

Incidence of Tuberculosis in Primary Health Care during the COVID-19 Pandemic: A Longitudinal Study and Perspective from Eastern Indonesia

Firshan Makbul¹⁾, Darmawati Amir²⁾

¹⁾Faculty of Medicine, Hasanuddin University, Makassar, Indonesia

²⁾Lau Primary Health Care Center, Maros, Indonesia

Received: 11 September 2023; Accepted: 31 October 2023; Available online: 16 January 2024

ABSTRACT

Background: Efforts to fight tuberculosis (TB) infection requires a deep understanding of disease control trends to consistently sustain and enhance the identification and treatment of at-risk populations. Indonesia is the third highest globally in TB cases, followed by India and China, accounting for about 10% of all cases. Over the past ten years, Indonesia has witnessed significant TB case reporting and treatment coverage growth. This study aimed to analyze TB case occurrences in a primary healthcare setting during the COVID-19 pandemic.

Subjects and Method: A cross-sectional study, which included data from the Puskesmas Lau reports from July 2021 to July 2022. A total of 71 patients were conducted using the total sampling method. The collected data were processed descriptively to summarize participants' demographic characteristics and clinical profiles and various important indicators from WHO were analyzed to determine its effectiveness.

Results: The center's tuberculosis screening efforts have not reached their optimal level, falling below the national standard of $\geq 70\%$ for the Case Detection Rate (CDR). However, the treatment success rate (SR) exceeds 90%.

Conclusion: The evaluation of the TB control program at Puskesmas Lau reveals achievements in some areas but also highlights challenges posed by the pandemic and the need for strengthened strategies to improve case detection and management. Perceived vulnerability, seriousness, benefit, and barrier, as well as the availability of DOTS treatment, affect treatment adherence. Partnership between patients and health care personnel is recommended to increase the success of TB treatment.

Keywords: Tuberculosis, primary health care, COVID-19, longitudinal study, health services

Correspondence:

Firshan Makbul. Faculty of Medicine, Hasanuddin University. Jl. Perintis Kemerdekaan No.Km. 10, Tamalanrea Indah, Kec. Tamalanrea, Kota Makassar, Sulawesi Selatan 90245. E-mail: firshanandi@gmail.com, Phone: +6281242622535.

Cite this as:

Makbul F, Amir D (2024). Incidence of Tuberculosis in Primary Health Care during the COVID-19 Pandemic: A Longitudinal Study and Perspective from Eastern Indonesia. J Epidemiol Public Health. 09(01): 117-128. <https://doi.org/10.26911/jepublichealth.2024.09.01.11>.



© Firshan Makbul. Published by Master's Program of Public Health, Universitas Sebelas Maret, Surakarta. This open-access article is distributed under the terms of the [Creative Commons Attribution 4.0 International \(CC BY 4.0\)](https://creativecommons.org/licenses/by/4.0/). Re-use is permitted for any purpose, provided attribution is given to the author and the source is cited.

BACKGROUND

Tuberculosis (TB) is a multisystemic disease with diverse presentations and manifestations, representing the leading cause of

death attributed to communicable diseases on a global scale. It is triggered by pathogens within Mycobacterium group, specifically Mycobacterium Tuberculosis (Kemenkes RI,

2015). In 2019, a staggering 1.4 million individuals succumbed to TB among the 10 million individuals afflicted worldwide (including 208,000 individuals co-infected with HIV). A substantial projection indicates that 95% of TB cases and 98% of TB-related deaths occur in developing nations (WHO, 2019). Indonesia witnessed 562,049 new TB cases in 2019 (per WHO data updated until 13 November 2020). Remarkably, Indonesia ranks third globally, following India and China, in terms of its TB patient count, representing approximately 10% of the worldwide total (Kemenkes RI, 2018). Over the past decade, both the TB case notification rate and treatment coverage have experienced substantial growth.

Moreover, focusing on South Sulawesi province, the estimated incidence reached 30,985 cases within a populace of 8,771,970. However, the documented cases stood at 23,427, resulting in a Case Notification Rate (CNR) of 267 per 100,000 residents and a case detection rate of 75.6% (Dinkes Prov Sulawesi Selatan, 2015; Kemenkes RI, 2018). Reports from the South Sulawesi Provincial Health Office for 2015 reveal that each district/city recorded 12,625 pulmonary TB cases. Among these, 8,348 were identified as acid-fast bacilli (AFB) smear-positive sputum cases, of which 7,008 individuals (78.36%) recovered. Furthermore, 8,943 individuals underwent treatment for AFB smear-positive sputum. Among children aged 0-14 years, 581 cases of TB were reported, with 680 individuals (7.60%) completing treatment and achieving a commendable success rate of 85.97% (comprising 84.58% men and 88.04% women) (Dinkes Provinsi Sulawesi Selatan, 2015).

