



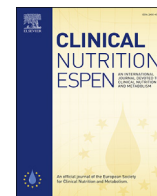
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## Original Article

# Outcomes of nutritionally at-risk Coronavirus Disease 2019 (COVID 19) patients admitted in a tertiary government hospital: A follow-up study of the MalnutriCoV study



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## SUMMARY

**Background and aims:** The prevalence of malnutrition among adult Filipino patients with COVID 19 is 71.83%. Malnutrition has long been associated with poor outcomes among patients with pneumonia. This may be due to the increased risk of malnourished patients to develop impaired muscle and respiratory function. We aimed to determine the outcomes of adult COVID 19 patients admitted in a tertiary government hospital accordingly to nutrition status and risk.

**Methods:** Retrospective study on the adult COVID 19 patients admitted from July 15 to September 15, 2020 who were screened using the Philippine Society for Parenteral and Enteral Nutrition modified Subjective Global Assessment Grade tool. Chi-square or Fisher exact test, as well as Mann–Whitney U test or Kruskal–Wallis with post-hoc Dunn test, as appropriate were done. Survival analysis for mortality was done with right-censored data length of initial admission in days. Cox proportional hazard regression was done to determine the association of the main variables of interest with mortality with a 95% confidence interval.

**Results:** Malnourished patients were 30% less likely to be discharged [HR 0.70 95% CI (0.50, 0.97)]; malnutrition was also associated with length of hospital stay as those who were malnourished had longer lengths of hospital stay of about 4 days on the average [HR 3.55 95% CI (0.83, 6.27)]. High nutrition risk was significantly associated with length of hospital stay [HR 4.36 95% CI (0.89, 7.83)].

**Conclusion:** The only risk factor for mortality shown in this study is ICU transfer. Malnutrition, moderate nutrition risk, and high nutrition risk were risk factors of having longer lengths of hospital stays. While only malnutrition was the risk factor for being less likely to be discharged. We reiterate that nutrition assessment and support are important in mitigating the effects of COVID 19.

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## 1. Background

The Coronavirus Diseases 2019 (COVID 19) has affected more than 107 million people worldwide, resulting in more than 2.35 million deaths [1]. And with the introduction of a vaccine, these

numbers are expected to decrease over time. Locally (the Philippines), the disease has infected more than 549,000 people and resulted in more than 11 thousand deaths since the virus was first reported [2]. As of this writing, the country has yet to start its own vaccination program which is expected to curb the new daily cases.

A cross-sectional study by Li et al. from Wuhan, China reported that 27.5% of patients aged 65 years and above were at risk for malnutrition and at least 52.7% were malnourished [3]. These figures were higher than the global incidence of malnutrition in the

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elderly signifying that there may be a higher prevalence of malnutrition among COVID-19 patients [4].

While there has been no study yet on malnutrition and mortality among patients with COVID-19, malnutrition has long been associated with increased mortality and poor long-term outcomes among patients with community acquired pneumonia. This may be due to the increased propensity of malnourished patients to develop impaired muscle and respiratory function [5]. Our recent study (the MalnutriCoV study) showed that the prevalence of malnutrition among patients with COVID 19 admitted at the Philippine General Hospital was 71.83%. Factors associated with malnutrition include older age, severity of pneumonia, and chronic kidney disease. However, there was no data on the clinical outcomes of the patients [6].

In this follow-up study to the MalnutriCoV Study, we determined the clinical outcomes (discharged, mortality, or admitted into the intensive care unit) of the COVID-19 patients included in the MalnutriCoV study. Data gathered from this study will add to the body of knowledge on malnutrition among COVID-19 patients and their clinical outcomes.

This study aimed to determine the clinical outcomes of the adult patients with Coronavirus Disease 2019 (COVID 19) admitted in the COVID 19 wards of the Philippine General Hospital (PGH) between July 15 to September 15, 2020. Also, it aimed to compare the incidence of clinical outcomes across nutrition risk levels and nutrition status.

