

Innovations in Maternal and Child Health Services in Remote Areas: An Effective Strategy to Reduce Infant Mortality

Riska Maulidanita¹, Rizca Annur Hanya², Endrixs Endrianto³, Sulfianti⁴
Institut Kesehatan Helvetia Medan¹, Universitas Wira Husada Medan², ITPB³,
Universitas Sipatokkong Mambo⁴

e-mail: * riskamaulidanita@helvetia.ac.id¹, rizca1406@gmail.com²,
endrixsendrianto87@gmail.com³, sulfianti0712@gmail.com⁴

ABSTRACT

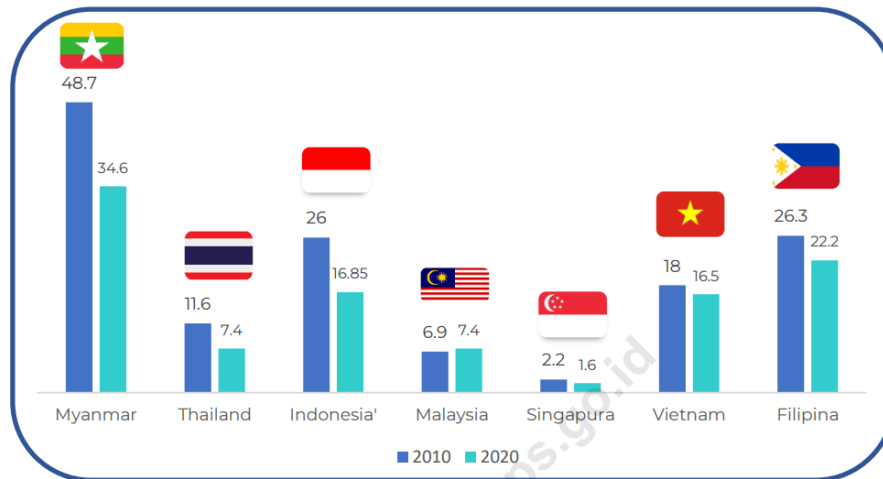
Infant mortality rates remain a serious public health issue, particularly in remote areas of Indonesia that face limitations in terms of facilities, infrastructure, and resources. This situation is exacerbated by difficult access to transportation, a shortage of health workers, and low levels of health literacy among the population. This article aims to examine various innovations in maternal and child health services that can contribute to reducing the IMR in remote areas. The method used is a literature review of recent studies discussing the implementation of innovative strategies, including the use of digital technology, strengthening the role of local healthcare workers, and community involvement in health programs. The findings indicate that the implementation of telemedicine, enhancing the capacity of village midwives, providing emergency transportation, and community-based health education have proven effective in improving access to and the quality of healthcare services. These findings underscore that innovative strategies tailored to local social and cultural conditions hold significant potential for sustainably reducing infant mortality rates in remote areas.

Keywords: Health Innovation; Mothers And Children; Remote Areas; Infant Mortality Rates

INTRODUCTION

The infant mortality rate (IMR) is a fundamental indicator that reflects the health status of a nation as well as the quality of health services available to the community. Globally, there has been a significant decline in IMR over the past two decades thanks to advances in medical science, improved access to health services, and interventions in maternal and child health programs (Esmaeilzadeh, 2021). However, significant disparities still exist between developed and developing countries. Low-income countries continue to face much higher IMRs compared to developed countries, particularly in rural and remote areas, which are often hindered by limited infrastructure, medical personnel, and inadequate healthcare systems (Mehboob, 2021; Sari, 2023).

Indonesia, as a developing country with a highly diverse geography, faces similar challenges. According to data from the Central Statistics Agency (BPS) and the Ministry of Health (2021), the IMR has shown a downward trend over the past ten years, indicating that Indonesia has experienced the fastest decline compared to other countries in Asia. Furthermore, the decline in the IMR has not been uniform but has been concentrated in urban areas with relatively complete health facilities. Conversely, remote areas, islands, border regions, and underdeveloped areas still have relatively high infant mortality rates, with some regions recording rates two to three times higher than the national average.



Source: Statistics, B. P. (2020)

Figure 1.1 Infant Mortality Rates in Several Asian Countries in 2010 and 2020

The high IMR in remote areas cannot be separated from geographical factors, which are the main challenges (Chew, 2022). The location of areas that are difficult to reach, limited transportation access, poor road conditions, and long distances to health facilities prevent pregnant women and babies from receiving timely health services (Situmorang, 2022). Many infant deaths occur due to delays in reaching healthcare facilities, especially during childbirth or when infants experience complications requiring immediate attention. This situation is exacerbated in island or mountainous regions, where it can take hours or even days to reach a referral hospital (Dewi, 2023).

