



OVERVIEW OF PUBLIC HEALTH LABORATORY READINESS IN PRIMARY HEALTH CARE IN INDONESIA: A SCOPING REVIEW

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ABSTRACT

This study examines the readiness of public health laboratories in Indonesia's primary healthcare services, focusing on resource distribution, critical result reporting, and health policy implementation. A review of several studies reveals that laboratory readiness is limited by facility constraints, drug availability, and healthcare workers' understanding of critical result handling. Policies like BLUD and lean hospital approaches can enhance operational flexibility in laboratories. Recommendations are directed toward strengthening resource distribution and staff training to improve laboratory service quality in primary healthcare.

Keywords: health policy; laboratory readiness; primary healthcare; resource distribution

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INTRODUCTION

The Public Health Laboratory (Labkesmas) has an important role in ensuring public health at the primary service level, such as health centers. The main functions of the laboratory include early detection of diseases, environmental monitoring (e.g. water and food quality), and supporting preventive and promotive health programs. In Indonesia, with its complex geographical and social diversity, reliable health laboratories are indispensable to support public health services. Health Laboratory is a health service facility that carries out measurement, determination and testing of materials of human origin and/or even non-human origin to determine the type of disease, cause of disease, health condition or risk factors that can affect the health of individuals and/or the community. Health laboratories are one of the supporting facilities in the implementation of health service efforts. Health laboratories are needed to examine, analyze, decipher, and identify materials in the determination of disease types, disease causes, and specific health conditions. The total number of health laboratories in Indonesia is 1,487, and as many as 32 (22%) laboratories have been accredited. The most accredited laboratories are owned by the private sector, which is 1,218 (50.2%) (The First World, 2024).

Research Arsyad et al., (2022) It also shows that the readiness of laboratories at the health center varies. Health centers in urban areas usually have more complete facilities than those in rural or remote areas, which often lack equipment and trained personnel. The COVID-19 pandemic has exacerbated these challenges, revealing the many limitations of public health laboratories in dealing with the surge in demand for rapid testing and analysis. Reports from WHO (2023) revealed that during the pandemic, laboratories at health centers were overwhelmed with increasing demand for PCR and antigen tests, and limited infrastructure and human resources in laboratories led to delays in test results. This shows the need to increase the capacity of health laboratories throughout Indonesia, especially in dealing with health emergency situations.

Furthermore, the Ministry of Health's report on the Rencana Pembangunan Jangka Menengah Nasional (RPJMN) 2020-2024 targets increasing the capacity of public health laboratories in primary services. One of the efforts launched is to increase the number of accredited laboratories, as well as intensive training for health workers in laboratories to improve service quality. This review of this article will provide a clearer picture of the challenges faced by laboratories in Indonesia. This article also explains the readiness of laboratory standard requirements, and answers the need for better public health services.

METHOD

The design of this study uses literature review. The data source comes from national articles using relevant databases, namely PubMed, SINTA, GARUDA, Science Direct. The search focuses on the findings of various studies that have been published in national journals in Indonesia. To get relevant articles, the publication period is limited to a span of five years between 2019 and 2024, by using a combination of keywords: Hospital Readiness Analysis, Health Center Readiness Analysis, Laboratory Readiness, The Readiness of Public Primary Health Care. Table 1 displays inclusion and exclusion criteria.

Table 1.
Inclusion and Exclusion Article Criteria

Inclusion Criteria	Exclusion Criteria
Articles that discuss Overview of the readiness of Public Health Laboratories in primary care in Indonesia	Articles that are not related to Overview of the readiness of Public Health Laboratories in primary care in Indonesia
Scientific and research articles	Non-scientific and non-research articles
Documents in English or Indonesian	Documents are not in English or Indonesian
Published in 2019-2024	Published outside 2019-2024
Available in full text	Not available in full text
Open access	Access not open
Quantitative, qualitative, experimental, and other research methods	Systematic review methods, literature reviews, or non-research methods

Search Strategy

The electronic search was carried out using the final keyword: the relationship between nutritional knowledge in adolescents and the decrease in the prevalence of anemia. The data sources are PubMed, SINTA, GARUDA, ScienceDirect.

Selection of the Study

The results obtained from the previous phase are collected and stored in a database to assist authors in researching titles and abstracts to ensure qualified articles. Eligible articles are then re-evaluated to eliminate any duplicates identified. Furthermore, the remaining articles are carefully reviewed to ensure that they meet the inclusion requirements.

