

WORKING PAPER

# Using DHIS 2 Software to Collect Health Data in Bangladesh

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## ABBREVIATIONS

ANC	antenatal care
CHCP	community healthcare provider
DGHS	Directorate General of Health Services
DGFP	Directorate General of Family Planning
e-health	electronic health
FGD	focus group discussion
HIS	health information system(s)
HMIS	health management information system(s)
IDI	in-depth interview
IT	information technology
KII	key informant interview
MIS	management information system(s)
MOHFW	Ministry of Health and Family Welfare
MNCH	maternal, newborn, and child health
PNC	postnatal care
RMNCAH	reproductive, maternal, newborn, child, and adolescent health
UHFPO	upazila health and family planning officer
WHO	World Health Organization

## EXECUTIVE SUMMARY

**Background:** Accurate and high-quality data are important for improving program effectiveness and informing policy. As part of Bangladesh's district health information system (HIS), which allows data to be entered at the community level and analyzed at the central, state, and district levels, the country adopted the web-based platform DHIS 2 in 2009. In Bangladesh, real-time health service use data, with particular attention to reproductive, maternal, newborn, child, and adolescent health (RMNCAH), are available from the community level to the tertiary hospital level. However, health data are being underused for health planning purposes, because of poor data quality and reporting.

**Objectives:** The main study objective was to understand the user's perceptions of and experiences with using DHIS 2 to collect and analyze RMNCAH data in Bangladesh and to identify facilitators and barriers to using these data at different levels of the healthcare system. Insights from this study are expected to contribute to the development of effective strategies for successful DHIS 2 implementation and, ultimately, the design of a responsive health management information system (HMIS) in Bangladesh.

**Methods:** The study employed three qualitative research methods: key informant interview (KII), in-depth interview (IDI), and focus group discussion (FGD). The study sites were Jessore District in southwestern Bangladesh and Brahmanbaria District in the east-central part of the country, which represented high- and low-performing districts, respectively. Study participants were individuals involved with DHIS 2 implementation from the community level to the national level. The data were analyzed thematically.

**Results and Discussion:** The majority of study participants had a positive attitude toward electronic HIS. They felt that a strong government commitment, along with extensive donor support, could make nationwide implementation of DHIS 2 possible. Timeliness and completeness of data reporting has improved over time. Quality checks and feedback loops at multiple levels of data gathering points play a key role in improving data quality. Introducing a dashboard in DHIS 2 could encourage peripheral-level health managers to use DHIS 2 to monitor RMNCAH targets. Study participants mentioned barriers to DHIS 2 implementation that are similar to other research findings, such as lack of human resources, low Internet connectivity, frequent change of DHIS 2 versions, a defensive attitude toward electronic data capture systems from some staff, and donor-driven financial support. In Bangladesh, DHIS 2 is the only platform to report health indicators from different health departments. The same RMNCAH indicators are being reported separately by two different management information systems (MIS). Thus, compiling the data gathered from multiple reporting formats increases staff workloads. Moreover, RMNCAH data from most urban health facilities, which are dominated by the private sector, are not being captured in DHIS 2.

**Conclusion and Recommendations:** To sustain the achievements of digital data culture, focused strategic direction is needed. The workload among field-level staff can be minimized by an automated data reporting system with one standard reporting format for all stakeholders. Field-level staff motivation can be increased through incentives and engagement in the local planning process. Periodic refresher trainings would help improve computer literacy. Data from private health facilities should be captured in DHIS 2 to get the complete picture of the RMNCAH status in the country. A national electronic health (e-health) strategy and implementation framework can facilitate creating a culture of DHIS 2 use for planning, setting priorities, and decision making among stakeholder groups.



# INTRODUCTION

An MIS, one of the six building blocks of a health system, is essential for strategic planning, priority setting and decision making (World Health Organization [WHO], 2009; WHO, 2010). In contrast to a paper-based system, e-health provides timely and accurate collection of health data leading to better healthcare planning and improved diagnosis (Fox, 2005). A significant initiative under the umbrella of e-health has been the introduction of DHIS 2, which offers users the option of entering data at the community level and analyzing accurate health data at the central, state, and district levels (Garg & Garg, 2015).

Developed at the University of Oslo in 2008, DHIS 2 is an integrated, open-source, and web-based platform for health data collection, validation, analysis, and presentation of aggregated and individual data, that aims to improve health service delivery (Manoj, et al., 2013; Gathogo, 2014). One early use of DHIS 2 was Sierra Leone's 2008 initiative to integrate various district-level data reporting structures (Karuri, et al., 2014). Since then, it has been adopted around the world as a country-owned platform for health information technology (DHIS 2, 2017). Census data, population-based surveys, and validated research findings can also be transferred to DHIS 2, which could serve as a national data warehouse (WHO, 2016).

To date, DHIS 2 has been an integral part of the HMIS in 46 countries and, in 2015, had been translated into eight languages: English, French, Spanish, Portuguese, Hindi, Vietnamese, Chinese, and Norwegian. However, the level of implementation varies: 16 countries, including Bangladesh, have adopted it for nationwide implementation, 12 countries have used it for specific health programs (e.g., HIV) or partial national rollout, and 18 countries are at the pilot stage or initial rollout phase (Garg & Garg, 2015).

Easy aggregation of RMNCAH data in DHIS 2 is a supportive factor for effective strategic planning, priority setting, and decision making (Krishnan, et al., 2015). The effect of successful DHIS 2 implementation on RMNCAH service delivery has been documented in several countries (WHO, 2016). Evidence from Uganda and Kenya shows that DHIS 2 implementation improved reporting of certain health indicators, such as immunization coverage, antenatal care (ANC) visits, and facility delivery (Kiberu, et al., 2014; Manya, et al., 2012). In Laos, the effect of DHIS 2 implementation on maternal and child health surveillance data was noted. Information gathered through extended DHIS 2 on why mothers die, their access to health facilities, and the challenges health workers face when delivering maternal services supported Laos's planning process for maternal, newborn, and child health (MNCH) service improvement (WHO, 2016). Sri Lanka is using DHIS 2 data for MNCH information management and improved quality of care (Manoj, 2012).

However, multiple implementation challenges have been noted with DHIS 2, particularly in the developing country context, including inadequate infrastructure support, poor workforce capacity to manage the data, lack of awareness of data requirements, and uncoordinated data collection (Karuri, et al., 2014; Kiberu, et al., 2014). Bureaucratic disparities (e.g., uncoordinated data collection, fragmented hierarchy, and lack of organizational structure) also play a role in lack of coordination (Karuri, et al., 2014). These issues must be addressed for effective implementation of the software.

## Collecting and Recording Health Data in Bangladesh

Bangladesh's HMIS is considered an active contributor to global DHIS2 implementation strategy (Federal Ministry for Economic Cooperation and Development, Germany [BMZ], 2014). Two directorates under the Ministry of Health and Family Welfare (MOHFW) offer RMNCAH services: the Directorate General of Health Services (DGHS) and the Directorate General of Family Planning (DGFP), where the major service focus is on family planning (Steen et al., 2015). At the district level, the service delivery points under DGHS are district hospitals, while DGFP delivers service at maternal and child welfare centers. Both types of health facilities offer MNCAH care, including ANC, postnatal care (PNC), delivery

(including Caesarean section), adolescent healthcare, integrated management of childhood illness, and other services. Family planning services and postabortion care are not provided at district hospitals; they are only available at maternal and child welfare centers.

At the subdistrict level, administrative units are upazilas, unions, and wards. Both directorates have separate service delivery points under each of these administrative units. Under the DGHS, these are upazila health complexes, rural dispensaries, community clinics, and Expanded Program on Immunization (EPI) outreach centers. Under the DGFP, service delivery points below the district level are the MNCH units at upazila health complexes, upazila health and family welfare centers, domiciliary services (i.e., household visits), and satellite clinics.

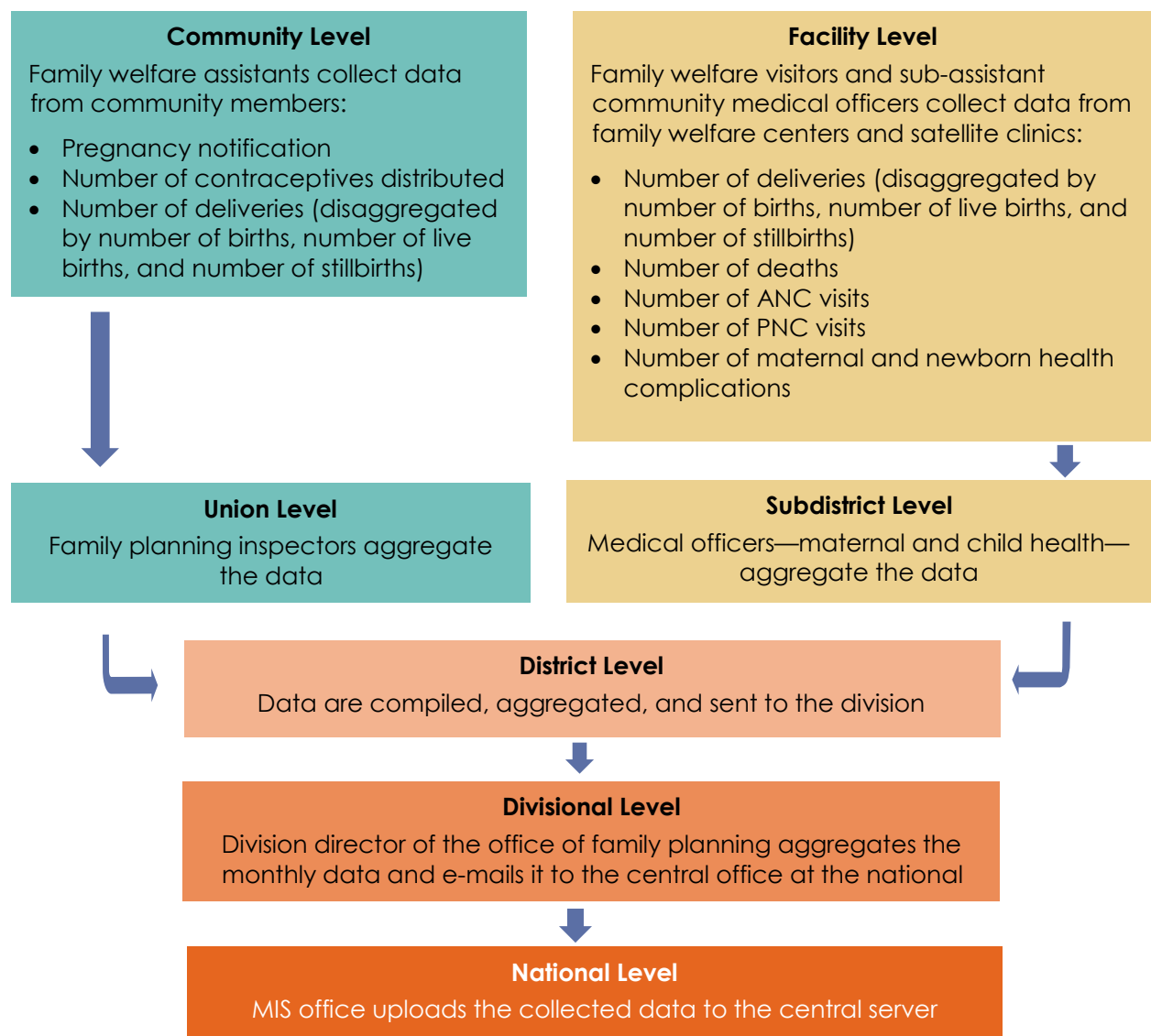
All RMNCAH service use data retrieved from community- and facility-based service delivery points are tracked by two different MIS under the two directorates. The service delivery points under DGFP and DGHS use two separate MIS to aggregate RMNCAH data collected from all female clients of reproductive age, children under five, and adolescent women residing in an individual district. Each district sends the aggregated data to the central-level MIS (WHO, 2015).

