



# The Relation of Nutritional Assessment and Pneumonia Severity Index among Elderly Patients with Community Acquired Pneumonia Admitted at Cardinal Santos Medical Center

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## Abstract

**Introduction:** Community Acquired Pneumonia is among the leading causes of morbidity and mortality among the Filipino elderly community. Nutrition is one of the most neglected yet significant aspects in the initial evaluation of elderly patients with community acquired pneumonia, despite the availability of nutrition assessment tools. This study aims to determine the relation of the subjective global assessment of nutrition status and mini nutritional screening score with the pneumonia severity index among elderly individuals with community acquired pneumonia admitted in Cardinal Santos Medical Center.

**Methods:** This is an observational, analytical, cross-sectional study whose target population are the elderly patients of Cardinal Santos Medical Center diagnosed with Community Acquired Pneumonia. The study was conducted among elderly patients, diagnosed with Community Acquired Pneumonia, admitted in Cardinal Santos Medical Center. Upon admission, the Pneumonia Severity Index, Mini Nutritional Screening Score and Subjective Global Assessment Grade were determined. Data collected were then encoded in Open Epi ver. 3.03a for statistical analysis. Means, frequency distribution, and odds ratio were determined for statistical analysis.

**Results and Discussion:** A total of 220 patients were included in the study. Using the Subjective Global Assessment, patients classified as being moderately to severely malnourished had 14 times greater odds to develop intermediate risk pneumonia ( $p < 0.05$ ) and 30 times greater odds to develop high risk pneumonia ( $p < 0.05$ ). Patients at risk for malnutrition and being malnourished using the Mini Nutritional Screening Score had 6 times greater odds of developing intermediate risk pneumonia ( $p < 0.05$ ) and 5 times greater odds of developing high risk pneumonia ( $p < 0.05$ ). Patients classified who were underweight using Body Mass Index, however, did not correlate significantly with determining the odds of developing intermediate risk pneumonia ( $p = 0.1079$ ) but had 4 times greater odds of developing high risk pneumonia ( $p < 0.05$ ). Although calf circumference of  $< 31$  cm did not significantly determine the odds of developing intermediate risk pneumonia ( $p = 0.6289$ ), there was evidence that the aforementioned anthropometric measurement increased the odds of developing high risk pneumonia by 7 times ( $p < 0.05$ ).

**Conclusion:** Elderly patients with malnutrition have a higher risk for a more severe Community Acquired Pneumonia. Nutrition assessment tools, including the Subjective Global Assessment of Nutrition and the Mini Nutrition Screening Scores can be used in determining clinical outcome of elderly patients. Anthropometric measurements including body mass index and calf circumference, may aid in predicting disease severity.

**Keywords:** Nutrition assessment; Elderly; Community Acquired Pneumonia

## Introduction

Community Acquired Pneumonia is the third leading cause of morbidity and mortality among the Filipino community based on the 2010 Philippine guidelines for Community Acquired Pneumonia [1]. Among the elderly population, pneumonia remains to be the leading infectious cause of mortality. In Cardinal Santos Medical Center, 6% of its annual admissions are elderly patients with community acquired pneumonia. In the evaluation of patients with the disease, the Pneumonia Severity Index is a scoring system developed to calculate the probability of mortality and

morbidity of a patient with pneumonia. The Pneumonia Severity Index stratifies patients in 5 risk classifications with Class I-II as low risk, Class III as intermediate risk, and Class IV - V as high risk pneumonia. In 1999, Flanders., *et al.* conducted a validation study on the Pneumonia Severity Index which showed that this tool has good discriminatory ability and has identified that a higher Pneumonia Severity Index score predicted higher 10 year mortality rate [2]. In 2010, Shah., *et al.* further stated that the Pneumonia Severity Index was more sensitive in predicting ICU admissions for pneumonia as compared to CURB 65 [3].

Nutrition is a significant determinant of the health status among the elderly. Despite its clinical significance, nutrition assessment has been understated in the clinical setting. Nutrition evaluation has been one of the most commonly overlooked aspects in the initial assessment of in-patient care. The Mini Nutrition Assessment Tool has been developed to accomplish rapid assessment of the nutritional status in the the elderly. In 1999, Vellas., *et al.* identified this as a single, rapid assessment of nutritional status in elderly patients in outpatient clinics, hospitals, and nursing homes [4]. The scoring was noted to identify malnutrition in the elderly population with a sensitivity of 96% and specificity of 98%. Despite being available for perusal, this screening tool has not been utilized commonly in clinical practice.

