Timed Up and Go in assessing the frailty of older farmers in Rio Grande do Sul: cross-sectional study

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Abstract

Objectives: To evaluate the sensitivity of the Timed Up and Go test (TUG) as a predictor of frailty syndrome in the elderly (IFS) in the elderly rural population of Rio Grande do Sul (RS) and to identify the prevalence of IFS in this population. Method: Cross-sectional study, carried out with 604 farmers over 60 years of age (321 men and 283 women) identified through clusters structured from the regions of the Federation of Agricultural Workers of Rio Grande do Sul (FETAG-RS) and respective unions. In addition to demographic variables (gender, age), functional mobility was assessed by performing the TUG and reported frailty. The Receiver-Operating Characteristic (ROC) curve was constructed to assess a TUG test cutoff point for frailty. Results: IFS or frailty was identified in 52.5% (n=317) of the surveyed population; 35.1% (n=212) pre-frail and 12.4% (n=75) non-frail. And the mean time to perform the TUG varied according to gender was 11.6 seconds for women and 10.8 seconds for men – (p=0.0001). The progression of age was related to longer time spent on the age test (young elderly - 60-64 years old; older elderly -75-79 and oldest old - 80+ - p=0.0001). The ROC curve indicated 10 seconds in the execution of the TUG test as the best cutoff point for diagnosing the SF frailty syndrome in rural elderly. Conclusion: The frequency of frailty and pre-frailty in this research indicates a condition of vulnerability of rural workers in RS in their aging process. Demonstrating, from the TUG test, characteristics of functional mobility and risk of frailty of older farmers, important for future considerations on the singularities of the health of this population and necessary professional interventions.

Keywords: Rural Population. Frailty. ROC Curve. Health of the Elderly.

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INTRODUCTION

The accelerated process of Brazilian population aging[1-3], so emphasized in research and studies on the subject, has raised concerns about the quality of life of older people. Above all, in offering adequate services for an effective assistance that results in a positive impact on social and health policies[4].

It is a fact that the demographic transition taking place in the country has deserved recognition for the profound changes in the epidemiological profile[5]. And, due to the growing demand for health services, where characteristics that are adverse to those of care models centered on health care for acute illnesses, impose measures with a proposed line of care, focusing on education, health promotion, prevention of preventable diseases, postponement of illnesses, early care and rehabilitation[4].

Recognizing the multifactorial character that influences the health and illness of these people, it is worth noting the living conditions of those who age in rural areas. In this sense, several researches[6-8] draw attention to the specificity of this group, especially the physical and emotional aspects, represented by the use of the body in the work process and the often observed isolation character, in addition to the susceptibility to diseases and disabilities that advance with age. Other factors that contribute to this scenario are the difficulties in accessing the Unified Health System (SUS), due to geographic problems and long distances, which distance the population from social and health services[5,8].

Furthermore, taking into account the recognition of the characteristics of the older person in the multiple facets that permeate their lives, the biological character and the perception of individuals about the health/disease condition in the environment in which they live[5,9,10] stand out. In this regard, research on Frailty Syndrome (FS) in older people has been identified as an important instrument in tracking clinical conditions capable of impacting the quality of life of the older person[11-14].

FS, in its conception, has been identified based on the typology proposed by Fried *et al.*[12], also known as the frailty phenotype in which it recognizes unintentional weight loss[13], reduced gait speed, decreased physical strength, reported fatigue and low physical activity, as clinical conditions that impose greater vulnerability on the subject in relation to the risk of falls, disability, hospitalization and mortality.

Based on the typology of Fried *et al.*[12], Nunes *et al.*[13] validated an instrument for tracking FS by self-reported assessment. This tool makes it possible, in a simple and quick way, to identify the problem in the population and to reduce the negative impact of the effects of FS with appropriate interventions aimed at regional realities.

The search for evaluative tests that can track physiological aspects of vulnerability and health integrity of the older person is extremely important[14]. Especially if we consider those that indicate, in addition to the condition of frailty, other conditions associated with the bodily function of functional mobility, such as the *Timed Up And Go* (TUG) test[14,15].

