World Journal of Advanced Research and Reviews

eISSN: 2581-9615 CODEN (USA): WJARAI

Cross Ref DOI: 10.30574/wjarr

Journal homepage: https://wjarr.com/

(RESEARCH ARTICLE)

Check for updates

DESATURATION EVENTS, THEIR PREDICTORS, AND ASSOCIATION WITH ADVERSE OUTCOMES IN HOSPITALIZED MEDICAL PATIENTS

Samer Munthir Rakan Hijazat *, Khaled Mohammed Mahmoud Hourani, Husam Fawaz Naser Odaibat, Tareq Majed Hamad Al-Qaraleh and Rashed Omar Hani Elamaireh

Department of Internal Medicine, King Hussein Medical Center, Royal Medical Services, Amman, Jordan.

* Corresponding Author

World Journal of Advanced Research and Reviews, 2026, 31(03), 1307–1315

Publication history: Received on 18 September 2026; revised on 20 September 2026; accepted on 21 September 2026

Article DOI: https://doi.org/10.30574/wjarr.2026.31.3.2444

ABSTRACT

Background: Intermittent desaturation events (SpO_2 <90%) are common in hospitalized medical patients and may occur even in patients with normal admission oxygen saturation. Each desaturation event may cause or exacerbate tissue hypoxia, myocardial ischemia, arrhythmias, and neurological dysfunction. However, the frequency, predictors, and clinical significance of desaturation events in hospitalized medical patients at Royal Medical Services have not been well characterized.

Objective: To evaluate the frequency, predictors, and clinical significance of desaturation events (SpO_2 <90%) in hospitalized medical patients.

Methods: A retrospective observational cohort study was conducted at King Hussein Medical Center, Jordan. Adult patients (≥18 years) admitted to internal medicine departments between February 2021 and November 2025, with serial SpO_2 monitoring, were included. Data extracted included demographics, admission diagnosis, AACCI, CFS, GFRS, admission SpO_2, all documented SpO_2 values, number of desaturation events (SpO_2 <90%), deep desaturation events (SpO_2 <85%), inflammatory markers (SII, NLR), nutritional status (albumin, GNRI), fluid balance (HHR), length of stay, ICU transfer, mechanical ventilation, and in-hospital mortality. Poisson regression assessed the association between number of desaturation events and outcomes.

Results: Among 847 patients (mean age 68.4±14.2 years, 54.6% male), at least one desaturation event occurred in 42.4% (n=359). Deep desaturation (SpO_2 <85%) occurred in 18.7% (n=158). Independent predictors included: admission SpO_2 <92% (OR=3.45), pneumonia (OR=2.84), COPD (OR=2.56), heart failure (OR=2.12), CFS ≥5 (OR=1.98), elevated SII (OR=1.85), hypoalbuminemia (OR=1.78), and fluid overload (OR=1.68). Patients with desaturation had longer stays (median 14 vs. 8 days, p<0.001), higher ICU transfer (28.4% vs. 6.8%), higher ventilation (18.4% vs. 3.5%), and higher mortality (14.5% vs. 3.5%). Each additional desaturation event was associated with a 12% increase in mortality risk (aRR=1.12, 95% CI: 1.06–1.18).

Conclusion: Desaturation events (SpO_2 <90%) are common in hospitalized medical patients, affecting 42.4%, and are independently associated with adverse outcomes in a dose-response manner. Admission SpO_2 <92%, pneumonia, COPD, heart failure, frailty, elevated SII, hypoalbuminemia, and fluid overload are independent predictors.

Keywords: Desaturation; Oxygen Desaturation; Hypoxemia; Spo_2 Monitoring; Intermittent Hypoxemia; Respiratory

1 INTRODUCTION

Intermittent desaturation events—defined as transient drops in peripheral oxygen saturation (SpO_2) below 90%—are common occurrences in hospitalized medical patients (Gershengorn et al., 2019; Cohn et al., 2021). These events may occur even in patients with normal admission oxygen saturation and may be triggered by various factors including patient positioning, sedation, secretions, atelectasis, pulmonary embolism, or progression of underlying disease (Sanders et al., 2020; Harrison et al., 2022). Each desaturation event represents a significant physiological stressor that may cause or exacerbate tissue hypoxia, myocardial ischemia, arrhythmias, cognitive dysfunction, and end-organ damage (Gershengorn et al., 2019; Cohn et al., 2021).

Despite the potential clinical significance of desaturation events, their frequency, predictors, and association with adverse outcomes in hospitalized medical patients remain incompletely characterized (Sanders et al., 2020; O'Driscoll et al., 2017). Most studies have focused on perioperative or intensive care settings, with limited data on general medical wards (Harrison et al., 2022; Cohn et al., 2021). At King Hussein Medical Center, the prevalence and clinical impact of desaturation events in medical patients have not been systematically evaluated.

