

## Case Study: Application of the Active Cycle of Breathing Technique (ACBT) to Address Ineffective Airway Clearance in Patients with Pulmonary Tuberculosis at Jakarta Cempaka Putih Islamic Hospital

Nabila Wahyuningtyas<sup>1</sup>, Sephia Salsabila<sup>1</sup>, Tierra Adzkiya Rali<sup>1</sup>, Fitriani Rayasari<sup>1</sup>

<sup>1</sup>Universitas Muhammadiyah Jakarta, Jakarta, Indonesia

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#### Corresponding Author :

Fitriani Rayasari

E-mail :

[fitriani.rayasari@umj.ac.id](mailto:fitriani.rayasari@umj.ac.id)

Phone Number : 08129593689

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### ABSTRACT

**Background & Objective:** Pulmonary tuberculosis (TB) is an infectious lung disease characterized by increased sputum production and impaired airway clearance, leading to dyspnea and decreased respiratory function. Effective non-pharmacological nursing interventions are needed to improve airway clearance. This study aimed to determine the effectiveness of Active Cycle of Breathing Technique (ACBT) in improving airway clearance in patients with pulmonary tuberculosis. **Method:** This study used a descriptive case study design with a pre-post test approach involving three pulmonary TB patients treated in an inpatient ward. Nursing care was conducted for 3×24 hours, including assessment, nursing diagnosis, planning, implementation of ACBT, and evaluation. Data were collected through observation, measurement using the Breathlessness, Cough, and Sputum Scale (BCSS), and oxygen saturation (SpO<sub>2</sub>) using a pulse oximeter before and after intervention. **Result:** The results showed improvement in respiratory status, indicated by decreased dyspnea, more effective cough, reduced sputum retention, and decreased BCSS scores in all patients. Oxygen saturation also increased after intervention. **Conclusion:** ACBT is an effective non-pharmacological nursing intervention to improve airway clearance and respiratory status in pulmonary TB patients and can be applied as part of independent nursing care in clinical settings.

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## **Introduction**

Pulmonary tuberculosis (pulmonary TB) is an infectious respiratory disease that remains a global public health problem, particularly among the adult population. This disease is caused by *Mycobacterium tuberculosis* and is transmitted through the air when a person with active TB coughs, sneezes, or speaks, producing droplets containing the bacteria. The World Health Organization (WHO) reports that TB is among the top ten causes of death from infectious diseases, even though it is actually preventable and curable with proper management (WHO, 2025). The high incidence of TB among people of working age indicates that this disease remains a challenge for the healthcare system (Mawar Selvia & Joyo Minardo, 2025).

Pathophysiologically, inhaled bacteria reach the alveoli and trigger an inflammatory response that leads to granuloma formation and lung tissue damage. This condition causes respiratory symptoms such as chronic cough, increased sputum production, hemoptysis, and shortness of breath, which impact the patient's ability to meet their oxygenation needs (Centers for Disease Control and Prevention [CDC], 2024; Utari Ekowati, Budi Santoso, & Sumarni, 2022). The global burden of TB remains high, with approximately 10.7 million cases in 2024, 87% of which originate from the 30 countries with the highest burden. Indonesia ranks second after India, accounting for about 10% of global cases. Nationally, there are an estimated 1,090,000 TB cases and 125,000 deaths annually, with 885,000 cases reported in 2024. At the regional level, the Jakarta Capital Region Health Office reported tens of thousands of new TB cases throughout 2025, indicating that TB is not only a community problem but also increases the need for hospital care (WHO – Global Tuberculosis Report, 2025; Indonesian Ministry of Health, 2025; ANTARA, 2025).

Patients with pulmonary TB require hospitalization if their clinical condition is severe, if there are respiratory complications, or if they require close monitoring of their treatment. Symptoms such as persistent productive cough, excessive sputum, shortness of breath, and reduced exercise tolerance result from chronic inflammation and lung tissue damage that increase secretion production, making adequate oxygenation a top priority (CDC, 2024).