The TUG is a tool that is easy to apply, low cost and reproducible at different levels of health care. Validated in Brazil since 2016, the test has been indicated for the combination of different capacities and physical abilities and may represent an important instrument in determining the individual's physical and functional fitness profile[16]. And, therefore, with great potential for tracking FS in populations, such as the rural older population, in view of their specificities and particularities in relation to physical abilities.

The identification of rural older people with FS is then built on the prerogative of knowing the multiple faces of the Brazilian aging process, especially those residing in the state of Rio Grande do Sul and the search for epidemiological characteristics that may indicate appropriate interventions by health professionals[1]. Thus, the objectives of this study were to evaluate the sensitivity of the *Timed Up and Go* test (TUG) as a predictor of FS in the rural older population of Rio Grande do Sul (RS) and to identify the prevalence of FS in this population.

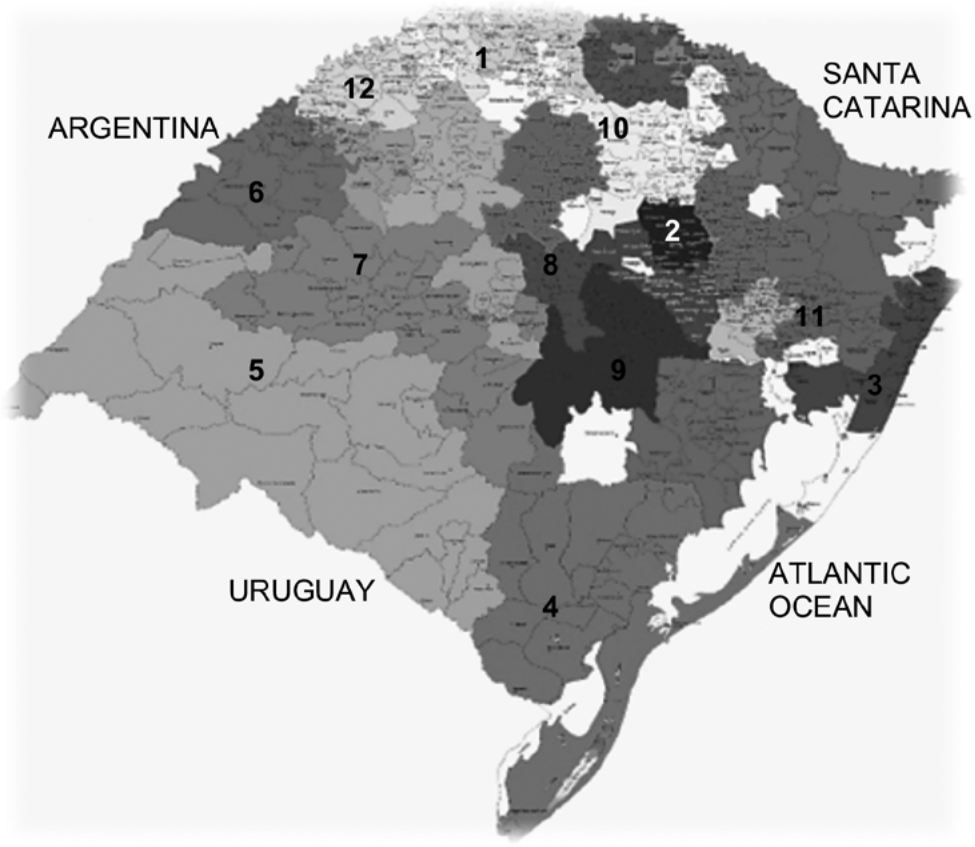
METHOD

Cross-sectional, population-based study, carried out by conglomerates and structured from all the regions (n=24) of the Rural Workers Unions

(STR-N=394), linked to the Federation of Agricultural Workers of Rio Grande do Sul (FETAG -RS), with distribution in the 497 municipalities of the state (Figure 1). 12 regional participants were randomly drawn, observing the dispersion in the territory of the state, in its mesoregions (Northeast; Northwest; Western Center; Eastern Center; Metropolitan Porto Alegre; Southwest and Southeast) and identification of the respective unions with their retired and aged 60+ members (Figure 1).

