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Clinical Effects of Active Cycle of Breathing Technique in COPD: A Case Report

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Abstract

Background: Chronic obstructive pulmonary disease (COPD) is a progressive respiratory disorder characterized by persistent airflow limitation, dyspnea, and reduced physical capacity. The Active Cycle of Breathing Technique (ACBT) is a physiotherapy intervention aimed at improving ventilation, airway clearance, and functional capacity.
Objective: To describe the clinical effects of ACBT on cardiorespiratory fitness and dyspnea severity in patients with COPD.
Methods: This case report followed the CARE Guidelines and involved two patients with COPD treated at a primary healthcare center in Surakarta, Indonesia. ACBT, consisting of breathing control, thoracic expansion, and huffing, was administered twice daily for two weeks. Outcomes assessed before and after the intervention included blood pressure, oxygen saturation, the Six-Minute Walk Test (6MWT), and dyspnea severity using the modified Medical Research Council (mMRC) Dyspnea Scale.
Results: Both patients demonstrated improvements in walking distance on the 6MWT, exceeding the minimal clinically important difference (25–33 m). Oxygen saturation remained stable in both patients. Patient 1 achieved a 6MWT distance of 300 m, while Patient 2 achieved 210 m. Changes in blood pressure reflected individual physiological responses.
Conclusion: ACBT was associated with improved functional exercise capacity and stable oxygen saturation in two patients with COPD. Further studies with larger samples are needed to confirm these findings.

Keywords
Pulmonary Disease, Chronic Obstructive; Breathing Exercises; Physical Therapy Modalities; Six-Minute Walk Test; Dyspnea

Introduction

Chronic obstructive pulmonary disease (COPD) is a major global health problem and a leading cause of morbidity and mortality worldwide. The disease is characterized by persistent airflow limitation that is usually progressive and associated with an enhanced chronic inflammatory response in the airways and lungs to noxious particles or gases. Clinically, COPD manifests as chronic cough, sputum production, dyspnea, exercise intolerance, and a gradual decline in functional capacity, all of which substantially impair quality of life and daily functioning.[1]

According to the Global Burden of Disease Study 2019, COPD was responsible for approximately 3.3 million deaths globally, placing it among the leading causes of death worldwide.[2] This significant disease burden is also reflected in low- and middle-income countries, including Indonesia. National health survey data indicate that the prevalence of COPD in Indonesia remains considerable, particularly among adults over the age of 40 years.[3] At the primary care level, many patients with COPD present with reduced physical endurance, limitations in daily activities, and persistent dyspnea, which often remain insufficiently addressed due to limited access to comprehensive pulmonary rehabilitation services.

Reduced cardiorespiratory fitness is a hallmark of COPD and is closely associated with disease severity, hospitalization rates, and mortality risk. Functional exercise capacity in patients with COPD is commonly assessed using the Six-Minute Walk Test (6MWT), a simple and reliable field test that reflects the ability to perform daily physical activities. The 6MWT has been widely adopted in clinical practice and research because it is sensitive to changes following rehabilitation interventions and correlates with health-related quality of life.[4] In parallel, dyspnea remains one of the most disabling symptoms of COPD and is frequently evaluated using the modified Medical Research Council (mMRC) Dyspnea Scale. Higher mMRC scores are associated with poorer functional status, increased healthcare utilization, and reduced survival.[5]

Pulmonary rehabilitation is a cornerstone of non-pharmacological management for COPD and has been shown to improve exercise capacity, reduce dyspnea, and enhance quality of life. Physiotherapy interventions within pulmonary rehabilitation aim to optimize ventilation, reduce the work of breathing, facilitate airway clearance, and improve tolerance to physical activity. Among various airway clearance and breathing techniques, the Active Cycle of Breathing Technique (ACBT) is widely used in clinical practice. ACBT consists of three components—breathing control, thoracic expansion exercises, and forced expiration (huffing)—which are performed in a structured sequence to improve ventilation distribution, mobilize airway secretions, and promote effective expectoration.[6]

Previous studies have demonstrated that ACBT can enhance airway clearance, improve breathing efficiency, and support functional improvements in individuals with chronic respiratory diseases.[7,8] Evidence suggests that ACBT may contribute to improved pulmonary mechanics, reduced sputum retention, increased peak expiratory flow, and enhanced exercise tolerance in patients with COPD. In addition, ACBT is considered safe, low-cost, and easy to perform, making it particularly suitable for use in primary care settings and in populations with limited access to specialized rehabilitation facilities.