Implementation of nutritional evaluation in Cardinal Santos Medical Center has been done with the use of the Subjective Global Assessment of Nutrition, which is currently being administered in all patients. Even as early as 1987, Detsky., *et al.* was able to demonstrate that the use of Subjective Global Assessment of Nutrition had a high inter-observer agreement and was recognized as being reproducible, to include medical residents, and nurses [5]. This assessment tool considers weight loss, dietary intake, functional capacity, stress level of the disease in relation to nutritional requirements, and physical examination findings to include loss of subcutaneous fat, muscle wasting, edema, and ascites in nutritional status assessment. Based on the evaluation of each of these entities, the patient is classified as being well nourished, moderately malnourished, or severely malnourished.

Malnutrition has been one of the most common yet unrecognized medical problem in the elderly. According to Wells and Dumbrell in 2006, malnutrition has been increasingly recognized as a morbid condition involved in development of heart disease, pulmonary conditions and cancer [6]. In the study of Zhang., *et al.* in 2013, malnutrition has also been recognized to decrease quality of life, increase fatality rate, and decrease survival rate among elderly patients with pulmonary pathology [7]. Hence, early detection of a malnourished state is recognized as vital in the medical management of elderly patients.

## Objectives

### Primary Objective

To determine the relation of the mini nutritional screening score, subjective global assessment and the pneumonia severity index among elderly individuals with community acquired pneumonia admitted in Cardinal Santos Medical Center

### Secondary Objective

To determine the relation of the body mass index, calf circumference and the pneumonia severity index among elderly individuals with community acquired pneumonia admitted in Cardinal Santos Medical Center.

## Methods

### Study Design and Settings

This is an observational, analytical, cross-sectional study whose target population are the elderly patients diagnosed with Community Acquired Pneumonia. The study was conducted among elderly patients, diagnosed with Community Acquired Pneumonia, admitted in Cardinal Santos Medical Center during the period of August 2015 to August 2016.

### Participants and Study Size

All patients diagnosed with Community Acquired Pneumonia, of at least 60 years old, were included in the study. The study included the entire strata of the elderly population. Only those with radiographic finding of Pneumonia and fulfilled the clinical criteria for the diagnosis of Community Acquired Pneumonia were included. Patients with other indication for admission unrelated to Community Acquired Pneumonia were excluded. An informed consent was obtained accordingly prior to the commencement of the study procedure for each identified potential participant.

## Inclusion Criteria

1. At least 60 years old
2. Diagnosed with Community Acquired Pneumonia on admission
3. Admitted in Cardinal Santos Medical Center

## Exclusion Criteria

1. Must not have other indications for admission not related to community acquired pneumonia such as bleeding, loss of consciousness, abdominal pain
2. Must not be undergoing hemodialysis
3. Must not be in congestive heart failure
4. Must not be a resident of a nursing home or hospice care

## Definition of Terms

1. Community Acquired Pneumonia- A disease entity that may present with fever, cough, difficulty breathing; diagnosis must be confirmed by radiographic imaging.
2. Elderly- Individuals at least 60 years of age. The elderly population is stratified as young old at 60 to 74 years, middle aged old at 75 to 85 years old, and oldest old at age beyond 85 years.
3. Pneumonia Severity Index (PSI)- A validated risk stratification tool for patients with community acquired pneumonia. Risk classification is based on demographic factors, coexisting illnesses, physical examination findings, laboratory and radiographic findings. The sum of all points satisfied by each elderly individual is added of which the patient is subsequently stratified. Risk class I has an PSI score of < 51, and Risk class II has a PSI score of 51 to 70. Both risk class I and II are classified as low risk pneumonia. Risk class III are those with a PSI score of 71 to 90 and the patient is classified as having intermediate risk pneumonia. Risk class IV are those patients with a PSI score of 91 to 130, and Risk Class V are those whose PSI score are above 130. Both risk class IV and V are classified as having high risk pneumonia.
4. Mini Nutritional Screening Score- Score obtained by the participant who underwent evaluation using the Mini Nutrition Assessment Tool. This screening tool evaluated food intake, weight loss, neuropsychological stress, body mass index, and calf circumference. A score of 12-14 identifies normal nutrition status; 8-11 as at risk for malnutrition, and 0-7 as malnourished.
  - a. Body Mass Index- used as an indicator for appropriateness of weight for height; calculated by dividing the weight in kg by the height in m<sup>2</sup>. Based on the WHO guidelines, Body Mass Index is classified as underweight for BMI <18.5; normal for BMI 18.5 to 24.9; overweight or obese for BMI >25.
5. Calf Circumference- Anthropometric measure obtained with the patient in the sitting position, ideally. This anthropometric has been shown to be in positive correlation with body mass index. In the mini nutritional assessment, 31cm was set as the upper limit for a calf circumference suggestive of malnutrition.
6. Subjective Global Assessment of Nutrition Status- A validated nutrition assessment tool which considers weight loss, dietary intake, functional capacity, stress level of the disease in relation to nutritional requirements, and physical examination findings to include loss of subcutaneous fat, muscle wasting, edema, and ascites.

