



The age marker as a predictive indicator for frailty syndrome in the elderly

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ABSTRACT. The objective of the study was to analyze the age marker in males and females as a predictor of the absence of frailty syndrome in the elderly. This was a cross-sectional study with 624 individuals. Receiver Operating Characteristic (ROC) curves were constructed and compared to areas of age, gender and absence of frailty. Cut-off points for age (years) were established to predict the absence of frailty (95% CI). The largest areas under the ROC curve for age were found for females. It was observed that the age of 72 years (women) or 67 (men) were the best cut-off points for predicting the absence of frailty. The age marker can serve as an important indicator in selecting priority groups for certain interventions.

Keywords: frail elderly, ROC curve, health of the elderly.

Marcador etário como indicador preditivo para síndrome de fragilidade em pessoas idosas

RESUMO. O objetivo do estudo foi analisar o marcador etário, nos sexos feminino e masculino como preditor da ausência da síndrome de fragilidade em idosos, que se procedeu o estudo transversal com 624 indivíduos. Foram construídas curvas *Receiver Operating Characteristic* (ROC) e comparadas às áreas de idade, por sexo e a ausência da fragilidade. Identificaram-se pontos de corte de idade (anos) para prever a ausência de fragilidade (IC 95%). Encontrou-se maior área sob a curva ROC para a idade no sexo feminino. Observou-se que a idade de 72 anos (mulheres) ou 67 anos (homens) foram os melhores pontos de corte para prever a ausência de fragilidade. O marcador etário pode servir como importante indicador para seleção de grupos prioritários a determinadas intervenções.

Palavras-chave: idoso fragilizado, curva ROC, saúde do idoso.

Introduction

An emerging topic in the field of public health is the understanding of factors that affect the ability of the elderly to perform daily activities. The importance of this issue is due to an reversing trend in the makeup of the age pyramid in some developing countries in coming decades – with progressively more elderlies than young citizens – as already happens in most developed nations.

The preservation of functional condition leads to the construct of human frailty syndrome. Although controversial in terms of definition, the term ‘frailty’ has been used in practice to denote, among the elderly population, those who feature clinical traits attributed to aging, combined with the existence of comorbidities such as reduced muscle mass and strength, exhaustion, altered gait and balance, anorexia and progressive weight loss (MACEDO et al., 2008).

The construct of frailty is a predictor of reduced functional ability, but there is no concordance in the

combined occurrence of frailty, comorbidities and disability (ABELLAN et al., 2010). Nevertheless, the understanding of markers and/or factors associated with loss of human frailty favors a more effective planning of interventions directed at preserving the functional ability of elderly patients.

Certain studies have attempted to link these factors – whether socio-demographic, clinical or behavioral – to some of the markers commonly used to define frailty syndrome (WONG et al., 2010; CHEN et al., 2010). Age is highlighted among commonly cited factors due to issues directly related to primary aging, and amplified by factors of the aging process.

The variable ‘age group’ has been underused and given little emphasis, partly because of the belief that age is a marker which, by itself, offers little explanation and cannot be reversed. Nevertheless, the understanding of certain occurrences typical of certain age ranges can serve as an important indicator for public policies in terms of electing priority groups for certain interventions.

Thus, the purpose of this study was to analyze the predictive ability and identify age cut-off points for the absence of frailty in elderly people from both genders.

Material and methods

A cross-sectional study was carried out from May to August 2010 in the city of Uberaba, located in southeastern Brazil, 494 km from the capital city of Minas Gerais state, Belo Horizonte.

The sample consisted of 624 people aged 60 or older, selected at random based on household and representing the city's urban area, proportional to district, Family Health team and gender. To determine sample size, the procedures proposed by Luiz and Magnanini (2000) for finite populations were applied. In that calculation, a significance level of 5% (representing a confidence interval of 95%, $z [a]/2 = 1.96$) was adopted, with an acceptable sampling error of 3%, resulting in a required sample of 490 subjects. That first sample size estimate was increased by 20% in order to explore adjusted associations between the analyzed components, in addition to a 10% increase to compensate any losses, resulting in a minimum necessary sample size of 647 elderly people.