Current international clinical practice guidelines strongly recommend pulmonary rehabilitation for patients with chronic respiratory diseases, including COPD, in both stable conditions and following exacerbations.[9] Despite these recommendations, the availability and utilization of structured pulmonary rehabilitation programs remain limited in many healthcare systems, particularly in resource-constrained settings. In Indonesia, barriers such as limited infrastructure, financial constraints, and a shortage of trained

rehabilitation professionals often prevent patients from receiving optimal non-pharmacological management.[10] As a result, many patients experience persistent functional limitations and reduced quality of life despite pharmacological treatment.

Local evidence describing the clinical effects of ACBT in Indonesian patients with COPD, particularly in primary healthcare settings, is still scarce.[11] While several international studies have investigated the physiological and functional benefits of ACBT, there is a lack of real-world clinical reports that document patient responses to this intervention in routine primary care practice. Case reports may provide valuable preliminary insights by illustrating individual clinical trajectories, feasibility of intervention delivery, and potential functional outcomes in specific healthcare contexts.

Therefore, this case report aimed to describe the clinical application of the Active Cycle of Breathing Technique in two patients with COPD treated at a primary healthcare center in Indonesia. Specifically, this report sought to document changes in cardiorespiratory fitness, as measured by the Six-Minute Walk Test, and dyspnea severity, as assessed using the mMRC Dyspnea Scale, following a two-week ACBT intervention. By presenting these clinical observations, this study aims to contribute preliminary evidence supporting the potential role of ACBT as an accessible physiotherapy intervention for patients with COPD in primary care settings.

Methods

Study Design

This study was designed as a case report and was prepared in accordance with the CARE (CAse REport) Guidelines. The report describes the clinical response of two patients diagnosed with chronic obstructive pulmonary disease (COPD) who received a physiotherapy intervention using the Active Cycle of Breathing Technique (ACBT) in a primary healthcare setting.

Participants

Two patients with a confirmed medical diagnosis of COPD were recruited from Puskesmas Nusukan Surakarta, Indonesia. Participants were selected based on predefined inclusion and exclusion criteria. The inclusion criteria were: (1) a confirmed diagnosis of COPD by a physician, (2) age over 40 years, (3) clinically stable condition without acute exacerbation, (4) ability to walk independently without assistive devices, and (5) willingness to participate in the intervention program for two weeks.

Exclusion criteria included: (1) clinical deterioration during the study period, (2) presence of neurological disorders that could interfere with mobility or breathing control, (3) inability to ambulate independently, and (4) refusal or inability to complete the intervention protocol. Prior to participation, both patients received a detailed explanation of the study objectives, procedures, potential benefits, and risks. Written informed consent was obtained from all participants.

Setting and Ethical Approval

The intervention was conducted at Puskesmas Nusukan Surakarta between 27 October and 10 November 2025. Ethical approval for this study was obtained from the Ethics Committee of the Faculty of Health Sciences, Universitas Muhammadiyah Surakarta (Ethical Approval No. 013622331121113202509130018/2025). Permission to conduct the study was also granted by Puskesmas Nusukan Surakarta. Participant confidentiality was maintained throughout the study in accordance with ethical research principles.

Intervention

The physiotherapy intervention consisted of the Active Cycle of Breathing Technique (ACBT), which comprises three sequential components: breathing control, thoracic expansion exercises, and forced expiration (huffing). Breathing control involved slow, relaxed diaphragmatic breathing aimed at reducing respiratory muscle tension and stabilizing the breathing pattern. Thoracic expansion exercises consisted of deep inhalation with a brief inspiratory hold of approximately 2–3 seconds to enhance lung expansion and ventilation distribution. Huffing involved forced expiration with an open glottis to facilitate mobilization and clearance of airway secretions. Each component was performed three times per session. The complete ACBT cycle was administered twice daily for a total duration of two weeks. All sessions were supervised by a physiotherapist to ensure correct technique execution and adherence to the intervention protocol.

