THE BEST STATISTICAL MODEL TO ASSESS THE RELATIONSHIP BETWEEN DEPRESSION, COGNITIVE IMPAIRMENT, SARCOPENIA AND FRAILTY: DATA FROM A RETROSPECTIVE STUDY OF S.I.M.M.S. PROJECT

Lorusso Letizia[1,2], D'Onofrio Grazia[3], Sancarlo Daniele[4], Bartolomeo Nicola[5], Trerotoli Paolo[5]

[1] School of Medical Statistics and Biometry, Interdisciplinary Department of Medicine, University of Bari Aldo Moro, 70124 Bari, Italy
[2] Innovation and Research Unit, IRCCS Fondazione Casa Sollievo della Sofferenza, 71013 San Giovanni Rotondo (FG), Italy
[3] Clinical Psychology Service, Health Department, IRCCS Fondazione Casa Sollievo della Sofferenza, 71013 San Giovanni Rotondo (FG), Italy
[4] Complex Structure of Geriatrics, Department of Medical Sciences, Fondazione IRCCS Casa Sollievo della Sofferenza, San Giovanni Rotondo, Foggia
[5] Interdisciplinary Department of Medicine, University of Bari Aldo Moro, 70124 Bari, Italy.

Introduction

The relationship between clinical pathological conditions in older adults as depression, sarcopenia and cognitive status has been investigated among different populations using different statistical models [1,2,3]. A multivariate regression model has been used by Lyu et al. to investigate specific factors that could predict depression, building a structural equation model [4]. One study tried to assess this causal relationship with the use of Path Analysis [5]. In literature, logistic regression is compared to SEM models in different works [6-8].

Objectives

The aim is to test which statistical models fits best the relationships among depression, cognitive impairment and sarcopenia in frail older adults, using the most common diagnostic tests [9-14].

Methods

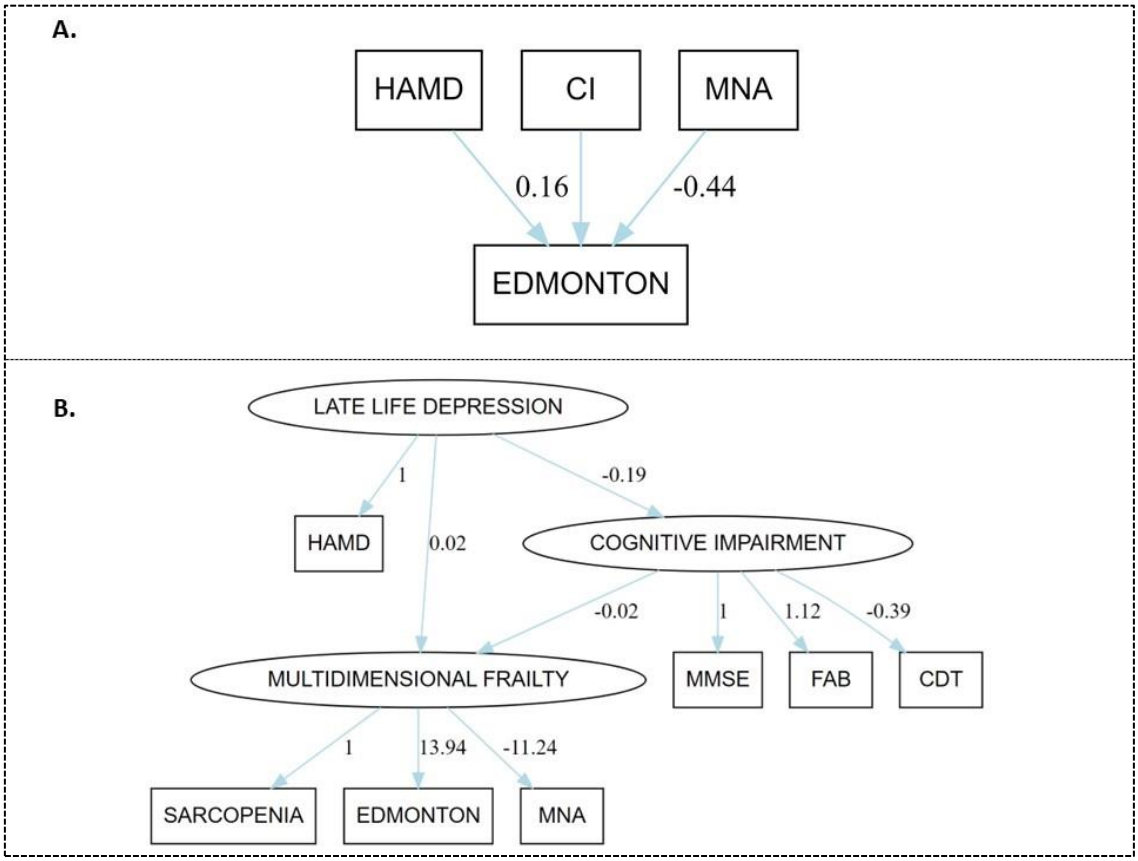
S.I.M.M.S. project has performed on a cohort of patients aged ≥ 65 years and at risk or affected by sarcopenia in the hospital of "Casa Sollievo della Sofferenza", following specific exclusion criteria. All patients signed the informed consent. Sarcopenia was assessed following the 2nd EWGSOP guidelines [9], and the nutritional status with the Mini Nutritional Assessment – Short Form (MNA-SF) [10]. Cognitive impairment was measured by Mini Mental State Examination (MMSE) [11], considering a pathological score < 24, by Clock Drawing Test (CDT) [12] and by Frontal Assessment Battery (FAB) [13]. State of depression was obtained with Hamilton Rating Scale for Depression (HAM-D) [14]. For assessing frailty, we used the Edmonton Frailty Scale. To identify the risk of prevalence of depression, cognitive impairment and sarcopenia in frail people we used the univariate and multivariate logistic regression. To predict a causal relationship among these pathological conditions we used two different SEM algorithm [15-19]. To assess the best model, we compare AIC score between [6-8]. Results with p-value < 0.05 were considered statistically significant. The statistical analyses were developed with version 4.2.2 of software R [20], and the R packages "lavaan" [21] was used to execute the two structural equation modelling (SEM).

