Triage Decisions and Outcome among the Critically Ill at the University Hospital of the West Indies

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ABSTRACT

The worldwide scarcity of intensive care therapy leads to the rationing of this expensive resource. This prospective study investigates the rationing of intensive therapy at the University Hospital of the West Indies (UHWI) by recording triage decisions for intensive care unit (ICU) admission and the impact of these decisions on patient outcome. Between June 2001 and May 2002, all patients triaged for admission to a multidisciplinary ICU were studied. For each patient, data were collected including APACHE II score, ICU resource availability and patient survival. There were 356 eligible requests, and 285 (80%) were admitted to the ICU, with 73 (26%) of these admitted patients receiving intensive care outside of the ICU due to space limitations. The APACHE II score was the strongest predictor of ICU admission, with admission more likely as the score decreased (odds ratio = 0.94, 95% confidence interval 0.91, 0.98, p = 0.001). Of 311 requests considered suitable for admission, 26 (8%) were refused admission due to resource limitations. Mortality among these eligible refusals was 81%, compared to 34% among admitted patients (p < 0.001). Although triage decisions are based predominantly on a patient's disease severity, the demand for ICU space exceeds supply, and patient care is negatively impacted by this imbalance.

Decisiones de Triage y Resultados Clínicos en los Pacientes Graves del Hospital Universitario de West Indies

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RESUMEN

La escasez mundial de terapia de cuidados intensivos conduce al racionamiento de este recurso costoso. Este estudio prospectivo investiga el racionamiento de la terapia intensiva en el Hospital Universitario de West Indies (HUWI) a partir del registro de las decisiones de triage respecto a los ingresos en la unidad de cuidados intensivos (UCI), y el impacto de estas decisiones en la evolución clínica de los pacientes. Entre junio 2001 y mayo 2002, se estudiaron todos los pacientes seleccionados tras una clasificación de triage para ingresar en una UCI multidisciplinaria. De cada paciente se recopilaron datos que incluían: puntuación APACHE II, disponibilidad de recursos en términos de UCI, y supervivencia del paciente. Se produjeron 356 solicitudes elegibles, de las cuales 285 (80%) obtuvieron ingreso a la UCI, para lo cual fue necesario ofrecer el cuidado intensivo a 73 (26%) de estos pacientes fuera de la UCI, debido a limitaciones de espacio. La puntuación APACHE II fue el predictor mayor en los ingresos a la UCI, siendo el ingreso tanto más probable cuanto menor se hacía la puntuación (odds ratio = 0.94, 95% intervalo de confianza 0.91, 0.98, p = 0.001). De 311 solicitudes para las cuales era aconsejable el ingreso, a 26 (8%) se les negó a la admisión debido a limitaciones de recursos. La mortalidad entre los rechazados elegibles fue de 81%, en contraste con un 34% entre los pacientes ingresados (p < 0.001). Aunque las decisiones del triage se basan predominantemente en la gravedad de la enfermedad del paciente, la demanda de espacio para la UCI se halla muy por encima de la oferta, y la atención al paciente se ve afectada negativamente debido a esta falta de equilibrio.

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INTRODUCTION

Intensive care beds are an expensive and limited resource throughout the world, with demand often exceeding supply (1–3). The overall benefits of intensive care therapy remain unclear due in part to the ethical conundrums created by a prospective randomized study, which would require controls, and the difficulties associated with setting standards for measuring outcome (1, 4, 5). It was evident early in the evolution of intensive care therapy that although it did increase the number of survivors, it only delayed death amongst patients destined not to survive, thereby increasing the overall cost of care (6, 7).

In spite of attempts to streamline triage by creating guidelines for admission (8, 9), the natural instinct to preserve life results in difficulty in allocation of this resource to primarily those who will most benefit. In this era of cost containment, the manner in which scarce resources are being utilized must be examined in an attempt to maximize efficiency. This is especially relevant in developing countries where there is limited economic wealth to allocate to healthcare.

Casual observation suggests that in Jamaica the demand for intensive care unit (ICU) admission is greater than supply. There are no local or regional studies investigating the demand for ICU or factors affecting triage decisions. In 1999, Sprung *et al* (1) found that such studies were uncommon, that they were from developed countries, were more than a decade old and were retrospective. This study aims to quantify the demand for intensive care, record triage decision-making, determine the basis for these decisions and examine the impact of such decisions on patient outcome.

