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Utilization of the District Health Information Software (DHIS) in Botswana: from Paper to Electronic Based System

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Abstract: Concerns on the status of Botswana's health information systems were raised as early as the late 1980s. Several assessments overtime revealed weaknesses in the system including fragmentation, weak approaches to data collection, management, reporting, dissemination and use. A number of initiatives designed to improve the HIS were also undertaken. The BEANISH (Building Europe Africa collaborative Network for applying Information Society Technologies in the Healthcare Sector) as one of the initiatives aimed to address the issue of poor data coordination, management and reporting through a data warehousing system, the District Health Information Software. Rapid assessment was conducted as part of Routine Data Quality Assessment to determine the capacity of the District Health Management Teams to collect, analyse, and use data. Several challenges were cited including inadequate IT infrastructure including computers and unreliable internet access; limited skills in using the system and inadequate human resource capacity. There is need for more investment and leadership for health information management.

Keywords: Health Information Systems. District Health Information Software. District Health Team. Ministry of Health

1. Introduction

This paper draws from a larger project designed to promote data use among health managers in Botswana. It focuses on the health information system, exploring the extent to which a system intended to facilitate collection, storage, analysis and reporting of health data is used in the health districts.

National health information systems are central to provision of data necessary for supporting the functioning of the health system. The World Health Organization (WHO) views health information systems (HIS) as one of the building blocks of any health system (1). An effective and efficient health information system is considered as one that ensures that appropriate data are collected and analysed, and health information is disseminated in a timely manner to promote effective planning and management of health services (1, 2)

Concerns on the status of Botswana's HIS were raised as early as the late 1980s (3). Several assessments made over time revealed an array of weaknesses in the system including fragmentation, weak approaches to data collection, management, reporting, dissemination and use (3-5). A number of initiatives designed to improve the HIS were also

undertaken. A collaborative project between the Government of Botswana and the Government of Norway in 1996-2003 aimed to develop an efficient health information system that would facilitate planning and monitoring of the health care system (6). This project focused on upgrading of computer systems to improve the system's capacity to capture, store, transmit, analyse and disseminate health information. To that effect a software called Health-net was installed in most of the health districts (7, 8). It was, however, reported that the Health-net was not effectively utilized (7) and HIS challenges therefore remained.

Another project, which is of particular interest to this paper, commonly known as the BEANISH (Building Europe Africa collaborative Network for applying Information Society Technologies in the Healthcare Sector) project in 2005-2007 focused on developing and implementing an integrated national HIS. The project aimed to address the issue of poor data coordination, management and reporting through a data warehousing system, District Health Information Software (DHIS). DHIS 1.4 was piloted in 4 districts from 2004 to 2006. This pilot was evaluated and the results were disseminated in 2008. The evaluation highlighted a number of issues including inadequate user support, poor central coordination, inadequate IT infrastructure and unreliable internet connectivity. Following the evaluation, DHIS 1.4 was rolled out to all districts by end of 2008.

In 2013, it was observed that reporting through the DHIS by the districts to the MOH headquarters was infrequent and inconsistent. On average, out of the 27 health districts, only 10 districts were reporting. As part of promoting data use project, we investigated the use of DHIS in the districts.

1.1 Background

The MOH in Botswana has overall responsibility for provision of health services. The public health system is organized into different levels based on the complexity of services provided. At the lowest level are 894 mobile health stops, 357 health posts and 290 clinics(9). Midway there are 17 Primary Hospitals and 15 District Hospitals. There are three National Referral Hospitals representing the highest level of the system (9). Before April 2010, the Ministry of Local Government was responsible for primary health care services provided by clinics, health posts and mobile stops, while MOH focused on hospital services. With the reorganization of the health delivery system in 2010, the MOH assumed responsibility for all levels of care including primary health care.

The current organizational structure of MOH comprises six departments namely:- Department of Health Policy Development, Monitoring and Evaluation (HPDME); Public Health; HIV/AIDS Prevention and Care; Clinical Services; Health Inspectorate and Corporate Services. The HPDME houses the Monitoring and Evaluation Division which has overall responsibility for coordinating and managing health information. However there are other monitoring units such as the Health Statistics Unit, Performance Improvement Unit and the Strategy Office which are directly responsible for the MOH's corporate plan and monitoring.