In addition to geographical factors, the uneven distribution of health workers also exacerbates high IMR in remote areas (Muharram, 2024). Most medical professionals, especially pediatricians and obstetricians/gynecologists, are concentrated in large cities. Meanwhile, healthcare services in remote areas rely heavily on village midwives or nurses, whose numbers are limited and who are not fully skilled in handling neonatal emergencies. As a result, many cases of babies with birth complications or serious health issues cannot be properly managed. Limited medical facilities and equipment also pose significant barriers. Many auxiliary health centers or posyandu in remote areas are not equipped with basic facilities such as sterile delivery rooms, incubators, or infant

resuscitation equipment (Yuliyanti, 2024). Additionally, some health facilities still face limitations in electricity and clean water, which should be basic necessities. Without adequate support, existing healthcare workers find it difficult to provide optimal care, thereby increasing the risk of infant mortality.

Low health literacy among the community is also an important factor that cannot be ignored. Many pregnant women in remote areas do not understand the importance of antenatal care (ANC), immunization, balanced nutrition, and danger signs during pregnancy. This lack of knowledge causes most mothers to delay visiting health facilities until their condition becomes critical. On the other hand, trust in traditional practices that do not meet medical standards remains strong, thereby increasing the risk of complications and infant mortality (Dion, 2025). Socio-economic factors further exacerbate the situation. The relatively high poverty rate in remote areas makes it difficult for many families to access healthcare services (Osadolor, 2022). Transportation costs, medications, and medical services are considered expensive, so most people choose not to undergo routine check-ups or wait until the situation is truly urgent. However, delays in accessing healthcare services actually increase the risk of infant mortality.

Cultural aspects also play a significant role in high MMR. In some areas, decisions regarding maternal and child health are often influenced by traditional leaders or extended families (Asiah, 2025). Traditional practices passed down through generations are still considered more reliable than modern medical interventions. This situation poses challenges for healthcare workers in educating the community and introducing medically appropriate approaches. Without the right cultural approach, efforts to reduce IMR struggle to achieve optimal results. The Indonesian government has launched various programs to reduce IMR, such as the National Health Insurance (JKN) program, strengthening posyandu services, increasing the number of village midwives, and providing basic health facilities. However, the effectiveness of these programs is often not maximized in remote areas. In a global context, various innovations have been introduced to address similar issues. Telemedicine technology, for example, enables people in remote areas to access remote medical consultations with experts in major cities. Additionally, innovations such as mobile clinics, motorized ambulances, and emergency boats have been successfully implemented in some developing countries to overcome transportation limitations. However, the implementation of such innovations in Indonesia remains limited, both in terms of geographical coverage and sustainability.

Community-based approaches have proven to be one of the most effective strategies in reducing MMR. The involvement of health cadres, community leaders, and local organizations can strengthen public awareness of the importance of maternal and child care (Maulani, 2025). Through community-based education programs, the public is more receptive to health information because it is conveyed by people who are socially and culturally close to them. This helps improve the health behavior of pregnant women and increase the use

of available medical services. The urgency of addressing IMR in remote areas must also be viewed within the framework of achieving the Sustainable Development Goals (SDGs), particularly the third goal, which targets a reduction in the neonatal mortality rate to below 12 per 1,000 live births by 2030. Without innovative interventions capable of reaching remote areas, this target will be difficult to achieve. Indonesia risks falling behind in achieving the SDGs if the health service gap between urban and remote areas is not addressed promptly.

Based on the above description, it can be understood that the problem of maternal mortality in remote areas is multidimensional, covering geographical, economic, socio-cultural aspects, as well as limitations in the health system. Therefore, an innovative strategy is needed that is adaptive to local conditions, community empowerment-oriented, and supported by technology and cross-sector collaboration. Such an approach is not only relevant for addressing issues in Indonesia but can also serve as an applicable model for other developing countries facing similar challenges. This article aims to analyze various forms of innovation in maternal and child health services that have proven effective in reducing infant mortality rates in remote areas. The analysis is conducted through a review of current literature and best practices in various regions. It is hoped that this article will contribute to enriching academic discourse while offering policy recommendations that can be implemented by governments, health workers, and other stakeholders in efforts to reduce infant mortality rates and improve the health status of communities in remote areas.

METHODOLOGY

This study uses a descriptive qualitative approach with a systematic literature review method to analyze various maternal and child health service innovations implemented in remote areas in order to reduce infant mortality rates. Data collection was carried out through a search of scientific articles, official reports from international health agencies such as the WHO and UNICEF, and publications from the Indonesian Ministry of Health. The inclusion criteria used include: (1) publications published between 2020 and 2025, (2) articles discussing maternal and child health services in remote areas, and (3) research emphasizing innovative strategies in efforts to reduce infant mortality rates. The data obtained were then analyzed using content analysis techniques, which include the stages of identification, reduction, categorization, and synthesis of information to achieve a more comprehensive understanding. The first stage is to identify various relevant health service innovations, the second stage is to screen publications according to inclusion criteria, the third stage is to group them based on innovation categories such as the use of digital technology, strengthening local health workers, providing emergency transportation, and community empowerment, and the fourth stage is to compile a synthesis of findings to identify strategies that are proven to be effective and relevant to the context of remote areas in Indonesia. Thus, this method enables researchers to present a systematic and in-depth overview of innovative practices in reducing

infant mortality rates, as well as generating strategic recommendations that can serve as a foundation for future health policy development and interventions.

