

INFLUENCE OF THE ADMISSION PATTERN ON THE OUTCOME OF PATIENTS ADMITTED TO A RESPIRATORY INTENSIVE CARE UNIT: DOES A STEP-DOWN ADMISSION DIFFER FROM A STEP-UP ONE?

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ABSTRACT

Objective: The outcomes of patients admitted to a Respiratory Intensive Care Unit (RICU) have been evaluated in the past but no study has so far considered the influence of location prior to RICU admission

Design: Prospectively collected data from a total of 326 consecutive patients were analyzed

Settings: A 7-bed RICU (Respiratory Intensive Care Unit).

Measurements: The primary endpoints were the patients' survival and severity of morbidity-related complications, evaluated according to the patients' location prior to the RICU admission. Three different admission pathways were considered: (i) "step-down" for patients transferred from the Intensive Care Units (ICU) of our hospital; (ii) "step-up" for patients coming from our Respiratory Wards (RW) or other Medical Wards (MW); and (iii) "directly" from the Emergency Room (ER). The secondary end-point was the potential influence of several risk factors for morbidity and mortality.

Main results: Of the 326 patients, 92 (28%) died. Overall, patients admitted in a step-up process had a significantly higher mortality ($p < 0.001$) than patients in the other groups. The mortality rate was 64% for patients admitted from RW, 43% for those from MW and 18% for patients from both ICU and ER (RW vs MW $p < 0.05$; RW vs ER $p < 0.001$; RW vs ICU $p < 0.001$; MW vs ER $p < 0.001$ and MW vs ICU $p < 0.001$). Patients admitted from a RW had a lower albumin level and SAPS II score was significantly higher in patients following a step-up admission. About 30% of the patients admitted from a RW received non-invasive mechanical ventilation (NIV) as a "ceiling treatment". The highest odds ratios related to

survival were patients' location prior to RICU admission and female gender. Lack of use of NIV, younger age, female gender, higher albumin level, lower SAPSII score, higher Barthel score and the absence of chronic heart failure were also statistically associated with a lower risk of death.

KEY WORDS: Respiratory Intensive Care Unit - Critically ill patient – Non-invasive ventilation - SAPS II – Weaning - Intensive Care Units - Acute respiratory failure

INTRODUCTION

Respiratory Intensive Care Units (RICU) have developed around the world as specialized single organ units providing an intermediate level of care between that supplied in Intensive Care Units (ICU) and general wards (1). This model of care has been generally considered as an example of good management of hospital resources enabling effective control of costs (2), although its actual cost-effectiveness has been questioned by some authors (3). According to the European Respiratory Society a RICU is defined by the following characteristics: a nurse-patient ratio $>1:3$, the presence of multifunctional monitors and life support ventilators, and the possibility of applying both invasive and non-invasive ventilation in patients with lung failure or more than one organ failure (1). Depending on patients' previous level of care, a RICU can provide: (i) "step-up" care when they admit patients transferred from general wards, needing specific treatments, such as non-invasive and invasive ventilation and/or close monitoring, for an acute respiratory failure episode that developed during the hospital admission, or (ii) "step-down" care when patients no longer require all the facilities of an ICU, but are not yet ready to be transferred to general medical wards (MW) because of specific care needs (e.g. the management of tracheotomy) or because they still require invasive mechanical ventilation. A third pathway of admission involves patients admitted directly from the Emergency Room (ER). It is rather intuitive that patients "getting better" (i.e. transferred from an ICU) may have a more favorable outcome than those "getting worse" (i.e. those transferred from a MW), but this point has never been systematically investigated in the specific environment of the RICU, characterized by the pathways of admission described above, in which there is a flow of admission working in two different directions, as opposed to the ICU in which admission flow is "unidirectional" (i.e. only those patients getting worse are admitted). In fact,

previous studies had already addressed this issue in the ICU. For example Gerber *et al.* found that transfer of patients to a tertiary care ICU from the ER of a referring hospital was associated with significantly better outcomes than transfers from a referring hospital ICU (4), confirming the observations of other authors (5,6). It is totally unknown whether or not the location prior to RICU admission could influence the in-hospital survival rates, in patients admitted to the unit. An analysis of data on this issue could help clinicians and hospital administrators to better understand the role and effectiveness of RICU. Surprisingly, none of the studies assessing patients' characteristics and their outcomes have ever considered these three patterns of admission as variables potentially influencing outcomes. We, therefore, analyzed survival rate, patients' clinical characteristics at admission and the variables that best correlated with the patient's outcome in a single RICU located in a large academic hospital. An analysis of data with sample excluding DNI patients is also shown.

