Original Article

Intrarater reliability of Timed Up and Go Test to patients with COPD

Reprodutibilidade intraobservador do teste Timed Up and Go para pacientes com DPOC

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ABSTRACT | INTRODUCTION: The Timed UP and Go Test (TUG) is an important test used to assess functional outcomes in COPD, such as mobility, dynamic balance, and risk of falling. In clinical practice, the repeated application of the TUG is performed several times by the same observer to evaluate different interventions applied in COPD. **OBJECTIVE:** To assess the degree of intraobserver reproducibility of TUG in individuals with COPD. **METHODOLOGY:** Descriptive, cross-sectional study carried out with individuals with COPD treated in an outpatient clinic in the city of Salvador-Bahia. Sociodemographic and clinical characteristics such as spirometry (FEV_1/FVC) were verified, as well as two practices of the TUG Test on the same day. The reproducibility of TUG was evaluated fur Intraclass Correlation Coefficient (ICC). CAAE number 38143214.0.0000.0057. RESULTS: Thirty-one volunteer patients were evaluated, of which 24 (77.4%) men, mean age 68.6 ± 9.8 years, with post-bronchodilator FEV^1//FVC ratio 59.0 ± 10.8%. In the analysis of intraobserver reproducibility of the TUG by the ICC, α = 0.897 (CI 95%: 0.786; 0.950; p < 0.0001) was obtained. **CONCLUSION:** The TUG test has excellent intraobserver reproducibility and a small variability when applied twice in patients with COPD, being the application for mobility assessment, in care practice, considered viable.

KEYWORDS: Chronic obstructive pulmonary disease. Test reproducibility. Outpatient Assistance. Physiotherapy. Data reliability.

RESUMO | INTRODUÇÃO: O *Timed UP and Go Test* (TUG) é um importante teste utilizado para a avaliação de desfechos funcionais na DPOC, como mobilidade, equilíbrio dinâmico e risco de queda. No cenário clínico prático, a aplicação repetida do TUG é realizada muitas vezes pelo mesmo observador, no objetivo de avaliar diversas intervenções aplicadas na DPOC. **OBJETIVO:** Avaliar o grau de reprodutibilidade intraobservador do TUG em indivíduos com DPOC. **METODOLOGIA:** Estudo descritivo, de corte transversal, realizado com indivíduos com DPOC, atendidos ambulatorialmente na cidade de Salvador-Bahia. Foram verificadas características sociodemográficas e clínicas como a espirometria (VEF_1/CVF), e tempo de realização de duas práticas no mesmo dia do teste TUG. A reprodutibilidade do TUG foi avaliada pelo Coeficiente de Correlação Intraclasse (CCI), CAAE número 38143214.0.0000.0057. **RESULTADOS:** Trinta e um pacientes voluntários foram avaliados; destes, 24 (77,4%) homens, média da idade de 68,6 ± 9,8 anos, com relação VEF_1/CVF pós-broncodilatador de 59,0 ± 10,8 %. Na análise da reprodutibilidade intraobservador do TUG pelo CCI, obteve-se α = 0,897 (CI 95%: 0,786; 0,950; p < 0,0001). **CONCLUSÃO:** O teste TUG possui excelente reprodutibilidade intraobservador e uma pequena variabilidade quando aplicados duas vezes em pacientes com DPOC, sendo a aplicação para avaliação da mobilidade, na prática do cuidado em saúde considerada factível.

PALAVRAS-CHAVE: Doença Pulmonar Obstrutiva Crônica. Reprodutibilidade dos Testes. Assistência Ambulatorial. Fisioterapia. Confiabilidade dos dados.

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Introduction

Chronic Obstructive Pulmonary Disease (COPD) is a preventable and treatable disease characterized by persistent respiratory symptoms and airflow limitation, determined by alveolar and airway abnormalities usually caused by significant exposure to harmful particles or gases.[1] In addition to these repercussions, people with COPD have extrapulmonary impacts such as sarcopenia and others, which can contribute to exercise intolerance[1]; and when compared to healthy individuals, patients with COPD are less active.[2] The consequences of reduced skeletal muscle strength and endurance, increased by the individual's inactivity, may reduce performance in performing functional tests.[3]

