
**UNIVERSITI PUTRA MALAYSIA**

# *LENGTH OF HOSPITAL STAY AND ITS ASSOCIATED FACTORS AMONG SURGICAL PATIENTS IN HOSPITAL SERDANG*

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# LENGTH OF HOSPITAL STAY AND ITS ASSOCIATED FACTORS AMONG SURGICAL PATIENTS IN HOSPITAL SERDANG

**BY**

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A project submitted as a partial fulfillment of the requirement for the degree of Bachelor of Science in Dietetics with Honours from the Faculty of Medicine and Health Sciences, Universiti Putra Malaysia

This project entitled “Length of Hospital Stay and Its Associated Factors among Surgical Patients in Hospital Serdang” was prepared by Siti Nursyafiqah Sulaiman and submitted to the Faculty of Medicine and Health Sciences as a partial fulfillment of the requirement for the degree of Bachelor of Science in Dietetics with Honours from the Faculty of Medicine and Health Sciences, Universiti Putra Malaysia



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## Abstract

**LENGTH OF HOSPITAL STAY AND ITS ASSOCIATED FACTORS AMONG SURGICAL PATIENTS IN HOSPITAL SERDANG**

**SITI NURSYAFIQAH SULAIMAN**

Hospital length of stay (LOS) is one of the measurable indicators which can be used to evaluate hospital administration, operative performance and quality of patient care. Prolonged LOS have been associated with poor outcomes in patients and inefficient use of hospital resources. Due to scarcity of findings on this field in Malaysia, this study aims to identify the factors affecting LOS. A single health facility-based retrospective cross-sectional study was conducted in Hospital Serdang. Data of patients who were admitted in surgical ward from 2017 to 2021 were retrieved. A total of 114 surgical patients' data were analysed of which mostly were adults (72.8%), female (69.3%) and Malay (67.5%). The mean LOS was 5.90 ± 4.35 days. Pearson correlation revealed age ($r = 0.309$, $p = 0.001$) and preoperative albumin ($r = -0.397$, $p < 0.001$) having significant correlation with LOS. An independent samples t-test showed that male had significantly higher mean LOS compared to female ($t = 2.653$, $p = 0.009$). Surprisingly, having been seen by dietitians and being supplemented by oral nutrition supplements (ONS) had longer stay compared to groups who were not seen by dietitian and given ONS respectively ($t = 4.278$, $p<0.001$), ($t = 3.111$, $p = 0.002$). Those who had moderate and high risk of malnutrition spent approximately 3.27 days longer hospitalization compared to low-risk patients ($t = -2.868$, $p = 0.007$). Factors that influence LOS are age, gender, preoperative albumin, seen by dietitian, risk of malnutrition and oral nutrition supplementation.

## Abstrak

**TEMPOH TINGGAL DI HOSPITAL DAN FAKTOR BERKAITANNYA DALAM KALANGAN PESAKIT PEMBEDAHAN DI HOSPITAL SERDANG**

**SITI NURSYAFIQAH SULAIMAN**

Tempoh tinggal di hospital adalah salah satu pemboleh ubah yang boleh diukur bagi menilai pentadbiran hospital, prestasi operasi dan kualiti penjagaan pesakit. Tempoh tinggal yang berpanjangan telah dikaitkan dengan kesan buruk pada pesakit dan penggunaan sumber hospital yang tidak cekap. Oleh kerana kekurangan penemuan mengenai bidang ini di Malaysia, kajian ini bertujuan untuk mengenal pasti faktor-faktor yang mempengaruhi tempoh tinggal di hospital. Kajian keratan rentas retrospektif berasaskan fasiliti kesihatan tunggal telah dijalankan di Hospital Serdang. Data pesakit yang dimasukkan ke wad pembedahan dari 2017 hingga 2021 telah diperolehi. Sebanyak 114 data pesakit pembedahan telah dianalisis yang majoritinya adalah dewasa (72.8%), perempuan (69.3%) dan Melayu (67.5%). Purata tempoh tinggal di hospital adalah 5.90 ± 4.35 hari. Korelasi Pearson mendedahkan umur ($r = 0.309$, $p = 0.001$) dan albumin pra pembedahan ($r = -0.397$, $p < 0.001$) mempunyai korelasi yang signifikan dengan tempoh tinggal di hospital. Ujian-t sampel bebas menunjukkan bahawa lelaki mempunyai purata tempoh tinggal di hospital yang lebih tinggi berbanding perempuan ($t = 2.653$, $p = 0.009$). Walaubagaimanapun, pemboleh ubah dilihat oleh pakar diet dan pemberian suplemen pemakanan oral tinggal lebih lama di hospital berbanding kumpulan yang tidak dilihat oleh pakar diet dan tidak diberi suplemen pemakanan oral masing-masing ($t = 4.278$, $p<0.001$), ($t = 3.111$, $p = 0.002$). Mereka yang mempunyai risiko malnutrisi sederhana dan tinggi menghabiskan lebih kurang 3.27 hari lebih berbanding pesakit berisiko rendah ($t = -2.868$, $p = 0.007$). Faktor-faktor yang mempengaruhi tempoh tinggal di hospital adalah umur, jantina, albumin pra pembedahan, dilihat oleh pakar diet, risiko malnutrisi dan pemberian suplemen pemakanan oral.

# CHAPTER 1: INTRODUCTION

## 1.1 Background

Hospital length of stay (LOS) is one of the measurable indicators which can be used to evaluate hospital administration, operative performance and quality of patient care (Baek et al., 2018). Broadly, LOS is defined as the days of patient stay in the healthcare facility during a single hospitalization (USLegal, n.d.). Over the past couple of decades (1999-2019), there has been a significant rise of research (29 to 298 records per year) carried out on hospital LOS (Katsnelson, 2021). A recent bibliometrical analysis on LOS by Katsnelson (2021), it was reported that most systematic review on LOS discussed predictors of LOS and interventions to reduce LOS. Prolonged LOS have been associated with poor care such as inefficient use of hospital resources and increased risk of patients being infected by hospital-acquired infections and developing complications (Aung et al., 2020). Consequently, this increases the cost as it consumes more hospital resources and is a burden for the patients, caretaker and the society (Aung et al., 2020; Su et al., 2020; Upadhyay et al., 2019) . Thus, adequate LOS is crucial for all patients who were admitted to hospital to be discharged with optimum outcome. Katsnelson (2021) also found that studies on risk factors is one of the topics which had high interest among researchers. This is because by identifying the risk factors that affect LOS, improvements can be done to provide better outcomes, which was the hope of most researchers (Jo et al., 2021; Khosravizadeh et al., 2016; Martínez-Pérez et al., 2021). Similarly, this study aims to identify the association of factors affecting LOS in Malaysian population setting. This is because research on surgical LOS in Malaysia is minimal while countries highly contributed to this field are Australia (133 studies), England (183 studies), Canada (187

studies) and the United States (1403 studies) as reported by the recent bibliometric analysis (Katsnelson, 2021). These differences in population sample are the main cause results of those studies are not generalizable among the Malaysian population. Thus, warranting further study. This study will be able to draw the attention of researchers to further investigate a focused variable on the mechanism of its action on how those factors affect LOS. More research on focused variables might create a path for Malaysia to have its own surgical guidelines on enhanced recovery for surgical patients suitable to Malaysia's population.

**1.2 Problem Statement**

According to the Malaysian health expenditure report, there was a constant increment of health expenditure from 1997 to 2019 (Ministry of Health Malaysia, 2020). Escalating healthcare costs is a burden for the nation. Surgical services are one of the services that has high resource consumption (Aung et al., 2020). A lengthier period of LOS among surgical patients exerts a greater burden in resource use. Besides health expenditure alone, prolonged LOS will increase bed occupancy in the health institutions. In 2015, it was reported that three out of 10 patients were denied for ICU admissions due to bed unavailability (Ministry of Health Malaysia, 2016). The report further identified that one third of ICU admissions were surgical patients. As compared to non-operative cases which accounts two third of ICU bed occupancy, the cases were more varied like sepsis, head injury and community acquired pneumonia (Ministry of Health Malaysia, 2020). Thus, focusing on surgical patients can encompass a larger group of population that resides hospital which include patients in both ICU and surgical ward. Modifying LOS will help

to reduce the economic burden of health expenditure cost on the nation and provides more opportunities for every individual to receive appropriate care that is needed without a need to be compromised.

### 1.3 Significance of Study

The studies on investigating factors affecting LOS in surgical patients among Malaysia's population are very minimal. Identifying factors that are associated with LOS among surgical patients will open an insight for future studies to study on examining the variable that has association on LOS and how it can be modified to reduce LOS among these surgical patients. Current guidelines that are being referred to for surgical patients are European Society for Clinical Nutrition and Metabolism (ESPEN) where the guidelines were created by reviewing studies mainly from the United States. As the population background is not similar, applying the guideline entirely might not be ideal for Malaysia's population. Therefore, studies like this will enable more Malaysian researchers to study on identifying mechanisms of each variable that affects LOS. More studies in this field will enable Malaysia to have its own surgical guidelines suitable for its population in providing optimum health care.

### 1.4 Research Question

What are the factors associated with hospital length of stay among surgical patients in Hospital Serdang?

## 1.5 Research Objectives

### 1.5.1 General Objective

To determine the hospital length of stay and factors associated with hospital length of stay among surgical patients in Hospital Serdang.

### 1.5.2 Specific Objectives

1. To examine the sociodemographic factor (age, gender, ethnicity), anthropometric factor (BMI), biochemical factor (preoperative albumin), clinical factors (seen by dietitian, risk of malnutrition, type of admission) and dietary factors (preoperative protein intake adequacy, oral nutrition supplements) of surgical patients in Hospital Serdang.
2. To determine mean hospital length of stay among surgical patients in Hospital Serdang.
3. To study the associations between age, BMI, preoperative albumin and preoperative protein intake adequacy with hospital length of stay among surgical patients in Hospital Serdang.
4. To compare the means among groups in sociodemographic factors (gender, ethnicity), anthropometric factor (BMI), clinical factors (seen by dietitian, risk of malnutrition, type of admission) and dietary factor (oral nutrition supplements) on hospital length of stay among surgical patients in Hospital Serdang.

### 1.6 Research Hypothesis

1. There are significant associations between age, BMI, preoperative albumin and preoperative protein intake adequacy with hospital length of stay among surgical patients in Hospital Serdang.
2. There are significant differences among groups in sociodemographic factor (gender, ethnicity), anthropometric factor (BMI), clinical factors (seen by dietitian, risk of malnutrition, type of admission) and dietary factor (oral nutrition supplements) on hospital length of stay among surgical patients in Hospital Serdang.

### 1.7 Research Framework

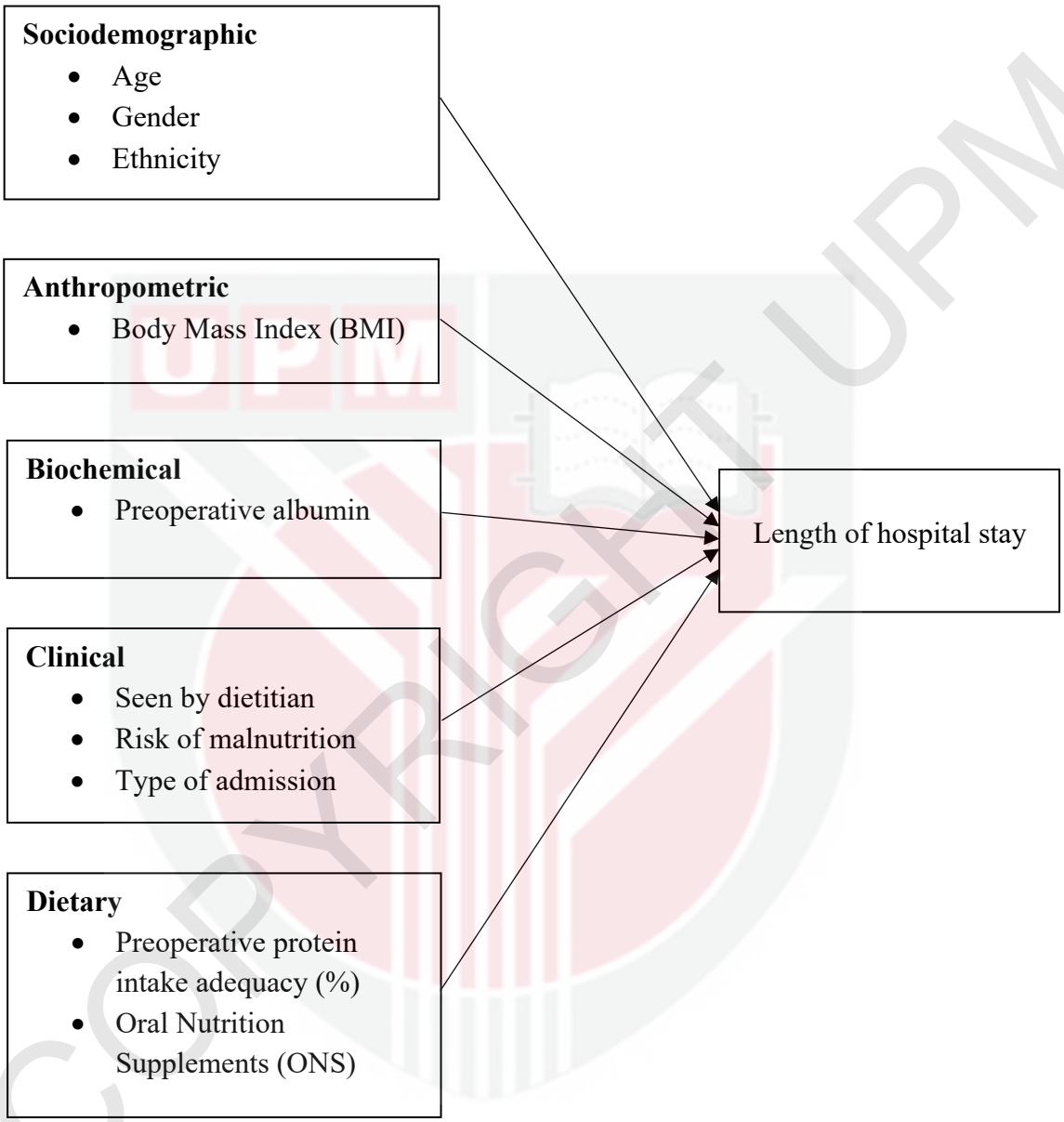


Figure 1: Conceptual framework between independent variables and dependent variables

# CHAPTER 2: LITERATURE REVIEW

## 2.1 Overview of Length of Hospital Stay

Length of hospital stay is defined as the total number of days stayed by an inpatient during a single ward admission in a hospital calculating from the day patient was admitted till the day discharged (USLegal, n.d.). In the perspective of surgical patients, length of hospital stay is also known as total perioperative period which is the sum of preoperative, operative and postoperative days. Average length of stay is frequently used as an indicator in diagnostic and surgical division to evaluate healthcare quality among hospitals (Lubitz, 1981 as cited in Katsnelson, 2021). Prolonged length of stay (PLOS) has been associated with various unfavorable outcomes including increased healthcare cost (Almashrafi et al., 2016). In fact, Syed (2021) has highlighted in his study that was carried out in Malaysia that rising healthcare expenditure in developing countries have caused public sectors to be squeezed due to financial constraints. In addition, PLOS also leads to increased risk of hospital-acquired infection, hospital bed shortages and increased mortality (Jin Toh et al., 2017; Ofori-Asenso et al., 2020). Thus, many research has been carried out in this field for the past two decades especially on identifying factors that affect PLOS (Katsnelson, 2021). According to the first bibliography on LOS by Katsnelson (2021), she analyzed that the highly researched region in this field was among the Europe countries. Most developing countries are still lacking this research including Malaysia. Thus, it is a need to carry out further studies in this field especially during these times as the world healthcare system faces the burden of pandemic COVID-19 that has led to tremendous surge of hospitalization. Ruling out the factors that contribute to prolonged length of

hospital stay may ensure adequate bed capacity and sufficient care for all patients that are admitted to hospitals.