The leading cause of TB's increasing burden is poverty across various populations, including developing countries, and the failure of prevention and control programs. Additionally, the inadequacies of TB

prevention and control programs contribute to this trend. These inadequacies may arise from factors such as insufficient TB service organization (limited public accessibility, non-standard case discovery/diagnosis, unreliable drug supply, lack of standardized monitoring, recording, and reporting) and suboptimal case management (non-standard diagnosis and drug regimens, failure to cure diagnosed cases) (WHO, 2014; Kemenkes RI, 2015).

The WHO envisions a world free from TB, devoid of TB-related deaths, diseases, and suffering, with a mission to end the global TB epidemic. Indicators are necessary for evaluating and monitoring the success of a program. WHO established three TB indicators and their targets that countries worldwide should achieve in The End TB Strategy: Global Strategy and Targets for Tuberculosis Prevention, Care and Control After 2015 in 2014. These indicators include reducing TB deaths by 95% by 2035 compared to the deaths in 2015, decreasing TB incidence by 90% by 2035 compared to 2015 (less than 10 TB cases per 100,000 population), and ensuring no TB patient's family faces financial burden due to TB treatment by 2035 (WHO, 2014).

The top 10 priority indicators for assessing progress or success in implementing TB control globally and nationally include a Case Detection Rate (CDR) of $\geq 90\%$ for new smear-positive TB cases treated, a TB treatment Success Rate (SR) of $\geq 90\%$, 0% of TB-exposed households burdened with TB treatment costs, $\geq 90\%$ of new and relapse TB cases tested using WHO-recommended rapid tests at initial diagnosis, a $\geq 90\%$ coverage of treatment for latent TB infection, a $\geq 90\%$ coverage of contact investigation with TB patients, 100% continuation of treatment testing for TB patients, $\geq 90\%$ treatment with new TB drugs, 100% documentation of HIV status in

TB patients, and a Case Fatality Ratio (CFR) of $\leq 5\%$.

CDR represents the percentage of estimated new smear-positive TB patients found and treated among the estimated total new smear-positive TB patients in a given area. The target CDR for pulmonary smear-positive TB patients in Indonesia has reached 67% (WHO, 2019). SR is the percentage of new pulmonary smear-positive TB patients who complete treatment (either cured or completed) among the total registered new pulmonary smear-positive TB patients. The SR for pulmonary smear-positive TB patients in Indonesia has reached 83%. CFR is the number of laboratory-confirmed death out of the individuals with confirmed or suspected disease symptoms. The CFR for pulmonary smear-positive TB patients in Indonesia has reached 11% (WHO, 2019). These achievements have yet to meet the expected targets, implying that Indonesia's TB control efforts have failed.

Ending TB infection requires knowledge of disease control patterns to sustain and enhance efforts in identifying and treating illnesses in populations at risk of TB. This research aims to determine TB patients' characteristics at the Lau Primary Health Care Center, enabling an evaluation of TB prevalence and prevention strategies.

SUBJECTS AND METHOD

1. Study Design

This cross-sectional study was conducted at Lau community health center, from July 2021 to July 2022.

2. Population and Sample

The population consists of all subjects who were under investigation and met the specified characteristics. This study comprises TB patients who underwent treatment at Puskesmas Lau Maros. The sample was obtained by including the entire population that met the inclusion criteria: 1) registered

in the TB control program registration book and Puskesmas Lau website, diagnosed clinically or bacteriologically with tuberculosis between July 2021 and July 2022; 2) for pulmonary TB cases, primary symptoms such as persistent cough for approximately two weeks, with or without additional symptoms (coughing up blood, shortness of breath, fatigue, loss of appetite or weight, malaise, night sweats, prolonged fever); 3) for extra-pulmonary TB cases, symptoms and complaints depend on the affected organ with some symptoms of pulmonary TB, ruling out other possible diseases through supportive examinations and excluding samples that meet exclusion criteria (patients with incomplete medical record data). The sample was obtained from all TB patients who underwent examinations at Puskesmas Lau during the data collection period.

3. Study Variables

These study variables capture essential demographic, clinical, and treatment-related data for the tuberculosis cases under investigation. Each variable provides vital knowledge into the characteristics and management of TB patients over a particular time frame.

4. Conceptual Definition

The report provides key variables for further study.

Gender: is the biological and social classification of men and women.

Age: categorizes people into children (0-17 years), adults (18-60 years), and the elderly (>60 years), enabling a more detailed study of age-related phenomena.

TB Classification: classifies cases into Pulmonary Tuberculosis (PTB) and Extra-Pulmonary Tuberculosis (EPTB) based on clinical assessments and diagnostic testing.

Type of Patients: classifies tuberculosis patients as new relapse, resuming treatment

after a break, unknown, revealing clinical history and treatment status.

