

# Bangladesh Health Information Systems Mapping Analysis

July 2015



**USAID**  
FROM THE AMERICAN PEOPLE

**SIAPS**   
Systems for Improved Access  
to Pharmaceuticals and Services



## **Bangladesh Health Information Systems Mapping Analysis**

Steen Anderson  
Md. Humayun Kabir  
Mohammad Kibria  
Kyle Duarte

July 2015



This report is made possible by the generous support of the American people through the US Agency for International Development (USAID), under the terms of cooperative agreement number AID-OAA-A-11-00021. The contents are the responsibility of Management Sciences for Health and do not necessarily reflect the views of USAID or the United States Government.

## **About SIAPS**

The goal of the Systems for Improved Access to Pharmaceuticals and Services (SIAPS) Program is to ensure the availability of quality pharmaceutical products and effective pharmaceutical services to achieve desired health outcomes. Toward this end, the SIAPS result areas include improving governance, building capacity for pharmaceutical management and services, addressing information needed for decision-making in the pharmaceutical sector, strengthening financing strategies and mechanisms to improve access to medicines, and increasing quality pharmaceutical services.

## **Recommended Citation**

This report may be reproduced if credit is given to SIAPS. Please use the following citation.

Steen A, Kabir MH, Kibria M, Duarte K. . 2015. *Bangladesh Health Information Systems Mapping Analysis*. . Submitted to the US Agency for International Development by the Systems for Improved Access to Pharmaceuticals and Services (SIAPS) Program. Arlington, VA: Management Sciences for Health.

## **Key Words**

Health information systems, systems mapping, information governance

Systems for Improved Access to Pharmaceuticals and Services  
Center for Pharmaceutical Management  
Management Sciences for Health  
4301 North Fairfax Drive, Suite 400  
Arlington, VA 22203 USA  
Telephone: 703.524.6575  
Fax: 703.524.7898  
E-mail: [siaps@msh.org](mailto:siaps@msh.org)  
Web: [www.siapsprogram.org](http://www.siapsprogram.org)

## CONTENTS

Acronyms and Abbreviations .....	iv
Glossary .....	v
Acknowledgment .....	vii
Executive Summary .....	viii
Brief Overview of Bangladesh Health Information System .....	1
Scope of Work .....	2
Introduction.....	3
Mapping Exercise .....	4
HIS Systems in Use under DGHS and DGFP .....	4
Recommendations.....	13
Operational/Tactical.....	13
Short Term .....	13
Recommendations in Detail.....	13
Annex A. List of HIS Systems in Bangladesh.....	15
Annex B. Key Persons Met.....	18

## ACRONYMS AND ABBREVIATIONS

API	application programming interface
DGDA	Directorate General of Drug Administration
DGFP	Directorate General Family Planning
DGHS	Directorate General Health Services
DHIS 2	District Health Information System version 2
eHealth	Electronic Health
FWA Register	Field Workers Record Keeping Book
HIE	Health Information Exchange
MIS	Management Information System
MOHFW	Ministry of Health and Family Welfare
NIPORT	National Institute for Population Research and Training
OpenMRS	Open Medical Record System
RHIS	Routine Health Information System
SCMP	Supply Chain Management Portal
SHR	Shared Health Record
SIAPS	Systems for Improved Access to Pharmaceutical and Services [Program]
SS	Service Statistics
SWAp	Sector-wide approach
USAID	US Agency for International Development

## GLOSSARY

API	Application programming interface. In computer programming, an application programming interface is a set of routines, protocols, and tools for building software applications. An API expresses a software component in terms of its operations, inputs, outputs, and underlying types. One important use of APIs is to link with the database of a system for extracting records.
Architecture	Architecture, also referred to as enterprise architecture, refers to the organizing logic for business processes, data, applications, and IT infrastructure reflecting the integration and standardization requirements of the health system's operating model.
Data governance	Data governance is a control that ensures that the data entry by an operations team member or by an automated process meets precise standards, such as a business rule, a data definition and data integrity constraints in the data model
Data security	Data security refers to protective digital privacy measures that are applied to prevent unauthorized access to computers, databases and websites.
Data standard	Data standardization or standardization is the process of developing and implementing technical standards for data
Data warehouse	Where an organization's electronically stored data is kept.
Desktop program	A program running on a desktop/laptop personal computer (PC), independent of a network/internet connection (same as off-line). The data is captured locally and processed on the PC before eventual synchronization with a server takes place
Health Information Exchange	Health information exchange is the electronic movement of health related information among organizations according to nationally recognized standards.
HIS	Health information system. This term used for management information systems in health. Health information systems refer to any system that captures, stores, manages, or transmits information related to the health of individuals or the activities of organizations that work within the health sector.  An integrated effort to collect, process, report and use health information and knowledge to influence policymaking, program action, and research (WHO 2003).
Inter-operability	In health care, interoperability is the ability of different information technology systems and software applications to communicate, exchange data, and use the information that has been exchanged.

Maturity	The amount of time that the software has been on implementation
meta data	Data about data
MIS	Management information system— provides reports to management on predefined indicators. Data are normally stored in a database. Reports can be automatic generated on a schedule or generated interactively initiated by the user. Reports can be distributed in paper form or online as part of a website.
Open source	Open source refers to a computer program in which the source code is available to the general public for use and/or modification from its original design. Open-source code is meant to be a collaborative effort, where programmers improve upon the source code and share the changes within the community.
Robustness	In computer science, robustness is the ability of a computer system to cope with errors during execution. Robustness can also be defined as the ability of an algorithm to continue operating despite abnormalities in input, calculations, etc.
Web-based system	A program running on a server and capturing data and displaying its reports in a browser. Most networked systems today will be web-based

## ACKNOWLEDGMENT

The SIAPS project would like to thank Prof. Dr. A.K. Azad, Additional Director General (Planning and Development) and Director, Management Information Systems (MIS), DGHS, MOHFW; Md. Ferdous Alam and Sukhendu Shekhar Roy from DGHS; Muhammed Abdul Hannan Khan, senior technical advisor, HIS-Deutsche Gesellschaft für Internationale Zusammenarbeit; Mr. Abdul Mannan Ilias, Director MIS, DGFP; and Md Abdul Kalam Azad, deputy program manager, LMIS, for their support in facilitating the meetings and site visits. Additionally SIAPS would also like to thank Mr. Humayum Kabir for his invaluable assistance to the SIAPS staff in conducting the visits and gathering information on health information systems.

Special thanks to the MOHFW partners, UNICEF, UNFPA, CARE, Save the Children, and staff from the sites visited—upazilas in Gazipur and Central Warehouse Dhaka.

