

THE DIFFERENCE IN THE RESULTS OF THE MOLECULAR RAPID TEST (TCM) EXAMINATION IN TUBERCULOSIS SUSPECTS WHO WERE IMMEDIATELY EXAMINED AND SAMPLES THAT WERE DELAYED FOR 12 HOURS AT DR. HI HOSPITAL.

ZAINAL UMAR SIDIKI

Istivani Ismail¹⁾, Rizman Naim²⁾, Mindi Eka Astuti³⁾

^{1,2,3)}Bina Mandiri University Gorontalo

Email: istivaniismail03@gmail.com, rizmannaim9@gmail.com, mindyekaastuti@ubmg.ac.id

ABSTRACT

Tuberculosis is a disease that can cause death caused by the bacterium *Mycobacterium tuberculosis*. In some areas in Indonesia, far from health facilities, samples are required to experience delays in examination because they go through the delivery process. Developed Molecular Rapid Test (TCM) examination technology is able to detect Tuberculosis using the *GeneXpert* MTB/RIF tool. The purpose of this study was to find out the difference in the results of the Molecular Rapid Test (TCM) examination in Tuberculosis samples that were directly examined and samples that were postponed for examination. This research method uses a quantitative approach that aims to find out the difference in the results of the Molecular Rapid Test (TCM) examination in samples of tuberculosis suspects who were immediately examined and the examination was postponed for 12 hours at the Dr. Hi Regional General Hospital. Zainal Umar Sidiki. The type of data used is primary data obtained from research results and secondary data obtained from *Medical Record data* at Dr. Hi Regional General Hospital. Zainal Umar Sidiki. The results of this research show that the results of the examination that were immediately examined obtained the results of 6 samples that were MTB Not Detected and 9 samples that MTB Detected Rif Resistance Detected, as well as tuberculosis samples that were delayed for 12 hours, there were 6 samples of MTB Not Detected and 9 samples that were MTB Detected Rif Resistance Detected.

Keywords: Tuberculosis, TCM, Direct Examination and 12 Hour Delay.

INTRODUCTION

Tuberculosis is the leading cause of death and health problems worldwide. *Bacillus Mycobacterium tuberculosis*, which causes tuberculosis disease, spreads into the air through coughing and coughing (WHO, 2021).

70% of 10.0 million cases of tuberculosis are reported worldwide. It continues to be a global health problem. Indonesia has the highest number of tuberculosis cases in the world. About 845,000 people have drug-resistant

tuberculosis (RO TB), with a mortality rate of about 98,000, or 11 deaths per hour, and 24,000 cases of drug-resistant tuberculosis.

In addition, Indonesia is included in 30 countries with the number of cases

Tuberculosis is the highest in the world and ranks second (WHO, 2021).

There were 397,377 cases of tuberculosis detected in 2021, an increase from 351,936 cases in 2020. According to the Case Detection Rate (CDR) in Indonesia's Health Profile in 2021, Gorontalo Province has the

third highest CDR rate, with 71.3% (WHO, 2021).

One hundred percent of the 10.0 million cases of tuberculosis reported worldwide. A significant increase from 5.7–5.8 million per year from 2009–2012 to 6.4 million in 2017. Worldwide, the highest number of tuberculosis cases is found in Indonesia. About 845,000 people develop drug-resistant tuberculosis (RO TB), with a mortality rate of about 98,000, or 11 deaths per hour, and 24,000 cases of drug-resistant tuberculosis. In addition, Indonesia is among the 30 countries with the highest cases of tuberculosis in the world. The seven countries that account for 64% of TB cases worldwide are Indonesia, India, China, the Philippines, Nigeria, Pakistan, and South Africa. Indonesia is in second place (WHO, 2021).

Gorontalo Province has the third highest Case Detection Rate (CDR) in Indonesia's Health Profile in 2021, at 71.3%. These figures are much higher than the CDR report in the previous year. There were 34 cases of drug-resistant tuberculosis in 2020 out of 126 projected cases, or 26.98 percent. The number of cases increased to 58 in 2021, or 46.03% of the total cases.

