FACTORS AFFECTING DATA QUALITY IN THE MALAWIAN HEALTH MANAGEMENT INFORMATION SYSTEM

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ABSTRACT

The Health Management Information System (HMIS) was introduced in Malawi with the District Health Information System (DHIS) as a tool for collecting, processing, transmitting, analysing and providing feedback of health information to various levels of the health system. Despite this effort among several others, the importance of data use in decision-making remains low and its quality is still poor. It is either incomplete, inaccurate and out-dated when being reported to health managers and policy makers. The aim of this study was to determine factors that affect data quality in the HMIS in Malawi.

The study was conducted in various purposively selected hospitals countrywide. These are Kamuzu Central Hospital (KCH), Bwaila, Kasungu and Ntcheu hospitals in the central region of the country. Mangochi and Balaka district hospitals were selected in southern region. Data quality was assessed by physically assessing it in registers for correctness and completeness over a period of six months to one year. Timeliness was investigated in reports that were made from health facilities to districts and finally the Health Management Unit (HMU) in the Ministry of Health (MoH) and visa versa. Semi-structured questionnaires were administered on health workers in addition to conducting focus group discussion for in-depth interview. Stakeholders were interviewed to assess the impact of feedback and the appropriate formats for feedback presentation. Patient flow and management were analysed using turnaround time and throughput as measures at Mangochi and Bwaila district hospitals to determine the efficiency and effectiveness of the health service delivery system to patients but also to determine how it affected data quality.

Higher numbers of discrepancies were observed between data in registers and physical reports in comparison to HMIS. Data collectors used different standards to measure indicators, which affected the consistency of the data. These were aggravated by lack of training and supervision among data collectors. Programme managers never used HMIS data due to limited government funding. This was a major limitation in the implementation of informed decisions that could be made from HMIS. The implication of patients flow was that some data elements such as drug stocks were recorded in HMIS before actually being issued at the pharmacy, which affected correctness of the data.

KEY WORDS

Data Quality, Heath Service, Feedback, Correctness, Completeness, Throughput.

1. Introduction

In Malawi, the Ministry of Health and Population introduced an integrated routine Health Management Information System in January 2002. The system aimed at integrating all routine data collection activities and decentralization of information generation activities. [1] It was the first time in Malawi, to have continuous monthly data collection for indicators from health facilities, district and national level.

HMIS at different levels (facility, district as well as national) was designed to provide programme managers with information on how the health system functioning. At district level, HMIS was managed by the District Health Management Team (DHMT) to enable them to use information in an appropriate manner but also to provide timely feedback to health centers, the community and stakeholders. [2] A number of interdependent sub-systems were identified as components of the national HMIS. These subsystems included the Financial Management Information System (FMIS), Human Resource Management Information System (HRMIS), Logistic and Supply Management Information System (LMIS), Physical Assets Management Information System

(PAMIS), and Integrated Health Services Management Information System (HSMIS). [3] To ensure that planned health targets were achieved, a systematic monitoring system was imperative. However, the existing HMIS was unable to ensure timely data entry, analysis, and feedback. Hence, the District Health Information System (DHIS) was identified as a tool for collecting, analysing and reporting. HMIS officers were recruited in all districts to manage data collection and analysis activities.

The mission of the HMIS was to improve the health status of all people by providing managers with reliable, relevant, up-to-date, adequate, timely and complete information. Informed decisions could allow increased effectiveness and efficiency of health services. [4] HMIS had to ensure that the required health and management information was available to all users for their needs. To achieve this, data had to be collected; management of some health service had to be integrated into one; data had to be locally analysed and used. Complete information was made available at a single repository with strong links to data collection systems to avoid duplication but also to produce synergy in data analyses and dissemination. [5]

The preliminary analysis revealed among other things that data gathering systems were uncoordinated. [6] Data was rarely used in planning and management of health services because it was unreliable. Hence, inadequate appreciation and use of information in planning and management of health services consequently contributed to generation of data of poor quality.

In evidence-based decision making for health service, data quality is critical. [7] One of the primary obstacles in implementing quality health care delivery system especially in developing countries is lack of appropriate information for effective decision-making. It has been shown that poor data quality in decision-making can have far-reaching socioeconomic consequences. It can reduce client's satisfaction; increase operational costs, lower effectiveness of decision-making and the ability to plan. [8] Poor data quality can result in lowered morale among health workers and create mistrust in organizations resulting into inefficiencies.

