

# Characteristics of patients receiving nutrition care and its associations with prognosis in a tertiary hospital

María Teresa Pérez-Romero<sup>1</sup> , José Luis Villanueva-Juárez<sup>1</sup> , Aurora Elizabeth Serralde-Zúñiga<sup>1</sup> , Lilia Castillo-Martínez<sup>1\*</sup> 

## SUMMARY

**OBJECTIVE:** The aim of this study was to describe the medical nutritional therapy (MNT) of adult non-critically ill hospitalization patients.

**METHODS:** In a retrospective study, adults hospitalized for more than 48 h in non-intensive care unit medical and surgical areas that were classified as being at nutritional risk were included. Malnutrition was defined according to Global Leadership Initiative on Malnutrition (GLIM) criteria.

**RESULTS:** A total of 255 patients, aged 54.13±18.4 years, who were at risk of malnutrition were included in this study. Of these, 50% were males. Notably, 52.5% received oral nutrition supplementation (ONS), 23.5% enteral nutrition (EN), 15% parenteral nutrition (PN), and 9% received enteral and parenteral nutrition (EPN). Patients with EPN presented the highest frequency of malnutrition (52%), and therefore they received more than 100% of energy and protein requirements. The median length of stay was 25 days. Among patients with nutritional risk receiving EPN, no deaths occurred. Patients, identified at nutritional risk, but without malnutrition according to GLIM, and receiving ONS had significantly lower mortality than patients receiving other MNT.

**CONCLUSIONS:** Oral nutrition supplementation was the more frequent MNT prescribed. The frequency of malnutrition and percentage of prescribed energy and protein were higher in patients receiving PN and EPN compared with those receiving ONS.

**KEYWORDS:** Nutritional therapy. Malnutrition. Malnutrition. Hospitalization. Adults.

## INTRODUCTION

Disease-related malnutrition in hospitalized patients is a major public health problem, with a reported prevalence from 40 to 60% at admission in Latin American<sup>1</sup> and Mexico. In a previous study, we found 44.2% of patients with severe malnutrition<sup>2</sup>. This could be due to insufficient nutrient intake, with anorexia as a physiological factor, impaired absorption or loss of nutrients due to illness or trauma, or increased metabolic demands during illness<sup>1,3</sup>.

Disease-related malnutrition is associated with muscle wasting, poor wound healing, impaired immune function, longer hospital stay, and higher morbidity and mortality<sup>3-5</sup>. Given these consequences, current clinical practice guidelines recommend to consider initiating medical nutritional therapy (MNT) during the hospital stay of malnourished medical inpatients or those at risk of malnutrition in order to increase the uptake of essential nutrients and improve clinical outcomes<sup>6,7</sup>.

However, current knowledge and guidelines of MNT for polymorbid hospitalized medical patients remain unclear and have been derived from clinical trials or systematic reviews based on critical care or surgical populations<sup>5,8</sup>. Patients with

multiple comorbidities often have varying degrees of chronic malnutrition exacerbated by acute or chronic medical illness, which presents challenges to the nutritional and metabolic milieu. In addition, even negative outcomes of nutrition interventions have been reported<sup>6,9</sup>.

The aim of this study was to describe the MNT of adult non-critically ill hospitalization patients and its association with in-hospital mortality and intensive care unit (ICU) transfer.

## METHODS

An observational, retrospective study was conducted during the period of 2016–2020 at Instituto Nacional de Ciencias Médicas y Nutrición Salvador Zubirán (INCMNSZ). Adults hospitalized for more than 48 h in non-ICU medical and surgical areas that were classified as being at nutritional risk and managed by the Clinical Nutrition Service were included and those with oral nutrition and uncompleted/partial charts in medical records were excluded.

The protocol for the research project was approved by the ethics committee at the institution.

<sup>1</sup>Instituto Nacional de Ciencias Médicas y Nutrición Salvador Zubirán, Department of Clinical Nutrition – Mexico City, Mexico.

