

Literature review of the impact of nurse practitioners in critical care services

Margaret Fry

ABSTRACT

Aims: The comprehensive review sought to examine the impact of Critical Care Nurse Practitioner models, roles, activities and outcomes.

Method: The Medical Literature Analyses and Retrieval (MEDLINE), The Cumulative Index of Nursing and Allied Health Literature (CINAHL); PubMed; PROQUEST; ScienceDirect; and the Cochrane database were accessed for the review. Alternative search engines were also included. The search was conducted with the key words: critical care, intensive care, acute, adult, paediatric, trauma, disease management programs, disease management, case management, neonatal, cardiology, neurological, retrieval, transfer and combined with Nurse Practitioner. From the identified 1048 articles 47 studies were considered relevant.

Results: Internationally, Critical Care Nurse Practitioners were located in all intensive care areas and services including post intensive care discharge follow-up, intensive care patient retrieval and transfers and follow-up outpatient services. The role focussed on direct patient management, assessment, diagnosis, monitoring and procedural activities. Critical Care Nurse Practitioners improved patient flow and clinical outcomes by reducing patient complication, morbidity and mortality rates. Studies also demonstrated positive financial outcomes with reduced intensive care unit length of stay, hospital length of stay and (re)admission rates.

Conclusions: Internationally, Critical Care Nurse Practitioners are demonstrating substantial positive patient, service and nursing outcomes. Critical Care Nurse Practitioner models were cost effective, appropriate and efficient in the delivery of critical care services.

Relevance to clinical practise: In Australia, there was minimal evidence of Critical Care Nurse Practitioner impact on adult, paediatric or neonatal intensive care units. The international evidence suggests that the contribution of the role needs to be strongly considered in light of future Australian service demands and workforce supply needs. In Australia, the Critical Care Nurse Practitioner role and range of activities falls well short of international evidence. Hence, it was necessary to scope the international literature to explore the potential for and impact of the Critical Care Nurse Practitioner role. The review leaves little doubt that the role offers significant potential for enhancing and contributing towards more equitable health services.

Key words: Advanced nursing roles • Advanced practice in ICU • Advanced practice/nurse specialist roles • Advancing practice

INTRODUCTION

The comprehensive literature review was undertaken to identify areas of research that have examined the value of Adult, Paediatric and Neonatal Critical Care Nurse Practitioners. Whilst generally many studies can be methodologically challenged the volume, breath, depth and consistency of findings provided strong support for Critical Care Nurse Practitioner roles. In Australia generally, there remains little evidence

of Nurse Practitioner impact, and more specifically regarding adult, paediatric or neonatal intensive care roles. While a handful of Australian Critical Care Nurse Practitioner roles exist, the scope, independence, autonomy and range of activities is significantly less than many of our international peers.

Internationally, 95 Nurse Practitioner roles were identified, which were located or co-located within hospitals inpatient or outpatient services. The Nurse Practitioner role was well established in the USA (1960s), UK (1980s), Canada (2000) and to a lesser extent Australia (1995) and New Zealand (2000). In 2005 a USA Census Survey identified that there were 141 209 authorized Nurse Practitioners and 6000 Nurse Practitioners educated annually (The U.S. Census Bureau, 2005).

In Canada by 2005, there were 1026 licensed Nurse Practitioners. A 2005 survey identified 75% of Nurse

Author: M Fry, RN BaSc MEd NP PhD, Associate Professor, Higher Research Degree Coordinator, Faculty of Nursing, Midwifery and Health, University of Technology, Sydney, NSW 2007 Australia

Address for correspondence: Higher Research Degree Coordinator, Faculty of Nursing, Midwifery and Health, University of Technology, Level 7, 235-253 Jones Street (PO Box 123), Broadway, Sydney, NSW 2007 Australia

E-mail: margaret.fry@uts.edu.au

Practitioners were employed full-time (compared with 51–54% of Registered Nurse). Within Australia there are 202 735 registered nurses (Australian Institute of Health and Welfare, 2009) and approximately 350 authorized Nurse Practitioners (National Nursing & Nursing Education Taskforce, 2005). In New Zealand by 2006 there were 25 Nurse Practitioners authorized (Ministry of Health New Zealand, 2006). While there are no international Nurse Practitioner standards the role is widely accepted to involve advanced practice knowledge and skills with which clinicians autonomously manage a range of patient conditions and injuries (Duffield *et al.*, 2009).

