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# Implementation of Telemedicine-Based Baby Incubator Technology to Reduce Premature Infant Mortality Rates at Taman Health Center in Sidoarjo

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**ABSTRACT** Low Birth Weight (LBW) remains a major contributor to neonatal morbidity and mortality, particularly in developing regions where access to continuous and high-quality neonatal care is limited. In Sidoarjo Regency, Indonesia, health centers face persistent challenges in monitoring LBW infants due to the absence of real-time monitoring systems and limited family access to neonatal intensive care units. This condition results in delayed responses to clinical deterioration and suboptimal family involvement in infant care. This study aims to implement and evaluate a telemedicine-based baby incubator as an appropriate technology to strengthen neonatal care services and support continuity of care at the primary healthcare level, specifically at Taman Health Center, Sidoarjo Regency. The method employed was an implementation-based community service approach consisting of preparation, training, installation, operation, monitoring, and evaluation stages. Health workers and infant caregivers were trained to operate and maintain the telemedicine-based baby incubator, which enables real-time monitoring of vital parameters through an Android-based application. Monitoring and evaluation were conducted over a three-month period to assess usability, compliance with standard operating procedures, and perceived benefits in service delivery. The results demonstrated an improvement in health workers' knowledge and technical skills related to neonatal monitoring and equipment maintenance. The telemedicine-based incubator enhanced accessibility to neonatal information, accelerated clinical response times, and facilitated greater family participation in infant care. Operational efficiency was also improved, as health personnel were able to monitor infants more effectively and systematically. Despite these positive outcomes, challenges related to internet connectivity, technological literacy, and resource constraints were identified during implementation. In conclusion, the application of a telemedicine-based baby incubator represents a feasible and beneficial innovation for strengthening neonatal care services at community health centers. By integrating digital health technology with capacity-building activities, this initiative contributes to improved quality of care for LBW infants and holds potential for broader adoption to support reductions in premature infant mortality rates.

**INDEX TERMS** Low birth weight, telemedicine, baby incubator, neonatal care, community health center.

## I. INTRODUCTION

Low Birth Weight (LBW) remains a critical public health problem and a leading cause of neonatal morbidity and mortality worldwide, particularly in low- and middle-income countries [1], [2]. Globally, approximately 20 million infants are born with LBW each year, with the majority occurring in developing regions that face limitations in neonatal care infrastructure and skilled human resources [3]. In Indonesia, LBW continues to contribute substantially to neonatal and infant mortality, accounting for a significant proportion of preventable deaths during the first year of life [4]. East Java Province, including Sidoarjo Regency, consistently reports high LBW prevalence, underscoring the need for strengthened neonatal services at the primary healthcare level [5].

Sidoarjo Regency, located in East Java and commonly referred to as the "Delta City," has a dense population distribution and rapid urban development. Taman District is one of the most populated areas in the regency and serves as a strategic catchment area for maternal and child health services [6]. Despite its proximity to urban centers, primary health facilities in this district experience constraints in providing continuous neonatal monitoring, particularly for infants requiring intensive care such as those born with LBW [7]. Existing incubator monitoring practices at community health centers largely depend on manual

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observation and periodic documentation, which may delay early detection of clinical deterioration and limit family involvement in infant care [8].

Recent developments in digital health and telemedicine offer promising solutions to address gaps in healthcare accessibility, efficiency, and quality [9]. Telemedicine systems enable real-time data transmission, remote clinical supervision, and enhanced communication between healthcare providers and patient families [10]. In neonatal care, the integration of telemedicine with medical devices such as baby incubators has been associated with improved response times, optimized resource utilization, and greater parental engagement in care processes [11], [12]. Moreover, telemedicine-based monitoring supports continuity of care by allowing families to access infant health information beyond the confines of healthcare facilities [13].

However, the implementation of telemedicine-based neonatal technologies in Indonesia remains predominantly hospital-centered. Studies on LBW management have mainly emphasized clinical interventions such as nutritional support, nesting, and environmental modification, with limited attention to digital health integration and user capacity building at the primary care level [14], [15]. Furthermore, evidence regarding the feasibility, sustainability, and operational challenges of telemedicine-based baby incubators in community health centers is scarce [16]. This gap highlights the need for applied studies that focus on implementation strategies, training models, and contextual adaptation of digital neonatal technologies in primary healthcare settings.

