

# Evolving role of intensive and high-dependency care

**D Nehra FRCS**

*Registrar in General Surgery*

**M K H Crumplin FRCS**

*Consultant Surgeon*

**A Valijan FFARCS\***

*Associate Specialist in Anaesthesia*

**A E Edwards FFARCS**

*Consultant Anaesthetist*

Departments of Surgery and Anaesthesia, Maelor General Hospital, Wrexham

**Key words:** High-dependency unit; Critically ill; Intensive care unit; Bed occupancy

As stratified patient care evolves, and with an increasing population of elderly patients undergoing major surgery there is a growing demand for critical and high-dependency care beds. Results of an audit comparing the activity of a combined Intensive Care and High-Dependency Unit (ITU/HDU) in 1981 with 1991 has shown an increase in the number of patients admitted, particularly for high-dependency care. The overall mortality in 1981 was 12% compared with 9.5% in 1991. The greatest improvement was seen in ventilated patients, where the mortality was reduced from 54% in 1981 to 30% in 1991.

An attempt is made to predict the demand for critical care and high-dependency beds for the future in a population of approximately 250 000 based on current trends. It is perceived that it will be necessary to establish a six-bed ITU and eight high-dependency surgical beds in two separate but adjacent units, where there will be a free interchange of skills at the different levels of care.

In 1981 an audit of activity of a four-bed combined intensive care/high-dependency (ITU/HDU) facility was evaluated and compared with a previous survey performed in 1978 (1). This audit was performed to assess requirements for a purpose-built eight-bed intensive care unit to be constructed in a nucleus complex. The 1981 study revealed an increase in bed occupancy (from 51% to 71%), the mean age of patients (57 years to 63 years), and proportion of critically ill when compared with high-dependency care patients (1978, 48% critically ill; 1981, 61% critically ill). There was a decrease in mortality of critically ill surgical patients (1978, 42%; 1981, 18%), and a zero mortality in the 112 HD-type patients in 1981.

Present appointment: Consultant Anaesthetist at Ysbyty Gwynedd, Bangor, Gwynedd

Correspondence to: Mr M K H Crumplin FRCS, Maelor General Hospital, Wrexham, Clwyd LL13 7TD

The authors concluded that a policy of mixing ITU/HDU patients was of benefit. A prospective review of admissions to the new eight-bed ITU has been undertaken to evaluate further the expanding requirements of this hospital and to compare results with those of the previous decade.

## Materials and methods

The computerised records of patients admitted to the ITU/HDU during 1991 were analysed prospectively and compared with the data of patient records for the year 1981 published previously (1). As was the practice then, each patient was allocated into one of the two categories based upon their status on admission; high-dependency (HD) patients are those who are elderly or who are of ASA categories 1–3 and who undergo major surgery, eg abdominoperineal resection of the rectum. They may also be those patients who have had intermediate or major surgical procedures and who are elderly and/or in ASA categories 3–4 and who do not need any formal organ support, eg a patient with a symptomatic abdominal aortic aneurysm, after surgery. Critically ill (CI) patients are those patients who require formal organ support for continued survival, eg severely septicaemic patients and patients after major trauma. Nursing requirements for the high-dependency patients are generally agreed to be 2.3 whole-time equivalents (WTE) per bed, whereas the requirements for critically ill patients for intensive care are 6 WTE per bed.

## Results

The Maelor General Hospital serves a population of approximately 250 000 and has 660 beds for acute

admissions. For most of 1991 only six of the eight beds in the ITU/HDU were staffed. For a period of 4 weeks in that year seven beds were staffed by existing staff working overtime, or bank nurses.

Comparative patient data for 1981 and 1991 are shown in Table I and Table II. The mean stay for surgical patients on the unit is illustrated in Table III. Of note was that surgical HD patients showed an increase from 1.9 days to 3.1 days.