Aims

The review sought to explore the evidence base for potential health care reform within critical care areas in relation to Nurse Practitioner roles. Therefore, the aim of the review was to i) identify appropriate studies and examples of the range of Nurse Practitioner roles and tasks in intensive care settings, and ii) identify the impact on quality of care, efficiency gains and costs in relation to nurse practitioner roles.

Database search strategies and extraction

Database sources included: General databases – Medical Literature Analyses and Retrieval (MEDLINE), The Cumulative Index of Nursing and Allied Health Literature (CINAHL); PubMed; PROQUEST; ScienceDirect and The Cochrane database of Systematic Reviews (CDSR). Search Engines – Google scholar; and International Organisational Nurse Practitioner Committee New South Wales Health; South Australia Health; Victoria Health; Western Australia Health; Tasmania Health; Commonwealth Department of Health and Aging; Australian Primary Health Care Research Institute. The literature review dates were from 1980 to 2009. Nurse Practitioner studies which examined the impact on acute services, emergency care and primary health care were sought. The search was conducted with the key words: critical care, intensive care, acute, adult, paediatric, trauma, disease management programs, disease management, case management, neonatal, cardiology, neurological, retrieval, transfer and combined with Nurse Practitioner. The inclusion criteria included: setting (acute and chronic care, hospital, outpatient, inpatient), and study design (randomized controlled trial, controlled before-and-after-study, quasi experimental, comparative), and role (e.g. skills and staff mix). The search identified 1048 articles considered relevant. Excluded from the review was grey literature, descriptive role studies and studies that did not have measurable outcomes. Forty-seven studies were found to be relevant.

Findings of the review: critical care settings and outcomes

In the 1990s the Critical Care Nurse Practitioner role began to develop first in the USA followed by the UK, Canada, Australia and New Zealand. The Nurse Practitioner was developed largely because of the clinical needs of critically ill patients and had extended into all intensive care fields (adult, neonatal and paediatric) (Caserta *et al.*, 2007). Many Critical Care Nurse Practitioner studies compared Nurse Practitioners with Physician Assistants and or Medial Officers. For the most part they examined patient management outcomes and complications.

Kleinpell-Nowell (2005) conducted a 5-year longitudinal survey of Critical Care Nurse Practitioner role development commencing in 1996. Consistent responders (437 Nurse Practitioners) identified that the role included: History and physical examination, diagnostic management, prescribing treatments and coordination of patient care, initiating consultation and discharge planning, discussing care with family members. The survey identified 68% were based in intensive care units (ICU) or undertaking acute care procedures.

ADULT CRITICAL CARE NURSE PRACTITIONERS

In the USA, Hoffman *et al.* (2005) compared Critical Care Nurse Practitioner and trainee Physicians (pulmonary/critical care fellows) in the management of ICU patients. The 12-month, comparative single site study was set in a high dependency medical unit. Nurse Practitioner work activities were examined (direct management of patients, coordination of care and non-unit activities). Comparisons between Nurse Practitioners and Physicians identified both spent half their time in activities related to patient management (40% vs 44%, not significantly different). However, Nurse Practitioners spent more time in coordination of care ($p < 0.001$), less time in non-unit activities ($p < 0.001$); and, more time interacting with patients and collaborating with health team members. Physicians spent more time in non-unit activities.

A study by Rudy (1998) compared Critical Care Nurse Practitioners ($n = 11$) and Physician Assistants ($n = 5$) with medical officers ($n = \text{unknown}$) for care activities and patient outcomes in one ICU. The USA study had a large sample size and lasted 14 months. The Nurse Practitioners/Physician Assistants had 187 patients and the trainee Physician group had 202 patients. The Nurse Practitioner and Physician Assistant groups managed similar patients but undertook minimal invasive procedures compared with the medical officer group. Again no difference in patient clinical outcomes was identified for patients

managed by a Nurse Practitioner, Physician Assistant or Medical Officer.

