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RESEARCH ARTICLE

MULTIDRUG-RESISTANT INFECTIONS IN ICU TRAUMA PATIENTS: INCIDENCE AND PROGNOSTIC IMPLICATIONS

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Abstract

Background: The increasing prevalence of multidrug-resistant (MDR), extensively drug-resistant (XDR), and pan-drug-resistant (PDR) organisms in the ICU has raised concerns regarding their impact on clinical outcomes in critically ill trauma patients. For this study, MDR, XDR, and PDR were defined according to the international consensus by Magiorakos et al. (2012): MDR = non-susceptibility to ≥3 antimicrobial classes; XDR = non-susceptibility to all but one or two classes; PDR = non-susceptibility to all agents in all classes. This study investigates the correlation between microbial resistance and severity indicators, length of stay, and patient outcomes.

Method and Material: A prospective observational study was conducted in a single-center ICU, including adult patients admitted due to severe trauma. Demographic data, clinical scores (SOFA, APACHE II, ISS), presence of MDR/XDR/PDR colonization or infection (defined using CDC/NHSN criteria), duration of mechanical ventilation and hospitalization, and patient outcomes were recorded and analyzed using appropriate statistical methods.

Results: Multidrug resistant pathogens were frequently encountered in this trauma ICU cohort and were associated with significantly worse clinical outcomes. Age and BMI were associated with mortality in bivariate analyses; however, these findings should not be interpreted as independent risk factors in the absence of multivariable adjustment. Sex, smoking status, and ARDS did not show significant associations.

Conclusions: The presence of multidrug resistant infections represents a substantial clinical burden in critically ill trauma patients and was linked to worse outcomes in this cohort. These findings highlight the clinical importance of early detection, optimized antimicrobial stewardship, and careful management in this vulnerable population. Given the very small sample size for PDR cases, these findings should be interpreted with caution. Despite the significant associations identified, the study's limitations—including the small sample size, single-center design, lack of long-term follow-up, and absence of time-dependent or multivariable analyses—warrant cautious interpretation. Future multicenter and longitudinal studies are needed to further investigate resistance mechanisms, optimize therapeutic strategies, and reduce bias in outcome attribution.

Keywords: Multidrug-resistant organisms, trauma patients, ICU, mechanical ventilation, clinical outcomes.

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INTRODUCTION

Infections represent one of the leading causes of morbidity and mortality in Intensive Care Units (ICUs), as reported by international organizations such as the European Centre for Disease Prevention and Control (ECDC) and the Centers for Disease Control and Prevention (CDC).[1,2] The high incidence of infections in these vulnerable populations underscores the urgent need for continuous vigilance and the strict implementation of preventive protocols. In this context, the adequate training of healthcare professionals and the consistent application of infection control measures are critical strategies to mitigate the rise of antimicrobial resistance.[3,4,5]

Several factors have been associated with the increased fre-

quency of ICU-acquired infections. Specifically, the use of invasive devices—such as endotracheal intubation and central venous catheters—and the administration of pharmacological agents including sedatives, neuromuscular blockers, corticosteroids, and antibiotics, disrupt physiological barriers and the normal microbiota. These conditions create a favorable environment for colonization by multidrug-resistant (MDR) organisms.[6,7,8]

In this context, the escalation of antimicrobial resistance in the ICU refers to the progressive increase in both the prevalence and spectrum of multidrug-resistant organisms, accompanied by rising resistance rates to first-line and broad-spectrum antibiotics, which collectively complicate treatment decisions and worsen patient outcomes.[6,9]

Importantly, antimicrobial resistance is not evenly distributed worldwide, as demonstrated by surveillance data. For example, in Greece, resistance rates for Gram-negative pathogens such as *Klebsiella pneumoniae* and *Acinetobacter baumannii* exceed 75–80%, whereas in Australia, the corresponding rates remain approximately 8%. Specifically, these comparisons reflect carbapenem resistance rates among Gram-negative bacteria. Globally, ICUs serve as reservoirs for colonization and infection with MDR organisms, with bloodstream infections attributed to these pathogens in up to 47.8% of cases.[7]

