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Analysis of Perceptions of the Readiness of Healthcare Human Resources as Support for the Digitalization of Health Services In Banten Province

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ABSTRACT: The digitalization of health services is a key strategy to improve access, quality, and efficiency of care in Banten Province, Indonesia, addressing challenges like limited facilities, healthcare human resources and unequal access. This study aims to formulate effective strategies for implementing digitalization to enhance health service delivery, focusing on the readiness of health personnel. Utilizing a qualitative descriptive method, primary data was collected through questionnaires and interviews, supplemented by secondary data from regional planning documents and evaluations. The results highlight uneven distribution of healthcare human resources and varying levels of digital readiness among health facilities. Key challenges include inadequate infrastructure, limited digital literacy, and the need for more comprehensive training and support for healthcare human resources to ensure successful digital transformation. Limitation of the research strongly highlights a critical shortage of technical support personnel as a primary bottleneck impact to leaving a data gap regarding the precise quantitative deficit of IT human resources across Banten Province. The recommendation research conduct training on the use of digital health technology and provide adequate incentives and facilities for medical personnel and IT personnel and allocate budget for the development of digital health infrastructure for General Regions Hospitals and Community Health Centers.

KEYWORDS:
digitalization of health services; digital literacy; digital readiness; healthcare human resources; Banten provinces

1. INTRODUCTION

Background of Study

This Digital transformation is a key pillar in achieving the ideals of health services. In realizing the vision of a healthy, productive, independent, and equitable Indonesian public health, the Ministry of Health (Kemenkes) works within the framework outlined in the 2021-2024 Health Digital Transformation Blueprint document. The blueprint framework includes:

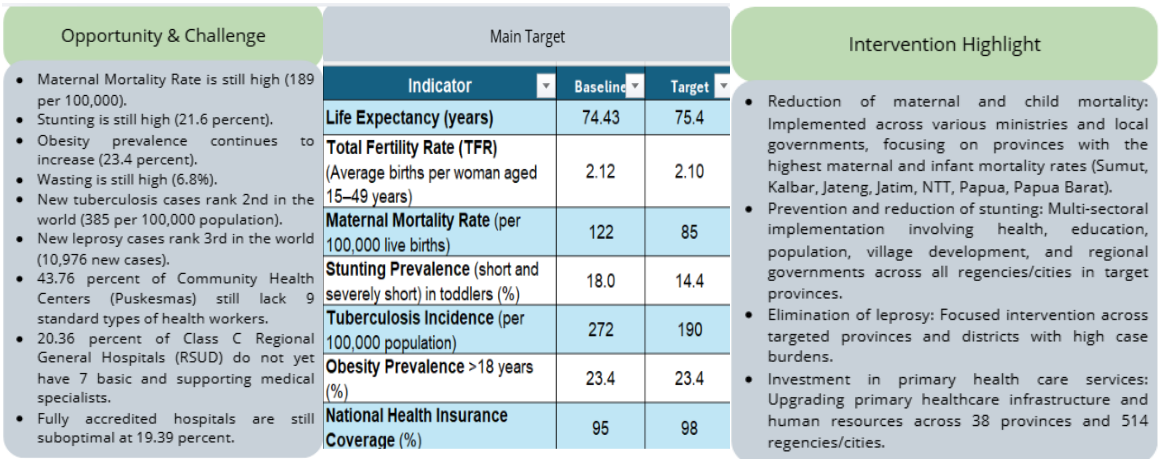
a. Individual Based Health Data Integration:Bringing together individual health data from multiple sources to provide a complete picture of a patient's health history, facilitating diagnosis and improving care. All data can be shared.
b. Simplification and Digitalization of Health Services: Adapting all aspects of health services to the digital era and simplifying the input system based on the Electronic Medical Record System, thereby reducing the burden on medical personnel in recording.
c. Development and Support of Health Innovation Ecosystem: Developing and providing ongoing support to the health innovation ecosystem. Ensuring the role of the health innovation ecosystem in the framework of collaboration on health technology transformation.

One of the health problems in Indonesia today is fragmented health data due to the large number of applications and regulatory limitations in data standardization and exchange. Based on the current mapping results, there are more than 400 health applications developed by the central and regional governments. This condition makes health policies not fully based on comprehensive data and health services are less efficient. Technological developments encourage the Indonesian Ministry of Health to immediately carry out a digital transformation of health as a leap towards an increasingly advanced and equitable Indonesian health sector. The Indonesian Ministry of Health has a vision to carry out digitalization in the health sector from the beginning of life in the womb to integrated health services for elderly patients. This vision is stated in Regulation of the Ministry of Health Number 21 of 2020 Concerning the Strategic Plan of the Ministry of Health for 2020-2024which has required efforts to change the governance of health development which includes the integration of health information systems, research and development.

