Uptake and caseload of intensive care unit liaison nurse services in Australia

The Australian ICU Liaison Nurse Forum

Patients admitted to modern hospitals have greater complexity and comorbidity than patients in the past.[1] Hospital wards, however, may not be optimally resourced to provide the complex level of care these patients require, potentially exposing them to adverse events.[2] Adverse events are defined as any unintended harm or injury to patients that is caused by their health care rather than the underlying disease or illness.[3] Many factors contribute to adverse events, including knowledge and skills of ward staff, adequacy of vital sign measurements[4,5] and recognition of clinical deterioration.[6,7]

Timely and appropriate recognition of, and response to, clinical deterioration has been identified as an essential component of safe, high-quality care.[8] In the past decade, several strategies have been developed to assist ward staff in caring for complex patients, including patient-at-risk teams (PART) and critical care outreach services (CCOS) in the United Kingdom,[9,10] and the rapid response team (RRT) in Australia.[11]

Another Australian approach for recognising and preventing clinical deterioration in ward patients involves intensive care unit liaison nurses (ICULNs). These nurses play a particularly important role in patient care after discharge from the ICU.[12,13] Due to the recent development of the role, there is limited understanding of the ICULN service. To date, research has focused on ward nurses' perceptions of the ICULN role,[14,15] the impact of ICULNs on patients' and families' anxiety before ICU discharge,[16] and their impact on discharge delay after prolonged ICU stay,[17] as well as ICU readmission, inhospital mortality[18,19] and adverse events.[20]

However, several recent developments may have influenced the provision of ICULN services. These include an increased federal focus on clinical deterioration in patients,[8] the development of a model for ICULN services in some jurisdictions,[21,22] and dedicated funding for ICULN services.[23]

Although information exists on the uptake of RRT services in Australia,[24] there is little information on the rate and timing of implementation of ICULN services. The type of services these nurses provide and how their roles have developed is also unknown. A limited number of studies[18,25] have reported the evolution of the ICULN role, and only one recently published study has reported the national uptake of the ICULN role in Australia.[26]

The aims of this study were to identify how many hospitals in the Australian College of Critical Care Nurses

ABSTRACT

Background: Intensive care unit liaison nurses (ICULNs) represent a new clinical service role in the Australian health care system. These nurses aim to improve patient outcomes by providing a specialised support service to ward staff caring for acutely ill patients. As this role is relatively new, it is not known how many hospitals employ ICULNs or what the demand for their services is.

Objectives: We aimed to identify the number of hospitals in the Australian College of Critical Care Nurses ICULN special interest group that report having an ICULN service, to document the timing of their introduction, and to assess changes in caseload since introduction.

Design and setting: We conducted a retrospective observational study of the changes in ICULN operating hours and monthly patient reviews, and the timing of implementation of the services in Australian hospitals. We also assessed aspects of the ethics submission and approval process.

Results: Seventeen Australian hospitals submitted data. Before 2004, there were only two ICULN services. The number of services dramatically increased between 2004 and 2007. In 14 sites, monthly patient reviews increased by a median of 54.3%. After adjustment for staff hours, 10 hospitals reported an increase in monthly patient reviews (median increase, 48.8%). Between 1999 and 2011, the 17 services performed 123 236 patient reviews, including 73 022 ICU discharges (59.3%), 26 800 during or after rapid response team review (21.7%), and 23 414 de-novo referrals from ward staff (19.0%).

Conclusion: The demand for ICULN services has increased in most hospitals since the role was adopted, although this varies considerably. The majority of patients are reviewed after ICU discharge. Further research is needed to define the scope of practice of the role and its impact on patient outcome, particularly in patients after ICU discharge.

Crit Care Resusc 2012; 14: 221–226

(ACCCN) ICULN special interest group report having an ICULN service, and to document the timing of introduction of the ICULN service in participating hospitals and changes

in caseload since their introduction. We also aimed to examine annual patient reviews based on the source location of the initial referral, and to assess variables related to the ethics approval process, including time to receiving approval and the number of revisions required.

