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COVID-19 MOLECULAR-BASED TESTING CAPACITY IN FIVE CUSTOMARY AREAS OF PAPUA

Kapasitas Pemeriksaan Swab Covid-19 Berbasis Molekuler di Lima Wilayah Adat Papua

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Abstract

Background: Covid-19 (Corona Virus Disease-19) emerged at the end of December 2019, and the current gold standard for Covid-19 testing is molecular-based virus detection with Real Time-Polymerase Chain Reaction (RT-PCR) and Rapid Molecular Test (RMT). In the early of this pandemic, Indonesia, especially Papua, still had difficulty in examining Covid-19.
Aims: This study aimed to identify the Covid-19 molecular-based testing capacity of laboratories from various regencies representing five customary areas of Papua in the early pandemic.
Methods: This cross-sectional descriptive study with purposive sampling method collected primary data and secondary data from the Papua Provincial and Regency Covid-19 Response Acceleration Task Force and the representative hospitals in five customary areas of Papua (Saireri, Ha anim, Mee Pago, Lapago, Mamta) in May-June 2020.
Results: The Covid-19 molecular-based testing capacity in Papua has yet to be maximum in the early pandemic.
Conclusion: The Covid-19 molecular-based testing capacity has yet to reach its maximum capacity in the beginning of the pandemic. Regency, which applies the GeneXpert test, is recommended to supply RT-PCR. RT-PCR can be procured in several cities/regencies within one customary area, and samples of the specimens can be delivered more quickly in the same area.

Keywords: Covid -19, Papua, RT-PCR

Abstrak

Latar Belakang: *Covid-19 merupakan penyakit yang muncul pada akhir Desember 2019 dan standar pemeriksaan Covid-19 tercanggih hingga saat ini adalah deteksi virus berbasis molekuler dengan Real Time- Polymerase Chain Reaction (RT-PCR) dan Tes Cepat Molekuler (TCM). Pada awal pandemi, Indonesia, khususnya Papua masih kesulitan dalam melakukan pemeriksaan Covid-19.*
Tujuan: *Penelitian ini bertujuan untuk melihat kemampuan laboratorium dalam melakukan pemeriksaan Covid-19 berbasis molekuler dari berbagai kabupaten yang mewakili lima wilayah adat Papua pada masa awal pandemi.*
Metode: *Penelitian deskriptif potong-lintang ini menggunakan metode purposive sampling dengan mengumpulkan data primer dan data sekunder dari Gugus Penanganan Covid Provinsi dan Kabupaten serta Rumah Sakit perwakilan di lima wilayah adat Papua (Saireri, Ha anim, Mee Pago, Lapago, Mamta) pada bulan Mei-Juni 2020.*
Hasil: *Kapasitas pemeriksaan Covid-19 berbasis molekuler di Papua belum maksimal pada awal pandemi.*
Kesimpulan: *Kapasitas pemeriksaan Covid-19 berbasis molekuler belum maksimal. Kabupaten yang hanya memiliki GeneXpert disarankan untuk menyuplai RT-PCR. Pengadaan RT-PCR dapat dilakukan di beberapa kota/kabupaten dalam satu wilayah adat sehingga pengiriman sampel dapat dilakukan dengan lebih cepat pada wilayah yang sama.*

Kata kunci*: Covid-19, Papua, RT-PCR*

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Introduction

The Covid-19 pandemic due to the SARS-CoV2 virus (Severe Acute Respiratory Syndrome Coronavirus-2) is a global's health issue, impacting all aspects of life, such as education, tourism, economy, and others. Covid-19 was first detected in Wuhan, Hubei province, China, and quickly spread to other countries in a short period. The spread has threatened global public health. Covid-19 mainly affects the respiratory system with primary symptoms such as anemia, fever, cough, chest pain, flu, and fatigue. Besides, it affects the cardiovascular, gastrointestinal, nervous system, and renal. Covid-19 can infect people of all ages, both young and old (Agustina and Fajrunni'mah, 2020; Chilamakuri and Agarwal, 2021; Krishnan *et al.*, 2021; Leonard *et al.*, 2021). Older people, especially 65 years old and older, are more at risk for Covid-19 infection (Brooke and Jackson, 2020; Heid *et al.*, 2021). Covid-19 is not the first infection in the world, but in the last two decades, there have been several new viral infections, such as SARS-CoV1, Ebola, and MERS-CoV. However, the spread rate of these viruses is not as fast as Covid-19, which ultimately makes countries over the world unprepared for the extreme changes due to Covid-19 (Djalante *et al.*, 2020; Wu and McGoogan, 2020).

