Section: Critical Care

Original Research Article

NUTRITIONAL ASSESSMENT, PRESCRIPTION PRACTICES, ACHIEVEMENT OF NUTRITIONAL GOALS, AND CLINICAL OUTCOMES IN CRITICALLY ILL PATIENTS: A PROSPECTIVE OBSERVATIONAL STUDY

Vikas Aron[1], Mortues Lavi[2], Patel Deepkumar Rashminbhai[3], Siddharth Shukla[4]

[1]Associate Professor, Department of Anaesthesiology, Rajshree Medical Research Institute & Hospital Bareilly, Uttar Pradesh, India.
[2]Junior Resident, Department of Emergency Medicine, Rajshree Medical Research Institute & Hospital Bareilly, Uttar Pradesh, India.
[3]Junior Resident, Department of Emergency Medicine, Rajshree Medical Research Institute & Hospital Bareilly, Uttar Pradesh, India.
[4]Junior Resident, Department of Internal Medicine, Rajshree Medical Research Institute & Hospital Bareilly, Uttar Pradesh, India.

Received : 16/06/2026
Received in revised form : 29/07/2026
Accepted : 12/08/2026

Keywords:
Hypermetabolic, clinical outcomes, Nutrition Risk, systemic inflammation

Corresponding Author:
Dr. Mortues Lavi,
Email: mortues56@gmail.com

DOI: 10.47009/jamp.2026.8.4.251

Source of Support: Nil,
Conflict of Interest: None declared

Int J Acad Med Pharm
2026; 8 (4); 1503-1508

ABSTRACT

Background: Malnutrition is highly prevalent among critically ill patients and is associated with increased morbidity, prolonged intensive care unit (ICU) stay, and mortality. Early nutritional risk assessment using the modified Nutrition Risk in the Critically Ill (mNUTRIC) score, along with timely nutritional intervention, may improve clinical outcomes. Ultrasonographic assessment of quadriceps muscle mass provides a practical bedside method for monitoring nutritional status. **Materials and Methods:** A prospective observational study was conducted among 245 adult critically ill patients admitted to a multidisciplinary ICU and identified as having high nutritional risk (mNUTRIC score ≥5). Nutritional prescriptions, achieved calorie and protein intake, time to nutritional goal attainment, causes of enteral feeding interruption, and quadriceps muscle mass index were prospectively evaluated. Clinical outcomes including 28-day mortality, ICU stay, healthcare-acquired pressure injuries, and hospital-acquired infections were analyzed. **Results:** Most participants were aged 61–80 years (45.7%), and 64.5% were male. An mNUTRIC score of 5–6 was observed in 75.9% of patients. Although most patients were prescribed 1,501–2,000 kcal/day and 51–100 g protein/day, achieved caloric intake was lower than prescribed. Nutritional targets were most frequently achieved between Days 4 and 5, while airway procedures and gastrointestinal intolerance were the leading causes of enteral feeding interruption. Quadriceps muscle mass showed no significant decline during the first week (p=0.228). Higher mNUTRIC scores were significantly associated with increased 28-day mortality (p=0.023) and prolonged ICU stay (p=0.005), whereas associations with pressure injuries and hospital-acquired infections were not statistically significant. Gram-negative organisms, particularly *Escherichia coli*, predominated among hospital-acquired infections. **Conclusion:** Early nutritional risk assessment using the mNUTRIC score, protocol-based enteral nutrition, and serial bedside ultrasonographic assessment of muscle mass facilitate optimized nutritional management and identify patients at increased risk of adverse outcomes. These strategies may contribute to improved survival and reduced ICU stay in critically ill patients.

INTRODUCTION

Critical illness is associated with a hypermetabolic and hypercatabolic state characterized by increased energy expenditure, accelerated protein catabolism, systemic inflammation, and progressive skeletal muscle wasting. These metabolic alterations contribute to impaired immune function, delayed wound healing, prolonged mechanical ventilation, increased susceptibility to nosocomial infections, and higher mortality. Consequently, nutritional therapy has evolved from supportive care to an

essential therapeutic intervention in modern intensive care practice.[1,2]