A number of research studies have investigated the effectiveness of HMIS in Malawi and elsewhere. Most of these studies have not assessed the effectiveness of HMIS at district level. Mukama [9] reported minimal use of information due to integration of different programmes such as malaria, HIV/AIDS, EPI and others. There was also a continuous aggregation of data as it moved upward the administration hierarchy, thereby masking health facility information, making it difficult to analyse and use it for local management activities. It also found that reporting was done in one-way upward direction with no supervision and feedback from the top authorities. Centralization of routine the health management information system is known to influenced low information use and poor data quality at lower levels. However, further research is needed to support these findings and to inform HMIS planners. Evaluation of DHIS in Kenya found that key personnel at the district level were not involved in the development and implementation of activity plans. The DHMIS were fragmented to the extent that their information products were bypassing the levels they were created to serve. [10]

This work investigated factors that affect data quality in the Malawian Health Management Information System. Prior work has shown that none-use of information for evidence-based decision-making is probably one of the major reasons for poor data quality. [5] Volumes of data are collected but never used. [11] Data is not used because of several reasons one of which is that data is of poor quality. The possible cause of poor data quality could be due to inadequate data analysis; lack of an information culture and shortage of trained personnel. Information processing activities are seen as a burden due to high workloads especially at health facility levels. [12] Other reasons for failing to use the data are because of its relevance to decisions to be made, data reliability, its level of detail in terms of aggregation and timeliness, characteristics of the required decision, the nature of an organisation, and cultural differences between data collection people and decision-makers. [12] Information is valuable when it is accurate, relevant, timely, properly structured and presented in a useable format. [8] The success of a health information system is determined by informed decisions that are made to lead into action and positive change in the health system. [2] The type of an organisation as to whether it is private or public also affects the use of information. Private organisations use information more than public ones because they are profit-oriented and are under pressure to perform. [13] Public health organisations however, are under less pressure to perform hence they do not use information effectively resulting into wastages and inefficiencies.

2. Methods

This work investigated factors that affect the quality of data in the Malawian Health Management Information System. At Kamuzu Central Hospital, data was analysed for a period of twelve months, from January to December 2011 in medical and paediatric wards. These wards were selected because they had high patient turnover with diverse disease range. Patient registers and reports were analysed for completeness, correctness and timeliness during the study period. A total of 22 health workers such as nurses, ward clerks and hospital administrators were interviewed for in-depth understanding of issues, in addition to gathering their expectations on the HMIS.

Semi-structured questionnaires and focus group discussions were used to gather information.

At Kasungu district hospital, semi-structured questionnaires were administered to twenty-three long-serving staff members such as members of the DHMT, statisticians and stakeholders. Stakeholders included non-governmental organisations and other government departments, which implement health services, or whose programmes were directly affected by health services. Thirty-two stakeholders were interviewed to determine feedback reach and the format of feedback that was appropriate for them. Data quality was assessed in maternal and child health registers over a period six months.

Further analysis was done by comparing data quality between Ntcheu and Balaka districts for a period of six months. Patient registers were analysed for correctness, consistency and completeness. Reports were also analysed for timeliness. In these two districts data quality was compared with respect to different factors such as training, experience and level of education of health staff.

To establish how the flow of patients in the hospitals affected the quality of data, two hospitals were studied Bwaila hospital in central region and Mangochi hospital in the south. Patient turnaround time and throughput were used as measure of efficiency and effectiveness. Turnaround time was measured by calculating the average time taken by patients from arrival at a hospital to the time when they left. Individual turnaround times were also measured for consultations, laboratory tests as well as pharmacy. The efficiency of the system was measured by patient throughput, which is the average number of patients that passed through the hospital system in consultations, lab tests or pharmacy per unit period of time. Bottlenecks and redundancies were assessed as to how they affected data collection and the efficiency of service delivery.

3. Results

3.1 Data quality

There are several data quality variables, which can be assessed. This work however, focused on three main properties of data quality and these are correctness, completeness and timeliness. Correctness is the true representation of the actual object on the ground. Completeness is determined by two variables: missing and unknown values. Unknown variables are responses where the interviewee doesn't know the answer or forgot the answer. Missing values are mandatory values, which either the interviewer forgot to ask or record and are therefore blank. Completeness attempts to the achieve collection of all mandatory data elements to eliminate both missing and unknown values. Timeliness is when data is delivered at the required time because data delayed is data denied. These data quality variables were analysed in the selected hospitals in Malawi.

