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SHORT REPORT

Reliability of the Breathing Pattern Assessment Tool for Remote Assessment in People With COPD

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ABSTRACT

Background and Purpose: Assessing breathing patterns in people with chronic obstructive pulmonary disease (COPD) is essential, yet assessment tools are often inaccessible outside of specialized care. The Brompton Breathing Pattern Assessment Tool (BPAT) enables quick, contactless evaluations, making it suitable for remote assessments. Although the BPAT has been shown to be reliable for remote evaluation of asthma patients, there is no evidence regarding its reliability for COPD patients. The aim of this study was to assess the reliability of the BPAT for remote assessment in patients with chronic obstructive pulmonary disease (COPD).

Methods: This cross-sectional study included 18 adults with medically confirmed stable COPD (mean age 80 ± 8.3 years; 72.2% female). One physiotherapist conducted in-person BPAT evaluations, while a high-definition smartphone camera and microphone captured video of the participants' full upper bodies. Three physiotherapists participated as remote assessors, independently evaluating the same recorded breathing patterns. The main outcome measure was the total scores from the BPAT. The intraclass correlation coefficient ($ICC_{3,1}$) was used to assess inter-rater reliability, and Bland–Altman analyses were conducted between the in-person assessor and each remote assessor.

Results: The reliability of the BPAT was positive and moderate between the four assessors (ICC 0.70 [0.50–0.86]) and the three remote assessors (ICC 0.70 [0.47–0.86]). The mean differences from the Bland-Altman analyses ranged from −1.17 to −0.22 points.

Discussion: This study demonstrates that the BPAT seems to be reliable for remote use in people with COPD and may serve as a useful screening instrument to identify individuals who could benefit from further specialist assessment of breathing pattern disorders.

1 | Background

Chronic obstructive pulmonary disease (COPD) is a prevalent respiratory condition characterized by persistent respiratory symptoms and airflow limitation (Global Initiative for Chronic Obstructive Lung Disease 2025). Patients with COPD often exhibit breathing pattern disorders, with such disorders being detected in approximately 50% of patients (Law et al. 2018), highlighting the clinical need for accurate and timely assessment of breathing patterns (Yentes et al. 2020). This is particularly relevant given the growing evidence that targeted breathing exercises, often delivered within pulmonary rehabilitation programs, can provide symptomatic benefits. Notably, these benefits include improved functional exercise capacity and, in select patients, reduced dyspnea via decreased dynamic hyperinflation (Cai et al. 2024). However, traditional assessment methods often require specialist training and equipment that are not always accessible, particularly outside specialist centers (Pryor and Prasad 2008).

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The Brompton Breathing Pattern Assessment Tool (BPAT) has been developed to facilitate a structured, observational and quantitative evaluation of breathing patterns across diverse clinical settings (Todd et al. 2018). Originally developed for people with asthma, the BPAT evaluates important characteristics such as chest wall movement, breathing channel, respiratory noise, air hunger, rate and rhythm. This simple tool requires no physical contact or equipment and can be completed in 1 min (Bondarenko and Holland 2023), making it ideal for remote use via telehealth. This is particularly relevant for people with COPD because frequent exacerbations, symptom burden and mobility limitations can restrict access to in-person care (Janjua et al. 2021). Although the BPAT has been shown to be reliable for remote evaluation of asthma patients (Bondarenko et al. 2021), there is no evidence regarding its reliability for COPD patients.

Therefore, the aim of this study was to evaluate the reliability of the BPAT when used to remotely assess breathing patterns in patients with COPD.

2 | Methods

We conducted a cross-sectional study involving patients with COPD recruited from the community between March and May 2025. Ethical approval for the study was granted by the Ethics Committee of the Fernando Pessoa University (632/24-2, 18th March). This study was written according to STROBE guidelines (Elm et al. 2007).

