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Implementation of e-Puskesmas in Badung District, Bali, Indonesia

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ABSTRACT

Background and purpose: Development of e-Puskesmas information system is one of the government's efforts to improve efficiency and effectiveness of primary healthcare services. A comprehensive evaluation of e-Puskesmas implementation has not been conducted. This study aims to explore the implementation of e-Puskesmas system in Badung District from health providers' perspectives.

Methods: This study was an explorative qualitative study conducted in Badung District from July to August 2019. Data collection was carried out through in-depth interviews with 14 informants who were selected purposively, consisted of managers and operators of e-Puskesmas in Badung District, Health Office and Public Health Centre (*puskesmas*). Semi-structured interview guidelines were developed based on the Health Metrics Network (HMN) Framework. Data were analyzed by thematic analysis. Data validation was carried out through source triangulation, member checking and peer debriefing.

Results: The input of e-Puskesmas is generally sufficient in terms of policies, financing and infrastructure, but it is necessary to improve the quality and quantity of human resources, the internet network, and availability of standard operating procedure. The e-Puskesmas indicators have not accommodated the overall minimum health service standards of *puskesmas*, data on promotive and preventive programs, and data from private health care facilities. Data management is non optimal due to poor data completeness, breach of confidentiality and also the existence of other disease specific information system that is not integrated into the e-Puskesmas system. The quality of information produced from the system should be improved since there is lack of validity and unable to provide comprehensive information regarding health status of the community. The use and dissemination of information is limited to reporting to the health office while dissemination to the public has not been optimal.

Conclusion: The implementation of e-Puskesmas in Badung District has not been optimal. Concerted efforts should be undertaken to overcome the barriers in the implementation and to develop a more effective, efficient and integrated health information system.

Keywords: e-Puskesmas, implementation, health information system, Badung

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INTRODUCTION

An adequate Health Information System (HIS) should be able to improve the efficiency and effectiveness of health service delivery. The fundamental problem in various countries related to HIS is the inadequate policy support, incomprehensive work plans, poor coordinating mechanisms, non optimal investment on resources including human resources in health information. In addition, the data generated by HIS is often lack of timeliness, completeness, accuracy and consistency.[1] This certainly has implications for the limited use of information generated by HIS for decision making related to health development.

HIS in Indonesia has not yet reached an ideal condition. An evaluation of HIS in Indonesia by the Data and Information Center of the Ministry of Health in 2007 showed that HIS in Indonesia falls into inadequate category, especially in the resource and data management component. Other problems in the implementation of HIS are less optimal data collection process and poor utilization of the information for decision making.[2,3]

Low performance of HIS is also encountered in public health centre *(puskesmas)* as the frontline of health system in Indonesia. The government tried to improve HIS in puskesmes by digitizing its information system through development of e-Puskesmas. Implementation of e-Puskesmas is expected to overcome the weaknesses of conventional HIS such as poor data quality, delays in reporting data to the health office, lack of dissemination and utilization of data for decision making.[4]

Badung District is the only district in Bali Province implementing e-Puskesmas as an effort to improve the quality of health data and information. Since its inception in 2017, there has been no comprehensive evaluation of this system implementation.[5]

Evaluation of e-Puskesmas implementation has been carried out in several regions of Indonesia. However, these studies focused on resources aspects (input) and process of implementing e-Puskesmas such as the adequacy and competence of human resources, supporting facilities and data completeness.[4,6] There has no comprehensive studies evaluating e-Puskesmas in terms of input, process, to system output, namely the dissemination and utilization of the information.

World Health Organization (WHO) developed and applied the Health Metrics Network (HMN), a comprehensive framework, to evaluate the performance of HIS in various countries. Based on the HMN Framework, there are six components of HIS that must function optimally to achieve an effective and efficient HIS, namely resources, indicators, data sources, data management, information products, dissemination and use of data.[2] This paper will discuss the evaluation of e-Puskesmas implementation in Badung District using the HMN Framework.

METHODS

This qualitative study was conducted in Badung District from July to August 2019. In-depth interviews were conducted with 14 informants who were selected purposively by considering the categories of *puskesmas* and the performance of e-Puskesmas management. The informants consisted of HIS personnels from inpatient *puskesmas*, non-inpatient *puskesmas*, rural *puskesmas*, urban *puskesmas*, *puskesmas* with good and poor e-Puskesmas management performance, and two informants from Badung District Health Office.

