Med Intensiva. 2011;**35(3)**:143–149

medicina *intensiva*

www.elsevier.es/medintensiva

ORIGINAL

Impact of the premature discharge on hospital mortality after a stay in an intensive care unit

M. Rodríguez-Carvajal,* D. Mora, A. Doblas, M. García, P. Domínguez, A. Tristancho, M. Herrera

Unidad de Cuidados Intensivos Polivalente, Hospital Juan Ramón Jiménez, Huelva, Spain

Received 12 August 2010; accepted 13 January 2011

KEYWORDS
Intensive care unit;
Patient discharge;
Withdrawing treatment;
In-hospital mortality;
Patient readmission;
Outcome

Abstract
Objective: To determine the frequency and to evaluate the relationship between premature discharge and post-ICU hospital mortality.
Design: A prospective registry was made for patients admitted during six consecutive years, performing a retrospective analysis of the data on the first admission of ICU survivors.
Setting: A 10-bed general ICU in a 540-bed tertiary-care community hospital.
Patients: 1,521 patients with an ICU stay longer than 12 hours, discharged alive to wards with known hospital outcome.
Interventions: None.
Main variables: We recorded the patient data, including types of ICU discharge, normal or premature, and studying their relationship with post-ICU hospital mortality. The types of ICU discharge were also evaluated versus ICU readmission rate and post-ICU length of stay.
Results: There were 165 patients (10.8%) with premature discharge. Mortality rate was 11.6% (176 patients). The factors related with mortality were withdrawal and limitation of life-sustaining treatments (OR=14.02 [4.6-42.6]), readmissions to ICU (OR=3.46 [1.76-6.78]), premature discharge (OR=2.6 [1.06-4.41]), higher organ failure score on discharge from the ICU (OR=1.16 [1.01-1.32]) and age (OR=1.03 [1.01-1.05]). Readmission rates and post-ICU length of stay were similar among patients with premature and normal discharge (7.3% vs. 8.2%, P=.68 and 16.7±16.7 days vs. 18.7±21.3 days, respectively, P=.162).
Conclusions: Premature discharges appear to be common in our setting and have a significant impact on mortality. Types of ICU discharge do not seem to be related with other outcome variables in the hospital care of critically ill patients.

*Corresponding author.
E-mail address: mjrcarvajal@gmail.com (M. Rodríguez-Carvajal).

PALABRAS CLAVE
UCI;
Altas no programadas;
LET;
Mortalidad hospitalaria post-UCI;
Readmisión;
SOFA

Impacto de las altas no programadas en la mortalidad hospitalaria tras la estancia en una unidad de cuidados intensivos

Resumen

Objetivos: Comprobar la frecuencia de altas no programadas y su relación con la mortalidad hospitalaria tras la estancia en UCI.

Diseño: Registro prospectivo de los ingresos de 6 años consecutivos. Análisis retrospectivo de la primera admisión de la cohorte de los supervivientes a UCI.

Ámbito: UCI polivalente de 10 camas en hospital general de segundo nivel con 540 camas.

Pacientes: 1.521 pacientes con más de 12 horas de estancia, dados de alta vivos y con desenlace hospitalario conocido.

Intervenciones: Ninguna.

Principales variables de interés: Se registró el tipo de alta de la unidad, normal o no programada, y se exploró su relación con la mortalidad hospitalaria post-UCI, las tasas de readmisión y la estancia hospitalaria post-UCI.

Resultados: Hubo 165 altas no programadas (10,8%). La tasa de mortalidad fue del 11,6% (176 pacientes). Los factores relacionados con la mortalidad fueron la limitación del esfuerzo terapéutico (OR = 14,02 [4,6-42,6]), las readmisiones (OR = 3,46 [1,76-6,78]), las altas no programadas (OR = 2,16 [1,06-4,41]), la puntuación de fallos orgánicos al alta de UCI (OR = 1,16 [1,01-1,32]) y la edad (OR = 1,03 [1,01-1,05]). Las readmisiones y las estancias post-UCI no diferían significativamente entre las altas no programadas y las normales (el 7,3 frente al 8,2%; p = 0,68 y 16, 7 ± 16,7 frente a 18,7 ± 21,3 días, respectivamente; p = 0,162).

