



**UNIVERSITI PUTRA MALAYSIA**

***NUTRITION CHARACTERISTICS AND DELIVERY IN RELATION TO  
28-DAY MORTALITY IN MECHANICALLY-VENTILATED PATIENTS  
ADMITTED TO A GOVERNMENT HOSPITAL IN THE MALDIVES***

**ABDUL RAHEEM ASIYA**

**FPSK(m) 2022 23**



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By

**ABDUL RAHEEM ASIYA**

**Thesis Submitted to the School of Graduate Studies, Universiti Putra Malaysia in Fulfilment of the Requirements for the Degree of Master of Science**

**May 2021**

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Abstract of thesis presented to the Senate of Universiti Putra Malaysia in fulfilment of the requirement for the degree of Master of Science

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Maldives and other South Asian countries are lacking on data regarding nutrition characteristics and delivery of critically ill patients. Mortality rate of mechanically-ventilated patients in South Asian countries is not much researched. Involvement of dietitian in managing critically ill patients is not very well mentioned. Besides, nutritional characteristics and delivery of critically ill patients is not very well established. The purpose of this prospective observational study was to investigate nutrition characteristics and delivery, and its association with 28-day mortality of mechanically-ventilated patients admitted to intensive care units of a tertiary-care hospital of the Maldives. Data of the mechanically-ventilated patients were collected using universal sampling method from patient charts in the ICU using a self-developed questionnaire. Disease severity was assessed using APACHE II score and SOFA score. Nutritional screening was done using mNUTRIC score. Energy and protein were calculated from commercial feeds, blended tube feeds and parenteral nutrition based on manufacturers instruction on energy and protein content in the products. Each patient was followed for a maximum of 28 days. From the total of 115 recruited in the study, 53% died within 28 days of admission in ICU. Patient characteristics, nutrition characteristics and nutrition delivery were not associated with 28-day mortality. In the unadjusted logistic regression analysis, intervention by dietitian (OR = 0.250, 95% CI: 0.066 – 0.940,  $p = 0.040$ ) significantly contributed to 28-day mortality. After adjusting to sex, length of stay in ICU, SOFA score and mNUTRIC score, intervention by dietitian no longer contributed to 28-day mortality (OR = 0.338, 95% CI: 0.081 – 1.417,  $p = 0.138$ ). 28-day mortality was much higher in this study than that of similar studies. Although none of the nutritional characteristics and delivery were related to mortality, patients receiving intervention by dietitian had lesser chance of death within 28 days of ICU admission.

Abstrak tesis yang dikemukakan kepada Senat Universiti Putra Malaysia sebagai memenuhi keperluan untuk ijazah Master Sains

**CIRI-CIRI DAN PEMBERIAN PEMAKANAN DAN PERKAITAN DENGAN KEMATIAN DALAM TEMPOH 28-HARI DALAM KALANGAN PESAKIT YANG MENERIMA BANTUAN PERNAFASAN MEKANIKAL YANG DIMASUKKAN KE DALAM HOSPITAL RUJUKAN KERAJAAN MALDIVES**

