

Awareness and Knowledge of Pulmonary Rehabilitation among Individuals with COPD in Tirupati District, Andhra Pradesh: A Cross-Sectional Study

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Abstract: ***Background:** Pulmonary rehabilitation (PR) is among the most effective non-drug treatments for chronic obstructive pulmonary disease (COPD), yet few people in India reach it. Poor patient awareness may be one reason. No study has examined this in Tirupati district. **Aim:** To assess knowledge of COPD and awareness of PR among individuals with COPD in Tirupati district. **Methods:** In this cross-sectional study, 70 adults with physician-diagnosed COPD were recruited by consecutive sampling. Written consent was obtained. A structured, interviewer-assisted questionnaire captured demographic and clinical details, a 12-item COPD knowledge scale (maximum 48) and a 9-item PR awareness scale (maximum 27). Scores were converted to percentages and graded poor (<60%), moderate (60–79%) or good (≥80%). Non-parametric tests, chi-square/Fisher's exact tests, Spearman correlation with Holm correction, linear regression and Cronbach's alpha were used (two-sided $\alpha = 0.05$). **Results:** Participants (43 men, 27 women) had a mean age of 63.0 ± 10.7 years. Mean COPD knowledge was 60.3% (SD 7.2) and mean PR awareness was 62.4% (SD 7.7), with no significant difference (Wilcoxon $p = 0.152$). Knowledge was poor in 29 (41%), moderate in 40 (57%) and good in 1 participant. PR awareness was poor in 38 (54%) and moderate in 32 (46%), and no one reached the good category. Never-smokers scored higher on COPD knowledge than current or ex-smokers (Kruskal–Wallis $H = 7.01$, $p = 0.030$; ever vs never smoked $p = 0.016$, $r = 0.36$). No other comparison was significant, and no correlation survived Holm correction. Internal consistency was low ($\alpha = 0.31$ and 0.06). **Conclusion:** COPD knowledge and PR awareness were both at the poor–moderate boundary, and no participant showed good PR awareness. Never-smokers knew more about COPD than smokers. The findings support routine PR discussion in COPD care and community education in the district. The scales need validation before reuse.*

Keywords: COPD, pulmonary rehabilitation, awareness, knowledge, Tirupati, India

1. Introduction

COPD is a heterogeneous lung condition marked by persistent respiratory symptoms and progressive airflow obstruction, and it is often accompanied by muscle weakness, cardiovascular disease, osteoporosis, depression and anxiety. [1, 2] The Global Burden of Disease Study 2021 estimated 213.4 million people living with COPD and about 3.7 million deaths worldwide, with the heaviest burden in low- and middle-income countries.[3] In India, prevalence estimates range from 7% in adults over 30 (meta-analysis) to 14.4% obstructive lung disease in adults over 45 in the spirometry-based LASI study, where only about 11–12% of those with obstruction had ever been diagnosed. [6,8] Biomass fuel, tobacco, occupational dust and air pollution are the main drivers. [3,4,9]

PR combines exercise training, education and behaviour change, and has the strongest evidence among non-drug measures. A Cochrane review of 65 trials showed improved quality of life and exercise capacity and reduced breathlessness and fatigue.[14,15] Even so, fewer than 3% of people with chronic respiratory disease in LMICs can access PR, owing to cost, limited services and poor awareness among patients and providers.[16] Studies in Pune, Jodhpur and Mangalore show that patients often have never heard of PR, and that services are concentrated in the private sector.[17,18,20] In Mangalore, awareness of COPD was 47.84% but awareness of PR only 25.14%.[20]

No published study has evaluated COPD or PR awareness in Tirupati district or the wider Rayalaseema region. This study aimed to fill that gap.

2. Methods

Design and setting. Observational cross-sectional study in Tirupati district, Andhra Pradesh, over 4 weeks.

