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CERTIFIED PCR TRAINING AS AN INNOVATIVE PROGRAM FOR ENHANCING THE COMPETENCE OF HEALTH LABORATORY HUMAN RESOURCES

PELATIHAN PCR BERSERTIFIKAT SEBAGAI PROGRAM INOVATIF UNTUK MENINGKATKAN KOMPETENSI SUMBER DAYA MANUSIA LABORATORIUM KESEHATAN

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Abstract

The increasing threat of emerging and re-emerging infectious diseases necessitates the strengthening of the capacity of the Health Laboratory (Labkes) network, including Public Health Laboratories (Labkesmas), through the availability of competent and standardized laboratory human resources (HR). Polymerase Chain Reaction (PCR) testing has become the primary diagnostic method for pathogen detection, both in routine services and in public health emergency situations. The development of a PCR training curriculum and modules by the Center for Health Biology Laboratory (BBLBK) represents a strategic step toward standardizing the competencies of laboratory personnel. This article aims to describe the urgency of implementing certified PCR training policies as part of a national system for enhancing the competence of health laboratory human resources. The writing method employs policy analysis based on document review and the framework of national health regulations. The analysis results indicate variations in laboratory personnel competencies, the absence of a national certification scheme, limited availability of trainers, and the need for continuous curriculum updating. Certified PCR training is therefore recommended as a national instrument for fulfilling competency standards in health laboratories. The integration of training into the health human resource development system, along with the strengthening of quality- and safety-based approaches, is key to the successful implementation of this policy.

Keywords: PCR, Training, Health Laboratory, HR Competency, Certification.

Abstrak

Meningkatnya ancaman penyakit menular yang muncul dan muncul kembali menuntut penguatan kapasitas jaringan Laboratorium Kesehatan (Labkes), termasuk Laboratorium Kesehatan Masyarakat (Labkesmas), melalui ketersediaan sumber daya manusia (SDM) laboratorium yang kompeten dan terstandarisasi. Pengujian Polymerase Chain Reaction (PCR) telah menjadi metode diagnostik utama untuk deteksi patogen, baik dalam layanan rutin maupun dalam situasi darurat kesehatan masyarakat. Pengembangan kurikulum dan modul pelatihan PCR oleh Pusat Laboratorium Biologi Kesehatan (BBLBK) merupakan langkah strategis menuju standardisasi kompetensi personel laboratorium.

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Artikel ini bertujuan untuk menjelaskan urgensi implementasi kebijakan pelatihan PCR bersertifikat sebagai bagian dari sistem nasional untuk meningkatkan kompetensi sumber daya manusia laboratorium kesehatan. Metode penulisan menggunakan analisis kebijakan berdasarkan tinjauan dokumen dan kerangka peraturan kesehatan nasional. Hasil analisis menunjukkan variasi kompetensi personel laboratorium, tidak adanya skema sertifikasi nasional, ketersediaan pelatih yang terbatas, dan kebutuhan akan pembaruan kurikulum yang berkelanjutan. Oleh karena itu, pelatihan PCR bersertifikat direkomendasikan sebagai instrumen nasional untuk memenuhi standar kompetensi di laboratorium kesehatan. Pengintegrasian pelatihan ke dalam sistem pengembangan sumber daya manusia di bidang kesehatan, bersamaan dengan penguatan pendekatan berbasis kualitas dan keselamatan, merupakan kunci keberhasilan implementasi kebijakan ini.

Kata Kunci : PCR, Pelatihan, Laboratorium Kesehatan, Kompetensi SDM, Sertifikasi.

1. INTRODUCTION

Health Laboratories (Labkes), including Public Health Laboratories (Labkesmas), play a pivotal role as the backbone of Indonesia's diagnostic health service system. Labkes not only provide clinical testing and disease surveillance but also serve as the frontline in early infection detection and in supporting evidence-based decision-making for public health responses. Polymerase Chain Reaction (PCR) testing is one of the molecular diagnostic methods that has become a global standard for the detection of infectious diseases, including COVID-19 and other communicable diseases, due to its high sensitivity and specificity.[1,2]

Although the demand for PCR testing has increased significantly in recent years, particularly since the emergence of the COVID-19 pandemic, challenges remain in sustaining the capacity of laboratory human resources (HR). Technical training programs developed by the Center for Health Biology Laboratory (BBLBK) reflect efforts to enhance the skills of laboratory personnel in PCR testing, encompassing principles of molecular biology, quality control, biorisk management, as well as laboratory result recording and reporting. This curriculum is designed to strengthen the technical competencies of laboratory staff in accordance with the functional needs of health laboratories utilizing PCR technology.[3,4]