Indonesia's digital health transformation is targeted to be able to produce human resources (HR) who are capable of analyzing health data. This aims to formulate data-based policies in every health institution. In relation to the above, the Indonesian Ministry of Health has formulated the 2024 Health Digital Transformation Strategy Blueprint which is based on the spirit of realizing a Healthy Indonesia collaboratively with the entire ecosystem of health industry players in an Indonesia Health Services (IHS) Platform called SATUSEHAT. The IHS Platform is a digital health ecosystem platform that provides data connectivity, analysis, and services to support and integrate various health applications in Indonesia.

SATUSEHAT is a digital health platform that integrates individual health data between health service facilities (fasyankes) in Indonesia. SATUSEHAT is the embodiment of the pillar of health technology transformation in the national health system. Health Service Facilities (Fasyankes) have a role as the vanguard of services, they need to prepare themselves in carrying out digital transformation. Fasyankes need to develop a comprehensive digitalization strategy and allocate adequate resources for its implementation. Fasyankes must choose an Electronic Medical Record (EMR) system that suits their needs and integrate it with clinical workflows. In the Use of Digital Technology, Fasyankes need to provide training to medical and non-medical staff on how to use digital technology effectively and implement strict security measures to protect patient data from unauthorized access.

In the 2025-2045 RPJPN document, Health development is faced with a demographic transition accompanied by increasing population mobility, urbanization, epidemiological transition, and unhealthy lifestyles. This increases the burden of infectious and non-infectious diseases, including health problems of the elderly and mental health. Unaffordable access to quality food and unhealthy consumption patterns lead to micro and macro nutritional deficiencies, as well as excess nutrition. The health system must be able to respond to various changes, technological advances, health shocks and the risk of a pandemic, and be able to address the inequality of access to food, a healthy environment, health service facilities, medicines and medical devices, medical personnel and health workers, and increase health financing capacity with mobilization and innovation of health financing.



Picture 1.National Priorities in the Health Sector in the 2025-2029 RPJMN Plan

The image above represents the National Priority in the Health sector covering challenges and opportunities, the main targets to be achieved and highlights of the Interventions to be carried out in the 2025-2029 period which are summarized in the Initial

Draft of the 2025-2029 RPJMN. Public health services are one of the vital sectors in human development, which directly affects the welfare of the community. In Banten Province, although there has been progress in terms of access and quality of health services, there are still various challenges that hinder the achievement of optimal health service equality. One of the main challenges is the limited health facilities, the lack of medical personnel in remote areas, and the gap in the timely distribution of health information. This can have an impact on the low quality of life of the community, which is reflected in the Human Development Index (HDI) in the health sector which still needs to be improved (BPS Team, 2023).

Effective and efficient health services are one of the important factors in improving the quality of life of the community. In the era of rapidly developing digitalization, the health sector is also facing significant transformation through the adoption of information and communication technology. Digitalization in health services is expected to improve access, quality, and effectiveness of services, as well as optimize health data management. One of the provinces that is trying to implement digitalization in its service system is Banten Province. Banten, as one of the provinces with rapid population growth and urbanization, faces major challenges in providing equitable and quality health services. According to data from the Central Statistics Agency (BPS) of Banten Prxovince, the population of Banten in 2024 is estimated to reach more than 13 million people.(BPS Team, 2024). This figure shows an increasing need for faster, more accessible, and integrated health services. Therefore, digitalization of health services is a strategic step in responding to these challenges. The digitalization of health services in Banten Province encompasses a wide range of initiatives, including the implementation of electronic medical records (EMRs), telemedicine services, technology-driven hospital management systems, and mobile health applications that facilitate public access to healthcare information and services. These innovations have the potential to improve the efficiency, accessibility, and quality of healthcare delivery. Broad implementation of digital health solutions remains hindered by persistent obstacles. Primary impediments include inadequate technical infrastructure, disparities in digital accessibility across rural and remote regions, and systemic reluctance to adopt new technologies among both clinicians and the general public.

According to data from the Central Statistics Agency (BPS Team, 2024), life expectancy in Banten Province stands at 70.9 years, marginally under the national benchmark of 71.4 years. This difference reflects continuing disparities in the availability and quality of healthcare services across the province, particularly in geographically isolated regions. Persistent barriers—including remote location, high costs, and a shortage of facilities and personnel—prevent many individuals from accessing sufficient healthcare. Enhancing public health services through digital integration offers a viable strategy to extend care to underserved populations.

