

# Mortality and outcomes of elderly patients admitted to the intensive care unit at Cairns Base Hospital, Australia

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The provision of expensive medical treatment to elderly patients is controversial, especially when the likely mortality is high. The controversy arises partly from the fact that as we age, life expectancy decreases. In addition, age is thought to be strongly associated with intensive care outcomes, but this relationship is confounded by many clinical variables.<sup>1</sup> Elderly patients often go through an informal selection process before admission to the intensive care unit, making generalisations high impossible.<sup>2,3</sup> Nevertheless, it is useful for clinicians and patients' families to have historical data on local outcomes as a guide on which to base informed decisions about treatment.

Cairns Base Hospital is a regional hospital in Queensland serving a community of about 300 000 people. The catchment extends south of Cairns and north to Cape York and the Torres Strait Islands. The hospital has no cardiac or neurosurgical services. The ICU is a Level 2 general unit that cares for both adult and paediatric patients. The generally younger population in the far north, and the fact that the unit admits children, results in the median age of patients being lower than in most metropolitan and tertiary referral hospitals. Additionally, this means that elderly patients are more conspicuous than in many other ICUs.

We undertook this study to determine the long-term outcome of older patients in our ICU.

## Methods

This was a retrospective observational study. Following hospital ethics committee approval, a list of patients aged 60 years or over who were admitted to the ICU between 1 January 2003 and 31 December 2005 was obtained from the Hospital Based Corporate Information Systems database. This was expanded by reference to the Australian and New Zealand Intensive Care Society AORTIC (Australasian Outcomes Research Tool for Intensive Care) database. ICU and hospital survival plus demographic and clinical data were also obtained from these sources. This list was referenced against the Queensland register of deaths.

All patients who had consented to be contacted by the hospital and were believed to be alive were mailed a questionnaire. This was followed up with a telephone call. The EuroQol-5D questionnaire<sup>4</sup> was administered to assess quality of life, either through self-assessment or by nursing

## ABSTRACT

**Objective:** To determine the survival and outcome of elderly patients admitted to the intensive care unit at Cairns Base Hospital.

**Methods:** A retrospective review of patients aged 60 years or over admitted to the ICU (a Level 2 general unit) at Cairns Base Hospital, a regional hospital in Queensland, during 2003–2005. Mortality was determined by review of hospital records, the Queensland register of deaths, and direct patient or family contact in November 2006. Demographic and clinical details were collected, and the EuroQol-5D questionnaire was used to assess current and pre-ICU quality of life.

**Results:** 432 patients aged  $\geq 60$  years had 469 admissions to the ICU during 2003–2005. Long-term outcome was determined for 68%: 201 (46%) were confirmed dead, and 94 (22%) were confirmed alive, while the outcome for 137 (32%) remained unknown. Allowing for an estimated mortality of 39% in the unknown group, the overall estimated mortality was 60%. Mean follow-up time was 2.4 (SD, 0.9) years (range, 11–35 months). As age increased, mortality increased: 37% for the 60–70 years age group; 50% for 70–80 years; 61% for 80–90 years, and 83% for > 90 years. The quality of life of survivors was lower on follow-up than on ICU admission.

**Conclusions:** Elderly patients admitted to the ICU have high mortality. As age increases, mortality increases. Elderly survivors can expect a lower quality of life after an ICU admission, although on average the difference is not great.

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staff. For analysis, a score was assigned to each of the three-point domains in the questionnaire for mobility, self-care, usual activities, pain/discomfort and anxiety/depression (eg, 1 = I have no problems in walking about; 2 = I have some problems in walking about; and 3 = I am confined to bed). Thus, the higher the score, the poorer the quality of life in the domain measured. Data were analysed using Graphpad InStat V 2.04 (Graphpad Software, San Diego, Calif, USA). Unless otherwise indicated, values were compared using two-sided Student's *t* tests.