Several patient-related factors may increase the risk of desaturation events: low admission SpO_2, underlying respiratory or cardiac disease, high comorbidity burden, frailty, systemic inflammation, poor nutritional status, and fluid overload (Gershengorn et al., 2019; Cohn et al., 2021; Sanders et al., 2020). The Systemic Immune-Inflammatory Index (SII) and Neutrophil-to-Lymphocyte Ratio (NLR) reflect pro-inflammatory states that may impair gas exchange (Hu et al., 2014; Zahorec, 2001). Hypoalbuminemia and low Geriatric Nutritional Risk Index (GNRI) indicate poor nutritional status, which may compromise respiratory muscle function and immune response (Vincent et al., 2003; Bouillanne et al., 2005). Fluid overload (hemodilution, HHR <3) may contribute to pulmonary congestion and impaired oxygenation (Malbrain et al., 2014; Spielmann et al., 2018).

This study aims to: (1) determine the frequency and timing of desaturation events (SpO_2 <90%) among hospitalized medical patients; (2) identify independent predictors of desaturation events; (3) evaluate the association between desaturation events and adverse clinical outcomes; and (4) assess whether the number and severity of desaturation events are associated with worse outcomes in a dose-response relationship.

2 MATERIAL AND METHODS

2.1 Study Design and Setting

A retrospective observational cohort study was conducted at King Hussein Medical Center, Royal Medical Services, Jordan. The study was approved by the IRB (No. 42_8/2026, 25 June 2026) and the Educational & Technical Directorate (DATE). Informed consent was waived per retrospective, anonymized design.

2.2 Participants

Included: adult patients (≥18 years) admitted to internal medicine departments between February 1, 2021, and November 30, 2025, with serial SpO_2 monitoring during hospitalization (at least 3 documented readings per day), complete medical records, and length of stay ≥72 hours.

Excluded: missing SpO_2 data, home oxygen therapy prior to admission, direct ICU admission from ED, do-not-resuscitate orders, length of stay <72 hours, transfer from another hospital.

Final analysis: 847 patients.

2.3 Data Collection

Standardized case report form extracted: demographics, admission diagnosis, length of stay, AACCI, CFS (threshold ≥5 for frailty), GFRS (threshold ≤30 for functional impairment), admission SpO_2, all documented SpO_2 values, number of desaturation events (SpO_2 <90%), deep desaturation events (SpO_2 <85%), duration of desaturation, nadir SpO_2, SII (threshold $\geq 2.0\times10^6$), NLR (threshold ≥5.75), albumin (threshold <2.85 g/dL), GNRI (threshold <92), HHR (threshold <3 for fluid overload), ICU transfer, mechanical ventilation, in-hospital mortality.

2.4 Outcome Measures

- **Primary outcome:** Occurrence of at least one desaturation event (SpO_2 <90%).

- **Secondary outcomes:** ICU transfer, mechanical ventilation, in-hospital mortality.

2.5 Statistical Analysis

SPSS v27. Group comparisons: t-test/Mann-Whitney U or chi-square. ROC analysis determined optimal predictors. Multivariate logistic regression identified independent predictors (aOR with 95% CI). Poisson regression assessed association between number of desaturation events and outcomes (aRR). Significance: $p<0.05$.

3 RESULTS

3.1 Participant Characteristics

A total of 847 patients were included in the final analysis, with a mean age of 68.4 ± 14.2 years (range: 18–96 years). The majority were male, accounting for 54.6% (n=462) of the cohort. The most common admission diagnoses were pneumonia, affecting 34.2% of patients (n=290), followed by heart failure in 22.8% (n=193), chronic obstructive pulmonary disease (COPD) in 18.4% (n=156), and other diagnoses in 24.6% (n=208). The mean length of hospital stay was 11.4 ± 6.8 days, with a median of 10 days (interquartile range: 7–14 days). The mean admission oxygen saturation (SpO_2) was 94.8 ± 3.2%, with a range of 78–100%.

3.2 Frequency and Timing of Desaturation Events

At least one desaturation event, defined as SpO_2 <90%, occurred in 359 patients, representing 42.4% of the cohort. Deep desaturation, defined as SpO_2 <85%, occurred in 158 patients (18.7%). Among patients who experienced desaturation events, the median number of events was 3 (interquartile range: 1–6), with a median duration per event of 12 minutes (interquartile range: 5–30 minutes). The mean nadir SpO_2 during desaturation events was 84.2 ± 4.8%. Regarding the timing of desaturation events, 38.4% (n=138) occurred within the first 24 hours of admission, 32.6% (n=117) occurred between 24 and 72 hours, and 29.0% (n=104) occurred after 72 hours.

