# Nutritional Assessment in ICU Patients: Incidence, Identification and Effects of Malnutrition in Critically Ill Patients Admitted in the ICU

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## Contents

## Study Title

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## Research Question

What is the incidence of malnutrition in ICU patients and its effects on the course of the patient during ICU stay?

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## Introduction

Malnutrition is an imbalance in nutrition in the form of under or over nutrition. Malnutrition may result from deficiency in dietary intake, increase in requirement or as a complication of certain diseases. It is a prevalent cause of hospitalization in the intensive care unit. It was recorded that the prevalence of malnutrition can go as high as 78% among the acute care patients.[1] Prompt identification and provision of adequate nutrition in patients may improve their outcome, however there is a lack of widely acceptable screening programs to identify patients requiring additional nutritional support.[2] The aim of this study is to determine the incidence of malnutrition and assess its effects on the course of patients during ICU stay.

## Review of Related Literature

Malnutrition is often seen in patients admitted in the hospital and it has proved to be a continuing problem in the inpatient setting including the critical care units with a prevalence going as high as 40% among critically ill patients. Illnesses from gastrointestinal, cardiovascular, neuromuscular, arthritic, oncologic and infectious causes may present with malnutrition already upon admission. Some of these patients are at risk for malnutrition on admission and further deteriorates when transferred to the ICU. Critical illnesses may contribute to the poor nutritional status of the patient due to the increase in metabolism leading to higher energy requirement and loss of lean body mass.[3] In one study, poor nutrition is correlated with longer length of hospital stay and increased morbidity and mortality among critically ill patients. Therefore early nutritional risk assessment and screening are important factors to prevent and minimize nutritional crises in critically ill patients.

There are various clinical indicators that are used to assess the nutritional status of a critically ill patient. These indicators include anthropometric measurements, biochemical and immunologic markers. Together with nutritional screening tools, the clinical indicators can be used to determine the nutritional

status of the critically ill patients. Subjective global assessment (SGA) is a clinical questionnaire to assess nutritional status based on the patient's history and physical examination at bedside. By using this clinical assessment tool, the patient can be grouped to well-nourished, moderately malnourished and severely malnourished.[4, 5] This tool does not need laboratory data and it has the most diagnostic value for critically ill patients among the different nutritional screening tools.[1]

## Significance of the study

In the United States, the Joint Commission on Accreditation of Healthcare Organizations mandates that every patient have a nutritional screening within 24 hours of admission to an acute care center. Despite the availability of nutritional screening tools, malnutrition continues to be underrecognized.[6] Studies have shown that adequate nutritional support during admission improves the outcome of the critically ill patients hence timely assessment of nutritional status and identification of malnourished patients are important to improve the inpatient malnutrition in our institution.

## Objectives

A. General Objectives

1. To describe the nutritional status of the ICU patients on admission and on discharge from the ICU.

B. Specific Objectives

1. To compare the nutritional status of each patient admitted in the ICU on admission and during discharge from the ICU
2. To determine the factors which influence nutritional status of the patients during ICU stay

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Study design and method

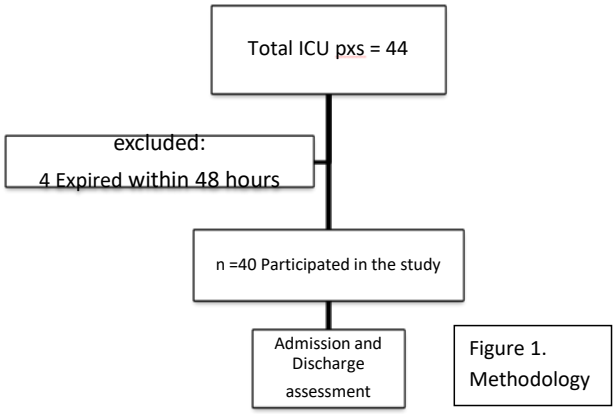


Figure 1. Methodology

This study was a prospective cohort study which included patients in the University of Santo Tomas who were admitted in the intensive care unit in a span of 2 months. The clinical profile of the patients were recorded which included age, gender, admitting service (medical or surgical), diagnosis, type of feeding, ventilator dependency and energy requirement in kilocalories (kcal). The Acute Physiology and Chronic Health Evaluation (APACHE II) score, Sequential Organ Failure Assessment (SOFA) score and the Glasgow Coma Scale (GCS) were taken on admission and discharge. The anthropometric data of each patient were taken on admission and discharge. This included height, weight, BMI (kg/m$^2$), mid arm circumference (MAC) and calf circumference. The lymphocyte count were recorded a well. Subjective global assessment (SGA) questionnaires were filled up based on the patient's history and the physician's clinical assessment. The type of feeding pattern (enteral versus parenteral) were be recorded and time of initiation of feeding. The presence and type of morbidity as well as the outcome of patient on discharge were described as well.

