Evaluation of the Pulmonary Tuberculosis Control Program

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Abstract: Pulmonary Tuberculosis is still a priority health problem in Indonesia, and around 1.5 M people experience TB resistance where the treatment rate is only 38% in 2019 and the global TB treatment rate is only 57% successful, resistant TB costs a lot, is difficult treated so that it becomes a priority for global TB control programs. The high burden of disease and treatment for patients, poor recovery, mortality, and high mortality lead to distress for patients, families, and caregivers. This study aims to determine the success of the program, program achievements include detection rates, conversion rates, cure rates and cross checks, as well as management of human resources and facilities in implementation, as well as obstacles to pulmonary TB disease control programs in Pangkep Regency, the research method used is descriptive to obtain an overview of the P2TB Pulmonary Program in Pangkep Regency. Based on the results of the evaluation of the P2TB program at the community health centers, when viewed from the input aspect, the process is still not in accordance with the applicable requirements and guidelines, the detection of positive smear patients does not reach the target, the cure rate is low below the national target, the error rate is unknown because no cross check is carried out, so it is necessary to have officer training and refreshing courses for laboratory staff, carry out cross checks and cross-program collaboration and PMO guidance, and there is a need for screening activities in areas where there are many sufferers.

Keywords: Program evaluation; Public health; Pulmonary Tuberculosis

Introduction

In 2020, around 10 million people are estimated to be infected with TB worldwide, with 5.6 million cases of men and 3.3 million cases of women. In the same year, the highest number of new TB cases occurred in Southeast Asia with 43% of new cases, then Africa with 25%, and the West Pacific with 18%. As many as 86% of new TB cases occur in 30 countries with a high TB burden. The eight countries that account for two-thirds of all new TB cases are India, China, Indonesia, the Philippines, Pakistan, Nigeria, Bangladesh and South Africa. In industrialized countries, cases of TB are more common in individuals arriving from tuberculosis-endemic areas, health workers, and individuals with HIV (Diedrich et al., 2016; Brocklehurst & French, 1998; Geldmacher et al., 2012).

The Government of Indonesia is committed to improving the quality of healthy human resources through increasing access and quality of health services towards universal health coverage. Comprehensive tuberculosis control efforts will support qualified and competitive human resources so that this is very relevant to Indonesia's 2020-2024 development agenda as stated in the 2020-2024 National Medium-Term Development Plan (RPJMN) document (Mulfiyanti et al., 2022). In line with the 2020-2024 RPJMN, efforts to tackle tuberculosis are also part of the 2020-2024 national health development strategy and policy directions which are part of the 2005-2025 Long Term Health Sector Plan

(RPJPK) of the Ministry of Health of the Republic of Indonesia. The main goal of tackling tuberculosis listed in the 2020-2024 RPJMN and the 2020-2024 National Health Development Strategy of the Indonesian Ministry of Health is to reduce the incidence of tuberculosis from 319 per 100,000 population in 2017 to 190 per 100,000 population in 2024 (Oliveira et al., 2020; Cui et al., 2016).

The Ministry of Health reported that there were 351,936 cases of Tuberculosis (TBC) found in Indonesia in 2020. This number decreased by 38% from the previous year of 568,987 cases. The majority of TB sufferers come from productive age. In detail, as many as 17.3% of TB sufferers are aged 45-54 years. As many as 16.8% of TB patients aged 25-34 years. Then, as many as 16.7% of TB sufferers are aged 15-24 years. In addition, 16.3% of TB sufferers aged 35-44 years, 14.6% of TB sufferers had an age range of 55-64 years. TB sufferers aged 0-14 years or not yet entering productive age reached 9.3%. Meanwhile, 9% of TB sufferers were aged over 65 years or were no longer productive. Based on gender, more men were infected with TB, namely 203,243 people. Meanwhile, women with the disease reached 148,693 people (Hasanuddin et al., 2022).

