

ANALYSIS OF THE ACCEPTANCE PROCESS OF DISTRICT HEALTH INFORMATION SYSTEMS (DHIS) FOR VERTICAL HEALTH PROGRAMMES: A CASE STUDY OF TB, HIV/AIDS AND MALARIA PROGRAMMES IN TANZANIA

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ABSTRACT

District Health Information System (DHIS) is used in many parts of the world to report aggregated data at the district level. Tanzania is one of the countries where the ministry of health endorsed DHIS for such use. Although the system has been rolled out recently throughout the country, Vertical Health Programmes (VHPs) are on their way to fully adopting the system. The objective of this study was to analyse the acceptance process of DHIS by three VHPs so as to examine the facilitating conditions and the challenges that they face. Data was collected through interviews, document review and observation. Analysis of the data showed the facilitating conditions to be having a consensus on which VHP indicators to include in the DHIS, existence of infrastructure including the routine Health Information System (HIS), and support from development partners. Challenges of acceptance process of DHIS include inadequate human resource for HIS, data quality and information flow issues, and existence of separate monitoring and evaluation systems for the VHPs. The study recommends integration or interoperation of DHIS with VHP systems, creating a pool of resources for HIS, training and motivating human resource for HIS.

Keywords: District Health Information System, DHIS, Vertical Health Programmes, adoption, acceptance

1. INTRODUCTION

The development of the Health Management Information System (HMIS) in Tanzania has undergone many milestones which have seen several revisions of the software used up to the current version of District Health Information System that is available. Prior to the uptake of DHIS in Tanzania as the software of choice for managing health information, a proprietary software, that is, Mfumo wa Taarifa za Uendeshaji Huduma za Afya (MTUHA) was used. The proprietary software had limitations which included lack of source code to enable changing data fields or incorporating new ones, lack of some standard functionalities and lack of means for validating data (Kimaro and Twaakyondo, 2005).

DHIS 1.3 based on Microsoft Access was developed by Health Information System Programme (HISP) in South Africa. In 2005, DHIS was upgraded to version 1.4 which was later adopted in the country and then customised to meet the Tanzanian context. This replaced the proprietary software that was used by then. District Health Information System version 2 (DHIS2) as it is popularly known is a web based Free and Open Source Software (FOSS) that was developed in 2005 by University of Oslo in collaboration with Health Information System Programmes of India and Vietnam. The system was piloted in Tanzania between November 2008 and August 2009 in Kibaha and Bagamoyo districts. The roll out throughout the country was completed in December 2013.

The Ministry of Health and Social Welfare (MoHSW) of the United Republic of Tanzania endorsed DHIS as the software of choice to support data handling, analysis and

reporting to higher levels as a way of improving health information management and tackling fragmentation caused by strong VHPs running their own information systems (MoHSW, 2007). Information systems of VHPs run parallel to the routine health information system. These programmes are funded by development partners including President's Emergency Plan for AIDS Relief (PEPFAR) and Global Fund to fight AIDS, Tuberculosis and Malaria. Hence VHPs have funds to develop, implement and maintain information systems that meet their demands. The ability to have their infrastructure causes fragmentation of the HMIS and their sustainability is maintained because of the considerable funding they receive from development partners. Typical examples of information systems that are maintained by development partners include CTC2 database for National AIDS Control Programme (NACP) and ETR.Net for National Tuberculosis and Leprosy Programme (NTLP).

Considering the timeframe since proposition of the use of DHIS, there has been a substantial delay in the adoption and acceptance of the system. The delay has been caused by reluctance of VHPs to use DHIS due to fear of direct loss of control of their data. This called for investigation so as to uncover factors that hinder and those that facilitate the whole process. Analysing the adoption process is important because it is at this stage that organisations can ensure that systems fit their information needs. In addition, Nyella (2011) noted the need of investigating post integration of HIS and how individuals get involved in the use of the system.

The objective of this research was to analyse the acceptance process of DHIS by TB, HIV/AIDS and Malaria programmes and hence identify challenges and facilitating conditions from which other VHPs can learn from. Challenges of information system fragmentation can be surmounted when VHPs accept to use data collected by the Routine Health Information System (RHIS) instead of running their own parallel information systems. Once DHIS is accepted by VHPs, funds spent on maintaining VHP information systems can be used to improve the data quality, use, and management of the RHIS.

2. RELATED WORK

2.1 Migration from Legacy Systems

Kumar et al. (2002) noted that the adoption of an innovation is initially strongly powered by the anticipated benefits in the organisation. Although health programme managers may view integrated systems are satisfactory for their needs (Williamson et al., 2008), they may continue to use systems that are specific for their programmes (Galimoto, 2007; Williamson et al., 2008). This is because they are accustomed to using the systems and managing their data (Nyella, 2011). Data in legacy information systems can be safely extracted to new information systems using Extract Transform and Load (ETL) software (Lungu, 2003).