The semi-structured interview guidelines for this study were developed with reference to the HMN Framework which outlines six components of the HIS assessment.[2] The interview was preceded by providing research-related information and informed consent to the informants. The interviews were lasting for an average of 35 to 60 minutes. The researcher recorded the opinion and the informant's response to the questions and recorded the conversation using a recording device.

Records of interview were then translated into interview transcripts, and analysed using thematic data analysis with deductive and inductive techniques.[7] Interview transcripts were read repeatedly by the researcher. Sentences that were considered important in the interview transcripts were marked, then data reduction was carried out. The codes obtained were grouped into sub-themes, which were then understood in their entirety to determine the emerged main themes.[8]

The validity assurance of the data in this study was carried out using source triangulation, member checking and peer debriefing techniques.[9] Triangulation of sources was carried out by interviewing various informants, consisting of managers of e-Puskesmas from *puskesmas* with different categories and officials from health office. Member checking was conducted to ensure informant's explanations or statements were properly understood. Further clarification was made by the interviewers if the statements had not been well understood. Peer debriefing was done by discussing the findings of in-depth interviews with research supervisor.

This study was approved by the Ethics Committee of the Faculty of Medicine, Udayana University/Sanglah General Hospital, Number: 1621/UN14.2.2.VII.14/LP/2019 on May 27, 2019.

RESULTS AND DISCUSSION

A. Characteristics of Informants

Characteristics of the informants are presented in Table 1. Most of the informants were female. Informants' length of working is ranged from two to twenty years. The most predominant position was general practitioner, who served as the head of the *puskesmas*. Most of the personnel managing the e-Puskesmas system were medical personnel, none of whom had a background in information technology (IT).

The results of in-depth interviews produced six themes related to the implementation of e-Puskesmas in Badung District, namely: the availability and quality of resources, the suitability and clarity of indicators, the quality of data sources, the process of data management, the quality of information products, the dissemination and use of information.

B. E-Puskesmas Resources

B.1. Legal Base and Standard Operating Procedure

The availability and quality of e-Puskesmas resources in Badung District are generally adequate, but there are a number of aspects which need improvement. Regarding the policy aspect, the development of the e-Puskesmas system has been based on a legal basis and it also refers to the Regional Medium-Term Development Plan (*RPJMD*) of Badung District. Management of the e-Puskesmas system in Badung

Table 1. Characteristics of informants

Code	Gender	Working Time	Education	Position	Institution
KBP_DK	Female	18 years	Public Health	Head of Planning	District health office
OPD_DK	Male	7 years	Public Health	Operator of e-Puskesmas	District health office
KP_PM3	Male	2 years	Medicine	Head of *puskesmas*	*Puskesmas* Mengwi 3
KP_ PP2	Male	4 years	Medicine	Head of *puskesmas*	*Puskesmas* Petang 2
KP_PA1	Female	2 years	Dentistry	Head of *puskesmas*	*Puskesmas* Abiansemal 1
KP_PK1	Female	5 years	Medicine	Head of *puskesmas*	*Puskesmas* Kuta 1
KP_PP1	Female	6 years	Medicine	Head of *puskesmas*	*Puskesmas* Petang 1
KP_PKU	Female	13 years	Medicine	Head of *puskesmas*	*Puskesmas* Kuta Utara
OP_PM3	Female	18 years	Nursing	Operator of e-Puskesmas	*Puskesmas* Mengwi 3
OP_PK1	Male	10 years	Radiology	Operator of e-Puskesmas	*Puskesmas* Kuta 1
OP_PKU	Female	7 years	Public Health	Operator of e-Puskesmas	*Puskesmas* Kuta Utara
OP_PP2	Female	17 years	High School	Operator of e-Puskesmas	*Puskesmas* Petang 2
OP_PP1	Male	20 years	High School	Operator of e-Puskesmas	*Puskesmas* Petang 1
OP_PA1	Female	11 years	Midwifery	Operator of e-Puskesmas	*Puskesmas* Abiansemal 1

District refers to the 2014 Government Regulation Number 46 concerning health information system. However, the operators of e-Puskesmas are not supported with a designation decree to serve as a technical operator in implementing the information system.