METHODS

The study was carried out at the University Hospital of the West Indies (UHWI), a 500-bed tertiary referral centre for Jamaica and the Caribbean. The department of Anaesthesia and Intensive Care operates an eight bed general ICU serving the entire hospital. Additional patients are accommodated in the recovery room and its two-bed annex, which served as the original ICU when intensive care therapy was first introduced to UHWI in 1964.

Approval for this study was obtained from The University of the West Indies/University Hospital of the West Indies Ethics Committee.

Information was collected on all requests for ICU admission between June 1, 2001 and May 31, 2002 at the UHWI. A request for admission was defined as a physician requesting the evaluation of a patient for admission to the ICU.

Admission decisions were made by the anaesthetists on call and the following data were collected retrospectively; date of admission, patient demographics, nursing staff availability, ICU occupancy levels, and eventual patient outcome (death/discharge). The APACHE II (10) score was calculated for all patients for whom the score was valid using the physiologic and chronic health status data recorded at the time of triage.

The distributions of selected continuous information (age in years, APACHE score) were analyzed using kernel density estimation, with distribution differences assessed using the Mann-Whitney distribution-free procedure.

The number of ICU patients and number of available nurses was assessed, using a 21-session moving average (with three sessions per day, this equates to one week of sessions). The nurses were categorized in three ways: regular (those who were working a 40-hour week), sessional (those who were working over time), and in training (those who were doing the ICU nursing course). The ratio of available nurses to ICU patients is graphed for three nurse groups: regular, regular and sessional and all nurses including non-ICU trained). The ratio was summarized across the one-year period, using a one-month moving average.

Anticipated predictors of admission (APACHE score, number of nurses in ICU, number of patients in ICU) were assessed using logistic regression after adjusting for the potentially confounding effects of age, gender, reason for admission request, and 'request cohort' (first six month period between June and November 2001 or final six month period between December 2001 and May 2002).

Eventual patient outcome (death or discharge from hospital) was compared across admission decision categories using the chi-squared test. The number of days to death or discharge was presented graphically using the Kaplan-Meier statistic and summarized using median time to outcome.

RESULTS

ICU Requests

There were a total of 384 requests for ICU admission, 22 patients being excluded from the study because APACHE II score was not validated for their pathologies. These included, eleven neonates, nine coronary bypass patients and two burns victims. Six patients were excluded because they died before the required data could be collected.

The number of monthly and weekly ICU requests and admissions is presented in Table 1 and Figure 1 respectively. Of 356 requests for ICU admission, 285 (80%) were admitted and 71 (20%) were refused admission, 212 (74%) were admitted to the ICU, 48 (17%) to the recovery ward and 25 (9%) to the annex. Emergency admissions (217 or 76%) dominated elective admissions (68 or 24%). There were equivalent numbers of men and women requesting admission (binomial exact test $p = 0.79$) and being admitted (χ^2 test, $\chi^2 = 1.7$, $p = 0.19$).

ICU Admissions and Refusals

Without adjustment for other factors, the odds of admission were twice as great if the request came in the second six-month period (December 2001 to May 2002) (OR = 2.1, 95% CI 1.2, 3.6, $p < 0.01$). This univariate effect was weakened primarily by the number of patients admitted at the time of

Table 1: Number of ICU requests for admission and admissions per month between June 2001 and May 2002.

Month	ICU admission requests	ICU admissions	Percentage admitted
June 2001	36	22	61
July 2001	42	29	69
August 2001	23	19	83
September 2001	25	20	80
October 2001	25	21	84
November 2001	18	14	78
December 2001	30	26	87
January 2002	41	37	90
February 2002	22	20	91
March 2002	30	29	97
April 2002	33	20	61
May 2002	31	28	90