Data Extraction

After that, data is collected from papers that are eligible for inclusion in the research findings. This data includes information such as the author and year of publication, research objectives, data collection instruments, research techniques, and results. The extracted data is displayed descriptively without any additional analysis. Information was obtained from 15 articles that met the inclusion criteria.

RESULT

Based on a study from the literature, 15 articles related to the relationship between the readiness of Public Health Laboratory in Primary Health Care in Indonesia. The details of the content of the article can be seen in the following table:

Table 2.

List of Eligible Articles

Title, Author, Year	Aims	Sample Size	Methods	Result
Laboratory Readiness and Response for SARS-Cov-2 in Indonesia (Aisyah Et Al., 2021)	This paper reviews laboratory readiness in Indonesia during the early months of the pandemic	685 laboratories from 34 provinces	Cross-sectoral collaboration among previously siloed central and local government agencies, international development agencies, and private sector stakeholders.	This ongoing pandemic has tested the readiness, response and resilience of laboratory systems in Indonesia for more than 1 year. Indonesia is one of the countries with inadequate diagnostic laboratory readiness, especially with the uneven distribution of staff, equipment, and consumable capacity in several provinces.
Readiness of Primary Health Services (Puskesmas) for Cardiovascular Services in Makassar City, Indonesia (Arsyad Et Al., 2022)	This study aims to provide information about readiness in providing CVD (Cardiovascular Disease) health services in primary health services, namely Puskesmas.	47 health centers	This research questionnaire is adapted from the World Health Organization (WHO) Service Availability and Readiness Assessment,	The readiness score of the Puskesmas to provide CVD health services ranges from 60 to 86 for. In addition, there are 11 health centers (23.4%) with a score below 75, which indicates less than optimal readiness to provide CVD (Cardiovascular Disease) health services. The shortage of essential medicines and the low capacity for diagnostic tests are the most glaring shortcomings that lead to suboptimal readiness for high-quality CVD (Cardiovascular Disease) health services.
What Factors Influence Primary Health Care Choices When Access to Health Care in Limited Health Insurance Schemes: A Cross-sectional Study in Bandung, Indonesia (Fauziyyah Et Al., 2024)	The study investigated the geographical coverage of BPJS-Kesehatan's primary healthcare options and BPJS-Kesehatan beneficiaries, based on their healthcare characteristics and preferences in the target areas in Bandung,	216 adults	Cross-sectional study	Sociodemographic characteristics, health service preference factors, and health insurance status were associated with participants' primary health care choices in the target area in Bandung, Indonesia. The map of BPJS Kesehatan partner service coverage and preference factors is potentially important for policymakers, especially for the development of BPJS Kesehatan partnerships in the future.

Title, Author, Year	Aims	Sample Size	Methods	Result
Indonesia.				
Availability of Essential Medicines in Health Centers in Indonesia: Achievements and Challenges Across the Archipelago (Fanda Et Al., 2024)	The study examines the availability of essential medicines in health centres across Indonesia, the reasons why medicines are unavailable, and the extent to which communities have access to alternative distribution points.	9831 health centers	Correlate the results with national village censuses to assess the relationship between availability, poverty, and access to alternative points of expenditure.	The study shows that the availability of prioritized essential medicines in health centres across Indonesia is relatively high, which is an important finding given the low price of government-purchased medicines. The average availability of 60 more complete essential medicines was lower (58%), and some medicines were often deemed unnecessary by local health officials. Drug availability is found to be lowest in rural districts, especially in eastern Indonesia, where access to other drug providers is also the most limited.
Distribution of Catheterization Laboratories in Indonesia 2017-2022: National Survey (Muharram Et Al., 2024)	This study investigated the correlation between the incidence of heart disease, regional GDP per capita (PPP), and the proportion of cardiac laboratories in different regions.	GIS (Geospatial information system) data of the Ministry of Home Affairs	Direct surveys are used to collect data	The results suggest that areas with a greater incidence of heart disease typically have a higher proportion of cath labs, which is consistent with the logical assumption that health care resources, such as cath labs, are distributed based on the health care needs of the population. Further examination of the regression model confirmed the effect of heart disease prevalence and regional GDP per capita on the cath lab ratio. This study confirms the complex nature of the allocation of health resources, which is influenced by health needs and economic capacity.
Analyzing Drug Administration Patterns in Health Centers in Indonesia Based on WHO Prescribing Indicators (Zairina Et Al., 2024)	This study aims to investigate drug use patterns based on WHO prescribing indicators in several health centers in Surabaya, East Java, Indonesia.	5 health centers	This research is cross-sectional descriptive.	This study concluded that the prescribing indicators in five health centers in Surabaya, Indonesia are different from WHO standards. Antibiotic prescribing, injection prescribing, and the proportion of medications prescribed based on the list of essential medicines are lower than WHO standards. The study found that the percentage of prescriptions containing generic names almost met the WHO indicator. Regulation and supervision of drug prescribing practices are needed to encourage rational drug use and minimize adverse drug reactions.
Hospital Readiness in Indonesia to Handle COVID-19 at the Beginning of the Outbreak: A Qualitative Study of Nurse Managers (Asmaningrum Et Al., 2022)	To explore the perspective of nurse managers regarding hospital readiness in handling the COVID-19 pandemic in the early	9 head nurses	Qualitative studies	Indonesia's healthcare system has made responsive adjustments to handle COVID-19 by increasing the flexibility and adaptability of the physical structure of institutions, services, and human resources in the early phases of the COVID-19 pandemic.

