Reasons for refusal of admission to intensive care and impact on mortality

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Abstract *Purpose:* To identify factors influencing triage decisions and investigate whether admission to the intensive care unit (ICU) could reduce mortality compared with treatment on the ward. *Methods:* A multicentre cohort study in 11 university hospitals from seven countries, evaluating triage decisions and outcomes of patients referred for admission to ICU who were either accepted, or refused and treated on the ward. Confounding in the estimation of the effect of ICU admission on mortality was controlled by use of a propensity score approach, which adjusted for the probability of being admitted. Variability across centres was accounted for in both analyses of factors influencing ICU admission and effect of ICU admission on mortality. *Results:* Eligible were 8,616 triages in 7,877 patients referred for ICU admission. Variables positively associated with probability of being admitted to ICU included: ventilators in ward; bed availability; Karnofsky score; absence of comorbidity; presence of haematological malignancy; emergency surgery and elective surgery (versus medical treatment); trauma, vascular involvement, liver involvement; acute physiologic score II; ICU treatment (versus ICU observation). Multiple triages during patient's hospital stay and age were negatively associated with ICU admission. The area under the receiver operating characteristic (ROC) curve of the model was 0.83 [95% confidence interval (CI): 0.81–0.84], with Hosmer–Lemeshow test $P = 0.300$. ICU admission was associated with a statistically significant reduction of both 28-day mortality [odds ratio (OR): 0.73; 95% CI: 0.62–0.87] and 90-day mortality (0.79; 0.66–0.93). The benefit of ICU admission increased substantially in patients with greater severity of illness. *Conclusions:* We suggest that intensivists take great care to avoid ICU admission of patients judged not severe enough for ICU or with low performance status, and they tend to admit surgical patients more readily than medical patients. Interestingly, they do not judge age per se as a reason for refusal of ICU admission. Admission to ICU was associated with a reduction of both 28- and 90-day mortality, particularly in patients with greater severity of illness at time of triage.

Keywords ICU triage · ICU admission · ICU refusal · ICU effectiveness · ICU–hospital mortality

Introduction

With more complex medical procedures and increasing patient age and expectations, there is greater demand for all medical services [1, 2], often exceeding supply especially for intensive care services [3]. As a consequence, rationing of intensive care unit (ICU) beds is common [4–11] and often leads to admission refusal [2, 8, 9, 12–15]. Decisions on whether to admit a critically ill patient to ICU are complex, since they need to balance the potential risks and benefits for the individual patient with the limited bed availability and thus the implication for future patients. Although recommendations for ICU triage are available [16], compliance with them has been shown to be poor [11]. Decisions regarding ICU admission are currently not based on scientific evidence, yet refusal is associated with increased mortality [4–7, 13].

While several studies have provided information on the reasons for ICU admission and refusal, few studies (all with sample size smaller than 1,000 patients [4–9]) have evaluated the effect of ICU admission on patients' outcome by comparing it with the outcome of patients not admitted to ICU. These studies produced some unexpected results, including survival benefit of ICU treatment limited to the first 72 h of acute deterioration [8, 9], and ICU characteristics [11] and bed provision not contributing to excess mortality [5]. To provide stronger evidence on the possible benefit of ICU admission on patients' mortality, we performed a large cohort study in 11 university hospitals from seven countries. Our study evaluated triage decisions and outcomes of patients referred for admission to ICU who were either accepted, or refused and treated on the ward, with the specific aims of: (1) identifying factors influencing ICU triage decisions, and (2) assessing the effect of ICU admission on mortality after controlling for possible confounders, through adjusting for factors influencing ICU admission (propensity score analysis).

Methods

The present analysis is part of the ELDICUS project, a prospective cohort study investigating ICU triage decisions in 11 university hospitals from Denmark, France, Israel, Italy, The Netherlands, Spain and the UK, from September 2003 to March 2005.

The hospitals were all located in urban areas, and differed by presence of intermediate units and ICU size. Ethical committee approval with a waiver of informed consent was received in all centres.