The overall mortality in the unit in 1981 was 12% while that in 1991 was 9.5%. Mortality among the HD patients remained low. There was minimal reduction in the mortality rates of surgical and medical CI patients, the most marked reduction was in trauma cases (from 18% to 5%) (Table IV).

On reviewing the surgical admissions for 1991 (Table V), there were 271 patients; 249 patients underwent surgery. The procedures are listed in Table VI. Table VII indicates the diagnoses of the medical admissions to the unit.

Table VIII compares the mortality rate of ventilated patients. More than twice the number of patients required ventilator support in 1991. There was, however, a marked reduction in the overall mortality, from 54% in

Table I. Comparative data 1981/1991

	1981	1991
Total admissions	281	412
Surgical	231	271
Medical	23	73
Trauma and orthopaedics	27	45
Others	N/A	23
Mean age (years)	63	62
(range)	(14-92)	(2-97)
Bed occupancy	71%	76%

N/A, Not assessed

Table II. Status of patients on admission to the ITU/HDU

	1981	1991
High-dependency patients	112 (39%)	208 (50.5%)
Critically ill patients	169 (61%)	204 (49.5%)
Total	281	412

Table III. Mean stay on unit (days)

	1981	1991
Surgery HD + CI	3.0	3.6
Surgery HD	1.9	3.1
Surgery CI	4.1	4.1

Table IV. Comparison between 1981 and 1991 mortalities

	1981 (n = 281)	1991 (n = 412)
<i>High-dependency care patients</i>		
Number of patients	112	208
Surgery	112 (0)	186 (2; 0.96%)
Others	0	22 (0)
Overall mortality (%)	0	0.96
<i>Critically ill patients</i>		
Number of patients	169	204
Medical	23 (8; 35%)	73 (21; 29%)
General surgical	119 (21; 18%)	85 (13; 15%)
Trauma and orthopaedic	27 (5; 18%)	38 (2; 5%)
Others	0	8 (1; 12.5%)
Overall mortality (%)	12	9.5

Numbers in parentheses give the number of deaths followed by the percentage mortality

Table V. Surgical admissions 1991 (n = 271)

<i>Operated</i>	249*
Elective	186
Deaths	2 (1.1%)
Non-elective	63
Deaths	7 (11.1%)
<i>Non-operated</i>	22
Deaths	6 (27.3%)
Overall mortality	5.5%

\* 179/249 over 65 years of age

Table VI. ITU/HDU admissions 1991—Operations

	No. of patients
Oesophagectomy	17
Gastrectomy	13
Cholecystectomy	16
Repair of duodenal perforation	6
Appendicectomy	4
Small bowel resection	9
Intestinal obstruction	22
Hemicolectomy	35
Hartmann's procedure	13
Anterior/AP resection	38
Repair abdominal aortic aneurysm	13
Vascular reconstruction	7
Incisional hernia repair	10
Thyroidectomy	4
Urology	22
Others	20
Total	249

Table VII. Medical ITU admissions 1991

	<i>No. of patients</i>
Respiratory	
COAD	14
Status asthmaticus	6
Pneumonitis	4
Cardiac	
Infarct/failure	12
Arrest	9
Renal failure	4
Neurological	
Meningitis	7
Subarachnoid haemorrhage	5
Drug overdose	9
Diabetic ketoacidosis	2
Septicaemia	1
Total	73

1981 to 30.1% in 1991. Of particular note was the reduction in non-elective surgical ventilated patients.

This report does not take into account that, in addition to the 412 admissions to the unit in 1991, there were at least 50 patients who were nursed and closely monitored in the recovery bay beside the theatre when the bed quota in the unit was full. Data were not retrieved from these and other potential HD cases. The criteria for admission to the recovery bay was the same as for admission to the unit.

Figure 1 and Figure 2 reveal the fluctuations in the number of patients who were in the high-dependency category or who required ventilation during the 1991 survey. It can be seen that the demand for one type of bed determined the availability of the other. As far as high-dependency capacity is concerned, the need for such beds has almost doubled in 10 years and for almost half the year six beds have been occupied (with other patients being denied entry). With regard to ventilator bed capacity, it is apparent that four beds had been

required for 23 out of 52 weeks of the year and there was occasionally need for seven or more ventilator beds.

