

## ORIGINAL ARTICLE

# The prognostic importance of chronic end-stage diseases in geriatric patients admitted to 163 Italian ICUs

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## ABSTRACT

**BACKGROUND:** The number of elderly patients undergoing major surgical interventions and then needing admission to intensive care unit (ICU) grows steadily. We investigated this issue in a cohort of 232,278 patients admitted in five years (2011-2015) to 163 Italian general ICUs.

**METHODS:** Surgical patients older than 75 registered in the GiViTI MargheritaPROSAFE project were analyzed. The impact on hospital mortality of important chronic conditions (severe COPD, NYHA class IV, dementia, end-stage renal disease, cirrhosis with portal hypertension) was investigated with two prognostic models developed yearly on patients staying in the ICU less or more than 24 hours.

**RESULTS:** 44,551 elderly patients (19.2%) underwent emergency (47.3%) or elective surgery (52.7%). At least one severe comorbidity was present in 14.6% of them, yielding a higher hospital mortality (32.4%, vs. 21.1% without severe comorbidity). In the models for patients staying in the ICU 24 hours or more, cirrhosis, NYHA class IV, and severe COPD were constant independent predictors of death (adjusted odds ratios [ORs] range 1.67-1.97, 1.54-1.91, and 1.34-1.50, respectively), while dementia was statistically significant in four out of five models (adjusted ORs 1.23-1.28). End-stage renal disease, instead, never resulted to be an independent prognostic factor. For patients staying in the ICU less than 24 hours, chronic comorbidities were only occasionally independent predictors of death.

**CONCLUSIONS:** Our study confirms that elderly surgical patients represent a relevant part of all ICUs admissions. About one of seven bear at least one severe chronic comorbidity, that, excluding end-stage renal disease, are all strong independent predictors of hospital death.

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**Key words:** Aged - Critical care - Prognosis.

Advances in health care treatment have contributed to increase life expectancy in the

last decades. The post-world war II baby boom further raised the today prevalence of elderly in western countries.<sup>1</sup> This, combined with the decrease of contraindications to major surgical

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interventions for older people, have caused the rate of elderly undergoing surgical interventions to continuously grow.<sup>2</sup> However, great attention should be paid in the selection and perioperative management of these patients, as they are at the highest risk of death, especially when bearing debilitating chronic conditions.<sup>3-7</sup> In this context the role of the intensive care unit (ICU) is crucial for both elective- and emergency-surgery procedures.<sup>8</sup> Moreover, since most of these patients are admitted to the ICU at least for postoperative monitoring, the ICU represents a privileged vantage point for epidemiologic observation and outcome evaluation of this population.

In Italy a large research network of intensive care units (ICUs) has been operative since 1991 (GiViTI - Italian Group for the Evaluation of Interventions in Intensive Care Medicine).<sup>9</sup> Since 2002 GiViTI is coordinating the international MargheritaPROSAFE project, currently involving 256 ICUs, to evaluate and improve the quality of care in this field. We used the GiViTI Italian database to investigate a population of geriatric surgical patients carrying chronic diseases in an advanced phase, who had been admitted to the ICU for postoperative management. Our aim was to offer an epidemiological sight of the Italian setting and to assess the prognostic impact of chronic organ failures in geriatric patients undergoing surgery.

### Materials and methods

The protocol concerning the data collection was submitted to the Institutional Review Board of the Hospital "Alessandro Manzoni" in Lecco that, given the observational and retrospective nature of the study, in accordance with Italian law, waived the need for a formal approval.

The Italian ICUs that join the MargheritaPROSAFE Project use the same software to collect data relative to all patients they have admitted. The electronic case-report form includes demographics, admission diagnoses, comorbidities, surgical status, reasons for admission, physiologic parameters on admis-

sion, failures and diseases during the ICU stay, major procedures and interventions, ICU and hospital outcomes. Study homogeneity and data quality were assured by a complex and standardized set of operating procedures. Data concerning patients admitted to general ICUs between 2011 and 2015 were considered. We selected geriatric patients with 75 years or more who had undergone a surgical procedure within seven days before, the same day of, or the day after ICU admission. We divided this sample in subsets according to their surgical status: elective surgery with planned ICU admission, elective surgery with unplanned ICU admission, and emergency surgery, and on the presence of debilitating chronic conditions, that we labeled chronic end stage diseases (CEDs), as classified by the Charlson Comorbidity Index:<sup>10</sup> severe chronic obstructive pulmonary disease (COPD) defined as dyspnoea at rest, despite treatment, oxygen therapy at home, hypercapnia, or severe chronic hypoxia; class IV heart failure according to the New York Heart Association (NYHA) Classification;<sup>11</sup> cirrhosis with portal hypertension with or without bleeding; end-stage renal disease defined as established kidney failure with glomerular filtration rate <15 mL/min/m<sup>2</sup> or permanent renal replacement therapy; dementia defined as any condition characterized by an acquired, persistent alteration of cognitive skills impairing daily activities.

### Statistical analysis

We used proportions, median and interquartile ranges, means and standard deviations as descriptive statistics. 95% test-based confidence intervals were computed for each estimate of interest. Relative risks and their confidence intervals were calculated for unadjusted mortality rate comparisons. We performed bivariate analyses using the *t*-test for quantitative variables and the *z*-test and the  $\chi^2$  Test for qualitative variables. We considered an alpha value less than 0.01 for the rejection of the null hypothesis.

For benchmarking purposes, every year two multivariable logistic regression models are fit-

ted to predict hospital mortality on the cohorts of patients staying in the ICU less and more than 24 hours (the development procedure is reported in Online Supplementary Material 1). As summarized in Figure 1, we excluded from the prognostic models development dataset pediatric and cardiothoracic patients, and patients admitted for palliation, and those admitted to the ICU in months in which the proportion of patients with incomplete data exceeded 10%, so as to exclude months in which a selection bias could have occurred. All data describing patients' conditions on admission, including the five covariates object of this study (severe COPD, NYHA class IV, dementia, end-stage renal disease, cirrhosis with portal hypertension) were considered as potential covariates.

The area under the Receiver Operating Characteristic (ROC) curve was used to measure the discrimination of the model, while calibration was assessed with the GiViTI calibration test and belt for model development.<sup>12-15</sup> In brief, the calibration test indicates if there are overall statistically significant differences between observed and predicted (by the model) death rates. The calibration belt, instead, offers a visual representation of the calibration in a plot reporting predicted mortality on the x-axis and observed mortality on the y-axis.<sup>14</sup> When the calibration belt does not include the bisector (the line of perfect correspondence between observed and predicted deaths) a statistical significant deviation is present. This tool is crucial to test the model and assess the effectiveness of inclusion of interaction terms during the development phase.

The GiViTI calibration test and belt for model validation were also used to evaluate the uniformity of fit across subsets defined by the variables eventually included in the models. Interactions driven by clinical reasoning were tested to improve the fit in subgroups where the model proved to miscalibrate.<sup>13</sup> In this study we evaluated the calibration and discrimination of the models on the six predefined subsets, obtained by combining surgical status (elective surgery with planned ICU admission, elective surgery with unplanned ICU admission, emergency surgery) with the

presence of end-stage chronic conditions (yes/no variable) in elderly patients. For each patient we used the individual expected mortality provided by the appropriate model (e.g., the 2012 prognostic model for 2012 patients) to build the corresponding specific calibration belt and ROC curve for each surgical subset including patients from 2011 through 2015. This approach was adopted to assess whether the variables included in the general prognostic models (developed on the entire GiViTI cohort) maintained their predictive ability in the six subgroups.

All statistical analyses were performed with packages for R version 3.2.5.<sup>16</sup>

## Results

As illustrated in Figure 1, overall, 232,278 patients admitted to 163 Italian general ICUs in 2011, to 178 in 2012 and 2013, to 171 in 2014, and to 167 in 2015, participating to the MargheritaPROSAFE Project, fulfilled the criteria for inclusion in the prognostic models. Of these patients 44,551 (19.2%) were surgical, 75 years old or more, submitted to emergency (47.3%) or elective surgery (52.7%). In the latter group, admission to the ICU was planned in 77.5% of cases and unplanned in 22.5%. Overall 6507 (14.6%) bore at least one CED, with a higher rate in the emergency-surgery subset compared to the other two subsets ( $P < 0.001$ , Table I).

Almost all ICU admissions occurred on the same day after elective surgery with scheduled ICU admission (Table I). Among those with unplanned ICU admission, instead, the proportion of patients who underwent surgery on a day different from the day of ICU admission were 24.3% and 18.3% for patients with and without CEDs ( $P < 0.001$ ). For emergency surgery patients the proportions were 13.9% and 15.4% (Table I,  $P = 0.024$ ).

Among elective-surgery patients with planned ICU admission, abdominal interventions were the most performed, more frequently in those without CEDs (40.8% and 46.7% in patient with and without CEDs,  $P = 0.001$ ), followed by orthopaedic surgery that was preva-





TABLE I.—Main features of the three surgical subsets. Patients with and without advanced chronic diseases are compared. Absolute numbers are reported followed by percentages in brackets, unless differently specified.

Chronic End-stage Diseases	Elective surgery with planned admission (N.=18201)		Elective surgery with unplanned admission N.=(5298)		Emergency surgery N.=(21,052)	
	Yes (N.=2290 - 12.6%)	No (N.=15,911 - 87.4%)	Yes (N.=655 - 12.4%)	No (N.=4643 - 87.6%)	Yes (N.=3562 - 16.9%)	No (N.=17,490 - 83.1%)
Age – mean (SD)	81.5 (4.8)	80.7 (4.5)	82.3 (4.8)	81.2 (4.7)	82.6 (4.9)	82.2 (5.0)
Male	1407 (61.4)	9282 (58.3)	328 (50.1)	2318 (49.9)	1826 (51.3)	8913 (51.0)
Trauma	449 (19.6)	1161 (7.3)	196 (29.9)	697 (15.0)	511 (14.3)	2757 (15.8)
Surgery the same day of admission	2235 (97.6)	15625 (98.2)	496 (75.7)	3793 (81.7)	3067 (86.1)	14,797 (84.6)
Abdominal surgery	934 (40.8)	7430 (46.7)	201 (30.7)	1594 (34.3)	2325 (65.3)	10,699 (61.2)
Vascular surgery	198 (8.6)	1825 (11.5)	49 (7.5)	441 (9.5)	290 (8.1)	1969 (11.3)
Orthopedic surgery	659 (28.8)	2699 (17.0)	287 (43.8)	1450 (31.2)	487 (13.7)	1662 (9.5)
Nephro-urologic surgery	252 (11.0)	2081 (13.1)	64 (9.8)	559 (12.0)	94 (2.6)	592 (3.4)
Severe COPD	1007 (44.0)	0 (0)	214 (32.7)	0 (0)	1104 (31.0)	0 (0)
NYHA class 4	325 (14.2)	0 (0)	68 (10.4)	0 (0)	383 (10.8)	0 (0)
Dementia	706 (30.8)	0 (0)	302 (46.1)	0 (0)	1750 (49.1)	0 (0)
End-stage renal failure	171 (7.5)	0 (0)	42 (6.4)	0 (0)	289 (8.1)	0 (0)
Cirrhosis with portal hypertension	216 (9.4)	0 (0)	57 (8.7)	0 (0)	277 (7.8)	0 (0)
Moderate COPD	280 (12.2)	3835 (24.1)	92 (14.0)	875 (18.8)	463 (13.0)	3383 (19.3)
NYHA class 2 - 3	403 (17.6)	2495 (15.7)	101 (15.4)	547 (11.8)	569 (16.0)	2566 (14.7)
Any tumour without metastasis	526 (23.0)	4478 (28.1)	122 (18.6)	998 (21.5)	405 (11.4)	2356 (13.5)
Chronic arrhythmia	663 (29.0)	3946 (24.8)	188 (28.7)	1098 (23.6)	1076 (30.2)	5112 (29.2)
Diabetes type II (not requiring insulin)	175 (7.6)	2371 (14.9)	84 (12.8)	607 (13.1)	437 (12.3)	2218 (12.7)
Myocardial infarction	486 (21.2)	3425 (21.5)	81 (12.4)	659 (14.2)	570 (16.0)	2667 (15.2)

SD: standard deviation; COPD: chronic obstructive pulmonary disease; NYHA: New York Heart Association Classification.

intensive treatment on admission to the ICU was comparable between patients with and without CEDs in the emergency-surgery subset (61.3% vs. 60.0%,  $P=0.15$ ), while it was prevalent among patients bearing advanced chronic comorbidities in the elective-surgery patients with unplanned (51.1% vs. 40.9%,  $P<0.001$ ) and planned (17.9% vs. 12.8%,  $P<0.001$ ) ICU admission.

ICU and post-ICU discharge mortality were lower for elective-surgery patients with planned ICU admission, and progressively increased in patients with unplanned admission and in those submitted to emergency surgery. Within each subset, the presence of CEDs significantly increased mortality (Table II).

#### Prognostic weight assessment of end-stage chronic diseases

The ten models (patients' length of stay  $\geq 24$  and  $<24$  hours for every year of the study period) were robust with good discriminative

ability and calibration (Online Supplementary Material 1).

The severe COPD, NYHA class IV, and cirrhosis were independent predictors of death in the five models developed for patients staying in the ICU at least 24 hours (Figure 2). Dementia was instead an independent predictor of hospital death in four of the five models that covered the study period (Figure 2).

End-stage renal disease never ended up to be an independent prognostic factor during the study period, whereas age was always so.

While the models discriminated well in all the surgical subsets, they calibrated well only in five of the six subsets defined by the combination of each of the three surgical groups with or without CEDs (Online Supplementary Material 2). In the emergency-surgery with CEDs subset the model miscalibrated in the first decile, specifically for patients with an expected hospital mortality predicted by the model in the range between 2% and 11% (GiViTI calibration test  $P=0.027$ ).

TABLE II.—*Severity on admission to the ICU and outcome measures in the three subsets object of the study. Patients with and without advanced chronic conditions are compared. Absolute numbers are reported followed by percentages in brackets, for continuous variables the use of medians and interquartile ranges is specified. Expected hospital mortalities are based on the GiViTi prognostic models predictions. Hospital and post-ICU discharge rates are calculated accounting for missing values and after post-ICU exclusion criteria application.*

	Elective surgery with planned admission (N.=18,201)		Elective surgery with unplanned admission (N.=5298)		Emergency surgery (N.=21,052)	
	Yes (N.=2290 - 12.6%)	No (N.=15,911 - 87.4%)	Yes (N.=655 - 12.4%)	No (N.=4643 - 87.6%)	Yes (N.=3562 - 16.9%)	No (N.=17,490 - 83.1%)
Chronic end-stage diseases						
Admission for intensive treatment	411 (17.9)	2030 (12.8)	335 (51.1)	1900 (40.9)	2184 (61.3)	10,500 (60.0)
Acute organ failures on admission	1041 (45.5)	5353 (33.6)	445 (67.9)	2648 (57.0)	2824 (79.3)	13,251 (75.8)
Acute respiratory failure	368 (16.1)	1700 (10.7)	289 (44.1)	1546 (33.3)	2033 (57.1)	9626 (55)
Acute cardiovascular failure	155 (6.8)	726 (4.6)	189 (28.9)	1083 (23.3)	1342 (37.7)	6307 (36.1)
Acute renal failure	775 (33.8)	3798 (23.9)	276 (42.1)	1447 (31.2)	2013 (56.5)	8413 (48.1)
SAPS II - median (IQR)	28 (24-35)	25 (22-32)	33 (25-43)	28 (22-38)	46 (37-59)	43 (35-55)
SOFA - median (IQR)	3 (2-5)	2 (1-4)	4 (3-7)	3 (2-6)	6 (3-9)	5 (3-8)
Complications during the stay	301 (13.6)	1562 (9.2)	145 (22.1)	832 (17.9)	1085 (30.5)	5520 (31.6)
New failures during the stay	127 (5.5)	636 (4)	71 (10.8)	344 (7.4)	516 (14.5)	2489 (14.2)
ICU LOS: survivors - median (IQR)	1 (1-2)	1 (1-2)	1 (1-3)	1 (1-2)	2 (1-4)	2 (1-5)
ICU LOS: non-survivors - median (IQR)	4.5 (1-10.8)	6 (2-14)	3 (1-9)	2 (1-7)	2 (1-7)	3 (1-9)
H LOS: survivors - median (IQR)	16 (10-25)	15 (10-23)	16 (46631)	15 (9-24)	16 (10-25)	17 (11-29)
H LOS: non-survivors - median (IQR)	20 (11-33.2)	22 (12-38)	15 (8-26)	14 (6-28.5)	10 (4-21)	11 (4-23)
Mortality ICU	98 (4.3)	314 (2.0)	107 (16.3)	430 (9.3)	940 (26.4)	3670 (21.0)
Expected H mortality	329.8 (14.4)	1284.3 (8.1)	179.5 (27.4)	749.1 (16.2)	1549.5 (43.5)	5876.6 (33.1)
Observed H mortality	336 (14.7)	1299 (8.2)	186 (28.5)	777 (16.8)	1584 (44.6)	5939 (34.1)
Missing H mortality	11	55	3	19	12	81
RR (95% CI) ICU: CEDs yes vs. no	2.15 (1.88-2.46)		1.75 (1.39-2.21)		1.26 (1.16-1.36)	
RR (95% CI) hospital: CEDs yes vs. no	1.79 (1.6-2.0)		1.70 (1.48-2.21)		1.30 (1.24-1.36)	

RR: relative risk; 95 CI: 95% confidence interval; LOS: length of stay; H: hospital; ICU: intensive care unit; 95% CI: 95% confidence interval; IQR: interquartile range.

To achieve good calibration the 2014 and 2015 models included interactions between some of the end-stage comorbidities and other variables (Online Supplementary Material 1).

In the mortality models dedicated to patients with short length of ICU stay (<24 hours), instead, CEDs only occasionally turned out to be significant. Severe COPD was never included in the models. NYHA class IV was an independent mortality predictor in 2013, dementia in 2014, cirrhosis in 2014 and 2015, end-stage renal diseases entered the model with a protective effect in 2012 (Online Supplementary Material 1).

In all prognostic models, age always turned out to be an independent predictor of hospital mortality.

## Discussion

As life expectancy increases, the probability of developing diseases that require surgical procedures also grows.<sup>19</sup> Our study confirms this result with 19.1% of all the patients that matched the criteria for inclusion in the prognostic model development cohort, having 75 years or more and being admitted to the ICU after surgery. The burden of comorbidities progressed to advanced stages was high in our sample (about one in seven patients bore at least one CED) consistently with literature findings.<sup>20</sup> Severe COPD was common, the prevalent end-stage comorbidity in patients undergoing elective surgery when ICU ad-

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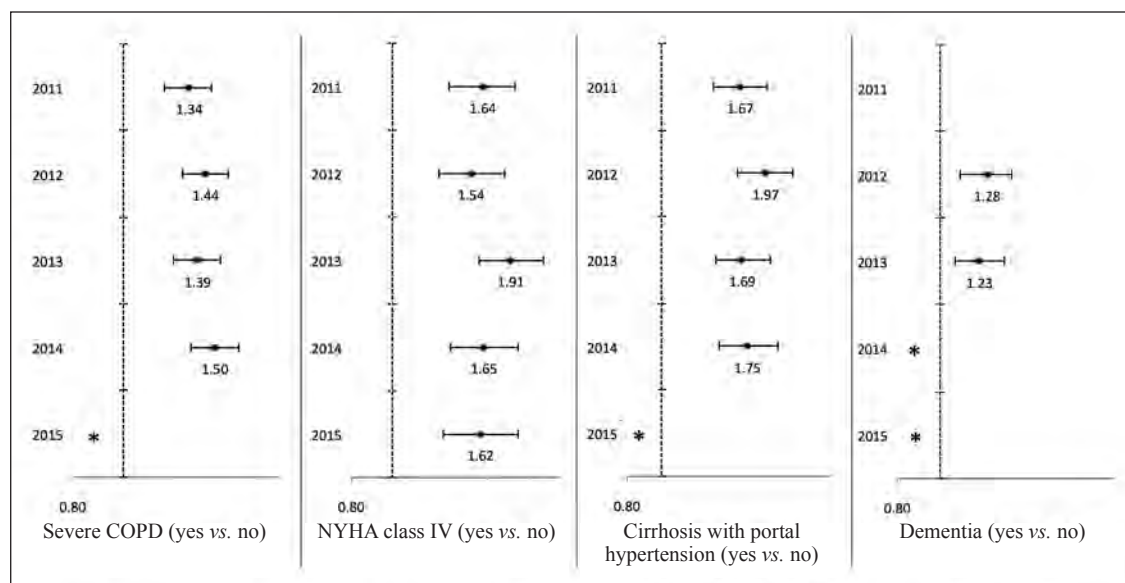


Figure 2.—Chronic end-stage diseases entering the GiViTI prognostic models for patients with an ICU stay of 24 hours or more, from 2011 through 2015. End-stage chronic renal disease is not reported since it never entered the models. COPD: chronic obstructive pulmonary disease; NYHA: New York Heart Association; OR: odds ratios; 95%-CI: 95% confidence interval; NS: statistically non-significant.

\*Interactions between chronic end-stage diseases and other variables were found. In these cases we did not report ORs. Interactions can be viewed in detail in Online Supplementary Material 1.

mission was planned. This finding is consistent with the strong rationale for postoperative ventilation of patients with severe COPD, that may induce anaesthesiologists to schedule postoperative stays in the ICU.<sup>21</sup>

Among patients with CEDs with unplanned admission to the ICU after elective surgery or admitted after emergency surgery almost half were affected by dementia. Although we could not find in the literature data comparable with ours, it has been demonstrated an independent association between dementia and postoperative complications on a very large cohort of surgical patients 60 years old or older.<sup>22</sup> Although this result was not confirmed in a study investigating the role of dementia in postoperative complications after hip fracture surgery, a significant higher rate of ICU admissions was reported.<sup>23</sup> Our findings suggest that dementia may be a facilitator for medical or surgical critical events after elective and emergency surgery leading to postoperative ICU admissions.

Interestingly, in our sample among patients with CEDs and unplanned admission after

elective surgery, orthopedic interventions were the most frequent (43.8%). This result is consistent with the high prevalence of dementia in this group, since this condition strikingly increases the risk of hip fracture especially in the elderly.<sup>24</sup>

In this subset about one-quarter of ICU admissions occurred in the seven days after the day of surgery, while about 20% of such delayed admissions occurred among those without CEDs. This pattern was more pronounced than in the emergency-surgery subset. This finding suggests that, especially among patients with unplanned admissions after elective surgery, in many cases postoperative medical complications could have been the cause of clinical deterioration. We can also suppose that CEDs may have had a facilitating influence on medical complications.

The presence of CEDs was associated with increased mortality in the ICU and in the hospital after ICU discharge. According to the crude mortality relative risks their influence appeared larger in elective-surgery patients with planned and unplanned admissions (RR

1.79 and 1.70), than in the emergency surgery subset (RR 1.30). In this high risk-of-death subgroup, absolute mortality rates in patients with CED peaked at 44.6%.

However, the adjusted prognostic weight of CEDs was explored with our prognostic models after adjusting for tenths of important confounders. These models are based on the overall population of critically ill patients admitted to the ICUs that participate to the MargheritaPROSAFE project. We applied the results of these general models to the study subsets defined by the combination of age  $\geq 75$ , surgical status (elective surgery with planned or unplanned ICU admission, and emergency surgery), and the presence or not of end-stage comorbidities. This is an appropriate procedure when goodness of fit is proven in the study subsets. Actually, the GiViTI assesses the calibration of the model in all subgroups defined by each variable included in the model using the calibration belt.<sup>15</sup> When miscalibration is found clinically meaningful interactions are explored and tested until the model calibrates well in each subgroup. Our models calibrated well in five of the six study subsets, in which the results of our general model could be applied reliably. The models slightly underpredicted in the first decile of the emergency-surgery with CEDs subset. This is, however, a statistical finding with limited predictive implications. Actually, the deviation from the bisector was quantitatively small and concerned only patients with expected mortality between 2% and 11%.

