UNIVERSITY MOHAMMED V – RABAT
FACULTY OF MEDICINE AND PHARMACY OF RABAT

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PREVALENCE AND PROGNOSIS IMPACT OF MALNUTRITION IN ELDERLY OF AN ACUTE MEDICAL UNIT
- A prospective cohort study -

THESIS

Publicly submitted and defended On

BY

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الْمَغْضُوبِ عَلَيْهِمْ وَلاَ الضَّالِّينَ

وَوَصَّيْنَا الإِنْسَانَ بِوَالِدَيْهِ

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أَنِ اشْكُرْ لِي وَلِوَالِدَيْكَ إِلَيَّ الْمَصِيرُ

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عِلْمٌ فَلَا تُطِعْهُمَا وَصَاحِبْهُمَا فِي الدُّنْيَا مَعْرُوفاً وَاتَّبِعْ

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ABBREVIATIONS

ADL	Activities of Daily Living
AMD	Acute Medical Department
ASPEN	American Society for Parenteral and Enteral Nutrition
BADL	Barthel Index of Activities of Daily Life
BAPEN	British Association for Parenteral and Enteral Nutrition
BMI	Body Mass Index
CCI	Charlson Comorbidity Index
CGA	Comprehensive Geriatric Assessment
CI	Confidence Interval
CIRS	Cumulative Illness Rating Scale
ED	Emergency department
ENPA	Enquête nationale sur les personnes âgées (National Survey of Elderly Persons)
ENT	Ears Nose and throat
EQ-5D-3L	EuroQol 5 Dimensions 3 Levels
EQ-VAS	EuroQol Visual Analogue Scale
ESPEN	European Society for clinical Nutrition and Metabolism
ESS	Exton-Smith Scale
GCS	Glasgow Coma Scale
GOF	Goodness Of Fit
HAS	Haute Autorité de Santé
HCP	High Commission for Planning
HR	Hazard Ratio
HRQoL	Health Related Quality of Life
i.e.	That is
IADL	Instrumental Activities of Daily Life

ICU	Intensive Care Unit
LOS	Length Of Stay of hospitalisation
MAP	Mean Arterial Pressure
mmHg	Millimeter of Mercury
MMSE	Mini Mental State Examination
MNA	Mini-Nutritional Assessment
MNA-LF	Long-form of the Mini-Nutritional Assessment
MNA-SF	Short-form of the Mini-Nutritional Assessment
MPI	Multidimensional Prognostic Index
MUST	Malnutrition Universal Screening Tool
NRS-2002	Nutritional Risk Screening - 2002
SGA	Subjective Global Assessment
SPMSQ	Short Portable Mental Status Questionnaire
SPSS	Statistical Package for the Social Sciences
Vs.	Versus
WHO	World Health Organisation
WWLT	Withholding or Withdrawal of life-sustaining treatment
yo	Years old
χ2 test	Chi-squared test

INTRODUCTION

The world is witnessing an inevitable population ageing as the fertility rate is declining more and more and the life expectancy is rising.

According the World Health Organization (WHO) [1], the older population growth is expected to go from 605 million in 2002 to 1,2 billion in 2025, with almost 70% living in low-income countries and a great proportion of them being women (as their life expectancy is higher than men).

This phenomenon didn’t spare Moroccan population, which has motivated many investigations to assess and quantify this age profile changing, and study all the parameters involved in the health care and quality of life of elderly.

The demographic profile and its consequences in Morocco:

The High Commission for Planning (HCP) has conducted an investigation on the Moroccan elderly population and the demographic transition from 1960 to 2006.

Some results showed below [2]:

- A fertility declining
- A lower rate of youths (less than 15 years old)
- A raise in life expectancy: from 47 to 72 years old
- Elderly rate going: from 7,2% to 8,1%. And expected to reach 15,3% in 2030.
- Women life expectancy being higher than men's.

Figures below illustrate the evolution of the demographic profile of the Moroccan population through 54 years. (**Figure 1, Figure 2** and **Figure 3**)

Figure 1: Age distribution in Morocco - 1960

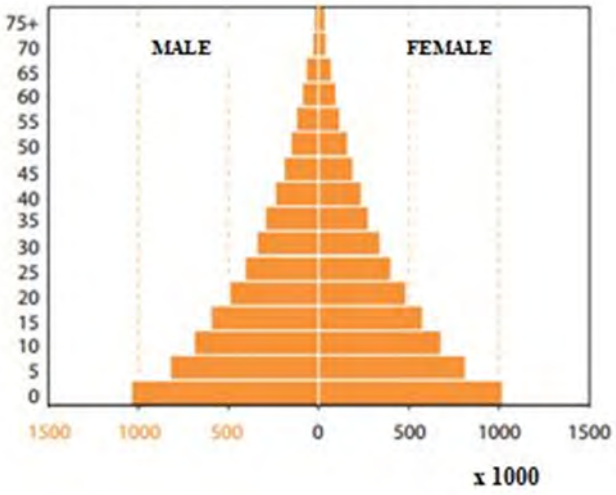


Figure from one of the reports of the Moroccan High Commission for Planning (HCP): **"Prospects – Morocco 2030"** [3]

Figure 2: Age distribution in Morocco - 2004

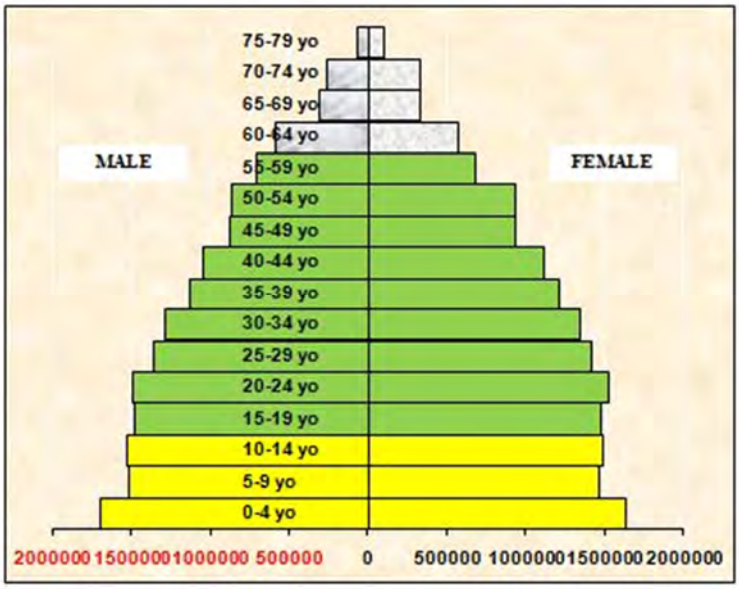


Figure from one of the reports of the Moroccan High Commission for Planning (HCP): **"General Population and Housing Census – 2014"** [4]

Figure 3: Age distribution in Morocco - 2014

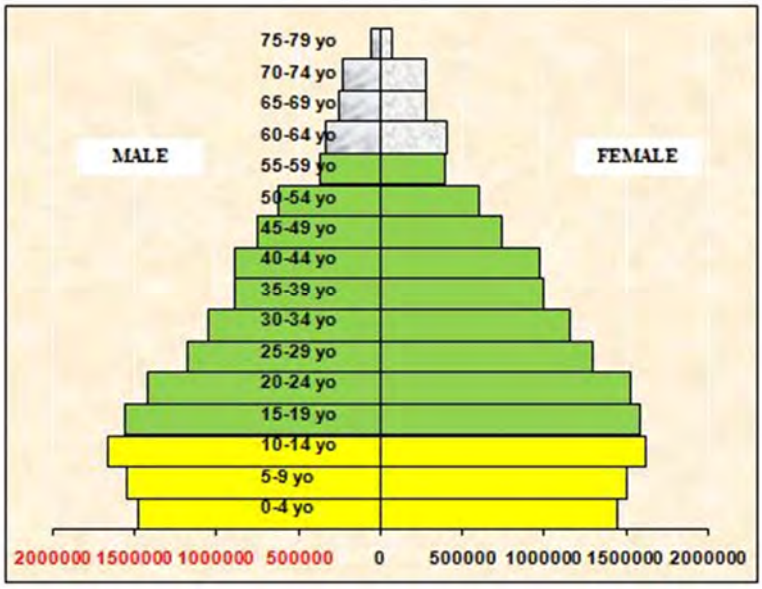


Figure from one of the reports of the Moroccan High Commission for Planning (HCP): "**General Population and Housing Census – 2014"** [4]

This population ageing comes with geriatric health issues:

- **58,9%** suffer from chronic disease.
- **30,7%** have a moderate or severe disability to accomplish daily tasks.
- **86,7%** of elderly have no social health care.
- **62,8%** of women and **55,1%** of men have no access to health care due to lack of material means.
- And a trend of elderly loneliness and social isolation, but the rate is still low thanks to complex households who keep **58,3%** of elderly [4].

In 2014, results have been updated by the general population and housing census [4]: showing **elderly rate (>or= 60 yo): reaching 9,6%, with 51% of women.**

Geriatrics issues are therefore becoming a challenge to the Moroccan health system since the elderly subjects have often complex medical history, despite their psychological and physical changing. This leads to a greater rate of those patients'

visits to medical facilities, and particularly Acute Medical Units as it is witnessed in many other countries [5].

Due to those medical issues, older patients' outcome, quality of life and mortality depend on many factors. Those factors have been studied by many researchers groups all over the world [6]. Among them, there is "the nutritional status" often neglected or misdiagnosed, and that is becoming an important health problem due to the phenomenon of aging in the world population [6].

To the best of our knowledge, no other Moroccan group of researchers has studied malnutrition of elderly in an Acute Medical Unit so far.

For this purpose, we decided to conduct a prospective cohort study in the Acute Medical Unit (AMU) of IBN SINA University hospital of Rabat, using the Mini Nutritional Assessment (MNA). We have set three leading objectives:

(1) To identify the characteristics of elderly in a Moroccan AMU and the prevalence of malnutrition among them.

(2) To compare Moroccan AMU elderly inpatients' characteristics according to their nutritional status.

(3) To analyze the prognosis impact of malnutrition on elderly in a Moroccan AMU.

REVIEW ARTICLES

Malnutrition is prevalent among older populations and even more in those hospitalized [7]. Several studies conducted either in geriatric institutions or in Acute Medical Units have proved that malnourished inpatients are more likely to have poor outcomes such as complications, longer length of stay or mortality. Some authors have also reported that many factors can predict which elderly inpatients are more predisposed to develop malnutrition (i.e. physical, psychical, socio-environmental and financial factors); those factors are detailed later in "**Pathophysiology and risk factors of malnutrition in elderly**:" section – page 29.

I. Definitions:

1. Elderly:

The retirement age has, by default, been considered as the definition of elderly in many countries [8]. Besides, "most developed world countries have accepted the chronological age of 65 years as a definition of elderly", but this wouldn't be applicable on developing countries (like in Africa), where the cut-off would preferably go from 50 to 65 years old depending on many factors [8]. According to the World Health Organization (W.H.O.) there is, so far, no United Nations standard numerical criterion to define an old person, but a cut-off of 60+ years have been agreed on by the U.N. [8], [9].

Additionally, elderly are subdivided by some authors into three age-groups depending on the comorbidities and disabilities of each group: the young-old (65–74 years), the old-old (75–84 years) and the oldest-old (85 years and over) [10].

2. Aging process:

Since 1950's Denham Harman has studied one of the theories defining Ageing process, then he came with the following definition in 2003 [11]:

"Aging is the progressive accumulation of diverse deleterious changes in cells and tissues with advancing age that increase the risk of disease and death".

But many other biological theories have been developed and as a result, there is no consensus, so far, about the explanation of the different phenomena of aging [12]. One thing is sure; the multiple theories may be complementary rather than contradictory as the aging is a multifactorial and complex process [13].

3. Anorexia, cachexia and sarcopenia: [14]

As the ageing process became a major area of interest especially when it comes to nutritional disorders, the ESPEN (European Society for clinical Nutrition and Metabolism) created the "Special Interest Group (SIG) nutrition in geriatrics" in 2006 after the creation of the "SIG on cachexia-anorexia in chronic wasting diseases" in 2005. Those 2 groups worked together on a consensus definition of many concepts related to nutritional disorders, and published a joint document in 2009.

a. Sarcopenia:

"The term sarcopenia is derived from the Greek words 'sarx' (flesh) and 'penia' (poverty). Sarcopenia is a condition characterized by loss of muscle mass and muscle strength.**"**

It can be the result of malnutrition, cachexia and/or disuse of the muscle; and it's called "Age-related sarcopenia" when it's associated with the aging process.

b. Disease-related (Secondary) anorexia:

Secondary anorexia is defined as a reduced desire to eat that accompanies chronic diseases.

c. Pre-cachexia:

"Pre-cachexia is defined based on the presence of all the following criteria:

(a) Underlying chronic disease
(b) Unintentional weight loss of 5% of usual body weight during the last 6 months
(c) Chronic or recurrent systemic inflammatory response
(d) Anorexia or anorexia-related symptoms**"**

d. Cachexia:

"The term cachexia is derived from the Greek words 'kakòs' (bad) and 'héxis' (condition). Cachexia may be defined as a multifactorial syndrome characterized by severe body weight, fat and muscle loss and increased protein catabolism due to underlying disease(s).**"**

In the ancient Greece, Hippocrates had noticed cachexia among diseased people and said :[15] *"The flesh is consumed and becomes water... the abdomen fills with water, the feet and legs swell, the shoulders, clavicles, chest and thighs melt away... This illness is fatal"*

Secondary cachexia is, therefore, related to a disease state or co-morbidities, while undernutrition (commonly referred to as malnutrition commonly by error) is primarily related to a low protein energy intake. But an overlap still exists between those 2 concepts.

4. Malnutrition:

Confounding “Malnutrition” with “Undernutrition” is a common error.

The **UNICEF** [16] defines Malnutrition as:

“A broad term commonly used as an alternative to undernutrition but technically it also refers to overnutrition.

- People are malnourished if their diet does not provide adequate calories and protein for growth and maintenance or they are unable to fully utilize the food they eat due to illness **(undernutrition).**
- They are also malnourished if they consume too many calories **(overnutrition).”**

The definition above has been completed by **Encyclopedia Britannica** as they define it as:

“Physical condition resulting either from a faulty or inadequate diet (i.e., a diet that does not supply normal quantities of all nutrients) or from a physical inability to absorb or metabolize nutrients, owing to disease” [17].

In **Merck Manuals** [18]**,** John E. Morley defines the “Protein-energy undernutrition (PEU)” previously called protein-energy malnutrition as:

“An energy deficit due to deficiency of all macronutrients. It commonly includes deficiencies of many micronutrients. PEU can be sudden and total (starvation) or gradual. Severity ranges from subclinical deficiencies to obvious wasting (with edema, hair loss, and skin atrophy) to starvation. Multiple organ systems are often impaired**”**

II. Specific characteristics of elderly:

Some characteristics of this special -and hard to define- population are to be reviewed, especially those related to the body changing through aging.

1. Anthropometric characteristics:

According to the **WHO expert committee on physical status**: "Anthropometry is the single most universally applicable, inexpensive and non-invasive method available to assess the size, the proportions and the composition of the human body" [19]

That's why they met in Geneva on November 1993 to set a report about "The use and interpretation of anthropometry" [19].

This same report has noted, at older age, a significant decline in **height** of approximately 1 – 2 cm or more per decade as a result of changes in the backbone, the muscle tone and the posture.

The **weight**, on the other side, shows a decrease with age too, but varies between men and women; men tend to decline in weight earlier and greater compared to women (women are predisposed to increase in fat mass after menopause). This weight loss is associated with reduced body water content and lean body mass (or cell mass, particularly muscle cells).

As a result of the fall in those 2 anthropometric parameters (Height and Weight), **BMI (Body mass index)** may remain constant, or even get higher in some cases if backbone changes are so important that height is strongly affected. A low BMI is mainly associated with an important weight loss.

By comparing data collected from many countries of different continents, the WHO expert committee noticed that all those parameters above clearly vary depending on ethnic groups.

2. Geriatric conditions:

Elderly have many other characteristics linked to their particular conditions. They are more likely to develop a group of health problems defined as “geriatric conditions” [6]. Those latter, according to B. M. Buurman et al., are mainly represented by a decreased ability to perform Activities of Daily Living (ADL), cognitive impairment, delirium, falls and malnutrition [6]; they are often accompanied by chronic diseases comorbidities and are assessed by the Comprehensive Geriatric Assessment (CGA). Many studies, conducted either on acutely hospitalized or free-living and institutionalized elderly (65+ yo), have reported that geriatric conditions have strong impact on functional decline and long-term mortality, during hospital stay or outside hospital [6], [20].

Given these geriatric conditions and the comorbidities often encountered in elderly, and their potential negative impact, this particular population is considered to be frail. Frailty has been defined by Qian-Li Xue from Johns Hopkins University as “A clinically recognizable state of increased vulnerability resulting from aging-associated decline in reserve and function across multiple physiologic systems such that the ability to cope with everyday or acute stressors is comprised” [21].

Therefore, those conditions have to be put in the center of geriatric health care management. That’s why several studies have been conducted to prove that early diagnosis of geriatric conditions using the CGA allows early intervention and better decision making which leads to better outcomes before and after discharge [22]–[24]

3. Geriatric diagnosis tool:

To remedy the issue of managing acutely hospitalized old inpatients with geriatric conditions, the work of Marjory Warren from United Kingdom during 1930's have led to a geriatric assessment that has been developed later to become the "Comprehensive Geriatric Assessment (CGA)" [25] . The latter is defined by the British Geriatrics Society [26] as "A multidimensional and usually interdisciplinary diagnostic process designed to determine a frail older person's medical conditions, mental health, functional capacity and social circumstances. The purpose is to plan and carry out a holistic plan for treatment, rehabilitation, support and long term follow up". Those different dimensions measured in CGA use many scales and tools (ADL and IADL for functional ability, MMSE and depression scales for the psychosocial health and MNA for the nutritional status).

4. Geriatric prognosis tool:

As the CGA has brought to light the multidimensional impairment of old inpatients, the team of A. Pilotto et al. went further and developed and validated, in 2008, the "Multidimensional Prognostic Index (MPI)" for 1 year mortality specific to **hospitalized elderly** [27]**.** The MPI was based on the CGA and includes clinical, functional, cognitive, nutritional and social parameters by using multiple existing validated tools (Activities of Daily Living (ADL), Instrumental Activities of Daily Living (IADL), Short Portable Mental Status Questionnaire (SPMSQ), Mini-nutritional Assessment (MNA), Exton-Smith Scale (ESS), Cumulative Illness Rating Scale (CIRS), medications, and co-habitation status).

To sum up, old inpatients are, therefore, very vulnerable to acute illnesses, frequently admitted to emergency departments (ED) (accounting for almost one quarter of ED visits) and hard to manage during their hospitalization [5]. Considering the complexity of the health status in this special population and its multiple dimensions, elderly are to be managed in highly specialized geriatric departments with adequate protocols applied by qualified health care professionals who are aware of this complexity.

III. Epidemiology of malnutrition in elderly:

Old people are considered to be highly affected by malnutrition problems due to the aging process and many other external factors. This puts “malnutrition” as a priority to take in consideration while managing old people in different care settings.

The prevalence of malnutrition can vary because of the absence of a Gold Standard tool to assess it, but MNA (Mini-nutritional assessment) has proven its reliability and relevance especially that it was specifically designed for elderly and officially became a part of CGA (Comprehensive Geriatric Assessment) [28].

So, according to the last and largest statistics available since 2010 given by M.J. Kaiser et al. [29] through their multinational study of malnutrition frequency using the MNA, 69% of old people worldwide were either malnourished old people or at risk of malnutrition (22,8% of malnourished).

Their proportion ranges from almost 40% to more than 90% depending on the healthcare settings with higher rates in hospitals and rehabilitation facilities [29], and the **Figure 4** below shows the detailed results of this multinational study.

Figure 4: Prevalence of malnutrition depending on the care settings

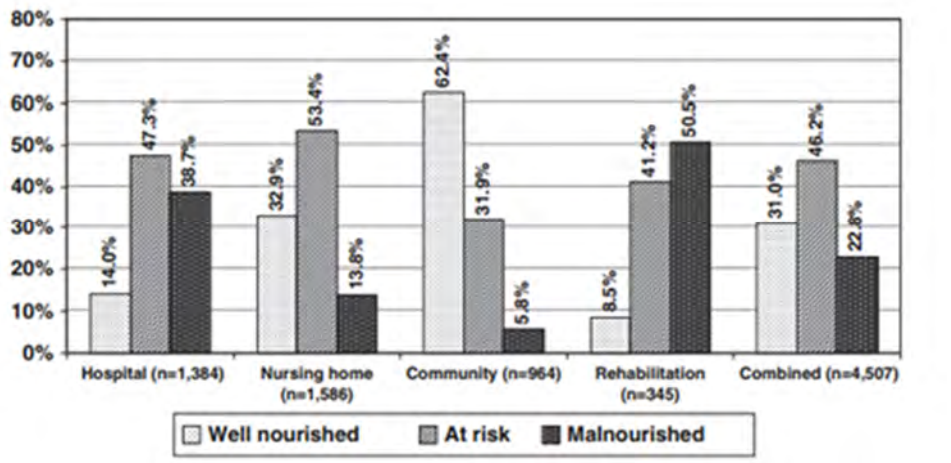


Figure from: **"Frequency of Malnutrition in Older Adults: A Multinational Perspective Using the Mini Nutritional Assessment"** By M.J. Kaiser et al. [29]

IV. Pathophysiology and risk factors of malnutrition in elderly:

As the person grows old, nutrient requirements change but the change of quality and quantity of food intake is often neglected, which causes inadequate nutrition that can subsequently turn into malnutrition. Furthermore, ageing process is responsible of many intrinsic changes and declines; likewise it predisposes to many diseases (mainly cancer and inflammatory diseases) that are related to malnutrition independently from age. Some of those changes are defined by a decrease of many biochemical parameters that are involved in nutrition such as proteins, lipids, minerals, vitamins and others [30]; the decrease in total body water due to disturbances of water and sodium regulatory systems (Thirst perception, renal function and hormonal systems) [31]; and the loss of free fat mass – *muscle, organ tissue, skin and bone* – that has also been reported in healthy old people [32].

Factors involved in the deterioration of food intake that leads to malnutrition can be subdivided into physiological, pathological and socio-economic [33].