## **The DGFP MIS**

In the DGFP MIS, the majority of data collection, compilation, and transmission are manual and paper-based. At the community level, family welfare assistants collect data from community members, manually record it in their registers, then transfer it to family planning inspectors. These inspectors, who are positioned at the union level, report the data to the division office.

Family welfare visitors and sub-assistant community medical officers working in primary-level union health facilities (i.e., family welfare centers and satellite clinics) collect facility-level data. Family welfare visitors and sub-assistant medical officers maintain manual registers (with the exception of one upazila, where electronic tablets are being piloted) for service use data. They compile the data at the end of the month and send the aggregated data to the medical officer-maternal and child health stationed at the upazila level. The aggregated data from the upazilas (subdistrict) are then sent to the divisional director of DGFP. The statistician or data manager working at the divisional level e-mails the aggregated data, in a Microsoft Excel-based template, to the DGFP's central-level MIS. The data are uploaded to the central server and updated in the online dashboard (MIS DGFP, n.d.). The dataflow system under the DGFP is presented in Figure 1.

**Figure 1. MIS dataflow under the DGFP**



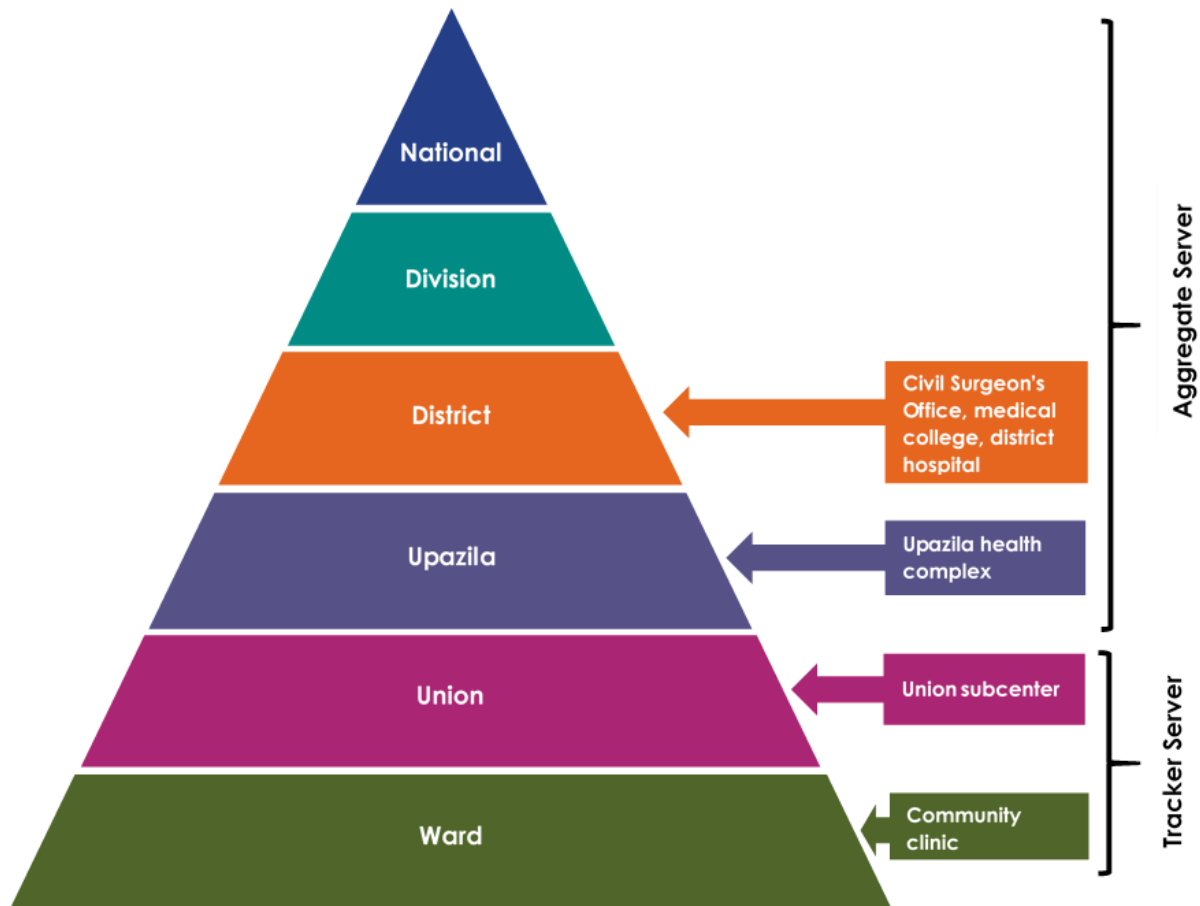
Unfortunately, the DGFP MIS is not connected to DHIS 2, so data cannot be accessed and visualized with DHIS 2. At the community level, vital statistics collected in households and RMNCAH service use data such as pregnancy identification, birth and death notification, ANC, PNC, and delivery are collected and compiled by community-level health workers. The process is time-consuming and fraught with data quality issues, including data duplication, overreporting and underreporting.

### The DGHS MIS

GHS established a wireless Internet network using DHIS 2 that has been used for data reporting since 2009 (Anderson, et al., 2015). Currently, about 75 percent of public health facilities in Bangladesh are covered under the DHIS 2 network and real-time health service use data, with particular attention to RMNCAH, are available from the community level to the tertiary hospital level. DGHS health facilities, along with community-level lay health workers, are equipped with information technology (IT) equipment (laptops, desktop computers, and handheld devices) and Internet connectivity for smooth running of online data collection, analysis, feedback, and use. More than 13,000 community clinics provide information in DHIS 2 on each pregnant woman and under-five child coming to receive services. Monthly aggregated data are collected through specific data forms from each subdistrict, district, and specialized

public health facility, including medical college hospitals. However, the vast majority of private facilities (registered and unregistered) are not covered by the DGHS MIS; service statistics are collected from a sample of only 26 private facilities. The national data warehouse in the DGHS MIS division is linked to different vertical data repository silos through an interoperable and standardized framework (MIS DGHS, 2018). The dataflow system under DGHS is shown in Figure 2.

**Figure 2. MIS dataflow under the DGHS**



Data available through DHIS 2 are mostly aggregated data by which cumulative service coverage data can be retrieved for an entire district (see Table 1). In 2013, individual patient tracking was introduced on a pilot basis at select community-level health facilities under the Commission on Information and Accountability project. The availability of individual patient-level data in the DHIS 2 platform increases data accuracy and decreases the workload of clinical staff who are responsible for data reporting. But data collected in the MIS focus mainly on the supply side: what the facilities have done and what type of inputs they have used. The MIS has not been able to track information on the demand side. The recently introduced hospital reform strategic guidelines attempt to address this by presenting some metrics (e.g., waiting time, client perception and client satisfaction) to capture demand-side information in the system.

In 2014, the integration of DGFP data with DHIS 2 was discussed at Ministry of Health level, to address data quality concerns and avoid the MOHFW maintaining two separate MIS, however, a final decision was not made.

**Table 1. Reported data in DHIS 2 under DGHS**

Type of Data	Related Indicators*
Emergency obstetric care	Number of ANC visits
	Number of PNC visits
	Type of delivery (disaggregated by normal or caesarean section)
	Skilled delivery rate
	Pregnancy complications
Immunization	Number of pregnant women receiving tetanus-toxoid vaccine
	Number of children under five receiving scheduled vaccines, by type
Integrated management of childhood illness	Number of integrated management of childhood illness pneumonia cases treated at outdoor and indoor department of health facility
Mortality	Number of maternal deaths
	Number of stillborn deaths
	Number of neonatal deaths
	Number of under-five deaths, by month
Nutrition status of women and children under five	Number of underweight and stunting cases treated for children under five
	Number of anemic mothers receiving iron folate supplements
Family planning	Number of short- and long-term contraceptives distributed
	Number of referrals given for long-acting family planning methods
Health education sessions	Number of health education sessions held on family planning methods
	Number of health education sessions held for pregnant women on nutrition, danger signs of pregnancy, etc.
Other reproductive health	Number of vaginal inspection assessments
	Number of cervical cancer screenings done at health facility
Human resources	Number of sanctioned (i.e., allocated) posts
	Number of available posts
Hospital logistics	Number of amenities and hospital equipment
	Percentage of equipment functioning

\* Not a complete list

HMIS data are underused for health planning purposes due to their poor quality. Thus, policy planners still rely on survey data, which is financially burdensome for a country's health system (WHO, 2015). Ensuring data quality has received attention from policymakers and some innovative strategies are being developed to improve the situation. A pilot project funded by USAID is supporting DGHS and DGFP to strengthen the routine HIS at the community level. This project is being implemented in 20 subdistricts of Tangail and Habiganj where both the health assistant and family welfare assistant registrars are being digitized and linked to matching client data at health facilities using unique identification numbers. In these pilot subdistricts, every eligible mother and under-five child at the community level has received a health card with a unique identification number that allows the system to retrieve and monitor their MNCH service uptake data at any service delivery point (Routine Health Information System, 2016).

