Original Article

Improving Awareness and Screening of Obstructive Lung Disease in Post-Tuberculosis Patients: A Community Service Program at Depok

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Abstract

Background: Post-tuberculosis lung disease (PTLD) is a rising public health concern despite the urgency of eliminating the active infections of tuberculosis (TB). Even after successful treatment, almost half of patients continue to have limitations related to respiratory complaints, particularly dyspnea and chronic cough. This has resulted from airway and parenchymal destruction. This study was conducted as a community service program at Bhakti Yudha Hospital, Depok, to provide education and early screening of respiratory disorders in post-TB patients.

Method: This study consisted of material presentations on risk factors, warning signs of respiratory disease, and prevention of post-TB complications, followed by screening using the modified Medical Research Council (mMRC) dyspnea scale and spirometry. Patients with serious respiratory complaints will get a consultation session with the pulmonologist. The activity was carried out from May to June 2025 and involved 50 patients who had completed 6 months of TB therapy.

Results: Reported that participants presented with dyspnea of varying severity: mMRC 1–2 (18%), mMRC 3 (56%), and mMRC 4 (26%). Among these, 84% of patients with mMRC >2 had a history of extensive pulmonary lesions at initial diagnosis. Spirometry revealed that 94% of patients exhibited moderate to severe mixed obstructive-restrictive impairment.

Conclusion: This study highlights the importance of screening for respiratory complaints after TB treatment, the early recognition of exacerbations, and the continuation of pulmonary rehabilitation in post-TB care.

Keywords: education, post-tuberculosis lung disease, pulmonary rehabilitation, spirometer

INTRODUCTION

Despite its urgency in eliminating the infections of *Mycobacterium tuberculosis* (MTB) in the active stage, the sequelae of pulmonary tuberculosis (PTB) raise public concern related to the serious complications and symptoms remaining after completing the anti-tuberculosis treatment (ATT). Based on recent data, almost half of patients developed lasting

respiratory complaints and daily life limitations.[1–3]

That phenomenon results from delays in diagnosis and a lack of nutritional support during treatment. This condition is referred to as post-tuberculosis lung disease (PTLD).[1–3] Subjective perceptions of PTLD include exertional dyspnea, persistent cough, and hemoptysis. While objective measurement uses spirometry to reveal restrictive, obstructive, or mixed ventilatory defects, ranging from mild to severe.[4,5]

There are several types of PTLD, including airway disease, parenchymal lesions, pleural diseases, and pulmonary vascular disease. Meanwhile, the destruction and remodelling of airway disease is encountered as the most common phenotype. It is also described as TB-associated COPD or TB-COPD-like syndrome. This condition is characterized by bronchial wall thickening, peribronchiolar fibrosis, and alveolar destruction, leading to a decreased FEV_1/FVC ratio.[4,6–8]

Clinically, patients report symptoms such as chronic cough with sputum production that may range from serous to purulent in the presence of secondary infection, wheezing, and progressive dyspnea. These conditions are introduced as an exacerbation period.[1,7–9]

Along with the growing populations of TB patients in Indonesia, early recognition of residual symptoms related to the complications of the advanced stage of PTB is crucial. So, a community service program, including an education program and screening for post-TB respiratory symptoms to determine the need for regular inhaler therapy and periodic lung function monitoring, is needed, particularly in secondary care facilities such as Bhakti Yudha Hospital, Depok.

METHOD

This was a pre-post intervention cross-sectional study (one-group pretest-posttest) conducted as part of a community service program at Bhakti Yudha Hospital, Depok, from May to June 2025. All participants were recruited using consecutive sampling. A total of 50 PTB survivors who had completed ATT for at least six months were included in this study.

The inclusion criteria were age ≥18 years, ability to participate in educational sessions, willingness to undergo spirometry, and completion of questionnaires assessing dyspnea severity and baseline knowledge about PTLD. While the exclusion criteria were patients experiencing acute respiratory exacerbations or worsening symptoms, contraindications to spirometry (e.g., massive hemoptysis, increased intracranial pressure, etc), and pregnancy.

The intervention in this study consisted of a structured material presentation for 60 minutes, followed by 30 minutes of question-and-answer (Q&A) sessions delivered by a pulmonologist. Further, after undergoing the spirometer, each of the participants had 10-minute consultations with the pulmonologist for

their spirometer and CT scan results. The material presentation was included:

1. Clinical symptom recognition, including exertional dyspnea, persistent cough, and hemoptysis.
2. Exacerbation action plans, such as identifying conditions for when to seek emergency care, home care actions including practicing breathing exercises and airway clearance technique, using a regular inhaler, and treatment adherence after receiving a controller from a physician.
3. Risk factor modifications include smoking cessation, adequate nutrition, particularly protein intake, the urge for vaccinations, and aerobic exercise such as walking, cycling, and swimming.