> *"There is no decree for the operators (of e-Puskesmas) because all of us, in each unit, are demanded to be able to operate the system." (OP_PM3)*

The above quotation explains that the operators of e-Puskesmas do not have a decree as a legal basis for implementing their role as an operator. A decree is a legal tool to emphasize the roles and obligation, also to reinforce rewards and punishment. Therefore, it has an important role to ensure the optimal implementation of e-Puskesmas.[10]

Moreover, the e-Puskesmas system does not yet have a standard operational procedure (SOP) in data management and no technical document available as stated by the informant as follows.

> *"There is no SOP for data input and for handling system error, nor are there technical implementation documents available" (OP_PM3)*

Basically, an SOP is a guideline for an organization to operate, to ensure that every decision, action or step involving people and utilizing facilities in an organization have been carried out effectively and systematically.[11]

B.2. Funding and Budget Allocation

The budget allocation for supporting the implementation of e-Puskesmas is sufficient for system development and procurement of facilities and infrastructure, but remain inadequate for system maintenance, especially for the internet network. The additional budget for the internet network is required mainly by the *puskesmas* that located in northern part of Badung, an area with a more difficult access to a stable internet network.

> *"In my opinion, it (the budget) is still not enough. We are only given an internet speed of 5mbps while the internet connection in the northern part of Badung is poor. Therefore, we have to buy and use our own internet modem. If possible, the budget given by the district health office should consider puskesmas' geographic variation in access to the internet" (OP_PP1)*

The finding of this study indicates the need of a more equitable funding allocation to support *puskesmas* in implementing e-Puskesmas. To ensure optimal implementation of e-Puskesmas across the district, it is necessary to have not only sustainable and sufficient health financing, but also equitable distribution of the funding.[12]

B.3. Human Resources

Some *puskesmas* in Badung have also faced a problem with the quantity and quality of human resources to support the implementation of e-Puskesmas. In these *puskesmas*, due to limited number of staff, there is no dedicated staff assigned for data entry, which leads to double burden of work carried out by the staffs. These staffs are required to assist with data entry of e-Puskesmas, while undertaking their main duties.

> *"We don't have enough staff to assist. All of us have to help when we can with data entry" (KP_PKU)*

Furthermore, all staff who were involved in the operationalization of e-Puskesmas do not have competency in information technology. This finding is similar to what was found in a study by

Lestari (2016), that poor quantity and quality of human resources are among the inhibiting factors for the implementation of HIS in Central Java.[13]

B.4. Infrastructures

In addition to the human resources problems, there is an issue regarding the infrastructures of the e-Puskesmas. Although the supporting facilities were generally perceived as sufficient, unstable internet is still considered to be a problem in the implementation of the system, especially in rural *puskesmas*. This is reflected in the following quote from the informant:

> *"The internet connection is so unpredictable-sometimes the network is fast, sometimes it is slow." (OP_PM3)*

This finding is in line with the studies conducted by Ganing (2017) and Nusa (2018) which show that unstable internet connection has impeded the implementation of e-Puskesmas and resulted in non-optimal staff performance and prolonged services time in *puskesmas*. Reliable network connectivity is an essential prerequisite of a well functioning HIS. Inadequate infrastructures disable staff to work effectively and efficiently that lead to poor quality of services.[6,14]

C. Health Service Indicators

There is a set of minimum health service standard *(standar pelayanan minimal/SPM)* indicators that should be fulfilled by *puskesmas*, as mandated by the Health Minister Regulation Number 4 Year 2019. The informants revealed that although most of the SPM indicators for *puskesmas* are accommodated, there are some sub-indicators related to promotive and preventive efforts i.e. detection of high-risk pregnant women in the community yet to be included in the e-Puskesmas.

> *"Indicators of minimum health service standards (SPM) are there in the application (e-Puskesmas), such as indicators of mother and children health. Unfortunately, there are some indicators that are not accommodated in the system" (KBP_DK).*

Informant also claimed that e-Puskesmas is unable to accommodate the development of innovative programs in the *puskesmas*. Another important indicator that is absent from the e-Puskesmas is data related to promotive and preventive activities conducted outside of the *puskesmas* building i.e. health education in community and schools.

The main function of *puskesmas* is to serve as a promotive and preventive agent, with most activities are conducted outside the *puskesmas* building. Therefore, current available indicators in the e-Puskesmas unable to reflect the performance of *puskesmas* in conducting their main function.[15,16]

D. Data Source

The data in the e-Puskesmas system in Badung District mostly comes from community visits to *puskesmas* so it is limited to the data of *puskesmas* curative efforts. Morbidity data in the e-Puskesmas system was also obtained from the *puskesmas* visits to the community through mobile clinics and through the Health Indonesia Program with the Family Approach (PIS-PK). However, there are some *puskesmas* that did not run mobile clinics due to the existence of many private healthcare facilities in their working area.

