MESTRADO INTEGRADO EM MEDICINA

# Does the hospital length of stay until admission to Intensive Care impact mortality? A retrospective observational study

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## Resumo

**Introdução e objetivos:** Há vários fatores que influenciam o *outcome* dos doentes críticos. O principal objetivo deste estudo é analisar o impacto do tempo até à admissão em cuidados intensivos no *outcome* dos doentes internados numa unidade de cuidados intensivos. Outro objetivo é perceber se os doentes referenciados precocemente para cuidados intensivos, sendo admitidos a partir da sala de emergência, têm um melhor *outcome*.

**Metodologia:** Realizou-se um estudo observacional, longitudinal e retrospetivo de coorte no Hospital de Santo António, Centro Hospitalar Universitário do Porto, onde a gestão da sala de emergência é da responsabilidade da Medicina Intensiva. Foram incluídos todos os doentes adultos admitidos na Unidade de Cuidados Intensivos Polivalente (UCIP) entre janeiro de 2016 e dezembro de 2019, tendo-se excluído 37 admissões por ausência de dados. Colheram-se variáveis, incluindo dados demográficos, *scores* de comorbilidade e gravidade de doença, tempo desde a admissão hospitalar até à admissão na sala de emergência e em cuidados intensivos, tempo de internamento hospitalar e em cuidados intensivos, e o *outcome* à alta da unidade de cuidados intensivos e do hospital. O tempo até à admissão em cuidados intensivos foi organizado em quintis. As variáveis colhidas potencialmente associadas à mortalidade e ao tempo de internamento hospitalar foram estudadas através de regressões logísticas.

**Resultados:** Incluíram-se 1705 admissões. A idade média era 61,24 anos, 62,6% era do sexo masculino e 47,2% foi admitido da sala de emergência. O tempo médio até à admissão na unidade de cuidados intensivos foi 3 dias 9 horas e 52 minutos e até à sala de emergência foi 2 horas e 52 minutos. A mortalidade nos cuidados intensivos foi 24,5% e no hospital foi 31,7%. Um maior tempo até à admissão em cuidados intensivos estava associado a mortalidade e tempo de internamento hospitalares maiores. O último quintil do tempo até à admissão em cuidados intensivos tinha um tempo de internamento hospitalar mais longo. Na análise multivariada apenas o tempo até à admissão na sala de emergência se manteve associado à mortalidade, e os doentes admitidos em cuidados intensivos a partir da sala de emergência tinham um tempo de internamento mais curto.

**Conclusões:** Este estudo mostra que um maior tempo desde a admissão hospitalar até à referenciação à Medicina Intensiva (sala de emergência e cuidados intensivos) está associado a uma maior mortalidade. Mostra ainda que um maior tempo até à admissão em cuidados intensivos está associado a um maior tempo de internamento hospitalar.



**Palavras-chave:** Serviços de Urgência, Sala de Emergência, Unidades de Cuidados Intensivos, Tempo de Internamento, Mortalidade.

## Abstract

**Introduction and objectives:** Several factors influence the outcome of critically ill patients. The aim of this study is to analyse the impact that hospital length of stay prior to admission to intensive care has on the clinical outcome of the intensive care unit patients. It is the second aim of this study to determine whether patients referred to intensive care earlier, through the emergency room, have a better outcome than the others.

**Methods:** We conducted an observational, longitudinal and retrospective cohort study at Hospital Santo António, Centro Hospitalar Universitário do Porto, where the emergency room is run by Intensive Care physicians. We included all adult patients admitted to the intensive care unit between January 2016 and December 2019, excluding 37 admissions with incomplete follow-up. We collected several variables, including demographic data, comorbidity and disease severity scores, time from hospital admission to emergency room and intensive care unit admission, intensive care unit and hospital length of stay, and outcome at intensive care unit or hospital discharge. The time from hospital to intensive care unit admission was organized in quintiles. All collected variables potentially associated with hospital mortality and hospital length of stay were studied through logistic regression.