All consecutive adult patients referred for admission to ICU during the study period were eligible for inclusion. Information recorded at triage included: referral site (operating/recovery room, emergency room, ward, other); demographic variables; patient's functional status prior to hospitalisation (Karnofsky performance status [17]); type of referral (medical, elective surgery, emergency surgery); severity of illness at time of triage, measured using the Simplified Acute Physiology Score (SAPS II) [18] and the APS II score (defined as SAPS II without age, comorbidity and type of admission [19]); organ involvement at triage; indications for triage (ICU observation or active treatment); triage decision (accepted to study ICU, referred to other ICU, treated in ward). In all participating ICUs, triage was performed by ICU physicians according to local criteria. Reasons for refusal of ICU admission at triage were recorded using multiple-choice items, which included patient "too well"; patient "too ill"; patient "too old"; bed not available (chosen when this was the only reason); more data needed to decide (with a subsequent triage being performed once additional information became available); other (e.g. patient/family refused ICU admission). Outcomes evaluated were mortality at 28 and 90 days after triage.

Patients were excluded if information on either time of triage or triage decision was missing. Patients not accepted to ICU but referred to a coronary unit were also excluded, since this treatment area could not be considered as a standard ICU or a ward.

Descriptive statistics utilized mean with standard deviation and median with interquartile range (IQR), as appropriate. Statistical significance of differences in baseline characteristics was tested using: Mann–Whitney test for ordinal variables, chi-square test for categorical variables, Fisher's exact test for binary variables, and t test and/or Mann–Whitney tests for continuous variables, as appropriate. Statistical significance threshold was $P < 0.05$. Statistical analysis was performed using

Stata 10.1 software (StataCorp, College Station, TX, USA). Quality of the data collected in a random sample of 5% of the patients was checked at two levels: (1) transcription of data from patient charts into the data collection form, and (2) input of data from the data collection form into the website.

Factors influencing ICU admission decision

Using data on all triages, we identified the factors associated with triage decision using a multilevel model clustered at the hospital level (mixed-effects logistic regression model). Patients were considered admitted if either accepted into the study ICU or referred and accepted to other ICU in the same or another hospital.

Variables associated with ICU admission with $P < 0.15$ on bivariate analysis were initially included in the model. A manual backward stepwise procedure was used to define the final model, where variables with $P < 0.10$ were retained. We assessed the calibration of the model by the Hosmer–Lemeshow goodness-of-fit statistic, and the discrimination ability by the area under the receiver operating characteristic (ROC) curve.

Effect of admission at study ICUs on 28- and 90-day mortality

Only data from the first ICU triage were used for patients being triaged more than once during their hospital stay. Patients for whom mortality data were not available, and those admitted to other ICUs of the same or other hospitals, were excluded from the analyses. The mortality of patients accepted into the study ICU was compared with that of patients rejected using a propensity score approach [20], where the logistic regression analysis is adjusted for the observed probability (propensity) to be admitted based on patients' characteristics at time of triage. The analysis was also adjusted for hospital to account for possible differences in local organisation, case mix and quality of care.

The effect of ICU admission on mortality at 28 and 90 days from the first triage was expressed as an odds ratio (OR), with 95% confidence interval (CI). Subgroup analyses were performed by SAPS II score at triage, categorized as: ≤33rd percentile, 34th–66th, >66th. We also performed a sensitivity analysis restricted to patients triaged only once during their hospital stay.

Patients could have been rejected either for being not critical enough to justify ICU admission or for having very low life expectancy due to acute and/or chronic illness. Therefore, in the subset of patients who had only one triage during their hospital stay, we evaluated the correspondence of the physician's perception with the actual outcome in those patients rejected for being "too well", "too ill", or "too ill and too old".

Results

Three hospitals (B, H, I: see Appendix) had an intermediate unit, and two had availability of ventilators in ward (C, D). Median ICU size was 11 beds (IQR: 7–16), with five units (A, B, E, F, M) having fewer than ten beds. All ICUs were closed, and eight had a fixed staff of doctors and nurses (A, B, D, E, G, I, L, M). Three ICUs (A, L, M) used 1:1 nurse-to-patient ratio.

