An Exploration of E-Puskesmas Technology Application in Indonesian Public Health Centers: a Qualitative Study

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Abstract— **Background: The development of communication and information technology can positively impact healthcare services. E-puskesmas (E-Public Health Center) is an application developed to meet the needs of digital data recording at Puskesmas (PHC). Objective: This study explored the application of e-Puskesmas in the Public Health Center in Luwu Regency, South Sulawesi, Indonesia. Method: This study used a descriptive qualitative research approach with semi-structured interviews. The participants in the study were 16 Puskesmas (PHC) staff members who were selected via the purposive sampling method. Data analysis adopted a thematic analysis approach. Results: We found in this study that there are three interrelated main themes: (1) Experiences of e-puskesmas implementation, (2) Barriers of e-puskesmas implementation, and (3) Facilitators of e-puskesmas implementation. Conclusion: The study findings indicated that the application of e-Puskesmas in terms of human resources, organization, and technology has not been optimal. There were still some obstacles to e-Puskesmas implementation. A joint commitment is still needed between the health office and the public health centers to overcome the barriers or challenges of e-Puskesmas application in PHC.**

Keywords: E-Puskesmas, technology, application, Public Health Center, Puskesmas, Indonesia.

I. INTRODUCTION

Public Health Center (PHC), ALSO CALLED PUSKESMAS (INDONESIA), is a health service that organizes promotive, preventive, curative, and rehabilitative activities (Surita & Andry, 2021). Puskesmas ORGANIZES individual and public health efforts at the primary level (Suciono et al., 2019). In addition, Puskesmas organizes registration and reporting activities related to health data and information. This is reflected in the use of the Puskesmas management information system. An information system is a system that meets the needs of daily transaction management and supports operational functions to provide the necessary reports to produce information. Health information systems are one of the building blocks of health development, namely input, output, technology, hardware, software, databases, and control components (Gavinov & Soemantri, 2016). E-Puskesmas is an integrated system that implements desktop-based applications with online-based applications (websites). Puskesmas uses these to record daily service data from patient data, medical records, and drugs and crosscheck health insurance data from patients. The e-Puskesmas system is a web-based Puskesmas management application aimed at supporting the implementation of health services ranging from patient registration and poly-level services to the health office level to online and integrated reporting according to the Ministry of Health standards that

integrate the Puskesmas information system. Patient information and management of registration or registration data, research activities (diagnosis), and patient care are integral to the Puskesmas management information system (Dona et al., 2019). The information obtained from patients is then classified according to the needs of accountability reports, such as daily visit reports, most disease reports, and other reports needed in caring for patients: data management procedures and patient recording. If done manually, resulting in an extended health service process, especially if the service is registered, this can be inefficient because it takes a long time to find patient numbers, especially for patients who do not carry a medical card. Not to mention card searches and other information (Surita & Andry, 2021). Therefore, there is a need for technological and health changes, including the use of basic service health information systems (Dona et al., 2019). One of the Puskesmas management systems that support basic health services excellently is the e-Puskesmas application system (Suciono et al., 2019). The e-Puskesmas system aims to assist in storing and collecting patient data electronically and integrated. The e-Puskesmas application service also facilitates the monitoring of stakeholders, managers, and related institutions using public health data and information (Dona et al., 2019). Health Information Systems must be implemented by health facilities such as PHCs, clinics, and hospitals. PHC, as one of the basic health facilities, runs a Health Information System known as the Puskesmas Management Information System. Currently, two health information system management models in Indonesia are manual and electronic.