**Results:** There were 1705 admissions included in the analysis. The mean age was 61,24 years, 62,6% were male and 47,2% came from the emergency room. The average time until intensive care unit admission was 3 days 9 hours and 52 minutes and until emergency room admission was 2 hours and 52 minutes. The intensive care unit mortality was 24,5% and the hospital mortality was 31,7%. A longer time to intensive care unit admission was associated with increased hospital mortality and with prolonged hospital length of stay. The fifth quintile of time from hospital to intensive care unit had a significantly longer hospital length of stay compared to the first quintile. In the multivariate analysis only time from hospital to emergency room remained associated with hospital mortality, and in the hospital length of stay analysis patients admitted to the intensive care unit from the emergency room had a shorter hospital length of stay.

**Conclusions:** This study shows that a longer time from hospital admission to referral to intensive care (emergency room and intensive care unit) is associated with a higher mortality. It also shows that a longer time from hospital admission to intensive care unit admission is associated with a longer hospital length of stay.



**Keywords:** Emergency Departments, Emergency Room, Intensive Care Units, Length of Stay, Mortality.

## List of abbreviations

ICU – Intensive Care Unit
ED – emergency department(s)
ER – emergency room(s)
LOS – length of stay
SAPS II – Simplified Acute Physiology Score II
CCI – Charlson Comorbidity Index
SPSS – Statistical Package for the Social Sciences
OR – odds ratio
CI – confidence interval

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# Introduction

Patients can be admitted to the Intensive Care Unit (ICU) from different areas – postoperative patients needing intensive care, deteriorating patients from the ward or acute critically ill patients from the emergency department (ED). Several factors influence the outcome of critically ill patients. Ideally, critically ill patients should be admitted to an ICU as early as possible to receive the most appropriate, optimized and differentiated care, given that this can have an important impact on the final outcome of the patient.[1] However, delays frequently occur in the admission to the ICU and to the emergency rooms (ER). In this hospital, the ER is an area within the ED that receives critically ill patients[2] and is run by Intensive Care physicians with nurses and doctors from the ICU. An ER can optimise critical care given outside of the traditional inpatient ICU structure.

Several studies have tried to find whether the time between hospital admission and admission to an ICU impacts morbidity and mortality of the critically ill patient. However, the results of these studies are contradictory. Some studies found that the hospital length of stay (LOS) before admission to an ICU did not impact mortality of critically ill patients[3-6], but found that a delayed admission was associated with a higher need and longer duration of mechanical ventilation.[5] Others found that a longer hospital stay until ICU admission was associated with a higher mortality rate.[7-15]

Even when critically ill patients are admitted through the ER, the time to ICU admission varies due to many factors. Besides the existence of a proper triaging system, that can recognise and diagnose the most severely ill patients, and the care provided in the ED and in the ER, the ICU bed strain is an important factor which can lead to a delayed ICU admission and to worse patient outcomes.[16]

Although several studies analyse the association between a longer stay from hospital admission to ICU admission and adverse outcomes, the reason why there are delayed admissions has not been explored as much. In this setting, an ER can provide a dedicated space with resources, including ICU nurses and physicians, based on the traditional inpatient ICU model. Thereby, it can be used to optimise time-sensitive diagnosis and treatment for critically ill patients and to decrease the impact of delays in admission to the ICU.

Therefore, the aims of this study are to analyse the relationship between hospital length of stay prior to ICU admission and clinical outcome of the ICU patients, as well as to determine whether patients admitted to the ICU directly from the ER have a better outcome than the others.

## Materials and Methods

This is an observational, longitudinal and retrospective cohort study conducted at Hospital Santo António, Centro Hospitalar Universitário do Porto, a university, tertiary care, 600-bed hospital in Porto, Portugal, between January 2016 and December 2019.

The study protocol was approved by the local Institutional Ethics Committee.

Hospital Santo António is a public hospital that serves a population of approximately 600.000 people that reside in half of the city of Porto and half of the northern region of Portugal.

The population in this study consists of all adult patients admitted to the ICU during this period, excluding incomplete follow-up patients.

We obtained the patient data from the medical and nursing electronic records collected from the hospital electronic record system. The data was collected to an anonymous Excel database.