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Maldives dan negara-negara Asia Selatan yang lain kekurangan data mengenai ciri-ciri dan pemberian pemakanan bagi pesakit kritikal. Kematian pesakit kritikal di negara-negara Asia Selatan tidak banyak dikaji. Penglibatan pegawai dietetik dalam pengurusan pesakit kritikal tidak banyak dijelaskan. Ciri-ciri dan pemberian pemakanan kepada pesakit kritikal tidak banyak diketahui. Tujuan kajian ini adalah untuk mengkaji ciri-ciri dan pemberian pemakanan, dan perkaitannya dengan kematian pesakit yang menerima bantuan pernafasan mekanikal dimasukkan ke dalam Unit Rawatan Intensif (ICU) dalam tempoh 28 hari di sebuah hospital Maldives. Ini adalah kajian secara pemerhatian prospektif. Semua pesakit kritikal yang dimasukkan ke ICU semasa kajian ini dilakukan telah diambil untuk masuk ke dalam kajian. Data pesakit dikumpulkan daripada carta pesakit di ICU. Setiap pesakit dipantau sehingga maksimum 28 hari. Daripada jumlah 115 pesakit yang terlibat di dalam kajian ini, 53% meninggal dunia dalam tempoh 28 hari dari hari kemasukan ke ICU. Ciri-ciri pesakit, ciri klinikal yang berkaitan dengan pemakanan dan pemberian pemakanan tidak berkait dengan kematian pesakit dalam tempoh 28 hari. Di dalam analisis regresi logistik yang tidak dilaraskan, intervensi oleh pegawai dietetik ( $OR = 0.250$ , 95%  $CI$ : 0.066 - 0.940,  $p = 0.040$ ) secara signifikan telah menyumbang kepada kadar kematian pesakit dalam tempoh 28 hari. Setelah pelarasan data kepada jantina, tempoh tinggal di ICU, skor *SOFA* dan skor *mNUTRIC*, intervensi oleh pegawai dietetik tidak lagi menyumbang kepada kematian pesakit dalam tempoh 28 hari ( $OR = 0.338$ , 95%  $CI$ : 0.081 - 1.417,  $p = 0.138$ ). Kematian dalam tempoh 28 hari adalah jauh lebih tinggi dalam kajian ini berbanding kajian lain. Walaupun ciri-ciri dan pemberian pemakanan tidak berkait dengan kematian pesakit, pesakit yang mendapat intervensi oleh pegawai dietetik mempunyai peluang kematian yang lebih rendah dalam tempoh 28 hari selepas kemasukan di ICU.

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**Asiya Abdul Raheem, (May 2021)**

This thesis was submitted to the Senate of Universiti Putra Malaysia and has been accepted as fulfilment of the requirement for the degree of Master of Science. The members of the Supervisory Committee were as follows:

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## Declaration by Members of Supervisory Committee

This is to confirm that:

- the research conducted and the writing of this thesis was under our supervision;
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## TABLE OF CONTENTS

	Page
<b>ABSTRACT</b>	i
<b>ABSTRAK</b>	ii
<b>ACKNOWLEDGEMENTS</b>	iii
<b>APPROVAL</b>	iv
<b>DECLARATION</b>	vi
<b>LIST OF TABLES</b>	x
<b>LIST OF FIGURES</b>	xi
<b>LIST OF APPENDICES</b>	xii
<b>LIST OF ABBREVIATIONS</b>	xiii
<b>CHAPTER</b>	
<b>1 INTRODUCTION</b>	1
1.1 Background of the Study	1
1.2 Problem Statement	3
1.3 Research Questions	4
1.4 Research Objectives and Hypothesis	4
1.5 Significance of the Research	5
1.6 Conceptual Framework	6
<b>2 LITERATURE REVIEW</b>	8
2.1 An Overview of Intensive Care Unit	8
2.2 Mortality in ICU	9
2.3 Mortality End-points	10
2.4 Mortality Around the Globe, in Asia and in South Asia	12
2.5 Nutrition Characteristics and Delivery Associated with Mortality in Critically Ill Patients	15
2.6 Research Gaps	36
<b>3 METHODOLOG</b>	37
3.1 Research Design and Ethical Approval	37
3.2 Research Location	37
3.3 Research Population and Patient Selection	42
3.4 Sample Size Estimation	42
3.5 Research Procedure and Data Collection	43
3.6 Data Analysis	47
<b>4 RESULTS</b>	48
4.1 Screening and Recruitment	48
4.2 Nutrition Characteristics and Nutrition Delivery	49
4.3 28-day Mortality	51
4.4 Nutrition Characteristics and Delivery related to 28-day Mortality	51
4.5 Factors contributing to 28-day Mortality	56

<b>5</b>	<b>DISCUSSION</b>	59
5.1	Nutrition Characteristics	59
5.2	Nutrition Delivery	60
5.3	28-day Mortality	61
5.4	Factors Associated with 28-day Mortality	62
5.5	Factors Contributing to 28-day Mortality	62
<b>6</b>	<b>CONCLUSIONS, STRENGTHS, LIMITATIONS, AND RECOMMENDATIONS</b>	64
6.1	Conclusions	64
6.2	Strengths	64
6.3	Limitations	65
6.4	Recommendations	66
	<b>REFERENCES</b>	67
	<b>APPENDICES</b>	77
	<b>BIODATA OF STUDENT</b>	84
	<b>PUBLICATION</b>	85