Improving the quality of Banten's healthcare system relies significantly on integrating digital technologies, which streamline service delivery and expand public access to health information. For example, telemedicine can be an effective tool to connect patients with medical personnel, even in remote areas. In addition, health applications that can provide information on disease prevention, medication reminders, and remote medical consultations can be a useful tool for the community in managing their health. The use of an electronic data management system or Electronic Health Record (EHR) can also increase service efficiency and reduce the potential for medical errors, by facilitating digital access to patient data at health facilities.

However, although the digitalization of health services has a lot of potential, its implementation in Banten Province also faces several challenges. One of them is the uneven digital infrastructure, where not all areas in Banten have a stable internet network to support digital services. In addition, there are still limitations in the capacity of human resources, both medical personnel and the community, in utilizing this technology. According to a report from(Minister of Health Regulation No. 24 of 2022 Concerning Medical Records, nd), the gap in technological mastery among medical personnel and the community is still a significant obstacle in the implementation of digitalization. Therefore, this study aims to formulate policy recommendations and strategies in strengthening public services in the health sector through digitalization in Banten Province, by considering the existing challenges and opportunities. The development of digital technology in the health sector offers great opportunities to overcome these challenges. Digitalization of health services, such as the use of health applications, electronic-based hospital information systems, and telemedicine, has the potential to increase the efficiency, accessibility, and quality of health services. By utilizing technology, it is hoped that health services can become more accessible to the public, especially in areas that are difficult to reach physically, and increase the capacity of the health system to serve more patients. Therefore, a study on strengthening public health services through digitalization in Banten Province is important to find the right strategy to improve the quality of health services in the area.

Formulation of The Problem

The formulation of the problem in the study of improving public services in the health sector in Banten Province through digitalization of health services, namely :

a. What is an effective strategy in implementing digitalization of health services to improve access and quality of health services in Banten Province, especially in terms of the readiness of medical personnel?
b. What are the challenges and inhibiting factors faced by Banten Province's medical personnel in implementing digitalization of health services, and what solutions can be taken to overcome these obstacles in order to improve public health services?

2. MATERIALS AND METHODS

2.1 Ten Human Resources for Health (HRH) theories and their impact on health digitalization services

The digital transformation of healthcare is intricately linked to various Human Resources for Health (HRH) theories that elucidate the dynamics of technology adoption and implementation within health systems. The Diffusion of Innovation (DOI) Theory posits that the adoption of new technologies, such as electronic health records (EHRs), is influenced by factors such as perceived benefits and compatibility with existing workflows. In Mauritius, a study applying DOI found that healthcare workers' readiness to adopt e-health technologies was significantly driven by expectations of improved efficiency and modernization of healthcare management (Jeilani & Hussein, 2025). Analyzing implementation through the Technology–Organization–Environment (TOE) framework demonstrates that technological infrastructure alone cannot guarantee digital health integration; organizational culture and external environmental forces play an equally decisive role (Jeilani & Hussein, 2025). Normalization Process Theory (NPT) builds on this by centering the behavioral dimension, demonstrating that systems like electronic health records (EHRs) achieve long-term embedding only through the routine, shared efforts of clinical staff (May et al., 2007). Understanding the multi-faceted nature of digital health adoption relies on several established conceptual models. For instance, the Social Ecological Model (SEM) illustrates how individual behaviors, interpersonal dynamics, organizational norms, and broader policy environments collide to impact technology uptake (Sattlegger et al., 2025). Similarly, operationalizing Learning Health Systems (LHS) requires a workforce skilled in translating clinical data into quality improvements (Reid et al., 2024)—competencies routinely fostered through Health Systems Science (HSS) curricula covering healthcare economics, policy, and clinical operations (Bartoletta & Starr, 2021). Finally, context-specific population adaptation is structured through the applied framework of the Precede–Proceed Model.

Ultimately, organizational performance hinges on two core structural elements: acquiring necessary capital and specialized knowledge—a core tenet of Resource Dependence Theory—and leveraging middle management to convert high-level strategy into operational practice amid digital transformations. Simultaneously, applying the PAD Emotional State Theory underscores the psychological dimension, demonstrating that healthcare professionals' feelings of pleasure, arousal, and dominance directly shape their willingness to adopt and utilize new technologies (Heinsch et al., 2021). Actually, these theoretical perspectives demonstrate that technical implementation in clinical settings depends ultimately on human capital and organizational culture.