A multidimensional interview was devised for evaluation and applied individually, consisting of the following socio-demographic aspects: age, schooling (years of education), marital status, occupation, family size and income class.

The Brazil Economic Classification Criterion (CCEB) (ABEP, 2010) was selected for income classification. It stratifies the population into five income classes (from A to E) based on the answers given by interviewees with regard to ownership of material goods, presence of salaried maid at home and education level of the head of the household. The point-scale allows inferences on mean family income: class A (R\$ 8,295.00 to R\$ 11,480.00); class B (R\$ 2,656.00 to R\$ 4,754.00); class C (R\$ 962.00 to R\$ 1,459.00); class D (R\$ 680.00); and class E (R\$ 415.00).

In the evaluation of physical and mental health aspects: reported illnesses and cognitive deficit (Mini Mental Exam) (BRUCKI et al., 2003); behavioral aspects: habitual physical activity (BENEDETTI et al., 2004).

Frailty

Frailty was measured according to the modified version of Fried et al. (2001) and identified by the presence of three or more of the five examined components: reduced grip strength in the dominant

hand, measured using a dynamometer and adjusted for gender and body mass index (BMI); unintentional weight loss, greater than 5% of body weight in the previous year; reports of 'exhaustion' evaluated through the question 'do you feel full of energy?'; functional limitations when rising from sitting in a chair, evaluated by the inability to stand up five straight times without using the arms; and low level of physical activity (< 150 min. / without physical activity).

Statistical analysis

The characterization of the variables was presented as mean, standard deviation, minimum/maximum values and frequencies. To compare the distribution of variables according to gender, Student's t-test was used for independent samples (continuous data) and the Chi-squared test was applied for categorical data.

The predictive power and age cut-off points for the absence of frailty in both genders were identified through Receiver Operating Characteristic (ROC) curves, which are used often to determine cut-off points in diagnostic or triage tests (THAKKINSTIAN et al., 2011).

First, the total area under the ROC curve was identified for age in the male and female genders for the absence of frailty. The larger the area under the ROC curve, the greater is the discriminatory power of physical activity for the absence of frailty. A confidence interval (CI) of 95% was used, which determines whether the predictive capacity of physical activity patterns in different settings is not due to chance, with a minimum limit not lower than 0.50 (LI et al., 2010).

Next, sensitivity and specificity were calculated, as well as the cut-off points for the patterns of physical activity in different settings (work, transportation, domestic activity and leisure activity) and total physical activity total for the absence of frailty. Values identified by ROC curve are cut-off points that should promote a more adequate balance between sensitivity and specificity for age as a discriminator of the absence of frailty. The data were analyzed using MedCal software, version 11.4.4.

This research study followed the ethical principles set forth in the Helsinki Declaration and in Resolution 196/96 of Brazil's National Council of Health. Research protocols were evaluated and approved by the local Research Ethics Committee (decision 1521/2009).

Results

The study sample features mean age of 71.08 years (SD = 7.77), ranging between 60 and 96 years. The elderly in the study are predominantly married or living with a partner (52.7%; $n = 357$), reside in

multigenerational households (54.8%), especially bigenerational ones (30.6%, grandparents and sons), with low education levels (89.1% did not conclude elementary school). With regard to occupational condition, 81.5% were retirees or pensioners belonging to income classes 'C' (51.4%) and 'D' (33.2%); that is, low economic classification.

The distribution of the variables age, body mass, height, years of schooling, physical activity, cognitive deficit and frailty of the 624 elderly participants of this study are shown in Table 1.

Table 1. Description of the variables analyzed in the study.