We collected the variables age, gender, admission category (medical, surgery, trauma or coronary), admission source (another hospital, emergency department, emergency room, medical or surgical ward, high dependency unit, another ICU), date and time of hospital admission, date and time of ICU admission, date and time of ER admission, Simplified Acute Physiology Score (SAPS) II, Charlson Comorbidity Index (CCI), ICU LOS, hospital LOS, and outcome at ICU or hospital discharge (deceased/discharged).

Patients admitted to the ICU from surgical or medical wards for medical or surgical reasons, were classified as medical or surgical patients, respectively. If a patient from the ED or the ER had to have surgery and go to the operating room before admission to the ICU, the source of admission was still considered the ED or the ER. If a patient was transferred from another hospital's ED or ER, the source of admission was considered as being the ED or ER. The time from hospital admission to ICU admission, as well as from hospital admission to ER admission, was calculated automatically in Excel from the collected data. If the patient was a readmission to the ICU, the two episodes counted as two different admissions. In this case, for the second admission, the time from hospital admission to ICU admission was calculated as the time from the hospital ward admission after discharge from the ICU to the second ICU admission. Regarding the hospital LOS, the total LOS was considered for both admissions, meaning that the two episodes have the same hospital LOS.

We performed the data analysis using Statistical Package for the Social Sciences (SPSS) version 27. The time from hospital to ICU admission was organized in quintiles and the sample characteristics of each quintile were compared using Chi-square tests and Kruskal-Wallis tests for categorical and continuous variables, respectively. All variables potentially associated with hospital mortality and hospital LOS were studied through logistic regression. Hospital LOS was computed into a new binomial variable and prolonged LOS was considered for hospital LOS over 25 days. Those with a clear association in the univariate analysis ($p < 0.05$) were included in the multivariate analysis, where covariates with a $p > 0,05$ were stepwise removed from the model. The results of the multivariate models are expressed as odds ratio (OR) with a 95% confidence interval (95% CI) and p-values.

## Results

During the study years, there were 1742 admissions to the ICU, of which 37 were excluded according to the exclusion criteria, leaving 1705 admissions, referring to 1661 patients.

Table I lists the general characteristics of the ICU admissions. The mean age was 61,24 ± 16,49 years, 62,6% of the patients were male and 47,2% came from the ER. There were 2,6% readmissions. The time from hospital to ICU was on average 3 days 9 hours and 52 minutes ± 11 days and 4 minutes, with a median of 5 hours and 34 minutes. The time from hospital to ER was on average 2 hours and 52 minutes ± 10 hours and 21 minutes, with a median of 9 minutes. The average ICU LOS was 7,26 ± 9,4 days and the average hospital LOS was 26,99 ± 36,72 days. The ICU mortality was 24,5% and the overall hospital mortality was 31,7%.

When comparing the quintiles, the mean age was slightly higher in the fourth and fifth quintiles. The later admissions had a higher proportion of surgical patients and the earlier admissions had a higher proportion of trauma and coronary patients. All admission sources were significantly different between quintiles. The earlier admissions were essentially admissions from another hospital, the ED and the ER. The later admissions had a higher proportion of patients from medical and surgical wards, high dependency units and another ICU. Although SAPS II showed no significant difference between quintiles, the later admissions had a higher CCI. ICU LOS showed no statistically significant difference between quintiles, but hospital LOS showed a difference. The hospital LOS was significantly longer from the second to the third and from the fourth to the fifth quintiles. Similarly, ICU mortality did not differ between quintiles, but hospital mortality was significantly higher in the later admissions.

In the univariate logistic regression (Table II), age, trauma patients, ED and medical ward admissions, SAPS II, CCI and ICU and hospital length of stay were associated with hospital mortality. A prolonged time from hospital to ICU and from hospital to ER were associated with a higher mortality. In the quintiles' logistic regression, only the fifth quintile of time from hospital to ICU had a significantly higher mortality compared with the first quintile. However, regarding the time from hospital to ER, none of the quintiles showed a significantly higher mortality compared with the first quintile.

Regarding the multivariate logistic analysis (Table III), higher age, higher SAPS II, longer ICU LOS, shorter hospital LOS and prolonged time from hospital to ER remained independently associated with hospital mortality.