The GiViTI strategy is to develop every year two models according to the duration of the ICU stay, less or more than 24 hours. The rationale for this choice is that patients with short stays are either very seriously ill (those who die) or in fair conditions (those discharged alive early after their arrival), thus prognosis is likely to be determined by different variables, or by same variables but with different weights, compared to those staying longer in the ICU. For example, CEDs variables, which were stably included in the  $\geq 24$ -hour ICU-stay models, inconstantly entered

the short-stay models. This is not surprising since patients who die shortly after the admission to the ICU usually bear very severe physiologic derangements (e.g. shock, severe acute hypoxia, severe acidosis, severe acute renal failure) that carry the main prognostic weight. In these patients, chronic conditions are less likely to be determinant in the outcome. Instead, in patients who survive the early acute phase (that we arbitrarily indicate as those surviving at least 24 hours) CEDs play a major prognostic role.

Severe COPD, NYHA class IV, and cirrhosis constantly entered the  $\geq 24$ -hours ICU-stay annual models in the five-year study period, while dementia turned out to be an important predictor in four out of five years. Chronic end-stage renal disease never turned out to be a predictor in the five years under scrutiny.

Our results were consistent with data from the literature concerning COPD, chronic heart failure, cirrhosis, and dementia,<sup>25-28</sup> but conflicted with evidence concerning end-stage renal disease.<sup>29, 30</sup> However, our models included more prognostically important variables and should be thus more reliable for explanatory purposes than the cited studies.<sup>31</sup> Actually, when a model does not include most causal variables it may include some confounders that have a predictive but not a causal relation with the outcome. A model that instead includes most causal factors has a higher probability of accounting adequately for confounding.

A substantial strength of our study is that prognostic models were developed annually, assessing the constancy of predictors' effect over time. Actually, we have developed ten models over five years that are consistent in indicating the prognostic role of CEDs. In the short ICU-stay models CEDs were not prognostically relevant, while in the long ICU-stay models four CEDs were consistently present with quantitative prognostic weights that did not change significantly over the study period (Figure 2). NYHA class IV and cirrhosis with portal hypertension were the strongest predictors of death (adjusted odds ratios ranges were 1.54-1.91 and 1.67-2.29, respectively), while



severe COPD and dementia had lower odds ratios. No interaction between age and any of the CEDs variables was tested since the model calibrated well in the subsets defined by the CEDs variables. Thus, we could exclude any synergic relation between age and the severe chronic comorbidities that entered the model. This means that elderly surgical patients have an increased risk related to their age but only an additional, and not a multiplicative, risk when end-stage chronic comorbidities are associated.

Chronic end-stage renal disease, instead, did not enter these models. This seems to contrast with reports from the literature indicating that dialyzed patients are frequently frail, with average rates around 70% that increase to almost 80% in the elderly.<sup>32, 33</sup> However, a part of these patients are well compensated, and the negative prognostic weight bore by the most severe conditions is thus diluted. Moreover, and most important, the higher risk of death these patients have is not entirely ascribable to advanced nephropathy itself. Other clinical conditions frequently associated with chronic end-stage renal disease, such as heart failure or diabetes,<sup>34, 35</sup> may explain part of the mortality burden. We thus hypothesize that chronic end-stage renal disease may have a confounding effect, which is accounted for by our prognostic models.

### Limitations of the study

The main limit of our study is that we did not know how many patients were submitted to surgery without accessing the ICU that would have provided a more informative denominator. Second, we think that a 6-month follow-up for functional status assessment would have provided a clearer picture of the true outcome of geriatric patients with advanced comorbidities, which may be misjudged by hospital mortality alone. Third, the study was retrospective and the definitions we used were created for our general database, and may not fit perfectly the categories of patients object of our investigation.

### Key messages

- ICUs frequently admit elderly patients submitted to surgical procedures.
- A relevant percentage of these patients bears chronic endstage diseases and has high in-hospital mortality rates.
- Dementia, chronic hepatic, cardiac, and respiratory endstage diseases are strong independent predictors of death in the ICU.

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## SUPPLEMENTARY MATERIALS

APPENDIX 1.—Prognostic models development Categorical variables were crossed with hospital mortality, and excluded if leading to poorly represented cells. The linearity of the logit in the continuous variables was graphically assessed. Variables whose plot evidently deviated from the straight line were either log-transformed and re-assessed for linearity, or categorized. A stepwise selection using likelihood ratio test was used to select covariates. The final models calibration was

assessed with the GiViTI calibration belt and test.<sup>13, 14</sup> The same methods were used to assess the calibration in subgroups defined by the final covariates, to guarantee the uniformity of fit of the model. The area under the Receiver Operating Characteristic (ROC) curve was calculated to assess the discrimination of the model. Uniformity of fit was tested for all the subsets defined by each variable that entered the model with the calibration belt and test.



**National report for general ICUs - Year 2011**  
**Prognostic models - Adult patients with LOS>=to 24 hours**

**Model:** Logistic regression.  
**Dependent variable:** Hospital mortality.  
**Sample used for model development:** Patients with LOS>=24 hours from general Italian ICUs.  
**Sample size:** 30615 patients.

Independent variables	Coefficients (95% CI)	Odds Ratio (95% CI)	p
Intercept	-14.75 (-15.42;-14.08)	/	/
<b>Miscellanea</b>			
Age	0.01 (0.00;0.01)	1.01 (1.00;1.01)	<0.0001
Body mass Index (BMI) (Underweight vs. Normal)	0.29 (0.15;0.42)	1.33 (1.16;1.53)	
Body mass Index (BMI) (Overweight vs. Normal)	-0.14 (-0.21;-0.07)	0.87 (0.81;0.94)	<0.0001
Body mass Index (BMI) (Obese vs. Normal)	-0.22 (-0.30;-0.13)	0.81 (0.74;0.88)	
Surgical status (Non surgical vs. Elective surgical)	0.55 (0.38;0.73)	/	×
Surgical status (Emergency surgical vs. Elective surgical)	0.60 (0.46;0.73)	/	×
Coming from operating theatre (Yes vs. No)	-0.24 (-0.38;-0.11)	0.78 (0.69;0.89)	0.0003
Admitted from other ICU for treatment continuity (Yes vs. No)	-0.26 (-0.43;-0.10)	0.77 (0.65;0.90)	0.0012
Stay before ICU (days) (logarithm)	0.29 (0.25;0.33)	1.34 (1.28;1.40)	<0.0001
Admitted in hospital the same day of ICU admission (Yes vs. No)	0.15 (0.05;0.25)	1.16 (1.05;1.28)	0.0025
<b>Comorbidities</b>			
Severe COPD (Yes vs. No)	0.29 (0.19;0.39)	1.34 (1.20;1.48)	<0.0001
Diabetes with insuline treatment (Yes vs. No)	0.23 (0.12;0.33)	1.25 (1.13;1.39)	<0.0001
Moderate or severe liver disease (Yes vs. No)	0.51 (0.34;0.68)	1.67 (1.40;1.98)	<0.0001
Autoimmune disease (Yes vs. No)	0.32 (0.16;0.49)	1.38 (1.17;1.63)	0.0002
Malignant haematological disease (Yes vs. No)	0.70 (0.51;0.88)	2.01 (1.67;2.41)	<0.0001
Restrictive lung disease (Yes vs. No)	0.32 (0.13;0.51)	1.38 (1.14;1.66)	0.0009
NYHA class II-III (Yes vs. None)	0.13 (0.04;0.22)	1.14 (1.05;1.25)	
NYHA class IV (Yes vs. None)	0.49 (0.31;0.68)	1.64 (1.36;1.96)	<0.0001
Metastatic cancer (Yes vs. No)	0.75 (0.61;0.89)	2.11 (1.84;2.42)	<0.0001
<b>Clinical conditions on admission</b>			
ARDS (Yes vs. No)	0.53 (0.35;0.70)	1.70 (1.42;2.02)	<0.0001
Ascites (Yes vs. No)	0.67 (0.32;1.03)	1.96 (1.37;2.80)	0.0002
Systemic hypertensive crisis (Yes vs. No)	-0.62 (-0.95;-0.29)	0.54 (0.39;0.75)	0.0002
Seizures (Yes vs. No)	-0.44 (-0.65;-0.23)	0.64 (0.52;0.79)	<0.0001
Spontaneous Subarachnoid haemorrhage (Yes vs. No)	0.48 (0.26;0.71)	1.62 (1.30;2.03)	<0.0001
Cerebral artery stroke (Yes vs. No)	0.30 (0.12;0.48)	1.35 (1.13;1.62)	0.0016
Bowel ischaemia (Yes vs. No)	0.41 (0.16;0.65)	1.50 (1.18;1.91)	0.0011
Acute intoxication (Yes vs. No)	-1.37 (-1.78;-0.95)	0.26 (0.17;0.39)	<0.0001
Pulmonary hypertension (Yes vs. No)	0.52 (0.23;0.82)	1.68 (1.25;2.26)	0.0006
Restrictive lung disease, exacerbation (Yes vs. No)	0.49 (0.20;0.77)	1.63 (1.23;2.16)	0.0008
Left heart failure with pulmonary edema (Yes vs. No)	-0.44 (-0.58;-0.30)	0.64 (0.56;0.74)	<0.0001
Spontaneous intracerebral bleeding (Yes vs. No)	0.53 (0.30;0.76)	/	×
Traumatic diffuse brain injury with oedema (Yes vs. No)	0.94 (0.40;1.48)	2.56 (1.50;4.38)	0.0008
Traumatic brain injury (Yes vs. No)	-0.13 (-0.36;0.09)	/	×
Multiple trauma (Yes vs. No)	-0.48 (-0.69;-0.28)	0.62 (0.50;0.76)	<0.0001
NON-surgical urinary tract infection or Post-surgical urinary tract infection (Yes vs. No)	-0.26 (-0.45;-0.06)	0.77 (0.64;0.94)	0.0084
Primary peritonitis (Yes vs. None)	0.62 (0.30;0.94)	1.86 (1.35;2.57)	
NON-surgical secondary peritonitis or Tertiary peritonitis (Yes vs. None)	0.32 (0.12;0.53)	1.38 (1.13;1.70)	<0.0001
Infection severity on admission (Infection vs. nessoninfazione)	1.85 (0.82;2.88)	/	×
Infection severity on admission (SEVERE SEPSIS vs. No infection)	2.55 (1.45;3.66)	/	×
Infection severity on admission (SEPTIC SHOCK vs. No infection)	2.58 (1.45;3.71)	/	×
<b>Organ failures</b>			
Physiopathological index <sup>Δ</sup> (logarithm)	3.27 (3.07;3.48)	/	×
GCS (3,4 vs. 15)	0.07 (-0.11;0.25)	/	×
GCS (Not evaluable in the first 24 hours in neurological patient* vs. 15)	-0.25 (-0.59;0.09)	/	×
GCS (Not evaluable in the first 24 hours in NON-neurological patient* vs. 15)	0.09 (-0.09;0.26)	/	×
GCS (Worsened during first 24 hours vs. Not worsened)	0.60 (0.43;0.77)	1.82 (1.54;2.16)	
GCS (Worsening not evaluable in neurological patient* vs. Not worsened)	0.32 (-0.03;0.66)	1.37 (0.97;1.93)	<0.0001
GCS (Worsening not evaluable in NON-neurological patient* vs. Not worsened)	0.08 (-0.14;0.30)	1.09 (0.87;1.35)	
Metabolic failure (Yes vs. No)	0.29 (0.21;0.37)	1.33 (1.23;1.44)	<0.0001
Neurologic failure (Cerebral coma vs. None)	0.17 (0.00;0.34)	1.19 (1.00;1.41)	
Neurologic failure (Metabolic coma vs. None)	-0.64 (-0.88;-0.40)	0.53 (0.41;0.67)	
Neurologic failure (Postanoxic coma vs. None)	-0.06 (-0.27;0.14)	0.94 (0.76;1.15)	<0.0001
Neurologic failure (Toxic coma vs. None)	-1.22 (-2.11;-0.34)	0.29 (0.12;0.71)	
Neurologic failure (Not evaluable in the first 24 hours vs. None)	-0.10 (-0.26;0.06)	0.90 (0.77;1.06)	
Respiratory failure (Only hypoxic failure or Hypoxic-hypercapnic failure vs. None)	0.29 (0.20;0.39)	1.34 (1.22;1.47)	
Respiratory failure (Only hypercapnic failure vs. None)	0.12 (-0.02;0.27)	1.13 (0.98;1.31)	<0.0001
Respiratory failure (Intubation for airway maint. vs. None)	0.34 (0.24;0.44)	1.40 (1.28;1.55)	
Cardiovascular failure (Without shock vs. None)	0.17 (0.05;0.28)	1.18 (1.05;1.33)	
Cardiovascular failure (Cardiogenic shock vs. None)	0.30 (0.18;0.42)	1.35 (1.20;1.53)	
Cardiovascular failure (Neurogenic shock vs. None)	0.94 (0.61;1.27)	2.56 (1.84;3.56)	<0.0001
Cardiovascular failure (Other shock vs. None)	0.08 (-0.04;0.20)	1.08 (0.96;1.22)	
Cardiovascular failure (Mixed shock vs. None)	0.36 (0.12;0.60)	1.44 (1.13;1.83)	

(to be continued)

° For patients transferred to other ICU or to rehabilitation/high dependency care unit in other hospital, it is considered the outcome at the last hospital discharge.

× See interaction significance.

Δ See below.

\* A neurological patient is a one with an altered consciousness, probably due to a direct brain injury. It is defined by the presence of at least one of these clinical conditions on admission: Cerebral artery stroke, Vertebral basilar ischemic stroke, Intracranial hypertension, Spontaneous Hydrocephalus, Non traumatic cerebral oedema, Metabolic/postanoxic encephalopathy, Seizures, Brain tumour, Cerebral Aneurysm, AVM (ArterioVenous Malformation), Chronic Subdural haematoma, Spontaneous Subarachnoid haemorrhage, Spontaneous Intracerebral haemorrhage, Spontaneous Intracerebral haemorrhage, CNS degenerative disease, Brain and skull malformations, Cerebral contusion/laceration, Traumatic diffuse injury without oedema, Traumatic diffuse injury with oedema, Extradural/epidural haematoma, Traumatic Subdural haematoma, Traumatic Intracerebral haemorrhage, Traumatic subarachnoid haemorrhage, Skull fracture, NON-surgical CNS infection, Post-surgical CNS infection, Ventriculostomy-related CNS infection.

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**National report for general ICUs - Year 2011**  
**Prognostic models - Adult patients with LOS<24 hours**

**Model:** Logistic regression.  
**Dependent variable:** Hospital mortality.  
**Sample used for model development:** Patients with LOS<24 hours from general Italian ICUs.  
**Sample size:** 11424 patients.

Independent variables	Coefficients (95% CI)	Odds Ratio (95% CI)	p
Intercept	-7.40 (-7.93;-6.87)	/	/
<b>Miscellanea</b>			
Age	0.04 (0.03;0.04)	1.04 (1.03;1.04)	<0.0001
Body mass Index (BMI) (Underweight vs. Normal)	0.39 (0.07;0.71)	1.47 (1.07;2.03)	<0.0001
Body mass Index (BMI) (Overweight or Obese vs. Normal)	-0.29 (-0.46;-0.12)	0.75 (0.63;0.89)	<0.0001
Surgical status (Non surgical vs. Elective surgical)	0.68 (0.33;1.04)	/	x
Surgical status (Emergency surgical vs. Elective surgical)	0.67 (0.41;0.93)	/	x
Ward of admission (Medical ward vs. Surgical ward)	0.64 (0.32;0.97)	1.91 (1.38;2.63)	
Ward of admission (Emergency room vs. Surgical ward)	0.51 (0.18;0.84)	1.67 (1.20;2.33)	0.0006
Ward of admission (Other ICU vs. Surgical ward)	0.66 (0.10;1.22)	1.94 (1.11;3.39)	
Ward of admission (High dependency care unit vs. Surgical ward)	1.07 (0.31;1.84)	2.92 (1.36;6.28)	
Stay before ICU (days) (logarithm)	0.44 (0.33;0.54)	1.55 (1.40;1.72)	<0.0001
Admitted in hospital the same day of ICU admission (Yes vs. No)	0.45 (0.17;0.74)	1.57 (1.18;2.09)	0.0019268
<b>Comorbidities</b>			
Peripheral vascular disease (Yes vs. No)	0.34 (0.09;0.58)	1.40 (1.10;1.79)	0.0080
Any tumour without metastasis (Yes vs. None)	0.42 (0.18;0.66)	1.52 (1.20;1.94)	<0.0001
Metastatic cancer (Yes vs. None)	1.07 (0.80;1.35)	2.92 (2.22;3.85)	
<b>Clinical conditions on admission</b>			
Acute intoxication (Yes vs. No)	-2.20 (-3.41;-1.00)	0.11 (0.03;0.37)	<0.0001
Spontaneous intracerebral bleeding (Yes vs. No)	0.64 (0.19;1.09)	1.90 (1.20;2.99)	0.0062
Left heart failure with pulmonary edema (Yes vs. No)	-0.77 (-1.21;-0.33)	0.46 (0.30;0.72)	0.0006
<b>Organ failures</b>			
GCS (3,4 vs. 13,14,15)	2.99 (2.58;3.40)	19.84 (13.19;29.85)	
GCS (5 vs. 13,14,15)	1.49 (0.66;2.32)	4.43 (1.93;10.13)	
GCS (6 vs. 13,14,15)	1.20 (0.52;1.88)	3.32 (1.68;6.58)	
GCS (7,8 vs. 13,14,15)	0.83 (0.35;1.30)	2.28 (1.42;3.66)	<0.0001
GCS (9,10,11,12 vs. 13,14,15)	0.53 (0.24;0.83)	1.71 (1.27;2.28)	
GCS (Not evaluable in the first 24 hours in neurological patient* vs. 13,14,15)	0.29 (-0.34;0.93)	1.34 (0.71;2.54)	
GCS (Not evaluable in the first 24 hours in NON-neurological patient* vs. 13,14,15)	0.37 (-0.12;0.85)	1.44 (0.89;2.34)	
Bilirubin (mg/100ml) (4-11.9 vs. <4)	0.75 (0.22;1.28)	2.12 (1.24;3.61)	0.0216
Bilirubin (mg/100ml) (>=12 vs. <4)	0.43 (-0.72;1.59)	1.54 (0.49;4.89)	
Heart rate (bpm) (<40 vs. 40-120)	0.78 (0.39;1.16)	2.17 (1.48;3.19)	0.0003
Heart rate (bpm) (>=120 vs. 40-120)	0.21 (-0.05;0.46)	1.23 (0.95;1.58)	
HCO3 (mEq/L) (<15 vs. >=15)	0.51 (0.18;0.83)	1.66 (1.20;2.30)	0.0023
Platelets (10 <sup>9</sup> /mm3) (99-50 vs. >=100)	0.43 (0.09;0.77)	1.54 (1.10;2.16)	
Platelets (10 <sup>9</sup> /mm3) (49-20 vs. >=100)	0.69 (0.15;1.24)	2.00 (1.16;3.44)	0.0058
Platelets (10 <sup>9</sup> /mm3) (<20 vs. >=100)	0.67 (-0.31;1.66)	1.96 (0.73;5.25)	
Systolic Blood Pressure (mmHg) (<70 vs. >=100)	1.34 (1.03;1.66)	3.83 (2.80;5.25)	
Systolic Blood Pressure (mmHg) (70-99 vs. >=100)	0.54 (0.34;0.74)	1.72 (1.40;2.11)	<0.0001
Urine Output (L/24h) (<0.2 vs. >=1)	1.54 (1.23;1.86)	4.68 (3.41;6.41)	
Urine Output (L/24h) (0.2-0.49 vs. >=1)	1.41 (1.07;1.75)	4.10 (2.93;5.74)	<0.0001
Urine Output (L/24h) (0.5-0.99 vs. >=1)	0.52 (0.30;0.74)	1.68 (1.35;2.09)	
PaO2/FiO2 (100*mmHg/%) (100-199 vs. >=200)	0.44 (0.20;0.68)	1.55 (1.23;1.97)	
PaO2/FiO2 (100*mmHg/%) (<100 vs. >=200)	0.94 (0.51;1.36)	2.56 (1.67;3.91)	<0.0001
Cardiovascular failure (Without shock vs. None)	0.71 (0.27;1.15)	2.03 (1.31;3.15)	
Cardiovascular failure (Cardiogenic shock vs. None)	1.20 (0.81;1.60)	3.34 (2.24;4.96)	
Cardiovascular failure (Septic shock vs. None)	1.11 (0.59;1.62)	3.03 (1.81;5.08)	
Cardiovascular failure (Haemorrhagic/hypovolemic shock vs. None)	1.17 (0.74;1.60)	3.21 (2.09;4.94)	
Cardiovascular failure (Hypovolemic shock vs. None)	0.45 (-0.23;1.13)	1.57 (0.79;3.11)	<0.0001
Cardiovascular failure (Neurogenic shock vs. None)	2.22 (1.13;3.31)	9.18 (3.09;27.29)	
Cardiovascular failure (Other shock vs. None)	1.62 (0.75;2.49)	5.06 (2.12;12.09)	
Cardiovascular failure (Mixed shock vs. None)	1.87 (0.87;2.87)	6.49 (2.38;17.67)	
Respiratory failure (Only hypoxic failure vs. None)	0.49 (0.17;0.80)	1.63 (1.19;2.23)	
Respiratory failure (Only hypercapnic failure vs. None)	-0.04 (-0.58;0.50)	0.96 (0.56;1.65)	0.0014
Respiratory failure (Hypoxic-hypercapnic failure vs. None)	0.75 (0.32;1.19)	2.12 (1.37;3.28)	
Respiratory failure (Intubation for airway maint. vs. None)	0.31 (0.05;0.57)	1.36 (1.05;1.78)	
Metabolic failure (Yes vs. No)	0.50 (0.26;0.74)	1.65 (1.30;2.10)	<0.0001
<b>Surgical and non surgical procedures</b>			
Gastrointestinal surgery (Yes vs. No)	0.36 (0.12;0.60)	1.43 (1.13;1.82)	0.0036
Neurosurgery (Yes vs. No)	0.71 (0.32;1.10)	2.04 (1.38;3.02)	0.0006
Interventional cardiology (Yes vs. No)	-1.26 (-1.84;-0.67)	0.29 (0.16;0.51)	<0.0001
<b>Interactions among independent variables</b>			
Surgical status (Non surgical) x GCS Not evaluable in the first 24 hours	1.31 (0.72;1.91)	/	<0.0001
Surgical status (Emergency surgical) x GCS Not evaluable in the first 24 hours	0.78 (0.15;1.41)	/	
<b>Dependent variable explained</b>		<b>Goodness-of-fit</b>	
Likelihood ratio test:	7586	Area under the ROC curve:	0.95
Degree of freedom:	58	GIVITI Calibration Test:	4.08e-13
p-value:	<0.0001	p-value:	1

\* For patients transferred to other ICU or to rehabilitation/high dependency care unit in other hospital, it is considered the outcome at the last hospital discharge.

x See interaction significance.