Notably, resistance has markedly increased among key pathogens—defined as the microorganisms most frequently responsible for ICU-acquired infections and associated with multidrug resistance—such as *Staphylococcus aureus* (MRSA), *Pseudomonas aeruginosa*, *Acinetobacter baumannii*, *Klebsiella pneumoniae*, and *Escherichia coli*. Resistance to critical antibiotics—defined as antimicrobial agents regarded as essential for the treatment of severe infections in the ICU, including carbapenems and third-generation cephalosporins—substantially limits therapeutic options, particularly against Gram-negative bacteria. Additionally, organisms like *Clostridioides difficile*—which may develop reduced susceptibility to metronidazole, fluoroquinolones, and vancomycin rather than classic multidrug resistance traits—and *Candida spp.* may evolve into highly virulent pathogens when such resistance characteristics are acquired.[10,11]

Although ICU – acquired infections have been widely studied in the general critical care population, data focusing specifically on trauma ICU patients remain comparatively limited. Available studies suggest that trauma ICU patients may exhibit distinct patterns of MDR pathogens involvement and risk factors compared with other ICU cohorts, including differences in causative organisms and the incidence of MDR ventilator – associated pneumonia.[12,13] However, existing evidence is heterogeneous in design, patient selection and microbiological focus and only a limited number of studies have specifically addressed MDR epidemiology in trauma populations, with inconsistent evaluation of their prognostic impact. Consequently, the overall burden, microbiological characteristics and outcome implications of MDR infection in trauma ICU patients remain incompletely defined. This gap justifies focused investigation of MDR infection incidence and outcomes specifically in trauma patients admitted to the ICU.[12,13,14]

The aim of this study was to investigate the incidence of multidrug-resistant infections in trauma patients admitted to the ICU and to evaluate their prognostic implications in relation to illness severity, duration of mechanical ventilation, length of ICU stay, and patient outcomes.

METHOD AND MATERIAL

Study design

This was a prospective observational single-center study conducted in the Intensive Care Units (ICUs) of a major regional general adult hospital located in the capital city of country XXX. The study spanned a period of ten months and included trauma patients who were admitted to the ICU during this timeframe.

Data were collected in real time through systematic monitoring and documentation from electronic medical records and nursing charts. The variables recorded included demographic characteristics (sex, age), cause of admission, comorbidities (such as hypertension, chronic obstructive pulmonary disease, diabetes mellitus, heart failure, thyroid disorders, psychiatric conditions, malignancies, and smoking status), as well as hospitalization-related parameters including the duration of mechanical ventilation, pharmacological sedation, and total ICU length of stay.

Patient outcomes were evaluated based on discharge destination from the ICU and the Glasgow Outcome Scale – Extended (GOSE), originally developed from the Glasgow Outcome Scale by Jennett and Bond (1975) and further refined in the updated manual by Wilson et al. (2021),[15] as has been used in other contemporary studies.[16] In the present study, GOSE was applied as a global functional outcome measure (GOSE-All), reflecting the overall impact of all traumatic injuries on functional status rather than restricting assessment solely to deficits attributable to traumatic brain injury.[17,18] Clinical severity scores were calculated upon admission using standardized time points to ensure they reflected baseline illness severity than complications developing during ICU stay. The Sequential Organ Failure Assessment (SOFA) score was assessed on ICU day 1 and considered the baseline organ dysfunction score.[19] Similarly, the Acute Physiology and Chronic Health Evaluation II (APACHE II) score was calculated based on the worst physiological values recorded within the first 24 hours following admission.[20] Also, trauma severity was evaluated via the Injury Severity Score (ISS), derived from the Abbreviated Injury Scale (AIS), version 2005 updated 2008. ISS was calculated after completion of the initial diagnostic work – up, including imaging and surgical findings. Although newer AIS versions exist, AIS 2005/2008 was used to ensure consistency with the majority of previously published trauma ICU literature, recognizing that ISS values are not directly interchangeable across AIS versions.[21]

Microbiological cultures were performed upon ICU admission and subsequently when clinically indicated (e.g., fever, leukocytosis, suspected sepsis). For the purposes of this study, colonization was defined as the isolation of microorganisms from clinical samples in the absence of clinical signs or symptoms of infection. Infections were classified according to the CDC/NHSN surveillance criteria, including ventilator-associated pneumonia (VAP), central line–associated bloodstream infection (CLABSI), and catheter-associated urinary tract infection (CAUTI). Outcome analyses (mortality, ICU length of stay, etc.) were restricted to confirmed infections, while colonization events were reported separately for surveillance purposes.