Although the Incidence of Tuberculosis (TB) in Indonesia has shown a downward trend in the last decade as shown in the graph. The TB incidence is an estimate of the number of new and relapsed TB cases that occur in a given year. This TB incidence tally includes people living with the human immunodeficiency virus (HIV). The calculation of TB incidence is expressed in numbers per 100 thousand populations. Based on World Bank data, Indonesia's TB incidence is 301 per 100 thousand populations in 2020. This figure is lower than in 2010 which reached 242 per 100 thousand populations (Hasanuddin et al., 2020). Even though it has fallen, Indonesia's TB incidence rate is high compared to other Southeast Asian countries. According to data from the Ministry of Health, Indonesia's TB disease ranks third in the world after India and China. In Indonesia there are 824 thousand tuberculosis and a death rate of 93 thousand per year or the equivalent of 11 deaths per hour. To find and treat these cases, the Ministry of Health carried out a large-scale screening. Meanwhile, the Ministry of Health noted that the trend of TB patient treatment success rates had decreased since 2016 and the TB patient treatment success rate was 82.7% in 2020, lower than the previous year which reached 82. This 9% means that the treatment of TB disease has not reached the national target set in the strategic planning of the Ministry of Health of 90%. The notification rate for all tuberculosis cases in 2020 by province in Indonesia varies between 65 per 100,000 population in Bali Province and 244 per 100,000 populations in Papua Province. The notification rate for all Tuberculosis cases in South Sulawesi Province is

ranked eleventh out of 34 provinces in Indonesia. So the government needs to improve pulmonary TB treatment services (Parisot & Decker, 1960; Parisot & Wood, 1960).

Meanwhile, the transmission rate of Tuberculosis (TBC) or TB in Makassar City is still quite high. Based on data compiled from the Makassar City Health Office, TB sufferers in 2019 reached 5,412, with a cure rate of 83%. Then in 2020, cases had decreased to 3,250 with a cure rate of 85%, and in 2021 it jumped again to 3,911. Pangkep District Health Office recorded the number of pulmonary TB cases in 2016 as many as 379 cases. Results of the study, OR = 1.522, ventilation area (p value = 0.045, OR = 6.000), humidity (p value = 0.033, OR = 5.211), and type of floor (p value = 1.000, OR = 1.144). While those that are not risk factors for pulmonary TB in the working area of Liukang Tupabbiring Health Center, Pangkep Regency are age (p value = 0.182, OR = 0.306), nutritional status (p value = 0.144, OR = 0.345), smoking status (p value = 0.211, OR = 0.412) and temperature (Navarro-Flores et al., 2022).

In order to achieve the objectives of the pulmonary TB program, an operational policy has been established, namely the implementation of pulmonary TB control covering all government and private health service facilities by involving the community in a comprehensive and integrated manner, the program target is to reach 80% at the end of the initial (intensive) phase of treatment, especially new positive AFB sufferers and achieves a cure rate of at least 85% of new cases found with good quality as evidenced by laboratory error rates < 50%, treatment of patients is carried out free of charge and designated referral laboratory centers carry out routine slide cross check services, training and coaching of officers microscopy so that the examination so that the examination of the diagnosis of AFB is of high quality. Based on this description, it is necessary to evaluate the pulmonary tuberculosis control program in Pangkep Regency considering the high incidence of pulmonary TB in the Archipelago area of Pangkep Regency (Syarif & Hasanuddin, 2022).

Method

The evaluation subjects were the implementing community health center group (KPP) in all health centers and the Pangkep District Health Office as the evaluation program coordinator covering input, process and output aspects. Input aspects include manpower, facilities and tools. Process aspects include planning, implementation and monitoring and output aspects include the scope of finding suspected pulmonary TB suspects, the coverage of positive BTA found, the sputum conversion rate, the cure rate and the quality of microscopic examination (Cross check), the research design used is descriptive to compare between

conditions running according to the standards in force (Hasanuddin & Muzaki, 2019).

