, (as evidenced in the 'SLN staffing problem' data presented earlier in this chapter), while there was also a view that non-clinical managers were out of touch, and the best solution was for them simply not to be involved in staffing decisions.

CRI 16: *Our manager needs to be firmer with staff who come to work to play and chat. Buck passing to us team leaders is not fair.*

CRI 31: *Supportive nursing co-ordinators.*

CRI 32: *Removal of remote vertical hierarchical structures who have no idea of what is going on.*

CRI 67: *Co-operation from hierarchy.*

CRI 122: *Ask staff what they need and have management listen instead of telling.*

CRI 127: *Manager should trust judgement of clinical nurses.*

CRI 203: *Support of managers/CNS/other staff on the floor.*

CRI 295: *All staffing level/needs should be unit based, not as dictated by management that have no clinical input.*

CRI 98: *Management reduce pressure on unit manager to reduce man- hours.*

CRI 195: *Management more supportive to critical care nurses to enable retention of senior ICU nurses.*

A parallel solution related to improved support from medical staff within the ICU, with 4 SLNs suggesting this needed to be improved. These specifically included 'stopping patient admissions when they know we have no staff to look after them'; being more supportive 'going on bypass when we have no staff' (a resource management strategy whereby patients are diverted elsewhere for admission); and 'being more collaborative with use of resources instead of assuming we can find staff'.

7. Adequate Clinical Resources/Increased Supply

The seventh main theme or solution, which was suggested by 15.49% of SLNs, related to the need for increased nurse supply and or improvements in clinical resources. Many SLNs wanted extra resources, as well as clear guidelines on when these could be obtained.

CRI 3: *Clear guidelines as to when the unit can have a team leader & coordinator.*

CRI 58: *Guidelines set out by the unit manager adequate.*

On-call systems and emergency contingency staff who were readily available were suggested by 5 SLNs, while 10 SLNs' solutions related purely to the number of available nurses (supply):

CRI 20: *Have staff, can allocate.*

CRI 46: *Availability of staff development nurses to provide support for new ICU staff & give support to others learning new skills.*

CRI 111: *Increase proportion of senior/trained staff.*

Some SLNs wanted extra staff as clinical resource nurses: that is, 'have clinical support nurses available as required', and 11 SLNs thought that the best solution would be to have a dedicated floating/supernumerary staff member as their clinical resource:

CRI 233: *Keep 'in-charge nurse' on the shift 'free' (i.e. not allocated a specific patient)*

CRI 243: *Increased ICU budget to give team leaders supernumerary status. After hours educator support.*

CRI 245: *Ensure that the Shift leader ALWAYS remains supernumerary. This is not easy to predict but could be managed better.*

CRI 135: *Increase staffing levels in ICU & increase supernumerary orientation for new staff members.*

CRI 9: *Extra pair of hands on busy shifts to assist everyone.*

CRI 17: *Extra 'floating' or resource nurse to support inexperienced staff.*

CRI 64: *Ensure staff are supernumerary until their scope of practice is competent for new staff members.*

CRI 263: *Provide an ACCESS or "floater" nurse on every shift for support and education.*

CRI 7: *Always provide 1 extra person for the next shift to facilitate education or admission.*

8. Better Communication between Team Leaders/Attitude

Lack of communication was a problem that SLNs faced in regards to staffing (as presented earlier in this chapter), and in this section, 6.64% of SLNs suggested solutions to improve communication, staff attitudes, and associated behaviours. It was proposed that improved communication should be encouraged between SLNs and their peers, management, and with each other:

CRI 106: *Ensuring SLNs are aware of individual staff levels of expertise by good communication.*

CRI 145: *Education is required for nurses in administration who believe ICU hasn't changed much since they worked there 20-30 yrs ago.*

CRI 186: *Practice, practice, practice & continuing non-blame open communication approach.*

CRI 41: *Some people need to change their attitude & perhaps do some co-ordinating.*

CRI 144: *Experience, communication with all staff in a non judgemental way to evoke all possible skills and to be able to utilise them.*

9. Improved Conditions

The final main theme offered by 4.87% of SLNs to solve problems in ICU staffing allocation decision-making processes, related to improving different aspects of staff working conditions, in order to 'make it attractive to keep staff' and 'make people want to work in ICU'. Five SLNs cited increased pay as a solution, two suggested improving career options and having to work less night duty, while more funding for scholarships and education was also proposed.

> CRI 237: *Make it easier to obtain post grad qualifications with monetary compensation as there just are not enough nurses with crit care qualifications.*

> CRI 306: *scholarships, funding for study leave, creating an environment conducive to learning*

4.6. Synopsis of Main Results

A number of key findings were identified in this comprehensive national ICU staffing issue profile. This synopsis is focused on key data from: critical care qualifications of ICU RNs and SLNs; employment of ENs in direct patient care; characteristics/profile of ICU SLNs; SLN staffing decision-making regarding nurse numbers and nurse-to-patient allocations; SLNs' use of systems/tools when making these staffing decisions; agency staff use and skill assessment; nurse staffing decision-related problems and suggested solutions.

Critical care qualifications of employed ICU RNs and Shift Leader Nurses

Knowledge of both the number and geographic spread of ICU qualified nurses provides important data on nurse skill level in ICU. There were 67.39% of participating ICUs (n = 46) that had employed 50% or greater ICU qualified nurses (i.e. that complied with the ACCCN 'acceptable minimum' level), and 19.57% of ICUs that employed 75% or greater (i.e. complied with 'recommended' ACCCN level)[3]. Notably, 32.61% of ICUs had less than the ACCCN acceptable minimum, including one ICU (2.17%) that had less than 25%. Across sectors, virtually identical figures (67.74% of public ICUs, and 66.67% of private ICUs) met the acceptable minimum. These findings have not been previously described.

Use of ENs

Contrary to anecdotal opinion held by a number of Australian healthcare policy-makers on how many ENs work in Australian ICUs, the findings in this study showed that (in April 2005), 95.56% of ICUs did not, and only 4.44% (n = 2) did, have ENs working in direct patient care in their ICU. These represent very small numbers within the ICU workforce and suggest this level of nurse is not highly sought for direct ICU patient care.

Nursing hours

These data were limited as they were not standardised as hours per bed. Instead a categorical approach was used. Ten public sector ICUs and 1 private ICU (of 46 total participating ICUs) did not provide data on the total number of hours worked by nurses in their ICU over the 2003/2004 financial year, which may reflect sensitivities regarding dissemination of this type of information to external parties. The majority (42.68% of responding ICUs) utilised between 50,000-100,000 nursing hours, and 28.57% used 100,001-1,000,000 nursing hours in the 2003/2004 financial year (counting only hours worked by employed RNs and ENs). In private ICUs, 93.34% 100,000 or fewer nursing hours in the 12 month period, with the remaining private ICU not providing data for the question. Comparatively, in the public sector, 29.03% of ICUs used 100,000 or fewer hours, while the majority (38.70%) used 100,000 to 1,000,000 nursing hours. This data provides, for the first time, useful benchmark nursing hours data across all ICUs whilst maintaining confidentiality due to the associated sensitivities in this type of data disclosure.

SLN profile

The SLN profile reflects for the first time the numbers of key decision-makers in ICUs. The majority of ICUs (53.33%) employed 11-20 rostered SLNs, 13.33% had 6-10 SLNs, and just 11.11% had more than 30 SLNs in their ICU. Of those SLNs who provided data on their highest ICU qualification, 93.35% held either a Critical Care Certificate, a Graduate Diploma or a Masters degree, although a relatively few SLNs (6.65%) performed the shift leader role despite having no ICU qualification. In 4 Australian states (Victoria, South Australia, ACT, and Northern Territory), all SLNs held a formal ICU qualification. This data has not been previously described.

SLNs' ages ranged from less than 24 to more than 60 years old, with 39.87% of the 311 responding SLNs being aged 40 years or older. The majority (48.87%) were aged 30 to 39 years. The average age of SLNs were almost identical in the public (average 38.33 years old) and private sectors (average 39.4 years), though when examining SLNs aged 40 years and older there was a marked difference, with just 16.33% of public ICU SLNs falling into this age group, compared with 58.68% in private ICUs. This data supports existing evidence of the ageing nursing workforce in Australia and provides useful insights that will be useful in succession planning strategies for the future SLN workforce.

Overall, the SLN-related results demonstrate that the SLN role is generally given to older nurses with more experience and qualifications, with younger nurses not placed in the SLN role very often.

SLN Shift profile

Evidence for the practice of nurses working long shifts in ICUs (colloquially known as '12 hour shifts') can be seen in the distribution of long and short shifts across states and sectors, though this data are limited to the SLN dataset in this research. In Tasmania, Western Australia, and New South Wales, the majority of SLNs worked more long than short shifts, and mostly long shifts were worked by the majority of both public (53.94%) and private 57.89% ICU SLNs. This may reflect the 'flexibility' opportunities that ICU managers have often had to adopt as they strive to recruit and retain staff. However, the data collected here did not include whether working long (or short) shifts was mandated or voluntary for participating SLNs.

Older SLNs appear to work mainly rotating rosters (which include night duty) with 62.37% of the 40-49 age group, 53.57% of the 50-59 year age group, and 66.67% of the over 60 years age group predominantly working these shifts. This shows for the first time that the ageing SLN demographic is working these rotating combined rosters. Detailed data on shift types worked in ICUs has not been described in a national context previously.

Agency staff usage and skill assessment

The agency nurse usage results show agency workforce data in Level III ICUs across Australia for the first time. This information is important in acknowledging the broad range of available, but often unrecognised or unquantified skills belonging to agency nurses working in Australian Level III ICUs. Anecdotally, a commonly used fiscal target used by hospital administrators is 'less than 10% of an ICU's (or Ward area) total nursing workforce made up of agency nurses'. If used as a guiding benchmark for these data, there were 35.89% of responding ICUs that used less than 5% agency nurses, while 12.82% used 5-9% agency nurses. Overall, 48.71% total ICUs met the 'less than 10% agency nurse use' goal.

There were 15.38% of ICUs that used between 10-14% agency, and 20.51% of ICUs who used 15-24% agency nurses. Although small numbers there were a few ICUs that had 25% or more of their nurses comprised of agency nurses.

Across sectors, 61.54% of public ICUs, compared to just 23.08% of private ICUs, used less than 10% agency nurses. However, in the higher agency nurse use categories, 69.23% of private ICUs used 10-24% agency nurses, versus the 19.23% in public, and the only two ICUs that reported using greater than 50% agency were public ICUs (5.13% of ICUs in that sector). All of the metropolitan (100%) and rural ICUs (100%) in the study employed less than 5% agency nurses within their total ICU nursing workforce, while in contrast, the proportion of agency nurses was much more varied between capital city-located ICUs. This agency nurse utilisation data has not previously been demonstrated in the literature.

When asked whether they requested nurses with specific skills when ordering agency staff, 63.09% of SLNs reported that they *always* or *often* asked the nursing agency providers for specific agency nurse skills, 4.10% *rarely* asked, and 7.89% *never* asked for specific skills. Across sectors, 10.37% of public SLNs and no (0%) private SLNs said they *never* asked, while 56.25% of rural SLNs, compared to 9.93% of capital city SLNs, and 8.16% of metropolitan SLNs said they either *rarely* or *never* asked agency nurse providers for specific skills. Of those SLNs who did ask for specific skills, 24.92% said that they usually asked for nothing specific besides a vent-comp or non-vent comp nurse as needed. Just 11.04% of SLNs usually asked for an agency nurse with an ICU qualification, and only 3.15% asked for an agency nurse with a certain number of years' experience in ICUs. Given the numerous problems cited by SLNs in the narrative data related to not having sufficient information on the skills held by available agency nurse, the information collected shows that SLNs may not actually be requesting information on agency nurses' skills, or not requesting an agency nurse with the skills needed for the ICU shift.

Use of systems/tools within staffing decisions

Also described in this study for the first time in the literature are the systems, tools, and other factors that influence and inform the decisions SLNs make regarding the nurse numbers required for a shift (volume) and the nurse-to-patient allocations (acuity), as well as who makes these decisions. The majority of SLNs reported that the team/shift leader from the previous shift generally decided both nurse numbers (57.41%) and nurse-to-patient allocations (60.57%) for the new/incoming shift. A much lower proportion of SLNs from the new/incoming shift made the nurse number decisions (0.32%) than made the nurse-to-patient (18.31%) decisions for their own shift.

When asked how they calculated their nurse numbers for each shift, SLNs' most common response was that they used their own *personal judgement from experience* (56.68%). Mandated pre-calculation systems/models were used by some SLNs, including a *mandated hospital dependency tool* (12.62%), *mandated hospital nursing ratios* (21.45%), and *mandated hospital nursing hours* (5.05%). Just 3 SLNs used *Excel care* or *TISS* pre-calculation systems in nurse number decisions, and 27.13% said they *utilised the ACCCN Position Statement on Staffing Guidelines*[3]. *Help from colleagues* was used by 11.36% and 6.94% reported they used their *own system*. This is the first time that national data on the influence and use of the ACCCN staffing guidelines has been available.

In regards to how SLNs decided nurse-to-patient allocations, 18.3% said they used *no system*, while the majority (82.02%) used *professional judgement from experience*. The next most cited were *depends whether other support staff are available* (58.68%), and *usually allocate most experienced nurse to sickest patient* (48.9%). *Help from colleagues* was used by 19.87% in deciding nurse-to-patient allocations, 29.65% of SLNs used a hospital-mandated tool, and 34.06% of SLNs used the TISS or Excel care systems. This data affirms that the decisions are varied, often multi-factorial and reflects the emphasis placed on personal judgement factors. It also contributes to evidence demonstrating how complex staffing systems are, and this has been identified as a key point for discussion in the next chapter.

On the topic of what types of information SLNs sought to ascertain from agency nurse providers, only 5.68% SLNs requested *the number of shifts the agency nurse had* *previously work in their ICU. Specific expertise in certain therapies* was requested by only 10.09% of SLNs, and very few SLNs (0.95%) reported that *specific preset criteria for their ICU had been previously advised to agency.* This is interesting, as on one hand the staffing problems that were reported in the thematic analysis highlight a marked lack of skill/unknown skill of the agency nurses, yet this data showed that very small numbers of them actually requested this type of information from agency providers.

Given the data presented above, the findings on 'how often ICU agency staff meet the required skill criteria for the shift when requested by SLNs' were of significant interest. Only 62.46% of SLNs said that agency nurses always or often met the required criteria, and across Australian states, the proportion of agency nurses always or often meeting the required skill levels per ICU ranged from 16.67% in the Northern Territory, to 87.81% in Western Australia. There was little difference across public and private sectors; however, across areas 75% of rural SLNs said that agency nurses rarely or never met their needs, compared to just 10.97% of capital city and metropolitan SLNs. This may reflect differing needs of the rural ICUs and may also be related to the complexities of availability of agency in rural settings.

If shift leaders do not clearly articulate needs at the outset, then it is unsurprising when their needs are not met. This responsibility sits with all three parties; the SLN to articulate needs, the agency provider to offer them, and the agency nurse to ensure the agency provider is well aware of them and his/her scope of ability and practice.

Availability of required skill information

Of responding SLNs, 11.67% said that all the 'skill information they needed prior to making nurse-to-patient allocation decisions' was *always* available, 54.57% said it was *often* available, and 26.81% said it was *rarely* available. Given the numerous, wide-reaching staffing problems described by SLNs in the thematic data, it appears many of this problems could be readily resolved by improved information systems of agency nurses' skills. This would then be available to SLNs to use in their decision-making. This evidence was critical in informing development of a Staffing Decision-Support Framework discussed in the next chapter.

When asked if they believed their system for deciding required nurse numbers for the next shift gave them an accurate staffing projection, 88.01% of SLNs reported that their system *always* or *often* did, reflecting a high degree of faith in their system. This is interesting given the separate thematic data on staffing problems in which SLNs reported many difficulties and provided a number of negative comments. An accurate staffing projection was provided *sometimes* for 10.09% of SLNs. When viewed across sector, 91.29% of public SLNs and 77.63% of private SLNs reported that their system gave an accurate projection *always* or *often.* The projection was accurate *sometimes* for 7.05% in public and 19.04% in private ICUs.

SLNs were less confident when asked if their chosen nurse-to-patient allocation system (as opposed to their nurse number calculation system) gave adequate information, with 63.09% saying that it was *always* or *often* adequate, 17.98% reporting that it *sometimes* provided adequate information, and 11.98% stating that it was *rarely* or *never* adequate. Only 4.73% were *unsure*. Overall, this data suggests (36.10% noting *sometimes, rarely or never*) there is room for improvement in patient allocation systems, despite a reasonable level of confidence in their patient allocation system expressed by 63.90% of SLNs.

Staffing problems identified by SLNs regarding nurse number decisions

From the 261 SLN responses on 'problems they had experienced in making nurse number decisions', 8 main themes (problems) were identified: emergency admissions, ICU environment unpredictability, budget constraints, lack of skill/inadequate skill-mix, nurse supply, lack of support, lack of communication, and conflict. The four most frequently reported problem themes related to making decisions on nurse numbers were regarding nurse supply (57.85%), ICU environment unpredictability (55.93%), emergency admissions (40.22%), and lack of nurse skill/inadequate skill mix (38.69%). This data on problems cited by those who make key staffing decisions has not been previously described, and is useful to inform strategies to address these problems.

Staffing problems identified by SLNs regarding nurse to patient allocation decisions

Problems SLNs faced regarding nurse-to-patient allocation decisions revealed some similar themes as noted in nurse number decision, as well as a number of new themes related only to allocations. Overall, 9 main themes (problems) were identified regarding nurse-to-patient allocation decisions, relating to: emergency admissions, ICU environment unpredictability, lack of skill/unknown skill, student/junior staff considerations, supply, staff preferences, allocation fallout, supervision and support, and conflict. *Lack of skill or unknown skill* was the most common problem cited by SLNs (26.82%), followed closely by problems related to the unpredictable nature of the ICU (23.98%).

Staffing solutions suggested by SLNs

Of the 317 SLNs, 226 specified their thoughts on how ICU staffing problems could be solved. Nine broad themes (solutions) were identified from this data, related to: no solution: despair (3.98%) and no solution: Status quo okay (4.42%), create skill database/list (25.22%), restrict/control patient demand/activity (3.09%), skill-mix formula guide (26.54%), staff preferences (3.53%), autonomy and support for decisions (10.61%), adequate clinical resources/increased supply (19.02%), better communication between team leaders/attitude (7.52%), and improved conditions for staff (5.75%). The most frequently cited solutions by SLNs related to creation/use of a skill database, and to other skill formula guide suggestions.

This data reflecting both the cited problems and solutions offered by those experienced ICU nurses who make key staffing decisions every day, has not previously been described. It is considered valuable new knowledge that affirms the researcher's view of the complexities of staffing decisions and will inform development of strategies that will benefit and contribute to, the ICU staffing debate. This information is also likely to inform creation and implementation of systems that could reduce the patient risk exposure arising from insufficiently informed decisions and inappropriate nurse to patient skill matching.

4.7. Summary

This chapter presented results that provided national data on the ICU shift leader profile and the systems, tool, practices, problems and solutions related to SLN decision-making in Level III Australian ICUs. An initial data analysis and results presentation framework (Table 4-1) presented at the beginning of the chapter gave the reader an overview of how the data were to be presented and helped to ensure that no key data were omitted. Response rate data from the ICUs that participated demonstrated a high response rate (86.20%) from 58 Level III ICUs.

Demographic data from the NUM questionnaire set the scene and contextualised the SLN data that followed. Forty-six NUMs responded with data presented on ICU demographic profile and key workforce classification data. This was followed by the SLN data from 317 SLNs across 50 ICUs. The SLN demographic information was also stratified across states, sectors, size, location and case-mix. Next a detailed national description of ICU shift leader nurse practices in relation to staffing decisions in their ICU was presented.

Following the SLN data, the thematic analysis of the 3 questions that required narrative answers was presented. Although frequency analysis is not necessarily a common feature of qualitative data analysis, it was useful in this part of the research in the context to understand how common or not the various themes emerged. The qualitative component of this study, whilst smaller than the vast amount of quantitative data collected overall from NUMs and SLNs, was considered to be of vital importance in this research to be able to present a comprehensive national nurse staffing study.

What is clear from the study findings is that the issue of nurse staffing is complex, dynamic and multi-dimensional. In the next chapter, three key substantive issues that represent new knowledge from the study findings are presented.

CHAPTER 5 DISCUSSION

5.1. Introduction

This chapter begins with a brief overview of the study limitations, background, design, conduct, and key findings. Following this overview, three substantive issues that represent new knowledge from the study findings are discussed. The three issues are:

1) Complexity of nurse staffing systems;

2) The deficit in nurse skill assessment and skill information;

3) The need to 'risk rate' staffing decision-making.

The chapter then identifies the potential contribution of the study findings to patient outcomes, outlines plans for the dissemination of the study findings, and identifies implications for practice followed by a conclusion and finally, recommendations are proposed.

5.2. Limitations

Use of a web-based communication system incorporating a purpose-built integrated database in this research increased the opportunity to scope the research into a national multi-centre study and provided a relatively inexpensive way of collecting and managing multi-centre data that could potentially achieve the study objectives. However, despite a number of advantages (as discussed in Chapter 3), there were also limitations that may have impacted on the study.

Recruitment may have been affected by use of this web-based technology, as some participants may have not wished to engage in this type of research. Separately, it is recognised that in research where survey is used, there are some people who are attracted to completing surveys and others who are averse to them, and this could have influenced recruitment and response rates. In this research, hospital protective systems such as firewalls and passwords may have limited participant access to electronic information. These protective elements appeared to be at varying levels of sophistication across differing hospitals.

It also appeared from this research that increasing numbers of organisations have internal 'approved internet site' lists. Server capacity (the amount of material that can be stored on an internal system) was likely to be another consideration by organisations, both in cost and in operational efficiency terms, which may also have affected participant access.

It would appear that organisation's IT managers have processes in place that allow staff to request access to additional 'work related internet site' access, but this can result in delays and be time consuming. Therefore it needs to be acknowledged as a possible deterrent for participants that could have effected study recruitment, although it is difficult to quantify the potential number 'lost' due to IT access inability and or frustration.

5.3. The Study

Research background in summary

What was already known about ICU staffing?

Nurse skill and nurse numbers (volume and supply) impact on patient outcome. Measurements of nursing workload tend to be one-dimensional. Agency nurses' skills for ICU work are ill defined, and there is a local, national and international shortage of ICU nurses. The relationship between staffing decisions and patient risk is poorly described.

What was not known at the outset of the study?

It was unclear who and what informs and dictates ICU nurse staffing decisions, or what staffing systems, tools and practices are in use in Australian ICUs. Problems experienced by ICU nurse decision-makers that relate to staffing decisions have not been researched.

The impetus for the study

If inappropriate *matching of nurses to patient acuity* may lead to poor outcomes, then optimal staffing decisions are critical to risk management in ICU. The researcher hypothesised that single-facet measurements underpinning staffing decision models are inherently limited when used as the sole determinant of nurse numbers (volume/supply) and nurse-to-patient allocation decisions. Evidence was needed to understand current knowledge and dynamics of all staffing related factors within both the *permanent* and the *casual* (incorporating *agency*) nursing workforce in Australian ICUs.