Drug Regimen: variable classifies instances by DOTS Categories 1, 2, and pediatric treatment plans.

Type of Confirmed Diagnosis: section distinguishes clinical and bacteriological confirmation.

HIV Test: HIV test results are classified as positive, negative, or unknown.

DM Test: classifies people by diabetes mellitus test results-positive, negative, or unknown.

Treatment Outcome: indicates treatment response: recovery, completed treatment, undergoing treatment, or deceased.

Geographic Distribution: lists cases within and outside Lau's health center authority, revealing the facility's reach and influence.

5. Study Instruments

The data used for the analysis were sourced from the Puskesmas Lau reports on the <http://sitb.id> website, covering the period from July 2021 to July 2022, and were managed using the Microsoft Excel application.

6. Data Analysis

The collected data were processed descriptively to summarize participants' demographic characteristics and clinical profiles. This information was then showcased through distribution tables. A comprehensive evaluation of the tuberculosis (TB) control program at Puskesmas Lau was conducted, and various important indicators from WHO were analyzed to determine its effectiveness.

7. Research Ethics

All information gathered for this study was kept strictly confidential. Personal identifiers were anonymized, and sensitive information was only accessible to authorized

research employees during the study. Data was securely stored, and all electronic files were password-protected.

RESULTS

A total of 71 tuberculosis cases were recorded at the health facility in Lau spanning the period between July 2021 and July 2022 in Table 1. At Lau's health center, a higher occurrence of tuberculosis cases was noted among females (59%) than males (41%). Grouped by age, tuberculosis cases were classified into three segments: children (0-17 years), adults (18-60 years), and the elderly (>60 years). The analysis revealed that the most significant cases were prevalent within the adult age bracket (82%). Regarding TB classification, pulmonary tuberculosis (PTB) instances were more frequent than extra-pulmonary tuberculosis (EPTB). Specifically, there were 70 cases of PTB, constituting 99%, while EPTB accounted for just 1% with one case. Among the cases, 54 were classified as new TB cases (76%), 14 as cases of recurrence (20%), and 1 case involved resuming treatment after a break (1%). Furthermore, there were 2 cases (3%) with an undisclosed medical history.

Based on the type of confirmed diagnosis, clinical diagnosis accounted for 13 cases (18%), while bacteriological confirmation was present in 58 patients (82%). Regarding the medication administration classification, TB cases at Lau's health center were guided by the prescription of drug regimens categorized as Directly Observed Treatment, Short-course (DOTS) Category 1 (76%), Category 2 (20%), and pediatric category (4%). Human immunodeficiency virus (HIV) test results revealed no patients with both positive HIV and TB; two individuals (3%) tested negative, and 69 cases (97%) had unknown results.

Table 1. Incidence of TB cases at Lau Health Center from July 2021 to July 2022 (N=71)

Characteristics	Category	Frequency (n)	Percentage (%)
Gender	Female	42	59.0
	Male	29	41.0
Age	Children	4	5.0
	Adult	58	82.0
	Elderly	9	13.0
TB Classification	Pulmonary	70	99.0
	Extrapulmonary	1	1.0
	New	54	76.0
Type of patients	Relapse	14	20.0
	Resuming treatment after a break	1	1.0
	Unknown	2	3.0
Drug regimen	Category 1	54	76.0
	Category 2	14	20.0
Type of confirmed diagnosis	Pediatric	3	4.0
	Clinical	13	18.0
	Bacteriological	58	82.0
HIV test	Unknown	69	97.0
	Negative	2	3.0
DM test	Positive	0	0.0
	Unknown	52	74.0
	Negative	5	7.0
Treatment Outcome	Positive	13	19.0
	Recover	8	11.0
	Complete Treatment	35	49.0
Geographic distribution	Undergoing treatment	27	38.0
	Death	1	2.0
	Lau	65	92.0
	Outside Lau	6	8.0

