Improving health care services through enhanced Health Information System: Human capacity development Model

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Abstract

Background: Quality of health care depends on how the health system is able to reduce errors through evidence-based decisions. Demand for data on patient care has increased over the years to improve the health care system, including planning and policy issues in several countries across the globe. However, there are challenges and opportunities in the process of recording, managing, analyzing, interpreting, and reporting data and/or information. Accordingly, several studies showed that an appropriate capacity development program is expected to improve data recording, data quality and use by professionals, planners, policymakers, and stakeholders.

Objective: This project aims to assess existing capacity-building efforts and formulate a new and better capacity-building model for the lower-level health facility staff of Addis ababa City administration, 2018-2020.

Methods: PRISM and SWOT analysis method were employed to assess existing HIS gaps and opportunities. The assessment was carried out in the health centers located in selected three sub-cities of Addis Ababa City Administration. We employed phase to phase approach to design an innovative human capacity development model, namely, desk review, data collection, data synthesis, design, and validation.

Results: The project designed interventions that were implemented simultaneously and one supporting the other. The capacity-building model includes a renewed approach to training; structured mentorship approach; practically oriented supportive supervision; 'experience sharing program' for helping those in a poor environment gain experience through experience sharing; quality improvement initiatives; and implementation science studies to tackle problems that may not be solved with activities listed earlier.

Conclusion and recommendation: The new capacity-building approach helped to improve individual knowledge, interpersonal relationship, strategic thinking, system management, and accountability, all of which lead to sustained and improved HIS. Improvement in HIS is often a collective effort of several forces, but the human element plays a decisive role. [*Ethiop. J. Health Dev.* 2021; 35(SI-1):42-49]

Keywords: Human Capacity Development Model, Health Information Systems, Quality of health care, data quality, Information use

Introduction

The health system sector of Ethiopia is guided by a 20-year health sector development strategy which is aligned with international commitments and implemented through a series of five-year health sector development program (HSDP)(1). The sector already prepared Growth and Transformation Plan one (2021/13–2025/17). The growing demand for information both in magnitude and the type of information needed in the health sector has increased tremendously over the years. There are several reasons for such increased demand: expansion of the health system, the advancement of health care diagnosis and treatment, rapid transition of diseases epidemiology and information technology planning at a different level of health sector management and administration, the steadily growing need for improving health care, and the growing call for estimating health sector revenue properly and for health-related policy issues (2,3). Over the last four years or so, the Federal Ministry of Health (FMoH) has been engaged in a strategic planning exercise to work out how the development of the Ethiopian primary health care system will ensure high quality, equitable, sustainable, adaptive, and efficient health services in the long-term to meet the health needs of the growing population both in magnitude and profile (2,3).

There are inevitable challenges and opportunities in this exercise. The challenges include poor infrastructure; low capacity in the data generation, management, and analysis, which leads to poor data quality and use; and donor-dependent funding which sometimes hit the ceiling where illusive improvement is registered and sometimes come down to the floor where personnel and mangers seem to re-treat from activities that have been started in 'good days'(3,4). There are also opportunities which should be seen as a driving force for the improvement of HIS: the advancement of information and communication technology (ICT), availability of funding, availability of universities with masters and Ph.D. degrees in HIS related fields, and political will to change the current trend in health information management and use.

It is believed that the capacity building of health professionals is the way to improve data quality, data management, data analysis, and information use. The capacity-building initiatives run by the FMoH, regional health bureaus, or projects often follow the usual ways of pick-a- sellable title, organize training sections, invite resource persons, and conduct training in the traditional way. Often pieces of training are organized and offered with little or no practical exercise mainly because things are done without proper planning and in hurry. Practical application/implementation of the training is left to the discretion of the trainees without proper follow up or augmenting such training with other complementary strategies. This paper thus attempts to provide a strategic approach, which was tested by the Capacity Building and Mentorship Project (CBMP), to the human capacity development program in the health information management and use. It can be adopted by FMoH or other stakeholders for future human resources development plan.