The study

The study's key aims were to identify tools, systems & processes that inform nurse skill-assessment and nurse-to-patient allocation decisions in Adult Level III Australian ICUs, and to develop a Nurse Skill Matching Decision-Support Framework that could be incorporated within an ICU risk management system. Data were collected primarily through a survey using two questionnaires and a web-enabled communication system. Nursing Unit Managers (NUMs), and Shift Leader Nurses (SLNs) responsible for key staffing decisions were recruited from all of the 58 Adult Level III Australian ICUs. A high response (86.20%) was achieved. Data method and data source triangulation were used.

Findings

A national multi-centre staffing profile of nurse decision-makers and practices across Australian Level III ICUs was obtained. The study findings demonstrated an implied link between staffing decisions, and patient safety, outcome and risk, in the ICU. Staffing systems and associated decisions are complex and multi-factorial, making single-facet staffing models inherently limited, with no single model capable of considering all elements of an 'optimal staff *mix* and *match'*. The study/survey findings highlighted a broad culture of frustration among shift leaders with current staffing systems in Australian ICUs. Evidence of potential clinical compromise and risk exposure resulting from poor skill matching to patient acuity may be compounded by a skill shortage, lack of skill assessment, budget constraints and a lack of trust of shift leader decisions by managers. Key findings of the research included:

- Despite some consistency in staffing decision-making being found in such factors such as use of professional judgement and various mandated tools, no single system or tool prevailed.
- Agency nurses' skill sets are often unquantified yet information is infrequently sought by shift leader decision-makers and, where it is sought, only in broad terms.
- Over half of the ICUs used greater than 10% agency nurse labour in the 2003/2004 financial year. A much higher proportion of private ICUs (69.23%) used between 10-24% agency nurse labour versus 19.23% in public sector ICUs.
- Use of Enrolled Nurses (Division 2 RNs) in direct patient care in ICU is rare.
- Over one third of Australian Level III ICUs have less than the nationally recommended (ACCCN) *acceptable minimum* of 50% qualified ICU nurses.[3]

- Shift leaders are the predominant staffing decision-makers in ICU although some have their decisions overruled by their managers.
- Over 90% of shift leader staffing decision-makers have a critical care qualification and almost 40% are over 40 years of age.
- A supply shortage of ICU nurses exists across both public and private ICUs.
- Wide-ranging staffing problems exist across most ICUs although shift leader nurses offer a number of strategies to improve staffing systems. Problems related to nurse supply, emergency admissions and unpredictability of admission type; lack of nurse skill assessment and inadequate skill mix; budget constraints; student/junior staff; supervision and support, and staff conflict. Suggested solutions included skill database/list creation; control of patient admissions; and attention to detail in skill mix formula. Autonomy and support for staffing decisions, adequate clinical resources and improved communication are sought by shift leader nurses in ICU.

The relationship of these research findings to patient safety

In a recently-published paper by Scobie, Thomson, McNeil and Phillips on strategies for improving measurement of the quality and safety of healthcare, it is suggested that:

> (W)e could all do more to understand and improve what we do with the measures, techniques and skills that are already available. However, for the longer term, investment is needed to extend the required measures and skills widely and systematically through our health care system, especially where the financial and human costs and consequences of variable performance are high.[257] (p. S54)

The research reported in this thesis is an example of such a strategy aimed at new knowledge of staffing systems in ICUs. It is envisaged that the study findings and discussion will lead to improvements in staffing decision-making, and skill and patient risk related measurement, with the objective of improving quality and safety of healthcare, in line with Scobie's suggestion.[257]

Embedded within the complexity of staffing is a continuum of risk. The development of tools that may have practical application to understand the multitude of factors, assess available nurse skill, and rate risk as discussed and represented in this chapter, is the first step towards a comprehensive new approach to staffing decision-making.

The three substantive issues that are central to the discussion in this chapter show how this research contributes to knowledge. The issues were introduced at the beginning of the chapter and are now discussed.

5.4. Complexity of nurse staffing systems

The findings of this research provide clear evidence of the multitude of factors that warrant consideration in nurse staffing decisions. They highlight and offer an evidence-based rationale for why single-facet staffing utilisation models (for example, ratios, nursing hour, and time-tasked models) are unable to factor in the multiple considerations required for safe staffing decisions. It seems unlikely that it would be possible to develop any single prescriptive staffing model capable of factoring in the multitude of variables and therefore a different approach is necessary. The multi-factorial contributing factors for informed staffing decision-making are interlinked and one or more factors have varying degrees of influence at any given time. This adds to the complexity.

This multitude of factors can be best understood by grouping them into categories, and six categories are suggested. These categories have been developed predominantly from the study findings, coupled with some existing knowledge from the literature, such as the work of Ball.[142]. The six staffing decision categories and the related components that underpin them are outlined below. They are:- experience; exposure; expertise; patient activity (at a macro-organisational level);organisational and Unit level culture; and micro-organisational factors.

<u>1. Experience:</u>

One nurse's:

- number of shifts worked in this ICU
- number and type of different ICUs worked
- months/years of ICU experience, whether part-time, full-time, career interrupted
- knowledge over time of required patient therapies/interventions in various settings.

<u>2. Exposure:</u>

One nurse's:

- familiarity /previous exposure to intensive care-related treatments, medications, therapy delivery

- familiarity /previous exposure to unit-specific technologies and operation of equipment.

3. Expertise:

Staff group as a whole:

- critical care qualifications (for example, overall compliance with ACCCN 50% qualified minimum standard)

One nurse's:

- demonstrated skill level (i.e. clinical competence)
- theoretical knowledge of intensive care nursing
- ability to work independently with 'minimal supervision' in managing specific therapies, (particularly if support staff are limited)
- peer/colleagial knowledge of the individual's attributes and critical care
- knowledge from previous worked shifts in that ICU.

Within the first three categories (experience, exposure and expertise), there is another parallel core element that sits across all three. A nurse may perceive herself a 'novice' in one context (i.e. one particular ICU setting) and yet an 'expert' in another; subject to the degree of his or her experience, exposure or expertise in that particular setting. This adds to the researcher's argument of the layers of complexity. Novice, Proficient, Competent and Expert are the four skill categories identified by Benner as previously discussed in Chapter 2.[82] Their relevance and potential application in ICU staffing decisions is described in more detail later in the chapter. Benner viewed expertise as embedded in practice and considered holistic care rather than the ability to proficiently conduct a series of tasks the hallmark of expertise. She attempted to provide a framework upon which a model of skill acquisition for nursing practice could be used to guide nurses to attain the status of Expert.

The strength of Benner's model is the emphasis it places on holistic clinical practice, promoting holistic nursing as being more significant than task allocation.[84] For example, in relation to an expert nurse, she considers the expert to be able to accurately 'zero in' on the problem without wasteful consideration of alternative, unfruitful diagnoses and solutions.

4. Patient activity (at macro-organisational level):

- awareness/understanding of patient volume and patient acuity (regardless of the systems of measurement)
- patient activity that requires nurse accompaniment outside the ICU during the shift (for example, nurse escort/supervison for diagnostic tests, and patient retrieval (anticipated and unanticipated)
- patient admissions and transfers (anticipated & unanticipated)
- bed-block.

Strategies that impact negatively on ICU access, such as intensive care bed closures and inter-hospital transfer of critically ill patients, are commonplace in ICUs where there are insufficient nurses. 'Bed-block' (or 'exit-block'), where patients are unable to be moved out of ICU due to lack of beds in ward areas, compounds the problem.[31]

5. Organisational and unit level culture:

- staff preferences/prevailing Unit or organisational cultural influences (for example, culture of blame through the continuum to a culture of success)
- previous staff allocations
- medical support
- manager support for shift leader (autonomy and trust)
- sick leave patterns.

The impact of organisational culture

Since completing the 1998-2004 literature review, the researcher became aware of a related study by Mulcahy and Betts,[259] that highlighted the importance of organisational culture as a factor that influences both staffing decisions and the nursing workforce environment. That research was initiated in 2002 in the neonatal intensive care unit of a hospital in Melbourne that had experienced an extended period of increased demand for both intensive and special care neonatal beds. Bed numbers in excess of 100% occupancy occurred on many occasions resulting in increased stress, absence of teamwork and low morale. Cultural improvements resulted in achieving full staffing with no ongoing nursing vacancies, reduced attrition and absenteeism, and improved interdisciplinary team work and staff satisfaction in a relatively short period, which was sustained over 3 years.[259] Although it was unclear whether the researcher's had adopted Magnet type principles, it was evident they found benefit in improvements to their unit's organisational culture and valued the experience.

The Magnet model as previously described in Chapter 2 is based upon a number of contributing organisational aspects that need to be in place for a hospital to achieve 'Magnet status/accreditation'. The related studies showed that improved patient outcomes in Magnet compared with non-Magnet hospitals relied on a multitude of organisational cultural factors, leadership characteristics and professional practice attributes of nurses within these organisations.[64] Despite some limitations, the Magnet model continues to be regarded internationally as a gold standard in hospital care delivery and outcome with a strong focus on work environmental factors.[30,65] Although the cause and effect relationships of the value and direct impact of any one or more specific factors is difficult to demonstrate (and notwithstanding the methodological challenges), the evidence of overall benefit in patient outcomes in the Magnet model studies is impressive. It seems reasonable then, in understanding the complexities of staffing, that both organisational and 'Unit specific' culture are important elements. It may be that there are differing cultures in individual units, as distinct from the broad culture across the organisation as a whole, and this has been described by Best Practice Australia in their nurse staffing survey findings in over 70 Australian hospitals over the last 6 years (www.bestpracticeadvice.com.au).

Previous research also found that to be registered nurses experience high levels of role conflict despite the type of staff mix model they work in; that nurses' job satisfaction is influenced by the type of staff mix model employed on the patient care unit; that nurses' perception of quality care differ with the type of staff mix model utilised.[70] Other research showed that stress, group cohesion, job satisfaction, nurse-physician collaboration, and nursing leadership behaviours explained 52% of the variance in organisational work satisfaction.[71] These issues are considered Unit or organisational cultural factors.

<u>6. Micro-organisational:</u>

- ICU specific layout i.e. physical location of patients in the unit; and available clinical resource support (e.g. availability and type of, and accessibility/proximity to: appropriate support staff (e.g. educators, float/access nurses, ancillary staff, and educational/preceptor needs).

On reviewing these six staffing decision categories, the complexity of staffing systems becomes clear as does the myriad of possible permutations and combinations of all factors and the variables in the detail behind each single component. It helps to explain why all of these contributing factors cannot be accommodated into any single-factorial staffing tool that could have any accurate predictive capacity. A parallel factor for consideration is a requirement for flexibility and autonomy for shift leaders, which some managers are likely to find challenging and outside their 'comfort zone', given the study findings. It is not surprising that shift leader decision-makers felt somewhat disgruntled by having to use systems that most feel inadequately reflected all due contributing factors, but the data also showed that they are disgruntled by a lack of managerial support.

However, despite awareness of the broad range of problems, shift leader nurses appear either reluctant or unable to improve their decision-making systems. For example, on the one hand, the data showed that SLNs reported a lack of skilled and qualified agency nurses, yet they also reported that few of them specifically request this information from the agencies. Furthermore, few shift leaders reported that they gave those agency nurses feedback on their performance after their first shift, or that they had any system or process for doing so. However, there were strong data that represented their difficulties and struggle to get enough skilled staff.

Differentiation between commonly interchangeable terms (or concepts) such as *skill-level*, *qualifications*, *experience*, and *exposure* (e.g. to events, therapies and equipment) add to the argument that staffing systems are complex. These terms were evident in the qualitative data in the thematic analysis as SLNs described their problems and solutions. A mixture of these terms was cited throughout the raw qualitative data. The difficulty, and therefore complexity, lies in the fact that the ICU nurse with the most *qualifications* may not have a commensurate *skill-level* at the bedside, and could have vastly different *experience* to that of a peer with exactly the same qualifications. In addition, their clinical *exposure* to events, therapies and equipment may vary widely across sites, and between employed staff and agency staff. Add to that the differences between employed nurses and agency nurses whom the study findings show frequently have unquantified skills, and already there are a myriad of possibilities in any staffing decision to be made in the clinical setting.

To understand staffing complexities further using a conceptual and visual element, the concept of a Rubik's® cube becomes quite helpful. It is apparent that the macro and micro-organisational factors, patients and staffing landscape is likely to be different on every shift on every day in every ICU. The multi-factorial components together with the matching to patient allocation considerations can be considered akin to a Rubik's® Cube; a toy puzzle developed by Enro Rubik (see Figures 5-1, 5-2, 5-3). As each face or layer of the puzzle cube is manipulated by hand, the colours become more mixed into random patterns with each turn affecting the outcome on another 'face' of the cube. The more turns, or permutations, the more mixed the look of the coloured patterns and the longer, and more difficult the task of restoring the cube back to its single face colours (see Figure 5-4).

The analogy to the complexity of staffing decisions comes from considering that each small square reflects a different staffing component (i.e. a contributing factor) from the list within the six categories, with the 'solved puzzle' equating to the 'ideal staffing mix and match scenario'; a type of 'staffing utopia' that may be difficult to achieve. However, notwithstanding the challenge in solving the puzzle and getting an optimal mix and match, it provides a useful schematic illustration of the staffing complexities and potential permutations. With so many possible permutations, it is not surprising that this researcher's experience recalls 'no two shifts or days being the same'.

The Rubik's cube® of intensive care skill matching

The Rubik's Cube® has become one of the most cherished icons of this century. The puzzle or its visual representation has appeared in major motion pictures, TV commercials, and newspaper adverts, on the cover of magazines, in videos, on CD roms and on the Internet. Erno Rubik, the inventor, was born in Budapest, Hungary. He studied architecture in college, invented the cube by accident and it went on to grip the world (www.rubik.com). The Rubik's Cube® in its three dimensional form, allows a person to play with the cube and turn or manipulate its 'layers', so as to make the 'faces' have solid colours. There are 26 mini 'cubes' on the outside of Rubik's Cube® and an invisible "cubie" - which is a rotating mechanism - in the middle. The centre cubes cannot move, being fixed. When solved, every face of Rubik's® Cube is a solid colour (see Figures 5-1, 5-2, 5-3). Once a person starts turning, twisting and flipping, it's easy to mix up the colours. The number of possible combinations of Rubik's Cube is 43,252,003,274,489,856,000 (www.rubik.com).

Figure 5-1 Rubik 1

Figure 5-2 Rubik 2

Figure 5-3 Rubik 3

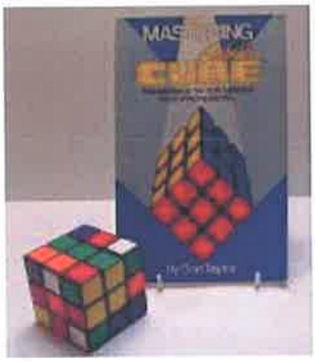


Figure 5-4 Rubik 4

Figure 5-4 shows a Rubik's® Cube that has been turned many times resulting in a combination of patterns across each face (see www.rubik.com). In Figure 5-6 below, which is a conceptual schematic representation for illustration purposes, each of the small cube faces represent some of the components from the six staffing decision categories. This is not suggesting the Cube as a 'tool' for use in staffing decision-making, moreso it is used here simply as a device to show the multi-factorial nature of staffing decision-making. In theory, if each face was manipulated, other faces (or facets) would be impacted upon, affecting and disrupting the 'ideal goal of good staffing' (i.e. a 'solved' puzzle).

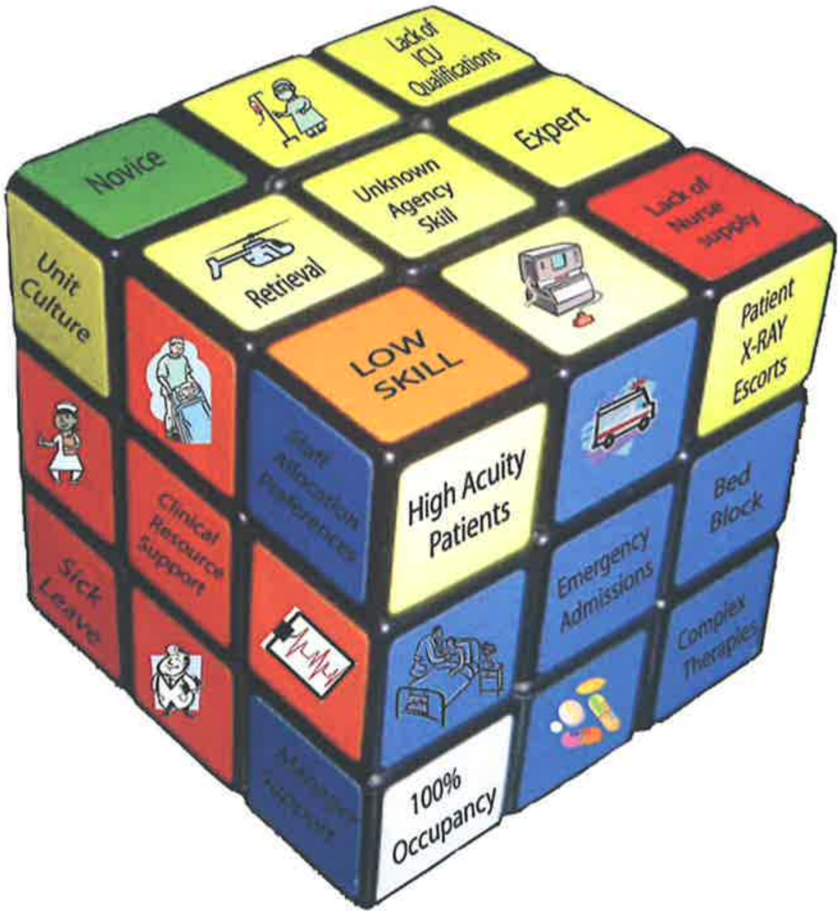


Figure 5-5 Schematic presentation of an ICU Staffing Rubik's Cube

Even if some consensus on favourable staffing models were acquired by collaborative groups (such as Williams attempted to do) they can only ever be one piece of a complex puzzle that requires expertise, experience, balanced judgement, and intuition in a supportive and trusted environment.[258]

Skill-matching

Even if single-factor, ratio-type staffing models are adopted within an initial budgetary framework it is imperative that they be viewed as just one component, rather than the only one of importance. Consideration of as many factors as possible is paramount to well-informed and well-justified staffing decisions. The concept of skill-matching, developed by the researcher, arguably provides this more comprehensive and innovative approach because it is based on this consideration of all contributing factors. The literature tends to focus on the skill-mix but with little emphasis on what to do with that skill-mix or how decision-makers allocate that mix to the patients in the ICU at the time. Arguably, although considerations of skill-mix factors are essential, they are not sufficient to adequately encompass all necessary elements for robust staffing decisions.

The study findings demonstrated diversity in RN classification, ICU qualifications, ICU case-mix, ICU occupancy, skill-mix, size of ICU, and inconsistency in systems of measuring staffing requirements. It makes sense then that a skill-matching mindset and approach would enable the nurse decision-maker (whether experienced in that role or not), to consider staff, expertise (both skill and qualifications), experience and exposure on the part of the staff, and also the patient acuity, physical layout of the ICU as well as the organisational micro and macro-system based factors as outlined in the six categories. The high proportion of SLNs who note that they used '*professional judgement from experience*' adds yet more factors that, although subtle and more difficult to quantify, are nevertheless critical to the decision-making process.

The final 'mix and match' staffing decisions on any given shift will be a key determinant of patient outcome. Hence it makes sense to elevate the significance of our understanding of skill-matching both conceptually and in an operational context. It also highlights a valuable link between this type of operational workforce planning and risk management, because if the *mix* and/or the *match* is poor or inadequate, the risk of adverse event and negative patient outcome is increased.

Multi-factorial staffing considerations in skill-matching

Although a number of staffing considerations, or factors, have been alluded to within some of the literature, the study findings expanded on this. Ball noted the importance of knowledge, skills and experience but was less expansive and inclusive in the factors she considered important.[142] She suggested that "concepts such as 'patient dependency' or 'nursing workload' fail to address the knowledge, skills and experience of nurses and consequently fail to acknowledge the risk presented by critically ill patients".[142] (p. 62). However, this is a less comprehensive view than the skill-matching concept and multi-factorial approach that is being advocated on the basis of the evidence that has been obtained from this research.

It makes sense that staffing considerations are inextricably linked to level of risk and patient outcome. Strategies aimed at both understanding the complex system of staffing decisions, and the important issue of risk in staffing decisions, are likely to improve patient outcome. It seems reasonable that this could be achieved by reducing adverse events, having therapies and patient management delivered in a timely, diligent and competent manner, by skilled nurses in a safe conducive environment. The more problems added to the staffing decision equation or puzzle, the less likely it is that this would be achieved. The linkage with patient risk and the issue of risk rating of shifts is discussed shortly in the third 'key issue' but first the next issue of 'Deficit in skill assessment and available information' requires discussion.

5.5. Deficit in skill assessment, skill and available skill information

Some research studies have identified approaches to managing the degree to which patients are exposed to adverse events in the absence of skilled, experienced and knowledgeable nurses in the area of critical care,[115-117] in hospitals generally,[65] and within the multidisciplinary team.[118] Contributing factors to inappropriate and hazardous care delivery include nurses working out of their scope of practice in the ICU; nurses receiving inadequate orientation and workplace training; a lack of adequate clinical and educational support systems in place; a lack of underpinning knowledge of critical care nursing and therapies; and working in an unsafe ICU environment.[52,55] The risks associated with inappropriate care delivery may be minimised by systems that inform managers about the nurse skill level in their ICU. One of the key findings of this study was the distinct lack of knowledge of the skill sets of the available staff, particularly agency nurses. This deficit has not previously been described. These new insights are valuable in understanding the potential impact on patient outcome when nurse skills are low or unknown. In addition to the lack of known skills, the study found that there is a substantive shortage of nurses with ICU skills (a nurse-supply issue), as opposed to a lack of skill assessment per se, and the other separate issue of nurses whose skill sets are unclear.

The impact that lower nurse skill is said to have on the occurrence of adverse events is shown in the work of Morrison who demonstrated the ability to help identify problems in which nursing staff inexperience (NSI) had been implicated.[55] Use of evidence-based practice is one vital component of clinical expertise, but the contribution and value placed on individual expertise should not be underestimated. The difficulty lies in quantifying that process, making assignment of a measurable value of that expertise almost impossible.

Not only have researchers suggested a positive association between nurse staffing levels and patient outcomes such as mortality,[65,96] but Aiken[65] and Elixhauser et al.. [97] suggested that staff expertise contributed to patient outcomes (e.g. mortality). It has also been reported that quality of care as an index of nursing tasks left undone was an important predictor of unmet patient needs.[98] Research on patient safety and clinical errors reveals that serious circumstances and adverse events that resulting from those errors occur frequently in ICUs.[103-105]

The findings from the study showed that only 4 ICUs (of 50) had a staff skill database, or any type of list or system containing skill information that might quantify or clarify nurses' available skills. Furthermore, over one third of SLNs cited a 'lack of known or available skills', which reflects a high presence and significance of this problem. In such a high-acuity environment of critically ill patients, this is of concern as the benefits of qualified skilled staff are well articulated in the research as well as being reflected in the minimum levels of qualified staff recommended by the national critical care nursing professional body (ACCCN). In addition, a number of SLNs reported the repeated occurrence of 'being sent poor quality/sub-optimal agency nurses', and 'unqualified agency nurses'. However, within the data regarding SLN solutions to this problem, over 40% said that there should be improved skill information such as a database or list. This shows a focus on improving the available skill information that the shift leaders are seeking, presumably to optimise knowledge that will better inform their staffing decisions. This strategy could include raising awareness of options for some contingency plan ideas should the various contributing factors in the relevant shift's staffing equation be less than ideal.