**Table 1. Long-term outcomes and APACHE scores (mean  $\pm$  standard deviation), by decade of age**

Age (years)	No. of admissions*	Total patients		Alive		Dead		Unknown outcome	
		No.	APACHE score	No.	APACHE score	No.	APACHE score	No.	APACHE score
60–70	198	184	21.8 $\pm$ 8.7	49 (27%)	18.2 $\pm$ 7.2	68 (37%)	26.4 $\pm$ 8.2	67 (36%)	18.7 $\pm$ 8.0
70–80	188	176	23.7 $\pm$ 9.3	37 (21%)	19.3 $\pm$ 8.1	88 (50%)	27.0 $\pm$ 8.9	51 (29%)	21.0 $\pm$ 8.7
80–90	70	66	24.6 $\pm$ 8.5	8 (12%)	21.3 $\pm$ 9.1	40 (61%)	27.0 $\pm$ 8.8	18 (27%)	21.1 $\pm$ 5.4
>90	6	6	24.8 $\pm$ 7.1	0	–	5 (83%)	(26.0 $\pm$ 7.2)	1 (17%)	–
All	462	432	23.1 $\pm$ 8.9	94	19.6 $\pm$ 8.1	201	26.6 $\pm$ 8.3	137	20.3 $\pm$ 7.4

\* Number of admissions may be greater than number of patients as some patients had multiple admissions.

**Table 2. Long-term outcomes of non-surgical and surgical patients and APACHE scores (mean  $\pm$  standard deviation), by decade of age**

Age (years)	Admission type	Total patients		Alive		Dead		Unknown outcome	
		No.	APACHE score	No.	APACHE score	No.	APACHE score	No.	APACHE score
60–70	Non-surgical	89	24.0 $\pm$ 8.6	18 (20%)	19.8 $\pm$ 6.0	39 (44%)	26.5 $\pm$ 8.2	32 (36%)	20.9 $\pm$ 7.6
	Surgical	94	19.5 $\pm$ 8.3	31 (33%)	17.8 $\pm$ 8.1	29 (31%)	23.6 $\pm$ 8.6	34 (36%)	17.2 $\pm$ 6.7
70–80	Non-surgical	80	26.1 $\pm$ 8.6	10 (12%)	25.2 $\pm$ 7.1	47 (59%)	27.3 $\pm$ 9.2	23 (29%)	23.4 $\pm$ 7.4
	Surgical	96	21.9 $\pm$ 9.5	27 (28%)	17.0 $\pm$ 7.3	42 (44%)	26.3 $\pm$ 9.0	27 (28%)	19.5 $\pm$ 9.3
80–90	Non-surgical	27	27.8 $\pm$ 6.6	3 (11%)	21.3 $\pm$ 3.2	18 (67%)	30.3 $\pm$ 5.5	6 (22%)	23.5 $\pm$ 6.9
	Surgical	38	22.4 $\pm$ 9.1	5 (13%)	21.2 $\pm$ 11.8	22 (58%)	24.1 $\pm$ 10.2	11 (29%)	20.0 $\pm$ 4.5
>90	Non-surgical	2	22.0 $\pm$ 2.8	0	–	2 (100%)	22.0 $\pm$ 2.8	0	–
	Surgical	4	26.3 $\pm$ 8.5	0	–	3 (75%)	28.7 $\pm$ 8.6	1 (25%)	19

## Results

During the period 2003–2005, 432 patients aged  $\geq$ 60 years had 469 admissions to the ICU at Cairns Base Hospital. They comprised 290 men and 142 women. Thirty-five different nationalities were recorded, with 118 patients listing their nationality as other than Australian.

Follow-up was performed in November 2006, equating to a mean post-hospital admission time of 2.4 (SD, 0.9) years (range, 11–35 months). Long-term outcome was confirmed for 432 patients (68%): 94 (22%) were confirmed alive, and 201 (46%) were confirmed dead, while outcome was unknown for 137 (32%). The percentage with unknown outcome was similar for non-Indigenous and Indigenous patients. Of the 118 non-Australian patients, 38 had unknown outcomes. The overall mean Acute Physiology and Chronic Health Evaluation (APACHE II) score was 23.1 (SD, 8.9).

Table 1 shows mortality by decade of age with the associated mean APACHE II score for each group. Within the 60–70 and 70–80-year decades, there was a highly significant difference ( $P < 0.001$ ) in APACHE scores between patients known to have survived and those known to have died. In the 80–90-year decade, there was no statistically

significant difference between the APACHE scores of survivors and non-survivors.