Conclusiones: Las altas no programadas son frecuentes en nuestro medio y contribuyen significativamente a la mortalidad post-UCI, sin que parezcan afectar a otros resultados de la asistencia a pacientes críticos.

Introduction

Critical patients who for different reasons do not gain admission to an Intensive Care Unit (ICU) have a poorer short-term prognosis than those patients who do gain admission to such Units.[1,2] ICU admission and discharge policies are not only important for correct management of the available resources, but are also crucial to the outcome of critical patient care. The patient admission and discharge recommendations included in the clinical guides are not based on consistent evidence and must be adapted to the particular situation of each ICU and hospital.[3,4] The decision to discharge a concrete patient from the ICU is generally fundamented upon clinical considerations regarding a favorable patient course in which special vigilance or treatment is no longer considered necessary, and were the required care is believed to be available in the area or destination of patient discharge. In situations of maximum occupation or saturation, and in the case of priority admission, intensivists, following due evaluation of the patients, must decide which individual should be discharged in order to make room for the new priority admission patient. This decision, although fundamented upon objective circumstances, always involves an important subjective component. Regardless of the intervening factors, non-programmed discharge of this kind may fall within the concept of premature or inappropriate discharge, considering the persistence of patient seriousness and organic dysfunction at the time of taking the decision – thereby conditioning the final outcome of the patient affected by discharge.[5,6] Recently, a subjective scale has been validated that could help in the taking of such decisions and in minimizing the risks.[7]

Non-programmed discharge of this type has not been specifically investigated, though some studies on nocturnal or weekend discharges mention that the great majority are determined by the need for a new admission.[8-11] In a study carried out in the United Kingdom[8] comprising 16,756 discharges from Intensive Care, 7.2% were seen to be due to the lack of a bed needed to accept a new admission and were thus considered premature. These situations in turn represented 42.6% of the nocturnal discharges and 5% of the diurnal discharges, and were associated to post-ICU hospital mortality (PICHM)(odds ratio [OR] = 1.35 [1.10-1.65]). In contrast, other authors have reported no relationship between the time of discharge and hospital mortality.[10,12]

Based on the hypothesis that premature or non-programmed discharge influences the post-ICU results, the present study was designed to evaluate the frequency of this type of discharge and its impact upon PICHM.

Patients and method

Study setting

The study was carried out in the Polyvalent ICU of Juan Ramón Jiménez Hospital in Huelva (Spain), which has 10 beds for non-coronary critical adult patients. This is a closed clinical-surgical ICU attended 24 hours a day by intensivists, with four staff intensivists, two residents in training in

Critical Care Medicine (fourth and fifth year of training), and a nurse/patient ratio of 1/2. The hospital has 540 beds serving a fixed population of 230,000 inhabitants, and possesses a coronary ICU with 6 beds and a neonatal ICU. The center has no intermediate care or dependency discharge unit, as a result of which the patients discharged from the ICU are moved directly to normal nursing wards, with nurse/patient ratios of between 1/8 to 1/32, depending on the wards and shifts. There is an awakening room, but no post-surgery resuscitation unit. The hospital has Departments for dealing with a broad range of clinical and surgical diseases, though it has no heart surgery or solid organ transplant facilities.

The admission and discharge policies of this ICU are documented in general lines and are established on a consensus basis with the rest of the hospital. It is a general policy of the ICU not to discharge terminal patients or patients subjected to invasive mechanical ventilation or intravenous vasoactive drug perfusion. In the daily staff meeting of the Unit (physicians and nurses), all the patients, including those subjected to some limitation of therapeutic effort (LTE), are classified on the basis of clinical and physiological appraisal, and according to medical and nursing criteria, as either dischargeable or non-dischargeable individuals. In the case of the dischargeable patients, a discharge report is prepared and the patient is moved to the ward as soon as a bed becomes available. Those patients not regarded as dischargeable remain in the ICU. The final decision on the admission or discharge of patients is made by the intensivist, and the purpose of this classification is to always have beds available for those critical patients that need them.

