Catarina Silva Oliveira

GLIM criteria: Use of C-reactive protein as a biomarker of inflammation in hospitalized patients

Ciências da Nutrição

Faculdade de Ciências da Saúde

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Declaro para os devidos efeitos ter atuado com integridade na elaboração deste Trabalho de Projeto, atesto a originalidade do trabalho, confirmo que não incorri em plágio e que todas as frases que retirei de textos de outros autores foram devidamente citadas ou redigidas com outras palavras e devidamente referenciadas na bibliografia.

Catarina Silva Oliveira

(Catarina Silva Oliveira)

Trabalho apresentado à Universidade Fernando Pessoa como parte dos requisitos para obtenção do grau de licenciado em Ciências da Nutrição, sob a orientação da

Orientadora: Prof. Doutora Ana Sofia Sousa

Co-Orientadora: Prof. Doutora Rita Guerra

I. Dedicatória

Dedico este trabalho a todos aqueles que me ajudaram ao longo desta jornada.

Agradeço à minha família pelo apoio e amor incondicional, por estarem sempre do meu lado e compartilharem as minhas alegrias e pela força nos momentos mais desafiadores ao longo destes quatro anos de curso.

O incentivo e a confiança que depositaram em mim foram fundamentais para o meu sucesso.

Aos meus amigos que sempre me encorajaram a acreditar em mim e estiveram presentes ao longo desta jornada.

Expresso também a minha gratidão aos meus professores que ao longo de quatro anos de curso transmitiram conhecimentos valiosos e contribuíram para o meu crescimento académico e profissional.

Às minhas orientadoras, Prof. Doutora Ana Sofia Sousa e Prof. Doutora Rita Guerra pela orientação, conhecimentos e paciência que foram fundamentais para o desenvolvimento deste trabalho. Sou profundamente grata pela confiança que depositaram em mim.

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IV. Abbreviations list

- ASPEN: American Society for Parenteral and Enteral Nutrition
- BMI: Body Mass Index
- CRP: C-Reactive protein
- GLIM: Global Leadership Initiative on Malnutrition
- IQR: Interquartile Range
- MNA: Mini Nutritional Assessement
- MNA-SF: Mini Nutritional Assessment Short Form
- MUST: Malnutrition Universal Screening Tool
- NRS-2002: Nutritional Risk Screening
- PG-SGA: Patient- Generated Subjective Global Assessment

V. Title/Authors/ Academic affiliation

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Contagem de palavras: 3078

Número de figuras/tabelas: 7

Número de referências bibliográficas: 24

Conflito de interesses: Nada a declarar

VI. Resumo

Background: O Global Leadership Initiative on Malnutrition (GLIM) é uma ferramenta baseada na avaliação de dois tipos de critérios: fenotípico e etiológico, com o objetivo de padronizar o diagnóstico de desnutrição em adultos. A inflamação é um dos critérios etiológicos utilizados nesta ferramenta.

Objetivo: O presente estudo tem como objetivo avaliar a validade concorrente e preditiva do GLIM utilizando a Proteína C-Reativa como critério para inflamação (GLIM-CRP), além dos critérios de inflamação baseados na doença, propostos na ferramenta original (GLIM).

Metodologia: Foi realizado um estudo observacional prospectivo em pacientes hospitalizados com idade ≥18 anos. O risco nutricional foi avaliado com o Nutritional Risk Screening (NRS-2002). A validade concorrente do GLIM e GLIM-CRP foi avaliada usando o Patient Generated Subjective Global Assessment (PG-SGA) como método de referência. A sensibilidade e especificidade foram calculadas. A concordância foi quantificada usando o coeficiente Kappa ponderado (K). A validade preditiva foi avaliada por meio de riscos relativos ajustados (HR) e intervalos de confiança a 95% (IC95%) para alta hospitalar, através da análise de regressão de Cox.

Resultados: A concordância entre PG-SGA e o GLIM foi 50,2%, K=0,391, enquanto que no GLIM-CRP foi de 41,3%, K=0,284. A sensibilidade para o GLIM foi de 72,8% e para o GLIM-CRP foi de 79,3%. A especificidade foi de 68,9% para o GLIM e de 60,5% para o GLIM-CRP. A desnutrição grave avaliada pelas duas ferramentas estava associada de forma independente a uma menor probabilidade de terem alta para domicílio, HR=0,672 (IC 95%: 0,494;0,914) e HR=0,249 (IC 95%: 0,244;0,995), respetivamente. No entanto, no que diz respeito à desnutrição moderada, essa associação foi significativa para o GLIM Criteria, mas não significativa para o GLIM-CRP HR=0,598 (IC 95%: 0,426;0,839) e HR=0,814 (IC 95%: 0,547;1,211), respetivamente.

Conclusões: Embora o GLIM utilizando a PCR como critério alternativo para inflamação mantenha a validade concorrente e preditiva, substituir o critério de inflamação baseado em doenças do GLIM pela PCR não melhorou a ferramenta. No entanto, na ausência de

diagnóstico clínico que permita a identificação de inflamação, a PCR pode ser usada como critério alternativo.