Adults with medically confirmed and stable COPD were included (Global Initiative for Chronic Obstructive Lung Disease 2025). Those unable to provide written informed consent, who had experienced a COPD exacerbation within the past 4 weeks, who had received an intervention for BPD in the previous 12 months, or who enrolled in a pulmonary rehabilitation program in the previous 12 months were excluded (Bondarenko et al. 2021).

The BPAT includes seven items: (1) abdominal or upper chest movement; (2) inspiratory flow; (3) expiratory flow; (4) channel of inspiration and expiration; (5) air hunger; (6) respiratory rate; and (7) rhythm. Answers are given on a scale of 0–2, except for item (7) where the answer is given as 0 or 2, with total scores ranging from 0 to 14. Higher scores indicate a more abnormal breathing pattern and a cut-off ≥ 4 was recently suggested to indicate a breathing pattern disorder (Todd et al. 2018). The Portuguese version of the BPAT was used in this study (Vilarinho et al. 2024).

The BPAT assessment was performed using participants seated in an upright supported position after a 5-min rest period in this position. One assessor (physiotherapist with > 5 years' experience) conducted all in-person BPAT evaluations. Simultaneously, a high-definition smartphone camera and a microphone, positioned approximately 1 m in front of the participant, captured their full upper body on video (Bondarenko et al. 2021).

Three physiotherapists, also with more than 5 years of experience, participated as BPAT remote assessors. Blinded to the in-person scores, remote assessors independently evaluated the same recorded breathing patterns and remained unaware of each other's assessments throughout the study. Prior to data collection, all assessors were instructed on how to use the BPAT to ensure consistency in assessment criteria and interpretation.

Statistical analysis was performed using IBM SPSS Statistics (version 30). Inter-rater reliability was assessed using a two-way mixed-effect intraclass correlation coefficient ($ICC_{3,1}$) model, based on a single rating and absolute agreement, for each rater and with a 95% confidence interval (CI). According to the COSMIN guidelines, an ICC value ≥ 0.70 is considered positive (Mokkink et al. 2024). Also, ICC was interpreted as excellent (> 0.75), moderate-to-good (0.4–0.75) or poor (< 0.4) (Fleiss 1986). Bland-Altman analysis was performed between the in-person assessor and each remote assessor (Martin Bland and Altman 1986).

3 | Results

Eighteen participants with COPD (females 13 [72.2%], mean age 80 ± 8.3 years) were included. Total BPAT scores ranged from 1 to 11 with a median score of 3.5 [2; 5]. The participants who demonstrated abnormal breathing patterns (BPAT ≥ 4) were 7 (38.9%) for the in-person assessor and 9 (50%), 10 (55.6%) and 10 (55.6%) for the remote assessors.

The reliability of the total score of BPAT was positive and moderate between the four assessors (ICC 0.70 [0.50–0.86]) and between the three remote assessors (ICC 0.70 [0.47–0.86]). Reliability was highest for items of expiratory flow, channel of inspiration and expiration and respiratory rate (ICC 0.59–0.88), and lowest for inspiratory flow, air hunger and rhythm (ICC 0.15–0.38) (Table 1).

The mean differences from the Bland-Altman analyses, conducted between the in-person assessor and each remote assessor, ranged from −1.17 to −0.22 (Supporting Information S1: Figures S1–S3).

4 | Discussion

This study demonstrates that the BPAT showed good reliability for remotely assessing breathing patterns in people with COPD. This result suggests that the BPAT could be a valuable tool in clinical settings when an in-person assessment is not possible.

Similar research involving people with asthma has also demonstrated good reliability and agreement of this instrument when assessed remotely, and the results are comparable to those of our study (ICC 0.70, mean difference −1.17 to −0.22 vs. Bondarenko study: ICC 0.76, mean difference 0.5) (Bondarenko et al. 2021). One possible contributing factor is that the assessments were conducted by experienced healthcare professionals, as in our study. However, it is important to point out that Bondarenko and colleagues found higher ICC values in-person assessments than when conducted via video. This finding is consistent with established reliability evidence, which demonstrates that in-person assessments often yield higher ICCs than

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TABLE 1 | Relative reliability between all the assessors and the remote assessors in assessing the breathing pattern using the Brompton Breathing Pattern Assessment Tool.