In physical therapy practice, specifically in the assessment and care of people with chronic lung diseases (which includes COPD), the use of accessible, effective, and low-cost, functional tests is increasingly frequent, being functional assessment modalities with recognized applicability the sit and stand test, the six-minute walk test and the Timed Up and Go Test (TUG).[4,5] The importance of these methods is mainly due to the need for patient assessment, which aims to functionally diagnose and assist in decision-making for the proper management of these individuals.[6]

The TUG is considered a possible tool to identify different outcomes in people with COPD, being applied in the assessment of functional mobility, static and dynamic balance, ability to walk, turn, sit and stand, and can predict the risk of falls[6] and sarcopenia in the elderly.[7] The test consists of getting up from a chair, walking for three meters, returning, and sitting down again. Elderly people with performance greater than 13.5 seconds are at greater risk of falls.[8] However, the reference value for the test in the specific population of individuals with COPD is a time greater than 11.2 seconds to detect mobility alterations.[4]

A review published by Holland et al. (2020)9 identified that the TUG test has a high test-retest reliability in patients with COPD, this finding is common in stroke patients[10] (intraclass correlation coefficient [ICC] > 95), and two other studies evaluated TUG responsiveness after a pulmonary rehabilitation program.[11,12]

Thus, in most health care settings (clinical settings), it becomes necessary for a human evaluator to integrate the evaluation system when applying a test, questionnaire, or a scale.[13] In this context, the need to assess intra-observer reproducibility/reliability becomes necessary to quantify either the stability or variability of the data recorded by the same observer during the act of measuring the specific clinical characteristic.[13]

Although TUG is a valid assessment method, the study of measurement or clinimetric properties, including intraobserver reliability, is important to help health professionals choose the test and how to apply and interpret it in practice.[6] Therefore, the study aimed to verify the intraobserver reliability of the Timed Up and Go Test in individuals with Chronic Obstructive Pulmonary Disease (COPD).

Methods

A descriptive, cross-sectional study was conducted from a convenience sample of COPD subjects selected from a public health outpatient clinic in Salvador-Bahia, Brazil. Patients with a diagnosis of COPD, according to the 2021 GOLD document (Global Initiative for Chronic Obstructive Lung Disease)[1], who underwent spirometry for at least six months from the date of assessment were included in the study. Those who had difficulty understanding the tests proposed by the study protocol were excluded.

Data collection was performed at the Exercise Physiology Laboratory, Department of Life Sciences, State University of Bahia (UNEB), Salvador, Bahia, Brazil. Subjects were selected from the Exercise Physiology Laboratory, Department of Life Sciences, State University of Bahia (UNEB) outpatient clinic. The individuals underwent an assessment in a single day, and sociodemographic characteristics were verified, in addition to the TUG Test, twice in sequence on the same day, with a minimum interval of one minute between each test. In addition, recent pulmonary function data were obtained on request to the patient.

To perform the TUG test, a manually operated stopwatch available on the iPhone 6 smartphone (Apple, Inc.), a measuring tape, a chair, and a cone were used. The individuals were instructed to sit in the chair without support, stand up, walk three meters to the cone floor, and sit down again. The cut-off time used to assess individuals with COPD poorer health outcome measurements was > 11.2 seconds.[4] The sociodemographic variables considered were age in years (median); sex; skin color; Body Mass Index (Kg / m^2); weight (kg); height (meter). Patients were divided according the classification of severity of airflow limitation proposed by 2021 GOLD[1] document: GOLD 1 (Mild COPD), had post-bronchodilator FEV_1 > 80%; GOLD 2 (Moderate COPD), post-bronchodilator 50 ≤ FEV_1 <80%; GOLD 3 (Severe COPD), post bronchodilator 30 ≤ FEV_1 <50%; GOLD 4 (Very Severe COPD), post bronchodilator FEV_1 <30%.[1]

Clinical variables were collected: peripheral oxygen saturation (SpO_2); the presence of hypertension; diabetes; smoking status. And medications in use.