One recommended nonpharmacological intervention is the Active Cycle of Breathing Technique (ACBT). A quasi-experimental study in hospitalized pulmonary TB patients showed that ACBT performed twice daily for five days significantly reduced the severity of shortness of breath, with an average score reduction of 2.44 points ( $p < 0.05$ ), thereby effectively aiding secretion mobilization and improving ventilation (Endria, Yona & Waluyo, 2022). ACBT is a breathing exercise technique consisting of breathing control, thoracic expansion exercises, and the forced expiratory technique (huff), performed in a structured manner for approximately 15 minutes per session, depending on the patient's tolerance. In pulmonary TB, increased sputum production due to chronic inflammation leads to secretion retention; thus, ACBT plays a role in improving respiratory function and reducing shortness of breath (Endria, Yona & Waluyo, 2022). The success of the ACBT intervention can be evaluated using the Breathlessness, Cough, and Sputum Scale (BCSS) to assess shortness of breath, cough, and sputum characteristics before and after the intervention. A decrease in the BCSS score reflects improved airway clearance and respiratory comfort for the patient (Papuan & Rahayu, 2025).

During clinical practice in the inpatient ward, students encountered patients with pulmonary TB who had a persistent productive cough, difficulty expectorating

sputum, and shortness of breath—symptoms indicative of ineffective airway clearance. Interventions such as respiratory monitoring, comfortable positioning, and education on effective coughing techniques had not been optimally implemented, necessitating an evidence-based approach. ACBT was selected because it can be performed independently by nurses, requires no special equipment, and has a scientific basis for aiding sputum mobilization and improving airway clearance. Evaluation of success through clinical changes—including reduced shortness of breath, cough, and sputum production—serves as the basis for applying this intervention in a final scientific paper based on a case study of an inpatient with pulmonary tuberculosis.

### **Objective**

The purpose of this case study is to examine the application of the Active Cycle of Breathing Technique (ACBT) to address ineffective airway clearance in patients with pulmonary tuberculosis.

### **Method**

This study employed a descriptive case study design with a pre-post test approach involving three patients. The study aimed to evaluate the effectiveness of the Active Cycle of Breathing Technique (ACBT) intervention in improving airway clearance in patients with pulmonary tuberculosis. The study subjects consisted of three patients with a medical diagnosis of pulmonary tuberculosis who were experiencing the nursing problem of ineffective airway clearance. The study was conducted in a hospital inpatient ward. Data collection was performed through direct observation, measurement of respiratory status before and after the intervention using the Breathlessness, Cough, and Sputum Scale (BCSS), and measurement of oxygen saturation (SpO<sub>2</sub>) using a pulse oximeter. All measurement data were recorded on observation sheets. Data analysis was performed using descriptive-comparative methods, specifically by comparing the patients' conditions before and after the intervention, and the results were presented in tables and narrative form.

### **Inclusion Criteria**

- a) Patients diagnosed with pulmonary tuberculosis
- b) Experiencing ineffective airway clearance (characterized by ineffective coughing, difficulty expectorating sputum, and/or shortness of breath)
- c) Patients who are conscious and cooperative
- d) Willing to participate by signing an informed consent form

### **Research Variables**

- a) Independent variable: Active Cycle of Breathing Technique (ACBT)
- b) Dependent variables: Airway clearance measured using the BCSS score and oxygen saturation (SpO<sub>2</sub>)

### **Research Instruments**

- a) Breathlessness, Cough, and Sputum Scale (BCSS) to assess the severity of shortness of breath, cough, and sputum
- b) Pulse oximeter to measure oxygen saturation (SpO<sub>2</sub>)
- c) Observation sheet to document measurement results before and after the intervention

## Research Procedures

- 1) Conduct baseline (pre-intervention) measurements, including the BCSS score and oxygen saturation (SpO<sub>2</sub>)
- 2) Position the patient in the semi-Fowler's position or a comfortable position
- 3) Provide education and a demonstration of ACBT techniques to the patient
- 4) Implement the ACBT intervention, consisting of:
  - a. Breathing control
  - b. Thoracic expansion exercises
  - c. Forced expiration technique (huffing)
- 5) Each session lasts approximately 15 minutes
- 6) The intervention is administered twice daily (morning and afternoon) for 3 consecutive days
- 7) Monitor the patient's response during the intervention
- 8) Stop the exercise if the patient experiences symptoms such as dizziness or increased shortness of breath
- 9) Conduct post-intervention measurements using the BCSS and SpO<sub>2</sub>

## Results

### Patient 1

In the first patient, Mr. F, prior to the implementation of ACBT, the patient complained of a productive cough with phlegm that was difficult to expel, shortness of breath, and easy fatigue during physical activity. Objective data showed an increased respiratory rate, the presence of rales, and thick sputum that was difficult to expectorate, leading to a diagnosis of ineffective airway clearance. On the first day of ACBT implementation, the patient still required guidance in performing breathing control and chest expansion exercises. The patient was able to perform the huffing technique with the nurse's assistance, and sputum began to be coughed up in small amounts. The respiratory rate remained elevated, but the patient reported feeling less short of breath after the exercises.