Within the context of the global health system, the International Health Regulations (IHR) 2005 stipulate that every country must possess adequate laboratory capacity to support early detection, reporting, and response to public health threats.[5] This mandate is reinforced by various World Health Organization (WHO) guidelines that emphasize the implementation of biosafety, biosecurity, and standardized public health laboratory networks.[6,7,8]

Nevertheless, Indonesia currently lacks a standardized national competency certification scheme to ensure that every laboratory officer performing PCR testing possesses measurable and equivalent levels of competence across regions. This condition results in variations in technical competencies among laboratories, which in turn affect the quality of testing and the reliability of diagnostic results, particularly in complex molecular examinations such as PCR. International standards, including the Clinical and Laboratory Standards Institute (CLSI) MM03 guideline and PCR training modules issued by the Centers for Disease Control and Prevention (CDC), underscore the necessity of technical competence, quality control, and result validation in PCR testing.[9,10]

At the international level, competency frameworks for laboratory human resources developed by the CDC and the Association of Public Health Laboratories (APHL) highlight the importance of comprehensive competency development, encompassing domains such as quality management, safety, communication, and effective workforce training. These guidelines demonstrate that human resource development should be based on structured and measurable competencies to support effective laboratory services and public health preparedness.[11]

At the local level, similar challenges are evident in various laboratory capacity-building initiatives. Training activities in several Labkesmas indicate that competency enhancement is a crucial

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component of disease control strategies and diagnostic service quality improvement. However, implementation in the field often encounters obstacles due to disparities in facilities and access to standardized training.[12]

Furthermore, global studies on the medical laboratory workforce reveal crises in recruitment and retention, as well as limited opportunities for continuous professional development, which collectively impact workload and service quality. These conditions further reinforce the urgency of comprehensive and sustainable policies for laboratory human resource competency development, including innovations in training and national certification.[13]

International standards such as ISO 15189 also emphasize that laboratory quality management systems must include education and training of human resources and ensure technical competence. This standard serves as a global benchmark to guarantee laboratory quality and reliability of test results, including complex PCR examinations.[14]

Based on these conditions, policy innovation in the form of certified PCR training integrated into the national health human resource development system is required to ensure equitable technical competence and to enhance the quality of laboratory services across the entire Labkes network, including Labkesmas.

At the national level, strengthening the competencies of health laboratory personnel aligns with statutory mandates, including Law No. 17 of 2023 on Health and Government Regulation No. 28 of 2024 concerning its implementation.[15,16] Additionally, the development of competencies for civil servants is regulated under Law No. 20 of 2023 on State Civil Apparatus, Government Regulation No. 11 of 2017 on Civil Servant Management, and National Institute of Public Administration (LAN) Regulation No. 10 of 2018 on the Development of Civil Servant Competencies.[17,18,19]

Specifically, the Decree of the Minister of Health No. 1801 of 2024 on Public Health Laboratory Standards emphasizes that laboratory human resources must possess competencies appropriate to their scope of work and biological risk.[20] Meanwhile, Minister of Health Regulation No. 2 of 2023 highlights the importance of managing environmental health risks, including those in laboratories.[21] Accordingly, enhancing competencies through certified PCR training is consistent with the national health legal framework.

2. RESEARCH METHOD

This research was conducted using a descriptive policy analysis approach through document review. The sources reviewed included health laws and regulations, Health Laboratory (Labkes) and Labkesmas standards, and the PCR training curriculum developed by the Center for Health Biology Laboratories (BBLBK). International literature related to laboratory personnel competency and molecular diagnostic training was also reviewed. All information was analyzed thematically to identify key issues and formulate policy recommendations for certified PCR training as an innovation to improve laboratory human resource competency.

3. RESULT AND DISCCUSSION

Results

The following is a summary of the key findings from the policy and literature analysis that support the issue of human resource competency in Health Laboratories (Labkes), including Labkesmas, particularly regarding PCR testing:

Table 1. Analytical Findings and Supporting Evidence for Strengthening Human Resource Competence in Health Laboratories in PCR Testing

Finding variables	Findings	Source
Variation in laboratory human resource	The need for competent molecular laboratory personnel is increasing but	CDC & APHL: Workforce competency framework

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competency in PCR examination	training is not yet structured nationally.	(underscores the importance of training and competency standards).
PCR training has not been institutionalized	The PCR training curriculum has been developed at the national level, but competency recognition has not yet been through a standard certification scheme.	PCR training curriculum document, Center for Health Biology Laboratory (BBLBK).
National certification needs for laboratory human resources	The absence of a national laboratory certification scheme leads to a lack of uniformity in competencies.	National laboratory accreditation standards indicate the need for ongoing training and evaluation of HR competencies (accreditation requirements).
Limited number of standardized PCR trainers	Many trainers are centrally located, but not evenly distributed across the regions; a tiered ToT is needed.	Evaluation of national laboratory technical training.
Rapid development of molecular technology requires a cutting-edge curriculum	Global literacy demonstrates the need for competency updates in line with modern diagnostic technology.	Peer-reviewed research on laboratory competency development strategies.