## 2.2 Association between Sociodemographic Factor and Length of Stay

### 2.2.1 Age

Age is one of the most highly researched variables in the field of hospital LOS. Though, age is not a modifiable factor, this variable should be looked into as the baby boomers (individuals who were born between 1946 to 1964) are reaching the elderly category, causing the ageing population worldwide to increase. Abidin et al. (2020) highlighted that "Malaysia is expecting to reach aged nation status within the next decades, which will provide significant challenges in social and economic development" (p.1). The Department of Statistics Malaysia (2017) also reported that since the 1970s, the elderly population in Malaysia has gradually climbed and it is expected to quadruple by 2040, from 2.0 million to more than 6.0 million. This urges study to be carried out on identifying age as a factor for PLOS as individuals who are at the age of 55 and above accounted for more than half of total healthcare cost in 2019 (Jared et al., 2021). Through this identification, preventative measures can be planned by addressing this issue to the higher ups whereby budget can be allocated on medical and nursing strategies to provide sufficient care to avoid unplanned hospital admission with severe conditions among the elderly population. Earlier studies have yielded mixed findings whether age is associated with LOS. Some studies found out that there is a significant association between age and LOS (Frugoni et al., 2020; Khosravizadeh et al., 2016; Tan et al., 2021). Gholson et al. (2017) reported for every increase in 1 year of age, it prolongs LOS by 0.02 days. In

addition, it was found that patients who are in the age of 20 to 30 had the least LOS while patients who are over 40 had the longest LOS (Khosravizadeh et al., 2016). On the other hand, other study resulted that age is not independently associated with LOS (Aung et al., 2020; Tefera et al., 2020; Yeung et al., 2017b) . Nonetheless, whether age and LOS are directly related remains unknown, thus requiring further investigations.

### 2.2.2 Gender

Based on recent studies, due to biological, behavioural and psychosocial differences, gender may have different outcomes and probability in developing and healing from certain diseases. Klein & Flanagan (2016) emphasized that due to wide differences in immune responses between gender which are contributed by sex chromosome genes and sex hormones (oestrogens, progesterone and androgens), including gender as a biological variable in immunological studies is crucial. In the field of surgical, there were various findings observed on association between gender and LOS. Studies that were carried on patient undergoing hepatobiliary surgery, neurosurgery, colorectal surgery and appendectomy reported that there were no significant difference of LOS among male and female (Lee et al., 2018; Martínez-Pérez et al., 2021; Yeung et al., 2017). Surprisingly, there were 2 studies reported that there is a significant association between gender and LOS (Tefera et al., 2020; Tan et al., 2021). Study carried out by Tan et al. (2021) on patients who are undergoing oral and maxillofacial surgery found that male had greater LOS compared to women most probably due to motor vehicle accidents involving motorcycles, thus PLOS were due to post trauma stabilization. Besides that, a study by

Tefera et al. (2020) on all surgical patients that were admitted for 3 consecutive months found out that female patients had longer LOS compared to male which was due to female patients were at higher numbers who had burn-related surgery which is contributed to spending more time near fire during cooking. The study by Tefera et al. (2020) had the closest similarity of study population as in this study since most of other studies were diagnosis specific. However, due to the unadjusted confounding variables in this study and minimal study including all patients who undergo surgery, there are no clear conclusions that can be drawn to identify the association of gender and LOS in surgical population thus requiring further investigation.

### 2.2.3 Ethnicity

Ethnicity may play an important role in health determinants as those who are in the same ethnic group share certain similar genes as it was passed down by the common ancestors (Medline Plus, n.d.). This is the reason behind the prevalence of some diseases are more higher in certain ethnic groups than the other. The role of ethnicity in surgical recovery were less focused thus there were only minimal findings in this area. Ghosh et al. (2021) found out that patients who were Black and have low socioeconomic status had a longer LOS compared to White and high socioeconomic status patients. In another study, that were carried out on oral and maxillofacial surgical patients where the sample resembles the Malaysia's population, it was found that patients who were of Malay and Indian ethnicity had significantly longer LOS compared to Chinese patients (Tan et al., 2021). Other studies reported that there were no significant differences of LOS when compared

with different ethnicities in Singapore populations (Jin Toh et al., 2017; Lee et al., 2018). Due to minimal findings and no consistent results were observed, this variable warrants further study to determine the relationship of ethnicity and LOS in surgical population in Malaysia setting.

## 2.3 Association between Anthropometric Factor and Length of Stay

### 2.3.1 Body Mass Index

Body mass index (BMI) is the measure of weight compared to height of an adult. According to Centres for Disease Control and Prevention (n.d.), elevated BMI may indicate an increased level of fat mass in the body. Numerous studies have been carried out investigating the association of BMI and various diseases. For many morbidities, BMI was found to be an indicator of survival rate. In the field of hospital LOS, majority researchers agree that BMI affects LOS while a few others expressed otherwise. Despite the agreement, there are also different results reported on which category of BMI leads to PLOS. Some researchers suggest the existence of "obesity paradox" in surgical patients (Akinyemiju et al., 2016a; Chen et al., 2015; Dotan et al., 2021; Tulinský et al., 2018). This is because overweight patients were observed to have shorter length of stay, lower risk of postoperative complications and higher survival outcomes compared to patients with normal BMI (Akinyemiju et al., 2016a; Chen et al., 2015). On the other hand, in some other surgeries like breast surgery, being overweight and obese were reported to increase the risk of post-operative complications and thus prolonging LOS (Konishi et al., 2020). Other studies carried out on hepatobiliary, neurosurgery and colorectal resection

patients argued that there is no significant association between BMI and LOS (Lee et al., 2018; Yeung et al., 2017b). Due to mixed findings, this warrants further studies as according to National Institutes of Health (NIH) (2019), 1 in 2 Malaysians are either overweight or obese. This may put the nation in a heavy socioeconomic burden to support Malaysia's healthcare if the initial step of identification of risk factors of PLOS is not taken. Determining whether BMI has association with LOS may address the concern of overconsumption of hospital resources and thus bringing it to an end point. Another reason for the importance of examining this variable is due to the different sociodemographic background of the sample as most studies were carried out in Europe. A study reported that a specific BMI in certain Asian populations (Singaporean Chinese, Malays and Indians) showed higher body fat percentage compared to white or European populations (WHO Expert Consultation, 2004 as cited in Deurenberg-Yap et al., 2020). Thus, it may pose a different effect to hospital LOS among surgical patients in Malaysians' population which requires further study.

## 2.4 Association between Biochemical Factor and Length of Stay

### 2.4.1 Preoperative Albumin

Preoperative albumin is defined as serum albumin measurement which is taken during pre-assessment for surgery. Albumin plays an important role in maintaining plasma oncotic pressure and other functions. Hypoalbuminemia is characterized by low count of albumin in blood. There is no global definite cut-off to diagnose hypoalbuminemia as the normal range values slightly vary according to different institutions. Majority researchers

agrees that low level of preoperative albumin is a strong predictor of PLOS (Arun et al., 2020; Bhalla et al., 2017; Lalhruaizela et al., 2020; Larson et al., 2020; Weimann et al., 2017). The reason behind this is that patients with low preoperative albumin were found to have increased risk of developing postoperative complications (Larson et al., 2020). Although there were agreements on the association, different authors presented with different cut offs and safe range of preoperative albumin to have prior to surgery which would avoid complications. It is suggested that albumin level above 30g/L signifies sufficient protein storage which would reduce LOS (Klingensmith & Washington University, 2008 as cited in Lalhruaizela et al., 2020). On the other hand, Bhalla et al. (2017) found that having albumin level above 40g/L is associated with shorter LOS. In addition, it was also reported that patients who had albumin level below 21g/L had 100% complication rate which leads to increased LOS (Lalhruaizela et al., 2020). There is a need to examine this variable as to observe the mean status of preoperative albumin in surgical patients in Malaysia as they are hospitalized prior to surgery. Besides that, this variable will also help to identify whether the association of preoperative albumin and LOS goes along with previous studies as most of the previous studies were carried out had different backgrounds of populations like India and United States which are low socioeconomic and high socioeconomic countries respectively. There were no studies found to be carried in upper-middle income countries.

## 2.5 Association between Clinical Factors and Length of Stay

### 2.5.1 Seen by Dietitian

In clinical setting, dietitians work to provide medical nutrition therapy (MNT) for patients to improve their health status or to manage diseases. Briefly, MNT is defined as therapeutic nutrition-based treatment which is provided through nutritional counselling or/and nutritional support individualized to a patient's condition. Clinical dietitians will only provide MNT to patients who are referred to them by physicians. In surgical setting, patients will be referred to dietitians if they are expected to or currently facing poor nutritional status. Studies shows that preoperative and early postoperative nutritional status has a great impact on surgical outcome and hospital LOS (Hogan et al., 2021; Hussen et al., 2020; Narendra et al., 2020; Torgersen & Balters, 2019). Ehresman et al. (2020) reported that patients who were provided preoperative nutrition consults had significantly reduced LOS compared to patients who did not. In another study by Assis et al. (2016), it was found out that patients who received nutritional therapy had higher mean calorie and protein intake which was much closer to their respective dietary recommendations and as a result these patients were at lower risk of acquiring infection and had shorter LOS. In line with this, the European Society for Clinical Nutrition and Metabolism (ESPEN) (2017) have published a recommendation guideline for clinical nutrition in surgery to provide best perioperative nutrition care for surgical patients to reduce the risk of postoperative complications (Weimann et al., 2017). Lower rate of postoperative complication will be able to shorten hospital LOS which would then reduce resource consumption and overall healthcare cost of both the individual and the institution. Despite the recommendation provided, ESPEN (2017) also highlighted the importance of

further studies as due to weaknesses in certain areas of the evidence. This is due to nutrition being a topic that has just recently got attention in the field of surgical due to increasing incidence of malnutrition. Though studies in this field are increasing, the cumulative studies are still low to draw a concrete association between seeing a dietitian to obtain nutritional consults and LOS.

### 2.5.2 Risk of Malnutrition

According to World Health Organization (WHO) (2020), malnutrition is refers to two broad categories which are undernourishment and overnourishment. In this study, the term malnutrition will be referred to specifically as undernourishment. Based on a systematic review which reviewed articles from 11 Asian countries, the prevalence of malnutrition in surgical patients ranged between 2% - 94% where most of it reported above 40% (Inciong et al., 2020). Inciong et al. (2020) further explained that the reason behind the broad range of prevalence is due to difference in methods and study population. In another study by Shpata et al. (2014), it was observed that gastrointestinal cancer surgical patients had a higher prevalence of malnutrition which is almost 9 out of 10 cases. Malnutrition leads to various negative outcomes perioperatively. Surgical patients who are malnourished had up to four times of morbidity and mortality rates compared to nourished patients, as well as longer hospital stays and expenses of up to 50% greater (Adugna, n.d; Goiburu et al., 2006; Leandro-Merhi et al., 2010; Saunders & Smith, 2010; Shpata et al., 2014; as cited in Abrha et al., 2019). Early identification of malnutrition is crucial to prevent further deterioration of health among patients who are admitted to hospital. Thus, using a nutrition screening tool to assess risk of malnutrition upon admission is the

quickest and cost-saving method to identify patients who are at risk. Previous studies agree that patients who were screened for risk of malnutrition upon admission and categorized at risk had increased LOS (Budzyński et al., 2016; Gomes et al., 2016; Maia et al., 2018). Despite the agreement, most studies in Malaysia for malnutrition in hospital were highly focused in vulnerable populations like elderly and children while only a few studies were carried out in surgical populations. In addition, studies that were carried out in surgical patients had mostly used tools that diagnose malnutrition like Subjective Global Assessment (SGA) and Patient-Generated Subjective Global Assessment (PG-SGA) instead of nutrition screening tools. Thus, there is a research gap on association of risk of malnutrition and LOS among Malaysian's population. Identifying the association between these variables might help hospital in predicting bed occupancy rate in a short period of time as nutrition screening can be done almost instantly.