## EXECUTIVE SUMMARY

At the request of MOHFW and the US Agency for International Development (USAID) mission in Bangladesh, the Systems for Improved Access to Pharmaceutical and Services (SIAPS) Program, funded by USAID, was asked to assist the Bangladesh Ministry of Health and Family Welfare (MOHFW) and other local partners to address the health information needs across the Family Planning and Health Systems directorates within the MOHFW. The SIAPS team of consultants was asked to assess existing health information systems (HIS) tools, their scope, and performance to explore opportunities to integrate/link the tools and improve efficiency and reduce wastage of resources.

The evaluation was performed to review maturity of systems' deployment and use, performed a systems mapping to help MOHFW and the Government of Bangladesh to streamline the development and management of HIS. This is primarily to facilitate the use of data and information for the MOHFW to effectively manage the health programs, medicines, and services for patients. In a discussion with the stakeholders—Directorate General Family Planning, Directorate General Health Services, Deutsche Gesellschaft für Internationale Zusammenarbeit, UNICEF, and CARE, a prioritized set of 20 systems were mapped and evaluated.

The recommendations for improving the HIS management for more effective data-driven decision making for improving supply chain management for medicines, and services to patients include the following:

- Develop an overarching IT leadership and governance framework that drives the national eHealth strategy. This will enable developing a long-term strategy, including look at human resource needs, to manage the eHealth needs for the MOHFW.
- Consider creating a stand-alone unit to oversee HIS governance and policy, and set standards to define interoperability protocols, manage shared services, best practices, etc.
- Analyze the reporting needs of managers across the MOHFW, review the status and use of existing reports, and identify any reporting gaps within the current systems. This is a critical step before replicating existing reports in the District Health Information System, version 2 (DHIS 2).

In the short term, the MOHFW should continue to use the DHIS 2 for data aggregation and reporting. However, as more data from different sources are added to DHIS 2, there should be a renewed look at data quality across the tool. Additionally, the team should conduct a study to see the data exchange capability through application programming interface (APIs) such as OpenMRS and DHIS 2.

The MOHFW should develop a long-term roadmap for the different national systems (SCMP, DHIS2, OpenMRS, etc.) that endorses common standards and interoperability, sets performance benchmarks, and identifies resources required for effective management and sustainability.

- **Limitations:** This report only covers areas served by the MOHFW. It will not cover activities taking place in other ministries or in the private sector even if these are health-related. This report is looking at HIS which is nationwide and sanctioned by MOHFW. HIS are mostly functioning in the public sector and not linked with private sector
- **Definitions**
  - The ability of two systems to exchange data, share functions, etc., through a well-defined layer of API or services. For this report, interoperability is seen as the ability of a HIS to send aggregated data to DHIS 2, with the purpose of having DHIS 2 store the data in its database, and then run reports.
  - System interoperability is rare in the health sector in Bangladesh.

HIS systems—

- There is significant fragmentation and duplication in data collection process which resulted in recording and reporting burden on front-line health workers
- The HIS is not adequately used by those providing or managing health services at the local level.



## **BRIEF OVERVIEW OF BANGLADESH HEALTH INFORMATION SYSTEM**

In recent years, there have been tremendous activity and innovations in the development of health information systems (HIS) in Bangladesh, encouraged in large part by technological advancement including mobile technology platform. The scale-up has generated a good deal of interest for these innovations in the health sector. It is also evident that availability of necessary health data at every level in health system has contributed to better decision making which ultimately affects better health outcomes.

The Ministry of Health and Family Welfare (MOHFW) is positioned in the lead role to administer the HIS initiatives through its implementing entities, i.e., Directorate General of Health Services (DGHS), Directorate General of Family Planning (DGFP), Directorate General of Drug Administration (DGDA), National Institute for Population Research and Training (NIPORT), and Directorate of Nursing Services. However, many national and international organizations are also working with these organizations to strengthen health information systems aligning with their own donor-specific mandates. This has resulted in a number of fragmented and disjointed HIS initiatives across the health programs. Most of these are being implemented at smaller scale and many are at different stages of maturity and not necessarily linked with the national health management information systems that are led by DGHS and DGFP. In addition, there is no or little coordination among the stakeholders at any stage of designing or implementation, which also contributes to create duplication of effort. Undoubtedly, these numerous independent systems have made positive impact on overall health system achieving MDG targets. On the other hand, these silo initiatives put a tremendous data collection burden on MOHFW staff and lead to availability of poor quality data and minimum data use, coupled with lack of standardization to operate across the HIS and lack of vision of sustainability which undermines these efforts overall.

MOHFW/DGHS has also been implementing the Directorate General Health Services version 2 (DHIS 2) tool as a national initiative with the technical and financial support from different donors to manage the health information for almost all health programs in Bangladesh. This initiative has been successful so far, which has encouraged MOHFW to replicate the initiative for other entities such as DGFP. At this stage, it has emerged as a critical discussion among the HIS experts at policy level on the capacity of this open-source tool to capture the enormous amount of individual patient data, the tool's level of integrity, robustness, and other technological aspects (API capability) including producing desired reports efficiently to use in generating a country indicator report. On the other hand, MOHFW is also implementing the supply chain management portal (SCMP) which has a number of modules that include a procurement tracker, drug database, equipment tracker, eLMIS, at the national and sub-national level and also came out a successful implementation and accepted to all including donors community. Now the hand-over phase has commenced.

It has been important for MOHFW to create a linkage for smooth data flow between these two MOHFW-led initiatives, which will help them to cross-validate the service data with logistics information. This will enhance confidence among the data users on the quality of the tool, will help to increase the efficiency of operations, enable better analysis and decision making, and improve accountability, transparency, and governance.

Realizing the fact, the MOHFW is now interested in streamlining the HIS initiatives across the entities and, subsequently, reflect into the national HIS strategic plan. With this view, MOHFW formally requested USAID-funded Systems for Improved Access to

Pharmaceutical and Services (SIAPS) Program, implemented by Management Sciences for Health,- to support them by undertaking a comprehensive mapping exercise (mapping out of all existing and agreed IT initiatives) and provide strategic guidance and specific recommendations to strengthen the national HIS. In response, SIAPS hired two consultants (international/national) on short-term basis to undertake the mapping exercise and provide necessary recommendations and strategic guidance.

## **Scope of Work**

The exercise focuses on reviewing existing HIS tools, their scope, and how they perform so as to explore opportunities to integrate/link the tools and improve efficiency and reduce wastage of resources. The team is also expected to conduct a technological assessment in terms of capacity, robustness, data security, and interoperability capability of the existing DHIS 2 tool and MOHFW SCMP. It is anticipated that this exercise will guide MOHFW with specific recommendations to streamlining the Pharmaceutical Management information initiatives across all the entities, i.e., DGFP, DGHS, DGDA, NIPORT.