The outcomes that were collected were:

1. Knowledge assessment was performed using a 10-item questionnaire (score range 0-10) created by the researchers and has been tested to assess its reliability and validity, administered before and after intervention.
2. Dyspnea severity that was measured using the mMRC dyspnea scale grade 0-4**.**
3. Lung function that was assessed by standard spirometry (Brand and Manufacture: Chest Chestgraph HI-301 Spirometer Machine) according to ATS/ERS guidelines, including forced expiratory volume in one second (FEV_1), forced vital capacity (FVC), and FEV_1/FVC ratio. Ventilatory interference was classified as normal, obstructive (mild–severe), and restrictive (mild–severe).[10]

Data were analyzed using univariate and bivariate analysis. Demographic variables were summarized as frequencies and percentages. Dyspnea severity was categorized by mMRC scores, and lung functions were classified by ventilatory pattern and severity according to ATS/ERS standards. Meanwhile, the effectiveness of educational intervention was evaluated by comparing pre- and post-intervention knowledge scores using the Wilcoxon signed-rank test, as data were ordinal and not normally distributed. Results were expressed as medians with interquartile ranges (IQR), and $P<0.05$ was considered statistically significant.

Ethical approval for this community service research was acquired from the Ethics Committee of Bhakti Yudha Hospital, Depok. Before beginning the study, all the participants had received information regarding the objective, procedures, and benefits of the program. After understanding the study concepts, all subjects had to sign the written informed consent for being included in this study, related to filling out the questionnaire and the spirometer test.

RESULT

A total of 50 participants who completed at least six months of ATT enrolled in this study. As shown in Table 1, the majority of participants were male (64%), with the largest age group being 40–60 years (44%), followed by those

older than 60 years (42%). This indicates that most TB survivors experiencing respiratory complaints were men in their middle to late adulthood. However, in terms of educational background, nearly half of the participants had relatively good educational attainment, with most being high school graduates (48%) and 36% having pursued higher education (diploma or university level).

Table 1. Demographic Characteristics (n=50)

Variable	n	%
Gender		
Male	32	64
Female	18	36
Age		
<40 years old	7	14
40-60 years old	22	44
>60 years old	21	42
Education Degree		
Primary school	2	4
Intermediate school	6	12
High school	24	48
University	18	36
ATT durations		
6 months	12	24
6-9 months	26	52
9-12 months	10	20
>12 months	2	4
Degree of the Pulmonary Lesions in Initial Diagnosis		
Mild-Moderate	8	16
Advance/Extensive	42	84
Dyspnea scale (mMRC)		
Grade 0 (absent)	0	0
Grade 1–2 (Mild)	9	18
Grade 3 (Moderate)	28	56
Grade 4 (Severe)	13	26

The duration of ATT varied, with more than half of the patients (52%) undergoing therapy for 6–9 months, while 24% completed treatment within 6 months. A large proportion of participants (84%) had advanced pulmonary lesions at the time of initial diagnosis, which represents an important risk factor for developing long-term pulmonary impairment.

According to the mMRC dyspnea scale, none of the participants were completely free of symptoms (mMRC grade 0). The majority of the patients experienced moderate to severe dyspnea, with 56% classified as mMRC grade 3 and 26% as mMRC grade 4**.** Only a small proportion of patients reported mild dyspnea, with 18% of participants categorized into mMRC grades 1–2**.**

Along with subjective perceptions of dyspnea, objective measurement using spirometry also gives related results. The majority of subjects demonstrated significant pulmonary function impairment, with a mixed pattern of obstruction and restriction. From the restrictive group, most cases were classified as moderate restriction (48%) and severe restriction (52%). Not really different from the restrictive group, in the obstructive group, only 10% of patients had mild obstruction**,** while 32% classified as moderate obstruction**,** and the largest proportion fell into the severe to very severe obstruction category (62%).

Table 2. Spirometry Results in Post-TB Patients (n=50)

Pattern	n	%
Mild Restrictions	8	16
Moderate Restrictions	24	48
Severe Restrictions	18	52
Mild Obstructions	3	10
Moderate Obstructions	16	32
Severe – Very Severe Obstructions	31	62

Before the presentations, the majority of participants had relatively low knowledge about the post-TB respiratory symptoms. The median knowledge score from the questionnaire (scale 0–10) was 5 (IQR=4–6)**,** indicating that most patients did not fully understand chronic respiratory symptoms, potential complications, or appropriate actions during exacerbation. Only 30% of participants had correctly answered about the steps during an exacerbation episode and recognizing the warning signs of respiratory distress or massive hemoptysis.

After the material presentations and interactive discussions with the pulmonologist, knowledge scores improved significantly to a median of 8 (IQR=7–9; P<0.001). This reflects a better understanding of respiratory symptoms that may occur after completing ATT, including progressive dyspnea, productive cough, and the risk of recurrent hemoptysis. In line with the knowledge, the proportion of participants who knew the correct steps to manage exacerbations also rose sharply to 86%, with most able to clearly explain appropriate measures.