In Namibia, DHIS was easily adopted because of the similarity with the data collection forms and how to use them. The resistance of VHP managers that is usually found in many countries was overcome by the "paper+" solution (Williamson et al., 2008). The authors described this strategy as transforming systems from paper form to electronic formats on screens with no structural changes; the disadvantage of this being that functionalities of computer systems are not utilised to the maximum due to the adherence to the paper forms (Williamson et al., 2008).

In order to overcome the problem of fragmentation, data warehouses have been set by the Health Metrics Network in places like South Africa, Botswana, Zanzibar and Sierra Leone (Kossi et al., 2009). Kossi et al. (2009) further argued that the challenge of integration is more of a political problem than a technical one since it involves many development partners and actors. Data warehouses have to be set up in order to facilitate establishment of DHIS. However, Watson et al. (1999), and Wixom and Watson (2001) argued that lack of management support and resources can lead to failure of data warehouses. In addition,

interoperability is still a problem in many sectors including health care. Open standards like Digital Imaging and Communications in Medicine (DICOM) and Health Level Seven (HL7) are not adequate to solve problems related to interoperability and hence free and open source software is suggested as having the potential of solving these problems (Murray et al., 2009).

Integration that involves many ministries in a country has to be handled cautiously. This can be evidenced in Botswana where the task of integrating the health information system involved other ministries like the Ministry of Science, Technology and Communication which factor caused lack of a champion in the health programmes since they saw those efforts as computer based (Kossi et al., 2009). This calls for integration efforts involving VHPs to be centrally managed by the Ministry of Health acting as champions. The relationships between the Ministry of Health, development partners, and software development team are crucial in the sustainability of HIS (Kimaro and Nhampossa, 2007).

2.2 Factors that Affect Adoption and Acceptance of Health Technologies

Use of Information Technology (IT) is important in improving health through the proper management of information (Braa et al, 2007; Kimaro and Twaakyondo, 2005; Scott, 2007; Wilson, 2000). However, the technology used has to be acceptable for users and to those for whom it is used. Mustonen-Ollila and Lyytinen (2004) noted that information system adoption process depends on learning mechanisms of individuals within an organisation, influence of legacy platforms that exist and differences in boundary spanning activities. Though information system undertakings in the health sector may result in unintended consequences like failure of acceptance, these challenges should be viewed as lessons learnt in order to avoid the same mistakes in future endeavours putting in mind cautionary measures of safe guarding patients' lives (Harrison et al., 2007). Shaw et al. (2008) noted the need to identify communities of practice, becoming aware of their needs, so as to ensure that the process of implementation is adapted to meet the necessities of particular communities.

Issues of human resource capacity for HIS in terms of both users and the implementation team (Sahay and Walsham, 2006) have to be considered when thinking of rolling out systems like DHIS. In Botswana, recruiting, providing on-job training and mentoring university graduates without training or experience in health information or health sciences proved to be beneficial in tackling the challenge of human resource for HIS through creating a non-existent cadre of monitoring and evaluation officers to work as personnel for HIS (Ledikwe et al., 2013).

Acceptability of IT is a major issue in many health undertakings and can affect success of such projects. In view of that, Kimaro and Nhampossa (2007) noted that provision of computers does not guarantee that health workers will use them for data management. Mohamadali and Garibaldi (2012) went ahead to note that possession of IT skills by a system user does not necessarily guarantee use or acceptance of a new system; however, the skills must go with the requirements of the system itself. Abukhzam and Lee (2010) noted that minimal concentration had been placed on understanding attitudes of employees towards technology adoption regardless of wide spread review of literature of technology adoption. Perceived threat to the privacy of system data can also affect acceptance of a system (Alzahrani and Goodwin, 2012).

It does not have to be assumed that users will perceive technology and use it in a form that was not originally meant. This was noted when DHIS trainees saw DHIS as merely a tool that could be used for storing data rather than one that can be used for tasks like manipulating and analysing data (Kimaro and Twaakyondo, 2005). Lungo (2008) noted that computer illiteracy among healthcare workers is an obstacle in the implementation of computer systems in the healthcare system. Igira (2008) also mentioned that although information officers may lack some computer skills, they are required to use the DHIS regardless of the limitations that

the system may have. Through discussions, problems associated with the use of the system can be explored and hence solutions suggested (Braa et al., 2012).