Autonomy and trust come into account here too with evidence in these findings of a marked lack of trust by some managers and with some shift leaders not being given the responsibility to make autonomous staffing decisions. A number of nurse managers overruled their shift leader's decisions and other SLNs reported significant conflict with their managers in 'always having to justify their decisions'. A number specifically mentioned the 'lack of trust' and this was inferred by others in their comments about having their staffing decisions 'checked' and or overruled.

The plight of the shift leader in regards to autonomy and trust is important as it was mentioned by over 25 % of the SLNs in the data on staffing problems they had encountered. It would appear unreasonable that although shift leaders are routinely entrusted to manage everything that a shift demands, including co-ordination of numerous concurrent complex therapies, their staffing decisions are either challenged or usurped. It makes no sense that staffing decisions be 'taken away' from the shift leader to be 'managed' or 'checked' by the ICU manager. It therefore seems logical, prudent and practical that the shift leader (who the study data showed predominantly has an ICU qualification), is be best placed to understand the various permutations of all core components and contributing factors attached to staffing, and therefore the person who is best placed to make informed optimal staffing decisions that would be most likely to improve patient outcome. However it is recognised that there may be instances when the SLN's may not 'get it right' in their staffing decisions.

The findings in this study support existing compelling evidence from Ball and McElligot and Whitman regarding the consequences when nursing resources are stretched due to contextual factors (geographical layout, decreased skill mix, increased patient dependency and unit activity).[26,73] In their research investigating factors that impacted on patient deterioration, the ability to provide proactive nursing care became task orientated, progress of the patient became hindered, nurses failed to appreciate the cues given by patients which indicated deterioration, coping was ineffective and there was an increase in emotional tension[26,73]. The fact that emotional tensions surfaced when the nursing resource was diminished sends an added warning that decision support strategies are needed. The data in this study showed the emotional tension of the shift leaders, reflected in the problems of lack of support, trust and clinical resourcing.

An extension of Ball's approach to one that is more comprehensive; that actively considers a broader range of important factors (that is, the six staffing decision categories), is arguably an important direction. Solving some of the many problems highlighted by the shift leaders in the study data is likely to improve staffing decision-making capacity, with potentially improved judgement skills and justification capabilities. As with any decision making process, the more information at hand, the better the starting point for the person who is to make the decision. The staffing problems included lack of support, uncontrolled emergency admissions, inadequate clinical resources, lack of known skill, conflict, staff preferences, junior staff educational support, staff preferences, allocation fallout (unhappy staff/unrest), budget constraints, constraint by mandated single factor tools, and lack of communication.

To address the issue of unknown nurse skill at an operational level, creation of a skill-set database is a readily achievable solution that was recommended in the study data by the SLNs. This researcher suggests that this database could be incorporated into the development of a Staffing Decision Support Framework, which was one of the aims of this research at the outset. SLN support for a solution to skill assessment and identification was evident within the study findings. Principles within a potential Staffing Decision Support Framework (DSF) are discussed here. Such a framework would encompass: nurse skill assessment and a nurse skill database, the six staffing decision categories and their components, and an ICU staffing related 'shift activity risk rating system'.

5.6. A Staffing Decision Support Framework

A staffing decision-support framework could help ICU shift leaders rapidly and judiciously assess nurse skill sets and scope of practice, allowing nurse allocation to patient care decisions to be better informed, more strategic, and, as a result patients would be likely to be less clinically compromised and exposed to risk of an adverse event. Any tools developed within such a framework would need to be user-friendly and simple because anything that was cumbersome and complex to administer would be unlikely to be used by staff. Such a framework would have particular application for those nurses deployed to an ICU from an agency. Equally, its use could be for a casual staff member, or a nurse from another ward/area who worked on an infrequent basis in the ICU.

The study data showed that agency nurses with unknown skill sets appeared to be allocated patients on the assumption that 'they would not have been sent to the ICU unless they were capable of the level of care required'. It is reasonable to presume that sometimes these nurses are well-skilled but it is also likely (based upon the SLN data on known lack of agency nurse skill) that there are also times where patient risk exposure would be increased if nurses working out of their scope of practice, within unknown or undeclared skill sets are deployed in the ICU. This situation is unfair to the agency nurse, unfair to the permanent nurses expected to supervise and assist (in addition to their own pre-allocated workload), and is likely to put patients at an increased level of risk of an adverse outcome.

A Staffing Decision Support Framework would ideally incorporate two key components; a practical nurse skill assessment tool (NSAT) that includes a skill-rating model, and a risk-rating framework for shift staffing decisions. The NSAT would include a skill category approach using overlaid 'Novice to Expert' principles of Benner (see Appendix A). In its preliminary design, Levels (1, 2, 3, and 4) have been created, with Level 1 equating to the most highly skilled ICU nurse through to Level 4 which would equate to the least skilled (for example in ICU) nurse.

It is envisaged that this skill rating would be allocated to an agency nurse following discussion between the shift leader and the agency nurse, on their first shift in a particular ICU. This would be an important recommended feature in any decision support framework, in line with the study findings that showed less than 38.19% of SLNs *rarely* or *never* gave feedback to agency nurses at the end of their first shift. The study also found over one third of SLNs reported 'agency nurses did not meet the required skill level of that ICU'. These were somewhat surprising findings because it might has been reasonable to assume that given the SLNs reported the problem of unknown skills, it would appear likely they may have had performance feedback systems in place, yet almost the opposite was evident. Hence, a NSAT, in principle, within the Decision Support Framework, could assist shift leaders to address improvements in skill assessment and provision of performance feedback to agency staff. The skill rating, together with the nurse's name and agency, would be recorded within a simple database in alignment with one of the recommended solutions from the study findings. A protective location of this information using a password protected Excel spreadsheet would be one approach to address potential privacy concerns.

The skill rating is seen a type of grading scale, but one that would be need to be dynamic. A nurse might be rated as Level 2 in one ICU but potentially rated as Level 1 in another; influenced by their knowledge of the particular unit and its equipment, therapies and protocols. Equally, a nurse could be given a rating of Level 3 but, over time, their skills could change as a result of their exposure to certain therapies and equipment and hence a re-assessment might re-rate them as a Level 2. This explains the dynamic and flexible nature of this proposed system.

Part of the NSAT would be a simple checklist of typical commonly utilised ICU therapies and types of equipment for a particular ICU (see Appendix A). Its use would involve a process whereby, at the beginning of a nursing shift, if an unknown nurse arrived for the shift, the shift/team leader would provide a copy of the checklist and ask him/her to rate what he/she (the nurse) perceives to be his/her capabilities in relation to a number of described therapies. The listed or described therapies could be modified by each ICU so that they become 'Unit specific' as it is unlikely that one therapy template could be applicable across all ICUs. The shift leader then would match the nurse's skills and allocate him or her to a patient. At the completion of the shift, the two staff would meet and discuss overall performance and feedback and the shift leader would rate the nurse's capabilities on the checklist. The more concordance with the agency nurse's 'ticked boxes' and the shift leader's view at the end of the shift, would equate to a reasonably well-matched allocation of nurse to patient. Although subjective, it is arguably a transparent system, with the more concordance reflecting the nurse had worked safely within her skill set capabilities and had not worked beyond her scope of practice. An additional and significant benefit would be that it might lessen the risk of adverse event by improved skill matching.

5.7. Risk rating shift activity in ICU

From the shift leader data regarding the diverse staffing problems, it is reasonable to believe that there exists clinical compromise and risk exposure from poor skill matching to patient acuity, compounded by a skill shortage, budget constraints and a lack of trust by managers. The findings of this research support the view of both Ball and Whitman and highlight further that, in circumstances where the skill of the nurse is unknown or compromised, those nurses are more prone to error; critical incidents will increase; and patients will take longer to recover.[26,73] There is an additional economic backlash too, as every additional day in ICU adds greater than $AUD3,000 to the cost of that episode notwithstanding the increased risk of complications likely with an extended ICU stay.[104,238] These costs are likely to escalate further should there be consequential iatrogenic harm (i.e. from poorly informed staffing decisions).

The concerns raised by the shift leaders in the study data, where they describe a multitude of serious problems attached to staffing decision-making, provide some evidence that there are likely to be some shifts that run 'close to the wire' in terms of patient risk and potential adverse events. The literature about adverse events adds support to this argument.[103-105] The study data highlighted the realities of the challenges faced by shift leaders in the thematic analysis. With frequently-cited problems related to poor staff-mix, lack of skill, unknown skill-sets, lack of supply, together with unpredictable emergency admissions and lack of clinical resource support, to name a few, it is more than reasonable to assume that risks are likely to be greater the more of these negative factors are present on a given shift. Whilst it is also highly likely that the shift leaders would make every attempt to minimise risk by proactive strategies - such as amending nurse to patient allocations, seeking external unit staff, or possibly diverting patient admissions - it is reasonable to accept that there may be shifts where little can be done to enhance the situation. The more shifts that occur in such a pressurised environment, the more likely it is that an adverse event may occur.

It is likely that shifts occur every day across ICUs that reflect varying degrees of risk exposure depending on the multiple contributing factors present at the time. An improved awareness of patient risk in these scenarios and how that may be influenced positively or negatively by the staffing decisions within a single shift is likely to be of benefit to future shift leaders.

Reducing risk exposure from poor skill matching

The challenge exists to develop decision-support systems that are dynamic, and with congruence between available nurse skill and patient demand, using skill-matching of both permanent <u>and</u> agency staff. It makes sense that use of the recommended multi-factorial, comprehensive approach could be incorporated into an overarching risk management plan. An innovative system using a 'risk rating' framework is shown in Figure 5-6.

ICU SHIFT RISK RATING FRAMEWORK

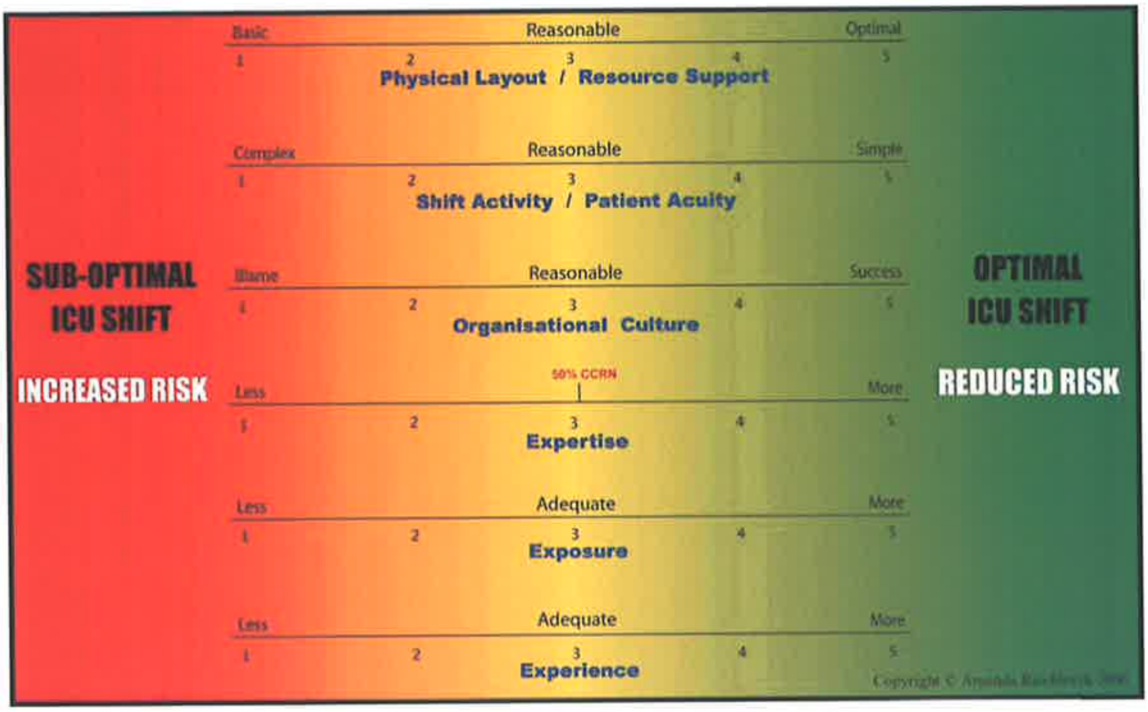


Figure 5-6 A schematic representation of an ICU Shift risk-rating framework

The ICU Shift risk-rating framework was devised by considering the six staffing categories in the context of the discussion, study findings and literature support regarding risk of adverse events. Hence in times of lower skill, negative organisational culture, high shift and patient activity, and basic micro-organisational factors such as Unit layout and support resources, the overall patient risk exposure is likely to be greater. Within this schematic framework, risk (that is, of patient adverse event), is shown as a continuum from one end ('Optimal shift with less patient risk') to the opposite end ('Sub-optimal shift with increased patient risk'). One end is the higher risk end of the scale as reflected by the increasing red shading. The centre sections are amber and reflect a comparatively neutral risk level. It then moves along the continuum to areas of green, reflecting less risk.

The six potential visual analogue scales are preliminary determinations that considered the six staffing decision categories and the relative positive and negative ends of the spectrums within each category. Hence, each of the six staffing categories is represented by respective scale. For example, the organisational culture scale adopts the Blame through to Success ratings. Again, although subjective, the framework offers a visual picture of how the complexities of staffing decisions transect the issue of patient risk. Clearly further detail, development and validation of this framework (and any associated tools), is required. This is beyond the scope of this research. However, it assists the discussion here because in Figure 5-6, the inextricable link between staffing decisions and risk in the ICU is highlighted.

This type of approach, that integrates the concept of risk and the complexity of staffing decisions, has the potential to prevent clinical compromise to ICU patients by highlighting potential risk areas in an early warning system. If such a framework could potentially reflect levels of risk on a given shift (e.g. high or extreme patient risk), it would bring a shared responsibility to both the ICU and the hospital executive staff to consider the level of risk, minimise it as much as possible, and establish what are (and what are not) 'acceptable' levels of risk. Furthermore, in principle, if risk rating was adopted for each shift, then across days and weeks, a benchmarking capability would be possible, with trends and patterns emerging that could be the subject of further scrutiny and review.

Adapting national risk standards to staffing decisions

Adapting national risk standards to staffing decisions based on national standards of risk management and process (see Appendix O) is a logical step. It becomes an obvious extension of risk registers and risk management processes that are increasingly being incorporated as part of sound clinical governance both in business and in healthcare.[13,113]

Low and moderate shift risk-rating would be managed by departmental heads, quality improvement strategies and local reviews, with local actions initiated by staff. 'High' or 'Extreme' risks would require more specific, targeted risk-reduction strategies. These could include staff education, equipment reviews and restructure of medical consumables, encouragement of guidelines/pathways/protocols, policy reviews, and risk analysis using a root cause analysis (non-blame) approach of any adverse events and 'near misses' (where an adverse event almost occurs but is halted by an intervention or fortuitous circumstance).

Use of a Staffing Decision-Support Framework could also be viewed as a positive risk reduction strategy in its own right. In the *National Guidelines for Managing Risk in the Healthcare Sector* (2002) 'gaps in risk management activities' are identified.[113] (p. 84) The gaps cited include: "potentially useful tools have not been used such as sentinel event analysis"; and "although large numbers of clinical performance indicators are collected, few accurately measure risk". [113] (p. 84) In addition, "identified risks are not prioritised or managed consistently across the organisation". It would appear critical then to align shift- and staffing-related risks within a risk management context and incorporate it into existing risk management processes. Whatever the system in place it needs to align with national standards and not be overly cumbersome to administer, as this is likely to negate the uptake by staff in understanding and having ownership of this issue.

Summary

This research provided a national profile of nurse staffing decision systems and practices in Level III ICUs in Australia in order to understand the commonalities and differences in experiences of shift leaders and the likely complexities within in ICU staffing systems, and to understand their relationship to risk. Skill-matching considers expertise (qualifications and skill), experience and exposure on the part of the staff, and also the patient acuity, physical layout of the ICU as well as many organisational micro and macro-system factors.

5.8. Dissemination of findings

The findings, conclusions and recommendations from this research will be disseminated in a number of ways using a range of networks. Firstly, all participating ICUs will be given a synopsis of the research in alignment with the researcher's undertaking at the outset of the study. Giving priority to this recognises their crucial contribution to the research, and to the new knowledge gained that will further inform the debates about nurse staffing in ICUs. In keeping with the pledge of confidentiality, participants will not be identifiable within any publications.

Spheres of influence that the researcher can exploit to disseminate this research of interest to practitioners, managers and researchers, include a mix of local, national and international networks. Research dissemination networks available to the researcher at a *local* level include: - ICU clinician colleagues, hospital Unit and executive level management, health policy identities such as the Chief nurse, and regional healthcare policy advisors. At a *national* level, professional critical care bodies that influence policy such as ACCCN, WFICCN, ANZICS, JFICM will be informed of the findings. Hospital accreditation bodies and Safety and Quality Councils have already shown interest in this research, including a preliminary invitation from the CEO of Patient Safety International to collaborate on patient safety strategies. The researcher has been invited to speak at a national Risk Management Forum in 2007 and has become a member of the Australian National Risk Management Association (ARIMA). In addition the researcher has been invited to contribute to the International Council of Nurses (ICN) 'Bank of Experts' in matters of nursing workforce and ethics issues.

From an international perspective, the researcher will publish the study findings in international journals and maintain her intensive care networks through a role of the ACCCN National Board and conference exposure. Another exciting future prospect relates to The World Health Organisation (WHO) patient safety classification group. It is hosting a web-based Delphi process to seek submissions from member countries as to which concepts should populate the *World Patient Safety Classifications*. The terms and definitions for patient safety have gained considerable currency (e.g. many are used by the National Patient Safety Agency in the United Kingdom), and are to be submitted for consideration for this worldwide patient safety classification.[260,261] This researcher has received a preliminary invitation to work with this project, which is in its early stages. The researcher's publications to date in peer-reviewed journals are included following the Reference section.

5.9. Conclusions

This information contributes new knowledge regarding how shift leader nurse staffing decisions are informed and unequivocally demonstrates the complex multi-factorial process that is involved in staffing decision-making and systems in the intensive care unit.

The findings of this research demonstrate the complexity of staffing systems and demonstrate why single facet staffing utilisation models (e.g. ratios and nursing hour based models) are inherently limited and unable to factor in the multiple considerations required for safe staffing decisions.

Skill-matching links nurse skill to patient acuity with the objective of providing quality care and reducing potential risk of adverse events and poor outcome. This concept highlights a valuable link between workforce planning and risk management.

How well ICU nurse managers understand the exposure to risk of adverse events and poor outcomes as a consequence of nurse staffing decisions remains unclear. Given the substantive agency nurse requirement in Australia and changing nurse workforce across many countries, it would appear that articulation of nursing workforce related risk, including consideration of the agency nurse and other contributing factors may not be given the priority it deserves.

If staffing allocation decisions are based on inadequate information and/or inappropriate consideration of all contributing factors to required nursing skill then the risk exposure to adverse events and poor outcome is likely to be greater.

5.10. Recommendations

Recommendations from this research are presented within the following four headings: - *Policy, Education, Practice and Research.*

Policy

There is a need to improve the recognition and value of the decision-making capabilities of the shift leader just as they are respected for their ability to 'lead' and 'manage' the events and duties of the shift.

There is a need for flexibility, autonomy and trust of shift leaders who make crucial complex nurse staffing decisions on every shift in the ICU. Improved clinical resourcing support of shift leaders is advocated.

Policy development should include requirements that elevate the importance of both skill assessment and known skill information as being paramount to improved nurse staffing decision capabilities. Improving the available information that the shift leader has at hand is critical for well-informed judgement in staffing decisions that match available skill with patient acuity and equally to improve support.

Practice

Development of a skill matching model incorporated within a risk management framework that aligned with national risk standards is likely to have practical and useful application in ICU, with a positive influence on staffing decisions and practices, workforce planning, and patient outcome.

Use of a dedicated Staffing Decision Support Framework and an ICU Shift Risk Rating system within existing organisational risk management may address some of the deficiencies highlighted in this research, but requires further strategy development. In addition, further exploration of new benchmarking opportunities for organisational improvement using staffing decision support and risk management principles with potential positive benefits for patient outcome are advocated. A potential Staffing Decision Support Framework (DSF) could encompass: a nurse skill assessment tool (NSAT) and a nurse skill database, the six staffing decision categories and their components, and an ICU staffing related 'shift activity risk rating system'.

Development and use of tailored nursing workforce resource indicators using commonly articulated workforce language, together with practicable skill-matching tools for use in intensive care, is likely to assist nursing managers and team/shift leaders in their important daily decision-making. Incorporated into a dedicated nursing decision support system, it could provide additional benefit as a risk management strategy to reduce risk of adverse event from inexperienced or insufficient staff. Nurses must also assume responsibility for decision-making just as they do for clinical decisions.

Education

A shift in focus from single-facet staffing models to a more comprehensive multi-factorial approach will require education and understanding of the evidence-base behind this new approach. Education regarding the role of risk-rating principles within risk management practices is warranted.

The relationship to risk of adverse event or poor patient outcome is likely to be positively or negatively affected directly by poor staffing volume and/or nurse to patient allocation decisions. Strategies that target improvements in understanding the multi-factorial core components within staffing decisions are likely to reduce risk and highlight areas of staffing related concern.

A shared ownership risk management model whereby staffing and shift related patient risk issues are understood by both ICU management and hospital management adds a new dimension to thinking around this complex issue. This new knowledge informs the debate on skill-mix and nursing utilisation patterns in ICUs, and exposes the very limited role of single factor utilisation staffing models.

Research

Useful information management insights from the research that were unanticipated were discovered which form recommendations for future nurse researchers relating to the influence of hospital information technology systems in research; specifically security of internal organisational systems. Researchers planning potential email and web-based correspondence need to be mindful of these possible limitations and structure the content and attachments accordingly. Careful contingency planning is important at the outset in early research design considerations. Future researchers should include up-front strategies within their design phase to ameliorate this problem.

Web-based systems can add efficiencies in time, cost and labour without necessarily compromising the ethical integrity of all research phases. The ability to conduct larger studies by using resource efficient web-based approaches is likely to be considered advantageous, notwithstanding the stated limitations. The core components of web-based system developed by this researcher for this study have transferability and are likely to be replicated in either a commercial application or via a not-for-profit partnership arrangement.

Further research is recommended to examine the role, development, application and validation of staffing related risk rating tools and systems in ICU. Although this has application in the ICU setting, the principles may be used in future opportunities for broader application across other types of clinical settings.