**Commented [c3]:** Since konti na lang po ang time na pwede po doc, pede po bang 2-3 months na lang po yung time ng study doc?

## Statistical analysis

The data that has been collected were recorded in Microsoft Excel and encoded in SPSS version 22. The descriptive statistics were expressed as mean, frequencies and percentages. The mean of the continuous variables were analyzed and compared using paired T-test. The SGA on admission and on discharge were also compared. The characteristics and outcomes of nourished and malnourished patients were compared using chi square test, and the factors that were related to development of malnutrition in the ICU were identified. Odds ratios were derived from logistic regression analysis of the factors that may influence malnutrition in ICU patients.

## Inclusion and Exclusion Criteria

All ICU patients who consented were included in the study. Patients who were below 18 years of age, those who expired within 48 hours of admission, and those who were transferred from other hospitals or ICU were excluded from the study.

## Ethical Considerations

The personal information of the patients that were gathered from this study were kept confidential. Each patient was assigned a case number to ensure anonymity. A consent form was given to each patient or patient's representative if patient is unable to give consent. No monetary incentives will be provided and no harm will be done to the participants as well.

## Results

Table 1. Clinical characteristics of patients on admission

| Variable | N 40 |
|---|---|

| | mean±SD or n(%) |
|---|---|
| Age (years) | 68 (±15.5) |
| Gender | |
| Male | 22(55%) |
| Female | 18 (45%) |
| Admitting Category | |
| Medical | 31 (77.5%) |
| Surgical | 9 (22.5%) |
| Diagnosis | |
| Cardiovascular | 13 (32.5%) |
| Pulmonary | 9 (22.5%) |
| Surgical | 9 (22.5%) |
| Neurologic | 5 (12.5%) |
| Gastro | 1 (2.5%) |
| Renal | 1 (2.5%) |
| Infectious | 1 (2.5%) |
| Others | 1 (2.5%) |
| NRS score | 3.9 (±1.11) |
| Nutrition status by SGA | |
| No malnutrition | 19 (47.5%) |
| With malnutrition | 21 (52.5%) |
| APACHE II score | 14.88 (±6.75) |
| Admitting SOFA score | 3.65(±3.30) |
| Admission GCS | 13.7 (±2.17) |

A total of 44 patients were admitted in the ICU for the month of October to November 2017. 4 of those were excluded because they expired within 48 hours of admission. A Total of 40 patients were included in the analysis and more than half of them were males. The mean age of the patients was 68(±15.5) years. Patients who were admitted were mostly medical cases than surgical and the most common admitting diagnosis was cardiovascular in nature (32.5%) followed by pulmonary cases (22.5%). Surgical cases comprise of 22.5% of the ICU admissions.

In screening and assessment for the nutritional risk of ICU patients we used NRS score and SGA scoring tool. A score of more than 3 in NRS is indicative of high risk for malnutrition and needs nutritional intervention or consult with a nutritionist. [7, 8] SGA is a more subjective tool to assess nutritional status of the patients. The mean NRS score was 3.92(±1.11) since patients who are critically ill and are admitted in the ICU would have at least a score of 3.

The incidence of malnutrition in all patients based on the SGA scoring tool was as high as 52.5% even as early as on admission to the ICU. The mean APACHE II score was 14.88 (±6.75) and the mean SOFA score was 3.65(±3.30).

Table 2. Comparison of clinical characteristics between patients with and without malnutrition based on SGA classification on admission

| Variables on admission | N 40<br>mean±SD or n(%) | | |
|---|---|---|---|
| | (-) malnutrition* | (+) malnutrition** | P value |
| Age in years mean SD | 60.32 (±12.95) | 74.95 (±14.52) | 0.002 |
| Gender | | | 0.09 |
| Male | 13(68.4%) | 9 (42.9%) | |
| Female | 6 (31.6%) | 12 (57.1%) | |