Based on data from the North Gorontalo Regency Health Office, the number of Tuberculosis patients in North Gorontalo Regency in 2020 was 187 cases, an increase of around 4% in 2021 as many as 192 cases of pulmonary tuberculosis and continued to experience a significant increase of around 13% compared to January 2022 when there were 30 cases of pulmonary tuberculosis.

The GeneXpert Molecular Rapid Test (TCM) uses bacterial DNA tests and is

automatically integrated with the Polymerase Chain Reaction (PCR) method. Bacteria resistant to rifampicin are also found in MTB. TCM found rifampicin resistance and multidrug-resistant tuberculosis (TB-MDR) with a sensitivity of 96.5% (Novianti and Simarmata, 2020).

2020 data from the Ministry of Health of the Republic of Indonesia. Pulmonary tuberculosis is caused by the bacterium *Mycobacterium tuberculosis* (MTB). This method has a drawback: it is too challenging for conventional testing. If the result is negative, the chances of you having tuberculosis are still there. Molecular, microscopic and sputum culture tests can also be used to confirm the diagnosis. Microscopic examination, which is inexpensive and easy to perform, makes it possible to quickly identify pulmonary tuberculosis. Nonetheless, these test failures are technical errors that can lead to inaccurate results. Sputum volume and consistency affect molecular rapid examination (TCM) (Ministry of Health of the Republic of Indonesia, 2020).

In some cases, due to the rather long distance to referral health facilities in some regions of Indonesia, it resulted in delays in examinations. In a study [6], delaying 24 hours at room temperature resulted in a positive microscopic examination result; however, a 24-hour delay at 25–8 °C did not produce results different from in-person examinations.

According to *the Journal of Fast TB Testing* of the Ministry of Health (2017), TCM testing can be stored for seven days at 2–8°C or for twelve hours at room temperature. Data collected by [3]. Molecular rapid examination (TCM) is

affected by the volume and consistency of sputum. The tuberculosis screening process can be delayed due to the long distance to several health facilities in some regions of Indonesia.

The GeneXpert assay can not only quickly and accurately find resistance to rifampicin, but can also find complex MTB DNA directly from the specimen. This method has a drawback: it becomes too difficult for conventional testing. If the result is negative, the chances of you being diagnosed with tuberculosis remain. Diagnosis can also be made by sputum culture, molecular tests, and microscopic. Pulmonary tuberculosis can be quickly identified through an inexpensive and easy-to-perform microscopic examination. But this test failure is a technical error. testing must also be integrated with MTB culture to prevent negative results (Ministry of Health of the Republic of Indonesia, 2020).

Testing and delivery are delayed unless the delivery location is remote. In research [6] a one-day delay at room temperature resulted in a positive microscopic examination result; however, a one-day delay at 25–8 °C did not produce different results from the in-person examination. The Journal of Fast TB Testing of the Ministry of Health (2017) states that TCM tests must be carried out as soon as possible. After five hours, the specimen can still be retested. They can be stored for seven days at a temperature of 2–8°C. With this assumption, the researchers wanted to find out how sample quality and delay time affected the results of Molecular Rapid Test (TCM) and microscopic tests.

Another way to detect *tuberculosis* bacteria is *the Interferon Gamma Release*

Assay (IGRA) test which can be applied independently, without anyone accompanying you. Test results are obtained within 24 hours without affecting the body's response if you want to undergo the test again. *The Bacille Calmette Guerin* (BCG) vaccine obtained does not cause a negative IGRA test result [5]

Due to the shortage of refrigerators in one of the hospitals in North Gorontalo Regency, the examination time was postponed. Phlegm is not stored in the refrigerator; instead, they should be stored at room temperature. Because laboratory staff not only check for possible pulmonary tuberculosis, but also sometimes have to do fieldwork, these tests are postponed. If the phlegm is stored at room temperature, the condition of the specimen will be more diluted. This clearly has an impact on the level of BTA positivity. This will complicate the process of making BTA preparations because the results are unclear and difficult to read. Taking this condition into account, "The Difference Between Rapid Molecular Test (TCM) Results in Tuberculosis Samples Directly Tested and Samples Delayed for 12 Hours at Dr. Hi Hospital. Zainal Umar Sidiki" can be used as research.