\* A neurological patient is a one with an altered consciousness, probably due to a direct brain injury. It is defined by the presence of at least one of these clinical conditions on admission: Cerebral artery stroke, Vertebral basilar ischemic stroke, Intracranial hypertension, Spontaneous Hydrocephalus, Non traumatic cerebral oedema, Metabolic/postanoxic encephalopathy, Seizures, Brain tumour, Cerebral Aneurysm, AVM (ArterioVenous Malformation), Chronic Subdural haematoma, Spontaneous Subarachnoid haemorrhage, Spontaneous Intraparenchymal bleeding, CNS degenerative disease, Brain and skull malformations, Cerebral contusion/laceration, Traumatic diffuse injury without oedema, Traumatic diffuse injury with oedema, Extradural/epidural haematoma, Traumatic Subdural haematoma, Traumatic Intraparenchymal bleeding, Traumatic subarachnoid haemorrhage, Skull fracture, NON-surgical CNS infection, Post-surgical CNS infection, Ventriculostomy-related CNS infection.

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**National report for general ICUs - Year 2012**  
**Prognostic models - Adult patients with LOS<sub>≥</sub>24 hours**

**Model:** Logistic regression.  
**Dependent variable:** Hospital mortality<sup>o</sup>.  
**Sample used for model development:** Patients with LOS<sub>≥</sub>24 hours from general Italian ICUs.  
**Sample size:** 34225 patients.

Independent variables	Coefficients (95% CI)	Odds Ratio (95% CI)	p
Intercept	-7.11 (-7.6; -6.63)	/	/
<b>Miscellanea</b>			
Age <=37	1.49 (1.25;1.73)	/	
Age in decades (continuous, 38-79)	0.40 (0.34;0.47)	/	<0.001
Age in decades (continuous, >80)	0.43 (0.37;0.49)	/	
Body mass Index (BMI) (Underweight vs. Normal)	0.38 (0.25;0.52)	1.47 (1.29;1.67)	
Body mass Index (BMI) (Overweight or Obese vs. Normal)	-0.16 (-0.22;-0.09)	0.86 (0.8;0.91)	<0.001
Surgical status (Non surgical vs. Elective surgical)	0.86 (0.73;1)	/	×
Surgical status (Emergency surgical vs. Elective surgical)	0.56 (0.43;0.7)	/	
Stay before ICU (days) (logarithm)	0.26 (0.22;0.3)	1.3 (1.25;1.36)	<0.001
Admitted in hospital the same day of ICU admission (Yes vs. No)	0.19 (0.09;0.29)	1.21 (1.1;1.34)	<0.001
Reason for admission (Intensive Treatment vs. Monitoring/Wearing)	0.8 (0.32;1.28)	/	×
Ward of admission: Medical ward	0.2 (0.12;0.28)	1.22 (1.13;1.33)	<0.001
<b>Physiopatological components</b>			
Bilirubin (mg/100ml) (4-11.9 vs. <4)	0.45 (0.27;0.64)	1.57 (1.31;1.89)	<0.001
Bilirubin (mg/100ml) (>=12 vs. <4)	1.13 (0.71;1.54)	3.09 (2.04;4.67)	
Sodium (mEq/L) (>=145 vs. <145)	0.19 (0.11;0.28)	1.21 (1.11;1.32)	<0.001
Platelets (10 <sup>3</sup> /mm3) (50-99 vs. >100)	0.32 (0.22;0.43)	1.38 (1.25;1.53)	<0.001
Platelets (10 <sup>3</sup> /mm3) (<50 vs. >100)	0.72 (0.57;0.86)	2.05 (1.77;2.37)	
MAP (mmHg) (<70 vs. >70)	0.4 (0.31;0.48)	/	×
Urine Output (L/24h) (<0.2 vs. >1)	0.8 (0.65;0.94)	2.21 (1.91;2.56)	
Urine Output (L/24h) (0.2-0.49 vs. >1)	0.47 (0.32;0.61)	1.59 (1.38;1.84)	<0.001
Urine Output (L/24h) (0.5-0.99 vs. >1)	0.3 (0.21;0.39)	1.35 (1.23;1.48)	
WBC (10 <sup>9</sup> /L) (<1 vs. 1-20)	0.47 (0.24;0.69)	1.59 (1.27;2)	
WBC (10 <sup>9</sup> /L) (>20 vs. 1-20)	0.18 (0.1;0.26)	1.2 (1.1;1.3)	<0.001
Serum urea (mg/100 ml) (>=60 vs. <60)	0.26 (0.18;0.34)	/	×
PaO2/FiO2 (100*mmHg/%) (200-299 vs. >=300)	0.11 (0.02;0.2)	/	
PaO2/FiO2 (100*mmHg/%) (100-199 vs. >=300)	0.26 (0.17;0.35)	/	×
PaO2/FiO2 (100*mmHg/%) (<100 vs. >=300)	0.69 (0.55;0.84)	/	
Heart rate (bpm) (>=120 vs. <120)	0.24 (0.16;0.32)	1.27 (1.18;1.37)	<0.001
<b>Clinical conditions on admission</b>			
Acute intoxication (Yes vs. No)	-0.98 (-1.32;-0.64)	0.38 (0.27;0.53)	<0.001
Spontaneous Intraparenchymal bleeding (Yes vs. No)	0.51 (0.33;0.7)	/	×
ALI (Acute Lung Injury) (Yes vs. No)	0.15 (0;0.3)	1.16 (1.1;1.36)	
ARDS (Yes vs. No)	0.45 (0.25;0.64)	1.56 (1.28;1.9)	
Haematological disease (Yes vs. No)	0.58 (0.25;0.9)	1.78 (1.28;2.47)	<0.001
Ascites (Yes vs. No)	0.49 (0.16;0.82)	1.63 (1.17;2.27)	0.004
Nephrourologic disease (Yes vs. No)	-0.26 (-0.42;-0.11)	0.77 (0.66;0.9)	<0.001
Lung cancer (Yes vs. No)	0.81 (0.52;1.09)	2.24 (1.69;2.97)	<0.001
Acute pancreatitis (Yes vs. No)	0.56 (0.29;0.83)	1.75 (1.33;2.29)	<0.001
Seizures (Yes vs. No)	-0.53 (-0.73;-0.32)	0.59 (0.48;0.72)	<0.001
Bowel ischaemia (Yes vs. No)	0.43 (0.2;0.66)	1.54 (1.22;1.94)	<0.001
Spontaneous Subarachnoid haemorrhage (Yes vs. No)	0.37 (0.14;0.59)	1.44 (1.15;1.8)	0.001
Systemic hypertensive crisis (Yes vs. No)	-0.44 (-0.76;-0.11)	0.65 (0.47;0.89)	0.007
Intracranial hypertension (Yes vs. No)	0.77 (0.19;1.34)	2.15 (1.21;3.81)	0.009
Gastrointestinal perforation (Yes vs. No)	0.22 (0.05;0.39)	1.25 (1.05;1.47)	0.010
Pneumonia (Yes vs. No)	0.23 (0.11;0.35)	1.26 (1.12;1.42)	<0.001
Peritonitis (Yes vs. No)	0.34 (0.15;0.53)	1.41 (1.16;1.7)	<0.001
Infection severity on admission (Infection with or without SIRS vs. None)	0.3 (-0.09;0.69)	/	
Infection severity on admission (SEVERE SEPSIS vs. None)	1.08 (0.59;1.58)	/	×
Infection severity on admission (SEPTIC SHOCK vs. None)	0.88 (0.35;1.4)	/	
Urinary tract infection (Yes vs. No)	-0.22 (-0.46;0.01)	/	×
Skin or soft tissue infection (Yes vs. No)	0.5 (0.26;0.73)	1.65 (1.3;2.08)	<0.001
Trauma (Yes vs. No)	-1.23 (-1.79;-0.66)	/	×
Multiple trauma (Yes vs. No)	-0.26 (-0.49;-0.04)	0.77 (0.61;0.96)	0.020
Traumatic brain injury (Yes vs. No)	0.03 (-0.21;0.27)	/	×
Spinal cord injury with complete neurologic deficit (Yes vs. No)	0.98 (0.35;1.6)	2.65 (1.42;4.97)	0.003
Traumatic diffuse injury with oedema (Yes vs. No)	0.68 (0.14;1.22)	1.98 (1.15;3.39)	0.015
<b>Comorbidities</b>			
Any tumour without metastasis (Yes vs. No tumor)	0.78 (0.12;1.45)	/	
Metastatic cancer (Yes vs. No tumor)	3.04 (2.24;3.84)	/	×
NYHA class I-III (Yes vs. None)	0.09 (0.01;0.18)	1.1 (1.01;1.2)	
NYHA class IV (Yes vs. None)	0.43 (0.25;0.61)	1.54 (1.29;1.84)	<0.001
Malignant haematological disease (Yes vs. No)	0.72 (0.52;0.92)	2.05 (1.68;2.51)	<0.001
Moderate or severe liver disease (Yes vs. No)	0.68 (0.5;0.85)	1.97 (1.64;2.35)	<0.001
Severe COPD (Yes vs. No)	0.36 (0.26;0.46)	1.44 (1.3;1.59)	<0.001
Diabetes with insulin treatment (Yes vs. No)	0.23 (0.13;0.32)	1.25 (1.14;1.38)	<0.001
Severe malnutrition (Yes vs. No)	1.89 (0.83;2.95)	/	×
Renal failure (Yes vs. No)	0.13 (0.04;0.23)	1.14 (1.04;1.26)	0.006
Dementia (Yes vs. No)	0.24 (0.11;0.38)	1.28 (1.11;1.46)	<0.001
Hemiplegia or paraplegia or quadriplegia (Yes vs. No)	0.27 (0.12;0.42)	1.31 (1.12;1.52)	<0.001
Immunosuppression (Yes vs. No)	0.28 (0.08;0.48)	1.32 (1.09;1.61)	0.005
Restrictive lung disease (Yes vs. No)	1.82 (0.95;2.69)	/	×
Arrhythmia (Yes vs. No)	0.09 (0.02;0.17)	1.1 (1.02;1.18)	0.017

<sup>o</sup> For patients transferred to other ICU or to rehabilitation/high dependency care unit in other hospital, it is considered the outcome at the last hospital discharge.  
 × See interaction significance.

(to be continued)

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Organ failures			
GCS (3,4 vs. 15)	2.14 (1.88;2.4)	/	
GCS (5 vs. 15)	1.71 (1.39;2.03)	/	
GCS (6 vs. 15)	0.91 (0.68;1.14)	/	
GCS (7,8,9,10 vs. 15)	0.5 (0.38;0.62)	/	×
GCS (11,12,13,14 vs. 15)	0.31 (0.22;0.4)	/	
GCS (Not evaluable in the first 24 hours in neurological patient* vs. 15)	1.59 (1.35;1.83)	/	
GCS (Not evaluable in the first 24 hours in NON-neurological patient* vs. 15)	0.67 (0.57;0.76)	/	
Neurologic failure (Cerebral coma vs. None or Not evaluable in the first 24 hours)	0.38 (0.22;0.54)	1.46 (1.24;1.71)	
Neurologic failure (Metabolic coma vs. None or Not evaluable in the first 24 hours)	-0.29 (-0.48;-0.11)	0.75 (0.62;0.9)	
Neurologic failure (Postanoxic coma vs. None or Not evaluable in the first 24 hours)	0.94 (0.25;1.63)	2.56 (1.28;5.11)	<0.001
Neurologic failure (Toxic coma vs. None or Not evaluable in the first 24 hours)	-0.78 (-1.32;-0.23)	0.46 (0.27;0.79)	
Cardiovascular failure (Cardiogenic shock vs. None or Without shock)	0.45 (0.32;0.57)	1.56 (1.38;1.76)	
Cardiovascular failure (Neurogenic shock vs. None or Without shock)	0.86 (0.54;1.18)	2.37 (1.72;3.26)	
Cardiovascular failure (Haemorrhagic/hypovolemic shock vs. None or Without shock)	0.23 (0.08;0.39)	1.26 (1.08;1.47)	<0.001
Cardiovascular failure (Other shock vs. None or Without shock)	0.08 (-0.07;0.24)	1.09 (0.93;1.27)	
Cardiovascular failure (Mixed shock vs. None or Without shock)	0.3 (0.05;0.55)	1.35 (1.05;1.74)	
Renal failure (AKIN) (Mild vs. None)	0.06 (-0.03;0.15)	/	×
Renal failure (AKIN) (Moderate or Severe vs. None)	0.44 (0.31;0.56)	/	
Respiratory failure (Yes vs. No)	0.21 (0.08;0.35)	1.24 (1.08;1.42)	0.002
Metabolic failure (Yes vs. No)	0.18 (0.1;0.25)	1.19 (1.11;1.29)	<0.001
Surgical and non surgical procedures			
Gastrointestinal surgery (Yes vs. No)	0.31 (0.2;0.43)	1.37 (1.22;1.54)	<0.001
Pancreatic surgery (Yes vs. No)	0.79 (0.5;1.08)	2.2 (1.64;2.95)	<0.001
Organ/s transplantation (Yes vs. No)	-1.84 (-2.63;-1.04)	0.16 (0.07;0.35)	<0.001
Interventional cardiology (Yes vs. No)	-0.33 (-0.52;-0.14)	0.72 (0.59;0.87)	<0.001
Interactions among independent variables			
GCS (3,4) × Serum urea (mg/100 ml) (>=60)	-0.26 (-0.49;-0.04)	/	
GCS (5) × Serum urea (mg/100 ml) (>=60)	-0.5 (-0.95;-0.06)	/	0.006
GCS Not evaluable in the first 24 hours in neurological patient* × Serum urea (mg/100 ml) (>=60)	-0.29 (-0.58;-0.01)	/	
GCS (3,4) × Infections	-0.81 (-1.07;-0.54)	/	<0.001
GCS Not evaluable in the first 24 hours in neurological patient* × Infections	-0.39 (-0.74;-0.04)	/	
MAP (mmHg) (<70) × Infections	-0.3 (-0.44;-0.16)	/	<0.001
GCS (3,4) × Spontaneous Intraparenchymal bleeding	0.99 (0.61;1.36)	/	<0.001
GCS (3,4) × Traumatic brain injury	0.85 (0.45;1.24)	/	
GCS (5) × Traumatic brain injury	0.13 (-0.51;0.77)	/	<0.001
GCS (6) × Traumatic brain injury	0.82 (0.26;1.39)	/	
Surgical status (Non surgical) × Infection severity on admission Infection with or without SIRS	-0.34 (-0.74;0.06)	/	
Surgical status (Emergency surgical) × Infection severity on admission Infection with or without SIRS	-0.42 (-0.87;0.02)	/	
Surgical status (Non surgical) × Infection severity on admission SEVERE SEPSIS	-0.88 (-1.39;-0.38)	/	<0.001
Surgical status (Emergency surgical) × Infection severity on admission SEVERE SEPSIS	-1.06 (-1.59;-0.53)	/	
Surgical status (Non surgical) × Infection severity on admission SEPTIC SHOCK	-0.71 (-1.22;-0.2)	/	
Surgical status (Emergency surgical) × Infection severity on admission SEPTIC SHOCK	-0.71 (-1.22;-0.19)	/	
Urinary tract infection × Renal failure (AKIN) (Moderate or Severe)	-0.51 (-0.85;-0.17)	/	0.003
Age <sup>Δ</sup> × Trauma	0.02 (0.01;0.02)	/	<0.001
Age <sup>Δ</sup> × Any tumour without metastasis	-0.01 (-0.02;0)	/	
Age <sup>Δ</sup> × Metastatic cancer	-0.03 (-0.04;-0.02)	/	<0.001
Age <sup>Δ</sup> × Severe malnutrition	-0.02 (-0.04;0)	/	0.012
Age <sup>Δ</sup> × Restrictive lung disease	-0.02 (-0.03;-0.01)	/	0.002
Age <sup>Δ</sup> × Neurologic failure (Postanoxic coma)	-0.01 (-0.02;0)	/	0.078
Age <sup>Δ</sup> × Reason for admission (Intensive Treatment)	-0.01 (-0.01;0)	/	0.016
GCS (3,4) × PaO2/FiO2 (100*mmHg%) (200-299)	-0.07 (-0.33;0.19)	/	
GCS (3,4) × PaO2/FiO2 (100*mmHg%) (100-199)	-0.37 (-0.65;-0.1)	/	
GCS (3,4) × PaO2/FiO2 (100*mmHg%) (<100)	-0.34 (-0.79;0.12)	/	
GCS Not evaluable in the first 24 hours in neurological patient* × PaO2/FiO2 (100*mmHg%) (200-299)	0.09 (-0.19;0.38)	/	0.020
GCS Not evaluable in the first 24 hours in neurological patient* × PaO2/FiO2 (100*mmHg%) (100-199)	0 (-0.35;0.35)	/	
GCS Not evaluable in the first 24 hours in neurological patient* × PaO2/FiO2 (100*mmHg%) (<100)	-0.92 (-1.72;-0.12)	/	

Dependent variable explained

Likelihood Ratio Test: 11382  
 Degree of freedom: 122  
 p-value: <0.0001

Goodness-of-fit

Area under the ROC curve: 0.848  
 GIVITI Calibration Test: 0  
 p-value: 1

\* A neurological patient is a one with an altered consciousness, probably due to a direct brain injury. It is defined by the presence of at least one of these clinical conditions on admission: Cerebral artery stroke, Vertebral basilar ischemic stroke, Intracranial hypertension, Spontaneous Hydrocephalus, Non traumatic cerebral oedema, Metabolic/postanoxic encephalopathy, Seizures, Brain tumour, Cerebral Aneurysm, AVM (ArterioVenous Malformation), Chronic Subdural haematoma, Spontaneous Subarachnoid haemorrhage, Spontaneous Intraparenchymal bleeding, CNS degenerative disease, Brain and skull malformations, Cerebral contusion/laceration, Traumatic diffuse injury without oedema, Traumatic diffuse injury with oedema, Extradural/epidural haematoma, Traumatic Subdural haematoma, Traumatic Intraparenchymal bleeding, Traumatic subarachnoid haemorrhage, Skull fracture, NON-surgical CNS infection, Post-surgical CNS infection, Ventriculostomy-related CNS infection.

<sup>Δ</sup> The age used in interactions is the maximum between the age and 37.  
 × See interaction significance.

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**National report for general ICUs - Year 2012**  
**Prognostic models - Adult patients with LOS<24 hours**

**Model:** Logistic regression.  
**Dependent variable:** Hospital mortality.  
**Sample used for model development:** Patients with LOS<24 hours from general Italian ICUs.  
**Sample size:** 12746 patients.

Independent variables	Coefficients (95% CI)	Odds Ratio (95% CI)	p
Intercept	-7.02 (-7.51;-6.52)	/	/
<b>Miscellanea</b>			
Age in decades	0.37 (0.31;0.43)	1.45 (1.37;1.53)	<0.001
Body mass Index (BMI) (Underweight vs. Normal)	0.33 (0.02;0.64)	1.39 (1.02;1.9)	<0.001
Body mass Index (BMI) (Overweight or Obese vs. Normal)	-0.41 (-0.57;-0.24)	0.67 (0.56;0.79)	
Surgical status (Non surgical vs. Elective surgical)	0.42 (0.16;0.69)	1.53 (1.17;1.99)	<0.001
Surgical status (Emergency surgical vs. Elective surgical)	0.44 (0.21;0.67)	1.55 (1.23;1.96)	
Stay before ICU (days) (logarithm)	0.36 (0.26;0.46)	1.43 (1.29;1.59)	<0.001
Admitted in hospital the same day of ICU admission (Yes vs. No)	0.42 (0.17;0.68)	1.53 (1.18;1.97)	0.001
Reason for admission (Intensive Treatment vs. Monitoring/Weaning)	-0.52 (-1.01;-0.03)	/	<0.001
Ward of admission: formato("admWard","medicalWard")	0.5 (0.24;0.75)	1.64 (1.27;2.11)	<0.001
<b>Physiopathological components</b>			
Bilirubin (mg/100ml) (>=4 vs. <4)	0.79 (0.33;1.25)	2.21 (1.4;3.5)	0.001
Heart rate (bpm) (<40 vs. >=40)	0.87 (0.42;1.31)	2.38 (1.52;3.71)	<0.001
WBC (10 <sup>9</sup> /L) (>20 vs. <=20)	0.44 (0.17;0.71)	1.55 (1.18;2.03)	0.002
HCO3 (mEq/L) (<15 vs. >20)	0.73 (0.38;1.08)	2.07 (1.47;2.93)	<0.001
HCO3 (mEq/L) (15-20 vs. >20)	0.23 (0.03;0.44)	1.26 (1.03;1.55)	
Platelets (10 <sup>3</sup> /mm3) (50-99 vs. >100)	0.31 (-0.01;0.63)	1.37 (0.99;1.88)	<0.001
Platelets (10 <sup>3</sup> /mm3) (<50 vs. >100)	1.02 (0.54;1.5)	2.77 (1.72;4.48)	
Systolic Blood Pressure (mmHg) (<70 vs. >=100)	1.08 (0.71;1.47)	/	<0.001
Systolic Blood Pressure (mmHg) (70-99 vs. >=100)	0.35 (0.13;0.57)	/	
Urine Output (L/24h) (<0.49 vs. >=1)	1.06 (0.63;1.49)	/	<0.001
Urine Output (L/24h) (0.5-0.99 vs. >=1)	0.41 (0.17;0.65)	/	
PaO2/FiO2 (100*mmHg%) (100-199 vs. >=200)	0.31 (0.1;0.53)	1.36 (1.1;1.69)	<0.001
PaO2/FiO2 (100*mmHg%) (<100 vs. >=200)	1.46 (1.02;1.9)	4.3 (2.76;6.69)	
<b>Clinical conditions on admission</b>			
Spontaneous Intracerebral bleeding (Yes vs. No)	1.56 (1.08;2.03)	4.76 (2.96;7.65)	<0.001
Nephrourologic disease (Yes vs. No)	-0.57 (-0.93;-0.21)	0.57 (0.39;0.81)	<0.001
Bowel ischaemia (Yes vs. No)	0.98 (0.31;1.65)	/	<0.001
Spontaneous Subarachnoid haemorrhage (Yes vs. No)	1.37 (0.79;1.95)	3.93 (2.2;7.04)	<0.001
Pulmonary embolism (Yes vs. No)	1.37 (0.69;2.06)	3.95 (1.99;7.85)	<0.001
Ruptured or fissured aneurysm (Yes vs. No)	1.05 (0.43;1.66)	2.85 (1.54;5.29)	0.001
Traumatic brain injury (Yes vs. No)	0.95 (0.53;1.38)	2.6 (1.7;3.97)	<0.001
Peritonitis (Yes vs. No)	0.74 (0.21;1.26)	2.09 (1.24;3.53)	0.006
Infections (Yes vs. No)	0.39 (0.06;0.71)	1.47 (1.06;2.04)	0.022
<b>Comorbidities</b>			
Metastatic cancer (Yes vs. No)	0.79 (0.53;1.05)	2.2 (1.69;2.85)	<0.001
Restrictive lung disease (Yes vs. No)	0.94 (0.51;1.37)	2.56 (1.66;3.93)	<0.001
End-stage renal disease (Yes vs. No)	-0.93 (-1.48;-0.39)	0.39 (0.23;0.68)	<0.001
Diabetes with insulin treatment (Yes vs. No)	0.39 (0.12;0.65)	1.47 (1.13;1.92)	0.005
Malignant haematological disease (Yes vs. No)	0.73 (0.22;1.25)	2.08 (1.24;3.49)	0.007
<b>Organ failures</b>			
GCS (3 vs. 15)	2.86 (2.45;3.28)	/	
GCS (4,5 vs. 15)	2.13 (1.59;2.67)	/	
GCS (6,7,8 vs. 15)	0.24 (-0.42;0.9)	/	<0.001
GCS (9,10,11,12,13,14 vs. 15)	0.66 (0.45;0.87)	/	
GCS (Not evaluable in the first 24 hours in neurological patient* vs. 15)	1.08 (0.64;1.51)	/	
GCS (Not evaluable in the first 24 hours in NON-neurological patient* vs. 15)	0.6 (0.28;0.93)	/	
Cardiovascular failure (Without shock vs. None)	0.52 (0.06;0.97)	1.68 (1.07;2.64)	
Cardiovascular failure (Cardiogenic shock vs. None)	0.94 (0.55;1.34)	2.57 (1.73;3.81)	
Cardiovascular failure (Septic shock vs. None)	1 (0.34;1.67)	2.73 (1.4;5.32)	
Cardiovascular failure (Haemorrhagic/hypovolemic shock vs. None)	0.67 (0.16;1.18)	1.96 (1.18;3.27)	
Cardiovascular failure (Hypovolemic shock vs. None)	-0.07 (-0.81;0.66)	0.93 (0.45;1.94)	<0.001
Cardiovascular failure (Neurogenic shock vs. None)	2.07 (1.07;3.06)	7.96 (2.92;21.69)	
Cardiovascular failure (Other shock vs. None)	1.33 (0.56;2.1)	3.79 (1.75;8.19)	
Cardiovascular failure (Mixed shock vs. None)	1.52 (0.42;2.63)	4.59 (1.52;13.82)	
Respiratory failure (Yes vs. No)	0.95 (0.51;1.4)	2.59 (1.66;4.06)	<0.001
Renal failure (AKIN) (Mild vs. None)	0.4 (0.17;0.63)	1.49 (1.19;1.87)	<0.001
Renal failure (AKIN) (Moderate or Severe)	0.64 (0.31;0.98)	1.9 (1.36;2.66)	
<b>Interactions among independent variables</b>			
GCS (6,7,8) × Systolic Blood Pressure (mmHg) (<70)	1.76 (0.42;3.1)	/	
GCS (6,7,8) × Systolic Blood Pressure (mmHg) (70-99)	1.08 (0.07;2.08)	/	<0.001
GCS (Not evaluable in the first 24 hours in NON-neurological patient*) × Systolic Blood Pressure (mmHg) (<70)	1.14 (0.39;1.89)	/	
GCS (Not evaluable in the first 24 hours in NON-neurological patient*) × Systolic Blood Pressure (mmHg) (70-99)	0.57 (0.03;1.11)	/	
Systolic Blood Pressure (mmHg) (<70) × Urine Output (L/24h) (<0.49 vs. >=1)	1.13 (0.45;1.8)	/	0.001
Systolic Blood Pressure (mmHg) (70-99) × Urine Output (L/24h) (<0.49 vs. >=1)	0.69 (0.15;1.23)	/	
Bowel ischaemia × Reason for admission (Intensive Treatment)	1.32 (-0.21;2.85)	/	0.071
<b>Dependent variable explained</b>		<b>Goodness-of-fit</b>	
Likelihood ratio test:	8558.6	Area under the ROC curve:	0.954
Degree of freedom:	60	GiVITI Calibration Test:	0
p-value:	<0.0001	p-value:	1