Antimicrobial resistance was classified according to the international consensus definitions proposed by Magiorakos et al. (2012).[22] Specifically, MDR was defined as non-susceptibility to at least one agent in three or more antimicrobial categories; XDR as non-susceptibility to at least one agent in all but one or two categories (i.e., susceptible to only one or two categories); and PDR as non-susceptibility to all agents in all antimicrobial categories.

Study population

Eligible participants were adult patients (≥18 years) with a history of trauma who were admitted to the ICU during the study period. Inclusion criteria required at least three consecutive days of mechanical ventilation and an ISS score greater than 9, to ensure a homogeneous population focusing on patients with at least moderate trauma severity and at high risk for ICU-related complications such as inhospital infection, organ dysfunction, prolonged ventilation.

Exclusion criteria included patients under 18 years of age, those with end-stage chronic diseases, and patients transferred from other ICUs. These exclusions were based on the distinct physiological and therapeutic needs of pediatric populations and the potential confounding effects of underlying comorbidities or previous exposure to different microbial environments, which could affect the internal validity of the epidemiological analysis.

Statistical Analysis

Statistical analysis was performed using IBM SPSS Statistics version 27. Descriptive statistics were initially applied, including the use of tables and graphs. The normality of continuous variables was tested and found to deviate from the normal distribution ($p < 0.05$). Consequently, non-parametric tests were employed, including the Mann–Whitney U and Kruskal–Wallis tests, with the level of statistical significance set at 5%.

The APACHE II score was reported as a mean value with standard deviation; predicted mortality percentage (29%) was derived from the APACHE II model but may not be perfectly calibrated for this trauma cohort.

Ethical Considerations

The study was conducted in full compliance with the principles of medical ethics and human rights protection, in accordance with Greek legislation (Law 1492/1950) and international ethical guidelines, including the Nuremberg Code, the Declaration of Geneva, and the Declaration of Helsinki.

Patient participation was based on the principle of respect for human dignity, ensuring that potential benefits outweighed any conceivable risks. The study protocol was approved by the Scientific Committee of the participating healthcare institution, which served as an independent supervisory body (Approval No. ES 11302/16-02-2024). It is important to emphasize that no therapeutic interventions or risk-inducing procedures were implemented for either the participants or the hospital environment.

RESULTS

During the ten-month prospective study period, a total of 115 patients were admitted to the Intensive Care Unit (ICU). Of these, 63 patients met the predefined inclusion criteria and comprised the final study sample. The majority of participants were male (76.2%), with a mean age of 50 years and a mean Body Mass Index (BMI) of 23.9. A significant proportion (63.5%) were active smokers, and nearly 40% had at least one comorbidity. Regarding the nature of injury, most patients were classified as polytrauma cases (58.7%), while the remainder suffered from traumatic brain injury, burns, or isolated fractures. The patients' baseline characteristics are detailed in Table 1.

Microbiological Findings

Most positive microbiological cultures were derived from blood samples (52%), followed by rectal swabs, respiratory tract specimens, wound surfaces, and urinary samples. MDROs were identified in the first surveillance cultures in 61.9% of patients, primarily reflecting colonization, whereas outcome analyses were restricted to confirmed infections according to CDC/NHSN definitions. Among the isolated pathogens, 28.4% were classified as multidrug-resistant (MDR), 25% as extensively drug-resistant (XDR), and 4.9% as pandrug-resistant (PDR). Notably, Gram-negative pathogens predominated; all XDR and 90% of PDR strains, along with the majority of MDR isolates, belonged to this group.

Severity Scores and Correlations

Upon ICU admission, the mean SOFA score was 9.3 (SD = 2.2), indicating moderate organ dysfunction. A moderate positive correlation was observed between BMI and SOFA score ($r = 0.3$, $p < 0.01$), suggesting that higher BMI was associated with greater organ failure (Table 2).