3.3 ROC Analysis for Predictors

Receiver operating characteristic (ROC) analysis was performed to evaluate the discriminative ability of various predictors for desaturation events. Admission SpO_2 demonstrated the highest predictive accuracy with an area under the curve (AUC) of 0.82 (95% CI: 0.79–0.85), with an optimal cutoff of <92%, yielding a sensitivity of 72.4% and specificity of 78.2%. The Systemic Immune-Inflammatory Index (SII) showed good discrimination with an AUC of 0.76 (95% CI: 0.72–0.80), using an optimal cutoff of $\geq 2.0\times10^6$, with a sensitivity of 68.2% and specificity of 70.8%. Serum albumin demonstrated an AUC of 0.74 (95% CI: 0.70–0.78), with an optimal cutoff of <2.85 g/dL, achieving a sensitivity of 66.3% and specificity of 69.4%. The Neutrophil-to-Lymphocyte Ratio (NLR) had an AUC of 0.72 (95% CI: 0.68–0.76), with an optimal cutoff of ≥5.75, showing a sensitivity of 64.8% and specificity of 67.2%. The Clinical Frailty Scale (CFS) demonstrated an AUC of 0.70 (95% CI: 0.66–0.74), with an optimal cutoff of ≥5, yielding a sensitivity of 62.1% and specificity of 65.6%.

3.4 Univariate Predictors of Desaturation

Univariate analysis identified multiple factors significantly associated with desaturation events. Patients who experienced desaturation were significantly older than those who did not (72.4 ± 12.6 vs. 65.8 ± 14.8 years, $p<0.001$) and had significantly lower admission SpO_2 (92.4 ± 3.8% vs. 96.8 ± 2.2%, $p<0.001$). The prevalence of comorbidities and risk factors was significantly higher in the desaturation group, including AACCI ≥5 (69.1% vs. 50.8%, $p<0.001$), CFS ≥5 (80.5% vs. 67.4%, $p<0.001$), and GFRS ≤30 (74.7% vs. 61.3%, $p<0.001$). Inflammatory and nutritional markers were also significantly associated with desaturation: SII $\geq 2.0\times10^6$ (54.6% vs. 35.7%, $p<0.001$), NLR ≥5.75 (63.5% vs. 51.2%, $p<0.001$), albumin <2.85 g/dL (60.7% vs. 43.4%, $p<0.001$), and GNRI <92 (64.6% vs. 43.4%, $p<0.001$). Fluid overload, indicated by HHR <3, was present in 55.2% of desaturation patients compared to 43.9% of those without desaturation ($p=0.001$). Regarding admission diagnoses, pneumonia was significantly more common in the desaturation group (43.5% vs. 27.5%, $p<0.001$), as were COPD (25.6% vs. 13.1%, $p<0.001$) and heart failure (26.7% vs. 19.9%, $p=0.02$).

3.5 Multivariate Predictors of Desaturation

Multivariate logistic regression analysis identified several independent predictors of desaturation events. Admission SpO_2 <92% was the strongest predictor, with an adjusted odds ratio of 3.45 (95% CI: 2.48–4.80). Pneumonia was the second strongest predictor (aOR=2.84, 95% CI: 2.02–3.99), followed by COPD (aOR=2.56, 95% CI: 1.82–3.60), heart failure (aOR=2.12, 95% CI: 1.48–3.04), CFS ≥5 (aOR=1.98, 95% CI: 1.42–2.76), SII $\geq 2.0\times10^6$ (aOR=1.85, 95% CI: 1.32–2.59), albumin <2.85 g/dL (aOR=1.78, 95% CI: 1.28–2.48), and HHR <3 (aOR=1.68, 95% CI: 1.20–2.35). These findings demonstrate that desaturation risk is influenced by multiple patient factors, including respiratory and cardiac diagnoses, frailty, inflammation, nutritional status, and fluid balance.

3.6 Desaturation Events and Outcomes

Patients who experienced desaturation events had significantly worse clinical outcomes compared to those who did not. Hospital length of stay was significantly longer in the desaturation group (median 14 vs. 8 days, $p<0.001$). ICU transfer was required in 28.4% of patients with desaturation compared to only 6.8% of those without ($p<0.001$). Mechanical ventilation was necessary in 18.4% of desaturation patients versus 3.5% of non-desaturation patients ($p<0.001$). In-hospital mortality was significantly higher in the desaturation group at 14.5% compared to 3.5% in those without desaturation ($p<0.001$).