Data acquisition and definition of premature discharge

The demographic data and information related to the disease of all admissions during 6 consecutive years (2000-2005) were prospectively entered (adopting consensus-based criteria) in a Microsoft Access database by the four physicians in the Unit, in a rotational and monthly manner. The intensivist in charge of data collection recorded as normal discharge all cases of discharge affecting dischargeable patients, regardless of the time of day of discharge. These cases were registered as type I discharges in the database, while premature discharge corresponded to the discharge of patients regarded as non-dischargeable. These discharges were registered as types II to IV, depending on whether the patients were receiving intensive treatment (e.g., mechanical ventilation, artificial airway or the titration of vasoactive drugs, etc., in the case of type IV) or not, and on the time during which they had been without this type of treatment (under 24 h in type III discharge or over 24 h in type II discharge). These premature discharges in all cases occurred at times when the ICU was saturated and a new patient had to be admitted. During weekends and on holidays, in which there was only one intensivist on duty and there were no joint staff meetings, premature discharges were taken to be exclusively those discharges decided to leave a bed vacant for another patient. Therefore, premature discharge means discharge not foreseen or agreed, and conditioned by the need for a new patient admission – with no associated time connotations (weekend, night shift, etc.).

Study variables and patients

Of all the patients admitted in the study period, the data analysis excluded those cases relating to readmissions to the ICU within the same hospitalization period, patients who died in the ICU, those with a stay of under 12 hours, and patients discharged to some other hospital and who were lost to follow-up.

The database variables included in the analysis were age; sex; origin upon admission to the ICU; hospital stay before admission to the ICU, in the ICU and post-ICU; patient category (clinical or surgical); emergency or elective surgery; presence of chronic disease and acute physiological score (APS) according to the APACHE II[13] in the first and last 24 h of stay in the ICU; evaluation of organ failure according to the SOFA (sequential-related organ failure assessment score) upon admission, the maximum reached during the course of stay and at discharge from the ICU[14,15]; assessment of the nursing workload in the first 24 h of admission and at discharge from the ICU using the NEMS (nine equivalents of nursing manpower use score)[16]; the presence or absence of mechanical ventilation and its duration; the existence of any written instructions in the clinical history relating to LTE; the type of discharge (normal or type I in the database, and non-programmed or types II, III and IV); and readmissions to the ICU within the same hospitalization interval. According to definitive destination at the time of hospital discharge, the patients were classified as survivors if sent home, or as deceased patients if death occurred anywhere in the hospital - including the ICU if the patient had been readmitted to the Unit.

Statistical analysis

The main objective of this study was to compare post-ICU hospital mortality (PICHM) according to the type of discharge (normal or premature). A sub-analysis was made to assess the characteristics of premature discharge. The secondary objectives were to compare the frequency of readmissions to ICU and post-ICU hospital stay according to the types of discharge involved.

The statistical analysis was carried out using the SPSS version 14.0 statistical package. The values are reported as means ± standard deviation (SD) for continuous variables or as percentages of the corresponding group in the case of categorical variables.

Statistical significance was assessed using the Student t-test for variables with a normal distribution, as determined by the Kolmogorov-Smirnov test, and the Mann-Whitney U-test for variables with a non-normal or skewed distribution. Categorical variables were analyzed using the chi-squared test or Fisher exact test. A probability of $2\alpha < 0.05$ was considered significant. Factors found to be significant in the univariate analysis were entered as independent variables in the step-by-step additive binary logistic regression analysis for estimating their influence upon post-ICU hospital mortality (PICHM), expressed as the odds ratio (OR) with the corresponding 95% confidence interval (95%CI).

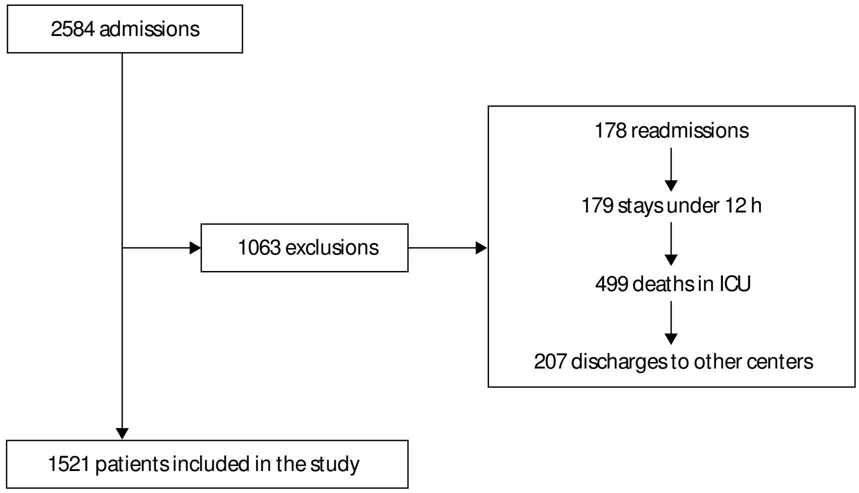

Figure 1 Patient selection structure. The exclusions were made in the order indicated by the arrows, i.e., readmissions were excluded first, followed by patients with stays of under 12 h, and so forth.

