

Confiabilidade interavaliador e teste-reteste do teste de AVD-Glittre em indivíduos saudáveis

Inter-rater and test-retest reliabilities of the Glittre-ADL test in healthy subjects

MONTEMEZZO, Dayane¹; SONZA, Anelise²; FERNANDES, Aline Andrioni³; ALEXANDRE, Hellen Fontão⁴; PEREIRA, Danielle Aparecida Gomes⁵; BRITTO, Raquel Rodrigues⁵.

Resumo

Introdução: O teste de AVD-Glittre (TGlittre) é válido para avaliar a capacidade funcional. Entretanto, poucos estudos verificaram suas propriedades de medida. **Objetivo:** Avaliar a confiabilidade interavaliador e teste-reteste do TGlittre em indivíduos saudáveis. **Métodos:** Treze indivíduos saudáveis (8 mulheres; 27,3 ± 3,94 anos) tiveram seu histórico de saúde, atividade física, antropometria e capacidade funcional avaliados. No primeiro dia, o TGlittre foi realizado duas vezes, randomizadamente, por dois avaliadores independentes. No segundo, apenas um TGlittre foi realizado, pelo avaliador 1. As avaliações foram separadas por, no mínimo, 7, e, no máximo, 14 dias. **Análise Estatística:** Foram utilizados, o coeficiente de correlação intraclasse (CCI) e o intervalo de confiança de 95% (IC95%) das médias entre os dois TGlittre (confiabilidades interavaliador e teste-reteste). **Resultados:** A média de tempo do TGlittre foi de 2,66 ± 0,26 minutos, no dia 1; 2,45 ± 0,22 minutos, no dia 2. CCI de 0,83 (IC95%: 0,52-0,94; p<0,001) e 0,88 (IC95%: 0,65-0,96; p<0,001) foram obtidos para as confiabilidades interavaliador e teste-reteste, respectivamente. **Conclusão:** O TGlittre demonstrou adequada confiabilidade, para avaliar a capacidade funcional de indivíduos saudáveis.

Palavras-chave: Reprodutibilidade dos Testes; Atividades Cotidianas; Participantes Saudáveis.

¹ Department of Physiotherapy, Physiotherapy Graduation Program - Santa Catarina State University (UDESC), Florianópolis, Santa Catarina, Brazil. Email: dayane.montemezzo@udesc.br

² Department of Physiotherapy, Physiotherapy Graduation Program - Santa Catarina State University (UDESC), Florianópolis, Santa Catarina, Brazil.

³ Master in Rehabilitation Science - Federal University of Minas Gerais (UFMG), Belo Horizonte, Minas Gerais, Brazil. Community Respiratory Team (CORE) - Whittington Health NHS Trust, London, United Kingdom.

⁴ Physiotherapy Graduation Program - Santa Catarina State University (UDESC), Florianópolis, Santa Catarina, Brazil.

⁵ Department of Physiotherapy, Rehabilitation Sciences Graduation Program - Federal University of Minas Gerais (UFMG), Belo Horizonte, Minas Gerais, Brazil.

Abstract

Background: The Glittre ADL-test (TGlittre) can assess functional capacity. However, few studies verified its measurement properties. **Aim:** To evaluate inter-rater and test-retest reliabilities of the TGlittre in healthy subjects. **Methods:** Thirteen healthy subjects (8 women; 27.3 ± 3.94 years) were assessed for health history, physical activity, anthropometry and functional capacity. On the first assessment, the TGlittre was randomly performed twice and independently by two different raters (rater 1 and rater 2). On the second assessment, the TGlittre was performed only once, by the rater 1. The assessments were separated by at least seven days and a maximum 14 days apart. **Statistical analyses:** the intraclass correlation coefficient (ICC) and its 95% confidence interval (95%CI) of the mean differences between two TGlittre were used (inter-rater and test-retest). **Results:** the mean time spent in the TGlittre was 2.66 ± 0.26 minutes on day 1 and 2.45 ± 0.22 minutes on day 2. An ICC of 0.83 (95%CI: 0.52-0.94; $p < 0.001$) and 0.88 (95%CI: 0.65-0.96; $p < 0.001$) was obtained for inter-rater and test-retest reliabilities, respectively. **Conclusion:** The TGlittre demonstrated adequate reliabilities to assess the functional capacity of healthy individuals.

Keywords: Reproducibility of results; Activities of daily living; Healthy participants.