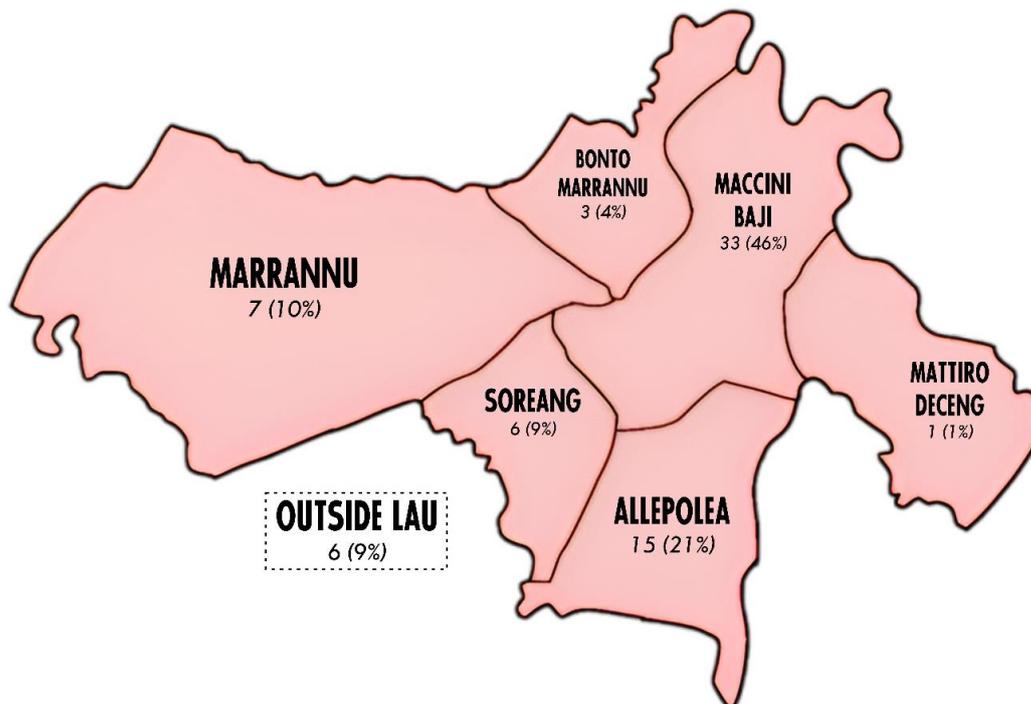


Figure 1. Geographic Distribution of TB Cases in Lau Primary Healthcare

Diabetes mellitus (DM) test results indicated that 13 cases (19%) tested positive for DM, 5 cases (7%) tested negative, and 52 cases (74%) had unknown results. Recovery outcomes varied, with 8 cases (11%) showing recovery (bacteriological tests turning negative at the end of treatment), 35 cases (49%) completing treatment as per the prescribed drug regimen despite the absence of evidence of bacteriological recovery, 27 cases (38%) still undergoing treatment, and one person (2%) passing away during treatment. Geographically, 65 patients (92%) were within Lau's health center jurisdiction, while 6 cases (8%) were outside in Figure 1. The number of cases increased from July 2021 to July 2022 in Figure 2. There was an escalation from 21 individuals in July-December 2021 to 50 individuals in January to July 2022. Similarly, screening for suspected TB also increased, going up from 51 individuals to 265 individuals.

The effectiveness of the tuberculosis (TB) control program at Puskesmas Lau is assessed through various indicators:

1. **Cure Rate:** The cure rate is determined by the number of patients who successfully recovered among all treated TB patients. The minimum target achievement is 85%, and the calculated rate is 88.89%.
2. **Treatment Success Rate:** This rate considers patients who completed treatment (recovery or completion) among all treated TB patients. The target is met with a rate of 97.72%.
3. **Case Fatality Rate (CFR):** CFR reflects the proportion of TB-positive cases that

result in death. The target is $\leq 5\%$ and the calculated rate is 1.4%.

4. **Case Detection Rate (CDR):** CDR represents the percentage of new smear-positive TB cases detected compared to the estimated new smear-positive cases in the area. The CDR for Puskesmas Lau is 61.2%, below the Ministry of Health's target of 70%. Challenges in cooperation and reduced health facility visits during the COVID-19 pandemic are attributed to low case detection.
5. **Suspect Screening Rate:** This rate, indicating the number of individuals tested for sputum among the population within a year, is 1,145 per 100,000 population.
6. **Proportion of Pediatric TB Patients:** Pediatric TB patients (<18 years) represent 5.6% of all TB cases, aligning with the acceptable limit of 15%. Higher proportions may lead to overdiagnosis.
7. **Case Notification Rate (CNR):** The CNR, indicating new cases per 100,000 population, is 257. It provides insights into the trend of case identification in Puskesmas Lau.
8. **The Proportion of Smear-Positive TB Patients:** This proportion, at 10.1%, adheres to the 5-15% standard. Elevated proportions could arise from rigorous screening or laboratory issues.

The evaluation of the TB control program at Puskesmas Lau reveals achievements in some areas but also highlights challenges posed by the pandemic and the need for strengthened strategies to improve case detection and management.