1. Physiological factors:

Physiological changes in elderly (compared to younger subjects) are due to hormonal modulations and are represented by a decreased hunger and desire to eat postprandially, a slower emptying of solid and liquid gastric content and an autonomic nerve dysfunction. However, the orocecal transit time remains unchanged between the 2 groups (elderly and youths) [34]. This may be explained by hormones and neurotransmitters modulation associated with ageing. **Cholecystokinin** (CCK: a peptide hormone of the gastro-intestinal system) is part of the satiety signals along with other gastro-intestinal peptides (For e.g.: Glucagon, Glucagon-like peptide,

Apolipoprotein A-IV and Somatostatin) [35]. Nevertheless, high CCK levels have been found in elderly which may induce a low food intake [33]. **Leptin** and Insulin (adiposity hormones) are responsible of adiposity signals and indicator of total body fat; they interact with satiety signals and external factors to modulate the size of meals. Thus, Leptin may be responsible of increasing the efficacy of CCK consequently reducing the food intake, and this adiposity hormone has been proven as a factor of anorexia in old men because of an age-related drop in testosterone (a known Leptin inhibitor). Oppositely, in old women the Leptin tends to decrease [33], [35]. Another food modulator is the NO (Nitric oxide) which is behind adaptive relaxation of the fundus and the increase of appetite; and due to high sensitivity of elderly to NO inhibitor, its effect drops with age [33].

Figure 5: Alterations in stomach motility that leads to Cachexia of aging

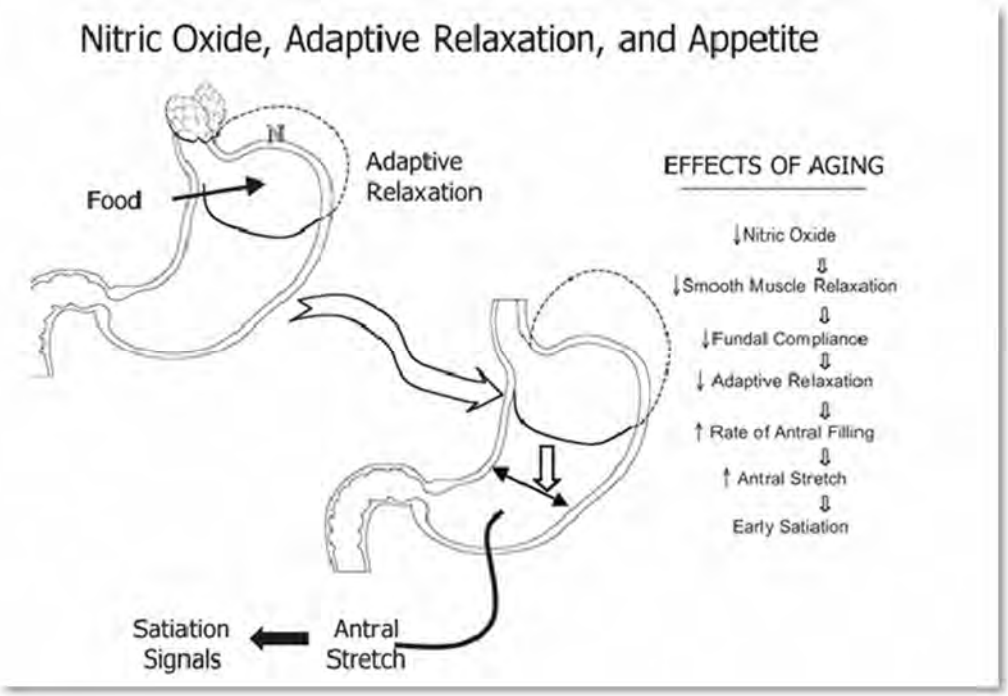


Figure from: **"Pathophysiology of Cachexia in the Elderly"** [36]

2. Pathological factors:

Pathological factors include acute and chronic inflammatory diseases, neuro-psychiatric illnesses, oro-dental disorders and dyspahgia.

a. Inflammatory diseases:

The inflammatory states magnified by the ageing process induce higher secretion than usual of many cytokines (e.g.: TNF-alpha, IL-1, IL-6). The latter are known to be involved in malnutrition and weight loss. High level of cytokines are behind **muscle protein breakdown** (hence, involuntary muscle loss: age-dependant sarcopenia) and **decreased serum albumin** to shift them into acute phase proteins. Moreover, cytokines play a role in **lipolysis**, **nitrogen loss** and **anorexia** by different mechanisms [33].

b. Psychological illnesses:

They are dominated by depression, a well-known cause of malnutrition in elderly. Those people at end of life are more likely to lose many landmarks in their lives (such as close people, health, jobs, financial comfort and daily activities) and most of them don’t make it through grief of their losses. Though, depressive syndromes are often neglected because of insidious manifestations and particularly when its only symptom is malnutrition.

Depressed elderly should therefore be controlled regularly not to miss food problems when they are still reversible [32], [37], [38].

c. Mechanical disorders:

Oro-dental disorders and dysphagia are mechanical obstacles to the feeding process (along with the muscle loss due to sarcopenia causing difficulties of handling

utensils, shopping and preparing meals). For example, D. Schlettwein-Gsell et al. [39] reported that edentulous with full prostheses or those with only natural teeth have less eating trouble than those without prostheses or with combination of natural teeth and prostheses.

3. Socio-economic factors:

When the financial comfort is lost, those people may skip meals in order to afford housing and medical care [38], which make poverty a relevant risk factor of malnutrition. But, the Human Development Report of 2015 by the United Nations Organization shows a decrease in global poverty seen in developing countries during the last 2 decades [40], which could be a good sign. On the other hand, the need of those old people to assistance at different stages of food intake (from shopping to eating) have motivated the creation of social programs; for example: Community meals such as “Meal-On-Wheels” program that consists of meal delivery for elderly to help them in their independency [39], [41].

See below **Table 1** that summarizes the risk factors of malnutrition that are age-related from the work of Carol Evans [38] and the Clinical Practice Guidelines of HAS [37].

Table 1: Age-related risk factors of malnutrition

Psycho-socio environmental factors	**Any acute disorder or decompensation of chronic disease**	**Long-term drug**
Social isolation (Lack of interaction with others - especially during meals)	Pain	Polymedication
Grieving	Infectious disease	Medication causing dryness of the mouth, dysgueusia, gastrointestinal disorders, anorexia, drowsiness, etc.
Emotionally stressful life events	Fracture causing a disability	
Financial difficulties		
Ill-treatment*	Surgery	
Hospitalisation	Severe constipation	
Change in lifestyle: admission to an institution	Pressure sores	Long-term corticosteroids
Oral and dental disorders	**Restrictive diets**	**Dementia and other neurological disorder**
Mastication disorders	Salt-free	Alzheimer's disease
Poor dental status	Slimming	Other forms of dementia
Poorly fitting dentures	Diabetic	Confusional syndrome
Dryness of the mouth	Cholesterol-lowering	Consciousness disorders
Oropharyngeal candidiasis	Long-term, residue-free	Parkinsonism
Dysgueusia		
Swallowing disorders	**Dependency in daily activities**	**Psychiatric disorders**
ENT disease (Dysphagia, …)	Eating dependency	Depressive syndromes
Degenerative or vascular neurological disorders	Dependency for mobility (though inability to shop for and/or prepare food)	Behavioral disorders
Physiologic factors		
Decreased taste	Decreased smell	Dysregulation if satiation
Delayed gastric emptying	Decreased gastric acid	Decreased lean body mass

* ill-treatment: to treat someone harshly and violently, or not treat them during their illness.

V. Assessment and screening tools of malnutrition:

Many methods have been developed to evaluate and diagnose nutritional status in order to study the prevalence of malnutrition, its predictive factors and how it can influence outcomes and evolution of patients.

Some of those methods have shown better results than others. As for serum albumin disorders, it was considered as a malnutrition marker but ended up being induced by inflammatory processes as well which makes it a confounding factor, therefore a none precise tool to diagnose malnutrition [42].

Consequently, we are going to focus on the most used and accurate assessment and screening tools (MNA, SGA, MNA-SF, NRS-2002, and MUST). Those latter have shown good results on different types of adult patients, like for example hospital inpatients, including acutely ill ones (except for MNA-SF, that is rather well accurate for elderly in community, sub-acute or residential aged care settings) [43].

The only limit for those nutrition tools for acute patients, especially in an intensive care unit, is the use of subjective parameters that are hard to obtain from that kind of patients. This makes tools that prioritize objective data to screen or assess the nutritional status more appropriate in those situations [44].

Screening and Assessing are 2 different notions we should understand before using the malnutrition tools.

Nutrition **screening**:

It is used to identify people **at risk of developing malnutrition** and who may need further investigations or assessment [45], [46] and a plan of nutrition support [47]. Screening tools are meant to be simple, quick, valid and reliable for the patient population [46]. Some of those validated tools are (they use almost the same parameters: BMI, recent weight or appetite loss, low food intake) [43]:

The Nutrition Risk Screening 2002 (NRS 2002)

The Malnutrition Universal Screening Tool (MUST)

The Mini-nutritional Assessment Short Form (MNA-SF)

Nutrition **assessment:**

It is a more detailed method based on objective and subjective elements combined and interpreted to make the **diagnosis** of malnutrition [45], [46]. Assessment is, therefore, the first step in the "Nutrition Care Process", the others steps are "Nutrition diagnostic" (Step 2), "Nutrition intervention" (Step 3), Nutrition Monitoring and Evaluation (Step 4) [46].

The most reliable tools are [43]:

The Subjective Global Assessment (SGA)

The Mini-nutritional Assessment long form (MNA)

1. The Subjective Global Assessment (SGA):

The SGA is a simple adult bedside non-numerical nutritional assessment tool based exclusively on clinical criteria and that was one of the first nutritional tools developed.

This assessment was first used for surgical patients [48] and then showed its validity in patients with cancer, on renal dialysis and in the ICU as well [49].

The limit of this assessment is that it's mostly based on subjective components that are hardly obtained from patients with critical illness which makes SGA less adapted to ICU inpatients [44].

The SGA is composed of 5 components of medical history:

Weight change - Dietary intake change (relative to normal) - Gastro-intestinal symptoms (nausea, vomiting, diarrhea, anorexia) - Functional capacity (whether or not there are changes in the ambulation and daily activities) - Metabolic demands of the patient's disease.

And 5 components of physical examination:

Loss of subcutaneous fat (triceps, chest) - Muscle wasting (quadriceps, deltoids) - Ankle edema - Sacral edema - Ascites.

The final result is estimated, subjectively by the examiner as it's a non-numerical assessment. It classifies patients into 3 groups, Well-nourished (A), Moderately malnourished (B), Severely malnourished (C) [50]. (Appendix 3 – page 150)

2. The Nutrition Risk Screening 2002 (NRS - 2002):

The NRS-2002 is a screening tool for undernutrition developed by the Danish Society for Parenteral and Enteral Nutrition with the participation of the 2 present authors: J. KONDRUP and H. HØJGAARD RASMUSSEN, and 2 others: M. Staun from the Department of Gastroenterology, Rigshospitalet, Copenhagen, and K. Ladefoged from the Department of Gastroenterology, Koege Hospital.

Then it has been validated by the ESPEN (European Society of Clinical Nutrition and Metabolism) as one of the screening tools used in hospitals for all kinds of inpatients [47], [51].

NRS-2002 aims to define whether or not the patient is at risk of: developing undernutrition or being undernourished, and indicate a possible food support if required.

This screening tool includes 2 principal parts: an “Initial screening” and a “Final screening”. The latter contains 2 components: the first one scores the “undernutrition severity” and the second one the “severity of the disease” considering that nutritional requirements increase with the severity of the disease. Those 2 components are sorted into 4 categories: Absent, Mild, Moderate, Severe corresponding to a score of 0, 1, 2 and 3 respectively. The maximum score that a patient can have for each component is 3 and the total varies from 0 to 6. Starting from Score = 3 the patient is considered at nutritional risk. An age-adjusted version has been validated given that elderly to have a free-fat mass loss with ageing. (Appendix 1 – page 146) [47], [51].

3. The Malnutrition Universal Screening Tools (MUST):

The MUST is a screening tool approved and recommended by ESPEN (along with NRS-2002) for hospitalized patients [47].

This tool is meant to detect or predict malnutrition (i.e. undernutrition, the risk of undernutrition or over-nutrition) [52]. It was initially developed for community (outpatients) and then got included in hospital adult inpatients evaluation with a good reliability [53], [54].

Therefore, it's now applicable for all care settings and groups of patients, and can be used by all medical professionals [52].

The MUST consists of 5 major steps; the first 3 steps include 3 criteria: BMI, Percentage of weight loss and Acute disease effect (causing or not a food intake stopping > 5days). The following step is to calculate the total score of the previous criteria. Final step is to set a nutrition care plan according to guidelines and local policy. If weight and height are impossible to obtain, making step 1 and 2 hard to obtain, there are Subjective alternatives to it [55]. (Appendix 2 – page 149)

4. The Mini-Nutritional Assessment Short Form (MNA-SF):

This screening tool has been developed in 2001 by L.Z. Rubenstein et al. to make the MNA easier and faster to take. The MNA long form (the following chapter « The Mini Nutritional Assessment long form ») has been validated worldwide for elderly with a high reliability but remains time consuming (10 – 15 minutes) compared to other nutrition tools [56], [57].

This has motivated L.Z. Rubenstein et al. to think of a MNA Short-form based on 6 items (BMI, Recent weight loss, Acute illness stress, Housebound, Dementia or depression, Appetite loss or eating difficulty) that are the most correlated with MNA-LF results. Therefore, MNA-SF is quicker to take (3 – 5 minutes) without losing the accuracy of the MNA. This Short Form maximum score is 14; it is now used as a screening tool of the risk of malnutrition and is a part of the MNA-LF that indicate for which patients the long form is going to get filled (if Score is 11 or less) [56]. (Appendix 4 – page 151)

5. The Mini-Nutritional Assessment long form (MNA):

The MNA is the nutritional assessment we chose to use in this study. It was designed at Toulouse (France) where was conducted the developmental study of MNA in 1991 by Bruno Vellas (Department of Geriatric Medicine, Toulouse University Hospital, France), Yves Guigoz (Researcher at the Nestlé Research Centre, Switzerland) and P.J. Garry (Clinical Nutrition Program, University of New Mexico - USA), then validated on 1993 [58]. Their objective was to develop a reliable, cheap and quick assessment for elderly [59].

In 2001, L.Z Rubenstein et al. designed a short form of the MNA, the MNA-SF [56] ("The Mini-Nutritional Assessment Short Form (MNA-SF)" – page 39)
It has also been translated into many languages, and 33 different language versions are now all available in the official website of MNA by Nestlé nutrition institute [60].
Furthermore, after its worldwide validation by the scientific community, MNA (a very reliable tool to assess nutritional status in elderly) became a part of the Comprehensive Geriatric Assessment (CGA) [61].
Since 2001, the MNA became a two-step nutrition tool: the first step is the MNA-SF with a maximum score of 14. If MNA-SF scores 11 or less (which means that there is a risk of malnutrition), the second step is performed to complete the full MNA and set the diagnostic of the protein-caloric malnutrition [59]. The MNA can, therefore, identify a drop of the nutrition intake at early stage, before the decrease of weight and albumin (previously considered as malnutrition markers but more related to the severity of the disease nowadays) and before clinical manifestations [62], [63]. It's a tool that can also guide the food support strategy (Appendix 5 – page 153); that's why

the earlier MNA is performed the better are the results of the nutrition care intervention [59].

The MNA-LF includes 18 items that we can categorize into 4 assessments:

- Anthropometric assessment with 4 items:
- Weight loss
- BMI
- Mid-arm circumference (MAC)
- Calf circumference (CC)

General assessment with 6 items related to lifestyle, medication and mobility:

- Mobility
- Psychological stress or acute disease
- Neuropsychological problems
- Lives independently or not
- Medication (number of drugs used)
- Pressure sores

Dietary assessment: with 6 items related to food habits:

- Decline in food intake
- Number of full meals
- Protein intake
- Fruit and/or vegetable consumption
- Fluid consumption
- Mode of feeding

Subjective assessment: with 2 items:

- Self-view of nutritional status
- Self-view of health status in comparison with people of same age

Six of these items constitute the MNA-SF; the rest is included in the assessment. The time needed to administrate is not more than 10 to 15 minutes [59]. For more details (Appendix 4 – page 151).

VI. Prognosis impact of malnutrition in elderly inpatients:

Malnutrition is an important clinical condition that is significantly associated with outcome of old patients in general, and acutely hospitalized ones in particular [6], [7], [64]–[68]. It became the center of interest in almost all studies dealing with elderly especially that it's a changing factor that can be controlled and improved with adequate nutritional intervention.

Mostly assessed by MNA, the deterioration of nutritional status in elderly (along with functional decline) was found to be a strong independent predictive factor of mortality during hospitalization and in short-term, mid-term and long term up to more than 2 years after discharge, particularly after an acute illness [7], [65], [66].

Many studies have also proven that malnutrition in elderly inpatients (or the risk of malnutrition) is highly associated with a longer hospital stay [7], [64], [68].

Moreover, according to some studies, the poor nutritional status has been associated with high rate of discharge to nursing homes or other wards for patients who were initially living at their own home and also with functional decline [64], [68], [69]. Functional decline is considered to be a risk factor and an indicator of malnutrition at the same time [70].

Table 2 below contains most important consequences of malnutrition as summarized by Y.P. Lim in her thesis [71].

Table 2: Common adverse clinical consequences of malnutrition

1.	Increased mortality
2.	Development of infections
3.	Decline in functional status
4.	Development of pressure ulcers
5.	Prolonged hospital stay
6.	Discharge to higher level of care
7.	Hospital readmissions
8.	Increased healthcare costs
9.	Reduced quality of life

VII. Food support:

The constant decrease of lean body is inevitable in elderly especially after 60 years old and even at constant body weight (less lean and more fat tissue) [72]. This constant decrease might be the reason why old patients have a frail nutritional status and are, therefore, susceptible to undernutrition but very responsive to nutritional support strategies [51].

Nutritional support is indicated for elderly patients who are malnourished or at risk of malnutrition based on the screening and assessment for malnutrition (seen previously) including those with severe diseases, as it's independently or in combination with undernutrition an indication for nutritional support [51]. The earlier nutritional support is started the more effective it is.

According to the HAS [37], the objective set for malnourished elderly is: an energy intake of **30 to 40kcal/kg/day** and a protein intake of **1.2 to 1.5 g of protein/kg/day.**

In the same guidelines, there are many methods to adopt for nutritional support; Oral nutrition, Enteral nutrition and Parenteral nutrition. In addition, some techniques are to be known to optimize oral nutrition in elderly and they are shown in **Table 3** below [73].

Table 3: Ways to optimize oral nutrition in elderly people

Problem	Solution
Loss of appetite	▪ Check medications: alter where possible to minimise adverse effects
	▪ Encourage "little and often" – three small meals with regular in-between snacks of energy rich, high protein foods. Encourage people to eat every three to three hours.
	▪ Maximise times of better appetite, e.g. if hungry in the morning suggest a cooked breakfast – eggs, baked beans, cheese on toast.
	▪ Serve meals and snacks that are appealing in size and appearance – large meals can be off putting, use small plates and maximise the "eye appeal" of the food.
	▪ Food has to be eaten to be of benefit – encourage the patient to select favourite foods that can be eaten at any time, e.g. cereal for supper, soup for breakfast.
	▪ Drinks can lessen appetite – suggest that drinks are taken after meals rather than before and during a meal.
	▪ Find ways to stimulate the appetite – a short walk before meals can be helpful.
	▪ Consider meal settings – make meal times enjoyable and avoid interruptions or rushing during meals.
Chewing problems	▪ Encourage adequate dental and mouth care.
	▪ Try soft foods that require little chewing – tender cuts of meat cooked in gravies are often more easily managed.
Swallowing difficulties	▪ Consider referral for speech language therapy assessment.
	▪ Modify the consistency of foods as appropriate

Table 4 (continued): Ways to optimize oral nutrition in elderly people

Problem	Solution
Fatigue or difficulty obtaining or preparing food	▪ Use convenience foods: frozen meals, canned items (soup, fruit, beans, fish) ready desserts (custard, yoghurt, rice pudding), snack bars, breakfast cereals.
	▪ Enlist family and carer support, consider Meals on Wheels*
	▪ Make the most of good days: prepare snacks and meals to eat later or to store in the freezer.
	▪ Fortify food with extra fats and sugar – add oil, butter, margarine, cream, cheese, dressings, sauces, sugar, honey and spreads to meals and snacks to boost energy intake.
Mobility problems	▪ Consider assessment by a physiotherapist or occupational therapist
	▪ Ensure shopping and food preparation assistance is available
Chronic pain	▪ Find and treat cause where possible – check analgesic use
Social isolation, depression	▪ Meals on wheels*; family, friends and social services
	▪ Check medication use, consider counseling

* **Meal on Wheels**: Is a social program that aims to help people disabled to prepare their own meals by delivering freshly prepared food (e.g.: Community Meals in Gloucestershire[74]).

That being said, nutritional support must be started very carefully depending on the situations. The right strategy is to start with 50% of the final nutrition objective (see above) and reach the full objective by 24-48 hours for severely ill patients, and after 2 days for those who have eaten little or nothing for 5 or more days [75]. The risk is to cause a “Re-feeding syndrome”.

“**Re-feeding syndrome** occurs when nutrition support is re-introduced too quickly after a period of significantly reduced intake or starvation. The subsequent change from fat to carbohydrate metabolism causes alterations in electrolyte levels, such as hypophosphatemia, hypokalemia and hypomagnesaemia. Thiamine levels may also be reduced.”[73]

Therefore, the subjects that are at risk of developing Re-feeding syndrome are those with [73]:

One or more of the following

- BMI less than 16 kg/m²
- Unintentional weight loss greater than 15% within the last three to six months
- Little or no nutritional intake for more than ten days
- Low levels of potassium, phosphate or magnesium prior to feeding

Two or more of the following:

- BMI less than 18.5 kg/m²
- Unintentional weight loss greater than 10% within the last three to six months
- Little or no nutritional intake for more than five days
- A history of alcohol misuse or taking medicines including insulin, chemotherapy, antacids or diuretics

MATERIAL

AND

METHODS

I. Data collection:

Data were collected using face to face patient questionnaire and medical files, then during the post-discharge follow-up period by phone calls.

1. Type of the study:

This was a prospective cohort study based on a survey.

2. Study setting:

This study was conducted in a Moroccan Acute Medical Unit (AMU). This was a survey of patients conducted in an acute medicine department of Rabat University Hospital. The unit admits approximately 950 patients annually with an average age of 40 years. Patients are admitted mainly from the emergency unit.

The service comprises 5 single rooms and 4 common rooms (6 beds per room) and admits patients exhibiting different medical illnesses.

The study was approved by the local ethics committee and informed consent was obtained from all patients.