The term "Capacity development" may mean different things to different people; some people in technical areas may take it as training or teaching someone to do something new to him/her; others may think training someone to improve activities already being done; for

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politicians or social activists, it may mean individual right or freedom. UNDP Capacity Development document iterates that *"there is now emerging agreement in the development community that capacity development is the engine of human development".* The document goes on to state that, "……. *people are best empowered to realize their full potential when the means of development are sustainable*"(5).

The current motto of UNDP is 'Developing countries should own, design, direct, implement and sustain the process themselves'. This motto focuses on empowering and strengthening local/indigenous capabilities. UNDP finds three platforms for the capacity to grow and nurtured, namely, an enabling environment, organizations, and individuals (5). The capacity development plan discussed in this manuscript is based on the last two platforms.

The World Health Organization (WHO) has developed a "Human Capacity-Building Plan" that proposes a set of unprecedented steps by which WHO, together with partners, will help countries to develop and sustain the workforce necessary to achieve 3 by 5 goals . It addresses five critical elements for building and sustaining human capacity at the country level (6). The United Nations Research Institute for Social Development defines capacity as the ability "to perform functions, solve problems, and set and achieve objectives." Here are three types of capacity in the health sector: clinical, management, and monitoring. MEASURE Evaluation studied capacity building interventions in the Health Information System under Action for a stronger health system. They identified studies used for capacity building as part of a strategy to (a) improve human capacity to manage HIS, resources, and staff; (b) improvethe methods, tools, and approaches that are meant to address health information challenges and gaps; or (c) strengthen the capacity for data collection, analysis, and use of routine health data (7,8).

Dickson et al. identified several capacity-related bottlenecks (9). Some examples include "weak staff capacity for data management and use"; "absence of or weak supervisory, mentoring, and monitoring systems in health facilities;" and "shortages of staff, poor deployment, and biased distribution between urban and rural areas" (9). But they did not consider weakness in data collection and data quality.

Interventions mentioned in the literature and commonly applied for individual capacity building programs include training (both in-service and pre-service), mentorship, and supervised practice. Data for Decision Making (DDM) project of a comprehensive package of interventions in Bolivia, Cameroon, Mexico, and the Philippines had three main objectives to enhance capacity: (a) to identify data needs and appropriate use for public health decisions; (b) to enhance quality data for decision-makers; and (c) to facilitate the collection, analysis, reporting, and presentation of data at all levels. Implementers conducted an assessment to identify problems, gaps and desired data-use outcomes (10).

The leadership and management capacity-building intervention, aimed to raise skills of participants, in Kenya was found to have contributed to improved service delivery, including improvements in the number of fully immunized children under one-year-old, women who delivered with a skilled birth attendant, and pregnant women who had four or more antenatal care visits (11). Capacity-building strategies used by MEASURE Evaluation include coaching and supportive supervision, provision of technical assistance to the HIS staff, and training (7,8).

The literature review shows that capacity building initiatives generally depend on the traditional type of training, mentorship, supportive supervision, and coaching, implemented usually as a stand-alone program.

Problem statement

The FMoH is vigorously working to improve HIS across the health tier of the country, starting from the lowest level (health centers) all the way up to the directorate levels of the ministry. The ministry is supporting universities on HIS initiatives with the spirit of solving the problem of data use and quality in a team approach rather than depending solely on its effort(3). The major goals of the Information Revolution targeted by the ministry are: to create a culture of data use to enhance evidence-based decision making, improve the tradition of data management and analysis, enhance data quality, and above all establish architecture to strengthen integration, standardization, and harmonization among priority data sources(2,3). This requires tackling the problem of data generation, analysis, quality, and use from a different perspectives. It is therefore important to document the capacity building model on HIS in the course of implementing capacity building plans envisaged by the CBMP project. The CBMP is a project funded by the FMoH and implemented by six universities to strengthen HIS in the health facilities of selected regions.