Introduction

Functional capacity is the ability of an individual to satisfy his or her needs in performing activities of daily living (ADL)¹. In this context, different field tests exist to evaluate this result, as the six-minute walk test being the most used and studied². However, the Glittre ADL-test (TGlittre), initially developed to assess functional capacity in patients with chronic obstructive pulmonary disease (COPD)³, seems to be a more accurate measurement tool. Since it involves multiple tasks such as sitting and standing up from a chair, going up and downstairs, manipulating objects and squatting, going beyond a single activity (such as walking on flat ground^{3,4}), the TGlittre is representative of ADL⁵.

Likewise, it is possible that TGlittre is closer to the daily reality of the individual and can better predict its functionality as most of the usual ADL involves the simultaneous use of the upper and lower limbs. Thus, the test can be useful for the identification of different levels of functional performance, according to the International Classification of Functioning, Disability, and Health (ICF)^{6,7}.

Although TGlittre is a relatively new instrument, the test has been used frequently in clinical practice, showing considerable importance⁷⁻⁹. As the aim of TGlittre is to measure, in a standardised way, an important outcome, the instrument has already been studied in different populations as children¹⁰, obese patients after bariatric intervention¹¹, cardiovascular and pulmonary diseases^{12,13} besides healthy subjects¹⁴. Besides, it consists of a simple test of easy and fast application³.

Previous studies have demonstrated that TGlittre is valid for assessing the functional capacity of healthy young adults¹⁴, as well can differentiate them from patients with COPD. As expected, the performance of healthy subjects is superior compared to patients with cardiopulmonary diseases. This is mainly because healthy subjects present a lower ventilatory response to the effort to which they are exposed^{15,16}. However, there are still few studies that verified the measurement properties of TGlittre to ensure the quality of the obtained results. Reliability measurements, in this context, are indispensable to achieve predictable results within health science and rehabilitation, providing the clinical applicability of the instrument^{17,18}. Therefore, the inter-rater and test-retest reliability investigation of the TGlittre is necessary to ensure that the measurements collected by different professionals in different assessment times are reproducible and likely to be generalized⁷.

Given those as mentioned above, the present study aimed to evaluate inter-rater reliability and test-retest in the application of TGlittre in healthy subjects.

Methods

This is a cross-sectional study, approved by the Ethics Committee on Research in Human Beings of the Universidade Federal de Minas Gerais (CAAE: 21864913.7.00005749). All participants signed an Informed Consent Form before the research began.

Study participants were recruited from the community, in the city of Belo Horizonte, in a non-probabilistic and for convenience. These healthy subjects were invited to participate in the study, aged up to 40 years old, body mass index (BMI) between 18.5 and 34.99 kg/cm², free of orthopaedic, neuromuscular, cardiovascular or respiratory diseases that could influence physical performance. As exclusion criteria, the following were adopted: blood pressure at rest ≥ 180 mmHg PAS x 100 mmHg PAD, peripheral oxygen saturation $< 90\%$, heart rate > 120 bpm¹⁹ prior to the TGlittre, as well as the inability to execute any of the procedures.

Protocol

The research procedures took place on two days that were separated by at least one week apart, respecting the limit of two weeks between the first and second assessment days. On the first day, the subjects were interviewed and asked about their health and physical activity history. The age, body mass and height of the participants were also measured. The TGlittre was performed twice on day one and conducted by two different raters, to analyse the inter-rater reliability. On the second day, TGlittre was performed only once and evaluated by rater 1, as a means of assessing test-retest reliability. The application of TGlittre respected a random sequence between rater 1 and 2.

The physical activity level was classified according to the American College of Sports Medicine²⁰ and the BMI calculated by the equation: weight/height². The subjects were instructed in advance to avoid strenuous physical activity for the 12 hours preceding the TGlittre.