## **Specific Tasks to be Performed**

- Collect the necessary information on existing and agreed upon HIS initiatives (an inventory matrix) within MOHFW and its key entities (DGHS, DGFP, DGDA and other relevant players)
- Analyse and map out the systems and processes of existing tools according to features, functionality, interoperability, and data standards including a data dictionary, data access and sharing, coverage and area of interventions, implementer's role, benefits from the system, life cycle of the tool including stage of maturity, sustainability approach, and financial viability
- Undertake a technological assessment in terms of back-end technology, robustness, data security, and data governance. From a health systems perspective, identify opportunities of scalability/replicable and interoperability of DHIS 2 and SCMP platforms.
- Recommend harmonization of meta data, sustainability including improving data quality, and use for SCMP and DHIS 2 tools
- Review and make recommendations the skeleton of the National Routine Health Information System (RHIS) strategic plan for SCMP and DHIS 2 tool for the period of 2016–21.

## **Methodology Plan for the Work**

To achieve objectives, the team deployed several tools for undertaking the mapping exercise as follows:

- Desk research
- Interviews
- Focus groups discussion/group discussion
- Round-table consultations
- Sites observations

## INTRODUCTION

The MOHFW is responsible for formulating health and population policies and their implementation. A large number of organizations ranging from government departments to autonomous and regulatory bodies exist under the MOHFW to provide implementation functions. These organizations perform variety of responsibilities such as delivery of health services, regulating professions, providing educational or research opportunities and creating physical structures. DGHS and DGFP, two departments within the MOHFW, provide health services through elaborate networks that include frontline health workers employed in the communities.

The MOHFW pursues sector-wide approach (SWAp) through a five-year strategic plan, which is the Program Implementation Plan and Operational Plans. Currently, MOHFW is implementing third SWAp called Health, Population and Nutrition Sector Development Program (HPNSDP). Two of the operational plans of HPNSDP deal with management information systems (MIS) or eHealth activities of DGHS and DGFP respectively. In the current SWAp, a number of resources has been allocated to the MIS to strengthen infrastructure. This has resulted in providing hardware including mobile equipment and laptops to the rural level. Data centers have also been built up at the central level in DGHS and DGFP. Efforts have been made to develop software for collecting administrative data across the country with the leadership of DGHS— the major software developed and used is District Health Information System version 2 (DHIS 2) tool for reporting health data, resulting in largest deployment of this open source tool in the world. OpenMRS has been piloted in a few hospitals. There has been a conscious effort to use open-source software for developing the systems.

With support from development partners, many vertical programs (silos) have developed their own software solutions. Other organizations have also developed their own software as silos. These efforts have resulted in fragmentation and lack of interoperability. As expected, this problem is most pronounced at the top or ministerial level but affects departments. The DGHS is aware of the complexities of managing large amount of public health data as well as building electronic health records of patients covering each encounter with facilities or providers over the foreseeable future. As a first step, the DGHS plans to the Shared Health Record (SHR) platform to handle resolve electronic health records.

An eHealth strategy was drafted via a different technical assistance consultancy. However, the document was not finalized and not made available to the team. Therefore, no observation is made on this issue.

## MAPPING EXERCISE

A number of HIS systems have been implemented in the health sector over the years. As of 2009, an effort to consolidate the number of different systems has resulted in a reduction of different systems operating within the MOHFW. However, the exact number of systems, while not known, is still high and MOHFW feels that a further reduction of the number of systems can be achieved.

### **HIS Systems in Use under DGHS and DGFP**

The SIAPS HIS mapping exercise has discussed and prioritized the HIS systems listed in Annex A during the mapping exercise. The list shows 40 different systems in use in the MOHFW. The team has made a prioritization of each based on a few properties: National Coverage, Health Information System, and collecting data for reporting.

### ***Inclusion/Exclusion Criteria***

The team has identified and separated 20 of the 40 systems into priority groups 1, 2, and 3. The remaining 20 systems will not be evaluated in this exercise. The purpose of the mapping exercise is to evaluate if and how the systems can report through DHIS 2. These are:

- **DGDA website.** Primarily an information tool for the DGDA, this system does not appear to overlap with other systems. Also, there does not appear to be any data that should be reported through DHIS 2.
- **Pharmadex.** There seems to be no overlap with other systems. DHIS 2. Also, there does not appear to be any data that should be reported through DHIS 2.
- **ICT4RH.** This system is in the pilot stage. The result of the pilot test should be evaluated and a decision on whether to expand the system should be made.
- **SCMP Procurement Tracker.** There seems to be no overlap with other systems. Also, there does not appear to be any data that should be reported through DHIS 2.
- **SCMP Equipment Tracker.** There seems to be no overlap with other systems. Also, there does not appear to be any data that should be reported through DHIS 2.

### ***Transactional System Versus Reporting System***

A system can be conceived in terms of two types: transactional and reporting.

A transactional system collects and computes the data, and initiates some sort of workflow that supports the functions of the organization the system is implemented for. In this context, Open Medical Record System (OpenMRS) is a transactional system. Patient information is entered in the system when the patient comes to the hospital, and updated throughout the visit. The new records (transactions) are generated and stored in the OpenMRS database with all follow-up visits. The database will typically contain many records for each patient. The detailed patient information can be retrieved at a later stage for further treatment/follow up.

Based on these transactional records, monthly reports can be generated on the services provided.

A reporting system stores aggregate data needed for producing reports. The MOHFW reporting systems do not capture the details (i.e., about a single visit of a patient to a facility) but tracks numbers of patients with a specific illness in a specific period at a specific facility. A reporting system will generate reports faster if it is working on aggregated records. If the reporting hospital has 10,000 patient visits in a month, there will be at least 10,000 transactions. The reporting system then aggregated data derived from these 10,000 transactions on illnesses, in this case 20 different illnesses. So the 10,000 patient records will be separated into 20 illness records and in this case, will only be computing on 20 records. This is 500 times less than the reporting system operates with and therefore reports will be generated much faster. DHIS 2 is an example of a reporting system.

### Description of the Key Health Information Systems

Figure 1 (Health Information System Map) below is a detailed description of each of the key systems and their relationships with other systems. The following descriptions will refer to the numbers in the yellow ovals.