The capacity building tradition both in the ministry and health bureaus is not well planned, not well coordinated, haphazardly provided, and different stakeholders with different interests are engaged. This occurred mainly because training is offered when funding is available. Often training is offered by projects that have training as their objective without establishing if the trainings are needed by the ministry and health bureaus. As a result, capacity-building efforts at the ministry or health bureaus are not sustainable and balanced. To the best of our knowledge, there is no standardized approach in capacity building that can serve as a model or gold standard for the nation to follow. If there were such standards, it would have been possible to maintain capacity building efforts even in the time when no sufficient funding is available. This paper therefore will try to address this gap using documented information regarding capacity building efforts during the CBMP lifetime.

Materials and Methods

Study area and Design: To help design the new model, PRISM (14) and SWOT analysis method were employed to assess existing HIS Gaps and opportunities.

The assessment was carried out in three sub-cities in Addis Ababa City Administration from 2018 to 2020. All primary health care units, general, referral, and specialized hospitals under the selected sub-cities were included in the assessment.

We employed phase to phase approach to design an innovative human capacity development model, namely, desk review, data collection, data synthesis, design, and validation.

Desk Review

The project team held a consultative workshop and reviewed all relevant documents such as HSTP; Information transformation agenda; and connected woreda manuals, guidelines, and research outputs using literature review logbook. Following the review result and consultative workshop input, study team designed a structured questionnaire, semi-structured guides and checklists.

Data collection phase

Quantitative and qualitative data collection was conducted. Intensive discussion held with HIS actors including the health facilities manager, health worker, HIS focal person, and partner working in the area of HIS on existing challenges, opportunities, and way forwards (14).

Synthesis and design phase

In this phase, intensive synthesis of key findings was carried out based on information obtained from various sources. Identified gaps and its root cause described using prioritized settings. Accordingly, the human capacity development model was designed.

Validation

The designed model was presented in a validation workshop to obtain comments, feedback, and other inputs. Based on the comments and feedback the model finalized, approved, and being implemented in project target areas.

Gaps were observed on the knowledge and skill of health professionals in generating, managing, analyzing, and using health and health-related data. Lack of practically oriented and coherent training strategy not only affected the understanding of employees but also resulted in poor data completeness, timeliness, and accuracy. Therefore, a structured training strategy was taken as a way out. From experience, providing training and abandoning trainees afterward did not pay off. Therefore, close follow up and provision of support afterward is necessary once the staff is trained on the tools. What is known as the 'Mentorship' program, was implemented to help health professionals develop skills on the site by putting what they learned in the training programs. While the staff is mentored occasionally, they were also supported by regular supportive supervision. This activity ensures whether a staff member who was trained and mentored on the listed items was indeed doing the activities as expected. Data management, data quality, and information use were the three major areas for training, mentorship, and supportive supervision.

Quality improvement strategy was also implemented along with training and mentorship activities to help participants work towards improving the quality of the health system in general. Facilities naturally differ in their absorption capacity and length of services; hence one may learn from others if opportunity opened up. Thus, experience sharing schemes were also used as a means to strengthen the capacity-building effort.

We thought that after injecting all these inputs into the system, there might still be some holes that need to be filled. Implementation research was designed to be done by university staff with support from the staff of the facilities, and Capstone studies to be done by facility staff. This is expected to help them identify why some of the schemes implemented so far did not work as expected and what additional strategies need to be in place to improve data management, data quality, and information use further.

Results

During the start of the CBMP, baseline information on the present status and an existing gap was identified using PRISM assessment, SWOT analysis and desk review to help determine the path of the project implementation to solve problems. Consequently, interesting information regarding the weakness of the system has emerged: lack of basic HIS training for health facility level staff; lack of updated guideline and manuals that can help the staff; poor supportive supervision and mentorship and lack of timely feedback; the intolerable level of poor data quality; poor culture of data use, etc. The high rate of attrition of HIS staff was also reported in several sites, indicating job dissatisfaction of these staff members possibly due to lack of incentives like training, unsatisfactory working environment, and inefficientorganizational structure. Because of such attrition of staff members, most of the health workforce lack appropriate capacity and experience to perform their duties effectively hence failed to register the required level of improvement over the years.