Analysis of correctness of data at KCH revealed several errors in registers and when compared to DHIS. There were discrepancies between figures in registers and reports when compared to those in the DHIS. For example, there were 2003 admissions recorded in ward registers while DHIS had recorded 2894 total admissions (see Table 1). These discrepancies were observed in all data elements. In-depth interviews with hospital staff revealed that the shortage of staff was the cause of these discrepancies as the staff who enter data into DHIS knocked off earlier thereby skipping admissions after hours and over the weekends. Such error could not be picked by hospital administration because they also did not use the data for decision-making. The reasons were that administration did not trust data from HIMS because it was littered with numerous errors. The second reason was that even when managers wanted to make decisions based on the data, the government funding was insufficient to implement their informed decisions in totality. Management could therefore use its own discretion to make priorities and decide how to spend government funding. HMIS data was described as 'for them', meaning, 'the Health Management Unit' at the ministry.

Different standards of calculating indicators were used by different data collectors, which affected the consistency of the data. This problem was escalated by lack of training and supervision as evidenced by several unchecked reports. Proper training would improve consistency of data by training users acceptable standards for calculating indicators as well as emphasising on the importance of those standards.

There was an improvement in correctness and completeness of data in registers in maternal and child health in Kasungu district after introduction of DHIS. It was found that 70% of the registers had missing pages before DHIS was introduced. But this was reduced to 10% missing pages in registers after DHIS was introduced. However, most reports were found still unchecked even after DHIS was introduced.

Analysis of completeness of data in Ntcheu and Balaka district hospitals revealed 85% and 80% of under-one registers respectively with gaps. A similar observation was made in the antenatal departments in both districts with all health centers reporting missing values on expected dates of delivery and vaccines received by pregnant mothers.

The set reporting date to district from health facilities was the 15th of every month. Results showed that all staffs were aware of this reporting date and others. There was late reporting for monthly reports. Monthly reporting was observed to be late in the first and last quarters of the year. A summary of findings of factors affecting data quality is presented in sections that follow.

Table 1
Data discrepancies between registers and DHIS

Month (2011)	HMIS data	Nurses Register	Difference
January	2,003	2,894	891
February	2,246	2,965	719
March	3,143	3,120	-23
April	2,069	3,007	938
May	2,108	3,134	1,026
June	1,464	1,985	521
July	1,029	1,436	407
August	841	1,142	301
September	1,165	1,551	386
October	1,240	1,817	577
November	1,386	1,802	416
December	1,153	1,575	422

Similar discrepancies were observed in reporting of disease diagnostics as shown in the Figure 1 below.

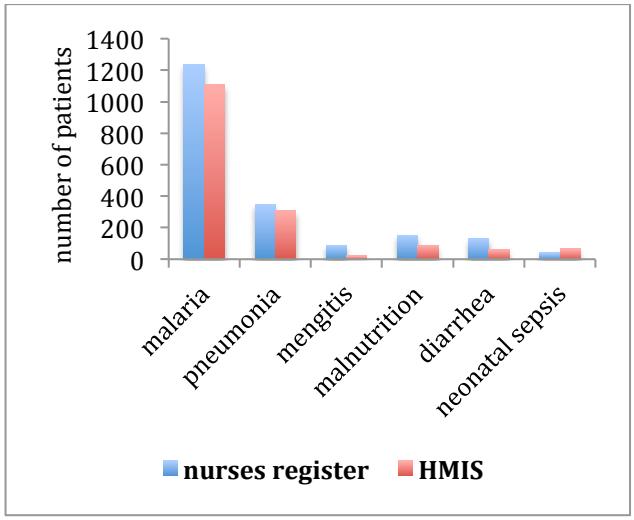

Figure 1: Discrepancies between reported diseases in the registers and HMIS system

3.2 Shortage of staff

Shortage of staff was defined as the difference between establishments in the institution and actual staff employed. The pressure of work among staff members highly affected data quality. This was observed in all studied hospitals. Due to pressure of work, staff stopped data collection issues to get back to it when they have less work. Clinicians could hardly concentrate on collecting data as they rushed to attend to patients but never come back to their records. As a result some values were never reported and followed. Pressure of work due to shortage of staff forced them to involve cleaners with low education, with neither training nor understanding of the use of data, which prevents urgent decision-making as data is collected. It restricts the scope for taking up new activities, which is not only inevitable at times but is also a critical requirement in the larger interest of the health service to meet new challenges. At Kamuzu Central Hospital, there were 13 ward clerks against 47 wards. And a shortage of 126 health staff was observed at Mangochi district hospital at the time of this study (see Table 2).