In the USA, Kirton *et al.* (2007) investigated the 'mid level' practitioner (Nurse Practitioners/Physician Assistants) staffing for the Department of Surgery (five surgical services – general surgery, vascular surgery, cardiothoracic surgery, plastic surgery and transplant surgery – and Three ICUs – neurointensive care, cardiac and general surgery). The role of the Nurse Practitioners/Physician Assistant appeared largely comparable. The role included: patient consultations, routine assessment and examination, initiating patient medications, diagnostics, admission and discharge and care coordination with family consultations. Data was extracted from clinical decision software, hospital staff and financial databases. The study demonstrated improvement in clinical coverage and workload staffing efficiency with Nurse Practitioner/Physician Assistant staff. Two of the three surgical ICUs (neurointensive care and cardiac units) had Nurse Practitioners/Physician Assistants, while the general surgery ICU had mixed coverage consisting of ICU fellows and postgraduate trainee Physicians. The addition of Nurse Practitioner/Physician Assistants in combination with medical staff ensured better clinical coverage of the critically ill patients across all surgical services. The study reported (although not defined) a significant reduction in medical staff overtime costs.

An additional role demonstrated by UK Nurse Practitioners, in 2001, was monitoring of ICU patient post discharge to ward areas. Increasingly, critical care areas need to discharge patients earlier to ward areas resulting in highly dependent patients being cared for by general ward staff. The role was introduced with the aim to reduce the readmission rate and build relationships between ward areas and ICU. Within the UK, national recognition of the changing ward requirement led to strategies to improve the continuity and quality of care for critically ill patients. While no statistical evidence was provided the authors describe the additional cardio-respiratory management support provided post ICU patient discharge which reduced the potential for deterioration and adverse outcomes (Haines and Coad, 2001; Caserta *et al.*, 2007). A similar role was piloted in Australia between 1997 and 2002. In Victoria the ICU 'Liaison Nurse' was to 'oversee' the transition of ICU discharged patients. Limited evidence of impact was available although, the outcome measure was ICU readmissions. Evidence of reduction was found, although only percentages were provided 2.3–0.5% (Green and Edmonds, 2004).

The national USA survey undertaken by Kleinpell and Goolsby (2006) identified that Critical Care Nurse Practitioners were involved in procedural

medical roles. Australian Nurse Practitioners did not appear to undertake any of these procedures. The USA Nurse Practitioner procedural role included: chest tube insertion; central line replacement; arterial line insertion; and endotracheal intubation, assistants in surgery and Physician-assisted insertion of a pulmonary artery catheters.

A study by Russell *et al.* (2002) in the USA explored Critical Care Nurse Practitioner patient complication rates in two critical care units. Nurse Practitioner complication rate data was compared, for the same period, with hospital medical record diagnostic coding and a random selection ($n = 122$) of retrospective medical records. The six-month study enrolled 402 patients. Nurse Practitioner care management included: History and examination, and initiation of diagnostic intervention, medicines and evaluation of care. Patients monitored and care managed by Nurse Practitioners had significantly shorter hospital length of stay ($p = 0.03$), shorter mean length of stay in ICU ($p < 0.001$), and lower patient complication rates ($p < 0.05$) compared with routine medical care. The Nurse Practitioner patient group was hospitalized 2306 fewer days than the non-NP group (total cost saving of US\$2 467 328) allocated to routine medical care. The study provided statistical evidence of positive clinical and financial outcomes. Similarly a retrospective study by Meyer and Miers (2005) identified gains when Nurse Practitioner directed postoperative care in collaboration with cardiovascular surgeons. Findings showed patient Hospital length of stay reduced by 1.91 days at an estimated cost of US\$5038.9/patient. Critical Care Nurse Practitioner patients were hospitalized for fewer days with cost savings of US\$2 467 328. Nurse Practitioner care was equal to or better than routine medical care and achieved significant hospital savings.

Few recent studies have demonstrated improvement in patient length of stay for critically ill trauma patients. Given a lack of studies with measurable outcomes older studies remain relevant. Hence, Spisso *et al.* (1990) in the USA compared Trauma Nurse Practitioners with routine medical care. The findings (1986–1987) whilst old identified that Trauma Nurse Practitioners were associated with a decrease in length of stay from 8.10 to 7.05 days (mean). Length of stay for other hospital patients remained the same during the study period. Medical record documentation improved substantially. Randomly sampled discharge summaries were completed in more than 95% of Nurse Practitioner notes compared with medical officers (75%). The Trauma complaint rate decreased from 16 to seven/year. When Nurse Practitioners were rostered to shifts medical staff time saved was 352 min/day

(mean). The introduction of the Critical Care Nurse Practitioner into the outpatient clinic led to a reduction of waiting time from 41 to 19 min. However, statistical relevance was not provided.