Giuse and Kuhn (2003) showed that cooperative work practices and communication can help improve health information systems. This can be combined with identification of enough super users (Braa and Hedberg, 2000) who can train others and solve minor problems as they arise in work places. The absence of ample support both technically and institutionally can lead to sustainability failure (Best and Kumar, 2008). Through institutionalisation, information systems can be sustained (Braa et al., 2004); and once fully accepted, it can be a sign of success (Braa et al., 2007). The capacity to use information that users generate from the DHIS tool can be a driving force (Braa et al., 2007) to make them continue using the system. However, a review report to assess the achievement of HISP noted that there is a threat of DHIS drive without lucid management of the system in respect to development and strategy (Lubinski et al., 2011). The authors further noted that nodes in form of country programmes pose a risk of fragmentation and loss of driving force for the system.

Although integration of VHPs' information systems with the national HIS has been successful in some countries, continual use and dependence to the integrated HIS by the VHP managers is still a big challenge (Galimoto, 2007). Tension exist between VHP information systems and the national HIS which results in a pulling effect where winning is influenced by adequate funding, effective strategies, and appropriate and adequate human resources (Nyella, 2011). Kawonga et al. (2012) carried out a study on aligning vertical interventions to health systems using a case study of the HIV monitoring and evaluation system in South Africa and found out that timely data reporting was one of the concerns of using DHIS. The scholars further found out that funding, politically motivated goals and mistrust of DHIS contribute to the continued existence of VHP M&E systems (Kawonga et al., 2012).

3. METHODOLOGY

This study was descriptive and employed qualitative methods to investigate issues in their natural setting with the aim of understanding phenomena and meaning that humans put to them (Creswell, 2003). Using the interpretivism was important since the researchers needed to understand the differences between humans as social actors (Saunders et al., 2009). This philosophy made a distinction between conducting research amongst humans instead of physical objects like computers. An inductive approach also guided the study since it puts emphasis on appreciating the interpretations humans attach to events and a close understanding of the research context (Saunders et al., 2009). A case study of three VHPs was suitable because it answers the "how" questions of research (Yin, 2003); and emerging technologies are affected more by the organisational environment and less of technical matters (Benbasat et al., 1987).

The study focused on the national and district levels of the HMIS and VHPs, and support agencies like HISP Tanzania and Ifakara Health Institute (IHI). In this study, the three districts in Dar es Salaam region, that is, Kinondoni, Ilala and Temeke were selected. Within the districts, the researcher interviewed the coordinators of the HMIS (3) and the three VHPs (9) under study in each of the districts. At the national level, one focal people from the HMIS (1) and one from each of the three VHPs (3) were interviewed. For the support agencies, one district support coordinator from IHI (1) and one programmer from HISP Tanzania (1) were interviewed. A total of eighteen (18) key informant interviews were conducted. The purposive selection of these individuals was appropriate because they had a deep understanding of the way that DHIS was being taken up in their programmes.

Oral informed consent was obtained from the respondents before the study in order to adhere to the standard ethical principles of research. Primary data was collected through

semi-structured key informant interviews and observation, whereas secondary data was collected through document review of public documents. Triangulation of the data that was collected through interviews, observation and document analysis was done. The qualitative data from the field were analysed using content analysis method. This was used to analyse the content of the interviews and the documents that were reviewed in order to make inferences of the phrases. The codes derived from the interviews, and document review data were collated so as to obtain common themes.

4. DESCRIPTION OF NACP, NMCP AND NTLP

4.1 National AIDS Control Programme

This programme is responsible for managing data related to HIV, Voluntary Counselling and Testing (VCT), Prevention of Mother to Child Transmission of HIV/AIDS (PMTCT), and Sexually Transmitted Infections (STIs). Data of NACP that can currently be extracted from DHIS includes that of PMTCT, VCT and STI. The data that is not reported in DHIS to date is that of Care and Treatment Centre (CTC). CTC2 is a patient based database that is responsible for handling patients' care and treatment data in the programme. The HIV/AIDS focal person at the district is the District AIDS Control Coordinator (DACC).

Generally, data concerning HIV/AIDS is categorised into two i.e. clinical and non-clinical data. The former is collected by health workers and community based health care providers who report through HMIS, DHIS and CTC2; while the latter is reported by Civil Society Organisation (CSOs), Non-Governmental Organisations (NGOs), Community Based Organisations (CBOs) and schools which report through Tanzania Output Monitoring System for non-medical HIV and AIDS interventions (TOMSHA) and Local Government Monitoring Database (LGMD). The HIV/AIDS non clinical data is managed by Tanzania Commission for AIDS (TACAIDS). The national HIV Database Suite is the central location where all data related to HIV/AIDS activities in the country is stored. HIV data in the country is disseminated through Tanzania Socio Economic Database, TACAIDS website and Country Response Information System.

