



Improved Access and Quality of Infant and Maternal Health Care in Vulnerable Areas

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ABSTRACT

Hypothermia is a condition of extreme loss of body temperature in infants and can increase mortality or morbidity in infants. Hypothermia, a condition where body temperature drops below normal limits, is a serious issue commonly found in newborns. This condition is particularly frequent in babies born prematurely or with low birth weight. This study aims to implement a smart infant warmer to decrease the case of hypothermia and to help the community service partner to care the patients. The method of this study applied to giving a prototype of a smart infant warmer with some steps, such as observation and problem identification, training and mentoring, grant, evaluation and monitoring, Device and Implementation. The implementer noticed this problem at Klinik Pratama Hidayah. The result of this study can increase a quality of the healthcare services at the clinic that it also had enhanced a profit of the healthcare services from patients. The clinic had experienced a revenue around IDR 525,000 after the implemented smart infant warmer. In addition, the implementer carried out community service to conduct training and mentoring of the tool for the clinic. This tool has a novelty to facilitate health workers in monitoring patients remotely through devices. This tool is also embedded with a telemedicine system to monitor the patient's body temperature and heart rate in real-time. This prototype device has been implemented in the clinic and improved the level of service quality for newborn care. Furthermore, the device has a limitation in that the implementation is dependent on the internet connection at the clinic.

Keywords: *Telemedicine, Internet of Things, Smart Infant Warmer, Neonatal Hypothermia.*

1. INTRODUCTION

Klinik Pratama Hidayah is one of the micro businesses of basic health services. The services offered include general health examination services, maternal and child health services. The clinic has a relatively simple condition of medical equipment. In fact, facilities and infrastructure are needed to support health services for patients. Not a few clinic patients have the status of pregnant women, pregnant women patients need the support of adequate examination medical equipment. Especially for childbirth services, after childbirth, usually newborns must be warmed with a baby warmer (Smart Baby Warmer). But clinics still don't have such devices, so delivery services can cause newborns to experience hypothermia. In fact, there are approximately 10 to 15 births of pregnant women in a month.

Of course, if the clinic experiences the absence of a baby warming device, it can reduce the health of newborn patients, especially when the patient suffers from an emergency condition. If there is a simultaneous delivery, of course, the clinic must provide a baby warmer to care for the newborn during the observation period before being handed over to the mother. This problem cannot be left alone, because the maternal and child health sector receives more attention from the government so that there is a decrease in maternal mortality or infant mortality. The problem of baby warmers has become very vital because many people access childbirth services at clinics. If this baby warmer does not immediately find a bright spot, newborn patients can experience various health problems. When the baby's inner body temperature and skin can decrease by about 0.1°C-0.3°C per minute, it is

still possible to prevent this case by using a baby warmer as the first treatment after the baby is born [1].

Cases of hypothermia or a decrease in body temperature below normal limits are significant problems that often occur in newborns. Hypothermia is often experienced in babies with premature conditions and low birth weight. There are more than 20 million premature babies and low birth weight babies born each year, and 95% of cases occur in developing countries. Then, there are 3 million babies who die in the first 28 days after birth due to hypothermia [2]. Neonatal hypothermia is widely known to be one of the major cases of high mortality and morbidity [3]. Cases of hypothermia in babies must be overcome with the need for medical technology that is autonomous in real-time in monitoring their temperature and heart rate. Smart baby warmers are life-support equipment used to provide relief from warm temperatures in normal babies and premature babies who are unable to maintain their own bodies from body temperature while in a new environment. Smart baby warmers are tools that are often used to keep the baby's body temperature stable [4]. Smart baby warmers play a role in providing warmth and comfort for premature or newborn babies. Babies need body temperature just like the temperature in their mother's womb between 34°C – 37°C [5].

In fact, newborns lose four times more heat in adults, resulting in a drop in temperature. In the first 30 minutes, the baby can experience a temperature drop of 3°-4°C. In a room with a temperature of 20°-25°C, the baby's skin temperature drops by approximately 0.3°C per minute. Temperature drops are caused by heat loss by conduction, convection, evaporation and radiation. The baby's ability to produce heat is not right, so the baby is very susceptible to hypothermia [6]. Neonatal hypothermia has been reported to occur in up to 85% of neonatal treatments in developing countries. Providing warmth is an essential element of the most basic care for small, sick babies, but it is often inadequate [7]. Newborn babies with low birth weight (BBLR) still experience instability in body temperature management, while this study also reports almost universal cases of hypothermia occurring either at home or in a health facility [8].