Data were analyzed in the SPSS software (v.17.0) and were expressed as a measure of central tendency, dispersion, and proportions. The paired T-Test was used to compare the performance of the two TUG tests. In addition, ANOVA was used to assess the difference between the TUG performance time between the airflow limitation classes of the GOLD 2021. The intrarater reliability of the TUG was assessed by the Intraclass Correlation Coefficient (ICC), with low reproducibility being assumed to be low reproducibility for values below 0.4, between 0.4 and 0.75, as good reproducibility and values above 0.75 were considered as excellent reproducibility.[14] Bland-Altman graphs were drawn. A $p < 0.05$ was considered statistically significant. UNEB Ethical Committee approved the present study (CAAE number 38143214.0.0000.0057) to analyze the dispersion between the two TUG tests.

Results

The sample consisted of 31 individuals with COPD. Of these, 24 (77.4%) were male; the mean age was 68.6 ± 9.8 years. In addition, it was observed that 25 (80.6%) individuals were classified as black and 19 (61.3%) married Table 1.

Data on post-bronchodilator (post-BD) values and severity of airflow limitation, comorbidities, and medicine use profile for COPD are described in Table 2.

In the four individuals with Very Severe COPD (GOLD 4), TUG was performed in 9.3 ± 2.5 seconds; in the 16 Severe COPD (GOLD 3) patients, the TUG time had 8.0 ± 1.3 seconds; and in the 11 patients with Moderate COPD (GOLD 2), the TUG was performed in 8.3 ± 2.3 seconds. None of the subjects has GOLD 1 COPD.

TUG times were considered similar between the three groups (ANOVA, p = 0.5).

TUG Reliability

Regarding the analysis of TUG intrastate reliability, the ICC, α = 0.90 (CI 95%: 0.79; 0.95; $p < 0.0001$) was obtained. Figure 1 illustrates the dispersion of individual data of TUG 1 and TUG 2 when presenting the intrarater reliability in seconds. Mean TUG 1 and 2 times were, respectively, 8.3 ± 1.8 seconds and 7.9 ± 1.9 seconds, with no statistical difference between them (p = 0.104). The mean difference value between TUG 1 and 2 was 0.35 ± 1.15 seconds.

Four (12.9%) subjects had a TUG test higher than 11.2 seconds (three patients in TUG1 and one in TUG2).

The variability in the performance (time) of the two TUG tests is shown in Figure 2 by the graphic layout of Bland & Altman. Of the 31 patients evaluated, 10 (32.3%) performed time in TUG1 = TUG2; 15 (48.4%) performed time TUG1 > TUG2 (reduced the time in the 2nd practice, that is, there was a performance improvement); six (19.3%) performed time TUG2 > TUG1 (increased time in second practice). No patient required a walking aid device.

Table 1. Sociodemographic characteristics of patients with Chronic Obstructive Pulmonary Disease (n=31)

Characteristics	Mean ± SD	n (%)
Age (years)	68.6 ± 9.8	
Gender		
Male		24 (77.4)
Female		7 (22.6)
Marital status		
Married		19 (61.3)
Unmarried		8 (25.8)
Widower		4 (12.9)
Skin color		
White		5 (16.1)
Black		25 (80.6)
Indigenous		1 (3.2)
BMI		
Low weight		1 (3.2)
Eutrophic		12 (38.7)
Overweight		14 (45.2)
Obese		4 (12.9)

SD: Standard Deviation; BMI: Body Mass Index.

Table 2. Clinical characteristics of patients with Chronic Obstructive Pulmonary Disease, n=31

Variables	Mean (%)	SD (±)
Pulmonary function		
FVC (% predicted post BD)	65.1	16.6
FEV_1(% predicted post BD)	45.9	14.9
FEV_1/ FVC	59.0	10.8
SpO_2	95.9	2.1
	n (31)	**%**
Degrees of airflow limitation (GOLD 2021)		
Moderate		
Severe	11	35.8
Very severe	16	51.6
	4	12.6
Arterial hypertension	20	64.5
Diabetes mellitus	4	12.9
Smoking Status		
Never smoked	3	9.7
Smoker	7	22.6
Ex- smoker	21	67.7
Bronchodilator use	25	80.6
Inhaled corticosteroid use	7	22.6

SD: Standard Deviation; FVC: Forced Vital Capacity; FEV_1: Forced Expiratory Volume 1 second; BD: Bronchodilator; SpO_2: Pulse Oxygen Saturation.