Discussion

The analysis presented in Table 1 indicates that the competencies of Health Laboratory (Labkes) human resources, including those in Public Health Laboratories (Labkesmas), in performing PCR testing remain uneven. Although a PCR training curriculum has been developed by the Center for Health Biology Laboratory (BBLBK) as a national technical reference, this training has not yet been fully institutionalized within the health human resource competency development system. Consequently, the recognition of laboratory personnel competencies remains inconsistent due to the absence of a standardized national certification scheme (BBLBK, 2025). This condition potentially leads to variations in laboratory testing quality, particularly in molecular examinations that require high technical standards.

These findings are consistent with international standards emphasizing the importance of a competency-based approach in laboratory workforce development. The Centers for Disease Control and Prevention (CDC), in collaboration with the Association of Public Health Laboratories (APHL), developed the *Competency Guidelines for Public Health Laboratory Professionals*, which underscore that laboratory personnel must possess standardized competencies encompassing technical skills, quality management, safety, and emergency response capabilities (CDC & APHL, 2015). Accordingly, training that is not structured at the national level carries the risk of generating inconsistencies in competency levels and service quality.

The COVID-19 pandemic has further highlighted the critical importance of laboratory workforce preparedness in molecular diagnostics. The World Health Organization (WHO) emphasizes that diagnostic success depends on laboratory personnel competence, the application of biorisk management, and continuous standardized training (WHO, 2020). In Indonesia, the observed variations in competencies and the limited availability of standardized PCR trainers indicate that these requirements have not yet been fully met. This situation explains why certified PCR training is necessary as a policy innovation to ensure that laboratory personnel possess measurable, well-documented, and nationally recognized competencies.

By integrating certified PCR training into the health human resource development system, several strategic benefits can be achieved. First, competency standards become clearer and more consistent across the entire Labkes network. Second, quality and occupational safety can be enhanced, as the training incorporates quality control and biosafety components. Third, public health preparedness is

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strengthened, as laboratory personnel acquire technical capabilities that are readily applicable in emergency health situations.

Based on the analysis and supporting references, several strategic recommendations for the Ministry of Health are proposed:

1. Establish certified PCR training as a national standard for health laboratory personnel competencies. This policy aligns with competency-based workforce development principles as recommended by the CDC and APHL.
2. Integrate PCR training formally and progressively into the health human resource competency development system, including for Labkes and Labkesmas across all regions.
3. Develop and implement a national PCR competency certification scheme. This certification will serve as formal recognition of laboratory personnel competencies at the national level.
4. Develop standardized Training of Trainers (ToT) programs. This initiative will ensure the equitable availability of qualified PCR instructors down to the regional level.
5. Conduct periodic evaluation and updating of the curriculum, in line with advances in molecular technology and WHO biosafety standards.

The recommendation to establish certified PCR training as a national policy becomes increasingly relevant when linked to Indonesia's regulatory framework. Law No. 17 of 2023 on Health and Government Regulation No. 28 of 2024 explicitly mandate the strengthening of health human resources based on quality and safety principles.[15,16] Furthermore, the Decree of the Minister of Health No. 1801 of 2024 requires Labkesmas to meet competency standards appropriate to their service scope.[20] From the perspective of civil service administration, the obligation to develop competencies is also emphasized through Law No. 20 of 2023 on State Civil Apparatus, Government Regulation No. 11 of 2017 on Civil Servant Management, and National Institute of Public Administration (LAN) Regulation No. 10 of 2018.[18,19] Therefore, the implementation of certified PCR training is not merely a technical initiative but also a direct application of national legal mandates. Through the implementation of these recommendations, certified PCR training will function not only as technical training but also as a national policy innovation to strengthen laboratory network capacity and public health resilience.

4. CONCLUSION

Certified PCR training represents a strategic policy innovation for enhancing the competencies of Health Laboratory (Labkes) human resources, including those in Labkesmas, in Indonesia. The analysis demonstrates that laboratory personnel competencies in PCR testing remain variable, while existing training programs have not been fully institutionalized and are not supported by a standardized national certification scheme. This condition affects the consistency of testing quality, occupational safety, and public health preparedness.

International standards from the WHO, CDC, and APHL emphasize the importance of competency-based workforce development, quality control, biosafety, and continuous training. Concurrently, the national legal framework in the fields of health and civil service administration provides a strong foundation for the systematic development of laboratory personnel competencies.

Accordingly, the establishment of certified PCR training as a national program will strengthen competency standards, enhance the quality of diagnostic results, expand laboratory network preparedness in responding to infectious diseases, and support the realization of a professional, safe, and responsive health system capable of addressing public health emergencies.

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