APPENDIX A

An Intensive Care Skill Assessment Model

Intensive Care Nurse Skill Assessment Tool **(NSAT)** **Amanda Rischbieth ©**

CATEGORY ONE **ICU - Expert**	CATEGORY TWO **ICU - Proficient**	CATEGORY THREE **ICU - Competent** **(= Crit Care student)** **HDU Proficient**	CATEGORY FOUR **ICU Novice** **HDU Competent**
Knowledge in all categories AND	Category Three Skills AND	Comprehensive Pain Assessment/ Management inclusive of PCA/Epidural	Novice practitioner – not suitable to ICU, may suit basic HDU
Critical Care Certificate or Graduate Diploma with recent & updated experience	Current ICU Experience with minimal supervision required. Minimal 8 shifts/month		
Advanced skilled practitioner in ventilation	Care for Ventilated Patient and good knowledge of ventilation principles/modes and practice	CVC care/CVPinterpretation. Basic mechanical ventilation principles/understanding.	Pulse oximetry knowledge including modes of oxygen therapy and clinical application
IABP Management	Non-invasive ventilation/CPAP independently	Non-invasive ventilation/CPAP with supervision	
Renal Dialysis CVVHD Management	Monitoring administration and effect	Arterial Line Management	Knowledge of vital signs, clinical assessment and identification of variances to 'normal' parameters.
ICP Monitoring and Catheter Care	Assist with Intubation	Tracheostomy Management (spontaneous ventilation)	Care of intravenous therapy and awareness of medications used in common use and post -operatively
ICU Escort/Retrieval	Assist with CVC insertion Assist with setup for pt transport		Awareness of principles of fluid management
Temporary Pacing knowledge and management	Epidural, PCA and modes of Pain Management		Awareness of correct documentation practices
Titration of Vasoactive Drugs and broad medication knowledge	Pulmonary Artery Monitoring and Catheter Care	Management of multiple infusions (excluding inotropes)	Knowledgeable in correct medication administration procedures
Assist with Insertion of Swan Canz Catheter	Monitoring of Vasoactive IV Drugs	Nasogastric/Enteric Management	Care of naso-gastric and nasoenteric feeding
Perform Cardiac Output Calculations	Assist with Arterial Line Insertion	Venepuncture Care of arterial line and calibration technique	
Defibrillation/ALS competent	BLS knowledge	Complex Wound Care BLS knowledge	Simple wound care BLS knowledge
Interpretation and management of Cardiac Arrhythmias		Recognition of life threatening Arrhythmia's. Perform 12 Lead ECG	Recognition of a pulse rate < 60 and > 100
Removal of Chest Drains	Assist with Chest Drain insertion and removal	Care of Chest Drain including suction use	May have observed a patient with a chest drain

Nursing Skill Assessment Checklist (NSAT) <u>CHECK LIST FOR AGENCY RNs</u>

This form is to be completed for all Agency Staff who are working their first shift in .... ICU. This will be completed by the Shift/Team Leader, and kept as a record to improve awareness of Agency nurse skills and to ensure they have the required skills to work in this ICU. The list is kept in-confidence for internal use only. Boxes on left ticked by agency nurse at shift beginning; the TL/shift leader ticks appropriate boxes on right at shift end.

	Check 2 Ag RN Shift Start	Check 2 TL Shift end		Check 2 Ag RN Shift Start	Check 2 TL Shift end
RESPIRATORY			***INTEGUMENT/GENERAL CARE***		
Servo Ventilator	☐	☐	Pressure Area Care	☐	☐
Drager Ventilator	☐	☐	Mouth / Eye Care	☐	☐
Hand Ventilation	☐	☐	Passive Limb Exercises	☐	☐
O2 Therapy – N/specs	☐	☐	Psychosocial - family	☐	☐
- CIG	☐	☐	- patient	☐	☐
Ventilation Modes	☐	☐	***G.I.T. / METABOLIC***		
CPAP – Drager	☐	☐	TPN – Administration	☐	☐
- Vision	☐	☐	Blood Glucose Monitoring	☐	☐

Endotracheal Suction	☐	☐
Tracheostomy	☐	☐
UWSD	☐	☐
Chest Physiotherapy	☐	☐

CADIOVASCULAR

Invasive Haemodynamic	☐	☐
Monitoring – Arterial Line	☐	☐
- CVC	☐	☐
- Pulmonary Artery	☐	☐
Basic Arrhythmia Interpretation	☐	☐
Inotrope Admin/ titration	☐	☐
Administration of drugs/fluids via CVC and line management	☐	☐
IABP	☐	☐
CVVHD (Aquarius)	☐	☐

Insulin Administration – sub-cut	☐	☐
– infusion	☐	☐
Naso-Enteric Feeding	☐	☐

SEDATION AND PAIN MANAGEMENT

Epidural Management	☐	☐
Pain assessment and Scoring	☐	☐
Narcotic Infusion	☐	☐
Sedation Score and Management	☐	☐
Transport of critically ill	☐	☐
Neuro surgical post-operative care	☐	☐

COMMENTS ______________________________

____

NAME:	AGENCY:	SIGNATURE OF AGENCY RN
SKILL RATING as per Nurse Skill Assessment Tool (NSAT) **(Circle) 1 2 3 4**		
SIGNATURE OF ASSESSING RN DATE: CRIT. CARE QUAL: (Circle) YES / NO .... Print Assessing RN Name:...		

APPENDIX B

Summary of Methods for Estimating the Size and Mix of Nursing Teams

Summary of Methods for Estimating the Size and Mix of Nursing Teams *

1. Professional judgement method
2. Nurses per occupied bed (NPOB) method
3. Acuity-quality method
4. Timed-task/activity method
5. Regression analysis method
6. Professional judgement method
7. Patient dependency method
8. Nursing activity method
9. Dependency-activity method
10. Quality of care
11. Dependency-activity-quality method
12. Grade mix and skill mix
13. Timed-task/activity

Hurst grouped these main nursing workforce planning systems described in the literature into five ways:

1. Professional judgement (Telford) approach.
2. Nurses per occupied bed (NPOB, also known as the top-down method).
3. Acuity-quality (also known as the bottom-up method).
4. Timed-task/activity approaches.
5. Regression-based systems.

* Selecting and Applying Methods for Estimating the Size and Mix of Nursing Teams. A systematic review of the literature commissioned by the Department of Health, April 2002. Dr Keith Hurst, Senior Lecturer, Nuffield Institute for Health, Leeds University.

APPENDIX C

Search Strategies

SEARCH STRATEGIES

Search History

#3 #1 and #2(341 records)
#2 ("Quality-Assessment" / all TOPICAL SUBHEADINGS / all AGE SUBHEADINGS in DE) or
("Outcomes-Health-Care" / all TOPICAL SUBHEADINGS / all AGE SUBHEADINGS in DE) or
("Outcome-Assessment" / all TOPICAL SUBHEADINGS / all AGE SUBHEADINGS in DE) or
("Outcomes-Research" / all TOPICAL SUBHEADINGS / all AGE SUBHEADINGS in DE)(11636 records)
#1 ("Intensive-Care-Units" / all TOPICAL SUBHEADINGS / all AGE SUBHEADINGS in DE) or
("Critical-Care" / all TOPICAL SUBHEADINGS / all AGE SUBHEADINGS in DE)(10085 records)

The search: #1 and #2 in the database(s) CINAHL (R) Database 1982-1996, CINAHL (R) Database
2002-2003/07, CINAHL (R) Database 1997-1999, CINAHL (R) Database 2000-2001

returned 341 records

Search History

#7 (#6 and (#1 or #4)) not (#3 or #5)(247 records)

#6 explode "Personnel-Staffing-and-Scheduling" / all TOPICAL SUBHEADINGS / all

AGE SUBHEADINGS

in DE(6405 records)

#5 (#4 and #2) not #3(10 records)
#4 "Critical-Care-Nursing" / all TOPICAL SUBHEADINGS / all AGE SUBHEADINGS in DE(7348 records)
#3 #1 and #2(341 records)
#2 ("Quality-Assessment" / all TOPICAL SUBHEADINGS / all AGE SUBHEADINGS in DE) or
("Outcomes-Health-Care" / all TOPICAL SUBHEADINGS / all AGE SUBHEADINGS in DE) or
("Outcome-Assessment" / all TOPICAL SUBHEADINGS / all AGE SUBHEADINGS in DE) or
("Outcomes-Research" / all TOPICAL SUBHEADINGS / all AGE SUBHEADINGS in DE)(11636 records)
#1 ("Intensive-Care-Units" / all TOPICAL SUBHEADINGS / all AGE SUBHEADINGS in DE) or
("Critical-Care" / all TOPICAL SUBHEADINGS / all AGE SUBHEADINGS in DE)(10085 records)
The search: (#6 and (#1 or #4)) not (#3 or #5) in the database(s) CINAHL (R) Database

1982-1996, CINAHL (R) Database 2002-2003/07, CINAHL (R) Database 1997-1999, CINAHL (R) Database 2000-2001 returned 247 records.

AustHealth

A collection of major Australian health databases including medical journals of Australia, health of Indigenous people, rural health and materials concerning social, political and economic circumstances.

AMI - Australasian Medical Index

Australia/New Zealand Reference Centre

The Australia/New Zealand Reference Centre combines Australia and New Zealand-specific magazines, newspapers, newswires, reference books and company information. This database provides local perspectives on current events, business, sports, and many other subjects.

Australian Bureau of Statistics Website. Statistics Section

Libraries Australia (Kinetica) The National Bibliographic Database

Libraries Australia is a web-based service for Australian libraries and their users.

CINAHL (Nursing and Allied Health)

CINAHL is equivalent to the printed Cumulative Index to Nursing and Allied Health Literature. It indexes English language nursing journals, as well as publications of the American Nurses' Association and the National League for Nursing.

Cochrane Library

Cochrane Library provides rapid access to high quality information about the effects of health care. It consists of a number of databases and these are described in detail at the National Institute of Clinical Studies site (www.cochrane.org).

Dissertation Abstracts Online

Citations and abstracts to doctoral dissertations submitted to accredited North American institutions and some other international institutions.

Health Source: Nursing/Academic Edition

This database provides over 550 scholarly full text journals focusing on many medical disciplines. It also features abstracts and indexing for 800 journals.

Index to Theses

Bibliographic information on theses accepted by the Universities of Great Britain and Ireland and the Council for National Academic Awards.

ISI Current Contents Connect

Current Contents Connect is a weekly table-of-contents database that displays the contents pages of current issues of the world's scholarly and technical journals, books, and proceedings literature. It is the best database for very recent articles.

Medline / PubMed

Medline / PubMed is a service of The National Library of Medicine and The National Institute of Health. PubMed Entrez is the integrated, text-based search and retrieval system used at National Center for Biotechnology Information (NCBI) for the major databases, including PubMed, Nucleotide and Protein Sequences, Protein Structures, Complete Genomes, Taxonomy, and others.

Expanded Academic Index

Expanded Academic Index is an interdisciplinary index to over 1,500 scholarly and general-interest journals and magazines. The full text of articles is available for over 900 of the journals indexed, including some nursing journals such as *Journal of Child and Adolescent Psychiatric Nursing*, *Nursing*, *Nursing Administration Quarterly*, *Nursing Economics*, *Nursing Forum*, and *Nursing and Health Care Perspectives*.

Health Source: Nursing/Academic Edition

This database provides over 550 scholarly full text journals focusing on many medical disciplines. It also features abstracts and indexing for 800 journals.

Reference lists of key articles were also reviewed for additional material, in addition to critical care professional body material and policies.

Specific searches:

(intensive care[mh] OR critical care[mh]) AND nurse* AND outcome

assessment(health care)[mh]
(intensive care[mh] OR critical care[mh]) AND personnel staffing and scheduling[mh]

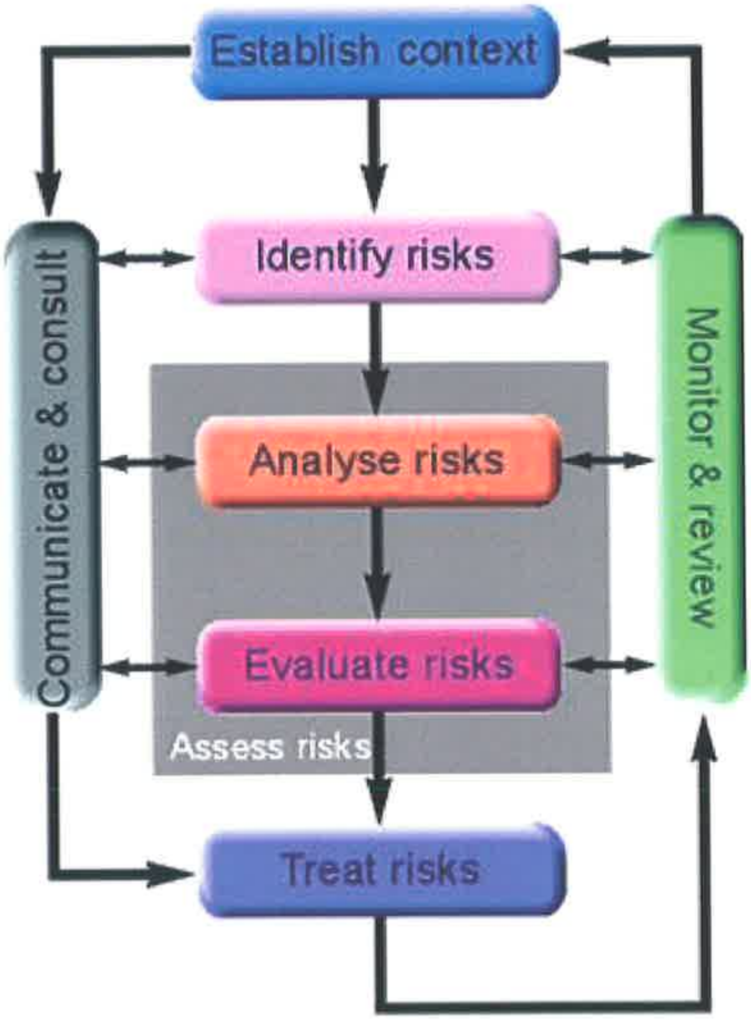
This strategy was intended to retrieve citations identified as systematic reviews, meta-analyses, reviews of clinical trials, evidence-based medicine, consensus development conferences, guidelines, and citations to articles from journals.
To pick up material not yet indexed a date limit on the search - (intensive care OR critical care) AND nurse* AND outcome space AND systematic [sb] added the strategy below:
((systematic review* [tiab] OR systematic literature review* OR
meta-analysis [pt] OR meta-analysis [ti] OR metaanalysis [ti] OR meta-analyses [ti] OR
evidence-based medicine OR (evidence-based AND (guideline [tiab] OR guidelines [tiab] OR
recommendations))
OR (evidenced-based AND (guideline [tiab] OR guidelines [tiab] OR recommendation*)) OR
consensus development conference [pt]
OR health planning guidelines OR skill-mix OR nurse skill OR guideline[pt]
OR
cochrane database syst rev OR
acp journal club OR
health technol assess OR
evid rep technol assess summ OR
evid based dent OR
evid based nurs OR
evid based ment health OR
clin evid)
OR
((systematic [tiab] OR systematically OR critical [tiab] OR (study [tiab] AND selection [tiab]) OR (predetermined OR inclusion AND criteri*) OR exclusion criteri* OR "main outcome
measures" OR "standard of care" OR "standards of care")
AND
(survey [tiab] OR surveys [tiab] OR overview* OR review [tiab] OR
reviews [tiab] OR search* OR handsearch OR analysis [tiab] OR critique [tiab] OR appraisal OR
(reduction AND risk AND (death OR recurrence)))
AND
(literature [tiab] OR articles [tiab] OR publications [tiab] OR publication [tiab] OR
bibliography [tiab] OR bibliographies [tiab] OR published [tiab] OR unpublished OR citation OR citations
OR database [tiab] OR internet [tiab] OR textbooks [tiab] OR references OR trials [tiab] OR
meta-analysis [mh] OR (clinical [tiab] AND studies [tiab]) OR treatment outcome))
AND
(case report [ti] OR editorial [ti] OR editorial [pt] OR letter [pt] OR newspaper article [pt]))

APPENDIX D

Standards Association of Australia

Risk Management Standard AS NZS 4360: 1999

Overview of Australian/New Zealand
Risk Management Standard
AS/NZS 4360



Source: Standards Association of Australia AS/NZS 4360: 1999

APPENDIX E

Nursing Workload and Outcome Measurements

Nursing Workload Measurement Instruments

Instrument	Components	Scoring/interpretation
TISS 1974[9]; 1983[3] (USA)	57[152]/76[153] nursing activities related to therapeutic interventions; 0–4 points per variable	most ICU patients: 10–60 points; Acuity: Class IV (≥40 points); III (20–39); II (10–19); I (<10)
UK ICS 1983,[75] 2003[5]	4 levels of care, with qualitative assessment of organ systems	0 = routine ward care 1 = ward care supported by critical care team 2 = support and monitoring of single organ dysfunction/failure 3 = complex support and monitoring of multiple organ dysfunction/failure
OMEGA 1990[1] (France)	47 therapeutic activities	classified into 3 levels according to frequency
TISS-28 1996[143] (Europe)	28 in 7 categories; points vary per item (0–8)	46 points = 1:1 nursing/shift 23 points = HDU patient (1:2 staff:patient ratio)
NEMS 1997[143] (Europe)	9 categories with varied points per item (3–12): basic monitoring; intravenous medication; mechanical ventilation; supplementary ventilatory care; single/multiple vasoactive medications; dialysis; interventions in / outside ICU	equivalent scores to TISS-28; lack of discrimination limits use in predicting or calculating workload at the individual patient level
CCPDT 1996[2] (Australia)	7 categories scored 1–4 points: (a) hygiene, mobility, wound care; (b) fluid therapy, intake & output, elimination; (c) drugs, nutrition; (d) respiratory care; (e) observations, monitoring, emergency treatment; (f) mental health care, support; (g) admission, discharge, escort	4 levels of nursing time per shift: A = ≤10 points = <8 hours B = 11–15 points = 8 hours (1:1 ratio) C = 16–21 points = 9–16 hours D = >22 points = >16 hours (2:1 ratio)
NAS 2003[12] (Europe/multinational validation)	23 items (5 with subitems); varied points per item (1.3–32.0) (see Table 3.7 for detail)	measures calculated percentage of nursing time (in 24 hours) on patient-level activities; 100 (%) = 1 nurse per shift

1 Le Gall JR, Lorait P, Mathieu D, Williams A. The patients in management of intensive care. In: Reis Miranda D, Williams A, Loirat P, eds. *Guidelines for better use of resources*. Dordrecht: Kluwer Academic; 1990: 11–53.

2 Ferguson L, Harris-Ingall A, Hathaway V. *NSW critical care nursing costing study*. Sydney: Sydney Metropolitan Teaching Hospitals Nursing Consortium; 1996.

3. Keene AR, Cullen DJ. Therapeutic intervention scoring system: Update 1983. *Critical Care Medicine* 1983; 11: 1–3.

4. UK Intensive Care Society. *Standards for intensive care units*. London: UK Intensive Care Society; 1983.

5. Royal College of Nursing. *Guidance for nurse staffing in critical care*. London: Royal College of Nursing; 2003.

6. Donoghue J, Decker V, Mitten-Lewis S, Blay N. Critical care dependency tool: monitoring the changes. *Aust Crit Care* 2001; 14: 56–63.
7. Reis Miranda D, de Rijk A, Schaufeli W. Simplified Therapeutic Intervention Scoring System: the TISS-28 items: results of a multicenter study. *Critical Care Medicine* 1996; 24: 64–73.
8. Reis Miranda D. The Therapeutic Intervention Scoring System: one single tool for the evaluation of workload, the work process and management? *Intensive Care Medicine* 1997; 23: 615–7.
9. Cullen DJ, Civetta JM, Briggs BA, Ferrara LC. Therapeutic intervention scoring system: a method for quantitative comparison of patient care. *Critical Care Medicine* 1974; 2: 57–60.
10. Reis Miranda D, Moreno R, Iapichino G. Nine equivalents of nursing manpower use score (NEMS). *Intensive Care Med* 1997; 23: 760–5.
11. Keene AR, Cullen DJ. Therapeutic intervention scoring system: Update 1983. *Critical Care Medicine* 1983; 11: 1–3.
12. Reis Miranda D, Nap R, de Rijk A, Schaufeli W, Iapichino G. Nursing activities score. *Critical Care Medicine* 2003; 31: 374–82.

Nursing Activities Score

Reis Miranda D, Nap R, de Rijk A, Schaufeli W, Iapichino G. Nursing activities score. *Critical Care Medicine* 2003; 31: 374–82.

Monitoring and titration	
a. Hourly vital signs, regular registration and calculation of fluid balance	4.5
b. Present at bedside and continuous observation or active for ≥2 h in a shift, for reasons of safety, severity, or therapy (e.g. non-invasive mechanical ventilation, weaning procedures, restlessness, mental disorientation, prone position, donation preparation and administration of fluids or medication, assisting specific procedure	12.1
c. Present at bedside and active for 4 h or more in any shift for reasons of safety, severity, or therapy (see 1b)	19.6
2. Laboratory, biomedical and microbiological investigations	4.3
3. Medication, vasoactive drugs excluded	5.6
4. Hygiene procedures	
a. Performing hygiene procedures such as dressing of wounds and intravascular catheters, changing linen, washing patient, incontinence, vomiting, burns, leaking wounds, complex surgical dressing with irrigation, or special procedures (e.g. barrier nursing, cross-infection-related, room cleaning after infections, staff hygiene)	4.1
b. The performance of hygiene procedures took >2 h in any shift	16.5
c. The performance of hygiene procedures took >4 h in any shift	20.0
5. Care of drains, all (except gastric tube)	1.8
6. Mobilisation and positioning, including procedures such as turning the patient, mobilisation of the patient, moving from bed to a chair and team lifting (e.g. immobile	

patient, traction, prone position)	
a. Performing procedure(s) up to 3 times per 24 h	5.5
b. Performing procedure(s) more frequently than 3 times per 24 h, or with two nurses	12.4
c. Performing procedure with three or more nurses, any frequency	17.0
7. Support and care of relatives and patient, including procedures such as telephone calls, interviews, counselling; often the support and care of either relatives or patient allow staff to continue with other nursing activities	
a. Support and care of either relatives or patient requiring full dedication for about 1 h in any shift such as to explain clinical condition, dealing with pain and distress, and difficult family circumstances	4.0
b. Support and care of either relatives or patient requiring full dedication for 3 h or more in any shift, such as: death, demanding circumstances (e.g. large number of relatives, language problems, hostile relatives)	32.0
8. Administration and managerial tasks	
a. Performing routine tasks such as: processing of clinical data, ordering examinations, professional exchange of information (eg. ward rounds)	4.2
b. Performing administration and managerial tasks requiring full dedication for about 2 hours in any shift such as: research activities, protocols in use, admission and discharge procedures	23.2
c. Performing administrative and managerial tasks requiring full dedication for about 4 hrs or more of the time in any shift such as a death and organ donation procedures, co-ordination with other disciplines	30.0
Ventilatory support	
9. Respiratory support: any form of mechanical ventilation/assisted ventilation with or without PEEP, spontaneous breathing with or without PEEP, with or without endotracheal tube supplementary oxygen by any method	1.4
10. Care of artificial airways: endotracheal or tracheostomy cannula	1.8
11. Treatment for improving lung function: thorax physiotherapy, incentive spirometry, inhalation therapy, intratracheal suctioning	4.4
Cardiovascular support	
12. Vasoactive medication, disregard type and dose	1.2
13. Intravenous replacement of large fluid losses. Fluid administration >3 L/m/day	2.5
14. Left atrium monitoring: pulmonary artery catheter with or without cardiac output	1.7
15. Cardiopulmonary resuscitation after arrest, in past period of 24 h	7.1
Renal support	
16. Haemofiltration techniques, dialysis techniques	7.7

17. Quantitative urine output measurement (e.g, by indwelling catheter)	7.0
Neurological support	
18. Measurement of intracranial pressure	1.6
Metabolic support	
19. Treatment of complicated metabolic acidosis/alkalosis	1.3
20. Intravenous hyperalimentation	2.8
21. Enteral feeding through gastric tube or other gastrointestinal route	1.3
Specific interventions	
22. Specific intervention in the ICU: endotracheal intubation, insertion of pacemaker, cardioversion, endoscopies, emergency surgery in the previous 24 h, gastric lavage; routine interventions without direct consequences to the clinical condition of the patient (e.g. X-ray, ECG, echo, dressings, insertion of CVC or arterial catheters) are not included	2.8
23. Specific interventions outside the ICU; surgery or diagnostics procedures	1.9
Total nurse activities score	

Organ Failure Measurement Instruments

Instrument	Items/organ systems	Scoring/interpretation
OSF USA, 1985	Five organ systems: cardiovascular, respiratory, neurological, gastrointestinal, metabolic/renal	Presence of one abnormal physiological value indicates organ system failure.
ODIN Europe, 1993	Six organ systems: respiratory, renal, hepatic, cardiovascular, haematological, neurological, plus clinical evidence of infection	0–7; higher scores indicate higher mortality (0 = 3% mortality, 1 = 10%, 2 = 17%, 3 = 32%, 4 = 65%, 5 = 75.9%, 6 = 94%, 7 = 100%)
MODS Canada, 1995	Six organ systems: respiratory, renal, hepatic, cardiovascular, haematological, neurological; 0–4 points per variable	0–24; ICU mortality: 9–12 points = 25%; 13–16 = 50%; 17–20 = 75%
SOFA Europe, 1998	Six organ systems: respiration, coagulation, liver, cardiovascular, central nervous system, renal; 0–4 points per variable	0–24; variable rate of mortality for each organ; valid for daily assessment
MODS = multiple organ dysfunction syndromes; ODIN = organ dysfunction and/or infection; OSF = organ system failure; SOFA = sequential organ failure assessment.		