## 2. Materials and methods

### 2.1. Study design

This is a retrospective study on the clinical outcomes of the COVID 19 patients admitted at the PGH from July 15, 2020 to September 15, 2020. This study was approved by the University of the Philippines Manila Research Ethics Board (UPMREB 2021-031-01).

### 2.2. Study setting

This study was conducted in the PGH, one of the COVID 19 referral centers in the National Capital Region. After it was designated as a COVID-19 referral center on March 23, 2020, PGH assigned its medical wards (Wards 1 and 3) and intensive care unit to be COVID areas, catering exclusively to patients with COVID-19 confirmed by at least one nasopharyngeal swab reverse transcriptase – polymerase chain reaction test. Patients in these areas were either admitted directly from the emergency room or transferred from other facilities. At the height of the pandemic, a total of 74 patients (maximum capacity) could be accommodated in the COVID 19 wards and Intensive Care Unit (ICU). There is no active nutrition support team in the hospital.

### 2.3. Study population

All adult patients aged 19 years and older with COVID-19 confirmed by a positive nasopharyngeal swab RT-PCR test, and admitted to the COVID wards from July 15 to September 15, 2020 were included. Patients who were unable to follow commands, answer when asked questions, stand to be weighed, needed maternity or psychiatric care, had missing data from their medical charts (e.g. no total lymphocyte count or serum albumin results), or did not consent were excluded.

### 2.4. Study outcomes

The outcomes of interest in this study are: discharge, mortality, transfer to a quarantine facility, and transfer to another hospital. Other outcomes of interest are: transfer to the ICU, home against medical advice, or readmitted to another hospital. The study also determined the length of hospital stay in days, ICU stay, and days on mechanical ventilator or high-flow oxygen support via nasal cannula (HFNC).

Nutritional status and risk were assessed using the modified Subjective Global Assessment (SGA) Grade developed by the Philippine Society of Enteral and Parenteral Nutrition (Phil-SPEN). The tool is inexpensive, rapid to conduct and can be effectively used by nurses, dietitians and physicians. In the Philippines, the modified SGA, developed by the Philippine Society of Enteral and Parenteral Nutrition (PhilSPEN), has been validated for use in the Filipino population. In addition to the standard SGA, the modified SGA tool also includes measurement of the Body Mass Index, serum albumin and total lymphocyte count; the patient is also interviewed for the following parameters: weight loss, food intake, gastrointestinal symptoms, functional capacity, disease and relation to nutrition requirements. This tool has been found to have a sensitivity of 94.7%, specificity of 96.2% and Positive Predictive Value of 95.7% in determining malnutrition in adults in both inpatient and outpatient settings [7].

An SGA grade of A is normal/not malnourished, Grade B is mild/moderate (if with +1/+2 subcutaneous fat or muscle loss) malnutrition and Grade C signifies severe malnutrition. Nutritional risk score of 0–2 corresponds to low risk, a score of 3–5 corresponds to moderate risk while a score equal to 6 or greater corresponds to a high risk for malnutrition. Malnutrition in this study was defined as having a modified SGA score of B (mild/moderate) or C (severe).

### 2.5. Data collection procedure

The nutritional status and risk of the patients were obtained using the modified SGA tool by the investigators upon the admission of the patients. The electronic medical records of all the patients included in the MalnutriCoV study were reviewed by the investigators. Information on the outcomes (discharge, mortality, transfer to another hospital, transfer to a quarantine facility, transfer to the intensive care unit, length of hospital stay in days, number of days on mechanical ventilator, number of days on high flow nasal cannula) were extracted from the electronic medical charts and recorded in electronic data collection forms using the Google form application. To ensure data quality, one of the investigators (HHC) not involved in data collection verified 20% of the data points in the study database against the information in the participants' electronic medical records. Any inconsistencies were flagged and corrected.

### 2.6. Statistical analysis

The data was organized in Microsoft Excel software and analyzed in STATA 15.1 (Stata corp, College Station, TX, USA). The clinical profiles and outcomes of the participants were summarized in a table. Quantitative variables were described as median and interquartile range (IQR) while qualitative variables were described as count and proportion. Chi-square or Fisher exact test of homogeneity, or association was done as appropriate, for determining association between categorical variables. While a Mann–Whitney U test or Kruskal–Wallis with post-hoc Dunn test, as appropriate, was done for the quantitative variables.