3. MATERIALS AND METHODS

The qualitative descriptive method in this study includes a general description related to the readiness of Health Worker HR in Banten Province. The data collected in this study are primary data and secondary data. Primary data were collected using a questionnaire and supplemented by interviews with Regional Apparatus (PD) that supervise and manage health services. Meanwhile, the secondary data needed are data related to regional planning documents, laws and regulations, monitoring and evaluation results, and evaluation results of the implementation of digital transformation of health services in the Banten Provincial Government. After the data is collected, it is compiled and data processing is carried out using Root Problem Analysis and SWOT analysis to be interpreted and conclusions drawn regarding the digital transformation strategy of Banten Provincial Health services to be used as a basis for formulating recommendations for implementing digital transformation of Banten Provincial health services.

4. RESULTS AND DISCUSSION

In order to support the operational activities of health services in public hospitals, private hospitals, health centers and primary clinics, it is necessary to be supported by reliable and professional health workers including doctors,

nurses, midwives, pharmacists, and nutritionists. The distribution of health workers in Banten Province according to district/city can be presented in the following table:

No.	Regency/City	Doctor	Nurse	Midwife	Pharmacy
1	Serang City	443	1,320	775	120
2	Cilegon City	487	1.127	550	174
3	Tangerang City	1,743	4,528	1.207	464
4	South Tangerang City	2,036	3,687	1.207	398
5	Pandeglang Regency	228	990	1.201	54
6	Lebak Regency	315	1,497	1.385	119
7	Serang Regency	463	1,382	1,069	87
8	Tangerang Regency	2.315	4.021	2.132	396
	Amount	8,030	18,552	9,526	1,812

Table 1.Number of Health Workers by Regency/City in Banten Province, 2025

Source: (BPS Team, 2025)

Based on the table above, it can be stated that the number of health workers in all general hospitals, specialist hospitals, community health centres and primary clinics in 8 (eight) regencies/cities in Banten Province, namely: 8,030 doctors, 18,552 nurses, 9,526 midwives and 1,812 nutritionists. The distribution of health workers in 8 regencies/cities in Banten Province also looks uneven, the largest number of health workers is in Tangerang Regency with 2,315 doctors, South Tangerang City with 2,036 doctors and Tangerang City with 1,743 doctors, and the fewest in Lebak Regency with 315 doctors and Pandeglang Regency with 228 doctors. Then for the largest number of nurses in Tangerang City with 5,528 nurses, Tangerang Regency with 4,021 nurses, South Tangerang City with 3,687 nurses and the smallest is Pandeglang Regency with 990 nurses. Meanwhile, the largest number of midwives is in Tangerang Regency with 2,132 midwives, Lebak Regency with 1,385 midwives, and the smallest in Cilegon City with 550 midwives and Serang City with 775 midwives. Then, the largest number of nutritionists is in Tangerang City with 464 people, South Tangerang City with 398 people, Tangerang Regency with 396 people, while the smallest number is Pandeglang Regency with 54 people and Serang Regency with 87 people.

If we look at the distribution of health workers in Banten Province, it is also not much different from the distribution of hospital facilities where the distribution of health workers, including doctors, nurses, midwives and nutritionists in 8 (eight) districts/cities is mostly concentrated in the eastern region, so that the western, northern and southern regions of the distribution of health workers are relatively small. This is because development in the eastern region is more advanced so that many health workers prefer the eastern region and of course it is also related to better welfare. Medical personnel in the northern and southern regions are relatively few when compared to the eastern region. In the future, an evaluation needs to be carried out and new policies need to be regulated so that the distribution of health workers is carried out evenly and in balance between the eastern region and the western, northern and southern regions, through the provision of adequate incentives.

Perception of Readiness for Implementing Digitalization of Health Services in the Aspect of Health Worker Human Resources

The perception of the readiness of human resources (HR) in the community towards the digitalization of health services in Banten Province reflects various aspects, ranging from the readiness of health workers to the challenges faced in implementing digital systems. Based on the results of interviews at various health facilities, such as hospitals, health centers, and clinics, it is clear that the adoption of technology in health services has experienced significant development. However, challenges in terms of regulation, infrastructure, and HR readiness are still the main obstacles in implementing optimal digitalization.

At General Region Hospitals Tangerang Selatan, the implementation of digitalization of health services has been quite advanced with the implementation of the Hospital Information System (SIRS) and electronic medical records

(RME). Although the system has been connected to BPJS (Social Security Assurance Agency) and Satu Sehat, there are still technical obstacles in data integration and internet network stability. One of the main challenges is the regulations that continue to change and do not fully support digitalization, including the ambiguity regarding Social Security Assurance Agency claims for telemedicine services. In addition, the readiness of human resources at this General Region Hospitals still needs to be improved through further training so that medical and administrative personnel can optimize the available digital systems.