Table 2 shows the mortality for non-surgical and surgical admissions. Table 3 shows the outcomes for Aboriginal and Torres Strait Islander patients. In the 60–70-year decade, the risk of death was significantly higher among Indigenous patients compared with non-Indigenous patients ( $P = 0.001$ , Fisher's exact test). In the 70–80-year decade, there was no significant difference in mortality between Indigenous and non-Indigenous patients. There were insufficient Indigenous patients in the over 80 years category for a meaningful statistical analysis. In the 60 years and over age group, Indigenous patients make up about 18% of general hospital admissions, but only 9% of ICU admissions.

Thirty-four patients were admitted within 24 hours of a cardiac arrest. In this group, there was one confirmed survivor (3%), five patients with unknown outcome (15%), and 28 confirmed deaths (82%), with three of those who died having survived longer than a month. Twenty-eight patients were admitted within 24 hours of respiratory arrest. In this group, there was also one confirmed survivor (4%), six patients with unknown outcome (21%), and 21 confirmed deaths (75%).

**Table 3. Long-term outcomes of Aboriginal and Torres Strait Islander (TSI) patients and APACHE scores (mean  $\pm$  standard deviation), by decade of age**

Age (years)	Group	Total patients		Alive		Dead		Unknown outcome	
		No.	APACHE score	No.	APACHE score	No.	APACHE score	No.	APACHE score
60–70	Aboriginal	14	28.9 $\pm$ 7.2	0	–	12 (86%)	30.3 $\pm$ 5.5	3 (14%)	20.5 $\pm$ 13.4
	TSI	8	25.4 $\pm$ 7.3	1 (13%)	–	1 (13%)	–	6 (64%)	24.4 $\pm$ 8.7
70–80	Aboriginal	10	25.7 $\pm$ 11.0	1 (10%)	–	6 (60%)	26.5 $\pm$ 11.5	3 (30%)	28.0 $\pm$ 14.0
	TSI	5	29.5 $\pm$ 5.5	0	–	4 (80%)	29.5 $\pm$ 5.3	1 (20%)	–
80–90	Aboriginal	2	26.0 $\pm$ 4.2	0	–	2 (100%)	26.0 $\pm$ 4.2	0	–
	TSI	0	–	0	–	0	–	0	–
> 90	Aboriginal	0	–	0	–	0	–	0	–
	TSI	0	–	0	–	0	–	0	–

**Table 4. Outcome of patients who had a tracheostomy, by decade of age**

Age (years)	Tracheostomy		Outcome		
	No.	% of patients	Alive	Dead	Unknown
60–70	25	14%	5 (20%)	10 (40%)	10 (40%)
70–80	25	14%	3 (12%)	13 (52%)	9 (36%)
80–90	37	56%	5 (14%)	21 (57%)	11 (29%)
> 90	0	0%	–	–	–

**Table 5. EuroQol-5D scores for quality-of-life domain measures\* (n = 99)**

Domain	Mean score $\pm$ SD		P
	Pre-ICU	Follow-up	
Mobility	1.25 $\pm$ 0.48	1.49 $\pm$ 0.58	0.002
Self-care	1.12 $\pm$ 0.36	1.34 $\pm$ 0.56	0.001
Pain/discomfort	1.36 $\pm$ 0.60	1.54 $\pm$ 0.63	0.04
Usual activities	1.25 $\pm$ 0.48	1.67 $\pm$ 0.73	<0.0001
Anxiety/depression	1.15 $\pm$ 0.35	1.38 $\pm$ 0.60	0.001
Global quality life	7.1 $\pm$ 2.1	6.3 $\pm$ 2.3	> 0.05

\* Individual domains were scored on a scale of 1 (no problems) to 3 (maximum disability). Global quality of life was scored on a 10-point scale from 0 (worst state of health) to 10 (best state of health).

Patients in their 80s had a tracheostomy rate about three times that of younger patients. Table 4 shows tracheostomy rates and survival for patients who underwent tracheostomy.