RESULTS AND DISCUSSION

A. The Use of Digital Technology in Healthcare Services

The use of digital technology, particularly telemedicine, has become one of the key breakthroughs in improving access to maternal and child health services in remote areas (Girmay, 2024). Geographical limitations that often hinder communities from accessing healthcare facilities can be minimized through remote consultation services (Gizaw, 2022). With telemedicine, pregnant women and parents of infants no longer need to undertake long and expensive journeys just to undergo routine check-ups. This service model not only provides convenience but also improves the continuity of healthcare services, which were previously often interrupted due to access barriers. Additionally, mobile health (m-health) applications have become an important tool in supporting the improvement of public knowledge regarding maternal and child health (Kabongo, 2021). Through easily accessible applications, the public can obtain information about balanced nutrition during pregnancy, postpartum care, child immunization schedules, and warning signs that require immediate medical attention. These applications not only serve as a medium for information but also as a means of communication between healthcare workers and patients, enabling more intensive interaction despite physical distance.

The implementation of telemedicine and m-health also provides significant benefits in terms of monitoring the health of pregnant women (Li, 2021). For example, high-risk pregnant women can be monitored regularly through the transmission of health data such as blood pressure, blood sugar levels, or fetal development using simple devices connected to digital applications. The data is then analyzed by medical personnel, enabling faster and more accurate medical decisions to be made. This innovation helps detect complications early on, thereby significantly reducing maternal and infant mortality rates. Digital technology also strengthens the health referral system in remote areas. With patient data integration through the app, medical personnel at community health centers can quickly send information to referral hospitals when an emergency case is detected. This speeds up the treatment process because medical personnel at the hospital already know the patient's condition before the patient arrives. Thus, the time previously wasted due to delayed information can be reduced, thereby increasing the chances of survival for mothers and babies.

In addition to being a clinical tool, telemedicine and m-health also play an important role in health education. Digital-based education has proven to be more easily accepted because it uses visual, audio, and interactive media that are appealing to the public (Sharma, 2025). For example, short videos on proper breastfeeding techniques, nutritious eating patterns, or

signs of pregnancy complications can be accessed anytime through an app. This approach is far more effective than face-to-face counseling, which is limited by time and resources. As a result, public awareness of the importance of maternal and child care can increase sustainably. However, the implementation of digital technology in maternal and child health services also faces several challenges. One of these is the limited technological infrastructure in remote areas, such as unstable internet connections or the lack of adequate digital devices (Capasso, 2024). Additionally, the public's digital literacy levels remain a barrier to the utilization of health apps. Therefore, technological innovations must be accompanied by supporting programs such as providing affordable devices, expanding internet networks, and improving public digital literacy to ensure that the benefits are fully realized.

On the other hand, the successful implementation of telemedicine also requires clear regulatory and government policy support. These regulations include service standards, patient data protection, and telemedicine service financing mechanisms so that they can be widely accessed by low-income communities. Without strong regulations, the use of digital technology is feared to be enjoyed only by a small portion of the population, thereby widening health access disparities (George, 2024). With the right policy support, telemedicine can be integrated into the national health system as one of the strategies to reduce infant mortality rates. The use of digital technology in maternal and child health services in remote areas is a strategic step to overcome access barriers, improve service quality, and accelerate the handling of high-risk cases (Aidoo, 2025). Telemedicine and m-health have proven effective in supporting routine check-ups, health education, monitoring the condition of pregnant women, and strengthening referral systems. Despite ongoing challenges, the significant potential of this technology can be realized through infrastructure support, improved digital literacy, and policies that prioritize remote communities. Thus, digital innovation is not merely a supplement to healthcare services but an integral part of efforts to reduce infant mortality rates in Indonesia.

B. Strengthening Local Health Workers

Strengthening local health workers is an important strategy in reducing infant mortality rates in remote areas (Diyaolu, 2025). The limited availability of medical specialists, such as obstetricians or pediatricians, is a major obstacle to maternal and child health services. Therefore, empowering midwives, community nurses, and local health cadres is a realistic alternative solution. By providing additional training and enhancing competencies, local healthcare workers can play a crucial role in detecting early pregnancy issues or complications in infants. This approach not only expands the reach of healthcare services but also ensures that communities have access to faster healthcare interventions. Additionally, local healthcare workers often have a deeper understanding of the social and cultural context of the local community (Mustapha, 2025). This

understanding is crucial, as some communities in remote areas still hold onto certain traditions or beliefs that can influence the health behaviors of pregnant women and infants. Through emotional closeness and social ties, midwives or local health workers can build trust, making communities more open to receiving health education and services. This differs from medical personnel from outside the area, who may require more time to adapt.