## Discussion

There has been a 47% increase in the use of the ITU/HDU in this hospital in the last 10 years. This has been the result of increased capacity and a perceived need for expanding care of HD-type patients, who have stayed longer in the unit than in 1981. Mortality rates in HD patients in both surveys have remained low (less than 1%), and there has been a minimal decrease in mortality in critically ill patients. The overall mortality rates of 12% (1981) and 9.5% (1991) are probably comparable with overseas (2,3) and United Kingdom results (4).

Surgical mortality has improved, largely reflecting the dilution of results by high-dependency-type patients. In 1981, 48% of the surgical patients were high-dependency cases compared with 66% in 1991. However, despite an increase in the total number of surgical admissions, the number of critically ill surgical patients decreased from 119 to 85. Although there was little change in mortality (1981, 18%; 1991, 15%) in this group of patients, maximum reduction in mortality was recorded in trauma cases (from 18% to 5%) and ventilator mortality has been almost halved over this period of time. Although the latter may reflect altered philosophy in providing greater elective ventilator support for some patients, non-elective surgical ventilated patients fared better in 1991 with a fall in mortality from 59% to 37%.

The internationally recommended provision of ITU beds varies from 1% to 6% (5) of all hospital beds, and the recommendation in the United Kingdom is for 1% to 2% (6), which may represent an underprovision (4). Mean ages of admission overseas may be lower than in this series (2).

Financial restrictions in the NHS will enforce maximum efficiency in intensive and high-dependency care units, but such inevitable restrictions must never be at the expense of appropriate patient management. It is

Table VIII. Ventilator mortality

	<i>Surgical</i>				
	<i>Medical</i>	<i>Elective</i>	<i>Non-elective</i>	<i>Trauma</i>	<i>Others</i>
<i>1981</i>					
Number of patients	11	7	27	5	—
Number of deaths	6	2	16	3	—
Mortality	54.5%	28.5%	59%	60%	—
	Overall mortality—54% (27/50)				
<i>1991</i>					
Number of patients	53	13	30	13	4
Number of deaths	19	1	11	2	1
Mortality	35.8%	7.7%	36.7%	15%	25%
	Overall mortality—30.1% (34/113)				

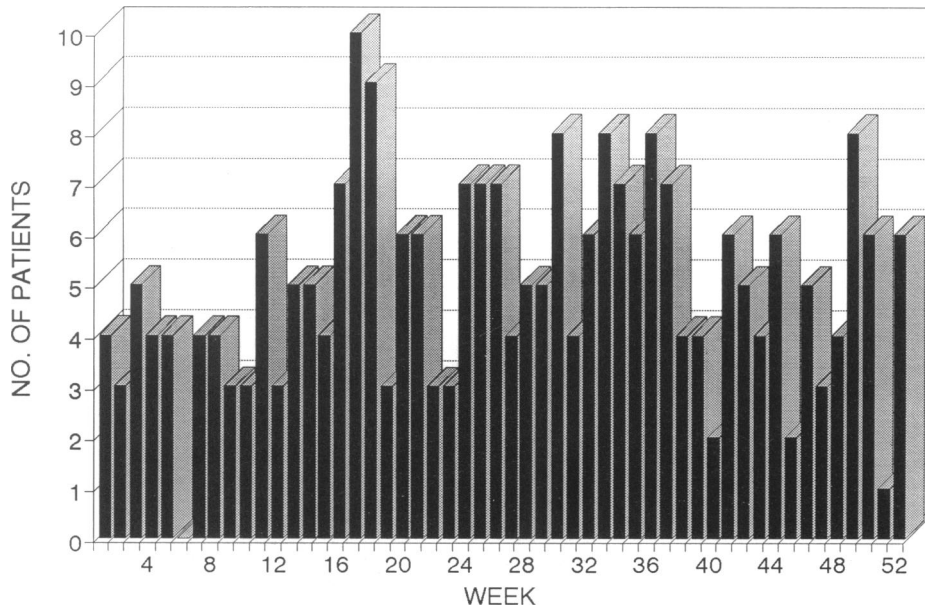


Figure 1. HDU admissions 1991.

important, therefore, not only to audit results, but also continuously to assess the need for appropriate numbers of beds and admission guidelines (6).