Palavras-chave: GLIM; inflamação; desnutrição; validade concorrente; validade preditiva.

VII. Abstract

Background: The Global Leadership Initiative on Malnutrition is a tool based on the evaluation of two criteria: phenotypic and etiological, aiming to standardize the diagnosis of malnutrition in adults. Inflammation is one of the etiologic criteria used in this tool.
Aims: The present study aims to evaluate the concurrent and predictive validity of GLIM using C-Reactive Protein as a criterion for inflammation (GLIM-CRP) other than disease-based inflammation criteria proposed in the original tool (GLIM).
Methodology: A prospective observational study was conducted among hospitalized patients aged ≥18 years. Nutritional risk was assessed with NRS-2002. Concurrent validy of both GLIM and GLIM-CRP was evaluated using PG-SGA as the reference method. Sensitivity and specificity were calculated. Agreement between these tools was quantified using weighed Kappa (K). Predictive validity was assessed by adjusted hazard ratios (HR) and 95% confidence intervals (95%CI) for being discharged home, trough Cox regression analysis.

Results: The agreement between PG-SGA and GLIM criteria was 50.2%, K=0.391 and between PG-SGA GLIM-CRP was 41.3% K=0.284. Sensitivity for GLIM criteria was 72.8% and 79.0% for GLIM CRP. Specificity was 68.9% for GLIM and 60.5% for GLIM-CRP. Severe undernutrition assessed by GLIM and GLIM-CRP was independently associated with lower probability of being discharged home, HR=0.672 (95% CI: 0.494;0.914) and HR=0.244 (95% CI: 0.244; 0.995), respectively. However, regarding moderate undernutrition, this association was significant for GLIM but not significant for GLIM-CRP HR=0.598 (95% CI: 0.426;0.839) and HR=0.814 (95% CI: 0.547; 1.211), respectively.

Conclusions: Although GLIM using CRP as an alternative criterion for inflammation maintains concurrent validity and predictive validity, replacing the disease-based GLIM inflammation criterion with CRP did not improve the tool. Notwithstanding this, in the absence of clinical diagnosis that allow for the identification of inflammation, CRP can be used as an alternative criterion.

Keywords: GLIM, inflammation, malnutrition, concurrent validity, predictive validity.

1. Introduction

Malnutrition is a term that expresses any imbalance in nutrition, and thus encompasses both undernutrition and overweight/obesity (1) Undernutrition is the form of malnutrition that refers to the insufficient consumption of energy and nutrients required to sustain optimal health (2). Thus, malnutrition in the form of undernutrition can occur due to different causes such as reduced dietary intake, reduced absorption of macronutrients and micronutrients, increased losses or altered requirements and increased energy expenditure. Malnutrition is associated with depression of the immune system, impaired wound healing, muscle wasting, longer lengths of hospital stay, higher treatment costs and hospitalization costs and increased mortality (3). The early identification of malnutrition if of utmost importance to the treatment and prevention of adverse clinical outcomes (4,5).

The lack of consensus and the need to standardize the diagnosis of malnutrition led to the development of Global Leadership Initiative on Malnutrition Criteria (GLIM) in 2016 (6). The GLIM Criteria uses a two-step approach for the diagnosis of malnutrition, begins with a malnutrition risk screening tool to identify the patients at risk. Those at risk of malnutrition continue to the second step for the diagnosis and grading of severity of malnutrition. GLIM uses three phenotypic criteria: weight loss, low body mass index and reduced muscle mass, and two etiologic criteria: reduced food intake or assimilation and inflammation or disease burden. GLIM criteria recommends the classification of inflammation according to the disease, i.e., disease-based inflammation.

Inflammation is a widely used parameter in current malnutrition screening and diagnosis tools (6), as this condition plays a significant role in causing nutritional deficiencies in the course of disease and is often associated with metabolic consequences such as decreased appetite and insulin resistance. Thus, inflammation is currently considered an underlying cause of malnutrition (7).

In fact, inflammation impacts intake and requirements and has an impact on malutriton and its adverse outcomes by increasing resting energy expenditure and muscle catabolism (8). The presence of major infection, burns, trauma, cancer, congestive heart

failure, chronic obstructive pulmonary disease, among other diseases is associated with inflammation. (6)

Besides the clinical diagnosis, there are other methods to assess inflammation namely through biochemical parameters such as C-reactive protein (CRP) plasmatic levels. CRP is synthesized by the hepatocytes. This protein is a biomarker of inflammation as the production of CRP is stimulated by the cytokines, IL-1, IL-6, and tumor necrosis factor, in response to infection or tissue inflammation (9,10). Therefore, plasmatic CRP levels increase during an inflammatory process (11) and for that reason its concentration is used to assess and monitor the evolution of an inflammatory process. Although clinical diagnosis can be used to identify inflammation, CRP is a proxy measure of inflammation (7) and may be an alternative criterion to identify inflammation when using GLIM to assess malnutrition in the absence of a clinical diagnosis. Notwithstanding this, according to our knowledge, the use of CRP as an alternative inflammation criterion in GLIM has not been described in the literature.