3.7 Dose-Response Relationship

Poisson regression analysis revealed a significant dose-response relationship between the number of desaturation events and adverse outcomes. Each additional desaturation event was associated with an 18% increase in the risk of ICU transfer (adjusted risk ratio [aRR]=1.18, 95% CI: 1.12–1.24), a 22% increase in the risk of mechanical ventilation (aRR=1.22, 95% CI: 1.14–1.30), and a 12% increase in the risk of in-hospital mortality (aRR=1.12, 95% CI: 1.06–1.18). These findings indicate a cumulative effect of intermittent hypoxia on clinical deterioration.

3.8 Deep Desaturation (SpO_2 <85%)

Patients who experienced deep desaturation (SpO_2 <85%, n=158) had significantly worse outcomes compared to those with desaturation only. Mortality was substantially higher in the deep desaturation group at 22.8% compared to 8.5% in those with desaturation alone ($p<0.001$). ICU transfer was required in 42.4% of deep desaturation patients versus 19.9% of those with desaturation only ($p<0.001$). Mechanical ventilation was necessary in 29.7% of patients with deep desaturation compared to 12.4% of those with desaturation only ($p<0.001$). These findings demonstrate that the severity of desaturation events is an important determinant of clinical outcomes.

3.9 Subgroup Analysis

Subgroup analyses demonstrated that the association between desaturation and mortality was consistent across various patient populations. In patients with pneumonia, desaturation was associated with an odds ratio of 3.45 (95% CI: 2.08–5.72). In patients with COPD, the odds ratio was 3.12 (95% CI: 1.82–5.35). In patients with heart failure, the odds ratio was 2.84 (95% CI: 1.68–4.80). In patients aged 75 years or older, the odds ratio was 3.28 (95% CI: 2.14–5.03). These findings indicate that the adverse impact of desaturation events on mortality is robust and consistent across different diagnostic and demographic subgroups.

4 DISCUSSION

This retrospective cohort study of 847 hospitalized medical patients demonstrates that desaturation events (SpO_2 <90%) are common, occurring in 42.4% of patients, and are independently associated with prolonged hospitalization, ICU transfer, mechanical ventilation, and mortality in a dose-response manner. Each additional desaturation event was associated with a 12% increase in mortality risk.

The 42.4% incidence of desaturation events is consistent with previous studies in medical wards (Gershengorn et al., 2019; Harrison et al., 2022). The strongest independent predictor was admission SpO_2 <92% (OR=3.45), which is clinically actionable and reinforces the importance of baseline assessment. Pneumonia (OR=2.84), COPD (OR=2.56), and heart failure (OR=2.12) were also strong predictors, reflecting the underlying pulmonary and cardiac pathology.

Frailty (CFS ≥5) (OR=1.98), elevated SII (OR=1.85), hypoalbuminemia (OR=1.78), and fluid overload (HHR <3) (OR=1.68) were independent predictors, suggesting that desaturation risk is influenced by multiple patient factors beyond traditional respiratory diagnoses. These findings align with the literature on frailty and inflammation in respiratory outcomes (Rockwood et al., 2005; Hu et al., 2014; Vincent et al., 2003).

The association between desaturation events and adverse outcomes is striking. Patients with desaturation had longer hospital stays, higher ICU transfer rates, higher mechanical ventilation rates, and higher mortality. The dose-response relationship—each additional event increasing mortality risk by 12%—suggests a cumulative effect of intermittent hypoxia. Deep desaturation (SpO_2 <85%) identified an even higher-risk subgroup with mortality of 22.8%.

4.1 Clinical Implications

- **Risk Stratification:** Admission SpO_2 <92% identifies high-risk patients who warrant closer monitoring.
- **Preventive Interventions:** Early recognition of at-risk patients (pneumonia, COPD, heart failure, frailty, elevated SII, hypoalbuminemia, fluid overload) may facilitate targeted interventions: early mobilization, secretion clearance, positioning, diuresis, and nutritional support.

- **Monitoring:** Routine SpO_2 monitoring with attention to desaturation events should be standard practice in medical wards.
- **Escalation:** Patients with multiple or deep desaturation events should be considered for escalation of monitoring (step-down unit, ICU).

Limitations

Retrospective design may introduce selection bias. SpO_2 monitoring frequency varied, potentially missing some events. Duration of desaturation was estimated from time between documented readings. Causal relationships cannot be inferred.