Survival analysis for mortality during initial admission in PGH was done with right-censored data length of initial admission in

days. Person-days at risk and the incidence rate for mortality during initial admission was computed. Cox proportional hazard regression was done to determine the association (hazard ratio) of the main variables of interest (i.e. nutritional status and nutritional risk, and other clinical profile of the patients during the initial admission) with mortality. Associations are reported as hazard ratios and 95% confidence intervals.

### 2.7. Ethical statement

The protocol of this study adheres to the ethical considerations and ethical principles set out in relevant guidelines, including the Declaration of Helsinki, WHO guidelines, International Conference on Harmonization–Good Clinical Practice, Data Privacy Act of 2012, and National Ethics Guidelines for Health Research 2017. Prior to commencement, the protocol was approved for Technical Review followed by University of the Philippines Manila Research Ethics Board (UPMREB) Review Panel 4.

## 3. Results

### 1.) Clinical outcomes according to nutrition risk

This study included 355 patients from the MalnutriCoV study. [Table 1](#) shows the outcomes of these patients according to their nutrition risk. Those classified as having a high risk for malnutrition had the longest median length of hospital admission (IQR) at 20 [14] days; while those with moderate and low had 16 and 13 days, respectively. More than 70% of all the patients were discharged to home, 76.12% in the low nutrition risk, 77.98% in the moderate nutrition risk, and 77.36% in the high nutrition risk groups. However, on further follow-up, 9.92% of the moderate nutrition risk patients who were discharged to home were readmitted, most as non-COVID 19 patients (76.92%). Patients classified as having high nutrition risk had the highest mortality rate (20.75%), ICU admission rate, and longest duration on mechanical ventilator (median of 7 days, IQR 4). Patients with moderate or high nutrition risk had the same median days on HFNC at 6 days.

Patients who were classified as having high nutrition risk had a significantly longer hospital stay than those who were classified as having low and moderate nutrition risk ( $p$ -value  $<0.0001$ ). Those who had moderate nutrition risk had a significantly longer hospital stay than those who had low nutrition risk. Nutrition risk is also significantly associated with disposition: discharged, mortality, transfer to quarantine facility, and transfer to hospital of choice ( $p$ -value 0.003) and transfer to the intensive care unit ( $p$ -value 0.001).

### 2.) Clinical outcomes according to nutrition status

Of the 355 patients included in the MalnutriCoV study, 255 (71.83%) were classified as being malnourished. Although more malnourished patients were sent home (79.22%), there were more patients in the malnourished group who were later readmitted (9.90%) mostly for non-COVID reasons. Furthermore, those who were malnourished had higher mortality and ICU admission rates compared to those who were not malnourished (18.04% vs 7.00%, and 14.12% vs. 2.00%, respectively). Malnourished patients also required a longer duration of mechanical ventilation or oxygen supplementation via HFNC, and stayed longer in the hospital compared to those who were not malnourished ([Table 2](#)).

### 3.) Association between the clinical outcomes and malnutrition

[Table 3](#) shows the univariable and multivariable regression analyses done between the clinical outcomes and nutrition status and

risk. Adjusting for all other factors (age, community-acquired pneumonia, and ICU admission), there is insufficient evidence to conclude that nutrition status and risk were significantly associated with mortality. Furthermore, malnutrition was significantly associated with discharge as those who were classified as malnourished were less likely to be discharged than those who are not malnourished. There is no sufficient evidence to conclude that nutrition risk is significantly associated with discharge. Lastly, malnutrition was significantly associated with length of hospital stay as those who were malnourished had longer lengths of hospital stay of about 4 days on the average. Nutrition risk was significantly associated with length of hospital stay. Those who were classified as having high nutrition risk had longer length of hospital stay of about 5 days on the average compared to those who were low risk. However, there was not enough evidence to conclude that those who were at moderate nutrition risk had a significantly different length of hospital stay when compared with those who were at low risk.