Figure 1. Intrarater reliability of performance, in seconds, in TUG 1 and TUG 2 (α = 0.90; CI 95%: 0.79– 0.95); p < 0.000; n = 31

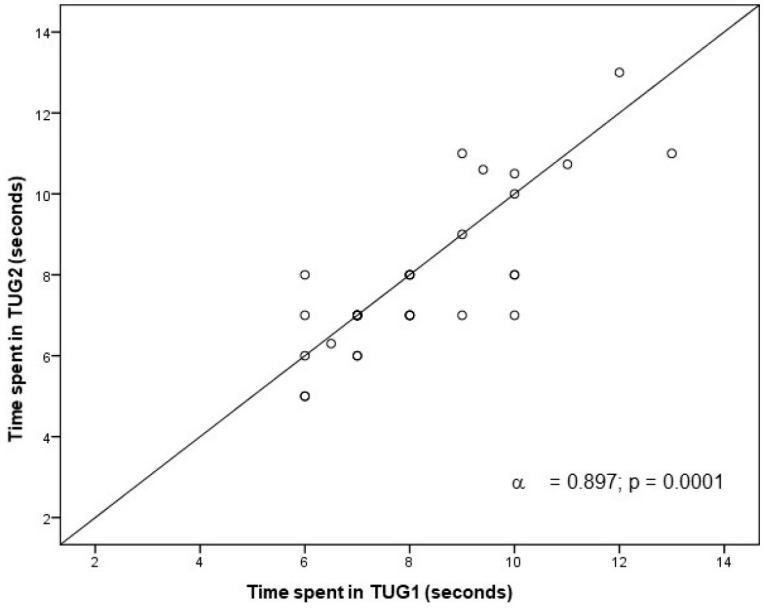
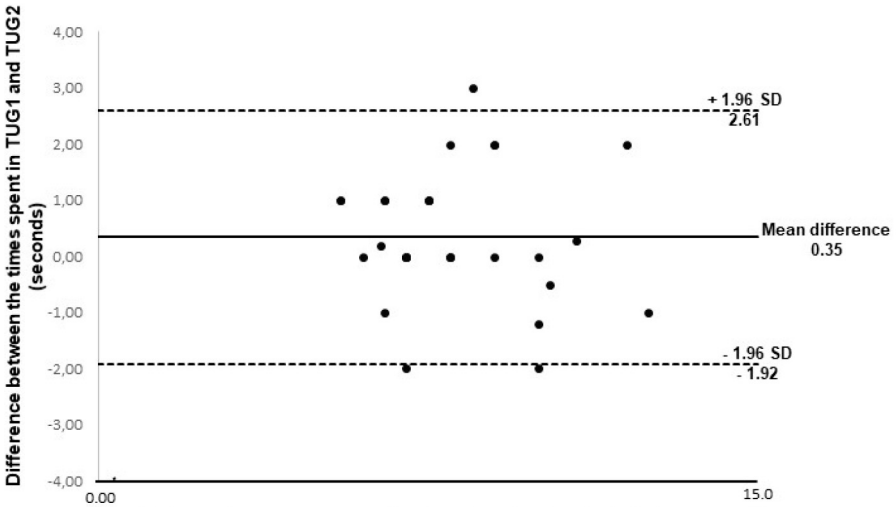


Figure 2. Bland-Altman Plots of the difference between the times spent in the two TUG practices (1 and 2) in relation to the individual performance mean (time) in the two tests [(mean: 0.35 seconds; CI 95% (- 1.92; 2.61)]



Discussion

The TUG is a test widely used in different populations because it can identify people at risk of falls. TUG is also easy to use in clinical practice, requiring few instruments to perform it.[4,6,15] In the present study, it was found that the TUG's performance was considered of low complexity and excellent intrarater reliability. A small test variability was also noted in COPD patients, according to data from a recently published review of functional tests, in which it was indicated that the mean difference between the tests ranged from 0.06 to 0.96 seconds.[4,9,11,16] O TUG was considered to have good intraobserver reliability not only in the present study but also in other publications in the literature, and not only for COPD but also for Chronic Heart Failure (CHF), Chronic Kidney Failure (CRI), and Stroke (CVA).[10,15]

In the analysis of the variability of the present study, there was a low mean difference between the two measurements of TUG, a finding also found in people with advanced chronic diseases, including COPD.[15] However, the application of repetition of the TUG by another observer (inter-observer reliability) may result in variability outside the limits of agreement, as can be seen in the literature.[11] In this way, it can be suggested that in a situation of repetition or reassessment by TUG (after an intervention, for example), it is recommended that this test be performed by the same health professional.

