

Assessment of Clinical Outcomes for Tuberculosis Patients in Makassar, South Celebes; Focusing on Quality of Life and the Efficacy of Antituberculosis Treatment

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ABSTRACT

Background: Tuberculosis is a highly prevalent infectious illness of the respiratory tract in Indonesia. Furthermore, tuberculosis management is incorporated into the national program of the Ministry of Health to diminish the incidence rate and enhance the recovery rate. Nonetheless, numerous individuals continue to disregard tuberculosis treatment, mainly due to the extensive array of medications required for sufferers. **Objectives:** This study will investigate the alterations in the quality of life of patients following antibiotic treatment for tuberculosis. **Materials and Methods:** This study used a cohort design with prospective sampling, utilising laboratory result parameters for efficacy and the Short Form-36 (SF-36) instrument to assess the patients' quality of life, involving a total of 41 participants. **Results:** This study further investigates understanding and adherence to tuberculosis therapy. The significant difference in leukocyte counts in tuberculosis patients before and after the initiation of Anti-Tuberculosis Drugs (ATDS) treatment with p -value <0.001 . The questionnaire comprises eight domains encompassing a total of 36 questions, which include the physical domain, the emotional function domain, the social function domain, the physical state domain, the emotional state domain, the pain domain, the vitality domain, and the general health domain. Measurement of quality of life using SF 36 shows that most patients have a good quality of life after undergoing treatment with an average score of 61.22. **Conclusion:** The findings of this investigation suggest that antituberculosis therapy is not only effective in reducing neutrophil and leukocyte levels to normal but also contributes to the improvement of the quality of life of tuberculosis patients.

Keywords: Antituberculosis, Quality of life, Therapeutic efficacy, Tuberculosis.

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INTRODUCTION

A persistent worldwide health issue is Tuberculosis (TB). Tuberculosis is among the most lethal first-tier infectious illnesses, possessing the second highest fatality rate globally, following HIV-AIDS. This condition is induced by an infection from Mycobacterium tuberculosis, primarily impacting the lungs. This condition is occasionally termed pulmonary tuberculosis illness.^{1,2} According to the World Health Organization data from 2021, the expected global incidence of Tuberculosis (TB) was 10.6 million cases, reflecting an increase of around 600,000 cases from the 10 million estimated in 2020. Indonesia is identified by the WHO as having a significant burden of tuberculosis incidence. The WHO reports that Indonesia's annual Tuberculosis (TB) data

collection reached a record high in 2022, ranking third globally after India and China, with 824,000 cases and 93,000 deaths annually, which translates to 11 deaths per hour, highlighting a substantial challenge in combating TB in Indonesia. In 2020, the incidence of tuberculosis in South Sulawesi, as reported, indicates that the city of Makassar had the greatest number of cases at 5,993, followed by Gowa Regency and Bone Regency. Makassar is the epicenter of the highest tuberculosis transmission, exhibiting a greater potential for spread than other regions. The incidence of tuberculosis patients is increasing as each TB patient (BTA+) transmits the disease to 10-15 additional individuals annually. Consequently, efficient, cohesive, and thorough control measures are required. The DOTS (Directly Observed Treatment Short-course) strategy is a tuberculosis treatment approach involving short-term medication, supplemented by patient supervision to guarantee adherence to the regimen until recovery.³⁻⁵ Pulmonary tuberculosis can be effectively treated with a therapeutic regimen. Tuberculosis treatment has emerged as the most effective strategy to cure the disease, mitigate the transmission of TB pathogens, avert mortality, and combat medication resistance. Tuberculosis treatment necessitates an



