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Design and implementation of a health management information system in Malawi: issues, innovations and results

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As in many developing countries, lack of reliable data and grossly inadequate appreciation and use of available information in planning and management of health services were two main weaknesses of the health information systems in Malawi. Malawi began strengthening its health management information system with an analysis of the strengths and weaknesses of existing information systems, sharing findings with all stakeholders. All were agreed on the need for reformation of various, vertical programme-specific information systems into a comprehensive, integrated, decentralized and action-oriented simple system. As a first step towards conceptualization and design of the system, a minimum set of indicators was identified and a strategy was formulated for establishing a system in the country. The design focused only on the use of information in planning, management and the improvement of quality and coverage of services. All health and support personnel were trained, employing a training of trainers cascade approach. Information management and use was incorporated into the pre-service training curriculum and the job description of all health workers and support personnel. Quarterly feedback, supportive supervision visits and annual reviews were institutionalized. Civil society organizations were involved in monitoring coverage of health services at local levels. A mid-term review of the achievements of the health information system judged it to be one of the best in Africa. For the first time in Malawi, the health sector has information by facility by month. Yet very little improvement has been noted in use of information in rationalizing decisions. The conclusion is that, no matter how good the design of an information system, it will not be effective unless there is internal desire, dedication and commitment of leadership to have an effective and efficient health service management system.

Key words: health management information system, health information management, Malawi

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Introduction

Information systems are increasingly important for measuring and improving the quality and coverage of health services (Campbell 1997; Lippeveld et al. 2000). The global shift from curative to preventive care, from hospital care to community and public health care, from centralized to decentralized health care, from a specific project approach to a comprehensive sectoral approach, has necessitated the restructuring of fragmented health information systems into single comprehensive health and management information systems. The restructuring of health information systems has become an important trend in the entire developing world since the adoption of primary health care as a global strategy for achieving the 'health for all' goals (Campbell 1997). Ever since, the restructuring or strengthening of information systems has been a learning process. A standard package that could be adapted to all situations has not yet been discovered. Hundreds of academics and practitioners are continuously contributing to the better understanding of the design and role of health information systems. Pioneering countries started with trial and error, and the countries starting at a later stage are benefiting from the lessons learned by their predecessors. Malawi has followed the global trend. The fourth 5-year (1999–2004) National Health Plan of Malawi puts emphasis on health sector reform, including the restructuring of health information systems (MOHP 1999a).

Malawi is a landlocked country situated in southeast Africa. The population is approximately 11 million with a growth rate of 2% per annum (World Bank 1999). The fertility rate is estimated at 3.9 (NSO 2001), which is mainly attributed to early marriages, early first pregnancies, relatively closely spaced births, and low contraceptive prevalence rates. Almost half of the population is under 15 years of age. Malawi is currently one of the poorest countries in the world, with per capita income estimated at US$170 in 2000 (World Bank 2002). According to the

National Health Accounts for 1998/99, the total health expenditure was roughly US$12.4 per capita, of which government accounted for only 25%, and donors for around 30% (MOHP 2001).

Malawi's health indicators are among the worst in the world. Life expectancy at birth stood at 37.3 and 38.4 years for males and females, respectively, in 1999. The infant mortality rate is 104 per 1000 live births (NSO 2001); the under-five mortality rate is 189 per 1000 live births. The maternal mortality rate is estimated at 1120 per 100 000 live births (NSO 2001). Statistics indicate that 70% of mortality among inpatients is due to communicable and other preventable diseases. Fatalities among the under-fives are mostly due to malnutrition, anaemia, pneumonia and diarrhoeal diseases. Maternal mortality rates are pushed up by poor access to essential obstetric services and the poor quality of these services. AIDS is now the leading cause of death in the most productive age group (15–49 years) and AIDS-related illnesses account for over 70% of all inpatient admissions.

Though health services are delivered through basic health service units in an integrated way, each service is administered vertically at headquarters, with very little coordination between the programmes. Health services are organized through a complex network of government, Christian Health Association of Malawi (CHAM) and several other providers. Health facilities are formally categorized into central hospital, district hospital, sub-district hospital, community hospital, health centre, dispensary and maternity unit. They can be further categorized into 20 or more groups based on the type and level of services they render.