Result and Discussion

Result

The P2TB Pulmonary Community Health Center (KPP) group in Pangkep Regency in 2020-2021 includes all health centers, namely 23 health centers with details of 7 microscopic referral health centers (PRM), 13 satellite health centers (PS) and 3 independent implementing health centers (PPM).

Input

The pulmonary TB prevention program is implemented in 23 community health centers or KPP, but not all community health centers have permanent doctors, still 21.8% of community health centers do not have permanent doctors so that a policy is made for equal distribution of services by dividing service days, especially in island areas where doctors will go back and forth to the mainland twice a month, coupled with the

bad weather factor which is an obstacle to crossing to the islands making it difficult for sufferers who need a doctor's consultation (Hasanuddin & Haq, 2016).

Type and Number of Health Workers

In addition to the presence of a doctor, it is also necessary to have a nurse on duty at the polyclinic, a laboratory officer who is responsible for laboratory examinations and a program manager who is responsible for recording and reporting. The types and number of officers who are closely related to the pulmonary CTA program can be seen in the Table 1.

All community health centers or KPP (100%) have appointed a paramedic as the managing officer for the Pulmonary TB P2 program. Program management officers are usually also on duty at the polyclinic and activities at the posyandu, each officer on average carries out 2-4 activities (multiple tasks), of the 23 community health centers there are still 30.5% who do not have laboratory staff (Cohen et al., 2019). All community health centers have laboratories has appointed an officer as a laboratory worker.

Table 1. Type and Number of Health Workers at KPP P2TB Lungs in Pangkep Regency 2023

Type and Number of Health Workers	PRM (n=7)		PS (n=13)		PPM (n=3)		KKP (n=23)	
	Total	%	Total	%	Total	%	Total	%
Permanent Doctor	6	85.7	10	62.5	3	100	18	78.2
Program manager Tuberculosis	7	100	16	100	2	66.6	23	100
Laboratory worker	7	100	7	43.7	2	66.6	16	69.5

Quality of Health Worker

The quality of personnel is measured based on the suitability of formal education with the tasks carried out and supported by training followed according to the program held. When viewed from the aspect of training that has been attended, then 74% of the officers managing the pulmonary TB program have attended training (Kementerian Kesehatan RI, 2015). By participating in the training, it is expected that the officers will have the ability to coordinate the implementation of the pulmonary P2TB program. Distribution of education for pulmonary TB program managers can be seen in Table 2.

Table 2. Distribution of Officers Managing the P2TB Lung Program by Education Level in Pangkep Regency in 2023

Education	Total	%
Public Health	17	0.74
Nurses	4	0.17
Nurse High School	2	0.09

Based on the P2TB Lung Program guidelines, the laboratory worker at PRM is an analyst or other officer who has been specially trained in microscopic TB of the

Lung. Microscopy officers must check sputum 10-20 slides per day with a cross check error < 5% in order to maintain the quality of the examination.

Tools and Materials

The Community Health Center has 18 KPP laboratory facilities, while 5 KPP do not yet have laboratory facilities. The distribution of tools and materials used in order to support the Lung CFT program can be seen in Table 3.

The table 3 observes that only 12 PS have laboratory facilities, out of 12 PS (92%) there are still 6 PS which do not have reagents. All KPPs that have laboratory facilities have sputum pots. All PPM and PRM have stock of anti-tuberculosis drugs (OAT) categories I and II and III, but PS is not available for OAT categories I, II and III. If smear positive sufferers are found, patients are usually asked to wait for OAT between 1-6 days. In addition to the availability of OAT, the availability of guidebooks and reporting formulas also supports the implementation of the pulmonary TB program, of the 23 KPPs there are still 10 PS that do not have a pulmonary TB program manual. Reporting forms are available throughout KPP (Yusuf & Allerberger, 2021).