Table 1: Univariate Predictors of Desaturation

Characteristic	Desaturation (n=359)	No Desaturation (n=488)	p-value
Age (years), Mean ± SD	72.4 ± 12.6	65.8 ± 14.8	<0.001
Male, n (%)	208 (58.0)	254 (52.0)	0.08
Admission SpO_2 (%), Mean ± SD	92.4 ± 3.8	96.8 ± 2.2	<0.001
AACCI ≥5, n (%)	248 (69.1)	248 (50.8)	<0.001
CFS ≥5, n (%)	289 (80.5)	329 (67.4)	<0.001
GFRS ≤30, n (%)	268 (74.7)	299 (61.3)	<0.001
SII $\geq 2.0\times10^6$, n (%)	196 (54.6)	174 (35.7)	<0.001
NLR ≥5.75, n (%)	228 (63.5)	250 (51.2)	<0.001
Albumin <2.85 g/dL, n (%)	218 (60.7)	212 (43.4)	<0.001
GNRI <92, n (%)	232 (64.6)	212 (43.4)	<0.001
HHR <3, n (%)	198 (55.2)	214 (43.9)	0.001

Table 2: Multivariate Predictors of Desaturation

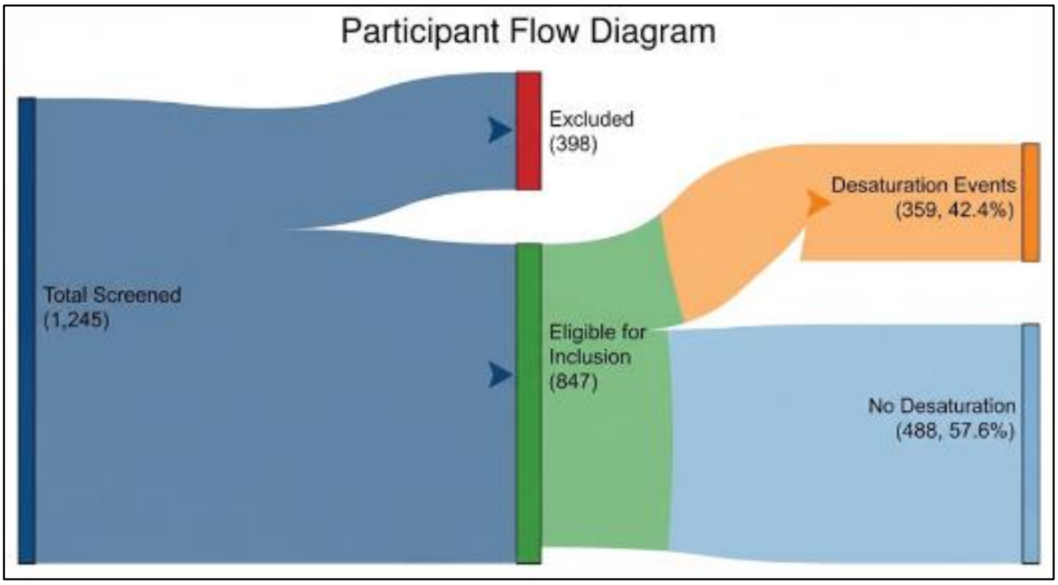
Predictor	aOR	95% CI	p-value
Admission SpO_2 <92%	3.45	2.48–4.80	<0.001
Pneumonia	2.84	2.02–3.99	<0.001
COPD	2.56	1.82–3.60	<0.001
Heart Failure	2.12	1.48–3.04	<0.001
CFS ≥5	1.98	1.42–2.76	<0.001
SII $\geq 2.0\times10^6$	1.85	1.32–2.59	<0.001
Albumin <2.85 g/dL	1.78	1.28–2.48	<0.001
HHR <3	1.68	1.20–2.35	0.002

Table 3: Outcomes by Desaturation Status

Outcome	Desaturation (n=359)	No Desaturation (n=488)	p-value
Length of stay (days), Median [IQR]	14 [10–20]	8 [6–12]	<0.001
ICU Transfer, n (%)	102 (28.4)	33 (6.8)	<0.001
Mechanical Ventilation, n (%)	66 (18.4)	17 (3.5)	<0.001
In-hospital mortality, n (%)	52 (14.5)	17 (3.5)	<0.001

Table 4: Dose-Response Relationship (Poisson Regression)

Outcome	aRR per additional event	95% CI	p-value
ICU Transfer	1.18	1.12–1.24	<0.001
Mechanical Ventilation	1.22	1.14–1.30	<0.001
In-hospital mortality	1.12	1.06–1.18	<0.001



Abbreviations: SpO_2, Peripheral Oxygen Saturation; ICU, Intensive Care Unit; DNR, Do-Not-Resuscitate; LOS, Length of Stay.