4.2 National Malaria Control Programme

National Malaria Control Programme (NMCP) is responsible for matters related to malaria in Tanzania. The Monitoring and Evaluation (M&E) section of this programme is responsible for handling malaria data. It collects data from health facilities, districts, regional up to national level following the hierarchical order. Data at the health facility level is collected in special forms and registers of health facilities which are then forwarded to the district coordinator. Previously, the coordinator was responsible for compiling the totals in an excel sheet which was then forwarded to the ministry as an email attachment and copied to the regional coordinator who compiles a report for the whole region. However, with the recent introduction of DHIS, either the district malaria coordinators or the HMIS coordinators fill the summaries, that is, the totals in the system. The data that is compiled in DHIS includes malaria tests, cases and deaths of malaria as well as stock of commodities. It is the work of the district malaria coordinator to validate the totals that are submitted in DHIS. Once this is done, the M&E section of NMCP is able to monitor data submission. Ten regions (Arusha, Manyara, Singida, Dodoma, Iringa, Njombe, Mbeya, Katavi, Rukwa and Pwani) were piloted for reporting total tests of malaria cases and commodities in DHIS.

DHIS does not collect all data that is needed by the MoHSW. Other indicators are collected from the Integrated Disease Surveillance and Response (IDSR). These include those who test positive for malaria and those who have signs and symptoms of clinical malaria. IDSR reporting is done either immediately or weekly depending on the type of disease. For the case of malaria, it is reported weekly. The system uses Unstructured Supplementary

Service Data (USSD) technology to report to the ministry. The system was piloted in four districts (Temeke, Bunda, Misungwi and Muleba) and was rolled out in Kagera region.

Unlike HIV data, there is no central database that manages both clinical and non-clinical data for malaria. Non-governmental organisations like IHI and Population Services International have malaria programmes that deal with non-clinical data and they operate their own information systems. Despite having other systems, there is national coordination for all malaria programmes in the country which is done through the guidance of NMCP.

4.3 National Tuberculosis and Leprosy Programme

NTLP operates under the Epidemiology and Disease Control unit of the Department of Preventive Services of MoHSW. NTLP coordinators are responsible for coordinating all activities pertaining to TB and leprosy control in the country. The responsibilities of District Tuberculosis and Leprosy Coordinators (DTLCs) not only include managing data but also extend to providing medical services to clients and supervising general health workers who diagnose and treat TB patients in health facilities as per the guidelines issued by NTLP.

Due to the large number of clients within Dar es Salaam, the administrative districts have been designated NTLP regions which are further sub divided into NTLP districts. This is done in order to bring services closer to the population. The Regional Tuberculosis and Leprosy Coordinators (RTLCS) are accountable to the Regional Medical Officer and DTLCs to Municipal Medical Officer of Health respectively. In addition, the RTLC supervises the DTLCs. Tuberculosis and leprosy control activities are fully integrated in the basic health services, supported and facilitated by NTLP through training, supervision, supply of drugs and laboratory reagents. The DTLCs maintain TB and leprosy registers in which they accumulate all data on patient notifications and treatment outcomes, as they are recorded in the health facility registers by general health staff. Quarterly reports (including drug stock/request forms) are extracted from these registers and forwarded to the RTLC and also copied to the district HMIS coordinator (for comprehensive community health planning). The DTLC advises the district council health management team on all matters pertaining to tuberculosis and leprosy control in the district. ETR.Net is proprietary software that is currently used to report NTLP data. DTLCs and RTLP coordinators received DHIS training. Preliminary measures for adoption of DHIS for reporting NTLP data have been taken.

5. FACTORS THAT FACILITATE DHIS ADOPTION AND ACCEPTANCE

5.1 Good Organisation of the routine HIS

Good organisation of the routine HIS provides various points of entry into the HMIS. The existence of infrastructure like computers and personnel in place coupled with the FOSS nature of DHIS shows that minimal cost is needed to make VHPs use DHIS. Since data of RHIS is collated at the district, the same point paves way for adoption of the system hence merging data from both the RHIS and VHPs.

During the pilot of DHIS in Pwani region, new data collection forms were designed and tested. Before initial roll out, proposed changes were implemented which saw additional VHP data elements being included in the revised system. This engaged the users to be involved in designing of the system rather than just being testers. Taking an example of NACP, a common understanding and agreement of the shared indicators for data collection between the VHP and HMIS team ensured that most indicators that are collected by the programme are included in DHIS. This ensured that there is no need to create separate systems for collecting NACP data.

5.2 Contribution of Development Partners

The contribution of development partners to the successful acceptance of DHIS cannot go

unmentioned. The IHI personnel (in each of the districts) are responsible for supporting DHIS use in the region. They are provided with a modem that is loaded with an internet bundle to facilitate accomplishment of their duties. DHIS use has also been enabled by other development partners like Japan International Cooperation Agency (JICA), Management and Development for Health (MDH) and Clinton Health Access Initiative (CHAI). JICA's choice of DHIS for monitoring their interventions greatly influenced the use of DHIS. This was seen as JICA was involved in the piloting of DHIS as a tool for reporting of STI and VCT data in the country. Preliminary measures that were taken by NACP like discussing issues of datasets have also been considered by NTLP which is on its way to using DHIS.