Table 3. Distribution of Facilities, Tools and Materials According to the Lung P2TB KPP in Pangkep Regency in 2023

Materials and Tools	PRM (n=7)		PS (n=13)		PPM (n=3)		KKP (n=23)	
	Total	%	Total	%	Total	%	Total	%
Laboratory	7	100	12	92.0	3	100	18	78.2
Microskop Binokuler	7	100	0	0	2	66.6	20	86.9
Reagen ZN	7	100	7	53.0	2	66.6	16	69.5
Pot Sputum	7	100	10	76.0	3	100	14	60.8
DAT Category I	7	100	0	0	3	100	12	52.1
DAT Category II	7	100	0	0	3	100	13	56.5
DAT Category III	7	100	0	0	3	100	20	86.9
Guide Book	7	100	13	100	3	100	23	100
Report	7	100	13	100	3	100	23	100

Process

In planning, the important activities carried out are the preparation of a work plan, setting targets and making a schedule of activities. Of the 23 community health centers, there were 8 (30.8%) community health centers that did not prepare work plans, 6 (23.1%) community health centers did not set targets and 10 (38.5%) community health centers did not schedule activities, as shown in Table 4.

Table 4. The Results of the Achievement of the KPP Process Aspects of the Pulmonary P2TB Program in Pangkep Regency in 2022/2023

Materials and tools	PRM (n=7)		PS (n=13)		PPM (n=3)		KKP (n=23)	
	Total	%	Total	%	Total	%	Total	%
Planning								
Plan	7	100	9	0	2	66.6	20	86.9
Target	7	100	7	53.0	3	100	16	69.5
Timetable	7	100	10	76.0	1	33.3	14	60.8
Organizational								
Structure organizational	7	100	13	0	3	100	23	100
Delegation of Authority	7	100	3	0	2	66.6	20	86.9
Implementation								
Motivation								
Incentive	3	42.8	9	69.2	1	100	11	47.8
Doctor training	5	71.4	10	76.0	2	66.6	17	73.9
Training Health Program	7	100	10	76.0	2	66.6	22	95.6
Training Health Laboratory	7	100	10	76.0	3	100	21	91.3
Supervision and technical guidance								
Supervision once every 3 months	4	57.1	5	38.4	1	33.3	10	43.4
Regular Meeting once a month	5	71.4	7	53.0	2	66.6	14	60.8
Correctness and completeness and recording and reporting	6	85.7	10	76.0	2	66.6	18	78.2
Supervision								
Evaluation of plan	4	57.1	7	53.0	1	33.3	12	52.1
Display result	4	57.1	5	38.4	1	33.3	10	43.4
Determine problem	2	28.5	3	23.0	1	33.3	6	26.0
Complete the work plan	4	57.1	7	53.0	0	S0	12	52.1

From the results of interviews conducted with officers managing the P2TB Lung program, the factor that caused the plan was not made was due to the officers' limited knowledge. Planning is the initial stage of an activity that must be carried out by a leader. The planning of an organization will determine the direction to be taken and is a basis for estimating the level of success that will be achieved (Trisnantoro, 1998). With planning the health center will be able to estimate the implementation of activities to achieve the target within a predetermined time by utilizing resources effectively and efficiently.

Organizing

In an organization there must be an organizational structure so that each officer has duties and responsibilities in accordance with the position held. Activities in organizing include preparing job descriptions and delegating authority for each of these tasks. The implementation of P2TB in each health center must be supported by doctors, paramedics, microscopic staff and a program manager (Alsdurf et al., 2021).

Each officer must have clear job descriptions and responsibilities described in a document. According to the guidelines for pulmonary CTB (Ministry of Health, 1999) it is stated that the duties of each person

responsible for pulmonary CTB are; Health center doctors have duties and responsibilities in upholding the diagnosis and treatment of patients. Paramedics have the duty and responsibility of assisting doctors in finding suspect sufferers, controlling treatment, taking notes and reporting. PS who do not have laboratory staff, the paramedics are also on duty to collect sputum and make microscopy referrals to PRM. Laboratory staff are in charge of and responsible for the results of laboratory examinations starting from collecting sputum to reading microscopic results, in contrast to laboratory workers in PS, laboratory workers only collect sputum and make preparations. KPP has not made a written delegation of authority. The delegation of authority by the leadership of the community health centers to the executors of the pulmonary P2TB program is conveyed verbally (Margineanu et al., 2022).