There were 8,751 triages in 7,994 patients eligible for the study, among which 8,616 triages in 7,877 patients were included in the analysis (Fig. 1).

Regarding data quality, the comparison between patient charts and ELDICUS data collection forms showed that about 3% of the data in the random sample were incorrectly recorded, while such percentage was about 2% when comparing ELDICUS data collection forms with the information inputted on the website (Supplementary Table 1s).

The number of patients with one, two or more triages was 7,280, 500 and 97, respectively. Patients with more than one triage had worse performance status [80 (IQR: 60–90) versus 80 (70–90), $P < 0.001$], were older [66 (53–75) versus 64 (48–74) years, $P < 0.001$] and had more severe acute illness [SAPS II at triage: 32 (24–42) versus 28 (20–39), $P < 0.001$; APS II 16 (7–24) versus 12 (5–22), $P < 0.001$] than those with one triage.

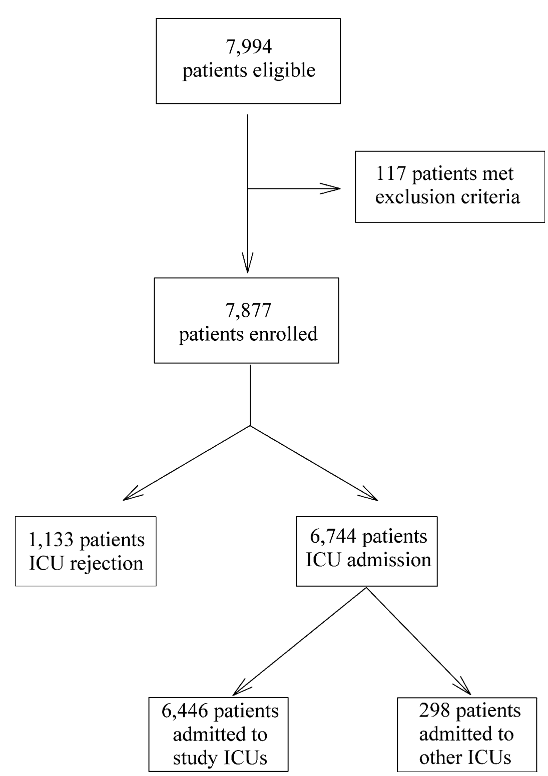


Fig. 1 Flow chart of inclusion and exclusion of patients

Table 1 Patients' characteristics at first ICU triage ($n = 7{,}877$ patients)

Patient characteristic	Accepted to ICU	Rejected	*P* value accepted versus rejected
Number (%)	6,744 (85.6)	1,133 (14.4)	
Age			
Mean (SD)	59.1 (18.1)	65.4 (17.2)	<0.001
Older than 65 years (%)	44.3	57.7	<0.001
Gender (% male)	58.2	55.1	0.047
Karnofsky score, median (IQR)	80 (70–90)	70 (50–90)	<0.001
SAPS II, median (IQR)	28 (20–40)	30 (22–40)	0.004
APS II, median (IQR)	12 (5–23)	11 (3–21)	<0.001
Hospital LOS			
Mean (SD)	19.9 (27.0)	16.8 (33.8)	<0.001
Median (IQR)	12 (6–24)	9 (3–18)	<0.001
Type of referral (%)			
Elective surgery	28.5	9.4	
Emergency surgery	23.9	6.9	<0.001
Medical	47.6	83.8	
Organ involved (%)			
Respiratory	38.3	44.8	<0.001
Cardiac	28.2	28.7	0.748
Neurological	22.8	18.3	0.001
Vascular	11.9	5.5	<0.001
Renal	9.1	10.8	0.087
Hepatic	3.4	2.3	0.047
Haematological	3.4	2.7	0.208
Metabolic	6.2	5.7	0.593
Digestive	12.5	10.0	0.016
Trauma and burns	8.0	2.4	<0.001
Other organ	3.5	2.3	0.032