Variable	Female (n = 406)		Male (n = 218)		p
	Mean	SD	Mean	SD	
Age (years)	70.80	7.95	71.60	7.40	0.43*
Schooling (years of education)	1.39	1.05	1.51	1.14	0.07
Body mass (kg)	65.75	14.74	72.51	14.20	0.41*
Height (cm)	153.17	6.36	165.13	7.03	0.26*
Physical activity (min. week ⁻¹)					
Work	23.24	123.22	64.40	221.60	0.00*
Transportation	60.37	70.42	77.94	95.38	0.00*
Domestic Activity	171.87	166.81	54.29	90.43	0.00*
Leisure/recreation	54.37	94.39	73.76	121.11	0.00*
Total	308.03	271.97	270.39	297.63	0.96*
	%	n	%	n	p
Cognitive Deficit					
No dementia	82	333	85.3	186	0.29**
Mild to moderate dementia	18	73	14.7	32	
Frailty (≥ 3 criteria)					
Presence	20.0	81	19.7	43	0.68**
Absence	80	323	80.3	175	

*value obtained through Student's t-test for independent samples; **value obtained through the Chi-squared test; Total physical activity = sum of the settings 'work', 'transportation', 'domestic activity' and 'leisure time'.

Despite the differences in the means and frequencies between the male and female groups for the analyzed variables, only the physical activity settings showed significant differences, with women spending less time (min. week⁻¹) in work, transportation and leisure activities. However, women spent more time in domestic activities than men.

The presence of mild to moderate dementia was observed in 14.7% of interviewed men and 18% of women; although the rate of cognitive changes was higher in women, the difference was not significant. Likewise, the frequency of frailty syndrome was similar between the genders.

ROC curves were drawn for both genders, as shown in Figures 1 and 2. The areas under the ROC can be seen with their respective confidence intervals for the age marker as a predictor of absence of frailty, with a larger area for females.

Figure 1 shows the cut-off point, with the respective sensitivity and specificity, for age as predictor of absence of frailty in elderly women. The established cut-off point for age was 72 years (sensitivity = 0.844; specificity = 0.814).

Figure 2 refers to elderly men. For that group, the cut-off point of the age marker was 67 years (sensitivity = 0.977; specificity = 0.320).

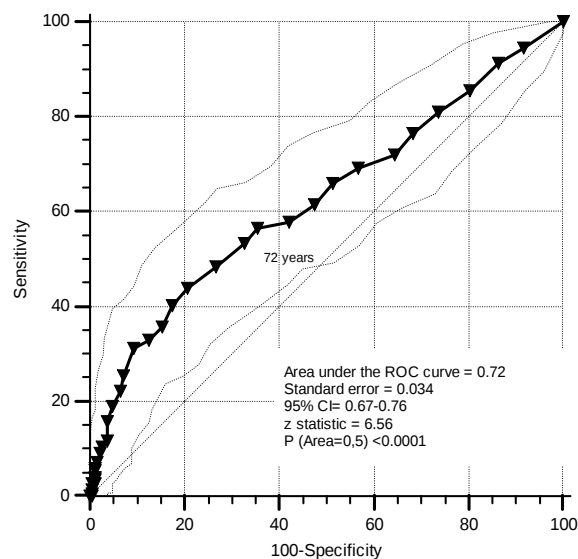


Figure 1. Area under the ROC curve, with the cut-off point for age as predictor of absence of frailty in elderly women.

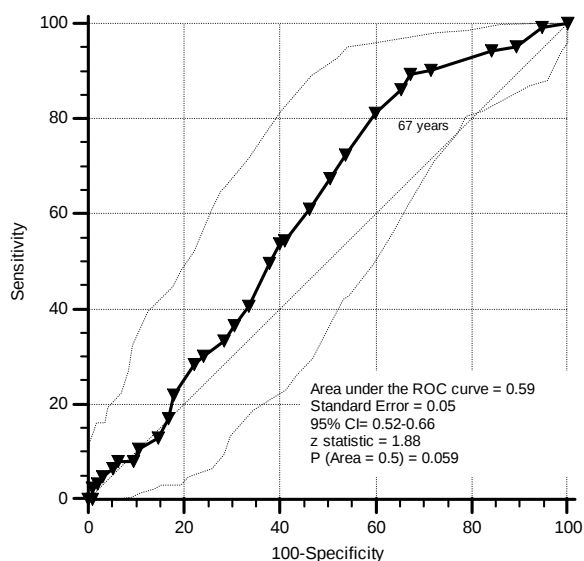


Figure 2. Area under the ROC curve, with the cut-off point for age as predictor of absence of frailty in elderly men.