Model of interventions

Training on HIS is not about preaching techniques of data management, data quality, and information use only; it is also about bringing cultural and behavioral changes among professionals working in the health facilities and health offices regarding these issues. The training was organized on three major problem areas: data management, data quality, and information use. The traditional approach to training has not been fruitful as much as expected in the history of the health facilities of Addis Ababa. This was found to be a problem related to the mode of instruction, level and quality of instructors, selection of trainees, and quality of materials used for the instruction. By reviewing these problems, we have devised a better approach to training: focused, personalized, practically oriented, structured, appropriate, participatory, and supported by useful training materials.

Changing the culture of generating and managing quality data; analyzing such data and converting it to information; providing well-organized data to users and

encouraging them to use it; and encouraging staff at a different levels to use the information to serve as an example for othersare challenging parts of the information revolution agenda of FMoH. The question is how best the capacity development model should have to be to address the barriers that are linked to technical, organizational, and behavioral factors. We envisaged that the major problem hindering professionals or managers from using data is simply because the data reported is rarely acceptable becuase officials reporting the data sometimes fabricate the data in order to impress their superiors as high performing personnel.. Besides, the data capturing process in healthcare determine the quality of the information produced. Data that is generated in the health facilities need to be carefully stored to describe the patient's condition. Besides individuals who are involveed in the data capturing process have a responsibility to improve data quality in healthcare. However, they are not the users of the data, and hence the data quality will not be approved at each level and the quality is compromised.

Therefore, the first step in the information use strategy should be to convince/provide managerial statistics training to heads of institutions and heads at a different levels to be conscious and sensitive about data generation, management, analysis, and reporting in the HIS. The second step is to support those generating data, managing data, and compile information to do it properly so that they gain trust from customers. If those preparing/using reports have little faith in the data, they may switch back to the old way of doing business. The capacity building process should therefore take such realities into account.

We went through several steps to overcome these problems. When the project kicked off, the major actors in the Addis Ababa Health bureau such as the deputy head of the bureau, department heads, hospital CEOs, health center heads, and other officials were invited to an orientation program where the purpose was well explained. Through presentation on data management, analysis, and reporting techniques for managers, effort was made to show them the fact that data is not being appropriately and sufficiently used at different levels and, due to this, planning and decision-making exercises are being affected. Efforts were also made to convince them how using the wrong data affects planning and policymaking efforts; during monitoring and evaluation activities it was learned that these efforts have born some fruit.

Training of trainers (TOT) was conducted with selected staff from sub-city health offices, regional health bureau and Addis Ababa University. The selected participants have good background training; have a better understanding of the use of data for planning and decision making; are relatively respected among their peers, and are believed to have some level of influence in their section on data generation, management, and use. Therefore, their role as a trainer will give them certain leverage to influence the process of training and help bring about cultural change among the participants.

We avoided generalizing topics and divided the materials into distinct sub-topics such that materials included in each section stand-alone from the other groups and trainees trained on each as a separate unit, practiced on, and assessed them. The major areas were Data Generation and Management, Data Quality, and Information Use. The following approach was used for the training.

The ToT included the following topics: basic knowledge of HIS, who is involved in the generation of health data, how and why health data is generated, how and why it is used, data and information, data quality aasurance, data management and analysis skills, validation of accuracy of data from reports, and presentation of results. The training went beyond data quality and use issues and included the following skills: facilitation, mentorship, implementation and capstone research, leadership, and conduct of supportive supervision.

Approaches to capacity building

Training

During the project implementation period, AAU has implemented competency-based training, focusing on building knowledge and skills in data generation, analysis, interpretation, and use among data users for service delivery, planning, and policy-making within the health system. The training began by providing advanced training for TOT participants selected using well-defined criteria. The participants came from University, regional health bureau, and sub-city health offices. The process was cascaded to all the sub-city health offices and health facility staff by using TOT participants.