○ For patients transferred to other ICU or to rehabilitation/high dependency care unit in other hospital, it is considered the outcome at the last hospital discharge.  
 × See interaction significance.  
 \* A neurological patient is a one with an altered consciousness, probably due to a direct brain injury. It is defined by the presence of at least one of these clinical conditions on admission: Cerebral artery stroke, Vertebral basilar ischemic stroke, Intracranial hypertension, Spontaneous Hydrocephalus, Non traumatic cerebral oedema, Metabolic/postanoxic encephalopathy, Seizures, Brain tumour, Cerebral Aneurysm, AVM (ArterioVenous Malformation), Chronic Subdural haematoma, Spontaneous Subarachnoid haemorrhage, Spontaneous Intracerebral bleeding, CNS degenerative disease, Brain and skull malformations, Cerebral contusion/laceration, Traumatic diffuse injury without oedema, Traumatic diffuse injury with oedema, Extradural/epidural haematoma, Traumatic Subdural haematoma, Traumatic Intracerebral bleeding, Traumatic subarachnoid haemorrhage, Skull fracture, NON-surgical CNS infection, Post-surgical CNS infection, Ventriculostomy-related CNS infection.

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**National report for general ICUs - Year 2013**  
**Prognostic models - Adult patients with LOS<sub>≥</sub>24 hours**

**Model:** Logistic regression.  
**Dependent variable:** Hospital mortality<sup>o</sup>.  
**Sample used for model development:** Patients with LOS<sub>≥</sub>24 hours from general Italian ICUs.  
**Sample size:** 35612 patients.

Independent variables	Coefficients (95% CI)	Odds Ratio (95% CI)	p
Intercept	-6.36 (-6.69;-6.04)	/	/
<b>Miscellanea</b>			
Age in decades (continuous, <40)	0.432 (0.342;0.521)	/	/
Age in decades (continuous, 40-80)	0.377 (0.338;0.416)	/	<0.001
Age in decades (continuous, >80)	0.401 (0.367;0.435)	/	/
Body mass Index (BMI) (Underweight vs. Normal)	0.15 (0.02;0.28)	1.16 (1.02;1.32)	<0.001
Body mass Index (BMI) (Overweight or Obese vs. Normal)	-0.19 (-0.25;-0.13)	0.83 (0.78;0.88)	/
Surgical status (Non surgical vs. Elective surgical)	0.5 (0.34;0.66)	/	×
Surgical status (Emergency surgical vs. Elective surgical)	0.34 (0.22;0.46)	/	/
Stay before ICU (days) (logarithm, if <28 days)	0.31 (0.26;0.36)	/	/
Stay before ICU (days) (>28 vs. <=28)	3.04 (2.24;3.85)	/	×
Admitted in hospital the same day of ICU admission (Yes vs. No)	0.27 (0.16;0.37)	/	/
Ward of admission: Medical ward vs. Surgical ward	0.15 (0.04;0.26)	/	/
Ward of admission: Emergency room vs. Surgical ward	-0.28 (-0.42;-0.14)	/	/
Ward of admission: High dependency care unit vs. Surgical ward	0.22 (0.04;0.39)	/	/
Ward of admission: Other ICU because of Specialist expertise vs. Surgical ward	-0.1 (-0.34;0.14)	/	×
Ward of admission: Other ICU because of Step-up care vs. Surgical ward	0.3 (0.0;0.6)	/	/
Ward of admission: Other ICU because of Logistical/organizational reasons vs. Surgical ward	-0.24 (-0.41;-0.06)	/	/
Ward of admission: Long-term chronic care hospital vs. Surgical ward	0.3 (-0.07;0.66)	/	/
Operating theatre (Yes vs. No)	-0.32 (-0.45;-0.19)	0.73 (0.64;0.83)	<0.001
<b>Physiopatological components</b>			
Bilirubin (mg/100ml) (1.2-3.9 vs. <1.2)	0.15 (0.07;0.22)	1.16 (1.07;1.25)	/
Bilirubin (mg/100ml) (4-11.9 vs. <1.2)	0.35 (0.17;0.53)	1.42 (1.18;1.7)	<0.001
Bilirubin (mg/100ml) (>=12 vs. <1.2)	0.52 (0.14;0.89)	1.68 (1.15;2.43)	/
Sodium (mEq/L) (>=145 vs. <145)	0.28 (0.19;0.37)	/	×
Platelets (10 <sup>9</sup> /mm3) (50-99 vs. >=100)	0.23 (0.13;0.33)	/	/
Platelets (10 <sup>9</sup> /mm3) (20-49 vs. >=100)	0.57 (0.41;0.74)	/	×
Platelets (10 <sup>9</sup> /mm3) (<20 vs. >=100)	0.73 (0.45;1.01)	/	/
Urine Output (L/24h) (<0.2 vs. >=1)	0.73 (0.54;0.92)	/	/
Urine Output (L/24h) (0.2-0.49 vs. >=1)	0.43 (0.28;0.59)	/	×
Urine Output (L/24h) (0.5-0.99 vs. >=1)	0.21 (0.12;0.3)	/	/
WBC (10 <sup>9</sup> /L) (<1 vs. 1-20)	0.35 (0.15;0.56)	1.42 (1.16;1.75)	<0.001
WBC (10 <sup>9</sup> /L) (>20 vs. 1-20)	0.15 (0.07;0.24)	1.17 (1.07;1.27)	/
Serum urea (mg/100 ml) (60-179 vs. <60)	0.19 (0.12;0.27)	/	×
Serum urea (mg/100 ml) (>=180 vs. <60)	0.51 (0.34;0.69)	/	/
PaO2/FiO2 (100*mmHg%) (200-299 vs. >=300)	0.2 (0.12;0.28)	/	/
PaO2/FiO2 (100*mmHg%) (100-199 vs. >=300)	0.36 (0.27;0.45)	/	×
PaO2/FiO2 (100*mmHg%) (<100 vs. >=300)	0.78 (0.63;0.92)	/	/
Heart rate (bpm) (<70 vs. 70-119)	-0.24 (-0.33;-0.15)	/	/
Heart rate (bpm) (>=120 vs. 70-119)	0.1 (0.02;0.18)	/	×
Systolic Blood Pressure (mmHg) (<70 vs. >=100)	0.51 (0.41;0.62)	1.67 (1.51;1.86)	/
Systolic Blood Pressure (mmHg) (70-99 vs. >=100)	0.19 (0.12;0.26)	1.21 (1.13;1.3)	<0.001
Potassium (mEq/L) (<3 vs. 3-4.9)	0.21 (0.08;0.33)	1.23 (1.08;1.39)	/
Potassium (mEq/L) (>=5 vs. 3-4.9)	0.1 (0.01;0.19)	1.1 (1.01;1.21)	0.001
<b>Clinical conditions on admission</b>			
Acute intoxication (Yes vs. No)	-0.89 (-1.22;-0.56)	0.41 (0.30;0.57)	<0.001
Spontaneous intraparenchymal bleeding (Yes vs. No)	0.72 (0.51;0.93)	/	×
ARDS (Moderate or Severe vs. No or Mild)	0.25 (0.09;0.41)	1.29 (1.09;1.51)	0.002
Haematological disease (Yes vs. No)	0.54 (0.21;0.88)	1.72 (1.23;2.4)	0.002
Ascites (Yes vs. No)	0.47 (0.13;0.81)	1.6 (1.14;2.25)	0.007
Lung cancer (Yes vs. No)	0.88 (0.61;1.15)	2.41 (1.84;3.15)	<0.001
Acute pancreatitis (Yes vs. No)	0.49 (0.24;0.74)	1.64 (1.28;2.1)	<0.001
Seizures (Yes vs. No)	-0.33 (-0.52;-0.13)	0.72 (0.6;0.88)	0.001
Bowel ischaemia (Yes vs. No)	0.66 (0.43;0.89)	1.94 (1.54;2.43)	<0.001
Spontaneous Subarachnoid haemorrhage (Yes vs. No)	0.61 (0.4;0.83)	1.85 (1.49;2.29)	0.001
Gastrointestinal perforation (Yes vs. No)	0.47 (0.31;0.63)	1.6 (1.36;1.88)	<0.001
Cardiac arrest (Yes vs. No)	0.31 (0.16;0.45)	1.36 (1.17;1.57)	<0.001
Cerebral artery stroke (Yes vs. No)	0.29 (0.12;0.46)	1.34 (1.13;1.59)	<0.001
Left heart failure with pulmonary edema (Yes vs. No)	-0.28 (-0.41;-0.16)	0.75 (0.66;0.86)	<0.001
Pancreatic malignancy (Yes vs. No)	0.6 (0.26;0.95)	1.83 (1.29;2.59)	0.001
Metabolic disorder (Yes vs. No)	-0.18 (-0.3;-0.06)	0.84 (0.74;0.94)	0.003
Pleural effusion (Yes vs. No)	0.18 (0.05;0.3)	1.19 (1.05;1.35)	0.006
Liver Dysfunction Syndrome (Yes vs. No)	0.61 (0.25;0.96)	1.83 (1.28;2.62)	<0.001
Infections (Yes vs. No)	0.08 (-0.02;0.19)	/	×
Pneumonia (Yes vs. No)	0.15 (0.03;0.26)	1.16 (1.04;1.29)	0.01
Urinary tract infection (Yes vs. No)	-0.45 (-0.63;-0.28)	0.63 (0.53;0.76)	<0.001
Skin or soft tissue infection (Yes vs. No)	0.4 (0.18;0.62)	1.49 (1.2;1.86)	<0.001
Cholecystitis/cholangitis (Yes vs. No)	-0.45 (-0.72;-0.18)	0.64 (0.49;0.83)	<0.001
Primary bacteraemia of unknown origin (Yes vs. No)	-0.39 (-0.66;-0.13)	0.67 (0.52;0.88)	0.004
Multiple trauma (Yes vs. No)	-0.39 (-0.59;-0.19)	0.68 (0.56;0.83)	<0.001
Traumatic brain injury (Yes vs. No)	-0.18 (-0.4;0.04)	/	×
Traumatic Subdural haematoma (Yes vs. No)	0.41 (0.13;0.69)	1.51 (1.14;2)	0.004

<sup>o</sup> For patients transferred to other ICU or to rehabilitation/high dependency care unit in other hospital, it is considered the outcome at the last hospital discharge.  
 × See interaction significance.

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PROSAFE project

Comorbidities			
Any tumour without metastasis (Yes vs. No tumor)	0.13 (0.03:0.22)	1.13 (1.03;1.25)	<-0.001
Metastatic cancer (Yes vs. No tumor)	0.93 (0.79;1.07)	2.54 (2.21;2.93)	
NYHA class II-III (Yes vs. None)	0.18 (0.10;0.27)	1.2 (1.1;1.31)	
NYHA class IV (Yes vs. None)	0.65 (0.47;0.83)	1.91 (1.6;2.29)	<-0.001
Malignant haematological disease (Yes vs. No)	0.55 (0.36;0.74)	1.73 (1.43;2.09)	<-0.001
Moderate or severe liver disease (Yes vs. No)	0.53 (0.35;0.7)	1.69 (1.42;2.02)	<-0.001
Severe COPD (Yes vs. No)	0.33 (0.23;0.43)	1.39 (1.25;1.54)	<-0.001
Severe malnutrition (Yes vs. No)	1.82 (0.75;2.89)		×
Dementia (Yes vs. No)	0.2 (0.07;0.33)	1.23 (1.08;1.4)	0.002
Immunosuppression or AIDS (Yes vs. No)	0.55 (0.36;0.73)	1.73 (1.44;2.08)	<-0.001
Restrictive lung disease (Yes vs. No)	0.36 (0.19;0.52)	1.43 (1.22;1.69)	<-0.001
Arrhythmia (Yes vs. No)	0.27 (0.18;0.35)		×
Hypertension (Yes vs. No)	-0.14 (-0.2;-0.07)	0.87 (0.82;0.93)	<-0.001
Cerebrovascular disease (Yes vs. No)	0.14 (0.06;0.22)	1.15 (1.06;1.25)	0.001
Autoimmune disease (Yes vs. No)	0.28 (0.11;0.44)	1.32 (1.12;1.55)	<-0.001
Organ failures			
GCS (3,4 vs. 14-15)	2.78 (2.31;3.25)		
GCS (5 vs. 14-15)	2.17 (1.63;2.71)		
GCS (6 vs. 14-15)	2 (1.51;2.49)		
GCS (7,8,9,10 vs. 14-15)	0.64 (0.51;0.78)		×
GCS (11,12,13 vs. 14-15)	0.32 (0.21;0.43)		
GCS (Not evaluable in the first 24 hours in neurological patient* vs. 14-15)	1.16 (0.92;1.4)		
GCS (Not evaluable in the first 24 hours in NON-neurological patient* vs. 14-15)	0.65 (0.52;0.78)		
Neurologic failure (Cerebral coma vs. None or Not evaluable in the first 24 hours)	0.18 (0.03;0.33)	1.2 (1.03;1.39)	
Neurologic failure (Metabolic coma vs. None or Not evaluable in the first 24 hours)	-0.25 (-0.44;-0.06)	0.78 (0.65;0.94)	
Neurologic failure (Postanoxic coma vs. None or Not evaluable in the first 24 hours)	-0.09 (-0.29;0.11)	0.92 (0.75;1.12)	<-0.001
Neurologic failure (Toxic coma vs. None or Not evaluable in the first 24 hours)	-0.89 (-1.41;-0.38)	0.41 (0.24;0.69)	
Cardiovascular failure (Neurogenic shock vs. None or Without shock)	0.9 (0.59;1.21)		
Cardiovascular failure (Mixed shock vs. None or Without shock)	0.51 (0.30;0.71)		×
Cardiovascular failure (Other shock vs. None or Without shock)	0.26 (0.17;0.34)		
Renal failure (AKIN) (Mild vs. None)	0.14 (0.05;0.22)		
Renal failure (AKIN) (Moderate vs. None)	0.68 (0.52;0.83)		×
Renal failure (AKIN) (Severe vs. None)	0.86 (0.67;1.05)		
Respiratory failure (Yes vs. No)	0.36 (0.28;0.45)		×
Metabolic failure (Yes vs. No)	0.24 (0.16;0.31)	1.27 (1.18;1.37)	<-0.001
Surgical and non surgical procedures			
Nephro/Urological surgery (Yes vs. No)	-0.59 (-0.82;-0.36)	0.55 (0.44;0.7)	<-0.001
Orthopaedic surgery (Yes vs. No)	-0.31 (-0.5;-0.11)	0.74 (0.61;0.89)	0.001
Peripheral vascular surgery (Yes vs. No)	0.37 (0.13;0.61)	1.45 (1.14;1.85)	0.003
Abdominal vascular surgery (Yes vs. No)	0.28 (0.07;0.49)	1.33 (1.07;1.64)	0.01
Interactions among independent variables			
GCS (3,4,5,6) × Platelets (10 <sup>3</sup> /mm3) (<50)	-0.79 (-1.19;-0.39)		<-0.001
GCS (3,4,5,6) × PaO2/FiO2 (100*mmHg%) (<200)	-0.65 (-0.85;-0.45)		
GCS Not evaluable in the first 24 hours in neurological patient* × PaO2/FiO2 (100*mmHg%) (<200)	-0.33 (-0.65;-0.01)		<-0.001
GCS (3,4,5) × PaO2/FiO2 (100*mmHg%) (<300)	-0.35 (-0.56;-0.13)		
GCS (7,8,9,10) × PaO2/FiO2 (100*mmHg%) (<100)	-0.6 (-0.92;-0.27)		
GCS (3,4) × Serum urea (mg/100 ml) (>=60)	-0.23 (-0.44;-0.02)		0.034
Serum urea (mg/100 ml) (>=180) × Urine Output (L/24h) (<0.5)	-0.35 (-0.6;-0.11)		0.004
Sodium (mEq/L) (>=145) × Urine Output (L/24h) (<0.5)	-0.33 (-0.56;-0.09)		0.007
Heart rate (bpm) (<70) × Urine Output (L/24h) (<1)	0.38 (0.21;0.54)		<-0.001
Surgical status (Non surgical) × Renal failure (AKIN) (Moderate or Severe)	-0.39 (-0.53;-0.24)		<-0.001
GCS (3,4) × Infections	-0.56 (-0.81;-0.31)		
GCS Not evaluable in the first 24 hours in neurological patient* × Infections	-0.59 (-0.96;-0.21)		<-0.001
GCS Not evaluable in the first 24 hours in NON-neurological patient* × Infections	-0.2 (-0.38;-0.03)		
GCS (3,4) × Ward of admission - Emergency room	0.66 (0.43;0.88)		
GCS (5) × Ward of admission - Emergency room	1.55 (1.2;4)		
GCS (6) × Ward of admission - Emergency room	0.3 (-0.06;0.66)		
GCS (7,8,9,10) × Ward of admission - Emergency room	0.26 (0.06;0.46)		<-0.001
GCS (11,12,13) × Ward of admission - Emergency room	0.21 (0.01;0.42)		
GCS (Not evaluable in the first 24 hours in neurological patient*) × Ward of admission - Emergency room	0.67 (0.39;0.94)		
GCS (Not evaluable in the first 24 hours in NON-neurological patient*) × Ward of admission - Emergency room	0.19 (0.0;0.39)		
GCS (3,4,5,6) × Age	-0.01 (-0.02;-0.01)		<-0.001
GCS (3,4,5,6) × Spontaneous Intraparenchymal bleeding	0.64 (0.33;0.94)		<-0.001
Severe malnutrition × Age	-0.02 (-0.04;-0.01)		0.01
Arrhythmia × Neurogenic shock or Mixed shock or Other shock	-0.28 (-0.43;-0.13)		<-0.001
GCS (3,4) × Traumatic brain injury	0.72 (0.37;1.07)		<-0.001
Ward of admission: Other ICU because of Step-up care × Renal failure (AKIN) - Mild	-0.25 (-0.78;0.27)		0.039
Ward of admission: Other ICU because of Step-up care × Renal failure (AKIN) - Moderate or Severe	-0.66 (-1.17;-0.15)		
Age × Stay before ICU (days) (>28)	-0.02 (-0.03;-0.01)		<-0.001
GCS (<11, Not evaluable in the first 24 hours) × Stay before ICU (days) (>28)	-0.44 (-0.76;-0.11)		0.008
Respiratory failure × Stay before ICU (days) (>28)	-0.33 (-0.66;0)		0.053

Dependent variable explained

Likelihood Ratio Test: 11254  
 Degree of freedom: 136  
 p-value: <0.0001

Goodness-of-fit

Area under the ROC curve: 0.843  
 GIVITI Calibration Test: 1.54  
 p-value: 0.214  
 Polynomial Degree: 2

\* A neurological patient is a one with an altered consciousness, probably due to a direct brain injury. It is defined by the presence of at least one of these clinical conditions on admission: Cerebral artery stroke, Vertebral basilar ischemic stroke, Intracranial hypertension, Spontaneous Hydrocephalus, Non traumatic cerebral oedema, Metabolic/postanoxic encephalopathy, Seizures, Brain tumour, Cerebral Aneurysm, AVM (Arterio Venous Malformation), Chronic Subdural haematoma, Spontaneous Subarachnoid haemorrhage, Spontaneous Intraparenchymal bleeding, CNS degenerative disease, Brain and skull malformations, Cerebral contusion/laceration, Traumatic diffuse injury without oedema, Traumatic diffuse injury with oedema, Extradural/epidural haematoma, Traumatic Subdural haematoma, Traumatic intraparenchymal bleeding, Traumatic subarachnoid haemorrhage, Skull fracture, NON-surgical CNS infection, Post-surgical CNS infection, Ventriculostomy-related CNS infection.

× See interaction significance.

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**National report for general ICUs - Year 2013**  
**Prognostic models - Adult patients with LOS<24 hours**

**Model:** Logistic regression.  
**Dependent variable:** Hospital mortality.<sup>o</sup>  
**Sample used for model development:** Patients with LOS<24 hours from general Italian ICUs.  
**Sample size:** 14548 patients.