President of Indonesia, Joko Widodo, announced the first confirmed Covid-19 case in Indonesia on March 2, 2020 (Siagian, 2020). The first initial case was tracked in the Special Capital Region of Jakarta (Solichin and Khairunnisa, 2020). Since its first detection back then, the Ministry of Health had to arrange strategies to prevent the spread. One of the initial steps taken was issuing a Decree of the Indonesian Ministry of Health Number HK.01.07/MENKES/2020 concerning the Covid-19 Testing Laboratory Network on March 16, 2020 as many as 12 units. The Center for Papua Health Research and Development, based on a Decree of the Indonesian Ministry of Health, is the first laboratory in Papua appointed to conduct COVID-19 testing. The laboratories, however, could not accommodate all Covid-19 testing required. On July 1, 2020, the Indonesian Ministry of Health added the number of testing laboratories as many as 163 laboratories as issued in Decree Number HK.01.07/Menkes/405/2020 concerning the Covid-19 Testing Laboratory Network.

The basic measures to tackle Covid-19 rest on the discovery of suspected/ probable cases, isolation, and laboratory tests. Patient confirmed positive in the RT-PCR result needs to receive therapy according to the protocol. Contact tracing needs to be carried out as soon as the suspect case is found. Close contacts will be quarantined and monitored for 14 days. If they do not show any symptoms, they will be released from quarantine. At the same time, those with symptoms will be immediately isolated and checked for Covid-19 using RT-PCR.

Specimens were collected from the upper respiratory tract, such as nasopharyngeal swab (NP) and/or oropharyngeal swab (OP). The RT-PCR test better needs to be taken through nasopharyngeal and oropharyngeal swabs due to the higher viral load. Sometimes, specimens are also collected from broncho alveolar lavage (BAL) for some cases.(Geri *et al.*, 2020; Vlek *et al.*, 2021)

The gold standard Covid-19 test examines a unique sequence of viral RNA using nucleic acid amplification testing (NAAT). One of the NAAT types is real-time reverse transcription-polymerase chain reaction (rRT-PCR) which is generally used to detect a genetic disease such as Tay-Sachs disease mutation, thalassemia,

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monogenic disease, and even bronchitis virus infection in chicken (Traeger-Synodinos, 2006; Fellahi *et al.*, 2016; Abdelrazik, Elshafie and Abdelaziz, 2020; Corman *et al.*, 2020; Tahamtan and Ardebili, 2020). The Covid-19's genome encodes the nonstructural proteins to form the replicase-transcriptase complex, four structural proteins, and the putative accessory protein. Covid-19 testing targets four primary genes which are E (Envelope), N (nucleocapsid), S (Spike), and RdRp. Patient will be confirmed positive if a typical sequence of viral RNA is found in the specimen sample obtained from nasopharyngeal-oropharyngeal swabs (Mögling *et al.*, 2020; Zhang *et al.*, 2020). This virus infects receptors on the cell surface or ACE 2 (Angiotensin Converting Enzyme 2). It spikes to ACE 2 that is abundantly expressed in the respiratory tract, lungs, renal epithelium, immune cells, and others. The amount of positive-sense single-stranded RNA genome (29.7 kilobases) shares 79.6% sequence identity with SARS-CoV-1 (Michaud *et al.*, 2020; Wahjudi, 2020; Yusra and Pangestu, 2020; Plescia *et al.*, 2021). The closed system of RT-PCR minimizes the false-positive results of running the sample. RT-PCR has excellent sensitivity and specificity, low contamination risk, easy, and fast operation, and thus becomes an appealing alternative to conventional culture-based or immunoassay-based testing methods used in the clinical microbiology in diagnosing many infectious disease (Egbuna and Brown, 2013).