| | | | |
|---|---|---|---|
| Admitting category | | | 0.431 |
| Medical | 14 (73.7%) | 17 (81%) | |
| Surgical | 5 (26.3%) | 4 (19%) | |
| Diagnosis | | | 0.276 |
| Cardiovascular | 6 (31.6%) | 7 (33.3%) | |
| Pulmonary | 2 (10.5%) | 7 (33.3%) | |
| Surgical | 5 (26.3%) | 4 (19%) | |
| Neurologic | 4 (21.2%) | 1 (4.8%) | |
| Gastro | 1 (5.3%) | 0 | |
| Renal | 0 | 1 (4.8%) | |
| Infectious | 0 | 1 (4.8%) | |
| Others | 1 (5.3%) | 0 | |
| NRS score | 3.58 (±0.961) | 4.19 (±1.17) | 0.08 |
| APACHE II score | 12.58 (±7.50) | 16.95 (±5.36) | 0.04 |
| Admitting SOFA score | 2.63 (±3.37) | 4.57 (±3.03) | 0.06 |

*SGA A , **SGA B and C. SGA scores were taken on admission to the ICU

Table 2 shows the comparison of the different variables among well-nourished and malnourished patients on admission. Patients who were malnourished on admission were significantly older than those who were not malnourished (mean age of 75 versus 60 years old) (p value 0.002). There was no significant difference between genders and diagnosis between malnourished and well-nourished patients. On the other hand, it was noted that patients who were malnourished on admission have higher APACHE and SOFA scores which were significantly different from the well-nourished group.

Table 3. Clinical and nutritional outcomes of patients with and without malnutrition on discharge from ICU

| Variable | Mean(SD) or n (%) | | | |
|---|---|---|---|---|
| | Total n = 40 | (-) malnutrition* | (+) malnutrition** | P value |
| Length of ICU stay (d) | 7.83 (±10.29) | 3.11(±2.23) | 12.10 (±12.71) | 0.004 |
| Hospital stay before ICU admission (d) | 2.75(±3.37) | 2.63 (±3.1) | 2.86 (±3.68) | 0.836 |
| Morbidity n(%) | | | | 0.562 |
| Cardiovascular | 1 (2.5%) | 0 | 1 (4.8%) | |
| Pulmonary | 5 (12.5%) | 2 (10.5%) | 3 (14.3%) | |
| Infectious | 2 (5%) | 1 (5.3%) | 1 (4.8%) | |
| Renal | 3 (7.5%) | 1 (5.3%) | 2 (9.5%) | |
| Surgical | 1 (2.5%) | 1 (5.3%) | 0 | |
| Neurologic | 1 (2.5%) | 0 | 1 (4.8%) | |
| Gastrointestinal | 2 (5%) | 0 | 2 (9.5%) | |
| ICU mortality n(%) | 3 (15.8%) | 3 (15.8%) | 0 | 0.098 |
| Hospital mortality n(%) | 0 | 0 | 0 | |
| Ventilator dependency (d) | 2.82 (±8.63) | 1.11 (±1.73) | 4.38 (±11.71) | 0.219 |
| Type of feeding n(%) | | | | 0.557 |
| Enteral | 32 (80%) | 15 (78.9%) | 17 (81%) | |

| | | | | |
|---|---|---|---|---|
| Parenteral<br>Mixed<br>NPO | 1 (2.5%)<br>0<br>7 (17.5%) | 0<br>0<br>4 (21.1%) | 1 (4.8%)<br>0<br>3 (14.3%) | |
| Total caloric prescription (kcal/d) | 1851 (±359.43) | 1967.37 (±298.72) | 1745.71 (±383.56) | 0.05 |
| Total kcal given (kcal/d) | 1693.75 (±273.20) | 1742.11(±209) | 1650 (±319.37) | 0.293 |

*SGA A, **SGA B. SGA scores were taken on discharge from the ICU

In Table 3, the differenct clinical and nutritional outcomes were compared between patients with and without malnutrition on discharge for the ICU. Patients who were malnourished during ICU discharge were noted to have statistically longer ICU stay [12.10 days vs 3.11 days (p value 0.004)]. The hospital stay before ICU admission was not significantly different between the two groups. There was no difference in the type of morbidity as well however most of the patients developed hospital acquired pneumonia. There were 3 ICU mortalities and no hospital mortalities during the course of the study. Ventilator dependency measured in days on mechanical ventilator was not statistically significant between the two groups. In terms of feeding and calories given to the patients on admission, most of the patients were given their full caloric requirement as early as on admission.