The sample used in this study was distributed among the population of 54,573 individuals over 60 years of age, affiliated to the state's STR, residing in 33 municipalities in 12 regions of the FETAGRS[18] (Chart 1), with dispersion in the state's mesoregions (Figure 1) and which correspond to 73.52% of retirees from rural work unionized in 2013 (n=74,226).

The calculations to define the population studied in this research considered a confidence level of 95% and a sampling error of 5%, a design effect of 1.5 and correction for a finite population. The initial calculation indicated 576 individuals (384 x 1.5 = 576) and a final sample of 604 older people (Figure 2). The calculation base considered a universe of 387,000 rural older people in 2013[1]. The sample allocation was carried out proportionally to the number of older people in each stratum, observed in the union units of each region elected in the investigation process (Chart 1). This method, often used for the selection of clusters, considers sampling with probability proportional to size (PPS). In this case, the primary units are selected with probabilities proportional to their size. Thus, in addition to being easy to apply, this method has the advantage of contributing to the reduction of variance between selection units[18,19].



Source: Modified from Federation of Agricultural Workers of Rio Grande do Sul (FETAG-RS). Notes: (1) Middle and Upper Uruguay (n=154); (2) Serra do Alto Taquari (n=26); (3) Coast (n=53); (4) South (n=30); (5) Border (n = 20); (6) Missions II (n=50); (7) Santa Maria (n=45); (8) Rio Pardo Valley and Baixo Jacuí (n=33); (9) Camaquã (n=27); (10) Passo Fundo (n=73); (11) Rio dos Sinos Valley and Serra (n=43); (12) Santa Rosa(n=50)

Figure 1. Distribution of regions FETAG-RS and indication of the 12 regional participants in the study with the respective fractions of the sample. 2015.

Chart 1. Discrimination of the STR regions and respective municipalities with distribution of retired older people and indication of proportions used for sampling.2015

Nº	Region	Municipalities	Unionized older people	%	Sample
1	Médio e Alto Uruguai	Liberato Salzano, Nonoai, Novo Xingu, Palmeira das Missões, Palmitinho, Pinhal, Pinheirinho do Vale, **Planalto**, Rio dos Índios, Rodeio Bonito, Ronda Alta, Rondinha, **Seberi**, Taquaraçu do Sul, Três Palmeiras, Trindade do Sul, Vicente Dutra, Vista Alegre, Alpestre, Ametista do Sul, Caiçara, Cristal do Sul, Dois Irmãos das Missões, Erval Seco, **Frederico Westphalen**, Gramado dos Loureiros, Irai, Jabuticaba.	13.959	26,63	154
2	Serra do Alto Taquari	Anta Gorda, Arvorezinha, Dois Lajeados, **Encantado**, Guaporé, Ilópolis, Itapuca, Muçum, Nova Brescia, **Putinga**, Relvado, São Valentin do Sul, União da Serra, Vespasiano Correa	2.289	4,37	26
3	Litoral	Gravataí, Mampituba, Maquiné, Morrinhos do Sul, Mostardas, **Osório**, **Terra de Areia**, **Torres**, Três Cachoeiras, Três Forquilhas, Viamão	4.180	7,97	53
4	Sul (Pelotas)	Arroio Grande, **Canguçu**, Herval, Jaguarão, **Pedro Osório**, **Pelotas,** Pinheiro Machado, Piratini, Rio Grande, Santa Vitoria do Palmar, **Santana da Boa Vista**, São José do Norte, **São Lourenço do Sul**, Tavares	2.551	4,87	30
5	Fronteira	**Alegrete**, **Bagé**, Cacequi, Dom Pedrito, Itaqui, Lavras do Sul, Quarai, Rosário do Sul, Santana do Livramento, São Gabriel, **Uruguaiana**	771	1,4	20
6	Missões II	Bossoroca, **Dezesseis de Novembro**, Garruchos, Itacurubi, Pirapó, Porto Xavier, **Roque Gonzáles**, Santo Antônio das Missões, São Borja, **São Luiz Gonzaga**, **São Nicolau**	4.533	8,3	50
7	Santa Maria	**Agudo**, Caçapava do Sul, Formigueiro, Jaguari, Manoel Viana, Mata, Nova Esperança do Sul, Paraiso do Sul, **Santa Maria**, Santiago, São Francisco de Assis, São Pedro do Sul, São Sepé, São Vicente do Sul, Silveira Martins, Tupanciretã, Vila nova do Sul	3.894	7,1	45
8	Vale do Rio Pardo e Baixo Jacuí	**Cachoeira do Sul,** Cerro Branco, General Câmara, Gramado Xavier, Pantano Grande, Rio Pardo, **Santa Cruz do Sul**, Venâncio Aires, Vera Cruz	2.769	5,28	33
9	Camaquã	Amaral Ferrador, Arroio dos Ratos, Barão do Triunfo, Barra do Ribeiro, Butiá, **Camaquã**, Canoas e Nova Santa Rita, Cerro Grande do Sul, Cristal, Dom Feliciano, Guaíba, São Jeronimo, **Sentinela do Sul**, Sertão de Santana	2.365	4,51	27
10	Passo Fundo	Camargo, Casca, Ciriaco, David Canabarro, Ernestina, Ibirapuita, **Marau**, Montauri, Muliterno, Nova Alvorada, Passo Fundo, Pontão, Santo Antônio da Palma, Serafina, Correa, Sertão, **Soledade**, Tapejara, Vanini, Vila Maria	6.735	12,85	73