Methods

Study design

We conducted a retrospective observational study of the changes in ICULN operating hours and monthly patient review rates, and the timing of implementation of the services.

Detailed description of ethics approval

Approval to perform the study was obtained from the human research ethics committees of all participating hospitals. We recorded time taken to obtain ethics approval as the interval between initial submission and receipt of approval. We also recorded the number of revisions required by the local ethics committees before approval was obtained.

Study infrastructure and coordination

The study was overseen and coordinated by management and writing committees (see Appendix). Their tasks included development and promulgation of the study protocol, an electronic tool for data collection, and a data dictionary to ensure consistency in the nature of data collection. The study protocol was developed to assist in the process of local ethics application, to standardise data collection and to provide overarching governance.

Recruitment of participating sites

Expressions of interest to participate in the study were sought via an email sent to all members of the ACCCN ICULN special interest group. Each participating site was required to sign an investigator protocol agreement.

Nature of data collection

Data at individual sites were collated into a pro-forma spreadsheet, and emailed to the chief investigator for collation and analysis.

We collected data on the date of ICULN service implementation, the annual equivalent full-time positions (EFTP) as a marker of hours of operation, and the number of patients reviewed who were recently discharged from the ICU, seen during or after RRT review, or who were de-novo referrals from ward staff.

Outcomes and statistical analysis

The timing of introduction of ICULN services is presented as number of services per year. Changes in the total annual number of patients reviewed for services by year are also presented, as reviews per month, and adjusted for EFTP for the corresponding year. The change in both EFTP and patients reviewed per month is described by comparing the most recent year of data submission with the baseline year of data submission within each hospital. The breakdown of patients reviewed according to source of referral by year is also presented.

Raw data are presented as absolute numbers and proportions. Changes in EFTP and the number of patients reviewed each month for individual hospitals are expressed as a percentage difference between the most recent year of review and the baseline year of review. In addition, aggregated data for all hospitals by calendar year are presented as a box-whisker plot showing median and interquartile range (IQR) for each year. To assess whether aggregated ICULN review rates changed with time across the participating hospitals, multiple variable linear regression analysis (MVLRA), using log (ICULN patients reviewed) as the dependent variable, and year and hospital as independent variables, was performed. Raw data were log-transformed as they were not normally distributed. A P value of <0.05 was taken to indicate statistical significance.

Results

### Characteristics of participating hospitals

Of 353 nurses on the ACCCN ICULN special interest group email list, 28 nurses from 17 hospitals agreed to participate in the study. Fourteen sites were in Victoria, and three in New South Wales. An additional site in Queensland returned an initial expression of interest, but did not contribute data.

The total number of beds in the 17 participating hospitals ranged from 77 to 475 (mean ± SD, 348 ± 137 beds). The annual number of hospital inpatient admissions ranged from 5788 to 83 182. The annual number of ICU admissions ranged from 418 to 2096 (mean ± SD, 1063 ± 482). Based on the minimum standards for ICUs set by the College of Intensive Care Medicine,[27] 13 hospitals were classified as a Level 3 ICU and three hospitals as a Level 2 ICU. One hospital did not have an ICU.

Details of ethics approval process

There was considerable variation between participating sites in the length of time to obtain ethics approval, ranging from 1 to 176 days, with a maximum of six revisions being required. Four hospitals required submission using the National Health and Medical Research Council (NHMRC) national ethics approval form (NEAF). In hospitals requiring a NEAF, the time to ethics approval was substantially longer than in those not requiring it (median

Figure 1. Estimated uptake of intensive care unit liaison nurse services by year, Victoria and New South Wales*
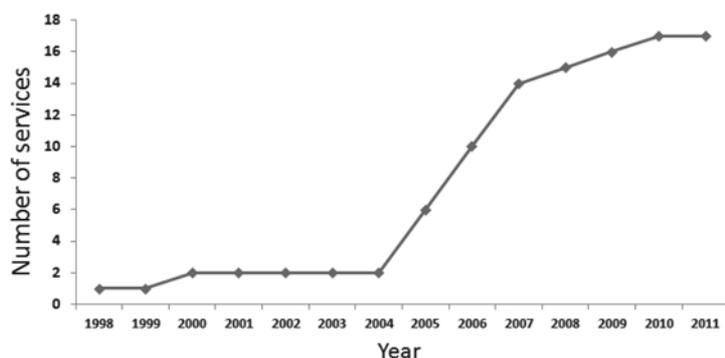
* Based on reported equivalent full-time positions from 17 hospitals.