SD standard deviation, *IQR* interquartile range, *SAPS II* Simplified Acute Physiology Score, *APSII* SAPS II without age and admission type, *LOS* length of stay

Table 1 reports patients' characteristics at first ICU triage, while Table 2 presents characteristics of all triages. Most triages resulted in admission to the study ICU (81.6%) or another ICU (3.8%). The mean overall rejection rate was 14.6%, with marked variation across the 11 hospitals (range 1.4–31.9%). The large majority of triages resulting in refusal of ICU admission were medical, as were 76.0% of patients referred to another ICU, in 47.1% of cases because of no beds availability. Surgical patients refused ICU admission (6.1% of elective and 4.5% of emergency surgical triages) remained in post-anaesthesia care or recovery units after surgery. Table 3 presents baseline characteristics of patients refused ICU admission, by reason for refusal.

Factors influencing ICU admission decision

Figure 2 shows variables associated with the probability of being admitted to ICU in the 8,616 triages, with only two variables representing hospital/ICU characteristics (ventilators in ward, bed availability). The area under the ROC curve for the model was 0.82 (95% CI: 0.81–0.84), and the *P* value for the Hosmer–Lemeshow test was 0.30. Performance within individual hospitals is reported in Supplementary Table 2s.

Table 2 Characteristics of all triages ($n = 8{,}616$ triages, in 7,877 patients)

Characteristic	Accepted to ICU	Rejected	*P* value accepted versus rejected
Number (%)	7,359 (85.4)	1,257 (14.6)	
Type of referral (%)			
Elective surgery	28.1	10.7	
Emergency surgery	24.4	7.5	<0.001
Medical	47.6	81.9	
SAPS II, median (IQR)	29 (20–40)	30 (22–40)	0.002
APS II, median (IQR)	13 (5–23)	12 (4–21)	<0.001
Organ involved (%)			
Respiratory	39.8	46.4	<0.001
Cardiac	28.2	28.6	0.786
Neurological	22.3	17.6	<0.001
Vascular	11.5	5.7	<0.001
Renal	9.4	10.7	0.178
Hepatic	3.4	2.2	0.030
Haematological	3.3	2.9	0.548
Metabolic	6.3	6.2	0.950
Digestive	12.8	9.8	0.003
Trauma and burns	7.5	2.3	<0.001
Other organ	3.4	2.2	0.024

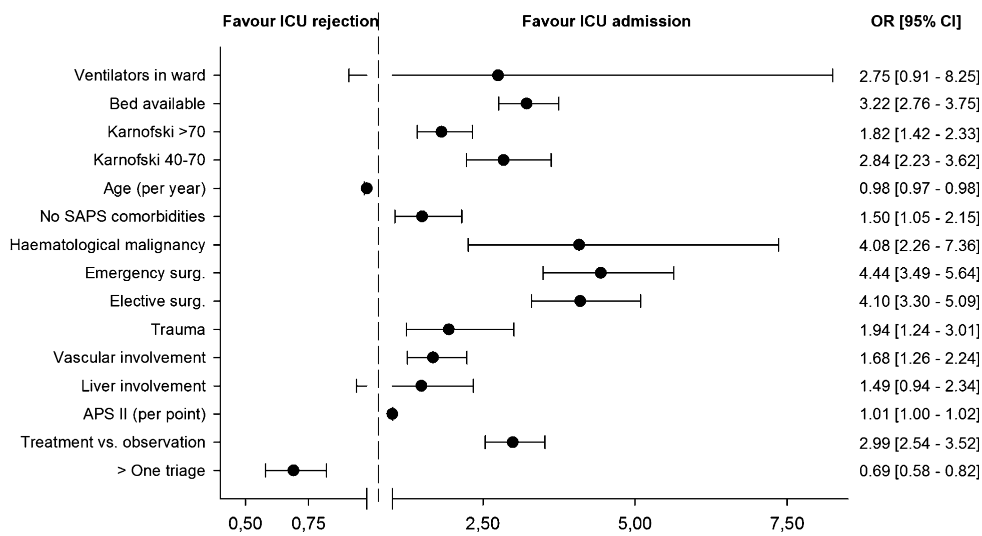
SAPS II Simplified Acute Physiology Score, *IQR* interquartile range, *APS II* SAPS II without age and admission type