In addition to rRT-PCR, Covid-19 testing can also be done with Rapid Molecular Test (RMT). Based on its location, RMT is categorized into mobile platform and facility-based platform RMT. One of the RMTs used in Indonesia is GenXpert® or Xpert®Xpress. GenXpert is a cartridge-based nucleic acid amplification machine commonly used to test TB and MDR TB (Becker *et al.*, 2020; Oladimeji, Atiba and Adeyinka, 2020; Yusra and Pangestu, 2020).

On March 22, 2020, the first positive case of Covid-19 in Papua was reported by the Papua Covid-19 Response Acceleration Task Force. The number of confirmed cases in Papua reached 124 cases a month after the first case was reported (Sahli *et al.*, 2020). It has prompted the Papua Provincial Government to take preventive measures against a significant increase in the number of cases. The Deputy Governor of Papua gave instructions to the Papua Covid-19 Response Acceleration Task Force to accelerate laboratory testing (Pratiwi, 2020). Two laboratories that have meet the requirements to perform Covid-19 testing include the Center for Papua Health and Research Development Laboratory and the Papua District Health Laboratory. However, it is not enough to lean towards the laboratories alone to serve all districts in Papua.

As of May 26, 2020, the Center for Papua Health Research and Development successfully examined 2,400 samples and detected 436 positive samples. Further, the number increased to 11,955 as of June 24, 2020, as a result of Covid-19 testing conducted by the Papua Health Research and Development Center for the Ministry of Health and the Papua District Health Laboratory.

Papua is divided into five customary territories: Mee Pago, La Pago, Ha-Anim, Saireri, and Mamta. They share similarities in kinship, marriage, customary rights, geographical conditions, and others (Papua Regional Liaison Institution , 2020). The customary areas have commonly been determined for program implementation by the Papua Provincial Health Office. Similarities in landscapes, customs, and cultures shared and easy access to

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transportation between districts are expected to ease the execution of health programs. In this study, representatives were taken from a district in each customary territory. The five districts represent their regions with adequate hospital and laboratory conditions than other districts. Mimika General District Hospital represents areas surrounded by central geographical mountains (Mee Pago), and Jayawijaya General District Hospital has attributes similar to La Pago. Merauke General District Hospital has the geographical area of the swamp (Ha anim), and Biak General District Hospital represents a coastal geographical area (Saireri). The last area is Yowari General District Hospital in Jayapura Regency which represents Mamta.

To deal with Covid-19, accelerating the completion of Covid-19 testing is a must. For instance, the government may increase the testing capacity in each region, such as the availability of reagents, consumables, adequate facilities, and human resources. Covid-19 testing laboratories should be ready to optimize national testing needs not only for Covid-19 but also other diseases to provide the best patient care (Kaul, 2020).

This study was necessary to conduct since testing laboratories in Papua were not available at the moment in other regions with unique geographical conditions. Therefore, this study mapped the availability of thermal cycler equipment and rapid molecular tests for Covid-19 in five customary areas of Papua.

Method

This cross-sectional descriptive study was conducted in May-June 2020 by collecting primary and secondary data sources. Availability of Rapid Molecular Test data collected from Papua Provincial Health Office (HIV Program). Samples were taken with purposive sampling from a district in each customary territory that have molecular test for Covid-19. The five districts represent their regions with adequate hospital and laboratory conditions than other districts. Mimika General District Hospital represents areas surrounded by central geographical mountains (Mee Pago), and Jayawijaya General District Hospital has attributes similar to La Pago. Merauke General District Hospital has the geographical area of the swamp (Ha anim), and Biak General District Hospital represents a coastal geographical area (Saireri). The last area is Yowari General District Hospital in Jayapura Regency, which represents Mamta The primary data was collected through interviews with related laboratory officers via a cell phone and video conference such as Google Meet. The Chairperson of the Papua Covid-19 Response Acceleration Task Force represented by the Spokesperson for the Chairperson of the task force, the Chair of the Regency Papua Covid-19 Response Acceleration Task Force representing five customary areas (Ha Anim, Saireri, Mee Pago, Lapago, Mamta) was represented by the spokesperson for the task force. The section head of human resources represented the Covid-19 referral hospital. The Papua District Health Laboratory was represented by the Head of the Papua District Health Laboratory. Center for Papua Health Research and Development was represented by the head of the Center for Papua Health Research and Development. Secondary data were obtained from records released by the Papua Provincial Health Office and other related institutions. Field observations were carried out at laboratories and referral hospitals in Jayapura city to identify types of PCR available, PCR location, infrastructure, human resources, SOPs, and other aspects. For laboratories outside