### 2.5.3 Type of Admission

There are two types of admission among surgical patients which are emergency admission and elective admission. Emergency admission in surgical patients is defined as unanticipated surgical treatment for illnesses within the domain of general surgery while elective admission is defined as surgical procedure that is arranged or scheduled ahead of hospitalization (Palayan et al., 2020). A study by McCord et al. (2015) reported that in most low and middle income countries, six out of 10 surgery performed are emergency surgery. One study that was carried out in a public hospital in Malaysia found that 58.1% surgery that was carried out in 2017 are emergency surgery (Palayan et al., 2020). This shows that emergency surgery accounts for larger populations of surgical cases compared

to elective surgery. Majority researchers agree that there is a significant association between type of admission and length of stay (Casalino et al., 2019; Marfil-Garza et al., 2018; Palayan et al., 2020; Wong & Holloway, 2019). Based on a case-control study by Casalino et al. (2019) who compared emergency admissions (case) and elective admissions (control), it was reported that emergency patients had 3 days longer stay than electively admitted patients. Reviewing studies that were carried out in Malaysia, two studies agreed that type of admission has association with LOS (Palayan et al., 2020; Wong & Holloway, 2019). Even so, both studies did not analyze the ethnicity background of their sample. Thus, it cannot be determined that it reflects the Malaysian population as there are chances of biased ethnicity background occurring in the sample of those studies according to location of the hospital. On the other hand, some studies also reported that there was no significant association between type of admission and length of stay (Khosravizadeh et al., 2016; Tefera et al., 2020). Due to lack of information on population background in local studies and mixed findings of previous research, this variable requires further investigation.

## 2.6 Association between Dietary Factor and Length of Stay

### 2.6.1 Preoperative protein intake adequacy

Often, protein is associated with healing process. It is unavoidable that a certain amount of muscle mass will be loss due to surgery (Hirsch et al., 2021). The loss of the total lean mass is around two kg in patients who undergo uncomplicated elective surgery (Schricker et al., 2007; Phillips et al., 2013 as cited in Yeung et al., 2017). To replace the loss, the

body had to recover from the surgical trauma requiring adequate protein intake for the repair and replace mechanism to take place (Weimann et al., 2017). Studies show the protein intake among surgical patients was low which ranging from 39% to 55% of protein adequacy (Chan et al., 2021; Yeung et al., 2017). Insufficient protein intake can result in severe muscle wasting, resulting in a loss of independency and an elevated mortality risk (Hirsch et al., 2021). Post-operatively, this may result in PLOS. Some researchers suggest intake of protein more than 60% is considered as adequate while others reported intake more than 75% for adequacy (Allaire et al., 2021; De Assis et al., 2016; Yeung et al., 2017b). A study conducted by Yeung et al. (2017) on elective colorectal surgery patients, he reported that patients who had more than 60% protein adequacy had significantly decreased LOS. In addition, it was found that patients who had less than 75% protein intake adequacy were at 89% increased risk for PLOS (De Assis et al., 2016). On the other hand, in another study where patients who had protein intake more than 60% were compared with patients who had protein intake less than 60%, it was observed that there were no significant differences between both groups (Allaire et al., 2021). Due to very limited studies in this area, there were no consistent findings that were observed to determine the association of preoperative protein intake adequacy and LOS. This warrants further studies on this variable.

### 2.6.2 Oral Nutrition Supplements

Oral nutrition supplements (ONS) is liquid, semi-solid or powders which are rich in macro and/or micronutrients which are supplement to patients who are not able to meet their dietary requirement solely from diet (British Association for Parenteral and Enteral

Nutrition, 2016). In the ESPEN (2017) on clinical nutrition in surgery guidelines, it recommended preoperative ONS administration for patients who were not able to meet their energy requirements from food regardless of nutritional status but with a low level of evidence. It was further elaborated that despite no significant results were observed in two studies, however, two other studies found that ONS may reduce minor complications and minimize postoperative weight loss (Smedley et al., 2004; Sullivan et al., 1998 as cited in Weimann et al., 2017). As the evidence used was outdated, further analysis was done to observe findings in current literature. Current research shows contraindicating findings. Some researchers reported that ONS was associated with shorter LOS, lower hospital expenses, reduction in probability of 30 days of readmission (Mullin et al., 2019; Philipson et al., 2013; Snider et al., 2015). ONS group resulted in reduced LOS ranging from 10% to 21% compared with the group that were not supplemented with ONS (Mullin et al., 2019; Philipson et al., 2013; Snider et al., 2015). On the contrary, other study reported that patients who were prescribed ONS had a longer LOS (Babb & Rohrer, 2017). Initially, Rattanachaiwong et al. (2019) also found that patients who were on ONS had longer LOS and lower probability of discharging within 30 days but after adjusting for the confounding factors, it was reported that the two groups that were studied are incomparable. Due to limitation on method of analysis in previous studies and differences in sample of study population as mostly were diagnosis specific like oncology, intensive care unit, heart failure and chronic obstructive pulmonary disease patients, there are lacking studies on general surgical populations thus further research is required to determine the association of ONS and LOS in these patients.

# CHAPTER 3: METHODOLOGY

## 3.1 Study Design

This is a retrospective cross-sectional study that aims to determine factors associated with length of stay among surgical patients in Hospital Serdang.

## 3.2 Study Location

The study was carried out at Hospital Serdang, Selangor. It is located approximately 22 kilometers from Malaysia's capital city, Kuala Lumpur. This hospital was built to provide medical services for about 570,000 residents who live in the area of Serdang, Putrajaya, Kajang and Bangi. This hospital has 620 beds which are equipped with various facilities and uses Hospital Information System (HIS) which is an electronic data system to manage various data in the hospital. Hospital Serdang is also known to be specialist in secondary unit and tertiary levels of care.

## 3.3 Study population

The participants of this study are surgical patients admitted in surgical ward from 2017 to 2021 in Hospital Serdang. The inclusion and exclusion criteria are as followed:

**Inclusion criteria:**

- Aged 18 years and above
- Surgery was carried out in Hospital Serdang
- Have at least 1 day of LOS

**Exclusion criteria:**

- Non-Malaysian citizen

### 3.4 Sample Size Determination

In order to obtain the optimal sample size, the formula of sample size for Pearson correlation was used. The highest number of samples is chosen as the final sample size of this study. The methods used are as follows:

**Sample Size for Pearson Correlation**

The sample size for Pearson correlation is determined by using the following formula (Hulley, Cummings, Browner, Grady, & Newman, 2013):

$$N = [(Z_\alpha + Z_\beta)/C]^2 + 3$$

Where,

N = Number of respondents required

$Z_\alpha$ = The standard deviation for α (1.96)

$Z_\beta$ = The standard deviation for β (1.28)

C = 0.5 * In [(1+r)/(1-r)]

r = The expected correlation coefficient

| Variables | Correlation coefficient, r | Total sample size needed, N |
|---|---|---|
| Age and LOS (Masip, 2019) | 0.931 | 6 |
| BMI and LOS (Akuzawa & Naito, 2015) | -0.488 | 31 |
| Preoperative albumin and LOS (Akuzawa & Naito, 2015) | -0.542 | 24 |
| Preoperative protein intake adequacy and LOS (Suga & Hashimoto, 2018) | 0.350 | 62 |

Table 1: Sample size calculation based on r-value

Adjust sample size with sample design effect:

62 x 1.3 = 80.6

Adjust sample size with the expected response rate (80%):

80.6/0.8 = 101

Hence, a total of 101 participants were required in this study.

**3.5 Sampling Design**

In this study, convenience sampling method was used whereby list of surgical patients from year 2017 to 2021 was obtained from the surgical department of Hospital Serdang.

### 3.6 Study Instruments

| Parameters | Tools | Scoring system |
|---|---|---|
| **Age** | Self-administered | Continuous variable: Age is calculated from date at birth till the date of data collection and recorded in unit years.<br>Categorical variable:<br>Adults: 18 – 59 years<br>Elderly: ≥ 60 years (National Health and Morbidity Survey: Elderly Health, 2018) |
| **Gender** | Self-administered | Categorical variable:<br>• Male<br>• Female |
| **Ethnicity** | Self-administered | Categorical variable:<br>• Malay<br>• Chinese<br>• Indian<br>• Others |
| **Body Mass Index (BMI)** | Calculated using Asian BMI cut offs | Categorical variable:<br>Asian BMI cut-off by Ko et al. (1999) will be used for adults and categorized as the following: |

(Cont.)

| Parameters | Tools | Scoring system |
|---|---|---|

| Body Mass Index (BMI) (kg/m$^2$) | Category |
|---|---|
| <18.5 | Underweight |
| 18.50 – 22.99 | Normal |
| 23.00 – 24.99 | Overweight |
| >25.00 | Obese |

Table 3: Asian BMI cut-off

Queensland Government of health (2017) cut offs was used for elderly ≥65 years:

| Body Mass Index (BMI) (kg/m$^2$) | Category |
|---|---|
| <23.00 | Underweight |
| 23.00 – 30.00 | Normal |
| >30 | Overweight |

Table 4: NEMO elderly cut-off

| | | |
|---|---|---|
| **Preoperative albumin** | Hospital Serdang's lab value cut-offs | Continuous variable:<br>Recorded using the same unit as recorded by<br>Categorical variable:<br>• Low: <34 g/L<br>• Normal: 34 -54 g/L (Cont.) |

| Parameters | Tools | Scoring system |
|---|---|---|
| **Seen by dietitian** | Self-administered | Categorical variable:<br>• Yes: Seen by dietitian<br>• No: Not seen by dietitian |
| **Risk of malnutrition** | Malnutrition Universal Screening Tool (MUST) | Categorical variable:<br>The study instruments that will be used in this study is Malnutrition Universal Screening Tool (MUST) which is to evaluate risk of malnutrition in five steps (Refer Appendix I). It is a validated tool in hospital setting and suitable to be used in surgical patients. The total score in the end is categorized into 3 groups which are as below:<br>1. Score 0: Low risk<br>2. Score 1: Medium risk<br>3. Score ≥ 2: High risk<br>(British Association for Parenteral and Enteral Nutrition, 2010) |
| **Type of admission** | Self-administered | Categorical variable:<br>• Elective<br>• Emergency (Cont.) |

| Parameters | Tools | Scoring system |
|---|---|---|
| **Preoperative protein intake adequacy** | Self-administered | Continuous variable:<br>Intake that is reported in the medical report will be divided with calculated recommended need and reported in unit percentage (%). The calculation method are as follows:<br>(Cont.)<br>Adequacy (%) = (Intake/Recommended) x 100%<br>• Intake: Achieved from dietitian's nutrition care process<br>• Recommended: Body weight x 1.2g/kg body weight (factor for patients who are moderately hypermetabolic) (Queensland Government of health, 2017)<br>Categorical variable:<br>• Inadequate intake: <75 % of recommended<br>• Adequate intake: ≥75 % of recommended (De Assis et al., 2016; Kong et al., 2020; Larby et al., 2016)<br>(Cont.) |

| Parameters | Tools | Scoring system |
|---|---|---|
| **Oral nutrition supplements** | Self-administered | Categorical variable:<br>• Yes: Given ONS<br>• No: Not given ONS |
| **Length of stay** | Self-administered | Continuous variable:<br>Calculated from the first day of admission for surgery until the day discharged and will be reported in unit days. |

Table 2: Study instruments and scoring system

### 3.7 Study Approval

Prior to the study, approval from the Medical Research & Ethics Committee (MREC) was obtained. The letter of allowance to proceed with the study was sought under protocol number NMRR-18-2625-43546 (Refer Appendix II). MREC letter were then sent to Hospital Serdang and permission to carry out the study were approved (Refer Appendix III). The confidentiality of the patients' was secured and data obtained were only used for the purpose of this study.

### 3.8 Data Collection

List of patient IDs who were registered under surgical ward of Hospital Serdang were given to researchers. Data collected was secondary data whereby patient information was gathered from the Hospital Information System (HIS) which is an electronic data system of Hospital Serdang that stores medical reports of the patients. The data was collected from November 2021 to March 2022.

### 3.9 Statistical Analysis

Data were analyzed using Statistical Package for the Social Sciences (SPSS) version-26 software. First, the data was evaluated for its normality distributions, to see if parametric or non-parametric tests should be used. A significance level of P-value equal to or less than 0.05 was used. Sociodemographic factors (age, gender and ethnicity), anthropometric factor (BMI), biochemical factor (preoperative albumin), clinical factors (seen by dietitian, risk of malnutrition, type of admission), dietary factors (preoperative protein intake adequacy, oral nutrition supplements (ONS)) are analyzed by descriptive statistics using mean, percentage and frequency. Then, the mean length of stay was determined using descriptive statistics. Pearson Correlation (parametric variables) and Spearman Rank (non-parametric variable) test were used to determine the association of the factors with length of stay. Lastly, Independent samples T-test (parametric variables) and Mann-Whitney U (non-parametric variable) test were carried out to compare means among groups of the factors on length of stay. Lastly, for missing data, the case for that specific variable were omitted using the option ‘exclude case pairwise’ and the remaining data were analyzed.

# CHAPTER 4: RESULTS AND DISCUSSION

## Response rate

A total of 114 surgical patients' data were retrieved from Hospital Serdang's Hospital Information System (HIS). The amount of data achieved the calculated sample size (response rate of 112.9%). However, there were certain variables which had missing datas and were not able to meet the minimum sample size. The variables are preoperative albumin (73.7% response rate) and preoperative protein intake adequacy (30.7% response rate).

## 4.1 Sociodemographic Characteristics

One hundred and fourteen patients from the year 2017 to 2021 who have undergone surgery were included in this study. The mean (± SD) age of the patients was 47.30 ± 16.50 years where 72.8% were adults and 27.2% were elderly. Majority of the patients were female (69.3%) followed by male (30.7%). 67.5% of them were Malay, 21.9% were Chinese and 10.5% were Indian. The ethnicity distribution of this study is almost similar to that of ethnicity composition in Malaysia in 2020 where 69.6% were Malay, 22.6% were Chinese and 6.8% were Indians (Department of Statistics Malaysia, 2021). Despite the relatively similar findings for Malay and Chinese ethnic groups, this study had a higher percentage of Indians compared to Indian ethnic groups in Malaysia in 2020 as due to Selangor being one of the highest states with Indian populations (Department of Statistics Malaysia, 2022). The sociodemographic characteristics of the patients are tabulated in Table 5.

Table 5: Sociodemographic characteristics of the patients (n = 114)

| Variables | n (%) | Mean ± SD |
|---|---|---|
| **Age (years)** | | 47.30 ± 16.50 |
| Adults (18-59) | 83 (72.8) | |
| Elderly (≥60) | 31 (27.2) | |
| **Gender** | | |
| Male | 35 (30.7) | |
| Female | 79 (69.3) | |
| **Ethnicity** | | |
| Malay | 77 (67.5) | |
| Chinese | 25 (21.9) | |
| Indian | 12 (10.5) | |

### 4.2 Anthropometry Data

The mean (± SD) body mass index (BMI) of the patients was 25.75 ± 5.88 kg/m$^2$. Almost half of the patients were obese (44.2%), followed by normal (28.8%), underweight (15.4%) and overweight (11.5%). The result was consistent with National Health and Morbidity survey (NHMS) (2019) where it is stated that 1 in 2 Malaysians are either overweight or obese. Table 6 shows the anthropometry data of the patients.