Malnutrition affects approximately 20–50% of hospitalized patients and is particularly common among those admitted to intensive care units (ICUs). The prevalence is further increased by inadequate nutrient delivery, gastrointestinal intolerance, repeated interruption of enteral feeding, and the severity of the underlying illness. Malnutrition has consistently been associated with prolonged ICU stay, increased healthcare costs, higher infection rates, delayed recovery, and poor survival.[3] Disease-related malnutrition has also been recognized as an independent predictor of adverse clinical outcomes in critically ill patients.[4]

Early initiation of enteral nutrition is considered the preferred nutritional strategy in critically ill patients whenever the gastrointestinal tract is functional. International guidelines recommend commencement of enteral nutrition within 24–48 hours of ICU admission to preserve gut integrity, reduce bacterial translocation, maintain immune function, and improve clinical outcomes.[5] The Indian Society of Critical Care Medicine has similarly emphasized protocol-based nutritional assessment and individualized calorie and protein prescription in critically ill patients.[6] Recent international guidelines continue to reinforce structured nutritional assessment, early enteral feeding, and continuous monitoring to optimize nutritional adequacy and improve patient outcomes.[7,8]

Identification of patients who are likely to benefit most from nutritional intervention requires reliable nutritional risk assessment. The modified Nutrition Risk in the Critically Ill (mNUTRIC) score is a validated bedside tool that combines age, disease severity, comorbidities, and duration of hospitalization before ICU admission to identify patients at high nutritional risk. Higher mNUTRIC scores have been associated with increased mortality, prolonged ICU stay, greater duration of mechanical ventilation, and poorer functional recovery.[9,10]

Adequate delivery of prescribed calories and proteins remains a major challenge in ICU practice. Factors such as airway procedures, gastrointestinal intolerance, hemodynamic instability, and diagnostic interventions frequently interrupt enteral feeding, resulting in failure to achieve nutritional targets. Studies have demonstrated that improved nutritional adequacy is associated with better preservation of lean body mass, fewer ventilator days, and improved survival.[11,12]

Bedside ultrasonographic assessment of quadriceps muscle thickness has emerged as a simple, reproducible, and non-invasive technique for monitoring skeletal muscle loss in critically ill patients. Progressive reduction in quadriceps muscle mass has been linked to prolonged ICU stay, delayed rehabilitation, and increased mortality, making it a valuable marker for evaluating the effectiveness of nutritional therapy.[13,14] However, data evaluating nutritional assessment, achievement of prescribed nutritional goals, preservation of muscle mass, and their association with clinical outcomes remain limited in routine clinical practice. Therefore, the present study was undertaken to assess nutritional risk using the mNUTRIC score, evaluate prescribed and achieved nutritional targets, monitor changes in quadriceps muscle mass, and determine their association with important clinical outcomes in critically ill adult patients admitted to the ICU.[15]

MATERIALS AND METHODS

This prospective observational study was conducted in the multidisciplinary intensive care unit (ICU) of a tertiary care teaching hospital after obtaining approval from the Institutional Ethics Committee. Adult patients (≥18 years) admitted to the ICU, receiving enteral nutrition, and identified as being at high nutritional risk (modified Nutrition Risk in the Critically Ill [mNUTRIC] score ≥5) were included. Patients with lower-limb amputation or conditions precluding ultrasound assessment of quadriceps muscle thickness were excluded. A total of 245 eligible patients were enrolled consecutively during the study period.

Baseline demographic and clinical characteristics were recorded at admission. Nutritional risk was assessed within 24 hours using the mNUTRIC score. Nutritional prescriptions, including daily calorie and protein requirements, were determined according to standard critical care nutritional guidelines. The timing of achievement of prescribed nutritional goals, interruptions in enteral feeding, and their underlying causes were prospectively documented throughout the ICU stay.

Quadriceps muscle mass index was assessed by bedside ultrasonography within 24 hours of ICU admission and repeated on the seventh day in patients who remained in the ICU. Clinical outcomes including 28-day mortality, length of ICU stay, healthcare-acquired pressure injuries, and hospital-acquired infections were recorded. Microbiological isolates from hospital-acquired infections were analyzed to determine the predominant causative organisms.

Data were analyzed using SPSS version 26.0. Categorical variables were expressed as frequencies and percentages, while continuous variables were presented as mean ± standard deviation (SD). Paired *t*-test was used to compare quadriceps muscle mass index between admission and Day 7. Associations between mNUTRIC categories and clinical outcomes were evaluated using the Chi-square test. A p-value <0.05 was considered statistically significant.