Critical Care Nurse Practitioners had widely demonstrated reduction in hospital length of stay. A recent USA study by Burns *et al.* (2003), conducted in a university hospital, used a before-and-after-study design across five adult ICUs (coronary care, medical, neuroscience, surgical trauma and thoracic cardiovascular). The 12-month prospective longitudinal study reviewed hospital and clinical databases. Four Critical Care Nurse Practitioners managed (with evidenced-based protocols) patient sedation and mechanical ventilation weaning for ICU patients. The patient sample was large and included 595 pre Nurse Practitioner patients (medical care) and 510 Nurse Practitioner patients. The patient ventilator duration reduced ($p = 0.0001$), ICU length of stay reduced ($p = 0.0008$), hospital length of stay reduced ($p = 0.0001$), and mortality rate reduced ($p = 0.02$). The Nurse Practitioner group achieved total savings in the first year of US\$3 000 000 with an average saving per patient of US\$3225. All patient and hospital outcomes improved for the Critical Care Nurse Practitioner patient group. While the study was not a randomized controlled trial the longitudinal approach added rigour to findings. Similar Nurse Practitioner findings are supported by Meyer and Miers (2005) with decreased length of stay by 1.91 days/patient; and (2002) with a one to eight day ($p < 0.001$) reduction in ICU length of stay, across a range of diagnostic groups, and hospital length of stay (3 days less; $p = 0.03$).

Marelich *et al.* (2000) also conducted a prospective 12-month randomized control trial of respiratory Physician Assistants and Nurse Practitioners in a medical and surgical ICU. While the USA study aimed to support a 'protocol', the outcomes of Nurse Practitioners were significant. Again Nurse Practitioner managed ICU patients had a reduced mechanical ventilation period from a median of 124 to 68 h ($p = 0.0001$). Interventions were more often required for patients in the surgical control group compared with the Nurse Practitioner group. Although not statistically significant ($p = 0.061$), Nurse Practitioner patient group pneumonia rates were less (5 patients) compared with the Physician Assistant patient group (12 patients). Mortality and ventilator discontinuation failure rates remained unchanged. Positive clinical outcomes were achieved with no variance in adverse events.

Hoffman (2005) more recently compared Nurse Practitioners and Physicians in a 31-month study. The large American study involved 526 consecutive

patients (admitted for > than 24 h to an ICU). At baseline groups were similar for workload, demographics, and medical condition variables. There was no difference in readmission rate to the high acuity unit ($p = 0.25$) or subacute unit ($p = 0.44$) within 72 h of discharge or in mortality rate with ($p = 0.25$) or without ($p = 0.89$) treatment limitations. No length of stay difference was found for patients having mechanical weaning subacute unit ($p = 0.42$), or duration of mechanical ventilation ($p = 0.18$), weaning status at time of discharge from the unit ($p = 0.80$), or discharge ($p = 0.28$). However, patients managed by Physicians were re-intubated more frequently ($p = 0.02$). The Critical Care Nurse Practitioners had equivalent or better patient outcomes than Physicians. Another Critical Care Nurse Practitioner role involved responding to emergency medical inpatient hospital activations. Pirret (2008) examined the Nurse Practitioner led critical 'outreach' role in a 12-month before-and-after-study. The comparative study examined readmission rate, LOS, ICU acuity on readmission, medical emergency and cardiac arrest alerts. Management of critically ill ward patients was targeted. Nurse Practitioners had access to ICU Physicians through the hospital paging system. The large study described 525 patient consultations with Nurse Practitioners primarily initiating diagnostic tests and medications (not explicit). While the study resulted in a sustained reduction in ICU readmissions (<72 h), statistical significance was not provided. Nonetheless, the author described a positive role impact, reduced ICU readmission rate and a positive response time (five minutes) for critically ill ward patients.

PAEDIATRIC CRITICAL CARE NURSE PRACTITIONER

A Paediatric Critical Care Nurse Practitioner role had also developed. In the USA, the majority of states (31) required Nurse Practitioners to undertake Acute Care certification with the rest having some variation in requirements (Percy and Spherhac, 2007). There were a number of professional surveys conducted of the Nurse Practitioner role, scope and activities. The bulk of this survey research was descriptive and examined role activities, barriers and implementation issues (Kelly *et al.*, 2001; Verger *et al.*, 2005; Shebesta *et al.*, 2006; O'Brien, 2007; Borgmeyer *et al.*, 2008). The Paediatric Nurse Practitioner research is limited as it is based largely on small or single site, comparative before-and-after-studies.