Of the 247 patients known to have been discharged from hospital alive, the ultimate outcome was known for 138. In this latter subset, 84 were known to still be alive (61%), and

54 were known to have died (39%). From this, we estimated a 39% mortality in the group whose ultimate outcome remained unknown.

The source of admission (accident and emergency department or ward) made no statistical difference to outcome.

Ninety-six patients were able to rate their overall state of health on a 10-point scale (from 0 = worst state of health to 10 = best state of health) for before and after the ICU admission. The mean ( $\pm$ SD) health state was 7.1 $\pm$ 2.1 pre-ICU versus 6.3 $\pm$ 2.3 post-ICU; this difference was not statistically significant. Ninety-nine patients completed scores in the isolated measures of quality of life of the EuroQol-5D survey (Table 5).

## Discussion

We were able to determine long-term outcome in 68% of patients. At a mean follow-up time of less than 2.5 years, this study found a mortality of almost 50% in patients aged  $\geq$  60 years admitted to the ICU. This finding is true regardless of the 32% of patients whose long-term outcome could not be determined. This unknown group reflects the retrospective nature of the study, the large number of visitors to Cairns, difficulties in contacting patients, and the relative mobility of the local population. Interstate and overseas death registers were not screened. As all the patients with unknown outcome were unlikely to have survived, we estimated the mortality within this group. Unknown outcomes were possible only in patients who survived to hospital discharge. To derive an estimate of the likely mortality in the whole unknown group, we examined the subset of patients who survived to hospital discharge and whose long-term outcome was known. This subset had a mortality of 39%. Applying this 39% to the unknown-outcome group (ie, 39% of 32%), we estimated an additional 12% mortality on top of the overall figure for all

admissions. Thus our estimated overall mortality was about 60% (ie, confirmed mortality of 46% plus additional estimate of 12% from the unknown group).

Mortality was observed to worsen with increasing age, so that patients aged in their 60s can be expected to have a better outcome than patients in their 80s. Similar results have been cited elsewhere.<sup>1,5,6</sup> Interestingly, the over 80s group was the only group in which there was no statistical difference in APACHE scores between survivors and non-survivors. This may reflect the absence of adequate validation of APACHE scoring at the extremes of age.

Survival without a reasonable quality of life has little meaning. Thus, we endeavoured to assess quality of life among survivors. Numerous measures for quality of life are available. The EuroQol-5D is simple to use and has been widely employed in studies relating to critical care.<sup>7-10</sup> We demonstrated that, within every individual domain measured on the EuroQol-5D survey, there was a statistically significant decrease. However, this did not carry across to a global assessment, where the change failed to reach statistical significance. Other studies have demonstrated decline in quality of life following ICU admission.<sup>5,10</sup>

Surgical patients had a better outcome than non-surgical patients in all age groups. This is expected, as some surgical admissions are elective, and major surgery needing postoperative ICU is usually offered only to healthier patients judged able to withstand the physiological stress. This can lead to bias. In addition, even in older patients having non-elective surgery, the problem is often confined to one organ.

Patients with cardiac or respiratory arrest in the previous 24 hours had very poor outcomes. The medical community and the community at large need to think carefully about their approach to offering supportive care to elderly patients known to have had a cardiac or respiratory arrest.

Our study revealed that the proportion of Indigenous patients among ICU admissions in the  $\geq 60$  years age group was about half their proportion among general hospital admissions. In addition, Indigenous patients had higher APACHE scores and higher mortality than non-Indigenous patients. The high prevalence of diabetes and renal disease among Indigenous ICU patients probably accounts for their higher APACHE scores, but the reason for the difference in admission rates is unknown.

Tracheostomy rates were three times higher in the over 80 years age group. This reflects longer admission times and longer ventilation weaning times. More than half the patients aged over 80 years underwent a tracheostomy. Knowing this, perhaps we should move to even earlier intervention in this age group.

The information gained from this study is not unexpected. Although application to individual cases remains problematic, our results provide a confirmatory guide — about 60% of patients aged  $\geq 60$  years admitted to the ICU will die within 2.5 years. This guide, combined with clinical experience and tools such as APACHE scores, may allow us to make more informed clinical decisions when caring for elderly patients in the ICU.

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