The e-Puskesmas application implements a web-based and mobile application to assist in the service and management of Puskesmas, from registration to reporting to the health office. It is integrated using the Ministry of Health's Puskesmas Information System standard. E-Puskesmas is one type of information technology utilized in the health sector. The main benefit of a technology-based Puskesmas Health Information System is that it can present information quickly, precisely, and reliably for decision-making at various levels (Jardim, 2013). In addition, computerization can improve efficiency and quality of service and can reduce staff workload. The availability of accurate, comprehensive, and up-to-date data and information in the health communication system can make accessing health services easier. Effective information technology can reduce clinical errors, support the performance of medical personnel, and improve the efficiency and quality of health services (Surita & Andry, 2021). Electronic reporting systems also have a role in disease surveillance and improving public health by reducing the financial effects of disease (Aziz, 2016). To determine whether an information system is running well, it is necessary to do an assessment. In addition, assessment is also helpful in finding out the factors that support and hinder the running of an information system. One method that can be used to assess is the Human-Organization-Technology (HOT) Fit Model. Ideally, human resources, data, technology, and processing are contained in the physical components of a management information system in PHC. These components support appropriate, accurate, and responsible information and help in decision-making (Subektianto et al., 2018). Implementing the Puskesmas management information system through e-Puskesmas has several obstacles, such as networks and lack of integration among all units in the Puskesmas. Therefore, it is vital to research the effectiveness of using the e-Puskesmas system as input and improvement. This study explored the application of e-Puskesmas. E-Puskesmas that are well implemented can contribute to the community, health services, and health professions to improve the effectiveness and efficiency of health services in Public Health Centers.

I. METHOD

Design

This research was conducted at eight Puskesmas (Public Health Centers) in Luwu Regency, South Sulawesi province, Indonesia. This qualitative descriptive research aims to explore the application of the e-Puskesmas in PHC. This study focuses on human resources, organization, and e-Puskesmas technology applications. The selection of 16 participants used purposive sampling techniques. Of the 16 participants, four were persons in charge of e-Puskesmas in PHC (doctors), 4 were heads of puskesmas, 4 were data entry staff, and 4 were puskesmas staff (nurses). The data analysis method used thematic analysis.

Data collection

Semi-structured interviews serve as the primary method of data collection. Interviews with study participants provided an understanding of the context of applying the e-Puskesmas in PHCs. For the semi-structured interview, a predetermined set of questions was utilized. Each participant read and signed a consent form and provided information regarding the research activity before the interview. The interviews were conducted for a duration between 25 and 45 minutes, adhering to the pre-planned interview questions.

Data analysis

The six steps of the thematic analysis methodology outlined by Braun and Clarke (2006) were utilized in our data analysis. (1) Familiarizing with data —In this step, we actively participated and immersed ourselves in the data by transcribing the exchanges, reading (and rereading) the transcripts, and listening to the recordings. First, thoughts ought to be written down. The groundwork for the analysis that follows was laid in this step. (2) Generating initial codes—The researcher began recognizing the intriguing and significant aspects after becoming acquainted with the data. We found that codes, although more numerous and detailed than themes, gave an idea of the interview's context. (3) Searching for themes—The third step involved beginning the interpretive study of the compiled codes. Then, relevant data extracts were grouped (merged or divided) based on broad themes. The relationship between codes, subthemes, and themes should be mentioned throughout the researcher's reasoning (Braun & Clarke, 2006). (4) Reviewing themes — Following identifying themes, a more thorough analysis was conducted, during which we decided to integrate, hone, divide, or discard the original concepts (Braun & Clarke, 2006). The process typically involves two stages. The first involves checking the themes against the coded extracts,

and the second involves checking the themes against the entire data set. This stage resulted in creating a thematic map. (5) Defining and naming themes—In this step, the themes and subthemes in the data were refined and defined. In addition, we made topic names and precise working descriptions that succinctly and effectively express the core of each theme. The themes came together at this stage to tell a cohesive tale of the facts. (6) Producing the report—We used strong examples relevant to the themes, research questions, and literature to turn the analysis into readable writing. The analysis's findings must be presented in the report to persuade the reader of its validity and worth. It must depict an analysis backed by empirical data that answers the research topic, going beyond just summarizing the concepts (Braun & Clarke, 2006).

Ethical Consideration
The Helsinki Declaration's updated 1975 criteria constitute the foundation for this study. The University of Binawan's Ethics Committee in Jakarta, Indonesia, approved this study (No: 111/EP/KE/UBINAWAN/IV/2022). All participants were informed about the study orally and in writing before providing their permission. Participants received guarantees of confidentiality and that the results would not reveal any personal information. The participants were made aware that their decision to participate or not participate would not affect their future studies, that their participation is voluntary, and that they have the freedom to withdraw from the study at any time. Before beginning data collection, we got participants' written informed consent and took precautions to protect the privacy and confidentiality of their information. Every participant received a unique alpha-numeric code to guarantee that transcriptions were unassociated with specific subjects.