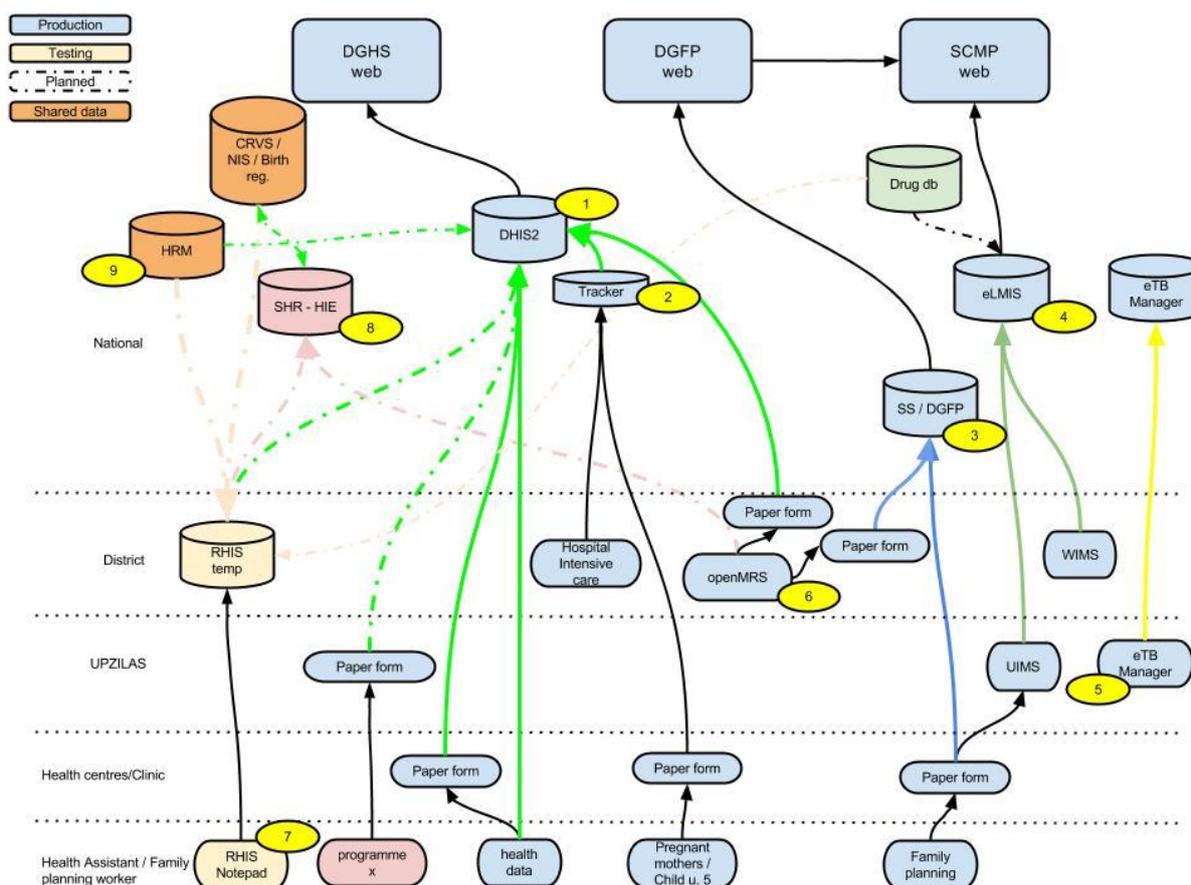


Figure 1. Health information system map

### **DHIS 2 Reporting (1)**

- The system collects and stores aggregated data on monthly basis from a wide range of points in the Nationwide Health System and generate reports.
- DHIS 2 is Open Source and is available with no license fee. Open Source means that the organisation that is using the DHIS 2 has access to the source code and can create new or change modules in the code ([Open Source Initiative](#)). These modules are then shared with other DHIS 2 users. Running and customizing the software, however, does pose some cost in terms of hardware, network, training, programmers, etc.
- Data can be entered directly by the facilities into DHIS 2 using on-line (via internet) forms or data can be sending to DHIS 2 using one of many electronically interfaces.
- The data is stored in a PostgreSQL database. This database can scale up to a large very big size, but if the size is becoming a problem, another database system can be employed.
- From the base data, an analytics database is built every night.
- The reports are accessed through a web page and can be exported in other formats for further analysis or to be printed, i.e., as a PDF file for distribution to other users.
- In Bangladesh, DHIS 2 was introduced in 2009 and has been in use for reporting since 2011.
- Data is entered into the DHIS 2 from several sources. All functional community clinics (approx. 13,000) in Bangladesh have recently been equipped with laptops and mobile internet connection
- From our field visit, we could observe that Internet access was not working in this facility. The health worker mentioned that she often needed to take her laptop home to upload the data during the evening hours.

The health care providers use the laptops to enter monthly service statistics directly into DHIS 2. If the community clinic does not have internet access, the health care provider will fill in a monthly paper form and send it to the supervisor at upazila (sub-district) level health facility staff who will then enter the data directly into DHIS 2.

Other facilities, hospitals, and upazillas will enter data directly into DHIS 2 using a desktop computer via the internet. If the hospital is running OpenMRS, the data is extracted from the system in a report and then entered manually into DHIS 2.

An electronic Routine Health Information System (RHIS) is underway as a pilot and it will generate statistics at the point of service. RHIS will be able to use the DHIS 2 for reporting.

### **DHIS 2 Patient Tracker (2)**

- In 2013, DHIS 2 was provided with a patient tracker system, which allows tracking of individual patients, specifically patients with special conditions that needs close

surveillance. In some countries, the patient tracker is used for tracking HIV/AIDS patients who need to have their condition and medication monitored and adjusted on a regular basis. Generally, the tool is based on defined workflows for the specific types of patients. The system does not support general patient handling like in a clinic or hospital.

- Aggregated data from the patient tracker is transferred to DHIS 2 at the end of the month.
- As DHIS 2 is an information system, it does not make sense to collect transactional data (patient records) with the system. However, the introduction of the patient tracker was a response to the need to track individual patient data in some of the 40-plus countries.
- The system is built using the same technology stack as DHIS 2.
- In Bangladesh, there was a specific need to closely monitor pregnant women and children under five as part of the WHO Commission on Information and Accountability for Women's and Children's Health (COIA) initiative. Since 2013, approximately 300,000 pregnant women and 1,200,000 children under five have been registered, but there are no plans to extend the registration to other groups of patients.
- Data from the patient tracker is stored in a separate database from the other DHIS 2 data.

### **Service Statistics at DGFP (3)**

- The Service Statistics (SS) is a web-based system that is the main source of family planning performance data at the national level. This component deals with close monitoring of the reproductive health, family planning, and maternal and child health services.
- Data on current contraceptive use are being recorded continuously in the FWA Register, with five types of reporting forms being used at different levels.
- The Family Welfare Assistant aggregates data from the register and send the forms to the supervisor at upazila level, who enters the data into the SS system.
- Similarly, hospitals and family planning clinics are aggregating their data manually and entering them into the SS system.
- The SS system has been developed locally by the DGFP using Joomla content management system for the front end and a MySQL database at the back-end management. Maintenance and further development is handled by in-house resources.
- Reports from the system are available from the DGFP website. The current system meets all requirements of the DGFP. However, DGFP is currently testing SS reporting in two districts through DHIS 2 platform. The consultants also realized that there is no integration planned for between the SS and other systems.