The capacity of local health workers can be improved through ongoing training programs. The government and non-governmental organizations need to organize workshops, seminars, and field-based training to strengthen their skills (Flint, 2025). For example, training on obstetric emergency management, the use of simple digital technology for medical record-keeping, and effective communication skills in providing health education. With these skills, midwives and health workers can respond more promptly in providing services that meet standards, even with limited facilities. Not only skill enhancement, but facility support and incentives are also crucial factors in strengthening the role of local healthcare workers. Many health workers are reluctant to be stationed in remote areas due to the lack of facilities and insufficient recognition of their work. By providing financial incentives, government housing, and other supporting facilities, health workers will be more motivated to stay and provide the best possible care. This highlights that strengthening human resources in the health sector must be accompanied by adequate structural support.

Collaborative programs between local health workers and specialists from large cities can also be an effective strategy (Ijiga, 2024). Through a rotation system or regular visits, specialists can share their knowledge while supervising local health workers. Additionally, telemedicine technology can be utilized to strengthen this relationship, allowing local midwives or nurses to consult in real-time with medical experts when encountering challenging cases. This collaborative model not only enhances competencies but also boosts the confidence of local healthcare workers in making decisions. The success of strengthening local healthcare workers also requires active community involvement. For example, through the establishment of posyandu or pregnant women's groups, where midwives and health workers can provide regular education. With this platform, local healthcare workers have a more structured communication channel to convey information about pregnancy care, nutrition, and immunization. At the same time, the community also feels a sense of ownership in maintaining the health of mothers and babies, thereby creating a mutually supportive relationship.

Regular evaluations of the performance of local health workers need to be conducted to ensure the sustainability of the program (Osamika, 2024). Local governments and health agencies can develop a monitoring system that assesses the extent to which local health workers are able to reduce pregnancy complications or increase infant immunization coverage. The

results of these evaluations can be used as a basis for improving training programs and incentive policies. Thus, this strategy is not only short-term but also sustainable in building a stronger health system in remote areas. Strengthening local health workers is a strategic step that can bridge the limitations of access to health services in remote areas. By increasing capacity, providing incentive support, building collaboration, and involving the community, local health workers can play a leading role in reducing infant mortality rates. This strategy demonstrates that the success of maternal and child health services does not solely depend on advanced technology or modern facilities, but also on the quality of human resources who are close to the community and sensitive to local needs.

C. Provision of Emergency Transportation

Improving access to emergency transportation is one of the key strategies for reducing infant mortality rates in remote areas (Brito, 2024). Many cases of maternal and infant deaths occur due to delays in medical treatment, which are largely caused by difficulties in accessing transportation to healthcare facilities. Geographical challenges, such as steep roads, damaged bridges, or terrain that can only be traversed by boat, make it difficult for pregnant women and infants to receive timely care. Therefore, providing fast, affordable, and easily accessible emergency transportation is a crucial step in an integrated healthcare system (Cvetković, 2024). In many remote areas of Indonesia, the distance between villages and health centers or referral hospitals can reach tens of kilometers. Without emergency transportation, families must make their own efforts to transport patients using whatever vehicles are available, such as motorcycles or carts. This situation poses a serious risk to the safety of pregnant women and newborn babies, especially in emergency cases such as postpartum hemorrhage, preeclampsia, or neonatal asphyxia. The presence of village ambulances, modified three-wheeled vehicles, or even motorboats in water-based areas could serve as solutions to expedite patient referrals to more comprehensive healthcare facilities.

In addition to providing emergency transportation, a good coordination system is also essential. Often, even when vehicles are available, delays occur due to the lack of communication mechanisms between the community and healthcare workers or transportation drivers. The use of simple technology, such as mobile phones or emergency messaging apps, can help expedite the transportation mobilization process. With an emergency call system in place, the community can immediately report cases, and transportation can be deployed more quickly. Improving access to emergency transportation must also consider sustainability aspects. Many programs providing village ambulances or motorboats have failed to sustain themselves due to insufficient operational funds, such as fuel costs, vehicle maintenance, or driver salaries. Therefore, local governments and communities need to design sustainable funding schemes, such as through village funds, regional health insurance, or corporate social responsibility

(CSR) programs from private companies. With a clear funding system in place, emergency transportation can function optimally and not break down midway.

In some areas, local community participation is a key factor in the success of emergency transportation programs (Tomoh, 2024). For example, communities can form volunteer groups tasked with assisting in patient evacuations or operating emergency vehicles. This participation not only lightens the burden on healthcare workers but also fosters a sense of community ownership of the program. Thus, emergency transportation is not only a facility provided by the government but also a part of social solidarity in ensuring the safety of mothers and babies. In addition to land transportation, air and water transportation also need to be considered in areas with extreme geographical conditions. Air ambulance programs, although costly, can be a solution in mountainous or island regions (Kolivand, 2024). Similarly, the provision of fast boats or motorized boats equipped with basic medical facilities in water areas is also important. Transportation innovations based on local wisdom, such as the use of modified traditional boats for evacuation, can also be effective alternatives. This demonstrates that emergency transportation solutions must be tailored to geographical conditions and the needs of the local community.