Until 1999, the systems used to gather information for the management of health services were too many and uncoordinated. Most were not able to produce the information required for management decision-making (MOHP 1999a). Data were of poor quality and rarely used in planning and management of health services. Collection of data for performance monitoring and evaluation was not a priority in the districts (MOHP 1999a). Information related to diseases, vital statistics, maternal, child and reproductive health indicators, and tracking of financial resource allocations was neither systematized nor easily accessible for proactive analysis or planning purposes (MOHP 1999a). Various national vertical programmes imposed their unilateral data requirements upon frontline staff, resulting in duplication and wastage of time and resources (MOHP 1999a,b). The backlog of health facilities' raw data directly reported to headquarters but not captured or analyzed was enormous (MOHP 1999a,b).

The purpose of this paper is to describe how a comprehensive health information system has been designed and implemented in Malawi, taking into account the complex design of health service delivery systems, the health status of the people, the economic status of the country, major health problems and immediate and long-term plans and programmes of the health sector, as well as the lessons drawn from, among others, Campbell et al. (1996), Cibulskis et al. (2002), Heeks (1999, 2002), Husein et al. (1993), Indrayan (1995), Lippeveld et al. (2000), Opit (1987), Sandiford et al. (1992), Veney et al. (1984), Wilson (1984) and the World Health Organization (1989, 1999). A number of innovative elements were included in the design. This paper attempts to discuss each innovation and considers the degree to which each contributed to success in resolving the targeted issues.

System design and establishment process

The process of restructuring the health information systems in Malawi began in September 1999, with an analysis of the strengths and weaknesses of the existing information systems. The findings were presented in a workshop attended by many stakeholders. There was agreement regarding the need to establish a comprehensive system capable of feeding information to the users at community, health facility, district and national levels. The design process started with identification of minimum indicators, datasets and a 5-year strategy for strengthening the routine health management information system (HMIS). Consensus on indicators led to revision of the tools for data collection, processing and reporting. The revised procedures manual was tested in phases over 18 months, starting from three health facilities and progressing to an entire district and a tertiary care facility. The testing focused not only on data collection and processing but also on the use of information in routine management at local and district levels.

Soon after a consensus had been reached on indicators, and while waiting for newly devised comprehensive tools and guidelines, District Health Management Team (DHMT) members from all districts were given training. They were provided with tools and skills to utilize existing data in calculating indicators and using them in planning and management of health services at district and periphery. In this way, the revision and testing of tools and the maximization of use of available information began simultaneously. All health workers were oriented on information management and use. The orientation was completed within 6 months using a cascade-training approach in which a group of trainers was prepared for each district and each central hospital. These in turn trained other health personnel within their jurisdiction. The system was put into effect in the entire country from 1 January 2002. The newly devised HMIS tools and procedures were included in the curricula of all pre-service health training programmes. Information management and use functions were added in the job description of all health and support personnel.

A pattern of regular meetings and reporting was instituted. This included a monthly meeting at health facility level, quarterly reporting to district and from district to headquarters, quarterly feedback from headquarters to district and district to facility. A regular

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pattern of quarterly management meetings and annual performance review meetings at facility, district and national level was established. A health information policy, an indicators handbook, routine monitoring and guidelines for an annual health sector joint review were developed.

The steps and the process followed in designing and implementing the system have been summarized in Figure 1. It should be noted that the process of implementing the information system is designed to offer follow-up and support until such time as the collection, analysis and use of information becomes fully accepted as part of the culture in the entire health sector.

The information reformation process started simultaneously with several health sector reform initiatives: decentralization of the management of health services to local government, hospital autonomy and the development of a Sector Wide Approach (SWAp). The overall health sector reform process has been slower than the establishment of the new information system. The environment resulting from health sector reform was expected to be conducive to optimum utilization of information in rationalizing the decisions regarding planning and management of health services. This has not, however, been fully realized.

The government-led health information reform process is fully supported by most development partners including the Government of the Netherlands, the UK Department for International Development (DFID), United Nations Population Fund (UNFPA), United Nations Children's Fund (UNICEF), US Agency for International Development (USAID), Norwegian Agency for Development Cooperation (NORAD), Japan International Cooperation Agency (JICA), European Union (EU), World Bank, Canadian International Development Agency (CIDA), World Health Organization (WHO) and others. It has been viewed as an ideal example of collaboration.