Table 4. Anthropometric and biochemical measurements of patients on ICU admission and discharge

| | Mean(SD) | | |
|---|---|---|---|
| Measurements | ICU admission | ICU discharge | P value |
| Weight (kg) | 61.83(11.9) | 60.97(11.4) | 0.001 |
| BMI (kg/m$^2$) | 23.6(3.7) | 23.3(3.5) | 0.001 |
| MUAC (cm) | 26.33(3.8) | 26.23(3.7) | 0.128 |

| | | | |
|---|---|---|---|
| Calf circumference (cm) | 31.9(4.9) | 31.9(4.9) | 0.831 |
| SGA n(%)<br>A<br>B<br>C | <br>24(69%)<br>10(29%)<br>1 (2%) | <br>15 (43%)<br>18 (51%)<br>2 (6%) | 0.012 |
| TLC | $2.17x10^9$(±1.4) | $1.61x10^9$ (±1.5) | 0.054 |

*Only 35 patients were included in the analysis because 3 expired during the course of ICU admission and 2 were still admitted in the ICU

A comparison of anthropometric variables and biochemical test was done in Table 4 and it showed that patients lost weight [60.97 vs 61.83 (p value 0.001)] and their BMI decreased significantly [23.3 vs 23.6 (0.001) upon measurement on ICU discharge. The mid-arm and calf circumference did not change significantly on discharge from ICU. Table 4 also showed that there was a shift in SGA classification of patients from well-nourished (SGA A) to malnourished (SGA B and C) upon discharge from ICU with a p value of 0.012. The total lymphocyte count was not significantly different between the 2 groups.

Table 5. Comparison of admitting anthropometric measurements in patients with and without malnutrition on discharge day

| | (-) malnutrition Mean(±SD) | (+) malnutrition Mean(±SD) | P value |
|---|---|---|---|
| Weight (kg) | 65.58 (±9.96) | 58.19(±12.79) | 0.05 |
| BMI ($kg/m^2$) | 24.19(±2.82) | 22.66(±3.88) | 0.164 |
| MUAC (cm) | 27.76(±3.43) | 25.31(±3.68) | 0.036 |
| Calf circumference (cm) | 33.61(±4.39) | 30.26(±4.84) | 0.028 |

| | | | |
|---|---|---|---|
| TLC | $2.04x10^9$ (±1.3) | $2.3x10^9$ (±1.4) | 0.632 |
| APACHE | 12.58(±7.5) | 16.95(±5.36) | 0.043 |
| NRS | 3.58(±0.96) | 4.19(±1.17) | 0.08 |
| SOFA | 2.63(±3.37) | 4.57(±3.03) | 0.06 |
| Kcal given on admission | 1742.11(±209) | 1650(±319.37) | 0.293 |

When we compared the anthropometric measurements (on admission) of well-nourished and malnourished patients assessed on discharge from ICU, it was noted that there was no significant difference in their weight and BMI, however the APACHE score, MUAC and calf circumference seemed to have a significant difference between the two groups.

Table 6. Factors predictive of malnutrition on ICU discharge

| Variable | OR | CI | P value |
|---|---|---|---|
| Weight (kg) | 0.95 | 0.92-0.98 | 0.003 |
| ICU stay (d) | 1.84 | 1.24-2.71 | 0.002 |

Among the different variables that were studied and analysed in the previous tables, only the weight and length of ICU stay had a significant correlation with malnutrition during ICU stay. Table 6 showed that as the patient's weight decreases the chances of him/her developing malnutrition during ICU stay is 0.95 times higher (p value 0.003). Those who have longer ICU stay were 1.84 times more likely to develop malnutrition during ICU hospitalization. (p value 0.002)

## Conclusion

The incidence of malnutrition in patients admitted in the ICU increases from 31% to 57% on ICU discharge. Subjective global assessment tool is a useful nutritional assessment tool to determine the nutritional status of the patients in order for the physician to be able to promptly recognize and give adequate nutritional support and referral to a nutritionist. Older patients tend to be more nutritionally deficient upon admission to the hospital. APACHE score and SOFA score were noted to be higher in malnourished patients however these values were not predictive of further malnutrition in ICU patients. The initial weight of the patient and length of hospital stay and the only variables in this study that were predictive of malnutrition during ICU admission, however a larger population is recommended for more accurate data. Proper screening for malnutrition with emphasis on screening tools such as SGA, and monitoring of weight are important in all patients admitted in the hospital especially in the ICU setting. Healthcare workers especially the physicians should give importance in nutritional assessment in order to detect malnutrition early in the course of the admission to be able to provide necessary nutritional intervention to prevent ICU malnutrition and its complications.

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