The bacterium *Mycobacterium tuberculosis* is the cause of tuberculosis (TB). Acid-resistant bacteria (BTA) are so called because they have a rod shape and are not easily damaged by acids. One of the diseases that can spread is phlegm tuberculosis. *Mycobacterium tuberculosis* that cannot be killed by acid. Most of these diseases affect the pulmonary parenchyma, but the following bacteria can also infect the intestines, digestion. In addition,

tuberculosis is a medical problem for everyone on Earth because its treatment takes a long time and the main cause of death is *Mycobacterium tuberculosis*, the most powerful intracellular bacterium [9]

Taxonomy *Mycobacterium tuberculosis*. The following is the taxonomy of *Mycobacterium tuberculosis* (Febriani *et al.*, 2022)

1. Superdomain : *Biota*
2. Supergovernment: *Prokaryota*
3. Government : *Bacteria*
4. Sub-government : *Posibacteria*
5. Phylum : *Actinobacteria*
6. Class : *Actinobacteria*
7. Order : *Mycobacteriales*
8. Family : *Mycobacteriaceae*
9. Genus : *Mycobacterium*
10. Species : *Mycobacterium Tuberculosid*

Mycobacterium tuberculosis bacteria are rod-shaped and grow best. The fats in the germs make them resistant to acids and physical and chemical damage. These germs die quickly in sunlight; they can also live in dark humidity and in body tissues; and germs can remain silent for years. *Mycobacterium tuberculosis* causes a productive cough for approximately two weeks, followed by additional symptoms such as loss of appetite, weight loss, weakness, convulsions, daily sweating without activity, and fever for more than a month [7].

Inhaling fluids containing tuberculosis bacteria. Sometimes, one or three of these large bacilli bacteria stick to the alveolar surface of the nasal passages, allowing them to inhale them. It is often found in the lower lobe, lungs, or lower alveolar lobes. Even if neutrophils are present in the place

*and engulf the bacteria, they do not kill the bacteria themselves. In addition, the bacteria *Mycobacterium tuberculosis* causes inflammation. After the first day, *Mycobacterium tuberculosis* bacteria enter the alveoli through the respiratory tract. There, the bacteria gather and develop, and macrophages replace leukocytes. *Mycobacterium tuberculosis* can also infect the kidneys, bones, cortex (base of the brain), and other areas. Mariyah and Zulkarnain, 2021.*

Clinical Symptoms of Tuberculosis. TB has two types of symptoms: generalized systemic symptoms and organ-related symptoms. When first given a diagnosis, it is difficult because the symptoms are not clear. He has systemic or systemic symptoms, which usually include coughing for three weeks, coughing up blood and body health problems. Bronchial obstruction, which causes weak breathing sounds, fluid in the pleural space, which causes chest pain, bone infections, which can interfere with children's brains, and a decrease in symptoms of high fever are some of the symptoms. same as seizures. [1]

Molecular Rapid Test (TCM). If the presence of *mycobacterium* bacteria is found, this indicates positive for tuberculosis. In the TCM tool, several things will also appear such as resistant rifampicin, sensitive rifampicin, indeterminator rifampicin, negative and failed.

In 2020, there were 1,168 TCM devices spread across Indonesia. However, its use in health facilities is still low, this is because there is still a lack of understanding of how to use it.

GeneXpert Examination Currently, TCM is used for the diagnosis of drug-resistant TB; TB-HIV; New tuberculosis in children; diabetes mellitus; extra-pulmonary tuberculosis; and a diagnosis of tuberculosis with a negative BTA result (Marissa et al., 2021).