Therefore, this study aims to implement a telemedicine-based baby incubator at Taman Health Center, Sidoarjo Regency, as an appropriate technological innovation to support LBW infant monitoring and improve neonatal care services [17]. The initiative seeks to enhance the knowledge and technical skills of healthcare workers and families in operating and maintaining the technology, while simultaneously improving service accessibility and continuity of care [18].

This study contributes to the existing body of knowledge in several ways :

1. It provides an applied model for integrating telemedicine-based neonatal technology within a community health center context [19].
2. It offers empirical insights into capacity-building and mentoring strategies for healthcare workers and families in utilizing digital health innovations.
3. It presents practical evidence on the potential role of telemedicine-based baby incubators in improving service quality and supporting efforts to reduce LBW-related neonatal mortality at the primary care level [20].

The remainder of this article is organized as follows. Section II describes the methods and implementation stages of the telemedicine-based baby incubator initiative. Section III presents the implementation results. Section IV discusses the findings in relation to existing literature and identifies challenges and implications. Finally, Section V concludes the article and outlines recommendations for future development and wider adoption of telemedicine-based neonatal care services.

## II. METHOD

This community service activity was conducted under the Community Partnership Program scheme and employed a prospective, implementation-based, non-experimental design. The program focused on the application of a telemedicine-based baby incubator at Puskesmas Taman, Sidoarjo Regency, as an effort to support the sustainability of neonatal health services. The methodological approach emphasized practical implementation and replicability, aiming to describe in detail how the intervention was carried out, what materials and technologies were used, who was involved, and how monitoring and evaluation were conducted. The primary objective of this method was to enable healthcare workers and families to access real-time neonatal health information, thereby strengthening continuity of care and family involvement in infant monitoring [21].

### *A. STUDY DESIGN AND RASIONALE*

The study was designed as a prospective implementation study without randomization or a control group. This design was selected because the primary focus was not to test the clinical efficacy of the incubator, but to implement, operate, and evaluate the utilization of telemedicine technology within a real-world primary healthcare setting. Such an approach is commonly used in early-stage digital health and community-based technology adoption studies, where feasibility, usability, and sustainability are prioritized over experimental comparison [21], [22]. The implementation design allowed direct observation of operational processes, user adaptation, and compliance with standard operating procedures (SOPs) during routine neonatal care services.

### *B. STUDY SETTING*

The activity was conducted at Puskesmas Taman, a primary healthcare facility located in Taman District, Sidoarjo Regency, East Java, Indonesia. This health center provides maternal and neonatal services for a densely populated urban–suburban community and serves as a referral point for infants requiring basic incubator care. The implementation period took place over approximately three months, encompassing preparation, training, operational use, monitoring, and evaluation phases. The selection of this setting was based on the absence of telemedicine-based incubator systems and the identified need for improved neonatal monitoring at the primary care level [22].

### *C. STUDY POPULATION AND PARTICIPANTS*

The study population consisted of healthcare personnel and service users directly involved in neonatal care at Puskesmas Taman. Participants included nurses, midwives, electromedical personnel, and families of infants receiving incubator-based care. Inclusion criteria for healthcare workers were active involvement in neonatal services and responsibility for operating or maintaining the baby incubator system. Families were included if their infants

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were indicated for incubator use, such as those identified with low birth weight or other neonatal health abnormalities, and if they provided informed consent to participate in telemonitoring activities. No random sampling was applied; instead, total sampling was used to ensure inclusion of all relevant stakeholders involved in the implementation process. This approach is appropriate for implementation studies aiming to maximize operational relevance and technology adoption [23].

### *D. MATERIALS AND TECHNOLOGY DESCRIPTION*

The primary material used in this study was a telemedicine-based baby incubator system equipped with integrated sensors to monitor key neonatal vital parameters, including body temperature, oxygen saturation, and heart rate. Data generated by the sensors were transmitted to a specialized Android-based application, enabling real-time monitoring by healthcare workers and family members. Supporting materials included standard neonatal care equipment, mobile devices for application access, instructional manuals, and training modules. The system design followed principles of digital health and medical instrumentation, emphasizing reliability, ease of use, and compatibility with primary healthcare infrastructure [22], [23].

### *E. IMPLEMENTATION PROCEDURE*

The implementation of this community service activity followed a structured and sequential approach to ensure systematic adoption and sustainable utilization of the telemedicine-based baby incubator. The overall implementation strategy comprised three interrelated phases, namely preparation, implementation, and monitoring–evaluation, as illustrated in FIGURE 1.