Table 6: Anthropometry data of the patients (n = 104)

| **Variable** | **n (%)** | **Mean ± SD** |
|---|---|---|
| **Body Mass Index (kg/m$^2$)** | | 25.75 ± 5.88 |
| Underweight (<18.50)[a] / (<23.00)[b] | 16 (15.4) | |
| Normal (18.50 – 22.99)[a] / (23.00 – 30.00)[b] | 30 (28.8) | |
| Overweight (23.00 – 24.99)[a] / (>30.00)[b] | 12 (11.5) | |
| Obese (≥25.00)[a] | 46 (44.2) | |

a = adults Asian cut-off, b = elderly Nemo's cut off (≥ 65 years)

### 4.3 Biochemical Data

Preoperative albumin had the mean (± SD) of 34.32 ± 6.05g/L. 2 out of 5 patients had low preoperative albumin level (39.2%). Comparing the mean with previous findings by Arun et al., (2020) which was a study on major gastrointestinal surgical patients had a mean preoperative albumin of 30.3g/L which is slightly lower to this current study. This is because this study includes all patients despite major or minor surgeries which had led to the differences. Other studies on patients undergoing upper gastrointestinal and abdominal surgery reported a range of 21.0% to 46.4% of patients having hypoalbuminemia (Ahmed & Sarma, 2022; Inagaki et al., 2017; Truong et al., 2016). This study that includes all surgical patients were found to be in the range of previous study which may be due to gastrointestinal surgery as the most common type of surgery performed (Abrha et al., 2019). The biochemical data of the patients is tabulated in Table 7.

Table 7: Biochemical data of the patients (n = 74)

| **Variables** | **n (%)** | **Mean ± SD** |
|---|---|---|
| **Preoperative albumin (g/L)** | | 34.32 ± 6.05 |
| Low (<34) | 29 (39.2) | |
| Normal (34 – 54) | 45 (60.8) | |

### 4.4 Clinical Data

Most of the patients were not seen by dietitians (85.1%) while 14.9% patients were referred to dietitians. The findings were nearly similar to a cross-sectional study conducted by Eglseer & Bauer (2020) which had a large sample of patients (n = 8405) admitted in all wards where the referral rate to dietitian was 16.8%. The reason behind most patients were not seen by dietitians is because clinical dietitians in hospitals see patients on referral basis. Predictors of dietitian referral include diabetes, cancer and gastrointestinal disease related issues, pressure injury and risk of malnutrition (Eglseer & Bauer, 2020). 22.0% of patients were found to be at risk (low and medium) of developing malnutrition. The result was inconsistent with a study conducted in Hospital Universiti Sains Malaysia (HUSM) surgical patients where 37.3% patients were at risk of developing malnutrition (high and medium risk) (Omaid et al., 2016). Other studies on vascular, gastrointestinal and general surgical patients reported risk of malnutrition ranging from 24.1% to 53.8% whereby patients with cancer are at the higher ends (Banning et al., 2020; Güzel et al., 2021; Seo et al., 2021) .

The finding of this study had much lower patients who are at risk of developing malnutrition as it might be under-diagnosed as not all the patients were assessed with MUST. Almost all the patients (93.9%) had elective admission. In contrast with a study by Palayan et al. (2020) it was reported that emergency surgeries accounted for a majority of the surgical procedures (58.1%) at Hospital Tuanku Ja'afar (HTJS), Seremban, Negeri Sembilan. Discrepancies may be due to lack of documentation of the surgical clinic of Hospital Serdang for emergency admission or that emergency admitted patients might be

registered under the emergency department instead of the surgical department. The clinical data of the patients is tabulated in Table 8.

Table 8: Clinical data of the patients

| **Variables** | **n (%)** |
|---|---|
| **Seen by dietitian** (n = 114) | |
| Yes | 17 (14.9) |
| No | 97 (85.1) |
| **Risk of malnutrition** (n = 104) | |
| Low risk | 79 (69.3) |
| Medium risk | 10 (8.8) |
| High risk | 15 (13.2) |
| **Type of admission** (n = 114) | |
| Elective | 107 (93.9) |
| Emergency | 7 (6.1) |

### 4.5 Dietary Data

The median (IQR) of preoperative protein intake adequacy was 67.50 (50.30) %. Most of the patients had inadequate protein intake (61.3%) followed by adequate protein intake (38.7%). Consistent with a prospective cohort study by De Assis et al. (2016), he reported that most (83.0%) patients consumed less than prescribed protein. However, this study had a much lower percentage of patients with inadequate intake due to a large number of missing data for this variable as protein intake is not monitored in all surgical patients in Hospital Serdang. 1 out of 10 patients received oral nutrition supplements (ONS) (11.4%). Only a small number of patients received ONS since Hospital Serdang only provides it for severely malnourished patients. Table 9 shows the dietary data of the patients.

Table 9: Dietary data of the patients

| **Variables** | **n (%)** | **Median (IQR)** |
|---|---|---|
| **Preoperative protein intake adequacy (%)** (n = 31) | | 67.50 (50.30) |
| Inadequate intake (<75%) | 19 (61.3) | |
| Adequate intake (≥ 75) | 12 (38.7) | |
| **Oral nutrition supplements** (n = 114) | | |
| Yes | 13 (11.4) | |
| No | 101 (88.6) | |

### 4.6 Mean Hospital Length of Stay

The mean (± SD) hospital length of stay (LOS) is 5.90 ± 4.35 days. In previous studies on general surgical patients, LOS was reported for 5 days and 6 days in Korea and United Kingdom respectively (Baek et al., 2018; Ward et al., 2021). On the other hand, LOS in an Ethiopian study was 25.06 ± 21.415 days which involved all patients admitted to the surgical ward (Tefera et al., 2020). The result of this current study was in range of previous studies except as compared to the Ethiopian study as this may be due to Ethiopia being a low socioeconomic country where there was a high rate of hospital-acquired infection in the study as discussed by the author herself.

Table 10: Length of stay of the patients (n = 114)

| **Variables** | **Mean ± SD** |
|---|---|
| **Length of stay (days)** | 5.90 ± 4.35 |

**Hypothesis testing**

**4.7 Association of selected variables and hospital length of stay**

**a) Sociodemographic factor (Age)**

Based on Table 11, there is a medium positive correlation between age (r=0.309) with length of stay (LOS) and the results were statistically significant (p = 0.001). The result indicates that as the age increases, the days spent in hospital also increase linearly. This is in line with a previous study that reported there was a significant association between age and LOS (Frugoni et al., 2020; Khosravizadeh et al., 2016; Tan et al., 2021). Khosravizadeh et al. (2016) further found that those who were aged 40 and above had longer stay compared to those who were 20 to 30 years old. As justified by Tan et al. (2021), the reason behind the number of days spent in hospital increases along with age is due to the higher prevalence of having comorbidities among older aged groups compared to younger adults. Furthermore, longer LOS can also be contributed by a slower healing process as one ages. This occurs due to changes in physiological performance which leads to slower metabolic response that is a part of the aging process (Amarya et al., 2018).

Table 11: Results of Pearson correlation of age and LOS

| **Variables** | **Length of stay (days)** | |
|---|---|---|
| | ***r*** | ***p*-value** |
| **Age (years)** | 0.309 | 0.001* |

**b) Anthropometric factor (Body Mass Index)**

As shown in Table 12, there is a weak negative correlation between body mass index (BMI) ($r$ = -0.173) with length of stay and the results were statistically not significant ($p$ = 0.080). This suggests that BMI is not associated with LOS. The current finding is in contrast with previous study that reported patients with higher BMI had longer LOS (Akinyemiju et al., 2016a; Nguyen et al., 2016). This might be due to previous studies using a different BMI cut off which is the World Health Organization BMI cut-off and generalize it regardless of age. In this current study, Asian BMI cut off were used for adults and NEMO elderly cut off used for elderly which brings a new insight of the association between BMI and LOS.

Table 12: Results of Pearson correlation of BMI and LOS

| **Variables** | **Length of stay (days)** | |
|---|---|---|
| | ***r*** | ***p*-value** |
| **BMI** | -0.173 | 0.080 |

**c) Biochemical factor (Preoperative albumin)**

Table 13 shows that there is a medium negative correlation between preoperative albumin ($r$= -0.397) with length of stay (LOS) and the results were highly significant ($p$<0.001). This indicates that the higher the preoperative albumin, the shorter the LOS among patients. The result is consistent with previous study where majority researchers reported

preoperative albumin as one of the predictors of prolonged LOS among major gastrointestinal, urinary and colorectal cancer surgical patients (Arun et al., 2020; Bhalla et al., 2017; Lalhruaizela et al., 2020; Larson et al., 2020; Weimann et al., 2017). Low albumin level impairs optimum wound healing time as it leads to decreased collagen production (an essential component in tissue formation in surgical wounds) and it also impairs immunological response (Lohsiriwat et al., 2007 as cited in Ahmed & Sarma, 2022). Consequently, some studies reported having low albumin levels increases risk of developing complications such as infections in the postoperative period causing the lengthened days of treatment (Ahmed & Sarma, 2022; Larson et al., 2020). Including the assessment of preoperative albumin in preoperative assessment might be beneficial for both the treatment center and the individual. Patients who are identified as having hypoalbuminemia may receive medical or nutritional intervention prior to surgery to elevate the albumin levels to improve the postoperative outcome.

Table 13: Results of Pearson correlation of preoperative albumin and LOS

| **Variables** | **Length of stay (days)** | |
|---|---|---|
| | ***r*** | ***p*-value** |
| **Preoperative albumin** | -0.397 | <0.001** |

**d) Dietary factor (Preoperative protein intake adequacy)**

As shown in Table 14, there is negligible relationship between protein intake adequacy ($r$ = 0.044) with length of stay (LOS) and the results were statistically insignificant ($p$ = 0.814). This suggests that LOS is not affected by preoperative protein intake adequacy. The results disagree with earlier studies that have found preoperative protein intake adequacy leads to prolonged LOS (De Assis et al., 2016; Yeung et al., 2017). The reason for different findings might be due to only a small number of patients having their protein intake recorded in their medical file which the size of sample is insufficient to observe significant changes. This is because recording protein intake was not performed in all patients. Only patients who were referred to dietitians had the data of their preoperative protein intake. Hence, recording preoperative protein intake as a part of preoperative assessment might help to determine a patient's nutritional status and future studies might be able to further assess the relationship of this variable with LOS.

Table 14: Results of Spearman correlation of dietary factors and LOS

| **Variables** | **Length of stay (days)** | |
|---|---|---|
| | *r* | *p*-value |
| **Preoperative protein intake adequacy** | 0.044 | 0.814 |

### 4.8 Means among group of selected variables on hospital length of stay

#### a) Sociodemographic factors (gender and ethnicity)

**Gender**

An independent sample *t*-test was conducted to compare the length of stay (LOS) with sociodemographic factors. As shown in Table 15, male (7.49 ± 4.54 days) had significantly higher mean LOS compared to female (5.20 ± 4.10 days) $t = 2.653$, $p = 0.009$. The current study results are inconsistent with previous findings on hepatobiliary surgery, neurosurgery, colorectal surgery and appendectomy patients where there were no significant difference of LOS among the genders (Lee et al., 2018; Martínez-Pérez et al., 2021; Yeung et al., 2017). There are a few possibilities behind the results obtained. Firstly, it may be due to more surgery in male that is related to motor vehicle accidents which require longer periods of stay for post trauma stabilization (Tan et al., 2021). Another possible reason could also be due to differences in median age among both of these groups as reported by Song & Bian (2014) where in his studies the male had 4 years of higher median age compared to female, consequently the result showed male having longer LOS compared to females.

**Ethnicity**

There were also no significant differences in mean length of stay (LOS) between Malay and non-Malay $t = -1.672$, $p = 0.101$. This indicates that different groups in ethnicity does not affect LOS. Aligned with studies conducted previously that reported that different ethnic groups among Singapore population is not a determinant of LOS (Jin Toh et al., 2017; Lee et al., 2018).

Table 15: Results of independent samples t-test of sociodemographic factors and length of stay

| Variables | Mean | SD | t-value | *p*-value |
|---|---|---|---|---|
| **Gender** | | | | |
| Male | 7.49 | 4.54 | 2.653 | 0.009* |
| Female | 5.20 | 4.10 | | |
| **Ethnicity** | | | | |
| Malay | 5.35 | 3.41 | -1.672 | 0.101 |
| Non-Malay | 7.05 | 5.73 | | |

**b) Anthropometric factor (body mass index)**

**Body Mass Index**

Table 16 shows that there is an insignificant effect of body mass index (BMI) on length of stay (LOS) ($F = 1.648$, $p = 0.183$). Though, more recent studies suggests the existence of obesity paradox among surgical patients where it is reported underweight and obese patients had longest LOS while overweight patients having the shortest LOS, the current study is not consistent with it (Akinyemiju et al., 2016b; Chen et al., 2015; Dotan et al., 2021; Tulinský et al., 2018). As previous studies used World Health Organization (WHO) BMI cut-off this may be the reason why the findings yielded differences compared to this current study. Using WHO BMI cut-off, places elderlies with 25.0 to 30.0 $kg/m^2$ in the overweight group. Some studies have found being moderately overweight among elderlies with BMI 23.0 to 30.0 $kg/m^2$ serves a protective effect (El Moheb et al., 2021; Pes et al., 2019; Queensland Government of health, 2017b). Thus, overweight elderly patients in previous studies might have shorter LOS affecting the differences in mean among the BMI groups. This is the first study that used two different cut-offs for different age groups (adults and elderly) among surgical patients to prevent age from being a confounding factor affecting relationship of BMI and LOS. Thus, more studies are recommended to determine the consistency of this finding.