## LIST OF TABLES

<b>Table</b>		<b>Page</b>
2.1	Different Studies with 60-day Mortality Endpoints	11
2.2	Different Studies with 28-day Mortality Endpoints	12
2.3	Summary of Nutrition Characteristics Shown to have An Association with Mortality	16
2.4	Observational Studies Showing Higher Energy and / or Protein Intake is Beneficial	19
2.5	RCT Showing Benefits of Higher Energy and / or Protein	24
2.6	Observational Studies Showing Higher Energy and / or Protein Intake is Harmful	25
2.7	RCTs Showing Benefit of Energy and Protein Restrictions	29
2.8	Observational Studies Showing Energy and / or Protein Intake is Not Associated with Clinical Outcomes	30
2.0	RCTs Showing Inconclusive Results	33
3.1	Estimated Energy and Protein from Enteral Tube Feeds	45
4.1	Nutrition Characteristics	49
4.2	Nutrition Delivery	50
4.3	Nutrition Characteristics Associated with 28-day Mortality	53
4.4	Nutrition Delivery Associated with 28-day Mortality	55
4.5	Factors Contributing to 28-day Mortality Before Adjusting to Covariates	56
4.6	Factors contributing to 28-day Morality After Adjusting to Covariates	57
4.7	Factors contributing to 28-day Mortality After Further Adjustments	58

## LIST OF FIGURES

<b>Figure</b>		<b>Page</b>
1.1	Conceptual Framework of the Study	7
2.1	Maldives on the World Map	9
2.2	Mortality Endpoints and Mortality Percentages Around the Globe, in Asia and in South Asia	14
2.3	Routes of Nutrition in Critically Ill Patients	17
3.1	Location of Tertiary Hospitals in the Maldives	38
3.2	A Picture of IGMH ICU Patient Cubicle with a Patient on Mechanical-Ventilation and Continuous Enteral Nutrition	40
3.3	Nutrition Care Process of patients in IGMH ICU	41
3.4	Sample Selection Procedure	41
3.5	Data Collection Timeline	43
4.1	Flowchart Showing Screening and Recruitment of Subjects for this Research	48
4.2	28-day Mortality of the Patients	51

## LIST OF APPENDICES

Appendix		Page
A	Ethical Approval Letter from JKEUPM	77
B	Ethical Approval Letter from National Health Research Com	78
C	Ethical Approval Letter from National Health Care Academy - Indira Gandhi Memorial Hospital	79
D	Case Report Form	80



## LIST OF ABBREVIATIONS

ADK	Abdulrahman Dhon Kaleyfaanu
APACHE	Acute Physiological Assessment and Chronic Health Evaluation
BiPAP	Bilevel Positive Airway Pressure
BMI	Body Mass Index
BTF	Blended Tube Feeds
CF	Commercial Feeds
COPD	Chronic Obstructive Pulmonary Disease
CPAP	Continuous Positive Airway Pressure
EN	Enteral Nutrition
HDU	High Dependency Unit
ICU	Intensive Care Unit
IGMH	Indira Gandhi Memorial Hospital
IMV	Invasive Mechanical Ventilation
LOS	Length of Stay
MNT	Medical Nutrition Therapy
mNUTRIC	Modified Nutrition Risk in Critically Ill
MOH	Ministry of Health
NABH	National Accreditation Board of Hospitals and Healthcare Providers
NABL	National Accreditation Board for Testing and Calibration Laboratories
PEEP	Positive End-Expiratory Pressure
PEM	Protein Energy Malnutrition

PN	Parenteral Nutrition
RCT	Randomized Control Trial
SAPS	Simplified Acute Physiological Assessment
SGA	Subjective Global Assessment
SMR	Standard Mortality Ratios
SOFA	Sequential Organ Failure Assessment
SPSS	Statistical Package for Social Sciences
UPM	Universiti Putra Malaysia