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extended duration comprising two phases: the intense phase and the continuation phase, to prevent relapse. The treatment must be sufficient, typically involving a combination of at least four medications in the form of an ATDs to avert the development of resistance.^{6,7} Treatment for tuberculosis patients includes an intensive phase of 2 months followed by a continuation phase of 4 months. The complete regimen for pulmonary tuberculosis spans six months. Patients with tuberculosis are administered Isoniazid (INH), Rifampicin, Ethambutol, Streptomycin, and Pyrazinamide during the intense phase, which is conducted daily for a duration of 2 months under direct supervision to avert the emergence of resistance to all Anti-Tuberculosis Drugs (ATDs). Patients with tuberculosis receive isoniazid and rifampicin for a duration of four months during the continuation phase.^{8,9} Nonetheless, prolonged consumption of anti-tuberculosis medications can result in adverse effects on the body. Anti-tuberculosis medications may induce haematological abnormalities, including leucocytosis, leukopenia, and eosinophilia. 10 TB treatment with ATDs can reduce the number of leukocytes, which had previously increased due to infection, so that after a few months of treatment, the leukocyte count and differential leukocyte count return to normal levels.

Previous research have indicated that, despite the availability of therapy, tuberculosis can adversely affect Health-Related Quality of Life (HRQoL).^{10,11} Individuals with chronic diseases can sustain prolonged lifespans despite the challenges posed by chronic sickness or impairment; therefore, healthcare services must prioritise quality of life. In addition to the therapeutic components highlighted in tuberculosis management programs, the quality of life of tuberculosis patients is regarded as a significant element for evaluation.¹²⁻¹⁴ The correlation between quality of life and the efficacy of antituberculosis treatment is underscored by the assertion that an individual afflicted with tuberculosis would suffer a deterioration of the immune system, resulting in health complications, and is traditionally linked to substandard living conditions. Proceeded with results on other quality of life determinants.¹⁵ The length of TB treatment can induce alterations in the health state of patients, both physically and psychologically, thereby impacting the quality of life of individuals with pulmonary TB.¹⁶ The aforementioned research indicates that an individual afflicted with tuberculosis will see a decline in immune system function. Tuberculosis entails an inflammatory process that can impact the hemopoietic system, resulting in various alterations in haematological examination outcomes, including leukocyte, erythrocyte, platelet counts, and Erythrocyte Sedimentation Rate (ESR).¹⁷ Balai Besar Kesehatan Paru Masyarakat (BBKPM) in Makassar is a governmental organization dedicated to tuberculosis management. According to the researchers' observations, the assessment at the lung clinic is thorough, prompting tuberculosis patients to pursue treatment

there. Certain individuals undergo a comprehensive assessment and are subsequently referred for treatment at alternative healthcare facilities. The assessment at the lung clinic is crucial for comprehending tuberculosis treatment patterns to avert treatment errors and enhance quality of life through efficient therapy. Previous research on the knowledge and adherence of tuberculosis patients in Makassar indicated that multiple factors affect the outcome of tuberculosis treatment.⁹ The aforementioned description and prior research indicate that the duration and efficacy of antituberculosis medications influence the fluctuation in leukocyte counts, necessitating prompt intervention in the treatment protocol to mitigate adverse effects on the healing process. Consequently, the researchers anticipate that this study will evaluate clinical outcomes in relation to quality of life and the efficacy of antituberculosis treatment in patients with tuberculosis.

MATERIALS AND METHODS

This study employs a cohort research design utilizing a prospective data collection method derived from the medical records of tuberculosis patients and the Short Form-36 (SF-36) instrument, implemented through purposive sampling procedures. Sample calculations suggest that 41 people are required for this investigation. The study was carried out in the Balai Besar Kesehatan Paru Masyarakat Makassar in Makassar City, South Celebes Province. The inclusion criteria for this study encompass patient medical records indicating a diagnosis of tuberculosis, pulmonary TB patients who have received ATDs therapy at the Makassar Centre for Community Lung Health, patients with comprehensive blood test results, and individuals aged over 18 years. The exclusion criteria for this study encompass tuberculosis patients with HIV comorbidity and individuals lacking medical records or comprehensive blood testing. The cohort approach was used for the investigation of Tuberculosis (TB) treatment efficacy because it facilitates the longitudinal assessment of causal linkages, identification of risk variables, and precise measurement of outcomes. Cohorts enable researchers to monitor tuberculosis patients from the initiation of treatment to the ultimate outcome. Tuberculosis necessitates prolonged therapy, making a cohort design optimal for the ongoing assessment of patient improvement.