II. RESULTS

The research was conducted to explore the application of e-Puskesmas and to find out the human resources, organizational aspects, and technological aspects of the application of e-Puskesmas. In this study, we contacted the 8 heads of PHCs in Luwu Regency Indonesia and informed them about our study, its nature, and our prospective participants. In this study, with thematic analysis, we identified three distinct but connected themes which emerged from the interviews: 1) Experiences of e-Puskesmas implementation; 2) Barriers of e-Puskesmas Implementation; and 3) Facilitators of e-Puskesmas Implementation in PHCs.

Theme 1: Experiences of e-puskesmas implementation
Subtheme: Supervision of e-Puskesmas Application
The supervision carried out in implementing the e-Puskesmas application is currently not optimal. Management only sees the completeness of data input by entry staffs. One participant said:
> *"... every day, usually after working hours, an evaluation is carried out by the leadership here (PHC) whether it can be run or not the e-Puskesmas data.*

> *Haven't looked at implementation related barriers and their supporting factors" (Participant 3)*

Theme 2: Barriers of e-puskesmas implementation
Subtheme: Lack of knowledge
Some participants did not know how to pull data inputted in the e-puskesmas application to be used as a report. A participant said:
> *"This is the problem because I tried in the beginning but now, I forget it again. Understandably because of the many jobs and also the age factor. Besides, I still need to learn a lot about computer technology." (Participant 10)*

Subtheme: Lack of Qualified Human Resources (HR)
In implementing information systems such as the e-Puskesmas application, sufficient human resources are needed in terms of quantity and quality. The interviews with participants found that there was no special staff appointed to do so. All service rooms were able to make the entry. A participant said:
> *"... To enter the data the patient has nothing in particular, they alternate to enter the data. Also, there are no special personnel with information technology education backgrounds..."for now in our puskesmas where there is no IT background." (Participant 12).*

Subtheme: Lack of good internet network
There are obstacles in the form of poor internet networks in the Puskesmas. A participant said:
> *"The problem is indeed the internet network, often Wi-Fi is problematic. The queue has been waiting for a long time, they have been waiting for registration for a long time, and they will arrive in the room at 10 o'clock. It can be in a queue for 1 hour at the registration..." (Participant 14)*

Subtheme: Lack of data integration
The data generated by the e-Puskesmas application cannot be used as a report to the health office because it has not been integrated with the e-Puskesmas in the health office. A participant said:
> *"Not yet. Yesterday there was a plan from the health office to send a report through e-Puskesmas, but it seems that it has not been realized..." (Participant 8)*

Subtheme: Lack of guidance
There are still some PHCs who do not have a staff determination decree. In addition, there is no SOP for using the e-Puskesmas application as a guide in implementing the application. A participant said:
> *"At the puskesmas where I am employed, no SK (decree) has been implemented yet. Such is the case; verbal appointments are*

the only ones. Furthermore, there is currently no information regarding SOPs (standard operating procedures)". (Participant 16)

Theme 3: Facilitators of e-puskesmas implementation
Subtheme: Support from organizational leaders
Participants said the leadership strongly supported the implementation of the e-Puskesmas application. Support from leaders or managers can be in the form of policy support such as the determination of staff decrees and the creation of Standard Operation Procedures (SOPs). A participant said:

> *"Everything. Yes, organization is very supportive… in everything, starting from infrastructure. Head [the head of puskesmas] is with supportive with this program." (Participant 11)*

Subtheme: Trainings availability
The interviews with participants indicated that all puskesmas had actually received training on the e-Puskesmas application 2 times. A participant said:

> *"Yes… Already... The training has been twice, eh no, 3 times actually. During the initial e-puskesmas training, 3 people were selected from the Puskesmas to be trained to work for the office..." (Participant 14).*