Glittre-ADL Test

The TGlittre is composed of a functional activities circuit and was performed as described previously by Skumlien³, in a 10-meter flat corridor. Subjects have to go up and down two steps of a ladder interposed in the middle of the circuit and walk again until they reach a shelf. After that, three bags of 1 kg each, placed on the upper shelf (with height adjusted at shoulder level), should be moved one by one to the lower shelf (at waist level) and the floor. These objects should then be placed back on the bottom shelf and finally on the top shelf. Once this task is completed, the individual returns through the entire course, ending a lap. Immediately afterwards, another lap is resumed, following the same circuit described. The TGlittre consists of 5 laps, and subjects were instructed to complete them in the shortest possible time. The time taken to complete the TGlittre, in minutes, was recorded and used for analysis as the main variable to verify inter-rater and test-retest reliability. During the test, the participants carried a backpack containing 2.5 (women) or 5.0 (men) kg and physiologic parameters (i.e., blood pressure, heart rate and peripheral oxygen saturation) were evaluated for safety reasons. On the first day of assessment, two TGlittre were performed separated by 10 minutes to ensure the return of vital signs to their baseline levels. Before each TGlittre, the participants received instructions about the rules to perform it and the height of the shelves was adjusted. Both tests were

done at the same period of the day³ and in an outpatient and closed environment. The estimated time to complete the TGlitter was also calculated using predicted reference equations⁹.

Data analyses

Data were analysed with SPSS 20.0 software (IBM, Armonk, NY) and are presented as means and standard deviations. The variables age, sex, weight, height, BMI, and level of physical activity were used to characterise the sample. Intraclass correlation coefficients (ICCs) and 95% confidence intervals (CIs) of the mean differences between the two TGlitter were used to analyse the inter-rater and test-retest reliabilities. Paired sample T-test was used to compare the time spent to perform the TGlitter. Alpha of 5% was considered statistically significant.

Sample size

The sample size was calculated using the time spent for TGlitter as the endpoint variable and considered an ICC of at least 0.70. A sample size of 10 subjects was indicated based on the level of significance of 0.05 and statistical power of 0.80¹⁸.

Results

Twenty subjects were selected based on the inclusion criteria and were potentially eligible for the study. Of these, four were excluded because of the presence of abnormal levels of blood pressure, heart rate or the inability to perform the tests. Sixteen individuals started the evaluations, and three did not return for the second day of data collection. Therefore, thirteen (8 women) completed the protocol and had their data considered for the analyses. Figure 1 shows the flowchart of the study. Other characteristics of the sample are described in Table 1.

Figura 1 | Flow chart of the study.

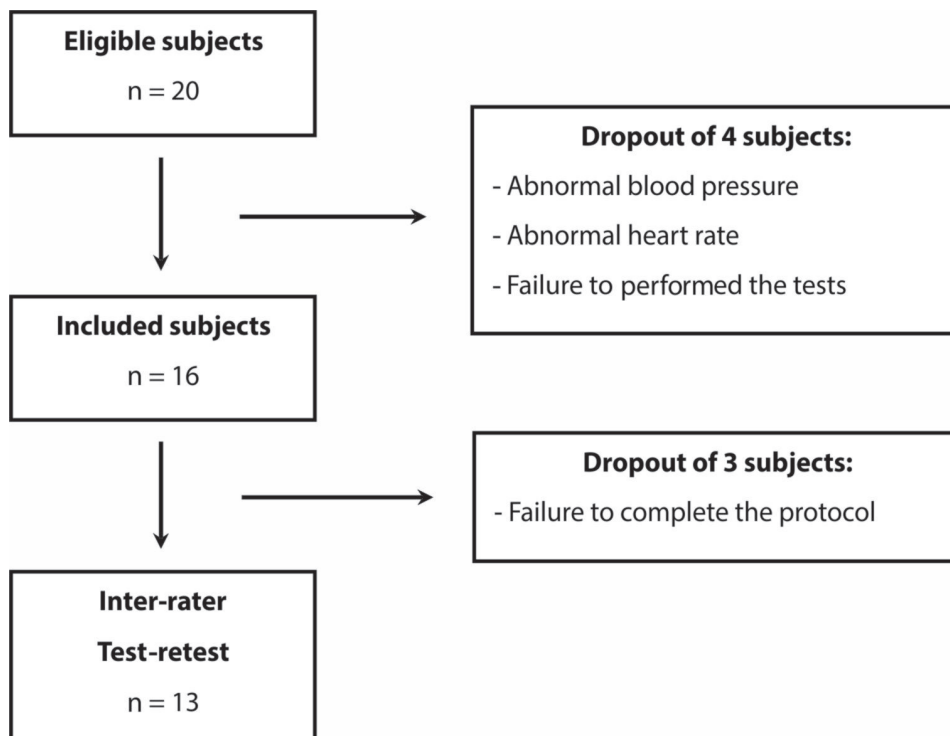


Table 1 | Demographic, anthropometric and physical activity level data of the sample (n=13).