The effectiveness of emergency transportation must also be evaluated periodically. Local governments need to assess whether the availability of such transportation truly speeds up referrals and reduces maternal and infant mortality rates. Data related to travel time, the number of patients referred, and the success rate of medical treatment after using emergency transportation can serve as indicators of program success. This evaluation is crucial to ensure that the program not only provides the means but also delivers tangible results in saving lives. Thus, improving access to emergency transportation is a comprehensive strategy that involves providing the means, communication systems, sustainable funding, and community participation. Effective emergency transportation can break the chain of delayed medical referrals and be a key factor in efforts to reduce infant mortality rates in remote areas. This strategy underscores that access to healthcare is not solely determined by the availability of medical facilities but also by the community's ability to reach those facilities in a timely manner.

D. Community Education and Empowerment

Health education is one of the main pillars in efforts to improve the quality of maternal and child health services, especially in remote areas (De, 2024). Lack of public knowledge about pregnancy warning signs, maternal nutrition, and newborn care often leads to delays in seeking medical help. Through structured education programs, pregnant women and their families can become more vigilant about risky conditions and take appropriate action promptly when faced with emergencies. This education

not only reduces the risk of pregnancy complications but also increases public awareness of the importance of regular prenatal check-ups. In addition to targeting pregnant women, health education should also involve family members, particularly husbands and parents. In many cases, the decision to bring a pregnant woman or baby to a healthcare facility is made by the family. If the family understands the importance of seeking immediate medical assistance, the decision-making process can be expedited. Therefore, health education programs should be designed inclusively to involve all family members, enabling them to support pregnant women in maintaining their health throughout pregnancy and childbirth.

Community empowerment is an important aspect that complements health education (Ogbuagu, 2024). When communities are involved in efforts to maintain maternal and child health, they will feel a collective responsibility for mutual safety. For example, through the establishment of village health cadres or posyandu, communities can play an active role in providing information, monitoring the condition of pregnant women, and assisting in the emergency referral process. These local health cadres can serve as a bridge between medical personnel and the community, especially in hard-to-reach areas (Yatni, 2025). Community empowerment can be realized through basic health skills training. For example, training on first aid for pregnant women with minor complications, how to maintain infant hygiene, or simple infant resuscitation techniques. With these basic skills, the community can take initial actions before medical personnel arrive or before the patient reaches a healthcare facility. Timely initial actions often play a decisive role in saving the lives of mothers and infants.

Digital media can also be used to strengthen health education in remote areas. The use of m-health applications, text messages, or social media-based communication groups can be a means of disseminating health information quickly and widely (Sulistyawati, 2023). Educational materials in the form of videos, infographics, or interactive modules can help communities better understand important information. In this way, the shortage of healthcare workers in remote areas can be partially addressed through the use of technology as a medium for community health education. However, the success of health education does not solely depend on the provision of information but also on the appropriate cultural approach. Each region has its own traditions, beliefs, and local health practices that influence community behavior. Therefore, health education must be designed with respect for local cultural values while still conveying accurate medical messages. With a culturally sensitive approach, health messages will be more easily accepted and practiced by the community.

Thus, health education and community empowerment are fundamental strategies in reducing infant mortality rates in remote areas. Both not only increase knowledge but also build community capacity to play an active role in maintaining maternal and child health. If education is implemented

consistently and community empowerment is effective, a community-based health system will be formed that is independent, sustainable, and capable of supporting the success of national health programs.

E. Multi-sector collaboration

Collaboration between the government and non-governmental organizations is an important factor in strengthening maternal and child health services in remote areas (Widjaja, 2025). The government has the authority to formulate policies, regulations, and provide health facilities, while non-governmental organizations such as civil society organizations, international institutions, and the private sector have the flexibility, resources, and innovation to complement the role of the government. Synergy between the two creates significant opportunities to deliver more equitable, sustainable, and responsive health services tailored to local needs. The government's role in this collaboration primarily lies in strengthening health policies and systems. The government can set standards for maternal and child health services, ensure regulations that support telemedicine, and allocate special budgets for health programs in remote areas. On the other hand, the government also needs to provide broader participation opportunities for non-governmental institutions so they can contribute maximally through innovative programs.

Meanwhile, non-governmental organizations have advantages in terms of program flexibility, the ability to reach the lowest levels of society, and speed in implementing innovations. Many non-governmental organizations focus on improving the capacity of local health workers, community empowerment, and the provision of health technology (Rendy, 2025). They can act swiftly on the ground to provide training, technical assistance, or other resources that the government may not always be able to provide due to bureaucratic constraints and budget limitations. Effective collaboration can be achieved through partnership programs between community health centers or regional hospitals and non-governmental organizations. For example, international humanitarian organizations can help provide portable medical equipment, emergency ambulances, or logistical support to reach hard-to-access areas. On the other hand, local organizations can play a role in health advocacy, community education, and ensuring cultural and social support for health programs being implemented.