This research data will undergo statistical analysis via bivariate analysis to evaluate the significance of variables, facilitating a meaningful comparison between the relationship of quality of life and treatment efficacy through the measurement of leukocyte and neutrophil counts. This research data will undergo statistical analysis via bivariate analysis to evaluate the significance of variables, facilitating a meaningful comparison between the relationship of quality of life and treatment efficacy through the measurement of leukocyte and neutrophil white blood cells.

RESULTS AND DISCUSSION

The clinical outcome represents the patient's response to treatment in relation to the efficacy of the therapy administered.¹⁸ This study employs stringent selection criteria for patient samples and concentrates on biological mechanisms or local reactions, so 41 participants are enough if substantiated by statistical analyses. Population representation is guaranteed by rigorous inclusion criteria, valid sampling methods, and subject uniformity. Nevertheless, the extrapolation of findings should be approached with prudence and accompanied with honesty concerning constraints. This study measures kinetic outcomes based on the efficacy of antituberculosis treatment in relation to leukocyte and neutrophil levels. Favourable clinical outcomes, like symptom alleviation or recovery from tuberculosis, directly enhance patients' quality of life. Individuals who achieve physical recovery are better equipped to engage in everyday activities, maintain employment, and partake in social interactions.¹⁹

This study was performed at the Balai Besar Kesehatan Paru Masyarakat (BBKPM) in Makassar. Data collecting commenced in March-April 2024, with an intensive phase followed by a follow-up phase. The data was obtained from patient medical records via questionnaires administered directly by the researcher to 40 respondents. The data was subsequently processed and statistically analysed utilising the Statistical program. The objective of this data analysis is to assess the impact of antituberculosis efficacy on the quality of life of tuberculosis patients at the Balai Besar Kesehatan Paru Masyarakat Makassar (BBKPM) in Makassar. This will outline the attributes of the respondents and the clinical results achieved.

The data in Table 1 indicates that, on average, male patients are more significantly impacted by tuberculosis, comprising 22 patients (55%). This aligns with the research indicates that the prevalence of tuberculosis cases is higher in males than in women. This results from the less healthful lifestyle of men, including smoking and alcohol consumption, which can diminish the body's immune response to tuberculosis pathogens, rendering the body more vulnerable to TB infection. Numerous prior research indicate that men exhibit greater mobility and social engagement outside the home than women, hence elevating the risk of exposure to tuberculosis agents.²⁰ The adult demographic under 60 years old exhibits the highest prevalence of tuberculosis, with 34 individuals (85%). The 2022 global TB report indicates that the largest incidence of TB cases in Indonesia occurs among the productive age demographic, particularly among individuals aged 45 to 54 years. That age is when most individuals are employed. Four. This aligns indicated that individuals of productive age face a 5 to 6 times greater chance of acquiring pulmonary tuberculosis. This pertains to the elevated activity levels throughout the productive age, augmenting the probability of exposure to tuberculosis pathogens. Moreover, the tuberculosis germs exhibit increased activity in adults of working age.²¹ The prevalence of

tuberculosis is greatest among the unemployed, comprising 11 patients (28%). This corresponds with prior research indicating that an individual's occupation influences family income, which subsequently affects daily living patterns, including the consumption of unhealthy food, health status maintenance, and the absence of a healthy home environment characterised by high population density, insufficient ventilation and lighting, as well as suboptimal temperature and humidity conditions. Failure to meet physical, mental, and social demands can adversely impact health, leading to a weakened immune system and increased susceptibility to diseases caused by germs, such as pulmonary tuberculosis.²² The prevalence of tuberculosis patients is greatest among those with a secondary education, totalling 28 patients (70%). This corresponds with Bintang's research findings, which indicated that the majority of respondents possessed a high school education, including 60%. Adolescents exhibit insufficient awareness of tuberculosis prevention and typically exhibit a disregard for healthy lifestyle practices, frequently participating in outdoor activities.^{23,24}

