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EXTENDED ABSTRACT

Charlson Comorbidity Index Score and the odds of death in COVID-19 patients

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Introduction:

The Charlson Comorbidity Index Score (CCIS) was developed by Charlson et al. in 1987 [1]. This was developed based on the relative risk of death and measures the severity of disease using morbidities with different impacts on prognosis. Each morbidity is associated with a score. For example, a metastatic solid tumor is associated with a score of 6 and diabetes with target organ damage is associated with a score of 2. The sum of the scores associated with each morbidity results in a final morbidity score. This score has been widely used as a predictor of prognosis and long-term survival [2] – [4].

This work aims to understand if the assessment of the morbidities of the patients hospitalized due to COVID-19 and consequent stratification by CCIS, allows obtaining any association with this index and the occurrence of death.

Methods:

This study included the patients hospitalized in Baixo Vouga Hospital Centre due to COVID-19 who were admitted since 18th March 2020 and who were discharged until 21st October 2021.

The morbidities of the patients with COVID-19 were assessed on patient admission and the values of CCIS were calculated and divided into four categories: 0, 1 – 2, 3 – 4 e ≥ 5. The study began with a descriptive analysis (absolute and relative frequencies). Then, binary logistic regression models were used. The outcome of interest was the death (yes or no), the predictor variable was the CCIS category and the covariate considered was the gender (male or female). The performance of the model was assessed considering the following performance metric: area under the curve (AUC).

All analyses were performed with a significance level of 5% and using the software R (version 4.1.0).

Results:

A total of 1026 patients were included in this study. During the period of study 276 (26.9%) patients died. The number of patients within the categories of CCIS 0, 1-2, 3-4 e ≥5 are 99 (9.7%), 190 (18.5%), 350 (34.1%) e 387 (37.7%), respectively. The most frequent morbidities are the following: uncomplicated diabetes (269, 26.2%), dementia (172, 16.8%) and chronic obstructive pulmonary disease (85, 8.3%). The age group ≥ 80 years is the one with the most patients (409, 39.9%).

Regarding the multivariate logistic regression model, the odds of death are significantly higher in the patients who belong to the category CCIS 3 – 4 (OR = 9.27, 95%CI = [3.74, 30.90]) and CCIS ≥ 5 (OR = 17.8, 95%CI = [7.22, 59.00]) compared to those who belong to the category CCIS 0. Although the association is not significant, there is a trend for the odds of death being higher in the patients who belong to the category CCIS 1 – 2 (OR = 2.03, 95%CI = [0.71, 7.29]) compared to those who belong to the category CCIS 0. These results are depicted in table 1 and figure 1. The model has a moderate capacity of discrimination (AUC = 0.71, 95%CI = [0.68, 0.74]).

Discussion:

The use of scores can help doctors to identify patients on admission who are at greater risk of developing more severe forms of the disease. CCIS is commonly used to evaluate the impact of comorbidities on mortality prediction. In this study, an increased risk of mortality was found in patients with higher scores, showing the weight of comorbidities and age in the prognosis of COVID-19. CCIS can remove some of the unpredictability of the infection, identifying patients at higher risk at the time of diagnosis. With the increase in knowledge, new scores will be needed for better patient management.

Keywords:
Charlson Comorbidity Index Score, COVID-19, Logistic regression

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Conflict of interest:
The authors declare no conflict of interests.

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Table 1 – Multivariate logistic regression model.

Predictor variables	Multivariate analysis		
	OR [1]	95%CI [2]	p-value
Gender (Male)	1.67	1.24, 2.26	<0.001
CCIS [3] category (ref. 0)			
1 – 2	2.03	0.71, 7.29	0.220
3 – 4	9.27	3.74, 30.90	<0.001
≥ 5	17.8	7.22, 59.00	<0.001

[1] Odd Ratio; [2] 95% Confidence Interval; [3] Charlson Comorbidity Index Score.

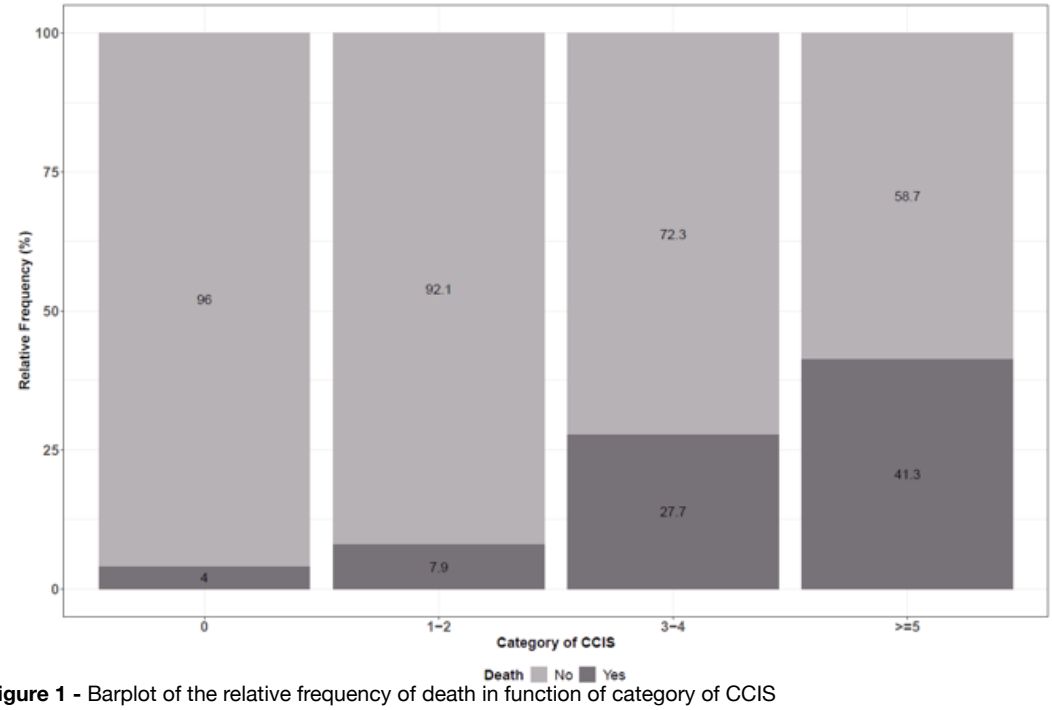

Figure 1 - Barplot of the relative frequency of death in function of category of CCIS

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