Subtheme: Provider's support
According to study participants, in terms of service quality, PT. Infokes Indonesia as the e-puskesmas provider is quite responsive if there are problems faced by puskesmas related to applications. A participant said:

> *"... So far, their response time has been pretty good, responded quickly and tried to finish one day." (Participant 7).*

Subtheme: Financial support
The availability of HR and funds also affects the implementation of the e-Puskesmas application. Each puskesmas uses the BLUD (money or fund from government) budget to buy devices, maintenance of the e-Puskesmas application and maintenance of Wi-Fi networks. A participant said:

> *"...With BLUD [money from government] funds, we pay this e-Puskesmas fee…in addition to the devices we buy from the BLUD puskesmas fund" (Participant 12)*

Subtheme: Information Technology (IT) support
Facilities and infrastructure are also important in the application of e-Puskesmas. The availability of computers in quantity is sufficient and Wi-Fi is available in all Puskesmas. According to a participant:

> *"Alhamdulilla [Thank God], there is a computer in every room. There is also an internet network. Here we use Wi-Fi. The*

e-Puskesmas application looks quite attractive in my opinion, easy to understand and the data generated is accurate." (Participant 15).

III. DISCUSSION

Organizational leaders carry out supervision to ensure that work can be done and completed according to the plan that the organization wants to achieve (Karyoto, 2016). The study results found that the head of the Puskesmas carried out routine supervision related to inputting patients' data. The head of the puskesmas will ask directly in the puskesmas group regarding this matter so that it is followed up. Supervision is an integral part of the evaluation system to see and monitor the effectiveness of the implementation process of the online health information system (Al Kuwaiti et al., 2023; Aziz, 2016). Human resources are very influential in developing health information systems in an institution. These human resources are IT personnel and staff for the application itself. HR is critical in implementing IT systems, especially in health institutions. HR is a user who has a significant impact on the organization because it greatly determines the level of success of the organization in implementing management information systems (Hakam, 2016). We found that participants already knew about the e-Puskesmas application, the features available, and how to input patient data. Knowledge or cognition is critical in forming a person's actions (Notoatmodjo, 2018). The Government Regulation of the Republic of Indonesia No. 46 of 2014, in article 51, paragraph 2, explains that Human Resources who manage Health Information Systems must have at least competence in statistics, computers, and epidemiology (Presiden Republik Indonesia, 2014). Based on the study results, it is known that each Puskesmas did not have IT-based personnel. The educational background of the staff and person in charge of the e-Puskesmas is not by applicable regulations. Ideally, recruiting IT personnel responsible for managing IT systems in Puskesmas is necessary. The training provided should be carried out on an ongoing basis. Education has a relationship with the implementation of SIK, where employees of puskesmas who have higher education have three times the opportunity to improve the application of SIK compared to employees with low education (Lisa, 2013). There is a relationship between the level of education and the level of teachers' knowledge about dental health, which shows that the level of knowledge is influenced by a person's education level (Dharmawati & Wirata, 2016). Although the organization has a sound system, if the users cannot and do not want to use it, then the existence of the SIM will be useless. The study's results found that staff still felt no benefits from implementing the e-Puskesmas application. The increased workload and time employees use to input data into the e-Puskesmas application will decrease the effectiveness of employee performance (Oktora & Putri, 2018). In addition, if staff consider the system essential to improve both individual and organizational performance, there will be a sense of satisfaction in using the system (Octavia, 2018). HR is an essential component in assessing the implementation of Information Systems. One of

the two challenges in implementing electronic-based health information systems is the human factor, where user acceptance is determined by user motivation and satisfaction (Khalifa, 2013). The strength of HR can be improved by training and recruiting new employees. Training is needed to improve the knowledge and ability of staff in the Puskesmas. The study's results found that all staff had received training on how to use the e-Puskesmas application. However, some staff did not understand how to pull data in the application to be used as reports. This could be because staff never use this application to make reports. Therefore, staff need refresher training to use this application optimally. Education or training is one of the platforms through which health human resources can gain expertise (Salamate, 2014).