to be continued

Continuation of Chart 1

Nº	Region	Municipalities	Unionized older people	%	Sample
11	Vale do Rio dos Sinos e Serra	Canela, **Caraa**, Gramado, Igrejinha, Novo Hamburgo, Rolante, Santa Maria do Herval, **Santo Antônio da Patrulha**, **São Francisco de Paula**, Sapiranga, Taquara, Três Coroas	3.834	7,31	43
12	Santa Rosa	Alecrim, Alegria, Boa Vista do Burica, Campina das Missões, Candido Godoi, **Giruá**, Horizontina, Independência, Porto Lucena, **Santa Rosa**, Santo Cristo, São Paulo das Missões, Senador Salgado Filho, Três de Maio, Tucunduva, Tuparendi, Ubiretama	4.529	8,4	50
	Total		54.573	100	**604**

Source: Modified from Federation of Agricultural Workers of Rio Grande do Sul (FETAG-RS).2015

Recruitment of participants took place at random in home visits, facilitated by the local STR and/or at meetings of unionized older people, also randomly. In the image of Chart 1, we can observe the calculated values and the surplus in the sample column, considering a rounding factor and the adoption of a minimum of 20 people per region (Border – 10 +10=20), resulting in a final value of the number of collections carried out in each region. In the "Municipalities" column, the cities in bold are the ones that were visited.