ISSN (O): 2687-5365; ISSN (P): 2753-6556

RESULTS

A total of 245 critically ill patients at high nutritional risk were included in the study. Most participants were aged 61–80 years, were male, and had at least one comorbid illness. The majority had an mNUTRIC score of 5–6 and were prescribed 1,501–2,000 kcal/day with 51–100 g protein/day. Nutritional monitoring enabled most surviving patients to achieve their prescribed calorie and protein targets within the first week. Quadriceps muscle mass was largely preserved during the first week of ICU stay, while higher mNUTRIC scores were significantly associated with increased 28-day mortality and prolonged ICU stay.

Table 1: Demographic Characteristics of Participants

Characteristic	Frequency, n	Percentage
Age group, years		
20–40	31	12.7
41–60	79	32.2
61–80	112	45.7
≥81	23	9.4
Gender		
Male	158	64.5
Female	87	35.5
Comorbid illness		
Present	245	100.0
Dietary pattern		
Vegetarian	52	21.2
Non-vegetarian	193	78.8

Table 1 shows the baseline demographic characteristics of the study participants. Nearly half of the patients (45.7%) belonged to the 61–80-year age group, while males constituted 64.5% of the study population. All participants had at least one comorbid illness, and the majority (78.8%) followed a non-vegetarian diet.

Figure 1 demonstrates the primary indications for ICU admission. Sepsis or septic shock was the most frequent diagnosis (35.9%), followed by respiratory failure (24.9%), neurological illness (15.5%), postoperative critical care (12.7%), cardiovascular illness (6.9%), and other diagnoses (4.1%).

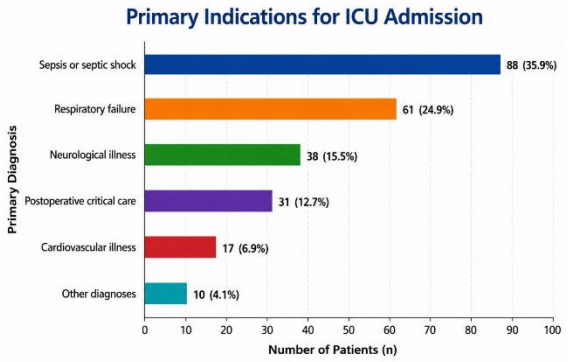

Figure 1: Primary indications for ICU admission among critically ill patients (n = 245)

Table 2: Distribution According to mNUTRIC Score

mNUTRIC score	Frequency, n	Percentage
5	112	45.7
6	74	30.2
7	35	14.3
8	17	6.9
9	7	2.9
Total	**245**	**100.0**

As shown in Table 2, an mNUTRIC score of 5 was the most common (45.7%), followed by a score of 6 (30.2%). Overall, 75.9% of patients had mNUTRIC scores of 5–6, whereas 24.1% had scores of 7–9, indicating that most patients belonged to the lower high-risk nutritional category.

Table 3: Prescribed and Achieved Energy and Protein Intake

Nutritional parameter	Prescribed, n (%)	Achieved, n (%)
Energy, kcal/day		
500–1,000	0 (0.0)	12 (4.9)
1,001–1,500	82 (33.5)	151 (61.6)
1,501–2,000	146 (59.6)	76 (31.0)
2,001–2,500	17 (6.9)	6 (2.4)
Protein, g/day		
0–50	78 (31.8)	95 (38.8)
51–100	153 (62.4)	142 (58.0)
>100	14 (5.7)	8 (3.3)

ISSN (O): 2687-5365; ISSN (P): 2753-6556

Table 3 summarizes the prescribed and achieved nutritional targets. Most patients were prescribed 1,501–2,000 kcal/day (59.6%) and 51–100 g protein/day (62.4%). However, the majority achieved an intake of 1,001–1,500 kcal/day (61.6%), while 58.0% achieved the prescribed protein intake of 51–100 g/day, indicating satisfactory but incomplete attainment of nutritional goals.

Figure 2 illustrates the time required to achieve prescribed energy and protein targets. Nutritional goal attainment progressively increased during the first week, with the highest number of patients achieving both energy (48 patients) and protein (50 patients) targets on Day 5. Thirty-four patients failed to achieve energy targets and 35 failed to achieve protein targets because of death before nutritional goals could be met.