METHODS

In an analysis of data prospectively collected and entered into a database, we evaluated 326 consecutive patients admitted over a 22-month period into our seven-bed RICU, with three beds located in a single room.

The study protocol was approved by the ethical and scientific committee of our institution (Sant'Orsola Malpighi Hospital). Patients gave written consent to participation in the study: however, 34 patients were not able to sign the consent form and in these cases a relative signed it for the patient. In 18 of these cases, the patients were later able to sign the informed consent form.

The primary endpoint of the study was the impact of the patients' location prior to RICU admission on their survival and their severity score. The three different pathways of admission were classified as follows: (i) step-down, when patients were transferred from one of the three ICU in our hospital (i.e. the general ICU, the post-surgical ICU and the post-transplant/ECMO ICU); (ii) step-up, when the patients entered the RICU from our respiratory ward (RW) or other wards in the hospital (i.e. internal medicine, gerontology, cardiology, physical therapy unit, orthopedic unit and hematology unit); and (iii) directly, when they were admitted straight from the ER.

The following variables were also recorded in all patients at admission: age, sex, comorbidities, albumin level, Simplified Applied Physiology II (SAPS II) score defined as the worst value measured within the first 24 hours of RICU admission (7), Barthel Index, blood-gas values, long-term-oxygen or mechanical ventilation before hospitalization, invasive or non-invasive ventilation j RICU, length of hospital stay before admission into

the RICU, causes of acute respiratory failure, such as an exacerbation of chronic obstructive pulmonary disease (COPD), heart failure, pneumonia or acute respiratory distress syndrome (ARDS) (8), destination at discharge for survivors, and the new prescription of invasive or non-invasive ventilation or oxygen therapy at discharge. Patients had been previously diagnosed as having COPD if lung function testing showed a post-bronchodilator $FEV_1/FVC \leq 0.7$ (9); the diagnosis of hypoxemic respiratory failure was based on a PaO_2/FiO_2 ratio ≤ 300 (10). The secondary end-point was the potential influence of the above-mentioned variables, except the destination at discharge and the new prescription of oxygen and/or ventilation, on the survival of the patients, both according to the location prior to RICU admission and as a whole group.

STATISTICAL ANALYSIS

With regards to the three different patterns of admission to the RICU, for the data analysis we considered our RW as a stand-alone unit inside the step-up pathway, due to the fact that the RICU is located inside the RW and shares the same medical staff.

Descriptive statistics are expressed as mean and standard deviation (SD) for continuous variables and percentages for categorical variables. Demographic and disease characteristics were compared among the four provenance groups, RW, MW, ER and ICU, using Pearson's chi-squared test for categorical variables and one-way ANOVA followed by Schaffe post-hoc test for continuous variables.

Concerning the secondary endpoints, univariate and multivariate logistic regression analyses were done to investigate mortality-related risk factors and to determine independent risk factors that are related to mortality. The following variables were entered

into the univariate and multivariate analyses: age, sex, number of comorbidities, albumin level, SAPS II score defined as the worst value measured within the first 24 hours of RICU admission, Barthel Index, blood-gas values, long-term oxygen or ventilatory therapy before hospitalization, invasive or non-invasive ventilation on admission to the RICU, length of hospital stay before admission to the RICU, causes of acute respiratory failure. The odds ratio was then estimated from the above-mentioned analysis to identify factors associated with survival. A p-value lower than 0.05 was considered statistically significant. Statistical analyses were conducted using the Stata Intercooled program (College Station Texas, TX, USA).

RESULTS

Primary outcomes

Fig.1 illustrates the flow of patients admitted to our RICU during the study period and their mortality rate, according to the different pattern of admission; in total 92 patients (28%) died. Overall, patients admitted via the step-up pattern (from a RW or MW) had a significantly higher mortality rate ($p<0.001$) than those admitted as a step-down approach (from an ICU) or directly from the ER. Statistical differences between the “single” units are also illustrated in the figure. With regards to the patients transferred from the three ICU, 60 patients were admitted from the post-surgical ICU, 45 from the general ICU and 3 patients were transferred from post-transplant ECMO-ICU. No statistically significant differences were observed in mortality rate between patients from the first two different locations ($11/60=18\%$ vs $7/45=16\%$, for post-surgical ICU and the general ICU, respectively). Causes of death were mainly related to sepsis or end-stage pulmonary disease, in particular in patients with a ‘do not intubate’ (DNI) order. Overall, of the 326 patients studied, 27 with a DNI order died, accounting for 29% of the 92 patients who did die in the study. These 27 patients comprised 8 with advanced cancer (8% of all deaths), 10 with end-stage pulmonary fibrosis (11% of all deaths) as well as 9 with end-stage COPD (10% of all deaths) who had refused invasive treatments (Table 1).