At Permata Hospital, the use of the Afisen-based hospital information system has covered various aspects of service, including pharmacy and integration with Social Security Assurance Agency. However, the use of a system from a third-party vendor faces obstacles in terms of system maintenance and response to requests for change. Although expanding healthcare reach to out-of-town patients remains a key objective, the facility's telemedicine service is still in its infancy and underperforming. This sub-optimal delivery stems largely from incomplete EMR integration, ambiguous reimbursement procedures set by the Social Security Assurance Agency, and the inherent clinical limit of virtual care—namely, its inability to replace in-person physical exams crucial for chronic disease management.

Asa Medika Clinic faces several operational hurdles in its transition toward digital healthcare. Primary among these are recurring regulatory shifts and inconsistent policy communication from governing bodies. While the facility has integrated electronic health records and an AI-driven registration platform to streamline operations, infrastructure deficits—specifically unreliable network connection—frequently hamper digital service delivery, such as telemedicine. Additionally, workforce adaptability presents a critical challenge; staff require continuous training and professional development to keep pace with advancing platforms. Lastly, seamless patient care remains constrained by a lack of system interoperability between private clinics and public health institutions.

The integration of digital technology into primary healthcare services is exemplified by South Tangerang City's Health Center 1, which utilizes the Health Center Management Information System (SIMPUS). The system integrates multiple service components, including patient registration, clinical services, and pharmacy management, thereby improving workflow efficiency. In addition, SIMPUS has been integrated with both the Social Security Assurance Agency system and the Satu Sehat platform, facilitating data exchange and strengthening coordination across healthcare services.

The main obstacles faced are limited infrastructure, including inadequate network bandwidth and limited server capacity. In addition, the number of IT personnel in health centers is still very minimal, causing system management to be less than optimal. Improving the competence of medical personnel in using digital systems is also still a challenge, because not all health workers have adequate technological backgrounds.

Then, in the discussion conducted in the Forum Group Discussion (FGD) regarding the digital transformation of health services in Banten, it was revealed that the readiness of human resources in facing digitalization still varies in various health facilities. Several hospitals and health centers have adopted technology quite well, while others still face obstacles in terms of regulation, infrastructure, and limited human resources. One of the main challenges identified is the still low digital literacy among health workers and the community, which causes resistance to changes towards a digital-based system. In addition, limited infrastructure in several areas, especially in remote areas, is also an obstacle to the implementation of telemedicine and other technology-based services.

In conclusion, the readiness of human resources for digitalization of health services in Banten Province is still in the development stage. Although there are efforts to adopt technology in health services, challenges such as regulations that are not yet fully supportive, limited infrastructure, and low digital literacy are still the main obstacles. Therefore, a more comprehensive strategy is needed to improve human resource readiness, including through continuous training for health workers, improving digital infrastructure, and socializing the benefits of digitalization of health services to the community. With the right approach, digitalization of health services in Banten can be an effective solution in improving accessibility and quality of services for the wider community.

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Root Cause Analysis of Digitalization of Health Services Implementation in the Human Resources Dimension of Health Workers

The medical and supporting Human Resources (HR) aspect plays an important role in the success of the digital transformation of health services in Banten Province. The healthcare workforce encompasses both direct clinical practitioners—such as physicians, nurses, midwives, and nutritionists—and non-clinical operational personnel, including IT specialists and administrative staff who facilitate technology-driven care. In Banten Province, however, geographical disparities in workforce distribution present a critical barrier. According to the Banten Provincial Health Office, medical personnel are heavily concentrated in urban centers like South Tangerang, Serang, and Tangerang City, leaving rural and remote districts such as Lebak and Pandeglang severely understaffed. This workforce imbalance directly impedes equitable healthcare delivery and slows the regional adoption of digital health innovations like telemedicine.

One of the main obstacles in implementing telemedicine is the lack of digital skills among medical and support personnel. Although telemedicine technology has developed rapidly, many medical personnel have not been trained to operate digital-based devices and platforms used in telemedicine. According to a report from the Indonesian Ministry of Health, many medical personnel in areas outside Java, including Banten Province, require special training in the use of technology to support remote services. Without adequate training, the use of technology in remote medical consultations will be hampered, even though the devices and infrastructure are available.

In addition, limited training facilities for medical personnel in remote areas exacerbate this problem. Existing training facilities are often only available in large cities or health education centres, which are not easily accessible to medical personnel in rural areas. Data from the Central Statistics Agency (BPS) of Banten Province shows that more than 60% of the total medical personnel in remote areas have not received adequate digitalization training. This results in an inability to utilize digital technology for remote health services, which should be able to reduce the inequality of access to health services.