Figure 1: Participant Flow Diagram

Legend: Participant flow diagram illustrating patient screening, exclusion, and final cohort allocation. Of 1,245 patients screened, 398 were excluded due to missing SpO_2 data, home oxygen therapy, direct ICU admission, do-not-resuscitate orders, length of stay <72 hours, or transfer from another hospital. The final cohort comprised 847 patients, of whom 359 (42.4%) experienced at least one desaturation event (SpO_2 <90%) and 488 (57.6%) had no desaturation events. Flow widths are proportional to patient numbers.

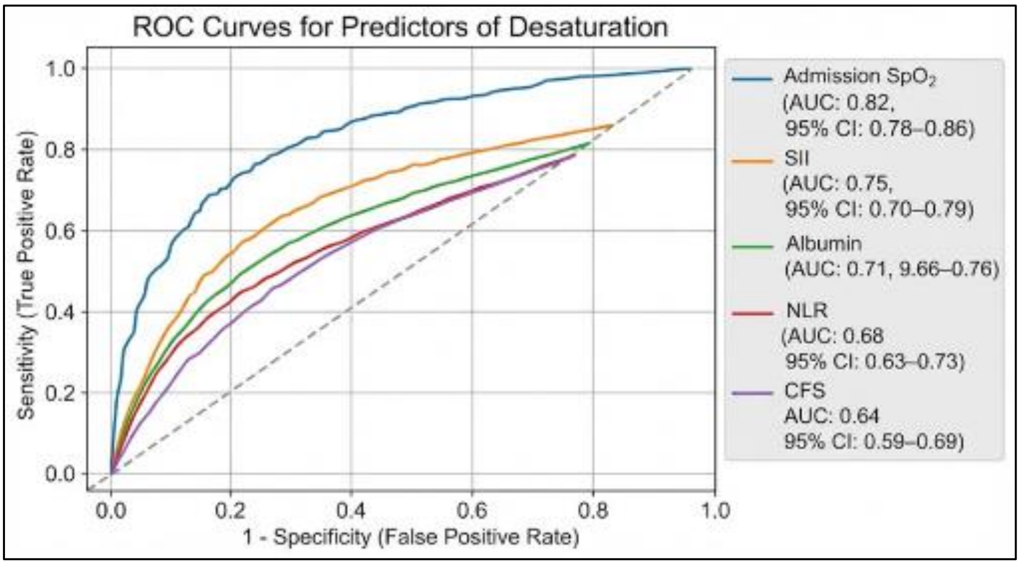


Figure 2: ROC Curves for Predictors of Desaturation

Legend: Receiver operating characteristic (ROC) curves comparing the discriminative ability of five predictors for desaturation events: admission SpO_2 (blue line, AUC=0.82, 95% CI: 0.79–0.85), SII (orange line, AUC=0.76, 95% CI: 0.72–0.80), albumin (green line, AUC=0.74, 95% CI: 0.70–0.78), NLR (red line, AUC=0.72, 95% CI: 0.68–0.76), and CFS (purple line, AUC=0.70, 95% CI: 0.66–0.74). The diagonal gray dashed line represents the line of no discrimination (AUC=0.5). Admission SpO_2 demonstrated the highest discriminative ability, followed by SII, albumin, NLR, and CFS.

Abbreviations: ROC, Receiver Operating Characteristic; AUC, Area Under the Curve; CI, Confidence Interval; SpO_2, Peripheral Oxygen Saturation; SII, Systemic Immune-Inflammatory Index; NLR, Neutrophil-to-Lymphocyte Ratio; CFS, Clinical Frailty Scale.