The mortality rate in the 285 patients without a DNI was similar to the overall one with the same statistical differences between the different patterns of admission (step-up vs step-down $p<0.001$). Of these 285 patients, 51 (18%) died: in detail, 12/25 (48%) patients admitted from the RW, 21/60 (35%) of those from a MW, 8/101 (8%) patients admitted directly from the ER and 10/99 (10%) patients admitted from an ICU.

The patients' characteristics at admission to the RICU, based on their previous location, are presented in Table 2. Patients admitted from the RW had a significantly lower serum albumin level than those from an ICU or the ER ($p=0.001$ and $p=0.029$, respectively). The SAPS II score was significantly higher in the patients admitted in a step-up approach (from a MW or RW) than in those following a step-down admission (RW vs ER, $p=0.005$; RW vs ICU, $p=0.001$; and MW vs ICU, $p=0.050$), except for MW vs ER. Almost all the patients had more than one comorbidity as shown by the Charlson Comorbidity Index score (11). The age-adjusted Charlson Comorbidity Index was significantly higher in patients coming from a RW (RW vs ER $p<0.01$; RW vs ICU, $p<0.02$). Causes of admission were sometimes multiple with overlap between groups (e.g. COPD exacerbation plus pneumonia or heart failure) and rather homogeneously distributed, but nevertheless with little difference according to the location prior to RICU admission. The time prior to RICU admission was statistically different between the groups, particularly between the patients transferred directly from the ER and those admitted from the other locations.

As shown in Table 3, overall about 25% of the patients did not require any form of ventilation. More than 50% of the patients transferred from an ICU were invasively ventilated (either via an endotracheal tube or tracheotomy). About 30% of the patients transferred from our Respiratory Ward received non-invasive ventilation (NIV) as a "ceiling treatment". At discharge the majority of patients did not need any ventilatory support. No statistical differences were found between the four groups in terms of ventilation methods on admission. Less than 6% of the patients were discharged home directly from the RICU; most of the patients (62%) were transferred from the RICU to our RW. Only 3% of the survivors needed re-admission to an ICU.

Secondary outcomes

As shown in Table 4, using the univariate analysis, the highest odds ratio related to survival was the patients' location prior to RICU admission with those patients transferred from the ER or ICU having the highest chances of survival. The lack of NIV use, younger age, female gender, higher albumin level, lower SAPSII score, higher Barthel score, longer hospital stay prior to RICU admission and the absence of chronic heart failure were statistically associated with a lower risk of death.

Moreover a multivariate analysis was performed to identify variables possibly associated with survival; the results are expressed as odds ratios. Using this multivariate model, some of these variables lost their "individual" power. Considering categorical variables, the probability of survival was almost six times higher for women, whereas patients admitted from the RW had about a four times lower probability of surviving than those admitted directly from the ER. Considering the continuous variables, survival probability decreased by 8% for every one point increment of the SAPS II score; in contrast, for every 1 gram increase of albumin concentration, the survival probability was three times higher.

DISCUSSION

In this study we have demonstrated, for the first time, that the patients' location prior RICU admission may profoundly influence the patients' outcomes, since those admitted as a step-down approach to care or those admitted directly from the ER had a better survival rate than those admitted following a step-up pattern and had, therefore, transited through a MW or RW. These latter patients were also, on average, more severely ill than those transferred from an ICU or the ER, likely because they developed a progressive worsening of their conditions while being outside of a "protected" environment.

In Europe, a RICU located inside an acute care hospital should admit patients suffering from acute or acute-on-chronic respiratory failure not immediately needing endotracheal intubation but requiring close monitoring, patients with single organ failure needing invasive ventilation, patients requiring NIV and patients to be weaned from invasive mechanical ventilation (1). In North America most of the intermediate care units accept a variety of patients, not just patients in respiratory failure (12,13), so the results of this study may not be generalized, but may basically reflect a different "international" attitude.