Therefore, the present study aims to evaluate the concurrent and predictive validity of GLIM using CRP as a criterion for inflammation (GLIM-CRP) other than disease-based inflammation criteria, as proposed in the original tool (GLIM).

2. Methods

2.1.Study design and subjects

A prospective observational study was conducted in a Portuguese university hospital between July 2011 and December 2014. Detailed descriptions of the study population and methods have been reported elsewhere (12). The total study sample was composed of 632 participants that were all followed up from admission until hospital discharge, transfer, or death.

The admitted patients who met inclusion criteria were invited to participate in the study. Eligibility criteria were age ≥18 years old, Caucasian ethnicity, expected length of stay > 24h, consciousness, cooperation, and ability to provide written informed consent.

Only patients who were at risk of undernutrition according to the Nutritional Risk Screening (NRS-2002) and who had also registed in the patient medical records their CRP value were included in the present analysis.

2.2.Ethical statement

The research was carried out according to the guidelines established by the Declaration of Helsinki and was approved by the Institutional Review Board and the Ethics Committee of Centro Hospitalar do Porto. All study participants signed an informed consent form. (Appendix-Fig. 3)

2.3.Data collection

Data on demographic characteristics, clinical history, medical diagnosis, date of hospital admission and of discharge and discharge destination were obtained from patient´s medical records. Two previously trained registered nutritionists collected the remaining information using a structured questionnaire. Independence in activities of daily living was assessed with Katz index wich assesses the ability to bathing, dressing, toileting, transferring, continence and feeding, and participants were classified was independent, moderately dependent or severely dependent (13). Nutritional risk was

assessed with NRS-2022, an extensively validated malnutrition screening tool (14) and proposed by GLIM for malnutrition screening. Patient-Generated Subjective Global Assessment (PG-SGA) was used to diagnose and classify the degree of undernutrition.

2.4.Measurement of C-reactive protein

The plasmatic CRP levels were retrieved from the medical records of each patient. Only patients with CRP values were included in the analysis.

2.5.Data analysis

The Kolmogorov-Smirnov test was used to test the normality of data distribution, the continuous variables are presented as median and interquartile range (IQR) based on data distribution and the categorical variables are presented as frequencies.

Patients' characteristics were compared according to conventional GLIM criteria (non malnourished, moderate or severe malnutrition), CRP (presence or absence of inflammation) and GLIM criteria using levels of CRP for inflammation identification – GLIM-CRP.

Based on PCR levels, participants were stratified into two categories, levels between 0.0 and 0.49 mg/dl indicate no inflammation, whereas levels ≥ 0.5 mg/dl are considered inflammation. (15)

For the construction of the GLIM CRP, it was developed a "new" etiological criterion for inflammation. Participants with CRP plasmatic levels between 0.0 and 0.49 mg/dl were classified with 0 points, whereas those with levels above 0.49 were classified with 1 point. With this "new" etiological criterion, the patient nutritional status was classified according to the GLIM-PCR: when presenting at least 1 etiological criterion and 1 phenotypic criterion, he/she was classified as presenting moderate undernutrition and when presenting at least 1 etiological and 2 or more phenotypic criteria, he/she was classified as presenting severe undernutrition.

Concurrent validy of GLIM and of GLIM-CRP was evaluated using Patient Generated Subjective Global Assessment (PG-SGA) as the reference method.(16) Sensitivity and specificity of GLIM and GLIM-CRP were computed. Agreement between the tools was quantified using percentage of agreement (%) and as Cohen's kappa weighed coefficient (K). Predictive validity of both GLIM and GLIM-CRP was assessed using Cox proportional hazards regression models to determine the unadjusted and the adjusted hazard ratios (HR) and the respective 95% confidence intervals (CI) for being discharged home.

Moreover, Kaplan-Meier analysis was applied to assess the cumulative probability of being discharged home over time according to nutritional status classified with GLIM and GLIM-CRP.

Statistical significance was defined for $p < 0.05$. All analyses were conducted using the Software Package for Social Sciences (SPSS) (version 28.0.1.0; SPSS, Inc, Chicago, IL).

3. Results

Out of the 632 participants in the total sample, 87.2% presented at risk of malnutrition according to the NRS-2002 and it was possible obtain the CRP levels from 398 participants. Therefore, 250 participants in wich was possible obtain the CRP levels and at risk of malnutrition were included in the analysis for the present study.

According to GLIM, 46.0% patients were classified as non-malnourished, 23.2% were classified as moderately malnourished and 30.8% presented severe malnutrition.

According to the GLIM CRP, 53.2% patients were classified as non-malnourished, 33.6% were classified as moderately malnourished and 13.2% presented severe malnutrition.