Implementation

In implementing activities there are 3 important activities to be carried out, namely, motivation, guidance and supervision as well as the implementation of recording and reporting.

Motivation

To increase the motivation of officers in carrying out the pulmonary P2TB program, awards should be given to officers according to their respective workload and responsibilities. Rewards can be in the form of incentives or in non-financial forms such as providing opportunities to attend training. Not all KPPs provide incentive money to their officers because there is no fund allocation for this, only 47.8% of KPPs provide incentive money. Heads of community health centers or community health centers doctors who have attended training in the Lung CTB program are 73.9%. For each KPP, community health centers leaders or community health centers doctors who had attended training amounted to 71.4% in PRM, 66.6% in PPM and 76% in PS, there were still leaders of community health centers doctors who had not been trained, among others, because the leaders of community health centers doctors had have been trained before changing jobs because the PTT period has ended. 95.6% of P2TB Lung program managers have attended training, all laboratory staff 91.3% have attended microscopy training, while laboratory workers in PS still have 3 people (76.%) who have not attended training out of 13 PS who have laboratories (Hasanuddin & Syarif, 2022).

Technical Guidance and Supervision

Supervision as well as technical guidance is an activity that is very important in supporting the success of the TB program at community health centers (KPP). In addition, supervision can identify obstacles or complaints faced by community health centers workers

to find solutions to problems. Based on the guidelines for the implementation of the P2TB pulmonary program that supervision must be carried out at least once every 3 months with the aim of knowing the progress of the implementation of the pulmonary TB program at the KPP and conducting periodic coaching.

Recording and Reporting

The Pangkep District Health Office has provided a formula for recording and reporting and all community health centers have received it, however, in filling it out, not all community health centers have filled out the formula completely and correctly. Of the 23 community health centers there were still 21.8% who had not filled them out completely and correctly. The incompleteness of completing this report is because the officers have never attended training, the officers do not understand the importance of recording and reporting, there are too many forms that must be filled in and the workload is too much (multiple assignments) so that officers are in a hurry to make reports (Kumar et al., 1998).

Supervision

Supervision activities include evaluating the work plan, displaying the results of activities and determining problems based on the evaluation results, it is known that only 52.1% of community health centers carry out evaluation of work plans, with the details of each KPP as follows 57.1% in PRM, 53% in PS and 0% in PPM. Evaluation of the work plan is important because the evaluation of the work can be used as a reference for the next month's activities (Hasanuddin et al., 2021).

Output

The output of the P2TB Lung program can be seen by calculating coverage indicators in the form of smear-positive pulmonary TB patients, conversion rates, cross checks and cure rates. In detail can be seen in Table 5.

In Table 5 of the 23 community health centers implementing the P2TB Lung program, only 2 KPPs were able to achieve positive BTA findings from the planned target due to the incorrect sputum collection method, inadequate sputum quality and quantity, improper staining technique, incorrect storage (exposed to direct sunlight, directly), the skills of lab staff are lacking, the conversion rate even though it reaches the national target but seen from each KPP there are still 2 PPM that do not reach the conversion rate: stopped treatment, lack of laboratory skills. To find out the results of microscopic examination at the health center, a cross test or cross check was carried out with the South Sulawesi Province Health Laboratory Center. Based on the results of the evaluation, it was found that no cross checks were carried out because funds were not available, so the quality of microscopic examination at PRM and PPM could not be determined. The TB cure

rate in Pangkep Regency is 74.34%, this figure is still below the national target, this happens because patients do not take medication regularly, there is resistance to drugs, patients do not come for examination at the end of treatment, because patients cannot expel phlegm.