The incidence rate of mortality is 0.87 (or around 1 person) per 100 person-days ([Table 4](#)). This means that for every 100 person at risk in one day, approximately 1 (0.87–1 person) dies. It can also be interpreted as 87 per 10,000 person-days.

## 4. Discussion

Malnutrition is associated with poorer outcomes among patients admitted for multiple reasons; one of the most extensively studied diseases associated with poor outcomes due to malnutrition is community-acquired pneumonia [5]. In this study, we provide information to supplement what little we know about COVID 19 pneumonia. Patients with increasing risk of nutrition risk had longer lengths of hospital stay (median): low (13 days), moderate (16 days), and high (20 days). While the proportion of patients who were discharged were more or less similar across the different nutrition risk levels, those who had high risks had higher readmission rates (low 6.86%, moderate 9.92%, and high 12.2%). The mortality rates were observed to be higher among those classified to be at higher risk for malnutrition.

Those who were assessed to be malnourished on admission had a longer hospital stay (17 vs 12 days). The malnourished group also had a higher proportion of patients who were discharged (79.22% vs 72%), but also had higher readmission rates (9.9% vs 6.94%) with higher mortality among those readmitted (30% vs 20%). Furthermore, the mortality rates (on initial admission) between those who were malnourished were higher (18.04%) than those who were not malnourished (7%). Overall, the incidence rate of mortality was found to be 0.87 (or around 1 person) per 100 person-days. Lastly, both the univariable and multivariable regression analysis done revealed that only transfer to the ICU was shown to be a risk factor for mortality (HR 6.53). However, malnutrition was associated with discharge (HR 0.70) with those who were malnourished being less likely to be discharged. Malnutrition and high nutrition risk were found to be both significantly associated with length of hospital stay with HR 3.55 and 4.36, respectively.

The findings of this study can be summarized as those in the higher nutrition risk groups or the malnourished group having higher proportions of poorer outcomes. Other studies have elaborated as to the pathophysiology linking malnutrition with poorer outcome such as malnutrition being associated with disturbing the lung's ability to resist infection which increased the incidence of the disease, more virulent infection, longer recovery rates, and ultimately poor long-term outcomes [5].

Taking all other factors in, only admission to the ICU was shown to be a risk factor for mortality in this study. The possible explanation for this could be the presence of co-morbidities, COVID 19

**Table 1**  
Outcomes according to nutrition risk.

	Nutritional Risk			p-value
	Low (n = 134)	Moderate (n = 168)	High (n = 53)	
<sup>a</sup> Length of admission	13 (9)	16 (10)	20 (14)	<0.0001
Disposition				0.003
Discharged	102 (76.12%)	131 (77.98%)	41 (77.36%)	
Readmitted	7 (6.86%)	13 (9.92%)	5 (12.20%)	0.550
Reason				0.395
COVID	–	3 (23.08%)	–	
NON-COVID	7 (100.0%)	10 (76.92%)	5 (100.0%)	
Disposition				0.252
Discharged	16 (85.71%)	10 (76.92%)	2 (40.00%)	
Mortality	1 (14.29%)	3 (23.08%)	3 (60.00%)	
Mortality	12 (8.96%)	30 (17.86%)	11 (20.75%)	
Transferred to Quarantine Facility	17 (12.69%)	5 (2.98%)	1 (1.89%)	
Discharged	17 (100.0%)	5 (100.0%)	1 (100.0%)	–
Readmitted to another hospital	–	–	–	
Transferred to Hospital of Choice	3 (2.24%)	2 (1.19%)	–	
Discharged	2 (66.67%)	1 (50.00%)	–	1.000
Transferred	1 (33.33%)	1 (50.00%)	–	
Mortality	–	–	–	
Transferred to ICU	6 (4.48%)	20 (11.90%)	12 (22.64%)	0.001
Days on Mech Vent	5 (5)	5 (3)	7 (4)	0.2689
Days on HFNC	–	6 (4)	6 (1)	0.6337

<sup>a</sup> Median length of admission in days with the IQR in parenthesis.