The mean APACHE II score was 22 (SD = 5.0). The corresponding predicted mortality (29%) was derived from the APACHE II model but should be interpreted cautiously as calibration may vary in trauma cohorts. A strong positive correlation was found between APACHE II scores and age ($r = 0.6$, $p < 0.01$), indicating that older patients faced an increased risk of mortality (Table 3). Trauma severity, assessed via the Injury Severity Score (ISS), had a mean value of 25.6 (SD = 12.1), reflecting serious to critical injuries. A moderate negative correlation was identified between ISS and age ($r = -0.42$, $p < 0.01$), suggesting that younger patients presented with more severe trauma (Table 4).

Outcomes and Prognostic Indicators

Analysis of patient outcomes using the Glasgow Outcome Scale Extended (GOSE) revealed statistically significant differences relative to APACHE II ($H_3 = 9.0$, $p < 0.05$) and ISS scores ($H_3 = 7.9$, $p < 0.05$). Patients with unfavorable outcomes (i.e., severe disability or death) had significantly higher scores on both severity indices, supporting an association between disease severity and diminished functional recovery (Table 5).

There was also a significant association between the presence of MDROs and higher severity scores (SOFA, APACHE II, ISS), with statistically significant differences favoring infected patients (Table 6). However, interpretation of the PDR subgroup should be cautious due to the very small sample size (n = 3), which resulted in inconsistencies (e.g., SOFA values lower than MDR/XDR but ISS higher).

Specifically, patients with XDR infections had significantly higher SOFA scores compared to those with MDR infections ($p < 0.05$). Moreover, Gram-negative pathogens were more frequently isolated from patients with higher ISS scores, suggesting an association between Gram-negative infections and trauma severity ($p < 0.05$).

Association of Resistant Pathogens on Clinical Course

The presence of multidrug-resistant pathogens was associated with lower GOSE scores, corresponding to higher mortality or poorer functional outcomes. Furthermore, patients infected with resistant organisms were observed to have significantly prolonged durations of mechanical ventilation, sedation, and ICU stay ($p < 0.001$ for all comparisons) (Table 7).

Given that MDRO acquisition often occurs after a period of ICU

exposure, these associations may be confounded by severity of illness, device use, and length of stay, and should therefore be interpreted cautiously.

In particular, patients with PDR infections showed longer ventilation durations compared to those with MDR infections ($p < 0.05$). Nevertheless, the robustness of this finding is limited due to the very small PDR subgroup. However, no statistically significant differences were found between pathogen Gram classification and the duration of ventilation, sedation, or ICU stay ($p > 0.05$).

DISCUSSION

High Prevalence of MDROs in ICUs

The present study revealed a high detection rate of multidrug-resistant organisms already from the first culture during ICU hospitalization, a finding that in many cases corresponded to colonization rather than true infection. By explicitly differentiating colonization from infection according to CDC/NHSN criteria, outcome attribution in the present study was restricted to confirmed infections, thereby minimizing misclassification bias. Positive cultures mainly originated from respiratory, circulatory, urinary tract, rectal samples, and wound sites, reflecting the wide variety and frequency of infections in ICU patients.

According to international literature, ICU hospitalization increases the risk of infection by MDROs by 5 to 10 times compared to other hospital wards, due to disease severity, immunosuppression, comorbidities, invasive procedures, and extensive use of antibiotics.[23]

Predominance of Gram-Negative Bacteria and Antibiotic Resistance

Additionally, multidrug-resistant Gram-negative bacteria were numerically dominant over Gram-positive bacteria in ICUs, showing resistance mainly to carbapenems and cephalosporins. Gram-positive bacteria were less frequent and mainly resistant to methicillin and vancomycin.

This predominance necessitates continuous revision of empirical treatment protocols based on local epidemiological data to reduce unnecessary use of broad-spectrum antibiotics. Moreover, local cost-effectiveness studies are required to assess the implementation of control measures.[24,25,26]

Correlation with Severity Scores (SOFA, APACHE II, ISS)

Regarding severity scores, a statistically significant correlation was found between the presence of MDROs and higher values in the SOFA, APACHE II, and ISS scores. Although no linear relationship was observed between resistance levels (Non-MDR, MDR, XDR-PDR) and the scores, patients with MDR pathogens generally had higher scores.