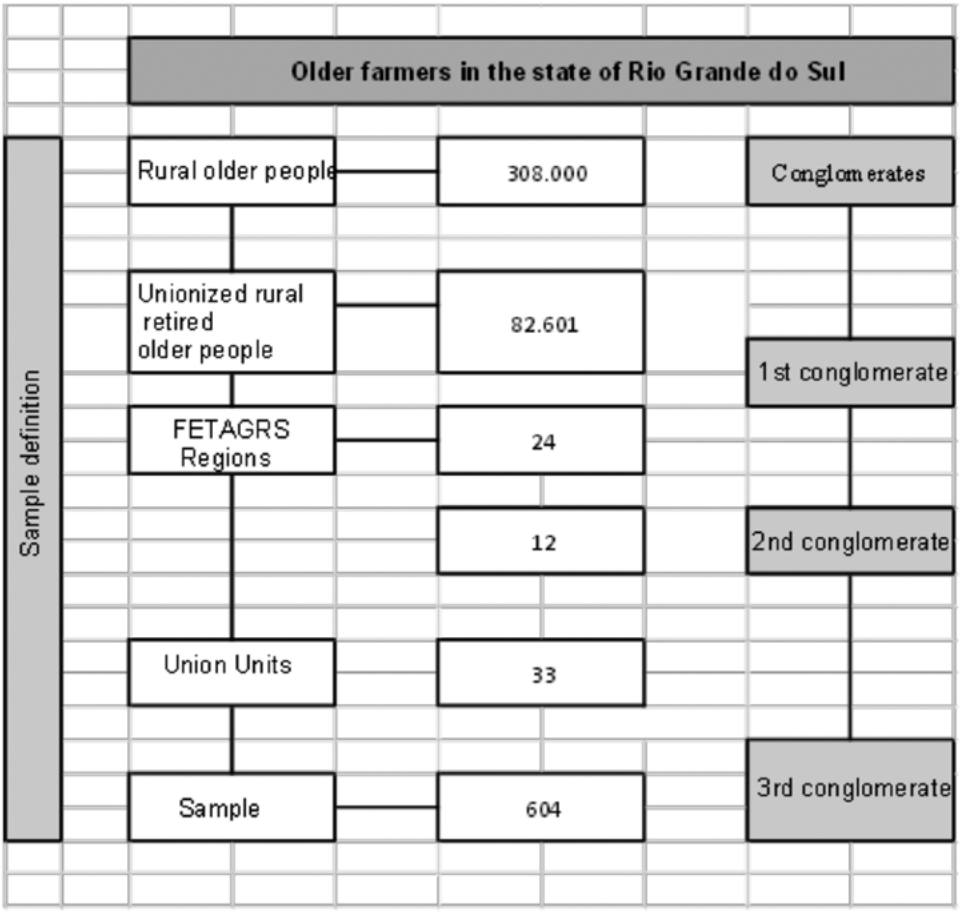


Figure 2. Research flowchart and sample definition – 2018.

The inclusion criterion in the study for the selection of the older people considered the cognitive assessment, in view of the application of a self-reported instrument. To this end, the Mini Mental State Examination (MMSE) was applied in a cut indicated in the literature, which considers 18 points minimum for illiterate older people and 23 points for literate older people with more than one year of schooling[20]. None of the participants fell below the cutoff point. People with communication difficulties and who resided in institutions were excluded.

Data collection took place in the period 2017 and 2018 with duly trained volunteer researchers (physiotherapists, and academics of physical education and physiotherapy).

The research followed Resolution 466/2012 and was approved by the Research Ethics Committee of the Federal University of Rio Grande do Sul, with opinion nº 1,716,579. All participants signed the Free and Informed Consent Form.

In this study, the FS of the rural older population was assessed using the self-reported frailty instrument by Nunes *et al.*[13], which classifies the presence of the elements proposed by Fried *et al.*[12], through the perception of the older people about unintentional weight loss, fatigue, low physical activity, reduced strength and gait speed. Subsequently, it was systematized according to the scores found in the instrument into: non-frail (no element mentioned); pre-frail (one or two elements mentioned) and frail (three or more elements indicated)[12,13].

To test functional mobility, the TUG was used, in which the subject sits in a chair, gets up and walks three meters and returns to the seat. For the purpose of measuring time, the indication of "go" is considered for the beginning and conclusion of the test after the individual has sat down completely. The time for performing the TUG was timed and the parameters indicated in the studies by Podsiadlo; Richardson; Cabral[21] were considered, in which they indicate a time of 11 to 20 seconds as being within the expected range; between 20 seconds and 29 seconds there is impairment of balance, gait speed and functional capacity and results above 30 seconds are predictive of falls. The TUG assessment was performed twice by each participant and the mean values were analyzed[21].

The TUG scores did not present a normal distribution verified through the Kolmogorov-Smirnov test. Comparisons between independent samples were performed using the non-parametric Mann-Whitney and Kruskal-Wallis tests. The associations between the prevalence of gender and age group variables versus frailty classification were examined using Pearson's chi-square test. The *Receiver-Operating Characteristic* (ROC) curve was constructed to assess the TUG test cutoff for frailty. All statistical procedures were performed using the IBM® SPSS® software (version 26), adopting a significance level of $p \leq 0.05$. Sample distribution tests and corrections were used for the test.