Results

A total of 2584 admissions to the ICU were registered during the study period. Mean occupation, assessed on a daily basis (number of patients x 100/10) at 8:00 a.m., during the study period, was 80%.

The analysis included the data corresponding to the first admission of 1521 patients discharged live from the ICU

Table 1 Characteristics of the 1521 patients and their relation to post-ICU hospital mortality

Variables	Survivors (n = 1345)	Deceased (n = 176)	p
Age (years)	54.9 ± 18	64.9 ± 14	< 0.001
Sex (% males)	64.7	73.4	0.02
Pre-ICU hospital stay (days)	5.1 ± 13	5.5 ± 9.1	0.22
Origin (%)			0.001
Emergency Department	37	24	
Clinical wards	14	23	
Surgical wards	6	8	
Operating rooms	35	35	
Other hospitals	6	8	
Others	2	2	
Type of patients (% clinical)	56.6	57.1	0.9
Type of surgery (% elective)	61.9	55.3	0.22
APACHE II (score)	15.7 ± 7.4	21 ± 6.6	< 0.001
APS (score)	11.9 ± 6.3	15.4 ± 6.4	< 0.001
Chronic disease (%)	16.4	31.6	< 0.001
SOFA (score upon admission)	3.7 ± 3.18	5.1 ± 3.3	< 0.001
NEMS (score first 24 h)	26.2 ± 7.9	28.8 ± 7.1	< 0.001
Mechanical ventilation (%)	36.6	50.5	< 0.001
Duration of mechanical ventilation (days)	6.4 ± 13.3	10.1 ± 14.9	0.003
Stay in ICU (days)	4.8 ± 9.7	8.1 ± 12.4	< 0.001
SOFA maximum (score)	4.7 ± 3.8	7.1 ± 4.1	< 0.001
LTE (% patients)	0.74	19.9	< 0.001
Premature discharge (% patients)	8.4	29.5	< 0.001
APS (score at discharge from ICU)	7.2 ± 4.4	9.9 ± 5.6	< 0.001
SOFA (score at discharge from ICU)	1.8 ± 1.9	3.3 ± 2.3	< 0.001
NEMS (score at discharge from ICU)	18.3 ± 2.7	18.7 ± 3.4	0.083
Readmissions to ICU (%)	6.1	23.3	< 0.001
Post-ICU hospital stay (days)	16.9 ± 16.3	16.9 ± 23.3	0.98

APS: acute physiology score of the APACHE II classification; LTE: instructions relating to limitation of therapeutic effort of any modality, reflected in the clinical history of the patient; NEMS: nine equivalents of nursing manpower use score; SOFA: sequential-related organ failure assessment score; ICU: Intensive Care Unit.

Table 2 Factors related to post-ICU hospital mortality in the multivariate logistic regression analysis

Factors	OR (95% confidence interval)	p
Age (per additional year)	1.03 (1.01-1.05)	0.001
LTE	14.02 (4.6-42.6)	< 0.001
SOFA (per score point at discharge from ICU)	1.16 (1.01-1.32)	0.003
Premature discharge	2.16 (1.06-4.41)	0.033
Readmission to ICU	3.46 (1.76-6.78)	< 0.001

LTE: instructions relating to limitation of therapeutic effort of any modality, reflected in the clinical history of the patient; OR: odds ratio; SOFA: sequential-related organ failure assessment score; ICU: Intensive Care Unit.