During the therapy phase, the intensive phase was characterized by the presence of 20 patients, constituting 70% of the total. The intense phase is a vital stage in tuberculosis treatment.²⁵ Consequently, during the intensive phase, patients are closely monitored for compliance and observation, receiving enhanced supervision and support from healthcare providers, frequently through Directly Observed Therapy (DOT), a strategy employed in healthcare services to ensure more rigorous monitoring of data during this phase. The data indicates that a greater number of patients encountered adverse effects, with 31 individuals (78%) experiencing symptoms including pruritus, vertigo, and arthralgia. Which indicates that the prolonged duration of tuberculosis therapy, involving various medications, presents a significant risk of side effects or toxicity.²⁶ The side effects seen in this trial are attributable to the combination of Rifampicin, Isoniazid, Pyrazinamide, and Ethambutol, which exhibit variability in bioavailability, potentially leading to diverse individual reactions while being administered as a fixed-dose combination. The vertigo effect from Isoniazid may result from GABA neurotransmitter activity in response to Rifampicin, whereas pruritus can come from histamine release due to hypersensitivity to both Rifampicin and Isoniazid. Furthermore, the utilisation of Pyrazinamide contributes to the accumulation of uric acid.

Clinical Outcome

The data presented indicates that the leukocyte levels in a sample of 40 individuals decreased from an average of 16.55 prior to ATDs consumption to 10.30 subsequent to ATDs use. This is attributable to the function of leukocytes as the body's cellular and humoral defence against pathogens and exogenous chemicals. Tuberculosis is an infection caused by the Mycobacterium tuberculosis bacteria; hence, during a tuberculosis infection,

leukocytes fulfil their function by enhancing the immune response, resulting in an elevation of leukocyte levels. Normal leukocyte counts following ATDs in tuberculosis patients may indicate the body's reaction to the healing process and treatment efficacy. The typical leukocyte count in tuberculosis patients under treatment is attributable to the pharmacological response that gradually eradicates the *Mycobacterium tuberculosis* germs throughout the therapy.²⁷ ATDs can inhibit bacterial proliferation and eradicate germs, thereby reducing the bone marrow's capacity to generate new blood cells.

The normalcy test findings indicated that the leukocyte group prior to ATDs consumption had a value of 0.72. Concurrently, the outcome following the ingestion of ATDs was 0.01. The distribution is not normal due to one variable failing to satisfy the normality criterion states that if the significance value exceeds 0.05, the Wilcoxon test serves as an alternative to the Paired t-test.²⁸ Table 2 presents the Wilcoxon test findings, indicating a significant (2-tailed) value of 0.01. Given that 0.01 is less than 0.05, it can be inferred that there is a significant difference in leukocyte counts in tuberculosis patients before and after the initiation of ATDs treatment. The administration of ATDs accelerates the demise of *Mycobacterium tuberculosis*, prompting the body to indicate a reduction in the proliferation and differentiation of leukocyte components. This is the reason for the reduction of leukocytes following therapy.

Table 3 presents the Wilcoxon test findings, indicating a significant value of 0.01. Given that 0.01 is less than 0.05, it can be inferred that there is a significant difference in neutrophil counts in tuberculosis patients before and after the initiation of ATDS treatment.

Quality of Life

The instrument employed to assess the quality of life of tuberculosis patients in this study is the Indonesian adaptation of the Short Form-36 (SF-36). The Short Form-36 (SF-36) is a standardised tool for evaluating quality of life, particularly in individuals with chronic illnesses. Table 4 indicates application of SF-36 in tuberculosis cases has not been extensively adopted, despite Tuberculosis (TB) being a chronic disease that continues to present a significant global health challenge, contributing to mortality and morbidity with an annual death toll of approximately 1 million individuals. The questionnaire comprises eight domains encompassing a total of 36 questions, which include the physical domain (challenges in daily activities stemming from physical health concerns), the emotional function domain (restrictions in daily activities), the social function domain (constraints in social interactions), the physical state domain (four questions), the emotional state domain (difficulties in daily activities due to emotional challenges), the pain domain (experiences of pain and activity limitations resulting from pain), the vitality domain (decreased energy and sensations of fatigue), and the general

Table 1: Demographic Tuberculosis Patients.