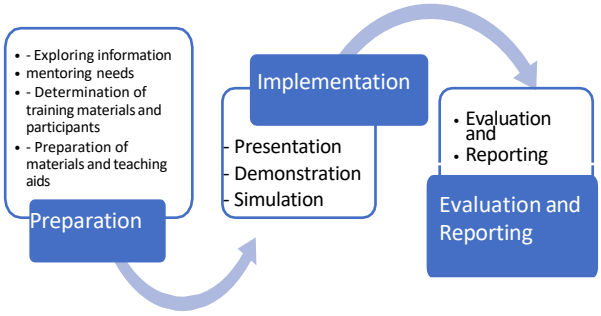


**FIGURE 1. Flow of Activity Implementation**

The preparation phase involved coordinated activities between the proposing team and partners at Puskesmas Taman. During this phase, mentoring needs were identified, the scope of materials and participants for the baby incubator demonstration was determined, and all required presentation tools, demonstration materials, and medical equipment were prepared. This phase aimed to ensure technical readiness, role clarity, and alignment between the community service team and healthcare providers prior to field implementation.

The implementation phase consisted of two main stages: training and operation. During the training stage, the telemedicine-based baby incubator was installed at the designated clinical location within the health center [21]. In parallel, a specialized Android-based application was installed and configured on the mobile devices of infants' families to facilitate real-time remote monitoring [22]. Healthcare workers, including nurses and midwives, received intensive hands-on training covering device operation, monitoring of vital parameters, and basic technical troubleshooting [23]. In addition, training on simple maintenance procedures, such as routine equipment checks and minor corrective actions, was provided to ensure optimal and safe device performance.

Following training, the operation stage focused on integrating the baby incubator into routine neonatal services. Health center staff prepared the necessary equipment and received infants identified with low birth weight or other neonatal health abnormalities requiring incubator support [24]. Prior to the intervention, informed consent was obtained from the infants' families. The community service team, particularly nurses, assisted in preparing infants for placement in the incubator [25]. Electromedical personnel worked collaboratively with Puskesmas officers to ensure smooth operation of the equipment and proper functioning of the telemedicine system [26]. Families were also guided on how to operate the application interface and interpret displayed monitoring data, thereby supporting active family involvement in infant care.

Monitoring and evaluation were conducted as an integral component of the implementation phase to assess operational effectiveness and identify areas for improvement. A dedicated monitoring team consisting of electromedical personnel and nurses supervised daily device operation [27]. Nurses routinely recorded key neonatal parameters, including body temperature, oxygen saturation, and heart rate, along with other relevant clinical indicators. These records were essential for ongoing clinical assessment and treatment planning and were documented systematically using established procedures [22].

The monitoring program was carried out periodically over a three-month duration. Activities included regular reviews of device usage and maintenance practices against established Standard Operating Procedures (SOPs), verification of appropriate device placement within the clinical environment, and assessment of infant comfort and safety during incubator use. At the end of the community service period, an evaluation was performed by classifying, recapitulating, and analyzing monitoring findings. The evaluation focused on identifying non-compliance with SOPs related to equipment operation, daily maintenance, and repair procedures. Based on the evaluation results, follow-up actions were formulated, including the provision of recommendations, additional mentoring, or refresher training sessions. Although this study does not report quantitative outcome measures such as patient numbers or clinical effectiveness indicators, the structured implementation, monitoring, and evaluation process establishes a solid foundation for systematic data collection

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and future research on the effectiveness and sustainability of telemedicine-based neonatal care services [28].

**FIGURE 2. Front view of the Integrated Laboratory of the Health Polytechnic of the Ministry of Health Surabaya**

FIGURE 2 presents the front view of the Integrated Laboratory of the Health Polytechnic of the Ministry of Health Surabaya, which functioned as a supporting facility during the preparation phase of the community service activity. This laboratory was utilized for preliminary device preparation, functional testing, and technical training prior to field implementation at Puskesmas Taman. The availability of this integrated laboratory ensured that the telemedicine-based baby incubator system met operational and safety requirements before deployment in the primary healthcare setting.

### *F. ETHICAL CONSIDERATIONS*

Information is not available.