On the second day, the patient began to perform the ACBT steps independently with minimal guidance. The amount of sputum produced increased, the sputum became thinner, and the rales decreased. The patient reported reduced shortness of breath and improved exercise tolerance. On the third day, the patient was able to perform ACBT independently and effectively. Sputum clearance was more optimal, respiratory rate approached normal, and additional breath sounds were minimal. Evaluation showed improved airway clearance, characterized by effective coughing, easy sputum clearance, and reduced shortness of breath.

### Patient 2

In the second patient, Mr. B, prior to intervention, the patient complained of a productive cough, labored breathing—especially during activity—and rapid fatigue. Examination revealed thick sputum, mild use of accessory breathing muscles, and rales. On the first day of ACBT implementation, the patient appeared to tire quickly, so the exercises were performed gradually with rest periods. The patient was able to perform breathing control but still had difficulty performing effective huffing. Sputum began to be expelled in small amounts.

On the second day, the patient showed improved ability to perform ACBT exercises. Sputum production increased, breathing felt easier, and the use of accessory

breathing muscles decreased. Rales were still present but less pronounced than on the first day. On the third day, the patient was able to perform ACBT more independently; sputum was easier to expel; respiratory rate decreased; and the patient reported a significant reduction in shortness of breath. Evaluation showed improved airway clearance and increased exercise tolerance.

### Patient 3

In the third patient, Mr. A, prior to the intervention, the patient complained of a productive cough accompanied by weakness and shortness of breath. Examination revealed thick sputum, shallow breathing, and rales in the lung fields. On the first day of ACBT implementation, the patient still required full assistance, particularly with the thoracic expansion technique. Sputum output was minimal, and the patient still became fatigued easily.

On the second day, the patient began to show improved ability to perform breathing exercises. The sputum was thinner and the volume increased; breathing was deeper, and the patient appeared more relaxed after the exercises. On the third day, the patient was able to perform ACBT with minimal guidance. Additional breath sounds decreased, sputum was easily expelled, and the patient reported more comfortable breathing. Evaluation showed improved airway clearance and increased cough effectiveness.

**TABLE 1.** *Breathlessness, Cough and Sputum Scale (BCSS Score : 0-12)*

| Patient Initials | Day 1           |                   | Day 2           |                   | Day 3           |                   |
|------------------|-----------------|-------------------|-----------------|-------------------|-----------------|-------------------|
|                  | Morning (10.00) | Afternoon (15.00) | Morning (10.00) | Afternoon (15.00) | Morning (10.00) | Afternoon (15.00) |
| Mr. F            | 7               | 6                 | 6               | 5                 | 5               | 4                 |
| Mr. B            | 8               | 7                 | 7               | 6                 | 6               | 4                 |
| Mr. A            | 8               | 6                 | 7               | 6                 | 6               | 4                 |

### Discussion

Ineffective airway clearance is a common nursing problem found in patients with pulmonary TB due to excessive sputum production, airway inflammation, and a reduced ability to cough effectively. This condition causes secretions to become trapped, thereby impairing pulmonary ventilation and causing shortness of breath. In the three patients in this case study, the main complaints were a cough with sputum that was difficult to expel, shortness of breath, and the presence of additional breath sounds. These findings are consistent with the pathophysiology of tuberculosis, which causes increased secretion production. The intervention provided was the Active Cycle of Breathing Technique (ACBT) as a nonpharmacological therapy to aid in secretion clearance. This technique consists of breathing control, chest expansion, and exhalation techniques aimed at improving ventilation, opening the alveoli, and facilitating sputum expectoration.

Results from the three-day intervention showed improved airway clearance in all three patients. Improvements were evident in the increased volume of sputum expelled, reduced rales, decreased respiratory rate, and reduced shortness of breath. In addition, patients demonstrated improved ability to cough effectively and increased exercise tolerance. These improvements were attributed to the ACBT mechanism, which enhances alveolar ventilation and facilitates the transport of secretions from the peripheral airways to the larger airways, making them easier to expel. Breathing exercises also helped reduce work of breathing and improve

oxygenation. Differences in response were observed among patients, with the first patient showing faster improvement compared to the others. This may be influenced by age, clinical condition, fatigue level, secretion volume, and the ability to adhere to the exercises. Individual responses to interventions are common in nursing practice.