[IQR], 139.5 [53.2–168.0] days v 30.0 [9.0–37.0] days; $P = 0.031$). NEAF hospitals also had a higher number of median revisions than did non-NEAF hospitals (3.5 v 0 revisions; $P = 0.009$).

Uptake of ICULN services with time
Before 2004, only two of the 17 participating hospitals had implemented an ICULN service. From 2004, the number of services dramatically increased, particularly between 2004 and 2007 (Figure 1).

Changes in ICULN resourcing with time
In eight of the study hospitals, funded ICULN staffing hours increased by between 11.1% and 140.0% (median increase [IQR], 85% [56.7%–102.5%]) when comparing the most recent year of data submission to the baseline year. In one hospital, the hours of ICULN operations decreased by 7.5% when the most recent year was compared with the baseline year, and in eight hospitals there was no change in resources with time.

In 1998, the one hospital with a service had 1.75 EFTP of ICULN time. In 2011, the median EFTP among the 17 hospitals was 1.68 (IQR, 1.40–2.35). Using MVLRA, there was no statistical association between calendar year and log-transformed EFTP ($P = 0.87$).

Changes in monthly patient reviews with time
In 14 of the study sites, monthly patient reviews increased (range of percentage increase, 1.4%–390.4%; median, 54.3% [IQR, 15.4%–88.9%]). In the remaining three hospitals, there was a reduction in the number of patient reviews per month when the last year of data submission was compared with the baseline year of data submission (percentage decreases, 2.1%, 16.7% and 26.1%).

Across the 17 hospitals, the median (range) number of patients reviewed per month increased from 89.9 (69.0–110.7)

in 1999 to 107.5 (66.8–190.8) in 2011 (Figure 2). Using MVLRA, there was a non-significant trend for a positive association between calendar year and log (reviews per month) ($P = 0.116$).

## Monthly patient reviews adjusted for ICULN operating hours
When monthly patient reviews were adjusted for the number of funded EFTP, the number of reviews/month/EFTP increased in 10 hospitals (range of percentage increase, 4.3%–320.3%; median, 48.8% [IQR, 20.2%–54.5%]). In the other seven hospitals, there was a decline in monthly adjusted ICULN operating hours of 2.1%–48.5% when compared with the baseline year (median percentage decrease, 19.5% [IQR, 14.4%–30.1%]).

Across the 17 hospitals over the study period, there was an increase in the median (IQR) patient reviews/EFTP/month from 44.9 (34.5–55.3) in 2000 to 70.7 (42.0–83.9) in 2011. However, MVLRA showed no statistical association between calendar year and log (reviews/EFTP/month) ($P = 0.372$) (Figure 3).

## Patient reviews by origin of referral
Between 1999 and 2011, a total of 123 236 patients were reviewed by ICULN services in the participating hospitals. Of these reviews, 73 022 (59.3%) were of patients after ICU discharge, 26 800 (21.7%) were in association with RRT review, and 23 414 (19.0%) were de-novo referrals from