### **SCMP/eLMIS**

The SCMP system consists of four major components. The Procurement Tracker and the Inventory Tracker will not be further discussed, as these are specialized systems with no

overlap with any other systems. The eLMIS part of SCMP consists of two systems—the UIMS and the WIMS.

- The Upazila Inventory Management System (UIMS) is a software program for maintaining inventory at upazila family planning stores. It enables Upazila Family Planning Store staff to maintain stock of commodities, monitor field reporting, generate supply plan, and automate issue voucher generation and automated monthly Logistics Management Information System (LMIS) reporting. UIMS is running on a stand-alone desktop computer, and synchronizes data with LMIS when prompted to by the user.
- The Warehouse Inventory Management System (WIMS) is a software program designed to maintain inventory at family planning warehouses at district level. It enables warehouse staff to maintain stock of commodities and monthly LMIS reporting. Like UIMS, WIMS is running on a stand-alone desktop computer, and synchronizes data with LMIS when prompted to by the user at any point of time.

Data from both systems is used in eLMIS to generate nationwide reports about the supply and stock of all commodities up to service delivery points.

### ***e-TB Manager***

e-TB Manager is a web-based tool that integrates all aspects of tuberculosis (TB) control into a single database for use by national TB programs. This unique, open access tool was designed to manage data of persons with presumptive TB, patients, medicines, laboratory testing, diagnosis, treatment, and outcomes. Thus, e-TB Manager allows for a holistic approach to TB management and avoids the common disconnect between:

- Activities focused on different types of treatment such as treatment for susceptible TB, drug-resistant (DR)-TB, TB-HIV co-infection, and pediatric TB
- Inventory management for first- and second-line TB medicines
- Reporting outcomes at various levels of a health system

Guidelines and best practices developed by the WHO's Green Light Committee are built into the system to follow a patient from first interaction with the doctor, through confirmation of TB, treatment protocols, generation of essential reports, and indicators to comply with both national and international requirements. The system has highly specialized workflows for handling TB patients.

The patient is entered into the system when first 'suspected' of having TB, and follows the protocols, from lab results, to the different stages of treatment. The system is used for multi-drug resistant TB as well as susceptible TB. A reporting module allows access to all reports (based on user profile); in addition, a data analysis module allows for unique ad-hoc data analysis request.

The system is currently used in and nationally endorsed in 12 countries, with over 3,000 sites, and over 3,500 data entry operators.

e-TB Manager is implemented in 196 upazila health complexes, 10 urban TB treatment centers, and 6 multidrug resistant TB sites. (Source: SIAPS Bangladesh Report)

### **OpenMRS (6)**

OpenMRS is an open source web-based patient record system which is used in hospitals and clinics to keep track of in- and out-patients and their journals. The software is installed in a server/client environment using a local intranet setup and operates with a set of predefined workflows in handling patients. However, it is open to individual handling of patients as well. Mentionable, patient data is stored in a local MySQL database at hospital level. OpenMRS is also used to handle payments for services as well as dispensing from the pharmacy. When the patient is dismissed, he or she is given a slip with the diagnosis, suggested treatment regimen, and the patient's identification. If the patient brings this slip for the next visit, his or her electronic file will be retrieved using the patient's identification, or other patient data such as patient's name or phone number.

Reports can be generated from the web-interface of the system. Monthly data from the system must be transferred manually to DHIS 2. If the plan is to roll out the OpenMRS to all hospitals and use it to store data from other systems, i.e., RHIS, it is important to automate the data transfer through web-API or interoperability.

In Bangladesh, OpenMRS is currently installed in three hospitals with another three hospitals planned.

### **RHIS (7)**

RHIS is a new system being developed in Bangladesh. RHIS uses computer tablets to collect data at the lowest level in the health system. The goal is that all health workers in Bangladesh will be equipped with tablets to collect patient information.

The patient data will be synchronised with a number of databases at a higher level, i.e., district. This database could be an instance of OpenMRS. The tablets will also contain educational material for the health workers.

### **SHR/HIE (8)**

Shared Health Record (SHR) and Health Information Exchange (HIE) are two systems under development by the DGHS. The aim of SHR is to collect all patient records in one large database. This will make it possible for health providers in any facility to see the history of any patient who comes to the facility. A Master Client Register (MCR) will be established for identifying patients in the system. The MCR will check a patient against other nationwide registers like the national ID database to validate the patient's identity.

Data for the SHR will be coming from the OpenMRS at hospitals and clinics and from the RHIS at community clinics. Aggregated data will be sent to DHIS 2 for monthly reporting.

A HIE being built as a bridge between the different systems. The bridge can be called by any health systems and forward this call to any other system connected to HIE, by using a set of predefined APIs. Any new system which may be implemented in Bangladesh in the future will benefit from this as the system will only be communicating with the HIE.

SHR/HIE is expected to start testing during 2015. However, a countrywide rollout will depend not only on the SHR/HIE system but also the rollout of the client systems—OpenMRS and RHIS.

**HRM (9)**

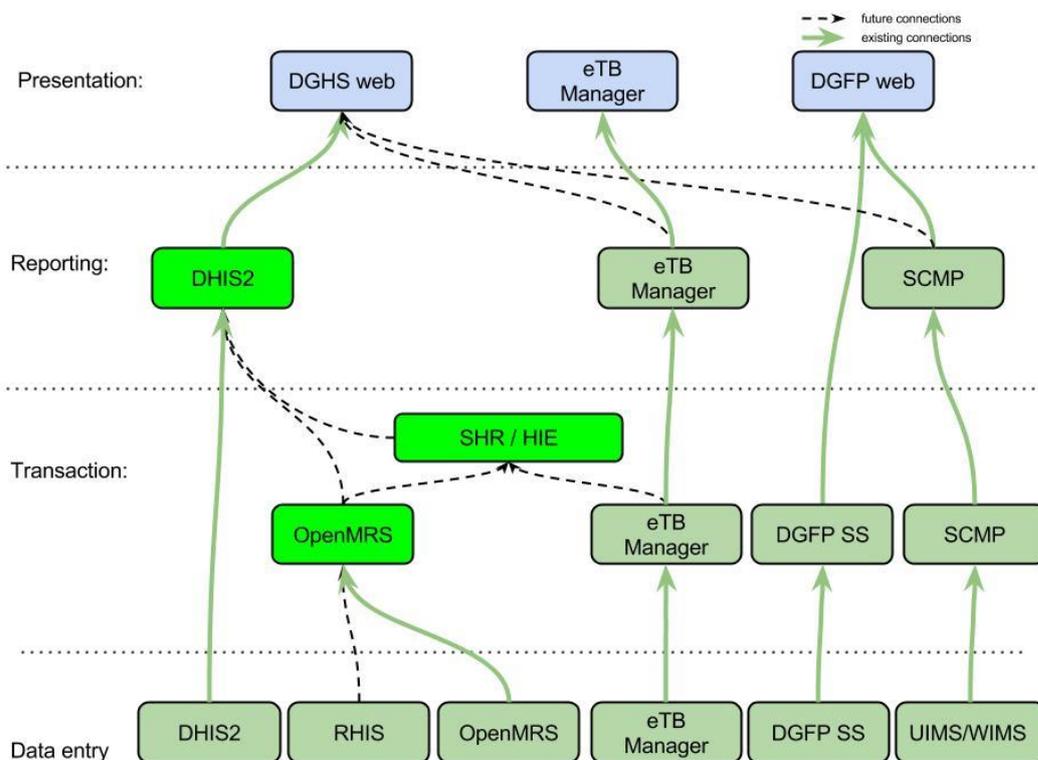
A new Human Resource Management system (HRM) has been developed for DGHS creating one system for all HR of the MOHFW. The HRM has been developed with well-defined APIs, which allows SHR to use the data for reference.