Results

We recruited 115 older people aged in mean 75.8 ± 7.1 years old. The participants with cognitive impairment were 75 (65.8%) (33.3% males and 32.5% females). Older people with a Late Life Depression (LLD) were 53 (46.1%) (20.0% males and 26.1% females). The participants at risk of malnutrition or with malnutrition were 37.4%, and older adults with probability of sarcopenia were 49.6%, instead of 17.4% with confirmed diagnosis. Using the univariate logistic regression, we obtained that people with elevated Frailty score showed an OD: 5.01, CI 95%: [2.16 – 12.34], p < 0.001 for presence of Late Life Depression (LLD), an OD: 4.09, CI 95%: [1.72– 9.97], p = 0.002 for presence of Cognitive Impairment (CI), an OD: 4.44, CI 95%: [1.64

– 12.60], p = 0.004 for presence of confirmed Sarcopenia and an OD: 25.38, CI 95%: [9.36 – 78.59], p < 0.0001 for risk or malnutrition. Respectively the AIC score are: AIC_{LLD} =132; AIC_{CI}=136; AIC_{SARC} =138; AIC_{MALNU}=98. In the multivariate logistic regression model, using the presence or absence of frailty as dependent variable we obtained an AIC_{MULT}=124. In the multivariate model the relationship among frailty and depression, cognitive impairment and nutritional state remains statistically significant (respectively: p = 0.007; p = 0.002; p = 0.001); not with sarcopenia. The first SEM model is Path Analysis 4A [17] showed in (fig.1A). We used three observed endogenous variables omitting sarcopenia, because it did not fit the model. The best fitted model obtained have: χ^2/df = 1.138 (p = 0.286); Comparative Fit Index (CFI) = 0.99; Tucker-Lewis Index (TLI) = 0.993; RMSEA = 0.035; SMRS= 0.044; AIC_{PM}= 1803.88 [22-24]. In addition, we present another structural regression model using more than two endogenous variables and comparing latent to latent variables, using the model 6b [17] showed in (fig.1B), obtaining: χ^2/df = 0.815 (p = 0.635); Comparative Fit Index (CFI) = 1.00; Tucker-Lewis Index (TLI) = 1.013; RMSEA < 0.0001; SMRS = 0.031; AIC_{SRM}= 3053.84 [22-24].

Figure 1 A. Descriptive diagram of the relationships in path analysis' regression model showing the estimates β for each variable with significative p-values **B.** Descriptive diagram of the structure of the second SEM's model: exogenous latent variables in circles and the endogenous ones in squares; the estimates β for each variable with significative p-values [17] (MMSE, Mini Mental State Examination; FAB, Frontal Assessment Battery; CDT, Clock Drawing Test; MNA, Mini Nutritional Assessment; HAM-D, Hamilton Rating Scale for Depression; EDMONTON, Frailty Assessment Scale; CI, Cognitive Impairment).



Conclusion

The statistical relationship among dementia, depression and sarcopenia has been for years difficult to assess [25]. Until now there is not only one criterion used in literature for diagnosis of sarcopenia, among population in the wide world [6, 25,26], and in case of diagnosis of depression different tests had been used [2,4,5]. In multivariate logistic model frailty have a significant relationship with depression, cognitive impairment and nutritional status but not with sarcopenia. SEM models showed can't describe a real causal relationship [17-19, 27], otherwise it seems to maintain the same relationships showed in literature (fig.1A/B) [1-3, 5]. The SEM model estimation with latent variables shows that factors as depression and cognitive impairment have respectively a positive and negative impact on multidimensional frailty. Depression has a negative impact on cognitive impairment (fig.1B). Therefore, considering AIC score, the best fitted model was described from the multivariate logistic regression. The model should be tested on a larger sample size and in a multicentric study [5].

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