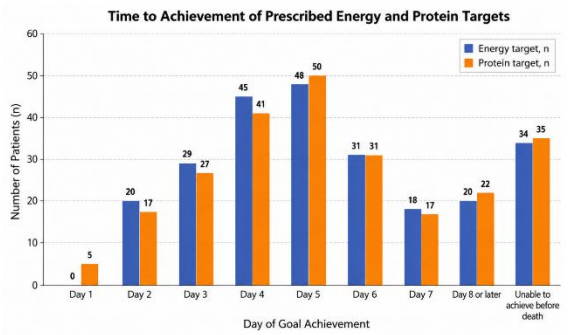

Figure 2: Time to achievement of prescribed energy and protein targets among critically ill patients

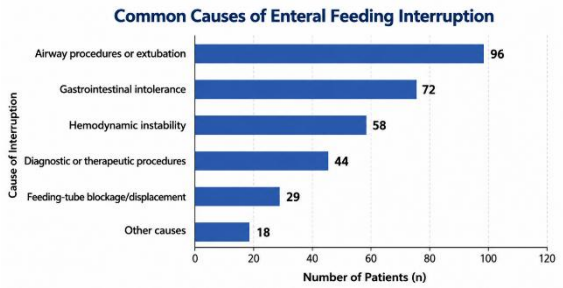

Figure 3: Common causes of enteral feeding interruption during ICU stay.

Figure 3 depicts the common causes of interruption of enteral feeding. Airway procedures or extubation accounted for the largest proportion (96 patients), followed by gastrointestinal intolerance (72), hemodynamic instability (58), diagnostic or therapeutic procedures (44), feeding-tube blockage/displacement (29), and other causes (18).

As presented in Table 4, the mean quadriceps muscle mass index decreased slightly from 1.49 ± 0.48 within 24 hours of admission to 1.47 ± 0.47 on Day 7. The mean reduction of 0.02 units was not statistically significant (t = 1.21, p = 0.228), suggesting preservation of skeletal muscle mass during the first week of nutritional therapy.

Table 4.: Change in Quadriceps Muscle Mass Index

Time point	Participants, n	Mean ± SD	Mean change	95% CI	t value	p value
Within 24 hours of admission	245	1.49 ± 0.48				
Day 7	184	1.47 ± 0.47	−0.02	−0.053 to 0.013	1.21	0.228

Table 5 demonstrates the association between mNUTRIC category and clinical outcomes. Patients with higher mNUTRIC scores (7–9) had significantly greater 28-day mortality (χ^2 = 5.136, p = 0.023) and prolonged ICU stay (χ^2 = 7.883, p = 0.005). However, no statistically significant association was observed between mNUTRIC category and healthcare-acquired pressure injuries (p = 0.098) or hospital-acquired infections (p = 0.201).

Table 5: Association Between mNUTRIC Category and Clinical Outcomes

Clinical outcome	mNUTRIC 5–6, n = 186	mNUTRIC 7–9, n = 59	χ^2 value	p value
Healthcare-acquired pressure injury			2.733	0.098
Present	61	27		
Absent	125	32		
28-day mortality			5.136	**0.023**
Died	62	30		
Survived	124	29		
ICU stay			7.883	**0.005**
≤15 days	154	38		
>15 days	32	21		
Hospital-acquired infection			1.634	0.201
Present	78	31		
Absent	108	28		

ISSN (O): 2687-5365; ISSN (P): 2753-6556

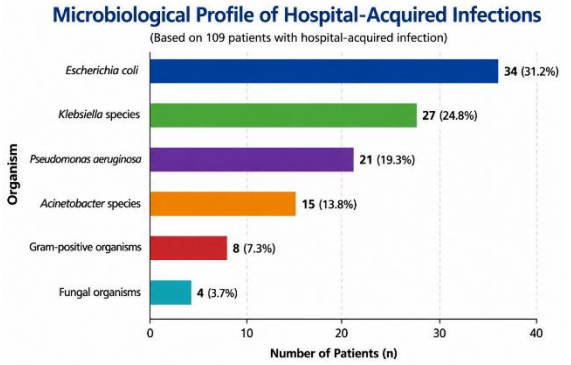

Figure 4: Microbiological profile of hospital-acquired infections among ICU patients (n = 109)

Figure 4 shows the microbiological profile of hospital-acquired infections. Among the 109 isolates, Escherichia coli was the predominant organism (31.2%), followed by Klebsiella species (24.8%), Pseudomonas aeruginosa (19.3%), Acinetobacter species (13.8%), Gram-positive organisms (7.3%), and fungal organisms (3.7%).