The HRM consist of four modules:

- Facility Register—a list of all health facilities in Bangladesh
- Geo Location Registry—with defined codes for each facility
- Provider Registry
- User Management System

The provider registry will register all health personnel under MOHFW. The web-based system will allow a facility to identify the vacant position (from the Facility register). From the web-interface, the user can get a nationwide or facility overview of the current staff situation.

This figure shows the existing and planned key HIS systems under DGHS and DGFP and the map suggest how reports can be presented in one place.



**Figure 2. Recommended data/reporting flow of the existing HISs in Bangladesh**

The figure shows the existing data flows with green arrows and the possible data flows with dotted lines. There are four levels in the drawing.

- **Data entry level:** the program where data is entered into the system using a form of client hardware, i.e., a laptop or notepad/tablet.
- **Transaction level:** The transactions in the database are now computed. Events entered from the clients will trigger actions in the system (initiate a workflow). On specific dates, predefined actions are carried out by the system, such as generating aggregated data for the reporting level.
- **Reporting level:** The transactional data is aggregated to enable reports to be generated. Data may be modelled into new forms and dimensions (data sharing across the hierarchies and reporting and data visualization), and put in a data warehouse/analytics system to create reports in more dimensions than would be possible reporting on flat data.
- **Presentation level:** This level will present predefined reports or allow the end user to generate reports using a set of parameters. This is done in a browser interface and reports are shown on the screen and can be exported as PDF files, sent as e-mail, or printed on paper.

### ***Reporting Patterns and Reports in One Place— a Need for Further Study***

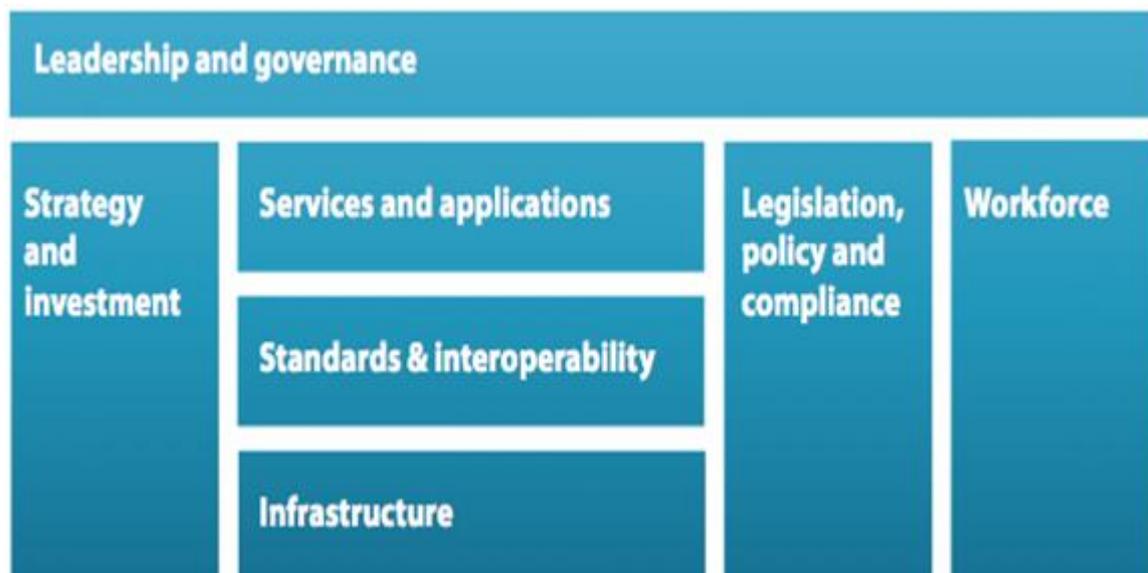
The team identified a wish to consolidate all aggregate data and reports in DHIS 2. But before any major changes to or expansion of DHIS 2 is implemented, a detailed reporting analysis should be carried out. This analysis should map the current reporting pattern from all systems, list the existing needs from decision makers, and finally identify suitable changes to the existing systems. The major transactional systems have unique reporting features and it does not make sense to squeeze all these features and logic into DHIS 2.

A major concern is the availability of reports in one place. This can be accomplished by making all reports available in one website, such as the DGHS website. This change can be implemented immediately at low cost. The figure 2 shows how reports are currently available in three different websites—DGHS, DGFP, and SCMP. It is a small effort to make all of these reports available in a new website or eventually in one of the existing websites.

If the need for a stronger analysis tool is identified later on, it is recommended to start building a national Data Warehouse which can include data from all sources and carry out analyzes across these data.

### ***IT Leadership and Governance Framework that drives the national eHealth strategy.***

In a modern organization like MOHFW, it is important to make the right decisions regarding the use of IT. Decision about taking new tools/systems in use in any department should be a coordinated decision to ensure that the systems do not overlap and they follow certain set of standards.



**Figure 3. IT governance framework**

A technical work group (TWG) should be established with technical experts and managers from the user organizations within the DGHS/DGFP. The TGW will support the implementation of existing and new systems by defining best practices and standards. The group will maintain a common data dictionary, a terminology dictionary, and list of APIs for the different systems and suggest new APIs. It also should have the power to enforce the agreed protocols and best practices.