Table 3 Baseline characteristics by reason for rejection in the 1,257 triages with ICU rejection

Baseline characteristics	Patient too well	Patient too ill	Bed not available	More data needed for decision	Patient too old	Other reason	Total
Number (%)	515 (39.3)	314 (23.9)	198 (15.1)	127 (9.7)	74 (5.6)	84 (6.4)	1,312 (100)
Age, mean (SD)	63.9 (17.3)	72.0 (14.0)	60.6 (16.4)	61.2 (18.6)	84.5 (7.9)	62.3 (15.8)	65.5 (17.1)
Older than 65 years (%)	55.6	75.2	43.5	49.6	98.7	45.1	58.1
Karnofsky, median (IQR)	80 (60–90)	50 (40–70)	80 (60–90)	80 (70–90)	50 (40–60)	80 (70–90)	70 (50–90)
Medical (%)	85.2	88.2	80.3	73.2	93.2	51.2	81.9
APS II, median (IQR)	8 (2–18)	16 (7–27)	13 (5–24)	16 (8–22)	8 (4–22)	10 (0–17)	12 (4–22)
SAPS II, median (IQR)	27 (20–35)	37 (29–50)	30 (21–41)	32 (24–40)	32 (28–45)	25 (18–33)	30 (22–41)

SD standard deviation, *IQR* interquartile range, *APS II* SAPS II without age and admission type, *SAPS II* Simplified Acute Physiology Score

Fig. 2 Variables associated with ICU admission in the multilevel logistic regression model. Karnofsky score categorized as: <40 (unable to care for self; requires equivalent of institutional or hospital care; disease may be progressing rapidly); 40–70 (unable to work; able to live at home; cares for most personal needs; a varying amount of assistance needed); >70 (almost normal ability)



Effect of admission at the study ICUs on 28- and 90-day mortality

The analysis of mortality based on data at first triage included 7,308 patients for 28-day mortality and 6,763 patients for 90-day mortality. After adjusting for probability of ICU admission (propensity score analysis) and for hospital, ICU admission was associated with lower mortality at 28 and 90 days in the overall sample and in the subgroup of patients with SAPS II >36 (66th percentile) (Table 4). Similar results were obtained in the sensitivity analyses restricted to patients triaged only once during their hospital stay (Table 4).

Discussion

Our study provides important insights into the ICU triage process, through identification of variables influencing triage decisions and reporting of physicians' justifications for refusal of admission. Our study also demonstrates a substantial reduction in mortality associated with ICU admission, 27% and 21% on 28- and 90-day mortality, with reduction in mortality reaching 43% and 33%, respectively, in the most severe critically ill patients. These results did not change when excluding patients triaged for ICU admission more than once during their hospital stay.

The large majority of patients included in our study underwent only one triage during their hospital stay, which may represent a marker of appropriate clinical decision-making. The average refusal rate of 15% was at the lower limit of the 16–72% range previously reported [2, 4, 7–11], despite the fact that all participating ICUs were located in busy urban hospitals. However, refusal rate varied widely across centres, which might be explained by differences in ICU physicians' culture and skills and involvement of ICU teams in the emergency setting, as well as ICU size and number of intensive care facilities within the hospital.