Administratively, the health system is divided into health districts managed by District Health Management Teams (DHMTs). Currently there are 27 health districts. The DHMTs are currently undergoing restructuring (10). The transitional DHMT structure comprises three functions: curative, preventive, and corporate. In general, the management team is made up of a DHMT head with overall responsibility for coordinating and overseeing activities of the DHMT. This position is held by people with varied health professional background including public health specialists, medical doctors, and public health nurses. The head of curative services who is a medical practitioner oversees delivery of patient care services in all facilities in the district; the head of preventive services coordinates public

health related activities, while the head corporate services is responsible for managing all forms of resource inputs including human resources. A central position, though not necessarily part of the management team across the districts, is the Monitoring and Evaluation Officer featuring in almost half of the districts.

2. Objectives

The overall objective of the study was to determine the utilization of the DHIS in the districts. Specifically, the study sought to:

- Assesses the capacity of DHMTs to collect, analyse and use data to support decision-making
- Identify factors that impact on the utilization of the DHIS by DHMTs
- Make recommendations to improve the use of DHIS by the districts and the MOH

3. Methodology

Rapid assessment was conducted between December 2013 and March 2014, as part of Routine Data Quality Assessment (RDQA) to determine the capacity of the DHMTs to collect, analyses, and use data using a self-administered semi-structured questionnaire. Most of the questions were adapted from the RDQA tool. The questionnaire explored respondents attitudes towards and ownership of health information responsibilities; availability of health information management resources in the district, data reporting, feedback and use. The questionnaires were sent to all DHMT heads and Monitoring and Evaluation Officers in each of the 27 districts and were requested to encourage any other officers with data management responsibilities to participate. A total of 4 districts with 22 respondents returned the questionnaires. While this response rate was somewhat too low as a basis for generalization, the views of these respondents were nonetheless considered as critical for the Monitoring and Evaluation Division which has data management, reporting and use in the districts as one of its priorities.

Furthermore, monitoring and evaluation support visits were undertaken in six districts between March and May 2014 to supplement the survey. A combination of observations, interviews and small group discussions with staff managing and using data were conducted. A total of 21 officers comprising district management, Monitoring and Evaluation officers, IT officers and program officers mainly Community Health Nurses participated in the support visits. All data collected were analysed using descriptive statistics and content analysis.

4. Technology Description

4.1 District Health Information Software

DHIS version 1.4 was introduced in Botswana as part of the BEANISH project of the World Information Technology Forum (WITFOR). The BEANISH project brought together several countries and organizations from Africa and Europe, interested in the use of information technology in the health sector. These included Botswana, South Africa, Malawi, Mozambique, Tanzania, Ethiopia, Sweden, Norway and the International Federation of Information Processing (5). The focus of the project in Botswana was on developing and implementing an integrated National HIS under the leadership of the Ministry of Communication, Science and Technology.

DHIS was an open-source warehousing system based in the health districts with overall coordination at the Ministry level (5). Some of the main capabilities of DHIS included data collection, data validation, data analysis, and presentation of aggregate statistical data. The system also used a patient tracker that allowed patient level information to be managed,

inbuilt analysis tools like GIS, pivot tables and graphs which did not need specialised knowledge to be used.

The main aim of introducing the DHIS in Botswana was to address the many challenges facing the national HIS including the fragmented data flows between the health districts and the national level (11). This system was also envisaged to incorporate aggregated routine data from other systems such as patient-based systems, financial and human resource systems in the Government (11).

The DHIS was to allow each program to maintain its data set while providing for integration. Availability and use of health information were to be enhance through the system's capability of allowing the users at all levels to generate various types of reports (11), while access to information was to be improved by linking the various patient-based information systems with the DHIS. Data reported through the DHIS was to enable the districts and the national level to monitor implementation of the national health strategies and programs and their impact on overall policy goals and health outcome. This information was also considered critical as feedback to guide review, planning, and implementation of health programs. This system was already in use in South Africa and other countries participating in the WITFOR project which were to provide learning experiences.

At the end of its project life in 2007, the DHIS had been piloted in four districts and rolled out to all health districts where it was used mainly for monitoring HIV/AIDS activities due to keen interest of the HIV/AIDS program in the system (12) while all other programmes maintained their individual systems. The main drivers of the DHIS hence became the National AIDS Coordinating Agency and the Ministry of Local Government.