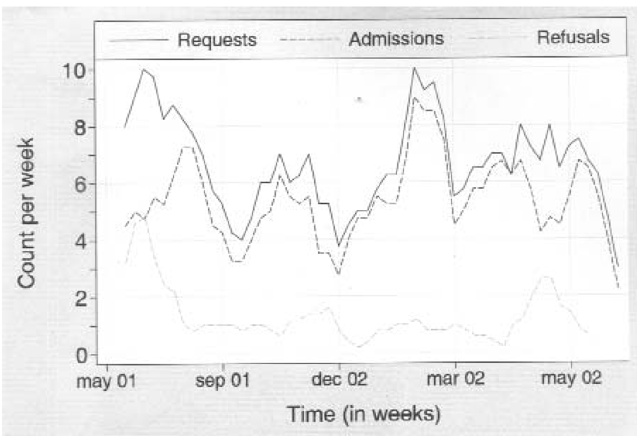

Fig. 1: Number of weekly requests for ICU admission and the number of admissions and refusals.

the request, which decreased gradually throughout the second period. After adjusting for all other regression terms, this 'request cohort' effect was not important (OR = 1.6, 95% CI 0.85 to 3.00, p = 0.14).

The distribution of age by admission decision is presented in Figure 2a. The median age at admission request was 48 years (inter-quartile range (iqr) 31 to 68, range 1 to 96) among admitted patients and 60.5 years (iqr 40 to 72, range 1 to 94) among non-admitted patients. Admitted patients were significantly younger than non-admitted patients (Mann-Whitney z = 2.6, p = 0.01).

APACHE II score by admission decision is presented in Figure 2b. The median APACHE II score was 14 (iqr 9 to 21, range 0 to 38) among admitted patients and 19 (iqr 13 to 27, range 2 to 40) among non-admitted patients. Non-admitted patients had a higher APACHE II score than admitted patients (1.4, 95% CI 0.6 to 3.4).

Among 71 patients not admitted, 45 (63%) did not fit the criteria for admission to ICU (9), nurse shortage accounted for 18 (25%), lack of ventilator for 5 (7%) and lack of bed space for 3 (4%). Among the 45 unsuitable patients, 20 (44%) were considered not severe enough for admission, the health condition of 13 (29%) patients was considered irre-

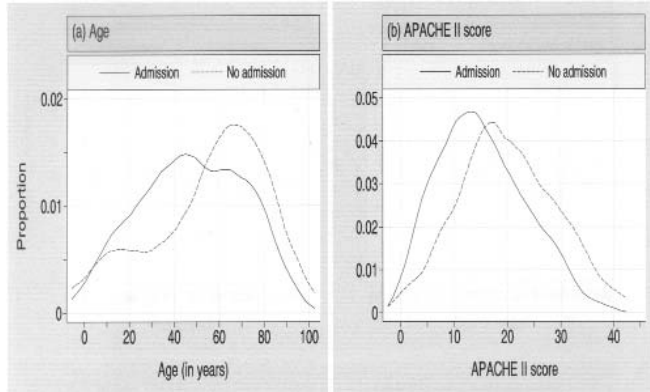

Fig 2: Distribution of age at ICU request for admission, and APACHE II score by triage decision.

versible and 12 (27%) died before admission was possible. This last subgroup consisted of patients referred to the ICU team for assistance with resuscitation or operative management but who died on the ward or in the operating theatre.

After adjusting for the potentially confounding effects of age, gender and reason for admission request, the APACHE II score was the strongest predictor of admission (OR = 0.94, 95% CI 0.91, 0.98, p = 0.001). The occupancy level at the time of the request weakly predicted the likelihood of admission (OR = 0.81, 95% CI 0.66 to 1.00, p = 0.06) and the number of nurses available had no additional predictive effect on admission. Among patients admitted to the ICU, the APACHE score was the only significant predictor of eventual death (OR = 1.14, 95% CI 1.10, 1.19, p < 0.001).

ICU Resources

There was a median of six patients (iqr 5 to 7, range 2 to 10) in the ICU when requests were admitted and seven patients (iqr 6 to 8, range 4 to 10) when requests were refused (Mann-Whitney z = 3.0, p = 0.003). There was a median of eight nurses (seven trained) when requests were either admitted or refused (Mann-Whitney z = 1.6, p = 0.12).