Title, Author, Year	Aims	Sample Size	Methods	Result
	phase.			
Analysis of the Quality of Rt-PCR Examination Services on Patient Satisfaction at the UPDT Regional Health Laboratory of Mojokerto Regency (Munandar et al., 2023)	This study aims to determine the influence of the quality of RT-PCR examination services at the Mojokerto Regency Health Laboratory UPTD in 2022.	38 respond	Studi cross-sectional	The results of the study explained that the quality of RT-PCR examination services on patient satisfaction at the Mojokerto Regency Health Laboratory UPTD in 2022 had a positive effect on patient satisfaction, which means that the better the quality of services provided by the Mojokerto Regency Health Laboratory UPTD, the higher the patient satisfaction.
Lean Hospital Approach in Optimizing Hospital Laboratory Services (Wardani et al., 2023)	The purpose of this study is to find out the lean hospital approach in optimizing laboratory services and conditions before and after the lean hospital approach is carried out in hospital laboratories.	Hospital A Cimahi City and Hospital B Bandung City	This type of research is qualitative in nature	The results showed that the ratio of value-added activities to total activities in both hospitals was less than 30%. The improvement proposals submitted to the management at the two hospitals showed quality improvements, including a decrease in patient waiting times, clear directions to the laboratory, an integrated hospital information system (SIMRS), and appropriate standard operating procedures (SOPs) were adhered to. In conclusion, the two hospitals are considered not lean because they have a ratio of value-added activities to total activities is less than 30%, waste on waiting time, process, transportation, motion and defects are influenced by man, methods, machine, and environmental.
Analysis of the Critical Results Report of Laboratory Examinations on Patient Health Services in the Internal Medicine Inpatient Room at Telaga Bunda Bireuen Hospital in 2019 (Sumaidi et al., 2022).	The purpose of this study is to evaluate and provide an overview of the procedures for reporting laboratory critical results at Telaga Bunda Hospital	Critical diagnostic examination results report	The research design is qualitative	The results of the study show that not one hundred percent of nurses have reported critical results to the DPJP, nurses who have reported the critical results of laboratory examinations have not read back one hundred percent to DPJP doctors, and not 100% of nurses have documented the critical results of laboratory examinations in the patient's medical record, namely recording the critical results of laboratory examinations written in the CPPT of the patient's medical record. The critical results of laboratory examinations are not all reported to the DPJP by nurses and laboratory officers because the officers do not understand the meaning of critical laboratory examination results correctly. Re-socialization of patient safety, critical examination results and effective communication to nurses and laboratory staff is needed.
Analysis of the Completeness of Facilities and	The purpose of this study is to analyze the	The data that can be generated	Qualitative descriptive methods	Based on the results of observations in the field and the results of interviews that have been conducted, it was found that

