Implementation of an IoT-Based Smart Health Mirror to Enhance Community Health Awareness at Posyandu Cempaka, Pagelaran Village

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Abstract: Community health is a crucial aspect of improving quality of life, particularly through the role of Posyandu (Integrated Health Service Post) as a primary healthcare service at the village level. However, low public awareness of conducting independent health check-ups remains a significant challenge, especially in areas with limited facilities and digital literacy. This community engagement program aimed to enhance community health awareness through the implementation of an Internet of Things (IoT)-based Smart Health Mirror at Posyandu Cempaka RW 05, Pagelaran Village. The implementation methods included socialization activities, cadre training, technology deployment, and evaluation using a pre-test and post-test approach, followed by a three-month monitoring and mentoring phase. The results indicated an improvement in community health literacy, with the average score increasing from 62.4 (pre-test) to 81.7 (post-test), representing a 31% improvement. The implementation of the Smart Health Mirror also encouraged greater community participation in self-health monitoring and strengthened the function of Posyandu as a technology-supported health service center. Overall, this program contributed to improving the quality of community health services and has the potential to be replicated in other Posyandu as a model for technology-based community engagement initiatives.

Keywords: Smart Health Mirror, Internet of Things, Posyandu, Community Health, Digital Literacy.

Introduction

Posyandu (Integrated Health Service Post) serves as the frontline of community-based healthcare services and plays a vital role in monitoring the health of mothers, infants, and older adults (Kruse, Mileski, & Moreno, 2017; WHO, 2021). Nevertheless, several limitations persist, including manual record-keeping, basic facilities, and uneven digital literacy among cadres. These challenges reduce service effectiveness and may delay the early detection of health problems. At Posyandu Cempaka RW 05, Pagelaran Village, health services still rely on manual equipment such as weighing scales and sphygmomanometers, with records maintained in paper-based logbooks that are vulnerable to data loss and documentation errors. In addition, public awareness of conducting self-health examinations remains low, resulting in health services that tend to be reactive rather than preventive (Mesko, Drobni, Benyei, Gergely, & Gyorffy, 2017).

Digital transformation through Internet of Things (IoT) technology offers a promising solution to improve the quality of community health services (Farahani et al., 2018; Kelly, Campbell, Gong, & Scuffham, 2020; Yin, Zeng, Chen, & Fan, 2016). IoT enables the integration of health devices with digital systems to support real-time and continuous health monitoring (Abdulmalek et al., 2022; Marjani et al., 2017; Sharma et al., 2018). Previous studies have demonstrated that the implementation of such technology enhances the effectiveness of primary

healthcare services and accelerates data-driven decision-making (Keesara, Jonas, & Schulman, 2020; Sharma et al., 2018). One IoT-based health innovation is the Smart Health Mirror, a device that integrates health sensors with an interactive display to facilitate self-examination and health education. The use of smart devices in community health services has been shown to increase public health awareness and strengthen community-based monitoring systems (Abdulmalek et al., 2022).

This community engagement program aims to enhance public health awareness through the implementation of an IoT-based Smart Health Mirror at Posyandu Cempaka RW 05. Through this innovation, community members are expected to become more proactive in conducting independent health checks, while Posyandu cadres are supported in delivering more effective and data-based services. The program also emphasizes empowering cadres to operate and maintain the Smart Health Mirror to ensure sustainability, encouraging community members to adopt routine self-health monitoring through accessible and user-friendly technology, and developing a simple IoT-based health database to support more organized, efficient, and traceable recording and reporting. Furthermore, the initiative seeks to strengthen the role of Posyandu as a technology-supported health education center (Mesko et al., 2017; WHO, 2021), thereby promoting modern service delivery and improving digital literacy within the community. Socialization activities on health awareness and healthy lifestyles, based on monitoring results, are also conducted to encourage more proactive health behaviors (Kruse et al., 2017).

This program aligns with the Merdeka Belajar Kampus Merdeka (MBKM) policy, which provides opportunities for students to participate directly in community engagement activities through Independent Projects or Thematic Community Service Programs (KKN Tematik). Students gain practical experience in integrating IoT technology with healthcare and community empowerment, thereby enhancing both academic competence and social skills. The program also supports the achievement of Higher Education Key Performance Indicators (IKU). First, it contributes to IKU 2 by providing students with off-campus experiential learning opportunities. Second, it supports IKU 3 by enabling lecturers to engage directly with the community through service activities. Third, it contributes to IKU 5 by producing tangible outputs in the form of the implemented Smart Health Mirror technology utilized by the community.