The number of patients admitted and the number of nurses on duty are presented in Figure 3, for regular nurses (Fig. 3a), regular plus sessional nurses (Fig. 3b) and all nurses (Fig. 3c). The ratio of nurses to patients is presented in Figure 3d. The mean regular nurse to patient ratio was 0.83 (95% CI 0.81, 0.86) for the entire period. The nurse/patient ratio increased to 1.18 (1.16, 1.20) using sessional nurses, and to 1.27 (1.25, 1.29) using all nurses.

Patient Outcome

Mean APACHE II scores in four patient categories: surviving patients (admitted and not-admitted) and patients that died (admitted and not-admitted) are presented in Table 2. Patients who died had a higher mean APACHE II score than patients who survived (OR = 8.2, 95% CI 6.6, 9.8).

Among the 285 admitted patients overall mortality was 34%. Seventy-seven (27%) died in the ICU, 20 died on the

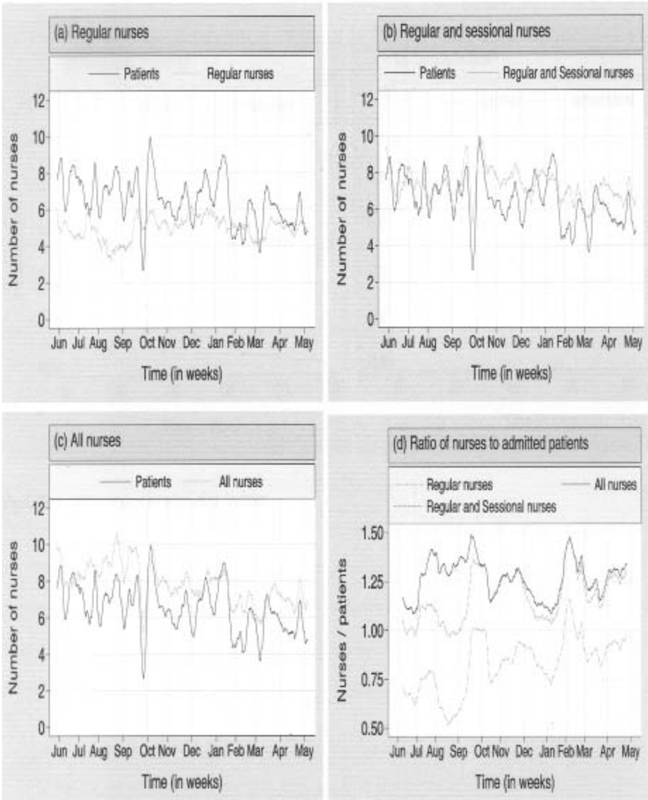

Fig. 3: Number of admitted patients and available nurses using all nurses.

Table 2: Mean APACHE II score for each the four patient triage-outcome categories

Patient group	Mean APACHE II score (95% ci)	SD
Admitted and survived	12.7 (11.7 to 13.8)	7.3
Admitted and died	20.3 (18.9 to 21.7)	7.1
Not-admitted and survived	11.6 (9.3 to 14.0)	4.7
Not-admitted and died	22.9 (20.8 to 25.1)	7.9

ward after discharge from ICU (7%) and 169 (59%) were discharged. Six remained in ICU and 13 were on the wards at the end of the study. Among 71 non-admitted patients, 53 (75%) died on the ward, 16 (30%) were discharged from hospital and two remained on the ward at the end of the study. Significantly more ICU admitted than non-admitted patients survived ($\chi^2 = 38.5$, $p < 0.001$).

Among the 45 considered not suitable for admission, 32 (71%) died, 11 (24%) were discharged, and two (4%) remained on the ward at the end of the study. Among the 26 considered suitable but not admitted, 21 (81%) died in hospital, and five (19%) were discharged – their risk of death being eight times higher than patients that were admitted (OR = 8.1, 95% CI 2.9, 22.0).

All 13 patients who were refused admission, because they were considered to have irreversible pathology, died. Among the 20 patients that were refused admission because their illness was not severe enough, the risk of death was the same as those that were admitted (OR = 1.1, 95% CI 0.4, 2.7). Four patients who were initially refused admission were subsequently admitted when ICU space became available. All of these patients eventually died in hospital, three of them in ICU.