It is important to reiterate that NACP piloted, led and accelerated the initiation of DHIS roll out process for managing information related to STIs and VCT in Pwani region. This commitment of the top management of NACP with the support of JICA contributed to the successful adoption of DHIS by the programme. The process involved DHIS training of regional and district teams, and providing hardware to support their activities. The initial success can be attributed to the support given by NACP management as one DACC said;

We are one with the top management at the national level in our activities

5.3 Support and Maintenance

On-job support has also played part in the successful adoption of DHIS. Let us focus on NACP that is reporting through DHIS. DACCs are not yet well conversant with DHIS operation; this makes them ask for help from the HMIS coordinators for certain DHIS tasks. This was noted in Temeke district where the DACC was seen asking the district HMIS focal person to print for him a copy of the data for the previous month. For the case of Dar es Salaam where IHI supports HMIS, VHP coordinators may ask for assistance from either the HMIS coordinator or IHI support staff. Problems that are experienced with VHP information systems can help in changing the mind set of VHP coordinators that DHIS is the right alternative to opt for. One M&E Specialist of NMCP went ahead to say;

DHIS is the saviour to the data problems that we face like dual reporting.

The existence of a discussion forum within DHIS has contributed to solving some technical problems of the system. In case of bugs, DHIS has a forum where system users send questions or inquiries and then receive responses from whoever is online. The forum links individuals with different skills including practitioners, researchers and academicians. This was seen in Temeke district where the DHIS focal person requested the system to produce an aggregated report but it was not responding. She posted the issue to the forum and received a response within minutes. In addition to the forum, technical help can be obtained from either the MoHSW or University of Dar es Salaam Department of Computer Science.

5.4 Belief in use of DHIS

The belief of VHP coordinators that it is possible to report their data through DHIS is a strength that has to be built on. They attributed their readiness to use DHIS to the IT fundamentals training that they had in conjunction with the ETR.Net training (for the case of NTLP) meaning that they believe they will use less effort to learn and DHIS. The coordinators expressed readiness to use DHIS as one district malaria coordinator mentioned;

We are ready to use DHIS since it will solve some data challenges that we face like delay in reporting of data.

In addition, one national NMCP focal person noted the need to continue using DHIS so

as to increase proficiency of the coordinators..

6. CHALLENGES THAT HINDER ADOPTION AND ACCEPTANCE OF DHIS

6.1 Existence of VHP Information Systems

Vertical Health Programmes are majorly supported by development partners. These partners have their indicators of interest which are incorporated in their M&E plans. Incorporating their indicators into the RHIS means that they lose direct control of the data and the process of collecting it. Since all projects are unique, this means existence of unique M&E plans for the projects. Many of the plans focus on indicators which can harness their collection from the data that is already available from the RHIS and surveys. Creating separate processes for collecting the same data would be a waste of resources that are already scarce.

NACP operates CTC2 database that deals with HIV/AIDS patient management data at health facility level. It is not easy to completely phase out CTC2 because of its strong installed base just as is the same case for ETR.Net. ETR.Net is strongly embedded in the coordinators' routine duties of reporting. This has contributed to the confidence and perception of ease of use of ETR.Net which were attributed to the training, experience with the software and technical support in case of system failure. In case of any technical problem of ETR.Net, there is a hotline to call for help and the solution to the problem is provided promptly.

6.2 Confidential nature of VHP data

Vertical health programmes such as NACP and NTLP hold confidential information like HIV status. Such information has to be handled by only those who are in direct care of such individuals. Using DHIS and integrating CTC2 database within HMIS would mean surrendering such data for collection and storage by third parties hence losing the ability to control privacy. In line with the mentioned, such programmes hesitate migrating from their information systems to DHIS. This results into perceived threat of system data privacy as described by Alzahrani and Goodwin (2012).

6.3 Inadequate Human Resources for HIS

Training about HMIS has been incorporated in the curricular of diploma in nursing students to improve their knowledge about it. However, there is inadequate human resource for HIS for not only catering for the HIS but also for training students who will later contribute to human resource for HIS. This makes it hard for the VHPs to adopt DHIS since adequate personnel with appropriate skills are not available.

All district and national VHP coordinators received DHIS training. However, there was a time lag for over six months between the training and actual use of the system. Because of the time that passed, VHP coordinators inquiry about some procedures of using DHIS. This shows a decrease in confidence of using DHIS and in turn leads to delay in report submission.