Derengowski *et al.* (2000) introduced the Critical Care Nurse Practitioner into a university paediatric ICU to act as the primary care giver. The Nurse Practitioner role was similar to the Adult Critical Care

Nurse Practitioners. The Nurse Practitioner managed on average three patients per day ($n = 10$ complex acute medical patients). Outcomes at 6 months, of medical (70%) and surgical (30%) patients, identified patients with a predicted mortality rate of 72.7% and a Paediatric Risk of Mortality score of 28. However, the NP group had an actual mortality rate of 10% with nine patients surviving to discharge. No medical officer comparison of mortality rate was provided. Only subjective evidence of cost savings was provided. Patient and family satisfaction rates were also noted to be high. The implementation study identified barriers which related to educational needs, scope of practice, daily role activities and professional practice.

A more recent, study by Fanta *et al.* (2006) compared Trauma Nurse Practitioner and resident medical officers caring for injured children. The prospective comparative study identified patients in the Nurse Practitioner group had shorter length of stay and that higher patient satisfaction scores were achieved. Clinical outcomes were equivalent although, the study was small and no statistical datum was provided. However, Schweer *et al.* (2004) in the USA conducted a retrospective analysis and identified no difference in length of stay, clinical and functional outcomes for Trauma Nurse Practitioner patients compared with medical care. The statistical evidence was weak.

NEONATAL CRITICAL CARE NURSE PRACTITIONER

While in the UK, Canada and the USA the acute Neonatal Critical Care Nurse Practitioner has begun to emerge, there was minimal evidence of the implementation of the role within Australia. Internationally, there was greater evidence of practice scope, activities and patient safety outcomes in this field. However, the evidence comprised largely of descriptive, comparative or before-and-after-studies with minimal evidence of clinical or economic impact (Hall and Wilkinson, 2005, Cusson *et al.*, 2008). For the most part the comparative studies compared junior medical officers with Nurse Practitioner knowledge, skills and interpersonal communication.

The neonatal critical care role has developed broadly across the USA (Bissinger *et al.*, 1997; Beal *et al.*, 1999a). Beal *et al.* (1999a) conducted a survey of Nurse Practitioners working in five neonatal intensive care unit. Nurse Practitioners were involved in: neonatal intensive care unit management, ante partum consultations, delivery room management, transport and outpatient follow-up. Neonatal Critical Care Nurse Practitioners also provided parent support and teaching, post neonatal intensive care unit follow-up care and professional education and research.

In terms of role acceptance, a survey was conducted in the UK by Redshaw *et al.* (2002). They investigated the views of Neonatologists. Sixty-six neonatal units with one or more qualified Nurse Practitioners were surveyed. The response rate was high (86%; $n = 57$). Role activities were in keeping with Adult and Paediatric Critical Care Nurse Practitioners. While Neonatologists perceived that case-load management, involvement in ward rounds, accepting referrals and leading emergency transfers were not part of the core role of Neonatal Nurse Practitioners, they strongly supported the position. A similar survey was conducted across Canada and the USA by Hunsberger (1992). The sample targeted university neonatal intensive care units and sampled 665 Nurse Practitioners ($n = 655$). The early findings supported the role comprised advanced practice, management, education, research and administrative responsibilities.

An earlier study by Mitchell (1991) compared the knowledge, and clinical and communication skills of recent Neonatal Nurse Practitioner graduates with resident medical officers. Critical Care Nurse Practitioner graduate ($n = 10$) knowledge was compared with 13 second-year paediatric residents. Each group was tested using a 100 multiple-choice examination, 20 radio graphical films, an oral Viva Voce. The examination results yielded comparable statistical findings suggesting that the graduating NPs had knowledge and skills equivalent to a second-year paediatric residents. The Critical Care Nurse Practitioner's knowledge, clinical skills and communication were equivalent with those of second-year paediatric residents.

A large number of comparative studies with medical staff and Critical Care Nurse Practitioners were undertaken. In the UK, Lee *et al.* (2001) conducted a prospective comparative study of Nurse Practitioners and medical officers in two acute hospitals. The outcome variable measured was neonatal assessment skill. The sample was large (527 infants enrolled). Nurse Practitioners were better at detecting hip abnormalities ($p < 0.05$); and eye abnormalities ($p < 0.05$). However, for the identification of cardiac abnormalities or underlying incidence of abnormalities no significant difference was found.