RESULTS

604 retired rural workers aged between 60 and 93 years old, with an average of 69.6 +7.1, participated in this research. The female population surveyed comprised 46.9% (n=283) and the male 53.1% (n=321) as we can see in Table 1. In general, the prevalence of FS in this population corresponds to 52.5% (n=317) of the sample and 35% (n=212) reported one or two elements of frailty being classified as pre-frail. Regarding the gender variable, we observed a relatively similar distribution in the groups (p=0.583), however, the distribution in relation to age groups shows a higher prevalence according to age progression (p=0.020).

Table 1. Distribution of gender, age and regional demographic variables in relation to frailty in rural older people in Rio Grande do Sul (N=604), 2018.

Variables		Frailty				*p**
		Non-frail	Pre-frail	Frail	Total	
		n (%)	n (%)	n (%)	n (%)	
Age Group	60 - 64 years	29 (16.5)	71 (40.3)	76 (43.2)	176 (100)	0.020
	65 - 69 years	15 (10.2)	51 (34.7)	81 (55.1)	147 (100)	
	70 - 74 years	20 (14.3)	47 (33.6)	73 (52.1)	140 (100)	
	75 - 79 years	7 (9.7)	27 (37.5)	38 (52.8)	72 (100)	
	80+ years	4 (5.8)	16 (23.2)	49 (71)	69 (100)	
Sex	Female	31 (11)	102 (36)	150 (53)	283 (46.9)	0.583
	Male	44 (13.7)	110 (34)	167 (53)	321 (53.1)	

* Pearson's chi-square test.

Regarding the TUG, men performed the task in a shorter time (10.8 seconds) than women (11.6 seconds), configuring a significant difference between groups (p=0.001).

In Figure 3, we can see a better performance in the execution of the TUG by the younger seniors (60-64 years) and a significant difference (p=0.0001) between the age groups, especially when we compare these and the other age groups with those who are in the 80+ range (p=0.0001).

The analysis of the ROC curve (*Receiver-Operating Characteristic*) indicated a value of >10 seconds in the performance of the TUG test as the best cutoff point for the diagnosis of FS (Figure 4). The sensitivity and specificity of frailty were 62.8% and 65.5%, respectively.

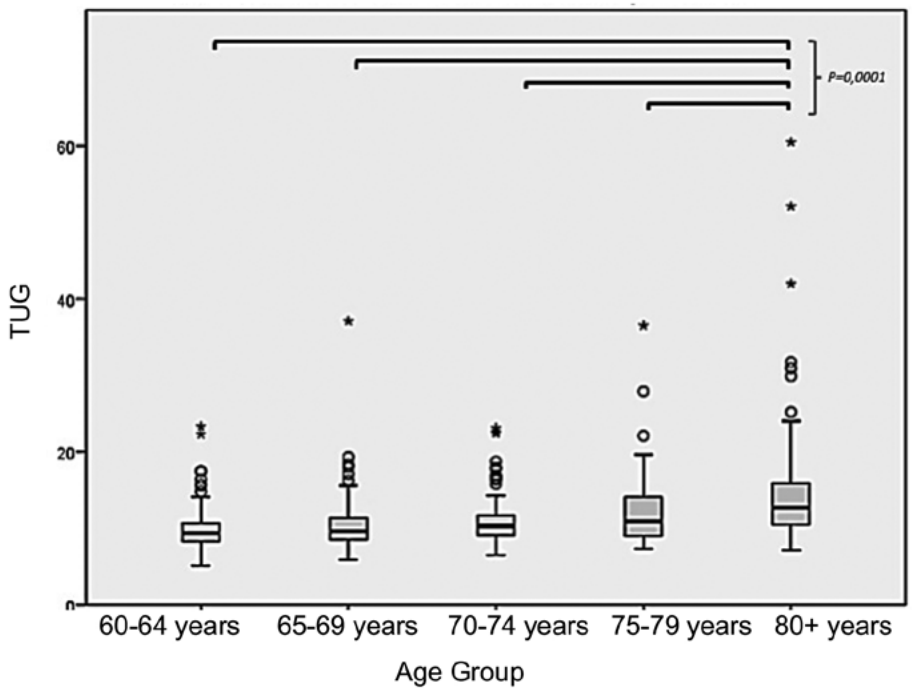


Figure 3. Distribution of rural retired older people in Rio Grande do Sul in relation to performance in the TUG and age group - [Average of 11 seconds and standard deviation +4.7] (n=604) - (p<0.0001), 2018.