# CHAPTER 1

## INTRODUCTION

### 1.1 Background of the Study

Critically ill patients are considered the most seriously ill patients in a health care facility, and those who need close observation, monitoring, and treatments that cannot be given in general wards. First recorded critical care was given back in the 1950s at the time of Crimean War, where patients were kept nearer a place where nurses stay so they can be closely monitored (Vincent, 2013). Critical care medicine had evolved to a patient-centered holistic approach with a patient care team of dietitians, physiotherapists, pharmacists, and other patient care team members in addition to the care provided by doctors and nurses (Vincent, 2013). Allied Health professionals like dietitians will lead and manage nutrition of patients in the Intensive Care Units (ICU). Optimal care from a team of different disciplines can reduce ventilation days, length of stay in ICU, and improve mortality (Sharma, Hashmi & Friede, 2019).

Mortality is one of the worse outcomes of ICU admission. Mortality was reported to be higher in patients admitted to ICU compared to high dependency units (HDU) (Molina et al., 2014). From all the deaths in hospital, ICU accounts for most deaths (Mukhopadhyay et al., 2014). ICU mortality around the globe is approximately between 10 and 20% (Brown et al., 2018; Cahill et al., 2013; Oliveira et al., 2011; Rojek-Jarmuła et al., 2016; Weijs et al., 2014). In some southeast Asian countries such as in Malaysia, the 60-day mortality of critically ill patients was reported as 44.8% (Lee et al., 2018a). In that same study, in-ICU mortality was reported as 27.9% and in-hospital mortality as 42.2% including the in-ICU mortality. The critically ill patients in this study were mostly medical ICU patients; hence, the mortality rate could be comparatively higher than mortality rates in the general ICUs or surgical ICUs (Lee et al., 2018a). The data was also comparable to its national audit in 2015. The crude in-ICU and in-hospital mortality rates for the Malaysian Ministry of Health (MOH) hospitals were between 18.8% and 26.5%, respectively (Geok, et al., 2015).

In Nepal, average mortality were reported as 15.2% to 39.3% in the ICUs included in the survey (Acharya, 2013). This was a descriptive survey of ICUs within the Kathmandu Valley of Nepal and included 33 hospitals with ICUs (Acharya, 2013). In a cross-sectional observational study of all adult ICUs in state sector hospitals in Sri Lanka, death rates were reported as 32% and 15% in medical and surgical ICUs respectively (Fernando et al., 2012). Death rates in general ICUs were reported as 21.6% in Sri Lanka (Fernando et al., 2012). In a multi-center observational point prevalence study in India, mortality was reported as 34% (Divatia et al., 2016).

Mortality as such is not reported yet in the Maldives. 28-day mortality is enough to get information required for this study and can probably provide a comparison to the



neighboring country India's data. Mortality in the main government referral hospital of the Maldives – Indira Gandhi Memorial Hospital (IGMH) recorded in a register that is kept in ICU of IGMH and then transferred to the medical records for storage. This data is yet to be electronically recorded to make it available for online reference.

Mortality in critically ill patients can be due to malnutrition that can result from increased muscle catabolism (Vanhorebeek, Latronico, & Van den Berghe, 2020). Increased muscle catabolism and catabolic hormones can increase risk of lean mass loss due to imbalance of protein turnover and accelerated protein catabolism (Vanhorebeek, Latronico, & Van den Berghe, 2020), which can increase mortality. In critical illness, muscle stores are required to serve the increased demand for protein. If these demands are not met from feeds, this will increase the chances of mortality. Since critical illness increases muscle catabolism, patients with low lean mass will have higher chances of mortality due to lean mass stores being used in inflammation (Vanhorebeek, Latronico, & Van den Berghe, 2020). Nutritional status of critically ill patients can be vastly affected by stress catabolism and inadequate nutritional intake (Lee & Heyland, 2018b). Nutritional status is defined as the degree to which physiological or nutritional needs are met though nutritional intake for an individual (Mahan, Escott-Stump & Raymond, 2012).