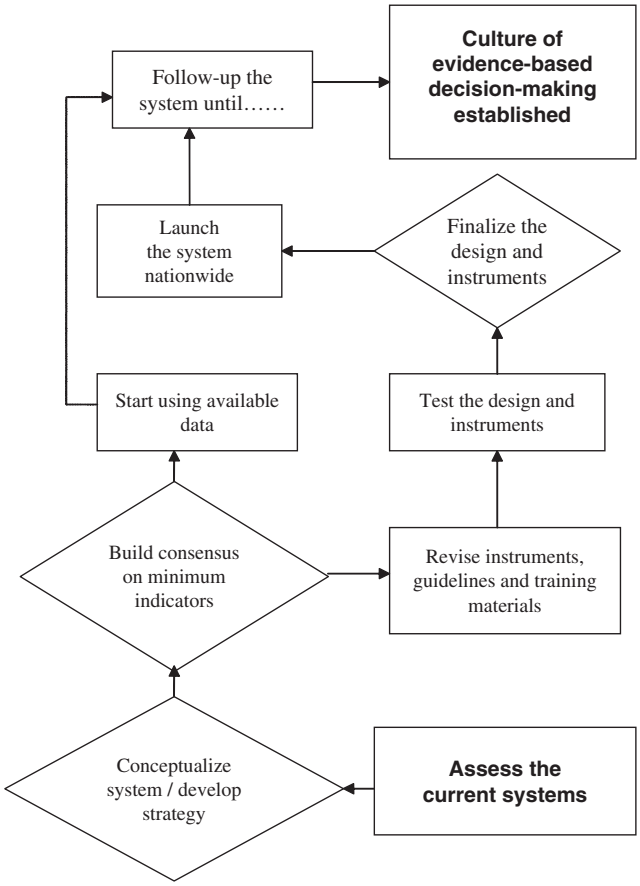


Figure 1. The process through which the health management information system evolved in Malawi. *Source*: Chaulagai et al. (2001).

Tools devised in order to improve management and use of information

In designing the tools, the aim was to optimize the quality of individual care, attain uniform coverage of health services in the communities, and improve the health status of people in the catchment areas. The tools devised can be grouped into four categories: (1) client health booklets (health passports); (2) facility-based registers; (3) data aggregation and monitoring workbook; and (4) annual planning and review tools.

Client health booklets

Three client health booklets (child, woman and general) were introduced to improve the quality of personal health care. All booklets contain records of the medical history of the individual, assessment of current problems and types of care given. The child health booklet is issued at birth. It contains specific information on immunization, vitamin A and growth monitoring. For a boy, the same booklet can be used for his entire life. The general health booklet can be annexed to the child health booklet for continuous recording of assessment and care. A girl, however, is given a woman's health booklet when she reaches puberty. The woman's health booklet contains specific information on tetanus toxoid injection, family planning services, antenatal check-ups, obstetric history and postnatal services, as well as her general history. These booklets are sold at cost to ensure re-supply of booklets without adding a burden to the already stretched government's financial resources.

Facility-based registers

Registers are designed to collect data on predefined minimum datasets and indicators. Additionally, each record includes data on four dimensions: age, sex, time and place. At the end of each day, data are aggregated on key elements for quick identification of any unusual situation. This is how occurrence of a notifiable disease is identified, proper and adequate preparations made, and appropriate actions taken in a timely manner.

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Data aggregation and monitoring workbook

A simple poster-sized wall chart has been introduced at facility level to aggregate data and monitor indicators. The quarterly report is prepared by transcribing data from the wall chart. The workbook contains data on current status, year-end targets, quarterly targets and achievements.

Annual planning and review tools

Districts prepare their annual district implementation plan (DIP). The DIP process follows the steps of situation analysis, prioritization, resource allocation and target setting. Standard forms have been introduced to show baseline values, year-end and monthly targets so that the performance level is monitored and necessary actions are taken on time in order to ensure achievement of end targets.

The results of the HMIS restructuring process

A comprehensive but simple and manageable HMIS was introduced in the country in January 2002. For the first time the country has continuous monthly data (see Figure 2) on all agreed indicators for each facility, district (see Figure 3) and the nation. It is also the first time that each public health facility and district health office knows the catchment area and population to be served. The defined catchment area and population has enabled each facility to monitor coverage, organize outreach clinics and plan community health development activities together with the respective communities. By defining catchment area, the accountability of each facility towards the communities it serves has become clearer. The catchment area maps, showing the essential features that affect the health of the people, compel managers to think about the equity in distribution of health resources and universal access to basic minimum health services.