Fagon JY, Chastre J, Novara A, Medioni P, Gibert C. Characterization of intensive care unit patients using a model based on the presence or absence of organ dysfunctions and/or infection: the ODIN model. *Intensive Care Medicine* 1993; 19: 137–44.

Knaus WA, Draper EA, Wagner DP, Zimmerman JE. Prognosis in acute organ-system failure. *Annals of Surgery* 1985; 202: 685–93.

Marshall JC, Cook DJ, Christou NV, Bernard GR, Sprung CL, Sibbald WJ. Multiple organ dysfunction score: a reliable descriptor of a complex clinical outcome. *Critical Care Medicine* 1995; 23: 1638–52.

Vincent JL, de Mendonca A, Cantraine F, Moreno R, Takala J, Suter PM, et al. Use of the SOFA score to assess the incidence of organ dysfunction/failure in intensive care units: results of a multicenter, prospective study. *Critical Care Medicine* 1998; 26: 1793–800.

APPENDIX F

Data Collection Instruments:
NUM Questionnaire
SLN Questionnaire

The Intensive Care Skill Matching Study (ICSMS)

Data collection sheet for ICU Nurse Unit Manager (NUM)

*DISREGARD IF YOU HAVE ALREADY DONE THIS ON-LINE

(www.dmac.adelaide.edu.au/icsms)

Date of completion [/ / 2005] (from email) Username..............

1. How many ICU ventilator beds do you currently have **open**?

.... ICU Beds

2. How many **open non-ICU** (ie. HDU, CCU, CSurg) beds (within your ICU) are also staffed by ICU nurses?
.... non-ICU Beds

3. What was your **average** ICU only bed occupancy (%) over the past 6 months

[ ]<25% [ ] 25-49% [ ] 50-74% [ ] 75-89% [ ] 90-100% [ ]unsure

4. How may Full Time Equivalent Registered Nurses (FTE RNs) are currently employed in the ICU?

.........FTE RNs

5a. How many Full Time Equivalent Enrolled Nurses (FTE ENs) are currently employed in the ICU?

.........FTE ENs

5b. How may Full Time Equivalent Enrolled Nurses (FTE ENs), with **direct patient care responsibilities,** are currently employed in the ICU?
.... direct patient care FTE ENs

6a. What was the **total number of nursing hours** worked by all employed FTE nurses

(Not Agency) over the 2003/2004 financial year?

................nursing hrs

Comment (optional)...

7. What was your **total number of nursing hours** worked by AGENCY nurses over the 2003/2004 financial year?
....nursing hrs

Comment (optional)...

8. What percentage of the total ICU nurse staffing budget was spent on AGENCY nurses over the 2003/2004 financial year?
[ ] <5% [ ]5-9% [ ]10-14% [ ]15-24% [ ]25-34% [ ] 35-49% [ ] >50-70%

[ ] >70% [ ] Unsure

9. What is the current percentage of nurses with an ICU qualification (e.g. Crit Care Cert., Grad Diploma, Masters, Doctorate) in the ICU?
Tick only one

[ ] <25% [ ] 25-49% [ ] 50-75% [ ] >75% [ ] Unsure

10. How many nurses on your current roster make staffing decisions?............Nurses (i.e. shift leader nurses).

The Intensive Care Skill Matching Study (ICSMS)

Data collection sheet for ICU SHIFT LEADER NURSES*

(Do not complete if you have done so already via study website)

***For this study, a** Shift Leader Nurse **is defined as one who makes decisions regarding required nurse numbers and/or nurse to patient allocation decisions**

Date of completion / / 05 Username code..........................
(either staple code slip from study envelope, or write it)

1.What is your Registered Nurse Classification?
[ ] RN Level 1 [ ]RN Level 2 (CN, CNS, AUM, ANM, ACN) [ ] RN Level 3 (CNC / CM / NM /)
[ ] RN Level 4 (NUM)

2. What is your highest **ICU** qualification?
[ ] Crit Care Cert [ ] Grad Diploma [ ] Masters [ ] Doctorate [ ] N/A

3. How long is it since you completed your most recent ICU qualification? **...... years /......months**

4a. What is your date of birth? **...../...../.....**

4b. What is your gender? **[ ]M [ ]F**

5. How long have you been working in this ICU? **...... years /......months**

6. How long have you been required to act as a Shift Leader Nurse in this ICU? **...... years/... months**

7. On average, how many shifts per month are you in the role of Shift Leader Nurse? **.......shifts**

8a. On average, how many shifts per month in total do you work? **.......shifts**

8b. Which shift type do you **predominantly** work?
[ ] day shift short (e.g. 7-8hrs)
[ ] day shift long (e.g. 10-12 hrs)
[ ] night shift short (e.g. 7-8hrs)
[ ] night shift long (e.g.10-12 hrs)
[ ]rotating roster - mix day/night short
[ ] rotating roster - mix day/night long

9. Currently, in your ICU, who **predominantly** determines the 'required numbers of nurses' for the upcoming (new) nursing shift?
Tick only one
[ ] A Level 4 RN - Nurse Unit Manager (NUM)
[ ] A Level 3 RN - Clinical Nurse Consultant (CNC) / Clinical Manager (CM) / Nurse Manager (NM)
[ ] A Level 2 RN - Clinical Nurse (CN) / Associate Charge Nurse (ACN)
[ ] Team/Shift Leader - previous shift
[ ] Team/Shift Leader - new shift
[ ] No one individual
[ ] Unsure
[ ] Other: please state...............

10. Who do **you think** should **predominantly** determine the 'required number of nurses' for the upcoming (new) nursing shift?
Tick only one
[ ] A Level 4 RN - Nurse Unit Manager (NUM)
[ ] A Level 3 RN - Clinical Nurse Consultant (CNC) / Clinical Manager (CM) / Nurse Manager (NM)
[ ] A Level 2 RN - Clinical Nurse (CN) / Associate Charge Nurse (ACN)
[ ] Team/Shift Leader - previous shift
[ ] Team/Shift Leader - new shift
[ ] No one individual
[ ] Unsure
[ ] Other: please state...........

11. Currently in your ICU, who **predominantly**_determines the 'nurse to patient allocations ' for the upcoming (new) nursing shift?
Tick only one
[ ] A Level 4 RN - Nurse Unit Manager (NUM)
[ ] A Level 3 RN - Clinical Nurse Consultant (CNC) / Clinical Manager (CM) / Nurse Manager (NM)
[ ] A Level 2 RN - Clinical Nurse (CN) / Associate Charge Nurse (ACN)
[ ] Team/Shift Leader - previous shift
[ ] Team/Shift Leader - new shift
[ ] No one individual
[ ] Unsure
[ ] Other: please state...........

12. Who do you think should **predominantly** determine the 'nurse to patient allocations' for the upcoming (new) nursing shift?
Tick only one
[ ] A Level 4 RN - Nurse Unit Manager (NUM)
[ ] A Level 3 RN - Clinical Nurse Consultant (CNC) / Clinical Manager (CM) / Nurse Manager (NM)
[ ] A Level 2 RN - Clinical Nurse (CN) / Associate Charge Nurse (ACN)
[ ] Team/Shift Leader - previous shift
[ ] Team/Shift Leader - new shift
[ ] No one individual
[ ] Unsure
[ ] Other: please state..................

13a. As Shift Leader, which of the following do you take into account when assessing your available nursing skill **before** making 'nurse to patient allocation' decisions?
May tick more than one box
[ ] N/A - This is not my decision
[ ] ICU Qualifications
[ ] Years of ICU experience
[ ] Number of shifts previously worked in this ICU
[ ] My personal knowledge of their capability with therapies (e.g. ventilation, IABP, dialysis)
[ ] My peers opinion
[ ] By what the nurse says is within their capability
[ ] None of the above - I just use my personal judgement
[ ] Unsure
[ ] Other: please state ....

13b. What other, if any, information you would like prior to allocating nurses to patient care in ICU
....
....

14. All of the required nursing skill information is available prior to 'nurse to patient allocation' decisions?
[ ] Always [ ] Often [ ] Sometimes [ ] Rarely [ ] Never [ ] Unsure

15a. How do you calculate the 'required number of nurses' for the next shift?
May tick more than one
[ ] No particular system
[ ] Using personal judgement from experience
[ ] Using the ACCCN Position Statement on intensive care staffing guidelines
[ ] Using my own system please describe..............
[ ] Using preset formula/calculation based on the proprietary model ' Excelcare'
[ ] Using preset formula/calculation based on the proprietary model 'TISS'
[ ] Using a mandated hospital specific nurse dependency tool/protocol. Please describe
....
[ ] Using a mandated hospital specific protocol based on nursing ratios. Please describe.......
....
[ ] Using a mandated hospital specific protocol based on nursing hours. Please describe.......
....
[ ] I ask for help from my colleagues
[ ] Although I am Shift Leader Nurse, my manager does this
[ ] Although I am Shift Leader Nurse, my manager always checks this
[ ] Unsure
[ ] Other: please state.........

15b. Do you find your system (as answered above in Q15a) gives an accurate projection of required nurses?
[ ] Always [ ] Often [ ] Sometimes [ ] Rarely [ ] Never [ ] Unsure

16a. How do you decide 'nurse to patient allocations' ?
May tick more than one box
[ ] No particular system
[ ] Using my own system
[ ] Using personal judgement from experience
[ ] Using preset formula/calculation based on the proprietary model Excelcare
[ ] Using preset formula/calculation based on the proprietary model TISS
[ ] Using a mandated hospital specific nurse dependency tool/protocol.
Please describe...... ....
[ ] Using a mandated hospital specific protocol based on nursing ratios.
Please describe... ....
[ ] Using a mandated hospital specific protocol based on nursing hours.
Please describe...... ....
[ ] I just allocate one nurse to one patient
[ ] I ask for help from my colleagues
[ ] Usually allocate the most experienced nurse to the sickest patient
[ ] Usually allocate the least experienced nurses to the sickest patient (for education)
[ ] Depends whether other support staff are available (e.g. access / equipment nurses)
[ ] Unsure
[ ] Other: please state...........

16b. Do you find the system you use (as above in Q16a) gives adequate information to decide nurse to patient allocations' ?
[ ] Always [ ] Often [ ] Sometimes [ ] Rarely [ ] Never [ ] Unsure

17. When requesting agency staff for the ICU, do you specify any required skills?
[ ] Always [ ] Often [ ] Sometimes [ ] Rarely [ ] Never [ ] Unsure

18. What information do you usually request when an ICU agency nurse is ordered/booked?
May tick more than one box
[ ] N/A – I do not order/book agency nurses
[ ] Nothing specific - just ask for 'an ICU nurse'
[ ] Nothing specific - just take 'whoever the agency send'
[ ] Nothing specific - Just ask for either 'ventilator-competent' or non-vent comp' nurses as I need
[ ] ICU Qualifications
[ ] Classification (e.g. RN 1 year 3)
[ ] Number of years of ICU experience
[ ] Number of shifts previously worked specifically in your ICU
[ ] Specific expertise in certain therapies (e.g. ventilation, IABP, dialysis)
[ ] Specific preset criteria for your ICU (previously advised to agency)
[ ] Unsure
[ ] Other: *please state……*

19. In your experience, how often is a nurse sent to you by an Agency who meets the skill level criteria required by your ICU for that shift?
Tick only one
[ ] Always [ ] Often [ ] Sometimes [ ] Rarely [ ] Never [ ] Unsure

20. At the end of an agency nurse's *first ICU shift in your ICU*, do you provide the nurse with feedback or brief appraisal of their performance?
Tick only one
[ ] Always [ ] Often [ ] Sometimes [ ] Rarely [ ] Never [ ] Unsure

21a. List any problems who have encountered in your decisions re number of required nurses

………

21b. List any problems you have encountered in your decisions re nurse-to-patient allocation decisions

………

22. List your solutions to improve ICU nurse staffing allocation decision-making processes in your ICU

……………………………………………………………………………………………………

PLEASE PLACE DIRECTLY IN RETURN-ADDRESSED Pre-paid Express Post STUDY ENVELOPE PROVIDED.

Thank you for your time in completing this survey. Your ICU will be provided with a synopsis of the de-identified analysis of all responses. Data is collected by an independent data manager and hence the researcher is blinded to any participant identification.

APPENDIX G

Ethics Approval letter: De-identified Hospital

[redacted]

[redacted]

[redacted]

Ms [redacted], Acting Clinical Nurse Consultant of Intensive Care [redacted], suggested I write to you regarding The National Intensive Care Skill Matching Study (ICSMS) which is part of my PhD study at the Department of Clinical Nursing (DCN) in The University of Adelaide.

As you would be aware DCN has close ties both formally and informally with [redacted]. The ICSMS is the first national study aimed at understanding the complexities of nurse staffing decision-making in the ICU. The impact of staffing decisions has a direct relationship to risk management as you would be aware. We are inviting ICU managers and any shift leader nurses who make staffing decisions to participate.

The ICSMS data is totally de-identified with myself, as the researcher, blinded to both the participating ICUs and individuals identity. This is both to maintain study rigour and to protect the identity of all participants. To achieve this we have contracted an external data management group who will supply the raw data for analysis in a de-identified format.

I write to assure you that all data results and any associated publications will have no identifiers, but that the results may provide new knowledge to ICU managers across Australia about staffing practices. This phase will also inform the next step of this research which is to develop a collaboratively developed national model to match more effectively available nursing skill with ICU patient acuity.

The study has received full ethics approval from [redacted] have enclosed a copy of the 2 surveys, the participant information sheet, and the ethics approval letter.

If you require any further information please do not hesitate to contact Ms [redacted] or myself.

Yours sincerely

Ms Amanda Rischbieth

PhD Candidate

Mobile: 0417 200 883

cc. Ms [redacted]
cc. Dr. Helen McCutcheon

cc. [redacted]

APPENDIX H

Royal Adelaide Hospital Research and Ethics Committee Approval

The University Research and Advisory Higher Degrees Subcommittee

ROYAL ADELAIDE HOSPITAL
North Terrace
Adelaide
South Australia 5000

RESEARCH ETHICS COMMITTEE
Level 3, Hanson Institute
Telephone: (08) 8222 4139
Fax: (08) 8222 3035
email: tpietraf@mail.rah.sa.gov.au

10 June 2004

Ms A Rischbieth
PhD Candidate
DEPARTMENT OF CLINICAL NURSING
THE UNIVERSITY OF ADELAIDE
ROYAL ADELAIDE HOSPITAL

Dear Ms Rischbieth,

Re: "Development of a model for matching nursing skills with patient acuity in Intensive Care." RAH Protocol No: 040603.

I am writing to advise that ethical approval has been given to the above project. Please note that the approval is ethical only, and does not imply an approval for funding of the project.

Research Ethics Committee deliberations are guided by the Declaration of Helsinki and NH&MRC National Statement on Ethical Conduct in Research Involving Humans. Copies of these can be forwarded at your request.

Adequate record-keeping is important and you should retain at least the completed consent forms which relate to this project and a list of all those participating in the project, to enable contact with them if necessary, in the future. The Committee will seek a progress report on this project at regular intervals and would like a brief report upon its conclusion.

If the results of your project are to be published, an appropriate acknowledgment of the Hospital should be contained in the article.

Yours sincerely,

DR M JAMES
CHAIRMAN
RESEARCH ETHICS COMMITTEE

ADELAIDE UNIVERSITY
AUSTRALIA

DEPARTMENT OF CLINICAL NURSING
FACULTY OF HEALTH SCIENCES

Dr. David Evans
LECTURER

LEVEL 3, ELEANOR HARRALD BUILDING
ROYAL ADELAIDE HOSPITAL
ADELAIDE UNIVERSITY SA 5005
AUSTRALIA

TELEPHONE +61 8 8303 6288
FACSIMILE +61 8 8303 3594
d.evans@adelaide.edu.au

7th June 2004

Ms. Amanda Rischbieth
Department of Clinical Nursing
The University of Adelaide

Dear Amanda

I write regarding your research proposal titled 'Development of a model for matching nursing skills with patient acuity in intensive care' that was recently submitted to the Research and Higher Degrees Sub-committee.

Following the review of your proposal by two peer reviewers, the sub-committee supports the submission of your research proposal to the ethics committee.

Regards

Dr David Evans
Chair: Research and Higher Degree Sub-committee
Department of Clinical Nursing
The University of Adelaide

APPENDIX I

ANZICS Adult Patient Database data access approval

ANZICS Adult Patient Database

ABN: 81 057 619 986

Guidelines for Access to Information / Data from the ANZICS Adult Patient Database

The ANZICS Adult Patient Database (APD) is an ANZICS initiative used to benchmark Intensive Care outcome performance to ensure the highest standards of care for patients.

Applications for information should be made only on this form and addressed to the Director, APD. Please note that direct access to the information held by the APD is not possible. ANZICS Database Management Committee (ADMC) publication policy should be read in conjunction with these guidelines. (Available at www.anzics.com.au)

Guidelines for requesting information:
Requests for information must be lodged on the proscribed application form.

- A statement explaining reasons for requesting information must be included.
- A non-refundable processing fee of $22 (including GST) is payable upon lodgement of the application form for all non-ANZICS members. (Cheque payable to ANZICS).
- Consultancy fees are $250 per hour for all non-ANZICS members.
- Fees charged are based on resources and time required to process request. An estimate of costs and any variations will be given in writing. All fees and charges payable prior to processing of request. A tax invoice will be issued.

The APD reserves the right to refuse access if the purpose of the request is inconsistent with the aims of the APD or ANZICS policies.

Request for Information / Data from the ANZICS Adult Patient Database

Name:......Ms Amanda Rischbieth...........

Organisation:..........Wakefield Hospital and University of Adelaide...

Position/Title:...........Nursing Resource Manager and PhD Candidate

Address:.....10 St Margaret Drive

Aldgate...

Postcode:.....5154.. State:..........SA...

Telephone:...0417 200 883.. Fax:.........08 83420316

Email:....amanda.rischbieth@adelaide.edu.au

ANZICS member: No (Please circle)

Other applicants: ☐ Payment enclosed - $22 (includes GST - cheque payable to ANZICS)

Please charge $ 22 to the credit card nominated: ǐ Visa

Credit Card Number: 4564 [redacted]

Card Expiry Date: ......02/05................................. Signature: ....electronic submission

Name on credit card (please print clearly): ....

MRS A M Rischbieth

Nature of information sought from the database:

Data as listed below

---

1. List of all Level III ICUs in Australia (self reported)
2. Geographic location of Level III ICUs and demographic profile (i.e public, private, remote, rural, metropolitan (or capital city)
3. Available ICU beds in each Level III ICU

Tracey, please call me if you need further clarification as this is the first time I have formally accessed the database. Many thanks, Amanda 0417 200 883

Reason for requesting information: (ie research project, unit audit etc)

PhD Research project

Nature of research project and / or uses to which data will be put.

National Intensive Care Skill Matching Study (a Critical Care Workforce related study)

Will the data be used in a publication (Yes)

If yes the ANZICS Database Management Committee policy on publications should be followed. Any manuscript using the APD data should be presented to the Project Manager, APD before submission for publication. The full policy is available from the Executive Officer, ANZICS. The undertaking on the following page is required to be completed before a request can be considered.

UNDERTAKING:

I.........Amanda Rischbieth............ , undertake that I will use this data only for the reasons stated in the application above. I will not provide this data to any persons nor other parties (including hospital, government, commercial bodies) unless expressly detailed in the above application.

submitted electronically...................................... Date:..July 30 2004...................

.... Date:.........................

.... Date:.........................

Signed: (All applicants must sign) Signed copy sent by post

APPENDIX J

ICSMS Recruitment Flyers and Letters sent to all 58 ICUs

THE UNIVERSITY OF ADELAIDE AUSTRALIA

April 8 2005

Dear

As you may be aware we extended the ICSMS study until April 15.

Enclosed are hard copies of surveys for The National Intensive Care Skill Matching Study (ICSMS). Your expertise and that of your shift leader nurses (SLNs) [who may make staffing decisions] is vital to inform this first national study of this type.

Some of your SLNs may have completed a survey via the on-line website using the posted study code envelopes. (www.dmac.adelaide.edu.au/icsms).

If so, thank you.

The hard copy is for those SLNs who would still like to participate but may have difficulties with internet access.

- **1. COMPLETE THE NUM SURVEY YOURSELF**
- **2. PLEASE GIVE ONE SLN SURVEY TO EACH OF YOUR SLNs.**
- **3. DIRECT SLNS TO PLACE COMPLETED SURVEYS in the enclosed return –addressed Express envelope and post on April 15.**
  INCLUDE ANY OTHER SURVEYS PRINTED FROM EMAIL
- **4. CALL ME DIRECT IF ANY QUERIES**

All data is managed by an independent data management group and is all de-identified and to which I am blinded.

Essentially ICSMS involves all Australian Level 3 ICUs. Whilst there is substantive literature about 'ratios' and 'resource utilisation' e.g. 'nurse labour hours', there is negligible evidence of the different systems used in ICU by RNs to calculate nurse numbers, assess available skill, assess patient acuity, and decide patient allocation. There is also almost no evidence about how ICUs assess the skill sets of ICU agency nurses. Thank you for considering this research project. I greatly appreciate your assistance.

Kind regards

Amanda Rischbieth

0417 200 883 amanda.rischbieth@adelaide.edu.au

The National
Intensive Care Skill Matching Study

THE UNIVERSITY OF ADELAIDE AUSTRALIA

... and the Department of Clinical Nursing

ATTENTION ICU NURSES

Your expertise is vital for a national study of ICU staffing practices across all Level 3 ICUs.

Are you a shift/team leader nurse (SLN)? Does your shift role ever include deciding nursing staff numbers and/or nurse-to-patient care allocation?

As one of the front-line nurses, tell me your views on staffing decision-making.

A web-based on-line survey tool has been developed to make it easy for you to participate from any computer (work, home etc). Both your personal details and ICU name are de-identified so be assured it is anonymous.