Table 5. The Results of the Achievement of the Output Aspects of the Pulmonary P2TB Program in Pangkep Regency in 2022/2023

Variable	PRM (n=7)		PS (n=13)		PPM (n=3)		KKP (n=23)	
	Total	%	Total	%	Total	%	Total	%
Indicator of Program								
Finding BTA (+) > 50%	2	28.5	0	0	0	0	2	86.9
Conversion rate > 80%	7	100	11	84.6	1	33.3	19	82.6
Cross Check < 5%	0	0	0	0	0	0	0	0
Cure rate > 85%	7	100	0	0	1	33.3	18	78.2

Discussion

Based on the evaluation results, it is known that the input and process aspects greatly influence the success of the Lung P2TB program, when viewed from the staffing aspect, the number of staff handling the TB program is still lacking, especially doctors, making it difficult for sufferers if the patient needs a doctor's consultation. There are enough program managers in a number of laboratories but have multiple assignments. From a quality perspective, there are still program managers who have not received training which affects knowledge of reporting and recording procedures.

In terms of facilities and infrastructure, tools and materials, it is known that there are still incomplete community health centers so that they cannot make sputum fixation, as well as the availability of OAT in PS, they don't have OAT at all so if the patient needs it, they have to come 1-6 days later because the officer has to took it in PRM. Meanwhile, according to the reference for pulmonary TB control, the health center must have supplies for 1 month.

The P2TB Pulmonary Program in Pangkep Regency has weaknesses including a lack of supervision and technical guidance for officers at the community health centers so that problems found in the community health centers are not known to find a solution (Khutlang et al., 2010). In addition, errors in recording and reporting were not immediately known to be the problem, supervision of the quality of laboratory examinations was not carried out so that the quality of microscopic examinations at PRM and PPM was not known. Some community health centers did not conduct sputum examinations for positive BTA household contacts which resulted in low detection of positive BTA cases and no there are incentives for officers from the local government thereby reducing motivation in carrying out work. In addition, the low detection rate is due to the suboptimal quality of service due to limited knowledge and abilities of pulmonary TB officers, the strategy for detecting patients does not make passive efforts by promoting actively through screening activities in slum housing areas with a poor environment, monitoring of PMO treatment has not functioned as intended should.

By knowing the factors that are obstacles in the implementation of the pulmonary TB program, it is hoped that for the coming year these factors can be minimized if possible eliminated.

Conclusion

Based on the results of the evaluation, it can be concluded that the P2TB program at the community health centers when viewed from the input aspect, the process is still not in accordance with the applicable requirements and guidelines, the findings of AFB sufferers do not reach the national target, the cure rate is low below the national target, the error rate is unknown because no cross check. The obstacles that hinder the success of the program are the lack of staff motivation, not all pulmonary TB officers have attended training and program planning, and the existing PMO has not functioned optimally.

Author Contributions
This article was written by MKA in scientific provided critical feedback of the manuscript. MKA = Muh Kidri Alwi; AH = Asni Hasanuddin.

Conflicts of Interest
The author stated that there was no conflict of interest with funding sponsor and did not have role in study design; collection, analysis, or data interpretation, script writing, and decision to publish the result.

References

Alsdurf, H., Empringham, B., Miller, C., & Zwerling, A. (2021). Tuberculosis Screening Costs and Cost-Effectiveness in High-Risk Groups: A Systematic Review. *BMC Infect Dis, 21*(1), 935. https://doi.org/10.1186/s12879-021-06633-3

Brocklehurst, P., & French, R. (1998). The Association Between Maternal HIV Infection and Perinatal Outcome: A Systematic Review of the Literature and Meta-Analysis. *Br J Obstet Gynaecol, 105*(8), 836-48. https://doi.org/10.1111/j.1471-0528.1998.tb10227.x

Cohen, A., Mathiasen, V. D., Schön, T., & Wejse, C. (2019). The Global Prevalence of Latent Tuberculosis: A Systematic Review and Meta-Analysis. *Eur Respir J, 54*(3), 1900655. https://doi.org/10.1183/13993003.00655-2019