Table 2
Shortage of staff at Mangochi district hospital

Staff	Required	Available	Shortage
Doctors	5	3	2
Medical Assistants	97	43	54
Nurses	146	76	70
Total	248	122	126

3.3 Low education and lack of training

Analysis of the impact of education as compared between Ntcheu and Balaka revealed that education of staff affected the quality of data. With no degree qualification among data collectors in the two districts, similar types of errors were observed. As previously alluded in most hospitals due to shortage of staff and work pressure, patient attendants and guards (with evidence from their personal files) who had worked for long time were used to collect data and fill in reports.

Comparing levels of training between the two districts, it was found that 33% and 11% of data collectors were trained from Balaka and Ntcheu respectively. These numbers were very low which resulted in the poor data quality. Follow-up interviews in focus group discussions confirmed lack of knowledge in best practices and standards in data collection due to lack of training and low education.

3.4 Shortage of data collection tools

Lack of registers for periods between 1 to 3 weeks was also discovered in health centers in Balaka and Ntcheu districts where 31% and 26% of respondents respectively agreed with the observation. This had serious

repercussions on quality of data as data collectors had to improvise tools, which could be easily lost.

3.5 Lack of ownership of HMIS

Due to insufficient funding, HMIS data was never used in the studied hospitals. Decisions were made based on the judgement and priorities of administrators. Lack of data use by administrators discouraged staff from taking data seriously and own it, which is key in improving its quality.

3.6 Lack of supervision and feedback

Results showed that several reports were sent to the HMIS officer unchecked, which could be the main reason for the continuation of discrepancies between data in DHIS and registers. Focus group discussions revealed that the HMIS office at the district level did not provide feedback to wards at hospital and health centers. Similarly, the Health Management Unit at the Ministry of Health just received reports but never providing specific feedback to districts and health centers. In Ntcheu and Balaka districts, focus group discussions indicated receiving feedback only in form of annual bulletins, which was not timely and over aggregated for the use of health centers. The bulletins were not prepared with the health facilities in mind but with donors and upper levels of administration. In Kasungu district, out of 33 stakeholders only 29% acknowledged receiving feedback through meetings, 50% through posters during programme campaigns, 14% in form of leaflets and 7% through written reports.

3.7 Patient flow and management

At Bwaila hospital, it was shown that patients took an average of 32 seconds in consultations, with an average of 22 seconds for males and 52 seconds for females for both diagnostics and prescriptions. At Mangochi district hospital, patients took an average of one minute in consultation rooms calculated for three clinicians with durations ranging from one to three minutes. The time spent with patients was affected by work pressure (see Figure 2). In the main OPD, three clinicians consulted 500 patients per day with approximately 166 patients per clinician per day. Redundancies due to repetitions and bottlenecks in the flow of patients affected data quality because they created unnecessary work pressure on clinicians. The poor flow of patients resulted in prescriptions being captured into HMIS before the drugs were actually issued. Some patients left the hospital without being recorded in DHIS.

4. Discussion

Data remains a critical problem in all stages of the information cycle in the Malawi HMIS - from collection, processing, analysis, interpretation and feedback. Due to poor quality, the situation has turned into a 'chicken-egg' problem where managers are reluctant to use it. At the same time data use is important for stimulating improvement of its quality. Users own the data and take it seriously if it adds value to their day-to-day work, which result into accurate, correct, complete and consistent data. If users do not appreciate the importance of data in their day-to-day work, they will have no reason to improve it. Lack of ownership of collected data was also found to be a contributing factor in the Tanzanian HMIS. [14,15]