In addition to training, low incentives are also a factor that worsens the distribution of medical personnel in Banten Province. Many medical personnel choose to work in big cities with higher salaries and more complete facilities. Data from the Banten Provincial Health Office shows that more than 40% of medical personnel in rural areas have difficulty staying in the area due to low incentives and inadequate work facilities. Without adequate incentives, it will be difficult to retain qualified medical personnel in remote areas, which ultimately hinders the implementation of digital health services evenly.

To support the implementation of digitalization of health services in Banten Province, policies are needed that support the training of medical human resources and increase incentives for medical personnel in remote areas. In addition, collaboration between local governments, the central government, and the private sector in building digital infrastructure and training is very important. A report from the Indonesian Telemedicine Association (ATMI) suggests that providing a user-friendly telemedicine platform and intensive training for medical personnel throughout Banten can be the first step to realizing equal access to digital health. This effort must be accompanied by improvements in incentive policies so that medical personnel are interested in working and staying in areas that need it, including in the implementation of telemedicine.

In the implementation of digitalization of health services in Banten Province, the aspect of medical and supporting HR (Human Resources) plays a crucial role in ensuring a smooth transition and successful implementation of technology in the health sector. Although technological developments are increasingly rapid, problems with medical and supporting HR can hinder the effective use of the technology. The following are 5 main problems in the aspect of medical and supporting HR in the implementation of digitalization of health services in Banten Province:

a. **Limited Number of Medical and Support Personnel**
   Banten Province is facing a shortage of medical personnel, including doctors, nurses, and other health workers, especially in remote or rural areas. The limited number of medical personnel available can hamper the adoption of digital technology, because they are already burdened with dense routine work. In fact, there are still many health workers who have other duties, such as IT personnel who also work as program staff

and IT personnel are usually assigned only one person without being supported by other IT personnel as a backup if the IT personnel concerned is unable to attend to carry out their duties. This also makes training on the use of new technology difficult to carry out effectively.

b. Lack of Digital Training and Competence among Medical Personnel
One of the main problems faced by Banten Province in implementing digitalization of health services is the lack of training and digital competence among medical personnel. Many medical personnel in Banten Province, especially in remote areas, do not yet have the skills to use digital technology to provide health services, such as telemedicine platforms, electronic medical record systems, and other health applications. Based on data from the Banten Provincial Health Office, around 35% of medical personnel in rural areas have not received training related to the use of information and communication technology (ICT) in medical practice. This hampers the implementation of telemedicine and limits the quality of digital-based health services.

c. Shortage of Medical Personnel in Remote Areas
A major challenge in establishing digital health services in remote areas of Banten Province is the limited availability of healthcare personnel. Although telemedicine has the potential to improve access to healthcare, its successful implementation still depends on the presence of an adequate health workforce. Data from the Central Statistics Agency (BPS) indicate a substantial imbalance in the distribution of healthcare personnel across the province. More than 60% of healthcare workers are concentrated in urban areas, particularly South Tangerang City, Tangerang City, and Serang, while remote districts such as Pandeglang and Lebak continue to experience shortages of medical staff. This uneven distribution limits the capacity of these areas to support telemedicine services, as the shortage of qualified healthcare personnel constrains the operation and sustainability of digital health systems.

d. Challenges in Improving Motivation and Incentives for Medical Personnel
Rural healthcare workers across Banten Province broadly resist digital health adoption, primarily due to uncompensated labor and a lack of institutional backing. Although telemedicine usage has expanded regionally, most rural clinicians remain committed to traditional face-to-face consultations. The reluctance reflects an asymmetrical effort-to-reward dynamic: personnel report that managing digital workflows adds to their duties without delivering higher pay, recognition, or municipal support. Local statistics reflect this trend, with Banten Provincial Health Office data showing routine telemedicine usage among rural staff at under 20%. Sustained expansion of digital care will ultimately require formal policy interventions that align technological workflows with clear financial and professional incentives.

e. Digital Knowledge Gap Between Medical Personnel in Cities and Remote Areas
Regional variation in digital competency among healthcare workers constitutes a critical challenge within Banten Province. While clinicians in urban municipalities—namely South Tangerang and Tangerang City—leverage greater access to modern infrastructure and continuous educational initiatives, those in peripheral regions face persistent disparities in technology integration and capacity building. In contrast, medical personnel in remote or border areas often do not have the same access, either in terms of training or technical support. This has the potential to create disparities in the quality of digital health services provided to the community, because medical personnel in remote areas have more difficulty in utilizing telemedicine platforms or other digital-based health systems.