The focus of this community engagement initiative encompasses three main aspects. First, appropriate technology, through the development and application of the IoT-based Smart Health Mirror as a

modern medium for basic health examination. Second, community empowerment, by strengthening the capacity of Posyandu cadres to improve technological literacy and deliver optimal services (Kelly et al., 2020; Yin et al., 2016). Third, public health, by providing health education and encouraging greater public awareness in maintaining healthy lifestyles and conducting independent health monitoring. Based on these considerations, this program aims to implement the IoT-based Smart Health Mirror as a medium for health education and monitoring at Posyandu Cempaka. It is expected to enhance community health literacy, strengthen the capacity of Posyandu cadres, and promote technology-based transformation of health services at the village level.

Method

The implementation method of this community engagement program was designed in a participatory and systematic manner through five main stages: socialization, training, technology implementation, mentoring and evaluation, and program sustainability.

Socialization

The initial stage was conducted through focus group discussions involving Posyandu cadres, village officials, and community members to introduce the concept of the Smart Health Mirror and emphasize the importance of independent health examinations. The main activities included (1) focus group discussions (FGDs) with Posyandu cadres, village authorities, and community representatives; (2) presentation of materials on the benefits of IoT-based self-health monitoring; and (3) formulation of mutual agreements regarding partner roles in the technology implementation process. This stage aimed to build initial understanding among cadres and the community regarding the function of the Smart Health Mirror and to foster a sense of ownership to ensure program acceptance. Posyandu cadres actively provided input regarding field-based needs, while community members participated in the socialization sessions.

Training

The training stage focused on strengthening the capacity of Posyandu cadres in operating IoT devices, managing digital health data, and interpreting examination results. The main activities consisted of (1) technical training on the use of the Smart Health Mirror, including sensor operation, data recording, and result interpretation; and (2) digital literacy workshops on health data documentation and management. This stage aimed to equip cadres with the skills required to independently operate the device and to support

improved community health literacy. A total of ten Posyandu cadres participated as the primary trainees, while community members received general educational sessions on how to read and understand examination results.

Technology Implementation

The Smart Health Mirror was installed at Posyandu Cempaka and pilot-tested with community members. The system enables independent health checks and digital data recording. The key activities included (1) installation of the Smart Health Mirror at Posyandu Cempaka; (2) pilot testing with community members to ensure optimal device performance; and (3) integration of digital data recording with real-time display of examination results on the mirror screen. This stage aimed to provide hands-on experience for the community in conducting self-health monitoring while modernizing Posyandu services. The primary issues addressed, particularly for this non-productive community partner, included improving health service delivery by facilitating routine examinations and data documentation, as well as enhancing health education through the display of digital educational materials on the device.

Mentoring and Evaluation

Mentoring was conducted over a three-month period through continuous monitoring of device utilization, collection of health data, and evaluation using pre-test and post-test methods to measure improvements in community health literacy. The main activities included (1) intensive mentoring for three months following implementation; (2) periodic evaluation of device usage, community understanding, and cadre performance; (3) monitoring community participation in independent health examinations; and (4) assessment of program impact through pre-test and post-test questionnaires. This stage aimed to determine the extent to which the program enhanced health awareness and improved the quality of Posyandu services. Posyandu cadres were responsible for managing evaluation data, while community members participated in health examinations and provided feedback.

Program Sustainability

Program sustainability was ensured through the formal handover of the Smart Health Mirror to Posyandu, preparation of a user manual, and the establishment of digital health cadres responsible for managing the technology. The sustainability strategies included (1) official transfer of the Smart Health Mirror to Posyandu; (2) formation of a digital health cadre team in RW 05; (3) integration of community health data into the village information system; and (4) collaboration with the local community health center (Puskesmas) for ongoing technical assistance. This stage aimed to ensure continued utilization of the device, strengthen cadre independence, and position Posyandu Cempaka as a model of IoT-based health service innovation at the village level.