In agreement with previous findings [2, 4, 6, 11, 13], surgical patients were much more likely to be admitted to ICU and less likely to be referred to other ICUs than were

Table 4 Effect of ICU admission on mortality in the whole sample and by severity of illness, after adjusting for confounding (propensity score approach) and controlling for centre. The overall mortality based on data at first triage was 22.6% for 28-day mortality and 29.6% for 90-day mortality

Mortality at 28 days

All patients at first ICU triage ($n = 7,308$)	OR (95% CI)	*P* value	Patients triaged only once ($n = 6,500$)	OR (95% CI)	*P* value
All	0.73 (0.62–0.87)	<0.001	All	0.77 (0.64–0.93)	0.007
SAPS II ≤23	0.89 (0.55–1.46)	0.659	SAPS II ≤ 23	0.97 (0.57–1.65)	0.919
23 < SAPS II ≤ 36	0.85 (0.63–1.15)	0.289	23 < SAPS II ≤ 36	0.94 (0.68–1.30)	0.726
SAPS II > 36	0.57 (0.43–0.76)	<0.001	SAPS II > 36	0.57 (0.42–0.77)	<0.001

Mortality at 90 days

All patients at first ICU triage ($n = 6,763$)	OR (95% CI)	*P* value	Patients triaged only once ($n = 6,231$)	OR (95% CI)	*P* value
All	0.79 (0.66–0.93)	0.005	All	0.82 (0.68–0.98)	0.030
SAPS ≤ 23	0.72 (0.47–1.08)	0.113	SAPS ≤ 23	0.79 (0.50–1.25)	0.315
23 < SAPS ≤ 36	0.95 (0.71–1.26)	0.713	23 < SAPS ≤ 36	1.01 (0.74–1.38)	0.931
SAPS > 36	0.67 (0.51–0.90)	0.007	SAPS > 36	0.67 (0.49–0.91)	0.012

Overall mortality based on analyses restricted to patients triaged only once during their hospital stay was 23.6% for 28-day mortality (22.1% for patients admitted to ICU and 32.8% for those refused) and 29.2% for 90-day mortality (28.1% for patients admitted and 39.3% for those refused). Mortality of patients triaged only once and rejected because "too well" ($n = 348$) was 11.5% and 17.5% at 28 and 90 days, respectively, while it was 73.5% and 80.4% in patients rejected because "too ill" ($n = 219$) and 78.8% and 81.2% in patients rejected because "too ill and too old" ($n = 33$)

OR odds ratio, *CI* = confidence interval, *SAPS II* Simplified Acute Physiology Score

medical patients. Our study also confirms previous evidence that patients refused ICU admission are older and less able to carry out normal activity before hospitalisation (Karnofsky score) [2, 4–7, 11, 13], and have higher severity of illness at time of triage (SAPS II score), compared with those accepted [6–9]. However, our findings show lower acute physiological impairment (APS II score) in patients refused ICU admission, which suggests that the observed association of refusal of admission with higher severity of illness could be due to a confounding effect of old age in increasing SAPS II score. Patients with multiple triages during their hospital stay (older, with lower performance status and more severe illness compared with those with only one triage) were also more likely to be refused ICU admission. Factors favouring ICU admission, in addition to a surgical condition, included absence of comorbidities, presence of haematological malignancy, acute clinical conditions and need for active intensive care treatment (as opposed to observation), trauma, vascular or hepatic involvement at triage, and acute severity of illness (APS II).

ICU and hospital characteristics have previously been reported as having no influence on triage decisions [11]. In our study, two such characteristics were found to favour ICU admission; the first was bed availability at time of triage, independently from the overall number of ICU beds; the second, which showed only borderline statistical significance ($P = 0.07$), was availability of ventilators in ward, maybe because it allows a more flexible ICU discharge policy of stable but still ventilated patients. ICU bed availability at time of triage favoured admission independently from the presence of a surgical condition. Moreover, the fact that reported ICU bed availability was more often observed with triages of elective and emergency surgical patients suggests a more prompt ICU discharge policy, or a higher tolerance of extra beds, when triaging intensivists are confronted with surgical rather than medical patient. The preferential admission of surgical patients in the presence of limited bed availability may be due to the clinical difficulty, and surgeons' resistance, associated with transferring post-operative patients to ICUs in other hospitals, or the difficulty for surgeons to care for these patients on the ward.