DISCUSSION

The present prospective observational study evaluated nutritional assessment, nutritional practices, quadriceps muscle mass, and clinical outcomes among critically ill patients at high nutritional risk. Most participants were elderly, with the majority belonging to the 61–80-year age group, and males predominated. These findings are comparable with those reported by Sharon et al., who observed that critically ill patients requiring nutritional assessment were predominantly older adults with multiple comorbidities, reflecting the increased nutritional vulnerability associated with advancing age and severe illness.[15]

Nutritional risk assessment using the modified NUTRIC score demonstrated that nearly three-fourths of patients had scores of 5–6, while approximately one-fourth had scores of 7–9. The mNUTRIC score has been extensively validated as a reliable predictor of adverse outcomes in critically ill patients. Jeong et al. reported that patients with higher mNUTRIC scores had significantly greater 28-day mortality and poorer nutritional outcomes despite nutritional therapy.[10] Similarly, Sharon et al. found that patients with higher nutritional risk experienced longer ICU stay and increased mortality, emphasizing the importance of early nutritional risk stratification.[15]

Adequate nutritional delivery remains one of the greatest challenges in intensive care practice. In the present study, although most patients were prescribed 1,501–2,000 kcal/day and 51–100 g protein/day, the achieved caloric intake was frequently lower than prescribed, whereas protein delivery was relatively satisfactory. Similar findings were reported by Alberda et al., who demonstrated that inadequate calorie and protein delivery was independently associated with increased mortality and prolonged ICU stay in critically ill patients.[12] Likewise, Fetterplace et al. showed that protocol-based optimization of energy and protein delivery improved nutritional adequacy and clinical recovery, although complete achievement of nutritional goals remained difficult in many patients.[11]

The majority of patients in the present study achieved prescribed nutritional targets between Days 4 and 5. However, airway procedures, gastrointestinal intolerance, and hemodynamic instability were the most common reasons for interruption of enteral feeding. These observations are consistent with the recommendations of Reintam Blaser et al., who emphasized minimizing avoidable interruptions and implementing structured feeding protocols to improve nutritional adequacy.[5] Similar recommendations have also been incorporated into the Indian Society of Critical Care Medicine guidelines and more recent Chinese and Japanese critical care nutrition guidelines, which advocate continuous monitoring and protocol-driven enteral nutrition practices.[6-8]

Assessment of quadriceps muscle mass demonstrated only a small, statistically non-significant decline during the first week of ICU stay. Preservation of skeletal muscle may reflect timely nutritional intervention and systematic monitoring. Comparable observations have been reported by Toledo et al., who demonstrated that bedside ultrasonography is a reliable tool for monitoring muscle mass during critical illness.[13] Likewise, Galindo Martín et al. highlighted that serial ultrasonographic muscle measurements provide valuable information regarding nutritional response and disease progression in critically ill patients.[14]

An important finding of the present study was the significant association between higher mNUTRIC scores and both 28-day mortality and prolonged ICU stay. However, no significant association was observed with healthcare-acquired pressure injuries or hospital-acquired infections. These findings closely parallel those reported by Jeong et al. and Sharon et al., both of whom demonstrated that higher nutritional risk is strongly associated with mortality and prolonged hospitalization but may not independently predict all hospital-acquired complications.[10,15]

The microbiological profile of hospital-acquired infections in the present study showed predominance of Escherichia coli, followed by Klebsiella species and Pseudomonas aeruginosa, indicating the continued predominance of Gram-negative pathogens in critically ill patients. This finding is consistent with contemporary ICU epidemiological data reported in critical care literature, emphasizing the importance of infection prevention strategies alongside optimal nutritional management.[3,6]

Overall, the present study reinforces that systematic nutritional risk assessment using the mNUTRIC

ISSN (O): 2687-5365; ISSN (P): 2753-6556

score, early initiation of enteral nutrition, continuous monitoring of nutritional adequacy, and bedside assessment of skeletal muscle mass are valuable components of comprehensive ICU care. These measures facilitate identification of patients at greatest nutritional risk and may contribute to improved survival and shorter ICU stay through timely, individualized nutritional interventions.