Disadvantages of GeneXpert. Countries with limited resources face challenges in implementing the stages of DNA transformation and extraction. The examination should be done in conjunction with the Mycobacterium tuberculosis breeding examination to avoid inaccurate negative results. The identification and sensitivity of Mycobacterium tuberculosis isolate will be possible (Utami et al., 2021).

RESEARCH METHODS

Quantitative Research Approach, which emphasizes numbers as a representation variable. Type of Research. *Results of the Molecular Rapid Test (TCM)* at Dr. Hi Hospital. Zainal Umar Sidiki was determined through an analytical examination with GeneXpert.

Research time. The time for this research is to be carried out in July 2024. Research Location. This research was carried out in the Laboratory of Dr. Hi Hospital. Zainal Umar Sidiki

Data Type. The primary data in this study came from the results of the research and secondary data from the Medical recordings at Dr. Hi Hospital. Zainal Umar Sidiki. Data Source. Primary data sources, which are collected by researchers by conducting TCM (Molecular Rapid Test) examinations, secondary data sources, namely data on Tuberculosis cases in

Indonesia through WHO, Health Office, and Riskesdas

Population. Pulmonary tuberculosis suspect at Dr. Hi Hospital. Zainal Umar Sidiki, Sample. The sample as a tuberculosis suspect is a Tuberculosis suspect at Dr. Hi Hospital. Zainal Umar Sidiki with a sample size of 15 samples with sampling techniques in the study was *accidental sampling*.

Operational Definition and Research Variables. Dependent Variables: Molecular Rapid Test checks. Independent variables can be described or influenced by any of the independent variables. For twelve hours, both live samples and deferred samples were used in this study.

Data Collection Techniques. Laboratory examinations using the GeneXpert tool. Pre-Analytical. Adding an identity label to each cartridge to be used, the phlegm pot is then uncovered, then adding a sample of reagents, closing the sample pot again, and then homogenizing. Put in room temperature for 10 minutes. Shake the sample again. Then let it sit for 5 minutes. It should be noted again, if the sample is still found lumps, it needs to be homogenized again so that it mixes well. Insert the cable into the TCM tool that has been tightly closed. Analytics Turn on the computer and TCM tools and run the GeneXPert program according to the guidelines, Press "*Created test*" on the main page of *the GeneXpert Dx System*, then a "Please scan the barcode cartridge" dialog box will appear. Do a barcode scanner or use a manual antrt by entering a 16-digit catalog serial number. After entering the cartridge serial number, then click "Start Test". The light on the TCM tool will turn

The Difference In The Results Of The Molecular Rapid Test (TCM) Examination In Tuberculosis Suspects Who Were Immediately Examined And Samples That Were Delayed For 12 Hours At Dr. Hi Hospital. Zainal Umar Sidiki

on The inspection process will last for 2 hours, and if the light on the TCM tool is off, the module door will open automatically and this indicates that the inspection is complete. Post Analytics

MTB Nott Detested = MTTB DNA Not found.

1. MTB DETESTED Rif Resistance
DETESTED = Found to have rpoB gene mutation
2. MTB DETESTED Rif Resistance
NOT DETESTED = Tidak ada mutasi gen rpoB
3. MTB DETECTED
4. DTED Rif Resistance
INDERTEMINATE = No rpoB gene mutation found due to signal interference.

Data Analysis. Univariate analysis The analysis in this study is a univariate analysis with a test to see the percentage of TCM (Molecular Rapid Test) examination results in new samples and samples that have been left alone for a long time at Dr. Hi Hospital. Zainal Umar Sidiki, and to see the percentage of respondents based on age and gender using SPSS. Bivariate Analysis The analysis used new samples and samples that had been left for 12 hours with a non-parametric test through McNemar.