One of the main limitations of DHIS 1.4.was that it was an MS-Access based application that operated on a local area network putting considerable strain on coordination as reports has to be sent to the national level on some form of medium to be compiled creating suboptimal use of the system at MOH headquarters (4). Consequently in 2011, DHIS 2.0 which is a web-based system was adopted and became available online to all districts with access to the GDN. The health districts began reporting using this system in 2012.

4.2 Benefits and Challenges of Using DHIS

Using DHIS has a number of benefits for the health system and the country. As open-source software, access to the system is free, cutting the costs associated with propriety software including prohibitive license costs. The flexibility of the system allows the users to make changes that address their specific requirements improving usability and relevance of data. Inbuilt data analysis capability at the lowest level promotes evidence based decision-making and planning where services are delivered which enhances appropriateness and quality of health services and programs. A network of global developers and users provide ongoing support ensuring the robustness of the system. The use of DHIS is however, not without challenges. Significant investment in building capacity of local technical staff providing system support, program officers and leadership is critical.

4.3 Issues During Implementation of DHIS

As noted earlier, the BEANISH project was initiated and coordinated by the Ministry of Communication Science and Technology while the MOH was regarded as the implementing ministry. It was at the end of the project that negotiations for takeover were held with the MOH and Ministry of Local Government (13) which were the key ministries responsible for delivery of health services. This situation created challenges of ownership and commitment to implementation of the system. The relocation of primary health care

services from the Ministry of Local Government to MOH in 2010 also negatively affected implementation of DHIS as accountability and issues of resource ownership shifted.

5. Developments

The DHIS as a data management system has suffered many challenges in the past including falling off the MOH policy agenda until NDP10 which emphasized the need for health information and has identified rolling out of the DHIS and integration of the different health information systems as some of the key activities (14). The DHIS is now the official system through which health districts are expected to manage their health information and report to the MOH headquarters. Data reported through the DHIS enable the districts and the national level to monitor implementation of the national health strategies and programs and their impact on overall policy goals and health outcome. This information is also critical as feedback to guide review, planning, and implementation of health programs.

At the technical level, DHIS development included designing and uploading of data collection forms and indicators. From August 2013 to March 2014 an additional 18 data collection tool were uploaded and pre tested, bringing the total to 19 tools. Uploading of historical program data and data sets from the old server to the new server was also done. This data dated as far back as 2002 for some health programs such as Prevention of Mother to Child Transmission of HIV/AIDS (PMTCT), Integrated Disease Surveillance and Response (IDSR) and Mental Health, designing and development of validation rules.

Validation rules were developed on the user interface to improve data quality; and procurement of DHIS Server and computers. DHIS servers and computers were purchased through collaboration with development partners (15). While a total of 19 data collection tools from various programs have been uploaded in this system, districts are reporting on only one form which is the District Health Indicators form.

6. Results

6.1 Socio-Demographic Characteristics Data of Respondents

The respondents were aged 29-51 years. Most were females (12:55%); had bachelor's degrees (10:45%); had nursing background (10:45%); and were program coordinators (8:38%). There were 3 (14%) monitoring and evaluation officers and only one head of DHMT.

6.2 Ownership and Attitudes Towards Health Information

All respondents valued the role of health information in the delivery of services, and accepted that it was their responsibility to ensure that data about services were collected.

6.3 System Resources for Collecting and Managing Health Information

Availability of health information resources was reported as a challenge by most of the respondents (figure 3). This included lack of computers (14:64%) and other accessories as also highlighted by this respondent:

> There is need for computers (desktops and laptops) for the community health nurse and the M&E as well. Also the external hard drives are needed by these offices for backup. We are just using our own (Monitoring and Evaluation Officer).

Availability of an efficient medium for sending reports such as email, fax and transport was also a key issue with 68% of the respondents reporting challenges.