Characteristic	Variable	(f)	Percentage (%)
Sex	Man	22	55%
	Woman	18	45%
Ages	Adult (<60 tahun)	34	85%
	Geriatric (>60 tahun)	6	15%
Jobs	Student	4	10%
	Civil servant	3	8%
	Entrepreneur	8	20%
	Private employee	3	8%
	Housewife	5	13%
	Worker	2	5%
	Fisherman	1	3%
	Retiree	3	8%
	Freelance	11	28%
Graduate	Not in school	7	18%
	High School	28	70%
	Bachelor	5	13%
Fase	Intensive	28	70%
	Continue	12	30%
Side Effect	Side Effect (itchy, dizzy, joint pain)	31	78%
	No Side Effect	9	23%

Table 2: Analysis results of the Wilcoxon test comparing leukocyte levels prior to and following the use of ATDs.

Leukocyte count	Sample	Lower	Upper	Mean		Std. Dev	p-Value
				Statistic	Std. Error		
Before	40	10.50	27.20	16.5493	0.53397	3.37714	0.01
After	40	4.30	26.30	10.2908	0.76879	4.86225	
Valid-N	40						

Table 3: Outcomes of the Wilcoxon analysis regarding neutrophil counts pre and post consumption ATDs.

Neutrophil count	Sample	Lower	Upper	Mean		Std. Dev	p-Value
				Statistic	Std. Error		
Before	40	69.50	90.40	78.9580	87527	5.53570	0.01
After	40	14.90	89.60	67.7750	2.18055	13.79098	
Valid-N	40						

health domain. Each domain receives a score ranging from 0 to 100. A higher score indicates superior quality of life in each domain. The SF-36 evaluation is performed by transforming the data from each question across the eight domains into a scale ranging from 0 to 10.²⁵

The mental health domain achieved the highest score of 70.77, signifying that the mental health status of tuberculosis patients is relatively favourable. Researchers argue that this transpires due to its role as a component of familial and relational social care for the patient. This indicates that support from family, friends, and the community is crucial for sustaining the mental health of tuberculosis patients.²⁹ The perception of support and care from loved ones alleviates the stress and anxiety associated with this illness. A score of 64.75 in the physical function domain signifies that the patient's health condition does not restrict their activities. The research before report a similar average score in the physical function dimension, indicating that most respondents feel unencumbered in their everyday activities, which are predominantly light, as the typical respondents in the study sample are not employed. In the realm of social function, a score of 62.50 was achieved, signifying that the health status of tuberculosis patients did not impede everyday activities or hinder work performance. The emotional limitation domain had a score of 61.96, suggesting that the patient's work or everyday activities are not significantly hindered by emotional concerns, while the overall health domain got 61.72. Indicating that patients' health conditions do not deteriorate following a tuberculosis diagnosis.³⁰ The SF-36 score (Short Form-36 Health Survey) assesses Health-Related Quality of Life (HRQoL) across 8 areas and 2 primary components (Physical and Mental). Nevertheless, there are no universal criteria for "good" or "bad," as these concepts are contingent upon the environment of the community and the research conducted. The standards for "good or bad" on the SF-36 are relative, contingent upon demographic norms or clinical goals. Supplementary tools assist in discerning

the underlying factors of low scores (e.g., depression vs physical symptoms) and enhance the analysis.

Research conducted indicates that tuberculosis patients exhibit the lowest scores in the vitality, pain, and physical limitation domains relative to other domains; nonetheless, they still maintain a satisfactory quality of life, since their scores exceed 50. The vitality score is 59.37, the physical restriction score is 55, and the pain level is 53.75. Despite modest pain interfering with daily tasks, the patient remains in relatively good health, and their activities are not substantially impacted. The reduction in score aligns with research indicating that tuberculosis patients frequently suffer from diminished vitality and physical constraints as a result of the disease's symptoms and treatment side effects.³¹ The SF-36 questionnaire is categorised into two dimensions: physical health and mental health. The physical health component include physical functioning, physiological discomfort, role-physical, and overall health, whereas the mental health component comprises role-emotional, vitality, social functioning, and mental health. The results derived from the calculation of quality of life scores are notably significant. The average score for physical health is 58.80, whereas the average score for mental health is 63.13. This indicates that the physical health of tuberculosis patients is more adversely impacted than their mental health, owing to direct physical symptoms and substantial treatment side effects.²⁹ Nonetheless, social support, a comprehensive understanding of the disease, and sufficient mental health services contribute to the preservation of patients' mental health at an improved level. The study's result reveals that the average overall quality of life across the eight areas is 61.22, signifying that tuberculosis patients experience a favourable quality of life. The scoring methodology for the SF-36, as outlined in the MOS (Medical Outcomes Study) and RAND Corporation criteria, involves calculating the average for each domain. The score conversion employed is an average score of ≤ 50 , signifying a compromised quality of life, whereas a score of >50 denotes a favourable quality of life. The score's