Providers and clients both agree that quality of care is much better when a client health booklet is consistently used. Duly completed wall charts enable health workers and other users to understand the magnitude of health problems, health services utilization rates and their subsequent results. Wall charts and health passport booklets are contributing to enhance the understanding of health by individual and society. The comparative figures provided in quarterly reports generated at district and national levels provide a basis for self-evaluation by facilities and district health offices. Each district or facility can rank its performance by making comparisons with other districts or facilities. The mid-term evaluation report qualifies the achievement of a newly implemented system as 'unprecedented in other countries' (Bijlmakers et al. 2002). However, the results are a mixture of some successes and some failures. The various achievements and a critical reflection on each are presented below.

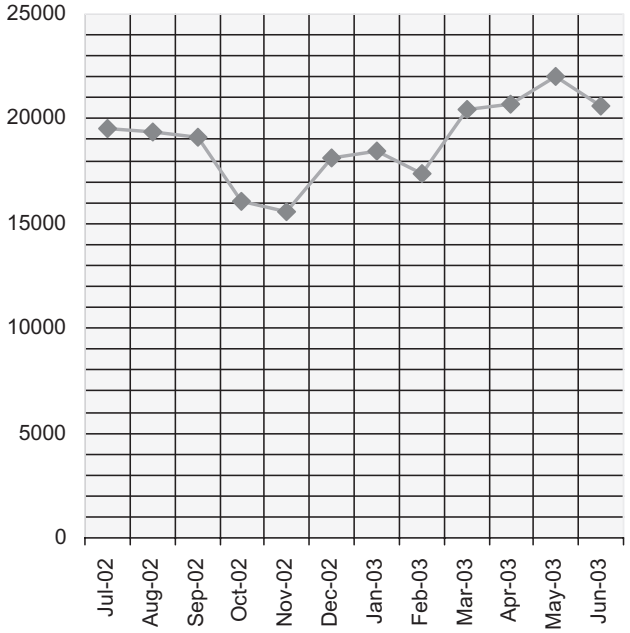


Figure 2. Number of deliveries attended by trained health personnel by month, Malawi, 2002–2003. *Source*: MOHP (2003b).

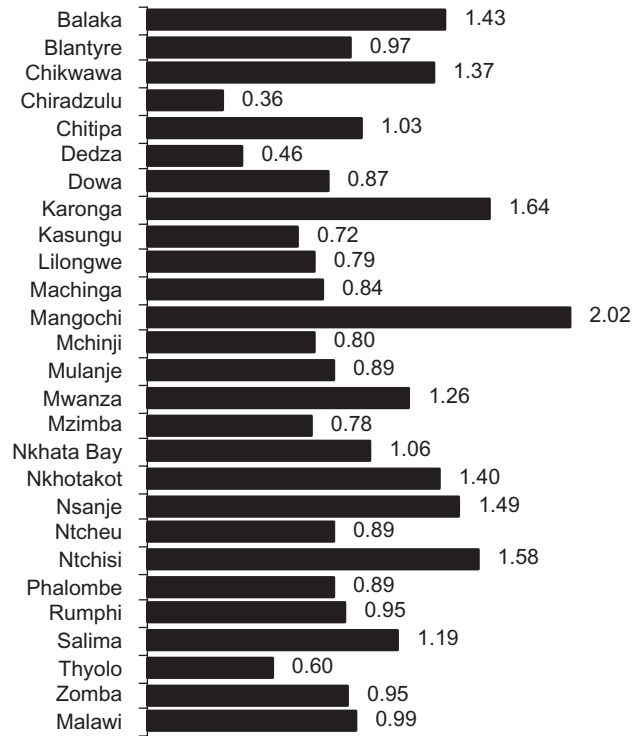
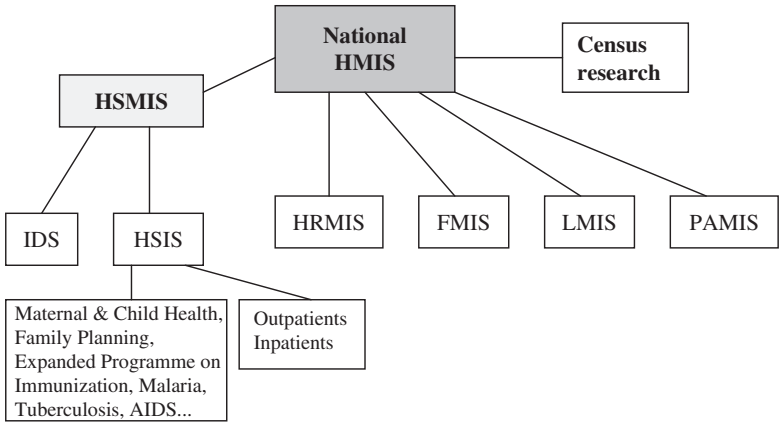


Figure 3. Outpatient department visits per capita by district, Malawi, 2002–2003. *Source*: MOHP (2003b).