Among discharged patients, the number of days until discharge was marginally higher among non-admitted patients ($\chi^2 = 3.6$, $p = 0.06$). Among those who died, the number of days until death was significantly less among non-admitted patients ($\chi^2 = 11.5$, $p < 0.001$) (Fig. 4).

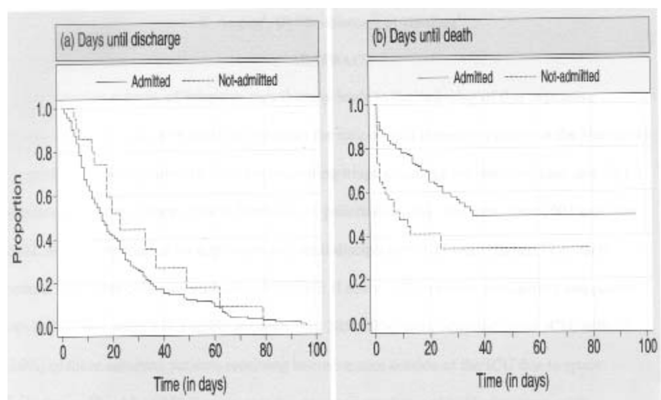

Fig 4: Days until outcome by admission decision

DISCUSSION

The APACHE II score was found to be a strong negative predictor of, and the only important predictor of admission. This finding suggests that some measure of triage is taking place, based on a doctors' perception of the patient's severity of disease, which attempts to restrict admission to those patients who are likely to benefit from ICU admission, rather than a first come, first served approach.

The number of patients already in the ICU at the time of the request was a weak negative predictor. This is not surprising since previous studies have suggested that during times of shortage of ICU space the threshold for admission goes up and for discharge goes down (11). Marshall *et al* (12) found that this trend, based on the literature, could be reversed, if hospital policy is strongly influenced by political and economic incentives. The ICU at UHWI appears not to be significantly influenced by these socioeconomic forces, contrary to what we might expect in a small society with limited resources.

The nursing shortage has been an area of significant concern. This study found, however, that the total number of nurses on call at the time of the request was not a predictor of admission. This was not immediately reconcilable with a nursing shortage, as occupancy levels and nursing availability should have similar impact because of the common 1:1 ratio of nurse, bed, ventilator and cubicle to patient required for admission. Data from this study suggested that numbers of nurses and patients correlated reasonably well, even when the unit was filled to capacity. Further analysis showed that sessional nurses (nurses working over 40 hours per week) were compensating for the shortfall in staff. In fact, sessional nurses often accounted for the majority of the staff on duty, especially on weekends and public holidays. This suggests that the total nursing staff on duty is actually a function of the patient numbers and the impact of the nursing shortage is diluted by the tendency to accommodate the patient as long as there is the physical space and equipment necessary.

The Kaplan-Meier analysis of survival estimates (Fig. 4) shows that patients admitted to ICU live longer and are more likely than non-admitted patients to be discharged home. Non-admitted patients die more quickly, and if they survive, stay in hospital for a longer period. This points to competing economic arguments: (i) ICU extends life – perhaps only temporarily – and so increases overall lifetime cost of care (ii) ICU reduces hospital stay and so reduced direct cost of care for particular ailments. The health-economics of competing arguments may be useful.

The difference in hospital mortality rates for patients admitted to ICU (34%) and for those considered suitable but not admitted (81%) suggests that the intensive therapy offered is having some impact on short-term outcome. The mortality among the patients not considered severe enough for admission was the same as for the admitted patients (OR = 1.0, 95% CI 0.4, 2.7), the mortality for the entire hospital (August 2001 to July 2002) was 3% (13). This comparative mortality may reflect poor judgment on the part of the triage team, a need for an improvement in conditions on the ward, or the need for introduction of a High Dependency Unit. Patients initially refused admission, but subsequently admitted when availability occurred, had a increased mortality (100%), suggesting that such delays were detrimental.

The APACHE II system is considered the benchmark against which other disease severity scoring systems are judged (14) and has been used internationally (1, 2, 15–17). The APACHE score was originally designed to stratify patient groups according to prognosis (10), however, Sprung *et al* and Franklin *et al* both applied it as a severity of illness grading tool to assess triage decisions (1, 17) as we have done. The APACHE II scoring was used in this study because of the need to grade patients according to severity of disease, so that a comparison between admitted and non-admitted populations could be made.