Table 4: Quality of Life Tuberculosis Patients.

Domain	Mean SD
Physical function	64,75
Physical role	55
Body pain	53,75
General Health	61,72
Vitality	59,37
Social function	62,50
Emotional limit	61,96
Mental Health	70,77
TOTAL	61,22

interpretation applies to both domain-specific quality of life and the overall quality of life score.

Socioeconomic factors significantly influence Tuberculosis (TB) treatment adherence and patient quality of life, frequently establishing systemic barriers that exacerbate disease outcomes. Socioeconomic issues engender a detrimental cycle: poverty, non-compliance, adverse consequences, and exacerbated impoverishment. A multidisciplinary strategy encompassing health, social, and economic factors is crucial to disrupt this cycle. Data from Indonesia indicates that integrated interventions can enhance adherence by as much as 40% and improve Quality of Life (QoL) ratings by 25 points (SF-36) over a period of 2 years.

Research from Makassar underscores the significance of a comprehensive approach (medical-social-economic) in addressing tuberculosis. Program replication must take into account the local environment (culture, geography, health system), prioritise community engagement, and implement rigorous monitoring through straightforward metrics (compliance rates, recovery). The Makassar model can effectively contribute to global objectives with appropriate adaptation.

CONCLUSION

Measurement of quality of life using SF 36 shows that most patients have a good quality of life after undergoing treatment with an average score of 61.22. The results of this study indicate that Antituberculosis Therapy (ATDs) is not only effective in reducing neutrophil and leukocyte levels to normal but also contributes to the improvement of the quality of life of tuberculosis patients. This shows a relationship between quality of life and the effectiveness of ATDs in achieving optimal clinical outcomes in TB patients.

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ABBREVIATIONS

ATDs: Anti-Tuberculosis Drugs; **BBKPM:** Balai Besar Kesehatan Paru Masyarakat; **ESR:** Erythrocyte Sedimentation Rate; **DOTS:** Directly Observed Treatment Short-course; **HRQoL:** Health-Related Quality of Life; **MOS:** Medical Outcomes Study; **RAND:** RAND Health Care promotes healthier societies by improving health care systems in the United States and other countries; **SF-36:** Short Form-36 Survey Instrument by RAND Health Care; **TB:** Tuberculosis.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

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ETHICAL APPROVAL

This research is approval by Ethics Universitas Muslim Indonesia with Register number UMI012402069.

SUMMARY

The questionnaire comprises eight domains encompassing a total of 36 questions, which include the physical domain (challenges in daily activities stemming from physical health concerns), the emotional function domain (restrictions in daily activities), the social function domain (constraints in social interactions), the physical state domain (four questions), the emotional state domain (difficulties in daily activities due to emotional challenges), the pain domain (experiences of pain and activity limitations resulting from pain), the vitality domain (decreased energy and sensations of fatigue), and the general health domain. The reduction in score aligns with research indicating that tuberculosis patients frequently suffer from diminished vitality and physical constraints as a result of the disease's symptoms and treatment side effects. The SF-36 questionnaire is categorized into two dimensions: physical health and mental health. The scoring methodology for the SF-36, as outlined in the MOS (Medical Outcomes Study) and RAND Corporation criteria, involves calculating the average for each domain. The average score for physical health is 58.80, whereas the average score for mental health is 63.13.

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