Based on the main problems above, then one main problem is determined as a priority to find a solution or way out through the analysis of the cause of the problem. Furthermore, from the results of the analysis of the cause of the problem, one of the most significant is selected to carry out the root cause analysis. To obtain solutions and solving strategies, the results of the root cause analysis are then carried out by a SWOT analysis as follows:

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Table 2.Identification of Root Causes and SWOT Analysis of Digital Transformation of Banten Province Health Services (Health Worker and Supporting Human Resources Dimensions)

PROBLEM	Limited and Uneven Distribution of Medical and Support Personnel
CAUSE OF THE PROBLEM	Inequality in the Distribution of Medical Personnel in the West, North, South and East Regions
	Lack of Digital Training and Skills Among Medical Personnel
	Limited Supporting Human Resources (Administrators and IT)
	Lack of incentives for medical personnel

CAUSE OF THE PROBLEM	FACTORS CAUSING THE PROBLEM	MAIN FACTORS & ROOT PROBLEMS	SWOT ANALYSIS OF ROOT PROBLEMS
Inequality in the Distribution of Medical Personnel in the Northern, Western, Southern and Eastern Regions	• Lack of Incentives and Facilities for Medical Personnel in the Northern and Southern Regions. • In rural or remote areas of Banten Province, limited incentives and a lack of medical facilities make it difficult to recruit and retain medical personnel. • Infrastructure and Accessibility Challenges in Rural Areas. The inability to provide adequate facilities, such as adequate housing or easy access to medical equipment, makes rural areas less attractive to health workers, who prefer to work in urban areas that are more accessible and have better facilities.	Key Factors Lack of Incentives and Facilities for Medical Personnel in the Southern and Northern Regions. Root of the Problem • Lack of Regional Budget Support for Health Infrastructure in the southern and northern regions.Without sufficient budget support, health facilities and incentives for medical personnel in the region remain limited, hampering the successful implementation of telemedicine. • Limited Access and Inadequate Technological Infrastructure and medical facilities in remote areas often lack adequate equipment and technology to support remote medical consultations.	**Strengths (Strengths):** Banten Province has the potential to improve its health sector, especially with rapid economic growth. This can be used as a basis for improving the distribution of medical personnel and increasing the implementation of telemedicine health services evenly. **Weaknesses (Weaknesses):** Medical personnel are more concentrated in Tangerang City, South Tangerang City and Tangerang Regency or urban areas that have better facilities and incentives, leaving rural and remote areas lacking trained medical and support personnel. **Opportunities (Opportunities):** Banten Province can open cooperation between local governments and the private sector to open opportunities to build health infrastructure in remote areas with private investment, which can help distribute medical personnel and technology more evenly. **Threats (Threats):** Without adequate incentives, medical and support staff will prefer to work inTangerang City, South Tangerang City and Tangerang Regency, leaving rural areas with a shortage of qualified medical personnel, hampering the implementation of telemedicine in those areas. **SO Strategy :** Banten Province can work with telecommunications and technology service providers to develop the infrastructure needed for remote health services, while local governments can provide incentives or adequate facilities to accelerate the distribution of medical and support personnel to areas with shortages. **WO Strategy:** Banten Province can allocate a larger budget for the development of digital health infrastructure, especially in the northern and southern regions. By utilizing existing opportunities from central government programs and cooperation with the private sector, proper budget allocation can help build digital-based health facilities that can reduce the inequality in the distribution of medical and supporting personnel.
Strategy Recommendations	• Local governments can provide incentives or adequate facilities for medical and IT personnel to accelerate the distribution of medical and support personnel to the northern and southern regions. • Banten Province must allocate a larger budget for the development of digital health infrastructure, especially in the northern and southern regions.		

Problems in the aspect of medical and supporting human resources in the implementation of digitalization of health services in Banten Province include the lack of digital training for medical personnel, limited number of medical personnel in the northern and southern regions, lack of support personnel trained in technology, lack of incentives for technology adoption, and the digital knowledge gap between medical personnel in cities and remote areas. To overcome these problems, Banten Province needs to accelerate technology training for medical and supporting personnel, increase incentives, and strengthen the distribution of medical personnel to remote areas. By improving this aspect of human resources, it is hoped that the digitalization of health services in Banten Province can run more effectively and evenly.

The digital transformation of health services in Banten Province plays a vital role in improving the quality, efficiency, and accessibility of healthcare delivery across the region. The adoption of digital technologies, such as integrated health information systems, Electronic Medical Records (EMRs), and telemedicine platforms, enables healthcare providers to deliver faster, more accurate, and more efficient services. These technologies are particularly valuable for expanding access to healthcare in underserved areas, including the northern and southern regions of Banten. Furthermore, the integration of health data through real-time information systems supports evidence-based decision-making, strengthens transparency, and enhances the capacity of health authorities to respond promptly to emerging public health challenges.