6.4 Data Quality and Information Flow Issues

Health data flows from community and health facilities up to the national level with the district being the centre of collation. Although most of the data from health facilities and the community flows through the district, both VHP and HMIS coordinators handle the data. Ideally, all data should flow to the district HMIS coordinator. This enables coordination and monitoring of all health activities within the district. Dual reporting as shown in figure 1 was observed for NMCP and NTLP. Data is reported both through the DHIS and other VHP information systems which can result in different figures for the same indicator.

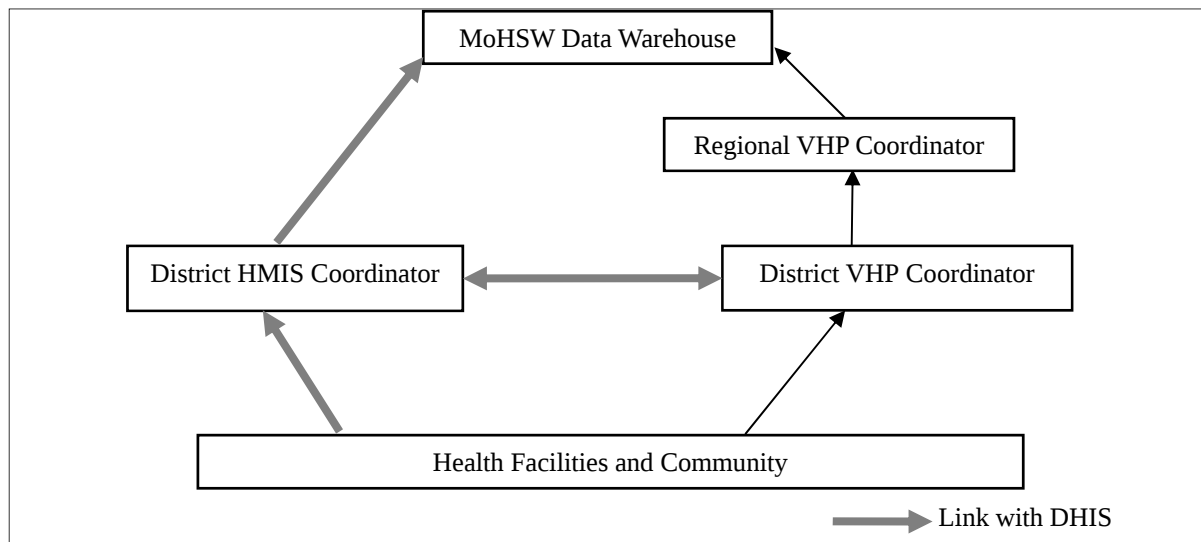


Figure 1: VHP Data Flow in relation to DHIS

Data quality challenges were noted in NMCP, that is, timeliness and incompleteness of submitted reports. Some reports were submitted with totals of those who tested positive without the total tests carried out making it impossible to calculate indicators like prevalence due to the lack of a denominator. Figure 2 shows an illustration of data flow through DHIS and its associated challenges.