3. Inclusion Criteria:

The study was conducted among patients aged of 65 years old and more consecutively admitted to AMU during study period.

4. Exclusion Criteria:

Were excluded the patients with serious physical or mental pathologies, such as terminal diseases and psychosis that could make the comprehension and completion of the questionnaire difficult.

5. Study period:

The study included elderly patients admitted to the AMU between June and September 2014. Then the follow-up period of all subjects, at 180 days and 540 days from discharge, ended up on April 2016.

II. Patients' characteristics:

1. Socio-demographic and anthropometric characteristics:

a. Age: 65 years old and older

b. Gender: Male and Female

c. Body mass index: Calculated using the formula: Weight/(Height)^2 and expressed in **Kg/m^2**

d. Marital status: Married and Unmarried subjects. The unmarried include: Single, divorced or widowed patients.

e. Distance hospital-residence: Expressing how far does the patient lives from the hospital in Kilometers.

f. Educational level: Whether the patient has been at school (primary school, middle school, high school or college) or never.

g. Phone number: For each patient, we collected 1 to 3 phone numbers.

2. Comorbid diseases:

a. Cardio-vascular diseases: Whether the patient has a history of cardio-vascular disease or not (Cardiac failure, Arrhythmia, High Blood Pressure, Valvulopathy, History of heart attack, Stroke)

b. Diabetes: Whether the patient has a diabetes or not

c. Other chronic diseases: Whether the patient has a chronic disease or not. We considered, in this parameter, those following chronic diseases:

- Chronic renal failure
- Neoplasia
- Chronic respiratory failure

d. Undiagnosed dyspnea: Whether the patient has or not a history of a dyspnea that is not clearly documented.

e. Charlson Comorbidity Index (CCI): Based on "The International Classification of Diseases (ICD)" the Charlson Comorbidity Index has been developed to classify and weight the patients' comorbidities allowing a prediction of the outcome and/or mortality risk [76]. It was first developed in 1987 by Charlson et al. [77]. In 1994 they updated the CCI by combining the age in the index [78]. In 2010, Quan et al. readjusted the comorbidity conditions and reweighted them to keep only 12 items instead of 19 in the previous index [79]. In our study, we used the age-adjusted CCI version of 1994 with 19 comorbidities. (Appendix 6 – page 154)

The more the patient has comorbidities the more the CCI goes up.

3. Clinical characteristics at admission to the AMU:

a. Consciousness disorder: Whether the patient had a GCS < or = to 14

~ Glasgow coma scale (GCS):

GCS is a neurological scale used to assess the impairment of consciousness depending on the response to different stimuli [80]. (Appendix 7 – page 156)

b. Shock: Whether or not the patient presented a shock; it's an acute hypotension that the fluid loading has failed to restore, requiring, therefore, the introduction of vasopressors. It results in many signs such as: cool extremities and/or marbling

c. Respiratory distress: Whether or not the patient a respiratory distress; it's a critical lung condition leading to a respiratory insufficiency resulting in signs such as: Cyanosis (reflecting hypoxia refractory to oxygen therapy), paradoxical breathing and/or indrawing

d. Mean arterial pressure: The average blood pressure of the patient **in mmHg.** It's calculated from the systolic and the diastolic blood pressures using the following formula: **(2*DBP + SBP)/3**.

DBP: Diastolic blood pressure

SBP: Systolic blood pressure

e. **Heart rate:** The heart rate of the patient by **Beats per minute.**

f. **Respiratory rate:** The respiratory rate of the patient by **Breaths per minute.**

4. Evolution characteristics during hospitalization:

a. **Intensive care unit (ICU) transit:** Whether the patient has been in an ICU right before the AMU admission or during his AMU stay or has been transferred to an ICU after the AMU discharge.

b. **Length of stay in the AMU:** The length of stay of the patient in the AMU (**in days**)

c. **Length of stay in the Hospital:** The total length of stay of the patient in the hospital (**in days**)

5. Prognosis characteristics: Mortality

The mortality in hospital, at 6 months and 18 months were collected by telephone follow-up.

a. **Mortality in the AMU:**

Includes patients who died during their AMU stay

b. **In-hospital mortality:**

Includes patients who died during their hospital stay, either in AMU or after transfer to another ward

c. Mortality at 180 days follow-up:

Includes all patients who were dead during the period from the "AMU stay" to "180 days' follow-up"

d. Mortality at 540 days follow-up:

Includes all patients who were dead during the period from "the AMU stay" to "540 days' follow-up"

6. Instruments:

To assess the autonomy in daily activities, the quality of life and the nutritional status, we used 3 instruments (questionnaires):

- **KATZ index of ADL** for the autonomy in daily activities
- **EuroQol-5D-3L** for the Quality of Life (QoL).
- **Mini-Nutritional Assessment long form** for the nutritional status

Those 3 instruments were filled during the face to face interview:

~ First we propose to the patient to fill the questionnaires.

~ When they are not able to fill it because they have a very low educational level and/or suffer from blindness, it's up to us to ask oral questions and fill it.

~ When the patient is suffering from confusion/dementia/psychosis or deafness with impossibility to communicate, the questionnaires are not filled and we notify it.

a. KATZ index of independence in (ADL) Activities of Daily Living:

Katz index is an instrument of assessing the ability to be independent in daily self-care activities (Bathing, Dressing, Toileting, Transferring, Fecal and urinary continence, Feeding). It has been developed and validated by Dr. Sidney KATZ et al. in 1963 to evaluate the result of the treatment and the prognosis of chronically ill elderly [81].

In our study, this index was filled from the patients' answers and/or their families' to evaluate the ADL:

- Before acute illness
- At admission to AMU

A decrease of 1 point or more in the KATZ index of the ADL was considered as a functional decline [82].

We used the French version (Appendix 8 – page 157) [83], but the questions were asked in Moroccan dialectal Arabic.

b. EQ-5D-3L: [84][85]

EuroQol 5 dimensions 3 levels (EQ-5D-3L) version is a standardized instrument used to evaluate health or functional status of the patients. This tool has been developed in 1990 by "EuroQol Group" initially founded in 1987 by European researchers and who became, nowadays, an international and multidisciplinary group.

EQ-5D is already available in a consented, reliable and valid Moroccan Arabic version. This version was adapted from the United Arab Emirates Arabic version using EuroQol group guidelines and input. (Appendix 9 – page 159)

We administered the EQ-5D-3L and EQ-VAS at the moment of admission to evaluate the QoL **before acute illness**; when the patient is unable to fill it himself (blind, illiterate or very tired), we ask the questions orally and fill it.

~ **EQ-5D Index :**

EQ-5D is the first part of the EuroQol, “Self classifier”, consists in 5 dimensions describing the health state:

1. Mobility
2. Self-care
3. Usual activities
4. Pain/Discomfort
5. Anxiety/Depression

For each item there are 3 possible responses given by the respondent to indicate the level of severity that best describes their personal health status before acute illness:

(1) No problems
(2) Some problems
(3) Unable to do/Extreme problems

The subject's global health state is finally defined as the combination of the level of problems described for each of the 5 dimensions contained in the EQ-5D. Therefore, it classifies a respondent’s health status into one of 243 health states. Each health state can be assigned a weighted utility score based on different scoring systems. The unweighted scoring rule based solely on answers provided by subjects to the descriptive system. The values are ranging from -0.59 (the lowest level on each dimension) to 1 (The highest level on each dimension). Negative values indicate that some health states are valued worse than death.

~ **EuroQol-Visual Analogue Scale:**

The EQ-VAS is the second part of the EuroQol. It's represented by a vertical line (comparable to a 20cm thermometer) graduated from 0% to 100%, as 0% is *"the worst imaginable health state"* and 100% is *"the best imaginable health state"*. This 2nd part is filled by asking the patient to rate their health status on a scale from 0% to 100%.

c. MNA-LF:[7]

As we can see in the literature, many tools have been developed to assess or screen malnutrition (page 34). The Subjective Geriatric Assessment and the Mini-Nutritional Assessment are the two best tools to use for acute hospitalized old patients [86].

We chose to use the MNA for malnutrition diagnosis in our study population because it was developed exclusively for elderly (hospitalized - acute or long term -, Institutionalized and those living in community) [87]. Additionally, it's easy to administer, it needs no paraclinical parameters and it has proven a high reliability in assessing the nutritional status of elderly in acute illness [43], [61].

The MNA-LF comprises 2 parts. The first is the screening part (MNA-SF), its maximum score is 14. When it scores 11 or less, it's an indication to complete the long form part (second part) of the MNA-LF to confirm or reverse malnutrition or the risk of malnutrition diagnosis. (Appendix 4 – page 151)

The summary scores of the MNA-LF distinguish between 3 nutritional statuses:

- **Malnourished patients:** less than 17 points
- **Patients at risk of malnutrition**: from 17 to 23,5 points
- **Patients with normal nutritional status:** from 24 to 30 points

As we previously said the MNA-LF (Appendix 4) contains 18 items and has a maximum final score of 30 points resulting from addition of 4 main sub-scores:

- **Anthropometric assessment** (or Anthropometric measurement): 4 items
- **General assessment** (or Global evaluation): 6 items
- **Dietary assessment** (or Assessment of dietetic habits): 6 items
- **Subjective assessment** (or Subjective assessment of self-perceived quality of health and nutrition): 2 items

The valid Arabic version of MNA is available and was used in this study [60]. (Appendix 4 – page 151).

III. Statistical analyses methods:

Of the 95 participants included in the analysis, missing information on all data was 8.1%. To use all the data from the 95 participants and test whether missingness (assuming that these values were missing at random) [88] influenced the results, we carried out multivariate imputation by chained equations that included all 29 conventional predictors**.** We created 5 imputed datasets and fitted each model separately on each. Results from the analysis of each imputed dataset were combined with Rubin's rules [89].

Continuous variables are expressed as mean ± standard deviation (SD) or as median ± interquartile range value.
Normality of data distribution was evaluated using the Kolmogorov-Smirnov test.
Categorical variables are expressed as frequency and percentage and compared by use of $\chi 2$ test. Comparison was made between participants based on three groups according to the nutritional status "well-nourished patients"; "at risk of malnutrition patients" and "malnourished patients" using $\chi 2$ test (for categorical variables), one way ANOVA (for continuous normally distributed variables), or the Kruskal–Wallis one-way analysis of variance test (for continuous, non-normally distributed variables).
Differences in survival were illustrated using Kaplan-Meier curves based on three groups nutritional status and assessed using the log-rank test.

Having in mind the main aim of our model (assess the effect of a nutritional status, adjusting for some established factors in a multivariable model) we selected a pool of variables representing known factors affecting the outcome [90]. Using parsimonious criteria and taking into account the study sample size, 4 potentially

prognostic independent variables have been selected (at least 10 patients were available for each prognostic factor tested). Parsimonious selection criteria were used to avoid overfitting bias. The Cox proportional hazards univariate analysis was used to identify the factors associated with mortality at 18 months after discharge from AMU. We set the significance level for variable selection at $p \leq 0.05$.

Multivariable model incorporating 4 conventional risks variables was calculated with Cox proportional hazards regression analysis. Predictors of mortality were developed by using, first; the conventional risk variables in the multivariable Cox model and then adding nutritional status. Hence, model with conventional risk variables (model 1) was compared to model with conventional risk variables and nutritional status (model 2). Non-linearity of the variables was checked visually by plotting the martingale residuals and statistically by using a Wald test. There was no evidence of non-linearity [91]. The proportional hazards assumption was tested and was not violated in any model. Also, colinearity was tested; and none was found between the independent variables.

We assessed the predictive performance of the regression model by examining measures of calibration, discrimination, and internal validity.

Calibration [92] verifies the concordance between the observed survival (Kaplan Meier) and the survival estimated with the Cox model in risk groups of the studied population using Goodness of fit assessment. We accomplished goodness of fit assessment with the Gronnesby-Borgan goodness-of-fit statistic based on the likelihood ratio [93]. Four contiguous strata of the prognostic index (the linear combination of the factors with their Cox coefficients) identify the risk groups. Non-significant test indicates good calibration.

Discrimination refers to how likely the model is to allocate higher predicted outcome to malnourished patients and lower predicted to well-nourished. For each model we obtained estimates of Harrell's concordance index (with 95% confidence intervals, calculated by jackknife method) using the method described by Newson [94]. A C index of 1.0 indicates perfect prediction of the order of failure, whereas a C-index of 0.5 is achieved purely by chance. Inference regarding improvement of the models incorporating outcome variables compared with the conventional risk model was undertaken by estimating the difference (and 95% confidence interval) in the concordance statistics. We also calculated Royston and Sauerbrei's index of discrimination (D) and optimism corrected D (D adjusted) to assess prognostic separation, and we used a measure of the explained variance in the natural scale of the Cox model (R2) [95].

To correct for optimism bias in the C statistic value (that is, over-fitting to a specific sample), Internal bootstrap validation, bias corrected 95% confidence intervals for hazard ratios in the final model, and bootstrap optimism corrected c-index were calculated using 100 re-samples [96].

We also performed integrated discrimination improvement (IDI) [95] and category free (Continuous) net Reclassification Improvement (cfNRI) [97] analyses to investigate the enhancement of a clinical model by the addition of nutritional status variables and to further assess model performance. The net reclassification improvement index assesses correctness of reclassification (for example, up for events and down for non-events) into different risk categories. The integrated discrimination improvement index is a continuous measure that can be interpreted as the improvement in average sensitivity minus the change in average (1−specificity). For

the net reclassification improvement index and integrated discrimination improvement index values above zero indicate improved risk classification with the addition of the new variable(s).

Traditional measures such as the c-statistic have limited value in clinical practice for decisions that result from using a prediction model. Therefore it is possible that no effect on the c-statistics is observed, but it can be of clinical relevance for prediction models [98].

To explore clinical utility, we performed a decision curve analysis [99]. This analysis allowed us to assess whether using a prognostic model to screen patients could be a superior decision-making approach to outcome, we used the theoretical relation between the threshold probability of disease and the relative value of false positive and false negative results to ascertain the value of the various prediction models (decision curve analyses), accounting for censored observations [100]. The net benefit is the difference in proportions of true positives and false positives when false positives are weighted by the odds of the selected cutoff

In the net benefit assessment, the adverse effects are incorporated. This means that a weight for detecting true positives versus false positives is taken into account reflected by the decision threshold.

To assess the incremental value of nutritional status, the net benefit (demonstrated on the y-axis) of the model should be higher compared to the model without the nutritional status. If decision curves are completely overlapping there is no incremental value, making the simplest model preferable. If there is incremental value of a marker

the decision curves for the two models would show divergence. If the model with the nutritional status shows divergence compared to the model without the nutritional status, it depends on the decision threshold whether this is of clinical relevance. If a false positive result is not harmful (e.g. decision threshold of 10%), and the models with and without the marker show divergence for decision thresholds of 30%, the model with the marker is not necessarily better.

Statistical analyses were carried out in SPSS Statistics for Windows version 20.0 (IBM Corp) and STATA version 14 (Stata Corp, College Station, TX). All probabilities were two tailed, and significance was set at $p \leq 0.05$. We adhered to the TRIPOD statement for reporting [101]

RESULTS

AND

ANALYSIS

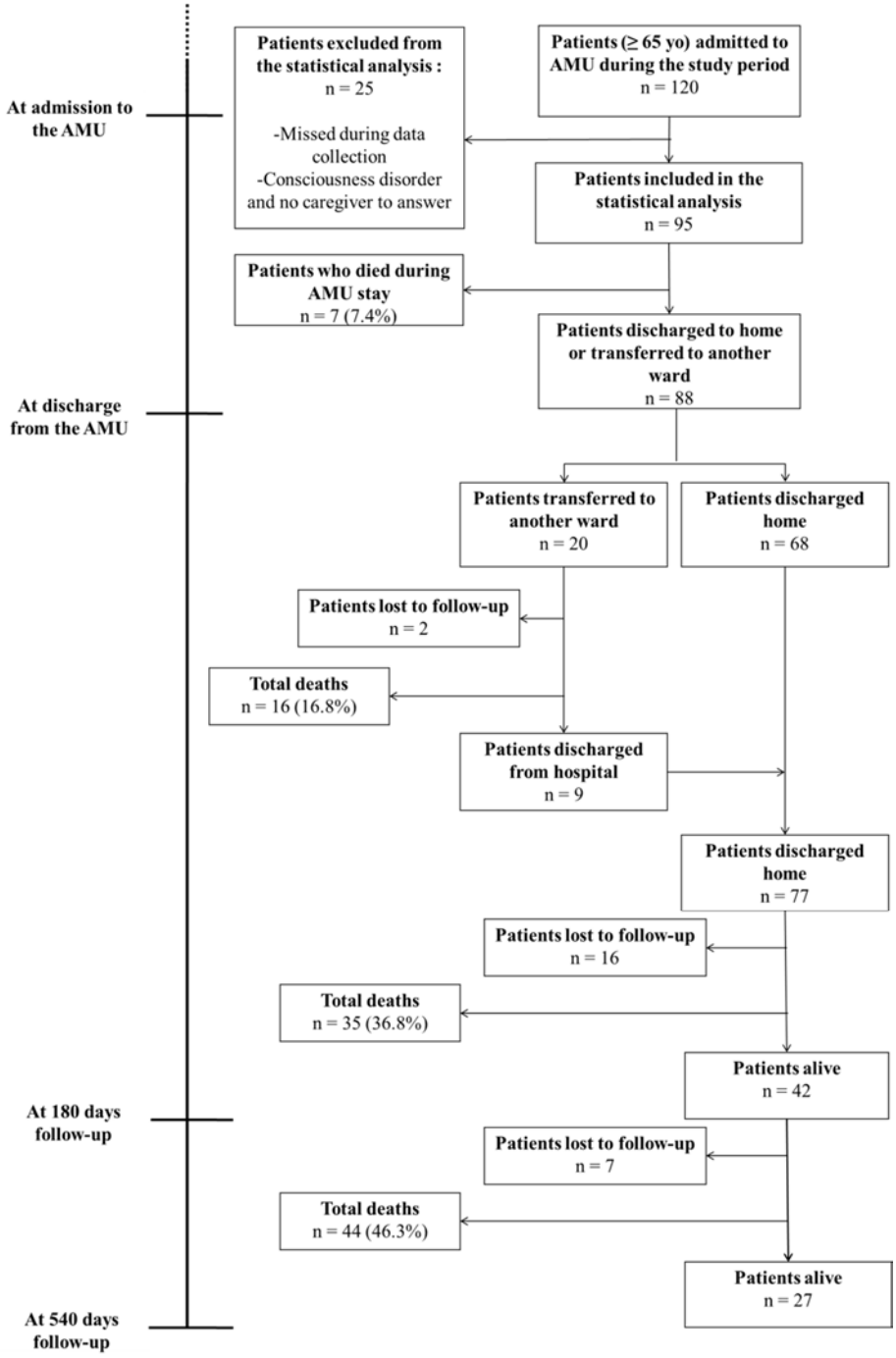
I. Descriptive analysis:

Characteristics of elderly inpatients:

1. The time-related patient flow chart:

Figure 6 below shows in detail the evolution of the study sample through time (from admission to the AMU to the end of the follow-up period).

Figure 6: Patients time related flow-chart

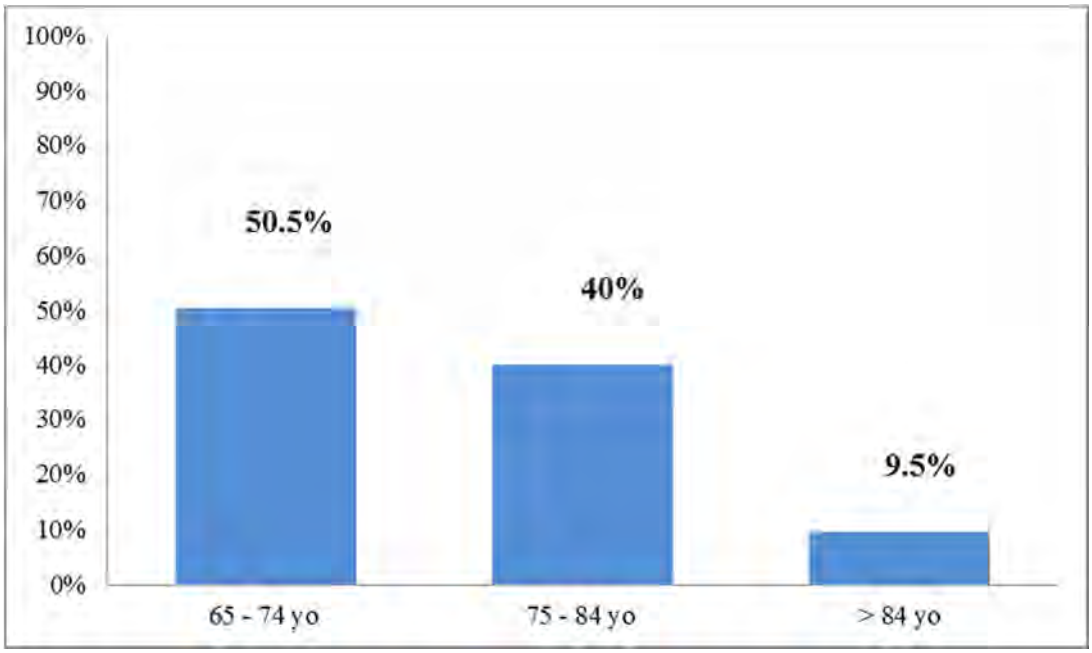


2. Socio-demographic and anthropometric characteristics:

a. Age:

The mean age of the study population was 75 ± 5.9 years old

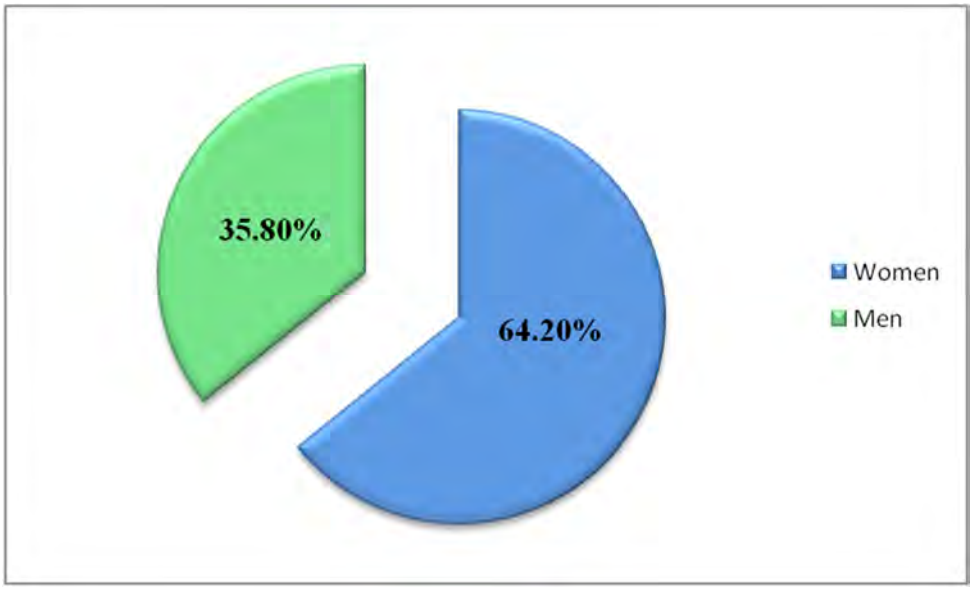
Figure 7: Age distribution of the study population



b. Gender:

In this study population there were 61 women Vs. only 34 men.