Most district general hospitals now have an ITU and a separate CCU, but few have a purpose-built HDU (7). In our district general hospital we have found it to be of benefit to mix intensive and high-dependency care type patients in a single unit. There are advantages to the high-dependency care patient being managed by ITU trained nurses, and there is also a beneficial effect of the case mix on nursing staff morale. This policy of a single unit has also allowed flexible use of the unit when there is increased demand for either CI or HD type patient.

With a high ratio of nurse to patient on an ITU however (six whole-time equivalents (WTE) per bed; 1:1

nurse-to-patient ratio) (8), this represents an overprovision of nurses for HDU-type patients (2.3 WTE per bed) (7).

Although an eight-bed intensive care unit was provided for this hospital, for all but 1 month of 1991 only six beds were staffed, which allowed a 50% increase of beds compared with 1981 using a four-bed unit. Increase in patient turnover was, therefore, equivalent to the increase in bed provision and the majority of the increased use of beds was by high-dependency patients (HD to CI patients 4:1).

The evolution of stratified (progressive) patient care allows clinicians to place patients in relevant therapeutic settings (9). It is therefore important to identify the appropriate number of beds for each category of patient.

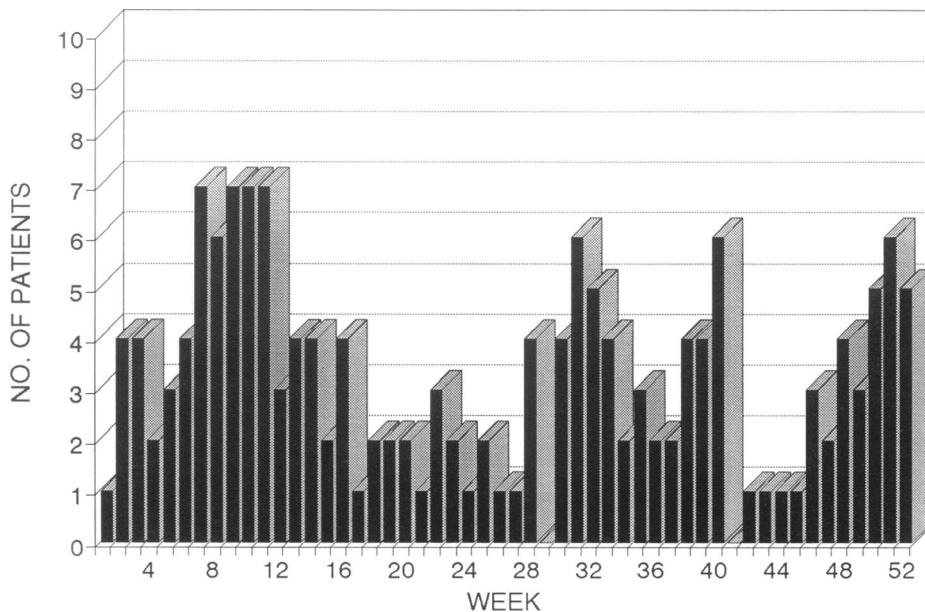


Figure 2. Ventilated patients 1991.

It is anticipated that there will be an increased demand for HD care as there are more elderly patients undergoing major surgery, increased specialisation, and changes of nursing practice on the wards. More than 50% of surgical patients in this hospital of the age of 65 years or above undergo major surgical procedures (10).