The main outcome measure of the TUG is the measurement of time in seconds, and in the present study, this was measured by a manual stopwatch with good intrarater reliability. However, it is known that the evaluator's skill[17] can influence timed time. In the literature, one can find studies that suggest the usefulness of using automatic chronometers to improve the reliability of the test, increasing the ICC.[17] Using an automatic stopwatch, an ICC > 0.88 was found in one study, with an ICC > 0.86 using a manual.[17] In the present study, the use of the manual stopwatch does not seem to have changed the reproducibility of the test, as well as this aspect increases the practicality and reduces the cost of resources to opt for the TUG for functionality assessment.

The number of TUG repetitions can vary up to three times in the literature, being identified in one study, a statistical difference between the first and the third assessment, suggesting a learning effect[15], something not checked in this review. Therefore, it is recommended that the TUG be executed twice, choosing the best performance and not requiring a third execution.[11,15]

A time reduction in TUG performance is expected after its repetitions, as found in some studies.[4] However, factors such as the effects caused by senescence, low exercise tolerance in COPD, as well as decreased quadriceps strength can play an important role in reducing performance in functional tests.[3,18] In the present study, most of the individuals evaluated presented a reduction in the time to perform the second test, but a significant part of the sample performed TUG1 = TUG2, and 19.3% obtained TUG2 > TUG1. These findings may be directly related to low effort tolerance, reduced muscle strength in the lower limbs, changes in mobility and balance, as mentioned above, impacting the increase in the time to perform the TUG after repetitions.[3,18]

Scientific evidence points to reduced functional mobility and global function[19,20] caused by fatigue, muscle dysfunction, and reduced exercise tolerance that can compromise balance, especially with advanced disease.[8] In COPD exacerbation states, individuals have worse mobility as assessed by the TUG compared to non-exacerbation states.[8,21] In this work, the test results in the individuals evaluated were below the cutoff point of 11.2 seconds[15] recommended for the population with COPD, except for one individual in the second practice, corroborating a study that assessed balance in people with the same health condition[22] that is, the population studied did not present any risk of falling or deficit balance, even though it is mostly between the moderate to severe stages of the disease, which may be related to the small sample size. This finding can also be justified since the study used as a reference[14] for the cutoff point in the test, it used only patients in an advanced stage of the disease in its sample, and in the present study, patients in a moderate stage were not used as an exclusion criterion. In addition, the difficulty of people in more advanced stages of the disease to go to health services is mentioned.

In the studied sample, the airflow limitation levels proposed by GOLD 2021[1] did not identify statistical

differences in the performance of the TUG test by the individuals, reinforcing the hypothesis defended by Pitta et al. two and Cavalieri et al.[23], who evaluated the relationship between air obstruction and performance in activities, even when verified in more advanced degrees of COPD. Thus, test performance is more closely related to the aforementioned musculoskeletal impairment already mentioned.[2,22]

A study subjected participant to minimal risk and the assessment was conducted with simple, affordable, and low-cost resources. Access to patients in more advanced stages of the disease is indicated as a limitation because of the convenience sample.

Conclusion

According to the present study results, TUG test had excellent intrarater reliability and a small variability when both practices are applied to individuals with COPD. TUG use in health clinical practice was considered feasible to assess mobility in COPD subjects.

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Authors' contributions

Costa HC and Santos BS participated in the conception, design, search and statistical analysis of research data, interpretation of results, writing of the scientific article. Santos NC participated in the conception, design and data search and final review. Barbosa TS and Miranda AG participated in data analysis, interpretation of results, writing of the scientific article. Camelier AA and Camelier FWR participated in the conception, design, search and statistical analysis of research data, interpretation of results, writing and review of the scientific article.

Compeeting interests

No financial, legal, or political conflicts involving third parties (government, companies, and private foundations, etc.) have been declared for any aspect of the submitted work (including, but not limited to grants and funding, advisory board participation, study design, preparation manuscript, statistical analysis, etc.). Aquiles Assunção Camelier has a part time contract with the GSK Brazil, and receives a grant to suport Scientific Production fron Maria Emília Foundation (since March 2020).

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