Puskesmas is responsible to the health of community in its working area. However, not all of the community members accessed *puskesmas* when they are in need of health services. There is a part of community members who prefers private healthcare facilities over *puskesmas*. Therefore, a partnership between *puskesmas* and private healthcare facilities is imperative to gain a more comprehensive data about community health condition in the *puskesmas* working area.[17]

The interviews revealed that the utilization rate of private healthcare facilities by the community in Badung is higher than *puskesmas*. However, the collaboration between *puskesmas* and private healthcare facilities in the area of *puskesmas* with regards to this HIS is lacking. Not all private healthcare providers are committed to regularly report their data to *puskesmas*.

> *"Because not all of the private clinics report their health data to puskesmas. It does not cover everything, because not all private practitioners want to cooperate." (OP_PKU)*

The Indonesian Health Minister Regulation Number 43/2019 regarding *puskesmas* stated that private healthcare facilities as the networks of *puskesmas* must report the activities and output of the health service activities to the *puskesmas* in their working area at any time and/or periodically. *Puskesmas* networks that do not report the results of their health services delivery are subject to administrative sanctions by the authorized official.[18] The enforcement of this regulation will positively impact the data collection from private providers which will strengthen the e-Puskesmas.

E. Data Management Process

Data management is one of the crucial phases of HIS. Several issues regarding data management process of e-Puskesmas were identified from the interviews.

One of the bottlenecks in the data management process is data entry. In the process of collecting data, coordination has been carried out, but reports by auxillary health centers *(puskesmas pembantu)* were often submitted late that lead to delay in processing the data in *puskesmas*. Lack of personnel in *puskesmas* to input data into the system has also contributed to the delay in data entry. Similar findings were reported by Pujihatuti & Sudra (2014) and Damayati & Rusmin (2015), stating that data input in HIS of *puskesmas* is constrained by limited human resources to deal with high burden of work and limited services time.[4,19]

Storage of health data on the system has been using a server but the confidentiality of the data, specifically patients' data, is perceived as sub-optimal because it accessible by other staff in the *puskesmas* and other *puskesmas*. Confidentiality is one of the essential components of network security. The finding of this study indicates that the security of e-Puskesmas as an information system should be improved in order to protect sensitive information from being misused by people who are not supposed to get the information.[20]

Another bottleneck in the data management is lack of integration. Not all relevant data owned by *puskesmas* can be documented in the e-Puskesmas so the data has not yet integrated into a single information system. There are other HIS for specific health issues (i.e. for HIV, TBC) existed in the *puskesmas*, yet integrated to e-Puskesmas.

> *"Currently, e-Puskesmas only contain the data of the curative efforts, there is no data regarding promotive and preventive efforts. And each program has its own application, such as TBC, HIV. It really confuses us. If only they could be merged into a single application, will be a lot easier for us." (KP_PP1)*

HIS is often developed partially to meet the need of certain units. Disintegration of HIS could lead to duplication, inefficiencies, jeopardized data quality and limited utilization of information products.[13,21]

The process of data analysis in the e-Puskesmas system was constrained by poor completeness of e-Puskesmas data. Several data required to develop *puskesmas* reports cannot be obtained from the system so further elaboration with other data sources is needed. Data completeness is one of the indicators of data quality in a HIS, therefore, there is a need to revisit current available data and develop strategies to improve comprehensiveness of data in e-Puskesmas.[22]

F. Information products

The e-Puskesmas system can produce information related to morbidity reports, monthly reports (*laporan bulanan*/LB) 3 and LB 4, however, it cannot generate several reports (i.e. annual *puskesmas* profile report) solely from e-Puskesmas data. Further elaboration with other data sources is required.

The quality of information produced by the e-Puskesmas system in Badung District remains non optimal either. The e-Puskesmas system has not been able to produce information that fully describe the health conditions of the community in *puskesmas* working area. The e-Puskesmas system only uses data from community visits to *puskesmas* and some morbidity data from mobile clinics. Considering that community members could do self-treatment or visited healthcare facilities other than *puskesmas*, the information from e-Puskesmas regarding the condition of community health status could be less accurate. Moreover, data resulted from promotive and preventive activities which are conducted outside the *puskesmas* building are not documented in the e-Puskesmas.