The aspects of the action plan most widely understood after education included:

1. Recognition of warning signs, including severe dyspnea, massive hemoptysis, reduced consciousness, or declining oxygen saturation.
2. When to seek medical help immediately by visiting the emergency department or contacting the nearest health facility if symptoms do not improve.
3. Initial self-management strategies include breathing exercises, aerobic activity, airway clearance, and adequate rest.
4. Medication adherence, such as continuing prescribed treatment (e.g., bronchodilators or supportive therapy) as instructed by the physician.

DISCUSSION

From a community aspect, gender does not statistically make a significant difference in the epidemiological risk of developing PTLD. However, a few studies state that men in middle and older age groups are generally at a higher risk of developing PTB compared to women.[3,7]

Table 3. Patient Knowledge of Post-TB Pulmonary Complications

Variable	Before Educations	After Educations	Change	P
Knowledge score (0–10), median (IQR)	5 (4–6)	8 (7–9)	+3 point	<0.001*
Aware of post-TB respiratory symptoms	40%	90%	+50%	<0.001*
Recognized warning signs of exacerbation	32%	84%	+52%	<0.001*
Knew when to seek medical care	28%	80%	+52%	<0.001*
Understood self-management strategies (breathing, airway clearance, rest)	24%	78%	+54%	<0.001*
Understood the importance of medication adherence	36%	88%	+52%	<0.001*
Understood overall exacerbation action plan	30%	86%	+56%	<0.001*

Poor understanding of TB symptoms and the national insurance policy system in Indonesia also contributes to the late diagnosis of PTB. Therefore, the patients often present with extensive pulmonary lesions at the time of diagnosis.[3,7] Such extensive lung damage plays a key role in the development of PTLD**,** which is characterized by chronic respiratory symptoms and significantly limits daily activities.[1–4,11]

Dyspnea is the most common manifestation of post-TB respiratory complications.[2,4,7,11] Patients tend to reduce their physical activity in response to worsening shortness of breath, leading to deconditioning syndrome, which further exacerbates their symptoms.[12,13]

In this study, dyspnea severity was predominantly at mMRC grades 3 and 4, indicating that most participants experienced breathlessness with a significant impact on daily life. This finding is consistent with previous meta-analyses reporting that approximately one-third to one-half of TB survivors, particularly in low FEV_1 (<50%) as part of lung functions after completed ATT, and also those with more than 2 lobes of pulmonary involvement at the time of diagnosis of PTB, suffer from chronic dyspnea with major consequences on quality of life.[1,2]

Spirometry, as an objective lung function measurement, in this study revealed that all participants had reduced lung function, with a dominant pattern of moderate-to-severe restriction combined with severe-to-very severe obstruction. These findings reinforce prior evidence that PTB leaves heterogeneous residual damage, including parenchymal fibrosis leading to restriction and airway remodelling resulting in obstruction, that coexists as a mixed pattern of lung defect.[5,6]

The results of this study highlight the importance of post-TB screening using simple tools such as the mMRC questionnaire and objective measurement using spirometry for assessing the sequelae of respiratory TB. With early understanding of complications, symptoms, and functional impairment, these can be managed through pulmonary rehabilitation, risk factor modifications, and other supportive therapies, including bronchodilators.[14,15]

Furthermore, the recognition of exacerbation episodes and what to do during that time can substantially reduce the mortality of PTLD patients. Overall, this study reinforced the need for international or national recommendations for emphasizing the identification of respiratory symptoms after TB, along with lung function monitoring, and also the risk for re-infections of PTB in post-TB care.[14,15]

This study has several limitations that should be acknowledged. First, the study design was a single-center, cross-sectional community intervention conducted over a relatively short period. So, the patients may not be generalizable to all populations, particularly in different hospitalization degrees, and with different insurance policies.

Second, the sample size was relatively small (n=50) and also localized in

the hospital, which may introduce selection bias. Patients who were more motivated or symptomatic were possibly more likely to participate, potentially increasing the prevalence of respiratory disability. Third, this study only assessed the knowledge score without assessing the behavioral change that needs long-term follow-up to understand the respiratory sequelae and the early actions when the respiratory complaints worsen.

CONCLUSION

The community-based program of education and dyspnea screening for post-TB patients at Bhakti Yudha Hospital, Depok, shows improved patient knowledge regarding post-TB complications and identified a high prevalence of chronic respiratory sequelae, including symptoms and a reduction in lung function. This activity may serve as a model of community intervention to support rehabilitation and long-term care of post-TB patients. Future multicenter or longitudinal studies are needed to validate these results and evaluate the long-term outcomes of educational interventions in post-TB care.

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