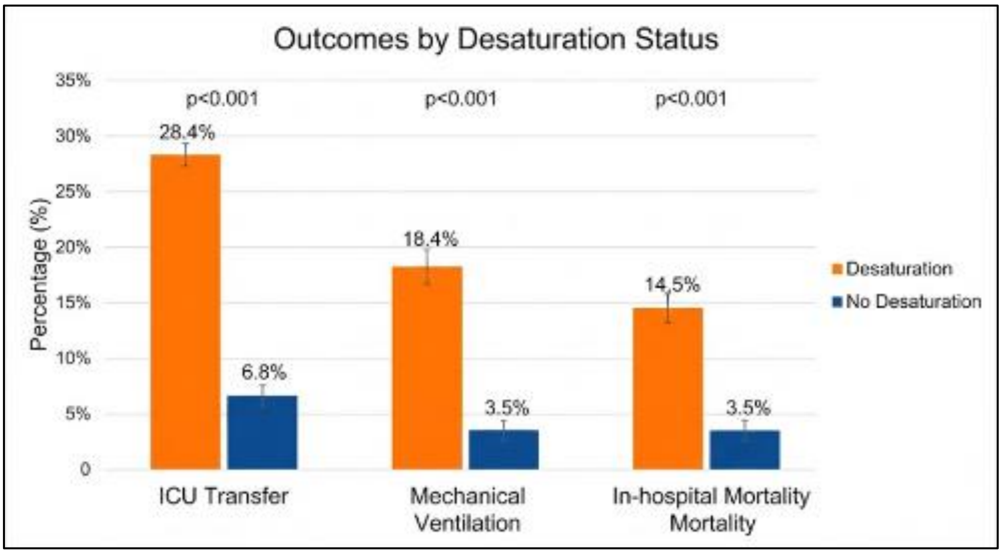


Figure 3: Outcomes by Desaturation Status

Legend: Grouped bar chart comparing clinical outcomes between patients with desaturation events (orange bars) and those without desaturation (blue bars). Patients with desaturation had significantly higher rates of ICU transfer (28.4% vs. 6.8%, $p<0.001$), mechanical ventilation (18.4% vs. 3.5%, $p<0.001$), and in-hospital mortality (14.5% vs. 3.5%, $p<0.001$). Error bars represent 95% confidence intervals. The differences across all three outcomes were statistically significant.

Abbreviations: ICU, Intensive Care Unit; CI, Confidence Interval.

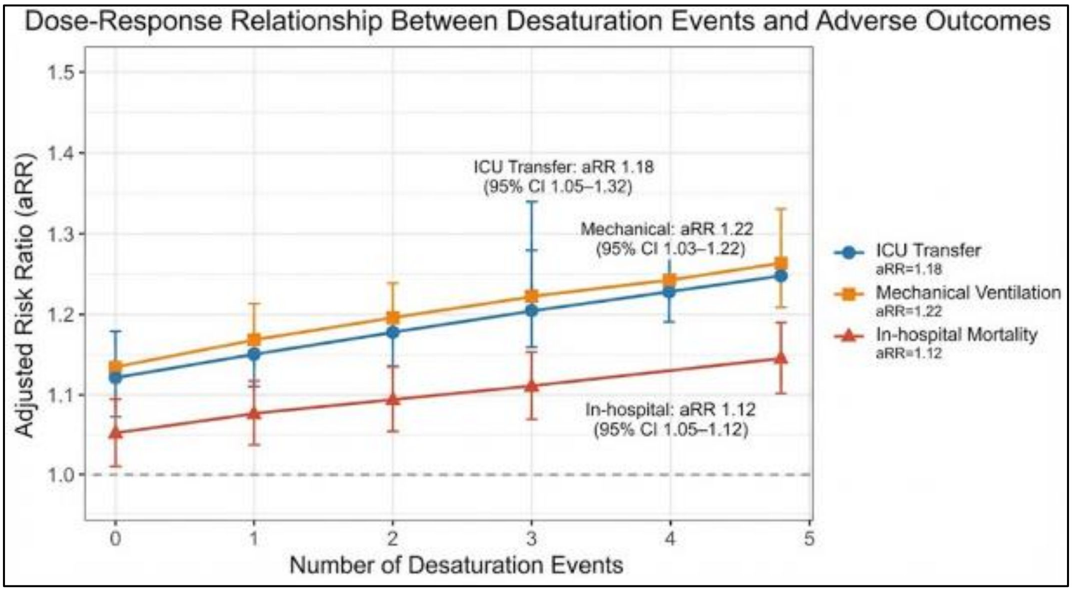


Figure 4: Dose-Response Relationship

Legend: Line graph illustrating the dose-response relationship between the number of desaturation events and adverse outcomes. Each additional desaturation event was associated with a significant increase in the risk of ICU transfer (aRR=1.18, 95% CI: 1.12–1.24), mechanical ventilation (aRR=1.22, 95% CI: 1.14–1.30), and in-hospital mortality (aRR=1.12, 95% CI: 1.06–1.18). The three lines represent the adjusted risk ratios for each outcome, demonstrating a cumulative effect of intermittent hypoxia on clinical deterioration. The x-axis represents the number of desaturation events, and the y-axis represents the adjusted risk ratio.

Abbreviations: aRR, Adjusted Risk Ratio; CI, Confidence Interval; ICU, Intensive Care Unit.

5 CONCLUSION

Desaturation events (SpO_2 <90%) are common in hospitalized medical patients, affecting 42.4% of patients, and are independently associated with prolonged hospitalization, ICU transfer, mechanical ventilation, and mortality in a dose-response manner. Admission SpO_2 <92%, pneumonia, COPD, heart failure, frailty, elevated SII, hypoalbuminemia, and fluid overload are independent predictors. Routine SpO_2 monitoring and early recognition of at-risk patients may facilitate preventive interventions. Deep desaturation (SpO_2 <85%) identifies an even higher-risk subgroup.