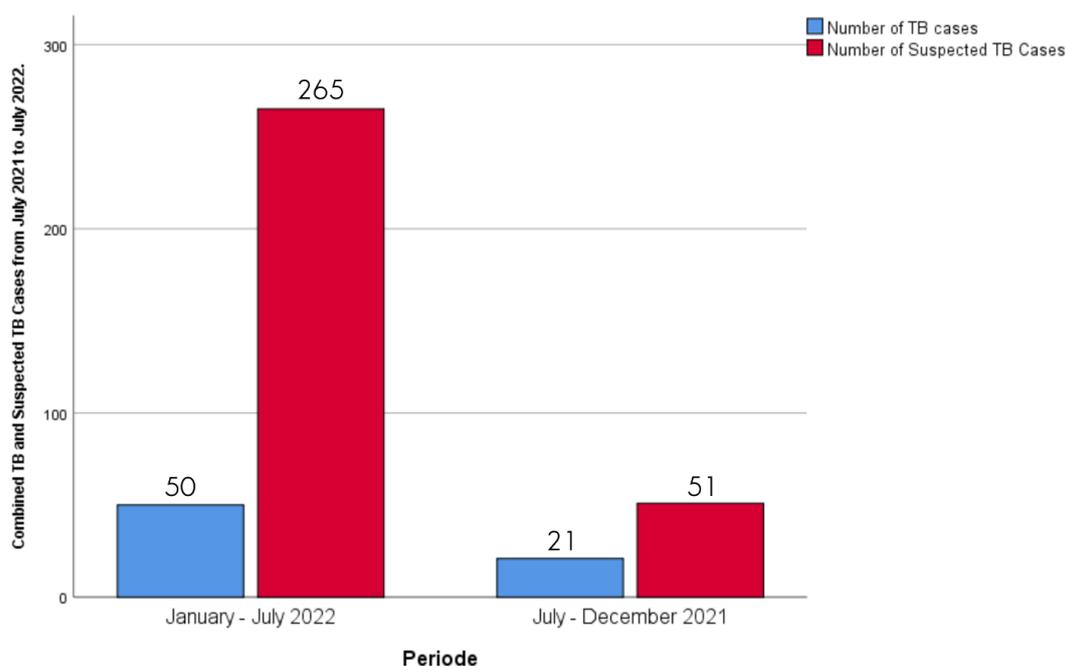


Figure 2. Combined TB and Suspected TB Cases from July 2021 to July 2022

DISCUSSION

Tuberculosis is among the top 10 diseases with the highest mortality rates globally and ranks first among infectious diseases. It is crucial for countries with high tuberculosis prevalence, such as Indonesia, to analyze tuberculosis cases in the community, particularly in primary health facilities. Research conducted at Lau Health Center found that the distribution of TB cases by gender was higher among males, accounting for 59%. Various domestic and international studies have reported a high male-to-female ratio among tuberculosis patients. For instance, in Padang, it was reported that over 50% of tuberculosis cases were male (Mughtar et al., 2018). Similar trends were observed in China (Zhang et al., 2020). Tuberculosis among males has also been observed in developed countries like the United States (Haddad et al., 2015). The higher number of tuberculosis cases in males is attributed to their higher mobility, increasing their likelihood of exposure (Sukmawati et al., 2017). Poor lifestyle habits, such as smoking and

alcohol consumption, can weaken immune system, making males more susceptible to *Mycobacterium tuberculosis* infection.

Regarding age, tuberculosis can affect individuals of all age groups. In this study, tuberculosis cases were categorized into three age groups: children (0-17 years), adults (18-60 years), and the elderly (>60 years). The analysis revealed that the highest number of cases occurred in the productive adult age group (18-60 years), accounting for 82%, followed by the elderly (>65 years) at 13% and children at 5%. The prevalence of tuberculosis cases among productive adults is consistent with findings from other studies with similar age groupings (Haddad et al., 2015; Zhang et al., 2020). According to Information (Pusdatin Kemenkes RI, 2018), the incidence of tuberculosis tends to increase with age, possibly due to the longer duration of exposure and the higher risk of reactivation. Another study (Sukmawati et al., 2017) also highlighted that the high incidence of tuberculosis among productive adults is linked to their high mobility and

frequent interactions with large groups of people.

TB can be classified based on the location of infection into Pulmonary Tuberculosis (PTB) and Extra-Pulmonary Tuberculosis (EPTB). The research conducted at Lau Health Center revealed that most cases were PTB (99%), while EPTB cases were only 1%. This aligns with the findings of Azizi et al. (2014), who found that pulmonary tuberculosis (89.2%) more common than extra-pulmonary tuberculosis (10.8%). The risk of extra-pulmonary tuberculosis is influenced by factors such as females, age ≥ 45 years, HIV positivity, excessive alcohol consumption in the past 12 months, and kidney failure (Qian et al., 2018). In Lau Health Center, the majority of tuberculosis cases were newly diagnosed, with 54 new cases (76%), 14 relapse cases (20%), and only 1 case of treatment resumption after interruption (1%). Similar findings were reported by Qiyaam et al. (2020), where the majority of patients (93.50%) were new cases, and a smaller percentage (6.49%) experienced relapse.