Figure 8: Gender distribution of the study population

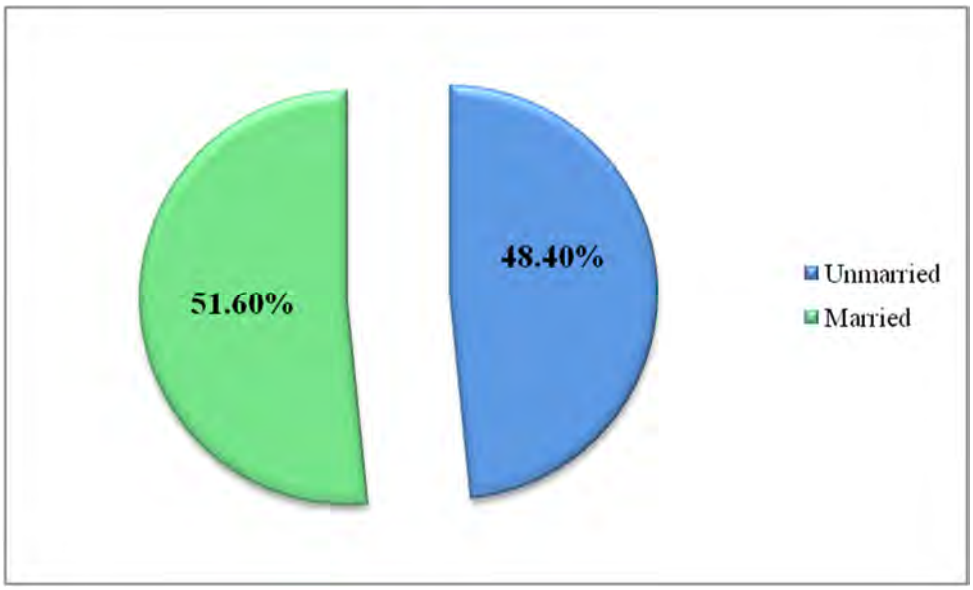


c. Body mass index:

The mean body mass index was 27.1 ± 5.7 kg/m² with a maximum of 43.9 kg/m² and a minimum of 8.9 kg/m²

d. Marital status:

Figure 9: The marital status of the study population



e. Distance hospital-residence (Km):

Half of the subjects were living at 13 Km or less from the hospital.

f. Educational level:

In this study population 89.5% of the subjects were illiterate

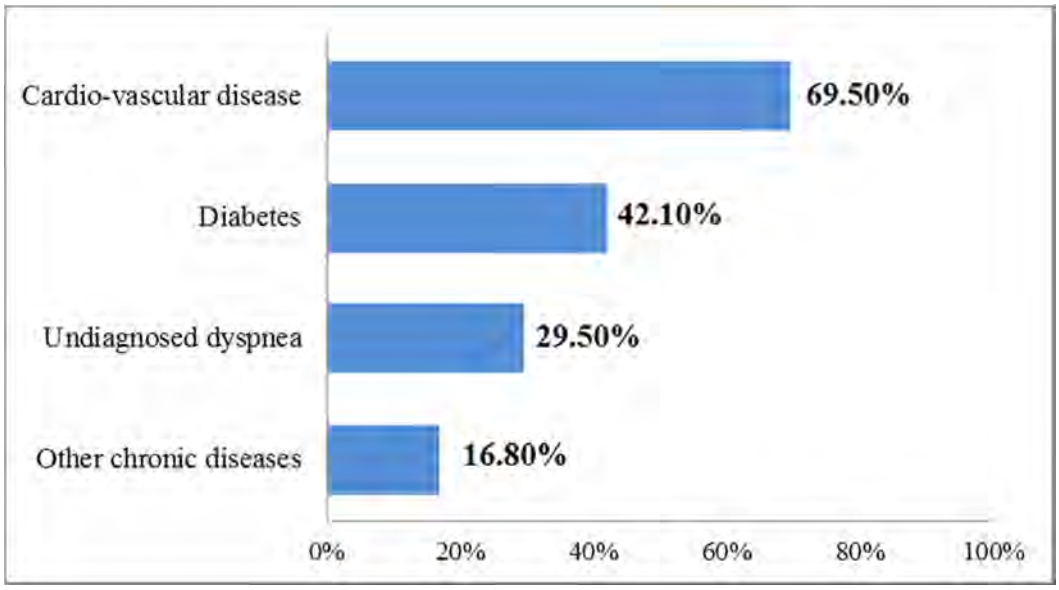
Table 5: Summary of the socio-demographic and anthropometric characteristics

	n = 95
Age (Mean ± SD) in years	75 ± 5.9
Gender n(%)	
Women	61 (64.2)
Men	34 (35.8)
BMI (Mean ± SD) in Kg/m²	27.1 ± 5.7
Marital status n(%)	
Unmarried	46 (48.4)
Married	49 (51.6)
Distance hospital-residence (Median [IQR]) in Km	13 [2 ; 44.02]
Educational level n(%)	
Never been to school	85 (89.5)
Has been to school	10 (10.6)

* SD: Standard Deviation, n: number, %: percentage, IQR: Interquartile range, Km: Kilometer

3. Comorbid diseases:

Figure 10: Comorbid diseases of the study population



a. Charlson Comorbidity Index

Charlson Comorbidity Index was 4 or more for 50% of inpatients with a mean value of 4.06 ± 1.8.

Table 6: Summary of the comorbid diseases

	n = 95
History of cardio-vascular disease n(%)	66 (69.5)
Diabetes n(%)	40 (42.1)
History of chronic disease n(%)	80 (84.2)
Undiagnosed dyspnea n(%)	28 (29.5)
Charlson Comorbidity Index (Median [IQR])	4 [3 ; 5]

* n: number, %: percentage, IQR: Interquartile range

4. Clinical characteristics at admission to the AMU:

Figure 11: Main clinical characteristics at admission to the AMU (1)

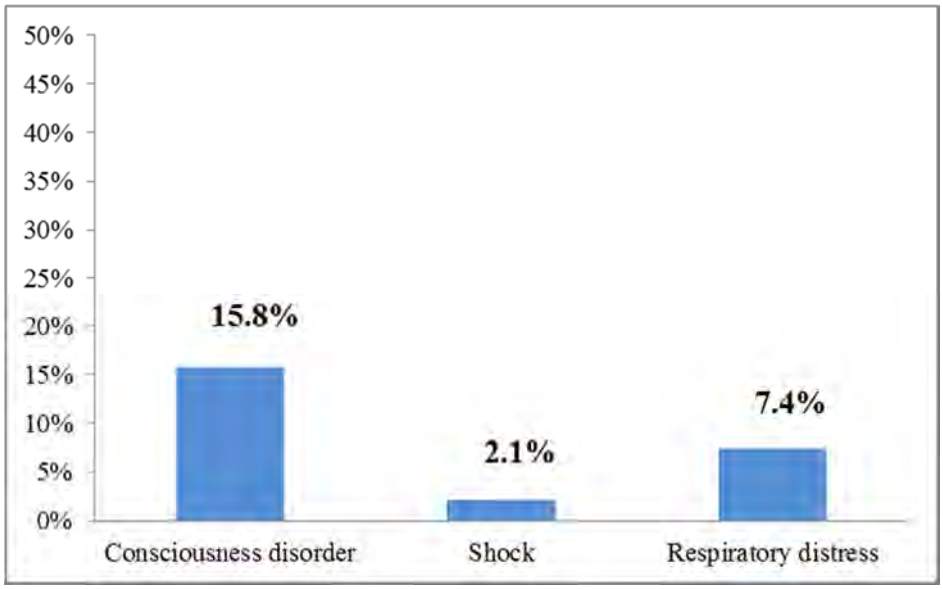
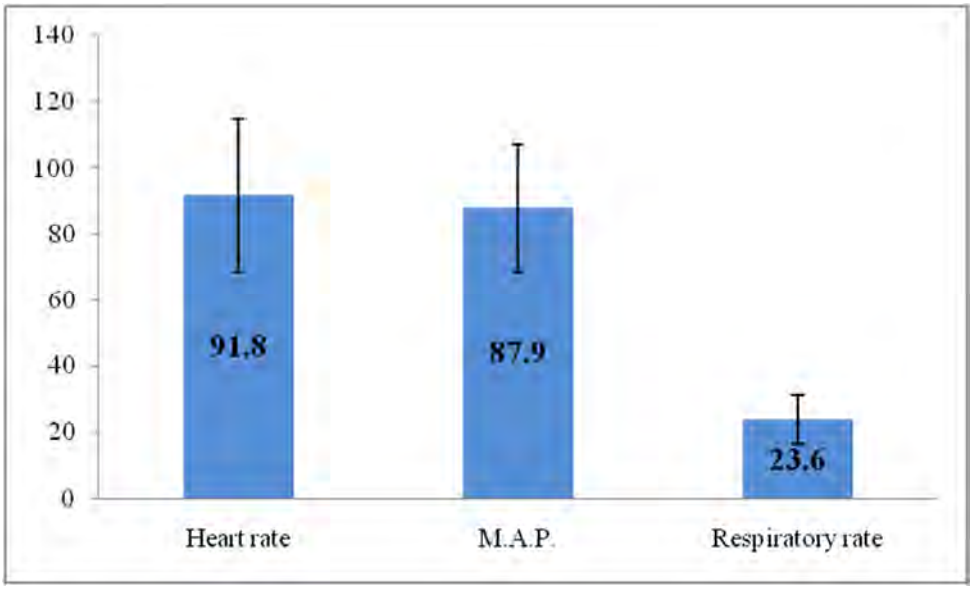


Figure 12: Main clinical characteristics at admission to the AMU (2)



In the previous chart **(Figure 12)** the mean value of the study population's M.A.P. was 87.9 ± 19.3 with a maximum of 173.3 mmHg and a minimum of 48.8 mmHg.

Table 7: Summary of the clinical characteristics at admission to AMU

	n = 95
Consciousness disorder based on GCS n(%)	15 (15.8)
Shock n(%)	2 (2.1)
Respiratory distress n(%)	7 (7.4)
Mean arterial pressure (Mean ± SD) in mmHg	87.9 ± 19.3
Heart rate in beats/min (Mean ± SD)	91.8 ± 23.1
Respiratory rate in breaths/min (Mean ± SD)	23.6 ± 7.3

* AMU: Acute Medical Unit, GCS: Glasgow Coma Scale, SD: Standard Deviation, n: number, %: percentage

5. Evolution characteristics during hospitalization:

a. ICU transit:

The percentage of patients who has transited through the ICU during the hospital stay was 15.8%.

b. Length of stay (LOS) in the AMU:

The mean value of the LOS in the AMU was 7.4 ± 6.2 days for our sample with a minimum value of 1 day and a maximum of 41 days.

c. Length of stay in the Hospital :

The average LOS in the hospital was 10.6 ± 9 days for our sample.

Table 8: Summary of evolution characteristics during hospitalization

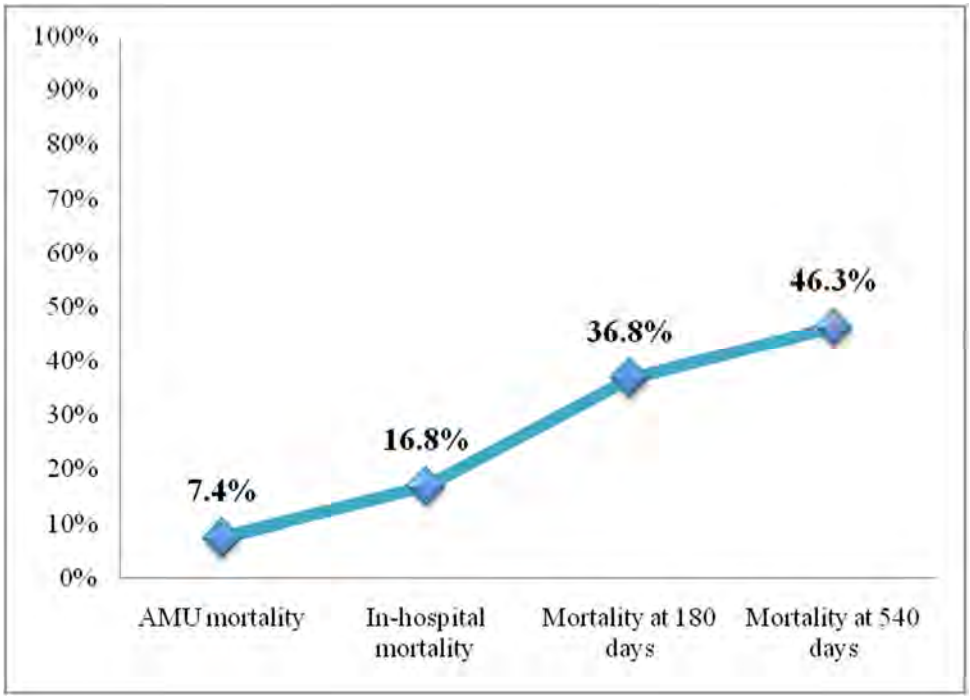
	n = 95
ICU transit n(%)	15 (15.8)
Length of stay in AMU in days (Mean ± SD)	7.4 ± 6.2
Length of stay in Hospital in days (Mean ± SD)	10.6 ± 9

* AMU: Acute Medical Unit, SD: Standard Deviation, n: number, %: percentage

6. Prognosis characteristics: Mortality

For more details about mortality see the patients time related flow-chart in **Figure 6**: Patients time related flow-chart (page 68). **Figure 13** shows the percentages of mortality at each point of the follow-up period; during AMU and In-hospital stay, then at 180 and 540 days post-discharge.

Figure 13: Mortality rates of our study population

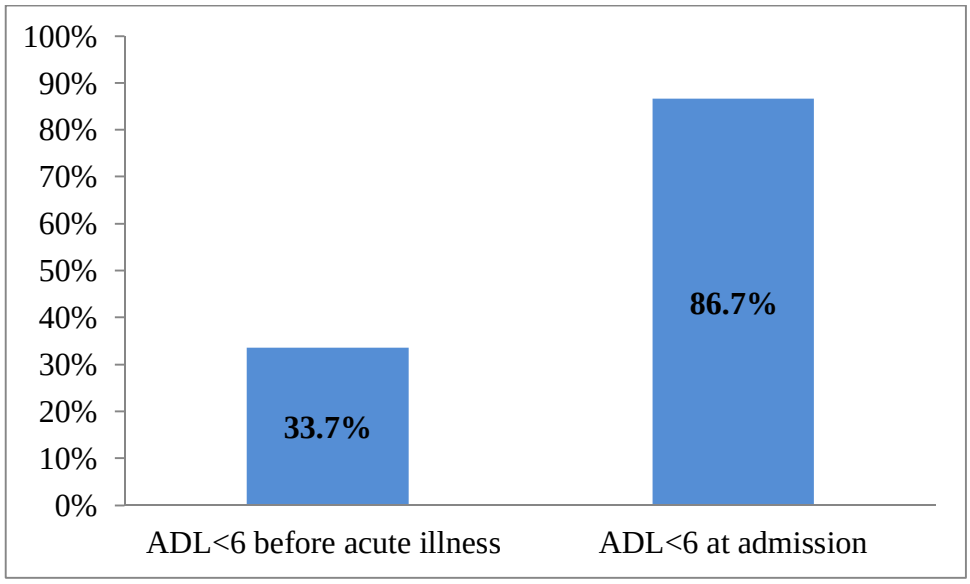


7. Instruments:

a. KATZ index for ADL:

Figure 14 shows a net decrease of the autonomy in daily activities for the elderly patients at admission to the AMU (ADL index at **1 [0 ; 3.5]**), compared to the autonomy before acute illness (ADL index at **5.5 [3.5 ; 6]**).

Figure 14: The ADL index evolution of our study population

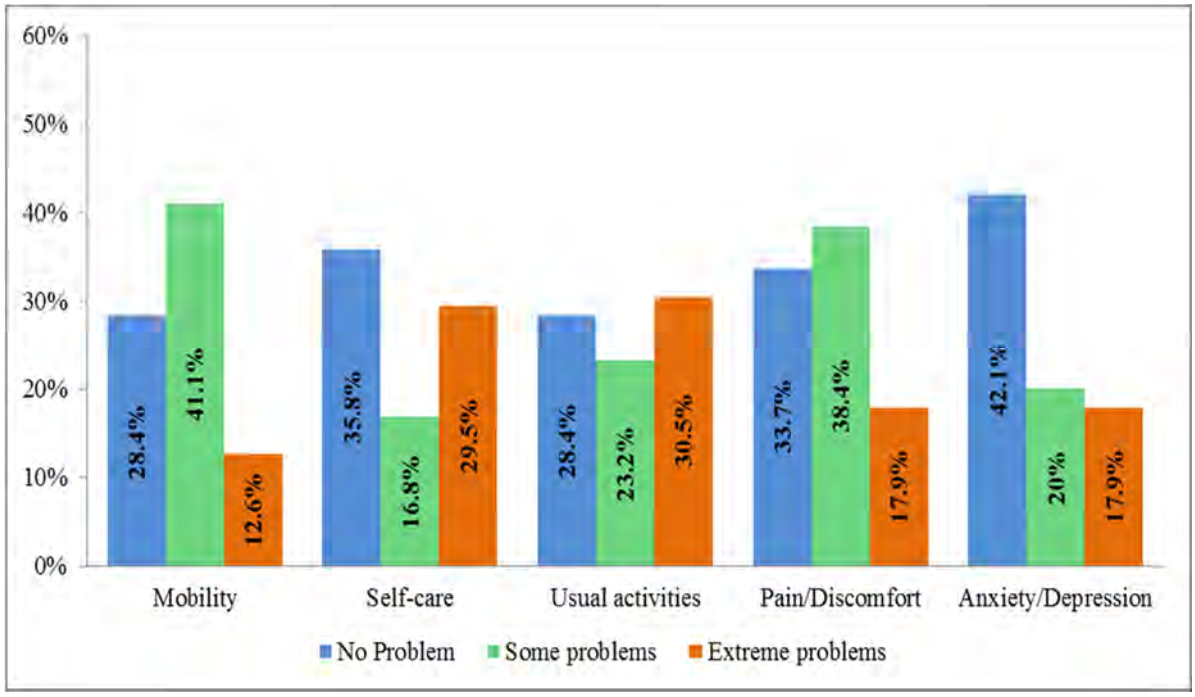


b. Health related quality of life (HRQoL) before acute illness:

EQ-5D index:

The median of EQ5D-Index before acute illness was **0.39 [-0.11 ; 0.81]** with a maximum of 1 and a minimum of -0.59. **Figure 15** shows percentages of each answer to the EQ-5D questionnaire.

Figure 15: Percentages of EQ-5D dimensions answers before acute illness in elderly inpatients



EQ-VAS:

In plus of that, the mean value of the EQ-VAS was 52.7 ± 32, with a maximum of 100% and a minimum of 0%.

c. The nutritional status based on MNA:

Table 9, Table 10 and **Table 11** show the results of the Mini-nutritional Assessment items.