The validity of applying the APACHE II score in this study is supported by a comparison of the mean APACHE II scores of four major patient groups; showing APACHE II score increasing as expected outcome worsened: non-admitted/survived 11.6, admitted/survived 12.7, admitted/died 20.3 and non-admitted/died 22.9 (Table 2).

This study has shown that the demand for ICU admission at the UHWI is significantly greater than the supply, in spite of the accommodation of patients outside the ICU, and nurses working overtime. In the face of this shortage, evidence suggests that for the most part triage decisions made by physicians are based on prognosis.

The imbalance between supply and demand has, however, resulted in patients who potentially may have benefitted from ICU being denied admission. The mortality among these patients was high. The setting up of a High Dependency Unit may have a positive impact on patient outcome. Planning for expansion of UHWI facilities should take this into account.

There needs to be further study of the predictive validity of disease severity scoring systems within the local ICU population, as these systems form the foundation of the enquiry into ICU populations. Ongoing data collection and health economic studies may prove useful in planning for the future of intensive care therapy at UHWI.

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REFERENCES

1. Sprung CL, Geber D, Eidelman LA, Baras M, Pizov R, Nimrod A et al. Evaluation of triage decisions for intensive care admission. Crit Care Med 1999; **27:** 1073–9.
2. Metcalfe MA, Sloggett A, McPherson K. Mortality among appropriately referred patients refused admission to intensive-care units. Lancet 1997; **350:** 7-11.
3. Attitudes of critical care medicine professionals concerning distribution of intensive care resources. The Society of Critical Care Medicine Ethics Committee. Crit Care Med 1994; **22:** 358–62.
4. Ridley SA. Intermediate care, possibilities, requirements and solutions. Anaesthesia 1998; **53:** 654–64.
5. Rushman GB. A Short History of Anaesthesia. Oxford: Butterworth-Heinmann; 1996.
6. Lassen HCA. A preliminary report on the1952 epidemic of poliomyelitis in Copenhagen with special reference to the treatment of acute respiratory insufficiency. Lancet 1953; **1:** 37–41.
7. Bion JF, Bennett D. Epidemiology of intensive care medicine: supply versus demand. Br Med Bull 1999; **55:** 2–11.
8. Recommendations for intensive care unit admission and discharge criteria. Task Force on Guidelines. Society of Critical Care Medicine. Crit Care Med 1988; **16:** 807–8.
9. Department of Health. Guidlines on admission to and discharge from Intensive Care and High Dependancy Units. 1996, National Health Service, United Kingdom.
10. Knaus WA, Draper EA, Wagner DP, Zimmerman JE. APACHE II: a severity of disease classification system. Crit Care Med 1985; **13:** 818–29.
11. Teres D. Civilian triage in the intensive care unit: the ritual of the last bed. Crit Care Med 1993; **21:** 598–606.

12. Marshall MF, Schwenzer KJ, Orsina M, Fletcher JC, Durbin CG, Jr. Influence of political power, medical provincialism, and economic incentives on the rationing of surgical intensive care unit beds. Crit Care Med 1992; **20:** 387–94.
13. Annual Statistical Report for August 2001 to July 2002. University Hospital of the West Indies, Department of Medical Records and Statistics, 2002.
14. Ridley S. Severity of illness scoring systems and performance appraisal. Anaesthesia 1998; **53:** 1185–94.
15. Sage WM, Rosenthal MH, Silverman JF. Is intensive care worth it? an assessment of input and outcome for the critically ill. Crit Care Med 1986; **14:** 777–82.
16. Moreau R, Soupison T, Vauquelin P, Derrida S, Beaucour H, Sicot C. Comparison of two simplified severity scores (SAPS and APACHE II) for patients with acute myocardial infarction. Crit Care Med 1989; **17:** 409–13.
17. Franklin C, Rackow E C, Mamdani B, Burke G, Weil WH. Triage considerations in medical intensive care. Arch Intern Med 1990; **150:** 1455–9.