Other studies confirm higher APACHE II and SOFA scores in patients with MDR/XDR infections, and highlight the strong prognostic association of these scores with mortality, especially in cases of Gram-negative MDR pathogens.[27,28,29]

However, in our study, APACHE II predicted mortality values should be interpreted cautiously, as model-based estimates may overestimate risk in specific trauma cohorts.

Role of the ISS Score in Trauma Patients

Furthermore, trauma severity, as reflected by the ISS, was associated with increased colonization by multidrug-resistant Gram-negative bacteria (e.g., K. pneumoniae, A. baumannii, P. aeruginosa). This finding agrees with a 2020 European multicenter study that documented a significant ISS–MDRO association ($p < 0.001$), with prolonged mechanical ventilation and extended ICU stay identified as additional risk factors.[30]

The absence of ISS–MDRO correlation in other regions, such as South Africa ($p = 0.63$), likely reflects local epidemiological differences.[31,32] This underscores the need for aggressive surveillance in patients with high ISS from the first day of admission.

Impact on Duration of Mechanical Ventilation and Sedation

The presence of MDROs was associated with longer durations of mechanical ventilation and sedation, a finding previously confirmed in research showing ventilator-associated pneumonia (VAP) increases ventilation duration by 4.75 times, while bacteremia and urinary tract infection increase it by 2 and 1.4 times, respectively.[33] Additionally, a study in Cyprus demonstrated that the average ventilation duration was 23 days for colonized patients versus 5 days for non-colonized ($p < 0.001$).[34] Similarly, the use of sedative drugs is also considered a risk factor for infections, as it suppresses natural airway reflexes.[35] Optimization of sedation—e.g., using a combination of propofol and midazolam—has been linked to faster extubation and reduced infections.[36]

Impact on Clinical Outcome and Mortality

However, one of the most important findings of the study is the association of MDRO infections with increased mortality, more severe complications, and poor outcomes. This observation was consistent even after restricting analyses to infections defined by CDC/NHSN criteria, further supporting the prognostic significance of true infections rather than colonization alone.

Although age and BMI were associated with mortality in our analysis, these findings were derived from bivariate correlations without multivariable adjustment (ΣΧΟΛΙΟ 5/19). Consequently, they should be interpreted with caution, as confounding factors such as severity scores, comorbidities, MDRO status, and organ support may attenuate or modify these associations.

This is not a new observation, as a Malaysian study showed that infection by A. baumannii increased the risk of death (HR 1.80, p = 0.005).[37] Also, a multicenter analysis found that MDRO colonization nearly tripled mortality, especially when appropriate therapy was delayed,[38] while another study showed MDROs were associated with lower Glasgow Outcome Scale (GOS-E) scores and increased mortality, although borderline statistically significant (p = 0.055).[30] Finally, a prospective Greek study confirmed increased hospital stay and mortality in MDR Gram-negative infections (p < 0.001).[39]

Nevertheless, the interpretation of results for PDR infections should be tempered, since the very small number of PDR cases (n = 3) leads to wide uncertainty and inconsistent associations.

CONCLUSION

The presence of multidrug-resistant pathogens in ICU patients was associated with a more severe clinical condition, prolonged mechanical ventilation, extended sedation, and increased mortality. The use of tools such as SOFA, APACHE II, and ISS enhances prognosis and monitoring.

Therefore, the research team considers it imperative to strengthen strategies for the early detection of MDROs, rational use of antibiotics, minimization of invasive procedures, and optimization of sedation and weaning protocols.

Given the small number of patients with PDR infections, conclusions regarding this subgroup must be interpreted with caution. A targeted and multifactorial approach is a key step towards reducing the burden of infections caused by multidrug-resistant organisms in trauma patients admitted to ICUs.

LIMITATIONS

This study has certain limitations that should be considered when interpreting the results. First, the relatively small sample size limits statistical power, particularly for subgroup analyses across resistance categories. This is especially relevant for the PDR subgroup, where the extremely low number of cases precludes reliable statistical comparisons and prevents any robust conclusions regarding the clinical course or outcomes of PDR infections. Observations related to PDR pathogens should therefore be interpreted as descriptive rather than inferential.