Assessment of nutritional intake is a part of nutritional assessments done in a nutrition care process. Nutrition Care Process includes nutritional assessment, nutrition diagnosis and Nutrition Intervention. Nutritional assessment involves assessment of clinical history, anthropometric data, biochemical data, nutrition-focused physical examination, and food history (Academy of Nutrition and Dietetics, 2020). All of these data may not be available in the assessment of nutritional status in critically ill patients, and certain factors like weight and Body Mass Index (BMI) of critically ill patients can vary based on fluid build-up, and clinical condition. Assessment of energy requirement in critically ill patients is best done using the gold standard: i.e.: Indirect Calorimetry (IC). However, IC may not be possible to carry out in all ICUs. The role of dietitians is critical especially in such situations, because careful assessments are required to decide the amount of energy and nutrition needs for the patient. In addition, certain procedures may prevent planned intervention to be delivered to critically ill patients, and edema in gut may hinder delivered nutrition reaching the metabolic pathways in the body (Lee & Heyland, 2018b). Therefore, nutritional assessment in critically ill patients get complicated (Lee & Heyland, 2018b). Lee & Heyland, (2018b) suggested Modified Nutrition Risk in Critically Ill score (mNUTRIC) and Subjective Global Assessment (SGA) Tool together with other criteria relevant to critically ill patients to assess nutritional status in critically ill patients.

Nutrition delivery involves nutrition intervention provided to critically ill patients. Nutrition characteristics and delivery have shown contribution to the mortality in critically ill patients. In the literature, nutrition characteristics including age (Brown et al., 2018; Fuchs et al., 2014; Molina et al., 2014; Zusman et al., 2016), admission category (Fuchs et al., 2014; Zusman et al., 2016), and body weight status (Weijs et al., 2014; Zusman et al., 2016). Nutrition-related clinical characteristics such as disease severity (Brown et al., 2018; Fuchs et al., 2014; Weijs et al., 2019; Zusman et al., 2016)

and biochemical findings (Brown et al., 2018; Molina et al., 2014; Weijs et al., 2019; Zusman et al., 2016) have also shown to have an association with mortality in critically ill patients. Nutrition delivery includes the time of initiation of feeds, mode and route of delivery, the professional who plans nutrition delivery, dosage and interruptions to feeding delivery. Some studies show that providing higher energy and protein is beneficial with regards to mortality in critically ill patients (Elke et al., 2014; Heyland, Cahill, et al., 2011; Tsai et al., 2011) while others show higher energy and protein can be harmful (Crosara et al., 2015; Peterson et al., 2018; Zusman et al., 2016). Some studies produced inconclusive results (Bellomo et al., 2014a; Bellomo, 2014b; Couto et al., 2019; Viana et al., 2020). All these were studies conducted in the countries other than South Asia. Data regarding nutritional characteristics or nutrition delivery in relation to mortality in ICU are not available from South Asian countries.

## 1.2 Problem Statement

Mortality in ICU patients remains high in most countries. The 28-day mortality is considered the ultimate important outcome in ICU-related studies. The 28-day mortality were usually chosen based on their ease of measurement during the ICU admission. Nonetheless, nutrition-related factors associated with 28-days ICU mortality are not available.

Data is available from some of the South East Asian countries including Malaysia and Singapore regarding critical care nutrition (Lee et al., 2018a; Molina et al., 2014). The importance of tailored nutrition in critically ill patients for their survival is clear (Lee et al., 2018b). Mortality in critically ill patients of South Asian countries is at an alarming range of 15% to 39%. The available data were limited to descriptive analysis, which did not look into factors associated with mortality in ICU (Divatia et al., 2016; Fernando et al., 2012). Besides, the ICUs that participated in the study done in India were not a representative population of general critically ill population. Previous data only include information from better performing ICUs, and it only includes clinical aspects of ICU (Divatia et al., 2016).