## Rationale

Health managers and policy planners have identified DHIS 2 as an important monitoring tool. It allows users to analyze aggregated information from the local level to track outcomes. Initiatives to strengthen HIS often focus on technical issues rather than capacity building and infrastructure support, which are also important for a robust implementation process (BMZ, 2014). Facility managers and frontline health workers should be trained to ensure sustainability, maintenance, and successful operation of DHIS 2

without donor support (BMZ, 2014). More studies are needed to identify the factors that contribute to effective data collection and use of DHIS 2, and the measures implementing countries must take to maintain and scale up the system for public health decision making.

Given the importance and potential benefits of a strong HMIS, it is critical that the deterrents and enablers that influence use of DHIS 2 are identified and effectively addressed. By identifying whether the health indicators covered under DHIS 2 are inclusive enough for local and central policy planning to meet national RMNCAH targets, research findings are expected to contribute to developing effective strategies for successful DHIS 2 implementation by highlighting instances of data duplication and underreporting. The study findings are expected to inform the design of a responsive HMIS and DHIS 2.

## **Research Objectives**

**General research objective:** The main objective of this study was to explore the perceptions and experiences of study participants with implementing DHIS 2 to collect, analyze, and use RMNCAH-related data in Bangladesh.

### **Specific research objectives:**

1. Identify facilitators and challenges to using RMNCAH data with DHIS 2 at different levels under DGHS.
2. Conduct a thematic comparison with other countries implementing DHIS 2 of facilitators and deterrents to DHIS 2 operation.
3. Generate evidence for recommendations to strengthen HMIS operations aiming to ameliorate RMNCAH health outcomes in Bangladesh.

# METHODS

## Study Design

The research team conducted a qualitative exploratory study from September 2017 to September 2018. This investigation explored the details of data collection and reporting processes to identify a range of enablers and challenges related to successful DHIS 2 implementation from the community to the central level.

## Study Sites

Two study sites were selected based on the variation in indicator performance among districts reported by DHIS 2. Ten different data sets related to RMNCAH services for the last one-year period were assessed to evaluate DHIS 2 performance among districts at the national level. To determine district performance with DHIS 2 use, we used the reporting time indicator across divisions and then districts. Data from the last 12 months showed that Khulna was the highest-performing division and Chittagong was the lowest-performing division in reporting RMNCAH data to DHIS 2. In Khulna, Jessore was the highest-performing district; in Chittagong, Brahmanbaria was the lowest-performing district. It was assumed that certain local-level factors such as management structures, human resource availability, staff skills, and training might impact workers' perceptions of and experiences with using DHIS 2. Keeping this in mind, two upazilas from each district were purposely selected to capture differences in perceptions of and experiences with using DHIS 2 that resulted from variations in management and DHIS 2 operations at the local level.

## Study Participants

Forty-seven stakeholders from all levels of the health system were selected for the study to gather details about experiences with using DHIS 2 at each level. The participants at the community level were community healthcare providers (CHCPs), nurses, health inspectors, upazila statisticians, and upazila health and family planning officers (UHFPOs). At the district level, participants were civil surgeons and district statisticians. The assistant chief of MIS was involved at the division level, and from the national level system analysts and program managers under MIS directorates and representatives (e.g., monitoring officers, IT programmers) from development partner organizations, such as the German Corporation for International Cooperation and the United Nations Children's Fund (UNICEF), were contacted.

The inclusion criterion was willingness to participate in the study. The exclusion criteria were unwillingness to participate, and those who had been working in the specified sector for fewer than six months.

## Data Collection Methods

The data collection methods were directed by the research objectives: primary data collection used IDIs, FGDs, and KIIs, and secondary data collection was from document review. Before initiating data collection, we pretested the interview and FGD guides several times to establish tool validity and reliability.

The IDI respondents were CHCPs, upazila statisticians, nurses, and health inspectors. We followed a convenient sampling technique. The FGDs were conducted with district statisticians. Each focus group had six to seven purposely selected participants.

The key informants were categorized into three subgroups at three different levels: health managers (UHFPOs and civil surgeons), HMIS experts (system analysts, IT programmers), and key decision makers (assistant chief MIS-DGHS, program managers from MIS directorates, and divisional focal persons from development partners). A purposive sampling strategy was followed to ensure participation from each

stakeholder group. The snowball sampling technique was also used to identify key personal to be interviewed, to ensure collection of rich data.

For the document review, we aimed to understand the DHIS 2 implementation process, existing problems, and other deterrents and enablers. We reviewed monthly and annual DHIS 2-DGHS reports, DGFP MIS reports, donor reports, newspaper articles, and other published documents relevant to DHIS 2., most of which were available on the MOHFW website. We reviewed existing published and gray literature from other DHIS 2 implementing countries to conduct a comparative analysis of agents (facilitators and deterrents) in DHIS 2 operation, aiming to understand other countries' experiences and how HMIS can be improved. Donor reports approved by the MOHFW were also reviewed. Table 2 shows the number of interviews conducted for each group of study participants. According to Guest, et al. (2005), data saturation can be reached by 12 IDIs with at least one hour per interview.

**Table 2. Data collection methods**

Data collection method	Study respondents	Number of interviews	Sampling technique	Purpose/main issues explored
IDI	CHCPs, nurses, health inspectors, upazila statisticians	23	Convenient	Efficiency of record keeping using DHIS 2; staff attitudes; reporting status; factors hampering data entry and processing
FGD	District statisticians	2	Purposive	Multiplicative information and knowledge of using DHIS 2; cross-checking reflections that emerged during IDIs
KII	Health managers (UHFPOs, civil surgeons)	5	Purposive, snowball	Role of DHIS 2 technology in improving RMNCAH service delivery; constraining and facilitating factors during DHIS 2 implementation; other implementation challenges; scope of improvement of servers and software
	HMIS experts (system analysts and IT programmers)	3		
	Key decision makers (assistant chief MIS-DGHS, program managers from MIS directorates, and divisional focal persons from development partners)	3		
Total sample size (N)		N= 36		
Document review	National reports on DHIS 2 use; published and grey literature from 15 other countries implementing DHIS 2 at the national level			

We audio recorded the interviews with the participants' consent. If they denied permission, we took verbatim notes in Bangla. Research assistants transcribed all the interviews into Bangla immediately after completion. We cross-checked confusing data against the recordings. The research team met regularly during data transcription to facilitate data familiarization.

We coded the transcripts with a codebook defining a priori codes using ATLAS.ti. We identified sub-codes and inductive codes from transcripts and incorporated those within a codebook. After coding, the research team translated the coded data into English. We analyzed IDIs, FGDs, and KIIs separately and drew collective inferences from the findings collectively.

At the end of study period, in a consultative workshop we will share and discuss the study findings with relevant stakeholders (including study participants), particularly those providing technical or financial support, at nationwide DHIS 2 implementation.



## **Ethical Considerations**

We obtained written informed consent from all study participants and secured those forms separately. The study protocol was reviewed and approved by icddr,b's own institutional review board under protocol number PR-17086.

## RESULTS

We organized the findings into three sections based on the study objectives. The first section characterizes the details of participants' perceptions of and experiences with using DHIS 2 for RMNCAH data collection and analysis under Bangladesh's DGHS. The second section describes the challenges of using DHIS 2 for RMNCAH data at different levels. The challenges are grouped into four categories: the DHIS 2 platform, workforce, logistics management, and capacity building. The third section identifies facilitators for using RMNCAH data with DHIS 2. In the fourth section we offer recommendations from the IDIs, FGDs, and KIIs to strengthen HMIS/DHIS 2 operations and implementation and ameliorate RMNCAH health outcomes.

### Section 1. Perceptions of and Experiences with Using DHIS 2 for Data Collection and Analysis

#### Data Collection

The majority of study participants expressed a strong, positive attitude toward using DHIS 2 for RMNCAH data collection. They described DHIS 2 as a dynamic system that has improved overall medical record keeping and the accountability of data reporting from community clinics at the periphery to district-level hospitals.

*Online is a perfect system. Previously I used to collect data in papers, and at the end of the year my office gets full of papers. It was also very difficult to retrieve data from thousands of piled up paper forms. Now, in online, by clicking the date or by name or phone number of the patients, I can easily check the data. I am getting the data collection form even in my mobile, by which I can fill up the form, from any place and any time! So, it is easier. — Community health care provider, IDI*

The supervisory team perceived that initiating such technology has contributed to instant monitoring, cross-checking collected data, setting priorities, and making decisions, which was time-consuming with the previous paper-based system.

*From DHIS 2, along with [the] national scenario, we can see the status of districts and subdistricts, even unions and wards. All the field staff are forwarding data on rate of using contraceptives, maternal death, amount of IUD [intrauterine device] delivered, and number of oral contraceptives supplied. — Information communication technology focal person, IDI*

A few health managers expressed a contrasting view of electronic HMIS implementation. One district-level health manager argued that staff orientation and adaptation to technology would be a major obstacle to electronic HMIS implementation. He expressed his concern about e-health during a KII: "In some places . . . a complex device, [like a] computer has been handed over to the hand of an old community health worker, hence she cannot use it."

The number of laptops, desktops and tablet personal computers at the field level was reported as sufficient for data collection needs. The CHCPs were allowed to take the tablets home to complete data entry. Step-by-step training on tablet use contributed significantly to their expertise in computer-based data entry. However, the Internet infrastructure is very weak in many areas, and frequent power cuts were also reported. These issues were noted by different respondent groups. Slow Internet connectivity was recognized as one reason to maintain hard copies. System analysts mentioned that using "offline" data entry could be an alternative to help mitigate Internet connectivity issues.

*We work in community clinics. For example, the number of patients is not that much today, so I log into the system [DHIS 2]. But due to problem in Internet connectivity, server is not working. I could not enter today's*

*data. At dawn, the Internet speed is good, I enter the data from my register book at that time. It is my personal plan. . . . Sometimes we search for places, where Internet connection is available. — CHCP, IDI*

CHCPs maintain four different registrar books to record services and treatments by individual patient name. The registrar books help them cross-check data for missing reports. After attending to the patients, CHCPs enter the data from the registrar books into different data entry forms in DHIS 2. This is done daily, and in some cases monthly. However, according to the district statisticians, data collection in hard copy not only makes the process time-consuming and complicated, but also increases the workload of field staff. As one senior programmer noted, “If you can exclude the registrar books, their suffering would reduce. . . . In register books, the information is much detailed. Many of this information is not required for DHIS 2” (KII)

## Data Analysis

Key informants who had been involved with DHIS 2 since its inception explained that the software is continually maturing. During 2009, when DHIS 2 was launched, it was not used for data visualization and decision making because accessing the system was challenging. Since DHIS 2 introduced the dashboard concept in 2012, it has drawn the attention of directors working at the national level, who demanded the platform be used for their own reporting. As a result, the online data entry forms increased from 12 in 2012 to 32 in 2013.