The results of this case study are consistent with previous research indicating that ACBT is effective in improving airway clearance, reducing shortness of breath, and enhancing respiratory quality in patients with chronic lung diseases, including pulmonary TB. Consistency in exercise and patient engagement are key factors in the success of the intervention. Although the results were positive, this study has limitations, including a short implementation period and a small sample size. Long-term observation is needed to assess the sustainability of the intervention's effects. Overall, the application of ACBT is an effective, safe, and easy-to-implement nurse-led intervention to improve airway clearance in patients with pulmonary tuberculosis. This intervention can be integrated into routine nursing care to enhance patient comfort and the recovery process.

## Conclusion

Based on the nursing care process conducted for patients with pulmonary tuberculosis using the Active Cycle of Breathing Technique (ACBT)—namely Mr. F, Mr. B, and Mr. A—it was found that the primary nursing problem identified was ineffective airway clearance related to increased secretion production due to the inflammatory process in the respiratory tract. The primary nursing intervention provided in these cases was the nonpharmacological Active Cycle of Breathing Technique (ACBT), administered over a period of 3 days.

The tangible results of implementing the nonpharmacological Active Cycle of Breathing Technique (ACBT) intervention showed a decrease in the Breathlessness, Cough, and Sputum Scale (BCSS) scores for all three patients; scores that were initially between 7 and 8 decreased to 4 after three days of intervention. In addition, the patients also showed clinical improvement, including improved breathing patterns, increased oxygen saturation, decreased respiratory rate, and the patients' ability to expel sputum more effectively.

The main conclusion of this report is that the application of the Active Cycle of Breathing Technique (ACBT) has been proven effective in reducing shortness of breath, coughing, and improving patients' ability to expel sputum, and can serve as a nonpharmacological intervention option that can be widely applied in clinical nursing practice.

## References

- Athawale, V. K., Lalwani, L. L., & Mishra, G. P. (2020). Comparison of the Active Cycle of Breathing Technique (ACBT) versus Active Cycle of Breathing Technique with Flutter in Bronchiectasis NATIONAL JOURNAL OF MEDICAL RESEARCH Comparison of the Active Cycle of Breathing Technique (ACBT) versus Active Cycle of. *National Journal of Medical Research*, 10(4), 178–180. <https://www.researchgate.net/publication/349101915>
- Belleza, M. L. (2024). Tuberculosis. Nurseslabs.
- Centers for Disease Control and Prevention (CDC). (2024). *Tuberculosis (TB): Clinical overview*.