	Mean ± SD
Age, years	27.3 ± 3.94
Sex	
Female, n (%)	8 (61.5) *
BMI, kg/m²	23.9 ± 3.0
Weight, kg	70.4 ± 13.1
Height, cm	171.0 ± 7.72
Physical activity	
Active, n (%)	8 (61.5) *
Sedentary, n (%)	5 (38.5) *

Captions: SD, standard deviation; BMI, body mass index
 *Results are presented as frequency.

For the inter-rater reliability of TGlitter, an ICC of 0.83 was obtained (95% CI: 0.52 - 0.94; $p < 0.001$). Regarding the test-retest reliability, an ICC of 0.88 (95% CI: 0.65 - 0.96; $p < 0.001$) was found. On average, subjects spent 2.44 ± 0.18 and 2.45 ± 0.21 minutes ($p > 0.05$) for completing the TGlitter, when applied by raters 1 and 2, respectively. Considering the different assessment days, the mean time spent in the TGlitter was 2.66 ± 0.26 minutes on day 1 and 2.45 ± 0.22 minutes on day 2 ($p < 0.001$).

The estimated average time to complete the TGlitter was 2.43 minutes, and the individuals reached 92.7% of the predicted time, considering the first test performed. The data concerning the inter-rater and test-retest reliability are presented in Tables 2 and 3, respectively.

Physiologic parameters were similar for teste-retest and inter-rater assessments. Day one, systolic blood pressure and heart rate at the end of TGlitter 1: 118 mmHg, 132 bpm, respectively; TGlitter 2: 118 mmHg, 138bpm, respectively, $p > 0.05$.

Table 2 | Inter-rater reliability of the Glitter ADL-test between rater 1 and 2.

	Rater 1 minutes	Rater 2 minutes	ICC	95%CI	p
Time	2.44 ± 0.18	2.45 ± 0.21	0.83	0.52-0.94	<0.001

Captions: CI: confidence interval; ICC: intraclass correlation coefficient.

Table 3 | Test-retest reliability of the Glittre ADL-test for rater one between day 1 and 2.

	Day 1 minutes	Day 2 minutes	ICC	95%CI	p
Rater 1	2.66 ± 0.26	2.45 ± 0.22	0.88	0.65-0.96	<0.0001

Captions: CI, confidence interval; ICC: intraclass correlation coefficient.

Discussion

As the main result of this study, the TGlittre shows adequate inter-rater and test-retest reliability for application in healthy subjects.

The reliability, as well as validity, are some of the primary measurement properties of instruments. Taken together, they are necessary to ensure the quality of measurement scales or field tests, for example, and to enable the generalisation of the obtained results. One can consider reliable the instrument that, in time and space, can reproduce measurements in a precise and robust way²¹. Since these properties can vary according to the tool itself, the application circumstances and the studied population, the current interest and its investigation are justified. Also, due to the growing importance of evidence-based practice within the health area, it has become essential to ensure real measurement properties, given the need to obtain real data that can reflect the individual's health with minimal possible errors^{17,21}. Therefore, this is a field of extreme interest in research and clinical practice in the rehabilitation sciences. Concerning TGlittre, it is already known that the test is valid to assess the functional capacity of healthy young adults¹⁴. However, there is still little evidence related to its reliability for application in this particular population.

To the best of our knowledge, the study from Dos Reis et al.¹⁴ was the only one that investigated the reliability of TGlittre in healthy subjects that performed the TGlittre twice, conducted by the same rater and in the same day, with a 30-minutes interval between them¹⁴. However, to analyse the inter-rater reliability and test-retest of an instrument, the tests must be performed by different professionals and on different days¹⁸, respectively, as adopted in our study. Regarding these aspects, the present study is the first to investigate the inter-rater and test-retest reliability of TGlittre for use with healthy subjects. In COPD, TGlittre also has adequate test-retest reliability (Spearman's correlation coefficient = 0.93; $p < 0.001$)³, but this study used a form of reliability measurement that is not the most adequate currently.