The private sector also has a strategic role in this collaboration. Through corporate social responsibility (CSR) programs, the private sector can contribute funds, technology, or infrastructure needed for health services (Febriansyah, 2024). For example, telecommunications companies can collaborate with the government and non-governmental organizations to expand internet networks in remote areas, thereby supporting the implementation of telemedicine and digital-based healthcare services. Additionally, this collaboration must focus on the sustainability of programs. Many healthcare programs in remote areas cease operations once

funding periods end. To address this, governments and non-governmental organizations must develop long-term strategies that include training local health workers, strengthening referral systems, and building basic infrastructure that can continue to be utilized even after funding projects have concluded.

Joint monitoring and evaluation are also important aspects of this collaboration. With an integrated evaluation mechanism, the government and non-governmental organizations can ensure that programs run according to their objectives, identify obstacles, and make continuous improvements. This evaluation also allows for transparency and accountability in the use of funds, thereby increasing public trust in health programs. Thus, collaboration between the government and non-governmental organizations is not merely a form of cooperation but a fundamental strategy in strengthening the health system in remote areas. Their synergy can overcome resource limitations, accelerate access to services, and introduce innovations relevant to community needs. If this collaboration is consistently and sustainably implemented, the goal of reducing infant mortality through improved maternal and child health services can be achieved more effectively.

CONCLUSION

Innovation in maternal and child health services in remote areas is an important and effective strategy in reducing infant mortality rates, which remain a public health challenge. These efforts encompass various approaches, ranging from the use of digital technology to facilitate telemedicine, app-based health records, to early warning systems for pregnancy and childbirth complications. Additionally, strengthening the role of local healthcare workers, such as village midwives and community health workers, is key because they have close ties to the community and understand local environmental conditions. Providing emergency transportation, whether through village ambulances, motorboats in water-based areas, or other simple modes of transport, is also crucial to ensure pregnant women and infants receive timely medical referrals. On the other hand, community-based education on reproductive health, infant care, nutrition, and pregnancy warning signs can improve community health literacy and encourage positive behavioral changes. The implementation of this strategy requires collaborative support across sectors, including the government, medical personnel, community organizations, and the private sector, so that innovation can be integrated and adapted to the local socio-cultural context. Thus, the target of reducing infant mortality rates as outlined in the Sustainable Development Goals (SDGs) can be achieved if this innovation is implemented in a sustainable, adaptive, and comprehensive manner within the healthcare system.

REFERENCES

Aidoo, E. M. (2025). Advancing precision medicine and health education for chronic disease prevention in vulnerable maternal and child populations.

- World Journal of Advanced Research and Reviews, 25(2), 2355-76.
<https://doi.org/10.30574/wjarr.2025.25.2.0623>
- Asiah, N. (2025). Analisis Faktor Sosial Budaya terhadap Pemanfaatan Layanan Kesehatan Ibu dan Anak di Aceh. *Assyifa: Jurnal Ilmu Kesehatan*, 1(1), 42-50.
- Brito, P. M., Ribeiro, K. S. Q. S., Melo, R. S., Tavares Netto, A. R., & Sarinho, S. W. (2024). Relationship between geographic accessibility to emergency services and infant mortality: A systematic review and meta-analysis. *Journal of Paediatrics and Child Health*, 60(10), 479-488.
<https://doi.org/10.1111/jpc.16627>
- Capasso, A., Colomar, M., Ramírez, D., Serruya, S., & de Mucio, B. (2024). Digital health and the promise of equity in maternity care: A mixed methods multi-country assessment on the use of information and communication technologies in healthcare facilities in Latin America and the Caribbean. *Plos one*, 19(2), e0298902.
<https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0298902>
- Chew, C. C., Lim, X. J., Low, L. L., Lau, K. M., Kari, M., Shamsudin, U. K., & Rajan, P. (2022). The challenges in managing the growth of indigenous children in Perak State, Malaysia: A qualitative study. *Plos One*, 17(3), e0265917.
<https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0265917>
- Cvetković, V. M., Tanasić, J., Renner, R., Rokvić, V., & Beriša, H. (2024, October). Comprehensive risk analysis of emergency medical response systems in Serbian healthcare: Assessing systemic vulnerabilities in disaster preparedness and response. In *Healthcare* (Vol. 12, No. 19, p. 1962). MDPI.
<https://doi.org/10.3390/healthcare12191962>
- de los Reyes, C. S., Nakamura, Y., & Crisostomo, M. E. (2024). Universal Health Care and the Maternal and Child Health Handbook for Indigenous Peoples: The Case of Tagbanua Mothers and Children of Coron Island, Palawan. *Hypertension Research in Pregnancy*, 12(2), 28-36.
<https://doi.org/10.14390/jsshp.HRP2024-003>
- Dewi, A., Supriyatiningsih, Sundari, S., & Nursetiawan. (2023, February). Improving Maternal Health Services in Remote Rural Areas: Through the Use of Geographic Information System Technology. In *International Congress on Information and Communication Technology* (pp. 787-797). Singapore: Springer Nature Singapore. https://doi.org/10.1007/978-981-99-3236-8_63
- Dion, Y., Tahu, S. K., & Tanggur, F. S. (2025). Tradisi Neno Bo'ha Dalam Perawatan Masa Nifas: Tantangan Integrasi Budaya dan Kesehatan Modern Di Masyarakat Dawan. *JUKEJ: Jurnal Kesehatan Jompa*, 4(1), 484-496.
<https://doi.org/10.57218/jkj.Vol4.Iss1.1619>
- Diyaolu, C. O. (2025). Advancing maternal, child, and mental health equity: A community-driven model for reducing health disparities and strengthening