Participants: Consecutive eligible patients were invited until 70 were recruited. Inclusion criteria: age ≥ 18 years, physician-diagnosed COPD, residence in Tirupati district, and written informed consent. Exclusion criteria: other major chronic respiratory disease (e.g., active tuberculosis), acute exacerbation or instability at interview, cognitive, hearing or speech impairment, and refusal or withdrawal. A sample of 70 gives about 80% power to detect a standardised group difference of 0.6–0.7 or a correlation of $r \approx 0.33$.

Instrument: A structured, interviewer-assisted questionnaire had three parts: (i) participant profile (age, sex, education, occupation, residence, smoking status and years smoked, COPD duration, exacerbations in the previous six months); (ii) a 12-item COPD knowledge scale (each item 1–4; total 12–48); (iii) a 9-item PR awareness scale (each item 1–3; total 9–27).

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Scoring: Percentages were calculated as COPD score/48, PR score/27 and total score/75. Using modified Bloom's cut-offs, <60% was poor, 60–79% moderate and ≥80% good. The knowledge–awareness gap was COPD % minus PR %.

Statistical analysis: Analyses used Python (SciPy, pandas). Categorical data are given as counts and percentages with 95% Wilson CIs, and continuous data as mean ± SD and median (IQR). Normality was tested with Shapiro–Wilk. Two-group comparisons used Mann–Whitney U (rank-biserial r), and multi-group comparisons used Kruskal–Wallis (ϵ^2). Paired comparison used Wilcoxon signed-rank and paired t-test. Categorical associations used chi-square or Fisher's exact test. Correlations used Spearman's ρ with Holm correction. Simple and exploratory multiple linear regression modelled PR awareness. Internal consistency was assessed with Cronbach's alpha. Significance was set at $p < 0.05$, two-sided. Subgroup comparisons were not adjusted for multiple testing.

3. Results

Participants. Ages ranged from 46 to 80 years (mean 63.0 ± 10.7). There were 43 men (61.4%) and 27 women (38.6%), and 39 (55.7%) were urban residents. Education: 7 illiterate (10.0%), 18 primary (25.7%), 19 secondary (27.1%), 15 intermediate (21.4%), 8 graduate (11.4%) and 3 postgraduate (4.3%), so 25 (36%) had primary education or less. Smoking status: 22 never (31.4%), 21 ex-smokers (30.0%), 27 current (38.6%). Mean COPD duration was 5.1 ± 3.0 years, and 37 (52.9%) reported ≥2 exacerbations in six months.

Table 1: Scores of participants (n = 70)

Measure	Mean ± SD	Median (IQR)	Range
COPD knowledge (/48)	28.9 ± 3.5	29.0 (26.3–31.0)	21–39
COPD knowledge (%)	60.3 ± 7.2	60.4 (54.7–64.6)	43.8–81.2
PR awareness (/27)	16.8 ± 2.1	16.0 (15.0–18.8)	13–21
PR awareness (%)	62.4 ± 7.7	59.3 (55.6–69.5)	48.1–77.8
Total (%)	61.0 ± 5.0	61.3 (57.3–65.3)	49.3–72.0

Item-level scores were uniform: all COPD items fell within 57–64% of maximum and all PR items within 59–69%.

Table 2: Distribution of participants by category (n = 70)

Domain	Poor (<60%)	Moderate (60–79%)	Good (≥80%)
COPD knowledge	29 (41.4%)	40 (57.1%)	1 (1.4%)
PR awareness	38 (54.3%)	32 (45.7%)	0
Overall	26 (37.1%)	44 (62.9%)	0

Knowledge vs awareness. The mean gap was –2.1 points (95% CI –4.9 to 0.6; paired $t = -1.58$, $p = 0.120$; Wilcoxon $p = 0.152$; $d_z = -0.19$). Individually, 39 participants scored higher on PR awareness, 29 on COPD knowledge, and 2 were tied.