Cui, A. M., Cheng, X. Y., Shao, J. G., Li, H. B., Wang, X. L., Shen, Y., Mao, L. J., Zhang, S., Liu, H. Y., Zhang, L., & Qin, G. (2016). Maternal Hepatitis B Virus Carrier Status and Pregnancy Outcomes: A Prospective Cohort Study. *BMC Pregnancy Childbirth, 26*(16), 87. https://doi.org/10.1186/s12884-016-0884-1

Diedrich, C. R., O'Hern, J., Wilkinson, R. J. (2016). HIV-1 and the Mycobacterium Tuberculosis Granuloma: A Systematic Review and Meta-Analysis. *Tuberculosis, 98*, 62–76. https://doi.org/10.1016/j.tube.2016.02.010

Geldmacher, C., Zumla, A., & Hoelscher, M. (2012). Interaction between HIV and Mycobacterium Tuberculosis: HIV-1-Induced CD4 T-cell Depletion and the Development of Active Tuberculosis. *Curr Opin HIV AIDS, 7*(3), 268-75. https://doi.org/10.1097/COH.0b013e3283524e32

Hasanuddin, A., & Haq, R. (2016). Aplikasi Penelitian Epidemiologi. Mimika Baru: Aseni. Retrieved from https://www.penerbitaseni.com/produk/aplikasi-penelitian-epidemiologi/

Hasanuddin, A., & Muzaki, M. (2019). Analisis Masalah Kesehatan di Kabupaten Sukoharjo. *UEJ: UNM Environmental Journals, 2*(3), 92-97. https://doi.org/10.26858/uej.v2i3.14550

Hasanuddin, A., & Syarif, J. (2022). Identifikasi Mycobacterium Tuberculosis pada Perokok Aktif dengan Metode Pewarnaan Ziehl–Neelsen. *JUKEJ: Jurnal Kesehatan Jompa, 1*(2), 45-49. Retrieved from https://jurnal.jomparnd.com/index.php/jkj/article/view/331

Hasanuddin, A., Syarif, J., & Nindrea, R. D. (2022). The Evaluation of Needs and Weaknesses of The Immunization Program in Kodingareng and Barranglompo Island, Makassar City, South Sulawesi, Indonesia. *IJCS: International Journal of Community Service, 1*(2), 173-181. https://doi.org/10.55299/ijcs.v1i2.208

Hasanuddin, A., Syarif, J., Rosdiana, R., Panyiwi, R., Yuswatiningsih, E., Rahmawati, A., Noerjoedianto, D., & Subandi, A. (2021). Kejadian Luar Biasa Pertusis di Desa Tandasura Kecamatan Limboro Kabupaten Polewali Mandar, Sulawesi Selatan. *JTCSA: Journal of Training and Community Service Adpertisi, 1*(1), 33–51. Retrieved from https://jurnal.adpertisi.or.id/index.php/JTCSA/article/view/57

Hasanudin, A., Djais, A. I., Dwiningsih, A., Yuswatiningsih, E., Suhariati, H. I., Muhammadong, M., Astutiningsih, C., Ruqiah, R., Ashriady, A., Saeni, R. H., Ashari, A. E., Handayani, R., & Nindrea, R. D. (2020). Malnutrition Screening in Pankep District, South Sulawesi, Indonesia. *International Journal of Pharmaceutical Research, 12*(2). Retrieved from http://repo.stikesicme-jbg.ac.id/id/eprint/4599

Kementerian Kesehatan RI. (2015). Petunjuk Teknis Surveilans Penyakit Tidak Menular. Retrieved from https://p2ptm.kemkes.go.id/dokumen-ptm/petunjuk-teknis-surveilans-penyakit-tidak-menular

Khutlang, R., Krishnan, S., Whitelaw, A., & Douglas, T. S. (2010). Automated Detection of Tuberculosis in Ziehl-Neelsen-Stained Sputum Smears using Two One-Class Classifiers. *J Microsc, 237*(1), 96-102. https://doi.org/10.1111/j.1365-2818.2009.03308.x