Table 16: Results of ANOVA test of anthropometric factor and length of stay

| Variables | Mean | SD | F | *p*-value |
|---|---|---|---|---|
| **Body Mass Index (kg/m$^2$)** | | | | |
| Underweight (<18.50)[a] / (<23.00)[b] | 7.56 | 6.44 | 1.648 | 0.183 |
| Normal (18.50 – 22.99)[a] / (23.00 – 30.00)[b] | 6.40 | 4.13 | | |
| Overweight (23.00 – 24.99)[a] / (>30.00)[b] | 5.92 | 4.50 | | |
| Obese (≥25.00)[a] | 5.02 | 3.07 | | |

**c) Clinical factors (seen by dietitian, risk of malnutrition and type of admission)**

**Seen by dietitian**

As shown in Table 17, patients who have seen by dietitian (11.29 ± 5.96 days) had significantly higher mean length of stay (LOS) compared to patients that have not seen by dietitians (4.96 ± 3.21 days) $t = 4.278$, $p<0.001$. The result is contrast with the previous findings where it was stated otherwise; group that is seen by dietitian had significantly reduced LOS compared to patients who did not (Ehresman et al., 2020a; Hogan et al., 2021; Hussen et al., 2020; Narendra et al., 2020; Torgersen & Balters, 2019). In the current study, the group that have seen dietitians appear to have longer LOS due to the practice in

Hospital Serdang. Patients were only referred to dietitians when they are already at medium or high nutritional risk especially malnutrition which in result require higher LOS to resolve nutritional issues. Due to this unadjusted confounding variable, the results yielded those patients who have seen a dietitian spend longer time hospitalized.

**Risk of malnutrition**

Referring to Table 17, patients who had moderate and high risk of malnutrition (8.40 ± 5.35 days) had significantly higher mean length of stay (LOS) compared to patients with low risk of malnutrition (5.13 ± 3.51 days), $t$ = -2.868, $p$ = 0.007. The result suggests that patients who are at moderate and high risk spent approximately 3.27 days longer hospitalization compared to those who had low risk. The result is aligned with majority previous studies that reported risk of malnutrition as a predictor of prolonged LOS (Budzyński et al., 2016; Gomes et al., 2016; Maia et al., 2018). The risk of malnutrition is associated with a range of adverse outcomes including depression of the immune system, imbalance in metabolic response and impaired wound healing which delays LOS (Barker et al., 2011). Consequently, due to the physiological effects of malnutrition, it puts an individual who is at risk to develop postoperative complications (Inciong et al., 2020). Thus, the European Society for Clinical Nutrition and Metabolism (ESPEN) (2017) on the guidelines for clinical nutrition in surgery recommended delaying surgery in a period of 7 to 14 days for patients at severe risk of malnutrition. Screening for malnutrition is crucial in an inpatient setting especially in surgical as patients will experience surgical-led trauma during the post-surgery state (Weimann et al., 2017). With early identification

of patients at risk of malnutrition, nutritional therapy can be given to improve their nutritional status to have an optimum outcome postoperatively.

**Type of admission**

Table 17 shows that there was also no significant difference between emergency and elective admission $t$ = -0.386, $p$ = 0.700. There was a difference in findings when compared to previous study where according to an experimental study by Casalino et al. (2019), emergency patients had 3 days longer stay than electively admitted patients. Similarly, two local studies also agreed that type of admission has association with LOS (Palayan et al., 2020; K. A. Wong & Holloway, 2019). A Malaysian report also stated 85% of perioperative mortality is caused by emergency surgery (Kandasmi et al., 2003 as cited in Palayan et al., 2020). However, this study had different findings as might be due to only a small number of patients having emergency admission in this study as due to missing data in surgery clinic list of Hospital Serdang.

Table 17: Results of independent samples t-test of clinical factors and length of stay

| Variables | Mean | SD | *t*-value | *p*-value |
|---|---|---|---|---|
| **Seen by dietitian** | | | | |
| Yes | 11.29 | 5.96 | 4.278 | <0.001** |
| No | 4.96 | 3.21 | | |
| **Risk of malnutrition** | | | | |
| Low risk | 5.13 | 3.51 | -2.868 | 0.007* |
| Moderate and high risk | 8.40 | 5.35 | | |
| **Type of admission** | | | | |
| Emergency | 5.29 | 4.11 | -0.386 | 0.700 |
| Elective | 5.94 | 4.38 | | |

**d) Dietary factor (oral nutrition supplements)**

**Oral nutrition supplements**

As shown in Table 18, patients who have been given oral nutrition supplements (ONS) (9.31 ± 3.64 days) had significantly higher mean length of stay compared to patients that are not given oral nutrition supplements (5.47 ± 4.25) $t = 3.111$, $p = 0.002$. Contrast findings to studies where researchers reported that ONS was associated with shorter LOS (Mullin et al., 2019; Philipson et al., 2013; Snider et al., 2015). A number of studies indicates that patients who were supplemented with ONS had better perioperative outcomes in terms of gaining weight and improving muscular strength (Mullin et al., 2019; Wong et al., 2022). However, in this study, the reason for the significance result is due to those who were given ONS had longer LOS. This is because in Hospital Serdang, patients are given ONS when the patient is already at medium or high nutritional risk which in result requires higher LOS to be treated.

Table 18: Results of independent samples t-test of dietary factors and length of stay

| Variables | Mean | SD | *t*-value | *p*-value |
|---|---|---|---|---|
| **Oral nutrition supplements** | | | | |
| Yes | 9.31 | 3.64 | 3.111 | 0.002* |
| No | 5.47 | 4.25 | | |

# CHAPTER 5: CONCLUSION

## 5.1 Conclusion

A total of 114 surgical patients' data were collected from Hospital Serdang. Majority of them were adults (18 -59 years old), female and Malay. Most of them were obese, had normal preoperative albumin and were not seen by dietitian. Majority of the patients were also categorized under low-risk malnutrition and they were mostly electively admitted. In terms of their dietary status, most of the patients had inadequate preoperative protein intake adequacy and were not supplemented with oral nutrition supplements (ONS).

The mean length of stay (LOS) among surgical patients in Hospital Serdang is $5.90 \pm 4.35$ days. A significant association was observed between age and preoperative albumin with LOS. There were also significant differences among groups in gender, seen by dietitian, risk of malnutrition and oral nutrition supplementation on LOS.

## 5.2 Strength, limitations and recommendations

The strength of the current study is that this study provides a new insight into the relationship between body mass index (BMI) that were analyzed with two different cut-offs (Asian BMI cut off and NEMO elderly cut off) as this is the first study that did so. Besides that, this is also the first study to differentiate LOS in surgical patients among different ethnicities in Malaysia. The background ethnicity of the patients in this study was able to represent Malaysian's population as previous studies on ethnicity were majorly focused on westerns' population.

The present results must be interpreted within the context of several limitations. Firstly, there were a number of missing datas due to secondary data collection as caused by incomplete documentation. Thus, some of the variables did not meet the sample size which are preoperative albumin and preoperative protein intake adequacy. To improve this, increment of non-response rate when calculating sample size can be done so that the variables with high missing datas have adequate sample size. On the other hand, assessing preoperative protein intake adequacy for all surgical patients during preoperative assessment by a dietitian is highly recommended to identify the nutritional status of patients.

Next, the variables seen by dietitian and oral nutrition supplements had severity of nutritional risk as its confounding factor and have largely impacted the results. This is due to only patients at risk of nutritional status being referred to a dietitian and given oral nutrition supplements. Thus, future studies may focus on comparing groups at moderate and high risk of nutritional status for both of those variables stated previously instead of including well-nourished patients.

Lastly, another limitation of the study is that the type of surgery (major or minor surgery) was not assessed in the current study as it may play a large role in affecting the LOS. It is suggested that future study to separate patients into groups of their type of surgery before assessing to prevent a biased result.

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# APPENDIX

Appendix I: Malnutrition Universal Screening Tool (MUST)

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## 'Malnutrition Universal Screening Tool'

MAG
Malnutrition Advisory Group
A Standing Committee of BAPEN

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## 'MUST'

'MUST' is a five-step screening tool to identify **adults,** who are malnourished, at risk of malnutrition (undernutrition), or obese. It also includes management guidelines which can be used to develop a care plan.

It is for use in hospitals, community and other care settings and can be used by all care workers.

**This guide contains:**

- A flow chart showing the 5 steps to use for screening and management
- BMI chart
- Weight loss tables
- Alternative measurements when BMI cannot be obtained by measuring weight and height.

## The 5 'MUST' Steps

### Step 1

**Measure height and weight to get a BMI score using chart provided. *If unable to obtain height and weight, use the alternative procedures shown in this guide.***

### Step 2

**Note percentage unplanned weight loss and score using tables provided.**

### Step 3

**Establish acute disease effect and score.**

### Step 4

**Add scores from steps 1, 2 and 3 together to obtain overall risk of malnutrition.**

### Step 5

**Use management guidelines and/or local policy to develop care plan.**

Please refer to *The 'MUST' Explanatory Booklet* for more information when weight and height cannot be measured, and when screening patient groups in which extra care in interpretation is needed (e.g. those with fluid disturbances, plaster casts, amputations, critical illness and pregnant or lactating women). The booklet can also be used for training. See *The 'MUST' Report* for supporting evidence. Please note that 'MUST' has not been designed to detect deficiencies or excessive intakes of vitamins and minerals and is of **use only in adults.**

# Step 1 – BMI score (& BMI)

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**Height (feet and inches)**