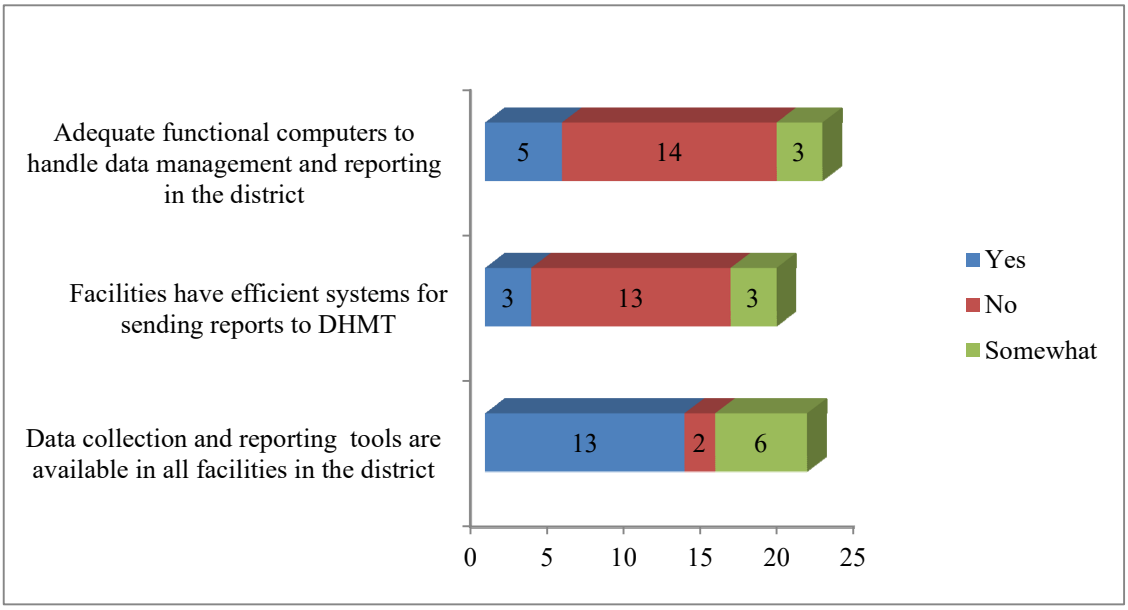

Figure 1: Views of Respondents on Availability of Health Information Resources in the Districts

Lack of transport was cited as a barrier not only to data management and reporting but to delivery of services including ability to conduct mentoring and support visits. This was also seen to affect the quality of data and timeliness of reporting.

Box 1: Views of Respondents on Availability of Transport in the Districts - Free Text from Questionnaires

> There is a serious problem of transport particularly for program officers…
> Due to lack of transport, mentoring on tools is not done on time; reports are not sent on time…
> There is shortage of transport, which makes it difficult to regularly visit facilities and follow up patients…
> There is need for effective transport allocation and use for regular data quality assessments and supportive supervision…
> There is need for transport to conduct regular data checks and audits…

6.4 Accessibility and Use of the District Health Information Software (DHIS)

The MOH headquarters through the Monitoring and Evaluation Division advocates for the use of DHIS to manage and report data in the districts. Since this is web based software implemented through the government data network (GDN), it is accessible in all districts as long as they are connected to the GDN. This study indicates that DHIS accessibility is a big challenge (figure 4). Only 4 (21%) of the respondents reported that the DHIS is available in the districts, while 2 (11%) reported that it effectively used. Only one respondent reported been able to access DHIS, while 3 (19%) respondents indicated that DHIS users were trained. Some of the challenges reported with DHIS included inability to log into the system and inadequate support from MOH headquarters:

> I have a problem logging into the system. If it happens that I log in, data entry files do not become active so that I can enter data. I have talked to Ministry of Health on several occasions but so far the problem has not been resolved (Monitoring and Evaluation Officer.)