Research done in the South Asian countries is meagre (Asiya et al., 2020) with no data regarding nutrition provision in ICU (Divatia et al., 2016; Fernando et al., 2012). Data from South Asian countries does not report regarding involvement of dietitians in the management of critically ill patients (Divatia et al., 2016; Fernando et al., 2012) and there is no available data from the Maldives regarding management of critically ill patients. Exhaustive literature search did not precipitate a single set of data that can illuminate light on nutrition characteristics in critically ill patients in the Maldives. Therefore, future research on nutrition characteristics and delivery in South Asian Countries and its association with mortality is warranted.

In the Maldives, the definition of risk factors for mortality are mandatory to guide ICU capacity and resource allocation. This is pertinent in the present context as data regarding the mortality of critically ill patients in the Maldives is scarce. One of the possible

reasons could be no intensivists practicing in the main government hospital of the Maldives at the time of research, which warrants the current study. The ICU is an open ICU that admits all categories of patients. Those patients who cannot be managed in the Maldives are sent abroad – usually to India. However, there is no data indicating that those admitted in the Maldives ICU have a higher risk of mortality than India and other South Asian countries.

There was no study reporting the reasons of ICU admission in the Maldives. Nonetheless, observational reports show that the main reasons of ICU admission were sepsis or septic shock, acute exacerbation chronic obstructive pulmonary disease, loss of consciousness and trauma (Molina et al., 2014). Most of the reasons of ICU admission are directly or indirectly related to nutrition (Molina et al., 2014).

Due to the vitality of the above-mentioned reasons, the purpose of this research was to investigate the nutrition characteristics and delivery in relation to 28-day mortality in mechanically-ventilated patients admitted to the government referral hospital of the Maldives.

### **1.3 Research Questions**

1. What are the nutritional characteristics and delivery of the mechanically-ventilated patients admitted to a government referral hospital of the Maldives?
2. What is the proportion of mechanically-ventilated patients who die within 28 days of admission in this ICU?
3. Are nutrition characteristics and nutrition delivery associated with 28-day mortality in these patients?
4. What are the factors contributing to 28-day mortality in these patients?

### **1.4 Research Objectives and Hypothesis**

#### **1.4.1 General Objective**

To determine nutrition characteristics and delivery in relation to 28-day mortality in mechanically-ventilated patients admitted to a government referral hospital of the Maldives.

### **1.4.2 Specific Objectives**

1. To determine the nutritional characteristics and delivery of the mechanically-ventilated patients admitted to a government referral hospital of the Maldives
2. To determine the proportion of mechanically ventilated patients who die within 28 days of admission in this ICU
3. To determine the nutrition characteristics and nutrition delivery associated with 28-day mortality in these patients
4. To determine the factors contributing to 28-day mortality in these patients.

### **1.4.3 Alternative Hypothesis**

Hypothesis testing was done for the analytical objectives. Objective 1 and 2 were descriptive objectives; hence, there was no hypothesis testing for these two objectives. Objectives 3 and 4 were analytical objectives, so hypothesis testing was done for these two objectives.

H<sub>A</sub> 1: There is a significant relation in nutrition characteristics, and nutrition delivery with 28-day mortality of the patients

H<sub>A</sub> 2: Nutrition characteristics and nutrition delivery contribute to 28-day mortality of these patients

### **1.5 Significance of the Research**

The findings of this research would provide fundamental data regarding 28-day mortality and nutrition characteristics and delivery among critically ill patients admitted in government referral hospital in the Maldives. The 28-day mortality data can be used as a summary measure of nutrition care process in the tertiary care hospitals. The rate of mortality in this research can help to plan interventions to improve critical care management in the Maldives. In addition, the nutrition characteristics and delivery of the critically ill patients can be used as a measurement to compare between what is in the international guidelines, and the nutrition care process being practiced currently in the Maldives. Understanding current the nutrition care process in the Maldives can facilitate in producing appropriate clinical nutrition practice guide tailored to the Maldives.