	All the assessors	Remote assessors
	ICC [95% CI]	
Item 1. Abdominal or upper chest movement	0.38 [0.15–0.64]	0.43 [0.11–0.70]
Item 2. Inspiratory flow	0.15 [0.01–0.43]	*
Item 3. Expiratory flow	0.82 [0.68–0.92]	0.88 [0.76–0.95]
Item 4. Channel of inspiration and expiration	0.82 [0.68–0.92]	0.84 [0.69–0.93]
Item 5. Air hunger	0.33 [0.11–0.60]	0.38 [0.11–0.66]
Item 6. Respiratory rate	0.61 [0.40–0.81]	0.59 [0.33–0.80]
Item 7. Rhythm	0.19 [0.01–0.47]	0.32 [0.04–0.62]
Total score of BPAT	0.70 [0.50–0.86]	0.70 [0.47–0.86]

Note: *not possible to compute as all the scores assigned were equal to 0.
Abbreviations: BPAT, Brompton Breathing Pattern Assessment Tool; CI, confidence interval; ICC, intraclass correlation coefficient.

remote assessments due to the increased availability of clinical cues and reduced potential for technical limitations such as video quality or restricted field of view. Nevertheless, while remote assessments may show lower ICCs, these values can still indicate good reliability and clinical utility, particularly when in-person evaluation is not feasible. The observed difference does not invalidate the use of the BPAT in telemedicine but rather underscores the need for careful interpretation of reliability metrics in different settings. Further research is needed to establish whether this level of reliability can consistently be achieved by professionals from different backgrounds in various healthcare settings. Moreover, other measurement properties of the BPAT also need to be analyzed, particularly with regard to its in-person and remote validity.

Some limitations should be acknowledged. The sample size was relatively small, and the assessments were conducted under controlled conditions using standardized equipment, which may not reflect typical telehealth scenarios. In routine practice, variability in device quality (good quality microphone and camera) and internet connectivity could affect video clarity and consequently assessment accuracy. Therefore, future studies should investigate how the tool performs under these real-world conditions. Another limitation of our study is the advanced age of our participants (mean age: 80 $\pm$ 8.3 years), which could result in age-related challenges when performing video and audio recordings, such as limited familiarity with technology and difficulty operating devices. Nevertheless, recent evidence suggests that remote monitoring and telehealth interventions are feasible among older adults with COPD. These interventions are highly usable and have high patient satisfaction rates, indicating that this age group can effectively perform video and audio recordings for remote assessments (Khor et al. 2025; Lippi et al. 2023). Finally, another limitation concerns the cut-off (≥ 4) used in our study to indicate a breathing pattern disorder, which was originally established for people with asthma (Todd et al. 2018). Therefore, the proportion analysis of participants in this study with breathing pattern disorder should be interpreted with caution, since asthma and COPD, despite both being chronic obstructive pulmonary diseases, have different clinical courses. Future studies should consider setting disease-specific cut-off points for people with COPD.

In conclusion, the BPAT seems to be reliable for remote use in people with COPD and may serve as a useful screening instrument to identify individuals who could benefit from further specialist assessment of breathing pattern disorders.

5 | Implications for Physiotherapy Practice

This study supports using the BPAT as a reliable tool for remotely assessing people with COPD. The BPAT can be included in remote consultations to screen for breathing pattern disorders and identify individuals who may benefit from a specialist assessment. Wider use of the BPAT could strengthen clinical decision-making, improve access to appropriate care, and facilitate earlier management of COPD-related symptoms.

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The authors have nothing to report.

Ethics Statement

Ethical approval for the study was granted by the Ethics Committee of the Fernando Pessoa University (Project reference 632/24-2, 18th March).

Consent

Written informed consent was obtained from all participants.

Conflicts of Interest

The authors declare no conflicts of interest.

Data Availability Statement

The data are available upon request from the corresponding author.

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Supporting Information

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