Luyt *et al.* (2002) conducted a randomized control trial to compare Critical Care Nurse Practitioner and registrar level medical officer's practices for weaning neonates from ventilators. The study was conducted in one neonatal intensive care unit and the sample was small with only 48 infants. The outcome measure, ventilator weaning time, was less for Nurse Practitioners than medical staff ($p = 0.0458$). Nurse Practitioners significantly reduced the time (median) from admission to the first ventilator change

(adjustment of any ventilation settings) compared with doctors. The median ventilator weaning time was 20 h (95% confidence interval [CI], 621–1779 min) in the NP group compared with 50 h (95% CI, 2650–3380 min; in the medical group ($p = 0.0458$). On average, the Nurse Practitioner made ventilator setting changes every 4.5 h compared with 7.2 h for doctors ($p = 0.003$). While statistically significant it may have little clinical relevance. The impact on clinical outcomes (length of stay, deterioration, initiation of treatment and ventilation weaning management) were better for the Nurse Practitioner group with no adverse outcomes identified.

There was a large randomized control trial conducted in Canada by Mitchell-DiCenso *et al.* (1996). They also compared Nurse Practitioners with medical officers. The study enrolled 821 infants (admitted to neonatal intensive care unit) which were randomized for management to either the Nurse Practitioner ($n = 414$) or medical officers ($n = 407$) group. The 12-month trial was conducted in one neonatal intensive care unit. Mortality and complications rates were not significantly different between groups. Average length of stay was reduced in the Nurse Practitioner group although, statistically not significant. There was a slight trend towards better documentation by the Nurse Practitioner group. Parent satisfaction scores were higher in the Nurse Practitioner group (not statistically significant) and the cost per infant was slightly higher for the Nurse Practitioner group (not statistically significant). Quality care outcomes, assessed by a quantitative indicator condition approach were comparable between groups.

Another comparative study compared the care of low-birth-weight infants by Critical Care Nurse Practitioners and medical officers in one neonatal intensive care unit over two years. The USA study by Karlowicz and McMurray (2000) compared the outcomes of 201 infants. The findings identified mortality rates were not statistically significant ($p = 0.87$). There were no significant care differences (pathology, radiology or medications). There was no statistically significant difference for length of stay or patient complication rates. Nurse Practitioner costs while not statistically relevant ($p = 0.89$) had a slightly higher but narrower range, than the medical group. Critical Care Nurse Practitioner group costs were US\$141624 while the medical group was US\$139388 (median hospital charges). Outcomes for both groups were comparable.

Bissinger *et al.* (1997) in the USA compared Neonatal Critical Care Nurse Practitioners with medical staff using an 'intention to treat' design. The sample included 187 infants, although a sample power calculation was not evident. Health outcomes included:

length of stay, days on oxygen, days on ventilation, morbidity and mortality, hearing loss, retinopathy and intra ventricular haemorrhage. Group baseline details were comparable. Clinical outcomes were comparable between groups. However, Critical Care Nurse Practitioners were significantly more cost effective. Nurse Practitioner infant costs were US\$18240 less per infant than those managed by doctors. It was difficult to determine whether charges represented total hospital costs as the formula for economic analysis was unclear.

Neonatal Nurse Practitioners were also exploring and expanding their role to include discharge follow-up from intensive care units. Beal *et al.* (1999b) undertook a descriptive survey to examine Nurse Practitioner perspectives follow-up post neonatal intensive care discharge. A random sample of 505 Nurse Practitioners agreed that the role would be beneficial to hospital services and patients (96%). However, only 52% of Nurse Practitioners perceived they were qualified to undertake the role. While 22% were currently in the role. Those involved in the role were more likely to have had previous primary care experience ($p = 0.010$). Nurse Practitioners with additional certification ($p = 0.016$) or previous primary care experience ($p = 0.003$) perceived appropriately qualified.

Around the same time in the UK, USA and Canada, Critical Care Nurse Practitioners began leading inter-hospital transfers of critically ill children. Traditionally, medical staff led critically ill children transfer teams. However, Davies and Lynch (2007) in London conducted a pilot study to introduce Critical Care Nurse Practitioner led transfer teams. While the study was descriptive in nature, Critical Care Nurse Practitioners were undertaking transportation of critically ill children with no evidence of inadequate or poor outcomes. The role was too new to determine significant impact or patient outcomes.