\*Corresponding author: [cam7125@gmail.com](mailto:cam7125@gmail.com)

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Data on characteristics, such as patient sex, age, principal hospital admission diagnosis, date of admission and date of discharge, and MNT prescription, were obtained from electronic medical charts and were captured in an Excel 2013 worksheet. In addition, Charlson Comorbidity Index was obtained, taking into consideration both the number and severity of comorbidities, based on a number of comorbidities that are each assigned an integer weight from 1 to 6, with a weight of 6 representing the most severe morbidity. The summation of the weighted comorbidity scores results in a summary score<sup>10</sup>.

Malnutrition risk was evaluated using the Nutritional Risk Screening-2002 (NRS-2002) tool by standardized nutritionists within 24 h after admission according to ESPEN guidelines<sup>11</sup>. Patient with a total score of  $\geq 3$  were classified as being at nutritional risk<sup>12</sup>.

Information about food intake and weight loss (compared to the usual weight) in last week were collected by interviewing the patients or, in the presence of altered mental status or impaired communication, their relatives/caregivers. Reduction of food intake was estimated by assessment of food consumed in the week before admission compared with the usual intake. Usual weight was obtained to calculate the percentage of body weight loss before admission. The severity of disease was scored according to the patient's history and reason of acute hospital admission<sup>11</sup>.

Weight and height were measured during the medical stay in the hospital. Body mass index (BMI) was calculated by dividing the total body weight (kg) by height (m) squared.

Percentage of food intake of preceding week before admission was evaluated with a Visual Comstock Scale<sup>13</sup>.

The diagnosis of malnutrition was made according to the GLIM criteria as follows: etiologic criterion of reduced food intake  $\leq 50\%$  in 1 week and phenotypic criterion with non-volitional weight loss  $>5\%$  in 6 months or low BMI  $<20$  (if age  $<70$  years) or  $<22$  (if age  $\geq 70$  years)<sup>14</sup>.

The calorie and protein requirements for MNT prescription were based on a validated "Algoritmo para el Soporte Nutricional Enteral Total" (ASNET) developed in our Service according to systematic literature search and international guidelines<sup>15</sup>. The adequacy of the energy and protein requirements was calculated based on the overall caloric protein received (from hospital admission until discharge) divided by the amount prescribed, represented as a percentage.

Follow-up information was obtained using the medical charts.

## Statistical analysis

The differences among subgroups of route of feeding (i.e., oral nutrition supplementation [ONS], enteral nutrition [EN],

parenteral nutrition [PN], and enteral and parenteral nutrition [EPN]) were assessed by a chi-square test in categorical variables and by Kruskal-Wallis test or an analysis of variance (ANOVA) in continuous variables, and a post-hoc analysis with a Tukey test was performed for continuous variables with  $p < 0.05$  in ANOVA simple comparison.

Kaplan-Meier survival curves with log-rank significance tests were also performed to assess survival based on the presence or absence of malnutrition. The data were analyzed using Jamovi version 1.6.15 and the Statistical Package for the Social Sciences version 21.

## RESULTS

A total of 686 hospitalized patients during 2016–2020 were classified as being at risk of malnutrition. Of these, 431 were excluded since they received oral nutrition, and 255 were included in the study. In all, 50% were males, aged  $54.13 \pm 18.4$  years, and 52.5% received ONS, 23.5% EN, 15% PN, and 9% EPN during a hospital stay that lasted 3 days or more. The gastrointestinal primary cause of hospital admission was the most frequent in all patients.

Weight and BMI were significantly lower and the frequency of malnutrition was higher in patients receiving EPN compared with those receiving EN. Patients receiving ONS were more likely to have lower NRS scores (Table 1).

The characteristics of MNT prescription are presented in Table 2 and we can see that the adequacy of protein and energy requirements was higher in the PN and EPN groups and lower in ONS group.

The proportion of patients with EN who received gastric feeding was 59.2% (11.1% by nasogastric tube; 22.3% received by jejunostomy, and 18.5% received by nasoenteric tubes). Specialized EN formula was prescribed in 23.8%, polymeric formulas in 76.2%, and extra protein modular supplement in 46% by continuous infusion (95%). On average, initial rate was  $31.2 \pm 22$  mL/h and progression rate was  $56.9 \pm 16.1$ .

In all patients with PN, this was administered through venous central catheter.

The length of stay was significantly higher in EPN group. Interestingly, no deaths occurred during hospital stay in this group. On the contrary, EN and PN groups presented higher mortality and higher frequency of patients who were transferred to ICU (Table 3).