These different conditions reflect different flows of patients once admitted to a general hospital. For example, in a survey conducted in 26 RICU in Italy, Confalonieri *et al.* (14) found that almost half the patients (47%) were admitted from emergency departments, 19% from other medical wards, 18% were transferred from an ICU, 13% from specialist respiratory wards, and 2% were transferred following surgical procedures. This is perfectly in keeping with the data collected in our seven-bed RICU located inside a general hospital for about 1,400 patients and serving a population of 800,000 inhabitants.

Despite the fact that several investigations have assessed the outcome of the patients admitted to an RICU (12-13-14), none has considered the effect of the admission pattern,

which may serve to deliver step-down or step-up care or to admit directly from the ER (15). The clinical outcome of patients requiring ICU admission (the step-down pattern) has been described in the recent literature, especially for the subset of patients requiring prolonged mechanical ventilation and transferred to a RICU located inside a rehabilitation center or long-term acute care hospital, which is increasingly utilized after a critical illness, especially in North America (16-17). Data collected on more than 3,000 patients admitted to five Italian RICU, mainly dedicated to weaning from mechanical ventilation, showed a mortality rate of about 15%(18), which is in line with our results. Concerning RICU located inside an acute care hospital, Bigatello *et al.* (19) suggested that a considerable number of patients were ready to come off mechanical ventilation at the time of admission to RICU, implying that in the preceding ICU stay, discontinuing mechanical ventilation had not always been a priority, and explaining the quite low mortality rate even 1 year after hospital admission.

The data obtained in the present study (~18% mortality) are in line with these from previous studies, and the deaths were homogenously distributed among patients from the three different ICU of provenience. No differences were observed between the two main different locations prior RICU admission. This is probably because the purpose of our RICU is to admit mainly “respiratory” patients, with single organ failure, so the characteristics of our transferred patients were rather homogeneous. No patients were admitted from the Coronary Care Unit of our hospital, since this is organized in such a way that the staff take direct care of their patients even when these need mechanical ventilation, or in the worst case they have a “preferential channel” with our post-transplant /ECMO ICU.

The mortality rate of the patients admitted directly from our ER was similar to that of the patients admitted from an ICU. This may be explained by the severity score of these

patients whose SAPSII score was almost identical to that of the patients admitted from an ICU, despite the fact that these latter were mainly invasively ventilated, but in a phase of clinical stability. The patients admitted through the ER were “acutely” ill and undergoing an episode of acute respiratory failure. Interestingly ~50% of this group of patients were ventilated non-invasively one could, therefore, have expected a better hospital survival, especially if the patients were treated within a protected environment. It should, however, be noted that not all the patients were affected by acute hypercapnic respiratory failure, in which NIV has been shown to be associated with the best outcome; in fact, some of the patients had “pure” hypoxic respiratory failure, such as ARDS, in which NIV is associated with a higher failure rate and mortality (20). Indeed, some patients, mostly those who were very elderly and with several comorbidities, had a DNI order, so that NIV was used as a ceiling treatment with a palliative aim to improve dyspnea (21). In our study, NIV was used as a ceiling treatment in 41 (13%) of all 326 patients.

The most interesting finding of the present study is that the mortality rate in the patients transferred to the RICU after having transited through general or specific wards (i.e., the RW) was higher than in those admitted from other locations, with those coming from the RW having the higher risk of death.

Patients admitted following the step-up pattern had a higher severity score and were older and it is not, therefore, surprising that their mortality rate was also much higher than that of patients with lower SAPSII scores transferred from an ICU or the ER. It may, therefore, be claimed that it is the severity of disease itself rather than the location that determines these patients' outcome (22-23-24). Unfortunately, given the lack of a standardized database in all the units, we were unable to detect a progressive deterioration of clinical conditions during the hospital stay. Simchen *et al.* (25) demonstrated that about 2% of all patients admitted to the “regular departments” of an acute care hospital deteriorate during the

hospital stay and they reach the criteria of admission to a critical care environment. The majority of these patients (55%) were not, however, transferred early to the ICU or similar environment so that their mortality was likely to increase. The authors concluded that prompt admission to a critical care environment in patients deteriorating while in hospital wards should be imperative to maximize survival, but that this occurred in only a small proportion of patients. This suggests that we should look carefully at patients admitted to wards with respiratory disease in case we are mistriaging some patients to lower levels of care than they truly need.