CONCLUSION

The present study demonstrates that systematic nutritional assessment using the modified NUTRIC (mNUTRIC) score, combined with protocol-based enteral nutrition and regular monitoring, enables timely achievement of nutritional goals in critically ill patients. Higher mNUTRIC scores were significantly associated with increased 28-day mortality and prolonged ICU stay, confirming its value as a prognostic tool. Bedside ultrasonographic assessment showed relative preservation of quadriceps muscle mass during the first week of ICU stay, supporting its usefulness as a non-invasive method for monitoring nutritional status. These findings highlight the importance of early nutritional risk stratification, optimized calorie and protein delivery, and continuous nutritional surveillance to improve outcomes in critically ill patients.

REFERENCES

1. Hill A, Elke G, Weimann A. Nutrition in the intensive care unit: A narrative review. Nutrients. 2021;13: 2851.
2. Ndahimana D, Kim EK. Energy requirements in critically ill patients. Clin Nutr Res. 2018;7:81–90.
3. Narayan SK, Gudivada KK, Krishna B. Assessment of nutritional status in the critically ill. Indian J Crit Care Med. 2020;24(Suppl 4):S152–S156.
4. Norman K, Pichard C, Lochs H, Pirlich M. Prognostic impact of disease-related malnutrition. Clin Nutr. 2008;27:5–15.
5. Reintam Blaser A, Starkopf J, Alhazzani W, et al. Early enteral nutrition in critically ill patients: ESICM clinical practice guidelines. Intensive Care Med. 2017;43:380–398.
6. Mehta Y, Sunavala JD, Zirpe K, et al. Practice guidelines for nutrition in critically ill patients: A relook for Indian scenario. Indian J Crit Care Med. 2018;22:263–273.
7. Guan X, Chen D, Xu Y, Chinese Society of Critical Care Medicine. Clinical practice guidelines for nutritional assessment and monitoring of adult ICU patients in China. Journal of Intensive Medicine. 2024 Apr 25;4(02):137-59.
8. Nakamura K, Yamamoto R, Higashibeppu N, Yoshida M, Tatsumi H, Shimizu Y, et al. The Japanese critical care nutrition guideline 2024. Journal of Intensive Care. 2025 Mar 21;13(1):18.
9. Özdemir U, Özdemir M, Aygencel G, Kaya B, Türkoğlu M. Ultrasonographic assessment of quadriceps muscle thickness in critically ill patients. Rev Assoc Med Bras. 2019;65:952–958.
10. Jeong DH, Hong SB, Lim CM, Koh Y, Seo J, Kim Y, et al. Relationship between nutrition intake and 28-day mortality using modified NUTRIC score in patients with sepsis. Nutrients. 2019 Aug 15;11(8):1906.
11. Fetterplace K, Deane AM, Tierney A, Beach LJ, Knight LD, Presneill J, et al. Targeted full energy and protein delivery in critically ill patients: a pilot randomized controlled trial (FEED trial). Journal of Parenteral and Enteral Nutrition. 2018 Nov;42(8):1252-62.
12. Alberda C, Gramlich L, Jones N, Jeejeebhoy K, Day AG, Dhaliwal R, Heyland DK. The relationship between nutritional intake and clinical outcomes in critically ill patients: results of an international multicenter observational study. Intensive care medicine. 2009 Oct;35(10):1728-37.
13. Toledo DO, de Freitas BJ, Dib R, do Amaral Pfeilsticker FJ, Dos Santos DM, Gomes BC, Silva-Jr JM. Peripheral muscular ultrasound as outcome assessment tool in critically ill patients on mechanical ventilation: an observational cohort study. Clinical nutrition ESPEN. 2021 Jun 1;43:408-14.
14. Galindo Martín CA, Ubeda Zelaya RD, Monares Zepeda E, Lescas Méndez OA. ROUNDS Studies: Relation of OUtcomes with Nutrition Despite Severity—round one: ultrasound muscle measurements in critically ill adult patients. Journal of nutrition and metabolism. 2018;2018(1):7142325.
15. Sharon T, Nayak SG, Shanbhag V, Hebbar S. An observational study of nutritional assessment, prescription, practices, and its outcome among critically ill patients admitted to an intensive care unit. Indian J Crit Care Med. 2024;28:364–368.

ISSN (O): 2687-5365; ISSN (P): 2753-6556