Discussion

Biological frailty syndrome is a construct that is difficult to understand. Nevertheless, it is an essential marker for any health diagnosis, particularly among the elderly, regardless of any other assumed markers (FULOP et al., 2010). The diagnosis of frailty syndrome in a sense makes it possible to anticipate the decline of social function related to the processes of functional incapacity and home isolation of the elderly (VIRTUOSO JÚNIOR; GUERRA, 2008). On the other hand, although limited in interventions, the age marker may serve as reference to define strategies and select groups for health interventions.

Although little explored, there is a theoretical tendency regarding the use of age markers to classify people, retirement ages and even define health insurance premiums (SILVA, 2008; LOUVISON et al., 2008). In the present study, the age marker showed predictive potential for frailty syndrome. However, there is a consensus in the literature that the variation in this marker depends on lifestyle; that is, more active people can live longer without showing functional losses that indicate frailty (KLEIN et al., 2005).

The cut-off points established for the age marker using the ROC curve make it possible to evidence the values for which there is greater optimization of sensitivity as a function of specificity in discriminating the absence of frailty in the elderly (THAKKINSTIAN et al., 2011). For females, the age of 72 was the cut-off point to predict frailty, older than for men (67 years). These differences can be explained by a series of factors, in particular that a larger number of women were interviewed and that this population group has a greater life expectancy.

After retiring from their work occupations, men in general seem to undergo greater functional loss due to the rapid decline in physical activity, regardless of the setting under analysis; with it come greater and earlier dependence for physical activities. Conversely, the change in routine for elderly women as their age advances is more subtle, due to the volume of physical activities at the domestic setting, resulting in functional conditions being preserved for longer periods.

When analyzing the curve areas as a function of the higher number of women in the study, it is possible to identify a larger area for women, which evidences the superior performance of that group in the test. On the other hand, the fact that women have a longer life expectancy than men favors a higher rate of damage to the body, and may partly explain the reason for the higher rates of frailty (CAMARGOS et al., 2005).

The different cut-off points for each gender indicate the need for specific actions for men and women, perhaps requiring a reassessment of the ages limits required for social and health assistance. The dynamism of society should also be mentioned, with women gradually holding the same job occupations as men, having fewer children and living longer.

The study has some limitations, such as the cross-section which makes it difficult to ascertain a cause-effect relationship between variables; self-perception measurements may have been influenced by the low educational level and motivation aspects of the respondents. Nevertheless, the evaluators of the study

underwent training to minimize motivational interferences and even standardize the explanations given to possible questions by respondents during the interviews, given the varying educational levels.

Despite some criticism regarding the use of the age marker, age is also used discretely in the planning of health promotion actions. The age indicator proposed by the United Nations (ONU, 1982) to classify elderly people should be considered dynamic and situational, as improvements in life conditions and access to new technologies makes monitoring necessary. The five-year difference observed between the genders in predicting frailty is nearly the additional life expectancy of women.

Age plays a prominent role in primary aging, but is only an indicator that can aid in defining groups in interventions. The combination of clinical and/or behavioral elements will enable a wider and more effective range of health interventions.

Conclusion

The results of this study indicated that the age marker can predict the absence of frailty in the elderly. With regard to age as a predictor for frail condition, frailty syndrome is observed earlier in life in men than in women, with a five-year difference.

The cut-off points for age described in this study represent only a reference estimate for use in population diagnoses, as well as in intervention actions to stratify groups in health promotion actions. However, cohort studies are necessary to more precisely identify the effect of the age marker combined with clinical and behavioral variable in the health of elderly people.

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