The baseline characteristics of the participants according to GLIM nutritional status are presented in Table 1. The majority of sample, 68.4%, is female, while 31.6% of the sample is male. Participants aged less than 65 years represent 26% of sample, while 72% is 65 years or older. Most of the sample, who were independent according to Katz index, 92.2% did not present malnutrition and the majority of participants classified with severe dependency, 15.6%, presented severe malnutrition according to GLIM.

The baseline characteristics of the participants according to presence or absence of inflammation according to CRP serum levels are presented in Table 2. The majority of the sample 85.2% presented inflammation according to the cut-off points mentioned above. Of these 68.1% were female and 31.9% male.

Regarding GLIM-CRP, 91.7% of participants classified as independent according to Katz index were classified as non malnourished, moderate dependency according Katz Index presented more participants classified as without malnutrition and moderate malnutrition, and the participants with severe dependency according to Katz were in the majority, 21.2% classified as having malnutrition.

Comparatively to the GLIM Criteria, more participants were classified as not presenting malnutrition, 53.2%, or as presenting moderate malnutrition, 33.5%, according to GLIM-CRP.

The baseline characteristics of the participants according to GLIM-CRP are presented in Table 3.

The sensitivity of the GLIM-CRP was higher than the one found for the GLIM Criteria, 79.3% and 72.8%, respectively. However, the specificity of GLIM-CRP was lower than the specificity of GLIM Criteria, 60.5% and 68.8% respectively.

Regarding agreement, GLIM Criteria exhibits a higher agreement with PG-SGA than does GLIM-CRP: 50.2% (K=0.391) and 41.3% (K=0.284) respectively.

GLIM presented a kappa value of 0.391 and GLIM CRP a value of 0.284.

Patients with moderate and severe malnutrition according to both GLIM Criteria and GLIM-CRP showed a lower probability of being discharged home as it is shown in Figures 1 and 2, respectively.

Using a crude (unadjusted) Cox proportional hazards model, moderate and severe malnutrition evaluated by GLIM Criteria, was associated with lower probability for being discharged to usual residence over time. After adjusting the model for for Katz Index and maritial status, malnutrition was associated with lower probability for being discharge home over time.

Regarding to GLIM-CRP, the results have no statistical significance, with the exception of severe malnutrition using a crude (unadjusted) Cox proportional hazards model. Severe undernutrition was associated with lower probability for being discharge to usual residence over time.

Severe undernutrition assessed by GLIM and GLIM-CRP was independently associated with lower probability of being discharged home, HR=0.672 (95% CI: 0.494;0.914) and HR=0.244 (95% CI: 0.244; 0.995), respectively. However, regarding moderate undernutrition, this association was significant for GLIM but not significant for GLIM-CRP (HR=0.598 (95% CI:0.426;0.839) and HR=0.814 (95% CI: 0.547; 1.211), respectively.

4. Discussion and conclusions

GLIM-CRP presented high sensitivity and patients classified as presenting severe malnutrition according to this tool showed a lower probability of being discharge from hospital to usual residence. However, when compared to PG-SGA, GLIM-CRP showed lower specificity than did GLIM and moderate undenutrition according to GLIM-CRP was not associated with lower odds of being discharged home. According to Cohen´s weighted Kappa, the level of agreement in both tools is minimal.

Failure to diagnosis undernutrition and lack of awareness have resulted in the high prevalence of undernutrition and detrimental effects. (17)

A nutritional screening tool that exhibits high sensitivity enables the identification of undernutrition cases accurately, facilitating subsequent diagnosis and appropriated intervention. Conversely, a nutritional screening tool with high specificity minimizes the chances of unnecessary treatment for undernutrition, particularly among individuals who do not require it. (18)

High sensitivity allows false negatives to be minimized, while high specificity allows true negatives to be correctly identifies, it is important for a malnutrition screening tools to have high sensitivity and specificity. However high sensitivity may be more important to prevent cases of malnutrition from going unidentified and leading to harmful consequences. In this case GLIM Criteria shows higher sensitivity, reducing the probability of unidentified cases of malnutrition, compared to GLIM-CRP.

The accuracy of GLIM Criteria has already been reported: a study conducted in patients with cancer showed that GLIM Criteria is accurate, a sensitive and specific tool, with a sensitivity of 76% and specificity of 73%, , k=0.32, wich shows fair agreement (19). This results are similar to those obtained in the present study.

A study conducted in 144 individuals from a mixed patient population, presents a sensitivity of 51% and specificity of 98%. In this case GLIM presents higher specificity but less sensibility (20).

Another study conducted in 217 gastric cancer hospitalized patients showed moderate agreement (K=0.483, P< 0.001) between GLIM and PG-SGA (21).

Also, malnutrition evaluated by PG-SGA, and GLIM was associated with higher length of hospital stay by 1.76 (CI95% 1.23-2.52) times in a prospective cohort study with 601 hospitalized patients (22).

GLIM Criteria presented satisfactory criterion validity, with a sensitivity of 86.6%, and a specificity of 81.6% in a prospective cohort study involving 183 adult and elderly hospitalized patients with gastrointestinal, head and neck and lung cancer. (23).