*In 2013, the DHIS 2 log in dashboard was much popular, everyone can access it. At that time, 5,000 to 6,000 graphs were made using DHIS 2, which was increased to 15,000 to 16,000. It means, people were trying to use it. Because, one single person did not prepare it; it was prepared by users from 64 districts! Then, in 2014, we emphasized data use. There were many error[s] and wrong results were [coming] up. Up to 2009, it [data] was inaccurate. . . . Then, in 2015 we started capacity building of health managers on data use. — HMIS expert, KII*

Routine monthly meetings were held in each subdistrict, district, and divisional health manager’s office to review the generated summary reports using DHIS 2. Most respondents, from the community to the national level, identified this review meeting as a platform for RMNCAH-related data observation, monitoring, and instant planning for the coming weeks. Usually, statisticians were assigned to tabulate the data from DHIS 2 and share the generated summary reports with district and divisional health managers. Managers observed and flagged gaps in service delivery and noted achievements. Findings were discussed at the meetings in the presence of field staff (e.g., CHCPs, health inspectors, EPI superintendent, statistician, and other staff). Comparisons were made with the previous month, present month, and yearly national targets to track improvements in performance and identify any hindrances to achieving targets.

*In October, 150 mothers came for ANC. In November, only 50 or 70 mothers visited for ANC, up to November 15th. Then, I will discuss with that CHCP, the number is decreasing, you will have to work more. . . . [Again] For example, target for normal delivery is 50 for this month. In next month, we will give them a target, to increase it by 5 percent or 10 percent. Now, we ask the CHCPs to try to achieve the targets. We ask them to send the pregnant mothers to hospitals so that we can achieve the target for institutional delivery. — UHFPO, KII*

During the FGDs and KIIs, the supervisory group identified data entry mistakes as common incidents. Since the DHIS 2 forms are in English, field staff often have difficulty understanding the instructions and indicators. Lack of understanding about the RMNCAH indicators and their definitions were also reported as reasons for data entry errors. After getting feedback on data errors, CHCPs check the data in their hard copies, identify the errors, and rectify them in DHIS 2 (for example, cross-checking the outliers). The assistant chief, MIS-DGHS offered one example: “The total number of deliveries is 200 [for example]. But the sum of normal [vaginal] delivery, cesarean section and number of still birth and live birth, is higher than 200. So, I can understand, there is a mistake” (KII).

## Section 2. Challenges to RMNCAH Data Collection and Analysis with DHIS 2

### DHIS 2 Platform

Several technical challenges with the DHIS 2 platform were highlighted during the KIIs. There is no provision of automated calculation for aggregated data, and key informants expressed that its absence increased the possibility of data disparity and generating errors.

*DHIS 2 has a problem. . . . There are [boxes] for entering aggregated data. But, now, it is needed to use the formula. Many of the staff do not understand these formulas. In training sessions, I provide them the formula, explain this using multimedia presentation. [Please] Apply this formula and input the result into this box. Many [field staffs] do not understand it. In several cases, they put the value of one indicator in boxes designated for other indicator. — IT expert for MIS, KII*

In addition, DHIS 2 has the provision to “SKIP” for all indicators, which contributes to data incompleteness. With incomplete data, it is difficult to retrieve valid results from DHIS 2.

*Everything can be skipped. We can lock that. . . . Without entering several key indicators, I will not allow to save the data. But those indicators were not identified. You will see, many boxes are blank, but [the patients are] registered, because the indicator is the total number of enrolled [patients]. But the [service use] boxes are empty. — Senior programmer, KII*

Respondents involved in data analysis identified minor issues with the data collection forms that should be checked to decrease misreporting.

*In [the] individual server, first, I put mother's name, her EDD [estimated date of delivery], date of enrolment, and then a box will pop up for gender. There is male, female and transgender. The data is on a pregnant mother, which is clear from this information, I don't understand what the need of gender then? There should be a system that [the] computer would recognize the gender automatically when pregnant women has been marked. We should not put it manually. Here our field workers are making mistake[s]. Even, in my district, I found 10 to 12 transgender mothers. — District statistician, FDG*

Instead of using unique health identification numbers to track patients, their cell phone numbers are used. However, it is difficult and time-consuming to search the database with a cell phone number. To get around this, CHCPs prefer to enroll follow-up patients as new ones. This raises a data quality issue since repeat clients are identified in the system as new clients. According to the key informants, this has created a gap in the system, as it is not possible to track the health status of a single patient in the existing system during data analysis and visualization. It was suggested that the system could be linked to Bangladesh's National Identification Database. It was also noted that the platform design makes data validation challenging.

*Yet DHIS 2 cannot give us the platform to analyze individual-level data. For example, Rabima is a pregnant woman. I want to get all her information in a single report. If we consider, Rabima is a pregnant lady who received service from different health facilities and delivered her baby in a subdistrict health complex. In the data sheet, what I will get for her? Rabima took first ANC on date X, second ANC on date Y, in different rows. I am not getting her information in a single row. Every time, I will have to search for her, and match her mother's name, date of birth! If you want to do monitoring, you will have to examine the full report of an individual patient in a row. But I did not get that. . . . You are not getting information of pregnant mothers from 13,000 community clinics in a [compiled] report. How will you know who have received what and where is the gap? — MIS consultant with WHO, KII*

Updating the data entry forms to facilitate comparisons among data variables is challenging. In 2009, data were first reported in DHIS 2 in Bangladesh with version 2.6, which was upgraded, version-by-version, to 2.13 at the end of 2013 to make the system faster. Continuing this thread, DHIS 2 is now using version

2.22. Each time the data entry forms are changed it becomes more difficult to compare the old and new data because the software cannot match the data variables, resulting in invalid findings.

*For those, who are computer literate, for them, version change is an “attraction.” “Let us explore, what are the new features?” But, our CHCPs do not perceive it in this way. They think, there was a box here in the older version, where did the box goes now with the newer version? They don’t understand, we are trying to make their work easier! It will take some time, to change the culture. — HMIS expert, KII*

Several informants reported that in the existing system, searching for subdistricts is a time-consuming process.

*For example, I will search “KALIGANJ” subdistrict. I will have to move forward step by step. It will take one minute, even for an expert to find “KALIGANJ.” If there is an option in the beginning, that if we write “KALI,” “KALIGANJ” will automatically pop up, that would be excellent. I gave this feedback several times, but it did not work. — Assistant chief, MIS-DGHS, KII*

## Workforce

At the supervisory level, district and subdistrict health managers could not find the time to use DHIS 2 on a daily basis because they were involved in other activities (e.g., attending meetings, conducting trainings, protocol management). However, as health managers who were already aware of the RMNCAH targets from their years of experience, they did not feel the need to use DHIS 2.

*A health manager knows clearly about his district’s targets on immunization coverage, or ANC coverage, or even for facility births from their years of experience. So, they do not need to open the computer and get into the DHIS 2. The mechanism is such; you cannot trap him for this reason. — Senior programmer, KII*

During FGDs, the statisticians shared their need to perform other administrative duties (e.g., preparing salary sheets, drafting letters). As a result, they cannot conduct data analysis tasks during office hours and must work on holidays to complete them. In addition, the post of statistician was vacant in many areas. The recruitment process for this position was halted for many days due to secretarial challenges (government bureaucracy). Experienced staff (who are nearing retirement) tend to be reluctant to complete their assigned tasks. Yet it takes time for newly recruited staff to understand their responsibilities.

*A statistician has to do a lot of analysis. If he is engaged in multiple tasks, it is not possible to analyze the data accurately. The [job description and responsibilities] of statistician should be kept separate. But, in many districts there is no designated statistician. . . . In area “YY,” a ward boy does all the work of statistician; you cannot expect anything better from him! There should be an assigned person, who will do research [with data]. — District health manager, KII*

National-level key personnel acknowledged the shortage of statisticians or other staff trained in data analysis. They admit that in many areas, qualified statisticians have not been recruited. Even so, many statisticians are not efficient in using computer software and do not understand health indicators and data compilation. In many areas, statisticians do not even attend trainings.

*The statisticians are currently working, they are not original statistician. Maybe, they were administrative staff. We gave some training and recruited them in the post of statistician. In real field, it takes time to understand the tasks and responsibilities [of statistician]. Because, the age group of statisticians varies as well, it will be better if we can recruit a new cadre under civil service for dealing with DHIS 2. . . . Every day, the working agenda of a statistician gets changed. It is a problem. — Assistant chief, MIS-DGHS*

The RMNCAH data collected by the MIS Division of DGHS have also been used by the RMNCAH line directorate of DGHS. However, data retrieval from the DHIS 2 platform is not the regular practice for the RMNCAH line directorates; like all other directorates they rely on their own reporting format.

*Now everybody wants their data from DHIS 2. NCD [Non-communicable Disease] division add some indicator[s], RMNCAH add some too. In some cases, the reporting format is also different than the one used by DHIS 2. For example, if [the] EmNOC [emergency newborn and obstetric care] reporting format for [the] MIS division and RMNCAH would be same, I can get the report by clicking on DHIS 2 data. But [the] EmNOC report for RMNCAH directorates have 27 indicators while it is 25 in DHIS 2 database.*  
— Subdistrict statistician

## Logistics Management

Although the participants said the number of electronics provided for data collection is sufficient, slow Internet connectivity makes real-time data entry difficult. Most of the CHCPs opined that an interrupted Internet connection sometimes delays their regular job. As one CHCP described, “At dawn, sometimes the Internet speed is better. In most cases, I enter the data at this time. It happened, I could not report for one week, two weeks, as the speed was slow. With a weak connection, I cannot even log in into the system” (IDI).

Replacing faulty computer hardware at the peripheral level is also time-consuming. The participants stated that most of the tablets were out of service at the community level. They also mentioned that the process of sending broken tablets to Dhaka for repairs and transporting them back to the community took a long time. The majority of respondents reported modem shortages as well.

*The district health office is an important institution. All the reporting and monitoring happens from here. For that reporting, only one modem is available. Statistician is taking that SIM to do X, [and] then the administrative staff is putting him in a hurry, “I will have to send an important letter immediately. Give me the modem first.” Another one is asking for the modem without any delay. One modem is being used by four persons.* — District statistician, FGD

In many areas, subdistrict and district health managers personally obtain a modem and Wi-Fi router in the event the Internet connection is not available with the existing modem.