It is known that the ICC is the index most used to measure reliability since it adequately reflects the correlation and the agreement. Although there is no consensus regarding specific cut-off values, it has been considered that ICC values higher than 0.75 indicate good reliability and lower values represent weak to moderate reliability¹⁸. Thus, from this result, it can be stated that TGlittre presents good test-retest reliability and there are no differences in the time spent by individuals when the test was applied at different times, under the same conditions. Likewise, the inter-rater reliability with an ICC of 0.83 also showed good reliability, demonstrating that there are no differences in performance in TGlittre when applied by different professionals. This information makes the test more practical regarding the possibility of different raters evaluating the same patient, keeping the quality of results.

Concerning the average of time spent completing TGlittre, these were similar between different raters and different in assessment days 1 and 2. The baseline characteristics of this sample were similar in terms of age, BMI and sex distribution. Likewise, it is already known that, for this particular population, the minimum time required to complete the AVD circuit of TGlittre without violating the protocol is two minutes, and the time averages are in accordance with this cut-off value³. In contrast, Corrêa et al.¹⁵ showed that ten healthy individuals took 3.3 ± 0.3 minutes on mean to complete the TGlittre. However, they were considerably older when compared to our study sample (63 ± 7 years vs 27 ± 4 years, respectively)¹⁵. Functional capacity and age are expected to be inversely proportional. Similarly, when compared to healthy individuals and patients with COPD, the latter tend to have worse performance on TGlittre, especially since they experience more significant ventilatory stress during the test, the main contributor to exercise limitation and ADL^{4,15,22}.

As limitations of the present study, it is possible to highlight the small sample size, which may have caused a type II error. However, the sample size was calculated based on the main objective of the study, and it was possible to find satisfactory results. Another limitation may be related to the learning effect produced by the achievement of more than one TGlittre by the participants during the protocol. Nevertheless, the repetition of the test becomes indispensable for the real evaluation of its reliability, since this needs to be evaluated if considering different raters and different moments of application.

Conclusion

The TGlittre demonstrated adequate inter-rater and test-retest reliability to evaluate the functional capacity of healthy individuals, which contributes to reinforce its clinical applicability and make its use feasible. Since this study is the first to investigate these measurement properties in these individuals, the need for further investigations about the TGlittre in this population is reinforced.

References

1. Leidy NK. Using functional status to assess treatment outcomes. *Chest*. 1994 Dec;106(6):1645-6. doi: 10.1378/chest.106.6.1645.
2. American Thoracic Society. ATS statement: guidelines for the six-minute walk test. *Am J Respir Crit Care Med*. 2002 Jul 1;166(1):111-7. doi: 10.1164/ajrccm.166.1.at1102.
3. Skumlien S, Hagelund T, Bjørtuft O, Ryg MS. A field test of functional status as performance of activities of daily living in COPD patients. *Respir Med*. 2006 Feb;100(2):316-23. doi: 10.1016/j.rmed.2005.04.022. Epub 2005 Jun 6.
4. Karloh M, Palú M, Mayer AF. Métodos de avaliação da capacidade funcional em pacientes com DPOC. *ConScientiae Saúde*. 2014;13(4):633-649. DOI: <https://doi.org/10.5585/conssaude.v13n4.4830>.
5. Janaudis-Ferreira T, Beauchamp MK, Robles PG, Goldstein RS, Brooks D. Measurement of activities of daily living in patients with COPD: a systematic review. *Chest*. 2014 Feb;145(2):253-271. doi: 10.1378/chest.13-0016.
6. Bui KL, Nyberg A, Maltais F, Saey D. Functional Tests in Chronic Obstructive Pulmonary Disease, Part 1: Clinical Relevance and Links to the International Classification of Functioning, Disability, and Health. *Ann Am Thorac Soc*. 2017 May;14(5):778-784. doi: 10.1513/AnnalsATS.201609-733AS.