Awareness creation was made among participants on how the process of data generation is highly challenged due to a lack of consistency in recording from physicians to the HIT team. Hence, physicians need to be briefed on how the quality of data is being affected simply because they could not report the data themselves directly using the e-health system. Data entry, cleaning, and management were demonstrated using the existing data set; how small change/problem in data affect the outcome demonstrated.

During each session, pre- and post-training knowledge of participants about the subject matter was assessed and the training evaluated at the end with checklists. During the training, participants were encouraged to prepare action plans. This has two benefits: (a) trainees will have a draft action plan which they can edit and avail for use later in their duties and (b) they will develop team spirit by working together on the training exercise, which they can use at the workplace afterwards.

Mentorship

A thirteen-page mentorship manual (called interface) was developed perhaps for the first time by CBMP, in discussion with Addis Ababa Regional Health Bureau AARHB. The manual contains various issues about the mentors, mentees, health facilities and health offices, where all entered a binding agreement regarding

conditions of services. The interface contained information on mentorship objectives, approach, roles and responsibilities of each party, duration of reporting, confidentiality, mode of communication, and frequency of meeting. This agreement has strengthened the mentorship process because of obligations entered by the parties involved.

Mentors, who took training of mentoring skills and have advanced education and experience in the city administration, were selected from the University, regional health bureau, and sub-city health offices. The regular mentorship and coaching were conducted by trained mentors every two months at health offices and health facilities. Health office-level mentorship was conducted by those mentors coming from the regional health bureau and university while that of health facilities level were done by sub-city level mentors. The sub-city health offices and facilities have been mentored using a standardized mentorship checklist prepared at the national level by CBMP. This checklist is a new contribution to the system. Problems identified and its implementation action plans prepared during the training program was also mentored during the regular mentorship program.

Supportive Supervision (SS)

SS is the process of mentoring staff to improve their work performance continuously. It is carried out in a respectful, friendly, and non-authoritarian way with a focus on using supervisory visits as an opportunity to improve skills. It is undertaken to ensure health workers have the support and resources they need to do their work, to measure and improve quality of care, and to identify gaps to be able to solve problems as they arise. It is an important tool to monitor individual health workers performance compared to standards and to provide real-time feedback.

During the CBMP implementation period, AARHB and AAU, in collaboration with three sub-city health offices, organized and conducted SS quarterly. The SS was conducted in all public health facilities of three target sub-cities of Addis Ababa using standard checklist. Different units from AAU/School of Public Health (SPH), plan and policy directorate from AARHB and Sub City Health Offices formed the SS team.

The objectives of SS were (a) to assess the overall status of the health facility's HIS implementation and performance by identifying strengths and challenges/limitations; and (b) to provide support and guidance, and develop action plans considering identified gaps. During the SS, guided discussions were held with medical directors (HF heads) on the management of HIS; interviews/discussions were made with HIT officers on HIS implementation with an emphasis on healthcare data management, data quality, and information utilization.

The provision of supportive supervision is one of the key CBMP strategies for improving and maintaining the quality of HIS at the facility level. CBMP continued to provide scheduled supportive supervision, coaching, and mentoring to the HCs in collaboration with the AARHB and Sub-city health offices.

The key findings of the supportive supervisions are described below.

Data recording and reporting tools*:* CBMP monitored data collection, analysis, utilization, and data recording and reporting tools. The program found that healthcare workers' understanding and use of the data recording tools have improved and most are documenting complete records.

Data quality*:* CBMP and AARHB check the quality of data captured by healthcare providers during the supervision visits. The data quality check examines the different data quality dimensions including validity, consistency, completeness, accuracy, and timeliness. Reasonable progress was observed over time regarding these milestones, despite some gaps in terms of timelines. Most health facilities tried to ensure the quality of healthcare data by conducting the LQAS technique regularly; and the majority of the facilities monitored data completeness and timeliness using a monitoring logbook.

Data use*:* Use of the data recording tool has improved. Healthcare providers have familiarized themselves with the data elements of this tool and are generating quality reports. Data is also being used for better planning; updated performance monitoring charts are used by case teams to inform planning based on past achievements.