Table 9: Summary of the screening parameters

SCREENING	n = 95
Has food intake declined over the past 3 months due to loss of appetite, digestive problems, chewing or swallowing difficulties? n(%)	
0 = severe decrease in food intake	15 (15.8)
1 = moderate decrease in food intake	11 (11.6)
2 = no decrease in food intake	56 (58.9)
Weight loss during the last 3 months n(%)	
0 = weight loss greater than 3kg (6.6lbs)	21 (22.1)
1 = does not know	12 (12.6)
2 = weight loss between 1 and 3kg (2.2 and 6.6 lbs)	5 (5.3)
3 = no weight loss	44 (46.3)
Mobility n(%)	
0 = bed or chair bound	15 (15.8)
1 = able to get out of bed / chair but does not go out	25 (26.3)
2 = goes out	42 (44.2)
Has suffered psychological stress or acute disease in the past 3 months? n(%)	20 (21.1)
Neuropsychological problems n(%)	
0 = severe dementia or depression	9 (9.5)
1 = mild dementia	4 (4.2)
2 = no psychological problems	69 (72.6)
Body Mass Index (BMI) = weight in kg / (height in m)^2 n(%)	
0 = BMI less than 19	6 (6.3)
1 = BMI 19 to less than 21	2 (2.1)
2 = BMI 21 to less than 23	11 (11.6)
3 = BMI 23 or greater	54 (56.8)

Table 10: Summary of the assessment parameters

ASSESSMENT:	n = 95
Lives independently (not in nursing home or hospital) n(%)	42 (44.2)
Takes more than 3 prescription drugs per day n(%)	14 (14.7)
Pressure sores or skin ulcers n(%)	11 (11.6)
How many full meals does the patient eat daily? n(%)	
0 = 1 meal	9 (9.5)
1 = 2 meals	6 (6.3)
2 = 3 meals	27 (28.4)
EgK1: *At least one serving of dairy products (milk, cheese, yoghurt) per day* ***n(%)***	29 (30.5)
EgK2: *Two or more servings of legumes or eggs per week* ***n(%)***	35 (36.8)
EgK3: *Meat, fish or poultry every day* ***n(%)***	26 (27.4)
Selected consumption markers for protein intake (EgK1, EgK2, EgK3) n(%)	
0 ou 1 "Yes"	12 (12.6)
2 "Yes"	9 (9.5)
3 "Yes"	22 (23.2)
Consumes two or more servings of fruit or vegetables per day? n(%)	33 (34.7)
How much fluid (water, juice, coffee, tea, milk...) is consumed per day? n(%)	
0.0 = less than 3 cups	9 (9.5)
0.5 = 3 to 5 cups	8 (8.4)
1.0 = more than 5 cups	25 (26.3)

Table 11: Summary of the assessment parameters (continued)

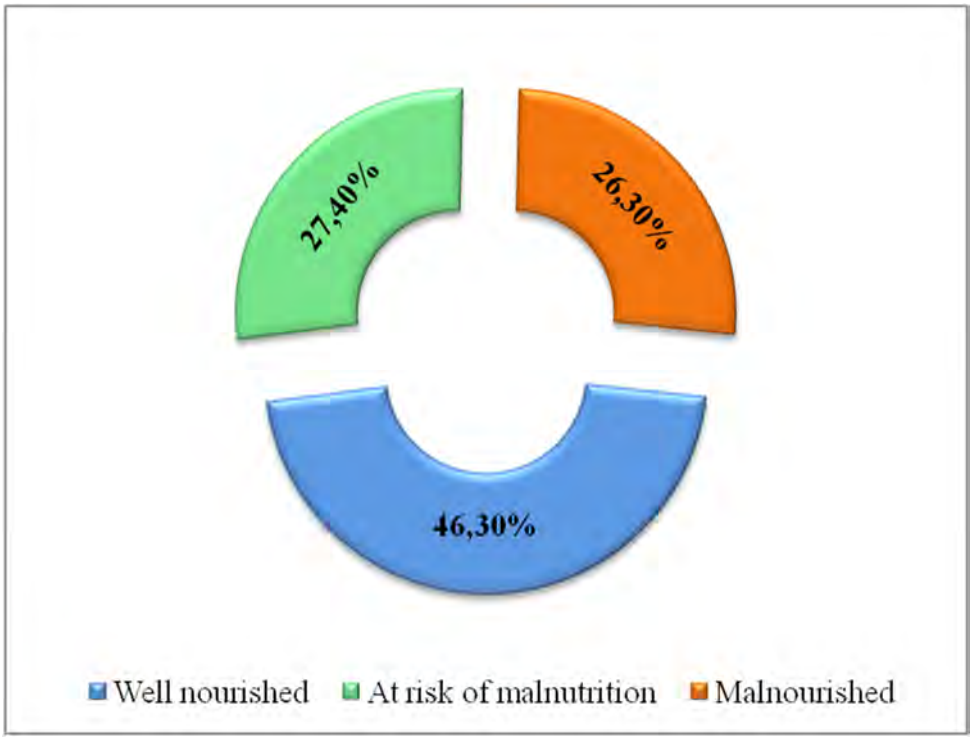
ASSESSMENT (continued)	n = 95
Mode of feeding n(%)	
0 = unable to eat without assistance	13 (13.7)
1 = self-fed with some difficulty	2 (2.1)
2 = self-fed without any problem	28 (29.5)
Self view of nutritional status n(%)	
0 = views self as being malnourished	12 (12.6)
1 = is uncertain of nutritional state	8 (8.4)
2 = views self as having no nutritional problem	11 (11.6)
In comparison with other people of the same age, how does the patient consider his / her health status? n(%)	
0.0 = not as good	17 (17.9)
0.5 = does not know	3 (3.2)
1.0 = as good	4 (4.2)
2.0 = better	7 (7.4)
Mid-arm circumference (MAC) in cm n(%)	
0.0 = MAC less than 21	6 (6.3)
0.5 = MAC 21 to 22	4 (4.2)
1.0 = MAC greater than 22	31 (32.6)
Calf circumference (CC) in cm n(%)	
0 = CC less than 31	24 (25.3)
1 = CC 31 or greater	18 (18.9)

*n: number, % : percentage, cm: centimeter

The final appreciation of the MNA:

According to the MNA, the study population was split into 3 groups of patients based on their nutritional status; **Figure 16** presents prevalence of malnutrition in the study population.

Figure 16: Prevalence of malnutrition



II. Comparative analysis: (between the 3 nutrition groups)

Characteristics of elderly patients admitted to the AMU were compared according to their nutritional status that subdivided them into 3 groups (Well-nourished, At risk of malnutrition and Malnourished).

1. Socio-demographic and anthropometric characteristics:

The comparison of the socio-demographic and anthropometric characteristics of elderly inpatients according to their nutritional status is presented in **Table 12**.

Table 12: Comparison of the socio-demographic and anthropometric characteristics of elderly inpatients according to their nutritional status

	Well-nourished patients (n=44)	**Patients at risk of malnutrition (n=26)**	**Malnourished patients (n=25)**	***p*-value**
Age (Mean ± SD) in years	74.6 ± 5.8	74.6 ± 6.5	76.1 ± 5.7	0.55
Gender n(%)				0.8
Women	27 (44.3)	18 (29.5)	16 (26.2)	
Men	17 (60)	8 (23.5)	9 (26.5)	
BMI (Mean ± SD) in Kg/m²	28.2 ± 5.2	25 ± 6.8	27.3 ± 5	0.07
Marital status n(%)				0.39
Unmarried	18 (39.1)	14 (30.4)	14 (30.4)	
Married	26 (53.1)	12 (24.5)	11 (22.4)	
Distance hospital-residence (Median [IQR]) in Km	13 [2 ; 58]	9 [2 ; 42.5]	13 [2 ; 38]	0.19
Educational level				0.25
Never been to school	37 (43.5)	25 (29.4)	23 (27.1)	
Has been to school	7 (70)	1 (10)	2 (20)	

* SD: Standard Deviation, n: number, % : percentage, IQR: Interquartile range, Km: Kilometer

2. Comorbid diseases:

Comparison of the comorbid diseases of elderly inpatients according to their nutritional status is shown in **Table 13**.

Table 13: Comparison of the comorbid diseases of elderly inpatients according to their nutritional status

	Well-nourished patients (n=44)	Patients at risk of malnutrition (n=26)	Malnourished patients (n=25)	*p*-value
History of cardio-vascular disease n(%)	29 (43.9)	17 (25.8)	20 (30.3)	0.41
Diabetes n(%)	19 (47.5)	9 (22.5)	12 (30)	0.61
History of chronic disease n(%)	37 (46.2)	24 (30)	19 (23.8)	0.28
Undiagnosed dyspnea n(%)	13 (46.4)	6 (21.4)	9 (32.1)	0.59
Charlson Comorbidity Index (Median [IQR])	4 [3 ; 5]	3 [3 ; 5]	4 [3 ; 6]	0.63

* SD: Standard Deviation, n: number, % : percentage, IQR: Interquartile range

3. Clinical characteristics at admission to the AMU:

Comparison of the clinical characteristics at admission to the AMU between the 3 nutrition groups of elderly inpatients is presented in **Table 14.**

Table 14: Comparison of the clinical characteristics of elderly inpatients at admission to the AMU according to their nutritional status

	Well-nourished patients (n=44)	Patients at risk of malnutrition (n=26)	Malnourished patients (n=25)	*p*-value
Consciousness disorder based on GCS n(%)	4 (26.7)	5 (33.3)	6 (40)	0.22
Shock n(%)	1 (50)	0	1 (50)	0.61
Respiratory distress n(%)	4 (57.1)	1 (14.3)	2 (28.6)	0.71
Mean arterial pressure (Mean ± SD) in mmHg	91.3 ± 21.5	83.3 ± 17.1	86.7 ± 16.6	0.23
Heart rate in beats/min (Mean ± SD)	90.4 ± 23.04	99.4 ± 18.8	86.2 ± 25.9	0.11
Respiratory rate in breaths/min (Mean ± SD)	24.3 ± 7.3	23.5 ± 7	22.6 ±7.8	0.7

* AMU: Acute medical unit, GCS: Glasgow coma scale, n: number, % : percentage, SD: Standard Deviation

4. Evolution characteristics during hospitalization:

There is no significant difference concerning evolution characteristics in the 3 groups of elderly inpatients according to their nutritional status. **Table 14** shows the comparison of evolution characteristics between the 3 nutrition groups of our population study.

Table 15: Comparison of the evolution characteristics of elderly inpatients according to their nutritional status

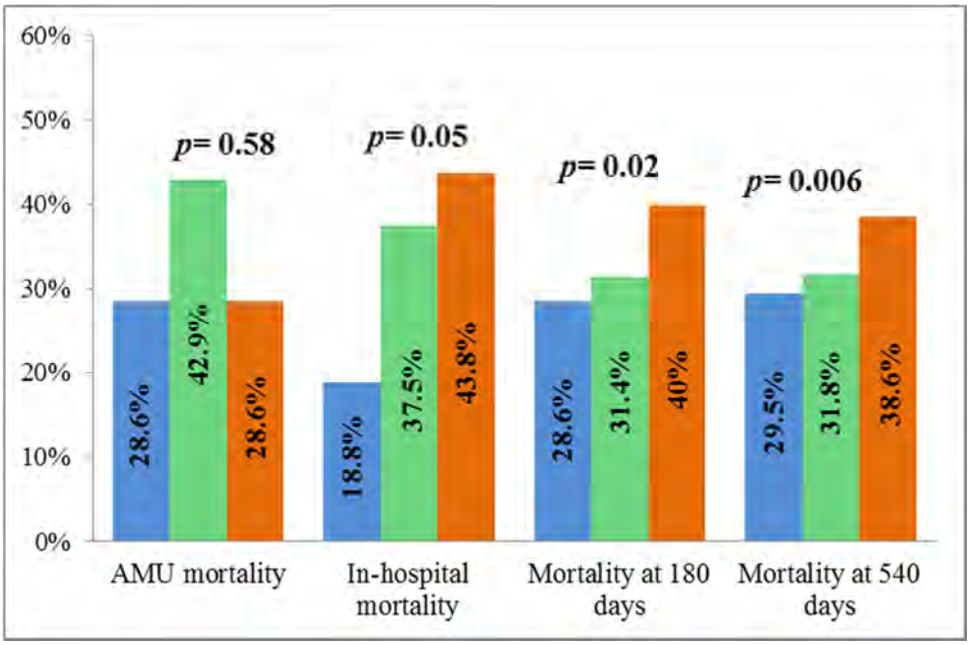
	Well-nourished patients (n=44)	**Patients at risk of malnutrition (n=26)**	**Malnourished patients (n=25)**	***p*-value**
ICU transit n(%)	3 (20)	5 (33.3)	7 (46.7)	0.06
Length of stay in AMU in days (Mean ± SD)	6.2 ± 5	7.4 ± 4.2	9.7 ± 9.1	0.07
Length of stay in Hospital in days (Mean ± SD)	9.8 ± 9.9	8.9 ± 6.3	13.8 ± 9.5	0.1

* n : number, % : percentage, ICU: Intensive care unit, AMU: Acute medical unit, SD: Standard Deviation,

5. Prognosis characteristics: Mortality

The difference of mortality between the 3 patients groups was not significant during AMU stay. However, In-hospital mortality as well as 180 days mortality and 540 days mortality were significantly higher in malnourished inpatients and those at risk of malnutrition. **Figure 17** shows the comparison of the percentages of mortality between the 3 nutrition groups of elderly inpatients.

Figure 17: Comparison of mortality between the 3 nutrition groups



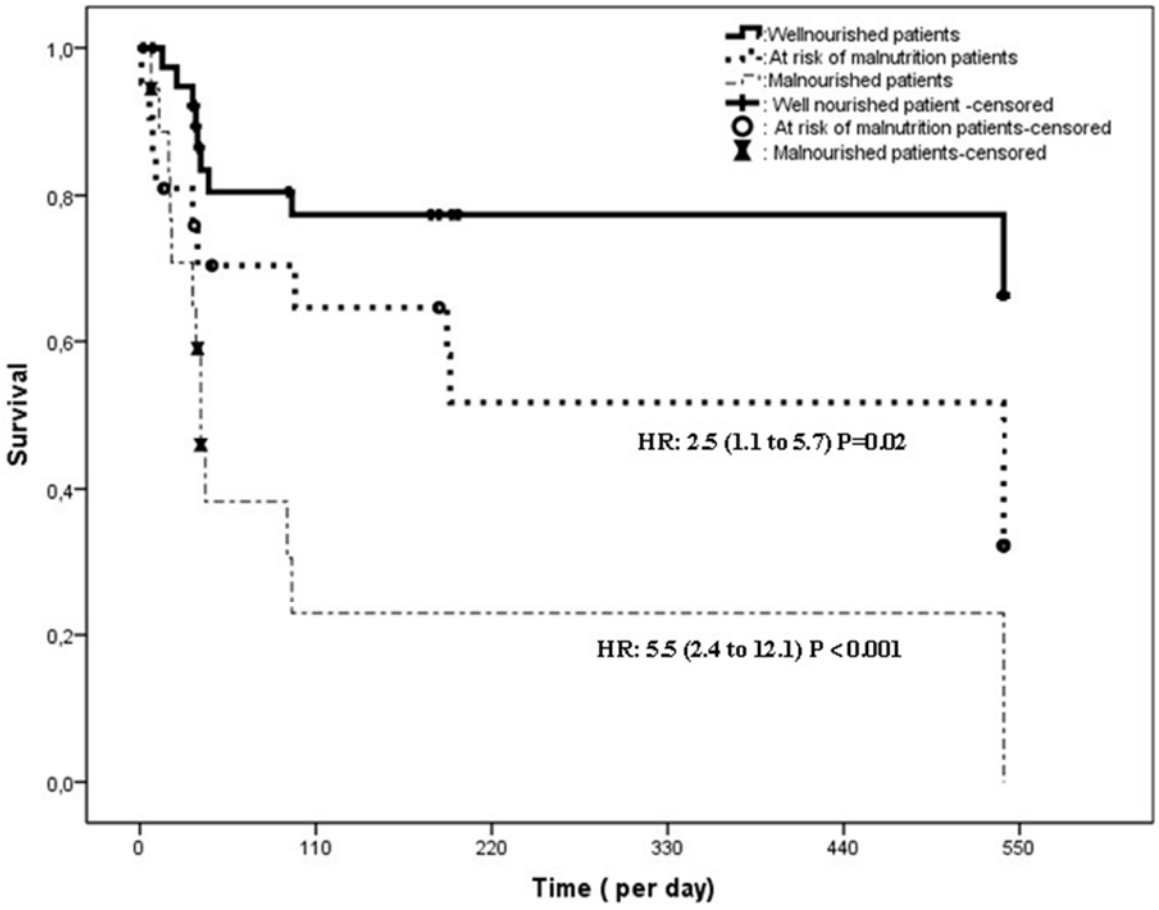
Kaplan-Meier survival curve:

Compared to the well-nourished patients, patients at risk of malnutrition and malnourished patients had significantly higher mortality, with respectively **HR: 2.5, (1.1 ; 5.7), *p*=0.02** and **HR: 5.5, (2.4 ; 12.1), *p*<0.001**

Figure 18 represents the Kaplan-Meier survival curve. It concluded that malnutrition and the risk of malnutrition were significantly associated with higher risk of mortality in the elderly patients admitted in the AMU compared to the normal nutritional status.

As illustrated on **Figure 18**, there are some censored observations because of patients who got lost to follow-up which made it impossible to determine accurately the total survival time for those patients.

Figure 18: Kaplan-Meier survival curve



* HR: Hazard Ratio, P: *p*-value

6. Instruments:

a. KATZ index for ADL:

~ **Before acute illness:** ADL index was significantly higher in well-nourished patients compared to the 2 other nutrition groups.

~ **At admission to the AMU:** Despite a decrease in ADL index at admission to the AMU, it remained significantly higher in well-nourished patients.

Table 16 shows the comparison of the ADL index medians before acute illness and at admission between the 3 groups of elderly inpatients according to their nutritional status.

Table 16: Comparison of the medians of ADL index according to the nutritional status

	Well-nourished patients (n=44)	Patients at risk of malnutrition (n=26)	Malnourished patients (n=25)	*p*-value
ADL before acute illness (Median [IQR])	6 [5.5 ; 6]	4.5 [2.7 ; 5.5]	2.5 [2 ; 4]	<0.001
ADL at admission to AMU (Median [IQR])	2.03 [0 ; 4]	0 [0 ; 1.5]	0 [0 ; 1.7]	0.008

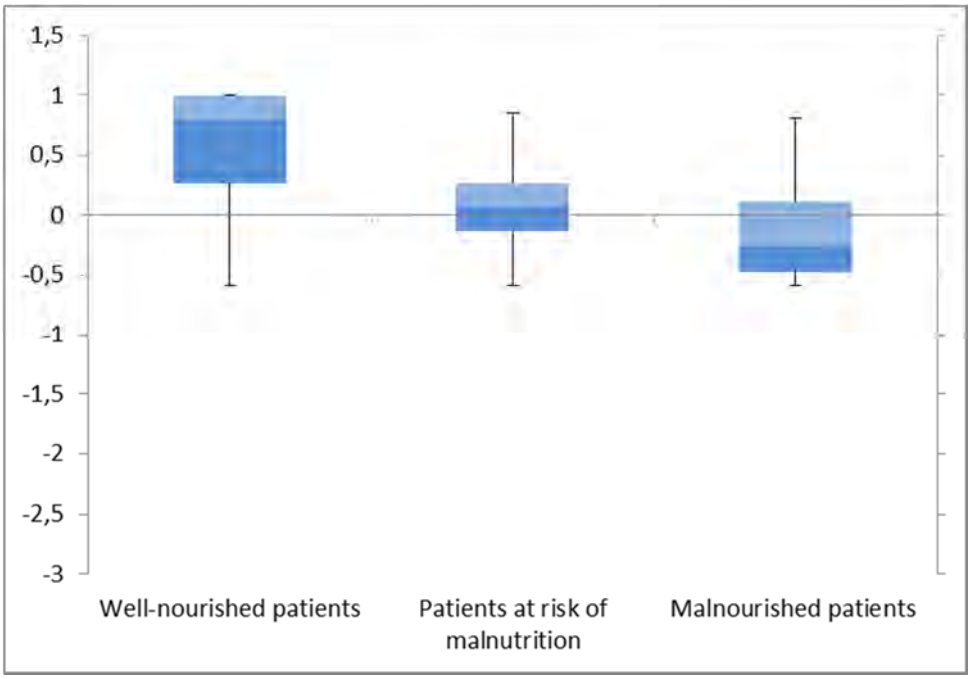
* AMU: Acute medical unit, n: number, IQR: Interquartile range

b. Health related quality of life (HRQoL) before acute illness:

EQ-5D Index before acute illness:

Before Acute illness, patients at risk of malnutrition and malnourished patients had a significantly lower EQ5D-Index compared to well-nourished patients (*p*=<0.001); respectively, **0.08 [-0.13 ; 0.27]** vs. **0.79 [0.27 ; 1]** and **-0.26 [-0.47 ; 0.12]** vs. **0.79 [0.27 ; 1]**. **Figure 19** illustrates the comparison of the EQ-5D index medians between the 3 groups of elderly patients according to their nutritional status.

Figure 19: Box plot of EQ-5D index medians before acute illness according to the nutritional status



EQ-VAS before acute illness:

Table 17 presents the comparison of EQ-VAS before acute illness between the 3 nutrition groups of elderly inpatients admitted to the AMU.

Table 17: Comparison of EQ-VAS means (± SD) of elderly inpatients before acute illness according to the nutritional status

	Well-nourished patients (n=44)	Patients at risk of malnutrition (n=26)	Malnourished patients (n=25)	*p*-value
(Mean ± SD)	52.7 ± 32	66.1 ± 30.5	29.6 ± 23	<0.001
Minimum (%)	5	0	0	
Maximum (%)	100	100	100	

* n: number, SD: Standard deviation, %: Percentage

III. COX proportional hazards analysis: The prognosis impact of the nutritional status in an AMU

1. UNIVARIATE ANALYSIS:

Socio-demographic and anthropometric characteristics:

In the socio-demographic and anthropometric characteristics, 1 parameter was found to be significantly predictive of mortality at 18 months after discharge from AMU:

Marital Status:

The risk of mortality is significantly higher for unmarried patients (Single, divorced or widowed) with a hazard ratio at **HR: 2.4, (1.2 ; 4.5), (*p* = 0.006)**

Table 18 shows the results of the Cox proportional hazards univariate analysis of socio-demographic and anthropometric characteristics in elderly inpatients admitted to the AMU.

Table 18: Cox proportional hazards univariate analysis results: The socio-demographic and anthropometric characteristics

	HR	CI 95%		*p-value*
		Inf.	Sup.	
Age per additional year	1.02	0.44	1.6	0.4
Gender				
Female	1			
Male	0.8	0.4	1.6	0.5
BMI per Kg/m²	0.9	0.8	1.006	0.06
Marital status				
Married	1			
Unmarried	2.4	1.2	4.5	0.006
Distance hospital-residence	0.9	0.99	1.003	0.7
Educational level				
Never been to school	1			
Has been to school	0.7	0.3	2.1	0.3

*CI: Confidence interval, HR: Hazard ratio, Inf.: Inferior, Sup.: Superior

Comorbid diseases:

No parameter from the comorbid conditions of the patients showed significance related to mortality at 18 months after discharge from AMU. (**Table 19**)

Table 19: Cox proportional hazards univariate analysis results: Comorbid diseases

	HR	CI 95%		
		Inf.	Sup.	*p-value*
Cardiovascular disease	0.7	0.4	1.3	0.2
Diabetes	1.3	0.7	2.4	0.3
No dyspnea	1.5	0.83	2.88	0.1
Charlson Comorbidity Index	1.1	0.9	1.24	0.2

*CI: Confidence interval, HR: Hazard ratio, Inf.: Inferior, Sup.: Superior

Clinical characteristics at admission to the AMU:

Lower mean blood pressure (MAP) at admission to the AMU was significantly associated with mortality at 540 days after discharge from the AMU, in univariate analysis; **HR: 0.9, (0.94 ; 0.98), *p*=0.004**

Table 20 presents the Cox proportional hazards univariate analysis of clinical characteristics of elderly inpatients at admission to the AMU.

Table 20: Cox proportional hazards univariate analysis results: Clinical characteristics at admission to AMU

	HR	CI 95%		
		Inf.	Sup.	*p-value*
Consciousness disorder	1.7	0.8	3.6	0.1
Mean arterial pressure (mmHg)	0.9	0.94	0.98	0.004
Heart rate in (beats/min)	1.01	0.99	1.02	0.3
Respiratory rate in (breaths/min)	1.04	0.9	1.08	0.09

*CI: Confidence interval, HR: Hazard ratio, Inf.: Inferior, Sup.: Superior

KATZ index for ADL:

Lower ADL score before acute illness was significantly associated to mortality at 540 days after discharge from the AMU, **HR: 0.7, (0.7 ; 0.9), *p* = 0.002.**

Health related quality of life (HRQoL):

EQ-5D Index before acute illness:

EQ-5D index before acute illness was significantly predictive of mortality at 540 days after discharge from the AMU, **HR: 0.4, (0.2 ; 0.7), *p* = 0.003.**

The nutritional status based on MNA:

Malnutrition was found to be significantly predictive of mortality 18 months after discharge from AMU.

(1) Patients at risk of malnutrition had 2 times risk to die by 540 days follow-up than well-nourished patients.