## Capacity Building

Statisticians reported not receiving any specific training on DHIS 2; rather it was a part of computer literacy training. It was also noted that the scheduled training on DHIS 2 is arranged once a year. However, the training honorarium has increased threefold this year, affecting the training budget and resulting in a shortage of funds. Yet the participants still expect the regular annual meeting. All the participants received DHIS 2 training manuals, though these were not updated to reflect changes in newer versions of the software and forms. Since DHIS 2 was introduced, the potential for health data to be analyzed has increased day by day, as claimed by several key informants. As there are no aggregated data available other than what is in DHIS 2, government officials are using it to prepare quarterly and monthly reports on RMNCAH-related status in the community.

## Section 3. Facilitators to RMNCAH Data Collection and Analysis with DHIS 2

Strong national-level commitment, mandatory data quality checks, monthly review meetings, and extensive donor support have all influenced successful DHIS 2 implementation.

Mandatory quality checks at different tiers and regular monthly feedback meetings have played a significant role in improving data quality. During KIIs, a medical officer, who is a first-level supervisor, explained, “For example, in previous months, number of ANC checkups was in between 200 to 500 per month. If it increases suddenly to 1200, then I can guess it is a mistake. Then I cross-check.”

A national-level expert shared his experience with checking data validity:

*For example, when we check MMR [maternal mortality ratio], we locate where the ratio is high. Then we review the ratio of that particular district for consecutive months to explore the consistency of data and reporting status, either it was low or high for the previous months. We check all these. Then we send an e-mail, to respective authority, to look into the matter. — HMIS expert, KII*

So far, DHIS 2's performance has been measured from the perspective of timeliness and completeness. A positive competition for service improvement has been nurtured. The best-performing district or division receives recognition from the national level.

*In our monthly meeting we discuss our shortfall; we plan how to improve the reporting rate. We always analyze the data; hence our performance is better!! We have a silent competition with other districts of this division and we do better always and got national award as model district. — District health manager, KII*

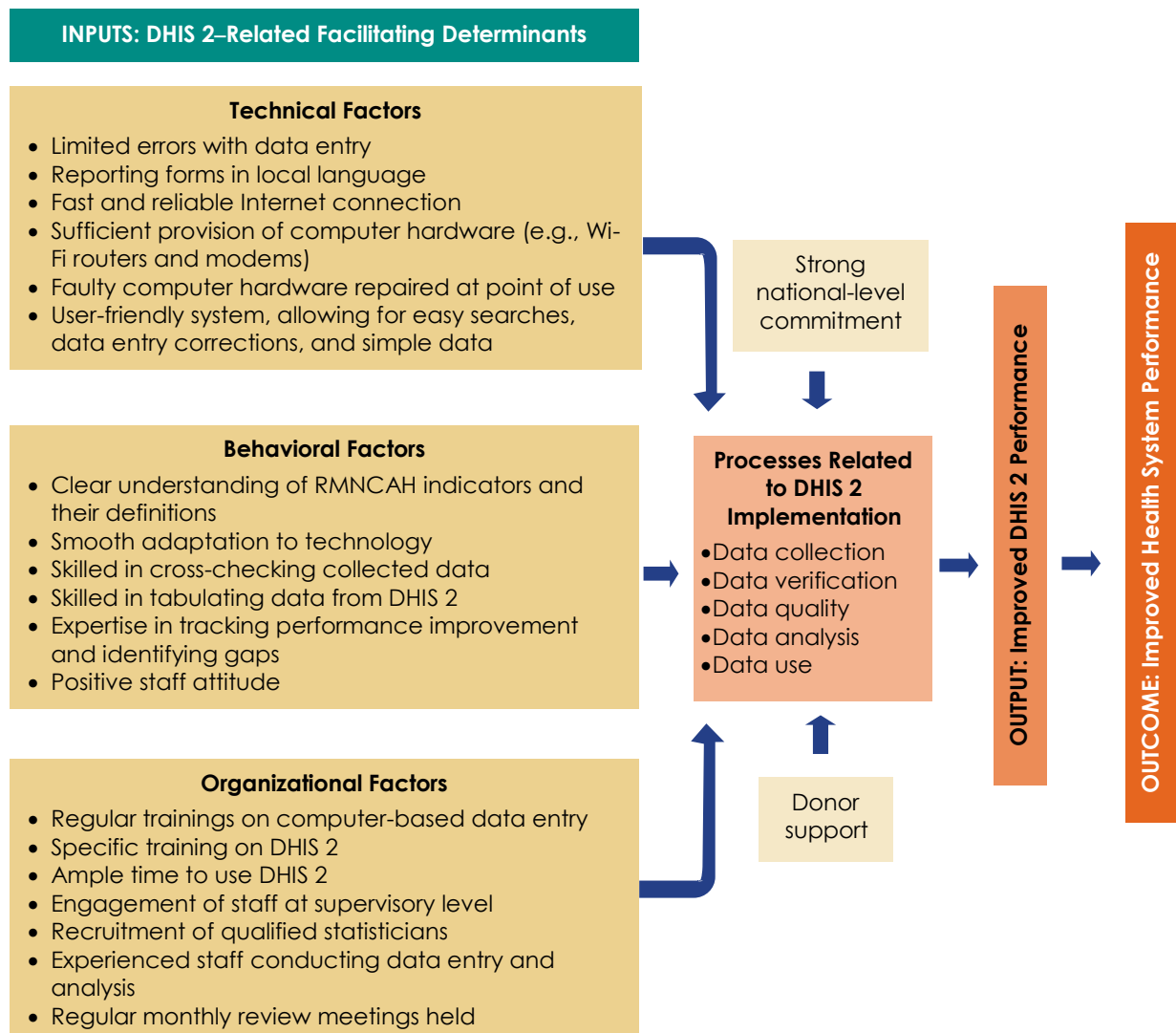
International donors like UNICEF and the German Corporation for International Cooperation strongly support strengthening Bangladesh's HMIS. They share financial costs with the government for national- and international-level training for the staff, IT equipment purchases, and other needs. In collaboration with other NGOs, like icddr,b, they are providing technical support to the IT programmer for online platform improvement and organizing a training on the DHIS 2 manual for staff working at different tiers of health system. Donor organizations have demonstrated a strong commitment to the successful implementation of DHIS 2 by deploying their staff as monitoring officers at each administrative division and ensuring their physical presence and participation during monthly coordination meetings at the divisional and central levels. In a collaborative effort, two successive international conferences related to e-HMIS have been organized in Bangladesh: Measurement and Accountability in 2016 and Data for Decision in Health (D4D) in 2017. Representatives from donor organization maintain close ties with the MIS office.

*We will have to be involved in new, massive initiatives. For example, the concept of impact and measuring outcomes in MIS. We are supporting each other mutually, aiming to strengthen the information system. At field level, staff are burdened with workload because DHIS 2 is working in different, multiple levels. Decentralization is very important. — MIS consultant in WHO, KII*

*The government has limited capacity and could not develop that capability till now. From the side of development partners, we are giving them that support. If development partners withdraw their support, how will the system run? But the DHIS 2 dashboard is already sustainable, and its automatic; staff have training and they can handle it. The government is cordial, and they have sufficient resources, training arrangement, hardware. In this context, strict monitoring and defined role of staffs are important. In addition, ownership of data is a major concern, many health managers do not own the data. — HMIS expert in UNICEF, KII*

The study respondents identified several determinants that affect how well DHIS 2 is implemented (Figure 3). These can be categorized as technical, organizational, and behavioral. These facilitating factors, along with strong national-level commitment and donor support, can affect DHIS 2 performance, thereby influencing health system performance.

**Figure 3. Analytic framework on strengthening DHIS 2 in Bangladesh**





## Section 4. Recommendations for Strengthening the HMIS to improve RMNCAH Outcomes

Based on the study findings, the participants' major recommendations for strengthening the HMIS to ameliorate RMNCAH outcomes in Bangladesh are elaborated below.

### DHIS 2 Platform

The DHIS 2 platform should be programmed to generate automated data for specific RMNCAH indicators. Similarly, a pop-up box with the indicator definition, calculation (if applicable), and any possible disaggregations should be included. This will provide instant help to the CHCPs and standardize data collection. The software should be translated into Bangla (the local language) to help create a clear understanding of instructions and RMNCAH indicators among data collectors. An online dashboard should be installed in the platform where instant RMNCAH-related reporting and performance status updates should be exhibited automatically at the subdistrict and district levels. Statisticians should be informed in advance about software updates and notified of specific changes so they can prepare the CHCPs.

### Data Collection System

Respondents suggested simplifying the present data collection forms to ease both the data collection process and data reporting. Creating unique health identification numbers for patients and issuing individual health cards will decrease the time spent on data entry and help mitigate data duplication. If unique health identification numbers are developed, it will create a built-in monitoring system. Since the system will contain clients' contact information, statisticians can verify the collected data through random phone calls. A geographic information system should be installed in CHCPs' electronic devices used for data collection to track the providers' movement. Users should be able to enter data into DHIS 2 daily, as aggregated data increase the risk of errors, thus compromising data quality.

### Capacity Building

Since DHIS 2 is used at different levels of the health system, from service delivery at the community level to policymaking at the national level, the DHIS 2 training curriculum should be tailored to the needs of health professionals working at different levels. The IDIs and FGDs revealed a need for separate training sessions on medical terminology for community and subdistrict level staff. After every update to the software or data collection forms refresher trainings should be organized to improve staff knowledge and efficiency. The statisticians, who are central to reviewing and analyzing RMNCAH data, articulated the need for trainings twice a year. A standardized training curriculum and tools are also needed. Furthermore, soft copies of training manuals should be shared with staff via e-mail so they can be easily updated and disseminated.

### Workforce

It was recommended that along with a statistician, another staff member should be trained in data compilation and analysis to complement the statistician's work and support the statistician in his/her absence. A separate MIS unit can be formed comprising, at a minimum, a statistician and a supporting staff member who will be assigned to perform all MIS-related tasks. This unit will not be responsible for other tasks. A specified data manager position can be created where a medical professional (i.e., physician) will be trained in IT to ensure proper data monitoring and technical assistance. However, this may require an innovative strategy to address staff retention if the position lacks a path to career advancement for the

medical professional. Subdistrict and district health managers should be more involved in data reporting and analysis to develop ownership and a regular practice of using DHIS 2.