Figure 2. Change in monthly number of patients reviewed by intensive care unit liaison nurse services in 17 hospitals in Victoria and New South Wales, by calendar year
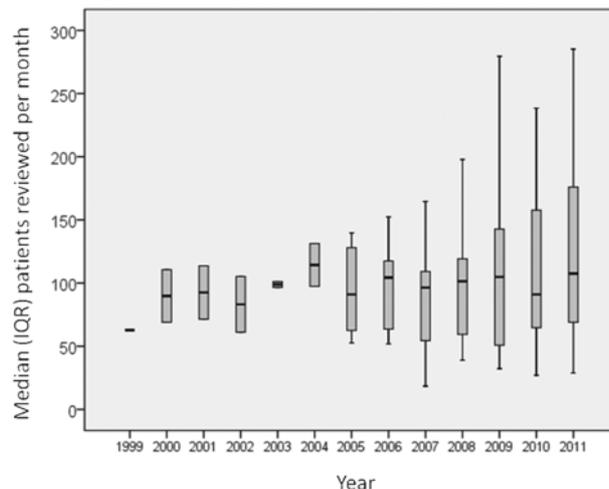
IQR = interquartile range.

Figure 3. Change in monthly number of patients reviewed by intensive care unit liaison nurse services in 17 hospitals in Victoria and New South Wales, adjusted for equivalent full-time (EFT) position, by calendar year

IQR = interquartile range.
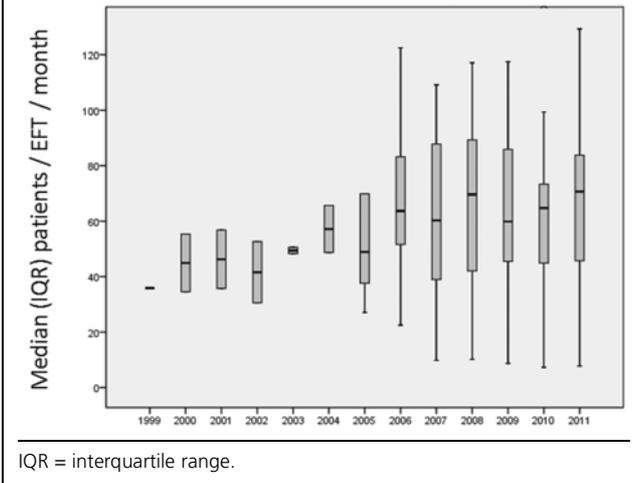
ward staff. The dominance of ICU-discharged patients as a referral source was present throughout the entire 13-year period, and ICU-discharged patients were the largest referral group for every year in the study period (Figure 4).

Discussion

In this analysis of the uptake and operational changes in 17 ICULN services over a 13-year period, we found that most

Figure 4. Number of patients reviewed by intensive care unit liaison nurse services in 17 hospitals in Victoria and New South Wales each calendar year, by referral source

MET = medical emergency team.

services were introduced after 2004 and that hours of operation have not changed significantly with time, but that there was a non-significant trend for increased monthly patient reviews. This marked uptake corresponds to a substantial funding commitment for these services in Victoria, the location of most of the hospitals in our study. Although there has been considerable recent focus on clinical deterioration in patients, there has been little increase in the EFTP available for ICULN services.

Most reviews occurred in patients recently discharged from the ICU. There was considerable variation in all measured variables between hospitals and in ethics approval processes, which were often protracted despite the study being an audit of negligible risk.

Comparison with previous studies

This study was conducted because ICULNs are a relatively new clinical service role in Australian health care settings, about which little is known. However, the ICULN role is comparable with CCOS in the UK, which aim to avoid admissions or ensure timely admission to the ICU, enable discharges from the ICU and share skills with ward staff.[28]

A recently published Australian questionnaire-based study by Elliot and colleagues[26] described the uptake of ICULN services in 31 Australian hospitals, and similarly found a spike in uptake in 2004. It reported a median weekly review of 25 patients (median of about 40 000 patients per year). However, it did not report on changes in patient review, staff EFTP or the referral source with time.

A recent survey of delegates (from 56 hospitals in the UK) attending a conference on CCOS found that most hospitals (72%) had an outreach service.[29] This proportion has not changed since a survey conducted in 2002.[30] In hospitals without CCOS, few had had a service in the past, while a third planned to start one within the next 6 months.[29] Nearly a quarter of hospitals did not perceive a need for CCOS. As we did not survey hospitals without a current ICULN service, we cannot report how many Australian hospitals had a service in the past but do not currently have one, nor how many plan on commencing ICULN services in the future.