- public health resilience in underserved US communities. *World J Adv Res Rev*, 26(03), 494-515. <https://doi.org/10.30574/wjarr.2025.26.3.2264>
- Esmaeilzadeh, F., Alimohamadi, Y., Sepandi, M., Khodamoradi, F., & Jalali, P. (2021). The comparing of infant mortality rate in different World Health Organization regions during 1990–2017. *Egyptian Pediatric Association Gazette*, 69(1), 1. <https://doi.org/10.1186/s43054-020-00048-6>
- Febriansyah, K., Hidayat, R., & Rifaid, R. (2024). Collaborative Pemerintah Desa Sekongkang Bawah dan PT. AMMAN MINERAL NUSA TENGGARA dalam Pengelolaan Corporate Sosial Responsibility Guna Peningkatan Pendidikan dan Kesehatan Masyarakat. *Jurnal Ranah Publik Indonesia Kontemporer (Rapik)*, 4(1), 14-26. <https://doi.org/10.47134/rapik.v4i1.62>
- Flint, J. A., Jack, M., Jack, D., Hammersley-Mather, R., Durrheim, D. N., Kirk, M. D., & Housen, T. (2025). Development of an impact evaluation framework and planning tool for field epidemiology training programs. *Human Resources for Health*, 23(1), 20. <https://doi.org/10.1186/s12960-025-00974-9>
- George, A. S. (2024). Universal internet access: A modern human right or a path to digital Colonialis. *Partners Universal International Innovation Journal*, 2(2), 55-74. <https://doi.org/10.5281/zenodo.10970024>
- Girmay, M. (2024). Digital health divide: opportunities for reducing health disparities and promoting equitable care for maternal and child health populations. *International Journal of Maternal and Child Health and AIDS*, 13, e026. doi: 10.25259/IJMA_41_2024
- Gizaw, Z., Astale, T., & Kassie, G. M. (2022). What improves access to primary healthcare services in rural communities? A systematic review. *BMC Primary Care*, 23(1), 313. <https://doi.org/10.1186/s12875-022-01919-0>
- Ijiga, A. C., Enyejo, L. A., Odeyemi, M. O., Olajide, F. I., Olajide, F. I., & Daniel, A. O. (2024). Integrating community-based partnerships for enhanced health outcomes: A collaborative model with healthcare providers, clinics, and pharmacies across the USA. *Open Access Research Journal of Biology and Pharmacy*, 10(2), 081-104. <https://doi.org/10.53022/oarjbp.2024.10.2.0015>
- Kabongo, E. M., Mukumbang, F. C., Delobelle, P., & Nicol, E. (2021). Explaining the impact of mHealth on maternal and child health care in low-and middle-income countries: a realist synthesis. *BMC pregnancy and childbirth*, 21(1), 196. <https://doi.org/10.1186/s12884-021-03684-x>
- Kolivand, P. (2024). Enhancing Health Economics: The Critical Role of Air Emergency Services in Remote and Inaccessible Regions. *IRANIAN RED CRESCENT MEDICAL JOURNAL*, 26(1).
- Li, J., Silvera-Tawil, D., Varnfield, M., Hussain, M. S., & Math, V. (2021). Users' perceptions toward mHealth technologies for health and well-being monitoring in pregnancy care: qualitative interview study. *JMIR formative research*, 5(12), e28628. <https://doi.org/10.2196/28628>
- Maulani, M. N., & Yulianingsih, W. (2025). Peran Edukasi Posyandu dalam Meningkatkan Kesadaran Masyarakat Bagi Kesehatan Ibu dan Anak di Desa Sumedangan Kabupaten Pamekasan. *J+ PLUS UNESA*, 14(1), 216-225.