Our study results indicated that Puskesmas leaders generally support implementing the e-Puskesmas application. This can be seen from the procurement of supporting facilities and infrastructure, application maintenance, and internet network maintenance through budgeting from Regional Business Service Agency funds. Organizational factors become essential to the information technology system because they run within the organization. There are four challenges in organizational factors: expensive deployment costs, top management support, supporting infrastructure, and security systems (Mohamadali & Zahari, 2017). The support provided by management can be in the form of supportive policies on information technology, including decrees and budgeting for allocating funds. SOPs are mandatory in the implementation of an activity. SOPs help staff become more independent and less dependent. This SOP needs to be held immediately as a reference for entry staff in running applications. So far, using the e-Puskesmas application is only based on knowledge gained during training. The staff only inputs data. Analysis of the implementation of the INA-CDGs system at a hospital in Padang indicated that the problem was that there was no SOP from the hospital, so there was no procedure as a guide for staff in doing their work (Leonard et al., 2020). Management must provide a work environment that supports and encourages workers to innovate and improve their work practices. Management is not only responsible for providing technology, but management must ensure that it is compatible with the current situation and conditions (Handayani et al., 2018).

One of the inhibiting factors in the implementation of web electronic information systems is the lack of wireless internet network connectivity, which impacts the efficiency of service quality. The quality of the internet network affects the integrity of data reports so that health information can be accessed nationwide if all the necessary infrastructure is adequate and available. The study found that the internet network in some Puskesmas was good, and in others, Puskesmas was still not good. Internet network control includes daily monitoring to ensure the network remains at the desired operating level. In addition, supporting devices also affect the efficiency of implementing e-Puskesmas (Dona et al., 2019). In the analysis of the implementation of the integrated recording and reporting system in Puskesmas, recording reporting is still manual; even though there is an e-Puskesmas application, it has not been appropriately utilized (Handayuni, 2013). The internet network is significant in implementing the e-Puskesmas application. There are technical obstacles to the Family Health Promotion entry application, considering that the Healthy Indonesia Program with a Family Approach is a new program at the Ministry of Health, the system that supports smooth running is not entirely perfect, and there are limited internet signals in the area so that it is difficult when having to enter the data online (Laelasari et al., 2017). Constraints in the network can affect performance and efficiency as well as user and customer satisfaction. Among other things, it causes high patient waiting times during registration because staff cannot search for patient data in the application or cannot input data. Technology can be an alternative solution to solving problems in processing registration data and retrieving patient queue numbers (Sundari, 2016). The lack of a good internet network also occurs due to increased users. The number of devices using the internet will directly affect the data speed, while the internet network capacity is limited. At the beginning of the application, the number of visits per day, month, and year is expected to be seen. Report data can be integrated with the Health Office so that Puskesmas does not need to send reports. In reality, this has not worked. Based on the research, it was also found that the report produced had not been integrated with the health office, which causes monthly reports to continue to be sent manually. Then, it was found that there was a difference in the format of the e-Puskesmas application with the format of the manual report sent to the health office. The e-Puskesmas application's report is complete and timely because the data is inputted when the patient arrives. This data does not yet describe the level of health in the Puskesmas because it only includes the number of visits of patients who seek treatment to the Puskesmas, not including those who seek treatment at sub-public health centers.

Conclusion

We found in this study that the e-Puskesmas application in several Puskesmas in Luwu district, South Sulawesi province, Indonesia, has not run as well as expected. In implementing the e-Puskesmas application, Human Resources still has an obstacle, such as no IT staff being available. Application entry staff are sufficient in numbers but still lacking in ability. There are still staff who feel no benefits to implementing this application. From the organizational aspect, it was found that there was no written policy in the form of an implementation from the Head of the Puskesmas. There is no SOP to guide the implementation of the e-Puskesmas application. Technology in implementing the e-Puskesmas application still has problems with the quality of the internet, although the availability of computers is relatively sufficient. The report generated by the e-Puskesmas application cannot be integrated with the health office. It is recommended that regular staff training be held and data integration at Puskesmas and main health offices be integrated. It is also essential to make SOPs related to implementing e-Puskesmas, increasing internet network capacity at Puskesmas, and applying this application to the sub-public health centers.

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