The National Tuberculosis Control Guidelines (Dirjen P2P, 2014) define new cases as patients who have never received tuberculosis treatment or have received treatment for less than one month, with positive or negative Bacteriological Test for Acid-Fast Bacilli (AFB) results. Relapse cases, on the other hand, are patients who were previously treated for tuberculosis, declared cured or completed treatment, and were diagnosed again with a positive Bacteriological Test for AFB. Various factors can contribute to relapse in tuberculosis patients, including HIV positivity, diabetes mellitus, the presence of cavities during initial diagnosis, positive bacteriological test for AFB during the second month of treatment, and low education levels linked

to treatment adherence (Jo et al., 2014; Mirsaeidi and Sadikot, 2018).

According to WHO (2014), treatment interruption refers to pulmonary tuberculosis patients with a positive Bacteriological Test for AFB for two or more months of consecutive treatment interruption. Side effects of treatment and the lack of Directly Observed Therapy (DOT) can increase the risk of treatment interruption in tuberculosis cases (Susmaneli et al., 2016; Kiros et al., 2020). Tuberculosis treatment guidelines are divided into several categories: Category 1 First-Line anti-tuberculosis drugs, Category 2 First-Line anti-tuberculosis drugs, Multi-Drug Resistant (MDR) tuberculosis, and pediatric categories based on body weight. The research findings at Lau Health Center indicated that 54 patients (76%) received Category 1 treatment, 14 patients (20%) received Category 2 treatment, and three patients (4%) fell under the pediatric category. No multiple drug resistance (MDR) tuberculosis cases were reported at Lau Health Center during this period. These results are consistent with the study conducted by Qiyaam et al. (2020), where 93.50% of patients were categorized under Category 1 treatment and 6.49% under Category 2 treatment. Tuberculosis diagnosis can be established through bacteriological or clinical approaches. Bacteriologically confirmed tuberculosis refers to positive AFB examination results, culture, or Molecular Genetic Test (MGT) results. Clinically confirmed tuberculosis refers to patients who do not meet the criteria for bacteriologically confirmed tuberculosis but show clinical and radiological symptoms supporting the diagnosis (Anam et al., 2018; Ruru et al., 2018).

This research at Lau Health Center identified 58 patients with bacteriologically confirmed tuberculosis (82%), and the remaining 13 patients were clinically con-

firmed (18%). Clinical diagnosis of tuberculosis facilitates diagnosis in patients who have difficulty producing sputum but exhibit typical tuberculosis symptoms. Patients initially clinically confirmed but later tested bacteriologically positive may have their diagnosis changed to bacteriologically confirmed tuberculosis (Bélaré et al., 2016). Tuberculosis is a common infection among individuals with HIV/AIDS due to compromised cellular immunity caused by HIV infection, leading to various opportunistic infections such as tuberculosis. TB-HIV coinfection is a significant challenge faced in Indonesia (Baedowi et al., 2020). According to the HIV testing results of tuberculosis patients at Lau Health Center, there were no confirmed cases of HIV positivity, two individuals confirmed as HIV negative (3%), and 69 tuberculosis patients who had not been tested for HIV. Another study reported a TB-HIV coinfection rate of 39.3% (Zhang et al., 2019; Baedowi et al., 2020). Coinfected TB-HIV patients face an increased risk of mortality, up to 3-4 times higher.

The prevalence of TB patients with DM is even higher than that of TB-HIV coinfection. Therefore, screening for DM in tuberculosis patients and vice versa is crucial. The analysis of DM testing in tuberculosis patients at Lau Health Center revealed 13 positive DM cases, five negative DM cases, and 52 cases where DM status was unknown. In Indonesia, a study reported a 23.4% prevalence of tuberculosis patients with DM (Sasmita et al., 2019). The treatment outcomes for tuberculosis patients can vary. Approximately 80-90% of tuberculosis patients receive successful and complete treatment, 4-7% die, and the remaining cases experience treatment failure (Bélaré et al., 2016; Tola et al., 2019). According to the Lau Health Center data, eight patients achieved a cure (11%), 35 completed treatment (49%), 27 were undergoing treatment

(38%), and one individual died (2%). Factors that increase mortality in tuberculosis patients include old age, comorbid conditions such as HIV and DM, lung cavities, and miliary tuberculosis (Bélaré et al., 2016; Tola et al., 2019).

The achieved CDR result falls short of the Ministry of Health's target of at least 70%. The inability to achieve target goals in patient identification indicates that TB screening at Lau Health Center still needs to be optimized. This issue can be attributed to insufficient collaboration, despite the health center personnel's active efforts in providing TB education. However, the lack of community involvement in seeking diagnosis and treatment at the health center hinders these efforts. The impact of the COVID-19 pandemic, which has led to reduced visits to the health center, is one of the reasons for the lower number of tuberculosis patients detected. Lau Health Center encounters various obstacles in executing its tuberculosis control program, encompassing reduced community visits prompted by the COVID-19 pandemic, potentially preventing proper examination of individuals displaying tuberculosis symptoms. Additionally, data inconsistency emerges due to a shift in the TB program's person in charge, consequently causing the reported data to diverge from the proper conditions within the Lau region. Moreover, challenges encompass inadequate environmental hygiene and densely populated residential areas.