Result and Discussion

The implementation of the Smart Health Mirror had a positive impact on improving the quality of health services at Posyandu Cempaka. The adoption of this technology transformed service delivery from a manual system into a digital system based on the Internet of Things (IoT) (Keesara et al., 2020; Kelly et al., 2020). From the perspective of health services, the Smart Health Mirror enabled digital and real-time recording of health data, thereby facilitating the monitoring of community health conditions (Abdulmalek et al., 2022). Data digitalization also improved recording efficiency and reduced the risk of data loss (Marjani et al., 2017).

Figure 1. Coordination Meeting for the Community Engagement Program

In terms of cadre empowerment, the training activities enhanced the ability of Posyandu cadres to operate digital health devices. The cadres were not only able to use the equipment but also capable of interpreting examination results and delivering health education to community members (Mesko et al., 2017). From the perspective of community health awareness, there was an observable increase in public participation in conducting independent health examinations. The results of the pre-test and post-test assessment demonstrated a measurable improvement in community health literacy. The average health literacy score increased from 62.4 (pre-test) to 81.7 (post-test), indicating a 31% improvement after the implementation of the Smart Health Mirror and the three-month mentoring phase. This finding indicates that the use of

interactive technological media can stimulate greater interest in self-health monitoring. These results are consistent with previous studies reporting that IoT-based technologies can increase community engagement in preventive health services (Abdulmalek et al., 2022; Farahani et al., 2018).

Furthermore, the presence of the Smart Health Mirror strengthened the role of Posyandu as a technology-supported health education center. Posyandu no longer functions solely as a site for routine health services but also as a center for digital health literacy within the community (Mesko et al., 2017; WHO, 2021). The implementation of this technology supports broader initiatives toward the digital transformation of community-based health services (Keesara et al., 2020). The main implementation activities were conducted on 13–14 February 2026, followed by a three-month mentoring and evaluation period. On the first day, 13 February 2026, activities focused on the socialization stage through a focus group discussion (FGD) involving Posyandu cadres, village officials, and community members. The session included presentations on the benefits of IoT-based independent health examinations and discussions to define the roles of partners in implementing the technology. The objective of this stage was to enhance the initial understanding of both cadres and community members regarding the function of the Smart Health Mirror, while fostering a sense of ownership to ensure long-term acceptance and sustainability of the program. During this phase, Posyandu cadres actively provided input regarding practical needs in the field, and community members participated as attendees in the socialization session.

Figure 2. Socialization and Education on the Benefits of Independent Health Examination

On the second day, 14 February 2026, the program continued with the training stage aimed at strengthening the capacity of cadres and community members in utilizing the technology. The training

covered the technical operation of the Smart Health Mirror, including sensor usage, data recording, and interpretation of examination results. In addition, a digital literacy workshop was conducted for cadres, focusing on digital health data management. This activity aimed to equip cadres with the skills required to operate the device independently and to improve overall community health literacy. A total of ten Posyandu cadres participated as the main trainees, while community members attended general educational sessions on understanding health examination results.

Figure 3. Implementation of the Smart Health Mirror for Community Use

Figure 4. Training and Mentoring of Posyandu Cempaka Cadres in using the smart health mirror

Overall, the findings demonstrate that the integration of IoT technology into community health services can enhance service quality, increase public health awareness, and strengthen cadre empowerment in a sustainable manner.

Despite these positive outcomes, this program has several limitations. The implementation was conducted within a limited time frame and involved a relatively small number of participants, which may restrict the generalizability of the findings. In addition, the evaluation relied partly on self-reported questionnaire data, which may introduce response bias. Future community engagement initiatives are encouraged to

involve a larger population, longer monitoring periods, and more comprehensive quantitative measurements to strengthen the evidence of impact.

Figure 5. Periodic evaluation of device utilization and community understanding

Conclusion

The implementation of the IoT-based Smart Health Mirror at Posyandu Cempaka, Pagelaran Village, successfully enhanced community health awareness and strengthened the capacity of Posyandu cadres in utilizing health technology. The adoption of this innovation transformed health services from a manual system into a digital-based system, increased community participation in independent health examinations, and reinforced the role of Posyandu as a technology-supported health service center. This program demonstrates strong potential for replication in other Posyandu as a model for digital technology-based community engagement initiatives.

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