Again in the UK, Leslie and Stephens (2003) compared the safety and appropriateness of Neonatal Nurse Practitioner led transfers with paediatric registrars. The 4-year study examined transport times, transport interventions and physiological variables. The Nurse Practitioner led team was more responsive to requests but took longer to stabilize infants. Both groups performed similar rates of procedures and no differences were evident in ventilator patterns. The doctor led group had worse values for pH and arterial oxygen ($p = 0.008$) before transfer, suggesting medical staff transferred sicker infants. Nurse Practitioner managed infants showed significant improvement in temperature and in oxygen saturation ($p = 0.01$). There were no clinical outcome differences between groups, which suggested that Critical Care Nurse Practitioner led

neonatal retrieval and transport teams were safe and appropriate. To date there is minimal evidence of clinical impact for Neonatal Nurse Practitioner retrieval led teams. Further research is required to determine any measurable clinical and economic differences.

Significant role diversity was demonstrated by Critical Care Nurse Practitioners. Internationally, Critical Care Nurse Practitioners are taking responsibilities for and managing a variety of adult, paediatric and neonatal patient conditions within critical care areas (Rimel and Langfitt, 1980; Caserta *et al.*, 2007). Greater evidence of role impact was noted by Adult Critical Care Nurse Practitioners compared with Paediatric and or Neonatal Critical Care Nurse Practitioners.

Relevance to practise

Internationally, Nurse Practitioners are located within all critical care areas caring for neonatal, paediatric and adult patients. Role activities involved direct patient, assessment, diagnosis, monitoring, management and procedural activities. Additional role expansion has included post intensive care discharge follow-up, intensive care patient retrieval and transfers, and follow-up outpatient care. Research outcomes were variable and could be challenged methodologically. For example, studies often involved small samples, short evaluation periods, descriptive statistics rather than correlation statistics and single sites. Nonetheless, positive trends or statistical significance was demonstrated in relation to patient outcomes (complication rates, morbidity and mortality rates, patient satisfaction, length of stay and readmission rates). The Critical Care Nurse Practitioner can provide professional and

clinical pathway opportunities for clinicians. Further, this role would appear critical for meeting future service demand and workforce supply issues within Australia.

CONCLUSION

This review provides significant evidence and much support for the Critical Care Nurse Practitioner role. Broadly, there is a significant volume of evidence examining Nurse Practitioner outcomes. Generally, Adult Critical Care Nurse Practitioners tended to investigate patients (investigations, prescriptions and referral) at similar rates to medical staff although, often achieved higher patient/family satisfaction rankings. The majority of Adult Critical Care Nurse Practitioner studies demonstrated evidence of a reduction in hospital costs; length of stay, investigations; patient complication (infection; morbidity and mortality) rates, and (re)admission rates. While there is a significant amount of evidence about the benefits of the Paediatric and Neonatal Critical Care Nurse Practitioners the impact evidence was weaker when compared with the Adult Critical Care Nurse Practitioner. The evidence strongly supported Adult Critical Care Nurse Practitioner roles with positive trends in Paediatric and Neonatal Critical Care Nurse Practitioners models of care. Given the evidence there is scope for further development of the Critical Care Nurse Practitioner role within Australia. It is clear that expansion of the Critical Care Nurse Practitioner workforce within Australia can go some way to meeting patient, workforce supply and critical care service demands.

WHAT IS KNOWN ABOUT THIS TOPIC

- Within Australia the Critical Care Nurse Practitioner role and indeed Nurse Practitioner roles broadly are not flourishing.
- Internationally Critical Care Nurse Practitioner roles are more diverse than within Australia.
- Critical Care Nurse Practitioners are demonstrating a range of significant improvements for critical care services.

WHAT THIS PAPER ADDS

- The literature provides evidence of a broad range of Critical Care Nurse Practitioner roles.
- Identification of service roles and patient activities which extend beyond Australian Nurse Practitioner roles and scope.
- Positive clinical trends or statistical significance demonstrated in relation to patient outcomes, length of stay and (re)admission rates.
- The Critical Care Nurse Practitioner workforce could potentially provide an opportunity for extensive health care reform in both acute and hospital services within Australia.

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