## III. IMPLEMENTATION RESULT

The implementation of Community Service was held in the meeting room of the Taman Community Health Centre (Puskesmas), Sidoarjo Regency, East Java on 12 Juli 2024. The coordination of activities was the Chairperson of community service and the Head of Puskesmas Taman, which was attended by 20 health workers and the person in charge of the tools and inventory of Puskesmas Taman health equipment.

The activity began with the opening, and continued with the delivery of the purpose of arrival and activities that will be carried out during Community Service at Puskesmas Taman. The purpose and objectives were conveyed by the Chairperson of the Community Service, namely :

1. Provide counselling for health workers or those responsible for operating the Baby Incubator Tool in carrying out the steps of use and maintenance
2. Provide training on the operation and maintenance of Baby Incubator Equipment by involving partners.
3. Provide regular mentoring to health workers Partners in carrying out maintenance steps of Baby Incubator Equipment until partners master and can do it independently.

Based on FIGURE 3, The activity continued with remarks from the Head of Puskesmas Taman. In brief, the Puskesmas welcomed the arrival of the Community Service Team to the Taman Puskesmas, and was grateful for the presentation and demonstration of telemedicine-based baby incubator equipment.

**FIGURE 3. Explanation of the journey to produce a baby incubator that is the result of the KRUPT scheme research**

The next activities are baby incubator preparation, baby incubator operation, and monitoring. The following is the Application of Telemedicine-based Baby Incubator Tool:

### *A. THE PREPARATION STAGES.*

Installing the telemedicine-based baby incubator tool in place. The first step taken is to install a baby incubator tool that has been equipped with telemedicine technology.

**FIGURE 4. The health workers who attended the Community Service event at Puskesmas Taman, Sidoarjo**

The device is equipped with advanced sensors and communication systems that enable remote supervision by health workers through the telemedicine platform. After the installation of the device, the team proceeded to install a specialised app on the Android devices of the family in charge of looking after the baby at home. The app allows parents to connect directly with the baby incubator and get real-time information on the baby's health condition. Furthermore, the team provided intensive training to health workers at the hospital on the operation of the telemedicine-based baby incubator (FIGURE 4).

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**FIGURE 5. Explanation of the baby incubator device and the parameters that make it a telemedicine device**

The training covered how to operate the device, monitor vital parameters, and address potential technical issues that may arise. Additionally, the team also provided training to health workers on simple maintenance of the baby incubators. This includes routine checks, maintenance, and minor troubleshooting that can help ensure optimal performance. With the implementation of this innovation, it is hoped that the quality of care for premature babies will improve and parents can feel more at ease as they can monitor their baby's condition more actively and be involved in their baby's health care[16] (FIGURE 5).

1. The operation stages.

is carried out by demonstrating the tool and simulating the use of the baby incubator tool[16]. It began with an officer preparing the tools that would be used to respond to a health concern. At that time, a baby with low birth weight (BBLR) and health abnormalities was under serious attention of the medical team[17]. The health centre staff received an infant patient who needed intensive care due to his health disorder. The patient's family quickly gave consent for the treatment to be carried out. They understand that the fastest possible effort is very important to save the baby's life. The Community Service team consisting of nurses and electromedical personnel are ready to assist with this treatment process. The nurses have the necessary medical knowledge and skills to condition the patient before being placed into the baby incubator[17]. They collaborate closely with the health centre staff to ensure good coordination during the treatment process. While preparing the patient, electromedical personnel help to carefully operate the baby incubator[16]. They ensure that the device is functioning optimally and ready to be used to help maintain the baby's body temperature and monitor his/her health condition closely. Effective medical teamwork between the Puskesmas staff, Community Service team, nurses, and electromedical personnel was the key to success in responding to this urgent situation[12]. All parties worked together with one common goal: to save the baby's life and provide the best possible care to ensure her recovery.

2. Simulated Monitoring Stage

Described as a hospital ward, the atmosphere is solemn. A team of electromedical personnel and nurses are focused on monitoring the operation of a medical device that is critical to the success of patient care. The electromedical personnel carefully inspect each component of the device, ensuring that all functions and parameters are set according to set standards. They ensure that the temperature, humidity, and other parameters in the device are within a safe range for the patient. Every indicator and monitor screen is carefully checked to detect any changes or potential problems. Meanwhile, the nursing staff concentrated on recording every activity of the device. They record the patient's body temperature, oxygen level, and heart rate, as well as other important data describing the patient's health condition.