Outcome Measures

Outcome measures were assessed at baseline (pre-intervention) and after completion of the two-week intervention (post-intervention). The primary functional outcome was exercise capacity, measured using the Six-Minute Walk Test (6MWT). The 6MWT was conducted according to the European Respiratory Society/American Thoracic Society technical standards, using a flat corridor with a minimum length of 30 meters. Participants were instructed to walk as far as possible within six minutes, with standardized encouragement provided throughout the test.

Dyspnea severity was assessed using the modified Medical Research Council (mMRC) Dyspnea Scale, which categorizes perceived breathlessness during daily activities on a scale from 0 to 4. Blood pressure and peripheral oxygen saturation were measured before and immediately after the 6MWT using a calibrated sphygmomanometer and pulse oximeter, respectively, to ensure participant safety during testing.

Procedure

Baseline assessments included measurement of blood pressure, oxygen saturation, 6MWT distance, and mMRC dyspnea score. Following baseline assessment, participants commenced the ACBT intervention program. Adherence to the intervention was monitored to ensure that no scheduled ACBT sessions were missed. After completion of the two-week intervention period, all outcome measures were reassessed using the same instruments and procedures as at baseline.

Data Analysis

Given the descriptive nature of a case report, data analysis was limited to descriptive presentation of individual patient outcomes. Changes in functional capacity, dyspnea severity, blood pressure, and oxygen saturation before and after the intervention were reported for each patient. No inferential statistical analysis was performed.

Results

Both patients completed the two-week Active Cycle of Breathing Technique (ACBT) intervention without missing any sessions. No adverse events or safety issues related to the intervention were reported during the study period.

Patient Characteristics and Clinical Timeline

Baseline clinical characteristics, pharmacological treatment, and disease classification of both patients are summarized in Table 1**.** Patient classification was determined according to the Global Initiative for Chronic Obstructive Lung Disease (GOLD) 2023 criteria, based on symptom severity assessed by the modified Medical Research Council (mMRC) Dyspnea Scale and functional capacity measured by the Six-Minute Walk Test (6MWT).

Patient 1, aged 49 years, presented with mild dyspnea during strenuous activity and productive cough in the morning. Based on an mMRC score of 1 and a baseline 6MWT distance of 270 m, the patient was classified as GOLD Group A. At the time of intervention, the patient was not receiving regular pharmacological therapy.

Patient 2**,** aged 64 years, reported dyspnea and dizziness during prolonged walking and had a medical history of hypertension. The baseline mMRC score was 3, and the baseline 6MWT distance was 150 m, corresponding to GOLD Group B. The patient was receiving pharmacological treatment, including bisoprolol fumarate, fluticasone/salmeterol, spironolactone, and vitamin B12.

Table 1. Clinical Timeline and Baseline Characteristics (CARE Guidelines)

Patient	Date	Event	Clinical Findings	GOLD Group	Pharmacological Therapy	Comorbidities
Patient 1 (49 y)	Jan 15, 2025	Initial diagnosis	Productive cough, dyspnea during heavy activity	A	None	None
	Oct 27, 2025	Pre-intervention assessment	Persistent morning sputum, exertional dyspnea			
Patient 2 (64 y)	Jan 17, 2025	Initial diagnosis	Dyspnea during walking, dizziness	B	Bisoprolol, fluticasone/salmeterol, spironolactone, vitamin B12	Hypertension
	Oct 27, 2025	Pre-intervention assessment	Dyspnea during prolonged walking			

Intervention Timeline

The intervention process and assessment timeline are summarized in Table 2**.** Both patients underwent baseline assessment, participated in twice-daily ACBT sessions for 14 consecutive days, and completed post-intervention evaluation.

Table 2. Timeline of Intervention and Assessments

Time Point	Procedure	Description
Day 0	Informed consent and baseline assessment	Explanation of study procedures; baseline measurement of blood pressure, oxygen saturation, 6MWT, and mMRC score
Day 1–14	ACBT intervention	Breathing control, thoracic expansion, and huffing performed twice daily
Day 14	Post-intervention assessment	Reassessment of blood pressure, oxygen saturation, 6MWT, and mMRC score
Post Day 14	Follow-up	Patient-reported description of changes following intervention

Baseline Outcome Measures

Baseline physiological and functional measurements for both patients are presented in **Table 3**. Prior to the intervention, Patient 1 demonstrated a longer walking distance on the 6MWT and a lower mMRC score compared with Patient 2. Oxygen saturation values were within acceptable ranges in both patients before and after the 6MWT.