***Ask your NUM/CM/CNC now for a blue study envelope with your personal code** (You can only receive one so keep it safe & destroy afterwards)

Get onto the net from any computer **between March 14-28** and go to: **http//www.dmac.adelaide.edu.au/icsms**

Login with your username and password and answer the survey questions. This should take around 10 minutes.

Call me on 0417 200 883 (24hrs) if you have any website or other queries.

Encourage your colleagues to participate because this is a unique opportunity to inform the first national picture of ICU staffing practices!

Thank you for being part of this national intensive care research project.

Amanda Rischbieth – PhD student, The University of Adelaide / Wakefield Hospital

THE UNIVERSITY OF ADELAIDE
AUSTRALIA

April 6 2005

Dear Shift Leader

This has been forwarded to you to invite you to participate in the *National Intensive Care Skill Matching Study* (ICSMS). Given website access may be difficult we are providing individual survey hard copies. If you have already done this survey on-line, thank you and please ignore this.

Your expertise as a senior nurse who makes staffing decisions, is vital to inform this first national study of this type.

Essentially ICSMS involves 58 Australian Level 3 ICUs. Whilst there is substantive literature about 'ratios' and 'resource utilisation' e.g. 'nurse labour hours', there is negligible evidence of the different systems used specifically in the ICU by RNs to calculate nurse numbers, assess available skill, assess patient acuity, and decide patient allocation. In addition, there is also almost no evidence about how ICUs assess the skill sets of ICU agency nurses.

All data is managed by an independent data management group and is all de-identified. Codes have been allocated to all participants to which I am blinded so be reassured it is totally anonymous.

This is part of my PhD work at The University of Adelaide. My interest in this research topic stems from my 10 years of experience as an ICU Manager at Wakefield Hospital. I am half way through a 3 year full-time PhD.

Please could you complete survey and return to your NUM (before April 18) to be sent back in the study return-addressed post express envelope.

Call me anytime if you have any queries.
Thank you for considering this research project. I greatly appreciate your assistance.

Kind regards

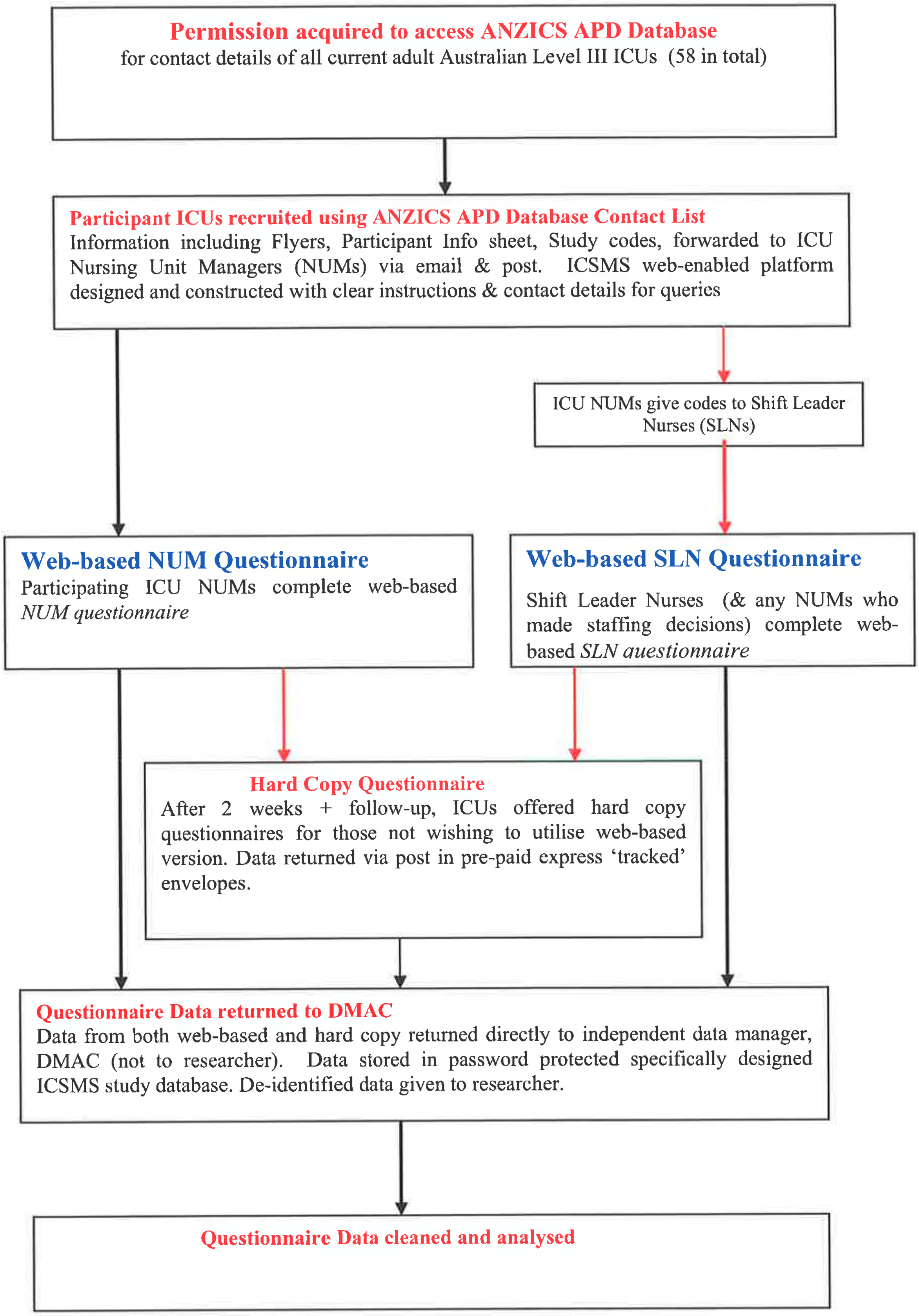
Amanda Rischbieth

0417 200 883 amanda.rischbieth@adelaide.edu.au

APPENDIX K

A Flow Chart of the Intensive Care Nursing Skill Matching Study (ICSMS)

National Intensive Care Skill Matching Study (ICSMS) Flow Chart



APPENDIX L

Coding records: 2 examples

UserLogi	UserPswd
794	hr6x4kh1
795	f2fkpi4a
796	658otyjs
797	5hjlfw72
798	mabq9cmk
799	luccv1at
800	3o5hyipl
801	4s8w486d
802	qdiu1tfb
803	86az49l3
804	hrlmhxi3
805	jjaasy7r
806	i4kw5wvr
807	ywc29daj
808	88noubxj
809	9lnpj1l6
810	zxds9daj
811	v8nzvpah
812	a9c2x3nw
813	8i8yixwf
814	eqhk2krn
815	vl9o5zw5
816	w7mdkzwh
817	bxcflez6

GENDERS	
GendNumb	GendName
1	Male
2	Female
3	Indeterminate
4	Unknown
9999	Not Available
HOW OFTEN	
HwOfNumb	HwOfDesc
1	Always
2	Often
3	Sometimes
4	Rarely
5	Never
6	Unsure
4444	Missing
5555	Other
6666	Unknown
7777	Not Required
8888	Not Defined
9999	Not Available
ICU QUALIFICATIONS	
ICUQNumb	ICUQDesc
1	Crit Care Cert
2	Grad Diploma
3	Masters
4	Doctorate
5	None
4444	Missing
5555	Other
6666	Unknown
7777	Not Required
8888	Not Defined
9999	Not Available
ORGANISATION	
ObjID	OTypDesc
9999	Not Available

8888	Not Defined
7777	Not Required
6666	Unknown
5555	Other
4444	Missing
10000	Public Hospital
10001	Private Hospital
PERCENTAGE SCALE	
PSclNumb	PSclName
1	<5%
2	<25%
3	5-9%
4	10-14%
5	15-24%
6	25-34%
7	25-49%
8	35-49%
9	50-70%
10	50-74%
11	50-75%
12	>70%
13	75-89%
14	>75%
15	90-100%
16	Unsure
4444	Missing
5555	Other
6666	Unknown
7777	Not Required
8888	Not Defined
9999	Not Available
PERSON TITLES	
TtleNumb	TtleName
1	NUM
2	NM
3	CM
4	CNC
5	CSM
6	ADON

7	CNM
8	CNS
9	SLN
4444	Missing
5555	Other
6666	Unknown
7777	Not Required
8888	Not Defined
9999	Not Available
REGISTERED NURSE CLASSIFICATIONS	
RNCnNumb	RNCnDesc
1	RN Level 1
2	RN Level 2
3	RN Level 3 (CNC/CM/NM)
4	RN Level 4 (NUM)
4444	Missing
5555	Other
6666	Unknown
7777	Not Required
8888	Not Defined
9999	Not Available
SHIFT TYPES	
STypNumb	STypDesc
1	Day Shift Short (eg. 7-8hrs)
2	Day Shift Long (eg. 10-12hrs)
3	Night Shift Short (eg. 7-8hrs)
4	Night Shift Long (eg. 10-12hrs)
5	Rotating Roster - Mix Day/Night Short
6	Rotating Roster - Mix Day/Night Long
4444	Missing
5555	Other
6666	Unknown
7777	Not Required
8888	Not Defined
9999	Not Available
STATES	
StTeNumb	StTeName
1	South Australia

2	Queensland
3	Victoria
4	New South Wales
5	Western Australia
6	Tasmania
7	Northern Territory
8	Australian Capital Territory
4444	Missing
5555	Other
6666	Unknown
7777	Not Required
8888	Not Defined
9999	Not Available
WHO DETERMINES	
WhDtNumb	WhDtDesc
1	A Level 4 RN – NUM
2	A Level 3 RN - CNC / CM / NM
3	A Level 2 RN - CN / CAN
4	Team/Shift Leader - Previous Shift
5	Team/Shift Leader - New Shift
6	No One Individual
7	Unsure
4444	Missing
5555	Other
6666	Unknown
7777	Not Required
8888	Not Defined
9999	Not Available
YES/NO	
YsNoNumb	YsNoDesc
1	Yes
2	No
3	Missing
9999	Not Available
10000	Not Sure

APPENDIX M

Regional Classification for Capital Cities, Metropolitan Centres and Rural

Modified Geographic Region Classification

1. Capital Cities

Australia: Sydney, Melbourne, Brisbane, Perth, Adelaide, Hobart, Darwin, Canberra

2. Metropolitan Centres

- *Urban centres with a population ≥ 100,000*

Australia: Gosford-Central Coast, Newcastle, Wollongong, Queanbeyan, Geelong, Gold Coast-Tweed Heads, Townsville-Thuringowa

3. Rural Centres

- **Rural centres with a population between 10,000 and 99,999.**

NSW: Albury-Wodonga, Armidale, Ballina, Bathurst, Broken Hill, Casino, Coffs Harbour, Dubbo, Lismore, Echuca-Moama, Forster-Tuncurry, Goulburn, Grafton, Griffith, Lithgow, Moree Plains, Muswellbrook, Nowra-Bombaderrry, Orange, Port Macquarie, Singleton, Tamworth, Taree, Wagga Wagga

VIC: Bairnsdale, Ballarat, Bendigo, Colac, Echuca-Moama, Horsham, Mildura, Moe-Yallourn, Morwell, Ocean Grove-Barwon Heads, Portland, Sale, Shepparton-Mooroopna, Traralgon, Wangaratta, Warrnambool

QLD: Bundaberg, Cairns, Caloundra, Gladstone, Gympie, Hervey Bay, Mackay, Maroochydore-Mooloolaba, Maryborough, Nambour, Rockhampton, Tewantin-Noosa, Toowoomba, Warwick

SA: Mount Gambier, Murray Bridge, Port Augusta, Port Lincoln, Port Pirie, Whyalla

WA: Albany, Bunbury, Geraldton, Mandurah

TAS: Burnie-Somerset, Devonport, Launceston

4. Remote Centres

Alice Springs, Mount Isa

Adapted from:

Department of Primary Industries and Energy and Department of Health and Family Services (1994) Rural, Remote and Metropolitan Areas Classification in Australian Institute of Health & Welfare (1999) *Medical Labour Force 1997*. AIHW catalogue No. HWL 13, AIHW, Canberra (p75).

APPENDIX N

Classification Codes for location, sector, ICU type, RRMA

Hostype

1 Public
2 Private

Geog

1 NSW
2 VIC
3 QLD
4 SA
5 WA
6 TAS
7 ACT
8 NT

ICUTYPE

1 General
2 ICU/CCU
3 Cardiothoracic
4 Paediatric
5 Other

RRMA

1 Capital City
2 Metro
3 Rural
4 remote
5 unknown

ARIA

1 highly accessible
2 accessible
3 moderately accessible
4 remote

ARIA+

1 > 250,000
2 48,000-249,999
3 18,000-47,999
4 5,000-17,999

APPENDIX O

Risk Analysis / Safety Assessment Code (SAC)

RISK ANALYSIS / SAFETY ASSESSMENT CODE (SAC) as/nz 4630:1999

Risk Score / Rating	Description of Likelihood
A Almost Certain	Is expected to occur again either immediately or within a short period of time (likely to occur most weeks or months)
B Likely	Will probably occur in most circumstanceseveral times a year)
C Possible	Probably will recur, might occur at some time (may happen every 1 to 2 years)
D Unlikely	Possibly will recur - could occur at some time in 2 to 5 years
E Rare	Unlikely to recur - may occur only in exceptional circumstances (may happen every 5 to 30 years)

ACTION REQUIRED
• SAC 1 = Extreme risk: immediate action required.
• SAC 2 = High risk: senior management attention required.
• SAC 3 = Moderate risk: management responsibility must be specified.
• SAC 4 = Low risk: manage by routine procedures.

CONSEQUENCE / LIKELIHOOD	5. Extreme	4. Major	3. Moderate	2. Minor	1. Insignificant
(A) Frequent (almost certain)	1	1	2	3	3
(B) Probable (likely)	1	1	2	3	3
(C) Occasional (possible)	1	2	2	3	4
(D) Uncommon (unlikely)	1	2	3	4	4
(E) Remote (rare)	2	3	3	4	4

RISK ANALYSIS / SAFETY ASSESSMENT CODE (SAC)

Risk score	Risk rating	Risk description	Description of impact / consequence			
			Financial	People	Political / Probity	Service/Program Delivery
		Generic impact description	**Revenue loss** **Cost increases** **Financial or Budget Liability**	**Security incident** **OH&S effect** **Reduced performance** **Key people / Resources unavailable**	**Adverse press** **Ministerial fallout** **Reputation damage** **Legal repercussions**	**Clients not served** **Operations interrupted Assets / Infrastructure unusable** **Info Systems out**
5	Extreme	**Disaster with potential to lead to business failure.**	Huge financial loss. Significant over expenditure of Hospital budget and output level. No capacity to adjust budget to seek additional funding. Funds completely used up due to misappropriation or mismanagement	Multiple staff / patients or public affected - debilitating injuries and fatalities or widespread medical attention required. *Loss of a significant number of key management level staff impacting on skills, knowledge, and expertise.* *Major industrial strike action.* Severe staff morale problems.	Concentrated public and political interest and major loss of public, Government or Community support. Parliamentary inquiry or Medical Board commissioned and union involvement.	Major detrimental effects on clients / patients and Hospital. Consequences would threaten survival of the Hospital. Long-term sustained loss of production capability.
4	Major	**Critical event which will be endured with proper management.**	Major financial loss. Significant overrun of Hospital budget. CEO and management response requires significant additional funding, or termination or reduction of other initiatives.	Extensive effects, injuries, hospitalisation or single fatality. Loss of some key staff resulting in skills, knowledge, and expertise deficits. Severe morale or other organisational problems affecting performance and productivity.	Short-term public and political interest. Consistent state-media attention, major internal inquiry and some union resistance.	Loss of production capability. Consequences would threaten survival or continued effective function of the Hospital. Requires Board of Management or even ministerial intervention.
3	Moderate	**Significant event which can be managed undenormal circumstances.**	Significant financial loss. The impact can be overcome with some redistribution of existing budget.	Significant effects needing management action, medical treatment but no fatalities. Short-term skills, knowledge, expertise deficits.	Isolated public interest. Some media interest and/or industry complaints, small internal inquiry.	Consequences could mean that the Hospital is subject to a significant performance review or changed way of operating. Senior management involvement.
2	Minor	**Event with consequences which can be readily absorbed but requires management effort to minimise the impact.**	Some financial loss contained within Hospital. Minor over expenditure requiring monitoring and corrective action within existing budget.	Minor effects & injuries but no fatalities. Health impact or probability leads to lost time or potential of public liability claim. Little skills deficit.	Local issue, isolated concerns raised by interest groups with little media interest.	Consequences effect efficiency or effectiveness of the program. Managed internally
1	Insignificant	**Not worth worrying about. Existing controls and procedures will cope with event.**	Little or no financial loss.	No injuries or fatalities, little support action required. No skills or knowledge loss occurring.	No investigation required, Minimal to no effect on public or Government reputation	Affect only a small aspect of service delivery. Negligible program impacts dealt with by routine operations

APPENDIX P

Codes created for each question to facilitate data spreadsheet management

The Intensive Care Skill Matching Study (ICSMS)
[data codes from Excel spreadsheet in red]
Data collection sheet for ICU SHIFT LEADER NURSES*
(Do not complete if you have de so already via study website)

***For this study, a** Shift Leader Nurse **is defined as one who makes decisions regarding required nurse numbers and/or nurse to patient allocation decisions**

Date of completion / / 05 Username code............................
(either staple code slip from study envelope, or write it)

1.What is your Registered Nurse Classification?
[ ] RN Level 1 [ ]RN Level 2 (CN, CNS, AUM, ANM, ACN) [ ] RN Level 3 (CNC / CM / NM /)
[ ] RN Level 4 (NUM)
D SLNDRNCn

2. What is your highest **ICU** qualification?
[ ] Crit Care Cert [ ] Grad Diploma [ ] Masters [ ] Doctorate [ ] N/A
E SLNDICUQ

3. How long is it since you completed your most recent ICU qualification? **...... years /......months**
F SLNDCQuY **G SLNDCQuM**

4a. What is your date of birth? **...../...../.....** **H SLNDDOfB**

4b. What is your gender? **[ ]M [ ]F** **I SLNDGend**

5. How long have you been working in this ICU? **...... years /......months**
J SLNDWrkY **K SLNDWrkM**

6. How long have you been required to act as a Shift Leader Nurse in this ICU? **...... years/... months**
L SLNDSLNY **M SLNDSLNM**

7. On average, how many shiftsper month are you in the role of Shift Leader Nurse? **.......shifts**
N SLNDSPMR

8a. On average, how many shifts per month in total do you work?
.......shifts
O SLNDSPMW

8b. Which shift type do you **predominantly** work? **P SLNDSTyp**
[ ] day shift short (e.g. 7-8hrs)
[ ] day shift long (e.g. 10-12 hrs)
[ ] night shift short (e.g. 7-8hrs)
[ ] night shift long (e.g.10-12 hrs)
[ ]rotating roster - mix day/night short
[ ] rotating roster - mix day/night long

9. Currently, in your ICU, who **predominantly** determines the 'required numbers of nurses' for the upcoming (new) nursing shift? Q SLNDWDRN

Tick only one

[ ] A Level 4 RN - Nurse Unit Manager (NUM)
[ ] A Level 3 RN - Clinical Nurse Consultant (CNC) / Clinical Manager (CM) / Nurse Manager (NM)
[ ] A Level 2 RN - Clinical Nurse (CN) / Associate Charge Nurse (ACN)
[ ] Team/Shift Leader - previous shift
[ ] Team/Shift Leader - new shift
[ ] No one individual
[ ] Unsure
[ ] Other: please state...............R SLNDDRNO

10. Who do **you think** should **predominantly** determine the 'required number of nurses' for the upcoming (new) nursing shift? S SLNDWSRN

Tick only one

[ ] A Level 4 RN - Nurse Unit Manager (NUM)
[ ] A Level 3 RN - Clinical Nurse Consultant (CNC) / Clinical Manager (CM) / Nurse Manager (NM)
[ ] A Level 2 RN - Clinical Nurse (CN) / Associate Charge Nurse (ACN)
[ ] Team/Shift Leader - previous shift
[ ] Team/Shift Leader - new shift
[ ] No one individual
[ ] Unsure
[ ] Other: please state............T SLNDSRNO

11. Currently in your ICU, who **predominantly** determines the 'nurse to patient allocations ' for the upcoming (new) nursing shift? U SLNDWDNP

Tick only one

[ ] A Level 4 RN - Nurse Unit Manager (NUM)
[ ] A Level 3 RN - Clinical Nurse Consultant (CNC) / Clinical Manager (CM) / Nurse Manager (NM)
[ ] A Level 2 RN - Clinical Nurse (CN) / Associate Charge Nurse (ACN)
[ ] Team/Shift Leader - previous shift
[ ] Team/Shift Leader - new shift
[ ] No one individual
[ ] Unsure
[ ] Other: please state............V SLNDDNPO

12. Who do you think should **predominantly** determine the 'nurse to patient allocations' for the upcoming (new) nursing shift? W SLNDWSNP

Tick only one

[ ] A Level 4 RN - Nurse Unit Manager (NUM)
[ ] A Level 3 RN - Clinical Nurse Consultant (CNC) / Clinical Manager (CM) / Nurse Manager (NM)
[ ] A Level 2 RN - Clinical Nurse (CN) / Associate Charge Nurse (ACN)
[ ] Team/Shift Leader - previous shift
[ ] Team/Shift Leader - new shift
[ ] No one individual
[ ] Unsure
[ ] Other: please state...................X SLNDSNPO

13a. As Shift Leader, which of the following do you take into account when assessing your available nursing skill **before** making 'nurse to patient allocation' decisions?
May tick more than one box
[ ] N/A - This is not my decision Y SLNDASNA
[ ] ICU Qualifications Z SLNDASIQ
[ ] Years of ICU experience AA SLNDASYE
[ ] Number of shifts previously worked in this ICU AB SLNDASNS
[ ] My personal knowledge of their capability with therapies (e.g. ventilation, IABP, dialysis) AC SLNDASPK
[ ] My peers opinion AD SLNDASPO
[ ] By what the nurse says is within their capability AE SLNDASSC
[ ] None of the above - I just use my personal judgement AF SLNDASPJ
[ ] Unsure AG SLNDASUn
[ ] Other: AH SLNDASOt please state .... AI SLNDSOtT

13b. What other, if any, information you would like prior to allocating nurses to patient care in ICU
AJ SLNDASOI
....
....
14. All of the required nursing skill information is available prior to 'nurse to patient allocation' decisions?
[ ] Always [ ] Often [ ] Sometimes [ ] Rarely [ ] Never [ ] Unsure
AK SLNDNSHO

15a. How do <u>you</u> calculate the 'required number of nurses' for the next shift?
May tick more than one
[ ] No particular system AL SLNDCNNS
[ ] Using personal judgement from experience AM SLNDCNPJ
[ ] Using the ACCCN Position Statement on intensive care staffing guidelines AN SLNDCNPS
[ ] Using my own system AO SLNDCNOS please describe...............AP SLNDCOST
[ ] Using preset formula/calculation based on the proprietary model ' Excelcare' AQ SLNDCNME
[ ] Using preset formula/calculation based on the proprietary model 'TISS' AR SLNDCNMT
[ ] Using a mandated hospital specific nurse dependency tool/protocol. Please describe AS SLNDCNDT.. AT SLNDCDTD
[ ] Using a mandated hospital specific protocol based on nursing ratios. Please describe.......
AU SLNDCNNR...AV SLNDCNRD
[ ] Using a mandated hospital specific protocol based on nursing hours. Please describe.......
AW SLNDCNNH...AX SLNDCNHD
[ ] I ask for help from my colleagues AY SLNDCNHC
[ ] Although I am Shift Leader Nurse, my manager does **this** AZ SLNDCNMg
[ ] Although I am Shift Leader Nurse, my manager always checks this BA SLNDCNMC
[ ] Unsure BB SLNDCNUn