7. Bui KL, Nyberg A, Maltais F, Saey D. Functional Tests in Chronic Obstructive Pulmonary Disease, Part 2: Measurement Properties. *Ann Am Thorac Soc*. 2017 May;14(5):785-794. doi: 10.1513/AnnalsATS.201609-734AS.
8. Gulart AA, Munari AB, Klein SR, Santos da Silveira L, Mayer AF. The Glittre-ADL Test Cut-Off Point to Discriminate Abnormal Functional Capacity in Patients with COPD. *COPD*. 2018 Feb;15(1):73-78. doi: 10.1080/15412555.2017.1369505.
9. Reis CMD, Karloh M, Fonseca FR, Biscaro RRM, Mazo GZ, Mayer AF. Functional capacity measurement: reference equations for the Glittre Activities of Daily Living test. *J Bras Pneumol*. 2018 Sep-Oct;44(5):370-377. doi: 10.1590/S1806-37562017000000118. Epub 2018 Jul 16.
10. Martins R, Assumpção MS, Bobbio TG, Mayer AF, Schivinski C. The validity and reliability of the ADL-Glittre test for children. *Physiother Theory Pract*. 2019 Aug;35(8):773-780. doi: 10.1080/09593985.2018.1457747. Epub 2018 Apr 16.
11. Monteiro F, Ponce DA, Silva H, Carrilho AF, Pitta F. Validity and Reproducibility of the Glittre ADL-Test in Obese and Post-Bariatric Surgery Patients. *Obes Surg*. 2017 Jan;27(1):110-114. doi: 10.1007/s11695-016-2244-7.
12. Fernandes-Andrade AA, Britto RR, Soares DCM, Velloso M, Pereira DAG. Evaluation of the Glittre-ADL test as an instrument for classifying functional capacity of individuals with cardiovascular diseases. *Braz J Phys Ther*. Sep-Oct 2017;21(5):321-328. doi: 10.1016/j.bjpt.2017.06.001. Epub 2017 Jul 3.
13. Dal Lago P, Reinaldo GP, de Araujo CL, Schneider B, Menezes V, et al. Applicability and reproducibility of the Glittre-ADL test and association with the muscle thickness of pectoralis major and latissimus dorsi in patients with idiopathic pulmonary fibrosis. *ASSOBRAFIR Ciência*. 2018 Out;9(Supl 1):115. Abstract.
14. dos Reis CM, Da Silva TC, Karloh M, De Araújo CLP, Gulart AA, Mayer AF. Performance of healthy adult subjects in Glittre ADL-test. *Fisioter Pesqui*. 2015 Jan-Mar;22(1):41-47. doi: <https://doi.org/10.590/1809-2950/13125722012015>. Portuguese.
15. Corrêa KS, Karloh M, Martins LQ, dos Santos K, Mayer AF. Can the Glittre ADL test differentiate the functional capacity of COPD patients from that of healthy subjects? *Rev Bras Fisioter*. 2011 Nov-Dec;15(6):467-73. Epub Nov 21, 2011. doi: <https://doi.org/10.1590/S1413-35552011005000034>.
16. Vardar-Yagli N, Erdem F, Inal-Ince D, Coplu L, Kutukcu EC, Saglam M, et al. Determinants of the Glittre ADL test in patients with chronic obstructive pulmonary disease. *Eur Respir J*. 2014;44(Suppl 58).
17. Jette AM, Tao W, Norweg A, Haley S. Interpreting rehabilitation outcome measurements. *J Rehabil Med*. 2007 Oct;39(8):585-90. doi: 10.2340/16501977-0119.
18. Portney LG, Watkins MP. *Foundations of clinical research: Applications to practice*. 3rd ed. New Jersey: Prentice Hall; 2015.
19. American Thoracic Society, American College of Chest P. ATS/ACCP Statement on cardiopulmonary exercise testing. *Am J Respir Crit Care Med*. 2003 Jan 15;167(2):211-77. doi: 10.1164/rccm.167.2.211.

20.Garber CE, Blissmer B, Deschenes MR, Franklin BA, Lamonte MJ, Lee IM, et al. American College of Sports Medicine position stand. Quantity and quality of exercise for developing and maintaining cardiorespiratory, musculoskeletal, and neuromotor fitness in apparently healthy adults: guidance for prescribing exercise. *Med Sci Sports Exerc.* 2011 Jul;43(7):1334-59. doi: 10.1249/MSS.0b013e318213febf.

21.Souza AC, Alexandre NMC, Guirardello EB. Psychometric properties in instruments evaluation of reliability and validity. *Epidemiol Serv Saude.* 2017 Jul-Sep;26(3):649-59. doi: 10.5123/S1679-49742017000300022.

22.Souza GF, Moreira GL, Tufanin A, Gazzotti MR, Castro AA, Jardim JR, et al. Physiological Requirements to Perform the Glittre Activities of Daily Living Test by Subjects With Mild-to-Severe COPD. *Respir Care.* 2017 Aug;62(8):1049-1057. doi: 10.4187/respcare.05113. Epub 2017 May 30.

Submissão em: 10/09/2019

Aceito em: 10/07/2020