Another recent study of CCOS, based on a national critical care database from England, Wales and Northern Ireland, similarly found that most hospitals (73%) had an outreach service.[28] These services commenced between 1996 and 2004, probably in response to a recommendation from the British Department of Health[31] that these
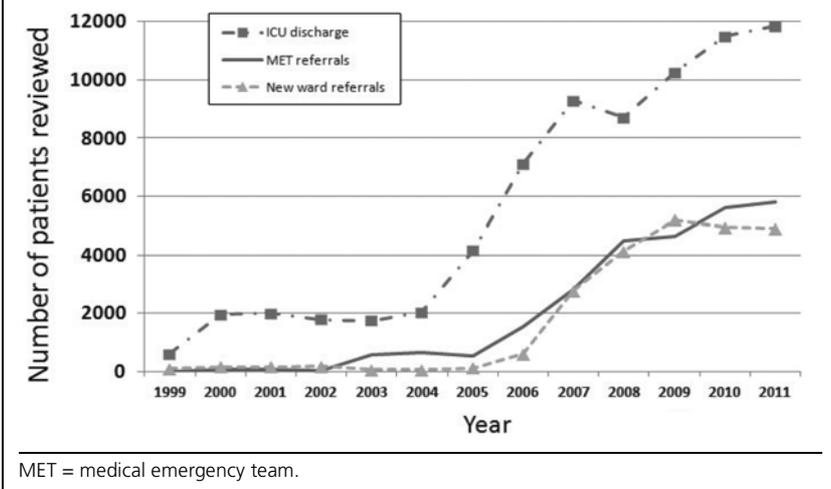
services be developed as a pragmatic approach to supporting the management of critically ill or at-risk patients who are outside a critical care unit. We are not aware of similar recommendations in Australia.

Strengths and weaknesses

To our knowledge, this is the first study to conduct a detailed analysis of the uptake of ICULN services in Australia. It is also the first to conduct a detailed analysis of ICULN EFTP, nature and rate of review, and changes in these variables over time. Despite these strengths, our study is retrospective in design, contains no information on patient demographics, service interventions or the effect of ICULN services on patient outcomes. In addition, we did not use a methodology that would allow us to identify the actual total number of ICULN services in Australia and how the non-participating sites differ from those presented here. This relates to the method of site selection (using the ACCCN ICULN special interest group) and the potential for responder bias in this group. Accordingly, our findings may not be representative of those for the whole of Australia. A further limitation is that we cannot comment on variability of the intensity or duration of patient review, or the complexity of patients subject to review. Such information may partially explain differences in review rates between hospitals and over time.

Implications for clinicians and policymakers

Our descriptive study found increased ICULN workload over time in many hospitals, although this varied considerably between hospitals.

Patients recently discharged from the ICU were the predominant patient group reviewed. It is anticipated that this will be the patient group most likely to be included in future observational and interventional studies of the ICULN service. There is a need to conduct further studies to illustrate the characteristics and outcomes of patients reviewed by ICULN services, and the interventions performed. Differences in patient caseload, hours of operation and nature of patient reviews between hospitals will make the performance of multicentre research in the area of ICULN services difficult. The variation in services and scope of practice provided by ICULNs also needs to be documented.

Our study also suggests that in the most recent calendar year, more than 20 000 patients were reviewed by ICULN services. The study by Elliot and colleagues[26] suggests this figure may actually be much higher. Combined, these studies indicate that the ICULN service is a major mechanism for the review of at-risk or deteriorating patients. Accordingly, there is a need to develop mechanisms for data collection (including a minimum dataset), educational resources, and prospective observational and interventional research studies in this area of Australian intensive care practice.

Conclusion

We have demonstrated increased uptake of ICULN services since the role was adopted. There was considerable variation in caseload and EFTP between hospitals. The most common patient type reviewed was patients seen after ICU discharge. Further studies are needed to more clearly define the ICULN scope of practice, interventions provided, and the impact of such interventions on patient outcomes.

Competing interests

None declared.

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