Title, Author, Year	Aims	Sample Size	Methods	Result
Infrastructure in Improving the Quality of Health Services at the Pratama Islamic Center Clinic, East Kalimantan Province (Tiana et al., 2024)	completeness of facilities and infrastructure in improving the quality of health services at the Pratama Islamic Center Clinic in East Kalimantan Province	is in the form of interviews, field notes, photos, videos and other documentation		there are still several health equipment facilities that are not yet owned by the Islamic Center Pratama Clinic in East Kalimantan Province, including laboratory health service units and general examination clinics
The Effect of the Health Laboratory Information System (SILK) on Service Quality at the Makassar Health Laboratory Center (Latif et al., 2020)	The purpose of this study is to find out how SILK affects the quality of services at the Makassar Health Laboratory Center in 2020	100 responses	Descriptive explanatory analysis by cross sectional study	The statistics of Standard Operating Procedures (SPO) on service quality through minimum service standards are 0.016, while the coefficient of direct influence is 0.128. The value of the indirect influence coefficient is smaller than the value of the direct influence coefficient, meaning that the implementation of SPO does not indirectly affect the quality of service through minimum service standards. Meanwhile, the competence of human resources on the quality of service through minimum service standards is 0.016, while the coefficient of direct influence is 0.362. The value of the indirect influence coefficient is smaller than the value of the direct influence coefficient, meaning that the competence of human resources does not indirectly affect the quality of service through minimum service standards. Conclusion; SPO is very necessary because it is one of the main bases to create good service at BBLK Makassar.
Analysis of the Readiness of the Technical Implementation Unit (UPT) of the Pekanbaru City Health Laboratory in Implementing the Policy of the Regional Public Service Agency (BLUD) in Pekanbaru City in 2020 (Heriyadi et al., 2020)	The purpose of this study is to analyze the readiness of the Pekanbaru City Health Laboratory UPT in the Implementation of BLUD policies in Pekanbaru City in 2020.	6 Reporting	Qualitative	The results of the study show that readiness in terms of input is still lacking in human resources in the fields of finance and administration. In terms of process, the Pekanbaru city health laboratory UPT has completed all substantive, technical, and administrative requirements. And in terms of output, the Pekanbaru City Health Laboratory UPT is ready to implement the BLUD policy. It is hoped that the Pekanbaru City Health Laboratory UPT will immediately submit an assessment of the implementation of the BLUD policy. By becoming a BLUD, it can meet needs independently with a faster process.
Study on Potential Hazards in the Laboratory of the Kendari City Regional General Hospital 2019	The purpose of this study is to find out the description of potential hazards in the	Head of Laboratory and Laboratory Staff of Kendari	Qualitative Descriptive	The results of the study showed that potential physical hazards in the form of moderate noise, vibration, dust-producing devices, low climate/temperature in the room that could cause the risk of injury, and the

Title, Author, Year	Aims	Sample Size	Methods	Result
(Aristha et al., 2021)	Laboratory of Kendari City Hospital	City Hospital		absence of slippery floor signs. Potential biological hazards have potential dangers related to disease transmission. Potential chemical hazards include potential hazards related to the use of chemicals as reagents in the inspection process. Potential ergonomic hazards are in the form of the use of Personal Protective Equipment (PPE) and facilities that are not suitable for body size. Potential psychosocial dangers in the form of emotional pressure on workers can refer to work stress. Potential mechanical hazards such as nearly being pinned and/or pinned if the Standard Operating Procedures (SOPs) are not observed. Potential electrical hazards in the condition of untidy wiring and untight plugs/switches.
Overview of the Implementation of Occupational Safety and Health in Hospital Laboratories (Susilwati, 2021)	To find out an overview of the implementation of occupational safety and health in hospital laboratories	21 Respondents (8 Hospitals)	Qualitative Descriptive	Compliance with hand washing and the use of PPE is more than 80%. The number of work accidents is still high, namely: 12 people have been pierced by needles, 10 people have been spilled B3 and infectious and fires were experienced by 2 respondents. As many as 90.47% did not undergo periodic health checks and 71.43% did not receive the hepatitis B vaccine. . In conclusion, the implementation of occupational safety and health in the hospital laboratory has not fully run well.

DISCUSSION

The basis for establishing a public health laboratory

Study Buchari Lapau (2015) The development of medical science is formulated into 4 stages as follows: first, diseases are diagnosed based on symptoms and signs; second, with the advancement of microbiology, the cause of the disease is known, so that treatment of the disease is based on the cause; third, there is a development of medical science towards specialization so that certain diseases are handled specifically by the relevant experts; fourth, there is a need for what is called a public health laboratory, where problems are identified, what causes them, and then solving the problem based on that cause.

The readiness of public primary health care for labortaory

Our findings also demonstrate that the diagnostic test capacity in the Puskesmas was limited. Meanwhile, low-density lipoprotein (LDL), high-density lipoprotein (HDL), creatinine, and blood urea nitrogen tests were not found in any Puskesmas, despite being regulated as the standard laboratory services in Puskesmas

Distribution and Readiness of Laboratories in Indonesia.