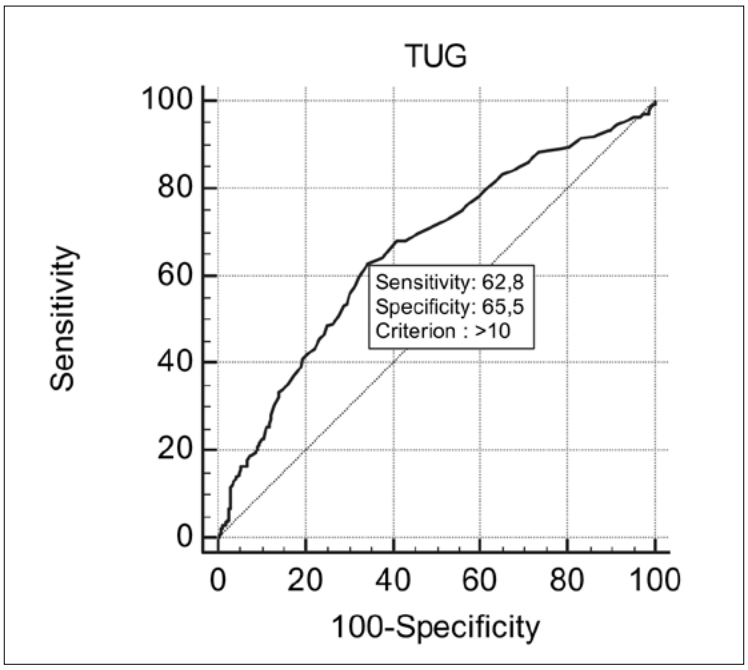


Figure 4. ROC curve (*Receiver-Operating Characteristic*) - (AUC - 0.658) demonstrating the sensitivity and specificity of the cut-off point for predicting Frailty Syndrome in the rural older population of Rio Grande do Sul (n=604) - *p*=0,001, 2018.

DISCUSSION

Assessing the age-related physiological decline, mainly associated with the condition of functional mobility and using simple screening instruments in the older population is a challenge. Sukkriang and Punsawad[22] evaluated the use of the TUG as a marker for the phenotypic definition of frailty in the older population and identified a significant sensitivity of the instrument. Rossi *et al.*[23] identified in their research that frail older people performed worse in the TUG when compared to non-frail older people. It can be observed in recent studies[24,25] that the test captures many aspects of the physiological aging process and predicts adverse outcomes without being specific to any particular disease, such as the functional mobility of older people, considering that its performance is linked to regular physical activity,[3,24] to the overall decline in health, disability in activities of daily living and falls[25,26].

However, there are few studies that assess the functional mobility of older rural workers in the current literature. Some studies carried out in municipalities in the interior[27,28] have appeared in the Brazilian scientific scenario, reiterating the differences between the older people who live in urban and rural areas. The researched sample is located in a young age group, where the subjects begin to perceive the aging process[6,7]. Although many factors that occurred in earlier stages of life can influence aging, biological, cultural or social conditions seem to be unique in the construction of the older person in the countryside, as pointed out by Xu *et al*[29].

Another question about the rural population and compatible with the findings of this study is the identification of a male population greater than the female, as has been pointed out in the National Household Sample Survey (PNAD), where men represent a contingent of 1.3 million more than women. For Ferraz *et al.*[30], the masculinization of the countryside has been observed due to situations related to the female rural exodus, the growth of the middle-aged population and the consequent tendency for the rural population to age[30]. In this scenario, for Trindade; Moraes; Dias[8], the vulnerabilities of older rural workers are added to an exhausting daily work routine, where there is exposure to several

occupational risk factors, aggravated by the physical weaknesses inherent in the condition of human aging, in addition to exposure to social vulnerability imposed by poor access to health services and other social resources present in the urban community[4,8].