(2) Malnourished patients had 4.5 times risk to die by 540 days follow-up than well-nourished patients.

Table 21 shows in detail the results of the Cox proportional hazards univariate analysis of the nutritional status.

Table 21: Cox proportional hazards univariate analysis results: The nutritional status

	HR	CI 95%		
		Inf.	Sup.	*p-value*
Well-nourished	1			
At risk of malnutrition	2.1	0.9	4.6	0.06
Malnourished	4.5	2	9.8	0.001

*CI: Confidence interval, HR: Hazard ratio, Inf.: Inferior, Sup.: Superior

2. MULTIVARIATE ANALYSIS:

In this part of the analysis we considered two Cox models:

(1) Model 1: a model with conventional risk variables only.

(2) Model 2: a model with conventional risk variables and nutritional status combined.

a. Socio-demographic and anthropometric characteristics:

The marital status showed a significant difference between the 2 Cox models: **HR: 2.1, (1.1 ; 4.1), *p*=0.02**

b. Current illness physical findings within admission to the AMU:

A significant difference was found between the 2 Cox models concerning the Mean arterial pressure (MAP): **HR: 0.97, (0.94 ; 0.99), *p* = 0.02**

c. Health related quality of life (HRQoL):

EQ5D-Index before acute illness was significantly different between the 2 Cox models: **HR: 0.5, (0.3 ; 0.9); *p* = 0.04**

d. The nutritional status based on MNA:

Table 22 shows the results of the Cox proportional hazards multivariate analyses with and without nutritional status variables added to risk prediction model incorporating conventional risk variables only considering 540 days mortality as the outcome.

Table 22: Results from Cox proportional hazards multivariate analyses with and without nutritional status (outcome was 540 days mortality; n=95)

	Model without nutritional status				Model with nutritional status			
	HR	CI 95%			HR	CI 95%		
		Inf.	Sup.	*p*-value		Inf.	Sup.	*p*-value
Marital status								
Unmarried	2.1	1.1	4.1	0.02	2.1	1.1	4.1	0.02
Married								
Mean arterial pressure mmHg	0.97	0.94	0.99	0.02	0.97	0.94	0.99	0.02
EQ5D before acute illness	0.5	0.3	0.9	0.04	0.5	0.3	0.9	0.04
Nutritional status								
Well-nourished					1			
At risk of malnutrition					1.8	0.7	4.6	0.1
Malnourished					3	1.2	7.7	0.01

*CI: Confidence interval, HR: Hazard ratio, Inf.: Inferior, Sup.: Superior

3. NUTRITIONAL STATUS AS A PREDICTOR OF MORTALITY:

a. Sensitivity analysis: Model performance

(1) Calibration:

Good agreement between observed and Cox estimated death rate in models 1 and 2 was acknowledged by a non-significant Gronnesby and Borgan calibration test respectively (p=0.3) and (p= 0.80). The likelihood improved significantly with addition of nutritional status. No models violated the Grønnesby and Borgan test (all p>0.05), indicating adequate GOF.

(2) Discrimination:

Table 23 summarizes the performance indices including Harrell's concordance index (C statistic) (and estimated bias), net reclassification improvement, integrated discrimination improvement, and Royston and Sauerbrei' index of discrimination (unadjusted and adjusted) for the conventional prediction model and the extended models including nutritional status data: Across the two models, optimism bias (or over-fitting) in the C statistic value was 0.022 for model 1, and 0.0031 for model 2.

- **Harrell's concordance index:**

The C statistic did increase with inclusion of nutritional status variable, and the change was significant 0.07 (0.002-0.12), p=0.04. The latter indicated that discrimination performance of the simple model as measured by the C statistic was significantly improved with the addition of nutritional status variable (**Table 23**).

- **Integrated discrimination improvement:**

The integrated discrimination improvement index was positive and significantly different from zero, suggesting improvement in reclassification, when the conventional model was compared with models incorporating nutritional status variable (integrated discrimination improvement 0.7; p=0.001).

- **Royston and Sauerbrei' index of discrimination:**

Furthermore, compared with the conventional model, Royston and Sauerbrei's index of discrimination (D) was higher (difference> 0.2) when nutritional status variable was added to the conventional model, indicating an improvement in prognostic separation.

Table 23: Statistical indices of model performance for conventional risk model with and without addition of nutritional status variables (outcome was 540 days mortality; n=95)

	Model 1 Without nutritional status	**Model 2** With nutritional status
P value for calibration	0.32	0.81
C statistic (95%) Harrell's concordance index †	0.68	0.75
Estimated optimism in C statistic value (***SE)***	0.022	0.0031
Difference between C statistic for two models* (95% CI of difference)	Reference	0.07 (0.002-0.12)
‡P value for difference between C statistic	Reference	0.04
Net reclassification improvement (SE), ϕP value	Reference	0.11 (0.05-0.17) <0.001
Integrated discrimination improvement (SE) ¶P value	Reference	0.7 (0.29-1.12) 0.001
D (SE)	1.33 (0.28)	1.59 (0.27)
P value for D statistic	P<0.001	P<0.001
R^2	0.29	0.37
D adjusted for optimism (SE)	1.22 (0.29)	1.40 (0.27)
P value for D adjusted for optimism statistic	P<0.001	P<0.001
R^2	0.26	0.32

*Model 1 includes marital status, Mean arterial pressure, physical function (EQ5D one month before acute illness),

†Estimated bias (over-fitting) in c statistic value based on 100 bootstrapped samples.

‡P value compares concordance statistic of conventional model (M1) with model that includes Nutritional status Variable.

ϕP value tests null hypothesis that net reclassification improvement index in population is zero.

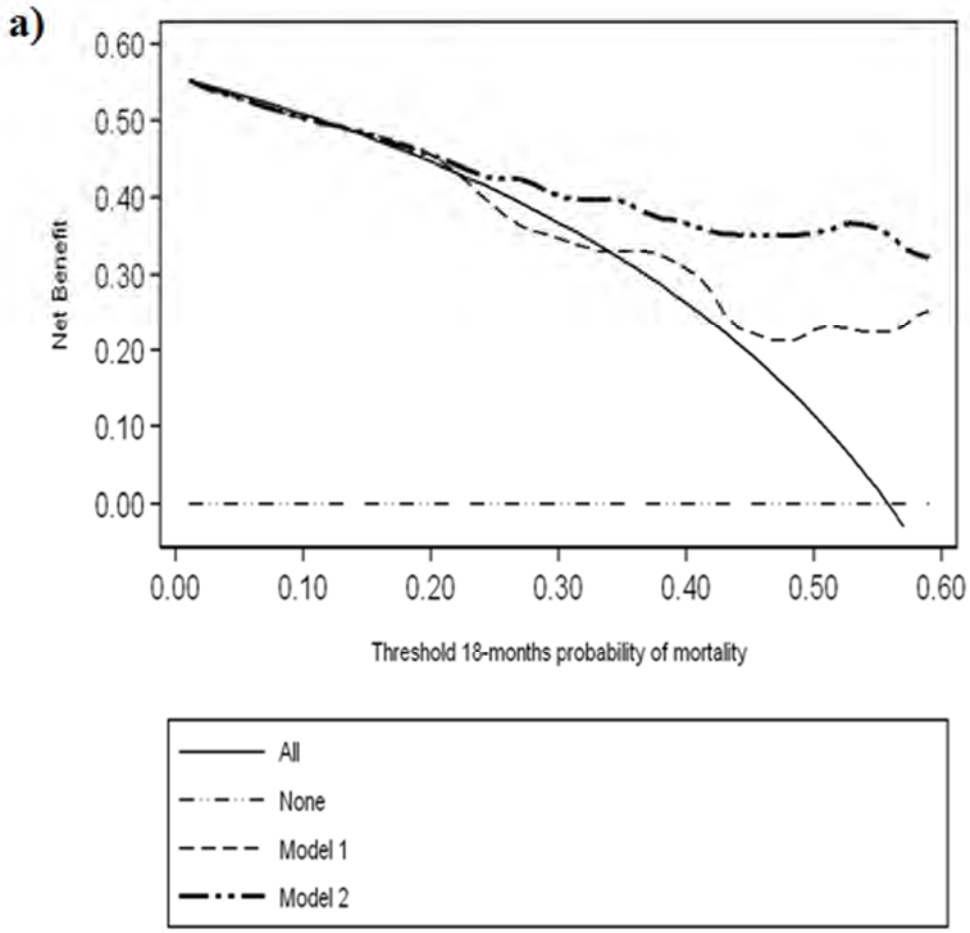
¶P value tests null hypothesis that integrated discrimination improvement index in population is zero.

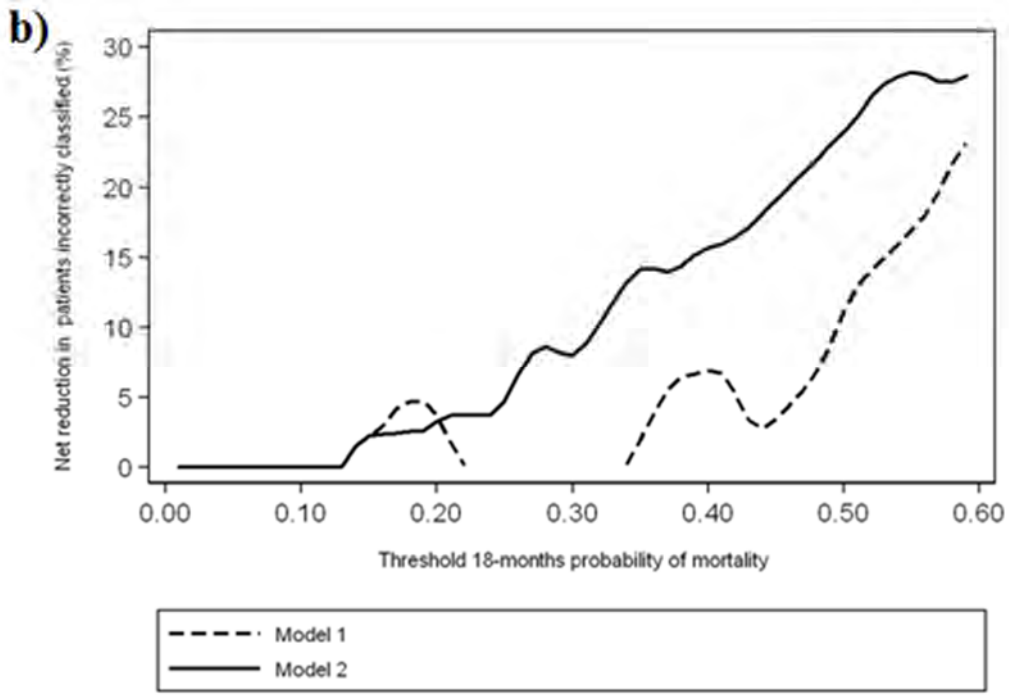
Decision curve analysis

It's a decision curve analysis for 18 months survival, for conventional risk model without (Model 1) and with (Model 2) addition of nutritional status variable. Net benefit is defined as the difference between the proportion of correctly classified subjects and the proportion of subjects classified incorrectly to be at or above a risk threshold.

Figure 20 (a) and (b) shows the net benefit curves for the conventional prediction model and the extended model that includes nutritional status. As shown, for increasing probability thresholds the models incorporating nutritional status combined had higher net benefit than the conventional model, suggesting that this model has potentially higher clinical utility.

<u>Figure 20:</u> (a) and (b) Accuracy of two models to classify subjects into risk categories





The upper part of the graph **(a)** shows the net benefit of 4 strategies to classify elderly subjects admitted in an acute medicine unit. The higher the values for net benefit the more patients are correctly classified. Two strategies do not use any predictors but assume that all patients would be above or below a risk threshold. The two other strategies use the model 1 and 2 and associated risks of 18-months mortality to classify patients. Net benefit is defined as the difference between the proportion of correctly classified subjects and the proportion of subjects classified incorrectly to be at or above a risk threshold. The lower part of the graph **(b)** shows percentage of patients that can be avoided to be classified incorrectly above risk threshold compared to a strategy where all patients are considered to be above risk threshold. For example at a threshold of 30% mortality risk, using the nutritional status would result in a net benefit similar to the reduction of 8 incorrectly classified patients per 100 subjects compared to considering all patients to be above a 30% mortality risk. The graph is restricted to subjects risk for 3-year mortality (<60%).

DISCUSSION

This was the first study about malnutrition in acutely ill elderly that has been conducted in the first Acute Medical Unit of Morocco. Furthermore, as the geriatric medicine has just started to be developed in Moroccan University hospitals, the present study would be a strong value-added to this area.

As stated in the introduction, the research was conducted in order to reach 3 objectives; and through the results analyses, we ended up answering all of them.

Firstly, we managed to describe many characteristics of elderly inpatients in AMU, and we reported a quite high prevalence of malnutrition in this population, describing therefore, for the first time, the nutritional status of acutely ill elderly in Morocco.

Secondly, the comparison between the patients showed a statistically significant difference in EQ-5D, ADL index and mortality according to the nutritional status; the group of malnourished patients had significantly lower HR-QoL before acute illness, lower ADL index before acute illness and at admission, and higher rates of short-, intermediate- and long-term mortality.

Finally, considering 540 days mortality as the outcome, the cox proportional hazards analyses found that malnutrition was a significant predictor of long-term mortality along with Marital status, Mean arterial pressure and EQ-5D,

In our study population, 51.6% of all the patients included were married, which agrees with the literature. Indeed, in the Moroccan National Survey, 59.2% of the persons aged of 60 yo and over were married [2]. While L.E.C. Schein and J.A. Cesar from Rio Grande had 50.2 % of married subjects among their elderly study population [102] and I. Lacerda Pedrosa et al. 62.5% [103].

Besides that, marriage in our population was a strong protective factor from long-term mortality. Indeed, marriage has generally been considered as a protective factor from health problems and consequently, from mortality of elderly by many authors [104]–[107]. Concerning old patients who went through acute illness (consequently more frail), it would be only logical that their marital status would influence their long-term outcome. Only few authors studied this influence in hospitalized elderly; L. Liu et al. found a strong relationship between marital status and 1 year mortality in elderly admitted to general wards [108]. By contrast, A.C. Lemay et al. study was about old patients with severe sepsis, and the "marital status – mortality" relationship was not significant [109]. This means that additional studies need to be conducted to validate the protective role of marriage in Moroccan acutely ill elderly.

Secondly, in our sample, the mean value of the MAP is consistent with De Gelder et al. study about elderly in a Dutch AMU [110]. In plus of that, through the Cox proportional hazards univariate and multivariate analyses, we found that the blood pressure was significantly predictive of long-term mortality; the lower it went the higher was the mortality risk, and that is in good agreement with the results of S.E. de Rooij et al. who found an association between MAP and long-term mortality [111]. This inverse relationship between blood pressure and long-term mortality has been explained by some authors by the fact that hypotension is probably a marker of underlying disease (especially cardio-vascular) that can precipitate the deterioration of old patients' health and lead to death [112], [113].

Concerning the HR-QoL in our study population, the comparison based on the nutritional status showed that low HR-QoL before acute illness was significantly associated with malnutrition ($p \leq 0.001$). J.M. Kvamme et al. from Norway also found a

strong association between malnutrition and problems in HRQoL in independently living elderly inhabitants using EQ5D for HRQoL and MUST for the nutritional status [114]. A cause-effect relationship between HR-QoL and malnutrition in elderly of an AMU should be studied profoundly.

In the Cox proportional hazards analyses, EQ5D-Index was also a strong predictor of long-term mortality after an AMU discharge. This finding is supported by previous studies about long-term mortality; E. Sacanella et al. (mean follow-up of 522 ± 315 days) and many other authors came to same conclusions [115]–[117]. In addition, other authors studied free-living elderly to find that low EQ-5D index constituted a strong risk factor for mortality among this population as well [117]. All this consolidates the independent predictive power of HR-QoL on elderly mortality inside and out of the hospital.

Regarding the nutritional status assessed by the MNA, **Table 24** below shows that the prevalence of malnutrition in our study population is within the range reported by other studies [48], [71], [118]–[120] (More results are presented in Yves Guigoz's article that compared the prevalence of malnutrition assessed by the MNA between different medical structures for elderly [121]).

In **Table 24**, we can notice that the sample sizes of the other studies are bigger than ours, this is mainly due to recruitment of patients from multiple wards (Almost all the studies) or from one ward [118] comprising higher number of beds than our unit, or because of longer study periods [71]. On the other hand, P.M. Sheean et al. [48] reported very high rate of well-nourished patients compared to other studies, this might be linked to the exclusion of 18% of the patients who were incapable of answering and no proxy was available to answer in their stead; those patients were

suspected to be probably sicker than the rest of the study population which could explain the low rate of malnutrition.

Table 24: Comparison of the nutritional status of our sample with the literature results

	Our sample (Morocco)	**P.M. Sheean et al.** [48] (USA)	**Y.P. Lim** [71] (Singapore)	**C. Gazzotti et al.** [118] (Belgium)	**M.R.M. Oliveira et al.** [119] (Brazil)	**Z. Lei et al.** [120] (China)
Study population	≥ 65 yo	≥ 65 yo	≥ 60 yo	(mean) 79.7 ± 8.45	≥ 60 yo	≥ 60 yo
Tool	MNA	MNA	MNA	MNA	MNA	MNA
Sample size	95 patients	260 patients	281 patients	175 patients	240 patients	184 patients
Study setting	AMU	ICU	Acute hospital	Acute geriatric wards	Hospital	Hospital
Prevalence of Well-nourished	46,30%	66%	24%	29.7%	33.8%	27.2%
Prevalence of those at risk of malnutrition	27,40%	24%	53%	48.6%	37.1%	53.2%
Prevelance of Malnourished	26,30%	10%	23%	21.7%	29.1%	19.6%

AMU: Acute Medical Unit, ICU: Intensive Care Unit, GEMU: Geriatric evaluation and management unit (Admits patients after an acute illness admission)

In the Cox proportional hazards analysis, we found that Malnourished subjects of our sample were significantly more likely (4.5 times) to die than well-nourished ones, which is supported by K.E. Charlton et al. and P. De Boissieu (using MNA) [122], [123], S. Tripathy et al. (using MUST) [124] and B.M. Buurman et al. (using CGA) [6]. Moreover, when the nutritional status measured by the MNA was added to that conventional model (to get the extended model "2"), it showed a higher significance in predicting the long-term mortality. This conclusion consolidated the Kaplan-Meier survival curve (**Figure 18** – page 93), and lends support to previous findings about hospitalized and non-hospitalized patients [7], [108], [116], [122].

Therefore, the decision curve analysis came to strengthen the importance of the nutritional status as a prognosis factor. This analysis showed a significantly higher net benefit when nutritional status was added to the conventional risk model (**Figure 20** – page 110), which demonstrated its high clinical utility. This has been previously proved by other authors who found that the nutritional status (by MNA) is a decisive and independent prognostic factor for long-term mortality in acutely ill elderly [122], [123] and has, consequently, a high clinical utility that suggests nutrition intervention as an efficient solution to reduce long-term mortality among old patients.

Given their importance in the present study, 2 more elements will be discussed in detail in this following part.

Firstly, mortality; in our study population, the global mortality rates during AMU and Hospital stay as well as intermediate and long-term mortality were coherent with other studies [66], [115], [124]–[126].

When we compared the mortality rates of elderly inpatients according to their nutritional status (3 nutrition groups), the results were also within the range reported by other authors.

In-hospital (short-term) mortality was significantly higher among the malnourished patients; this was supported by C. Gazzoti et al. [118] and M.-C. Van Nes et al. [64]. Similarly, intermediate- and long-term mortality rate was significantly linked with the nutritional status in our study population; which was very consistent with previous studies [7], [66], [71], [127], even while using other tools to evaluate the nutritional status [128].

The Kaplan-Meier curve (**Figure 18** – page 93), reinforced the previous conclusions by proving the strong association between the nutritional status and long-term mortality. Moreover, during follow-up, as the time goes by, the association between the admission nutritional status and the mortality rates becomes, and M.D. Persson et al. ended up with same conclusions in their Swedish acutely ill population [127] concerning elderly mortality at 1, 2 then 3 years post-discharge.

Secondly, the ADL index; it was found to be profoundly low in the group of malnourished patients compared to the patients at risk of malnutrition and the well-nourished patients before acute illness and at admission. This was consistent with previous studies. Those latter were conducted either outside the hospital (i.e. free living elderly or those living in long-term care settings/nursing homes) [129]–[132], or at the admission to the acute ward regardless of the tool used KATZ index [118], Barthel index of ADL [133] or IADL [119].

Moreover, in the Cox proportional hazards univariate analysis, ADL index before acute illness was significantly linked to the long-term mortality in elderly, which is in the line with previous studies [6], [115], [123].

Limitations:

Our study has some limitations that have to be kept in mind. The first weak point is the small size of the sample due to the short period devoted to patient recruitment (4 months) and the low patient flow in our AMU during this period; this makes our results hard to extrapolate on a bigger scale.

The second weakness is the 3 MNA items (BMI, and subjective items P and O (Appendix 4) that are sometimes hard to collect especially for very ill patients; an issue that L.M. Donini et al. tried to solve by modifying the original MNA to make it easier to administer (replacing BMI or excluding it) [134].

Strengths:

Despite those weaknesses, there are strengths we must not forget. Firstly, the study design, a prospective longitudinal study. The data were collected by the same team (2 medical students supervised by 3 professors) at admission, during hospitalization and then phone calls follow-up; which reduces the inter-observer variability.

Moreover, measurement biases were significantly reduced thanks to a planned and standardized data collection and adapted questionnaires especially MNA (Arabic version) and EQ-5D (Moroccan adapted version [85])

Not forgetting that we used different statistical methods and IBM SPSS Statistics 20 and STATA 14 (widely praised by researchers) to reach to most reliable and accurate results possible (Imputation, Cox proportional hazards analysis, Kaplan-Meier curve, etc…)

Finally, it's the first study conducted about malnutrition in Moroccan elderly admitted to the first and only Moroccan AMU; with a follow-up period up to 18 months after discharge from AMU, which is considerable.

RECOMMENDATIONS

Thanks to this study (especially the Decision curve analysis and Cox proportional hazards analyses), we now know how important is the nutritional status in the medical care of the AMU old patients.

Therefore, some recommendations can start to be discussed in order to improve elderly health status during their AMU stay or even before admission and after discharge. Y.P. Lim came to same conclusions [71].

Here are some propositions:

- Raising awareness of elderly nutritional problems in the society and among all the medical professionals. This would allow an early and efficient intervention.

- Control the risk factors of malnutrition (**Table 1** and **Table 3**, p 33 and p 46) when we detect them.