Planning and monitoring*:* Health facilities and sub-city health offices have prepared and documented annual, quarterly, and monthly plans and updated catchment maps, population profiles, and performance monitoring charts. Furthermore, supportive supervision activity enabled CBMP and AARHB to develop joint action plans to improve the performance and quality of HIS.

Quality Improvement initiative

During the CBMP hospital mentorship program, Tikur Anbesa Specialized Hospital (TASH) was identified to have major problems with patient data management. It was impossible to track patient medical records easily due to the disorganized and congested record room; client's current admission medical record or attendance at the health care facilityand continuity of care of the patient was not managed properly in the hospital. Full information about the patient's medical records was not kept; the majority of the units do not record all data elements on the registry and do not use the summary sheet at all. On the other hand, health care providers who generate data had very limited knowledge about data quality and information use. So, they didn't document medical records according to the national standard.

To overcome these problems, CBMP organized quality improvement training to improve health care by identifying problems, implementing and monitoring corrective actions, and studying its effectiveness. Accordingly, 12 TASH staff selected from different departments took training focusing on improving understanding of the staff regarding quality improvement (QI) means and how to implement QI activities in their facilities.

The initiative recommended three improvement areas:

- Improve data management in the card room,
- Improve data quality challenge and
- Improve the reporting completeness and timeliness

After the QI implementation, all improvement objectives were achived. The data management of the card room were improved, the quality of healthcare data with the selected dimentions were improved.

Experience sharing among facility staff of different sites

Experience sharing is one aspect of capacity development effort which can offer the most relevant and supportive technical assistance among facilities. CBMP facilitated experience sharing platform between Lideta Sub-city health facilities (6 HCs, one hospital, and sub-city health office) and Gullele sub-city. The visit comprised of a total of 30 health care providers who were drawn from Ledeta sub-city health office, health centers, and TASH.

Guto Meda health center was selected to host because of its excellent performance on community data management and information dissemination. The experience sharing platform was mainly focused on data quality and information use with the objectives to gain experience on several issues. The host health center presented the HIS implementation paths; activities conducted in preparatory, planning, and intervention phases; performance progress; and challenges faced and solutions provided with productive discussion involving participants.

The visit inspired the participants greatly and created awareness about how to overcome the potential challenge that is being faced throughout the country.

Graduate students' engagement in health facility quality improvement through HIS

Graduate students from health systems and policy and hospital administration tracks at SPH of AAU, were engaged during a hospital management course. The main challenges in TASH concerning HIS were identified during the discussion and the result from mentorship was also used. Students were organized in groups of three to five. Out of the five teams, three worked on the HIS as part of course completion for the course.

These students conducted a situation analysis in TASH using the identified HIS areas and presented a feasible recommendation based on their findings by outlining the responsible person, area of improvement, and a timeline for these activities. This is not included here since the volume of the activities is large.

Implementation research by health facility staff

HIS has the potential to increase efficiency and save considerable amounts of health expenditure. Poor data quality and low information use is a major challenge to improve healthcare services at the grassroots level. To improve data quality and information use, health worker capacity building and mentorship are considered effective mechanisms to achieve the required result. Hence, this implementation science approach tests capacity-building model effectiveness towards enhancing Performance Monitoring Team (PMT) to improve data quality and information use at project targeted areas. Intervention is designed to improve data quality through improving PMT activities.

Discussion

Some assumptions are required to link the improved capacity of staff and a stronger HIS. These assumptions include stakeholder coordination, the performance of e-health platforms such as DHIS 2, and existing strategies. The outcome of capacity building interventions may not be materialized quickly; they take time to show effect and the interventions themselves are not easily controllable. These issues made it difficult to get a meaningful outcome from the capacity building quickly. However, signs of improvement in data collection, data management, and data quality may reveal themselves faster than the data use habit which often takes time to be observed (4,7,9).