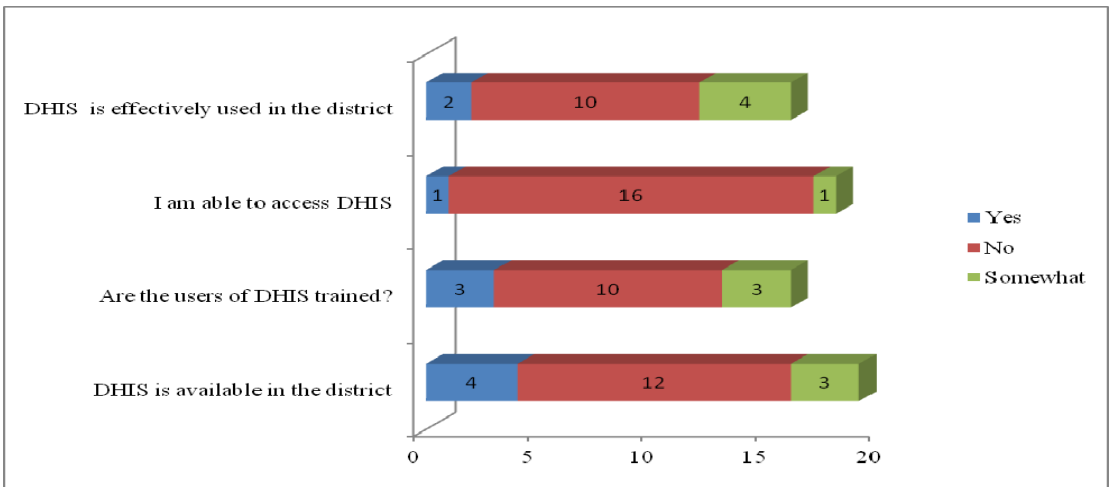

Figure 2: Views of Respondents on Accessibility and Use of DHIS in the Districts

Other challenges reported include poor internet connectivity related to bandwidth creating frequent inaccessibility of the software which discourages utilization by users:

> The DHIS is on and off and off mood you cannot constantly get all the relevant information /data the way you need it due to cumbersome activities...(DHMT head)

Lack of knowledge or awareness on the existence of DHIS was observed during district support visits among some officers with data management responsibilities who continued to compile and send reports manually. Less than 20 % of the survey respondents reported having had formal training on DHIS.

6.5 Responsibility for Data Collection, Analysis and Interpretation

Most of the respondents reported that responsibility for data recording at facility levels (14:67%), data aggregation at district level (15:75%) and analysing and interpreting data (10:66%) are clearly defined. However, these respondents cited shortage of staff as a limitation in undertaking health information management responsibilities:

> We do not have enough staff in the office of M&E. She is the only officer and that makes it hard for her to be able to enter all the data and analyze before sending to MOH or DHMT (Principal Nursing Officer- Head of clinics).

> There is need for data clerks to be placed in the offices of M&E officer and also in the office of the community health nurse (Monitoring and Evaluation Officer).

6.6 Data Reporting and Use in the Districts

Most of the respondents (14:67%) reported that data is analyzed and presented to management and other stakeholders regularly. A significantly higher proportion (17:80%) of the respondents indicated that the districts report to the MOH headquarters on a regular basis. Only a small proportion (5:26%) reported that districts receive feedback from the Ministry.

In terms of data use, generally, respondents felt that data is used to inform development of district health plans (18:90%), and in planning and decision-making about programs and services (15:79%) (Figure5). Health information was also seen to influence resource allocation decision in particular the ordering of medications and supplies (17:81%). Slightly

lower proportions felt that data is used to influence staff (12: 63%) and budget (12:57%) allocations.