The existing data collected was tested by the Non-Parametric Systematic method through the McNemar test, for the interval condation was 95% ($\alpha = 0.05\%$). If the sig value (signification) is $>$ from α (0.05) or (sig $>$ 0.05), then Ho is accepted and Ha is rejected, which means that there is no difference in the results of the Molecular Rapid Test (TCM) examination in the Tuberculosis sample that was immediately examined and the sample that was delayed

for 12 hours. If the sig value (signification) is $<$ from α , then Ho is rejected and Ha is accepted, which means that there is a difference in the results of the Molecular Rapid Test (TCM) examination on the Tuberculosis sample that was immediately examined and the sample that was delayed for 12 hours.

RESEARCH RESULTS

The univariate test analysis was carried out by testing to see the percentage of Molecular Rapid Test (TCM) test results on new samples and old samples that were left for 12 hours at dr. Hi Hospital. Zainal Umar Sidiki

Table 4.1 Respondents by Gender

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	15-25	4	26,7	26,7	26,7
	26-45	4	26,7	26,7	53,3
	46-65	6	40,0	40,0	93,3
	>65	1	6,7	6,7	100,0
	Total	15	100,0	100,0	

Sumber Data primer Penelitian Juli 2024

Table 4.1 Respondents by Gender

		Frekuensi	Persen	Valid persen	Persen kumulatif
Valid	Pria	8	53,3	53,3	53,3
	Wanita	7	46,7	46,7	100,0
	Total	15	100,0	100,0	

Sumber Data Primer Penelitian Juli 2024

Table 4.2 Respondents by Age

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	15-25	4	26,7	26,7	26,7
	26-45	4	26,7	26,7	53,3
	46-65	6	40,0	40,0	93,3
	>65	1	6,7	6,7	100,0
	Total	15	100,0	100,0	

Sumber Data primer Penelitian Juli 2024

Table 4.3 TCM Inspection Results

The Difference In The Results Of The Molecular Rapid Test (TCM) Examination In Tuberculosis Suspects Who Were Immediately Examined And Samples That Were Delayed For 12 Hours At Dr. Hi Hospital. Zainal Umar Sidiki

Hasil Pemeriksaan Tes Cepat Molekuler (TCM) GeneXpert	Sampel Yang Langsung Diperiksa	Sampel Ditunda Pemeriksaanya Selama 12 Jam
MTB Detected Rif Resistance Detected	-	-
MTB Detected Rif Resistance NOT Detected	9	9
MTB Detected Rif Resistance Indeterminate	-	-
MTB Not Detected	6	6
Invalid	-	-
Error	-	-
No. Result	-	-
Total	15	15

The bivariate test analysis was carried out to see the difference between the results of a new sample and a sample that had been left alone for a long time for 12 hours with a non-parametric test through McNemar.

Tabel 4.4 Test Statistic

Test Statistics ^a	
Langsung Diperiksa & Penundaan 12 Jam	
N	15
Exact Sig. (2-tailed)	1,000 ^b

Sumber Data Primer Penelitian Juli 2024

The results of the McNemar test showed that a p-value (Sig) of 1,000 was obtained, with a p-value (Sig) of 1,000 having to be greater than 0.5, which indicates that H_0 was accepted and H_a was rejected. These results showed that there was no effect or change on the delay of the examination for twelve hours. If the Sig value is greater than 0.05 or greater than alpha (0.05), then H_0 is accepted and H_a is rejected.

RESEARCH DISCUSSION

Worldwide, tuberculosis is the leading cause of death and health problems. *Bacillus Mycobacterium tuberculosis*, the cause of tuberculosis disease, spreads into E-ISSN: 2746-167X, Vol. 6, No. 1, Marc. 2025 – pp. 12-21

the air through coughing and coughing. (HO, 2021).

The research was conducted at dr. Hi Zainal Umar Sidiki Hospital for 2 days using *the accidental* method as a sampling technique from 9 to 10 July 2024. For the initial data obtained, the researcher knew tuberculosis patients through data in the hospital.