Another problem is the fact that intensivists (i.e. those working in an ICU) are usually involved as “first-line call” for patients admitted to a MW and that due to the paucity of ICU beds they often deny transfer for old patients or for those with several comorbidities, since the physician’s perception of poor prognosis is associated with less aggressive or invasive care. The paucity of beds is a limiting factor for access to general ICU, at least in most European Countries. The decision to admit a patient to this setting has been reported to be influenced by the physician’s perception of prognosis, which has been shown to be overly pessimistic, with the risk of barring access to ICU to patients who may have a chance of surviving (26). Other studies from different countries have confirmed the existence of this trend, indicating that intensivists are very selective in allowing transfer to the ICU (27,28). Specialized ICU such as the RICU may provide an alternative for the referral of patients who develop severe respiratory failure in regular MW, but their presence is generally limited to large hospitals and, even when available, ward physicians tend to consult first with the general intensivists.

A RICU usually cares for older, chronically ill patients, so that it is likely that the higher mortality in patients admitted from the wards may simply have reflected the fact that some

of these patients were affected by end-stage diseases. This is a striking finding of the patients transferred from our RW, where 31% of the admissions pertained to individuals in which NIV was considered a “ceiling” form of treatment. However, patients with a DNI order were separated in the analysis from other patients undergoing NIV treatment; they were also evenly distributed across patients from the various different pre-RICU locations: 27% were from the RW, 19% from MW, 32% from the ER and 22% from an ICU, so their inclusion in the analysis does not alter the finding that pre-RICU location affected prognosis.

The present study confirms most of the previous findings of other investigators in the same setting, for example that albumin level and age were predictors of hospital mortality. Malnutrition associated with advanced lung disease has been termed the “pulmonary cachexia syndrome”: it is associated with an accelerated decline in functional status and is recognized as an independent predictor of mortality in patients with lung diseases (22).

In the univariate analysis the use of NIV was associated with an increased risk of mortality, which was a surprising finding since the use of this technique has been shown to improve survival compared to standard medical treatment, at least during an episode of acute hypercapnic respiratory failure (29). It should, however, be noted, as previously stated, that NIV was used in the RICU in some cases (in patients with a DNI order) as a palliative tool. Moreover NIV was also used in patients with hypoxic respiratory failure, including those with pneumonia. Both these circumstances affect the perceived “success” of NIV in this study. Indeed, it is our policy to treat all patients with a COPD exacerbation with respiratory failure and a $\text{pH} > 7.25$ in the RW (30).

We found that only a small proportion of our patients were discharged from the RICU directly to their home, in line with data reported by Bigatello *et al.* (19) who reported that only 2% of their patients did so.

Interestingly, we have also confirmed that admission to a RICU is associated with a quite high rate of weaning from mechanical ventilation, since the percentage of patients invasively ventilated at discharge decreased from 70% to 40%.

The present study has some biases. The first, and probably most important, is that the data were collected in a single RICU located in an acute care hospital and the results, therefore, may not be extrapolated to other hospitals and geographical locations. Secondly, almost all the patients had been admitted for medical problems, while only three were post-surgery patients, and they are therefore representative of only one part of the population admitted to a critical care environment. Lastly, as previously stated, it was often difficult to collect a complete clinical history (in particular, previous lung function data) especially from patients transferred from a MW since these patients were often in critical conditions on admission to the RICU.

CONCLUSIONS

We have shown that the pathway of admission to a RICU is one of the major determinants of outcome, with patients transferred, because of a clinical deterioration, from a medical or respiratory ward (“step-up” pattern) being more severely ill and, therefore, more likely to die. Age, female gender, and nutritional status were also major determinants of survival. The use of NIV in such a setting is not only “curative” but also “palliative”.

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LEGENDS

Figure 1

The flow of patients admitted to our RICU during the study period and their mortality rate according to the different patterns of admission.

*p <0.05 for RW vs MW;

p <0.001 for RW vs ER;

p <0.001 for RW vs ICU;

p<0.001 for MW vs ER;

p<0.001 for MW vs ICU

Table 1. Causes of Death.