**Table 2**  
Outcomes of COVID-19 patients admitted in PGH according to nutritional status.

	Malnourished (n = 255)	Not Malnourished (n = 100)	p-value
Length of admission	17 (10)	12 (9)	<0.0001
Disposition			<0.001
Discharged	202 (79.22%)	72 (72.00%)	
Readmitted	20 (9.90%)	5 (6.94%)	0.454
Reason			1.000
COVID	3 (15.00%)	–	
NON-COVID	17 (85.00%)	5 (100.0%)	
Disposition			1.000
Discharged	14 (70.00%)	4 (80.00%)	
Mortality	6 (30.00%)	1 (20.00%)	
Mortality	46 (18.04%)	7 (7.00%)	
Transferred to Quarantine Facility	7 (2.75%)	16 (16.00%)	
Discharged	7 (100.0%)	16 (100.0%)	–
Readmitted to another hospital	–	–	
Transferred to Hospital of Choice	–	5 (5.00%)	
Discharged	–	3 (60.00%)	–
Transferred	–	2 (40.00%)	
Mortality	–	–	
Transferred to ICU	36 (14.12%)	2 (2.00%)	0.001
Days on Mech Vent	6 (3)	2 (4)	0.1873
Days on HFNC	6 (1.5)	–	–

**Table 3**  
Association between clinical outcomes and nutritional status.

Factor	Clinical Outcomes					
	Mortality		Discharge		Length of Hospital Stay (Days) <sup>b</sup>	
	Hazard Ratio (95% CI)		Hazard Ratio (95% CI)		Coefficient (95% CI)	
	Crude	Adjusted <sup>a</sup>	Crude	Adjusted <sup>a</sup>	Crude	Adjusted <sup>a</sup>
Not Malnourished	ref	Ref	ref	ref	ref	ref
Malnourished	1.61 (0.72, 3.61)	1.06 (0.37, 3.02)	0.54 (0.41, 0.71)	0.70 (0.50, 0.97)	5.78 (3.55, 8.02)	3.55 (0.83, 6.27)
Nutritional Risk						
Low	reference	Reference	reference	reference	reference	reference
Moderate	1.54 (0.78, 3.02)	1.05 (0.47, 2.34)	0.73 (0.56, 0.95)	1.00 (0.74, 1.36)	3.26 (1.06, 5.46)	0.50 (–1.94, 2.950)
High	1.28 (0.55, 2.95)	0.63 (0.22, 1.76)	0.47 (0.32, 0.68)	0.72 (0.47, 1.12)	7.87 (4.78, 10.95)	4.36 (0.89, 7.83)

<sup>a</sup> Adjusted for age, sex, education, place of residence, COVID-19 severity, CAP, HAP, co-morbidities, and ICU admission.

<sup>b</sup> Linear regression.

**Table 4**  
Incidence rate of mortality of COVID-19 patients during initial admission in PGH.

	Estimate	95% Confidence Interval
Mortality		
Count	53	
Person-days at risk	6083	
Incidence per 100 person-days	0.87	0.67–1.14