Based on the results of the difference in the examination of the Molecular Rapid Test (TCM) of the Tuberculosis Suspect who was immediately examined and the examination was delayed for 12 hours at the dr. Hi Hospital. Zainal Umar Sidiki which is attached in table 4.1 of 15 samples that were directly examined, there were 6 samples that were MTB Not Detected and 9 samples that MTB Detected Rif Resistance Not Detected, as well as tuberculosis samples that were delayed for 12 hours, there were 6 samples of MTB Not Detected and 9 samples that MTB Detected Rif Resistance Not Detected.

This supports the results of T., Bacteria, P., and Acid, T. (2021). In this study, sputum specimens were examined three times: without holding, holding for 24 hours, and holding for 48 hours. Of the five samples of twelve sputum examined directly, none showed negative results; But after that, the other two samples showed negative results after being delayed for 24 hours, and false negative results increased delayed for 48 hours.

Based on the results of the difference in the Molecular Rapid Test (TCM) examination in the Tuberculosis Supek, the samples that were immediately examined and the examination was postponed for 12 hours which is attached to

<https://journals.ubmg.ac.id/index.php/JHTS>

table 4.4 after being carried out with the McNemar test, a sigs or significant value of 1.00 was obtained. The Molecular Rapid Test (TCM) on the tuberculosis suspect was immediately examined and the examination was postponed for 12 hours at dr. Hi Zainal Umar Sidiki Hospital.

Acid-resistant Mycobacterium tuberculosis is the cause of almost all cases of tuberculosis. Mycobacterium tuberculosis humanus type and bovinus type are the two known types of Mycobacterium tuberculosis. The type of bovinus can also cause pulmonary tuberculosis.

CONCLUSION

The results of the Molecular Rapid Test (TCM) examination of the tuberculosis suspect sample were immediately examined at dr. Hi Hospital. Zainal Umar Sidiki obtained the results of 15 samples of tuberculosis suspects who were immediately examined, there were 6 samples that were MTB Not Detected and 9 samples that were MTB Detected Rif Resistance Not Detected.

The results of the Molecular Rapid Test of the tuberculosis suspect samples whose examination was postponed for 12 hours, there were 6 samples that were MTB Not Detected and 9 samples that were MTB Detected Rif Resistance Not Detected so that there was no difference in results after a delay of 12 hours.

After the McNemar test, the sample of the tuberculosis suspect was immediately examined and the examination was delayed for 12 hours, it was found that Ho was accepted and Ha was rejected.

BIBLIOGRAPHY

- [1] Cough, M., And, E., Cough, E., Adolescents, P., & Sman, D. I. (2023). *PREVENTION OF TUBERCULOSIS TRANSMISSION THROUGH THE IMPLEMENTATION OF BU DOT CEKORAN (PREVENT THE RISK OF TRANSMISSION*. 6(1), 77–87.
- [2] Dewi, D. K., & Sunarso, S. (2020). Strategies for Forming Student Personal Resilience Based on Pancasila Values to Build Awareness of the State (Study at SMA Taruna Nusantara Magelang. *Journal of National Resilience*.
- [3] Among them, L.B. et al. (2022). "Tuberculosis is a World Health Problem: A Review of Lit Eratur". *Journal of 'Aisyiyah Medika*, 7(2), p. 78–88. Available on: <https://doi.org/10.36729/jam.v7i2.855>.
- [4] Gorontalo City Health Office (2019) Number of Pulmonary TB Cases in Gorontalo City.
- [5] Gorontalo Regency Health Office. (2021). *Tuberculosis Integrated Information System (SITT) Report*.
- [6] Erizka Rivani, Tia Sabrina, V.P. (2019). "Comparison of GeneXpert MTB/RIF diagnostic test to detect rifampicin Mycobacterium tuberculosis resistance in pulmonary TB patients at dr. Moh. Hoesin Palembang". *Journal of Medicine and Health: Scientific Publications, Faculty of Medicine, Sriwijaya University*, 6(1), pp. 23–28.
- [7] Febriani, A., Aisyah Sijid, S., Hidayat, K. S., & Muthiadin, C. (2022). Overview of the results of <https://journals.ubmg.ac.id/index.php/JHTS>