## Logistics

Computers and other electronic devices for data collection should be repaired at the local level to save money and time. Providing CHCPs with an Internet data subscription can ensure timely reporting. The number of modems at the subdistrict and district levels should be increased, and each municipality should have its own dedicated laptop for the statisticians to use to ensure timely reporting.

## Policy and Advocacy

The country would benefit from a national e-health strategy and implementation framework to facilitate a culture of DHIS 2 use for planning, setting priorities, and decision making among different stakeholder groups. This strategy should include how the country intends to provide the resources to fund DHIS 2's long-term sustainability when donor support is no longer available.

## DISCUSSION

In general, a strong, positive attitude toward a digitized e-health system and corresponding actions taken from the directorates could make nationwide implementation of DHIS 2 possible in Bangladesh. Mandatory data quality checks, regular monthly coordination meetings at different tiers of the health system with active participation from all levels of key stakeholders, rewarding the best-performing district to enhance positive competition among DHIS 2 users, and close collaboration with donor organizations are some of the noteworthy initiatives taken by the MIS directorates. Although data accuracy and completeness remain an issue, data quality has improved with multiple levels of quality checks and feedback loops. Monthly data review meetings have been organized at each level of data gathering points. The importance of data review meetings to strengthen the HHS has been highlighted in other studies (Karuri, Waiganjo, Orwa, & Manya, 2014; Braa, Heywood, & Sahay, 2012).

The barriers to implementing an electronic HMIS mentioned under this study are similar to those reported by other developing countries: inadequate human resources, frequent power outages, low Internet connectivity, and a poor culture of using data for decision making (O'Connell, Bedford, & Thiede, 2014; Garrib, et al., 2008; Materia, et al., 1995; Poppe, 2012). The study findings revealed that some field staff are still struggling with the mindset change of moving from paper-based to electronic data collection and appreciating the usefulness of collected data. In this regard, another study highlighted that time is needed to allow community health workers to adapt and increase their computer literacy. This can be improved with onsite supportive supervision and providing troubleshooting at the district level (Kiberu, et al., 2014). Encouraging data ownership and adding incentives for accurate and timely reporting at the community level fostered a positive mindset change among field-level health workers in different country contexts including Kenya (Karuri, Waiganjo, Daniel, & Manya, 2014), Tanzania and Mozambique (Lungo, 2016), and parts of Asia (United Nations Development Programme—Asia-Pacific Development Information Programme, 2007). Data ownership enabled the field-level workers to understand the purpose of data collection and how the information would be used rather than considering it to be an administrative burden.

The data collected under DHIS 2 capture human resources, medicine and logistics, and RMNCAH health indicators. This data availability allows the health system to address broader contextual factors like human resource shortages or stockout episodes that sometimes affect the quality of RMNCAH data. One study documented that getting proper reports from routine data does not depend solely on the HIS, rather it requires the coordinated functioning of all components of the health system: human resources, medicine and commodities, leadership and governance, IT, financing, and service delivery. Above all, individual needs, motivations, and relationships among those working within the health system play a significant role in the successful implementation of an e-health information system (Okello, et al., 2018; Maternal and Child Survival Program (MCSP), United States Agency for International Development, 2017).

Although the study participants felt the data collected under DHIS 2 were comprehensive, the system lacks critical information, such as family planning statistics. Because the DGFP MIS is not connected to DHIS 2, data collected under the DGFP cannot be accessed and analyzed with DHIS 2. This lack of synchronization creates parallel reporting systems.

The study participants highlighted this duplicity in reporting and mentioned the difficulty of managing multiple forms and needing to report the same RMNCAH indicators in different formats for different stakeholders. Duplication of data with different reporting formats has been noted in other countries (Okello, et al., 2018). Although DHIS 2 could be the single online platform to meet different stakeholders' needs, if the district must report the same RMNCAH indicators in different formats to different stakeholders, this unnecessarily burdens the HMIS and increases the likelihood of data quality issues. A

standard reporting tool, developed in consultation with multiple level stakeholders, could be the best solution.

RMNCAH indicators from the majority of urban health facilities are not being reported in DHIS 2 in Bangladesh. The urban health system is dominated by the private sector, which is not accountable for monthly reporting to DHIS 2. However, some aggregated data, such as monthly delivery rate disaggregated by mode of birth and clinical causes of newborn and under-five admissions, are collected from the private facilities operating at the district level. Exclusion of data from private health facilities in DHIS 2 has been reported in other developing countries (Karuri, et al., 2014; Nielsen, 2013).

The key informants suggested that instead of generating monthly aggregated data, the electronic data collection forms should be designed to generate monthly reports automatically. Automating the system has proven to minimize the time required to generate reports and could increase completeness and accuracy of MNCH data reporting in some African countries as well (Kariuki, et al., 2016; Okello, Gerrets, Zakayo, Molyneux, & Jones, 2018). The DHIS 2 users from other countries opine that collected data need to be analyzed and used at more frequent intervals. Health managers should develop the daily practice of using a dashboard for data visualization. Errors in data collection or reporting can be immediately addressed from their feedback (Gathua, 2016; Karuri, Waiganjo, & Orwa, 2014). Moreover, the comprehensive evaluation of DHIS 2 after three to four years of implementation was also found to be beneficial to sort out gaps in information and set the strategic direction for system improvements (Eslami, Andargoli, Scheepers, Rajendran, & Sohal, 2017).

The national-level key stakeholders in this study mentioned that DHIS 2 implementation in Bangladesh is largely dependent on international donors. To ensure sustainability, the country should adopt its own strategy to self-finance the HIS. Evidence has shown that building the capacity of IT staff with public-private partnerships to generate funding has been a successful strategy for ameliorating donor dependency in other countries (Karuri, et al., 2014).

## CONCLUSION

We found that the majority of study participants exhibited a positive attitude toward an electronic HIS. Although DHIS 2 has become the data repository of choice for different health data, multiple reporting formats for different stakeholders, in addition to the ongoing reporting requirements for DHIS 2, negatively impact the workload of field-level health workers. The exclusion of data from Bangladesh's large private health sector in DHIS 2 is a hindrance to obtaining a complete picture of the country's RMNCAH status. In addition, slow Internet connectivity, some health workers' defensive attitude toward an electronic system, and limited use of data for local-level decision making prevent the successful implementation of DHIS 2. We recommend periodic refresher trainings to increase staff confidence in computer literacy. A national e-health strategy and implementation framework, as recommended by key stakeholders, will outline how the country will fund the sustainability of DHIS 2 and facilitate a culture of data use for planning, setting priorities, and decision making.

## REFERENCES

- Directorate General of Health Services (DGHS), Bangladesh Ministry of Health and Family Welfare. (2018). DHIS 2 user manual. Retrieved from [https://docs.DHIS 2.org/2.24/en/user/html/DHIS 2\\_user\\_manual\\_en.html](https://docs.DHIS 2.org/2.24/en/user/html/DHIS 2_user_manual_en.html)
- DHIS 2 in Action. (2017, May 10). Retrieved from <https://www.DHIS 2.org/inaction>
- Eslami Andargoli, A., Scheepers, H., Rajendran, D., & Sohal, A. (2017). Health information systems evaluation frameworks: A systematic review. *International Journal of Medical Informatics*, 97, 195–209. Retrieved from <https://www.ncbi.nlm.nih.gov/pubmed/27919378>
- Federal Ministry for Economic Cooperation and Development, Germany (BMZ) (2014). A quiet revolution: Strengthening the routine health information system in Bangladesh. Germany: Deutsche Gesellschaft für Internationale Zusammenarbeit. Retrieved from <http://www.jointlearningnetwork.org/resources/a-quiet-revolution-strengthening-the-routine-health-information-system-in-b>
- Fox, L. A. (2005). Fitting in, standing out. Leading effectively within your organization. *Journal of AHIMA*, 76(1), 24–28.
- Garg, R. & Garg, A. (2015). District Health Information System (DHIS 2) software in India. *Advances in Computer Science and Information Technology (ACSIT)*, 2(10), 39–42. Retrieved from [http://www.krishisanskriti.org/vol\\_image/21Jul201512071216%20%20%20%20%20%20%20Renu%20Garg%20%20%20%20%20%20%20%20%20%2039-42.pdf](http://www.krishisanskriti.org/vol_image/21Jul201512071216%20%20%20%20%20%20%20Renu%20Garg%20%20%20%20%20%20%20%20%20%2039-42.pdf)
- Garrib, A., Herbst, K., Dlamini, L., McKenzie, A., Stoops, N., Govender, T., & Rohde, J. (2008). An evaluation of the District Health Information System in rural South Africa. *SAMJ: South African Medical Journal*, 98(7), 549–552. Retrieved from <https://www.ncbi.nlm.nih.gov/pubmed/18785397>
- Gathogo, J. K. (2014). A model for post-implementation evaluation of health information systems: The case of the DHIS 2 in Kenya (Doctoral dissertation, University of Nairobi). Retrieved from [http://erepository.uonbi.ac.ke/bitstream/handle/11295/73090/Gathogo\\_post-implementation%20evaluation.pdf?sequence=1&isAllowed=y](http://erepository.uonbi.ac.ke/bitstream/handle/11295/73090/Gathogo_post-implementation%20evaluation.pdf?sequence=1&isAllowed=y)
- Gathua, P. W. (2016). Assessment of data use of the district health information system (DHIS 2): A case study of Nairobi county (MA Project). University of Nairobi, Nairobi, Kenya. Retrieved from <http://erepository.uonbi.ac.ke/handle/11295/99717>
- Githinji, S., Oyando, R., Malinga, J., Ejersa, W., Soti, D., Rono, J., & Noor, A. M. (2017). Completeness of malaria indicator data reporting via the District Health Information Software 2 in Kenya, 2011–2015. *Malaria Journal*, 16(1), 344. Retrieved from <https://malariajournal.biomedcentral.com/articles/10.1186/s12936-017-1973-y>
- Guest, G., Bunce, A., & Johnson, L. (2006). How many interviews are enough? An experiment with data saturation and variability. *Field Methods*, 18(1), 59–82. Retrieved from <https://journals.sagepub.com/doi/abs/10.1177/1525822x05279903>
- Kariuki, J. M., Manders, E. J., Richards, J., Oluoch, T., Kimanga, D., Wanyee, S., & Santas, X. (2016). Automating indicator data reporting from health facility EMR to a national aggregate data system in