Efforts in the Lau region are undertaken to diagnose tuberculosis cases through joint activities with secondary health facilities that use MGT for more accurate tuberculosis diagnosis. Furthermore, the provision of First-Line Anti-Tuberculosis Drugs is tailored to the specific type of tuberculosis identified in patients. To address potential complications, HIV testing is conducted to detect coinfections that can elevate the risk

of mortality and morbidity among tuberculosis patients. In addition, blood sugar testing is carried out to identify Diabetes Mellitus, a condition known to exacerbate tuberculosis patient mortality and morbidity. A comprehensive approach includes conducting home visits to families of tuberculosis patients, effectively extending tuberculosis screening efforts beyond healthcare facilities, and enhancing awareness of tuberculosis risks. To further strengthen the fight against tuberculosis, dedicated tuberculosis cadres have been established and trained, contributing to the overall prevention and control of this significant health challenge.

The incidence of tuberculosis cases at Lau Health Center from July 2021 to July 2022 totaled 71 individuals, primarily comprising adults aged 18 to 60 years. Almost all reported tuberculosis cases at the health center were pulmonary tuberculosis, classified as new cases and receiving treatment under the Category 1 First-Line Anti-Tuberculosis Drugs. Out of the 71 patients, 13 had a comorbidity of type 2 diabetes mellitus, while no patients were found to have a coinfection with HIV. There was an upsurge in tuberculosis cases at Lau Health Center, with 21 cases reported from July to December 2021, compared to 50 cases in the same period the previous year (January to July 2020). CDR and SR indicators are employed to evaluate the effectiveness of TB treatment. According to the TB report from Lau Health Center for July 2021 to July 2022, the CDR indicates that the center's tuberculosis screening efforts have not yet reached an optimal level, falling short of the national indicator criterion of $\geq 70\%$. However, the treatment success rate exceeds 90%.

To improve tuberculosis case detection at Lau Health Center. These include introducing telemedicine initiatives to simplify patient screening and follow-up, collaborating with past program person in charge to

ensure accurate patient data matching, educating the community using methods like flyers and brochures, strengthening cooperation between stakeholders to maximize the utilization of facilities, and forming extensive multi-sector partnerships involving the center, health workers, the community, private clinics, nearby hospitals, and local authorities. Implementing these actions aims to raise tuberculosis case detection rates and enhance management strategies at Lau Primary Health Center.

AUTHOR CONTRIBUTION

Firshan Makbul and Darmawati Amir worked on conceptualization, formal analysis, investigation, software, writing, review, and editing the original draft. Firshan Makbul has carried out Validation and Methodology in this research. Darmawati Amir who supervised this research.

ACKNOWLEDGMENT

The researcher would like to thank all health workers from the Lau Community Health Center in Maros, South Sulawesi.

FUNDING AND SPONSORSHIP

None.

CONFLICT OF INTEREST

The authors declare that the study was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

REFERENCE

- Anam M, Syaputri H, Dadiyanto DW, Sidhartani M (2018). Faktor Risiko Tuberkulosis Paru Terkonfirmasi Bakteriologis. *Sari Pediatri*. 19(6).
- Azizi FH, Husin UA, Rusmartini T (2014). Gambaran Karakteristik Tuberkulosis Paru dan Ekstra Paru di BBKPM Bandung Tahun 2014. *Prosiding*