Figure 1 presents the Kaplan-Meier survival curves of in-hospital mortality based on the presence or absence of malnutrition. Patients without malnutrition with ONS had significantly lower mortality than patients with EN or PN. No

deaths occurred among patients receiving EPN. With respect to patients with malnutrition, patients with ONS presented higher mortality than patients with MNT, but these differences did not reach statistical significance.

## DISCUSSION

In the present study, according to GLIM criteria, not all the patients with a prescription for medical nutritional support were malnourished, ONS and EN were more frequently provided to

**Table 1.** Demographic, clinical, and nutritional characteristics of the study population based on route of feeding.

Variables	ONS n=134	EN n=60	PN n=38	EPN n=23	P
Age, years	55±20	56.5±18.3	53.2±18.4	48.6±19.1	0.08
Sex, male (%)	66 (49.2)	32 (53.3)	19 (50)	12 (52.2)	0.29
Primary cause of hospital admission, n (%)					
Surgical	11 (8.4)	5 (8.8)	4 (11.5)	2 (8.3)	0.01
Cardiorespiratory	20 (14.9)	12 (20.1)	2 (6.1)	1 (5.6)	
Gastrointestinal	27 (20.4)	7 (11.8)	15 (38.2)	10 (44.4)	
Neurological disease	3 (2.1)	3 (5.8)	1 (0.6)	1 (2.8)	
Cancer	38 (28.4)	7 (11)	10 (26.1)	5 (22.1)	
Renal disease	7 (5.3)	2 (2.8)	1 (2.4)	0 (0)	
Metabolic disease/infection	19 (14.3)	21 (35.4)	5 (12.1)	3 (13.9)	
Others	4 (3.2)	1 (2.2)	1 (2.6)	0 (0)	
Disease severity, n (%)					
Mild	71 (53)	29 (48.3)	16 (42.1)	16 (70)	0.001
Moderate	62 (46.2)	47 (78)	22 (57.9)	5 (20)	
Severe	1 (0.7)	1 (1.7)	(0)	2 (8.7)	
Charlson comorbidity index (score)	2 (2-3)	2 (2-4)	2 (2-3)	2 (2-2)	0.91
Weight, kg	58.4±19	60.2±14	54.6±17.7	42.5±9.5	0.001*
BMI, kg/m <sup>2</sup>	21.8±5.5	22.8±4.5	20.8±6	17.1±4.1	0.001*
Malnutrition, n (%)	26 (19.4)	15 (25)	12 (31.6)	12 (52)	0.001
Obesity, n (%)	8 (6)	4 (7)	2 (5)	0	0.81
NRS 2002 score, n (%)					
3 points	34 (25.6)	7 (12.1)	5 (13.3)	4 (16.7)	0.001
4 points	55 (40.9)	15 (24.5)	11 (27.9)	7 (31.9)	
5 points	40 (29.9)	30 (49.6)	18 (48.5)	10 (41.7)	
>5 points	5 (3.7)	8 (13.8)	4 (10.3)	2 (9.7)	
% food intake of last week, n (%)					
>75	22 (16.4)	8 (13)	2 (5.3)	5 (22)	0.001
75-50	41 (30.8)	5 (8)	4 (10.5)	0 (0)	
50-25	30 (22.3)	5 (9.3)	10 (26.3)	2 (8.6)	
<25	41 (30.8)	42 (70.7)	13 (57.9)	15 (65.2)	
% weight loss before admission, n (%)					
<4	63 (47)	12 (20)	6 (15.8)	5 (22)	0.001
5-9	30 (22.3)	6 (10)	10 (26.3)	3 (13)	
>10	41 (30.6)	42 (70)	22 (57.9)	12 (66.7)	

Data are presented as mean±standard deviation or number (%). ONS: oral nutritional supplementation, EN: enteral nutrition, PN: parenteral nutrition, EPN: enteral and parenteral nutrition; BMI: Body mass index; NRS: nutritional risk screening. \*EN vs. EPN: p<0.05.

patients with MNT, which is similar to that recommended. Oral intake is optimal because it induces a cephalic-phase response that follows the oral ingestion of food<sup>16</sup>.