Kenya: An interoperability field-test using OpenMRS and DHIS 2. *Online Journal of Public Health Informatics*, 8(2), e188. Retrieved from <https://www.ncbi.nlm.nih.gov/pubmed/28149444>

Karuri, J., Waiganjo, P., Orwa, D., & Many, A. (2014). DHIS 2: The tool to improve health data demand and use in Kenya. *Journal of Health Informatics in Developing Countries*, 8(1), 38–60. Retrieved from <http://www.jhidc.org/index.php/jhidc/article/view/113>

Kiberu, V. M., Matovu, J. K., Makumbi, F., Kyoziira, C., Mukooyo, E., & Wanyenze, R. K. (2014). Strengthening district-based health reporting through the district health management information software system: The Ugandan experience. *BMC Medical Informatics and Decision Making*, 14, 40. Retrieved from <https://www.ncbi.nlm.nih.gov/pubmed/24886567>

Krishnan, A., Nongkynrih, B., Yadav, K., Singh, S., & Gupta, V. (2010). Evaluation of computerized health management information system for primary health care in rural India. *BMC Health Services Research*, 10, 310. Retrieved from <https://bmchealthservres.biomedcentral.com/articles/10.1186/1472-6963-10-310>

Lungo, J. H. (2016). Data flows in health information systems: An action research study of reporting routine health delivery services and implementation of computer databases in health information systems [master's thesis]. Oslo, Norway: University of Oslo. p.234. Retrieved from <https://www.duo.uio.no/handle/10852/937>

Materia, E., Imoko, J., Berhe, G., Dawuda, C., Omar, M. A., Pinto, A., & Guerra, R. (1995). Rapid surveys in support of district health information systems: An experience from Uganda. *East African Medical Journal*, 72(1), 15–18. Retrieved from <https://www.ncbi.nlm.nih.gov/pubmed/7781548>

Manoj, M. (2012). Customising DHIS 2 for maternal and child health information management in Sri Lanka. *Sri Lanka Journal of Bio-Medical Informatics*, 3(2), 47–54. Retrieved from [https://www.researchgate.net/publication/270056096\\_Customising\\_DHIS2\\_for\\_Maternal\\_and\\_Child\\_Health\\_Information\\_Management\\_in\\_Sri\\_Lanka](https://www.researchgate.net/publication/270056096_Customising_DHIS2_for_Maternal_and_Child_Health_Information_Management_in_Sri_Lanka)

Manoj, S., Wijekoon, A., Dharmawardhana, M., Wijesuriya, D., Rodrigo, S., Hewapathirana, R., ... & Dissanayake, V. H. W. (2013). Implementation of District Health Information Software 2 (DHIS 2) in Sri Lanka. *Sri Lanka Journal of Bio-Medical Informatics*, 3(4), 109–114. Retrieved from <https://sljbm.sljol.info/articles/abstract/10.4038/sljbmi.v3i4.5431/>

Many, A., Braa, J., Øverland, L.H., Titlestad, O.H., Mumo, J., & Nzioka, C. (2011). National roll out of District Health Information Software (DHIS 2) in Kenya, 2011–Central server and cloud based infrastructure. In *IST-Africa 2012 Conference Proceedings* (Vol. 5). Retrieved from [http://helina-online.org/wp-content/uploads/2013/04/National\\_roll\\_out\\_of-District-Health-Information-Software-Ayub-Many.pdf](http://helina-online.org/wp-content/uploads/2013/04/National_roll_out_of-District-Health-Information-Software-Ayub-Many.pdf)

Management Information System, Directorate General of Health Services (MIS DGHS). (n.d.) *Health Bulletin 2017*. Dhaka, Bangladesh: Ministry of Health and Family Welfare, Government of the People's Republic of Bangladesh. Retrieved from <http://www.dghs.gov.bd/index.php/en/home/4364-health-bulletin-2017>.

Management information system, DGFP. (n.d.). Retrieved from <https://www.dgfpmis.org>

Maternal and Child Survival Program (MCSP), United States Agency for International Development. (2017). Review of the maternal and newborn health content of national health management information systems in 24 countries. Retrieved from <https://www.mcsprogram.org/resource/hmis-review>

Miles, M., & Huberman, A. (1994). *Qualitative data analysis: An expanded sourcebook* (2nd ed.). Thousand Oaks, CA, USA: Sage Publications.

Okello, G., Gerrets, R., Zakayo, S., Molyneux, S., & Jones, C. (2018). “Every day they keep adding new tools but they don't take any away”: Producing indicators for intermittent preventive treatment for malaria in pregnancy from routine data in Kenya. *PLoS ONE*, 13(1), e0189699. Retrieved from <https://journals.plos.org/plosone/article?id=10.1371/journal.pone.0189699>

O’Connell, T., Bedford, J., Thiede, M., Dickey, C. (2014). *Integrating an approach to assess UHC access barriers into district health systems strengthening in Uganda, Ghana and Rwanda*. New York, NY, USA: UNICEF.

Nielsen, P. (2013). *Advancing health information systems: Experiences from implementing DHIS 2 in Africa*. Retrieved from [https://www.who.int/woman\\_child\\_accountability/ierg/reports/11\\_Nielsen\\_HISP.pdf](https://www.who.int/woman_child_accountability/ierg/reports/11_Nielsen_HISP.pdf)

Poppe, O. (2012). *Health information systems in West Africa: Implementing DHIS 2 in Ghana* (Master’s thesis). University of Oslo, Oslo, Norway. Retrieved from <https://www.duo.uio.no/handle/10852/34907>

One year of RHIS: looking back routine health information system. (2016). Retrieved from <https://www.measureevaluation.org/countries/bangladesh/focus-on-rhis-bangladesh-newsletter-february-2016>

Stewart, D. W., Shamdasani, P. N., & Rook, D. W. (2007). *Applied social research methods series: Vol. 20. Focus groups: Theory and practice* (2nd ed.). Thousand Oaks, CA, US: Sage Publications, Inc. Retrieved from <http://dx.doi.org/10.4135/9781412991841>

United Nations Development Programme. (UNDP) (2007). *Evaluation of UNDP’S second regional Cooperation framework for Asia and the Pacific 2002–2006*. Retrieved from [http://web.undp.org/execbrd/pdf/RFC\\_Asia\\_.pdf](http://web.undp.org/execbrd/pdf/RFC_Asia_.pdf)

Steen, A., Kabir, M. H., 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. Retrieved from <http://siapsprogram.org/publication/altview/bangladesh-health-information-systems-mapping-analysis/english/>

World Health Organization (WHO). (2008). *Medical products, Vaccines and Technologies: Toolkit on monitoring health systems strengthening*. Geneva, Switzerland: WHO. Retrieved from [https://www.who.int/healthinfo/statistics/toolkit\\_hss/EN\\_PDF\\_Toolkit\\_HSS\\_MedicalProducts.pdf](https://www.who.int/healthinfo/statistics/toolkit_hss/EN_PDF_Toolkit_HSS_MedicalProducts.pdf)

World Health Organization (WHO). (2010). *Monitoring the building blocks of health systems: A handbook of indicators and their measurement strategies* (p. 44). Geneva, Switzerland: WHO. Retrieved from [https://www.who.int/healthinfo/systems/WHO\\_MBHSS\\_2010\\_full\\_web.pdf](https://www.who.int/healthinfo/systems/WHO_MBHSS_2010_full_web.pdf)

World Health Organization (WHO). (2016). *Health management information systems improve data quality to support health sector development and reform in Laos*. Retrieved from [http://www.wpro.who.int/laos/mediacentre/releases/2016/20160406\\_health\\_mgt\\_info\\_systems/en](http://www.wpro.who.int/laos/mediacentre/releases/2016/20160406_health_mgt_info_systems/en)

World Health Organization (WHO). Regional Office for the Western Pacific. (2015). *Bangladesh health system review, Vol. 5*. Manila, The Philippines: WHO Regional Office for the Western Pacific. Retrieved from <http://www.who.int/iris/handle/10665/208214>



# APPENDIX 1. IN-DEPTH INTERVIEW GUIDE

**Protocol Title:** Perceptions and experiences on implementing technology (DHIS 2 software) to collect and utilize the reproductive, maternal and neonatal health related data in Bangladesh

**Protocol number:** 17086

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**Note:** Start by introducing yourself, the purpose and the expected time (1 hour). If agreeable to interview, proceed to the consent form. Request to record interview and make sure the tape recorder is switched on to the start of the interview. If denied, please make note.

1. Current Position
2. Age
3. Educational background
4. How have you been involved in using DHIS 2 software for data collection?
  - Since when?
  - What is your role?
  - **Make notes on:** Years of involvement in using DHIS 2 software
5. Let us brain storm and list freely list all tasks required to accomplish using DHIS 2 (probe on
  - What are the major tasks/type of tasks? & what type of data you need to enter
  - Does anyone assist you in this regard? And please mention how much helpful this assistance is?
6. Please share your experience of data collection and entry using DHIS 2 with us.
  - How frequently do you use it?
  - How do you use it?
7. From your experience, how do you perceive the data collection process? Please share your thoughts with us. (Aim: to know the practical experience with data collection, compilation and preparing report)
  - Ask about data collection forms (difficult/easy & why he perceive so)
  - Compilation: Probe on any difficulty on gathering required data, any need of maintaining hard copy of registrar (advantage or disadvantage of it)
  - Reporting: does it useful to report all required RMNACH indicators?
  - Others: language barrier, conflict with usual clinical task
8. How confident do you feel when you give the data entry?
  - Please rank on a 5-point scale: (Strongly agree) 1-2-3-4-5 (Strongly disagree)
  - Why did you rank yourself in that position?
9. Have you ever faced any challenges in using DHIS 2 for your work purpose?
  - Please mention about problems, that you are frequently facing
  - How did manage/overcome those problems?
  - Challenges that could be solved at low cost immediately
10. Have you ever faced any difficulty for data entry/forwarding the data to your supervisor?
11. How does your supervisor share the findings from DHIS 2 dashboard in the monthly meetings?  
What are the common feedbacks for data collections and entry?
12. Does your supervisor provide you any individual/group feedback?

- What are the suggestions, your supervisor provided you to improve your performance?
  - Do you find those helpful?
13. In your opinion, what are the common mistakes/confusions for data entry?  
How those common mistakes/confusions could be solved?
14. Have you received any training/attended any workshop on DHIS 2?
- When?
  - Have you received any training manual/reading materials?
  - Any feedback on training (e.g. course content, facilitation)
  - Future need for training (e.g. frequency of training, additional training for the staffs who are trained already)
15. What are the overall strengths/weakness in using DHIS 2 software for data collection in your locality, specifically?