Consensus on minimum indicators

The first step in the design process was to assess the need and agree on minimum indicators and datasets. Despite the fact that no programme was making adequate use of available information, each wanted to include all

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Abbreviations:
HMIS = Health management information system
HSMIS = Health services management information system
HRMIS = Human resource management information system
FMIS = Financial management information system
LMIS = Logistics management information system
PAMIS = Physical assets management information system
IDS = Integrated disease surveillance
HSIS = Health services information system

Figure 4. Integration model of the national health management information system

possible pieces of information in the routine data collection system. As experienced in Uganda (Gladwin et al. 2003), some donors keep on bringing new demands to meet their headquarters' interest rather than supporting the Ministry of Health and Population (MOHP) to implement its agreed strategy. As most stakeholders eventually extended their full cooperation, the MOHP eventually could officially endorse a limited set of core health sector indicators.

Integration of different information systems

Experiences reveal that the HMIS can never be fully integrated into a single entity in any setting. Therefore, logically grouped, a number of sub-systems have been identified as interdependent components of the national HMIS (Figure 4). They are: (a) the financial management information system (FMIS), (b) human resource management information system (HRMIS), (c) logistic and supply management information system (LMIS), (d) physical assets management information system (PAMIS), and (e) integrated health services management information system (HSMIS). The integrated health services management information system is at the core of this structure and derives information from all other sub-systems to serve as a comprehensive health and management information system. Malawi has fully integrated all service-related information systems and the disease surveillance system into a single entity of a health services management information system. The programme-specific logistics and supply components have been integrated into a broader logistics management information system. Besides the routine sub-systems, the national health information system obtains information from census, surveys and other research studies, and collects additional, less frequently required data on an ad-hoc basis through rapid assessment. The national HMIS is ultimately responsible for coordinating all data collection functions, compiling data from all sources, storing it in appropriate formats and disseminating the data in different ready-to-use formats to meet the requirements of different users.

Information management and use at the district and facility levels

Designing the system, developing tools and defining minimum datasets are centrally controlled in order to have nationally comparable data. Nonetheless, local analysis and local use is the primary purpose of collecting information. The health passport, service specific registers, data aggregation and monitoring tools, integrated supervision checklist and district implementation planning format are designed for the immediate use of information at the point of collection. Despite emphasis on maximizing the use at local levels, the traditional thinking of collecting data only for reporting purposes is still deeply rooted in the system. Some facilities still consider the submission of reports as the ultimate aim of the information system. Efforts are being made to encourage participation of civil society organizations in planning and monitoring of health services at local and district level. Routine community surveillance findings are shared with village health committees, while the quarterly performance reports of health facilities and districts are shared with heath facility committees and district assemblies.

Institutional set-up

The same people who manage and deliver services collect the routine data related to their own work performance.

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Accountants compile financial information; personnel administrators compile human resource information; service providers compile services- and disease-related information. The philosophy behind the design of the current system is that the people who provide services compile information and they are its first users.

However, storage, interpretation and dissemination to different users in different ready-to-use formats is done from a single point at each level. To provide comprehensive information from one point at district and national levels was not possible without having a separate set-up. A new post for a statistician was created for each district health office and central hospital to assist with computerized data processing at that level. To take up the revised role of the information system, a Health Management Information Unit was established in the ministry headquarters with a number of senior staff members who are trained in public health and epidemiology. This unit is charged with the responsibility of coordinating information collection functions; compiling complete health information from internal, external, primary and secondary sources; analyzing, interpreting and storing information in appropriate formats; generating reports in different ready-to-use formats; and disseminating information to all relevant stakeholders.

Pre-service training curriculum and job description of all health and support personnel

Revision of the academic training curriculum and of job descriptions were the main efforts towards creating a foundation for an information culture among health personnel right from the outset of their career in the health sector. Under the leadership of the Nursing and Midwives Council and Medical Council of Malawi, all training institutions participated in curriculum revision exercises and a subsequent training of trainers programme. This exercise itself was a remarkable achievement. Job descriptions of all health and support personnel were revised jointly by the MOHP and Department of Human Resources in the light of newly envisaged functions of information collection and use.