The reasons for refusal given by triaging intensivists confirm previous findings [2, 4–7, 11, 13–15], although they differ in frequency. The most frequent reasons were the patient being "too well" (39%) or "too ill" (24%), while less frequently the reason was lack of bed availability (15%). The patient being "too old" represented only 6% of the reported reasons, despite the fact that about half of the triaged patients were older than 65 years. This suggests that intensivists did not perceive age per se as a good reason for refusal of ICU admission, in agreement with recent indications of absence of ageism in access to critical care [1, 21].

Strengths of our study include its prospective design, with evaluation of all consecutive ICU triages over the study period, and the enrolment of a large general ICU case mix in 11 hospitals from seven countries, with different ethical attitudes towards end-of-life decision-making. Apart from the selection of academic hospitals, the main limitation of our study is inherent to its very observational nature. Although we adjusted the analyses for possible confounding factors using a propensity score approach, residual confounding is still likely to be present due to unmeasured clinical, structural, managerial and organisational factors. We tried to capture some of this residual confounding by accounting for a hospital effect in the analyses. However, the only way to ensure the absence of confounding in demonstrating the effect of ICU admission would be to perform a randomised clinical trial, where patients referred for admission to ICU could be randomised to either ICU or ward care. Such a trial, though, would be very difficult to perform and justify on ethical grounds.

A partly unforeseen finding of our study was the lower than expected overall mortality observed in the cohort of refused and never later accepted patients (33% at 28 days and 39% at 90 days). Refusal of ICU admission can result from opposite reasons: the patient is not critical enough to justify ICU admission, or has very low life expectancy even with intensive treatment. The observed 90-day mortality of patients refused ICU admission because "too ill" and "too ill and too old" was only 80% and 81%, respectively. However, interpretation of this finding should consider that triaging physicians face factors that go beyond life expectancy and include more subjective and patient-centred outcome measures, such as quality of life. Hence, the decision to refuse ICU admission does not necessarily mean that death is considered inevitable.

The substantial mortality reduction associated with ICU admission, particularly in the most severe patients, highlights the importance of organisational strategies designed to improve ICU receptivity through more appropriate use of resource [5]. The availability of step-down or intermediate units [13] allows earlier and safer discharge from ICU of those patients who need only observation but are too complex for the general ward. If intermediate units are not available, a strategy allowing flexibility in managing human resources and bed availability, independently from ICU size, might also increase ICU admissions. The progressive improvement of some critically ill patients treated in the unit, with consequent reduction in complexity of care over time, can result in increased availability of manpower and decreased equipment use. Whenever ICU structure allows flexibility in total occupancy and the possibility of extra beds (e.g. large rooms, common open spaces), increased availability of manpower and equipment may allow ICU admissions even when the unit is "full", whilst avoiding early ICU discharge. The notion of a fixed number of available beds per ICU could be substituted by a more dynamic one that defines bed availability in relation with the complexity of care of the patients treated in the unit [22, 23]. Such number, even with fixed personnel, should vary from a minimum, when all patients need high level of care, to a maximum, when all patients only require observation/monitoring. This strategy may increase ICU admissions [22] through a "continuous triage" scheme, where decisions on whether the patient needs ICU treatment are re-evaluated soon after initial ICU treatment [11, 24]. This allows a more liberal admission policy given the reversibility of treatment decisions within a few days, if it becomes clear that ICU will not change the patient's outcome [25]. Such a strategy may be particularly appropriate for the elderly, in whom reduced physiological reserve makes early recognition of complications or adverse events crucial in preventing further deterioration or even death [26].

In conclusion, our findings suggest that intensivists take great care to avoid admitting patients considered not severe enough for ICU, while they do not consider age per se as a good reason for refusing admission. Surgical patients are generally accepted at the expense of medical patients. Our study shows a substantial mortality reduction associated with ICU admission, with such benefit increasing in patients with more severe acute illness. The observed survival of a non-negligible part of patients refused because "too ill" suggests that greater care needs to be taken when triaging these patients.

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Appendix

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