Independent variables	Coefficients (95% CI)	Odds Ratio (95% CI)	p
Intercept	-5.92 (-6.49;-5.36)	/	/
<b>Miscellanea</b>			
Age in decades	0.36 (0.30;0.42)	1.43 (1.35;1.52)	<0.001
Body mass Index (BMI) (Underweight vs. Normal)	0.45 (0.18;0.72)	1.57 (1.2;2.05)	<0.001
Body mass Index (BMI) (Overweight or Obese vs. Normal)	-0.38 (-0.54;-0.22)	0.69 (0.58;0.8)	
Surgical status (Non surgical vs. Elective surgical)	0.01 (-0.4;0.42)	1.01 (0.67;1.53)	x
Surgical status (Emergency surgical vs. Elective surgical)	0.45 (0.22;0.69)	1.57 (1.24;1.99)	
Stay before ICU (days) (logarithm)	0.25 (0.17;0.33)	1.28 (1.18;1.39)	<0.001
Reason for admission (Intensive Treatment vs. Monitoring/Weaning)	-0.44 (-0.9;0.03)	0.65 (0.41;1.03)	0.063
Ward of admission: Medical ward vs. Surgical ward	0.69 (0.39;0.99)	1.99 (1.48;2.68)	
Ward of admission: Emergency room vs. Surgical ward	0.22 (-0.07;0.51)	1.24 (0.93;1.66)	
Ward of admission: High dependency care unit vs. Surgical ward	0.19 (-0.48;0.87)	1.21 (0.62;2.39)	
Ward of admission: Other ICU because of Specialist expertise vs. Surgical ward	0.14 (-0.85;1.13)	1.15 (0.43;3.1)	<0.001
Ward of admission: Other ICU because of Step-up care vs. Surgical ward	0.25 (-0.69;1.2)	1.29 (0.5;3.32)	
Ward of admission: Other ICU because of Logistical/organizational reasons vs. Surgical ward	0.72 (-0.04;1.48)	2.05 (0.96;4.4)	
Ward of admission: Long-term chronic care hospital vs. Surgical ward	1.01 (-0.31;2.32)	2.73 (0.73;10.2)	
Operating theatre (Yes vs. No)	-0.99 (-1.35;-0.63)	0.37 (0.26;0.53)	<0.001
<b>Physiopathological components</b>			
Bilirubin (mg/100ml) (>=4 vs. <4)	0.89 (0.47;1.32)	2.44 (1.59;3.73)	0.001
Heart rate (bpm) (<40 vs. 40-119)	0.74 (0.27;1.2)	2.09 (1.31;3.33)	<0.001
Heart rate (bpm) (>=120 vs. 40-119)	0.29 (0.05;0.53)	1.34 (1.05;1.71)	
WBC (10 <sup>9</sup> /L) (>20 vs. <=20)	0.4 (0.14;0.66)	1.49 (1.15;1.94)	0.003
HCO3 (mEq/L) (<15 vs. >=15)	0.61 (0.29;0.94)	1.84 (1.33;2.55)	<0.001
Systolic Blood Pressure (mmHg) (<70 vs. 100-199)	0.56 (0.11;1.02)	1.21 (0.82;1.76)	
Systolic Blood Pressure (mmHg) (70-99 vs. 100-199)	-0.04 (-0.3;0.22)	/	x
Systolic Blood Pressure (mmHg) (>=200 vs. 100-199)	-0.48 (-1.03;0.07)	/	
Urine Output (L/24h) (<0.49 vs. >=1)	1.14 (0.81;1.48)	/	x
Urine Output (L/24h) (0.5-0.99 vs. >=1)	0.44 (0.18;0.7)	/	
PaO2/FiO2 (100*mmHg/%) (100-199 vs. >=200)	0.3 (0.09;0.51)	1.35 (1.1;1.67)	<0.001
PaO2/FiO2 (100*mmHg/%) (<100 vs. >=200)	0.97 (0.53;1.42)	2.65 (1.69;4.14)	
Serum urea (mg/100 ml) (>=60 vs. <60)	0.38 (0.2;0.56)	1.46 (1.22;1.75)	<0.001
<b>Clinical conditions on admission</b>			
Spontaneous Intraparenchymal bleeding (Yes vs. No)	1.09 (0.56;1.63)	/	x
Ascites (Yes vs. No)	2.28 (1.37;3.16)	9.75 (3.94;24.16)	<0.001
Spontaneous Subarachnoid haemorrhage (Yes vs. No)	1.19 (0.63;1.75)	3.28 (1.88;5.73)	<0.001
Ruptured or fissured aneurysm (Yes vs. No)	1.26 (0.68;1.85)	3.54 (1.97;6.37)	<0.001
Seizures (Yes vs. No)	-1.05 (-1.76;-0.33)	0.35 (0.17;0.72)	0.002
Acute intoxication (Yes vs. No)	-1.07 (-1.89;-0.25)	0.34 (0.15;0.78)	0.006
Pulmonary embolism (Yes vs. No)	0.93 (0.22;1.65)	2.54 (1.24;5.19)	0.013
Infections (Yes vs. No)	0.26 (-0.02;0.54)	1.3 (0.98;1.71)	0.072
<b>Comorbidities</b>			
Metastatic cancer (Yes vs. No)	0.75 (0.49;1.01)	2.12 (1.64;2.75)	<0.001
Restrictive lung disease (Yes vs. No)	0.66 (0.23;1.08)	1.93 (1.26;2.95)	0.004
Malignant haematological disease (Yes vs. No)	0.94 (0.46;1.42)	2.55 (1.58;4.12)	<0.001
NYHA class IV (Yes vs. No)	1 (0.56;1.43)	2.71 (1.76;4.16)	<0.001
<b>Organ failures</b>			
GCS (3,4 vs. 15)	2.98 (2.49;3.47)	/	
GCS (5,6,7,8 vs. 15)	1.3 (0.84;1.76)	/	
GCS (9,10,11,12,13,14 vs. 15)	0.61 (0.4;0.82)	/	x
GCS (Not evaluable in the first 24 hours in neurological patient* vs. 15)	1.04 (0.46;1.62)	/	
GCS (Not evaluable in the first 24 hours in NON-neurological patient* vs. 15)	0 (-0.47;0.46)	/	
Cardiovascular failure (Without shock vs. None)	0.78 (0.34;1.23)	2.19 (1.4;3.42)	
Cardiovascular failure (Cardiogenic shock vs. None)	0.8 (0.4;1.2)	2.23 (1.49;3.33)	
Cardiovascular failure (Septic shock vs. None)	1.06 (0.47;1.66)	2.9 (1.59;5.27)	
Cardiovascular failure (Haemorrhagic/hypovolemic shock vs. None)	1.15 (0.68;1.61)	3.15 (1.98;5.01)	
Cardiovascular failure (Hypovolemic shock vs. None)	1.06 (0.43;1.69)	2.88 (1.53;5.41)	<0.001
Cardiovascular failure (Neurogenic shock vs. None)	1.69 (0.67;2.71)	5.42 (1.95;15.04)	
Cardiovascular failure (Other shock vs. None)	1.27 (0.41;2.12)	3.55 (1.51;8.33)	
Cardiovascular failure (Mixed shock vs. None)	1.48 (0.36;2.59)	4.37 (1.43;13.33)	
Respiratory failure (Only hypoxic failure vs. None)	0.83 (0.37;1.28)	2.28 (1.44;3.61)	
Respiratory failure (Only hypercapnic failure vs. None)	0.58 (-0.06;1.22)	1.79 (0.95;3.39)	
Respiratory failure (Hypoxic-hypercapnic failure vs. None)	0.95 (0.4;1.49)	2.58 (1.5;4.45)	0.004
Respiratory failure (Intubation for airway maint. vs. None)	0.59 (0.15;1.03)	1.8 (1.16;2.79)	
<b>Surgical and non surgical procedures</b>			
Gastrointestinal surgery (Yes vs. No)	0.55 (0.35;0.76)	1.74 (1.42;2.14)	<0.001
Pancreatic surgery (Yes vs. No)	0.76 (0.27;1.26)	2.14 (1.31;3.52)	0.005
Interventional cardiology (Yes vs. No)	-0.57 (-1.09;-0.05)	0.57 (0.34;0.95)	0.028

<sup>o</sup> For patients transferred to other ICU or to rehabilitation/high dependency care unit in other hospital, it is considered the outcome at the last hospital discharge.

x See interaction significance.

\* A neurological patient is a one with an altered consciousness, probably due to a direct brain injury. It is defined by the presence of at least one of these clinical conditions on admission: Cerebral artery stroke, Vertebral basilar ischemic stroke, Intracranial hypertension, Spontaneous Hydrocephalus, Non traumatic cerebral oedema, Metabolic/postanoxic encephalopathy, Seizures, Brain tumour, Cerebral Aneurysm, AVM (ArterioVenous Malformation), Chronic Subdural haematoma, Spontaneous Subarachnoid haemorrhage, Spontaneous Intraparenchymal bleeding, CNS degenerative disease, Brain and skull malformations, Cerebral contusion/laceration, Traumatic diffuse injury without oedema, Traumatic diffuse injury with oedema, Extradural/epidural haematoma, Traumatic Subdural haematoma, Traumatic intraparenchymal bleeding, Traumatic subarachnoid haemorrhage, Skull fracture, NON-surgical CNS infection, Post-surgical CNS infection, Ventriculostomy-related CNS infection.

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**National report for general ICUs - Year 2014**  
**Prognostic models - Adult patients with LOS $\geq$ 24 hours**

**Model:** Logistic regression.

**Dependent variable:** Hospital mortality<sup>o</sup>.

**Sample used for model development:** Patients with LOS $\geq$ 24 hours from general Italian ICUs.

**Sample size:** 34832 patients.

Independent variables	Coefficients (95% CI)	Odds Ratio (95% CI)	p
Intercept	-5.68 (-5.86;-5.49)	/	/
<b>Miscellanea</b>			
Max(Age - 41 , 0) in decades	0.41 (0.38;0.43)	/	×
Min((BMI - 33)/10, 0) <sup>2</sup>	0.21 (0.16;0.26)	1.24 (1.18;1.3)	<0.001
Max((BMI - 33)/10, 0) <sup>2</sup>	0.06 (0.02;0.09)	1.06 (1.03;1.1)	
Surgical status (Non surgical vs. Elective surgical)	0.76 (0.62;0.89)	/	×
Surgical status (Emergency surgical vs. Elective surgical)	0.38 (0.25;0.5)	/	×
Stay before ICU (days) (logarithm)	0.26 (0.22;0.31)	1.3 (1.25;1.36)	<0.001
Admitted in hospital the same day of ICU admission (Yes vs. No)	0.08 (-0.02;0.18)	1.09 (0.98;1.2)	0.10
Ward of admission: Medical ward, High dependency care unit, Long-term chronic care hospital vs. Surgical ward, Other ICU	0.27 (0.18;0.36)	/	×
Ward of admission: Emergency room vs. Surgical ward, Other ICU	0.09 (-0.02;0.2)	/	×
<b>Physiopathological components</b>			
Bilirubin (mg/100ml) (1.2-5.9 vs. <1.2)	0.2 (0.12;0.28)	1.22 (1.13;1.32)	<0.001
Bilirubin (mg/100ml) ( $\geq$ 6 vs. <1.2)	0.76 (0.52;1)	2.14 (1.68;2.73)	
WBC (10 <sup>9</sup> /L) (<1 vs. 1-20)	0.3 (0.06;0.53)	1.35 (1.07;1.71)	0.007
WBC (10 <sup>9</sup> /L) (>20 vs. 1-20)	0.09 (0.01;0.18)	1.1 (1.01;1.2)	
Sodium (mEq/L) (<125 vs. 125-145)	0.31 (0.07;0.56)	1.37 (1.07;1.74)	<0.001
Sodium (mEq/L) ( $\geq$ 145 vs. 125-145)	0.15 (0.06;0.24)	1.17 (1.07;1.27)	
Platelets (10 <sup>9</sup> /mm3) (20-99 vs. $\geq$ 100)	0.32 (0.22;0.41)	1.37 (1.25;1.51)	<0.001
Platelets (10 <sup>9</sup> /mm3) (<20 vs. $\geq$ 100)	0.73 (0.45;1.01)	2.07 (1.56;2.74)	
Urine Output (L/24h) (<0.2 vs. $\geq$ 1)	0.77 (0.59;0.95)	2.16 (1.81;2.59)	
Urine Output (L/24h) (0.2-0.49 vs. $\geq$ 1)	0.48 (0.34;0.63)	1.62 (1.4;1.87)	<0.001
Urine Output (L/24h) (0.5-0.99 vs. $\geq$ 1)	0.3 (0.21;0.4)	1.36 (1.24;1.49)	
Serum urea (mg/100 ml) (60-179 vs. <60)	0.2 (0.11;0.28)	/	×
Serum urea (mg/100 ml) ( $\geq$ 180 vs. <60)	0.43 (0.28;0.59)	/	×
PaO2/FiO2 (100 <sup>2</sup> mmHg%) (200-299 vs. $\geq$ 300)	0.14 (0.05;0.23)	/	
PaO2/FiO2 (100 <sup>2</sup> mmHg%) (100-199 vs. $\geq$ 300)	0.46 (0.36;0.56)	/	×
PaO2/FiO2 (100 <sup>2</sup> mmHg%) (<100 vs. $\geq$ 300)	1.1 (0.9;1.3)	/	
Heart rate (bpm) (<70 vs. 70-119)	0.16 (-0.24;-0.08)	/	×
Heart rate (bpm) ( $\geq$ 120 vs. 70-119)	0.28 (0.19;0.37)	/	×
MAP (mmHg) (<70 vs. $\geq$ 70)	0.31 (0.24;0.39)	/	×
Potassium (mEq/L) ( $\geq$ 5 vs. <5)	0.22 (0.13;0.32)	1.25 (1.13;1.37)	<0.001
Creatinine (mg/dl) (1.2-4.9 vs. <1.2)	0.15 (0.06;0.24)	1.16 (1.06;1.27)	<0.001
Creatinine (mg/dl) (>5 vs. <1.2)	-0.48 (-0.68;-0.28)	0.62 (0.5;0.76)	
<b>Clinical conditions on admission</b>			
Acute intoxication (Yes vs. No)	-0.76 (-1.09;-0.43)	0.47 (0.33;0.65)	<0.001
Spontaneous Intraparenchymal bleeding (Yes vs. No)	0.78 (0.6;0.96)	/	×
ARDS (Yes vs. No)	0.57 (0.38;0.77)	/	×
Haematological disease (Yes vs. No)	0.74 (0.38;1.09)	2.09 (1.46;2.98)	<0.001
Ascites (Yes vs. No)	0.71 (0.36;1.06)	2.03 (1.43;2.89)	<0.001
Lung cancer (Yes vs. No)	0.8 (0.5;1.09)	2.22 (1.65;2.99)	<0.001
Acute pancreatitis (Yes vs. No)	0.45 (0.18;0.73)	1.57 (1.19;2.07)	0.002
Seizures (Yes vs. No)	-0.45 (-0.65;-0.25)	0.64 (0.52;0.78)	<0.001
Bowel ischaemia (Yes vs. No)	0.63 (0.4;0.86)	1.88 (1.5;2.37)	<0.001
Spontaneous Subarachnoid haemorrhage (Yes vs. No)	0.79 (0.58;1.01)	2.21 (1.78;2.75)	<0.001
Cardiac arrest (Yes vs. No)	0.49 (0.29;0.69)	/	×
Cerebral artery stroke (Yes vs. No)	0.3 (0.12;0.48)	1.35 (1.13;1.62)	0.001
Left heart failure with pulmonary edema (Yes vs. No)	-0.37 (-0.5;-0.23)	0.69 (0.6;0.8)	<0.001
Metabolic disorder (Yes vs. No)	-0.17 (-0.3;-0.04)	0.84 (0.74;0.96)	0.008
Nephro-urologic disease (Yes vs. No)	-0.29 (-0.45;-0.13)	0.75 (0.64;0.88)	<0.001
Gastrointestinal bleeding: upper tract (Yes vs. No)	0.8 (0.49;1.1)	/	×
Acute on chronic liver disease (Yes vs. No)	0.67 (0.22;1.12)	1.95 (1.24;3.07)	0.003
Vertebral basilar ischemic stroke (Yes vs. No)	0.8 (0.35;1.24)	2.22 (1.42;3.46)	<0.001
Pneumothorax/Pneumomediastinum (Yes vs. No)	0.59 (0.25;0.93)	1.8 (1.28;2.54)	<0.001
Brain tumour (Yes vs. No)	0.77 (0.48;1.06)	2.16 (1.62;2.88)	<0.001
Post transplantation (Yes vs. No)	-0.92 (-1.29;-0.55)	0.4 (0.28;0.58)	<0.001
Systemic hypertensive crisis (Yes vs. No)	-0.49 (-0.85;-0.13)	0.61 (0.43;0.88)	0.006
Ruptured or fissured aneurysm (Yes vs. No)	0.41 (0.13;0.69)	1.51 (1.14;1.99)	0.004
Pneumonia (Yes vs. No)	0.34 (0.21;0.47)	/	×
Urinary tract infection (Yes vs. No)	-0.27 (-0.45;-0.08)	0.77 (0.64;0.92)	0.005
Skin or soft tissue infection (Yes vs. No)	0.6 (0.37;0.82)	1.82 (1.45;2.28)	<0.001
Cholecystitis/cholangitis (Yes vs. No)	-0.44 (-0.71;-0.16)	0.65 (0.49;0.85)	0.001
Peritonitis (Yes vs. No)	0.32 (0.15;0.49)	1.38 (1.16;1.64)	<0.001
Infection severity on admission (Infection with or without SIRS vs. None)	-0.12 (-0.26;0.01)	/	
Infection severity on admission (Severe sepsis vs. None)	0.84 (0.34;1.35)	/	×
Infection severity on admission (Septic shock vs. None)	0.05 (-0.1;0.2)	/	
Multiple trauma (Yes vs. No)	-0.4 (-0.6;-0.2)	0.67 (0.55;0.82)	<0.001
Traumatic Subdural haematoma (Yes vs. No)	0.58 (0.29;0.88)	1.79 (1.33;2.41)	<0.001
Traumatic intraparenchymal bleeding (Yes vs. No)	0.52 (0.11;0.93)	1.69 (1.12;2.54)	0.013
Spine trauma (Trauma with deficit vs. No trauma or Trauma without deficit)	0.88 (0.45;1.32)	2.42 (1.56;3.76)	<0.001
Post-traumatic diffuse injury (Yes vs. No)	0.64 (0.18;1.1)	1.9 (1.2;3.01)	0.007
Head trauma (Head trauma without skull fracture vs. No head trauma)	-0.4 (-0.79;-0.02)	/	×
Head trauma (Head trauma with skull fracture vs. No head trauma)	-0.03 (-0.4;0.35)	/	

<sup>o</sup> For patients transferred to other ICU or to rehabilitation/high dependency care unit in other hospital, it is considered the outcome at the last hospital discharge.  
 × See interaction significance.

(to be continued)

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PROSAFE project

Comorbidities			
Metastatic cancer (Yes vs. No)	0.96 (0.82;1.1)	2.61 (2.27;3)	<0.001
NYHA class II-III (Yes vs. None)	0.21 (0.12;0.3)	1.23 (1.13;1.35)	
NYHA class IV (Yes vs. None)	0.5 (0.31;0.68)	1.65 (1.37;1.98)	<0.001
Malignant haematological disease (Yes vs. No)	0.69 (0.49;0.89)	1.99 (1.64;2.43)	<0.001
Moderate or severe liver disease (Yes vs. No)	0.56 (0.37;0.75)	1.75 (1.45;2.12)	<0.001
Severe COPD (Yes vs. No)	0.4 (0.3;0.51)	1.5 (1.35;1.67)	<0.001
Severe malnutrition (Yes vs. No)	0.5 (0.24;0.76)	1.64 (1.27;2.13)	<0.001
Dementia (Yes vs. No)	0.43 (0.29;0.56)	/	×
Immunosuppression or AIDS (Yes vs. No)	0.3 (0.1;0.5)	1.35 (1.11;1.64)	0.003
Restrictive lung disease (Yes vs. No)	0.46 (0.29;0.63)	1.58 (1.34;1.87)	<0.001
Hypertension (Yes vs. No)	-0.13 (-0.2;-0.07)	0.88 (0.82;0.94)	<0.001
Cerebrovascular disease (Yes vs. No)	0.13 (0.04;0.21)	1.14 (1.04;1.24)	0.003
Peripheral vascular disease (Yes vs. No)	0.23 (0.13;0.33)	1.26 (1.14;1.38)	<0.001
Diabetes Type II with insulin treatment (Yes vs. No)	0.19 (0.08;0.3)	1.21 (1.09;1.35)	<0.001
Organ failures			
GCS (3,4 vs. 15)	2.43 (2.17;2.7)	/	
GCS (5 vs. 15)	1.64 (1.37;1.91)	/	
GCS (6 vs. 15)	1.41 (1.17;1.65)	/	
GCS (7,8,9 vs. 15)	0.94 (0.79;1.1)	/	
GCS (10,11,12 vs. 15)	0.48 (0.35;0.62)	/	×
GCS (13,14 vs. 15)	0.29 (0.18;0.4)	/	
GCS (Not evaluable in the first 24 hours in neurological patient* vs. 15)	1.24 (1.04;1.44)	/	
GCS (Not evaluable in the first 24 hours in NON-neurological patient* vs. 15)	0.57 (0.44;0.7)	/	
Neurologic failure (Cerebral coma vs. None or Not evaluable in the first 24 hours)	0.25 (0.09;0.42)	/	
Neurologic failure (Metabolic coma vs. None or Not evaluable in the first 24 hours)	-0.56 (-0.77;-0.36)	/	
Neurologic failure (Postanoxic coma vs. None or Not evaluable in the first 24 hours)	0.38 (0.04;0.71)	/	×
Neurologic failure (Toxic coma vs. None or Not evaluable in the first 24 hours)	-0.95 (-1.46;-0.43)	/	
Cardiogenic shock (Yes vs. No)	0.35 (0.23;0.47)	1.42 (1.26;1.6)	<0.001
Neurogenic shock (Yes vs. No)	0.94 (0.62;1.27)	2.57 (1.85;3.56)	<0.001
Non shock (Yes vs. No)	0.17 (0.05;0.29)	1.19 (1.05;1.34)	0.005
Haemorrhagic-Hypovolemic shock (Yes vs. No)	0.14 (-0.01;0.29)	1.15 (0.99;1.34)	0.069
Hypovolemic (non-haemorrhagic) shock (Yes vs. No)	0.05 (-0.14;0.23)	/	×
Renal failure (AKIN) (Mild vs. None)	0.09 (-0.01;0.19)	/	
Renal failure (AKIN) (Moderate vs. None)	0.48 (0.33;0.63)	/	×
Renal failure (AKIN) (Severe vs. None)	0.78 (0.59;0.97)	/	
Respiratory failure (Only hypoxic failure vs. None)	0.32 (0.22;0.41)	/	
Respiratory failure (Only hypercapnic failure vs. None)	0.26 (0.1;0.41)	/	×
Respiratory failure (Intubation for airway maint. vs. None)	0.42 (0.32;0.51)	/	
Metabolic failure (pH <= 7.3, PaCO2 < 45 mmHg vs. None)	0.44 (0.33;0.55)	/	
Metabolic failure (gsubi"" formato("metabolicFail", "baseMetaFail") vs. None)	0.23 (0.14;0.32)	/	×
Surgical and non surgical procedures			
Peripheral vascular surgery (Yes vs. No)	0.35 (0.09;0.61)	1.42 (1.1;1.84)	0.009
Gastrointestinal surgery (Yes vs. No)	0.31 (0.19;0.43)	1.36 (1.2;1.53)	<0.001
Pancreatic surgery (Yes vs. No)	0.54 (0.19;0.88)	1.71 (1.21;2.41)	0.003
Interactions among independent variables			
GCS (10,11,12,Not evaluable in the first 24 hours in NON-neurological patient*) × Heart rate (bpm) (>120)	-0.35 (-0.52;-0.17)	/	<0.001
GCS (Not evaluable in the first 24 hours in neurological patient*) × Heart rate (bpm) (<70)	0.49 (0.19;0.78)	/	
GCS (3,4) × Serum urea (mg/100 ml) (60-180)	-0.27 (-0.49;-0.04)	/	
GCS (3,4) × Serum urea (mg/100 ml) (>180)	-1.05 (-1.56;-0.55)	/	<0.001
GCS (3,4) × PaO2/FiO2 (100*mmHg%) (200-300)	-0.33 (-0.58;-0.08)	/	
GCS (10,11,12,Not evaluable in the first 24 hours in NON-neurological patient*) × PaO2/FiO2 (100*mmHg%) (200-300)	0.21 (0.05;0.36)	/	
GCS (3,4) × PaO2/FiO2 (100*mmHg%) (100-200)	-0.76 (-1.02;-0.5)	/	
GCS (5,6,7,8,9,Not evaluable in the first 24 hours in neurological patient*) × PaO2/FiO2 (100*mmHg%) (100-200)	-0.28 (-0.45;-0.11)	/	<0.001
GCS (3,4,5,6,Not evaluable in the first 24 hours in neurological patient*) × PaO2/FiO2 (100*mmHg%) (<100)	-1.15 (-1.51;-0.79)	/	<0.001
GCS (7,8,9,13,14) × PaO2/FiO2 (100*mmHg%) (<100)	-0.63 (-0.93;-0.32)	/	
GCS (10,11,12,Not evaluable in the first 24 hours in NON-neurological patient*) × PaO2/FiO2 (100*mmHg%) (<100)	-0.32 (-0.59;-0.05)	/	
Pneumonia × Renal failure (AKIN) (Severe)	-0.42 (-0.7;-0.15)	/	0.002
GCS (3,4,5,6) × Dementia	-0.53 (-0.9;-0.16)	/	0.005
ARDS × Infection severity on admission (Septic shock)	-0.57 (-0.94;-0.2)	/	0.003
Infection severity on admission (Infection with or without SIRS) × Renal failure (AKIN) (Severe)	-0.36 (-0.72;0.01)	/	
Infection severity on admission (Severe sepsis,Septic shock) × Renal failure (AKIN) (Moderate)	-0.27 (-0.46;-0.07)	/	0.002
Respiratory failure (Only hypercapnic failure) × Neurologic failure (Cerebral coma)	-0.82 (-1.51;-0.14)	/	0.016
GCS (3,4,5,6) × Head trauma with skull fracture	0.75 (0.23;1.26)	/	0.004
Max(Age - 41, 0) in decades × Head trauma without skull fracture	0.14 (0.03;0.24)	/	0.008
Max(Age - 41, 0) in decades × Neurologic failure (Postianoxic coma)	-0.15 (-0.25;-0.06)	/	0.002
GCS (3,4,Not evaluable in the first 24 hours in neurological patient*) × Infection severity on admission (Infection with or without SIRS)	-0.47 (-0.8;-0.15)	/	0.004
MAP (mmHg) (<70) × Gastrointestinal bleeding: upper tract	-0.79 (-1.25;-0.32)	/	<0.001
GCS (3,4) × Spontaneous Intraparenchymal bleeding	0.76 (0.42;1.11)	/	<0.001
Surgical status (Non surgical) × Infection severity on admission (Severe sepsis)	-0.93 (-1.44;-0.42)	/	0.002
Surgical status (Emergency surgical) × Infection severity on admission (Severe sepsis)	-0.84 (-1.38;-0.3)	/	
Hypovolemic (non-haemorrhagic) shock × Metabolic failure (pH <= 7.3, PaCO2 < 45 mmHg)	-0.48 (-0.91;-0.04)	/	0.032
MAP (mmHg) (<70) × Cardiac arrest	-0.45 (-0.69;-0.2)	/	<0.001
GCS (3,4,Not evaluable in the first 24 hours in neurological patient*,Not evaluable in the first 24 hours in NON-neurological patient*) × Ward of admission (Emergency room)	0.28 (0.15;0.42)	/	<0.001