Table IV shows the results from the univariate logistic regression analysis for hospital LOS. Medical and coronary patients had a shorter hospital LOS, whereas surgical and trauma patients had a longer LOS. Patients from another hospital or the ER had a shorter hospital LOS and admissions from wards as well as readmissions were associated with a longer hospital LOS. Although a prolonged time from hospital to ICU was associated with a longer hospital LOS, time from hospital to ER was not. The fifth quintile of time from hospital to ICU was the only one with a significantly longer hospital LOS when compared with the first quintile.

The variables associated with hospital LOS were therefore included in the stepwise backward logistic regression model. The multivariate logistic analysis (Table V) shows that medical, coronary and surgical ward admissions were independently associated with a shorter hospital LOS, and that readmission and a prolonged time from hospital to ICU were independently associated with a prolonged hospital LOS.

## Discussion

The present study was designed to examine the association between time to ICU admission and hospital LOS and mortality. This study shows that a longer time to ICU admission is associated with increased hospital mortality.

A question that arose during the analysis of the data, despite the adjustment for SAPS II, which includes diagnosis, was whether the admission diagnosis on its own could modify the association between time to ICU and hospital mortality. The comparison between quintiles of time from hospital admission to ICU admission shows that the later admissions had a higher proportion of surgical patients whereas the earlier admissions had a higher proportion of trauma and coronary patients. This is as expected, given that trauma and coronary patients are mainly admitted from the ED or ER, with shortened times to ICU admission. Surgical patients went to the OR prior to ICU admission if they were admitted from the ED or ER, and were admitted from hospital wards after surgical intervention or clinical deterioration. In this case they were included in the most common admission sources in later ICU admissions.

In the univariate analysis time from hospital to ICU was associated with hospital mortality, as had already been shown by several studies.[7-15] In the quintiles' logistic regression, the fifth quintile of time from hospital to ICU had a significantly higher mortality and a significantly longer hospital LOS compared with the first quintile. This shows that patients who are in hospital longer than 57 hours and 27 minutes, which is more than two days, have a significantly worse outcome than patients admitted in less than 1 hour and 37 minutes. This is an interesting result, taking into account that the later admission group is constituted mainly of patients admitted from hospital wards and that most studies[9,10,12-15] only analyse the impact of a delayed ICU admission from the ED. However, some studies[7,8,11] did include all ICU admissions and also found that a longer stay in hospital before ICU admission was associated with worse outcomes. Therefore, this study shows that the problem does not lie solely in the care provided in the ED or in ED boarding, but that admission to a hospital ward and a later transfer to intensive care is also associated with worse outcomes. Triage may be a major underlying factor that could influence time to ICU and mortality. A proper and reliable triaging system is necessary to recognise and diagnose the most severely ill patients and those at risk of deterioration. Implementing additional triage scoring systems could lead to better identification of the most severely ill or at-risk patients and prevent a possible delayed admission to the ICU, which could result in lower mortality. Furthermore, prediction models, which can identify patients at high risk of ICU admission, can be promising in helping the most severely ill patients in time and improving the adequacy of rapid response teams in the hospital.

Only time from hospital to ER remained associated with hospital mortality in the multivariate analysis. This is probably because, in the case of critically ill patients, the ER works as a way to diminish the impact of later ICU admission, as it provides a place for prompt and adequate stabilization in a more monitored environment with a higher nurse to patient ratio than in the ED. Furthermore, when analysing hospital LOS, patients admitted to the ICU from the ER had a shorter hospital LOS, thereby emphasising the ER as an important step in managing critically ill patients, which leads to shorter hospitalizations.

Prolonged time from hospital to ICU was associated with a prolonged hospital LOS. This is an expected result, as critical care is time sensitive.[1] An interesting result from the comparison between quintiles of time from hospital to ICU is the significantly longer hospital LOS from the fourth quintile (24,78 $\pm$ 30,98 days) to the fifth quintile (44,52 $\pm$ 44,28 days). The majority of the patients in the latter group were admitted from hospital wards, and it would be important to understand why they were not admitted earlier to the ICU. If it was because there was a lack of ICU beds availability, if their disease severity was misevaluated, if there was an unexpected deterioration or if it was the natural evolution of the disease. These results support the conclusions from several studies that showed that a later ICU admission was associated with a prolonged hospital LOS.[9-12,14,15]

This study has several limitations. It is a study conducted in a single hospital and may therefore not be an accurate representation of what happens in other hospitals. Furthermore, it is a retrospective observational study and the data was collected from electronic records. The time from hospital admission to ICU admission was calculated based on the admission times presented in the electronic records. This could mean that the calculated time is not an exact measure of the real time. This study only included the patients admitted to the ICU and therefore did not take into account the deaths before ICU admission.