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Jayapura city, observations were made via video conference. Descriptive data analysis described the province's readiness to face the Covid-19 pandemic and the results of RT-PCR testing. Data collection was conducted through telephone interviews and dissemination of questionnaire which consists of open questions. The main question of interview is about the laboratory. We asked about PCR brand, laboratory equipment, laboratory maintenance, laboratory safety capacity, human resources, and data management. Other devices used to collect the data were a notebook (field note) and a cell phone camera. Initially, the data would have been collected through virtual meetings, but due to limited signal providers, it was retrieved via WhatsApp and email.

Results and Discussion

Laboratory Safety Capacity

Rapid Molecular Test Equipment (GeneXpert) has been provided in several districts/cities (Table 1).

Following the Decree of the Indonesian Ministry of Health Number HK.01.07/Menkes/214/2020 concerning the Covid-19 Examination Laboratory Network, the Covid-19 testing laboratory must apply BSL-2 (Bio Safety Level 2). BSL-2 is also a safety guideline issued by the WHO for Covid-19 testing laboratories. It is also mentioned that Covid-19 testing should be done at the BSL-2 laboratory to protect laboratory personnel and the environment (Coronaviruses and New, 2013; WHO, 2020).

During the early Covid-19 pandemic in Papua province, Covid-19 testing was only available at two institutions: Center for Papua Health Research and Development and the Papua District Health Laboratory. The laboratories have fulfilled the requirements for being Covid-19 testing laboratories in Jayapura city.

Table 1. Availability of Rapid Molecular Test by Locations in Papua

No	Name of Regency	Public Health Facilities
1	Supiori	Supiori District General Hospital
2	Nabire	Nabire District General Hospital and Karang Tumaritis Primary Healthcare Center
3	Mimika	Mimika District General Hospital, Timika Primary Healthcare Center, Freeport Hospital
4	Biak	Biak District General Hospital, Biak Primary Healthcare Center
5	Yapen	Serui District General Hospital
6	Paniai	Paniai District General Hospital
7	Asmat	Asmat District General Hospital
8	Mappi	Mappi District General Hospital
9	Merauke	Merauke District General Hospital, Mopah Primary Healthcare Center
10	Jayapura	Yowari Hospital, Sentani Primary Healthcare Center & Nimboran Primary Healthcare Center
11	Jayawijaya	Wamena District General Hospital & Wamena Primary Healthcare Center
12	Keerom	Kwaingga District General Hospital
13	Boven Digoel	Boven Digoel District General Hospital
14	Jayapura City	Jayapura District General Hospital, Abepura Hospital, Marten Indey Hospital, Twano Primary Healthcare Center, Papua District Health Laboratory

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Table 2. Covid-19 Testing Capacity at Five hospitals

Hospital	Brands	Covid-19 Testing Capacity
Mimika District General Hospital	Abbott Real Time Robotic Model M2000 System (Eight-year operation)	96 samples per day, target genes: RdRp and N.
Merauke District General Hospital	RMT GeneXpert Model GX-IV (Four-year operation)	Since June 2020, 32 samples per day, target genes: E and N
Jayawijaya District General Hospital	RMT Cepheid GeneXpert Model GX-IV (Three-year operation)	Since June 2020, 95 samples per day, target genes: N and E
Biak District General Hospital	RMT GeneXpert	Since July 2020, 9 samples per day (Monday-Wednesday-Friday for Covid-19 services, Tuesday-Thursday-Saturday for TB services)
Yowari Hospital	RMT GeneXpert Model GX-IV (One-year operation)	Has not been used for Covid-19 testing