Studies referred to in the State Health Plan[1] show the demographic situation in municipalities in the interior with up to 10,000 inhabitants, showing the concentration of older people in the countryside. Which makes us reflect on physical and functional demands and the entire process of accessibility necessary for a condition of autonomy and quality of life inherent to the stage of life and the multiple realities of rural communities in the state.

The physical condition assessed in this study shows that age is a factor that influences susceptibility to situations inherent to higher TUG scores. TUG is a well-known functional mobility test. Ansai *et al.*[31] highlighted its use as an outcome measure to assess functional mobility in older people.

As observed in this research, Ibrahim *et al.*[32] showed that women and longer-lived older people of both genders took longer to complete the TUG when compared to older males or younger people of both genders. Regarding cognitive condition, sex and age, the highest scores were perceived in female individuals, when compared to younger male individuals who present lower values[32]. In a sample of older people from the interior of the state of RS, Cruz Alta, Hansen *et al.*[33] identified relationships between the TUG and age, as well as functional mobility conditions associated with the risk of falls at higher scores.

From a geographical point of view, no studies were found on the condition of functional mobility of the older rural population within the state of RS. However, research pertinent to the functional health conditions of rural older people in communities in the state, account for relationships between the prevalence of basic activities of daily living (BADL) and instrumental activities (IADL), such as that of Pinto *et al.*[34], which found a prevalence of 81.8% and 54.6% for capacity in the BADL and IADL variables, respectively. They also verified the association of this ability with age between 60-69 years and male sex, as the findings of this research. Llano *et al.*[2] also analyzed an association of functional decline associated with the female gender and advancing age in the rural population, however restricted to a rural community in the state of RS.

In addition to the condition and correlation with other factors, the TUG assessment has been used as a predictor of frailty in different population groups, reinforcing its indication in population diagnoses[23]. Sukkriang and Punsawad[15], for example, found greater sensitivity (72%) and specificity (82.54%) with the same cutoff value (10 seconds) in a Thai population. In Brazil, research by Silveira and Filipin[15] indicated sensitivity (90.0%), specificity (35.5%), PPV (32.6%) and NPV (90.9%) in predicting frailty, with a cutoff point of TUG≥7.21 seconds, indicating the suitability of using the test for screening in active urban populations.-

The practicality of using the TUG to identify vulnerability resulting from FS is extremely relevant for the rural older population, especially if we consider issues inherent to the context of life, access to specialized services and the fact that the test can be applied by any health professional, as demonstrated in other studies[31,35].

The frequency of frailty and pre-frailty in this study indicates a condition of vulnerability of rural workers in RS in their aging process. Demonstrating, from the TUG test, characteristics of functional mobility and risk of frailty of older farmers, important for future considerations on the singularities of the health of this population and necessary professional interventions.

The research presents as a limitation the exclusion of older people with cognitive impairment, which may represent the exclusion of frail older people, as well as the limitation of the number of cities and regions of union coordination offices visited, since it would require more time for data collection and the need for funding. However, this study presents data from a portion of the population for which little information is available about the specificities and particularities in relation to health-disease aspects.

CONCLUSION

Knowing the health/disease condition of the rural population that ages in the countryside brings elements of recognition of a specificity necessary to think about adequate policies for a better life condition of the retired rural worker. Thus, in addition to recognizing the fragile condition of this population, the development of diagnostic tools that are easy to use can be important in the practice of health professionals in the field of Primary Health Care. The *Time Up and Go*, in this sense, constitutes an easy-to-apply test that has demonstrated its relationship with the condition of functional mobility and multidiagnosis related to human mobility, so important for that portion of the population that uses their body as an element of work. In this study, we can identify a significant portion of the sample with perception of elements of frailty in their daily life. And establishing a sensitive cut-off point for the identification of Frailty Syndrome in older people makes it possible to direct preventive and/or therapeutic interventions for this population. However, we observe the need for further studies that consider predictive factors that can influence and characterize contexts of weakened health due to aging and rural conditions.

AUTHORSHIP

- Jorge L. de A. Trindade - Project Management, Formal Analysis, Conceptualization, Data Curation, Writing - First Drafting, Writing - Proofreading and Editing, Investigation, Methodology, Resources, Supervision, Validation and Visualization.
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