- Incite the use of the MNA by the medical staff of the ward to screen (MNA-SF) and assess (MNA-LF) elderly malnutrition since it's a reliable tool for early detection (before severe changes). It also outlines the weak items of the patient to allow a targeted intervention [59].

- Set nutritional intervention thresholds (**Appendix 5** p **Erreur ! Signet non défini.**)
- Implement standardized and evidence-based nutrition strategies to manage malnourished elderly inpatients or those at risk of malnutrition.
  Those strategies must be built on approved recommendations and guidelines [37], [73] to choose the best food support suitable for each patient (keeping in mind that

elderly are challenging to manage as they are frail and present different geriatric conditions).

- Multiply studies and include different wards or even community-dwelling population to establish a Moroccan nutritional profile and foster food support implementation.

CONCLUSION

The present study is the first one of its kind conducted in Morocco so far, providing, therefore, precious insight of the nutritional status of acutely ill elderly in a Moroccan AMU.

It highlighted the high prevalence of malnutrition among elderly patients admitted to the AMU. This reflects the poor nutritional status pre-existing in the free-living elderly and would justify a preventive intervention besides the intervention needed for hospitalized patients.

In addition, we found that functional and health status before acute illness and at admission (ADL and EQ-5D) were strongly related to malnutrition; further studies to prove the cause-effect relationship could be conducted.

Through this study we also proved that malnutrition among this frail population is a strong and independent risk factor (CHP analysis and Kaplan-Meier curve) that impacts on the short- and long-term mortality of our population.

Furthermore, the strong clinical utility of the nutritional status in the AMU inpatients has been confirmed. The latter let us think of new recommendations in order to improve the quality of our patient care and the outcome before and after discharge (Including the nutritional assessment at admission, implementing nutrition support).

Notwithstanding the small size of our population, our results were generally consistent with previous researches; but further studies on a bigger scale and longer periods would help to establish the nutrition profile of the Moroccan population and set adapted nutrition strategies designed for hospital wards and for free-living community as well.

SUMMARY

ABSTRACT

Title: Prevalence and Prognosis Impact of Malnutrition in Elderly of a Moroccan Acute Medical Unit

Author: Myriam BIZRANE

Introduction: Our study aimed to identify the prevalence of malnutrition in elderly admitted to an AMU and to compare patients according to their nutritional status; then analyze the prognosis impact of malnutrition at 540 days follow-up.

Method: This was a prospective cohort study conducted in the AMU of Ibn Sina University Hospital, Rabat, from June to September 2014, including patients aged of ≥65 years. Demographic, anthropometric and clinical characteristics, comorbid diseases and in-hospital evolution data were included. Survival status was evaluated in the hospital and at 540 days follow-up. For malnutrition we used MNA, and for the health and functional status, EuroQol-5D and ADL. Cox proportional hazards univariate analyses identified the factors associated with mortality at 540 days. Then, multivariable model incorporating conventional risk variables without (model 1), and with nutritional status (model 2) was calculated and its predictive performance was assessed. Statistical analyses were carried out in SPSS Statistics and STATA 14.

Results: We included 95 patients. Mean age was 75±5.9 years; 64.2% were women. In-hospital and 540 days follow-up mortality were respectively 16.8% and 46.3%. Median of ADL and EQ5D-Index before acute illness were respectively 5.5 [3.5;6] and 0.29 [-0.17;0.81]. Prevalences of well-nourished, at risk of malnutrition and malnourished patients were respectively 46.3%, 27.4%, and 26.3%. Compared to well-nourished patients, other patients had significantly higher mortality. Cox proportional hazards multivariate analyses showed that malnutrition was a strong independent predictor of long-term mortality. Model 2 included; unmarried patients, lower Mean arterial pressure, lower EQ5D index before acute illness and malnourished patients. Additionally, for increasing probability thresholds, the model 2 had higher net benefit, suggesting its potentially higher clinical utility.

Conclusion: Malnutrition has a negative prognosis impact on the long-term survival status of elderly in an AMU. Therefore, its high clinical utility should be considered to guide nutrition interventions during hospital stay and even after discharge to reduce the poor outcome of elderly patients.

Keywords: Acute medical unit (AMU), Elderly, Malnutrition, Mini-nutritional assessment, Mortality.

RESUME

Titre : La Prévalence et l'Impact Pronostique de la Malnutrition chez les Sujets Agés dans un Service de Médecine Aigue au Maroc.

Auteur: Myriam BIZRANE

Introduction: Notre étude a pour but d'identifier la prévalence de la malnutrition chez les sujets âgés dans un service de médecine aigue et de comparer ces patients selon leur état nutritionnel; puis d'analyser l'impact pronostique de la malnutrition à un suivi de 540 jours.

Méthode: C'était une étude de cohorte prospective menée dans le service de médecine aigue du CHU Ibn Sin, Rabat, de Juin à Septembre 2014, incluant les patients âgés de ≥65 ans. Les caractéristiques démographiques, anthropométriques et cliniques, ainsi que les comorbidités et l'évolution intra-hospitalière ont été recueillies. L'état de survie a été évalué à l'hôpital et à un suivi de 540 jours. Pour la malnutrition nous avons utilisé le MNA; pour l'état fonctionnel et l'état de santé nous avons utilisé l'ADL et l'EuroQol-5D. Les analyses univariées de la régression aléatoire de Cox ont identifié les facteurs associés à la mortalité à 540 jours. Puis, le modèle multivarié incorporant les covariables sans (modèle 1), et avec l'état nutritionnel (modèle 2) a été calculé et sa performance prédictive évaluée. L'analyse statistique a été effectuée par SPSS statistiques et STATA 14.

Résultats: Nous avons inclus 95 patients. L'âge moyen était 75±5,9 ans ; 64,2% étaient des femmes. Les mortalités intra-hospitalière et à 540 jours de suivi étaient respectivement 16,8% et 46,3%. La médiane de l'ADL et de l'EQ5D-index avant l'épisode aigue étaient respectivement, 5,5 [3,5;6] and 0,29 [-0,17;0,81]. Les prévalences de l'état nutritionnel normal, le risque de malnutrition et la malnutrition étaient respectivement 46,3%, 27,4% et 26,3%. Comparés aux patients bien-nourris, les autres patients avaient une mortalité significativement élevée. L'analyse multivariée de la régression aléatoire de Cox a montré que la malnutrition était un prédicteur puissant et indépendant de la mortalité à long terme. Le modèle 2 avait inclus; les patients non mariés, une pression artérielle moyenne basse, un EQ5D-index avant l'épisode aigue bas et les patients mal-nourris. De plus, pour un seuil de probabilité croissant, le modèle 2 avait un bénéfice prédictif net plus élevée, suggérant son utilité clinique potentiellement supérieure.

Conclusion: La malnutrition a un impact pronostique négatif sur la survie à long terme des sujets âgés dans un service de médecine aigue. Par conséquent, son utilité clinique élevée devrait être prise en compte pour guider les mesures nutritionnelles durant l'hospitalisation et même après la sortie, afin d'améliorer le devenir des patients âgés.

Mots-clés: Service de médecine aigue, Sujets âgés, Malnutrition, Mini-nutritional assessment (MNA), Mortalité.

الملخص

العنوان: مدى انتشار و تأثير الانذاري لسوء التغذية عند المسنين في مصلحة المستعجلات الطبية
المؤلفة: مريم بيزران

التمهيد: دراستنا هدفت إلى تحديد مدى انتشار سوء التغذية عند المسنين في مصلحة المستعجلات الطبية و المقارنة بين المرضى حسب حالة تغذيتهم؛ و بعدها، تحليل التأثير الانذاري لسوء التغذية في اليوم 540 من التتبع.
الطريقة: كانت هذه دراسة استباقية للأتراب أجريت في مصلحة المستعجلات الطبية للمستشفى الجامعي ابن سينا بالرباط، خلال فترة امتدت من يونيو إلى شتنبر 2014. و ضمَت المرضى في سن 65 سنة فما فوق. دونت الخصائص السكانية، الأنثروبومترية السريرية، الأمراض المتزامنة و تطور الحالة خلال الاستشفاء. كما تم تقييم وضع البقاء خلال الاستشفاء و في اليوم 540 من التتبع. أما بالنسبة لتقييم سوء التغذية، الحالة الصحية و الحالة الوظيفية، فقد استعملنا، بالتتالي، "تقييم التغذية المصغر" (MNA)، EuroQol-5D (EQ5D) و مؤشر أنشطة الحياة اليومية (ADL).التحاليل أحادية المتغيرللارتداد العشوائي لكوكس (Cox proportional hazards univariate analyses) نجحت في تحديد العوامل المرتبطة بالوفيات خلال 540 يوم من التتبع. بعدها، قمنا بحساب النموذج متعدد المتغيرات الذي أدمجت فيه المتغيرات المستقلة الأساسية بدون اعتبار (النموذج 1)، ثم باعتبار الحالة الغذائية (النموذج 2)، وقومنا كفآته التنبؤية. أنجز التحليل الإحصائي بواسطة SPSS statistics و STATA 14.
النتائج: أدمجنا 95 مريضا. كان معدل السنَ 75±5.9 سنة مع نسبة النساء 64.2%. كانت نسبة الوفيات خلال الاستشفاء ثم خلال 540 يوما من التتبع 16.8% و 46.3% بالتتالي. ناصف وسيط ADL و مؤشرEQ5D قبل المرض الحاد، بالتتالي، 5.5 [6;3.5] و 0.29 [0.81;-0.17]. مدى انتشار الحالة الغذائية الطبيعية، سوء التغذية و التعرض لخطر سوء التغذية هو، بالتتالي، 46.3%، 27.4% و 26.3%. مقارنة مع المرضى دوي الحالة الغذائية الطبيعية، كان عند المرضى الآخرين نسبة الوفيات مرتفعة بشكل ملحوظ. التحاليل متعددة المتغير(analyse multivariée) للارتداد العشوائي لكوكس بينت أن سوء التغذية كان منبئا مستقلا قويا للوفيات على المدى البعيد. النموذج 2 أدمج؛ المرضى الغير المتزوجين، انخفاض الضغط الشرياني الوسطي، انخفاض مؤشر EQ5D قبل المرض الحاد و المرضى دوي سوء التغذية. إضافة إلى ذلك، عند ازدياد عتبة الاحتمالات، يكون للنموذج 2 منفعة صافية أكثر ارتفاعا، الشيء الذي قد يدل على منفعة كلينيكية أعلى لهذا النموذج.
الخاتمة: لسوء التغذية تأثير إنذاري سلبي على الوفيات على المدى البعيد عند المسنين بمصلحة المستعجلات الطبية، لدى يجب أن تؤخذ منفعتها الكلينيكية العالية بعي الاعتبار لإرشاد الاستراتيجيات الغذائية خلال الاستشفاء وبعد الخروج من المستشفى لتحسين تطور المرضى المسنين.
الكلمات الأساسية: مصلحة المستعجلات الطبية، المسنين، سوء التغذية، الوفيات.

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APPENDIX

I. Appendix 1: Nutritional Risk Screening – 2002

Table 1: Initial screening

		Yes	No
1	Is BMI < 20.5?		
2	Has the patient lost weight within the last 3 months?		
3	Has the patient had a reduced dietary intake in the last week?		
4	Is the patient severely ill ? (e.g. in intensive therapy)		
Yes: If the answer is 'Yes' to any question, the screening in **Table 2** is performed.			
No: If the answer is 'No' to all questions, the patient is re-screened at weekly intervals. If the patient e.g. is scheduled for a major operation, a preventive nutritional care plan is considered to avoid the associated risk status.			

Table 2: Final Screening

Impaired nutritional status		**Severity of disease (≈ stress metabolism)**	
Absent Score 0	Normal nutritional status	**Absent Score 0**	Normal nutritional requirements
Mild Score1	Weight loss >5% in 3 months	**Mild Score1**	Hip fracture
	Or		Chronic patients, in particular with acute complications: cirrhosis
	Food intake below 50–75% of normal requirement in preceding week		COPD
			Chronic hemodialysis, diabetes, oncology
Moderate Score 2	Weight loss >5% in 2 months	**Moderate Score 2**	Major abdominal surgery. Stroke
	Or		
	Moderate BMI 18.5 – 20.5 + impaired general condition		Moderate Severe pneumonia, hematologic malignancy
	Or		
	Food intake 25–50% of normal requirement in preceding week		
Severe Score 3	Weight loss >5% in 1 month (≈ > 15% in 3 months (17))	**Severe Score 3**	Head injury
	Or		Bone marrow transplantation
	Severe BMI <18.5 + impaired general condition (17)		Intensive care patients (APACHE 10)
	Or		
	Food intake 0–25% of normal requirement in preceding week in preceding week		
Score	**(+)**	**Score**	**(=) Total Score**

Calculate the total score:

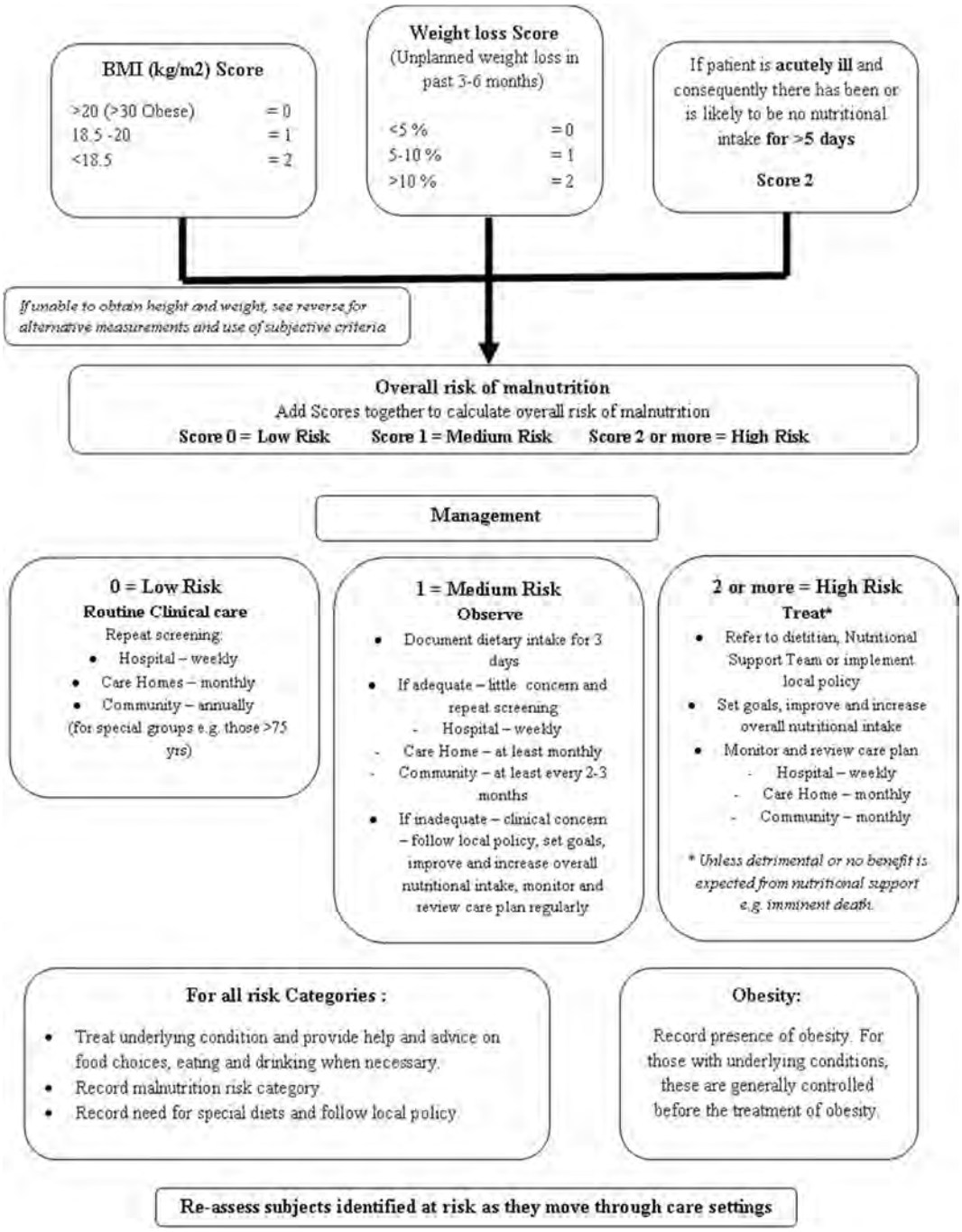
1. Find score (0–3) for **Impaired nutritional status** (only one: choose the variable with highest score) and **Severity of disease** (≈ stress metabolism, i.e. increase in nutritional requirements).
2. Add the two scores (--> total score)
3. If age ≥ 70 years: add **1** to the total score to correct for frailty of elderly
4. If age-corrected total ≥ 3: start nutritional support

Score ≥ 3: the patient is nutritionally at-risk and a nutritional care plan is initiated **Score < 3:** weekly rescreening of the patient. If the patient e.g. is scheduled for a major operation, a preventive nutritional care plan is considered to avoid the associated risk status.

Note that:

A patient with a **score = 1** is admitted to hospital due to complications associated with a chronic disease. The patient is weak but out of bed regularly. Protein requirement is increased, but can be covered by oral diet or supplements in most cases.
A patient with a **score = 2** is a confined to bed due to illness, e.g. following major abdominal surgery or due to severe infection. Protein requirement is substantially increased but can be covered, although artificial feeding is required in many cases.
A patient with a **score = 3** is the intensive care patient with assisted ventilation, inotropic drugs, etc. Protein requirement is increased to the extent, that in most cases it cannot be covered by artificial feeding, but protein breakdown and Nitrogen loss can be attenuated significantly.

II. Appendix 2: Malnutrition Universal Screening Tool "MUST"



III. Appendix 3: The Subjective Global Assessment

Features of subjective global assessment (SGA)

(Select appropriate category with a checkmark, or enter numerical value where indicated by "#.")

A. History

1. Weight change

Overall loss in past 6 months: amount = # _____ kg; % loss = # _____

Change in past 2 weeks: _____ increase,

_____ no change,

_____ decrease.

2. Dietary intake change (relative to normal)

_____No change,

_____Change _____duration = # _____ weeks

_____type: _____suboptimal liquid diet, _____ full liquid diet

_____ hypocaloric liquids, _____ starvation.

3. Gastrointestinal symptoms (that persisted for >2 weeks)

_____none, _____nausea, _____vomiting, _____diarrhea, _____anorexia.

4. Functional capacity

_____ No dysfunction (e.g., full capacity),

_____ Dysfunction _____ duration = # _____ weeks.

_____ Type: _____working suboptimally,

_____ambulatory,

_____bedridden.

5. Disease and its relation to nutritional requirements

Primary diagnosis (specify) _____

Metabolic demand (stress): _____ no stress, _____low stress,

_____moderate stress, _____high stress.

B. Physical (for each trait specify: 0 = normal, 1+ = mild, 2+ = moderate, 3+ = severe).

_____**loss of subcutaneous fat** (triceps, chest)

_____**muscle wasting** (quadriceps, deltoids)

_____**ankle edema**

_____**sacral edema**

_____**ascites**

C. SGA rating (select one)

_____A = Well nourished

_____B = Moderately (or suspected of being) malnourished

_____C = Severely malnourished

For more details about how to use this tool, refer to the chapter "DESCRIPTION OF THE MANEUVER" in "What is Subjective Global Assessment of Nutritional Status?" By A. S. DETSKY et al. [50]

IV. Appendix 4: MNA long form

English version

Mini Nutritional Assessment MNA®

Nestlé Nutrition Institute

Last name: First name:

Sex: Age: Weight, kg: Height, cm: Date:

Complete the screen by filling in the boxes with the appropriate numbers.
Add the numbers for the screen. If score is 11 or less, continue with the assessment to gain a Malnutrition Indicator Score.

Screening

A Has food intake declined over the past 3 months due to loss of appetite, digestive problems, chewing or swallowing difficulties?
0 = severe decrease in food intake
1 = moderate decrease in food intake
2 = no decrease in food intake ☐

B Weight loss during the last 3 months
0 = weight loss greater than 3kg (6.6lbs)
1 = does not know
2 = weight loss between 1 and 3kg (2.2 and 6.6 lbs)
3 = no weight loss ☐

C Mobility
0 = bed or chair bound
1 = able to get out of bed / chair but does not go out
2 = goes out ☐

D Has suffered psychological stress or acute disease in the past 3 months?
0 = yes 2 = no ☐

E Neuropsychological problems
0 = severe dementia or depression
1 = mild dementia
2 = no psychological problems ☐

F Body Mass Index (BMI) = weight in kg / (height in m)²
0 = BMI less than 19
1 = BMI 19 to less than 21
2 = BMI 21 to less than 23
3 = BMI 23 or greater ☐

Screening score (subtotal max. 14 points) ☐☐
12-14 points: Normal nutritional status
8-11 points: At risk of malnutrition
0-7 points: Malnourished

For a more in-depth assessment, continue with questions G-R

Assessment

G Lives independently (not in nursing home or hospital)
1 = yes 0 = no ☐

H Takes more than 3 prescription drugs per day
0 = yes 1 = no ☐

I Pressure sores or skin ulcers
0 = yes 1 = no ☐

J How many full meals does the patient eat daily?
0 = 1 meal
1 = 2 meals
2 = 3 meals ☐

K Selected consumption markers for protein intake
- At least one serving of dairy products (milk, cheese, yoghurt) per day yes ☐ no ☐
- Two or more servings of legumes or eggs per week yes ☐ no ☐
- Meat, fish or poultry every day yes ☐ no ☐

0.0 = if 0 or 1 yes
0.5 = if 2 yes
1.0 = if 3 yes ☐.☐

L Consumes two or more servings of fruit or vegetables per day?
0 = no 1 = yes ☐

M How much fluid (water, juice, coffee, tea, milk...) is consumed per day?
0.0 = less than 3 cups
0.5 = 3 to 5 cups
1.0 = more than 5 cups ☐.☐

N Mode of feeding
0 = unable to eat without assistance
1 = self-fed with some difficulty
2 = self-fed without any problem ☐

O Self view of nutritional status
0 = views self as being malnourished
1 = is uncertain of nutritional state
2 = views self as having no nutritional problem ☐

P In comparison with other people of the same age, how does the patient consider his / her health status?
0.0 = not as good
0.5 = does not know
1.0 = as good
2.0 = better ☐.☐

Q Mid-arm circumference (MAC) in cm
0.0 = MAC less than 21
0.5 = MAC 21 to 22
1.0 = MAC greater than 22 ☐.☐

R Calf circumference (CC) in cm
0 = CC less than 31
1 = CC 31 or greater ☐

Assessment (max. 16 points) ☐☐.☐
Screening score ☐☐.☐
Total Assessment (max. 30 points) ☐☐.☐

Malnutrition Indicator Score
24 to 30 points ☐ Normal nutritional status
17 to 23.5 points ☐ At risk of malnutrition
Less than 17 points ☐ Malnourished

References
1. Vellas B, Villars H, Abellan G, et al. Overview of the MNA® - Its History and Challenges. *J Nutr Health Aging*. 2006; **10**:456-465.
2. Rubenstein LZ, Harker JO, Salva A, Guigoz Y, Vellas B. Screening for Undernutrition in Geriatric Practice: Developing the Short-Form Mini Nutritional Assessment (MNA-SF). *J. Geront.* 2001; **56A**: M366-377
3. Guigoz Y. The Mini-Nutritional Assessment (MNA®) Review of the Literature - What does it tell us? *J Nutr Health Aging*. 2006; **10**:466-487.
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For more information: www.mna-elderly.com

Arabic version (Used in our study)

Nestlé Nutrition Institute

"تقييم التغذية المصغر"

Mini Nutritional Assessment

MNA®

أسم العائلة: الاسم الأول:

الجنس: العمر: الوزن(كجم): الطول(سم): التاريخ:

أكمل المسح الأولي بملأ المربعات بالأرقام (النقاط) المناسبة. اجمع النقاط فإذا كان المجموع أقل من أو يساوي (11) استكمل التقييم لتحصل على مجموع النقاط لمؤشر سوء التغذية.