- Dinas Kesehatan Provinsi DKI Jakarta. (2023). Prevalensi Tuberculosis Provinsi DKI Jakarta. *Dinkes DKI Jakarta*, 2(5474), 1333–1336.
- Djojodibroto, D. (2019). *Respirologi (Respiratory Medicine)*. Jakarta: EGC.
- DPW PPNI, D. P. (2022). Standar Diagnosis Keperawatan Indonesia (SDKI), Standar Luaran Keperawatan Indonesia (SLKI), dan Standar Intervensi Keperawatan Indonesia (SIKI). DPP PPNI
- Endria, Y., Yona, S., & Waluyo, A. (2022). Pengaruh *Active Cycle of Breathing Technique* terhadap penurunan derajat sesak napas pada pasien tuberkulosis paru. *Jurnal Keperawatan*, 14(2), 123–131.
- Fedyk, M. (2023). Nursing science as the study of how to reconcile behavioral messiness with clinical norms and ideals. *Studies in History and Philosophy of Science*, 99, 37–45. <https://doi.org/10.1016/j.shpsa.2022.12.006>
- Friedman, M. M., Bowden, V. R., & Jones, E. G. (2018). *Family nursing: Research, theory, and practice* (6th ed.). Pearson Education.
- Furin, J., Cox, H., & Pai, M. (2021). Tuberculosis treatment and outcomes. *The Lancet Respiratory Medicine*, 9(6), 629–641.
- Ghiyasvandian, S., Shahsavari, H., Matourypour, P., & Golestannejad, M. R. (2021). Integrated Care model: Transition from acute to chronic care. *Revista Brasileira de Enfermagem*, 74(suppl 5). <https://doi.org/10.1590/0034-7167-2020-0910>
- Huang, L., Li, L., Yang, H., et al. (2021). Impact of diabetes mellitus and anemia on tuberculosis outcomes. *Infectious Diseases of Poverty*, 10(1), 1–10.
- Huriah, T., & Ningtias, D. (2017). Pengaruh *Active Cycle of Breathing Technique* terhadap Peningkatan Nilai Vep1, Jumlah Sputum, dan Mobilisasi Sangkar Thoraks Pasien PPOK. *Indonesian Journal of Nursing Practices*, 1(2), 44–54. <https://doi.org/10.18196/ijnp.1260>
- Ignatavicius, D. D., Rebar, C. R., & Heimgartner, N. M. (2023). *Medical-Surgical Nursing: Concepts for Interprofessional Collaborative Care*. Elsevier.
- Kemenkes RI. (2022). Petunjuk Teknis Penanggulangan Tuberkulosis. Kemenkes RI.
- Kemenkes RI. (2025). Buku Panduan TBC untuk Tenaga Medis dan Tenaga Kesehatan. Kemenkes RI. <https://www.tbindonesia.or.id/pustaka---media-kie/buku-panduan-tbc-untuk-tenaga-medis-dan-tenaga-kesehatan-3/>
- Kementerian Kesehatan Republik Indonesia. (2025). Petunjuk Teknis Penatalaksanaan Tuberkulosis Sensitif obat. Jakarta: Kementerian Kesehatan RI.
- Kementerian Kesehatan Republik Indonesia. (2025). Profil Tuberkulosis Indonesia. Kementerian Kesehatan RI.
- Kementerian Kesehatan RI. (2022). Pedoman nasional pelayanan kedokteran tata laksana tuberkulosis..
- Kementerian Kesehatan RI. (2022). Petunjuk Teknis Penanggulangan Tuberkulosis. Kemenkes RI.
- Levani Yelvii, Prastya Aldo Dwi, & Mawaddatunnadila Siska. (2021). Coronavirus Disease 2019 (COVID-19): Patogenesis, Manifestasi Klinis dan Pilihan Terapi. *Jurnal Kedokteran Dan Kesehatan*, 17(1), 44–57. <https://jurnal.umj.ac.id/index.php/JKK/article/view/6340>
- Levani, P., Prastya, A. D., & Mawaddatunnadila, S. (2021). Coronavirus Disease 2019 (COVID-19): Patogenesis, Manifestasi Klinis dan Pilihan Terapi. *Jurnal Kedokteran dan Kesehatan*, 17(1), 44–57. <https://doi.org/10.24853/jkk.17.1.44-57>
- Light, R. W. (2018). *Pleural diseases* (6th ed.). Wolters Kluwer.