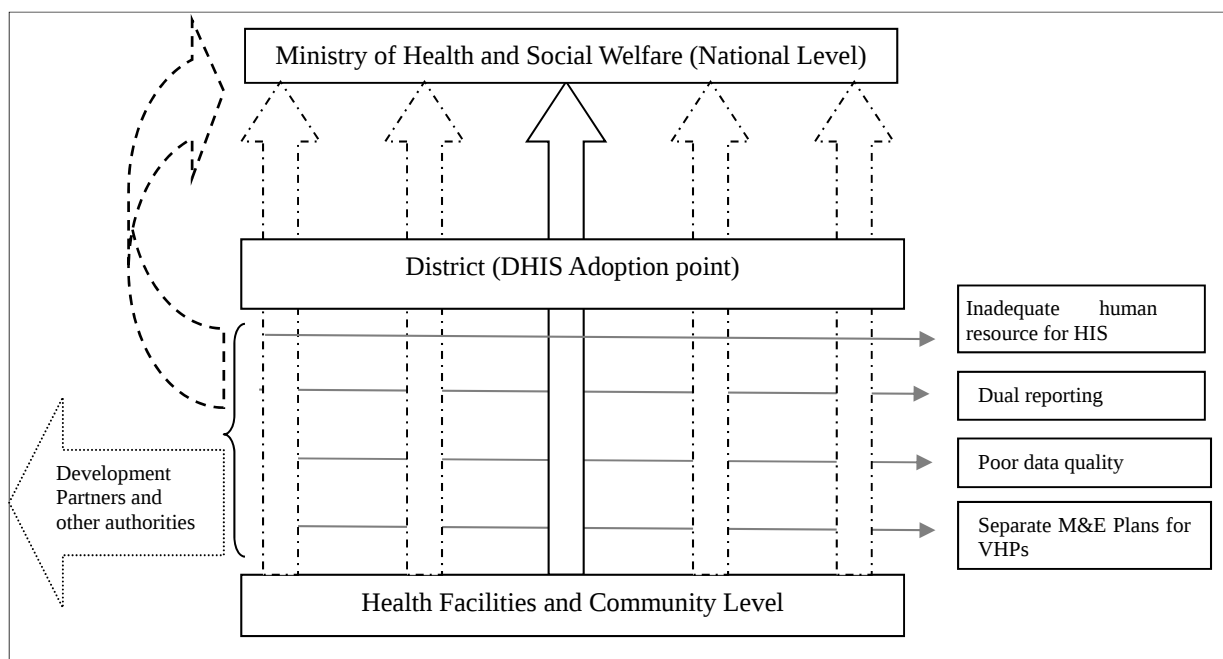


Figure 2: DHIS Data Flow and Associated Challenges

7. ADDRESSING THE CHALLENGES

In order to manage challenges associated with the acceptance process, it is important to discover tacit work in the organisation and put it into consideration since it can have negative consequences on the whole process. Since NACP succeeded to a great extent in using DHIS, the path that they took can be a lesson to learn from and of great value to the learning process

of other VHPs.

Human resource for HIS is a challenge in the successful acceptance of DHIS. Collaborative efforts between development partners and teaching institutions so as to build capacity of local human resource for health (Kimaro, 2006) can help to produce professionals of health informatics. This can narrow the HIS professionals' gap in the country. Universities for example University of Dar es Salaam teaches DHIS to students making them familiar with using the system even before they graduate. An approach that was used in Botswana can be applied to Tanzanian context. It involved training university graduates the basics of health informatics and monitoring and evaluation who had no prior training in health nor information technology and making them district monitoring and evaluation officers thus strengthening the health information system in the country (Ledikwe et al., 2013). However, since Tanzania has many information technology graduates, they can be taught the basics of health data management and take up the role of district health information officers.

The national HMIS office at the MoHSW has to coordinate all health related information in the country. This can control the mushrooming of parallel information systems that frustrate efforts of integration and improvement of data quality in the HMIS. Furthermore, this can be complemented by a policy that requires all development partners not to establish their own programme information systems if their indicators are already included in DHIS. Guidelines have to be in place concerning the operation of DHIS both within the routine HIS and VHPs. In case VHPs need to collect additional data, they can discuss with the DHIS programmers to include their indicators in the system. Some data do not have to be included in DHIS such non-clinical related data which is collected by TOMSHA, periodic surveys like demographic surveillance systems, Tanzania Demographic Health Survey and Tanzania HIV/AIDS indicator survey. The indicators that are collected by various projects might have different definitions with the ones of the national HMIS which can result in having two figures for the same indicator at national level. Thus, it has to be the duty of the national HMIS office to coordinate such issues. Figure 3 shows the suggested information flow of health information to district level for collation instead of by-passing the district.

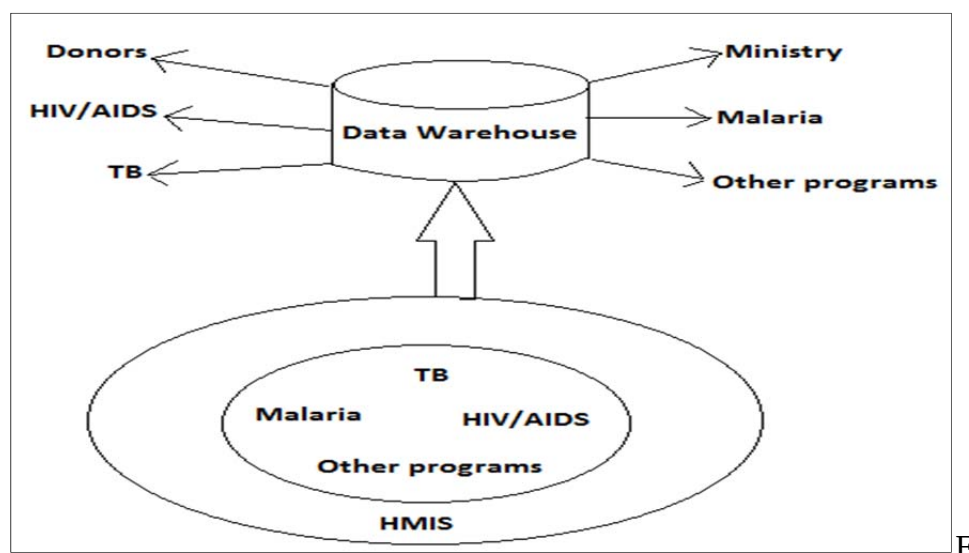


Figure 3: Suggested Information Flow for the HMIS

Extending the functionality of the system is an issue that was raised in one of the interviews. Due to the capability of extending DHIS to have mobile functionality, the need to

report totals using Short Message Service (SMS) came up. This was said to reduce the time and cost it takes to report the data from health facilities to the district coordinators. However, with such a reporting style, it is important for monitoring and evaluation officers to counter check the quality of data since reporting officers may merely decide to sit in their offices and send the data.