Of the five health service providers under investigation, Biak District General Hospital and Yowari Hospital did not possess a BSL-2 laboratory. Law Number I of 1970 and Law Number 23 of 1992 concerning Occupational Safety and Health are strong legal foundations in improving health service quality. The laws were then explained further in b the Decree of the Director-General of Medical Services Number HK 006.06.3.5.00788 of 1995 concerning Hospital Accreditation including clinical laboratory services and quality of health services at hospitals. Using the decree into hospital's policy, Covid-19 testing laboratories can equip themselves with standards operating procedures that can reduce the risk of the viral exposure in laboratory officers and limit the viral spread to the work environment and community. Each hospital has to apply BSL 2 in its laboratory to obtain excellent and accurate results since they are a determinant of success in case tracing.

Testing Capacity

The Center for Papua Health and Research Development and Papua District Health Laboratory had different tools. The Center for Papua Health Research and Development used Biorad CFX-96 with a sample testing capacity of 96 samples per running approximately 4 hours for RNA extraction and 2 hours for PCR. The average testing capacity was 300-400 samples/day. The Center for Papua Health Research and Development was assisted by the National Food Drug and Agency of Jayapura to perform the PCR test using the RotorGene machine, which routinely works on 70 samples/day. Meanwhile, the Papua District Health Laboratory has real-time Abbott Automatic to run 96 samples/day, and it takes 6.5 hours to proceed the testing.

Of the hospitals studied, only Mimika District General Hospital had PCR tool (Table 2). The other four hospitals had RMTs, which are used to check the Covid-19 infection. RMTs were already in the hospital before the pandemic occurred. The Rapid Molecular Test, a molecular in vitro diagnostic tool, was priorly used for

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Tuberculosis screening. The Xpert Xpress SARS-CoV-2 test, performed on GeneXpert, is an automated in vitro diagnostic test for qualitatively detecting the nucleic acid from SARS-CoV-2 that uses single-use cartridges. Primers and probes become an internal control for the in vitro qualitative detection of SARS-CoV-2 RNA in the Xpert Xpress SARS-CoV-2 kit.

Each laboratory has not achieved the Covid-19 testing acceleration targeted by the Papua Deputy Governor. Hospital laboratories with RMT tools also find it challenging to perform a large number of testing as they are also allocating the testing for TB services. The limited number of tests forced the district to deliver samples of specimens collected in those two laboratories to one of the hospitals in Jayapura city for examination.

Supporting Laboratory Facilities

The Covid-19 testing must be supported by good and complete supporting tools to generate accurate results. If the tools are not compatible and cannot be simultaneously operated, the samples of specimens cannot be investigated well. The laboratories studied had been equipped with supporting tools which had been utilized for other laboratory testings, such as clinical chemistry, hematology, and immunology testing.

This study revealed Yowari Hospital in Jayapura city had not set a BSC (Bio Safety Cabinet) for its laboratory. Apart from BSC, other essential tools such as autoclave, micropipette, freezer-20, 4-degree refrigerator, vortex, centrifuge, and other tools were available at all five hospital laboratories.

Data Management

One of the essential procedures in dealing with the Covid-19 pandemic is data management (Januraga and Harjana, 2020). Real-time reporting of the testing results could be made from each regional laboratory and task force to the National Institute of Health Research and Development, thereby providing inputs for accurate decision-and-policy making. The President of the Republic of Indonesia suggested to improve the Covid 19 data management, for example, by providing one-door data access. Data management should be the common concern in accelerating the Covid-19 pandemic handling. In addition to government policies, quick testing results will serve patients with immediate responses. All positive and negative results from PCR and Molecular Rapid Tests should be submitted to the National Institute of Health Research and Development (NIHRD) as instructed in the Circular Letter of the Indonesian Ministry of Health Number HK.02.01/MENKES/234/2020. The result submission was done through a digital application, and thus health service providers having neither PCR nor Molecular Rapid Test could check the reports in real-time. Currently, the results from GeneXpert Molecular Rapid Test were still reported through the SITB (Tuberculosis Information System), while PCR results were submitted by laboratory officer through the digital application. However, Jayawijaya District General Hospital, Biak District General Hospital, and Yowari District General Hospital had not used the application to report the testing results because they did not conduct the testing independently. All records application are only used to obtain the examinations conducted by the Center for Papua Health Research and Development and Papua District Health Laboratory in Jayapura city. At the Mimika Hospital Laboratory, it met the testing standards as it provided test request forms (doctor/ hospital introduction) and reported the results. Also, an information system was available for submission and collection of