## Ethical Considerations

Each identified potential subject was adequately informed of the aims, methods, sources of funding, institutional affiliation of the primary investigator, the anticipated benefits and potential risks and the possible discomfort it may entail, and post-study provisions [8]. The potential subject was informed of the right to refuse to participate in the study or withdraw consent to participate at any time. After ensuring that the potential subject has fully understood aforementioned information, the primary investigator sought the potential subject's freely given informed consent in writing. In cases wherein the patient is deemed incapable of giving informed consent, the primary investigator sought informed consent from the legally authorised representative [9]. When a potential research subject deemed incapable of giving informed consent is able to give assent to decisions about participation in research, the primary investigator sought that assent in addition to the consent of the legally authorised representative. Once informed consent was obtained accordingly, data collection, including nutrition evaluation and pneumonia severity scoring is done.

All data collected was saved in a password protected computer wherein only the researcher has access to. Hard copies of the nutritional assessment and pneumonia severity score were placed in an envelope and placed in a locker where

only the primary investigator has access to. All nominal data that will identify individual patients who took part in the study will not be publicly disclosed. No conflict of interest is identified concerning the primary investigator in the conduct of this study. This study is in no way sponsored by any company, institution, or organization. The entire research protocol was reviewed and approved by the ethics review board of Cardinal Santos Medical Center.

## **Data Measurement**

All participants were identified using the aforementioned inclusion criteria. Upon obtaining informed consent, the patient subsequently underwent evaluation using the Pneumonia Severity Index, Subjective Global Assessment, and Mini Nutritional Assessment. Based on the scores obtained, the patient was subsequently stratified accordingly.

The patients underwent clinical evaluation, including nutritional assessment. Weight was measured in standing position with the patient standing, without foot wear, stepping on the platform of the Manual Detecto® weighing scale with weight evenly distributed on both feet. Weight was measured to the nearest kilogram. Height was measured, with the patient standing straight, without foot wear, against the stadiometer, with weight distributed equally on both feet. The patient was instructed to maintain head in an upright position avoiding it to tilt sideways, forward nor backward. The stadiometer was lowered until it made contact with the top of the patient's head. Height was subsequently recorded to the nearest centimetre. Body mass index was subsequently computed using the patient's weight and height. Body mass was recorded in kilograms per square meter. The calf circumference was measured with the patient in the sitting position with weight evenly distributed on both feet. The patient was asked to roll up their trouser. The medial tibial plateau was palpated, and the point 4cm distal to this site was measured. At this point, the calf circumference was subsequently measured. In cases wherein the patient is unable to tolerate the sitting position, the patient is asked to lie supine, with the knee positioned in 90 degrees flexion. The calf circumference was subsequently recorded to the nearest 0.1 cm.

All data collected was recorded accordingly on the Mini Nutritional Assessment form, Subjective Assessment for Nutrition Form, and Pneumonia Severity Index. Data collected from the study were encoded in Microsoft Excel 2010 and stored in a password protected computer. Hard copies of the nutrition assessment forms and pneumonia scoring were placed in an envelope and stored in a locker where only the primary investigator has access to. Files, both soft and hard copies are maintained in their aforementioned storage for one year. This time period will be allotted for statistical analysis of gathered data and will be made available should there be a need to review collected data.

## **Statistical Approach and Design**

This research is an observational, analytical, cross-sectional study. Nutritional risk stratification scores, including the Mini Nutritional Screening Score, and Subjective Global Assessment were correlated with the Pneumonia Severity Index. The body mass index, and calf circumference measurements were also correlated with the Pneumonia Severity Index. Based on the 6% prevalence of community acquired pneumonia in the elderly in the hospital admissions, and for a 95% confidence interval, the sample size was determined to be at least 102 participants. Data collected were then subsequently run in Open Epi ver. 3.03a for statistical analysis. Means, frequency distribution, and determination of odds ratio were done for statistical analysis.