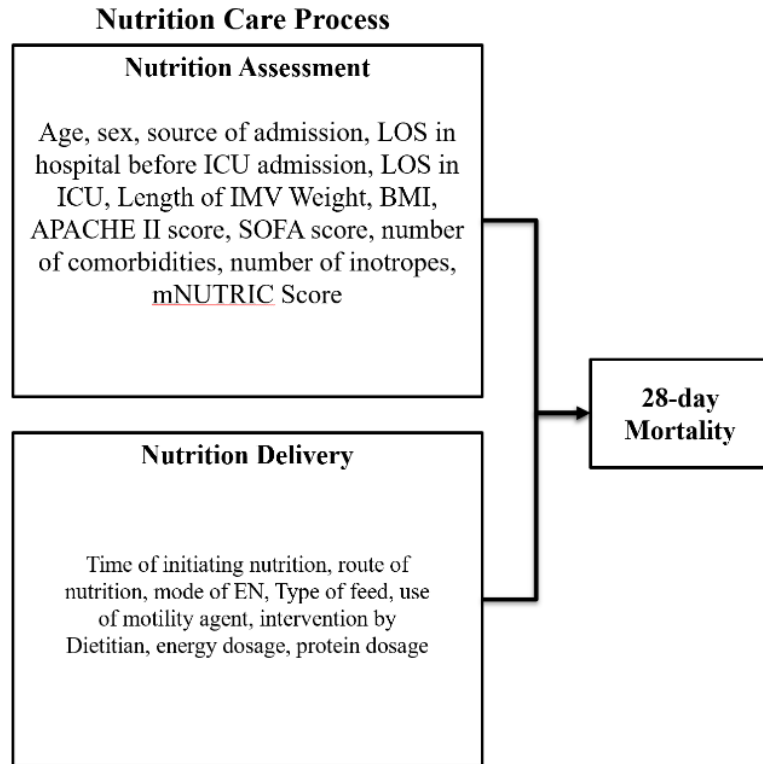
The results of this research can be used to understand the nutrition characteristics and delivery that are associated with 28-day mortality in government referral hospital in the Maldives. These data can be used to focus on areas which need improvement the nutrition

care process of the hospital. In addition, this data can add to the current literature, where debate is being made dosage of feed, and other characteristics that are important to study in this area.

Findings of this research can be used as benchmark to develop nutrition protocols and guidelines in the other tertiary care hospitals in the Maldives. At present there is no standard protocol or guideline in the Maldives, and nutrition delivery is very much based on individual understanding regardless of previous critical care nutrition management. The Maldives as well as other countries from South Asia lack data regarding nutrition characteristics and delivery in critically ill patients (Asiya et al., 2020). From the eight South Asian countries, only India and Sri Lanka have a Critical Care Nutrition guideline (Asiya et al., 2020; Dassanayake et al., 2014; Mehta et al., 2018), and Pakistan has Critical Care Nutrition protocol (Ikram et al., 2016). These guidelines or protocol may not be appropriate for Maldivian critically ill population in ensuring appropriate nutrition care process in critically ill patients as some of these guidelines are ancient. In addition, critically ill patients in other South Asian countries may differ in nutrition characteristics and how nutrition is delivered to those. Since ICU is the place where most seriously ill patients are in a hospital, it is needed to guide ICU's professionals in conducting assessment and provision of nutrition to critically ill adults.

## **1.6 Conceptual Framework**

The conceptual framework of this research is shown in Figure 1.1. nutrition assessment was presented as independent variable. Nutritional assessment of nutrition care process included age, sex, source of admission, length of stay in hospital before ICU admission, length of stay in ICU, length of invasive mechanical ventilation APACHE II score, SOFA score, number of comorbidities, number of inotropes, body weight, body mass index, and mNUTRIC score. Nutrition intervention was given as nutrition delivery. These included Time of initiating nutrition, route of nutrition, mode of enteral nutrition, type of feed, use of motility agent, intervention by Dietitian, energy dosage, and protein dosage. 28-day mortality was presented as the dependent variable.



**Figure 1.1: Conceptual Framework of the Study.** (LOS – Length of stay , ICU – Intensive Care Unit, IMV – Invasive Mechanic Ventilation, APACHE – acute physiological assessment and chronic health evaluation, SOFA – sequential organ failure assessment, EN – enteral Nutrition)

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