We reported gastrointestinal primary cause of hospital admission was the most frequent; however, the adequacy of the energy and protein requirements in patients with EN was higher in the present study<sup>2</sup>.

**Table 2.** Nutrition practice in-hospital of the study population based on route of feeding.

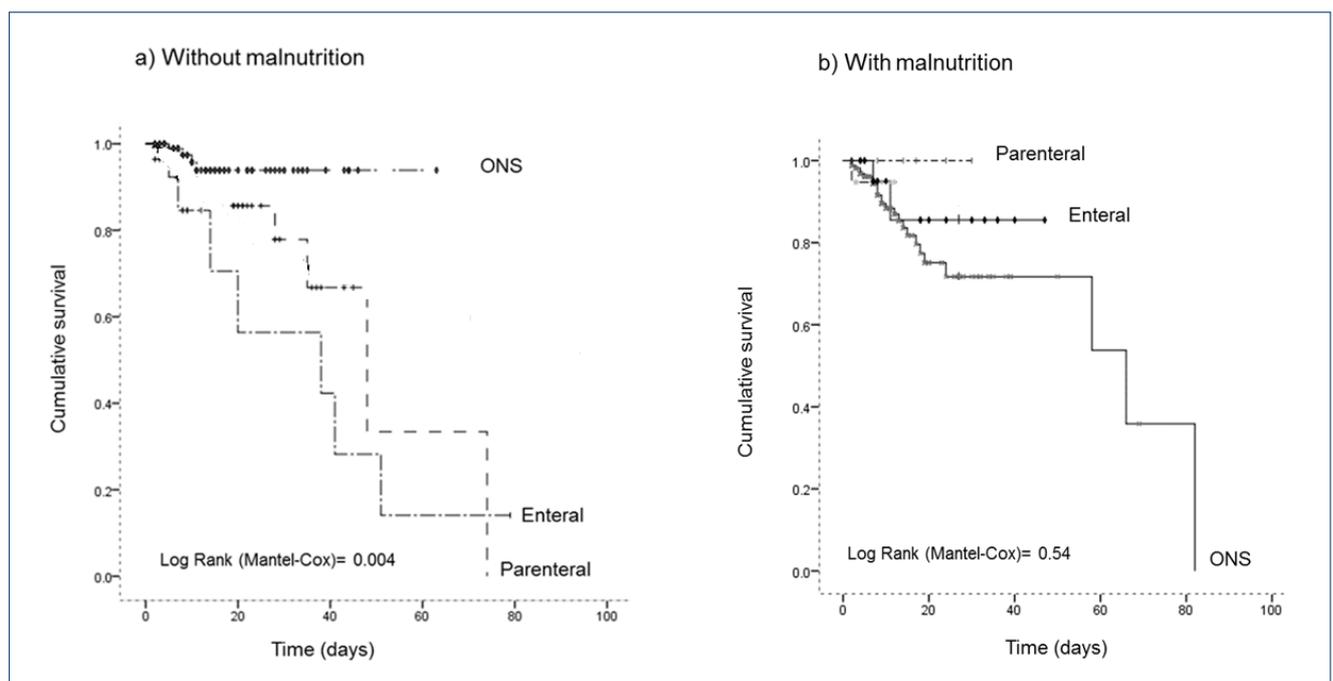
Variables	ONS n=134	EN n=60	PN n=38	EPN n=23	p
Goal of energy (kcal)	1626±668	1687±286.8	1550±280	1510±373	0.05
Goal of energy (kcal/kg)	27.9±11.4	28±4.8	28.4±5.2	35.5±8.8	0.05
Energy received (kcal)	1226±504	1421±379	1370±371.3	2380±765	0.001*†
Energy received (kcal/kg)	21±9	23.6±6.3	25.1±6.8	56±18	0.001*†
Energy adequacy (%)	75.4±45	84.2±21.2	90.6±24.5	160.5±34.3	0.001*†
Goal of protein (g)	65.8±11.7	73.2±15.9	70.7±21.3	57.4±10.2	0.01†
Goal of protein (g/kg)	1.1±0.2	1.2±0.26	1.3±0.39	1.3±0.24	0.05
Protein received (g)	50±23	60.2±19.7	70.7±20.5	79.2±30	0.02*†
Protein received (g/kg)	0.9±0.4	1.01±0.33	1.3±0.4	1.8±0.7	0.02*†
Protein adequacy (%)	76±4.2	84.8±25.4	102.4±30.9	138.2±50.4	0.001*†

Data are presented as mean±standard deviation. ONS: oral nutritional supplementation, EN: enteral nutrition, PN: parenteral nutrition, EPN: enteral and parenteral nutrition. \*ONS vs. EPN: p<0.05. †EN vs. EPN: p<0.05.