Dependent variable explained

Likelihood Ratio Test: 11570  
 Degree of freedom: 139  
 p-value: <0.0001

Goodness-of-fit

Area under the ROC curve: 0.851  
 GIVITI Calibration Test: 1.71  
 p-value: 0.191  
 Polynomial Degree: 2

\* A neurological patient is a one with an altered consciousness, probably due to a direct brain injury. It is defined by the presence of at least one of these clinical conditions on admission: Cerebral artery stroke, Vertebral basilar ischemic stroke, Intracranial hypertension, Spontaneous Hydrocephalus, Non traumatic cerebral oedema, Metabolic-postanoxic encephalopathy, Seizures, Brain tumour, Cerebral Aneurysm, AVM (Arterio Venous Malformation), Chronic Subdural haematoma, Spontaneous Subarachnoid haemorrhage, Spontaneous Intraparenchymal bleeding, CNS degenerative disease, Brain and skull malformations, Cerebral contusion/laceration, Traumatic diffuse injury without oedema, Traumatic diffuse injury with oedema, Extradural/epidural haematoma, Traumatic Subdural haematoma, Traumatic intraparenchymal bleeding, Traumatic subarachnoid haemorrhage, Skull fracture, NON-surgical CNS infection, Post-surgical CNS infection, Ventriculostomy-related CNS infection.

× See interaction significance.

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**National report for general ICUs - Year 2014**  
**Prognostic models - Adult patients with LOS<24 hours**

**Model:** Logistic regression.  
**Dependent variable:** Hospital mortality\*.  
**Sample used for model development:** Patients with LOS<24 hours from general Italian ICUs.  
**Sample size:** 13807 patients.

Independent variables	Coefficients (95% CI)	Odds Ratio (95% CI)	p
Intercept	-6.88 (-7.51;-6.26)	/	/
<b>Miscellanea</b>			
Max(Min(Age, 86), 36) (in decades)	0.39 (0.32;0.46)	1.48 (1.38;1.59)	<0.001
Max(Age - 86, 0) (in decades)	0.95 (0.43;1.47)	2.58 (1.53;4.34)	
Min(BMI - 24, 0)	-0.09 (-0.13;-0.05)	0.91 (0.88;0.95)	<0.001
Surgical status (Non surgical vs. Elective surgical)	0.65 (0.26;1.05)	1.92 (1.29;2.85)	<0.001
Surgical status (Emergency surgical vs. Elective surgical)	0.59 (0.36;0.82)	1.8 (1.44;2.26)	
Stay before ICU (days) (logarithm)	0.32 (0.24;0.39)	1.37 (1.27;1.48)	<0.001
Operating theatre (Yes vs. No)	-0.79 (-1.16;-0.42)	0.45 (0.31;0.66)	<0.001
Ward of admission: High dependency care unit vs. Other ward	0.77 (0.13;1.4)	2.15 (1.14;4.07)	0.021
<b>Physiopathological components</b>			
Heart rate (bpm) (<40 vs. 40-119)	1.01 (0.51;1.52)	2.75 (1.66;4.56)	<0.001
Heart rate (bpm) (>=120 vs. 40-119)	0.33 (0.08;0.59)	1.4 (1.08;1.8)	
WBC (10 <sup>9</sup> /L) (>20 vs. <=20)	0.61 (0.34;0.89)	/	x
HCO3 (mEq/L) (<15 vs. >=20)	0.62 (0.27;0.97)	1.85 (1.32;2.63)	
HCO3 (mEq/L) (15-19 vs. >=20)	0.23 (0.01;0.44)	1.26 (1.01;1.56)	0.002
Platelets (10 <sup>9</sup> /mm3) (<100 vs. >=100)	0.65 (0.37;0.93)	1.92 (1.44;2.55)	<0.001
Systolic Blood Pressure (mmHg) (<70 vs. >=100)	0.66 (0.24;1.08)	/	x
Systolic Blood Pressure (mmHg) (70-99 vs. >=100)	0.14 (-0.11;0.38)	/	
Urine Output (L/24h) (<0.2 vs. >=1)	1.45 (0.99;1.9)	/	
Urine Output (L/24h) (0.2-0.49 vs. >=1)	0.95 (0.58;1.32)	/	x
Urine Output (L/24h) (0.5-0.99 vs. >=1)	0.6 (0.38;0.82)	/	
PaO2/FiO2 (100*mmHg/%) (100-199 vs. >=200)	0.38 (0.16;0.59)	1.46 (1.17;1.81)	<0.001
PaO2/FiO2 (100*mmHg/%) (<100 vs. >=200)	1.38 (0.92;1.84)	3.99 (2.52;6.33)	
<b>Clinical conditions on admission</b>			
Spontaneous Intraparenchymal bleeding (Yes vs. No)	0.90 (0.43;1.37)	2.46 (1.54;3.94)	<0.001
Nephro-urological disease (Yes vs. No)	-0.52 (-0.93;-0.11)	0.59 (0.39;0.9)	0.011
Ruptured or fissured aneurysm (Yes vs. No)	1.06 (0.46;1.66)	2.88 (1.58;5.24)	<0.001
Pleural effusion (Yes vs. No)	0.87 (0.33;1.41)	2.39 (1.39;4.1)	0.002
Acute intoxication (Yes vs. No)	-1.45 (-2.33;-0.58)	0.23 (0.10;0.56)	<0.001
Bowel ischaemia (Yes vs. No)	0.82 (0.20;1.45)	2.28 (1.22;4.25)	0.011
Seizures (Yes vs. No)	-1.29 (-2.00;-0.58)	0.27 (0.14;0.56)	<0.001
Acute severe arrhythmia: bradycardias (Yes vs. No)	-1.54 (-2.43;-0.64)	0.22 (0.09;0.53)	<0.001
Peritonitis (Yes vs. No)	0.69 (0.18;1.2)	1.99 (1.2;3.32)	0.009
Infection severity on admission (Severe sepsis vs. Infection with or without SIRS or None)	-0.03 (-0.56;0.5)	/	x
Infection severity on admission (Septic shock vs. Infection with or without SIRS or None)	0.57 (0.05;1.09)	/	
<b>Comorbidities</b>			
Metastatic cancer (Yes vs. No)	1.02 (0.75;1.28)	2.76 (2.12;3.61)	<0.001
Dementia (Yes vs. No)	0.63 (0.29;0.98)	1.88 (1.33;2.66)	<0.001
Hypertension (Yes vs. No)	-0.23 (-0.4;-0.06)	0.80 (0.67;0.94)	0.009
Arrhythmia (Yes vs. No)	0.34 (0.14;0.54)	1.40 (1.15;1.71)	<0.001
Malignant haematological disease (Yes vs. No)	0.91 (0.39;1.43)	2.49 (1.48;4.19)	0.001
Moderate or severe liver disease (Yes vs. No)	0.9 (0.46;1.35)	2.47 (1.59;3.84)	<0.001
<b>Organ failures</b>			
GCS (3,4 vs. 15)	3.67 (3.24;4.14)	/	
GCS (5-10 vs. 15)	1.28 (0.94;1.62)	/	
GCS (11-14 vs. 15)	0.42 (0.19;0.66)	/	x
GCS (Not evaluable in the first 24 hours in neurological patient* vs. 15)	1.91 (1.44;2.38)	/	
GCS (Not evaluable in the first 24 hours in NON-neurological patient* vs. 15)	0.7 (0.4;0.99)	/	
Cardiovascular failure (Yes vs. No)	0.50 (0.24;0.76)	1.65 (1.27;2.15)	<0.001
Metabolic failure (Yes vs. No)	0.44 (0.2;0.68)	1.55 (1.22;1.97)	<0.001
Neurologic failure (Postanoxic coma or Toxic coma vs. None)	-1.29 (-1.84;-0.75)	0.27 (0.16;0.47)	<0.001
Renal failure (AKIN) (Moderate or Severe vs. None)	0.46 (0.16;0.76)	1.59 (1.18;2.14)	0.002
Respiratory failure (Yes vs. No)	0.37 (0.16;0.58)	1.44 (1.17;1.78)	<0.001
<b>Surgical and non surgical procedures</b>			
Gastrointestinal surgery (Yes vs. No)	0.57 (0.35;0.8)	1.78 (1.42;2.23)	<0.001
Pancreatic surgery (Yes vs. No)	0.85 (0.29;1.42)	2.35 (1.34;4.12)	0.006
<b>Interactions among independent variables</b>			
WBC (10 <sup>9</sup> /L) (>20) x Infection severity on admission (Severe sepsis)	-1.21 (-2.36;-0.06)	/	0.036
GCS (3-10, Not evaluable in the first 24 hours in neurological patient* or Not evaluable in the first 24 hours in NON-neurological patient*) x Systolic Blood Pressure (mmHg) (70-99)	0.77 (0.36;1.18)	/	<0.001
GCS (3-10, Not evaluable in the first 24 hours in neurological patient* or Not evaluable in the first 24 hours in NON-neurological patient*) x Systolic Blood Pressure (mmHg) (<70)	1.27 (0.71;1.84)	/	<0.001
Systolic Blood Pressure (mmHg) (<70) x Urine Output (L/24h) (<0.2)	1.19 (0.34;2.04)	/	0.003

**Dependent variable explained**

Likelihood ratio test: 9289.2  
 Degree of freedom: 54  
 p-value: <0.0001

**Goodness-of-fit**

Area under the ROC curve: 0.961  
 GiVITI Calibration Test: 0.286  
 p-value: 0.593  
 Polynomial Degree: 2

\* For patients transferred to other ICU or to rehabilitation/high dependency care unit in other hospital, it is considered the outcome at the last hospital discharge.

x See interaction significance.

\* A neurological patient is a one with an altered consciousness, probably due to a direct brain injury. It is defined by the presence of at least one of these clinical conditions on admission: Cerebral artery stroke, Vertebral basilar ischemic stroke, Intracranial hypertension, Spontaneous Hydrocephalus, Non traumatic cerebral oedema, Metabolic/postanoxic encephalopathy, Seizures, Brain tumour, Cerebral Aneurysm, AVM (ArterioVenous Malformation), Chronic Subdural haematoma, Spontaneous Subarachnoid haemorrhage, Spontaneous Intraparenchymal bleeding, CNS degenerative disease, Brain and skull malformations, Cerebral contusion/laceration, Traumatic diffuse injury without oedema, Traumatic diffuse injury with oedema, Extradural/epidural haematoma, Traumatic Subdural haematoma, Traumatic intraparenchymal bleeding, Traumatic subarachnoid haemorrhage, Skull fracture, NON-surgical CNS infection, Post-surgical CNS infection, Ventriculostomy-related CNS infection.

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**National report for general ICUs - Year 2015**  
**Prognostic models - Adult patients with LOS<sub>≥</sub>24 hours**

**Model:** Logistic regression.  
**Dependent variable:** Hospital mortality.  
**Sample used for model development:** Patients with LOS<sub>≥</sub>24 hours from general Italian ICUs.  
**Sample size:** 31883 patients.

Independent variables	Coefficients (95% CI)	Odds Ratio (95% CI)	p
Intercept	-6.62 (-6.95;-6.29)	/	/
<b>Miscellanea</b>			
Max(Min(Age,72),25) in decades	0.36 (0.32;0.4)	/	x
Max(Age-72,0) in decades	0.51 (0.44;0.58)	/	/
Min((BMI - 28)/10, 0) <sup>2</sup>	0.59 (0.48;0.7)	/	x
Max((BMI - 28)/10, 0) <sup>2</sup>	0.34 (0.19;0.49)	/	/
Surgical status (Non surgical vs. Elective surgical)	0.83 (0.67;0.98)	2.29 (1.96;2.67)	<0.001
Surgical status (Emergency surgical vs. Elective surgical)	0.31 (0.17;0.45)	1.36 (1.19;1.56)	<0.001
Stay before ICU (days) (logarithm)	0.32 (0.27;0.36)	1.37 (1.31;1.44)	<0.001
Admitted in hospital the same day of ICU admission (Yes vs. No)	0.08 (-0.03;0.19)	/	x
Admission source: Other ICU - Logistical/organizational reasons vs. Surgical ward	-0.52 (-0.73;-0.32)	/	/
Admission source: Emergency room vs. Surgical ward	0.03 (-0.09;0.15)	/	/
Admission source: Other hospital (Medical ward, High dependency care unit, Other ICU - Specialist expertise, Step-up care) vs. Surgical ward	0.06 (-0.12;0.24)	/	x
Admission source: Same hospital (Other ICU - Specialist expertise, Step-up care) vs. Surgical ward	0.66 (0.42;0.9)	/	/
Admission source: Same hospital (Medical ward, High dependency care unit) vs. Surgical ward	0.29 (0.17;0.41)	/	/
Admission source: Long-term chronic care hospital, Directly from the community vs. Surgical ward	0.33 (-0.08;0.73)	/	/
Reason for admission: Weaning vs. Ventilatory and cardiovascular support, Only ventilatory support	-0.34 (-0.5;-0.18)	0.71 (0.6;0.83)	<0.001
Reason for admission: Monitoring vs. Ventilatory and cardiovascular support, Only ventilatory support	-0.42 (-0.54;-0.3)	0.66 (0.58;0.74)	<0.001
Reason for admission: Only cardiovascular support vs. Ventilatory and cardiovascular support, Only ventilatory support	-0.35 (-0.51;-0.2)	0.7 (0.6;0.82)	<0.001
Sex: Female vs. Male	-0.05 (-0.12;0.01)	/	x
<b>Physiopathological components</b>			
Bilirubin (mg/100ml) (1.2-4 vs. <1.2)	0.04 (-0.05;0.13)	/	x
Bilirubin (mg/100ml) (≥4 vs. <1.2)	0.78 (0.51;1.05)	/	x
WBC (10 <sup>9</sup> /L) (<1 vs. 1-20)	0.06 (-0.19;0.31)	/	x
WBC (10 <sup>9</sup> /L) (≥20 vs. 1-20)	0.35 (0.21;0.49)	/	x
Sodium (mEq/L) (≥145 vs. <145)	0.31 (0.22;0.41)	1.37 (1.25;1.5)	<0.001
Platelets (10 <sup>9</sup> /mm3) (50-99 vs. ≥100)	0.4 (0.3;0.51)	/	/
Platelets (10 <sup>9</sup> /mm3) (20-49 vs. ≥100)	0.64 (0.45;0.82)	/	x
Platelets (10 <sup>9</sup> /mm3) (<20 vs. ≥100)	1.45 (1.11;1.78)	/	x
Urine Output (L/24h) (<0.2 vs. ≥1)	0.72 (0.54;0.91)	/	x
Urine Output (L/24h) (0.2-0.49 vs. ≥1)	0.47 (0.32;0.63)	/	x
Urine Output (L/24h) (0.5-0.99 vs. ≥1)	0.27 (0.17;0.36)	/	/
Serum urea (mg/100 ml) (≥60 vs. <60)	0.3 (0.21;0.38)	/	x
PaO <sub>2</sub> /FIO <sub>2</sub> (100*mmHg/%) (200-299 vs. ≥300)	0.2 (0.11;0.28)	/	/
PaO <sub>2</sub> /FIO <sub>2</sub> (100*mmHg/%) (100-199 vs. ≥300)	0.38 (0.29;0.48)	/	x
PaO <sub>2</sub> /FIO <sub>2</sub> (100*mmHg/%) (<100 vs. ≥300)	1.31 (1.11;1.52)	/	x
Heart rate (bpm) (<70 vs. 70-119)	-0.04 (-0.13;0.05)	/	x
Heart rate (bpm) (≥120 vs. 70-119)	0.14 (0.05;0.23)	/	x
Systolic Blood Pressure (mmHg) (<70 vs. ≥100)	0.66 (0.54;0.78)	/	x
Systolic Blood Pressure (mmHg) (70-99 vs. ≥100)	0.3 (0.21;0.38)	/	x
<b>Clinical conditions on admission</b>			
Acute intoxication (Yes vs. No)	-0.89 (-1.22;-0.56)	0.41 (0.3;0.57)	<0.001
Spontaneous Intraparenchymal bleeding (Yes vs. No)	-0.12 (-0.43;0.19)	/	x
ALI/ARDS (Yes vs. No)	0.39 (0.22;0.55)	/	x
Lung cancer (Yes vs. No)	0.76 (0.39;1.12)	/	x
Acute pancreatitis (Yes vs. No)	0.41 (0.13;0.69)	1.51 (1.14;2)	0.005
Seizures (Yes vs. No)	-0.17 (-0.45;0.11)	/	x
Bowel ischaemia (Yes vs. No)	0.43 (0.19;0.67)	1.54 (1.21;1.96)	0.001
Spontaneous Subarachnoid haemorrhage (Yes vs. No)	0.64 (0.34;0.94)	/	x
Cardiac arrest (Yes vs. No)	0.56 (0.35;0.78)	/	x
Cerebral artery stroke (Yes vs. No)	0.49 (0.31;0.68)	1.63 (1.36;1.97)	<0.001
Left heart failure with pulmonary edema (Yes vs. No)	-0.65 (-0.81;-0.49)	/	x
Metabolic disorder (Yes vs. No)	-0.22 (-0.35;-0.09)	0.81 (0.71;0.92)	0.001
Brain tumour (Yes vs. No)	0.45 (0.1;0.8)	1.57 (1.11;2.23)	0.013
Systemic hypertensive crisis (Yes vs. No)	-0.67 (-1.08;-0.26)	0.51 (0.34;0.77)	0.001
Intracranial hypertension (Yes vs. No)	0.9 (0.41;1.39)	2.46 (1.51;4.01)	<0.001
Other disease (Yes vs. No)	-0.28 (-0.46;-0.1)	0.76 (0.63;0.91)	0.002
Urinary tract infection (Yes vs. No)	0.21 (-0.49;0.07)	/	x
Cholecystitis/cholangitis (Yes vs. No)	-0.56 (-0.83;-0.28)	0.57 (0.44;0.75)	<0.001
Endocarditis (Yes vs. No)	0.85 (0.37;1.33)	2.34 (1.45;3.79)	0.001
Peritonitis (Post-surgical or secondary vs. None or primary)	0.33 (0.17;0.5)	/	/
Peritonitis (Tertiary vs. None or primary)	0.88 (0.2;1.56)	/	x
Infection severity on admission (Infection with or without SIRS vs. None)	0.02 (-0.1;0.13)	/	/
Infection severity on admission (Severe sepsis vs. None)	0.08 (-0.03;0.2)	/	x
Infection severity on admission (Septic shock vs. None)	0.49 (0.23;0.74)	/	/
Other injuries of the chest (Yes vs. No)	-0.44 (-0.73;-0.15)	0.64 (0.48;0.86)	0.002
Traumatic Subdural haematoma (Yes vs. No)	0.42 (0.11;0.73)	1.52 (1.12;2.07)	0.008
Skull fracture (Yes vs. No)	0.57 (0.24;0.9)	1.77 (1.27;2.46)	0.001
Maxillofacial fracture (Yes vs. No)	-0.53 (-0.87;-0.18)	0.59 (0.42;0.83)	0.002
Head trauma (Yes vs. No)	-0.76 (-1.15;-0.38)	/	x

\* For patients transferred to other ICU or to rehabilitation/high dependency care unit in other hospital, it is considered the outcome at the last hospital discharge.  
 x See interaction significance.