المسح الأولي

A أ. هل نقص تناول الطعام خلال الثلاثة أشهر الماضية نتيجة لفقدان الشهية أو مشاكل في الهضم أو صعوبات في المضغ أو البلع؟
0= فقدان شديد للشهية
1= فقدان متوسط للشهية
2= لا يوجد فقدان للشهية

B ب. مدى فقدان الوزن خلال الأشهر الثلاثة الأخيرة
0= فقدان الوزن أكثر من 3 كجم
1= غير معروف
2 = فقدان الوزن من 1 إلى 3 كجم
3= لا يوجد فقدان في الوزن

C ج. القدرة على الحركة
0= ملازم للفراش أو للكرسي
1 = قادر على القيام من الفراش / الكرسي ولكنه غير قادر على مغادرة المنزل
2 = يغادر المنزل

D د. أي إصابة بضغط نفسي أو مرض حاد في الأشهر الثلاثة الماضية
0= نعم 2= لا

E ه. أي إصابات عصبية ونفسية
0= خرف شيخوخة شديد أو اكتئاب
1= خرف شيخوخة خفيف (معتدل)
2 = غير مصاب بأمراض

F و. معدل كتلة الجسم[الوزن بالكيلوجرام) ÷ (الطول بالمتر²)]
0= معدل كتلة الجسم أقل من 19
1 = معدل كتلة الجسم من 19إلى أقل من 21
2 = معدل كتلة الجسم من 21 إلى أقل من 23
3 = معدل كتلة الجسم أكثر من أو يساوي 23

مجموع النقاط المحرزة في المسح الأولي (الحد الأقصى 14 نقطة)

12- 14 نقطة: الحالة الغذائية طبيعية
8-11 نقطة: معرض لخطر سوء تغذية
0- 9 نقطة: حالة سوء تغذية

من أجل تقييم أشمل، أكمل الأسئلة من (ز إلى ص)

التقييم

G ز. يعيش مستقل (ليس في دار رعاية أو مستشفى)؟
0 = لا 1 = نعم

H ح. يتناول أكثر من ثلاث أدوية موصوفة يوميا؟
0= نعم 1 = لا

I ط. يعاني من قرح الفراش أو قرح جلدية؟
0= نعم 1 = لا

J ي. كم وجبة كاملة يتناولها المريض يوميا؟
0 = وجبة واحدة
1 = وجبتان
2 = ثلاث وجبات

K ك. معدل تناول البروتينات
على الأقل حصة واحدة من منتجات الألبان (الحليب، الجبن، الزبادي) يوميا
نعم لا
حصتان أو أكثر من الحبوب أو البيض في الأسبوع
نعم لا
حصة من اللحوم / السمك / الدواجن (الطيور) يوميا
نعم لا
0 = (صفر - 1)اجابة بنعم
0.5 = (2) اجابتان بنعم
1 = 3 اجابات بنعم
الإجمالي

L ل. يستهلك حصتين أو أكثر من الفواكه أو الخضروات يوميا
0= لا 1= نعم

M م. ما هي كمية السوائل (مياه، عصير، قهوة، شاي، حليب.....) المستهلكة يوميا؟
0 = أقل من 3 اكواب
0.5 = 3 إلى 5 أكواب
1 = أكثر من 5 أكواب

N ن. أسلوب تناول الطعام:
0 = غير قادر على الأكل بدون مساعدة
1 = يطعم نفسه مع بعض الصعوبة
2 = يطعم نفسه بدون أي مشكلة

O ص. الرؤية الذاتية لحالة التغذية
0 = يرى أن لديه سوء تغذية
1 = غير متأكدا من حالة التغذية
2 = يرى انه ليس لديه مشكلة في التغذية

P ع. بالمقارنة بالأشخاص الآخرين من نفس العمر، كيف ينظر المريض الى حالته الصحية
0 = ليست بنفس الجودة
0.5 = لا يعرف
1 = بنفس الجودة
2 = أحسن

Q ف. محيط منتصف الذراع (بالسنتيمتر)
0 = أقل من 21 سم
0.5 = من 21 إلى 22 سم
1 = 22 سم أو أكثر

R ص. محيط كتلة (بطة) الساق (بالسنتيمتر)
0 = أقل من 31 سم
1 = 31 سم أو أكثر

مجموع النقاط المحرزة في التقييم (الحد الأقصى 16 نقطة)

+ مجموع النقاط المحرزة في المسح الأولي

مؤشر سوء التغذية

= التقييم الإجمالي (الحد الأقصى 30 نقطة)

24 - 30 نقطة: الحالة الغذائية طبيعية
17 - 23.5 نقطة: معرض لخطر سوء التغذية
أقل من 17 نقطة: حالة سوء تغذية

Ref. Vellas B, Villars H, Abellan G, et al. *Overview of MNA® - Its History and Challenges.* J Nut Health Aging 2006; 10: 456-465.
Rubenstein LZ, Harker JO, Salva A, Guigoz Y, Vellas B. Screening for Undernutrition in Geriatric Practice: *Developing the Short-Form Mini Nutritional Assessment (MNA-SF).* J. Geront 2001; 56A: M366-377.
Guigoz Y. The Mini-Nutritional Assessment (MNA®) *Review of the Literature – What does it tell us?* J Nutr Health Aging 2006; 10: 466-487.
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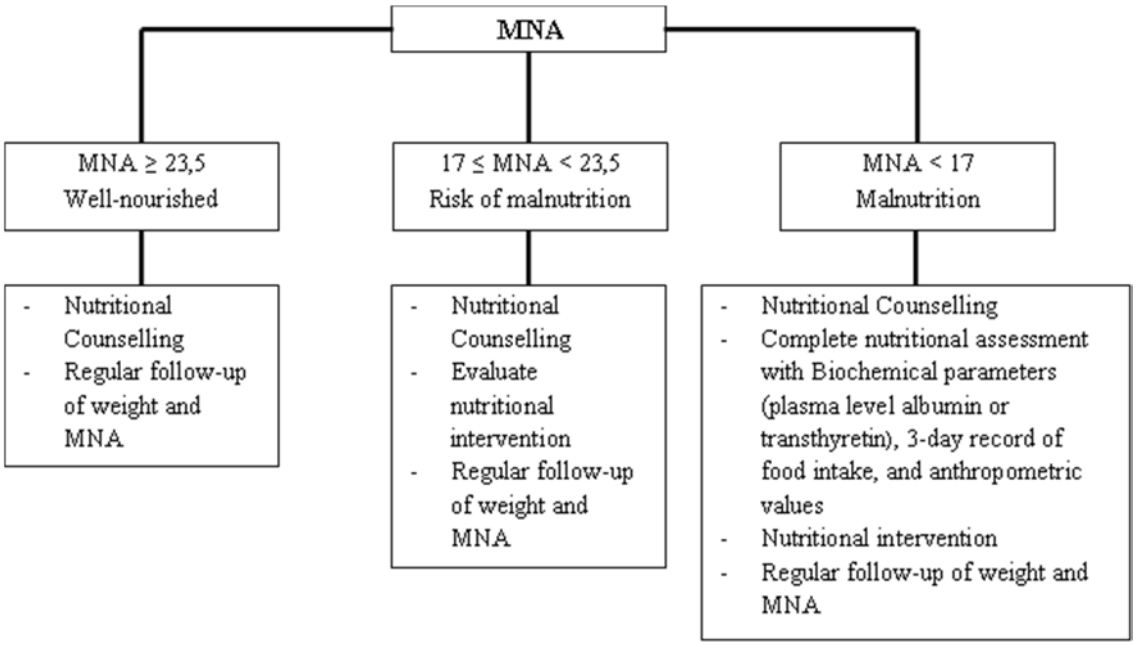
لمزيد من المعلومات : www.mna-elderly.com

V. Appendix 5: MNA as a guide for nutritional intervention



VI. Appendix 6: Charlson Comorbidity Index

- Clinical comorbidity conditions weighting -

Weight	Clinical conditions
1	- Myocardial infarct - Congestive cardiac insufficiency - Peripheral vascular disease - Dementia - Cerebrovascular disease - Chronic pulmonary disease - Conjunctive tissue disease - Slight diabetes, without complications - Ulcers - Chronic diseases of the liver or cirrhosis
2	- Hemiplegia - Moderate or severe kidney disease - Diabetes with complications - Tumors - Leukemia - Lymphoma
3	- Moderate or severe liver disease
6	- Malignant tumor, metastasis - AIDS

- Age weighting -

Age group	Points
0-49 years	**0**
50-59 years	**1**
60-69 years	**2**
70-79 years	**3**
80-89 years	**4**
90-99 years	**5**

A CCI score equal to 0, means that the patient has no comorbidity condition and is strictly aged less than 50 years old.

VII. Appendix 7: Glasgow Coma Scale

Patients Responses	Score
Eye Opening Response	
· Spontaneous	**4**
· To Speech	**3**
· To Pain	**2**
· None	**1**
Best Motor Response	
· Obeys Command	**6**
· Localizes Pain	**5**
· Flexor Withdrawal to Pain	**4**
· Abnormal Spastic Stereotypes Flexion Posture	**3**
· Extensor Response at Elbow	**2**
· No Movement	**1**
Verbal Response	
· Oriented Conversation	**5**
· Confused Conversation	**4**
· Inappropriate Words	**3**
· Incomprehensible Sounds	**2**
· No Vocalization	**1**
Total Score Possible	**3 to 15**

Teasdale, C. & Jennett, B. (1974). Assessment of coma and impaired consciousness. A practical scale. Lancet, 2, 81-84.

VIII. Appendix 8: KATZ index of Activities of Daily Living (ADL)

English version [81]

ITEM	POINTS
Bathing	
- Independent	**1**
- Needs assistance	½
- Dependent	**0**
Dressing	
- Gets clothes and gets completely dressed without assistance	**1**
- Gets clothes and gets dressed without assistance except for assistance in tying shoes	½
- Dependent	**0**
Toileting	
- Goes to "toilet room," cleans self, and arranges clothes without assistance	**1**
- Receives assistance in going to "toilet room" or in cleansing self or in arranging clothes	½
- Doesn't go to room termed "toilet" for the elimination process alone	**0**
Transfer	
- Moves in and out of bed as well as in and out of chair without assistance	**1**
- Moves in or out of bed or chair with assistance	½
- Doesn't get out of bed	**0**
Continence	
- Controls urination and bowel movement completely by self	**1**
- Has occasional “accidents”	½
- Incontinent	**0**
Feeding	
- Feeds self without assistance	**1**
- Feeds self except for getting assistance in cutting meat or buttering bread	½
- Depedent	**0**
TOTAL	**0 to 6**

French version (Used in our study)

"ECHELLE D'AUTONOMIE DE KATZ de l'ADL Activities of Daily Living"

ITEM	Points à attribuer
Hygiène corporelle	
- Autonomie	**1**
- Aide	½
- Dépendance totale	**0**
Habillage	
- Autonomie pour le choix des vêtements et l'habillage	**1**
- Autonomie pour le choix des vêtements et l'habillage mais a besoin d'aide pour se chausser	½
- Dépendance	**0**
Aller aux toilettes	
- Autonomie pour aller aux toilettes, se déshabiller et se rhabiller ensuite	**1**
- Doit être accompagné(e) ou a besoin d'aide pour se déshabiller ou se rhabiller	½
- Ne peut aller aux toilettes seul (e)	**0**
Locomotion	
- Se déplace seul (e)	**1**
- A besoin d'aide	½
- Grabataire	**0**
Continence	
- Continent (e)	**1**
- Incontinence occasionnelle	½
- Incontinent (e)	**0**
Repas	
- Mange seul (e)	**1**
- A besoin d'aide pour couper la viande ou peler les fruits	½
- Dépendant (e)	**0**
TOTAL	**0 à 6**

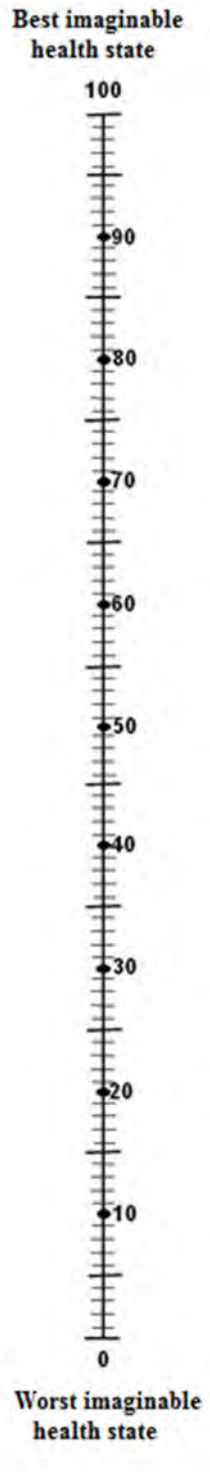
IX. Appendix 9: EQ-5D-3L and EQ-VAS

The UK English version

EQ-5D-3L

By placing a tick in one box in each group below, please indicate which statements best describe your own health state today.
Mobility I have no problems in walking about (1 point) I have some problems in walking about (2 points) I am confined to bed (3 points)
Self-Care I have no problems with self-care (1 point) I have some problems washing or dressing myself (2 points) I am unable to wash or dress myself (3 points)
Usual Activities (e.g. work, study, housework, family or leisure activities) I have no problems with performing my usual activities (1 point) I have some problems with performing my usual activities (2 points) I am unable to perform my usual activities (3 points)
Pain/Discomfort I have no pain or discomfort (1 point) I have moderate pain or discomfort (2 points) I have extreme pain or discomfort (3 points)
Anxiety/Depression I am anxious or depressed (1 point) I am moderately anxious or depressed (2 points) I am extremely anxious or depressed (3 points)

Visual Analogue Scale



To help people say how good or bad a health state is, we have drawn a scale (rather like a thermometer) on which the best state you can imagine is marked **100** and the worst state you can imagine is marked **0**.

We would like you to indicate on this scale how good or bad your own health is today, in your opinion. Please do this by drawing a line from the box below to whichever point on the scale indicates how good or bad your health state is today

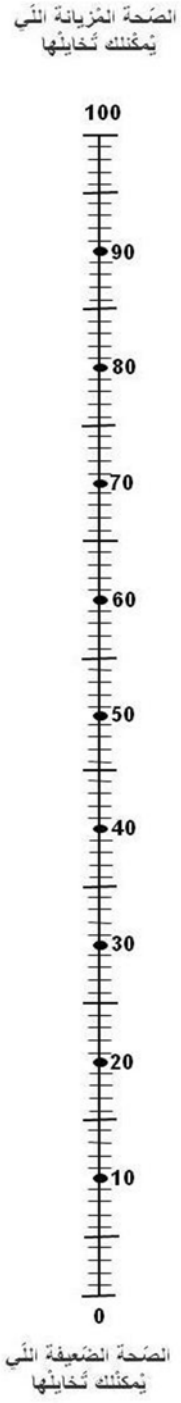
Your own health state is today

The Arabic version

EQ-5D-3L

عافاك دير علامة على مربّع واحْد ڤكل مجموعة دِيال الأجوبة وْ الّلي كايْوافقْ حالتْك الصّحية دْيال اليوم.
الحركة و المشي ما عْندي حتّى مشاكل فلمشي عْندي شْويّة دْيال المشاكِل فلمشِي أنا قابْطْ القراشْ
تڤدّ براسْكْ وْ تقادّ حالتكْ ڤدْرڤابْل راسي بوحْدي بْلا مشاكٍ عْندي شْوِيّة دْيال المشاكِل ڤلْغسيل وْ لْبيسْ الحْوايج ما كاڤدْرشْ ڤغسْلْ وْ ڤلْبسْ حْوايجي بوحْدي
الأنشطة اليوْميّة (مثلا الخْدْمة, القْراية, شْغالْ الدّار, شْغالْ العائِلة, شْغالْ الڤراعْ, الصّلاة) ما عْدْي حْتّى مشاكِل فلأنْشِطة دْ يالي اليوْميّة عْدْي شْويّة دْيال المشاكِل ڤلأنْشِطة دْ يالي اليوْميّة ما كاڤدْرشْ ندْيرْ الأنْشِطة دْيالي اليوْميّة
ألْحريقْ/ الرّاحة فالذّات ما فِيّاشْ الحْريقْ و مْرتاح فْذاتي فِيّا شْويّة دْيالْ الحْريق و مامْرتاحش فْذاتي فِيّا بْزّافْ دْيالْ الحْريقْ و مامْرتاحش ڤذاتي
القلق / الاكتِئاب ما مْقلّقْ ما مْكتائب مْقلّقْ وْلا مْكتائبْ شْويّة مْقلّقْ وْلا مْكتائبْ بْزّافْ

Visual Analogue Scale



باشْ نْعاوْنو النّاس يْبِيّنولينا مْزيانْ حالْتهم الصّحيّة, رْسمْنا واحْد الخطّ مْشْرّطْ (بْحال ميزان السّخانة) فِيه الرّقم 100 هو الصّحة المْزيانة اللّي يْمْكنْك تّخايْلها وْ 0 هو الصّحة الضّعيفة اللّي يْمْكنْك تّخايْلها.

بْغينا عافاكْ تْبِيّنْ لينا فْهاد الخطّ ْلمْشرّطْ فْقّاشْ كانْت صْحّتْك مْزْيانة وْلا ضْعيفة فْهاذْ اليوم.

عافاكْ رْسْم خطّ تيْبدا مْن المربّع اللّي ْلتْحْت وْ تايْمشي حْتّال شي نْقطة مْن النّقاطي الموجودين فْالخطّ المْشرّط وْ اللّي كْتبيّن: حالْتك الصّحيّة ذْيال اليوم

حالْتك الصّحيّة ذْيال اليوم

PHYSICIAN'S OATH

At the time of being admitted as a member of the medical profession:

I solemnly promise that I will devote my life to serve humanity.

I will give to my teachers the respect and gratitude that is their due.

I will practice my profession with conscience and dignity.

The health of my patient will be my first consideration.

I will not betray the secrets that are confided in me.

I will maintain by all the means in my power, the honor and the noble traditions of the medical profession.

My colleagues will be my brothers.

I will not permit considerations of religion, nationality, race, party politics or social standing to intervene between my duty and my patient.

I will maintain the utmost respect for human life from the time of conception.

Even under threat, I will not use my medical knowledge contrary to the laws of humanity.

I make these promises solemnly, freely and upon my honor.

SERMENT D'HIPPOCRATE

Au moment d'être admise à devenir membre de la profession médicale, je m'engage solennellement à consacrer ma vie au service de l'humanité.

Je traiterai mes maîtres avec le respect et la reconnaissance qui leur sont dus.

Je pratiquerai ma profession avec conscience et dignité. La santé de mes malades sera mon premier but.

Je ne trahirai pas les secrets qui me seront confiés.

Je maintiendrai par tous les moyens en mon pouvoir l'honneur et les nobles traditions de la profession médicale.

Les médecins seront mes frères.

Aucune considération de religion, de nationalité, de race, aucune considération politique et sociale ne s'interposera entre mon devoir et mon patient.

Je maintiendrai le respect de la vie humaine dès la conception.

Même sous la menace, je n'userai pas de mes connaissances médicales d'une façon contraire aux lois de l'humanité.

Je m'y engage librement et sur mon honneur.

قسم الطبيب

بسم الله الرحمن الرحيم

في هذه اللحظة التي تتم فيها قبولي عضوة في المهنة الطبية:

أقسم بالله العظيم

أن أراقب الله في مهنتي

وأن أصون حياة الإنسان في كافة أطوارها، في كل الظروف و الأحوال،

باذلًة وسعي في استنقاذها من الهلاك والمرض والألم و القلق.

وأن أحفظ للناس كرامتهم، وأستر عورتهم، وأكتم سرّهم.

وأن أكون على الدوام من وسائل رحمة الله، باذلًة رعايتي الطبية للقريب

والبعيد، للصالح و الطالح، والصديق و العدو.

وأن أثابر على طلب العلم، أسخِّره لنفع الإنسان لا لأذاه.

وأن أوقر من علمني، وأعلّم من يصغرني، وأكون أخًتا لكل زميل في

المهنة الطبية متعاونين على البر و التقوى.

وأن تكون حياتي مصداق إيماني في سري وعلانيتي، نقيًتا مما يشينها أمام الله

ورسوله والمؤمنين.

والله على ما أقول شهيد.

جامعة محمد الخامس – الرباط
كلية الطب والصيدلة بالرباط

سنـة : 2016 أطروحة رقم: 372

مدى انتشار و تأثير الانذاري لسوء التغذية عند المسنين في مصلحة المستعجلات الطبية

أطروحة

قدمت ونوقشت علانية يوم

من طرف

الآنسة: مريم بيزران
المزدادة في: **04** نونبر **1989** بليون (فرنسا)

لنيل شهادة الدكتوراه في الطب

الكلمات الأساسية: مصلحة المستعجلات الطبية – المسنين – سوء التغذية – الوفيات.

تحت إشراف اللجنة المكونة من الأساتذة

السيد رضوان أبوقال أستاذ في الإنعاش الطبي	**رئيس**
السيدة جيهان بلعياشي أستاذة في الإنعاش الطبي	**مشرفة**
السيد نوفل المدني أستاذ في الإنعاش الطبي	**أعضاء**
السيدة أمينة بركة أستاذة في طب الأطفال	