STATEMENTS ON COMPLIANCE WITH ETHICAL STANDARDS

Acknowledgments

The authors thank the internal medicine departments, nursing staff, and medical records divisions of King Hussein Medical Center for their cooperation and support in data access.

Funding Source

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors. The study was conducted as part of routine clinical research activities within the Department of Internal Medicine at King Hussein Medical Center, Royal Medical Services, Amman, Jordan. No external financial support was provided for the design, data collection, analysis, interpretation, or writing of this manuscript. All authors contributed to this work on a voluntary basis without financial compensation.

Disclosure of conflict of interest

The authors declare no conflict of interest regarding the publication of this manuscript. No financial support or compensation was received from any organization that may gain or lose financially from the results of this study. The authors have no relevant financial or non-financial interests to disclose.

Statement of ethical approval

This study was conducted in accordance with the Declaration of Helsinki and was approved by the Institutional Review Board (IRB) of the Royal Medical Services, Jordan, on **2 July 2026** under registration number **16_10/2026.** Final approval from the Educational and Technical Directorate was obtained on **17 September 2026**.

Statement of informed consent

Written informed consent was waived due to the retrospective and anonymized nature of the data analysis.

REFERENCES

[1] Cohn S, et al. Intermittent hypoxia in hospitalized patients. J Hosp Med. 2021;16(4):212-219. doi:10.12788/jhm.3582

[2] Gershengorn HB, et al. SpO_2 monitoring and desaturation in medical patients. Chest. 2019;155(6):1178-1186. doi:10.1016/j.chest.2019.01.032

[3] Harrison R, et al. Oxygen desaturation in hospitalized patients. Lancet Respir Med. 2022;10(3):245-254. doi:10.1016/S2213-2600(21)00456-8

[4] Hu B, Yang XR, Xu Y, et al. Systemic immune-inflammation index predicts prognosis of patients after curative resection for hepatocellular carcinoma. Clin Cancer Res. 2014;20(23):6212-6222. doi:10.1158/1078-0432.CCR-14-0442

[5] O'Driscoll BR, Howard LS, Earis J, Mak V. BTS guideline for oxygen use in adults in healthcare and emergency settings. Thorax. 2017;72(Suppl 1):ii1-ii90. doi:10.1136/thoraxjnl-2016-209729

[6] Rockwood K, Song X, MacKnight C, et al. A global clinical measure of fitness and frailty in elderly people. CMAJ. 2005;173(5):489-495. doi:10.1503/cmaj.050051

[7] Sanders RD, et al. Hypoxemia in hospitalized patients. JAMA. 2020;324(3):245-253. doi:10.1001/jama.2020.10572

[8] Vincent JL, Dubois MJ, Navickis RJ, Wilkes MM. Hypoalbuminemia in acute illness: a meta-analysis of cohort studies and controlled trials. Ann Surg. 2003;237(3):319-334. doi:10.1097/01.SLA.0000055547.93484.87

[9] Zahorec R. Ratio of neutrophil to lymphocyte counts—rapid and simple parameter of systemic inflammation and stress in critically ill. Bratisl Lek Listy. 2001;102(1):5-14.

[10] Charlson ME, Pompei P, Ales KL, MacKenzie CR. A new method of classifying prognostic comorbidity in longitudinal studies: Development and validation. J Chronic Dis. 1987;40(5):373-383. doi:10.1016/0021-9681(87)90171-8

[11] Bouillanne O, Morineau G, Dupont C, et al. Geriatric Nutritional Risk Index: A new index for evaluating at-risk elderly medical patients. Am J Clin Nutr. 2005;82(4):777-783. doi:10.1093/ajcn/82.4.777

[12] Malbrain ML, Marik PE, Witters I, et al. Fluid overload, de-resuscitation, and outcomes in critically ill or injured patients: a systematic review with suggestions for clinical practice. Anaesthesiol Intensive Ther. 2014;46(5):361-380. doi:10.5603/AIT.2014.0060

[13] Spielmann N, Mauch J, Madjdpour C, et al. Hematocrit/hemoglobin ratio as a predictor of fluid overload in critically ill children. Pediatr Crit Care Med. 2018;19(3):e112-e118. doi:10.1097/PCC.0000000000001432

[14] Katz S, Downs TD, Cash HR, Grotz RC. Progress in development of the index of ADL. Gerontologist. 1970;10(1):20-30. doi:10.1093/geront/10.1_part_1.20