Subgroup comparisons. Ever-smokers scored lower than never-smokers on COPD knowledge (58.9% vs 63.2%; $U = 338$, $p = 0.016$, $r = 0.36$). Across three smoking categories, knowledge fell from never-smokers (63.2%) to ex-smokers (60.0%) to current smokers (58.1%) ($H = 7.01$, $p = 0.030$, $\epsilon^2 = 0.10$). PR awareness did not differ by smoking status ($p = 0.451$). Sex, residence, exacerbation frequency, age group

and education showed no significant differences (all $p \geq 0.17$), and chi-square associations with awareness category were non-significant.

Correlation and regression. No coefficient in the 15-pair Spearman matrix survived Holm correction. COPD knowledge and PR awareness were weakly and non-significantly correlated ($\rho = -0.16$, Holm-adjusted $p = 1.000$). Simple regression showed COPD knowledge explained 2.6% of PR awareness variance ($B = -0.174$, $p = 0.179$). The multiple regression (age, education, COPD duration, exacerbations, COPD knowledge) was non-significant ($R^2 = 5.3\%$; $F(5,64) = 0.72$, $p = 0.61$).

Reliability. Cronbach's α was 0.31 for the COPD knowledge scale and 0.06 for the PR awareness scale.

4. Discussion

In this sample of 70 people with COPD, knowledge of the disease and awareness of PR were both limited and comparable, sitting at the boundary between poor and moderate. No participant reached a good level of PR awareness. This is consistent in direction with the Mangalore survey, where PR awareness trailed COPD awareness, although the instruments and populations differ.[20] The finding also fits the Pune qualitative work, in which patients knew about exercise and breathing techniques but had never heard the term "pulmonary rehabilitation".[18]

The one significant pattern was that never-smokers knew more about COPD than ex-smokers, who knew more than current smokers. Possible explanations, which the data cannot test, are denial or minimisation among current smokers, and clinical contact focused on cessation rather than broader disease education. PR awareness ran in the opposite direction, though non-significantly, which may reflect more frequent respiratory contact among smokers. Because group comparisons were unadjusted, this result should be treated as hypothesis-generating.

Education, age, sex, residence, disease duration and exacerbations did not predict either score, and knowledge did not predict awareness. Schooling therefore appears an unreliable proxy for health literacy about PR, echoing the Pune finding that high local literacy did not translate into COPD awareness.[24] Clinically, knowing a patient understands their COPD does not mean they know about rehabilitation, so the two need to be assessed and taught separately.

Strengths:

The study is the first quantitative description for Tirupati district. Knowledge and awareness were measured in the same individuals, and conservative non-parametric methods, Holm correction of the correlation matrix and effect sizes were used.

Limitations:

(1) The sample came from one district by consecutive sampling, limiting generalisability. (2) Responses were self-reported and interviewer-assisted, so social-desirability bias

is possible. (3) The scales were not validated, and their low internal consistency and flat item profile mean they did not clearly discriminate between easier and harder content. (4) The 60% and 80% cut-offs are conventional rather than criterion-validated. (5) Cooking-fuel exposure, spirometric severity, medications, comorbidities, prior PR exposure and sources of information were not captured. (6) Group comparisons were not corrected for multiple testing.

5. Conclusion and Recommendations

Knowledge of COPD (60.3%) and awareness of PR (62.4%) were at the poor-moderate boundary among people with COPD in Tirupati district, and none of the 70 participants achieved good PR awareness. Never-smokers knew more about COPD than smokers. The shortfall cut across demographic groups, so it needs deliberate, targeted information rather than reliance on general education or clinical contact.

Recommendations

- Make PR discussion and referral a standard part of every COPD consultation, with structured pathways from primary care and district hospitals to physiotherapy-led PR.
- Assess COPD knowledge and PR awareness separately, and give particular attention to smokers.
- Use home-, community- or tele-based PR where centre-based services are unavailable.
- Run community education using spoken, demonstrated and video formats, delivered through frontline health workers and self-help groups, and integrate COPD/PR messaging into smoking-cessation and clean-cooking-fuel campaigns.
- Future research should validate the scales, add spirometry, exposure, prior PR and information-source data, follow up the smoking-knowledge finding qualitatively, extend to other districts, and test an awareness intervention with referral and uptake as outcomes.

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