The results of Aisyah et al. (2021) research results show that the COVID-19 pandemic is a challenge for laboratory readiness in Indonesia, especially related to the uneven distribution of staff and equipment. These capacity limitations highlight the need for increased cross-sectoral coordination between governments, development organizations, and the private sector to deal

with similar emergency situations in the future. The research of Muharram et al, (2024) shows the relationship between the prevalence of heart disease and the distribution of catheterization laboratories in areas with different income levels. These results reflect challenges in the allocation of health resources, especially in laboratories that require specialized equipment. In addition, research by Fanda et al, (2024) shows that the distribution of essential drugs is uneven, especially in rural areas. These shortages hinder primary health services, including laboratory services that rely heavily on the availability of drugs for immediate treatment.

Service Effectiveness and Reporting System

A study by Arsyad et al. (2022) identified that the readiness of diagnostic services in health centers is still varied. The readiness score of health centers in Makassar ranges from 60 to 86, with some health centers not optimal due to a lack of diagnostic equipment and essential medicines. Based on research by Munanda et al, 2023), the quality of RT-PCR services also has a significant influence on patient satisfaction. This shows the importance of the quality of laboratory services in meeting expectations and increasing public trust in health services.

Improving Quality and Operational Efficiency

Study by Wardani et al, (2023) In the laboratory, wastage often occurs in patient wait times, equipment coordination, and lack of effective SOPs (standard operating procedures). With a lean approach, laboratories can reduce waiting times, minimize errors, and improve efficient services. In primary care, especially in health centers, this approach can be a solution to make the laboratory service process leaner and more responsive to patient needs. The research of Tiaana et al, (2024) highlights the lack of complete facilities and infrastructure in health laboratories in primary clinics. Limited laboratory equipment and infrastructure limit the effectiveness of diagnostics as well as adequate public health surveillance. This study suggests the need to invest in basic laboratory equipment to support the quality of services, especially in areas with limited access. In the context of primary services in Indonesia, equipping basic laboratory facilities is essential to provide equitable and effective services to the community.

Social and Policy Factors

The readiness of public health laboratories in primary services is influenced by various policy and social factors. A study by Arsyad et al. (2022) shows that health center facilities are often less than optimal in handling chronic diseases, especially in remote areas. Asmaningrum et al. (2022) highlighted the need for laboratory flexibility in dealing with crises such as pandemics. The implementation of the BLUD policy in Pekanbaru (Heriyadi et al., 2020) provides an example of how management autonomy can accelerate the improvement of laboratory services. The combination of adaptive policies and self-management supports laboratory readiness effectively.

Developing laboratory networks

The Public Health Laboratory leads a network of clinical and other agency (e.g., food testing, veterinary, and local public health) laboratories to support public health response. The development of a robust national network of laboratories is, however, dependent on the existence of such laboratory networks within each state. The development of these statewide laboratory network is, in turn, dependent on state – specific leadership and resources.

The National Laboratory System

A more broad application of the LRN is the National Laboratory system (NLS). In a collaborative effort to promote the 10 essential Public Health Services and the core function and capabilities of state public health laboratories, in 2000 CDC and APHL developed the

concept of the NLS.

The Role of Local Public Health Laboratories

Local public health laboratories (PHLs) serve an important evolving role in supporting the broad mission of public health. To fulfill this role, local PHLs must be integrated with a diverse set of public health programs and services at the local state and national levels. Just as clinical laboratories provide a substantial proportion of the data used by health care providers to diagnose, monitor, and treat patients, so do local PHLs generate much of the data used by policy makers to assess the community's health status, identify health risks, and support public health program activities and decisions.

Role of the laboratory response network in advancing the Network Laboratory system concept.

It was the establishment of the laboratory response network and its rapid growth after the 2001 that motivated clinical laboratorians to recognize and embrace their role in public health testing, especially through closer collaborations between clinical and state Public Health Laboratory.

CONCLUSION

Overall, the readiness of public health laboratories in primary care in Indonesia still faces various challenges, ranging from equipment availability, service quality, to workforce safety. Improving the quality and distribution of resources, the adoption of information systems, safety-related training, and policies that support operational independence in laboratories are needed to increase the readiness and effectiveness of laboratory services in Indonesia. The implementation of these improvements is expected to be able to answer the need for better public health services in the future.

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