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Table 3. Estimated examination cost

No	Laboratory	Estimated examination cost sample (Rp)	Estimated examination cost per day (Rp)
1	Center for Papua Health Research and Development	320.000	128.000.000 (for 400 samples)
2	Mimika Regional Hospital	730.000	73.000.000 (for 100 samples)
3	Merauke Regional Hospital	770.000	25.000.000 (for 32 samples)
4	Biak Regional Hospital	770.000	7.700.000 (for 10 samples)

testing results there. Besides, the Mimika Hospital laboratory also applied a reporting mechanism at the provincial level.

Costs

The Covid-19 testing cost was also compared to one laboratory to another. The Center for Papua Health Research and Development using RT-PCR Biorad CFX-96 purchased extraction reagent for 250 reactions of Rp 38,000,000 and PCR reagent Rp 40,000,000 with an estimated cost of Rp 320,000 per sample. The reagent procurement cost was allocated from the office budget. However, if the BNPB (National Disaster Management Authority) procures the reagent extraction, the laboratory only will supply consumables and other expenses. For 400 patients/sample, the laboratory needs to spend Rp 128,000,000 of the office budget for purchasing reagent extraction.

The Mimika Hospital Laboratory, which used Realtime Abbott Automatic M2000, spent Rp 69,000,000 per 96 samples for reagent extraction. An estimated cost per sample was Rp 730,000. In other words, 100 patients/sample would cost Rp 70,000,000 for reagent extraction per day. Unlike the previous laboratory, Merauke District General Hospital Laboratory spent Rp 7,700,000 for reagents per 10 cartridges using the Molecular Rapid Test GeneXpert. The estimated cost per sample was Rp 770,000. Everyday reagent extraction for 32 patients would cost Rp 25,000,000.

This study also found the Biak Regional Hospital Laboratory, using the Molecular Rapid Test GeneXpert, spent Rp 7,700,000 per 10 cartridges with an estimated cost of Rp 770,000 per sample. The possible reagent extraction cost required for ten patients was around Rp 7,700,000. Using the same testing tool, Jayawijaya Regional Hospital Laboratory spent Rp 7,700,000 per 10 cartridges or an estimated cost of Rp 770,000 per sample. An estimated everyday cost for 95 patients required Rp 74,000,000. However, Yowari Hospital Laboratory has not estimated any budget for Covid-19 testing.

To conclude, the cost of regular RT-PCR testing is more economical than automatic RT-PCR and RMT.

Standard Operating Procedure

One of the important considerations for the Covid-19 testing is the implementation of SOPs which regulate any activities in the laboratory and become a means of creating effective working conditions and systems. Standard operating procedure (SOP) is a set of written instructions to perform or complete a laboratory process safely and effectively. SOP helps laboratory officers examine the samples. They can carry out the procedure

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correctly every time and reduce the possibility of errors result or steps. SOP should be written by an expert and easy to read. SOPs available at five hospital laboratories regulate waste handling, decontamination, and the use of tools.

Laboratory Equipment Maintenance

The Covid-19 testing requires good laboratory equipment maintenance. Maintenance is all activities to maintain facilities and equipment for proper and well-operated system which should always be in ready-to-use condition. Laboratory equipment with a high frequency use may have a higher probability of contamination. Therefore, laboratory officers should make sure to daily disinfect the tools.

In Mimika District General Hospital, the RT-PCR had a periodic maintenance schedule and was calibrated annually by PT. Abbott Molecular. The tool was commonly used for HIV viral load testing prior to Covid-19 testing. Regarding the BSC, the hospital also conducted periodic maintenance schedule and hired annual calibration services of PT. Biobase.