These results are mostly very similar to those found in the present study.

The present study design is a strength once it allowed to follow the patients over time.

The use of PG-SGA as a reference method in the study is a strength because it is a widely employed nutritional assessment tool in clinical settings. It has gained recognition as an effective method due to its ability to assists professionals in detecting subtle alterations in clinical parameters, which might otherwise be overlooked.Is the most recognizable tool for undernutrition diagnosis. (4) PG-SGA has also been used as the reference method to validate tools in other studies. (24)

Failure to diagnosis undernutrition and lack of awareness have resulted in the high prevalence of undernutrition. (17)

However, since 301 patients were excluded from the analysis due to the absence of CRP values, the present study has a limited sample size. Moreover, the included patients may not represent the conditions of all the hospitalized patients which may affect comparability. Nevertheless, the present sample presents a wide age range (20-90 years old). Moreover, as far as we are concerned, this is the first study to propose an alternative criteria for the identification of inflammation, which can be useful for clinical practice.

Our results show that GLIM-CRP can be considered a valid tool. However, replacing the disease-based GLIM inflammation criterion with CRP levels did not improve the tool. Nevertheless, CRP may be used for assessing inflammation in the identification of malnutrition. Further research is needed regarding the use of alternative criteria for the

parameters proposed by GLIM, as those are not always easy to use and classify in clinical practice.

In conclusion, although GLIM using CRP as an alternative criterion for inflammation presents concurrent and predictive validity, replacing the disease-based GLIM inflammation criterion with CRP did not improve the tool. Notwithstanding this, in the absence of clinical diagnosis that allow for the identification of inflammation, CRP can be used as an alternative criterion.

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6. Figures and tables

		Without malnutrition [n=115]	Moderate malnutrition [n=58]	Severe malnutrition [n=77]	p
Sex					
	Female	83 (72.2%)	40 (69.0%)	48 (62.3%)	0.354
	Male	32 (27.8%)	18 (31.0%)	29 (37.7%)	
Age					
	<65 years	35 (30.4%)	11 (19.0%)	19 (24.7%)	0.254
	>=65 years	80 (69.6%)	47 (81.0 %)	58 (75.3%)	
Education					
	<= 4 years	53 (46.1%)	29 (50.0 %)	28 (36.4 %)	0.238
	>= 5 years	62 (53.9%)	29 (50.0 %)	49 (63.6%)	
Marital Status					
	Divorced/ Widower/Single	35 (30.4%)	20 (34.5%)	34 (44.2%)	0.147
	Married	80 (69.6%)	38 (65.5%)	43 (55.8%)	
Katz	Independece	106 (92.2%)	50 (86.2%)	62 (80.5%)	**0.026**
	Moderate dependency	4 (3.5%)	5 (8.6%)	3 (3.9%)	
	Severe dependency	5 (4.3%)	3 (5.2%)	12 (15.6%)	
Professional activity					
	Whithout professional activity	84 (73.0%)	42 (72.4%)	54 (70.1%)	0.905
	With professional activity	31 (27.0%)	16 (27.6%)	23 (29.9%)	

Table 1:Demographic characteristics of 250 Portuguese inpatients enrolled in a prospective longitudinal study according to GLIM.

		Absence of inflammation [n=37]	Presence of Inflammation [n=213]	p
Sex				
	Female	26 (70.3%)	145 (68.1%)	0.791
	Male	11 (29.7%)	68 (31.9%)	
Age				
	<=64 years	12 (32.4%)	53 (24.9%)	0.334
	>=65 years	25 (67.6%)	160 (75.1%)	
Education				
	<= 4 years	13 (35.1%)	97 (45.5%)	0.239
	>= 5 years	24 (64.9%)	116 (54.5%)	
Marital Status				
	Divorced/ Widower/Single	14 (37.8%)	75 (35.2%)	0.758
	Married	23 (62.2%)	138 (64.8%)	
Katz	Independent	32 (86.5%)	186 (87.3%)	0.982
	Moderate dependency	2 (5.4%)	10 (4.7%)	
	Severe dependency	3 (8.1%)	17 (8.0%)	
Professional activity				
	Whithout professional activity	26 (70.3%)	154 (72.3%)	0.800
	With professional activity	11 (29.7%)	59 (27.7%)	

Table 2: Demographic characteristics of 250 Portuguese participants enrolled in a prospective longitudinal study according serum levels of C-reactive protein.