Table 3. Baseline Measurements (Pre-intervention)

Outcome Measure	Patient 1	Patient 2
Blood pressure before 6MWT (mmHg)	110/72	96/61
Blood pressure after 6MWT (mmHg)	116/75	137/77
Oxygen saturation before 6MWT (%)	98	98
Oxygen saturation after 6MWT (%)	96	93
6MWT distance (m)	270	150
mMRC score	1	3

Post-intervention Outcome Measures

Post-intervention measurements are summarized in **Table 4**. Both patients demonstrated increased walking distance on the 6MWT following completion of the ACBT intervention. Oxygen saturation remained stable in both patients before and after the 6MWT.

Table 4. Post-intervention Measurements

Outcome Measure	Patient 1	Patient 2
Blood pressure before 6MWT (mmHg)	112/73	127/82
Blood pressure after 6MWT (mmHg)	105/67	132/83
Oxygen saturation before 6MWT (%)	94	97
Oxygen saturation after 6MWT (%)	92	96
6MWT distance (m)	300	210
mMRC score	1	3

Summary of Observed Changes

Following the two-week intervention, Patient 1 demonstrated an increase of 30 m in 6MWT distance, while Patient 2 demonstrated an increase of 60 m. Oxygen saturation remained relatively stable across assessments. Blood pressure responses varied between patients. No adverse events were observed during the intervention period.

Discussion

This case report describes the clinical response of two patients with chronic obstructive pulmonary disease (COPD) who underwent a two-week intervention using the Active Cycle of Breathing Technique (ACBT) in a primary healthcare setting. The main findings demonstrated improvements in functional exercise capacity, as reflected by increased Six-Minute Walk Test (6MWT) distances, while oxygen saturation remained stable in both patients. These observations suggest that ACBT may contribute to meaningful functional changes in patients with COPD when applied as part of physiotherapy management.

The observed increases in 6MWT distance in both patients exceeded the minimal clinically important difference (MCID) for individuals with COPD, which has been reported to range between 25 and 33 meters.[12,13] This finding indicates that the improvements were not only statistically observable but also clinically relevant. Functional exercise capacity, as measured by the 6MWT, is strongly associated with daily activity performance, hospitalization risk, and mortality in COPD.[14,15] Therefore, even modest improvements in walking distance may translate into meaningful benefits for patients' independence and quality of life.

The improvements in functional capacity observed in this report are consistent with previous studies demonstrating that ACBT can enhance ventilation efficiency, facilitate airway clearance, and reduce the work of breathing in patients with chronic respiratory diseases.[7,8] The structured sequence of breathing control, thoracic expansion, and huffing may optimize ventilation distribution and reduce dynamic hyperinflation, thereby improving exercise tolerance. These physiological mechanisms are particularly relevant in COPD, where airflow limitation and ventilatory inefficiency contribute significantly to exercise intolerance.

Differences in the magnitude of response between the two patients may be explained by variations in baseline characteristics, including age, dyspnea severity, and disease classification. Patient 1, who was younger and classified as GOLD Group A, demonstrated a smaller absolute increase in 6MWT distance compared with Patient 2; however, both improvements exceeded the MCID threshold. Patient 2, despite being older and having more severe dyspnea (mMRC score of 3), demonstrated a larger absolute improvement in walking distance. This finding suggests that patients with greater baseline functional limitations may still achieve clinically meaningful gains following targeted breathing interventions, even in the presence of comorbidities such as hypertension.

Dyspnea severity, as assessed using the mMRC Dyspnea Scale, remained unchanged in both patients following the intervention. While improvements in dyspnea are commonly reported following comprehensive pulmonary rehabilitation, changes in perceived breathlessness may require longer intervention durations or multimodal programs that combine breathing techniques with endurance and strength training. The absence of change in mMRC scores in this report may reflect the short duration of the intervention or the limited sensitivity of the scale to detect subtle changes over a two-week period.