UNDP finds three platforms for the capacity to grow and nurtured, namely, an enabling environment, organizations, and individuals. The capacity development plan discussed here concerns the last two. Also, the UNDP document highlights four core issues that have a due influence on capacity development effort (5): Institutional arrangement, leadership, knowledge, and accountability. The capacity development model carried out in Addis Ababa city administration health system fits into each of these core components. The information revolution strategy advocated by the FMoH provided a 'good' institutional arrangement for the model developed. That is the beginning of a nation-wide change-inspired program for HIS.

Leadership is all about inspiring, motivating, and influencing staff members to achieve beyond what they aspired for through the introduction of specific reforms and institutional mechanisms. The leadership training provided to these leaders improved their capacity of leading an institution, a department, a unit, or any group of people(13). The manual developed for mentorship must have helped those both at the managerial level and mentors to follow specific steps and procedures for mentorship that is thought to lead to fruitful mentorship activities. In the past, mentors at a different levels were providing mentorship without proper training and awareness. Training provided to mentors must have helped those involved not only improve their mentorship capacity, but also their leadership role in their respective positions.

The UNDP document, once again, iterates that *"knowledge has traditionally been fostered at the individual level, mostly through education. But it can also be created and shared within an organization, such as through on-the-job training or even outside a formal organizational setting through general life experience, and supported through an enabling environment of effective educational systems and policies"* (5). We have followed several approaches that may fall within this framework. The first is the provision of training. The topics for training include data generation

principles, the importance of data, data management aspect, data analysis using various statistical techniques, the importance of data quality and how to ensure it, and the use of information for different purposes. The training is programmed in such a way that trainees gain knowledge through some ways, theoretical understanding of the subject, cascading of training from top to bottom through revised TOT approach, practical experience with data, i.e., data entry into software, management, quality assurance, analysis, production of required outputs, and how to use them in reports. We thought knowledge may not be achieved merely through training. That is why several other capacity-building components were added. This is a unique approach whereby the same staff member is approached from a different angles to boost one's knowledge and understanding of data, it's quality and use.

The last pillar in the UNDP document is accountability. Even if someone has sufficient knowledge and understanding about a certain issue, and even if led very well, unless there is accountability at different levels for activities planned to be done by a single or group of persons, the change we aspire for in HIS may not be materialized so easily (5). We thought strengthening the PMT might be a good alternative to ensure accountability at a different levels (4). Accordingly, the PMT was re-structured; its domain, mandate, and responsibilities re-defined such that participants understand their role, their importance, and responsibility in the system and contribute as much as they can. The PMT framework and internal ethical procedures helped that each member is accountable for their actions. Since the members are also leaders of programs, they in turn enforced procedures that force their staff to be accountable for whatever they do in their capacities, ensuring accountability across the health system in the project sites.

Although capacity building interventions are necessary for sustained improvements in the HIS, there might be a fallback in the system due to staff attrition if capacity building targets individual staff only. In several pieces of literature, capacity building is perceived as improving human capital only; but our approach has shown to improve the strategic approach to the HIS and improved management system of the health facilities (7,8,10,13). Therefore departure of a single individual from the system may not bring disruption in the system, but might just be a temporary shock.

Conclusion

We found that there is evidence of positive effects of our capacity-building model on the institutional arrangement, leadership, knowledge, and accountability, which collectively leads to improvements in HIS. We, therefore, conclude that the new capacity-building approach (training, mentorship, and supportive supervision, quality improvement initiatives, experience sharing programs, graduate student involvement, etc.), helped to improve individual knowledge, interpersonal relationship, strategic thinking, system management, and accountability, all of which lead to sustained and improved HIS. Improved HIS, may also lead to improved infrastructure, initiate proper planning, and even sound policy which would again help improve HIS.

Improvement in HIS is often a collective effort of several forces; but the human element plays a decisive role. Therefore, further study is required to document how human behavior and accountability affect the performance of HIS. Also, it is reasonable to generate more evidence on the links among capacity building, HIS functioning, service delivery, and health outcomes. Specifically, the Capstone type of study method can help obtain evidence of the effects of capacity building interventions on HIS strengthening for specific areas of interest. Capstone and interventional studies can help develop strategies for capacity building for specific HIS components in the health facility context.

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