- Penelitian Sivitas Akademika Unisba (Kesehatan). 1(2).
- Baedowi A, Rusmini H, Prasetya T (2020). Hubungan Jumlah Viral Load Dengan Kejadian TBC Pada Pasien HIV/AIDS Yang Mendapatkan Terapi ARV. *ARTERI : J Ilmu Kesehatan*. 1(3): 233-240. doi: 10.37148/arteri.v1i3.76.
- Bélard S, Remppis J, Bootsma S, Janssen S, Kombila DU, Beyeme JO, Rossatanga EG, et al. (2016). Tuberculosis treatment outcome and drug resistance in lambaréné, Gabon: A prospective cohort study. *Am J Trop Med Hyg*. 95(2): 472-480. doi: 10.4269/ajtmh.-15-0668.
- DinkesProv Sulawesi Selatan (2015) Profil Kesehatan Provinsi Sulawesi Selatan, Makassar. Dinas Kesehatan Provinsi Sulawesi Selatan.
- Dirjen P2P (2014) Pedoman Nasional Pengendalian Tuberkulosis. Direktorat Jenderal Pengendalian Penyakit dan Penyehatan Lingkungan.
- Haddad MB, Mitruka K, Oeltmann JE, Johns EB, Navin TR (2015). Characteristics of tuberculosis cases that started outbreaks in the United States, 2002-2011. *Emerg Infect Dis*. 21(3): 508-510. doi: 10.3201/eid2103.141475.
- Jo KW, Yoo JW, Hong Y, Lee JS, Lee SD, Kim WS, Kim DS, et al. (2014). Risk factors for 1-year relapse of pulmonary tuberculosis treated with a 6-month daily regimen. *Respir Med*. 108(4): 654-659. doi: 10.1016/j.rmed.2014.0-1.010.
- Kemendes RI (2015) Profil Kesehatan Indonesia tahun 2014. Kementerian Kesehatan Republik Indonesia.
- Kemendes RI (2018) Data dan Informasi Profil Kesehatan Indonesia 2018. Kementerian Kesehatan Republik Indonesia.
- Kiros T, Dejen E, Tiruneh M, Tiruneh T, Eyayu T, Damtie S, Amogne K (2020). The magnitude and associated factors of pulmonary tuberculosis among HIV/aids patients attending antiretroviral therapy clinic at Debre Tabor Specialized Hospital, northwest Ethiopia, 2019. *HIV/AIDS- Res Palliat Care*. 12. doi: 10.2147/HIV.S282616.
- Mirsaeidi M, Sadikot RT (2018). Patients at high risk of tuberculosis recurrence. *Int J Mycobacteriology*. doi: 10.4103-/ijmy.ijmy_164_17.
- Muchtar NH, Herman D, Yulistini (2018). Gambaran Faktor Risiko Timbulnya Tuberkulosis Paru pada Pasien yang Berkunjung ke Unit DOTS RSUP Dr. M. Djamil Padang Tahun 2015. *J Kesehatan Andalas*. 7(1).
- Pusdatin Kemendes RI (2018) Infodatin Tuberculosis Indonesia. Pusat Data dan Informasi Kementerian Kesehatan Republik Indonesia.
- Qian X, Nguyen DT, Lyu J, Albers AE, Bi X, Graviss EA (2018). Risk factors for extrapulmonary dissemination of tuberculosis and associated mortality during treatment for extrapulmonary tuberculosis article. *Emerg. Microbes Infect*. 7(1). doi: 10.1038/s41426-018-0106-1.
- Qiyaam N, Furqani N, Hartanti JD (2020). Evaluasi Penggunaan Obat Antituberculosis (OAT) Pada Pasien Tuberculosis Paru di Puskesmas Kediri Lombok Barat Tahun 2018. *J Ilmu Kefarmasian*. 1(1).
- Ruru Y, Matasik M, Oktavian A, Senyorita R, Mirino Y, Tarigan LH, Werf VMJ, et al. (2018). Factors associated with non-adherence during tuberculosis treatment among patients treated with DOTS strategy in Jayapura, Papua Province, Indonesia. *Glob Health*

- Action.11(1). doi: 10.1080/16549716.2-018.1510592.
- Sasmita HY, Prasetyowati I, Wahjudi P (2019). Prevalence and Risk Factors of Diabetes Mellitus in Tuberculosis Patient at Patrang District Indonesia. *IJTID*.
- Sukmawati E (2017) Efektifitas Penyuluhan Kesehatan terhadap Pengetahuan Perawatan Pasien Tuberkulosis (TB). *J Ners LENTERA*. 5(1): 9–20
- Khamidah, Susmaneli H (2016). Faktor-Faktor yang Berhubungan dengan Putus Berobat Pada Penderita TB Paru BTA Positif di Wilayah Kerja Puskesmas Harapan Raya, *J Kesehat Komunitas*. 3(2).
- Tola A, Mishore KM, Ayele Y, Mekuria AN, Legese N (2019). Treatment Outcome of Tuberculosis and Associated Factors among TB-HIV Co-Infected Patients at Public Hospitals of Harar Town, Eastern Ethiopia. A five-year retrospective study. *BMC Public Health*. 19(1). doi:10.1186/s12889-019-7980-x.
- WHO (2014) The End TB Strategy: Global Strategy and Targets for Tuberculosis Prevention, Care and Control After 2015. World Health Organization.
- WHO (2019) Global Tuberculosis Report 2019. World Health Organization.
- Zhang CY, Zhao F, Xia YY, Yu YL, Shen X, Lu W, Wang XM, et al. (2019). Prevalence and risk factors of active pulmonary tuberculosis among elderly people in China: A population-based cross-sectional study. *Infect Dis Poverty*. 8(1). doi: 10.1186/s40249-019-0-515-y.
- Zhang L, Xing W, Zhou J, Zhang R, Cheng Y, Li J, Wang G, et al. (2020). Characteristics of tuberculosis patients in the integrated tuberculosis control model in Chongqing, China: a retrospective study. *BMC Infect Dis*. 20(1). doi: 10.1186/s12879-020-05304-z.