## **Participants**

Among the patients admitted under the Department of Internal Medicine from August 2015 to August 2016, a total of 235 patients were identified to satisfy the inclusion criteria. However, eleven (11) patients refused to sign the informed consent and hence were not included. Two (2) patients were noted to have concomitant upper gastrointestinal bleeding upon admission, hence were also excluded from the study. Two (2) patients were noted to have concomitant congestive heart failure and hence were also excluded from the study. A total of 220 patients were included in the study.

## **Results**

The baseline demographics of the 220 participants for this study is shown in Table 1. Patients included were of age 62 to 86 years of age, majority were males.

The frequency distribution of the Pneumonia Severity Index in relation to the Subjective Global Assessment Grade is shown in Table 2. Majority of the participants stratified as well-nourished had low risk pneumonia. In contrast, majority of those stratified as moderately to severely malnourished had intermediate risk pneumonia.

Subgroup analysis was done to determine the odds of having intermediate and high risk pneumonia when a patient was stratified as well-nourished or moderately to severely malnourished. As shown in Table 3, being classified

as moderately to severely malnourished using the subjective global assessment increases the odds of developing intermediate risk pneumonia by 14 times ( $p < 0.05$ ).

Baseline Demographic Characteristics of Study Participants,			
	Group 1	Group 2	Group 3
	PSI I-II (n = 29)	PSI III (n = 102)	PSI IV-V (n = 89)
Age, mean (yrs)	68.73 ± 5.08062	75.95 ± 2.70904	83.67 ± 2.90015
Males	52% (n = 15)	54% (n = 55)	49% (n = 44)
Females	48% (n = 14)	46% (n = 47)	51% (n = 45)

**Table 1:** Demographic Characteristics of Study Participants stratified according to Pneumonia Severity Index (PSI)

Subjective Global Assessment of Nutrition	Pneumonia Severity Index (PSI)			
		I - II	III	IV - V
	Well nourished (n = 25)	60% (n = 15)	28% (n = 7)	12% (n = 3)
Moderately to Severely malnourished (n = 195)	7.18% (n = 14)	48.72% (n = 95)	44.1% (n = 86)	

**Table 2:** Frequency Distribution of Subjective Global Assessment Grade in relation to Pneumonia Severity Index

Nutritional Evaluation		PSI I-II	PSI III	Odds Ratio	p-value
Subjective Global Assessment	Well Nourished	60% (n = 15)	28% (n = 7)	14.54 (5.047, 41.89)	0.000000311
	Moderately to Severely Malnourished	7.18% (n = 14)	48.72% (n = 95)		
Mini Nutritional Screening (MNA-SF)	Normal nutrition status	40% (n = 16)	40% (n = 16)	6.615 (2.674, 16.36)	0.00004912
	At risk for malnutrition and malnourished	7.22% (n = 13)	79.63% (n = 86)		
Body Mass Index (kg/m <sup>2</sup> )	<18.5	8.7% (n = 4)	6.52% (n = 3)	0.2542 (0.05234, 1.235)	0.1079
	18.5-24.9	16.67% (n = 20)	49.17% (n = 59)		
Calf Circumference (cm)	<31	5.56% (n = 7)	44.44% (n = 19)	1.298 (0.4754, 3.545)	0.6289
	>31	23.4% (n = 22)	48.94% (n = 46)		

**Table 3:** Odds ratio in developing intermediate risk pneumonia (PSI = Pneumonia Severity Index) in relation to Subjective Global Assessment, Mini Nutritional Screening, Body Mass Index, and Calf Circumference

Patients who were classified as moderately to severely malnourished using the subjective global assessment showed 30 times increased odds to develop high risk pneumonia ( $p < 0.05$ ), as depicted in Table 4.