- Mehboob, R., Gilani, S. A., Khalid, S., Hassan, A., & Alwazzan, A. (2021). Maternal mortality ratio in low income developing countries. *Global women's health*, 10.
- Muharram, F. R., Sulistya, H. A., Swannjo, J. B., Firmansyah, F. F., Rizal, M. M., Izza, A., ... & Romdhoni, A. C. (2024). Adequacy and distribution of the health workforce in Indonesia. *WHO South-East Asia journal of public health*, 13(2), 45-55.
- Mustapha, A. A., Sefinat, A. A., Anthony, O., Femi, V., Nnenna, O., & Anestina, F. H. (2025). Community-based mental health interventions: Empowering local leaders and organizations. Unpublished manuscript], ResearchGate. https://www.researchgate.net/publication/390970486_Community-Based_Mental_Health_Interventions_Empowering_Local_Leaders_and_Organizations (open in a new window).
- Ogbuagu, O. O., Mbata, A. O., Balogun, O. D., Oladapo, O., Ojo, O. O., & Muonde, M. U. R. I. D. Z. O. (2024). Community-based pharmacy interventions: A model for strengthening public health and medication accessibility. *IRE Journals*, 7(10), 477-482.
- Osadolor, O. O., Osadolor, A. J., Osadolor, O. O., Enabulele, E., Akaji, E. A., & Odiowaya, D. E. (2022). Access to health services and health inequalities in remote and rural areas. *Janaki Medical College Journal of Medical Science*, 10(2), 70-74. <https://doi.org/10.3126/jmcjms.v10i2.47868>
- Osamika, D., Forkuo, A. Y., Mustapha, A. Y., Chianumba, E. C., & Komi, L. S. (2024). Systematic Review of Global Best Practices in Multinational Public Health Program Implementation and Impact Assessment. *International Journal of Advanced Multidisciplinary Research and Studies*, 4(6), 1989-2009. <https://doi.org/10.62225/2583049X.2024.4.6.4249>
- Rendy, M., & HS, M. H. (2025). Peran Pemerintah Dalam Mengatasi Stunting: Upaya Bersama Untuk Pertumbuhan Dan Pembangunan Berkelanjutan. *Interelasi Humaniora*, 1(4), 227-233. <https://doi.org/10.24716/4afc42>
- Sari, I. P., Sucirahayu, C. A., Hafilda, S. A., Sari, S. N., Safithri, V., Fitria, F., ... & Hasyim, H. (2023). Faktor penyebab angka Kematian ibu dan Angka Kematian bayi serta strategi penurunan kasus (studi kasus di negara berkembang): Sistematic Review. Prepotif: *Jurnal Kesehatan Masyarakat*, 7(3), 16578-16593. <https://yapindo-cdn.b-cdn.net/article/60842/1729043383037.pdf>
- Sharma, A., & Jain, V. (2025). Remote Patient Monitoring and Telemedicine. In *AI-Driven Personalized Healthcare Solutions* (pp. 99-128). IGI Global Scientific Publishing. <https://doi.org/10.4018/979-8-3693-7858-8.ch004>
- Situmorang, H. E., Sweet, L., Graham, K., & Grant, J. (2022). Health care provider's perceptions of factors that influence infant mortality in Papua Indonesia: A qualitative study. *Women and Birth*, 35(2), 201-209. <https://doi.org/10.1016/j.wombi.2021.04.007>
- Statistik, B. P. (2020). Mortalitas Di Indonesia. *Mortalitas Di Indonesia Hasil Long Form Sensus Penduduk*, 1-98. <https://indonesia.unfpa.org/sites/default/files/pub-pdf/mortalitas-di>

- [indonesia-hasil-long-form-sensus-penduduk-2020.pdf](#)
- Sulistyawati, S. S. (2023). Peran social media di bidang kesehatan masyarakat. *Dasar Teknologi Kesehatan Digital*, 31.
- Tomoh, B. O., Soyege, O. S., Nwokedi, C. N., Mustapha, A. Y., Mbata, A. O., Balogun, O. D., & Iguma, D. R. (2024). Innovative Programs for Community Health: A Model for Addressing Healthcare Needs Through Collaborative Relationships. *Community health*, 42, 17. <https://doi.org/10.54660/IJMRGE.2024.5.6.1267-1273>
- Widjaja, G. (2025). Analisis Peningkatan Fasilitas Kesehatan Dan Pelatihan Tenaga Medis Dalam Mendukung Program Kesehatan Ibu Dan Anak: Kajian Pustaka. *Journal Of Community Dedication*, 4(4), 212-224.
- Yatni, S. H., Suhardi, M., Murtikusuma, R. P., & Setiawan, Y. (2025). Pandangan Tenaga Kesehatan Terhadap Tantangan Dalam Memberikan Edukasi Kesehatan Di Daerah Terpencil. *Diagnosa: Jurnal Hasil Riset dan Pengembangan ilmu Kesehatan*, 1(1), 30-38. <https://www.jurnalp4i.com/index.php/diagnosa/article/view/5166>
- Yuliyanti, S., Utarini, A., & Trisnantoro, L. (2024). A mixed-method analysis of provider adherence to integrated antenatal care guideline in BEmONC and Non BEmONC primary health center: An Indonesian case. *Plos one*, 19(8), e0309454.