## Conclusions

This study shows that a longer time from hospital admission to ER and ICU admission is associated with a higher mortality and that a longer time from hospital admission to ICU admission is associated with a longer hospital LOS.

The results we obtained suggest that an ER, where critically ill patients receive critical care from trained professionals within the ED, can be one way to diminish the impact of delayed ICU admissions, as the stabilization in the ER can be an important step in managing critically ill patients. This study shows that it is also important to study the delayed admission from hospital wards and that the problem is not just delayed admissions from the ED or ED boarding. Further studies are needed to assess the reasons that lead to delayed ICU admission, particularly in patients admitted from hospital wards, and the real time cut-off for a delayed admission.

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**Table I** Sample characteristics for the population and within each quintile of time from hospital to ICU (as mean ± standard deviation and percentages) and p-value for Chi-square and Kruskal-Wallis tests

| Variables | Total sample | < 1h37m | 1h37m - 3h45m | 3h45m - 10h07m | 10h07m - 57h27m | > 57h27m | p-value |
|---|---|---|---|---|---|---|---|
| **Age (years)** | 61,24 ± 16,49 | 60,06 ± 16,07 | 58,18 ± 17,34 | 60,82 ± 17,39 | 63,00 ± 15,86 | 64,16 ± 15,09 | <0,001 |
| **Male gender** | 62,6% | 64,2% | 64,2% | 63,3% | 61,0% | 60,1% | 0,714 |
| **Admission category** | | | | | | | |
| Medical | 60,6% | 59,8% | 60,1% | 62,8% | 57,8% | 62,8% | 0,629 |
| Surgical | 23,6% | 15,5% | 11,7% | 20,2% | 36,1% | 34,6% | <0,001 |
| Trauma | 12,7% | 19,6% | 23,2% | 15,0% | 5,0% | 0,9% | <0,001 |
| Coronary | 3,0% | 5,0% | 5,3% | 2,1% | 1,2% | 1,8% | 0,002 |
| **Admission source** | | | | | | | |
| Another hospital | 8,5% | 33,4% | 5,6% | 3,5% | 0,0% | 0,0% | <0,001 |
| ED | 15,2% | 13,8% | 13,2% | 20,8% | 26,1% | 2,1% | <0,001 |
| ER | 47,2% | 52,2% | 80,9% | 70,7% | 30,2% | 1,8% | <0,001 |
| Medical ward | 9,4% | 0,3% | 0,0% | 1,2% | 11,4% | 34,0% | <0,001 |
| Surgical ward | 13,0% | 0,3% | 0,0% | 1,5% | 22,6% | 40,5% | <0,001 |
| High dependency unit | 5,5% | 0,0% | 0,0% | 2,3% | 9,1% | 16,1% | <0,001 |
| Another ICU | 1,2% | 0,0% | 0,0% | 0,0% | 0,6% | 5,6% | <0,001 |
| **Readmission** | 2,6% | 0,3% | 0,0% | 0,3% | 3,2% | 9,1% | <0,001 |
| **SAPS II** | 49,12 ± 17,82 | 48,53 ± 16,81 | 50,20 ± 19,00 | 48,90 ± 18,28 | 47,10 ± 16,90 | 50,96 ± 17,85 | 0,138 |
| **CCI** | 3,37 ± 2,46 | 2,76 ± 2,12 | 2,82 ± 2,36 | 3,30 ± 2,42 | 3,65 ± 2,59 | 4,34 ± 2,45 | <0,001 |
| **ICU LOS (days)** | 7,26 ± 9,40 | 7,06 ± 7,73 | 7,04 ± 9,86 | 7,60 ± 11,99 | 7,17 ± 8,06 | 7,40 ± 8,76 | 0,091 |
| **Hospital LOS (days)** | 26,99 ± 36,72 | 21,39 ± 31,76 | 18,96 ± 31,02 | 25,30 ± 38,14 | 24,78 ± 30,98 | 44,52 ± 44,28 | <0,001 |
| **ICU mortality** | 24,5% | 22,6% | 23,8% | 23,8% | 23,2% | 29,0% | 0,287 |
| **Hospital mortality** | 31,7% | 27,6% | 28,2% | 29,9% | 30,8% | 42,2% | <0,001 |