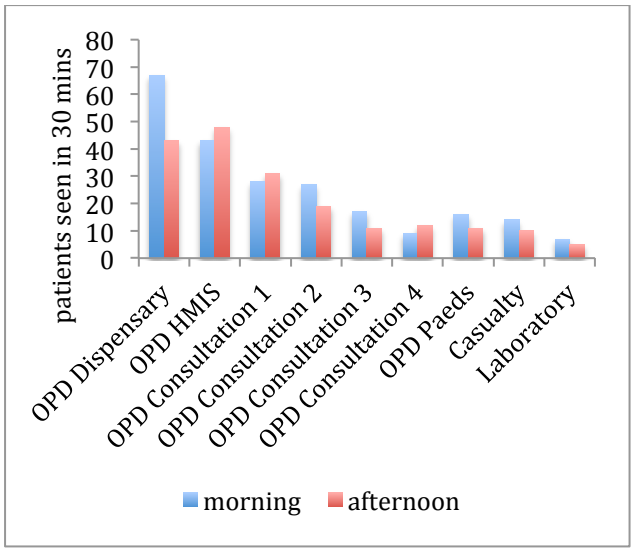

Figure 2: Number of patients seen in 30 minutes at Mangochi district hospital

Insufficient government funding worsened the problem of data quality as managers failed to implement informed decisions learned from the data. It could still be possible however to apply some of the informed decisions, particularly those, which did not require funding. Sufficient government funding is useful for implementing decision but can also enable managers to introduce incentives among data collectors to promote data quality, timeliness of reports and an information culture. Incentives and prices would be the primary technique to use in bringing value to the data and promoting an information culture. If managers were willing to spend funds on getting quality data then users would appreciate the importance of the data and also contribute to its quality. Failure to use data for decision-making results in under-budgeting or over-budgeting, which affects the overall health service delivery. The nature of organisations affects the use of information in several ways. Government institutions are usually not under pressure to perform. They do not evaluate losses and

profits. They usually make decisions without the use of information. Private organisations are different. They are keen to ensure that there are no wastages and losses. Even when they are making profits they try hard to optimise the profits and improve efficiency. The ultimate responsibility for data quality rests on the organisation producing the data. [14, 15] Data quality is the responsibility of an organisational and it is supposed to be everyone's responsibility instead of being left to information specialists only. Shortage of staff has a cascading effect on reporting, supervision and feedback. As pointed out by Krishna & Madon [16], shortage of skilled manpower is one of the most serious problems that affect the normal output process. Due to shortage of staff at all levels of the health sector, there are few data collectors who are also under pressure to report in time thereby affecting the quality of reports. Managers were found not to provide supervision and feedback to lower levels. When supportive supervision is done well, it clarifies objectives and expectations; it monitors performance; it helps in the interpretation of data; it provides focused education, helps with planning and problem solving and enhances community participation. [17] As a result guards and patients attendants with minimal education and no training were used to collect data and compile reports, which compromised the quality of the data. Lower education can be addressed by periodic training of data collectors to ensure best practices and enforce standards. The DFID study found that one of the most difficult parts of improving HMIS is ensuring that people filling forms at clinic level are skilled enough to report accurately, whether on diagnosed diseases or resources used [11]. As observed, data collectors used different standards for calculating indicators resulting into inconsistent values, which cannot be meaningfully compared. Ranges of indicators such as minimum and maximum values were violated in reports. The inclusion of predefined data ranges is useful in checking values to minimise errors and improve data quality. [18]

The flow of patients in a hospital affected data quality. Due to redundancies and bottlenecks, a small number of patients exerted pressure on already overburdened staff. The way patients flow in a hospital affected quality of data as some variables were captured prematurely. For example, drugs dispensed were recorded in HMIS before actually being issued at pharmacy. And yet the patients may not have found the drugs at the pharmacy. Data can also be omitted in HMIS as some patients may exit the system prematurely. The pressure created due to bottlenecks and redundancies results in mistakes in writing and paying less attention to patients. Clinicians fail to make thorough examination on patients due to pressure in order to finish examinations within their limited working hours. Spending less time in examining patients reduces patient's satisfaction, which has psychological effects on their self-belief to get healed. Clinicians writing also become less clear resulting into errors in the data. Evaluating the flow of patients can therefore considerably improve the efficiency and effectiveness of the service delivery as well as data quality.

5. Conclusion

Introduction of the Health Management Information System in Malawi brought hope that decisions for health services will be at long last be made based on information. However, HMIS brought far more complexity into the system as informed decisions for health service decisions appear to be far reached. The problems are several: insufficient government funding, shortage of staff, lack of information culture and lack of ownership of information by data collectors. Among other factors is the lack of supervision and feedback, low education among data collectors and lack of training among many others. Although the factors fit very well into the PRISM framework [19] for evaluating routing health information system, which categorise factors into environmental, technical and behaviour determinants, most of the factors observed in this study are behavioural and environmental in nature. There are less technical issues that affect functionality of HMIS and eventually data quality. Unless government funding improves, it will remain difficult for the health sector to implement informed decisions for implementations that require funding and of course stimulate an information culture. Commitment from government for the need for quality information and value in data quality is necessary to improve data quality. The philosophy behind data collection needs to be changed so that data collection is done without being noticed. Health workers need to see value that data adds to their job, as they are also able to use it to become more efficient and effective in discharging their duties.

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