Oxygen saturation remained relatively stable before and after the intervention in both patients, which is consistent with previous evidence indicating that ACBT primarily affects ventilatory mechanics and secretion clearance rather than directly improving arterial oxygenation.[16] Stable oxygen saturation during exercise is clinically important, as it suggests that the intervention did not impose additional physiological stress or compromise patient safety. Moreover, the absence of adverse events throughout the intervention period supports the safety and feasibility of ACBT in a primary care setting.

The findings of this case report align with current clinical practice guidelines that emphasize the importance of non-pharmacological interventions, including physiotherapy and pulmonary rehabilitation, in the management of COPD.[9] However, access to comprehensive pulmonary rehabilitation programs remains limited in many healthcare settings, particularly in low- and middle-income countries. In such contexts, simple, low-cost, and easily implemented interventions like ACBT may offer a practical alternative or adjunct to standard care. The ability to deliver ACBT in a primary healthcare facility underscores its potential applicability in resource-limited environments.

Despite these promising observations, this case report has several limitations. The small sample size (n = 2) limits the generalizability of the findings, and the absence of a control group precludes causal inference regarding the observed changes. Additionally, the short duration of follow-up prevents assessment of the long-term sustainability of the functional improvements. Potential confounding factors, such as variations in daily physical activity or medication adherence, could not be fully controlled in this descriptive design.

Future research should aim to evaluate the effectiveness of ACBT using more robust methodological designs, such as randomized controlled trials or prospective cohort studies with larger sample sizes and longer follow-up periods. Combining ACBT with other components of pulmonary rehabilitation, including aerobic and resistance training, may also provide greater benefits in dyspnea reduction and overall functional outcomes. Furthermore, studies conducted in primary care and community-based settings are needed to better understand the real-world feasibility and impact of ACBT in diverse patient populations.

In summary, this case report provides preliminary clinical evidence that ACBT may improve functional exercise capacity in patients with COPD when implemented in a primary healthcare setting. While the findings should be interpreted with caution due to methodological limitations, they support the potential role of ACBT as a safe and accessible physiotherapy intervention for individuals with COPD.

Conclusion

This case report described the clinical effects of a two-week Active Cycle of Breathing Technique (ACBT) intervention in two patients with chronic obstructive pulmonary disease (COPD) treated in a primary healthcare setting. The findings demonstrated clinically meaningful improvements in functional exercise capacity, as reflected by increased Six-Minute Walk Test (6MWT) distances, while oxygen saturation remained stable throughout the intervention period. These observations suggest that ACBT may contribute to enhanced activity tolerance without compromising patient safety.

The improvements in walking distance observed in both patients exceeded the minimal clinically important difference reported for individuals with COPD, indicating that the changes were relevant from a clinical perspective. Although dyspnea severity, as measured by the modified Medical Research Council (mMRC) Dyspnea Scale, did not change following the intervention, the stability of dyspnea scores alongside improved functional capacity may still represent a favorable outcome, particularly given the short duration of the intervention and the advanced disease characteristics of one patient.

From a clinical standpoint, ACBT represents a simple, low-cost, and easily applicable physiotherapy intervention that can be implemented in primary care and resource-limited settings. Its structured approach to breathing control and airway clearance may help address functional limitations commonly experienced by patients with COPD, especially in contexts where access to comprehensive pulmonary rehabilitation programs is limited.

However, the findings of this report should be interpreted with caution due to the descriptive nature of a case report, the small number of participants, and the absence of a control group. These limitations restrict the generalizability of the results and preclude causal conclusions regarding the effectiveness of ACBT.

In conclusion, this case report provides preliminary evidence supporting the potential role of ACBT as an adjunct physiotherapy intervention for patients with COPD in primary healthcare settings. Further studies employing more rigorous methodological designs, larger sample sizes, and longer follow-up periods are warranted to confirm these findings and to establish stronger evidence for the clinical effectiveness of ACBT in COPD management.

Author Contribution

Andini Sukma Ayu: Conceptualization, Methodology, Data curation, Formal analysis, Writing—original draft.
Isnaini Herawati: Writing—review & editing, Supervision.

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Conflict of Interest Statement

The authors declare no conflict of interest.