**Table II** Univariate logistic regression for mortality and mean ± standard deviation and percentages for each variable within the whole sample and among the patients who died

| Variables | Total sample | Dead | Mortality | |
|---|---|---|---|---|
| | | | OR (95% CI) | p-value |
| **Age (years)** | 61,24 ± 16,49 | 67,09 ± 14,37 | 1,036 (1,028 – 1,043) | < 0,001 |
| **Gender** | 62,6% (male) | 61,7 % (male) | 0,949 (0,769 – 1,171) | 0,624 |
| **Admission category** | | | | |
| Medical | 60,60% | 62,30% | 1,107 (0,897 – 1,365) | 0,343 |
| Surgical | 23,60% | 25,30% | 1,145 (0,903 – 1,451) | 0,264 |
| Trauma | 12,70% | 8,50% | 0,540 (0,383 – 0,760) | < 0,001 |
| Coronary | 3,00% | 3,90% | 1,476 (0,840 – 2,593) | 0,176 |
| **Admission source** | | | | |
| Another hospital | 8,50% | 7,90% | 0,899 (0,620 – 1,304) | 0,575 |
| ED | 15,20% | 11,60% | 0,651 (0,480 – 0,882) | 0,006 |
| ER | 47,20% | 46,80% | 0,977 (0,797 – 1,199) | 0,826 |
| Medical ward | 9,40% | 12,60% | 1,675 (1,202 – 2,334) | 0,002 |
| Surgical ward | 13,00% | 12,60% | 0,950 (0,700 – 1,290) | 0,742 |
| High dependency unit | 5,50% | 6,80% | 1,426 (0,930 – 2,185) | 0,103 |
| Another ICU | 1,20% | 1,70% | 1,624 (0,680 – 3,878) | 0,275 |
| **Readmission** | 2,60% | 2,80% | 1,116 (0,593 – 2,100) | 0,733 |
| **SAPS II** | 49,12 ± 17,82 | 62,25 ± 17,21 | 1,070 (1,061 – 1,079) | < 0,001 |
| **CCI** | 3,37 ± 2,46 | 4,10 ± 2,37 | 1,194 (1,144 – 1,246) | < 0,001 |
| **ICU LOS (days)** | 7,26 ± 9,40 | 6,02 ± 9,20 | 0,974 (0,960 – 0,988) | < 0,001 |
| **Hospital LOS (days)** | 26,99 ± 36,72 | 15,77 ± 24,01 | 0,977 (0,972 – 0,982) | < 0,001 |
| **Time from hospital to ICU (days)** | 3,41 ± 11,00 | 4,79 ± 13,90 | 1,016 (1,006 – 1,026) | 0,001 |
| **Second quintile** | | | 1,030 (0,737 – 1,439) | 0,864 |
| **Third quintile** | | | 1,121 (0,805 – 1,563) | 0,499 |
| **Fourth quintile** | | | 1,169 (0,840 – 1,627) | 0,354 |
| **Fifth quintile** | | | 1,921 (1,394 – 2,646) | <0,001 |
| **Time from hospital to ER (hours)** | 2,86 ± 10,35 | 4,35 ± 16,35 | 1,022 (1,004 – 1,041) | 0,016 |
| **Second quintile** | | | 1,110 (0,699 – 1,764) | 0,658 |
| **Third quintile** | | | 0,748 (0,470 – 1,192) | 0,222 |
| **Fourth quintile** | | | 0,727 (0,459 – 1,154) | 0,176 |
| **Fifth quintile** | | | 1,233 (0,799 – 1,903) | 0,344 |