[ ] Other: BC SLNDCNOt please state.........BD SLNDNOtT

15b. Do you find your system (as answered above in Q15a) gives an accurate projection of required nurses? BE SLNDCNHO
[ ] Always [ ] Often [ ] Sometimes [ ] Rarely [ ] Never [ ] Unsure

16a. How do you decide 'nurse to patient allocations' ?
May tick more than one box
[ ] No particular system BF SLNDNPNS
[ ] Using my own system BG SLNDNPOS
[ ] Using personal judgement from experience BH SLNDNPPJ
[ ] Using preset formula/calculation based on the proprietary model Excelcare
BI SLNDNPME
[ ] Using preset formula/calculation based on the proprietary model TISS
BJ SLNDNPMT
[ ] Using a mandated hospital specific nurse dependency tool/protocol.
BK SLNDNPDT
Please describe......BL SLNDNDTD..
[ ] Using a mandated hospital specific protocol based on nursing ratios.
BM SLNDNPNR
Please describe...
BN SLNDNNRD..
[ ] Using a mandated hospital specific protocol based on nursing hours.
BO SLNDNPNH
Please describe......BP SLNDNNHD...
[ ] I just allocate one nurse to one patient BQ SLNDNPNP
[ ] I ask for help from my colleagues BR SLNDNPHC
[ ] Usually allocate the most experienced nurse to the sickest patient
BS SLNDNPES
[ ] Usually allocate the least experienced nurses to the sickest patient (for education) BT SLNDNPEE
[ ] Depends whether other support staff are available (e.g. access / equipment nurses)
BU SLNDNPSA
[ ] Unsure BV SLNDNPUn
[ ] Other: BW SLNDNPOt please state...........BX SLNDPOtT

16b. Do you find the system you use (as above in Q16a) gives adequate information to decide nurse to patient allocations? BY SLNDNPHO
[ ] Always [ ] Often [ ] Sometimes [ ] Rarely [ ] Never [ ] Unsure

17. When requesting agency staff for the ICU, do you specify any required skills?
BZ SLNDRAHO
[ ] Always [ ] Often [ ] Sometimes [ ] Rarely [ ] Never [ ] Unsure

18. What information do you usually request when an ICU agency nurse is ordered/booked?
May tick more than one box
[ ] N/A – I do not order/book agency nurses CA SLNDIRNA
[ ] Nothing specific - just ask for 'an ICU nurse' CB SLNDIRIN

[ ] Nothing specific - just take 'whoever the agency send' CC SLNDIRWS
[ ] Nothing specific - Just ask for either 'ventilator-competent' or non-vent comp' nurses as I need
CD SLNDIRVC
[ ] ICU Qualifications CE SLNDIRIQ
[ ] Classification (e.g. RN 1 year 3) CF SLNDIRCn
[ ] Number of years of ICU experience CG SLNDIRYE
[ ] Number of shifts previously worked specifically in your ICU CH SLNDIRSW
[ ] Specific expertise in certain therapies (e.g. ventilation, IABP, dialysis) CI SLNDIRET
[ ] Specific preset criteria for your ICU (previously advised to agency) CJ SLNDIRPC
[ ] Unsure CK SLNDIRUn
[ ] Other: CL SLNDIROt please state……CM SLNDROtT

19. In your experience, how often is a nurse sent to you by an Agency who meets the skill level criteria required by your ICU for that shift?
Tick only one CN SLNDNAHO
[ ] Always [ ] Often [ ] Sometimes [ ] Rarely [ ] Never [ ] Unsure

20. At the end of an agency nurse's first ICU shift in your ICU, do you provide the nurse with feedback or brief appraisal of their performance?
Tick only one CO SLNDNFHO
[ ] Always [ ] Often [ ] Sometimes [ ] Rarely [ ] Never [ ] Unsure

21a. List any problems who have encountered in your decisions re number of required nurses
CP SLNDLPRN

……………………………………………………………………………………………………

21b. List any problems you have encountered in your decisions re nurse-to-patient allocation decisions
CQ SLNDLPAD

……………………………………………………………………………………………………

22. List your solutions to improve ICU nurse staffing allocation decision-making processes in your ICU
CR SLNDLSII
……………………………………………………………………………………………

APPENDIX Q

ICSMS Participant Coding System

Label sheet with random computer generated codes

Sample colour card sheet where codes were printed

De-identified codes used by data manager

Use For : Business Cards , Name Tags , Punch Cards , Gift Cards , Prize Drawings

Acid Free/ Lignin Free

For best results, fold back-and-forth along perforation
Pour des meilleures résultats, pliez en va-et-vient le long des perforations en pointillé
Am besten entlang der Perforation hin- und herfalten
Para mejores resultados, doble de un lado a otro a lo largo de la línea perforada

Business Cards:Allegro

www.geographics.com

Intensive Care Skill Matching Study
http://www.dmac.adelaide.edu.au/icsms
Username: **0001**
Password: **r2h8evrb**
Thank you for participating.
Any queries... Amanda - 0417 200 883

Intensive Care Skill Matching Study
http://www.dmac.adelaide.edu.au/icsms
Username: **0002**
Password: **8v9cjbw3**
Thank you for participating.
Any queries... Amanda - 0417 200 883

Intensive Care Skill Matching Study
http://www.dmac.adelaide.edu.au/icsms
Username: **0003**
Password: **658otxjs**
Thank you for participating.
Any queries... Amanda - 0417 200 883

Intensive Care Skill Matching Study
http://www.dmac.adelaide.edu.au/icsms
Username: **0004**
Password: **5fjlew62**
Thank you for participating.
Any queries... Amanda - 0417 200 883

Intensive Care Skill Matching Study
http://www.dmac.adelaide.edu.au/icsms
Username: **0005**
Password: **m9bp9cmk**
Thank you for participating.
Any queries... Amanda - 0417 200 883

Intensive Care Skill Matching Study
http://www.dmac.adelaide.edu.au/icsms
Username: **0006**
Password: **luccu19t**
Thank you for participating.
Any queries... Amanda - 0417 200 883

Intensive Care Skill Matching Study
http://www.dmac.adelaide.edu.au/icsms
Username: **0007**
Password: **zm2ewemj**
Thank you for participating.
Any queries... Amanda - 0417 200 883

Intensive Care Skill Matching Study
http://www.dmac.adelaide.edu.au/icsms
Username: **0008**
Password: **aye4becl**
Thank you for participating.
Any queries... Amanda - 0417 200 883

Intensive Care Skill Matching Study
http://www.dmac.adelaide.edu.au/icsms
Username: **0009**
Password: **pz56ctp9**
Thank you for participating.
Any queries... Amanda - 0417 200 883

Intensive Care Skill Matching Study
http://www.dmac.adelaide.edu.au/icsms
Username: **0010**
Password: **a9c37co6**
Thank you for participating.
Any queries... Amanda - 0417 200 883

APPENDIX R

Best Practice Australia Pty Ltd

Types of Organisational Culture

NOTE:

Appendix R is included in the print copy of the thesis held in the University of Adelaide Library.

REFERENCES

1. Australian College of Critical Care Nurses. Position statement on the use of non-registered nurses and unlicensed personnel in intensive care: ACCCN; 2003.
2. The World Federation of Intensive and Critical Care Nurses. Position statement on the provision of critical care nursing workforce - draft: WFICCN; 2004 July 2004.
3. Australian College of Critical Care Nurses. Position statement on intensive care staffing. Melbourne: ACCCN; 2001.
4. British Association of Critical Care Nurses. Position statement on nurse-patient ratios in critical care: BACCN; 2001.
5. Edbrooke D, Hibbert C, Ridley S, Long T, Dickie H. The development of a method for comparative costing of individual intensive care units. Anaesthesia 1999;54(2):110-120.
6. Aiken LH, Clarke SP, Sloane DM, Sochalski J, Silber JH. Hospital nurse staffing and patient mortality, nurse burnout, and job dissatisfaction. Journal of American Medical Association 2002;288(16):1987-1993.
7. Anderson J, Fennessy P, Fennessy G, Schattner R, Burrows E. Picking winners: Assessing new health technology. Medical Journal of Australia 1999;117:557-559.
8. Pelletier D, Duffield C, Mitten-Lewis S, Nagy S, Crisp J. Australian nurses and device use: The ideal and the real in clinical practice. Australian Critical Care 1998;11(1):10-14.
9. Hurst K. Selecting and applying methods for estimating the size and mix of nursing teams. Leeds: Nuffield Institute for Health, Leeds University; 2003.
10. Yang KP. Relationships between nurse staffing and patient outcomes. Journal of Nursing Research 2003;11(3):149-158.
11. Whiteman GR, Kim Y, Davidson LJ, Wolf GA, Wang SL. Measuring nurse-sensitive patient outcomes across specialty units. Outcomes Managent 2002;6(4):152-158.
12. The Australian Council on Healthcare Standards. Trends in quality of care: Results of the ACHS Clinical Indicators 1998-2000 Version 1. Newcastle: ACHS; 2001.
13. Standards Association of Australia. Australian/New Zealand standard: Risk management as/nzs 4360:1999. Strathfield: Standards Association of Australia; 1999.

14. Hargreaves J. Reporting of adverse events in routinely collected data sets in Australia. Canberra: Australian Institute of Health and Welfare (Health Division Working Paper No. 3); 2001.
15. Duckert SJ. Casemix funding for acute hospital inpatient services in Australia. Medical Journal of Australia 1998;169(Supplement):S17-21.
16. Australian Health Workforce Advisory Committee. The critical care nurse workforce in Australia 2001-2011. Sydney: AHWAC 2002.1; 2002.
17. Australian Health Workforce Advisory Committee. Annual report 2002-03. Sydney: AHWAC; 2003.
18. Angus DC, Kelly MA. Current and projected workforce requirements for the care of the critically ill patient and patients with pulmonary disease; can we meet the requirements of an aging population. Journal of American Medical Association 2000;284:2762-2770.
19. Harrison DA, Brady AR, Rowan K. Case mix, outcome and length of stay for admissions to adult general critical care units in England, Wales and Northern Ireland: The intensive care national audit & research centre case mix programme database. Critical Care Medicine 2004;8:R99–R111.
20. Carmel S, Rowan K. Variation in intensive care unit outcomes, a search for the evidence on organisational factors. Current Opinion in Critical Care 2001;4(284-296).
21. Nelson EC, Batalden PB. Microsystems in health care: Part 1. Learning from high-performing front-line clinical units. Joint Comm J Qual Safety 2002;28(9):472-493.
22. Clarke T, Mackinnon E, England K, Burr G, Fowler S, Fairservice L. A review of intensive care nurse staffing practices overseas: What lessons for Australia? Australian Critical Care 1999;12(3):109-118.
23. Taylor C, Ogle R, Oliverii D, English R, Dennis M. Taking on the student role: How can we improve the experience of registered nurses returning to study. Australian Critical Care 1999;12(3):98-102.
24. Considine G, Buchanan J. The hidden costs of understaffing: An analysis of contemporary nurses' working conditions in Victoria. Sydney: Australian Centre for Industrial Relations Research and Training University of Sydney; 1999.
25. Cook D, Brower R, Cooper J. Multicenter clinical research in adult critical care. Critical Care Medicine 2002;30:1636-1643.

26. Ball C, McElligot M. Realising the potential of critical care nurses: An exploratory study of the factors that affect and comprise the nursing contribution to the recovery of critically ill patients. Intensive Crit Care Nurs 2003;19:226-238.
27. Duffield C, Moran P, Beutel J, Bunt S, Thornton A, Wills J. Profile of first-line nurse managers in New South Wales, Australia, in the 1990s. Journal of Advnaced Nursing 2001;36(6):785-793.
28. Volpatti C, Leathley M, Walley KR, Dodek PM. Time-weighted nursing demand is a better predictor than midnight census of nursing supply in an intensive care unit. Journal of Critical Care 2000;15(4):147-150.
29. MERIT study investigators. Introduction of the medical emergency team (MET) system: A cluster-randomised controlled trial. The Lancet 2005;365(9477):2091-2097.
30. Aiken LH, Clarke SP, Sloane DM, Sochalski JA. An international perspective on hospital nurses' work environments: The case for reform. Policy Politics Nursing Practice 2001;2(4):255-263.
31. Australian Institute of Health and Welfare. Australia's health 2000: The seventh biennial report of the Australian Institute of Health and Welfare. Canberra: AIHW; 2000 2000.
32. Australian Institute of Health and Welfare. Nursing and midwifery labour force 2003 Canberra: AIHW (Health Labour Force Series no. 31); 2005.
33. Tierney AJ. What's the scoop on the nursing shortage? Journal of Advanced Nursing 2003;43(4):325-326.
34. Australian Institute of Health and Welfare. Nursing labour force 2001. Canberra; 2003.
35. Australian Institute of Health and Welfare. Health and community services labour force. 2001. National health labour force series no.27. Canberra: AIHW; 2003.
36. Australian Institute of Health and Welfare. Nursing labour force Victoria 2003; 2004.
37. Crickmore R. A review of stress in the intensive care unit. Intensive Care Nursing 1987(3):19-27.
38. ANZICS Adult Patient Database Management Committee. Icon 2.1 Database Manual; 1993.
39. Department of Health. Comprehensive critical care. A review of adult critical care services. London: Department of Health; 2000a.

40. Kendig H. Task force report. The ageing of Australian society: Economic fiscal and societal implications. Canberra; 2004.
41. Zimmerman P. The use of unlicensed assistive personnel: An update and skeptical look at a role that may present more problems than solutions. Journal of Emergency Nursing 2000;26(4):312-317.
42. Buchan J, Calman L. The global shortage of registered nurses: An overview of issues and actions. Geneva: International Council of Nurses; 2004.
43. Zimmerman P. Replacement of nurses with unlicensed assistive personnel:The erosion of professional nursing and what we can do. Journal of Emergency Nursing 1995;21(3):208-212.
44. Janiszewski Goodin H. The nursing shortage in the united states of america: An integrative review of the literature. Journal of Advanced Nursing 2003;43(4):335-343.
45. De Raeve P. Commentary: A European perspective. Journal of Advanced Nursing 2003;43(4):348-350.
46. Wickett D, McCutcheon M, Long L. Integrative literature reviews and meta-analysis commentary: An Australian perspective. Journal of Advanced Nursing 2003;43(343).
47. Pacquiao DF. Editorial: Foreign nurse recruitment and workforce diversity. J Transcult Nurs 2002;13(2):89-.
48. Seago JA, Ash M, Spetz J, Coffman J, Grumbach K. Hospital registered nurse shortages: Environmental, patient, and institutional predictors. Health Serv Res 2001;36(5):831-852.
49. Diehl-Oplinger L, Kaminski MF. Need critical care nurses? Inquire within. Nursing Management 2000;31(3):44.
50. Australian Institute of Health and Welfare. National health dictionary, version 10 aihw catalogue no. HW130. Canberra: AIHW; 2001.
51. Williams G. Nursing labour force in poor shape. Critical Times 1999;2(1):5.
52. Beckmann U, Baldwin I. Problems associated with nursing staff shortage: An analysis of the first 3600 incident reports submitted to the Australian Incident Monitoring Study (AIMS-ICU). Anaesth Intensive Care 1998;26:396-400.
53. World Congress of Critical Care Medicine. Declaration of Madrid in the preparation of critical care nurses. Australian Critical Care 1993;6(2):24.

54. Australian Council on Health Care Standards. Guidelines for intensive care units. Sydney: ACHS; 1997.
55. Morrison A, Beckmann U, Durie M, Carless R, Gillies D. The effects of nursing staff inexperience (NSI) on the occurrence of adverse patient experiences in ICUs. Australian Critical Care 2001;14(3):116-121.
56. Devine E, Cook T. A meta-analysis of effects of psychoeducational interventions on length of postsurgical hospital stay. Nursing Research 1993;32:267-274.
57. Prescott PA. Nursing: An important component of hospital survival under a reformed health care system. Nursing Economics 1993;11:192-199.
58. Al-Haider A, Wan T. Modelling organizantional determinants of hospital mortality. Health Services Research 1991;26(3):303-323.
59. Donovan M, Lewis G. Increasing productivity and decreasing costs: The value of RNs. Journal of Nursing Administration 1987;17(9):16-18.
60. Helt E, Jelinek R. In the wake of cost cutting, nursing productivity and quality improve. Nursing Management 1998;19(6):36-48.
61. Tourangeau AE. Developing risk-adjusted 30-day hospital mortality rates. Research in Nursing Health 2003;26(6):483-496.
62. Blegen MA, Goode CJ, Reed L. Nurse staffing and patient outcomes. Nursing Research 1998;47(1):43-50.
63. Aiken LH, Smith HL, Lake ET. Lower medicare mortality among a set of hospitals known for good nursing care. Med care 1994;32(8):771-787.
64. Scott J, Sochalski J, Aiken L. Review of magnet hospital research: Findings and implications for professional nursing practice. Journal of Nursing Administration 1999;29(1):9-19.
65. Aiken LH, Clarke SP, Sloane DM. Hospital staffing, organization, and quality of care: Cross-national findings. Nursing Outlook 2002;50(5):187-194.
66. Schein E. Organisational culture and leadership. San Francisco, USA: Jossey-Bass; 1992.
67. Simmons JC. Focusing on quality and change in intensive care units. Qual Lett Healthc Lead 2002;14(10):2-11.
68. Cho SH, Ketefian S, Barkauskas VH, Smith DG. The effects of nurse staffing on adverse events, morbidity, mortality, and medical costs. Nurs Res 2003;52(2):71-79.

69. Pronovost P, Holzmueller C. Partnering for quality. Journal of Critical Care 2004;19(3):121-129.
70. McGillis Hall L. Nursing staff mix models and outcomes. Journal of Advanced Nursing 2003;44(2):217-226.
71. Bratt MM, Broome M. Influence of stress and nursing leadership on job satisfaction of pediatric intensive care unit nurses. American Journal of Critical Care 2000;9(5):307-17.
72. Ball C. Patient:Nurse ratios in critical care - time for some radical thinking. Intensive Crit Care Nurs 2001a;17:125-127.
73. Whitman GR, Kim Y, Davidson LJ, Wolf GA, Wang SL. The impact of staffing on patient outcomes across specialty units. J Nurs Adm 2002;32(12):633-639.
74. Audit Commission. Critical to success, the place of efficient and effective critical care services within the acute hospital. London: Audit Commission; 1999.
75. Royal College of Nursing. Guidance for nurse staffing in critical care. London: Royal College of Nursing; 2003.
76. Department of Health. 2000b department of health, the NHS plan: A plan for investment. A plan for reform. London: Stationery Office; 2000.
77. Dent TH. From guidance to practice: Why nice is not enough. British Medical Journal 2002;324:842-845.
78. Smith R. Measuring the social impact of research. BMJ 2001;323:528.
79. Kennedy I. Learning from Bristol: The report of the public inquiry into children's heart surgery at the Bristol Royal Infirmary 1984–1995. The Stationery Office. Command paper: Cm 5207. Norwich: Bristol Inquiry Unit; 2001.
80. Needham K, Harris D, Kendrick T, Longabardi M, Creegan R. Intensive care nursing workforce report - NSW action plan for health, intensive care implementation group, draft report february. Sydney: NSW Department of Health; 2001.
81. Lookinland S, Crenshaw J. Rewarding clinical competence in the ICU: Using outcomes to reward performance. Dimensions of Critical Care Nursing 1996;15(4):206-215.
82. Benner P. From novice to expert: Excellence and power in clinical nursing practice. New York: Addison Wesley Publishing; 1984.
83. Dreyfus HL, Dreyfus S. Mind over machine: The power of human intuition and expertise in the era of the computer. Oxford: Blackwell Science; 1986.

84. Benner P, Tanner C, Chesla C. Expertise in nursing practice. Caring, clinical judgment, and ethics. New York: Springer Publishing; 1996.

85. Benner P, Tanner C. How expert nurses use intuition. American Journal of Nursing 1987;81(1):23-31.

86. Pyles S, Stern P. Discovery of nursing gestalt in critical care nursing the importance of the gray gorilla syndrome. Image J Nurs Scholarsh 1983;15(2):51-58.

87. Radwin L. Knowing the patient: A process model for individualised interventions. Nursing Research 1995;44(6):364-370.

88. Rolfe G. Closing the theory–practice gap: A model of nursing praxis. Journal of Clinical Nursing 1996;2:173-177.

89. McCutcheon HH, Pincombe J. Intution: An important tool in the practice of nursing. Journal Advanced Nursing 2001;35(5):342-348.

90. Dowding D, Thompson C. Using judgement to improve accuracy in decision-making. Nursing Times 2004;100(22):42-44.

91. Melling S, Hewitt-Taylor J. New flexible healthcare roles and the purpose of nursing. British Journal of Nursing 2003;12:1264-1270.

92. Woolery L. Expert nurse and expert systems. Comput Nurs 1990;8:23-27.

93. Meerabeau L. Tacit nursing knowledge: An untapped resource or a methodological headache? Journal of Advanced Nursing 1992;17:108-112.

94. Sackett DL, Rosenberg WM, Gray JA, Haynes RB, Richardson WS. Evidence based medicine: What it is and what it isn't. British Medical Journal 1996;312(13):71-72.

95. DiCenso A, Cullum N, Ciliska D. Implementing evidence based nursing: Some misconceptions. Evid Based Nurs 1998;1.

96. Needleman J, Buerhas PI, Mattke S, Stewart M, Zelevinsky K. Nurse staffing levels and the quality of care in hospitals. New England Journal of Medicine 2002;346:1715-1722.

97. Elixhauser A, Steiner C, Fraser I. Volume thresholds and hospital characteristics in the united states. Health Affairs 2003;22(2):167-177.

98. Sochalski J. Quality of care, nurse staffing, and patient outcomes. Policy Politics Nursing Practice 2001;2(1):9-18.

99. Aiken LH, Clarke SP, Cheung RB, Sloane DM, Silber JH. Educational levels of hospital nurses and surgical patient mortality. J Am Med Admin 2003;290:1617-23.

100. Blegen MA, Vaughn TE, Goode CJ. Nurse experience and education: Effect on quality of care. J Nurs Adm 2001;31(1):33-39.

101. O'Brien-Pallas L, Baumann A, Donner G, Murphy GT, Lochhaas-Gerlach J, Luba M. Forecasting models for human resources in health care. Journal of Advanced Nursing 2001;33(1):120-129.

102. Joanna Briggs Institute. Comprehensive systematic review training program. Adelaide: Joannna Briggs Institute; 2004.

103. Thomas EJ, Studdert DM, Runciman WB. A comparison of iatrogenic injury studies in Australia and the United States: Context, methods, casemix, population, patient and hospital characteristics. Int J Qual Health Care 2000b;12:371-378.

104. Runciman WB. Lessons from the Australian Patient Safety Foundation: Setting up a national patient safety surveillance system-is this the right model? Qual Saf Health Care 2002;11:246-251.

105. Donchin Y, Gopher D. A look into the nature and causes of human errors in the intensive care unit. Critical Care Medicine 1995;23:294-300.

106. Bracco S, Favre JB. Human errors in a multidisciplinary intensive care unit: A 1-year prospective study. Intensive Care Medicine 2000;27:137-145.