- microscopic examination of acid-resistant bacilli in patients with pulmonary tuberculosis at BBKPM Makassar. *PHILOLOGY: Journal of Biology Students*, 2(1), 21–26.
- [8] Handayani, D., & Silviani, Y. (2022). Effect of temperature difference and storage time of sputum on the number of acid-resistant bacteria. *Kusuma Husada Health Journal*, 13(2), 234–242.
- [9] Results, T., Bacteria, P., & Acid, T. (2021). *Journal of medical laboratory science and technology*. 7(2), 18–23.
- [10] Hermansyah, H. (2022). Kualitas Sputum Dalam Pemeriksaan Bta Metode Ziehl Nelssen Dan Test Cepat Molekuler Sputum Quality in Bta Examination With Ziehl Nelssen Method and Molecular Quick Test. *JMLS) Journal of Medical Laboratory and Science*, 2(1), 40–52.
- [11] Ministry of Health of the Republic of Indonesia. (2020). National Guidelines for Tuberculosis Management Medical Services. Jakarta: Ministry of Health of the Republic of Indonesia.
- [12] Ministry of Health of the Republic of Indonesia. (2020). National Guidelines for Tuberculosis Services Tuberculosis Management. *Ministry of Health of the Republic of Indonesia*, 4(1), 1–126.
- [13] Mar'iyah, K., & Zulkarnain. (2021). Pathophysiology of tuberculosis infectious diseases. In *Proceedings of the National Seminar on Biology*
- [14] Marissa, N. et al. (2021). "Molecular Rapid Test as a Diagnostic Tool for Rifampicin-Resistant Tuberculosis in Aceh Province". *Journal of Biotech Medisiana Indonesia*, 9(2), pp. 147–159.
- [15] Murtafi'ah, N. matul-, Fadhilah, F.R. and Krisdaryani, R. (2020). "Comparison of Mycobacterium tuberculosis examination results with GeneXpert and Ziehl Neelsen staining at Mitra Anugrah Lestari hospital". *Health Information Research*, 9(2), p. 188
- [16] Muttaqien, F., & Cahyaningati, R. (2023). Correlation of Conflict, Stress, Organizational Culture and Motivation to the Performance of BPR Nur Semester Indah Employees in Jember Regency. ... *of Management and*
- [17] Nelma, N., & Lumbantoruan, A. (2019). The Effect of Delay in Sputum Handling on Microscopic Preparation Readings in Tb Patients at UPT. Regional Health Laboratory of North Sumatra Province. *PANNMED Scientific Journal (Pharmacist, Analyst, Nurse, Nutrition, Midwifery, Environment, Dentist)*, 14(1), 95–100.
- [18] Novianti N, Simarmata OS, Lolong DB. Utilization of Genexpert Molecular Rapid Test (TCM) as a Pulmonary TB Diagnostic Tool at Wangaya Hospital, Denpasar City. *J Ekol Kesehat*. 2020
- [19] Situngkir, J. D., Damanik, I., & Siahaan, J. M. (2019). Comparison of BTA Positive Sputum and BTA Negative Sputum to Thoracic Photographs in Pulmonary TB Patients. *Journal of Methodist Medicine*, 12(1), 22–27.

- [20] Utami, P.R. et al. (2021). "GeneXpert Examination of the Positivity Level of Acid-Resistant Bacillus (BTA) Examination of the Ziehl Neelsen Method in Patients with Suspected Pulmonary TB". *PERINTIS'S HEALTH JOURNAL*, 8(1), p. 82–90
- [21] Wicaksana, I. N. K., Pestariati, & Syamsul, A. (2022). A Comparative Study of the Results of Mycobacterium Tuberculosis Examination in Patients with Suspected Tuberculosis Using Molecular and Microscopic Rapid Tests at Karangasem Hospital. *Journals of Nurses Community*, 13, 119–122.
- [22] Williams, M., & Wiggins, R. D. (2022). *Beginning Quantitative Research*. Newbury Park. California: SAGE Publication .