The GeneXpert Molecular Rapid Test at Merauke General District Hospital was calibrated every year. It was usually utilized for Tuberculosis testing before Covid-19 testing was required. PT. Basao Prima Sentosa was in place to check the BSC function both at Merauke and Biak District General Hospital. In Jayawijaya District General Hospital, the GeneXpert Rapid Molecular Test was calibrated annually by PT Mitra Tera, while for BSC maintenance, the hospital partnered with PT Arneta. However, Yowari Hospital was not appointed for the Covid-19 testing during the research. Most of the hospital laboratories, in summary, already had a periodic maintenance schedule and a calibration schedule every year for the equipment which was previously used for other laboratory testing such as hematology, immunology, and clinical chemistry examinations.

Human Resources

The Covid-19 laboratory testing must have trained human resources. Laboratory officers who were involved in the Covid-19 screening process dealt with active pathogens, and thus they had to have laboratory expertise. Trained human resources can conduct the extraction process and PCR test appropriately since they have been taught about laboratory practice standards and skills in the relevant technical and safety procedures. With the expertise, they have greater possibility to avoid the viral contamination.

A specific number of human resources are required in tool maintenance and sample testing. At the Center for Papua Health Research and Development designated 10 officers consisting of 4 officers in the extraction section and 6 officers in the RT-PCR section.

This study pointed out Mimika District General Hospital had three officers of whom two officers trained for the use of PCR. While, two officers were responsible for Covid-19 laboratory testing using RMT at Merauke District General Hospital. At Biak District General Hospital, six officers had been trained to use RMT. Meanwhile, three untrained officers were assigned to conduct RMT in Jayapura Regency, Yowari Hospital.

The Mimika District General Hospital has conducted training and mentoring with PT Abbott Molecular technicians. Before assigning the task to the officers, Merauke District General Hospital also partnered with Papua District Health Laboratory to train the officers about the use of RMT. The Jayawijaya District General Hospital, Biak District General Hospital, Yowari Hospital still required further assistance and training about the use of RMT from the Papua District Health Laboratory.

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Use of Laboratory Facilities during Pandemic

During the pandemic, the laboratory facilities described were not only used for Covid-19 testing. However, the laboratories also utilized the tools for other disease examinations such as Tuberculosis, HIV, genetic diseases, and others.

Conclusion

The Covid-19 molecular based testing capacity of laboratories from various regencies representing five customary areas of Papua has not yet reached its maximum capacity yet in the beginning of pandemic. Districts that only had the GeneXpert tool were recommended to procure RT-PCR, and thus the tool could accelerate the Covid-19 testing in Papua province. If RT-PCR is available in several cities/districts within one customary area, samples can be delivered more quickly. Papua province could carry out 1,000 RT-PCR tests/day which could target 30,000 samples/day as instructed. Districts in the customary area of Mamta (Jayapura district) are advised to have a Biosafety Cabinet (BSC) for safe and proper laboratory examination. The cost of RT-PCR testing is more economical than automatic RT-PCR and RMTs. However, some obstacles might be found in the use of regular RT-PCR. For example, it requires highly trained human resources to carry out the extraction process, mix PCR reagents, and analyze the machine's data.

Abbreviation

Covid-19: Corona Virus Disease-19; SARS-CoV2: Severe Acute Respiratory Syndrome Coronavirus-2; RT-PCR: Real Time-Polymerase Chain Reaction; RMT: Rapid Molecular Test; BNPB: *Badan Nasional Penanggulangan Bencana*; SOP: Standard operating procedure.

Declarations

Ethics Approval and Consent Participant

Respondents were addressed before the survey about the survey's objectives and purposes.

Conflict of Interest

The authors declared no conflict of interests

Availability of Data and Materials

Data and material research can be provided at open data repository (OSF, Zenodo, Repositori Ilmiah Nasional, Institutional Repository Data and etc.) or by upon request.

Authors' Contribution

MW and CI conceptualized the study; MI created the methodology; CI wrote, and edited the manuscript; CI wrote the original draft; MW reviewed the manuscript.

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