## RECOMMENDATIONS

- Develop an overarching IT leadership and governance framework that drives Bangladesh’s national eHealth strategy.
- Consider creating a stand-alone unit to oversee HIS governance and policy, and to set standards
- Analyse the reporting need and the status of the existing reports from each system to decide which data and reports should be moved to DHIS 2 or stay in the existing system

### Operational/Tactical

- Create an oversight committee to develop standards, define interoperability protocols, manage shared services, best practices.

### Short Term

- Continue using DHIS 2 for aggregation, analysis, and reporting
  - As multiple data sets are continuously being added to DHIS 2, data quality issues must be analyzed and recommendations put in place to address them.
  - A focused data quality and data use analysis exercise needs to be done fairly soon before bad data begins to “corrupt” good data within DHIS 2.
  - Develop an automated data exchange between OpenMRS and DHIS 2. This to eliminate manual data entry from sites using OpenMRS (and in the future, RHIS).
- Avoid using DHIS 2 for transactional data (patient and logistic data).
- Review, map, and analyze processes for managing master data/reference data. Additionally, map processes under key systems and tools to identify dependencies and overlaps.
  - A further assessment is needed to identify IT human capacity needs and address the HR gaps with respect to planning, managing, and maintaining information systems

### Recommendations in Detail

- DHIS 2 is built with a number of APIs. If APIs are missing, the architecture of the tool allows new APIs to be easily built. Specifically, OpenMRS should start sending data automatically to DHIS 2.
- Look for process optimizations—reduce the steps from other systems to paper-to DHIS 2.

- As multiple data sets are continuously being added (DHIS 2), data quality problems must be analyzed and recommendations put in place to address data quality issues.
- A focused data quality and data use analysis exercise needs to be done fairly soon before bad data begins to “corrupt” good data within DHIS2.

Avoid overload of DHIS 2 with transactional data (patient and logistic data).

- As DHIS 2 is not built to handle patient data at a larger scale, the registration of pregnant women and children under five should be stopped as soon as an alternative exist. OpenMRS could be a good alternative for this.
- In the current setting, SHR should be used for storing these individual patient data. It could be an implementation strategy for SHR to move the existing patient data from DHIS 2 and start registration directly to SHR.

Review, map, and analyze processes for managing master data/reference data. Additionally, map processes under key systems and tools to identify dependencies and overlaps.

- All key systems should be analyzed to identify reference data, which can be isolated from the system and used by other systems. The necessary APIs to access reference should be developed. These reference data would then be available through the HIE.
- Processes of a system can be reused by other systems using APIs, such as validation of phone number, validation of addresses, calculations of consumption.
- In addition, develop data validation protocol, define processes for “roll-back” functionality to restore databases on the event of upload, sync, or re-write/over-write failures.

Conduct a further assessment to identify human capacity needs and address the HR gaps with respect to planning, managing, and maintaining information systems in Bangladesh.

- A certain set of skills and infrastructure will be needed to maintain the HIS systems under DGHS and DGFP. One shared IT department for at least DGHS and DGFP should be formed. The hardware resources should be installed in one location. The IT staff should be brought together in one unit.
- The staff requirement for all the systems should be assessed and a plan should be drafted for how to recruit these staff members.

## ANNEX A. LIST OF HIS SYSTEMS IN BANGLADESH

HIS	Module	Priority (1=high, 2=medium, 3=low)	status	Type	MOHFW	DGHS	DGFP	DGDA
DHIS 2	Aggregated reporting	1	production	web-based		x	test	
DHIS 2	Patient tracker	1	production	web-based		x		
SCMP	Procurement tracker	1	production	web-based	x			
SCMP	WIMS & UIMS	1	production	desktop/web-based			x	
SCMP	eLMIS	1	production	web-based	x		x	
SCMP	Drug database	3	production	web-based		x	x	x
SCMP	Equipment tracker	3	test - in 1 district	web-based		x		
HRM	Provider - HR information about staff in DGHS	3	being implemented	Web-based		x		
HRM	Facilities registry	3	production	web-based		X		
HRM	Geo location registry based on Bangladesh Bureau of Statistics	3	production	web-based		X		
HRM	User management system	3	production	web		x		
eTB Manager	electronic TB manager - SIAPS	3	production	web		x		
DGFP SS	DGPMIS/SS	3	production	web			x	
DGDA web portal	Drug administration web portal	3	production					x
Pharmadex	Information system for drug registration through the DGDA web portal	3	pilot test pending					x
SHR	Shared health record	2	planned	web-based		X		
OpenMRS	Medical record system for hospitals and clinics	2	production at local level	web-based		X	X	

<b>HIS</b>	<b>Module</b>	<b>Priority (1=high, 2=medium, 3=low)</b>	<b>status</b>	<b>Type</b>	<b>MOHFW</b>	<b>DGHS</b>	<b>DGFP</b>	<b>DGDA</b>
RHIS	Routine Health inf. System - being tested up until end of 2016	2	Pilot test	Android		X	X	
ICT4RH	ICT 4 Reproductive Health	3	pilot test	desktop			x	
Bulk SMS Based system		5	Production	Mobile				
Website - MOHFW		5	Production		X	X	X	X
Content for website		5	Production		X	X	X	X
Telemedicine		5	Production	web		X		
Community Clinic Project	Strengthening reporting on MNCH in the community clinic	5	Production	web-based		X		
OpenSRP	Smart registry platform	5	Plan	concept				
COIA	WHO indicators (not a tool) to monitor MDG 4 and 5 using data from DHIS 2	5	production	Web-based 7 DHIS 2		x		
Social Media	Facebook, Twitter, LinkedIn	5	production	web-based				
Mobile-based complaint registration		5	Production	Mobile + Web				
Fingerprint reader for attendance		5	Production	Web-based				
mCare (maternal care)	Research project: Literature	5						
mTikka (vaccination)	Research project: Literature	5						
Others	Research projects	5						
HIV and AIDS program		5						

<b>HIS</b>	<b>Module</b>	<b>Priority (1=high, 2=medium, 3=low)</b>	<b>status</b>	<b>Type</b>	<b>MOHFW</b>	<b>DGHS</b>	<b>DGFP</b>	<b>DGDA</b>
Expanded Programme of Immunisation	Vertical reporting system	5				x		
MOHFW HRIS	Central human resources information system for whole of MOHFW	5	planning					
Deputation Management System	Registry of 30,000 government doctors. Decision making system. Has links to HRM	5	Production but not used	web-based	X			
Leave Management System	Approve leave	5	Production but discontinued	web-based	X			
Disciplinary Cases	Part of HRM	5	Production	desktop - local database	X			
ADP monitoring system	Annual development plan M&E system— financial data— for procurement tracker	5	production	web-based	x	x	x	x