### **Final observations**

16. What could be done to make the DHIS 2 software more usable and understandable at community level?
- What kind of support do you need?
  - Scope of improvement
17. Can you suggest names of other actors who might be interested in participating in this study? *[If yes]*  
Would it be okay if we used your name when we contact these people to say that you recommended them to us? *[Collect names and e-mail addresses of recommended individuals.]*

**Finish the interview by thanking the participant.**

## APPENDIX 2. FOCUS GROUP DISCUSSION GUIDE

**Protocol Title:** Perceptions and experiences on implementing technology (DHIS 2 software) to collect and utilize the reproductive, maternal and neonatal health related data in Bangladesh

**Protocol number:** 17086

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**Note:** Start by introducing yourself, the purpose and the expected time (1 hour). If agreeable to participate in the discussion, proceed to the consent form to every participant. Request to record FGD and make sure the tape recorder is switched on to the start of the discussion. Request to listen to others' opinions and to be respectful to one another.

Introduction with the participants

1. How have you been involved in using DHIS 2 software for data collection
  - Since when?
  - What is your role?
  - **Make notes on:** Years of involvement in using DHIS 2 software for each participant
2. Let us brain storm and list freely all tasks required to accomplish using DHIS 2. [*Please use a flip paper*]
  - What are the major tasks/type of tasks?
  - Does anyone assist you in this regard?
3. Where would you put yourself, in accomplishing your task using DHIS 2? [*Please use the same flip paper with enlisted tasks and paste green stickers for easier tasks and red sticker for difficult tasks*]. Please ask for what made these tasks more or less difficult.
4. Please share your experience of data collection and entry using DHIS 2 with us.
  - How frequently do you use it?
  - How do you use it?
5. From your experience, how do you perceive the data collection process? Please share your thoughts.
  - Do you think the data collection forms are difficult to understand?
  - Do you think the commands for data entry are critical?
  - Others: language barrier, limited logistic support
6. How confident do you feel when you give the data entry?
  - Please rank on a 5-point scale: 0-1-2-3-4-5
  - Why did you rank yourself in that position?
7. Have you ever faced any challenges in using DHIS 2 for your work purpose?
  - Please mention about problems, that you are frequently facing
  - How did manage/overcome those problems?
  - Challenges that could be solved at low cost immediately
8. Have you ever faced any difficulty for data entry/forwarding the data to your supervisor?
9. How does your supervisor share the findings from DHIS 2 dashboard in the monthly meetings?
  - What are the common feedbacks for data collections and entry?
10. Does your supervisor provide you any individual/group feedback?
  - What are the suggestions, your supervisor provided you to improve your performance?
  - Do you find those helpful?

11. In your opinion, what are the common mistakes/confusions for data entry?
  - How those common mistakes/confusions could be solved?
12. Have you received any training/attended any workshop on DHIS 2?
  - When?
  - Have you received any training manual/reading materials?
  - Any feedback on training (e.g. course content, facilitation)
  - Future need for training (e.g. frequency of training, additional training for the staffs who are trained already)
13. What are the overall strengths/weakness in using DHIS 2 software for data collection in your locality, specifically?

#### **Final observations**

14. What could be done to make the DHIS 2 software more usable and understandable at community level?
  - What kind of support do you need?
  - Scope of improvement
15. Can you suggest names of other actors who might be interested in participating in this study? *[If yes]*  
Would it be okay if we used your name when we contact these people to say that you recommended them to us? *[Collect names and e-mail addresses of recommended individuals.]*

**Finish the focus group discussion by thanking the participants.**

## APPENDIX 3. KEY INFORMANT INTERVIEW GUIDE

**Protocol Title:** Perceptions and experiences on implementing technology (DHIS 2 software) to collect and utilize the reproductive, maternal and neonatal health related data in Bangladesh

**Protocol number:** 17086

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### Note:

Start by introducing yourself, the purpose and the expected time (1 hour). If agreeable to interview, proceed to the consent form Request to record interview and make sure the tape recorder is switched on to the start of the interview. If denied, please make note.

1. Name
2. Current Position
3. How have you been involved in using DHIS 2 software?
  - Since when?
  - What did/do you do when using the DHIS 2 (monitoring of data collection and entry/ data analysis/ data utilization for decision making)
  - **Make notes on:** Years of involvement in using DHIS 2 software
4. Let us brain storm and list freely all tasks required to accomplish using DHIS 2.
  - What are the major tasks?
  - How does DHIS 2 software help you in this regard?
  - To carry out your roles and responsibilities using DHIS 2 software, what are the competencies needed?
  - Does anyone assist you in this regard?
  - If YES, how do the staffs support you?
5. Do you have sufficient workforce to assist you?
  - How do you manage, when staffs take leave of absence?
  - Does it affect your work?
6. Have you received any training/attended any workshop on DHIS 2?
  - When?
  - Have you received any training manual/reading materials?
  - Any feedback on training (e.g. course content, facilitation)
  - Future need for training (e.g. frequency of training, additional training for the staffs who are trained already)
7. Please share your experience of using DHIS 2 with us.
  - How frequently do you use it?
8. How confident do you feel when you use DHIS 2? Please rank on a 5-point scale: (Strongly agree) 1-2-3-4-5 (Strongly disagree).
9. Why did you rank yourself in that position?
10. How do you perceive your competencies for monitoring the data collection/analysis/utilization process? Please share your thoughts with us.
  - Please rank on a 5-point scale: (Strongly agree) 1-2-3-4-5 (Strongly disagree)
  - Why did you rank yourself in that position?

11. In your opinion, how far do you think DHIS 2 dashboard is understandable and usable for your work purpose?
  - Do you think the data collection forms are difficult to understand?
  - Do you think the commands for data analysis and utilization are critical?
  - Others: Language barrier
12. Have you ever faced any challenges in using DHIS 2 at your work?
  - Please mention about problems, that you/your staffs frequently face (e.g., logistical challenges)
  - How did/do manage/overcome those problems?
  - Challenges that could be solved at low cost
13. How do you share the findings from dashboard in the monthly meetings?
14. To what extent DHIS 2 helps you in planning, monitoring and decision making?
  - Can you please give us one or two examples?
  - Any challenges faced, in doing so
15. How do you encourage/motivate your staffs to use DHIS 2?
16. Do you know anyone who uses DHIS 2 frequently?
  - How do you know?
17. Do you share the findings from DHIS 2 dashboard in the monthly meetings?  
How do you use the findings for strategic planning?
18. What are the overall strengths/weakness in DHIS 2 software utilization in your locality, specifically?

### **Final observations**

19. Where would you put yourself in utilizing DHIS 2 software? Please rank on a 5-point scale: (Strongly agree) 1-2-3-4-5 (Strongly disagree)
20. Why did you rank yourself in that position?
21. What could be done to increase the usage of DHIS 2 software at your office/among your staffs?
  - What kind of support do you need?
  - Scope of improvement
21. Can you suggest names of other actors who might be interested in participating in this study? *[If yes]*  
Would it be okay if we used your name when we contact these people to say that you recommended them to us? *[Collect names and e-mail addresses of recommended individuals.]*

**Finish the interview by thanking the participants.**

## APPENDIX 4. CODE LIST

A Priori Codes	Brief Definition	Full Description	When to Use
DHIS 2 System (SYS)	System related to DHIS 2 software	Role and features of DHIS 2 software in evidence generation, recording keeping, data management, or quality assurance for RMNCH indicators	Any statement that mentions role of DHIS 2 software in evidence generation, recording keeping, data sharing, management, or quality assurance for RMNCH indicators <b>Sub-codes:</b> (1) Advantages of DHIS 2, (2) Starting history of DHIS 2, (3) Disparity, (4) Duplication, etc.
Logistics (LOG)	Logistics needed for DHIS 2/HMIS processes	Overall types of logistics and related support needed in the field for DHIS 2 software for RMNCH data collection, management, and its further usage	Any statement that mentions the different categories or types of equipment (e.g., tablet, computer, laptop, modem) needed in the field for DHIS 2 implementation
Technology (TECH)	Technology related to all information	Application of scientific knowledge and/or equipment during the initiation and/or continuation and/or use of DHIS 2 software for RMNCH data collection, analysis, and use for reporting, decision making, or evidence generation	Any statement that mentions Internet connection or other technological aspects needed in the field for DHIS 2 implementation
Data (DATA)	Data management-related information using DHIS 2	Information related to all aspects of data collection, reporting, analysis, record keeping, and overall management	Any statement that details the various aspects of DHIS 2 related to data collection and entry, analysis, and use; includes data checking and/or use for monitoring, target achieving, and decision making <b>Sub-codes:</b> (1) Data collection: Anything related to data collection and entry, (2) Data use: Anything related to using data for monitoring field staff and dissemination of data in monthly meetings, (3) Quality: Any mechanism followed to improve data validity
Workforce (WF)	Workforce for DHIS 2/HMIS process	All types of information on workforce engagement at multiple tiers (e.g., division, district, subdistrict, community clinic) during the initiation and/or continuation and/or use of DHIS 2 software for RMNCH data collection, analysis, and use for reporting, decision making, or evidence generation.	Any statement that details how staff responsibilities, capacity building, motivation, confidence, etc. were conducted or addressed; includes any details of experiences mentioned at the time of interview <b>Sub-codes:</b> (1) Experience of staff, (2) Involvement, (3) Training, (4) User confidence, (5) Knowledge
Supportive Factors (SF)	Support for DHIS 2 implementa-	Factors that supported the initiation and/or continuation and/or use of DHIS 2 software	Any statement that mentions factors that were supportive toward starting and/or continuing and/or using DHIS 2 software for RMNCH

	tion	for RMNCH data collection, analysis, and use for reporting, decision making, or evidence generation	data collection, analysis, and use for reporting, decision making, or evidence generation; can be regulatory, political, social, personal, or developmental. <b>Sub-codes:</b> (1) Staff motivation
Barriers and Challenges (BC)	Barriers and challenges to DHIS 2 software implementation	Barriers and challenges faced during the initiation and/or continuation and/or use of DHIS 2 software for RMNCH data collection, analysis, and use for reporting, decision making, or evidence generation (including field implementation of DHIS 2 software)	Any statement that mentions barriers and challenges that existed or came up during the initiation and/or continuation and/or use of DHIS 2 software in any time/place; issues/barriers/challenges can be related to data management, quality control, system feature, equipment, technology, workforce, etc.



# WORKING PAPER

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