Interface between paper and computer

The overall design of the system is paper-based. Each provider records, compiles, analyzes and makes use of information in day-to-day functions. Managing and using information related to his/her job is the function of every health and support staff member. When the system was first started, programme-specific coordinators at the district health offices were made responsible for compiling data specific to their department and carrying out routine monitoring functions. This was an advantage of the system as the concerned people get informed about the performance of a facility when the report arrives. The only disadvantage was the time it consumes to get the same report to all desks within a certain period. Sometimes it was difficult to trace the whereabouts of a report. Furthermore, manually transcribing data was an unnecessarily time-consuming task and manual compilation was error prone.

A computer programme developed in South Africa for such data processing was adapted for Malawi. The introduction of this programme expedited data processing; however, this was at the cost of participation of programme coordinators in the process. The introduction of the computerized data processing system made district programme coordinators passive consumers of information. The software has versatile functionalities, which have evolved over a long period. It intra/extrapolates data for a missing month, calculates reporting coverage of the population, generates a report from raw data or indicators and presents data on maps linked to the Geographical Information System (GIS). The introduction of the computer programme for routine data processing was a trade-off between participation of programme coordinators in data processing and timely availability of more reliable data to them.

Cascade approach training for the nationwide roll out of HMIS

The training for nationwide roll out of HMIS was initially planned in such a way that national trainers would conduct all the training in batches from district to district. However, because of insufficient cooperation from the national vertical programmes in allocating qualified persons for nationwide training, a cascade training-of-trainers approach was employed instead. Training teams were prepared from staff selected from the four central hospitals and 26 districts, so that they could train everybody in their respective district and central hospital. Nationwide training was completed within a period of 6 months. Supportive supervision visits were organized from headquarters during the training, and follow-up visits were made to the maximum possible number of facilities during the initial stage of implementation. Despite heavy inputs on training, little difference was observed in the performance of trained and untrained persons. In some facilities, the performance of a newly recruited person was even better than that of the person who had 5 days of training in HMIS. Analysis of the quality of collected data, quality of analysis and format used in dissemination showed that people could perform much better with 2 half-day practice-based training sessions, than their colleagues with 5 days training in a classroom setting.

Data quality

Routinely collected facility-based data has known limitations. It does not capture all the cases that exist in a community. Nevertheless, it can inform precisely about the people who have visited health facilities for consultation and health services. Completeness of facility-based routine data remains a big problem in Malawi. Data are incomplete in several ways. A number of facilities are not sending reports at all. Some other facilities are not sending reports regularly. The facilities regularly sending reports

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are nevertheless not reporting data on each element every month. The facilities that are sending reports regularly on each data element are still failing to capture all the records. Thus, an indicator value generated from routine data is always lower than actual and therefore each report needs adjustment for under-reporting.

Definitions of cases and of each data element are available at each desk nationwide but are not used consistently. Consequently, incorrect diagnosis, wrong coding and entry of wrong fields are commonly observed problems. Once the data are compiled, facilities generally do not revisit the figures. Those problems were gradually minimized through systematic data verification and feedback on flaws and inconsistencies.

Criteria for making diagnoses at primary and tertiary levels are not the same. Lay case definitions and the syndromic approach are used where there is no diagnostic facility. This is an absolutely necessary arrangement where services are organized in tiers of primary, secondary and tertiary levels. To come up with a clearer and more precise picture on major diseases, cases diagnosed at primary, secondary and tertiary care facilities should be disaggregated. As an example, the HMIS reported 16 000 new tuberculosis cases, whereas there were only 8000 confirmed sputum-positive cases. By disaggregating the data by level of care, the true picture could be revealed.