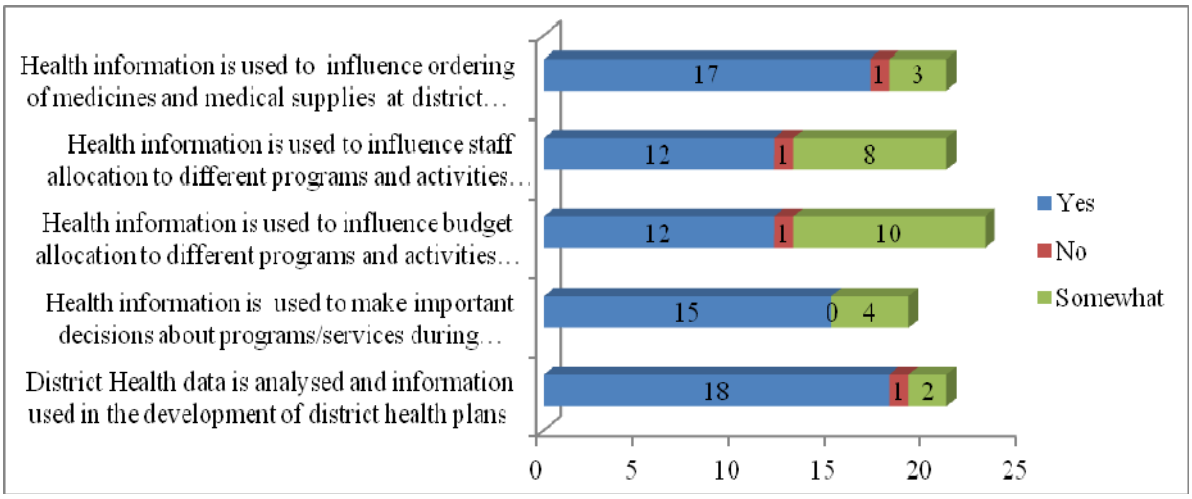

Figure 3: Views of Respondents on the Use of Data at District Level

This survey data was supported by information from the district support visits. In one district, it was reported that a health post was successfully upgraded to a clinic, while one clinic was downgraded to a mobile stop based on the volume of activities reported. In another district, information on nutritional status of under-five children was routinely reported to Department of Social Services (Drought relief program) which influenced supplementary feeding.

While districts are using health information to support local decision-making, there are some concerns with the quality and timeliness of data from facilities. The few respondents who raised this issue emphasized the need for evaluation of data collection tools and regular facility support visits to address data quality problems.

7. Discussion

DHIS has been used successfully to improve completeness and timeliness of reporting in many countries such as Uganda, Kenya, South Africa and Malawi (16, 17). While Botswana is one of the countries that adopted the DHIS earlier than most African countries, the impact of this system in reporting data from the health districts is unsatisfactory. In 2013/14 only 37% of the 27 health districts were reporting to MOH headquarters using DHIS. The Botswana HIS system therefore remains fragmented with limited access to data to support monitoring and planning of health programs and services. While health workers in the districts appreciate the importance of health information, lack of resources affects effective use of DHIS.

Although Botswana was reported to be doing better than most African countries in terms of infrastructure (18), disparities between urban and rural areas were observed with infrastructure in rural and remote areas poorly developed, with very limited access to ICT. Lack of internet connectivity and low bandwidth were cited as some of the challenges facing the districts limiting utilization of DHIS. Availability of basic computing equipment to facilitate data capture and transfer (such as computers and data storage devices) was also a challenge for the districts. ICT infrastructure challenges are not unique to Botswana. They have been reported in many African countries implementing DHIS (16, 17).

The districts lack the human resources to support health information management through DHIS. Earlier studies have reported limited capacity from data collection to data analysis and promotion of effective data use in Botswana (19, 20). Training of users is also a concern. Lack of training in health information management for personnel at different levels of the health system can have a significant impact on the availability and quality of

data and the extent to which information will be used for planning and decision making (21). The need for well-designed training programs that will assist health managers to understand and appreciate the role of information systems and technologies in their work is emphasized (22). While efforts were made to train health information officers in Botswana (20), staff turnover has limited progress in HIS development.

Similar to work done previously in Botswana (19), this study also highlights challenges in leadership capacity for health information management. Districts reported limited technical support and lack of feedback from the MOH headquarters. Challenges with resources may also be indications of lack of advocacy and effective negotiation for health information management and use (23). While health districts reported use of data to inform planning of health services, efforts are still needed to effectively use data to support resource allocation decisions.

8. Business Benefits

Using computer applications (DHIS) will assist the health care practitioners to improve efficiency and quality of data collection, management and reporting. District health managers and other stakeholders are likely to use health information more if it is of good quality and reported to them in a timely manner (17). The use of DHIS also strengthens decentralization by empowering the districts to actively make decisions and set their priorities using their own data (24, 25).

9. Conclusions and Recommendations

While the MOH in Botswana endeavours to improve HIS through the use of DHIS, a number of resource challenges limits the DHMTs capacity to effectively use the system to collect, analyse and use data to support decision making. Consequently, data management remains fragments and paper based.

Inadequate ICT infrastructure; limited human resources to undertake data management responsibilities; weak technical support, mentoring, monitoring and supervision are key factors hampering utilization of DHIS in Botswana. MOH needs to increase investment in resources needed for data management and use. Particular attention also needs to be given to transport which is essential in ensuring that facilities are adequately supported by the districts.

While user training and system development and procurement of the DHIS server has been sourced through development partners such as WHO, CDC and UNAIDS, significant investment is still needed in HIS infrastructure. Capacity building for the use of DHIS and HIS as a whole also remains a challenge that require innovative and sustainable strategies including collaboration with training institutions to offer short and long term health informatics related training. There is need to strengthen the MOH national office responsible for health information management to enable it to effectively coordinate HIS activities and support the districts. Health managers need training and empowerment on data use which will also create data demand.

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