Second, the single-center design limits the external validity of the findings. Local factors such as antimicrobial stewardship policies, empirical treatment protocols, ICU admission criteria, infection control practices, and the regional microbiological ecology may have influenced both the incidence and resistance patterns of pathogens. As a result, the resistance distribution and outcome associations observed in this cohort may not be representative of other trauma ICUs with different epidemiological profiles.

Although significant associations were identified between MDR presence and worse clinical outcomes, as well as between variables such as age and BMI with mortality, the absence of multivariable regression modeling limits casual interpretation. These relationships may be confounded by underlying trauma severity, organ dysfunction, comorbidities, duration of invasive support, or other unmeasured clinical variables. Therefore, the reported associations cannot be interpreted as independent predictors of mortality or poor functional outcome. Additionally, the study design does not allow precise determination of the temporal relationship between infection onset and clinical deterioration. Since MDR infections often develop after prolonged ventilation or ICU stay may partly reflect reverse causality.

Furthermore, the study did not incorporate molecular or genetic analyses that could clarify resistance mechanisms and contribute to personalized treatment.

Finally, the absence of long-term patient follow-up does not allow for the assessment of the long-term effects of multidrug-resistant organism infections on functional recovery and quality of life.

The lack of multivariable regression analyses, time-dependent models, and differentiation between empiric and targeted antimicrobial therapy, as well as omission of data on antimicrobial days, represent important methodological limitations.

For these reasons, future multicenter and longitudinal studies with more comprehensive design and detailed analysis are needed to enhance understanding and clinical management of multidrug-resistant infections in critically ill patients.

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Conflict of interest

The authors report that there is no conflict of interest.

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ANNEX

TABLE 1. Basic characteristics of study patients (mean ± standard deviation).

N (=63)	
Age (Years)	50 ± 22.1
Gender (Male/Female)	48 (76.2%) / 15 (23.8%)
Smoking (Yes/No)	40 (63.5%) / 23 (36.5%)
BMI	23.9 ± 4.9
SOFA	9.3 ± 2.2
APACHE II	22 ± 5.0
APACHE II %	29% ± 0.1
ISS	25.6 ± 12.1
Days on Mechanical Ventilation	25 ± 25
Days on Sedation	16.6 ± 15.1
Days in ICU	31.4 ± 29.1
Days until Infection Occurrence	7 ± 6.7
Admission Diagnosis	
Polytrauma	37 (58.7%)
Traumatic Brain Injury	14 (22.1%)
Thermal Burn	7 (11.1%)
Cervical Fracture	6 (9.6%)
Femoral Fracture	2 (3.2%)
Comorbidities	
Cardiovascular	15 (23.8%)
Diabetes	9 (14.3%)
Respiratory	2 (3.2%)
Malignancy	2 (3.2%)
Psychiatric	2 (3.2%)
None	38 (60.3%)
Patient Outcome	
High Dependency Unit (HDU)	1 (1.5%)
Other ICU	1 (1.5%)
Transferred to Other Hospital	4 (6.3%)
Neurosurgery Ward	15 (23.8%)
Medical Ward	2 (3.1%)
Plastic Surgery Ward	6 (9.5%)
Maxillofacial Surgery Ward	1 (1.5%)
Orthopedic Ward	10 (15.8%)
Surgical Ward	2 (3.1%)
Death	21 (33.3%)

TABLE 2. Spearman correlation analysis between the SOFA score and age, BMI, days of hospitalization until infection onset, days on mechanical ventilation, and days of sedation during ICU stay.

		SOFA
Age	R	.182
	P	.154
Body Mass Index (BMI)	R	.398**
	P	.001
Days of hospitalization until infection onset	R	.175
	P	.171
Days on mechanical ventilation	R	.217
	P	.088
Days of sedation	R	.177
	P	.164
Length of ICU stay	R	.140
	P	.274

TABLE 3. Pearson correlation analysis between APACHE II and age, BMI, days of hospitalization until infection onset, days on mechanical ventilation, and days of sedation during ICU stay.

		APACHE II
Age	R	,633**
	p	,000
Body Mass Index (BMI)	r	,163
	p	,202
Days of Hospitalization until Infection Onset	r	,088
	p	,490
Days on Mechanical Ventilation	r	,194
	p	,127

TABLE 4. Spearman correlation analysis between ISS Score and age, BMI, days of hospitalization until infection onset, days on mechanical ventilation, and days of sedation during ICU stay.