## ANNEX B. KEY PERSONS MET

Organization	Individual	HIS – system
DGHS, MOHFW	Prof. Dr. Abul Kalam Azad Additional Director General (Planning & Development) & Director, MIS Directorate General of Health Services (DGHS), MOHFW profakazad@gmail.com	Debriefing meeting – presentation of findings.
DGHS–MIS/Thoughtworks Ltd	Debashish Mishra dmishra@thoughtworks.com	Shared Health Record (SHR)
DGHS–MIS/Activation Ltd.	Enamul Haque <a href="mailto:enamul.haque@activationltd.com">enamul.haque@activationltd.com</a>	Human Resource Management (HRM)
DGHS–MIS	Engineer. Md. Ferdous Alam <a href="mailto:ceferdous@gmail.com">ceferdous@gmail.com</a> Consultant for Supervision of Software Development Teams, Directorate General of Health Services	General HIS
DGHS–MIS	Engineer Sukhendu Shekhar Roy, Systems analyst, DGHS MIS - <a href="mailto:sukhenbd@hotmail.com">sukhenbd@hotmail.com</a>	General HIS
DGHS–MIS/GIZ	Muhammad Abdul Hannan Khan, Senior tech advisor - HIS (GTZ SHSP II) – <a href="mailto:hannan.Khan@giz.de">hannan.Khan@giz.de</a>	District Health Information System v2 (DHIS 2)
DGHS–MIS/Japan Overseas Cooperation Volunteer (JOCV)	Koichi Harada - <a href="mailto:nc1267604@gmail.com">nc1267604@gmail.com</a>	DHIS 2
DGFP–MIS Unit	Mr. Abdul Mannan Ilias, Director (MIS), DGFP	Service Statistics (SS) Systems and DGFP web portal
DGFP–MIS Unit	Md. Abul Kalam Azad, Deputy program manager (LMIS) - <a href="mailto:azadmis@yahoo.com">azadmis@yahoo.com</a>	SS Systems and DGFP web portal
DGFP–MIS Unit	Khorsheda Akter, Programmer and DPMCSS <a href="mailto:khorsledaakter@yahoo.com">khorsledaakter@yahoo.com</a>	SS Systems and DGFP web portal
DGFP–MIS Unit	Golam Faruk, DPM MID Unit DGFP - <a href="mailto:gharuk62@gmail.com">gharuk62@gmail.com</a>	SS Systems and DGFP web portal
DGFP–MIS Unit	Krishna Pratim Datta, Statistician, MIS unit <a href="mailto:krishna-pratim@yahoo.com">krishna-pratim@yahoo.com</a>	SS Systems and DGFP web portal
SIAPS/Softworks	Hasan Mahmud Executive Director, SoftWorks Ltd.	Supply Chain Management Portal (SCMP including WIMS, UIMS, Procurement Tracker, Inventory Tracker)
DGHS/Measure Evaluation/ icddr(b)	Suman Kanti Chowdhury <a href="mailto:suman@icddr.org">suman@icddr.org</a> Dr. Reza Ali Rumi <a href="mailto:rumi@icddr.org">rumi@icddr.org</a> A.K.M. Tanvir Hossain <a href="mailto:thossain@icddr.org">thossain@icddr.org</a>	Routine Health Information System (RHIS)

Organization	Individual	HIS – system
	Fazlu Rahman <a href="mailto:fazlu.rahman_cse@yahoo.com">fazlu.rahman_cse@yahoo.com</a>	
DGHS/Measure Evaluation/ Save The Children	Jamil Zaman <a href="mailto:jamil.zaman@savethechildren.org">jamil.zaman@savethechildren.org</a> Dr. Islam, Farzana <a href="mailto:farzana.islam@savethechildren.org">farzana.islam@savethechildren.org</a>	RHIS
UNICEF	Dr. Shukhrat Rakhimjanov - Health Manager - <a href="mailto:srakhimjanov@unicef.org">srakhimjanov@unicef.org</a>  Health Section Dr. Abu Sadat Mohammad Sayem <a href="mailto:asayem@unicef.org">asayem@unicef.org</a>  Minjoon Kim <a href="mailto:mkim@unicef.org">mkim@unicef.org</a>  Farhana Sharmin <a href="mailto:fsharmin@unicef.org">fsharmin@unicef.org</a>	DHIS 2 – Patient Tracker
DGFP/UNFPA	Dr. Abu Sayeed Mohammad Hasan, Technical Officer-Family Planning UNFPA Bangladesh-DGFP - <a href="mailto:ahasan@unfpa.org">ahasan@unfpa.org</a>	eLearning – ICT 4 Reproductive Health
DGFP/UNFPA/CARE (Bangladesh)	Dr. Md. Jahirul Alam Azad, Team Leader MNH <a href="mailto:jahirul@bd.care.org">jahirul@bd.care.org</a> Jewel Bahi	eLearning – ICT 4 Reproductive Health
MOHFW–MIS	Ahmed Latiful Hossain, System Analyst, <a href="mailto:sa@mohfw.gov.bd">sa@mohfw.gov.bd</a>	General IT issues in the Ministry
MOHFW/COIA Secretariat	A.K.M. Nazrul Haider, Team Leader, <a href="mailto:nzhaider@yahoo.com">nzhaider@yahoo.com</a>	DHIS 2 – Patient Tracker
DGFP Kaliakair Upazilla in Gazipur District	Habibur Rahman UFPA - Upazilla Family Planning Assistant	Upazilla Inventory Management System (UIMS)
DGFP Kaliakair Upazilla in Gazipur District	K.M. Khadamed Islam TLCA UHC Kaliakair	E TB Manager
DGFP Kaliakair Upazilla in Gazipur District	community clinic: Takiya Afroz, C.H.C.PGualbothan,Sriboltany, Kaliakair and from the Upazila Health center: Bilkis Begum - SACMO UHC, Kaliakair	DHIS 2
DGFP, Central Warehouse FP, Dhaka	M.D. Anwar Hossain, assistant director, warehouse, DG. FP Md. Abdul Kadir, Central Supply Officer Shah Kibria Omar, Store keeper, CWH, Dhaka	Warehouse Inventory Management System (WIMS)
USAID	Dr. Niaz Chowdhury, Project Manager Specialist	USAID Debriefing
DGFP Maternal & Child Health Training Institute (MCHTI), Azimpur, Dhaka	Dr. Ishrat Jahan, superintendent, <a href="mailto:mchtidhaka@gmail.com">mchtidhaka@gmail.com</a>	Open Medical Record System (OpenMRS)
DGFP Maternal & Child Health training institute (MCHTI), Azimpur, Dhaka/Crystal Technology	Eng. A.H.M. Mojaddeque Karim, assistant project manager OpenMRS, Crystal Technology Bangladesh, <a href="mailto:shimul122@gmail.com">shimul122@gmail.com</a>	OpenMRS