We have noticed that high-dependency care patients are staying in this unit longer than they did in 1981, which accounts for the majority of the increased occupancy during 1991 and reflects the optimal care given to the higher risk patients.

Closer proximity of the ITU/HDU to other disciplines, coupled with the increased awareness of the skills offered in the unit, accounted for a threefold increase (from 50 to 163 patients) in the utilisation of the unit by disciplines other than general surgery. In fact, the number of general surgical admissions changed little (from 231 to 249) over the decade studied. This probably reflects the working patterns of the four general surgical units, and a lack of consultant expansion.

Predicting the proportion of ITU and HDU patients and the beds required is not simple as:

- 1 There are unpredictable fluctuations during the year in the number of patients admitted and ventilated.
- 2 Increased numbers of consultant surgical staff are anticipated.
- 3 There is an increase in the proportion of elderly patients undergoing major surgical procedures.

The number of patients requiring ventilation has more than doubled in 10 years (from 50 to 113). For the next 5 to 10 years the minimum number of ventilator beds required would seem to be six with, occasionally seven or eight needed at peak times of activity.

As far as the high-dependency beds are concerned, at least eight beds would be required for surgery. There should now be a redistribution of beds and nursing expertise into two separate but adjacent units (8). Whenever there is an increase or decline in the demand for either type of bed or nursing care, there should be free interchange of nursing expertise between the ITU and HDU. To allow the nursing staff in each unit to manage either type of patient, and to adjust for absence due to sickness, annual, study or maternity leave, we would probably require 38–40 WTE for ITU beds and 20 WTE for the high-dependency care unit. This would effectively double the current quota of nurses.

It is relevant to note that running below the recommended nursing staff levels might risk morbidity, mortality and litigation, which has already resulted from such problems in the United States (11).

At times of resource limitation, a policy of interchange of nursing skills could be taken even further and cross-cover might be arranged between coronary care, intensive care and high-dependency care units.

---

This paper is dedicated to the memory of the late Dr Wyn Thomas who served the ITU at Wrexham Maelor Hospital so well from June 1975 until his death in November 1992.

---

## References

- 1 Houghton PWJ, Donaldson LA, Crumplin MKH. The role of the Intensive Care Unit in a District Hospital. *Ann R Coll Surg Engl* 1984; **66**: 46–8.
- 2 Phillips GD, Austin KL. Intensive care data—II: a new unit's first two years. *Anaesth Intensive Care* 1979; **7**: 329–35.
- 3 Campion EW, Mulley AG, Goldstein RL *et al.* Medical intensive care for the elderly. A study of current use, costs and outcomes. *JAMA* 1981; **246**: 2052–6.
- 4 Tomlin PJ. Intensive care—a medical audit. *Anaesthesia* 1978; **33**: 710–15.
- 5 Zimmerman JE, Knaus WA, Judson JA *et al.* Patient selection for intensive care: a comparison of New Zealand and United States hospitals. *Crit Care Med* 1988; **16**: 318–26.
- 6 Ledingham JGG *et al.* Intensive care in the United Kingdom: report from the King's Fund panel. *Anaesthesia* 1989; **44**: 428–31.
- 7 Crosby DL, Rees GAD, Gill J. The role of high dependency unit in postoperative care: an update. *Ann R Coll Surg Engl* 1990; **72**: 309–12.
- 8 Major E *et al.* The intensive care service in the UK 1990. Document published by The Intensive Care Society.
- 9 Wildsmith JAW *et al.* The High Dependency Unit—acute care in the future, 1991. Document published by The Association of Anaesthetists of Great Britain and Ireland.
- 10 Barlow AP, Shillito RG, Zarifa Z, Crumplin MKH, Edwards AE, McCarthy JM. Changing pattern of general surgery in the elderly. *J R Coll Surg Edinb* 1988; **33**: 182–4.
- 11 Oddi LF, Huerta SR. Which patient gets the critical care bed? *Dimen Crit Care Nurs* 1990; **9**: 288–95.

Received 11 May 1993