	Number of patients (%)
Severe sepsis or Septic shock	33 (36%)
Refractory respiratory acidosis	9 (10%)
ARDS	2 (2%)
Ischemic heart attack	21 (23%)
DNI order patients:	27 (29%)
End-stage IPF	10 (11%)
End-stage cancer	8 (8%)
End-stage COPD	9 (10%)

ARDS= acute respiratory distress syndrome

IPF= idiopathic pulmonary fibrosis

DNI= do not intubate

COPD=chronic obstructive pulmonary disease

Table 2 The patients' characteristics on admission to the RICU, based on their previous location.

	RW	MW	ER	ICUs	p value between groups	p value Scheffe's post-hoc test
Age (years) [mean (SD)]	77.36 (9.24)	70.46 (17.55)	72.28 (16.25)	69.16 (15.87)	p=0.050	p=0.009 for RW vs ICU p=NS for RW vs MW p=NS for RW vs ER p=NS for MW vs ER p=NS for MW vs ICU p=NS for ER vs ICU
Gender (men/women)	25/11	32/36	52/62	53/55	p=0.088	
SAPS II score [mean(SD)]	43.47 (11.45)	38.34 (15.91)	34.38 (12)	32.83 (12.65)	p <0.001	p=NS for RW vs MW p=0.005 for RW vs ER p=0.001 for RW vs ICU p=NS for MW vs ER p=0.050 for MW vs ICU p=NS for ER vs ICU
Albumin gr/dL [mean(SD)]	2.93 (0.50)	3.22 (0.49)	3.46 (0.52)	3.23 (0.52)	p <0.001	p=NS for RW vs MW p<0.001 for RW vs ER p=0.029 for RW vs ICU p=0.027 for MW vs ER p=NS for MW vs ICU p=0.010 for ER vs ICU
Time prior to admission (days) [mean (SD)]	16.3 (18.6)	14.8 (19.81)	2.32 (4.10)	14.9 (18.16)	p <0.001	P=NS for RW vs MW p<0.001 for RW vs ER p=NS for RW vs ICUs p<0.001 for MW vs ER p=NS for MW vs ICU p<0.001 for ER vs ICU
Age-adjusted Charlson Comorbidity Index [mean (SD)]	8.69 (2.31)	6.49 (1.89)	4.67 (2.35)	5.51 (2.19)	p=0.001	p<0.01 for RW vs ER p<0.02 for RW vs ICU p=NS for RW vs MW p=NS MW vs ER p=NS MW vs ICU p=NS ER vs ICU
Causes of exacerbation (% pts)						
COPD exacerbation	64	61	73	54	p=0.036	
hypoxic respiratory failure	33	52	35	49	p=0.034	
chronic heart failure	58	52	53	49	p=NS	

RW= Respiratory Ward

MW=Medical Ward

ER=Emergency Room

ICU=Intensive Care Unit

SD= standard deviation

SAPS II score= Simplified Acute Physiology Score

COPD=chronic obstructive pulmonary disease

Table 3. Ventilation mode on admission and at discharge

		RW [n.of patients(%)]	MW [n.of patients(%)]	ER [n.of patients(%)]	ICU [n.of patients(%)]
RICU Admission	Non-invasive mechanical ventilation	9 (9 %)	20 (20 %)	52 (51%)	20 (20 %)
	Non-invasive mechanical ventilation as ceiling treatment (DNI patients)	11 (27 %)	8 (19 %)	13 (32%)	9 (22%)
	No mechanical ventilation	12 (14%)	20 (24%)	28 (34%)	23 (28%)
	Invasive mechanical ventilation	4 (11%)	20 (20%)	21 (19%)	56 (50%)
RICU Discharge	Non-invasive mechanical ventilation	16 (21 %)	18 (23%)	29 (38%)	14 (18%)
	Invasive mechanical ventilation	2 (4%)	18 (35%)	8 (15%)	24 (46%) (20 tracheotomies)
	No mechanical ventilation	18 (9%)	33 (17%)	76 (39%)	70(35%)