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Comorbidities			
Severe COPD (Yes vs. No)	0.42 (0.31;0.54)	/	×
Dementia (Yes vs. No)	0.53 (0.38;0.68)	/	×
Malignant haematological disease (Yes vs. No)	0.79 (0.54;1.04)	/	×
Restrictive lung disease (Yes vs. No)	0.46 (0.29;0.63)	1.58 (1.33;1.88)	<0.001
Hypertension (Yes vs. No)	0 (-0.08;0.09)	/	×
Immunosuppression or AIDS (Yes vs. No)	0.34 (0.14;0.54)	1.41 (1.15;1.72)	0.001
Any tumour without metastasis (Yes vs. No tumor)	0.17 (0.07;0.28)	/	×
Metastatic cancer (Yes vs. No tumor)	3.72 (2.57;4.87)	/	×
NYHA class II-III (Yes vs. None)	0.06 (-0.05;0.18)	/	×
NYHA class IV (Yes vs. None)	0.48 (0.28;0.69)	/	×
Mild liver disease (Yes vs. No liver disease)	0.3 (0.09;0.51)	/	×
Moderate or severe liver disease (Yes vs. No liver disease)	0.83 (0.61;1.07)	/	×
Diabetes with insulin treatment (Yes vs. No)	0.15 (0.04;0.27)	/	×
Organ failures			
GCS (3,4 vs. 15)	2.36 (2.14;2.58)	/	×
GCS (5,6 vs. 15)	1.58 (1.36;1.8)	/	×
GCS (7,8,9 vs. 15)	0.93 (0.78;1.08)	/	×
GCS (10 vs. 15)	0.41 (0.2;0.62)	/	×
GCS (11,12,13,14 vs. 15)	0.27 (0.17;0.36)	/	×
GCS (Not evaluable in the first 24 hours in neurological patient* vs. 15)	1.24 (1.05;1.42)	/	×
GCS (Not evaluable in the first 24 hours in NON-neurological patient* vs. 15)	0.68 (0.58;0.78)	/	×
Neurologic failure (Cerebral coma vs. None or Not evaluable in the first 24 hours)	0.11 (-0.11;0.33)	/	×
Neurologic failure (Postanoxic coma vs. None or Not evaluable in the first 24 hours)	2.27 (1.44;3.11)	/	×
Neurologic failure (Metabolic coma, Toxic coma vs. None or Not evaluable in the first 24 hours)	-0.54 (-0.73;-0.34)	/	×
Cardiovascular failure (Yes vs. No)	0.19 (0.05;0.33)	/	×
Cardiovascular failure (Hypovolemic (non-haemorrhagic) shock, Cardiogenic shock vs. (other))	-0.06 (-0.24;0.12)	/	×
Cardiogenic shock (Yes vs. No)	0.67 (0.42;0.91)	/	×
Neurogenic shock (Yes vs. No)	1.03 (0.69;1.36)	/	×
Metabolic failure (Yes vs. No)	0.23 (0.15;0.31)	1.26 (1.16;1.36)	<0.001
Renal failure (AKIN) (Mild vs. None)	0.14 (0.04;0.23)	/	×
Renal failure (AKIN) (Moderate vs. None)	0.71 (0.51;0.91)	/	×
Renal failure (AKIN) (Severe vs. None)	0.75 (0.5;1)	/	×
Hepatic failure (Yes vs. No)	0.62 (0.29;0.95)	1.85 (1.33;2.58)	<0.001
Surgical and non surgical procedures			
Gastrointestinal surgery (Yes vs. No)	0.31 (0.19;0.44)	1.37 (1.21;1.55)	<0.001
Abdominal vascular surgery (Yes vs. No)	-4.4 (-7.8;-1)	/	×
Interventional cardiology (Yes vs. No)	-2.62 (-4.03;-1.22)	/	×
Interactions among independent variables			
GCS (3,4) × Urine Output (L/24h) (0.2-0.49)	-0.66 (-1.08;-0.23)	/	×
GCS (7,8,9) × Urine Output (L/24h) (<0.2)	0.61 (0.18;1.03)	/	<0.001
GCS (10) × Urine Output (L/24h) (0.5-0.99)	0.78 (0.32;1.24)	/	×
GCS (3,4,5,6) × PaO2/FiO2 (100*mmHg%) (100-199)	-0.44 (-0.63;-0.25)	/	<0.001
GCS (3,4,5,6) × PaO2/FiO2 (100*mmHg%) (<100)	-0.67 (-0.99;-0.35)	/	<0.001
Serum urea (mg/100 ml) (>=60) × PaO2/FiO2 (100*mmHg%) (<100)	-0.39 (-0.6;-0.17)	/	<0.001
GCS (3,4,5,6,7,8,9) × Admission source (Other hospital - Medical ward, High dependency care unit; Other ICU - Specialist expertise, Step-up care)	-0.6 (-0.89;-0.31)	/	<0.001
GCS (3,4) × Admission source (Same hospital - Medical ward, High dependency care unit)	-0.57 (-0.84;-0.3)	/	<0.001
GCS (3,4, Not evaluable in the first 24 hours in neurological patient*) × Spontaneous Intraparenchymal bleeding	0.8 (0.48;1.11)	/	<0.001
GCS (3,4,5,6,7,8,9) × Infection severity on admission (Infection with or without SIRS, Severe sepsis)	-0.35 (-0.53;-0.18)	/	<0.001
Systolic Blood Pressure (mmHg) (<100) × Infection severity on admission (Septic shock)	-0.42 (-0.68;-0.17)	/	0.001
Sex (Male) × Head trauma	0.53 (0.21;0.85)	/	0.001
Sex (Male) × Spontaneous Subarachnoid haemorrhage	0.58 (0.16;1.01)	/	0.007
GCS (3,4) × Head trauma	0.68 (0.32;1.03)	/	<0.001
Max(Age - 72, 0) in decades × Head trauma	0.74 (0.46;1.02)	/	<0.001
Max(Min(Age-72), 25) in decades × Max(BMI - 28)/10, 0) <sup>2</sup>	-0.05 (-0.07;-0.02)	/	<0.001
Max(Min(Age-72), 25) in decades × Metastatic cancer	-0.41 (-0.58;-0.24)	/	<0.001
Max(Min(Age-72), 25) in decades × Neurologic failure (Postanoxic coma)	-0.35 (-0.48;-0.23)	/	<0.001
Max(Min(Age-72), 25) in decades × Interventional cardiology	0.33 (0.12;0.54)	/	0.001
Max(Min(Age-72), 25) in decades × Abdominal vascular surgery	0.69 (0.21;1.17)	/	0.002
Admitted in hospital the same day of ICU admission × Spontaneous Intraparenchymal bleeding	0.82 (0.49;1.14)	/	<0.001
Admitted in hospital the same day of ICU admission × Seizures	-0.68 (-1.1;-0.25)	/	0.002
Admitted in hospital the same day of ICU admission × Neurologic failure (Cerebral coma)	0.35 (0.13;0.57)	/	0.002
Admitted in hospital the same day of ICU admission × Cardiogenic shock	0.26 (0.04;0.47)	/	0.021
GCS (3,4) × Dementia	-0.62 (-1.05;-0.18)	/	0.007
Dementia × Peritonitis (Post-surgical or secondary)	-0.77 (-1.34;-0.21)	/	0.007
Dementia × ALI/ARDS	-1.11 (-1.92;-0.3)	/	0.006
Cardiovascular failure × Admission source (Other ICU - Logistical/organizational reasons)	0.63 (0.24;1.01)	/	0.001
Cardiovascular failure × PaO2/FiO2 (100*mmHg%) (<100)	-0.48 (-0.69;-0.26)	/	<0.001
Cardiovascular failure × Cardiac arrest	-0.5 (-0.76;-0.24)	/	<0.001
Cardiovascular failure × Hypertension	-0.25 (-0.38;-0.12)	/	<0.001
Cardiovascular failure × Neurologic failure (Cerebral coma)	-0.32 (-0.56;-0.08)	/	0.010
Cardiovascular failure × Bilirubin (mg/100ml) (>=4)	-0.54 (-0.89;-0.18)	/	0.003
Cardiovascular failure × Urinary tract infection	-0.64 (-1.0;-0.29)	/	<0.001
Cardiovascular failure × NYHA class II-III, NYHA class IV	0.39 (0.2;0.58)	/	<0.001
Cardiovascular failure × Malignant haematological disease	-0.42 (-0.79;-0.06)	/	0.025
WBC (10 <sup>9</sup> /L) (>20) × Neurogenic shock	-1.14 (-1.91;-0.38)	/	0.003
ALI/ARDS × Cardiogenic shock	-0.96 (-1.46;-0.46)	/	<0.001
Cardiogenic shock × Heart rate (bpm) (<70)	-0.35 (-0.61;-0.09)	/	0.001
Cardiogenic shock × Heart rate (bpm) (>=120)	-0.43 (-0.68;-0.17)	/	0.001
Cardiogenic shock × NYHA class II-III	-0.38 (-0.65;-0.11)	/	0.007

\* A neurological patient is a one with an altered consciousness, probably due to a direct brain injury. It is defined by the presence of at least one of these clinical conditions on admission: Cerebral artery stroke, Vertebral basilar ischemic stroke, Intracranial hypertension, Spontaneous Hydrocephalus, Non traumatic cerebral oedema, Metabolic/postanoxic encephalopathy, Seizures, Brain tumour, Cerebral Aneurysm, AVM (Arterio Venous Malformation), Chronic Subdural haematoma, Spontaneous Subarachnoid haemorrhage, Spontaneous Intraparenchymal bleeding, CNS degenerative disease, Brain and skull malformations, Cerebral contusion/laceration, Traumatic diffuse injury without oedema, Traumatic diffuse injury with oedema, Extradural/epidural haematoma, Traumatic Subdural haematoma, Traumatic intraparenchymal bleeding, Traumatic subarachnoid haemorrhage, Skull fracture, NON-surgical CNS infection, Post-surgical CNS infection, Ventriculostomy-related CNS infection.  
 × See interaction significance.

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Interactions among independent variables

Cardiovascular failure (Hypovolemic (non-haemorrhagic) shock, Cardiogenic shock) × Renal failure (AKIN) (Moderate)	-0.39 (-0.65;-0.13)	/	0.003
Bilirubin (mg/100ml) (>=1.2) × Renal failure (AKIN) (Severe)	0.45 (0.24;0.67)	/	<0.001
Serum urea (mg/100 ml) (>=60) × Renal failure (AKIN) (Moderate, Severe)	-0.34 (-0.54;-0.13)	/	0.002
GCS (3,4) × Severe COPD	-0.64 (-1.05;-0.23)	/	0.002
Severe COPD × Diabetes with insulin treatment	0.51 (0.21;0.8)	/	0.001
Heart rate (bpm) (<70) × Mild liver disease	-0.92 (-1.43;-0.41)	/	<0.001
Urinary tract infection × Mild liver disease	1.36 (0.46;2.27)	/	0.003
Max(Age-72),0) in decades × Moderate or severe liver disease	-0.61 (-1.09;-0.13)	/	0.012
Platelets (10 <sup>9</sup> /mm <sup>3</sup> ) (20-49) × Moderate or severe liver disease	-0.51 (-1;-0.03)	/	0.040
WBC (10 <sup>9</sup> /L) (>20) × Platelets (10 <sup>9</sup> /mm <sup>3</sup> ) (<20)	-1.09 (-1.78;-0.41)	/	0.002
WBC (10 <sup>9</sup> /L) (>20) × Systolic Blood Pressure (mmHg) (<100)	-0.3 (-0.47;-0.12)	/	0.001
WBC (10 <sup>9</sup> /L) (>20) × Platelets (10 <sup>9</sup> /mm <sup>3</sup> ) (<20)	-1.09 (-1.78;-0.41)	/	0.002
WBC (10 <sup>9</sup> /L) (>20) × Left heart failure with pulmonary edema	0.51 (0.16;0.87)	/	0.005
WBC (10 <sup>9</sup> /L) (>20) × Lung cancer	1.95 (0.8;3.09)	/	<0.001

Dependent variable explained

Likelihood Ratio Test: 11351  
 Degree of freedom: 155  
 p-value: <0.0001

Goodness-of-fit

Area under the ROC curve: 0.856  
 GiVTI Calibration Test: 2.59  
 p-value: 0.107  
 Polynomial Degree: 2

\* A neurological patient is a one with an altered consciousness, probably due to a direct brain injury. It is defined by the presence of at least one of these clinical conditions on admission: Cerebral artery stroke, Vertebral basilar ischemic stroke, Intracranial hypertension, Spontaneous Hydrocephalus, Non traumatic cerebral oedema, Metabolic/postanoxic encephalopathy, Seizures, Brain tumour, Cerebral Aneurysm, AVM (ArterioVenous Malformation), Chronic Subdural haematoma, Spontaneous Subarachnoid haemorrhage, Spontaneous Intraparenchymal bleeding, CNS degenerative disease, Brain and skull malformations, Cerebral contusion/laceration, Traumatic diffuse injury without oedema, Traumatic diffuse injury with oedema, Extradural/epidural haematoma, Traumatic Subdural haematoma, Traumatic intraparenchymal bleeding, Traumatic subarachnoid haemorrhage, Skull fracture, NON-surgical CNS infection, Post-surgical CNS infection, Ventriculostomy-related CNS infection.

× See interaction significance.

PROSAFE project

National report for general ICUs - Year 2015  
Prognostic models - Adult patients with LOS<24 hours

**Model:** Logistic regression.  
**Dependent variable:** Hospital mortality.<sup>o</sup>  
**Sample used for model development:** Patients with LOS<24 hours from general Italian ICUs.  
**Sample size:** 12586 patients.

Independent variables	Coefficients (95% CI)	Odds Ratio (95% CI)	p
Intercept	-7.22 (-7.77; -6.67)	/	/
<b>Miscellanea</b>			
Age (in decades)	0.04 (0.03;0.04)	1.04 (1.03;1.04)	<0.001
Mini(BMI - 28, 0)	-0.07 (-0.1;-0.05)	0.93 (0.91;0.96)	<0.001
Surgical status (Non surgical vs. Elective surgical)	1.34 (1.09;1.58)	3.82 (2.99;4.87)	<0.001
Surgical status (Emergency surgical vs. Elective surgical)	0.85 (0.62;1.09)	2.35 (1.86;2.97)	<0.001
Stay before ICU (days) (logarithm)	0.43 (0.35;0.51)	1.53 (1.41;1.66)	<0.001
Reason for admission: Monitoring/Wearing vs. Only ventilatory support	-0.61 (-0.84;-0.39)	/	/
Reason for admission: Ventilatory and cardiovascular support vs. Only ventilatory support	0.29 (-0.04;0.61)	/	x
Reason for admission: Only cardiovascular support vs. Only ventilatory support	-0.17 (-0.69;0.35)	/	/
<b>Physiopathological components</b>			
Bilirubin (mg/100ml) (>=1.2 vs. <1.2)	0.29 (0.08;0.51)	1.34 (1.08;1.67)	0.008
Heart rate (bpm) (<40 vs. 40-119)	0.93 (0.4;1.46)	2.54 (1.49;4.32)	<0.001
Heart rate (bpm) (>=120 vs. 40-119)	0.4 (0.15;0.65)	1.49 (1.16;1.91)	<0.001
HCO3 (mEq/L) (<15 vs. >=15)	0.46 (0.13;0.8)	1.59 (1.14;2.22)	0.006
Systolic Blood Pressure (mmHg) (<70 vs. >=100)	1.71 (1.32;2.09)	/	x
Systolic Blood Pressure (mmHg) (70-99 vs. >=100)	0.34 (0.13;0.54)	/	/
Urine Output (L/24h) (<0.2 vs. >=1)	1.07 (0.68;1.47)	/	x
Urine Output (L/24h) (0.2-0.49 vs. >=1)	0.57 (0.14;0.99)	/	x
Urine Output (L/24h) (0.5-0.99 vs. >=1)	0.23 (-0.03;0.48)	/	/
PaO2/FiO2 (100*mmHg%) (100-299 vs. >=300)	0.24 (0.06;0.42)	1.27 (1.07;1.52)	<0.001
PaO2/FiO2 (100*mmHg%) (<100 vs. >=300)	-1.17 (0.74;1.6)	3.21 (2.09;4.96)	<0.001
Sodium (mEq/L) (<125 vs. 125-145)	0.73 (0.04;1.41)	2.07 (1.04;4.11)	<0.001
Sodium (mEq/L) (>=145 vs. 125-145)	0.57 (0.25;0.88)	1.76 (1.29;2.41)	<0.001
Serum urea (mg/100 ml) (60-179 vs. <60)	0.27 (0.06;0.48)	/	/
Serum urea (mg/100 ml) (>=180 vs. <60)	-0.99 (-2.09;0.11)	/	x
Platelets (10 <sup>9</sup> /mm3) (50-99 vs. >=100)	0.67 (0.35;1)	/	/
Platelets (10 <sup>9</sup> /mm3) (<50 vs. >=100)	1.01 (0.49;1.53)	/	x
<b>Clinical conditions on admission</b>			
Spontaneous Intraparenchymal bleeding (Yes vs. No)	1.54 (1.06;2.01)	4.65 (2.89;7.48)	<0.001
Aneurysm (Non-ruptured aneurysm vs. No aneurysm)	-1.57 (-2.7;-0.45)	0.21 (0.07;0.64)	<0.001
Aneurysm (Ruptured or fissured aneurysm vs. No aneurysm)	0.81 (0.12;1.49)	2.24 (1.13;4.42)	<0.001
Coagulation disorder (Yes vs. No)	1.16 (0.49;1.82)	3.18 (1.63;6.2)	0.001
Digestive tract malignancy (Yes vs. No)	0.59 (0.31;0.88)	1.81 (1.37;2.4)	<0.001
Acute severe arrhythmia: bradycardias (Yes vs. No)	-1.85 (-2.79;-0.91)	0.16 (0.06;0.4)	<0.001
Lung cancer (Yes vs. No)	0.85 (0.32;1.38)	2.34 (1.38;3.97)	0.003
Bowel ischaemia (Yes vs. No)	0.86 (0.26;1.47)	2.37 (1.29;4.34)	0.006
Septic shock (Yes vs. No)	1.12 (0.59;1.65)	3.08 (1.81;5.23)	<0.001
Abdominal trauma (Yes vs. No)	1.2 (0.55;1.86)	3.33 (1.73;6.41)	0.001
<b>Comorbidities</b>			
Metastatic cancer (Yes vs. No)	0.91 (0.64;1.19)	2.49 (1.9;3.27)	<0.001
Mild liver disease (Yes vs. No liver disease)	-0.62 (-1.2;-0.05)	0.54 (0.3;0.95)	0.004
Moderate or severe liver disease (Yes vs. No liver disease)	0.56 (0.09;1.02)	1.75 (1.1;2.78)	
<b>Organ failures</b>			
GCS (3-4 vs. 15)	2.72 (2.34;3.1)	/	/
GCS (5-10 vs. 15)	0.64 (0.27;1)	/	/
GCS (11-14 vs. 15)	0.33 (0.07;0.58)	/	x
GCS (Not evaluable in the first 24 hours in neurological patient* vs. 15)	1.47 (1.02;1.93)	/	/
GCS (Not evaluable in the first 24 hours in NON-neurological patient* vs. 15)	0.69 (0.4;0.99)	/	/
Renal failure (Yes vs. No)	0.32 (0.09;0.56)	1.38 (1.09;1.75)	0.008
Metabolic failure (Yes vs. No)	0.32 (0.09;0.55)	1.38 (1.09;1.73)	0.008
Haemorrhagic-Hypovolemic shock (Yes vs. No)	-1.19 (-1.91;-0.47)	/	x
Neurogenic shock (Yes vs. No)	2.22 (1.05;3.39)	9.2 (2.86;29.64)	<0.001
<b>Interactions among independent variables</b>			
Serum urea (mg/100 ml) (>=180) × Platelets (10 <sup>9</sup> /mm3) (>=100)	1.94 (0.75;3.13)	/	0.002
GCS (5-10) × Urine Output (L/24h) (0.2-0.99)	0.91 (0.31;1.51)	/	0.003
GCS (Not evaluable in the first 24 hours in NON-neurological patient*) × Urine Output (L/24h) (<0.5)	1.34 (0.64;2.04)	/	<0.001
Systolic Blood Pressure (mmHg) (<70) × Intensive treatment (Only cardiovascular support)	-1.39 (-2.28;-0.51)	/	0.002
Urine Output (L/24h) (<0.2) × Systolic Blood Pressure (mmHg) (<70)	0.87 (0.08;1.66)	/	0.024
GCS (3-4) × Haemorrhagic-Hypovolemic shock	∞ <sup>§</sup>	/	<0.001
Urine Output (L/24h) (<1) × Haemorrhagic-Hypovolemic shock	1.59 (0.68;2.5)	/	<0.001

**Dependent variable explained**

Likelihood ratio test: 8340.5  
Degree of freedom: 54  
p-value: <0.0001

**Goodness-of-fit**

Area under the ROC curve: 0.957  
GIVITI Calibration Test: 2.26  
p-value: 0.132  
Polynomial Degree: 2

<sup>o</sup> For patients transferred to other ICU or to rehabilitation/high dependency care unit in other hospital, it is considered the outcome at the last hospital discharge.

<sup>x</sup> See interaction significance.

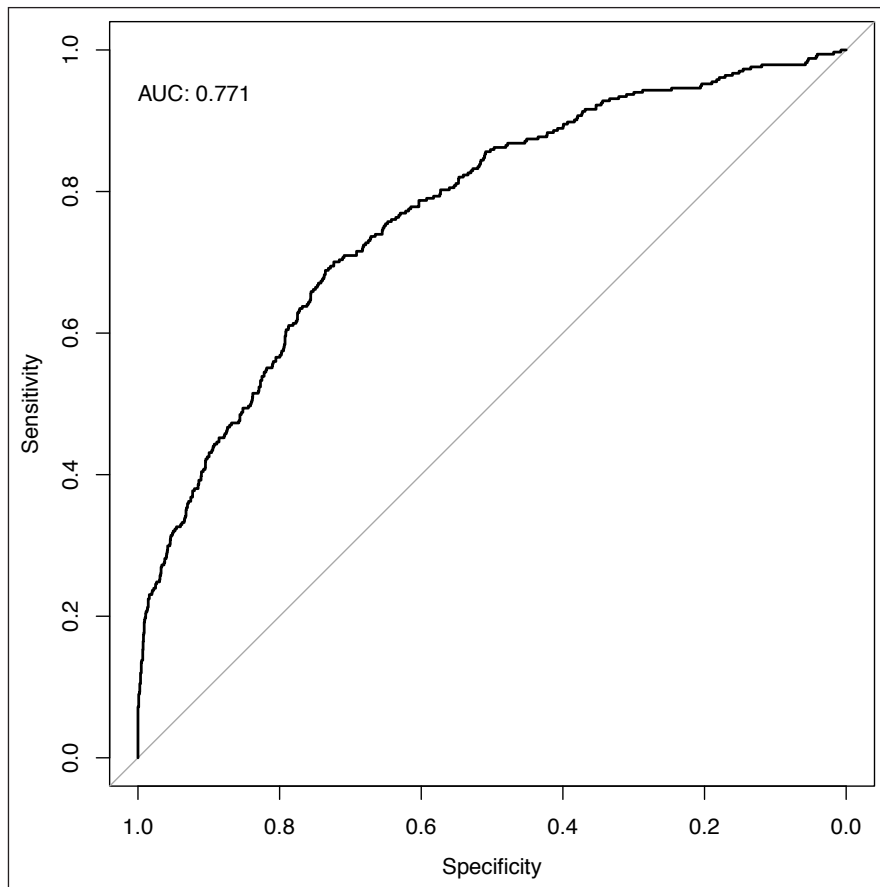
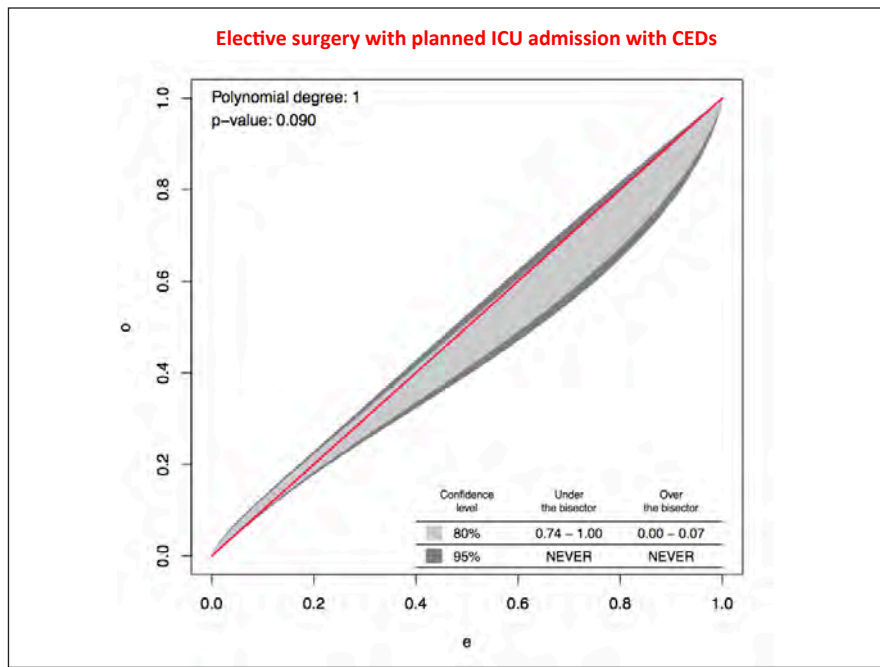
<sup>\*</sup> A neurological patient is a one with an altered consciousness, probably due to a direct brain injury. It is defined by the presence of at least one of these clinical conditions on admission: Cerebral artery stroke, Vertebral basilar ischemic stroke, Intracranial hypertension, Spontaneous Hydrocephalus, Non traumatic cerebral oedema, Metabolic/postanoxic encephalopathy, Seizures, Brain tumour, Cerebral Aneurysm, AVM (Arterio-Venous Malformation), Chronic Subdural haematoma, Spontaneous Subarachnoid haemorrhage, Spontaneous Intraparenchymal bleeding, CNS degenerative disease, Brain and skull malformations, Cerebral contusion/laceration, Traumatic diffuse injury without oedema, Traumatic diffuse injury with oedema, Extradural/epidural haematoma, Traumatic Subdural haematoma, Traumatic intraparenchymal bleeding, Traumatic subarachnoid haemorrhage, Skull fracture, NON-surgical CNS infection, Post-surgical CNS infection, Ventriculostomy-related CNS infection.