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Ethics Statement

This study was approved by the Ethics Committee of the Faculty of Health Sciences, Universitas Muhammadiyah Surakarta, and by Puskesmas Nusukan Surakarta (Ethical Approval No. 013622331121113202509130018/2025). Written informed consent was obtained from all participants prior to participation, and patient confidentiality was maintained in accordance with ethical research principles.

References

1. Adeloye D, Song P, Zhu Y, Campbell H, Sheikh A, Rudan I. Global, regional, and national prevalence of, and risk factors for, chronic obstructive pulmonary disease (COPD) in 2019: a systematic review and modelling analysis. Lancet Respir Med. 2022;10(5):447–458.
2. Safiri S, Carson-Chahhoud K, Noori M, Nejadghaderi SA, Sullman MJM, Ahmadian Heris J, et al. Burden of chronic obstructive pulmonary disease and its attributable risk factors in 204 countries and territories, 1990–2019: results from the global burden of disease study 2019. BMJ. 2022;378:e069679.
3. Rycroft C, Heyes L, Lanza K. Epidemiology of chronic obstructive pulmonary disease: a literature review. Int J Chron Obstruct Pulmon Dis. 2012;7:457–494.
4. Jo YS. Long-term outcome of chronic obstructive pulmonary disease: a review. Tuberc Respir Dis (Seoul). 2022;85(4):289–301.
5. Paneroni M, Vogiatzis I, Belli S, Savio G, Visca D, Zampogna E, et al. Is two better than one? The impact of doubling training volume in severe COPD: a randomized controlled study. J Clin Med. 2019;8(7):1052.
6. Jones AY, Pickering R, Gough S, Mandrusiak A. Practical guide: the active cycle of breathing technique (ACBT). J Physiother. 2025;71(3):211–215.
7. Westerdahl E, Osadnik C, Emtner M. Airway clearance techniques for patients with acute exacerbations of chronic obstructive pulmonary disease: physical therapy practice in Sweden. Chron Respir Dis. 2019;16:1479973119855868.
8. Yuniarti EV. Active cycle of breathing technique (ACBT) against peak expiratory flow in COPD patients. Int J Nurs Midwifery Sci. 2025;8(3):463–472.
9. Rochester CL, Alison JA, Carlin B, Jenkins AR, Cox NS, Bauldoff G, et al. Pulmonary rehabilitation for adults with chronic respiratory disease: an official American Thoracic Society clinical practice guideline. Am J Respir Crit Care Med. 2023;208(4):e7–e26.
10. Trisnowiyanto B, Fadli A. Effectiveness of PTR home-based exercise and education program in COPD patients: systematic review. FISIO MU Physiother Evid. 2023;5(1):1–6.
11. Mahadewi NLPC, Anantari NPD, Putra KSC, Laksmi IGAAAC, Prasana IGEJ, Jeviana A. The effect of active cycle of breathing techniques (ACBT) on shortness of breath and facilitation of airway clearance in obstructive pulmonary disease: literature review. FISIO MU Physiother Evid. 2025;6(1):78–81.
12. Deng N, Sheng L, Jiang W, Hao Y, Wei S, Wang B, et al. A home-based pulmonary rehabilitation mHealth system to enhance the exercise capacity of patients with COPD: development and evaluation. BMC Med Inform Decis Mak. 2021;21(1):1–15.
13. Agustí A, Celli BR, Criner GJ, Halpin D, Anzueto A, Barnes PJ, et al. Global Initiative for Chronic Obstructive Lung Disease 2023 report: GOLD executive summary. Arch Bronconeumol. 2023;59(4):232–248.
14. Holland AE, Spruit MA, Troosters T, Puhan MA, Pepin V, Saey D, et al. An official European Respiratory Society/American Thoracic Society technical standard: field walking tests in chronic respiratory disease. Eur Respir J. 2014;44(6):1428–1446.
15. Wagner LE, Rosa GH, Plachi F, Becker A, Imperador AS, Azevedo ACDe, et al. Impact of real-time assessment of pulse oximetry on the 6-min walk distance in patients with chronic respiratory disease. Respir Care. 2024;69(10):1294–1304.
16. Zisi D, Chryssanthopoulos C, Nanas S, Philippou A. The effectiveness of the active cycle of breathing technique in patients with chronic respiratory diseases: a systematic review. Heart Lung. 2022;53:89–98.