> *"Not yet, it (information from e-Puskesmas) hasn't been able to describe the overall health condition of the area, it just give us a general insight." (KP_PP2)*

Mapping the condition of an area is vital for assessing health risks and threats, understanding the distribution of disease and epidemic investigations, and can be used in planning and implementing health programs, as well as for program supervision and evaluation.[23]

Furthermore, there is a problem with data reliability indicated by the existence of gap between the data in the system and manual data. A quality data is a robust data. Data that is not robust will produce invalid information so that the main function of the HIS to inform the management process is not fulfilled.[24] Information product from a system will be more useful for informing the management process if it is reported in a timely manner, accurate, complete and relevant.[25]

> *"There are differences between (the number of) visits in hard copy and in the system (e-Puskesmas). I have not been able to analyze, to review, what the cause of the differences is." (OP_PA1)*

G. Dissemination and Use of Data

We revealed that the information generated from the e-Puskesmas system has been utilized by *puskesmas* as one of the references in decision making with regards to drug procurement, program planning, budget and human resources. The cumulative data from all of the *puskesmas* in Badung District has also become one of the supporting evidences

for decision making in the district health office. Nevertheless, decision could not be made based on the information from the e-Puskesmas solely since the information is not comprehensive and should be complemented by other sources of evidences.[26] The information from the e-Puskesmas mainly used to serve reporting purpose to the district health office.

Only limited information, particularly the ten most frequent diseases in *puskesmas*, was reported to the public by displaying its print-out in the *puskesmas* building. Meanwhile, dissemination of information through *puskesmas* or district health office' website is not optimal.

> *"This data cannot be accessed directly by the wider community, so far, we have never uploaded all of the information from the epus (e-Puskesmas) system. On the website, we mainly uploaded activities conducted at the puskesmas"(OP_PP1)*

The information generated from the system has not yet fully accessible by the public. Access of e-Puskesmas data for the public is enabled with the permission of district health office and head of *puskesmas*. Openness of information is important not only to fulfill the citizen's right but also to inform the community about current health situation in their area. However, controlled access to the database is also crucial to prevent data misuse by irresponsible parties.[27]

Study implications

This study findings revealed there are some barriers to the implementation of e-Puskesmas in Badung District. Inadequate input in terms of human resources, internet network, SOP of data management, commitment of private healthcare facilities, have hampered the system. Lack of comprehensiveness of data and fragmented HIS have impeded data management of e-Puskesmas, while, insufficient input and process consequently lead to non-optimal output, particularly in terms of the quality of information products which affects the use of information.

As the development of e-Puskesmas mainly aims to improve the effectiveness and efficiency of *puskesmas* health services, the operationalization of the system has to be efficient and the information from the system has to be relevant to the need of *puskesmas*. A more relevant and comprehensive data should be accommodated into the system to provide a valid and reliable information regarding community health status in the *puskesmas* working area. The findings from this study suggest that all related stakeholders in all levels to develop concerted efforts not only to overcome the barriers to the implementation of e-Puskesmas, but also to create a more effective and efficient integrated HIS.

Study Limitation

The study is subject to some limitations. The generalization of the results is limited to settings in the same context as Badung District. Badung is a district with high financial capacity and is spread geographically, covering rural and urban/ tourism area, which reflects in the varied situation of *puskesmas* particularly in terms of quality of internet network and distribution of private healthcare facilities.

CONCLUSION

The implementation of e-Puskesmas in Badung District has not been optimal. The input of e-Puskesmas in terms of human resources, the internet network, and the availability of SOP needs to be improved. Moreover, the system has not accommodated all relevant indicators. The data management has been impeded by the lack of data completeness, confidentiality and integration. There was also a lack of validity and comprehensiveness of the information products. Furthermore, the use and dissemination of information products were limited. Concerted efforts should be undertaken by all related stakeholders to overcome the barriers encountered in the implementation of the e-Puskesmas.

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AUTHOR CONTRIBUTION

KCDA designed the study, conducted data collection, analyzed the data, wrote the first draft of the manuscript and edited the manuscript. NMSN involved in designing the study, supported data analysis, provided feedback and edited the manuscript. PM involved in designing the study, supported data analysis and provided feedback to the manuscript.

CONFLICT OF INTEREST

None declared.

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