In order to achieve integration and interoperability of systems like ETR.Net and DHIS, openness and transparency have to be given emphasis. Standardisation is central in efforts aimed at realizing integration and interoperability. Unfortunately, many information systems of the vertical health programmes are proprietary which makes it hard to achieve the above mentioned aims. Openness has to be in terms of source code in order to prevent vendor lock in like what happened to the first HMIS that was installed in Tanzania which had no flexibility. Standards and initiatives like HL7, DICOM, Integrating Healthcare Enterprise (IHE) and Continua Health Alliance endeavour to achieve integration and interoperability.

National AIDS Control Programme has its own form of reporting patient data related to care and treatment which is popularly known as CTC2 which runs parallel to the routine HMIS. This is because such data is confidential in nature, that is, contains names and HIV status. In order to enable use of such data with DHIS, the University Computing Centre of the University of Dar es Salaam programmed CTC2 database to generate a file that can be exported to DHIS. This exemplifies the interoperability of DHIS with other systems due to its FOSS nature. This only exports data that cannot identify a client with confidential information. The same approach can be used for information systems that have data of such confidential nature.

Kinondoni district was innovative enough to create cascade nodes at ward level to further bring information management closer to wards. In this development, the cascade nodes that are set up are responsible for managing health information from various health facilities within the same ward. This lessens the duties of the VHP district coordinators and also encourages data use at lower levels of the health system.

8. CONCLUSION AND RECOMMENDATIONS

NACP and NMCP use DHIS in reporting their data. This was achieved through incorporating their indicators in DHIS followed by training of the coordinators. VHP coordinators saw DHIS as one that is instrumental in reporting data of their programmes. In every VHP, there has to be a champion of change to facilitate the acceptance process. Making DHIS part of the daily routines of VHPs can be realised by including aspects of the system in the workers' performance appraisal. Technical support through peers should be the driving force to act as solutions to system problems.

DHIS training should be actively incorporated in the curricular of various training institutions. This can be specifically targeted at students pursuing health, informatics and computer science courses. This will not only expose the students to the system at an early stage in their professional lives, but also to the standard of health information management at district level. Health institutions can play a vital role in the endeavour. Since nurses are more involved in handling of data than doctors, training of health informatics should focus on strengthening the nursing diploma programmes. Since nursing students work all over the country, this can facilitate the scaling of DHIS to ward level. In addition to training, research should also be continuously conducted on DHIS so as to manage challenges as they arise. Such endeavours can be spearheaded by teaching and research institutions like University of Dar es Salaam.

Human resource for HIS is inadequate and under motivated. Training of university graduates with no prior training in health or information technology has shown to strengthen health information systems (Ledikwe et al., 2013). This approach can still be replicated in a

country like Tanzania to tackle the same issue. However, since Tanzania has many IT graduates, they can get special training on health issues and then take up the role of health information officers. This can draw on the advantage that most universities teach basic computer knowledge and skills to students. This approach can be used in contrast with the Botswana approach which trained non health and information technology graduates to take up the role of managing health data. Recruitment of human resource for HIS should focus on the younger aged less than 40 years since they are most likely to adopt technology.

DHIS should be scaled down to ward and facility level through creation of cascade nodes. This will spread the DHIS role to include the private sector since they comprise over sixty percent of the health facilities. The public private partnership is instrumental in the successful acceptance of DHIS. This can be achieved through training of enough users of the system spread also in private hospitals. However, the time lapse between training and actual use of the system should be such that practice of the skills is done immediately after training; this increases competence in performing the skills that an individual gets from training. With a focus on rolling out the system, training has to focus on training of trainers preferably selected at district level that will be responsible for training colleagues in their respective districts. The approach of cascade nodes should be adopted for the various districts in the country. This will lessen the work of the district HMIS coordinator of aggregating data from the various health facilities to that of monitoring data quality, information use and other technical aspects.

Not all health data should be collected through DHIS. The FOSS nature of DHIS enables system integration and interoperability with other systems. Leverage of resources for funding of vertical health programme M&E systems for the national HIS is needed. This enables effective utilisation of resources for the HIS. Harmonisation of RHIS and VHP M&E systems can be done when a central pool of resources for HIS is created. Yet there should be commitment to the effective and efficient utilisation of the resources.

9. REFERENCES

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