Another problem, newborns also need periodic monitoring. During the observation period, the baby must be monitored by a doctor/nurse/midwife after birth. This also slightly hampers the performance of health workers when there are other patients who are in need of treatment as early as possible. Furthermore, an effective and efficient solution must be found in the care of inpatient and outpatient patients. This problem, which is seen by

the proposer, is the main concern to improve the micro business services of basic health services at the Pratama Hidayah Clinic with a coaching program system

2. METHOD

This service was carried out with a participatory approach involving Klinik Pratama Hidayah partners in training activities and grants for smart baby warmers. The method used includes several main stages as follows:

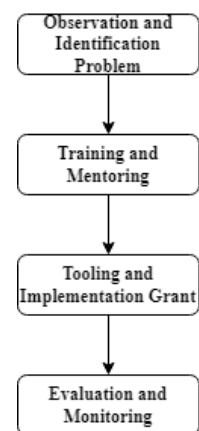


Figure1. Flow chart of the implementation of service

1. **Observation and Problem Identification:** Initial observation was carried out to identify the condition of health facilities at the Klinik Pratama Hidayah and understand the problem of hypothermia in infants that often occurs due to the cold climate at the foot of Mount Merapi. Interviews were conducted with midwives and health cadres to explore the need for more adequate medical equipment.
2. **Training and Mentoring:** The training activities focused on the introduction of IoT-based smart baby warmers to local midwives and health cadres. This training includes the use of technical tools, monitoring the baby's body temperature, and how to handle babies with hypothermia. In addition, the training also provides knowledge about the dangers of hypothermia in newborns and its preventive measures.
3. **Grant** for the sustainability of the use of the device by medical personnel at the clinic
4. **Evaluation and Monitoring:** Evaluation and monitoring activities are carried out by recording a decrease in hypothermia cases in infants in the clinic.
5. **Tools and Implementation:** IoT-based smart baby warmers were handed over to the Hidayah Primary Clinic to be used in the treatment of babies at risk of hypothermia. This service also compiled SOPs (Standard Operating Procedures) for the use of tools and video guidance to ensure that the Klinik Pratama

Hidayah after the implementation of smart baby warmers.

3. RESULTS & DISCUSSION

1. Observation and Problem Identification

In the observation and identification of problems, the service has found problems related to the lack of medical device technology to treat newborns. This can cause hypothermia in babies and requires medical devices to provide warm ambient temperatures. So, the solution is to hold a baby warmer to treat newborn patients. Furthermore, patient safety is also the main thing to improve service and consumer trust in partners. If patient safety is well maintained from adequate medical devices, of course, partners can be the first destination for consumers to seek treatment and childbirth. Then, calibrated medical devices can also convince consumers that partners are using medical devices to check with accurate and precise results.

2. Training and Mentoring

This partner training and mentoring was conducted to increase the capacity of partner health workers related to patient safety and the operation of smart baby warmer technology. This training includes improving patient safety procedures, maintenance, repair, and maintenance of smart baby warmers. Then, the introduction of this smart baby warmer regarding its operation which is connected to the admin's device.

On the topic of patient safety, health workers can supervise patients only through their gadgets. This is related to the utilization of internet of things technology to monitor the patient's body temperature indicator and heart rate. The automation system is also embedded in the tool, so that health workers are facilitated to monitor in real time for 24 hours. If the patient needs emergency treatment, the health worker on duty can directly video contact with the patient's pediatrician through the telemedicine system.



Figure 2. Workshop Implementation

3. Tool Grant and Implementation

This smart baby warmer is equipped with internet of things technology and a telemedicine system for 24-hour patient monitoring. Video contact can be made by the doctor with the duty nurse or the patient's family. This allows pediatricians to see the development of their patients with optimal supervision and minimize the distance and time between doctors and patients. Thus, the implementation of this tool can increase higher income for partners from the service of this tool to patients. The following is the data on the increase in income obtained from the implementation of the grant tool, namely:

Table 1. Partner Income Increase Data

No	Tool Usage Service			
	Patient	Caring (day)	Price per Day	Total
1	H	2	Rp 75000	Rp 150000
2	G	3	Rp 75000	Rp 225000
3	R	2	Rp 75000	Rp 150000
Total				Rp 525000

Table 1 above states that income reached Rp 525,000 from three patients who used the smart baby warmer. If without the device service, Mita does not get additional income from her patients. Thus, the implementation of this tool can be utilized by partners to improve maternal and child services and improve the health status of newborn and maternal patients.