after a stay in the latter of 12 hours or more, and with a known final destination (in-hospital death or discharge home) (Fig. 1). Of these patients, 176 (11.6%) died in the hospital before discharge home – this representing a little over one quarter (26%) of the total deaths of patients admitted to the ICU. The differential characteristics between these patients and the survivors (Table 1) basically indicate older age, seriousness and organic dysfunction among the former from the time of admission to the ICU until the final outcome, as well as a greater use of resources in the Unit, as estimated from indirect data of stay, NEMS (nine equivalents of nursing manpower use score) or mechanical ventilation. There were proportionally fewer deaths among the patients admitted to the ICU from the Emergency Department than from the medical wards. The days of hospital stay before and after the stay in the ICU, the clinical or surgical category of the patients and the elective or emergency nature of surgery did not differ significantly. The patients who died were receiving more intensive therapy as assessed by the NEMS at discharge from the ICU, though statistical significance was not reached.

There were 165 premature discharges in the study period (10.8% of the total patients), and this was the type of discharge from ICU among 29.5% of the patients who finally died, versus among 8.4% of the survivors (p < 0001). The PICHM of the patients with premature discharge was 31.5% (52 patients) versus 9.1% (124 patients) in the patients with normal discharge (p < 0.0001). Standardized mortality (observed mortality / expected mortality) according to the APACHE II prediction model was 0.39 in the patients with normal discharge and 0.81 in the patients with premature discharge. In the multivariate study, only 5 variables remained as factors independently associated to PICHM (Table 2): age (per year of increment), instructions relating to LTE, organ failure at discharge from the ICU (per SOFA score point), readmissions to the ICU and premature discharge (OR = 2.16 [1.06-4.41]; p = 0.033). In reference to these factors, the patients with premature discharge were older, presented greater organ dysfunction at discharge, and had more LTE instructions than the patients with normal discharge (Table 3). The readmission rate, which during the study period represented 7% of the total admissions to the ICU (178 readmissions) and 8.1% of the patients in the study (123 patients), did not differ significantly between the patients with normal discharge and those with premature discharge (111 [8.2%] versus 12 [7.3%]; p = 0.68). Hospital stay after discharge from the ICU did not differ according to the type of discharge (16.7 ± 16.7 days for normal discharge versus 18.7 ± 21.3 days in the case of premature discharge; p = 0.162).

Discussion

In this study 11% of all discharges from the ICU were not programmed. We consider this figure to be high, and it confirms the scant usefulness of mean occupation as an isolated measure of bed availability at specific points in time. In the study published by Goldfrad and Rowan,[8] involving somewhat lower figures and different definitions, nocturnal discharges were used as a surrogate marker of pressure upon the ICU; as this was a study comprising the temporal division of cohorts, the situation was viewed as a growing problem attributable to a lesser availability of beds for critical patients. The same results have been obtained in other studies,[17,18] and although our definition of premature discharge is unrelated to temporality or to the moment in which it occurs, the findings of the present study likewise illustrate this same problem.

In our hospital, patients with premature discharge from the ICU present on average a two-fold greater probability of dying in hospital than those with normal discharge. The post-ICU hospital mortality (PICHM) recorded in this study coincides with the observations of other authors,[7,12,17-19] and is conditioned not only by the type of discharge involved but also by other factors relating to discharge. Accordingly, the greater organ dysfunction seen among patients with premature discharge reflects incomplete resolution of the disease processes affecting these patients,[20] with an increased nursing workload,[5] and indicates that this type of

Table 3 Characteristics of the types of discharge in relation to the factors associated to post-ICU hospital mortality

Factors	Normal discharge (n = 1356)	Premature discharge (n = 165)	p
Age	55.5 ± 18.5	60.7 ± 16.4	0.001
LTE	25 (1.8%)	20 (12.1%)	< 0.001
SOFA (score at discharge from ICU)	1.8 ± 1.18	3.76 ± 2.56	< 0.001
Readmission to ICU	111 (8.2%)	12 (7.3%)	0.68

LTE: instructions relating to limitation of therapeutic effort of any modality, reflected in the clinical history of the patient; OR: odds ratio; SOFA: sequential-related organ failure assessment score; ICU: Intensive Care Unit.

discharge is inappropriate or even premature. Another factor, the limitation of therapeutic effort (LTE), is common practice in the ICU, and most of the patients subjected to LTE die in the Unit – contributing at least one-third of all deaths recorded in the ICU.[11,20,21] Of the patients of our study, only 44 (3%) had one or more LTE instructions in their clinical history, and the preferential distribution of these patients among the cases of premature discharge probably reflects a logical preference on the part of the intensivists when it comes to having to decide which patients to discharge in order to gain a vacant bed in the Unit.