		ISS
Age	R	-,426**
	P	,000
Body Mass Index (BMI)	R	,178
	P	,163
Days of Hospitalization until Infection Onset	R	,101
	P	,432
Days on Mechanical Ventilation	R	,162
	P	,203
Days of Sedation	R	,094
	P	,465
Duration of ICU Stay	R	,125
	P	,329

TABLE 5. Kruskal–Wallis Test between GOSE Outcome and Disease Severity according to SOFA, APACHE, and ISS Scores.

	GOSE	N	Mean Rank	H	Df	P-Value
SOFA	Death	21	36.5	3.0	3	0.383
	Severe Disability – Low Level	21	32.4			
	Moderate Disability – High Level	11	28.5			
	Good Recovery – High Level	10	25.4			
	Total	63				
APACHE II	Death	21	38.7	7.6	3	0.053
	Severe Disability – Low Level	21	33.4			
	Moderate Disability – High Level	11	26.3			
	Good Recovery – High Level	10	21.0			
	Total	63				
APACHE II (percentage)	Death	21	38.6	9.0	3	0.029
	Severe Disability – Low Level	21	34.1			
	Moderate Disability – High Level	11	26.0			
	Good Recovery – High Level	10	20.1			
	Total	63				
ISS	Death	21	39.5	7.9	3	0.047
	Severe Disability – Low Level	21	32.3			
	Moderate Disability – High Level	11	21.5			
	Good Recovery – High Level	10	26.9			
	Total	63				

TABLE 6. Severity results according to the presence or absence of multidrug-resistant microorganisms, by resistance category, and by GRAM classification (mean ± standard deviation.

		SOFA	APACHE II	ISS	GOSE
Multidrug-resistant	Yes	9.79 (±2.19)	22.65 (±5.04)	28.33 (±12.85)	2.87 (±1.76)
	No	8.41 (±1.96)	20.73 (±4.59)	22.36 (±8.09)	4.95 (±2.96)
P		**0.002**	**0.047**	**0.048**	**0.002**
Resistance Category	XDR	9.98 (±2.01)	22.37 (±5.84)	29.92 (±14.36)	3.04 (±2.12)
	MDR	9.53 (±2.22)	22.36 (±4.13)	28.41 (±12.28)	2.67 (±1.36)
	PDR	7.80 (±2.48)	22.80 (±4.05)	33.20 (±12.19)	2.20 (±1.03)
P		**0.034**	**0.921**	**0.387**	**0.617**
Classification by GRAM	GRAM-	9.56 (±2.21)	22.45 (±4.88)	29.91 (±13.05)	2.78 (±1.69)
	GRAM+	10.08 (±2.13)	22.86 (±5.32)	24.79 (±11.51)	3.14 (±2.00)
P		**0.202**	**0.489**	**0.002**	**0.293**

TABLE 7. Results regarding days on mechanical ventilation, sedation, ICU stay, and hospital stay according to the presence or absence of multidrug-resistant microorganisms, resistance category, and GRAM classification.

		Days on Mechanical Ventilation	*Days on Sedation*	*Days of ICU Stay*
Multidrug-resistant	*Yes*	*34.75* (±25.71)	*22.70* (±14.98)	*49.02* (±34.27)
	No	*9.95* (±5.825)	*8.95* (±6.18)	*12.40* (±6.65)
P		***< 0.001***	***< 0.001***	***< 0.001***
Resistance Category	*XDR*	*33.59* (±24.40)	*21.94* (±14.32)	*46.88* (±31.63)
	MDR	*33.52* (±24.56)	*23.84* (±13.62)	*49.14* (±37.37)
	PDR	*36.00* (±17.71)	*27.90* (±18.21)	*54.70* (±30.78)
P		***0.034***	***0.921***	***0.387***
Classification by GRAM	*GRAM-*	*33.19* (±23.37)	*22.86* (±14.20)	*47.41* (±32.84)
	GRAM+	*34.82* (±29.23)	*21.12* (±16.01)	*47.81* (±36.81)
P		***0.394***	***0.641***	***0.229***