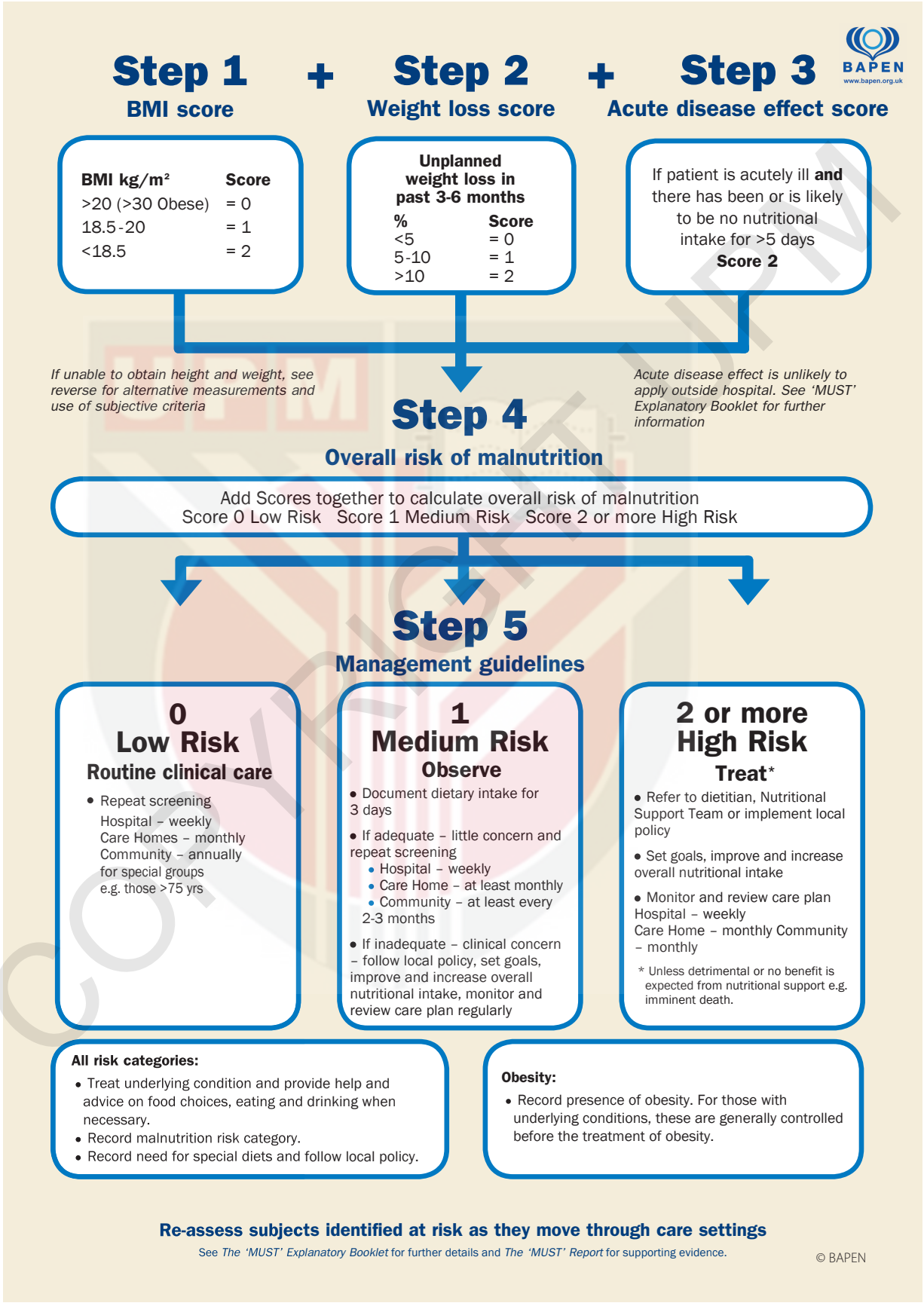
| Weight (kg) | 4'9½ | 4'10½ | 4'11 | 5'0 | 5'0½ | 5'1½ | 5'2 | 5'3 | 5'4 | 5'4½ | 5'5½ | 5'6 | 5'7 | 5'7½ | 5'8½ | 5'9½ | 5'10 | 5'11 | 5'11½ | 6'0½ | 6'1 | 6'2 | 6'3 | 6'3½ | 6'4½ | Weight (stones and pounds) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 100 | 47 | 46 | 44 | 43 | 42 | 41 | 40 | 39 | 38 | 37 | 36 | 35 | 35 | 34 | 33 | 32 | 32 | 31 | 30 | 30 | 29 | 28 | 28 | 27 | 27 | 15 10 |
| 99 | 46 | 45 | 44 | 43 | 42 | 41 | 40 | 39 | 38 | 37 | 36 | 35 | 34 | 33 | 33 | 32 | 31 | 31 | 30 | 29 | 29 | 28 | 27 | 27 | 26 | 15 8 |
| 98 | 46 | 45 | 44 | 42 | 41 | 40 | 39 | 38 | 37 | 36 | 36 | 35 | 34 | 33 | 32 | 32 | 31 | 30 | 30 | 29 | 28 | 28 | 27 | 27 | 26 | 15 6 |
| 97 | 46 | 44 | 43 | 42 | 41 | 40 | 39 | 38 | 37 | 36 | 35 | 34 | 34 | 33 | 32 | 31 | 31 | 30 | 29 | 29 | 28 | 27 | 27 | 26 | 26 | 15 4 |
| 96 | 45 | 44 | 43 | 42 | 42 | 40 | 39 | 38 | 38 | 37 | 36 | 35 | 34 | 33 | 32 | 32 | 31 | 30 | 30 | 29 | 28 | 28 | 27 | 27 | 26 | 15 2 |
| 95 | 45 | 43 | 42 | 41 | 40 | 39 | 38 | 37 | 36 | 35 | 34 | 34 | 33 | 32 | 31 | 31 | 30 | 29 | 29 | 28 | 27 | 27 | 26 | 26 | 25 | 14 13 |
| 94 | 44 | 43 | 42 | 41 | 40 | 39 | 38 | 37 | 36 | 35 | 34 | 33 | 33 | 32 | 31 | 30 | 30 | 29 | 28 | 28 | 27 | 27 | 26 | 25 | 25 | 14 11 |
| 93 | 44 | 42 | 41 | 40 | 39 | 38 | 37 | 36 | 35 | 35 | 34 | 33 | 32 | 31 | 31 | 30 | 29 | 29 | 28 | 27 | 27 | 26 | 25 | 25 | 24 | 14 9 |
| 92 | 43 | 42 | 41 | 40 | 39 | 38 | 37 | 36 | 35 | 34 | 33 | 33 | 32 | 31 | 30 | 30 | 29 | 28 | 28 | 27 | 27 | 26 | 25 | 25 | 24 | 14 7 |
| 91 | 43 | 42 | 40 | 39 | 38 | 37 | 36 | 36 | 35 | 34 | 33 | 32 | 31 | 31 | 30 | 29 | 29 | 28 | 27 | 27 | 26 | 26 | 25 | 25 | 24 | 14 5 |
| 90 | 42 | 41 | 40 | 39 | 38 | 37 | 36 | 35 | 34 | 33 | 33 | 32 | 31 | 30 | 30 | 29 | 28 | 28 | 27 | 27 | 26 | 25 | 25 | 24 | 24 | 14 2 |
| 89 | 42 | 41 | 40 | 39 | 38 | 37 | 36 | 35 | 34 | 33 | 32 | 32 | 31 | 30 | 29 | 29 | 28 | 27 | 27 | 26 | 26 | 25 | 25 | 24 | 24 | 14 0 |
| 88 | 41 | 40 | 39 | 38 | 37 | 36 | 35 | 34 | 34 | 33 | 32 | 31 | 30 | 30 | 29 | 28 | 28 | 27 | 27 | 26 | 25 | 25 | 24 | 24 | 23 | 13 12 |
| 87 | 41 | 40 | 39 | 38 | 37 | 36 | 35 | 34 | 33 | 32 | 32 | 31 | 30 | 29 | 29 | 28 | 27 | 27 | 26 | 26 | 25 | 25 | 24 | 24 | 23 | 13 10 |
| 86 | 40 | 39 | 38 | 37 | 36 | 35 | 34 | 34 | 33 | 32 | 31 | 30 | 30 | 29 | 28 | 28 | 27 | 27 | 26 | 25 | 25 | 24 | 24 | 23 | 23 | 13 8 |
| 85 | 40 | 39 | 38 | 37 | 36 | 35 | 34 | 33 | 32 | 32 | 31 | 30 | 29 | 29 | 28 | 27 | 27 | 26 | 26 | 25 | 25 | 24 | 24 | 23 | 23 | 13 5 |
| 84 | 39 | 38 | 37 | 36 | 35 | 35 | 34 | 33 | 32 | 31 | 30 | 30 | 29 | 28 | 28 | 27 | 27 | 26 | 25 | 25 | 24 | 24 | 23 | 23 | 22 | 13 3 |
| 83 | 39 | 38 | 37 | 36 | 35 | 34 | 33 | 32 | 32 | 31 | 30 | 29 | 29 | 28 | 27 | 27 | 26 | 26 | 25 | 25 | 24 | 23 | 23 | 23 | 22 | 13 1 |
| 82 | 38 | 37 | 36 | 35 | 35 | 34 | 33 | 32 | 31 | 30 | 30 | 29 | 28 | 28 | 27 | 26 | 26 | 25 | 25 | 24 | 24 | 23 | 23 | 22 | 22 | 12 13 |
| 81 | 38 | 37 | 36 | 35 | 34 | 33 | 32 | 32 | 31 | 30 | 29 | 29 | 28 | 27 | 27 | 26 | 26 | 25 | 24 | 24 | 23 | 23 | 22 | 22 | 22 | 12 11 |
| 80 | 38 | 37 | 36 | 35 | 34 | 33 | 32 | 31 | 30 | 30 | 29 | 28 | 28 | 27 | 26 | 26 | 25 | 25 | 24 | 24 | 23 | 23 | 22 | 22 | 21 | 12 8 |
| 79 | 37 | 36 | 35 | 34 | 33 | 32 | 32 | 31 | 30 | 29 | 29 | 28 | 27 | 27 | 26 | 26 | 25 | 24 | 24 | 23 | 23 | 22 | 22 | 21 | 21 | 12 6 |
| 78 | 37 | 36 | 35 | 34 | 33 | 32 | 31 | 30 | 30 | 29 | 28 | 28 | 27 | 26 | 26 | 25 | 25 | 24 | 24 | 23 | 23 | 22 | 22 | 21 | 21 | 12 4 |
| 77 | 36 | 35 | 34 | 33 | 32 | 32 | 31 | 30 | 29 | 29 | 28 | 27 | 27 | 26 | 25 | 25 | 24 | 24 | 23 | 23 | 22 | 22 | 21 | 21 | 20 | 12 2 |
| 76 | 36 | 35 | 34 | 33 | 32 | 31 | 30 | 30 | 29 | 28 | 28 | 27 | 26 | 26 | 25 | 25 | 24 | 23 | 23 | 22 | 22 | 22 | 21 | 21 | 20 | 12 0 |
| 75 | 35 | 34 | 33 | 32 | 32 | 31 | 30 | 29 | 29 | 28 | 27 | 27 | 26 | 25 | 25 | 24 | 24 | 23 | 23 | 22 | 22 | 21 | 21 | 20 | 20 | 11 11 |
| 74 | 35 | 34 | 33 | 32 | 31 | 30 | 30 | 29 | 28 | 28 | 27 | 26 | 26 | 25 | 24 | 24 | 23 | 23 | 22 | 22 | 21 | 21 | 20 | 20 | 20 | 11 9 |
| 73 | 34 | 33 | 32 | 32 | 31 | 30 | 29 | 29 | 28 | 27 | 26 | 26 | 25 | 25 | 24 | 24 | 23 | 23 | 22 | 22 | 21 | 21 | 20 | 20 | 19 | 11 7 |
| 72 | 34 | 33 | 32 | 31 | 30 | 30 | 29 | 28 | 27 | 27 | 26 | 26 | 25 | 24 | 24 | 23 | 23 | 22 | 22 | 21 | 21 | 20 | 20 | 20 | 19 | 11 5 |
| 71 | 33 | 32 | 32 | 31 | 30 | 29 | 28 | 28 | 27 | 26 | 26 | 25 | 25 | 24 | 23 | 23 | 22 | 22 | 21 | 21 | 21 | 20 | 20 | 19 | 19 | 11 3 |
| 70 | 33 | 32 | 31 | 30 | 30 | 29 | 28 | 27 | 27 | 26 | 25 | 25 | 24 | 24 | 23 | 23 | 22 | 22 | 21 | 21 | 20 | 20 | 19 | 19 | 19 | 11 0 |
| 69 | 32 | 32 | 31 | 30 | 29 | 28 | 28 | 27 | 26 | 26 | 25 | 24 | 24 | 23 | 23 | 22 | 22 | 21 | 21 | 20 | 20 | 20 | 19 | 19 | 18 | 10 12 |
| 68 | 32 | 31 | 30 | 29 | 29 | 28 | 27 | 27 | 26 | 25 | 25 | 24 | 24 | 23 | 22 | 22 | 21 | 21 | 21 | 20 | 20 | 19 | 19 | 18 | 18 | 10 10 |
| 67 | 31 | 31 | 30 | 29 | 28 | 28 | 27 | 26 | 26 | 25 | 24 | 24 | 23 | 23 | 22 | 22 | 21 | 21 | 20 | 20 | 19 | 19 | 18 | 18 | 18 | 10 8 |
| 66 | 31 | 30 | 29 | 29 | 28 | 27 | 26 | 26 | 25 | 25 | 24 | 23 | 23 | 22 | 22 | 21 | 21 | 20 | 20 | 19 | 19 | 19 | 18 | 18 | 18 | 10 6 |
| 65 | 30 | 30 | 29 | 28 | 27 | 27 | 26 | 25 | 25 | 24 | 24 | 23 | 22 | 22 | 21 | 21 | 21 | 20 | 20 | 19 | 19 | 18 | 18 | 18 | 17 | 10 3 |
| 64 | 30 | 29 | 28 | 28 | 27 | 26 | 26 | 25 | 24 | 24 | 23 | 23 | 22 | 22 | 21 | 21 | 20 | 20 | 19 | 19 | 18 | 18 | 18 | 17 | 17 | 10 1 |
| 63 | 30 | 29 | 28 | 27 | 27 | 26 | 25 | 25 | 24 | 23 | 23 | 22 | 22 | 21 | 21 | 20 | 20 | 19 | 19 | 18 | 18 | 18 | 17 | 17 | 17 | 9 13 |
| 62 | 29 | 28 | 28 | 27 | 26 | 25 | 25 | 24 | 24 | 23 | 22 | 22 | 21 | 21 | 20 | 20 | 20 | 19 | 19 | 18 | 18 | 18 | 17 | 17 | 16 | 9 11 |
| 61 | 29 | 28 | 27 | 26 | 26 | 25 | 24 | 24 | 23 | 23 | 22 | 22 | 21 | 21 | 20 | 20 | 19 | 19 | 18 | 18 | 18 | 17 | 17 | 17 | 16 | 9 8 |
| 60 | 28 | 27 | 27 | 26 | 25 | 25 | 24 | 23 | 23 | 22 | 22 | 21 | 21 | 20 | 20 | 19 | 19 | 18 | 18 | 18 | 17 | 17 | 17 | 16 | 16 | 9 6 |
| 59 | 28 | 27 | 26 | 26 | 25 | 24 | 24 | 23 | 22 | 22 | 21 | 21 | 20 | 20 | 19 | 19 | 19 | 18 | 18 | 17 | 17 | 17 | 16 | 16 | 16 | 9 4 |
| 58 | 27 | 26 | 26 | 25 | 24 | 24 | 23 | 23 | 22 | 22 | 21 | 21 | 20 | 20 | 19 | 19 | 18 | 18 | 18 | 17 | 17 | 16 | 16 | 16 | 15 | 9 2 |
| 57 | 27 | 26 | 25 | 25 | 24 | 23 | 23 | 22 | 22 | 21 | 21 | 20 | 20 | 19 | 19 | 18 | 18 | 18 | 17 | 17 | 16 | 16 | 16 | 15 | 15 | 9 0 |
| 56 | 26 | 26 | 25 | 24 | 24 | 23 | 22 | 22 | 21 | 21 | 20 | 20 | 19 | 19 | 18 | 18 | 18 | 17 | 17 | 17 | 16 | 16 | 16 | 15 | 15 | 8 11 |
| 55 | 26 | 25 | 24 | 24 | 23 | 23 | 22 | 21 | 21 | 20 | 20 | 19 | 19 | 19 | 18 | 18 | 17 | 17 | 17 | 16 | 16 | 16 | 15 | 15 | 15 | 8 9 |
| 54 | 25 | 25 | 24 | 23 | 23 | 22 | 22 | 21 | 21 | 20 | 20 | 19 | 19 | 18 | 18 | 17 | 17 | 17 | 16 | 16 | 16 | 15 | 15 | 15 | 14 | 8 7 |
| 53 | 25 | 24 | 24 | 23 | 22 | 22 | 21 | 21 | 20 | 20 | 19 | 19 | 18 | 18 | 18 | 17 | 17 | 16 | 16 | 16 | 15 | 15 | 15 | 14 | 14 | 8 5 |
| 52 | 24 | 24 | 23 | 23 | 22 | 21 | 21 | 20 | 20 | 19 | 19 | 18 | 18 | 18 | 17 | 17 | 16 | 16 | 16 | 15 | 15 | 15 | 14 | 14 | 14 | 8 3 |
| 51 | 24 | 23 | 23 | 22 | 22 | 21 | 20 | 20 | 19 | 19 | 18 | 18 | 18 | 17 | 17 | 16 | 16 | 16 | 15 | 15 | 15 | 14 | 14 | 14 | 14 | 8 0 |
| 50 | 23 | 23 | 22 | 22 | 21 | 21 | 20 | 20 | 19 | 19 | 18 | 18 | 17 | 17 | 17 | 16 | 16 | 15 | 15 | 15 | 14 | 14 | 14 | 14 | 13 | 7 12 |
| 49 | 23 | 22 | 22 | 21 | 21 | 20 | 20 | 19 | 19 | 18 | 18 | 17 | 17 | 17 | 16 | 16 | 15 | 15 | 15 | 14 | 14 | 14 | 14 | 13 | 13 | 7 10 |
| 48 | 23 | 22 | 21 | 21 | 20 | 20 | 19 | 19 | 18 | 18 | 17 | 17 | 17 | 16 | 16 | 15 | 15 | 15 | 14 | 14 | 14 | 14 | 13 | 13 | 13 | 7 8 |
| 47 | 22 | 21 | 21 | 20 | 20 | 19 | 19 | 18 | 18 | 17 | 17 | 17 | 16 | 16 | 16 | 15 | 15 | 15 | 14 | 14 | 14 | 13 | 13 | 13 | 12 | 7 6 |
| 46 | 22 | 21 | 20 | 20 | 19 | 19 | 18 | 18 | 18 | 17 | 17 | 16 | 16 | 16 | 15 | 15 | 15 | 14 | 14 | 14 | 13 | 13 | 13 | 12 | 12 | 7 3 |
| 45 | 21 | 21 | 20 | 19 | 19 | 18 | 18 | 18 | 17 | 17 | 16 | 16 | 16 | 15 | 15 | 15 | 14 | 14 | 14 | 13 | 13 | 13 | 12 | 12 | 12 | 7 1 |
| 44 | 21 | 20 | 20 | 19 | 19 | 18 | 18 | 17 | 17 | 16 | 16 | 16 | 15 | 15 | 15 | 14 | 14 | 14 | 13 | 13 | 13 | 12 | 12 | 12 | 12 | 6 13 |
| 43 | 20 | 20 | 19 | 19 | 18 | 18 | 17 | 17 | 16 | 16 | 16 | 15 | 15 | 15 | 14 | 14 | 14 | 13 | 13 | 13 | 12 | 12 | 12 | 12 | 11 | 6 11 |
| 42 | 20 | 19 | 19 | 18 | 18 | 17 | 17 | 16 | 16 | 16 | 15 | 15 | 15 | 14 | 14 | 14 | 13 | 13 | 13 | 12 | 12 | 12 | 12 | 11 | 11 | 6 9 |
| 41 | 19 | 19 | 18 | 18 | 17 | 17 | 16 | 16 | 16 | 15 | 15 | 15 | 14 | 14 | 14 | 13 | 13 | 13 | 12 | 12 | 12 | 12 | 11 | 11 | 11 | 6 6 |
| 40 | 19 | 18 | 18 | 17 | 17 | 16 | 16 | 16 | 15 | 15 | 15 | 14 | 14 | 14 | 13 | 13 | 13 | 12 | 12 | 12 | 12 | 11 | 11 | 11 | 11 | 6 4 |
| 39 | 18 | 18 | 17 | 17 | 16 | 16 | 16 | 15 | 15 | 15 | 14 | 14 | 13 | 13 | 13 | 13 | 12 | 12 | 12 | 12 | 11 | 11 | 11 | 11 | 10 | 6 2 |
| 38 | 18 | 17 | 17 | 16 | 16 | 16 | 15 | 15 | 14 | 14 | 14 | 13 | 13 | 13 | 13 | 12 | 12 | 12 | 11 | 11 | 11 | 11 | 11 | 10 | 10 | 6 0 |
| 37 | 17 | 17 | 16 | 16 | 16 | 15 | 15 | 14 | 14 | 14 | 13 | 13 | 13 | 13 | 12 | 12 | 12 | 11 | 11 | 11 | 11 | 10 | 10 | 10 | 10 | 5 12 |
| 36 | 17 | 16 | 16 | 16 | 15 | 15 | 14 | 14 | 14 | 13 | 13 | 13 | 12 | 12 | 12 | 12 | 11 | 11 | 11 | 11 | 10 | 10 | 10 | 10 | 10 | 5 9 |
| 35 | 16 | 16 | 16 | 15 | 15 | 14 | 14 | 14 | 13 | 13 | 13 | 12 | 12 | 12 | 12 | 11 | 11 | 11 | 11 | 10 | 10 | 10 | 10 | 9 | 9 | 5 7 |
| 34 | 16 | 16 | 15 | 15 | 14 | 14 | 14 | 13 | 13 | 13 | 12 | 12 | 12 | 11 | 11 | 11 | 11 | 10 | 10 | 10 | 10 | 10 | 9 | 9 | 9 | 5 5 |
| 33 | 15 | 15 | 15 | 14 | 14 | 14 | 13 | 13 | 13 | 12 | 12 | 12 | 11 | 11 | 11 | 11 | 10 | 10 | 10 | 10 | 10 | 9 | 9 | 9 | 9 | 5 3 |
| 32 | 15 | 15 | 14 | 14 | 13 | 13 | 13 | 13 | 12 | 12 | 12 | 11 | 11 | 11 | 11 | 10 | 10 | 10 | 10 | 9 | 9 | 9 | 9 | 9 | 9 | 5 1 |
| 31 | 15 | 14 | 14 | 13 | 13 | 13 | 12 | 12 | 12 | 12 | 11 | 11 | 11 | 10 | 10 | 10 | 10 | 10 | 9 | 9 | 9 | 9 | 9 | 8 | 8 | 4 12 |
| 30 | 14 | 14 | 13 | 13 | 13 | 12 | 12 | 12 | 11 | 11 | 11 | 11 | 10 | 10 | 10 | 10 | 9 | 9 | 9 | 9 | 9 | 8 | 8 | 8 | 8 | 4 10 |
| | 1.46 | 1.48 | 1.50 | 1.52 | 1.54 | 1.56 | 1.58 | 1.60 | 1.62 | 1.64 | 1.66 | 1.68 | 1.70 | 1.72 | 1.74 | 1.76 | 1.78 | 1.80 | 1.82 | 1.84 | 1.86 | 1.88 | 1.90 | 1.92 | 1.94 | |