**FIGURE 6. Simulating a baby incubator that has been equipped with telemedicine technology**

These accurate records will later assist the medical team in evaluating and planning subsequent treatments. Both teams work synergistically, collaborating efficiently to ensure that the device functions optimally and provides the necessary information for patient care. Their hard work and expertise are key to ensuring patients get the best and optimal care (FIGURE 6).

3. Monitoring and Evaluation

Monitoring is carried out by a team consisting of health workers and medical equipment technicians through regular reviews of the use and maintenance of medical equipment in accordance with the established Standard Operating Procedures (SOP). The team will supervise how the equipment is used by medical personnel in accordance with the established SOPs. They check whether each step of use is followed in accordance with the pre-established procedures. This aims to ensure that the equipment is used correctly for the welfare of the patient. In addition, the team also monitored the placement of medical devices in the room in accordance with the established SOPs. They check whether the location and arrangement of medical devices meet the safety and accessibility standards required for easy use and access by medical personnel. The importance of the convenience of the equipment for patients was not overlooked. The team conducted a review to ensure that the devices provided optimal comfort for patients during use. They ensure that the devices do not cause discomfort or harm to the patient. Monitoring of the use, maintenance, placement of equipment according to SOP, and comfort of equipment is carried out regularly every 3 months. This aims to ensure

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that medical devices are always in good condition, used correctly, placed according to standards, and provide the necessary comfort for patients. Thus, patient care can be carried out safely and effectively in accordance with established quality standards.

Evaluation of monitoring results is carried out after completing the Community Service. The evaluation results will be classified, recapitulated, processed, and followed up. Regular evaluation of the SOP for equipment operation is carried out to ensure that medical equipment is used in accordance with established procedures. On one occasion, the evaluation team saw several discrepancies in the operation of equipment according to the SOP.

1) The evaluation team observed discrepancies in the operation of equipment according to the SOP. Some health centre personnel did not fully follow the steps described in the SOP. This could endanger patients and affect the effectiveness of the care provided.
2) The evaluation team also reviewed the implementation of the daily maintenance SOP by health centre staff. Several discrepancies were found in the daily maintenance of medical equipment. Maintenance that is not in accordance with the SOP can reduce the life of the equipment and increase the risk of operational failure.
3) The evaluation team found discrepancies in the process of repairing equipment according to the established SOPs. The repair steps that should have been followed were not implemented correctly, which could affect the quality of the equipment and patient safety.

The results of the evaluation are then used as a basis for providing appropriate follow-up. The evaluation team provided recommendations and advice to the health centre personnel on improving and increasing compliance with the SOPs for device operation, daily maintenance, and repair. In addition, additional training was organised to improve the understanding and skills of health centre personnel in applying the SOPs correctly and according to established procedures. With this follow-up, it is expected that compliance with SOPs will improve, medical devices will be better operated and maintained, and quality health services can continue to be provided to the community.


**FIGURE 7. Photo with Dr. Linda Megasari Sumanto, The Head of Puskesmas and Community Service Team at Puskesmas Taman**

FIGURE 7 documents stakeholder engagement during the implementation phase, illustrating collaboration between the Head of Puskesmas Taman and the community service team. Such institutional support played a critical role in facilitating program implementation, ensuring alignment with primary healthcare priorities, and strengthening the sustainability of the telemedicine-based baby incubator initiative.

## IV. DISCUSSION

The implementation of a telemedicine-based baby incubator at Puskesmas Taman represents an initial strategic effort to strengthen the continuity and quality of neonatal health services, particularly for infants requiring intensive monitoring. As a primary healthcare facility, Puskesmas Taman was selected as the pilot site due to its direct role in serving vulnerable populations and its potential to function as a model for technology-assisted neonatal care in similar settings. The findings of this community service initiative indicate that the integration of telemedicine technology into routine neonatal services offers meaningful operational, clinical, and social benefits, despite several contextual challenges that require ongoing mitigation.

The primary outcome of this implementation was the successful adoption of a telemedicine-based baby incubator system that enabled continuous remote monitoring of neonatal vital parameters, including body temperature, oxygen saturation, and heart rate. Although quantitative clinical outcome measures were not formally assessed, observational evidence demonstrated improved accessibility and responsiveness of neonatal care services. The ability for healthcare providers to monitor infants in real time, regardless of physical location, allowed for more timely clinical decision-making and early intervention in response to changes in an infant's condition. This aligns with prior community-based initiatives emphasizing the role of telemedicine in enhancing service continuity and reducing delays in care delivery for vulnerable neonatal populations [29].