**Table III** Multivariate logistic regression for mortality

| Variables | Mortality | |
|---|---|---|
| | OR (95% CI) | p-value |
| **Age** | 1,026 (1,012 – 1,040) | < 0,001 |
| **SAPS II** | 1,073 (1,058 – 1,088) | < 0,001 |
| **ICU LOS** | 1,070 (1,032 – 1,109) | < 0,001 |
| **Hospital LOS** | 0,937 (0,916 – 0,958) | < 0,001 |
| **Time from hospital to ER** | 1,040 (1,013 – 1,068) | 0,004 |

**Table IV** Univariate logistic regression for hospital LOS and mean ± standard deviation and percentages for each variable within the whole sample and among the patients who had a prolonged hospital LOS

| Variables | Total sample | Prolonged hospital LOS | Hospital LOS | |
|---|---|---|---|---|
| | | | OR (95% CI) | p-value |
| **Age (years)** | 61,24 ± 16,49 | 60,55 ± 15,99 | 0,996 (0,990 – 1,002) | 0,23 |
| **Gender** | 62,6% (male) | 62,8% (male) | 0,985 (0,798 – 1,216) | 0,888 |
| **Admission category** | | | | |
| Medical | 60,60% | 52,70% | 0,618 (0,503 – 0,760) | < 0,001 |
| Surgical | 23,60% | 31,10% | 1,797 (1,426 – 2,264) | < 0,001 |
| Trauma | 12,70% | 15,60% | 1,435 (1,069 – 1,925) | 0,016 |
| Coronary | 3,00% | 0,50% | 0,125 (0,039 – 0,403) | < 0,001 |
| **Admission source** | | | | |
| Another hospital | 8,50% | 5,30% | 0,504 (0,331 – 0,768) | 0,001 |
| ED | 15,20% | 14,10% | 0,881 (0,661 – 1,176) | 0,39 |
| ER | 47,20% | 33,30% | 0,432 (0,349 – 0,534) | < 0,001 |
| Medical ward | 9,40% | 15,40% | 2,591 (1,865 – 3,600) | < 0,001 |
| Surgical ward | 13,00% | 19,40% | 2,187 (1,642 – 2,912) | < 0,001 |
| High dependency unit | 5,50% | 9,70% | 2,931 (1,924 – 4,467) | < 0,001 |
| Another ICU | 1,20% | 2,70% | 5,428 (2,095 – 14,069) | < 0,001 |
| **Readmission** | 2,60% | 6,60% | 10,156 (4,688 – 22,004) | < 0,001 |
| **SAPS II** | 49,12 ± 17,82 | 48,08 ± 15,73 | 0,995 (0,989 – 1,001) | 0,105 |
| **CCI** | 3,37 ± 2,46 | 3,34 ± 2,43 | 0,992 (0,951 – 1,034) | 0,694 |
| **Time from hospital to ICU (days)** | 3,41 ± 11,00 | 8,38 ± 18,09 | 1,168 (1,136 – 1,200) | < 0,001 |
| **Second quintile** | | | 0,809 (0,560 – 1,170) | 0,261 |
| **Third quintile** | | | 1,321 (0,935 – 1,867) | 0,114 |
| **Fourth quintile** | | | 1,173 (0,826 – 1,665) | 0,372 |
| **Fifth quintile** | | | 5,976 (4,272 – 8,360) | <0,001 |
| **Time from hospital to ER (hours)** | 2,86 ± 10,35 | 2,12 ± 6,18 | 0,987 (0,963 – 1,011) | 0,277 |

**Table V** Multivariate logistic regression for hospital LOS

| Variables | Hospital LOS | |
|---|---|---|
| | OR (95% CI) | p-value |
| **Medical** | 0,409 (0,322 – 0,520) | < 0,001 |
| **Coronary** | 0,087 (0,026 – 0,299) | < 0,001 |
| **Surgical ward** | 0,664 (0,459 – 0,961) | 0,03 |
| **Readmission** | 9,357 (4,045 – 21,643) | < 0,001 |
| **Time from hospital to ICU** | 1,177 (1,143 – 1,213) | < 0,001 |