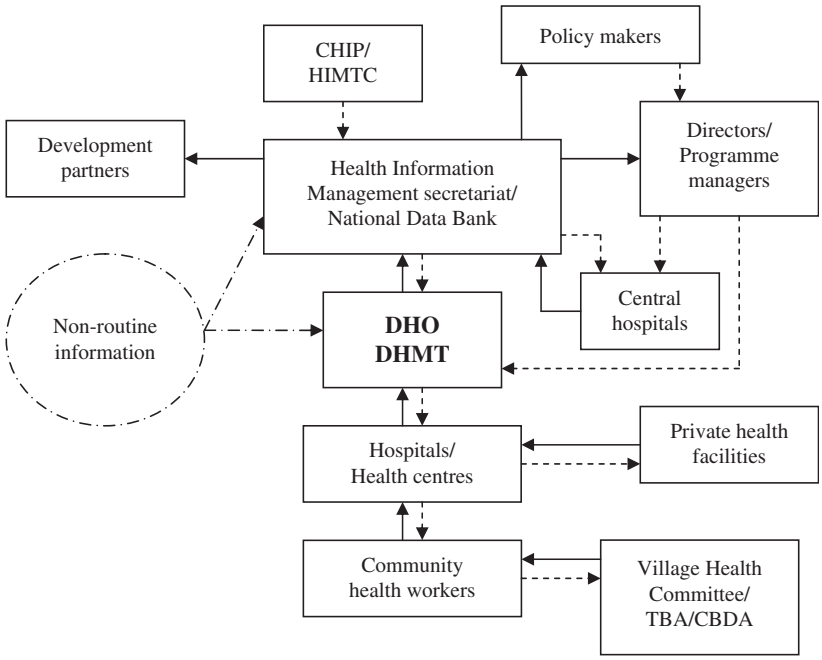
Timeliness of compilation, analysis and dissemination of information

Most routine data are collected for immediate actions. The routine information system requires daily compilation of data on key elements and immediate reporting of notifiable cases. Health facilities are required to update their monthly wall chart and constantly review disease and service coverage trends. Despite consistent follow-ups and reminders, such practice has been established as a discipline in barely 50% of health facilities.

Information dissemination

Information flows throughout the health system network as shown in Figure 5. Feedback on each report is considered to be as essential as submitting a report.

Information is regularly disseminated through wall charts, quarterly bulletins, quarterly and annual review meetings, annual review reports and thematic maps. For the benefit of external stakeholders, information is made available on the website. As a result of disseminating the information in a variety of ways, awareness among policy makers, development partners, programme managers, health workers, civil societies, local government, communities and individual clients is on the increase. The process itself is empowering the people.



Abbreviations:
CHIP = Committee for Health Information Policy
HIMTC = Health Information Management Technical Committee
DHO = District Health Office
DHMT = District Health Management Team
TBA = Traditional Birth Attendant
CBDA = Community-Based Distribution Agent

Figure 5. Channels of information flow within the health sector. *Source*: MOHP (2003b).

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Use of information in support of health service management

The HMIS is designed to support individual patient care, health unit management and health system management functions. The practice of operating the new HMIS has resulted in improvements in knowledge about the current health and management situation and use of such knowledge in routine management decisions. Some good examples of use are as follows:

Preparation of the district implementation plan (DIP)

The new HMIS in Malawi has contributed to a shift in the DIP preparation process and the content of the plan. The planning exercise begins with a review of the previous year's performance and establishing a baseline value for the current year, leading to priority and target setting. In principle, the DIPs are now evidence-based. Yet, most DIPs are vague and it is therefore difficult to track implementation status and results. A special computer programme is being used for costing and monitoring the DIP. By using this computerized programme, different components of the plan can easily be linked and monitored. However, as one person can feed the necessary data to the computer programme, it undermines the importance of the involvement of the entire team for planning and monitoring of health services.

Allocation of financial resources

There is a shift towards rational allocation of resources. Resources are now allocated to the districts using a number of criteria, including population size, magnitude of health problems, poverty status and some composite performance indicators. The composition of performance indicators is expected to be different every year in order to prevent distortion from the emphasis on inputs given to particular programmes at the cost of other programmes not included in the composite indicator.

Recently, a few donors have started directly topping up the district quarterly Other Recurrent Transactions (ORT) budget in order to optimize coverage and quality of services. The timely submission of the routine HMIS report to headquarters has been set as a single condition in order for the district to continue to receive the top-up quarterly budget. As 100% timely reporting is achieved, coverage and quality of performance on some indicators will be added as preconditions for acquiring the quarterly top-up. Thus, the financial incentives to the districts are directly linked to better management.

Priority supervision

A system has been established to carry out integrated and comprehensive quarterly supervision visits from sub-national to district and from district to health facility levels. Additional supervision visits are carried out based on reported performance status. Although there are some improvements in planning and management practices as stated above, the use of information is still grossly inadequate.

Reasons for inadequate use or non-use of information

If information is relevant, reliable and available for decision-makers, it can influence decisions but may not necessarily do so. There are a number of factors that foster or impede the use of information in decision-making. The reasons for non-use and under-use of information in Malawi are discussed below.