<sup>§</sup> All patients with haemorrhagic/hypovolemic shock and a GCS 3-4 died. The associated parameter is infinite.

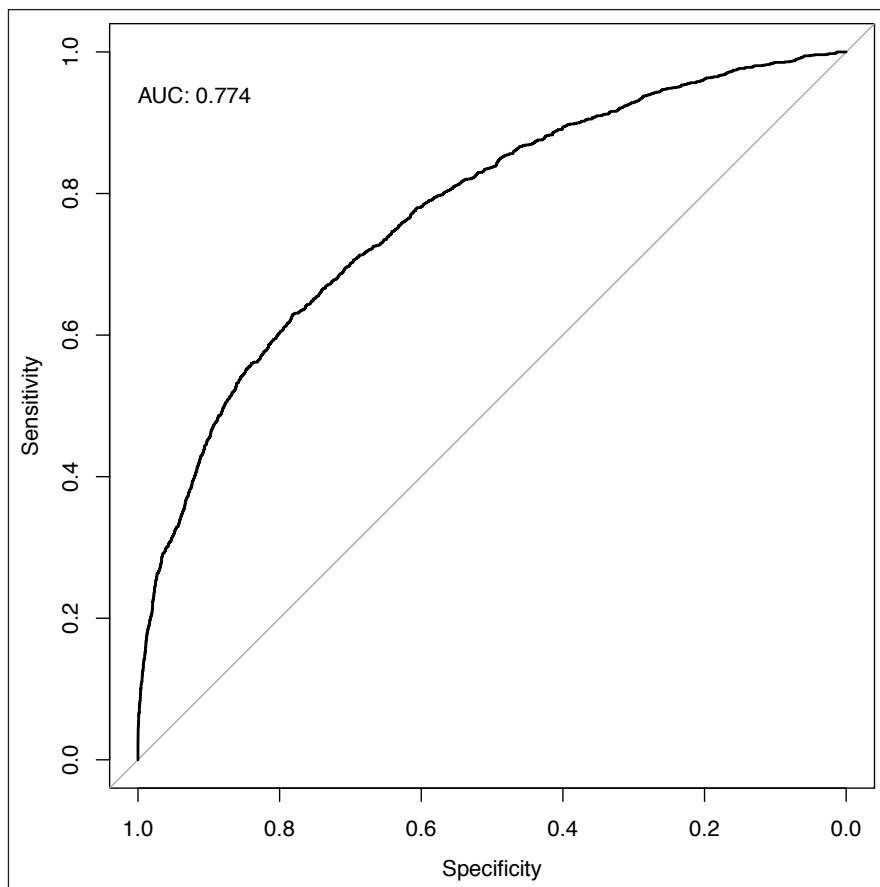
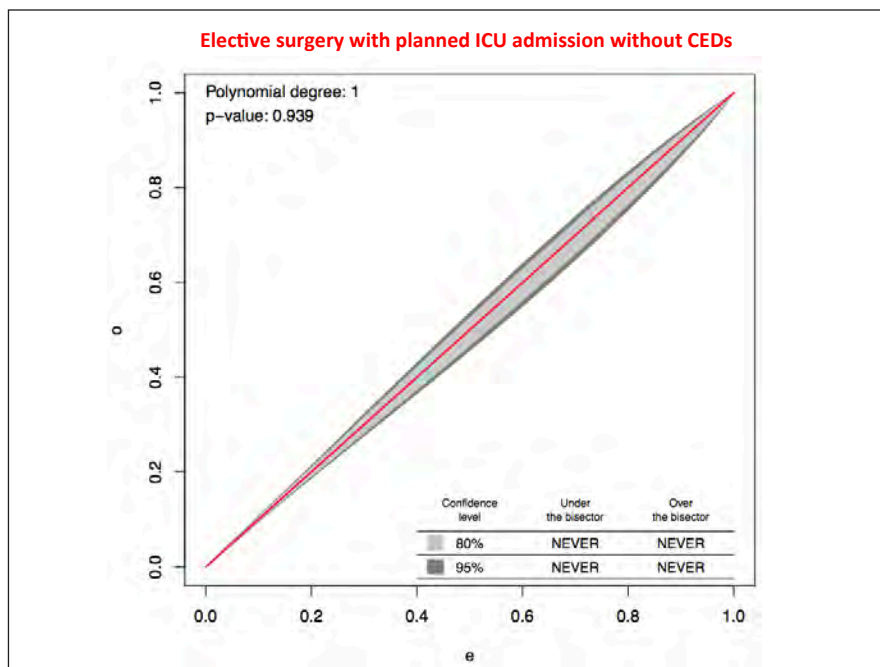
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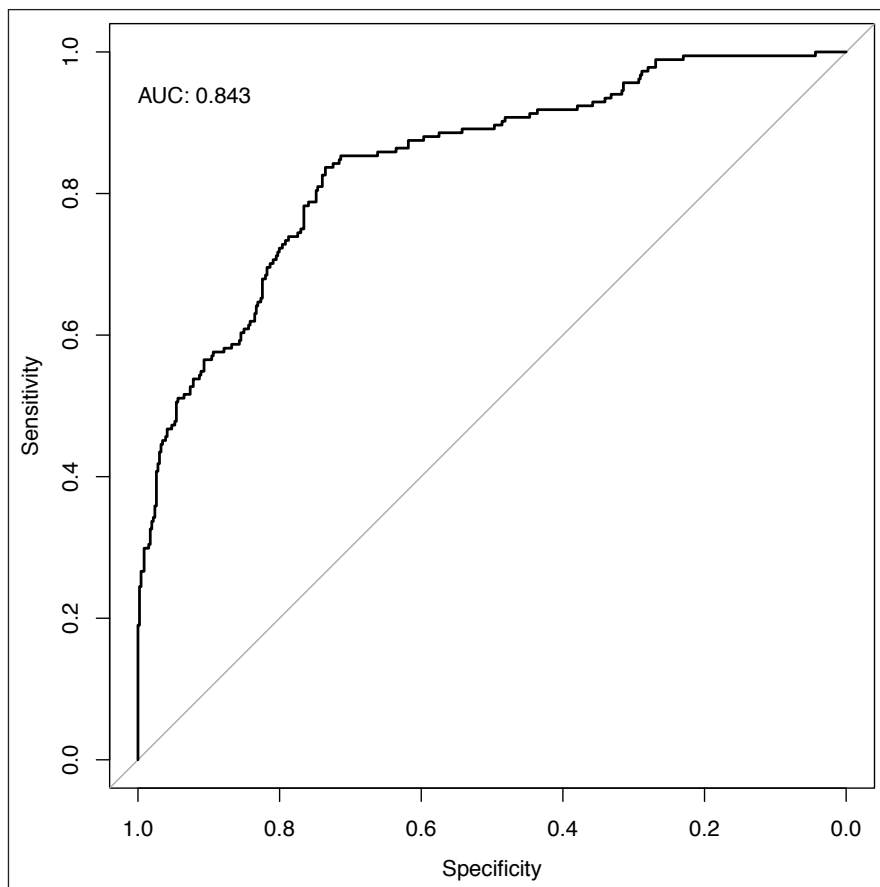
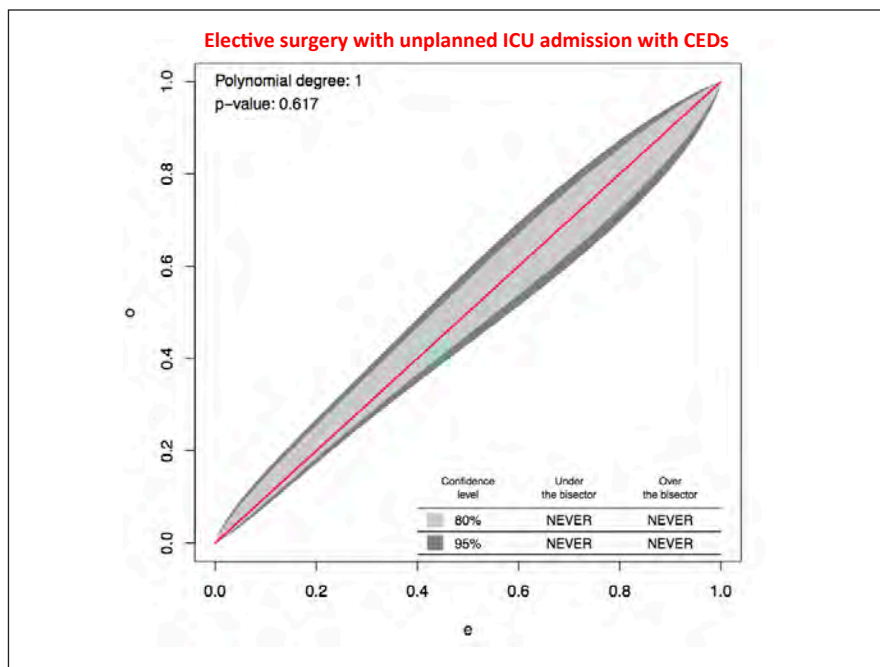
APPENDIX 2.—For each of the six subsets defined by the combination of surgical status (elective surgery with planned or unplanned ICU admission, and emergency surgery) and the presence or not of chronic end-stage diseases, we report the calibration belts followed by the respective Area under the Receiver Operating Characteristics (AuROC) curves and values.



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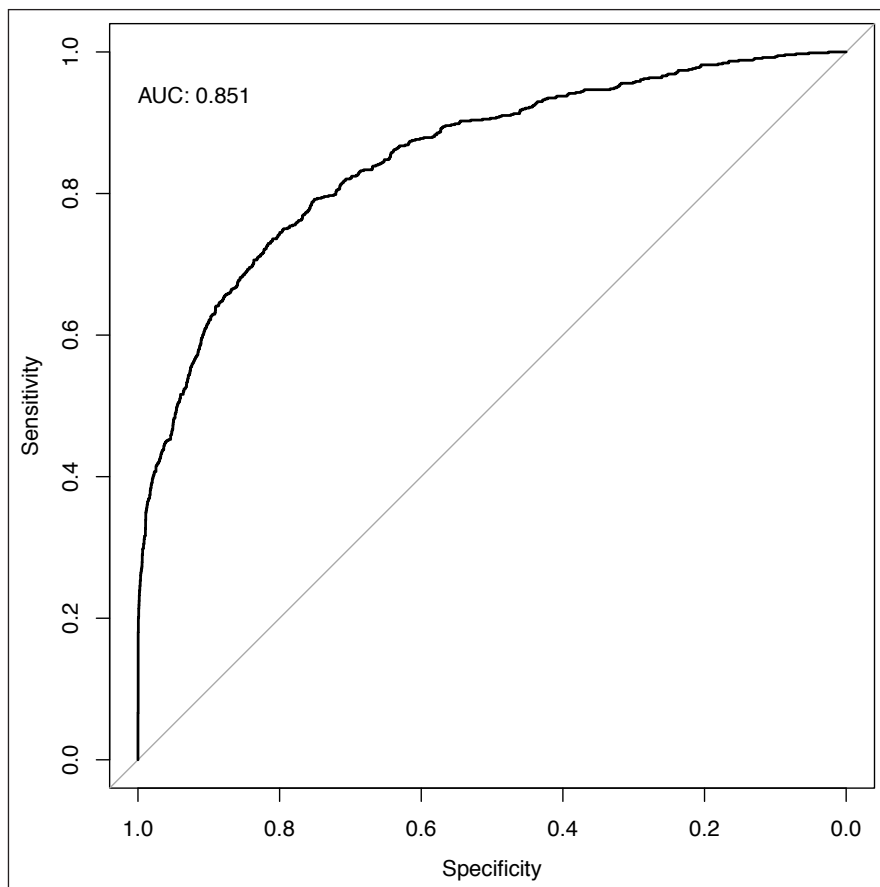
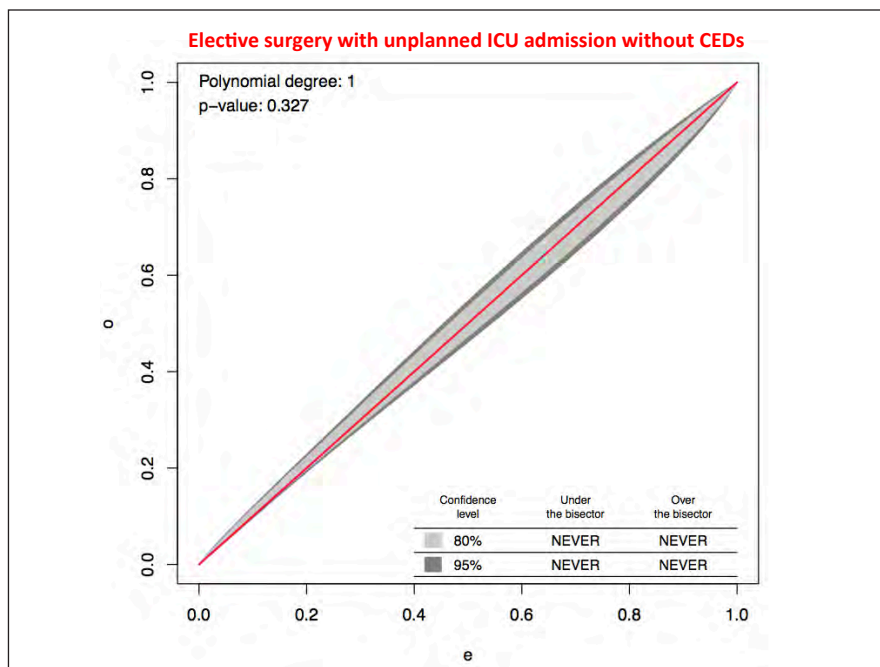


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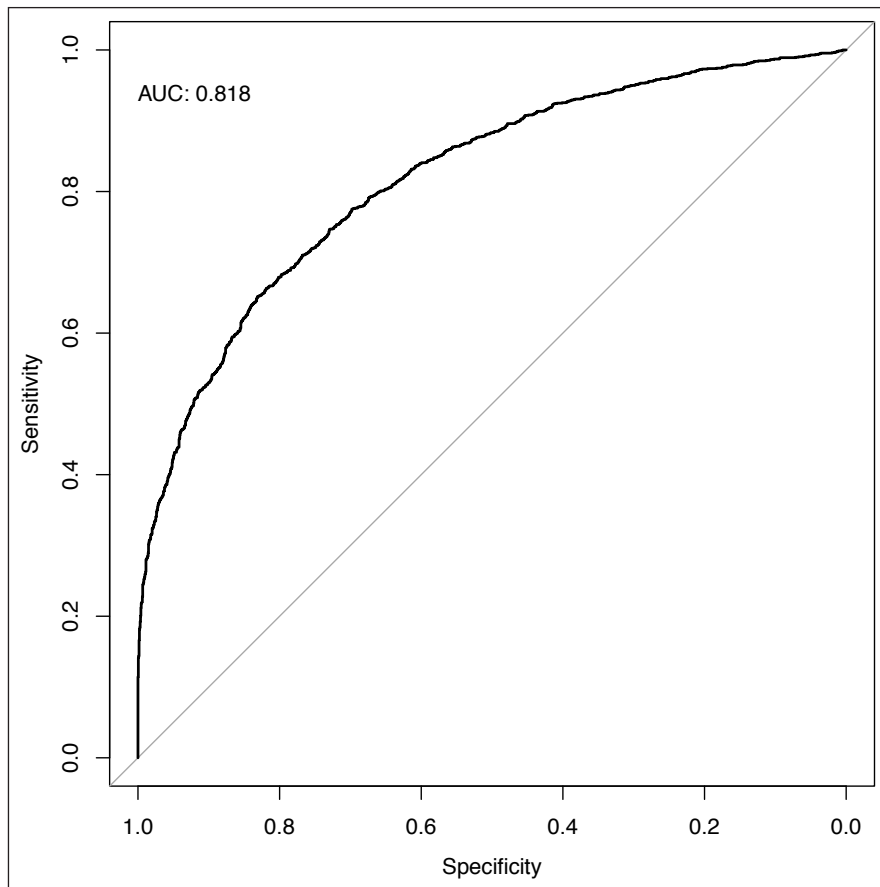
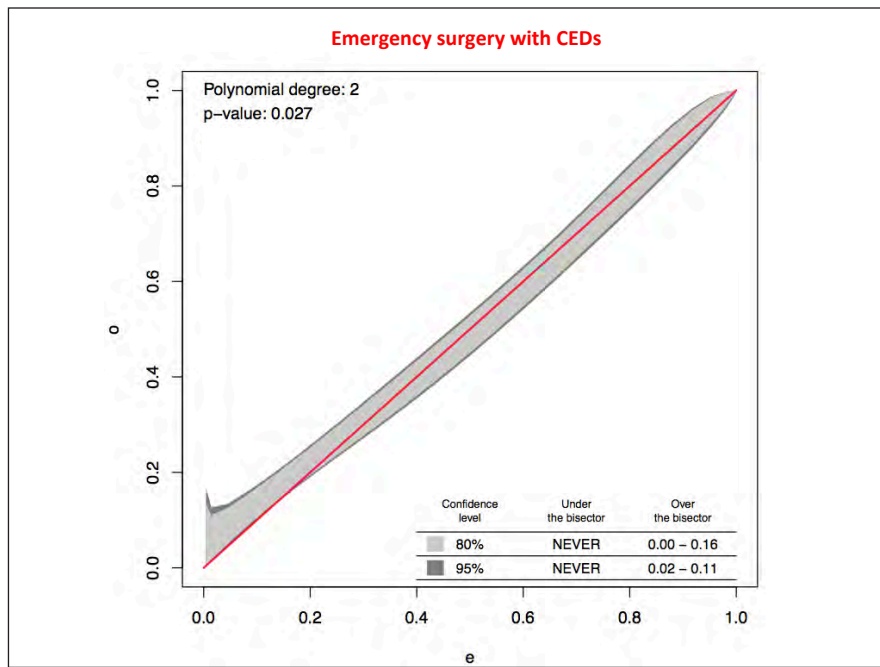


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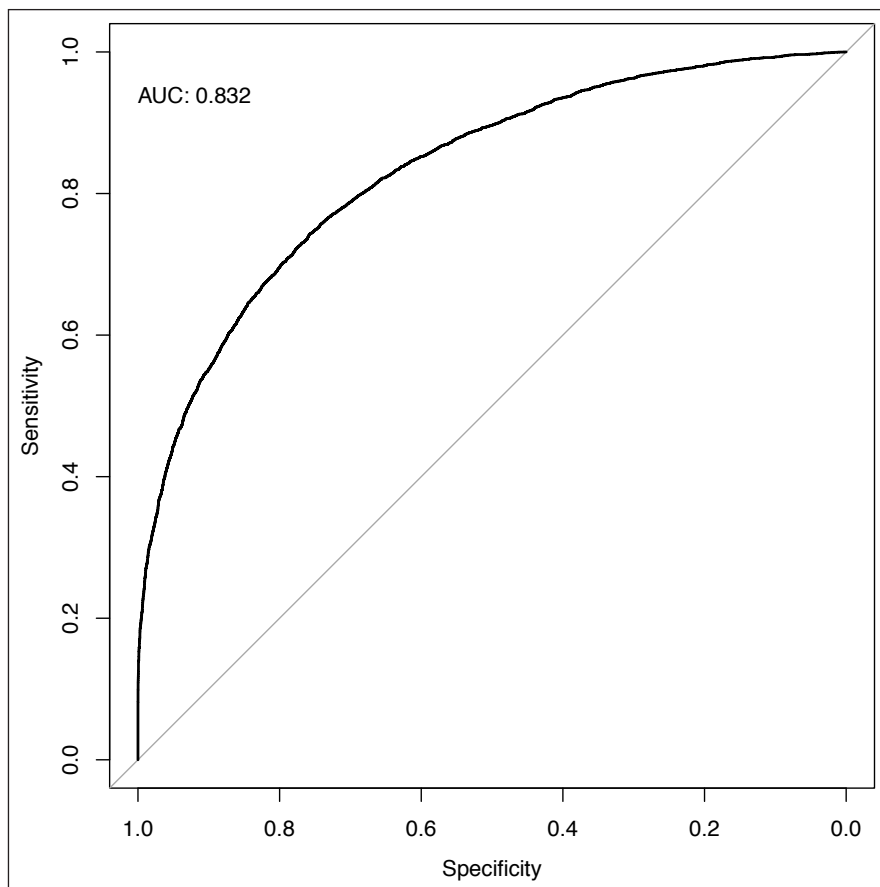
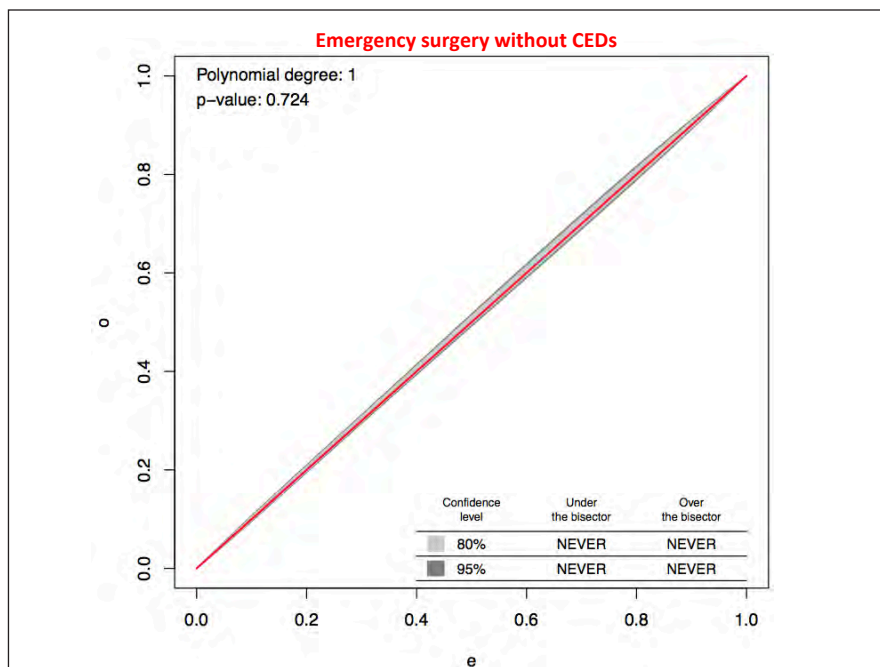




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