**Height (m)**

Score 0 (obese)
Score 1
Score 2



Note : The black lines denote the exact cut off points (30,20 and 18.5 kg/m²), figures on the chart have been rounded to the nearest whole number.


Step 1
BMI score
+
Step 2
Weight loss score
+
Step 3
Acute disease effect score
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BMI kg/m²
Score
>20 (>30 Obese)
= 0
18.5-20
= 1
<18.5
= 2
Unplanned weight loss in past 3-6 months
%
Score
<5
= 0
5-10
= 1
>10
= 2
If patient is acutely ill and there has been or is likely to be no nutritional intake for >5 days
Score 2
If unable to obtain height and weight, see reverse for alternative measurements and use of subjective criteria
Acute disease effect is unlikely to apply outside hospital. See 'MUST' Explanatory Booklet for further information
Step 4
Overall risk of malnutrition
Add Scores together to calculate overall risk of malnutrition
Score 0 Low Risk Score 1 Medium Risk Score 2 or more High Risk
Step 5
Management guidelines
0
Low Risk
Routine clinical care
• Repeat screening
Hospital – weekly
Care Homes – monthly
Community – annually
for special groups
e.g. those >75 yrs
1
Medium Risk
Observe
• Document dietary intake for 3 days
• If adequate – little concern and repeat screening
• Hospital – weekly
• Care Home – at least monthly
• Community – at least every 2-3 months
• If inadequate – clinical concern – follow local policy, set goals, improve and increase overall nutritional intake, monitor and review care plan regularly
2 or more
High Risk
Treat*
• Refer to dietitian, Nutritional Support Team or implement local policy
• Set goals, improve and increase overall nutritional intake
• Monitor and review care plan
Hospital – weekly
Care Home – monthly Community – monthly
* Unless detrimental or no benefit is expected from nutritional support e.g. imminent death.
All risk categories:
• Treat underlying condition and provide help and advice on food choices, eating and drinking when necessary.
• Record malnutrition risk category.
• Record need for special diets and follow local policy.
Obesity:
• Record presence of obesity. For those with underlying conditions, these are generally controlled before the treatment of obesity.
Re-assess subjects identified at risk as they move through care settings
See The 'MUST' Explanatory Booklet for further details and The 'MUST' Report for supporting evidence.
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## Step 2 – Weight loss score

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Current weight

| kg | Score 0 Wt loss < 5% — Weight loss in last 3 to 6 months: Less than (kg) | Score 1 Wt loss 5 - 10% — Between (kg) | Score 2 Wt loss > 10% — More than (kg) |
|---|---|---|---|
| 30 | 1.6 | 1.6 - 3.3 | 3.3 |
| 31 | 1.6 | 1.6 - 3.4 | 3.4 |
| 32 | 1.7 | 1.7 - 3.6 | 3.6 |
| 33 | 1.7 | 1.7 - 3.7 | 3.7 |
| 34 | 1.8 | 1.8 - 3.8 | 3.8 |
| 35 | 1.8 | 1.8 - 3.9 | 3.9 |
| 36 | 1.9 | 1.9 - 4.0 | 4.0 |
| 37 | 1.9 | 1.9 - 4.1 | 4.1 |
| 38 | 2.0 | 2.0 - 4.2 | 4.2 |
| 39 | 2.1 | 2.1 - 4.3 | 4.3 |
| 40 | 2.1 | 2.1 - 4.4 | 4.4 |
| 41 | 2.2 | 2.2 - 4.6 | 4.6 |
| 42 | 2.2 | 2.2 - 4.7 | 4.7 |
| 43 | 2.3 | 2.3 - 4.8 | 4.8 |
| 44 | 2.3 | 2.3 - 4.9 | 4.9 |
| 45 | 2.4 | 2.4 - 5.0 | 5.0 |
| 46 | 2.4 | 2.4 - 5.1 | 5.1 |
| 47 | 2.5 | 2.5 - 5.2 | 5.2 |
| 48 | 2.5 | 2.5 - 5.3 | 5.3 |
| 49 | 2.6 | 2.6 - 5.4 | 5.4 |
| 50 | 2.6 | 2.6 - 5.6 | 5.6 |
| 51 | 2.7 | 2.7 - 5.7 | 5.7 |
| 52 | 2.7 | 2.7 - 5.8 | 5.8 |
| 53 | 2.8 | 2.8 - 5.9 | 5.9 |
| 54 | 2.8 | 2.8 - 6.0 | 6.0 |
| 55 | 2.9 | 2.9 - 6.1 | 6.1 |
| 56 | 2.9 | 2.9 - 6.2 | 6.2 |
| 57 | 3.0 | 3.0 - 6.3 | 6.3 |
| 58 | 3.1 | 3.1 - 6.4 | 6.4 |
| 59 | 3.1 | 3.1 - 6.6 | 6.6 |
| 60 | 3.2 | 3.2 - 6.7 | 6.7 |
| 61 | 3.2 | 3.2 - 6.8 | 6.8 |
| 62 | 3.3 | 3.3 - 6.9 | 6.9 |
| 63 | 3.3 | 3.3 - 7.0 | 7.0 |
| 64 | 3.4 | 3.4 - 7.1 | 7.1 |

| kg | Score 0 Wt loss < 5% — Weight loss in last 3 to 6 months: Less than (kg) | Score 1 Wt loss 5 - 10% — Between (kg) | Score 2 Wt loss > 10% — More than (kg) |
|---|---|---|---|
| 65 | 3.4 | 3.4 - 7.2 | 7.2 |
| 66 | 3.5 | 3.5 - 7.3 | 7.3 |
| 67 | 3.5 | 3.5 - 7.4 | 7.4 |
| 68 | 3.6 | 3.6 - 7.6 | 7.6 |
| 69 | 3.6 | 3.6 - 7.7 | 7.7 |
| 70 | 3.7 | 3.7 - 7.8 | 7.8 |
| 71 | 3.7 | 3.7 - 7.9 | 7.9 |
| 72 | 3.8 | 3.8 - 8.0 | 8.0 |
| 73 | 3.8 | 3.8 - 8.1 | 8.1 |
| 74 | 3.9 | 3.9 - 8.2 | 8.2 |
| 75 | 3.9 | 3.9 - 8.3 | 8.3 |
| 76 | 4.0 | 4.0 - 8.4 | 8.4 |
| 77 | 4.1 | 4.1 - 8.6 | 8.6 |
| 78 | 4.1 | 4.1 - 8.6 | 8.7 |
| 79 | 4.2 | 4.2 - 8.7 | 8.8 |
| 80 | 4.2 | 4.2 - 8.9 | 8.9 |
| 81 | 4.3 | 4.3 - 9.0 | 9.0 |
| 82 | 4.3 | 4.3 - 9.1 | 9.1 |
| 83 | 4.4 | 4.4 - 9.2 | 9.2 |
| 84 | 4.4 | 4.4 - 9.3 | 9.3 |
| 85 | 4.5 | 4.5 - 9.4 | 9.4 |
| 86 | 4.5 | 4.5 - 9.6 | 9.6 |
| 87 | 4.6 | 4.6 - 9.7 | 9.7 |
| 88 | 4.6 | 4.6 - 9.8 | 9.8 |
| 89 | 4.7 | 4.7 - 9.9 | 9.9 |
| 90 | 4.7 | 4.7 - 10.0 | 10.0 |
| 91 | 4.8 | 4.8 - 10.1 | 10.1 |
| 92 | 4.8 | 4.8 - 10.2 | 10.2 |
| 93 | 4.9 | 4.9 - 10.3 | 10.3 |
| 94 | 4.9 | 4.9 - 10.4 | 10.4 |
| 95 | 5.0 | 5.0 - 10.6 | 10.6 |
| 96 | 5.1 | 5.1 - 10.7 | 10.7 |
| 97 | 5.1 | 5.1 - 10.8 | 10.8 |
| 98 | 5.2 | 5.2 - 10.9 | 10.9 |
| 99 | 5.2 | 5.2 - 11.0 | 11.0 |

# Alternative measurements and considerations

BAPEN
www.bapen.org.uk

## Step 1: BMI (body mass index)

**If height cannot be measured**

- Use recently documented or self-reported height (if reliable and realistic).
- If the subject does not know or is unable to report their height, use one of the alternative measurements to estimate height (ulna, knee height or demispan).

## Step 2: Recent unplanned weight loss

If recent weight loss cannot be calculated, use self-reported weight loss (if reliable and realistic).

## Subjective criteria

If height, weight or BMI cannot be obtained, the following criteria which relate to them can assist your professional judgement of the subject's nutritional risk category. Please note, these criteria should be used collectively not separately as alternatives to steps 1 and 2 of 'MUST' and are not designed to assign a score. Mid upper arm circumference (MUAC) may be used to estimate BMI category in order to support your overall impression of the subject's nutritional risk.

**1. BMI**

- Clinical impression – thin, acceptable weight, overweight. Obvious wasting (very thin) and obesity (very overweight) can also be noted.

**2. Unplanned weight loss**

- Clothes and/or jewellery have become loose fitting (weight loss).
- History of decreased food intake, reduced appetite or swallowing problems over 3-6 months and underlying disease or psycho-social/physical disabilities likely to cause weight loss.

**3. Acute disease effect**

- Acutely ill and no nutritional intake or likelihood of no intake for more than 5 days.

Further details on taking alternative measurements, special circumstances and subjective criteria can be found in *The 'MUST' Explanatory Booklet*. A copy can be downloaded at www.bapen.org.uk or purchased from the BAPEN office. The full evidence-base for 'MUST' is contained in *The 'MUST' Report* and is also available for purchase from the BAPEN office.

BAPEN Office, Secure Hold Business Centre, Studley Road, Redditch, Worcs, B98 7LG. Tel: 01527 457 850. Fax: 01527 458 718. bapen@sovereignconference.co.uk BAPEN is registered charity number 1023927. www.bapen.org.uk

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Royal College of Nursing

THE BRITISH DIETETIC ASSOCIATION

© BAPEN. First published May 2003 by MAG the Malnutrition Advisory Group, a Standing Committee of BAPEN.
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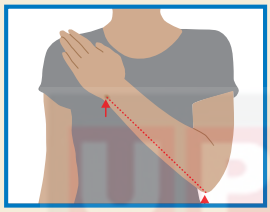
'MUST' is supported by the British Dietetic Association, the Royal College of Nursing and the Registered Nursing Home Association.