infection being critical (since the patients needed to be admitted to the ICU), hospital-acquired infections (with organisms usually being multi-drug resistant), limited number of mechanical ventilators/high flow nasal cannulas (especially in a developing country such as the Philippines), and malnutrition. This is consistent with a meta-analysis done on several studies done in different countries on the rate of ICU admission and their outcomes wherein the prevalence of mortality among adult patients with COVID 19 who were admitted to the ICU was high. The study also determined that the presence of a co-morbidity, male gender, age greater than 50 years-old, and having acute respiratory distress syndrome (ARDS) were independent predictors of mortality for this cohort of patients [8,9]. Another study done investigated the risk factors for ICU admission and mortality among 66 hospitalized COVID 19 patients. The study showed an overall mortality rate of 14% with a mean length of hospital stay  $8.4 \pm 8.9$  days [10]. This is similar to our study which reported that 53 patients out of the total 355 had died which resulted in a mortality rate of 14.9%. However, this mortality rate is higher compared to a similar cohort of patients in other countries [11–13]. In those studies, many patients were asymptomatic and others had mild symptoms. Thus, they did not go to COVID 19 hospitals nor sought consult with a healthcare professional which meant that they could not be tested. Unlike in this study where we also had a considerable number of participants who had mild disease severity. The ICU mortality rate of 73.68% (28 patients died out of the total 38 patients who were admitted to the ICU) is higher than those reported in studies done in Italy [10], China [14], the United States of America [15,16]. A possible explanation to the difference in rates would be that the studies done in Italy and China were multi-center studies (in contrast to our study which was a single center study); while the two studies done in the United States has fewer participants (no more than 30 patients in each study). Furthermore, other factors could have affected the results such as the limited resources and facilities in the Philippines in contrast to those in the U.S., Italy, and China. Lastly, other recent studies have shown that sex (male), older age, and comorbidities were significant risk factors for ICU admissions and mortality [17,18]. This is congruent to the findings in the other studies mentioned in this paragraph.

While the study did not reveal other risk factors of poor outcomes (which were highlighted in the other studies mentioned) among COVID 19 patients, it does not mean that there are none. There was just not enough evidence, and this could have been due to the relatively small participants in the study. Also, the participants in most of those studies were not assessed as to their nutrition status nor risk. The investigators also acknowledge that this is a retrospective study, thus it is difficult to determine causation, only association.

This study has some limitations. First, it is a follow-up study of a single-center study. This might have caused some selection bias and also possibly the reason why some factors were not found to be associated with clinical outcomes. The lack of evidence (translated here as the lack of participants in the study) can also be attributed to this being only a single-center study. The investigators suggest that a larger, multi-center/hospital study be done in the country to generate data that is more reflective of the present disease burden.

Second, part of the data (e.g. weight loss prior to hospitalization, food intake) were dependent on interviews with the patients. This is likely to be subjected to recall bias. For this limitation, the investigators recommend the use of more objective measurement of nutrition status or risk be taken (i.e. mid upper arm circumference and triceps skin fold).

Ultimately, this study shows that adult COVID 19 patients who were classified as having higher nutrition risk or poor nutrition status had poorer outcomes (higher mortality, longer days in the hospital, transfer to the ICU). Therefore, healthcare systems should include nutrition as part of their approach in managing these patients to provide better chances of survival.

## 5. Conclusion

Malnutrition, moderate nutrition risk, and high nutrition risk were risk factors of having longer lengths of hospital stays. While only malnutrition was the risk factor for being less likely to be discharged. Furthermore, the incidence rate of mortality is 0.87 per 100 person-days. The only risk factor for mortality shown in this study is ICU admission/transfer. The investigators still recommend routine nutrition screening and assessment for all patients admitted in the COVID 19 wards and larger, multicenter, and prospective studies that use more objective measures of malnutrition.

## 6. Implications for clinical practice

Patients with COVID 19 who were malnourished, moderately and highly nutritionally at-risk, and admitted to the ICU had poorer outcomes. While this study did not show an association between malnutrition and nutrition risk and mortality, a patient's need for ICU admission is multifactorial. This could range from worsening infection to that patient not having optimal nutrition as mentioned in literature. The study strengthens the call for a holistic approach and a mitigating strategy to combat COVID 19 by instituting preventive measures, nutrition screening and support, and management of co-morbidities.

## Statement contribution

**RBL**, Conceptualization, Methodology, Formal analysis, Investigation, Resources, Data curation, Writing – original draft, Visualization, Project administration, and Funding Acquisition. **HHC**, Formal analysis, Investigation, Resources, Data curation, Writing – original draft. **LPV**, Conceptualization, Methodology, Writing – original draft, and Supervision.

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## Declaration of competing interest

The principal investigators and co-investigators have no relevant conflicts of interest.

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## Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.clnesp.2021.04.008>.

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