The execution of digital health strategies in Banten relies heavily on cross-sector coordination among local government bodies, medical centers, community groups, and technology suppliers. Establishing a multi-stakeholder governance council—consisting of state officials, health system administrators, and IT specialists—is critical to guide policy creation, direct deployment, track outcomes, and resolve implementation roadblocks. Concurrently, upskilling healthcare workers through ongoing professional development is essential to ensure proficiency with Electronic Health Records (EHR) and telehealth platforms, while maintaining rigorous data privacy standards. Finally, targeted outreach campaigns are necessary to enhance digital health literacy, foster public trust in platform security, and promote service adoption across local communities.

To sustain digital health transformation across Banten Province, continuous funding must go toward foundational infrastructure—namely robust internet, secure IT networks, and updated medical technologies. Equally important is a solid legal framework that safeguards patient privacy, enables system interoperability, and enforces safety standards in digital care delivery.

Through these strategies and steps, Banten Province can achieve successful digital transformation in health services, improving the quality and equality of access to health services throughout the region. The strategies that must be carried out in Preparing Health Workers as supporters of the implementation of digital transformation of Banten Province's health services are as follows:

a. **Conduct training on the use of digital health technology and provide adequate incentives and facilities for medical personnel and IT personnel to accelerate their distribution to the northern and southern regions of Banten.**
b. **Allocate budget for the development of digital health infrastructure for General Region Hospitals and Community Health Centers, especially in the northern and southern regions of Banten.**

By implementing the strategies above, Banten Province is believed to be able to realize a digital transformation in health services that not only improves the quality of service, but also accelerates equal access to health for the entire community, especially in the northern and southern regions of Banten.

4. CONCLUSION

Conclusion

Banten Province needs more coordinated and planned efforts to improve the quality of better health services for the entire community. To that end, the digital transformation strategy in health services must be directed at improving technology infrastructure, integrating health application systems, and optimizing the use of telemedicine. Support from various parties, including the government, medical personnel, the business world and the community, is very important to create an inclusive, affordable and equitable health service system throughout Banten Province. Based on the analysis presented in the previous chapter, it can be concluded that:

a. The distribution of health workers in hospitals, health centers and primary clinics consisting of 8,030 doctors, 18,552 nurses, 9,526 midwives and 1,812 pharmacists is uneven between the western, eastern, northern and southern regions, resulting in significant disparities in health services in the northern and southern regions. This is due to the tendency of health workers to prefer working in the western and eastern regions which have better facilities and welfare.
b. The availability of IT personnel to support the implementation of digital health services in the Provincial Health Office, District/City Health Office, hospitals, health centers, primary clinics, Department of Communication and Information Service, and Banten Provincial Social Security Assurance Agency Health is very limited. So that most of them are still held by the program section and only have 1 (one) IT personnel without any backup/reserve if at any time the personnel concerned is assigned not to be there;
c. The understanding of digital literacy among some health workers and the community using health services is still low due to the lack of education and socialization. So that it becomes a challenge in implementing digitalization of health services in Banten Province.

Limitation

The interpretations in this study must be evaluated alongside several methodological and contextual constraints. Several limitations should be considered when interpreting the findings of this study. The qualitative interviews were conducted

primarily in relatively well-developed urban areas, particularly South Tangerang. As a result, the study may not fully reflect the workforce shortages and infrastructure limitations that continue to affect more remote districts, including Lebak and Pandeglang. The policy environment also presented a challenge, as repeated revisions to regulations related to SATUSEHAT integration, Electronic Medical Record (EMR) implementation, and BPJS telemedicine reimbursement introduced uncertainty that influenced healthcare providers throughout the study period.

A primary constraint of this study involves the scope of official labor metrics. While qualitative interviews repeatedly highlighted technical support deficits as a core operational bottleneck, regional workforce registries predominantly monitor clinical roles—including physicians, nurses, midwives, and nutritionists—to the exclusion of IT specialists. Consequently, the lack of standardized quantitative indicators obscures the true extent of IT staffing shortages across Banten Province, exposing a distinct gap in the empirical literature.

Recommendation

Based on the research results presented, several important recommendations can be drawn up as a follow-up to policy makers, namely regarding the readiness of health worker human resources through:

a. Conduct training on the use of digital health technology and provide adequate incentives and facilities for medical personnel and IT personnel to accelerate their distribution to the northern and southern regions of Banten.
b. Allocate budget for the development of digital health infrastructure for General Regions Hospitals and Community Health Centers, especially in the northern and southern regions of Banten.

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AUTHOR CONTRIBUTIONS

Ardy Firman Syah: Conceptualization, Investigation.

Rosidah: Methodology, Laboratory Analysis.

Sarman Paul Lumbantobing: Data Curation, Formal Analysis.

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CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

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