Accountability

Those responsible for holding public servants accountable do not have the skills to access information systems and interpret results. They need skills and motivation to hold public servants accountable. Similarly, senior managers within the organization are not prepared to hold juniors accountable for their performance. Nor are managers themselves serious about their managerial and financial accountability. This is not only due to lack of a system that takes disciplinary actions against poor performance or corruption, but also due to lack of management knowledge and skills.

Resource constraints

Health facilities, where problems are encountered on a daily basis and immediate actions are required, do not have the resources needed to address the problems. Knowledge alone without means can do very little at this level. Similarly, the inadequate supply of human resources is a major constraint for improving the quality of information, its use and the overall management of health services. In most health facilities, less than 50% of positions of nurses, doctors, clinicians and technicians are filled.

Leadership

Advocacy and leadership are needed to put a problem on the agenda and to influence and lobby for decisions. HMIS people must feel responsible for the use of information. They need to become information promoters and lobbyists, interested in and committed to fostering change through information (Lippeveld et al. 2000). Their role is not limited to providing relevant and understandable information to decision-makers and those influencing them, but also involves engaging in continuous dialogue with them. Unfortunately, the status of HMIS personnel at district, central hospital and the ministry headquarters is very low compared with the responsibilities that these officers should assume.

Lack of holistic vision/approach

The health sector still lacks the discipline of system thinking, shared vision and a team approach. Directors and programme managers at headquarters operate their

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programmes too much in isolation. Administrative responsibilities of human resources employed for running a health centre fall under different departments at headquarters, which have different mandates. This practice is a barrier against developing holistic vision and a team approach. Data people and health people often have different vocabularies. The level of teamwork and communication between them is almost zero.

Punitive environment

Motivation cannot be imposed. It has to come from inside, for which a conducive environment has to be created. The environment in the Malawi government system is a punitive, not an encouraging one. A renowned minister, while addressing the DHMT members at a national workshop, said, ''You all are thieves – you are stealing medicine and other supplies from government stores''. Actually, the minister knew the corrupt people by name and they were only few in number. Apart from this general accusation, no action was ever taken against the corrupt staff.

Lack of management training, skills and personality

Surprisingly, more than 90% of the health workforces are young people. A medical doctor who has just left medical college and joined government service may by default become the leader of the DHMT. Though the doctors are provided some training before they assume the team leader's position, they can potentially be dominated or manipulated by other senior DHMT members.

There are too many short training events related to management in a piece-meal way, but none is comprehensive. There is hardly a manager in the entire system who has adequate management knowledge and skills to perform his or her duty. There is a dearth of skills and competence in the use of data for decision-making and prioritizing. This issue can be resolved by implementing the proposals made in SWAp plans.

Incentives and disincentives

When the incentive to perform and to monitor quality is low, the use of information can be expected to be equally low. A system of paying an annual premium for reaching specific targets could promote the use of information. Budgetary/resource incentives could be offered, as well as non-monetary incentives such as institutional rewards, personal rewards, increased credibility, respect and prestige. No such practice prevails in the government system. Some donors tried hard to institute a reward and punishment system, but without success.

Inadequate dissemination

The social and political dimensions of any decision-making process are critical. Decision-making steps are influenced by socio-political pressure groups such as political parties, media and religious groups. Information can influence decisions only if it is made available to them. Several players never receive reports, or else do not receive the information in a manner sufficiently customized to meet their needs.

Organizational and behaviour change strategies

Changing the information process implies changing the operational process of an organization. Generally, the purpose of health sector reform is to increase efficiency, to transfer decision-making to lower levels, to make public sector staff more accountable for their decisions and actions, and to increase the effective use of human, financial and other resources. The newly designed information system is part of the reform process. The creation of new information systems is an essential component in the creation of accountability. Ironically, the operational pattern of the health sector has not yet changed.

Selecting targeted opportunities for strengthening HMIS under favourable conditions for sustainability

There is no quick-fix method for strengthening an information system. As shown in Figure 1, several years of follow-up was envisaged to fully achieve an information culture in the health sector. The results discussed in this assessment were observed over a period of 4 years only. This is not an adequate period to say whether the system has been successful or not. It still has the potential to be fully successful, or to be a failure, depending upon the commitment of the stakeholders and willingness of leadership to make it succeed.

Conclusion

Taking full advantage of lessons learned by pioneers around the world and others who had recent experience of HMIS reform, Malawi conceptualized, designed and implemented a simple, decentralized, action-oriented HMIS. Though the achievements made in 4 years are quite remarkable, the main aim of optimizing data quality and use have not yet been fully achieved. The support for further strengthening must be continued until a culture of information is created in the entire health sector.

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