		Without malnutrition [n=133]	Malnutrition [n=84]	Severe malnutrition [n=33]	p
Sex					
	Female	96 (72.2%)	54 (64.3%)	21 (63.6%)	0.390
	Male	37 (27.8%)	30 (35.7%)	12 (36.4%)	
Age					
	<65 years	41 (30.8%)	15 (17.9%)	9 (27.3%)	0.104
	>=65 years	92 (69.2%)	69 (82.1%)	24 (72.7%)	
Education					
	<= 4 years	58 (43.6%)	43 (51.2%)	9 (27.3%)	0.063
	>= 5 years	75 (56.4%)	41 (48.8%)	24 (72.7%)	
Marital Status					
	Divorced/ Widower/Single	43 (32.3%)	27 (32.1%)	19 (57.6%)	**0.018**
	Married	90 (67.7%)	57 (67.9%)	14 (42.4%)	
Katz	Independence	122 (91.7%)	72 (85.7%)	24 (72.7%)	**0.027**
	Moderate dependency	5 (3.8%)	5 (6.0%)	2 (6.1%)	
	Severe dependency	6 (4.5%)	7 (8.3%)	7 (21.2%)	
Professional activity					
	Whithout professional activity	92 (69.2%)	62 (73.8%)	25 (78.8%)	0.492
	With professional activity	41 (30.8%)	22 (26.2%)	7 (21.2%)	

Table 3: Demographic characteristics of 250 Portuguese participants enrolled in a prospective longitudinal study according to GLIM using C-reactive protein as an alternative criteria for identifying inflammation (GLIM-CRP).

	Hazard ratio (95% confidence interval)	
	Unadjusted	Adjusted
GLIM		
Without malnutrition	1	1
Moderate malnutrition	0.598 (0.426; 0.839)	0.639 (0.399; 1.023)
Severe malnutrition	0.672 (0.494; 0.914)	0.569 (0.357; 0.905=
GLIM CRP		
Without malnutrition	1	1
Moderate malnutrition	0.814 (0.547; 1.211)	0.798 (0.534; 1.191)
Severe malnutrition	0.244 (0.244; 0.995)	0.515 (0.253; 1.050)

Table 4: Hazard ratios of being discharge-free over time associated with undernutrition according to GLIM and GLIM-CRP in a sample of 250 Portuguese participants enrolled in a prospective longitudinal study.