**Table 3.** Clinical outcomes of the study population based on route of feeding.

Variables	ONS n=134	EN n=60	PN n=38	EPN n=23	p
Length of stay (days)	11 (7-19)	12 (7-20)	16 (9-31)	25 (14-43)	0.01*†
Transferred to ICU	3 (2.2)	4 (6.7)	3 (7.9)	1 (4.3)	0.01
In-hospital mortality, %	4 (3.1)	8 (13.3)	8 (20)	0 (0)	0.01

Data are presented as median (p25th–p75th) or n (%). ONS: oral nutrition supplementation, EN: enteral nutrition, PN: parenteral nutrition, EPN: enteral and parenteral nutrition; ICU: intensive care unit. \*ONS vs. PN and EPN: p<0.05. †EN vs. PN and EPN: p<0.05.



**Figure 1.** Kaplan-Meier survival for in-hospital mortality based on the (a) presence or (b) absence of malnutrition and route of feeding.

It is interesting that patients with EPN did not present deaths, and this could be due to the fact that this group received a higher percentage (>80%) of prescribed energy and protein and as a result they present longer length of stay; however, this observation can be just an isolated event that should be investigated in future studies to evaluate the potential benefits of the combination of EN and PN, especially in cases where EN alone is not sufficient.

In a recent systematic review and meta-analysis of randomized controlled trials evaluating the effect of supplemental PN versus EN alone on clinical outcomes in critically ill adult patients, the authors found that combined EN and PN improved the protein and energy intake and concluded that when EN fails to meet the energy requirements, PN might be considered at the right time and in the right amount as it helps to increase the energy and protein intake, and PN should be delayed until at least day 4 after the initiation of EN to allow sufficient EN and decrease the amount of PN needed<sup>17</sup>.

In a subanalysis between patients with and without malnutrition, we found that patients with EPN presented higher mortality than those with oral nutritional support and no support. This finding is important because it suggests that the screening evaluation of the risk of malnutrition is not sufficient to evaluate malnutrition based on GLIM criteria. Subjects with a risk of malnutrition that is not confirmed with GLIM and who receive MNT can have adverse outcomes. This finding is explained by the fact that the energy and protein adequacy of nutritional therapy was suboptimal, and continuous tube feeding and PN may potentially desynchronize a range of anabolic metabolic processes<sup>9</sup>. Therefore, if not strictly necessary, it is better to not prescribe MNTs because they are invasive and expensive<sup>3</sup>.

In patients with malnutrition, we did not find a statistically significant difference in mortality between feedings patients with

EPN and those with ONS, as previously mentioned in systematic reviews and meta-analyses of trials addressing nutritional intervention in malnourished medical inpatients<sup>3,5</sup>.

The present study investigation has limitations. The results were based on a retrospective study and this study was performed in a single center, which might limit the generalizability of our findings. Also, other prognosis variables such as infections rate and 6 months follow-up were not evaluated.

## CONCLUSIONS

In adults hospitalized for more than 48 h in non-ICU and surgical areas that were classified as being at nutritional risk, ONS was the more frequent MNT prescribed. Patients with EPN present the highest frequency of malnutrition; as a result, they received more than 100% of energy and protein requirements, the median length of stay was 25 days, and no deaths occurred during hospitalization in this group.

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## AUTHORS' CONTRIBUTIONS

**MTPR:** Conceptualization, Data curation, Supervision, Writing – review & editing. **JLVJ:** Methodology, Software, Writing – original draft. **AESZ:** Conceptualization, Project administration, Resources. **LCM:** Formal Analysis, Investigation, Methodology, Writing – review & editing.

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