This smart baby warmer is basically a technology with the advantages of automation and telemedicine. This allows patients to be more easily monitored in real time and doctors can also see their progress through their gadgets. Here is a cross-section of the device:



Figure 3. Smart Infant Warmer Grant

4. Evaluation and Monitoring

In the evaluation and monitoring, it was found that the smart baby warmer can improve health services at partners. Furthermore, partners gained an increase in revenue from the service of this device. Then, health workers can supervise patients remotely only through gadgets. The disadvantage of this tool is that it is affected by the internet signal at the partner, because this smart baby warmer must be connected to the internet for 24 hours during treatment. If the internet connection signal is problematic, of course this tool is less than optimal service.

Various neonatal services, such as retinopathy of prematurity (ROP) screening, tele-echocardiography, newborn resuscitation, and even family support around the world, have been supported by telemedicine. For NICU patients, tele-rounds are a reliable and safe method of care [9].

In another study, parents who were randomly assigned to receive care via telemedicine showed higher levels of satisfaction and a more positive view of the quality of care in general compared to standard methods [10]. Many neonatal units have implemented family-centered care, which includes supporting the transition from hospital to home, increasing parental participation, and maintaining regular communication with parents. Some aspects of family-centered care are supported by telemedicine; important interventions include webcam-based virtual visits, parent education, and virtual parent participation in care rounds [11].

Moreover, when their premature babies spend months in the NICU, parents often feel stressed and alienated. This gap has been resolved thanks to the use of technology, which initially allowed families to view videos and pictures of their babies before transitioning to the use of webcams [12]. Nowadays, many NICUs have been equipped with webcams, allowing relatives and parents to view their babies continuously from anywhere in the world. According to a recent review by Gibson et al, webcam visits can significantly increase parental attachment and reduce stress levels [13]. Similarly, Gutmann et al. found that using a webcam to remotely view an infant reduces caregiver stress, as measured by the Parental Stress Scale [14].

Parents of early newborns revealed that updates via text message improved communication [15]. In addition, another study found that receiving updates via daily text messages summarizing their baby's condition improved parents' satisfaction and their view of the doctor's availability [16]. In previous studies, telemonitoring was used to identify patients with heart failure (HF) to predict episodes of acute decompensation and the need to optimize therapy [17]. In the Telemonitoring to Improve Heart Failure Outcomes (Tele-HF) trial, 1,653 patients were randomly assigned to receive either usual care or an interactive voice response system over the phone within

30 days of hospitalization. Patients used buttons on their phones to enter answers to a series of questions regarding general health and heart failure symptoms in the voice response system [18]. According to a 2018 publication on the pediatric telehealth landscape, neonatology is one of the few subspecialties to adopt telemedicine, which also highlights the state of pediatric telemedicine [19].

4. CONCLUSION

The use of an Internet of Things (IoT)-based smart baby warmer at Klinik Pratama Hidayah has proven effective in improving the quality of newborn health services and reducing the risk of hypothermia. A training and mentoring program for health workers on the use of the device helped improve their ability to monitor and treat babies in real-time. The telemedicine technology integrated in the device enables remote communication between medical personnel and doctors, so that treatment can be carried out quickly in the event of an emergency. In addition to improving the health of infants, the implementation of this tool also increases the clinic's revenue from services provided to patients. However, the successful use of this tool is highly dependent on a stable internet connection, which is a major challenge in locations with limited infrastructure.

AUTHORS' CONTRIBUTIONS

Ekha Rifki Fauzi: Designing research, conducting observations and interviews, compiling methods, and writing most parts of the article. Coordinated all partner training and mentoring activities as well as the implementation of the IoT-based smart baby warmer.

Herenda Sela Wismaya: Contributed to the process of data analysis and evaluation of service results, and helped prepare the discussion section of the article.

Noor Alis Setiyadi: Developing technical training on the use of IoT-based smart baby warmers for health workers, as well as supporting the grant process and implementation in the field.

ACKNOWLEDGMENTS

We would also like to express our utmost appreciation to the Directorate General of Vocational Education of the Ministry of Education and Culture of the Republic of Indonesia for the financial support and guidance provided in the implementation of this activity. The assistance given has made a significant contribution to the success of this service program's implementation.

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