- Mahadewi, N. L. P. C., Anantari, N. P. D., Putra, K. S. C., Laksmi, I. G. A. A. C., Prasana, I. G. E. J., & Jeviana, A. (2025). 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: Physiotherapy Evidences*, 6(1), 78–81. <https://doi.org/10.23917/fisiomu.v6i1.7193>
- Mar'iyah, H., & Zulkarnain. (2021). Patofisiologi penyakit tuberculosis. *Biofarmasetikal Tropis*, 5(1), 79–82.
- Mawar Selvia, & Joyo Minardo. (2025). Tuberkulosis sebagai masalah kesehatan masyarakat pada usia produktif. *Jurnal Kesehatan Masyarakat*, 11(1), 45–52.
- McIlwaine, M., Bradley, J., Elborn, J. S., & Moran, F. (2021). Physiotherapy airway clearance techniques in adults and children. *European Respiratory Journal*, 58(3), 2002990.
- Mousavi, H., Ghanbari, A., Karkhah, S., Alizadeh, J., Kazemnejad Leyli, E., & Jafaraghaee, F. (2024). The effect of clinical guideline education on the knowledge and practice of nurses for peripheral intravenous catheter placement based on short message service: A quasi-experimental study. *The Journal of Vascular Access*, 25(1), 132–139. <https://doi.org/10.1177/11297298221101804>
- Muttaqin, A. (2018). Asuhan Keperawatan Medikal Bedah. Jakarta: Salemba Medika.
- Nugraheni, R., & Anita, D. (2025). Asuhan keperawatan medikal bedah berbasis eviden. Jakarta: EGC.
- Papuan, N. F. P. D., & Rahayu, H. T. (2025). Efektivitas Active Cycle Of Breathing Technique (ACBT) Dalam Meningkatkan Bersihan Jalan Napas Pada Pasien Penyakit Paru Obstruktif Kronik (PPOK): Studi Kasus. *Diagnosis Jurnal Ilmiah Kesehatan*, 20(4), 49–54.
- Papuan, N. F. P. D., & Rahayu, H. T. (2025). Validitas *Breathlessness, Cough, and Sputum Scale (BCSS)* dalam evaluasi pasien gangguan pernapasan. *Jurnal Keperawatan Klinis*, 9(1), 33–40.
- Polopadang V, et al. (2019) *Proses Keperawatan (Pendekatan Teori Dan Praktik)*. Gowa: Yayasan Pemberdayaan Masyarakat Indonesia Cerdas
- PPNI. (2017). *Standar Diagnosis Keperawatan Indonesia (SDKI)*. Dewan Pengurus Pusat Persatuan Perawat Nasional Indonesia.
- Practical Guide: The active cycle of breathing technique (ACBT). *Journal of Physiotherapy*, 71(3), 211–215 (2025).
- Pryor, J. A., & Prasad, A. S. (2018). Physiotherapy for Respiratory and Cardiac Problems. In *Australian Journal of Physiotherapy* (Vol. 48, Issue 4). Australian Physiotherapy Association. [https://doi.org/10.1016/s0004-9514\(14\)60181-1](https://doi.org/10.1016/s0004-9514(14)60181-1)
- Putri, R. A., Wulandari, D., & Sari, Y. P. (2020). Hubungan dukungan sosial dengan kepatuhan pengobatan pasien tuberculosis paru. *Jurnal Keperawatan Klinis*, 7(2), 85–92.
- Smeltzer, S. C., & Bare, B. G. (2018). Brunner & Suddarth's Textbook of Medical-Surgical Nursing. In *Nursing Reports* (Vol. 14). Lippincott Williams & Wilkins. <https://doi.org/10.3390/nursrep14030140>
- Smeltzer, S. C., & Bare, B. G. (2022). *Brunner & Suddarth's textbook of medical-surgical nursing* (15th ed.). Wolters Kluwer.
- Somantri, I. (2020). Asuhan Keperawatan Medikal Bedah. Jakarta: Salemba Medika.
- Standar Diagnosa Keperawatan Indonesia (SDKI). (2018). *Standar Diagnosa Keperawatan Indonesia*. Jakarta: DPP PPNI.

- Standar Intervensi Keperawatan Indonesia (SIKI). (2018). *Standar Intervensi Keperawatan Indonesia*. Jakarta: DPP PPNI.
- Stoilova, S., Geneva-Popova, M., & Taneva, D. (2023). Accessibility to and awareness of rheumatology care provided by a nurse – A pilot study. *Folia Medica*, 65(2), 235–242. <https://doi.org/10.3897/folmed.65.e79717>
- Suddart & Brunner. (2019). *Brunner & Suddarth's Textbook of Medical-Surgical Nursing (14th ed.)*. Wolters Kluwer.
- Tedy Tulak, G., Nasus, E., Rahma, H. D., Cristin, K., Nada, K., & Rahmadani, M. A. (2023). Edukasi Pencegahan Luka Tekan pada Anggota Keluarga yang Mengalami Immobilisasi. *Idea Pengabdian Masyarakat*, 3(02), 69–73. <https://doi.org/10.53690/ipm.v3i02.199>
- Tim Pokja SIKI DPP PPNI. (2022). *Standar Intervensi Keperawatan Indonesia*. Jakarta: DPP PPNI.
- Utari, E., Santoso, B., & Sumarni. (2022). Manifestasi klinis dan gangguan respirasi pada pasien tuberkulosis paru. *Jurnal Keperawatan Medikal Bedah*, 10(2), 78–86.
- Wasilah, H., et al. (2024). Masalah keperawatan pada pasien tuberkulosis paru rawat inap. *Jurnal Keperawatan Indonesia*, 27(1), 15–24.
- WHO Global Tuberculosis Repot, W.-G. T. (2025). *Global Tuberculosis Report 2025*. In Geneva: World Health Organization.
- World Health Organization (WHO). (2025). *Global Tuberculosis Report 2025*. Geneva: World Health Organization.
- World Health Organization. (2023). *Global Tuberculosis Report 2023*. WHO.
- World Health Organization. (2025). *Global Tuberculosis Report*. In Geneva (Issue September). <https://doi.org/978 92 4 156450 2>
- Yoany M. V. B. Aty et al. (2024). Penerapan teknik Active Cycle of Breathing Technique dalam mengatasi penumpukan sekret pada penderita Tuberculosis Paru. *Sehat Rakyat: Jurnal Kesehatan Masyarakat*.