107. Giraud T, Dhainaut JF, Vaxelaire JF, Joseph T, Journois D, Bleichner G, et al. Iatrogenic complications in adult intensive care units: A prospective two-center study. Critical Care Medicine 1993;21(1):40-51.

108. Cooley C, Gabriel J. Reducing the risks of sharps injuries in health professionals. Nursing Times 2004;100(26):28-29.

109. Leibman C, Hyman C. A mediation skills model to manage disclosure of errors and adverse events to patients. Health Affiliation (Millwood) 2004;23(4):22-32.

110. Lazzari S, Allegranzi B, Concia E. Making hospitals safer: The need for a global strategy for infection control in health care settings. World Hospital Health Service 2004;40(2):32,34,36-42.

111. Hundert M, Topp A. Issues in the governance of Canadian hospitals iv: Quality of hospital care. Hospital Quarterly. 2003;6(4):60-2,4.

112. Yourstone SA, Smith HL. Managing system errors and failures in health care organizations: Suggestions for practice and research. Health Care Management Review 2002;27(1):50-61.

113. Standards Australia International. Guidelines for managing risk in the healthcare sector HB 228: 2001. Sydney; 2001.

114. Bernstein PL. Against the odd: The remarkable story of risk; 1997.

115. Binnekade JM, Vroom MB, Kesecioglu J. The risk of nursing in an error prone environment. In: Vincent JL, editor. Yearbook of intensive care and emergency medicine; 2003. p. 963-967.

116. Dang D, Johantgen ME, Provonost P, Jenckes MW, Bass EB. Post-operative complications: Does intensive care unit staffing make a difference? Heart and Lung 2002;31(3):219-228.

117. Dimick JB, Swoboda SM, Provonost P, Lipsett PA. Effect of nurse to patient ratio in the ITU on pulmonary complications and resource use after hepatectomy. American Journal of Critical Care 2001;10(6):376-382.

118. Tarnow-Mordi WO, Hau C, Warden A, Shearer AJ. Hospital mortality in relation to staff workload: A 4-year study in an adult intensive-care unit. The Lancet 2000;356(9225):185-189.

119. Grap M, Munro C. Preventing ventilator-associated pneumonia: Evidence-based. Critical Care Nurse Clinician North America 2004;16(3):349-358.

120. Arah OA, Klazinga NS. How safe is the safety paradigm? Qual. Saf. Health Care 2004;13:226-232.

121. Brennan TA, Leape LL. Incidence of adverse events and negligence in hospitalized patients. Results of the Harvard Medical Practice Study. New England Journal of Medicine 1991;324(6):370-376.

122. Leape LL, Brennan TA, Laird N. The nature of adverse events in hospitalized patients. Results of the Harvard Medical Practice Study ii. New England Journal of Medicine 1991;324:377-384.

123. Wilson RM, Runciman WB, Gibberd RW. The quality in Australian healthcare study. Medical Journal of Australia 1995;163:458-471.

124. Australian Council for Safety and Quality in Health Care. (accessed 18 October 2003). 2003.

125. Australian Patient Safety Foundation. http://www.Apsf.net.au (accessed 11 October 2003).

126. Runciman WB. The Australian Patient Safety Foundation. Anaesthesia and Intensive Care 1988;18:114-116.

127. Brennan TA, Leape LL. Results of the Harvard Medical Practice Study i; incidence of adverse events and negligence in hospitalized patients. New England Journal of Medicine 1991;6:370-376.

128. Kohn LT, Corrigan JM, Donaldson MS. To err is human: Building a safer health system. Washington: National Academy Press; 2000.

129. Runciman WB, Roberts R, Madden R. An iatrogenic injury classification. Paper presented to the Annual Conference of the Heads of WHO Collaborating Centres for the Classification of Diseases. Cardiff; 1999.

130. Tissot E, Cornette C. Medication errors at the administration stage in an intensive care unit. Intensive Care Medicine 1999;25:353-359.

131. Adomat R, Hicks C. Measuring nursing workload in intensive care: An observational study using closed circuit video cameras. Journal of Advanced Nursing 2003;42(4):402-412.

132. Garfield M, Jeffrey R, Ridley S. An assessment of the staffing level required for a high-dependency unit. Anaesthesia 2000;55(2):137-143.

133. Manias E, Aitken R, Peerson A, Parker J, Wong K. Agency nursing work in acute care settings: Perceptions of hospital nursing managers and agency nurse providers. Journal of Clinical Nursing 2003;12(4):457-466.

134. Bates S. Contractual work: New production processes in nursing. Marrickville: Churchill Livingstone; 1998.

135. Manias E, Aitken R, Peerson A, Parker J, Wong K. Agency-nursing work: Perceptions and experiences of agency nurses. International Journal of Nursing Studies 2003;40(3):269-279.

136. Ward S, Moore A. Agency staff: Do the locumotive. Health Service Journal 2000;110:26-30.

137. Senate Community Affairs Committee. The patient profession: Time for action. Report on the Inquiry into Nursing. Canberra: Commonwealth of Australia; 2002.

138. Bloom JR, Alexander JA, Nuchols BA. Nurse staffing patterns and hospital efficiency in the United States. Social Science and Medicine 1997;44:147-155.

139. Schubert S. 'You're more your own boss': Nurses' experiences of agency work. Contemporary Nurse 1995;4(4):166-173.

140. McConnell EA, Nissen JH. The use of medical equipment by Australian registered nurses. Journal of Clinical Nursing 1993;2:341-348.

141. McConnell EA, Fletcher J. Agency registered nurse use of medical equipment: An Australian perspective. International Journal of Nursing Studies 1995;32(2):149-161.

142. Ball C, Walker G, Harper P, Sanders D, McElligot M. Moving on from patient dependency and nursing workload to managing risk in critical care. Intensive and Critical Care Nursing 2004;20:62-68.

143. Reis Miranda D, Moreno R, Iapichino G. Nine equivalents of nursing manpower use score (nems). Intensive Care Medicine 1997;23(7):760-765.

144. ICNARC. The ICNARC system of patient related activities (sopra). London: ICNARC; 1999.

145. Ruland CM, Ravn IH. Usefulness and effects on costs and staff management of a nursing resource management information system. Journal of Nursing Management 2003;11:208-215.

146. Pirret AM. Utilizing TISS to differentiate between intensive care and high-dependency patients and to identify nursing skill requirements. Intensive Critical Care Nurse 2002;18(1):19-26.

147. Miranda DR, de Rijk A, Schaufeli W. Simplified therapeutic scoring system: The tiss-28 items. Results from a multi-centre study. Critical Care Medicine 1996;24:64-73.

148. Mark B, Salyer J, Wan T. Market, hospital and nursing unit characteristics as predictors of nursing unit skill mix: A conceptual analysis. Journal Of Nursing Administration 2000;30:552.

149. Pronovost PJ, Angus DC, Dorman T, Robinson KA, Dremsizov TT, Young TL. Physician staffing patterns and clinical outcomes in critically ill patients: A systematic review. JAMA 2002;288(17):2151-62.

150. Clarke SP, Sloane DM, Aiken LH. Effects of hospital staffing and organizational climate on needlestick injuries to nurses. American Journal of Public Health 2002;92(7):1115-1119.

151. British Medical Association. Report on the working party on intensive care. London: BMA Planning Unit; 1967.

152. Cullen DJ, Civetta JM. Therapeutic intervention scoring system: A method for quantitative comparison of patient care. Critical Care Medicine 1974;2(2):57-60.

153. Keene AR, Cullen DJ. Therapeutic intervention scoring system: Update 1983. Critical Care Medicine 1983;11:1-3.

154. Le Gall JR, Loirat P. The patients in management of intensive care. In: Miranda DR, Williams A, Loirat P, editors. Guidelines for better use of resources. Dordrecht: Kluwer; 1990. p. 11-53.

155. Malacrida R, Bomio D, Matathia R, Suter PM, Perrez M. Computer-aided self-observation psychological stressors in an ICU. Int J Clin Monit Comput 1991;8(3):201-205.

156. Darvas JA, Hawkins LG. What makes a good intensive care unit: A nursing perspective. 15 2002;2(77-82).

157. Bratt MM, Kelber S, Broome M, Lostocco L. Influence of stress and nursing leadership on job satisfaction of paediatric intensive care unit nurses. American Journal of Critical Care 2000;9(5):307-317.

158. Cavanagh SJ. Job satisfaction of nursing staff working in hospitals. Journal of Advanced Nursing 1992;17:704-711.

159. McCloskey JC, McCain BE. Satisfaction, commitment and professionalism of newly employed nurses image. Journal of Nursing Scholarship 1987;19(1):20-24.

160. Tarnowski-Goodell T, Van Ess Coeling H. Outcomes of nurses' job satisfaction. Journal of Nursing Administration 1994;24(11):36-41.

161. Griffith CH, Wilson JF. Housestaff workload and procedure frequency in the neonatal intensive care unit. Critical Care Medicine 1999;27(4):815-820.

162. Anderson FD, Maloney JP. A descriptive, correlational study of patient satisfaction, provider satisfaction, and provider workload at an army medical center. Military Medicine 1998;163:90-94.

163. Llenore B, Ogle KR. Nurse-patient communication in the intensive care unit: A review of the literature. Australian Critical Care 1999;12(4):142-145.

164. Knaus WA, Zimmerman JE, Wagner DP. Apache—acute physiology and chronic health evaluation: A physiologically based classification system. Critical Care Medicine 1981;9:591-597.

165. Knaus WA, Wagner DP, Draper EA, Zimmerman JE, Bergner M, Bastos PG, et al. The Apache III prognostic system. Risk prediction of hospital mortality for critically ill hospitalised adults. Chest 1991;100:1619-1636.

166. Le Gall JR, Lemeshow S, Saulnier F. A new simplified acute physiology score (SAPS II) based on a European/North American multicenter study. Journal of American Medical Association 1993;270(24):2957-2963.

167. Lemeshow S, Teres D, Klar J, Avrunin JS, Gehlbach SH, Rapoport J. Mortality probability models (mpm ii) based on an international cohort of intensive care unit patients. Journal of American Medical Assocation 1993;270:2478-2486.

168. Mitchell PH, Shannon SE, Cain KC, Hegyvary SC. Critical care outcomes: Linking structures, processes and organizational and clinical outcomes. American Journal of Critical Care 1996;5(5):353-363.

169. Rowan KM. Outcome comparisons of intensive care units in Great Britain and Ireland using the Apache II method [D.Phil. Thesis]. Oxford: University of Oxford; 1992.

170. Buerhaus PI, Needleman J. Policy implications of research on nurse staffing and quality of patient care. Policy Politics Nursing Practice 2000;1(1):5-15.

171. Estabrooks CE. The impact of hospital nursing characteristics on 30-day mortality. Nursing Research 2005;54(2):74-84.

172. Amaravadi RK, Dimick JB, Pronovost PJ, Lipsett PA. ICU nurse-to-patient ratio is associated with complications and resource use after esophagectomy. Intensive Care Medicine 2000;26(12):1857-1862.

173. Pronovost P, Dang D, Dorman T, Lipsett PA, Garrett E, Jenkles M, et al. Intensive care unit nurse staffing and the risk of complications after abdominal aortic surgery. Effective Clinical Practice 2001;4(5):199-206.

174. Reis-Miranda D, Ryan D, Schaufeli W, Mitchell PH, Shannon SE, Cain KC. Organisation and management of intensive care: A prospective study in 12 European countries. Berlin: Springer-Verlag; 1998.

175. Rudy EB, Daly BJ, Douglas S, Montenegro HD, Song R, Dyer MA. Patient outcomes for the chronically critically ill: Special care unit versus Intensive care unit. Nursing Research 1995;44:324-331.

176. Australian Institute of Health and Welfare. Medical labour force 2002. National health labour force series no. 30. (aihw catalogue no. Hwl 30.). Canberra: AIHW; 2004.

177. Rischbieth A. Matching nurse skill with patient acuity in the intensive care units: A risk management mandate. Journal of Nursing Management 2006;14(5):397-404.

178. Kovner C, Gergen PJ. Nurse staffing levels and adverse events following surgery in acute hospitals. Image Journal of Nursing Scholarship 1998;4:315-321.

179. Moreno R, Miranda DR. Nursing staff in intensive care in Europe: The mismatch between planning and practice. Chest 1998;113(3):752-758.

180. O'Brien-Pallas L, Duffield C, Alksnis C. Who will be there to nurse? Retention of nurses nearing retirement. Journal of Nursing Administration 2004;34(6):298-302.

181. Lincoln Y, Guba EG. Paradigmatic controversies, contradictions and emerging confluences. In: Denzin NK, Lincoln YS, editors. Handbook of qualitative research. Thousand Oaks, California; 2000.

182. King K. Method and methodology in feminist research:What is the difference? Journal Advanced Nursing 1994;20(1):19-22.

183. Campbell J, Bunting S. Voices and paradigms:Perspectives on critical and feminist theory in nursing. Advances in Nursing Science 1991;13(3):1-15.

184. Neuman WL. Social research methods. Qualitative and quantitative approaches. 6th Edition ed. Boston: Pearson Education Inc.; 2006.

185. Hebert PC, Cook DJ, Wells G, Marshall J. The design of randomized clinical trials in critically ill patients. Chest 2002;121(4):1290-1300.

186. Roberts BL, Rickard CM, Foote J, McGrail MR. The best and worst aspects of the ICU research coordinator role. Nursing and Critical Care 2006;11(3):128-135.

187. Begley CM. Using triangulation in nursing research. Journal of Advanced Nursing 1996;24(1):122-128.

188. Begley CM. Triangulation of communication skills in qualitative research instruments. Journal of Advanced Nursing 1996;24(4):688-93.

189. Denzin NK. Strategies of multiple triangulation. In: Denzin NK, editor. The research act: A theoretical introduction to sociological methods. 3rd ed. Englewood Cliffs: Prentice Hall; 1989. p. 234-247.

190. Shih F. Triangulation in nursing research: Issues of conceptual clarity and purpose. Journal of Advanced Nursing 1998;28(3):631-41.

191. Thurmond J. The point of triangulation. Journal of Nursing Scholarship 2001;33(3):253-258.

192. Campbell DT, Fiske DW. Convergent and discriminant validity by the multi-trait, multi-method matrix. Psychological Bulletin 1959;56:81-105.

193. Denzin N, Lincoln Y, editors. Handbook of qualitative research. Thousand Oaks: Sage; 1994a,.

194. Kimchi J, Polivka B, Stevenson JS. Triangulation:Operational definitions. Nursing Research 1991;40(6):364-366.

195. Denzin N. The research act: A theoretical introduction to sociological methods. Chicago: Aldine; 1970.

196. Patton MQ. Qualitative evaluation and research methods. 2nd ed. Newbury Park, California: Sage; 1990.

197. Flick U. Triangulation revisited: Strategy of validation or alternative? Journal for Theory of Social Behaviour 1992;22:175-197.

198. Rice PL, Ezzy D. Qualitative research methods. A health focus. Melbourne: Oxford University Press; 1999.

199. Polit D, Hungler B. Nursing research: Principles and methods. 6th ed. Philadelphia: Lippincott; 1995.

200. Foss C, Ellefsen B. The value of combining qualitative and quantitative approaches in nursing research by means of method triangulation. Journal of Advanced Nursing 2002;40(2):242-248.

201. Myers ST, Haase JE. Guidelines for integration of qualitative and quantitative approaches. Nursing Research 1989;38:299-301.

202. Murphy SA. Multiple triangulation: Applications in a program of nursing research. Nursing Research 1989;38:294-298.

203. Jick TD. Mixing qualitative and quantitative methods: Triangulation in action. London: Sage; 1979.

204. Burns N, Grove SK. Selecting a research design. In: The practice of nursing research: Conduct, critique & utilization. 4th Edition ed. Philadelphia: W.B. Saunders; 2001.

205. Fielding NG, Fielding JL. Linking data. Beverly Hills, California: Sage; 1986.

206. Banik BJ. Applying triangulation in nursing research. Applied Nursing Research 1993;6(1):47-52.

207. Cobb AK. Acculturation and accommodation in qualitative and quantitative research. Journal of Professional Nursing 2000;16(4):188.

208. Dzurec LC, Abraham IL. The nature of inquiry: Linking quantitative and qualitative research methods. Advances in Nursing Science 1993;16(1):73-79.

209. Duffy ME. Methodological triangulation: A vehicle for merging quantitative and qualitative research methods. Image: Journal of Nursing Scholarship 1987;19:130-133.

210. Hinds PS. Method triangulation to index change in clinical phenomena. Western Journal of Nursing Research 1989;11(4):440-447.

211. Porter EJ. The qualitative-quantitative dualism. Image: Journal of Nursing Scholarship 1989;21(2):98-102.

212. Buchanan DR. An uneasy alliance: Combining qualitative and quantitative research method. Health Education Quarterly 1992;19(1):117-135.

213. Schneider Z, Elliot D, LoBiondo-Wood G, Haber J. Nursing research. Methods, critical appraisal and utilisation. 2nd ed. Marrickville: Elsevier; 2004.

214. Sohier R. Multiple triangulation and contemporary nursing research. Western Journal of Nursing Research 1988;10(6):732-742.

215. White L. Enhancing the quality of hermeneutic research: Decison trail. Journal Advanced Nursing 2004;45(5):512-518.

216. Koch T. Implementation of a hermeneutic inquiry in nursing: Philosophy, rigour and representation. Journal Advanced Nursing 1996;24:174-184.

217. Chapple A, Rogers A. Explicit guidelines for qualitative research: A step in the right direction, a defence of the 'soft option', or a form of socialogical imperialism? Family Practice 1998;15:556-561.

218. Baker C, Wuest J, Stern P. Method slurring: The grounded theory/phenomenological example. Journal Advanced Nursing 1992;17:1355-1360.

219. Patton M. Qualitative research and evaluation methods. CA USA: Sage Publications; 2002.

220. Ezzy D. Are qualitative methods misunderstood? Australian and New Zealand Journal of Public Health 2001;25(4):294-297.

221. McLennan W. An introduction to sample surveys: A user's guide. Canberra: Australian Bureau of Statistics; 1999.

222. McKenna H. Nursing theories and models. London: Routledge; 1997.

223. Morse JM. Approaches to qualitative-quantitative methodological triangulation. Nursing Research 1991;40(2):120-3.

224. Leininger M. Evaluation criteria and critique of qualitative research studies. In: Morse JL, editor. Critical issues in qualitative research methods. Thousand Oaks, California: Sage; 1994. p. 95-115.

225. Polit D, Beck C. Essentials of nursing research: Methods, appraisal, and utilization. 6th Edition ed. Philadelphia: Lippincott Williams & Wilkins; 2006.

226. Roberts K, Taylor B. Nursing research processes: An Australian perspective. Melbourne: Nelson ITP; 1998.
227. Burns N, Grove SK. Understanding nursing research. Philadelphia: W.B. Saunders; 1995.
228. Bradburn NM, Sudman S. Polls and surveys: Understanding what they tell us. San Francisco: Jossey-Bass; 1988.
229. Schrum L. Framing the debate: Ethical research in the information age. Qualitative Inquiry 1995;1(3):311-326.
230. Mann C, Stewart F. Internet communication and qualitative research. London: Sage Thousand Oaks; 2000.
231. Sharf B. Beyond net'iquette: The ethics of doing naturalistic research on the internet. In: Jones S, editor. Doing internet research. London: Sage Thousand Oaks; 1999. p. 243-256.
232. Dillman DA. Mail and internet surveys: The tailored design method. 2nd Edition ed. New York: Whiley; 2000.
233. Kralik D, Warren J, Price K, Koch T, Pignone G. The ethics of research using electronic mail discussion groups. Journal Advanced Nursing 2005;52(5):537-545.
234. Joint Faculty of Intensive Care Medicine. Minimum standards for intensive care units IC-1. Melbourne: JFICM; 2003.
235. Greenhalgh T. How to read a paper: Assessing the methodological quality of published papers. British Medical Journal 1997;315(7103):305-308.
236. Brehm J. Stubbing our toes for a foot in the door? Prior contact, incentives and survey response. International Journal of Public Opinion Research 1994;6:45-63.
237. Yammarino F, Skiner S, Childers T. Understanding mail survey response behaviour: A meta-analysis. Public Opinion Quarterly 1991;55:613-630.
238. Angus DC, Linde-Zwirble WT. The effect of managed care on ICU length of stay. Journal American Medical Association 1996;276:1075-1082.
239. Foddy W. Constructing questions for interviews and questionnaires. Cambridge: Cambridge University Press; 1993.
240. Frazer L, Lawley M. Questionnaire design and administration: A practical guide. Singapore: John Wiley & Sons; 2000.
241. Greenhalgh T. How to read a paper: Statistics for the non-statistician. I: Different types of data need different statistical tests. British Medical Journal 1997;315(7104):364-366.

242. DeSantis L, Ugarizza D. The concept of theme as used in qualitative nursing research. Western Journal of Nursing Research 2000;22:351-372.

243. National Health and Medical Research Council. National statement of ethical conduct in research involving humans. Canberra: NHMRC; 1999.

244. National Health and Medical Research Council. The Human Research Ethics Handbook. Canberra: NHMRC; 2002.

245. World Medical Association. Declaration of Helsinki, amended by 52nd WMA General Assembly. Scotland: WMA; 2000.

246. Rischbieth A, Blythe D. An Ethics Handbook for Researchers. Melbourne: ANZICS CTG; 2005.

247. Rischbieth A, Blythe D. Ethical intensive care research: Development of an ethics handbook for Australian and New Zealand Intensive Care Society Clinical Trials Group. ANZICS. Critical Care and Resuscitation 2005;7(4):282-283.

248. National Health and Medical Research Council. When does quality assurance in health care require independent ethical review ? Canberra: NHMRC; 2001.

249. Tourangeau R, Smith T. Asking sensitive questions: The impact of data collection mode, question format and question context. Public Opinion Quarterly 2004;60:275-304.

250. National Health and Medical Research Council. Guidelines under section 95 of the privacy act 1988. Canberra: NHMRC; 2000.

251. Emanuel EJ, Wendler D, Grady C. What makes clinical research ethical? Journal of American Medical Assocation 2000;283:2701-2711.

252. Holbrook, Allyson, Green M, Krosnok J. Telephone versus face-to-face interviewing of national probability samples with long questionnaires. Public Opinion Quarterly 2003;67:79-125.

253. National Health and Medical Research Council & Australian Vice-Chancellor's Committee. Statement and guidelines on research practice. Canberra: NHMRC & AVCC; 2001.

254. Polit D, Beck C, Hungler B. Essentials of nursing research: Methods, appraisal and utilization. New York: Lippincott; 1991.

255. Australian Bureau of Statistics. Census classification counts: Population. Canberra; 2001.

256. Hutchinson B. Development of 12 hour shifts in ICU. Conference paper, ANZICS CACCN ASM Christchurch; 1998.

257. Scobie S, Thomson R, McNeil JJ, Phillips PA. Measurement of the safety and quality of health care. Medical Journal of Australia 2006;184(S51-S55).

258. Williams G, Clarke T. A consensus driven method to measure the required number of intensive care nurses in Australia. Australian Critical Care 2002;14:106-115.

259. Mulcahy C, Betts L. Transforming culture: An exploration of unit culture and nursing retention within a neonatal unit. Journal of Nursing Management 2005;13:519-523.

260. Runciman WB. Shared meanings: Preferred terms and definitions for safety and quality concepts. Medical Journal of Australia 2006;184(10):15.

261. World Health Organization. World health organization family of international classifications. Geneva: WHO; 2004.

PUBLICATIONS

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