Another notable outcome was the increased involvement of families in the care process. Through the Android-based application, parents were able to access information regarding their infant's condition and communicate with healthcare providers. This approach not only promoted transparency in care but also strengthened trust between families and the medical team. Family-centered care models have been consistently associated with improved parental confidence and adherence to post-discharge care recommendations, particularly in neonatal and pediatric contexts [30]. The present implementation reinforces the importance of integrating telemedicine platforms that facilitate active family engagement as part of primary healthcare services.

Operational efficiency also emerged as a key benefit. Healthcare workers reported that the centralized monitoring system allowed them to oversee multiple infants simultaneously, thereby optimizing time allocation and reducing the burden of repetitive manual monitoring. This operational advantage is particularly relevant in primary

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healthcare facilities with limited human resources, where efficiency gains can directly translate into improved service coverage and quality [31].

The findings of this initiative are consistent with earlier studies highlighting the positive impact of telemedicine and digital health technologies on neonatal and pediatric care. Previous community service programs conducted in other Puskesmas settings in Indonesia have reported similar improvements in service accessibility and monitoring efficiency following the introduction of telemedicine-assisted incubator systems [32]. These similarities suggest that the benefits observed at Puskesmas Taman are not isolated and may be replicable in comparable primary healthcare environments.

International studies have likewise demonstrated that telemedicine-supported neonatal monitoring enhances clinical responsiveness and facilitates multidisciplinary collaboration across geographical boundaries. Bernuzzi et al. reported that pediatric telehomecare systems support value co-creation between healthcare providers and families, improving perceived care quality and continuity [33]. The current findings align with this perspective, particularly in terms of family involvement and shared responsibility for infant monitoring.

However, contrasts can be observed in terms of outcome measurement. While several studies have incorporated quantitative indicators such as reduced hospitalization duration, decreased complication rates, or improved survival outcomes [34], the present initiative focused primarily on implementation feasibility and process outcomes. This difference reflects the community service orientation of the project rather than a controlled clinical trial design. Nonetheless, the structured monitoring framework established through this initiative provides a foundation for future studies to incorporate more robust quantitative evaluations.

Despite its benefits, the implementation of the telemedicine-based baby incubator at Puskesmas Taman faced several limitations that warrant careful consideration. One of the most significant challenges was the availability and stability of internet connectivity. Inconsistent network access occasionally disrupted real-time data transmission, potentially limiting the effectiveness of remote monitoring. Similar challenges have been reported in other telemedicine implementations in low-resource or semi-rural settings, where infrastructure constraints remain a major barrier to digital health adoption [35]. Although temporary data caching strategies were introduced to mitigate this issue, sustained improvements in digital infrastructure are essential for long-term success.

Another limitation relates to the technological literacy of healthcare personnel. Initial unfamiliarity with telemedicine systems necessitated intensive training and ongoing technical support. While regular workshops and user-friendly operational guidelines were effective in addressing this gap, the reliance on continuous capacity-building highlights a potential vulnerability in settings with high staff turnover [36]. This finding underscores the importance of integrating telemedicine competencies into standard healthcare training curricula.

Financial constraints also posed a challenge. The procurement, maintenance, and upgrading of telemedicine equipment require substantial investment, which may be difficult for primary healthcare facilities with limited budgets. Similar concerns have been noted in studies examining the sustainability of digital health interventions in resource-constrained environments [37]. Although external funding and partnerships were explored, long-term financial planning remains a critical factor influencing scalability.

Additionally, this initiative did not include systematic quantitative assessments of clinical outcomes, user satisfaction, or cost-effectiveness. As a result, conclusions regarding the direct impact of the telemedicine-based incubator on neonatal morbidity or mortality cannot be drawn. This limitation reflects the community service nature of the project but also highlights the need for future research designs that incorporate standardized outcome measures.

The findings of this discussion suggest several important implications for primary healthcare practice and policy. First, telemedicine-based neonatal care has the potential to enhance service equity by reducing geographic and socioeconomic disparities in access to specialized monitoring. This is particularly relevant in regions where referral hospitals are distant or overcrowded [38]. The successful implementation at Puskesmas Taman demonstrates that primary healthcare facilities can play a proactive role in adopting innovative technologies traditionally associated with higher-level care institutions.