In coincidence with the study of Fernández et al.,[7] readmissions to ICU were also found to be associated to PICHM. In the same way as nocturnal discharges in the study published by Goldfrad and Rowan,[8] premature discharge did not imply increased ICU readmission rates. In other studies, however, nocturnal discharges were correlated to more readmissions.[11,23,24] In our case, the older age of the patients with premature discharge, together with the higher LTE rates applied in the ICU and the organic dysfunctions may have contributed to non-consultation of the intensivists for the readmission of certain patients, or even to rejection by the intensivists themselves ("occult LTE") – thus explaining the lack of a relationship between this type of discharge and readmission.

As in the case among survivors and patients who died in hospital, the duration of hospital stay after discharge from the ICU did not vary according to the type of discharge involved.

Reducing premature discharge with a view to reducing PICHM appears complicated. Keeping patients longer in the ICU has been found to be effective in some studies,[6] though it is impossible with our current hospital structure, and would lead to increased mortality among other patients who probably would stand to benefit more from admission to the ICU than those in which the stay is prolonged in order to facilitate recovery from organ dysfunction. In our study, however, we did not study those patients who were admitted and caused premature discharge, or those who remained in the ICU when such discharge occurred. Consequently, both the ethical aspects of the decisions taken by the intensivists and the results of the other possible alternatives are limited to the field of speculation. Contemplating structural and functional changes to improve critical patient care at discharge from the ICU is an attractive idea, but neither the design of the study nor the results obtained allow us to identify those patients amenable to special follow-up in other increased dependency units or by a special healthcare team, or to know whether such a measure would effectively reduce PICHM. In this sense, the recently validated Sabadell score[7] could prove to be a useful instrument.

Our study has important limitations that must be taken into account when interpreting the results obtained. Firstly, it has been carried out in a single institution, and the case mix, the functional structure, application of LTE, and the policies relating to admission, discharge and readmission may all be very different from those of other hospitals and ICUs. Secondly, we included no information on the diagnoses or reasons for patient admission, which could have modified the mortality model[25] but which also would have posed complications for the logistic regression analysis due to multiplication of the number of variables and the addition of further heterogeneity. Nevertheless, the APACHE II-based mortality risk prediction model includes the reasons for admission, and we have seen that performance as assessed by standardized mortality according to this model is poorer in premature discharge. On the other hand, we did not examine the timing of discharge, and it is feasible that non-programmed discharge occurred more often in the course of shifts in which there are fewer ward personnel members, thereby accounting for poorer performance with this type of discharge[9,11] - though neither the readmission rates nor posterior hospital stay appear to justify this assumption. Another limitation is that the information relating to discharge on weekends or holidays was obtained from the different intensivists on duty at the time, and in such situations the discharge criteria used when needing to gain a bed for another patient are not as homogeneous as when these decisions are taken in the context of the joint staff meetings of the Unit. Thus, some of these discharges might have been classified as normal if the decision had been taken in the mentioned routine joint staff meetings. In any case, it is unlikely that this would have modified our primary study endpoint.

Lastly, the present study is conditioned by the bias inherent to retrospective analyses, even if the data were collected prospectively.

In conclusion, premature discharge is relatively frequent in our setting and significantly contributes to post-ICU hospital mortality, without significantly affecting other outcomes of critical patient hospital care such as ICU readmission rate or post-ICU hospital stay.

Conflict of interest

The authors declare no conflict of interest.