RW= Respiratory Ward

MW=Medical Ward

ER=Emergency Room

ICU=Intensive Care Unit

RICU= Respiratory Intensive Care Unit

DNI= Do not intubate

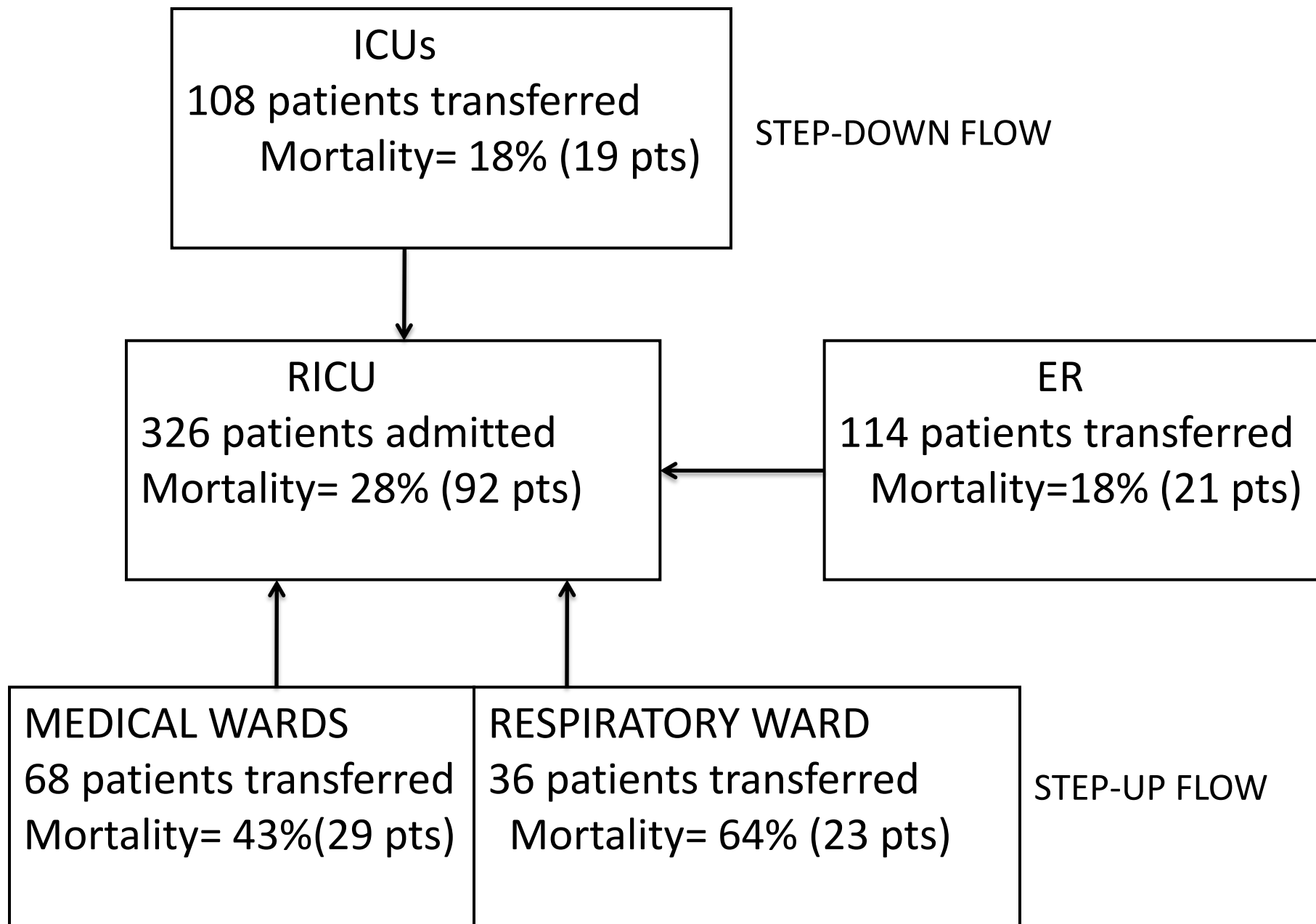
Table 4. Prognostic indices for survival.

a) Univariate logistic regression

Variables	Odds ratio	p value
Age (per 1 year increase)	0.96	0.001
Female gender	2.62	0.001
Location before RICU admission:	7.32	0.001
Non-invasive ventilation vs no ventilation at admission	0.51	0.041
Albumin (per 1 g/dL increase)	3.80	0.012
SAPS II score (per 1 unit increase)	0.92	0.001
Heart failure	0.53	0.001
Barthel index (per 1 unit increase)	1.04	0.001
Days before RICU admission (per 1 day)	0.98	0.011

b) Multivariate analysis

Variables	Odds ratio	p value
Sex (F vs M)	5.76	0.001
Location before admission	3.89	0.023
Albumin (per 1 g/dL increase)	3.12	0.011
SAPS II score (per 1 unit increase)	0.92	0.001



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