Second, the structured monitoring and evaluation framework established through this initiative creates opportunities for systematic data collection. Such data could be leveraged to conduct future effectiveness studies, inform clinical protocols, and support evidence-based policy decisions regarding telemedicine integration [39]. Incorporating standardized indicators into routine practice would enable more rigorous assessment of clinical and economic outcomes.

Finally, the emphasis on stakeholder engagement including healthcare workers, electromedical personnel, and families highlights the importance of collaborative approaches in digital health implementation. Institutional support from Puskesmas leadership was instrumental in facilitating adoption and sustainability, reinforcing findings from previous studies on the role of governance in successful telemedicine deployment [40].

In conclusion, while the implementation of a telemedicine-based baby incubator at Puskesmas Taman has demonstrated promising benefits in terms of accessibility, efficiency, and family involvement, its long-term impact will depend on addressing infrastructural, financial, and capacity-related challenges. With appropriate policy support and continued evaluation, this model holds significant potential to be scaled and adapted across other primary healthcare settings to improve neonatal care outcomes.

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## V. CONCLUSION

This community service initiative aimed to implement a telemedicine-based baby incubator at Puskesmas Taman as an effort to maintain the sustainability and continuity of neonatal health services, particularly for infants requiring intensive care such as those with low birth weight or other clinical vulnerabilities. The implementation was conducted through a structured, prospective, and non-experimental approach encompassing preparation, training, operational integration, and continuous monitoring and evaluation. The findings indicate that the program was successfully executed over a three-month implementation period, during which the telemedicine-based incubator system was fully installed and operated in accordance with established Standard Operating Procedures. Health workers and electromedical personnel participated in intensive training sessions, resulting in improved operational readiness and adherence to equipment usage and maintenance protocols, as reflected by routine compliance monitoring. Continuous monitoring activities enabled systematic recording of key neonatal parameters, including body temperature, oxygen saturation, and heart rate, thereby supporting real-time clinical observation and decision-making. Furthermore, the integration of a mobile-based monitoring application facilitated active family involvement in infant care, enhancing communication between families and healthcare providers and supporting continuity of care beyond the health facility setting. Although this initiative did not generate quantitative clinical outcome measures such as morbidity reduction or length of stay, the structured monitoring framework provided measurable process-based outcomes, including consistent daily device operation, regular maintenance checks, and periodic evaluation of SOP compliance throughout the service period. These findings demonstrate the feasibility and acceptability of telemedicine-based neonatal care implementation at the primary healthcare level. For future work, it is recommended that subsequent studies incorporate controlled or quasi-experimental designs to assess the effectiveness of telemedicine-based incubators on measurable clinical outcomes, user satisfaction, and cost-effectiveness. Expanding the implementation to multiple primary health centers and integrating long-term data collection mechanisms would further strengthen evidence regarding scalability, sustainability, and broader health system impact. Overall, this initiative establishes a foundational model for integrating telemedicine technologies into community-based neonatal services and provides a practical framework for future research and policy development in digital health innovation.

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## DATA AVAILABILITY

No datasets were generated or analyzed during the current study.

## AUTHOR CONTRIBUTION

Bambang Guruh Irianto conceptualized the initiative, served as Chairperson, and led the delivery of the project's objectives and counseling for health workers. Sari Luthfiyah acted as the corresponding author, coordinated field implementation, and oversaw the integration of the telemedicine platform. Anita Mifthahul Maghfiroh and Triana Rahmawati contributed to the preparation of training materials, participant coordination, and the execution of the demonstration and simulation phases. Dwi Purwanti and Abdul Kholik provided specialized clinical and technical expertise, with Abdul Kholik focusing on the maintenance and operational sustainability of the incubator equipment. Much Faiz Nafi'u Pradana, Rifan Ramandani, and Muhamad Muflih Ridwan assisted in the technical installation of the specialized Android applications and the monitoring of vital patient parameters during the simulation stage. All authors reviewed and approved the final manuscript.

## DECLARATIONS

### *ETHICAL APPROVAL*

Information is not available.

### *CONSENT FOR PUBLICATION PARTICIPANTS.*

Consent for publication was given by all participants

### *COMPETING INTERESTS*

The authors declare no competing interests

## VI. REFERENCES

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