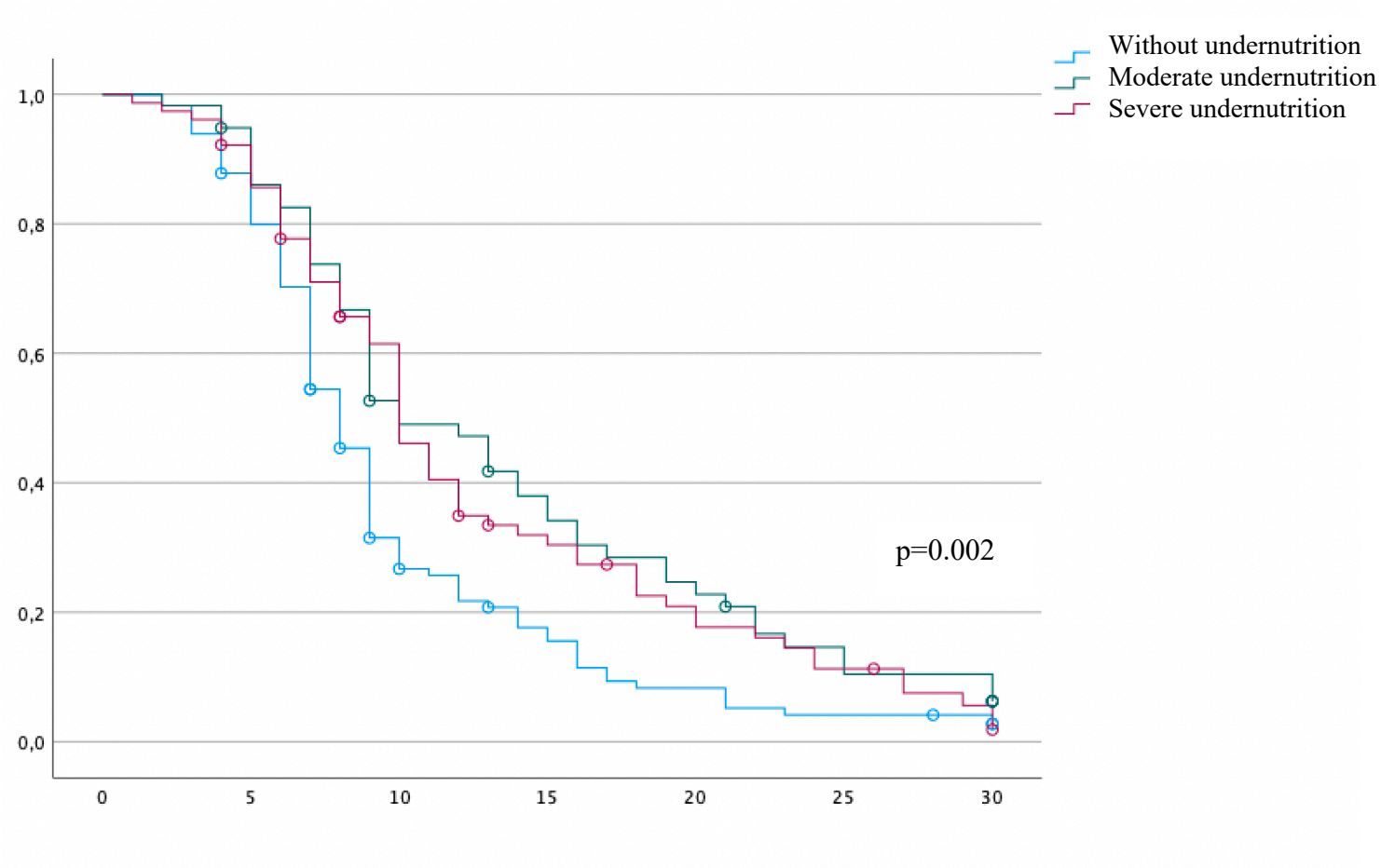


Figure 1:Kaplan-Meier curves for being discharge-free over time according to GLIM in a sample of 250 Portuguese participants enrolled in a prospective longitudinal study.

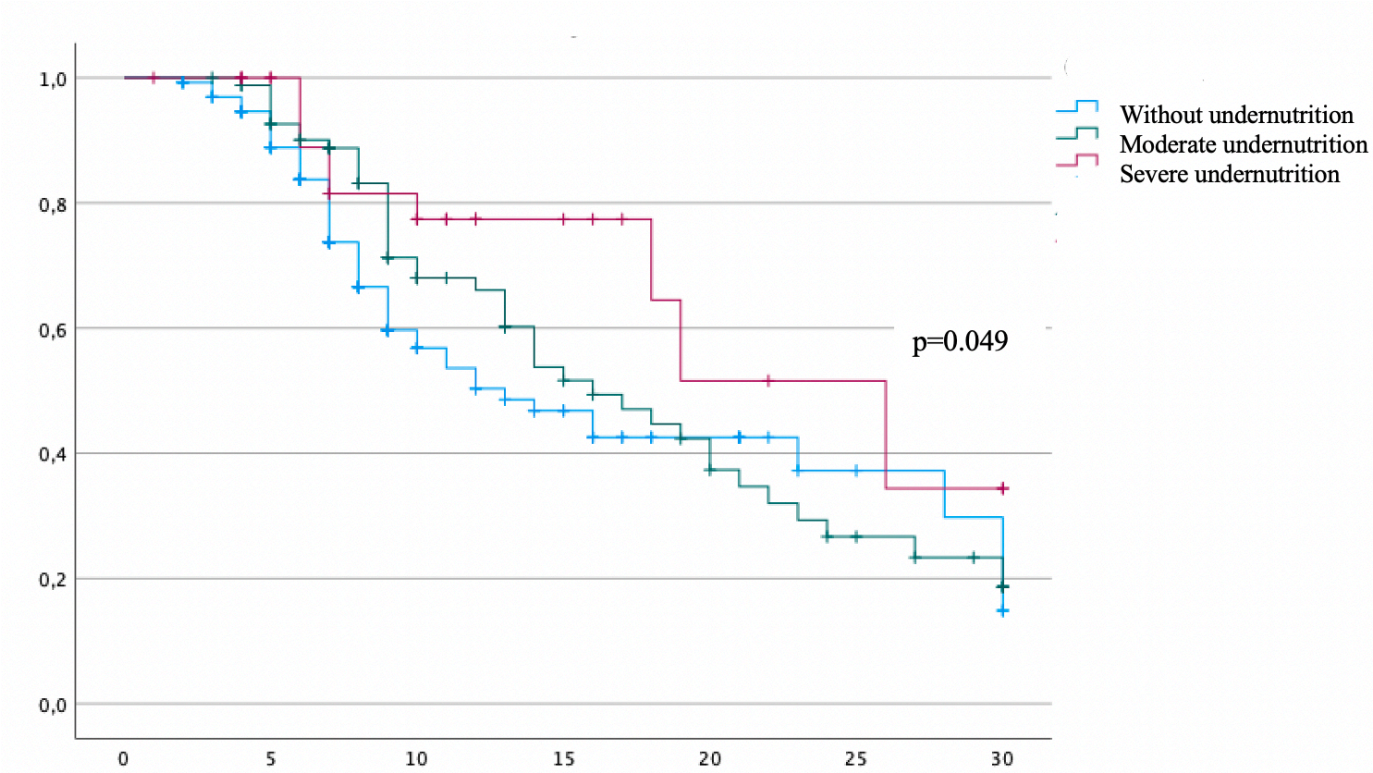
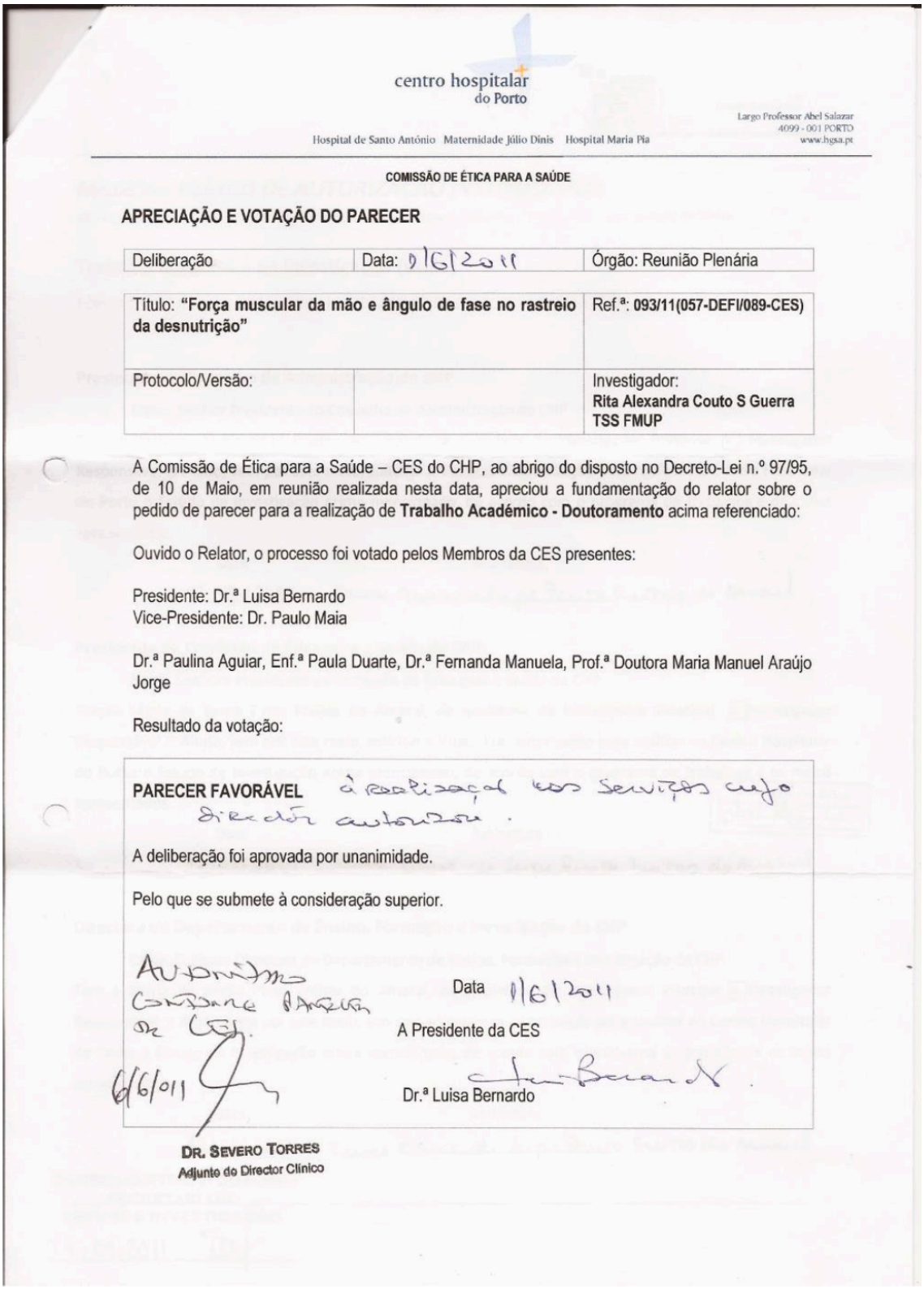