Nutritional Evaluation		PSI I-II	PSI IV-V	Odds Ratio	p-value
Subjective Global Assessment	Well Nourished	60% (n = 15)	12% (n = 3)	30.71 (7.866, 119.9)	0.0000001
	Moderately to Severely Malnourished	7.18% (n = 14)	44.1% (n = 86)		
Mini Nutritional Screening (MNA-SF)	Normal nutrition status	40% (n = 16)	20% (n = 20)	4.985 (2.067, 12.02)	0.0004079
	At risk for malnutrition and malnourished	7.22% (n = 13)	45% (n = 81)		
Body Mass Index (kg/m <sup>2</sup> )	<18.5	8.7% (n = 4)	84.78% (n = 39)	4.756 (1.492, 15.1)	0.004801
	18.5-24.9	16.67% (n = 20)	34.17% (n = 41)		
Calf Circumference (cm)	<31	5.56% (n = 7)	50% (n = 63)	7.615 (2.90, 20)	0.00001302
	>31	23.4% (n = 22)	27.66% (n = 26)		

**Table 4:** Odds ratio in developing high risk pneumonia (PSI = Pneumonia Severity Index) in relation to Subjective Global Assessment, Mini Nutritional Screening, Body Mass Index, and Calf Circumference



Majority of the patients classified as having normal nutritional status using the Mini Nutritional Screening Score had low to intermediate risk pneumonia while those classified as at risk for malnutrition and being malnourished were noted to mostly have intermediate to high risk pneumonia as demonstrated in Table 5.

Mini Nutritional Screening Score		Pneumonia Severity Index		
		I – II	III	IV – V
	Normal Nutrition status (n = 40)	40% (n = 16)	40% (n = 16)	20% (n = 8)
	At risk for malnutrition & Malnourished (n = 180)	7.22% (n = 13)	79.63% (n = 86)	45% (n = 81)

**Table 5:** Frequency Distribution of Mini Nutritional Screening Score in relation to Pneumonia Severity Index

As shown in Table 3, patients who were identified as at risk for malnutrition and malnourished based on the mini nutritional assessment had 6 times higher odds of developing intermediate risk pneumonia ( $p < 0.05$ ). In Table 4, this subpopulation was also noted to have 4 times higher odds of developing high risk pneumonia ( $p < 0.05$ ).

Having a low body mass index did not yield statistically significant odds in developing intermediate risk pneumonia ( $p = 1.079$ ). However, Table 4 depicts increased odds by 4 times of developing high risk pneumonia in elderly undernourished patients ( $p < 0.05$ ).

Majority of the participants with a calf circumference of  $< 31$  cm developed high risk pneumonia as compared to those with a calf circumference of  $> 31$  cm, majority of which had intermediate risk pneumonia. In Table 3, calf circumference measurement did not yield statistically significant odds in developing intermediate risk pneumonia ( $p = 0.6289$ ). However, in Table 4, having a calf circumference of  $< 31$  cm was noted to have 7 times higher odds of developing high risk pneumonia ( $p < 0.05$ ).

## Discussion and Conclusion

Community acquired pneumonia has been a growing concern for public health. Its incidence has increased from 5 to 11 per 1,000 persons worldwide. Locally, the Department of Health demonstrates pneumonia as among the top 5 leading causes of adult mortality. The diagnosis and management of this disease entity has been progressively evolving. However, the need to correctly stratify the patient as being low, intermediate or high risk is still imperative.

Findings of this study suggest that nutrition is thus, vital in the disease state of an elderly individual, particularly those with community acquired pneumonia. An adequate nutritional assessment aids the clinician in predicting severity of pneumonia among the elderly. Being stratified as severely malnourished using the subjective global assessment or as malnourished using the Mini Nutritional Screening is indicative that the patient is at higher risk to have a more severe pneumonia compared to one with a normal nutrition status. Body mass index has been used more commonly in nutritional assessment, and can also aid in the prognostication of an elderly patient diagnosed with community acquired pneumonia, especially when correlated with other components of clinical and nutritional assessment. Calf circumference was also noted to be significant among those with high risk pneumonia. Hence, in the absence of equipment to accurately measure a patient's weight or height, calf circumference may be used instead, for the assessment of nutrition status of the elderly patients and may aid in determining the prognosis in this population.

This study further re-emphasizes the significance of a thorough nutritional assessment for elderly patients with community acquired pneumonia. The determination of the nutrition status of patients of this age group is a helpful tool in prognosticating clinical outcomes, and hence aids in strategizing a therapeutic approach for the elderly patients.

## Recommendations

It is recommended that further studies be conducted on the nutrition of elderly patients with community acquired pneumonia, specifically one with more study subjects and with a longer duration of study. A longitudinal study, monitoring an elderly patient's nutrition status on admission until discharge, comparing with clinical outcomes is recommended. Furthermore, a thorough correlation study is recommended to define the significance of nutrition assessment in the determination of disease severity and prediction of clinical outcomes in the elderly population.

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