References

1. Metcalfe MA, Slogget A, McPherson K. Mortality among appropriately referred patients refused admission to intensive-care units. Lancet. 1997;350:7-12.
2. Joynt GM, Gomersall CD, Tan P, Lee A, Ai Yu Cheng C, Lai Yi Wong EL. Prospective evaluation of patients refused admission to an intensive care unit: Triage, futility and outcome. Intensive Care Med. 2001;27:1459-65.
3. Task Force of the American College of Critical Care Medicine, Society of Critical Care Medicine: Guidelines for intensive care unit admission, discharge, and triage. Crit Care Med. 1999;27:633-8.
4. Heidegger CP, Treggiari M, Romand JA, and Swiss ICU Network. A nationwide survey of intensive care unit discharge practices. Intensive Care Med. 2005;31:1676-82.
5. Moreno R, Reis Miranda D, Matos R, Fevereiro T. Mortality after discharge from intensive care: the impact of organ system failure and nursing workload use at discharge. Intensive Care Med. 2001;27:999-1004.
6. Daly K, Beale R, Chang RW. Reduction in mortality after inappropriate early discharge from intensive care unit: logistic regression triage model. BMJ. 2001;322:1274-6.
7. Fernández R, Serrano JM, Umarán I, Abizanda R, Carrillo A, López-Pueyo MJ, et al. Ward mortality after ICU discharge: a multicenter validation of the Sabadell score. Intensive Care Med. 2010;36:1196-201.

8. Goldfrad C, Rowan K. Consequences of discharges from intensive care at night. Lancet. 2000;355:1138-42.
9. Priestap FA, Martin CM. Impact of intensive care unit discharge time on patient outcome. Crit Care Med. 2006;34:2946-51.
10. Usaro A, Kari A, Ruokonen E. The effects of ICU admission and discharge time on mortality in Finland. Intensive Care Med. 2003;29:2144-8.
11. Duke GJ, Green JV, Briedis JH. Night-shift discharge from intensive care unit increases the mortality-risk of ICU survivors. Anaesth Intensive Care. 2004;32:697-701.
12. Iapichino G, Morabito A, Mistraletti G, Feria L, Radrizzani D, Reis Miranda D. Determinants of post-intensive care mortality in high-level treated critically ill patients. Intensive Care Med. 2003;29:1751-6.
13. Knaus WA, Draper EA, Wagner DP, Zimmerman JM. APACHE II—a severity of disease classification system. Crit Care Med. 1985; 13:818-29.
14. Vincent JL, Moreno R, Takala J, Willatts S, De Mendonça A, Bruining H, et al. The SOFA (Sepsis-related organ failure assessment) score to describe organ dysfunction/failure. Intensive Care Med. 1996;22:707-10.
15. Moreno R, Vincent JL, Matos R, Mendonça A, Cantraine F, Thijs L, et al. The use of maximum SOFA score to quantify organ dysfunction/failure. Intensive Care Med. 1999;25:686-96.
16. Reis-Miranda D, Moreno R, Iapichino G. Nine equivalents of nursing manpower use score (NEMS). Intensive Care Med. 1997;23:760-5.
17. Tobin A, Santamaría J. After-hours discharges from intensive care are associated with increased mortality. MJA. 2006;184: 334-7.
18. Goldhill DR, Summer A. Outcome of intensive care patients in a group of British intensive care units. Crit Care Med. 1998;26: 1337-45.
19. Wallis C, Davies H, Shearer A. Why do patients die on general wards after discharge from intensive care units?. Anaesthesia. 1997;52:9-14.
20. Azoulay E, Adrie C, De Lassence A, Pochard F, Moreau D, Thiery G, et al. Determinants of postintensive care unit mortality: A prospective multicenter study. Crit Care Med. 2003;31: 428-32.
21. Esteban A, Gordo F, Solsona JF, Alía I, Caballero J, Bouza C, et al. Withdrawing and withholding life support in the intensive care unit: a Spanish prospective multi-centre observational study. Intensive Care Med. 2001;27:1744-9.
22. Wunsch H, Harrison DA, Harvey S, Rowan K. End-of-life decisions: a cohort study of the withdrawal of all active treatment in intensive care units in the United Kingdom. Intensive Care Med. 2005;31:823-31.
23. Chrusch CA, Olafson KP, McMillan PM, Roberts DE, Gray PR. High occupancy increases the risk of early death or readmission after transfer from intensive care. Crit Care Med. 2009;37: 2753-8.
24. Hanane T, Keegan MT, Seferian E, Gajic O, Afeas B. The association between nighttime transfer from the intensive care unit and patient outcome. Crit Care Med. 2008;36: 2232-7.
25. Sakr Y, Vincent JL, Ruokonen E, Pizzamiglio M, Installe E, Reinhart K, et al. Sepsis and organ system failure are major determinants of post–intensive care unit mortality. Journal of Critical Care. 2008;23:475-83.