Figure 2: Kaplan-Meier curves for being discharge-free over time according to GLIM-CRP in a sample of 250 Portuguese participants enrolled in a prospective longitudinal study.

7. Appendix



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COMISSÃO DE ÉTICA PARA A SAÚDE

APRECIAÇÃO E VOTAÇÃO DO PARECER

Deliberação	Data: 9/6/2011	Órgão: Reunião Plenária
Título: **"Força muscular da mão e ângulo de fase no rastreio da desnutrição"**		Ref.ª: **093/11(057-DEFI/089-CES)**
Protocolo/Versão:		Investigador: **Rita Alexandra Couto S Guerra TSS FMUP**

A Comissão de Ética para a Saúde – CES do CHP, ao abrigo do disposto no Decreto-Lei n.º 97/95, de 10 de Maio, em reunião realizada nesta data, apreciou a fundamentação do relator sobre o pedido de parecer para a realização de **Trabalho Académico - Doutoramento** acima referenciado:

Ouvido o Relator, o processo foi votado pelos Membros da CES presentes:

Presidente: Dr.ª Luisa Bernardo
Vice-Presidente: Dr. Paulo Maia

Dr.ª Paulina Aguiar, Enf.ª Paula Duarte, Dr.ª Fernanda Manuela, Prof.ª Doutora Maria Manuel Araújo Jorge

Resultado da votação:

PARECER FAVORÁVEL à realização nos serviços cujo director autorizou.

A deliberação foi aprovada por unanimidade.

Pelo que se submete à consideração superior.

Autorizo conforme parecer da CES. 6/6/011

Data 1/6/2011

A Presidente da CES

Dr.ª Luisa Bernardo

DR. SEVERO TORRES
Adjunto do Director Clínico

Figure 3: Ethics committee approval