# Alternative measurements: instructions and tables

If height cannot be obtained, use length of forearm (ulna) to calculate height using tables below. *(See The 'MUST' Explanatory Booklet for details of other alternative measurements (knee height and demispan) that can also be used to estimate height).*

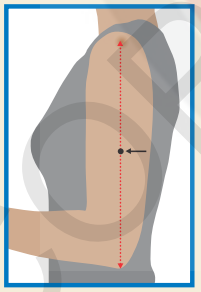
## Estimating height from ulna length



Measure between the point of the elbow (olecranon process) and the midpoint of the prominent bone of the wrist (styloid process) (left side if possible).

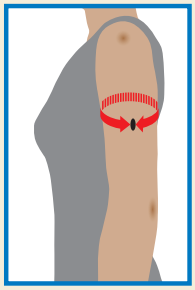
| | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Height (m) | men (<65 years) | 1.94 | 1.93 | 1.91 | 1.89 | 1.87 | 1.85 | 1.84 | 1.82 | 1.80 | 1.78 | 1.76 | 1.75 | 1.73 | 1.71 |
| | men (≥65 years) | 1.87 | 1.86 | 1.84 | 1.82 | 1.81 | 1.79 | 1.78 | 1.76 | 1.75 | 1.73 | 1.71 | 1.70 | 1.68 | 1.67 |
| | Ulna length (cm) | 32.0 | 31.5 | 31.0 | 30.5 | 30.0 | 29.5 | 29.0 | 28.5 | 28.0 | 27.5 | 27.0 | 26.5 | 26.0 | 25.5 |
| Height (m) | Women (<65 years) | 1.84 | 1.83 | 1.81 | 1.80 | 1.79 | 1.77 | 1.76 | 1.75 | 1.73 | 1.72 | 1.70 | 1.69 | 1.68 | 1.66 |
| | Women (≥65 years) | 1.84 | 1.83 | 1.81 | 1.79 | 1.78 | 1.76 | 1.75 | 1.73 | 1.71 | 1.70 | 1.68 | 1.66 | 1.65 | 1.63 |
| Height (m) | men (<65 years) | 1.69 | 1.67 | 1.66 | 1.64 | 1.62 | 1.60 | 1.58 | 1.57 | 1.55 | 1.53 | 1.51 | 1.49 | 1.48 | 1.46 |
| | men (≥65 years) | 1.65 | 1.63 | 1.62 | 1.60 | 1.59 | 1.57 | 1.56 | 1.54 | 1.52 | 1.51 | 1.49 | 1.48 | 1.46 | 1.45 |
| | Ulna length (cm) | 25.0 | 24.5 | 24.0 | 23.5 | 23.0 | 22.5 | 22.0 | 21.5 | 21.0 | 20.5 | 20.0 | 19.5 | 19.0 | 18.5 |
| Height (m) | Women (<65 years) | 1.65 | 1.63 | 1.62 | 1.61 | 1.59 | 1.58 | 1.56 | 1.55 | 1.54 | 1.52 | 1.51 | 1.50 | 1.48 | 1.47 |
| | Women (≥65 years) | 1.61 | 1.60 | 1.58 | 1.56 | 1.55 | 1.53 | 1.52 | 1.50 | 1.48 | 1.47 | 1.45 | 1.44 | 1.42 | 1.40 |

## Estimating BMI category from mid upper arm circumference (MUAC)



The subject's left arm should be bent at the elbow at a 90 degree angle, with the upper arm held parallel to the side of the body. Measure the distance between the bony protrusion on the shoulder (acromion) and the point of the elbow (olecranon process). Mark the mid-point.

Ask the subject to let arm hang loose and measure around the upper arm at the mid-point, making sure that the tape measure is snug but not tight.



If MUAC is <23.5 cm, BMI is likely to be <20 kg/m$^2$.
If MUAC is >32.0 cm, BMI is likely to be >30 kg/m$^2$.

The use of MUAC provides a general indication of BMI and is not designed to generate an actual score for use with 'MUST'. For further information on use of MUAC please refer to *The 'MUST' Explanatory Booklet.*

Appendix II: Ethical Approval of Medical Research & Ethics Committee (MREC)

**JAWATANKUASA ETIKA & PENYELIDIKAN PERUBATAN**
**(*Medical Research & Ethics Committee*)**
KEMENTERIAN KESIHATAN MALAYSIA
d/a Kompleks Institut Kesihatan Negara
Blok A, No 1, Jalan Setia Murni U13/52,
Seksyen U13, Bandar Setia Alam,
40170 Shah Alam, Selangor.
Tel: 03-3362 8888/8100/8205

Ref:(12)KKM/NIHSEC/ P18-1985
Date: 20-March-2019

**Dr Zalina Abu Zaid**
**UNIVERSITY PUTRA MALAYSIA (UPM)**

Dear Sir/ Mdm,

**ETHICS INITIAL APPROVAL:**

**NMRR-18-2625-43546 (IIR)**
**RESUBMISSION : Effectiveness of intensive perioperative nutrition therapy among adults undergoing surgery ( NMRR-18-459-40279 )**

This letter is made in reference to the above matter.

2. The Medical Research and Ethics Committee (MREC), Ministry of Health Malaysia (MOH) has provided ethical approval for this study. Please take note that all records and data are to be kept strictly **CONFIDENTIAL** and can only be used for the purpose of this study. All precautions are to be taken to maintain data confidentiality. Permission from the District Health officer/Hospital Administrator/ Hospital Director and all relevant heads of departments /units where the study will be carried out must be obtained prior to the study. You are required to follow and comply with their decision and all other relevant regulations, including the Access to the Biological Resources and Benefit Sharing Act 2017.

3. The investigators involved in this study are:

*HOSPITAL SERDANG*
Dr Zalina Abu Zaid (Principal Investigator)
Associate Prof. Dr Mohd Faisal Bin Jabar
Dr Barakatun Nisak Mohd Yusof
Dr Nyanamalar A/P Krishnan
Ms A'shah Zafirah binti Abdul A'zim

4. The following study documents have been received and reviewed with reference to the above study:

**Documents received and reviewed with reference to the above study:**

1. Study Proposal Version 1, dated 11 March 2019
2. Patient Information sheet & Informed Consent Form (English) Version 2, dated 11 March 2019
3. Patient Information sheet & Informed Consent Form (BM) Version 3, dated 11 March 2019
4. Questionnaire Version 4, dated 15 August 2018
5. Investigator's documents: IAHOD, CV, GCP certificate and COI declaration :

**JAWATANKUASA ETIKA & PENYELIDIKAN PERUBATAN**
**(*Medical Research & Ethics Committee*)**
KEMENTERIAN KESIHATAN MALAYSIA
d/a Kompleks Institut Kesihatan Negara
Blok A, No 1, Jalan Setia Murni U13/52,
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40170 Shah Alam, Selangor.
Tel: 03-3362 8888/8100/8205

Ruj.Kami:(11)KKM/NIHSEC/ P18-1985
Tarikh: 20-March-2019

**Dr Zalina Abu Zaid**
**UNIVERSITY PUTRA MALAYSIA (UPM)**

Dato'/ Tuan/ Puan,

**SURAT KELULUSAN ETIKA:**

**NMRR-18-2625-43546 (IIR)**
**RESUBMISSION : Effectiveness of intensive perioperative nutrition therapy among adults undergoing surgery ( NMRR-18-459-40279 )**

Dengan hormatnya perkara di atas adalah dirujuk.

2. Bersama dengan surat ini dilampirkan surat kelulusan saintifik dan etika bagi projek ini. Segala rekod dan data subjek adalah SULIT dan hanya digunakan untuk tujuan kajian dan semua isu serta prosedur mengenai *data confidentiality* mesti dipatuhi. Kebenaran daripada Pengarah Hospital/Institusi di mana kajian akan dijalankan mesti diperolehi terlebih dahulu sebelum kajian dijalankan. Dato'/ Tuan/ Puan perlu akur dan mematuhi keputusan tersebut dan undang-undang lain yang berkaitan, termasuklah Akta Akses Kepada Sumber Biologi dan Perkongsian Faedah 2017.

3. Penyelidik- penyelidik yang terlibat ialah:

*HOSPITAL SERDANG*
Dr Zalina Abu Zaid (Penyelidik Utama)
Associate Prof. Dr Mohd Faisal Bin Jabar
Dr Barakatun Nisak Mohd Yusof
Dr Nyanamalar A/P Krishnan
Ms A'shah Zafirah binti Abdul A'zim

4. Adalah dimaklumkan bahawa kelulusan ini adalah sah sehingga 19-Mac-2020. Tuan/Puan perlu menghantar dokumen-dokumen seperti berikut selepas mendapat kelulusan etika. Borang-borang berkaitan boleh dimuat turun daripada laman web Jawatakuasa Etika & Penyelidikan Perubatan (JEPP) (http://www.nih.gov.my/mrec).

i. ***Continuing Review Form*** selewat-lewatnya dalam tempoh 2 bulan (60 hari) sebelum tamat tempoh kelulusan ini bagi memperbaharui kelulusan etika.
ii. ***Study Final Report*** pada penghujung kajian.
iii. Mendapat kelulusan etika sekiranya terdapat pindaan ke atas sebarang dokumen kajian/ lokasi kajian/ penyelidik. Pihak JEPP mempunyai hak untuk menarik balik kelulusan etika sekiranya terdapat perubahan dokumen kajian yang tidak diisytiharkan.
iv. Kajian berkenaan intervensi klinikal sahaja: Laporan mengenai ***all Serious Adverse Events (SAEs), Suspected Unexpected Serious Adverse Reaction (SUSARs)*** dan ***Protocol Deviation/Violation*** di lokasi kajian yang diluluskan oleh JEPP jika berkenaan. *SAE* perlu dilaporkan dalam tempoh 15 hari kalender dari kesedaran kejadian (*awareness of event)* oleh

**MEMBERS OF THE MEDICAL RESEARCH & ETHICS COMMITTEE WHO ATTENDED THE MEETING ON 12th FEBRUARY 2019**

| No | NAME | GENDER | EXPERTISE | DESIGNATION/ AFFILIATION | ROLES | TICK (√) IF PRESENT |
|---|---|---|---|---|---|---|
| 1 | **MREC Chairperson** Dr. Salina binti Abdul Aziz | F | Psychiatry & Clinical Epidemiology | Hospital Kuala Lumpur | Medical member | √ |
| 2 | **Deputy Chairperson** Datin Dr Noriah bt Bidin | F | Public Health | Institute of Health Management | Medical member | √ |
| 3 | **MREC Secretary** Dr Lee Keng Yee | F | Bioethics/ Epidemiology | Clinical Research Centre | Secretary | √ |
| 4 | Dato' Dr Ong Loke Meng | M | Nephrology | Head, Clinical Research Centre, Hospital Pulau Pinang | Medical member | √ |
| 5 | Dr Goh Pik Pin | F | Ophthalmology | Director, Network of Clinical Research Centre | Medical member | X |
| 6 | Dr Sondi Sararaks | F | Public Health | Institute for Health System Research (MOH) | Medical member | X |
| 7 | Dr Hung Liang Choo | F | Paediatric Cardiology | Dept of Paediatrics Institute of Paediatrics, Hospital Kuala Lumpur | Medical member | √ |
| 8 | Dr Peter Gan Kim Soon | M | Law and Ethics | Hospital Ampuan Afzan, Kuantan | Medical member | √ |
| 9 | Dr Norharlina Bahar | F | Psychiatry | Dept. of Psychiatry, Selayang Hospital | Medical member | √ |
| 10 | Dr Kalaiarasu M. Peariasamy | M | Pediatric Dental | CRC, Sg Buloh Hospital | Medical member | √ |
| 11 | Dr Leong Huey Yin | F | Medical Member | Hospital Kuala Lumpur | Clinical genetics & | X |

| No | NAME | GENDER | EXPERTISE | DESIGNATION/ AFFILIATION | ROLES | TICK (√) IF PRESENT |
|---|---|---|---|---|---|---|
| | | | | | Paediatrics | |
| 12 | Dr Ho Tze Ming | M | Senior Researcher (Acarology) | Retired | Scientific member | √ |
| 13 | Ms Shahidah bt Mohamed Makki | F | Clinical Psychology | Dept of Psychiatry and Mental Health Kuala Lumpur Hospital | Scientific member | √ |
| 14 | Chew Chun Keat | M | Pharmacy | Clinical Research Centre, Ampang Hospital | Scientific member | √ |
| 15 | Pn Ching Shan Lii | F | Pharmacy | Dept. of Pharmacy, | Scientific member | √ |
| 16 | Dr Murizal Zainol | M | Molecular Pathology & Toxicology | Institute for Medical Research | Scientific member | √ |
| 17 | Ms Komathi Perialathan | F | Health Education | Institute of Health Systems Research | Scientific member | √ |
| 18 | Pn Teo Jau Shya | F | Clinical Data Management | ClinData Consult Sdn Bhd | Scientific member | X |
| 19 | Ms Amy Yu Bee Ling | F | Layperson | CEO Crest Evendz | Non-medical Non Scientific member | X |
| 20 | Pn Ooi Phak Hong | F | Layperson | - | Non-medical Non Scientific member | X |
| 21 | Pn Ong Mei Ching | F | Layperson | MaxStation Malaysia Sdn Bhd | Non-medical Non Scientific member | √ |
| 22 | Ms Tan Yi Wan | F | Layperson | - | Non-medical Non Scientific member | X |

| No | NAME | GENDER | EXPERTISE | DESIGNATION/ AFFILIATION | ROLES | TICK (√) IF PRESENT |
|---|---|---|---|---|---|---|
| 23 | Mr Yong Yoke Choon | M | Layperson | Max Family Society | - | √ |
| 24 | Dr Asyraf Syahmi Bin Mohd Noor | M | Medical officer | Secretariat of the National Institutes of Health | Secretariat of MREC | √ |
| 25 | En Nicholas Leow Chun Wei | M | Pharmacy | National Pharmaceutical Regulatory Agency | Independent Expert (Non-voting member) | X |

The MREC is constituted in compliance with ICH GCP and local regulatory requirements. Any member of the MREC who is involved in the study / project under review will not participate in the approval of the study / project

# 204282_Siti Nursyafiqah_Thesis_DTK

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