Kumar, N., Tiwari, M. C., & Verma, K. (1998). AFB Staining in Cytodiagnosis of Tuberculosis without Classical Features: A Comparison of Ziehl-Neelsen and Fluorescent Methods. Cytopathology, 9(3), 208–214. https://doi.org/10.1046/j.1365-2303.1998.00057.x

Margineanu, I., Louka, C., Akkerman, O., Stienstra, Y., & Alffenaar, J. W. (2022). eHealth in TB Clinical Management. *Int J Tuberc Lung Dis, 26*(12), 1151-1161. https://doi.org/10.5588/ijtld.21.0602

Mulfiyanti, D., Ramadani, F., Satriana, A., & Bintang, A. (2022). Patient Safety in Primary Care Socialization and Discussion. *IJCS: International Journal of Community Service, 1*(1), 105–110. https://doi.org/10.55299/ijcs.v1i1.182

Navarro-Flores, A., Fernandez-Chinguel, J. E., Pacheco-Barrios, N., Soriano-Moreno, D. R., & Pacheco-Barrios, K. (2022). Global Morbidity and Mortality of Central Nervous System Tuberculosis: A Systematic Review and Meta-Analysis. *J Neurol, 269*(7), 3482–3494. https://doi.org/10.1007/s00415-022-11052-8

Oliveira, D., Pereira, F., Martins, M. do R., Castro, R., Cordeiro, L., & Fronteira, I. (2020). A Systematic Review of the Maternal and Neonatal Complications in Hepatitis B Infection. *J Clin Virol,*

133, 104680. https://doi.org/10.1016/j.jcv.2020.104680

Osibote, O. A., Dendere, R., Krishnan, S., & Douglas, T. S. (2010). Automated Focusing in Bright-Field Microscopy for Tuberculosis Detection. *J Microsc, 240*(2), 155-63. https://doi.org/10.1111/j.1365-2818.2010.03389.x

Parisot, T. J., & Decker, A. H. (1960). A Comparative Study of the Causative Agent of A Mycobacterial Disease of Salmonoid Fishes. I. A Comparison of the Staining Characteristics of the Fish Disease with Human Tuberculosis in Sections Stained by the Fite-Faraco and Ziehl-Neelsen Methods. *Am Rev Respir Dis, 81*, 60–7. https://doi.org/10.1164/arrd.1960.81.1.60

Parisot, T. J., & Wood, E. M. (1960). A Comparative Study of the Causative Agent of A Mycobacterial Disease of Salmonoid Fishes. 2. A Description of the Histopathology of the Disease in Chinook Salmon (Oncorhynchus tshawytscha) and A Comparison of the Staining Characteristics of the Fish Disease with Leprosy and Human Tuberculosis. *Am Rev Respir Dis, 82*, 212-22. https://doi.org/10.1164/arrd.1960.82.2.212

Syarif, J., & Hasanuddin, A. (2022). Correlation of Maternal Knowledge and Attitudes towards Serology Screening Management for Pregnant Women at the Wisata Hospital of the Indonesia Timur University. *International Journal of Public Health Excellence (IJPHE), 2*(1), 279–284. https://doi.org/10.55299/ijphe.v2i1.226.

Trisnantoro, L. (1998). Hubungan Antar Organisasi dalam Sektor Pelayanan Kesehatan: Sebuah Visi Manajerial. *Jurnal Manajemen Pelayanan Kesehatan, 1*(1), 3-8. Retrieved from https://media.neliti.com/media/publications/22293-ID-hubungan-antar-organisasi-dalam-sektor-pelayanan-kesehatan-sebuah-visi-manajeria.pdf

Yusuf, E., & Allerberger, F. (2021). Infectious Disease Serology in 2021. *Clin Microbiol Infect, 27*(9), 1204-1206. https://doi.org/10.1016/j.cmi.2021.06.020.