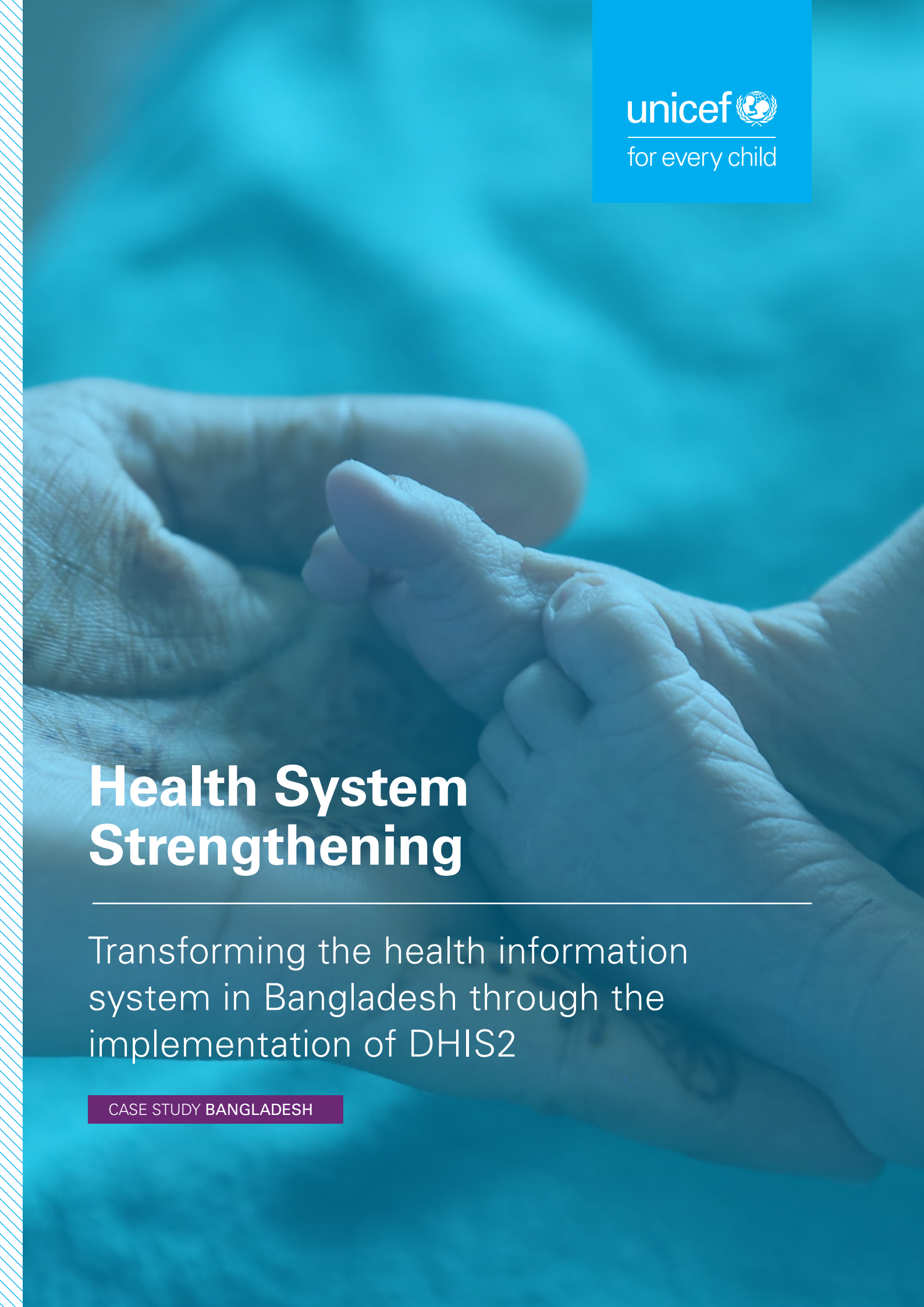

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Health System Strengthening

Transforming the health information system in Bangladesh through the implementation of DHIS2

CASE STUDY **BANGLADESH**

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United Nations Children's Fund
Regional Office for South Asia

P.O. Box 5815
Lekhnath Marg,
Kathmandu, Nepal

Tel: +977 1-4417082
E-mail: rosa@unicef.org

Websites:
www.unicef.org/rosa
www.facebook.com/unicefsouthasia

unicef

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Acronyms

DGFP	Directorate General of Family Planning, Bangladesh Ministry of Health and Family Welfare
DGHS	Directorate General of Health Services, Bangladesh Ministry of Health and Family Welfare
DHIS2	District Health Information System
DMIS	Data Management and Information System
FDMN	Forcibly Displaced Myanmar Nationals
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH
HIS	Health Information System
HISP	Health Information Systems Programme
HMIS	Health management information system
HPNSDP	Health, Population & Nutrition Sector Development Program
ICDDR,B	International Centre for Diarrhoeal Disease Research, Bangladesh
IT	Information Technology
MDG	Millennium Development Goal
MIS	Management Information System
MOHFW	Ministry of Health and Family Welfare, Bangladesh
MOLGRDC	Ministry of Local Government, Rural Development and Cooperatives
MDSR	Maternal Death Surveillance and Response
MPDSR	Maternal Perinatal Death Surveillance and Response
NCD	Non-communicable disease
NGO	Non-governmental organization
PHC	Primary health care
SCANU	Special care new-born units
SDG(s)	Sustainable Development Goal(s)
UHC	Universal Health Coverage

"Ten years ago, Bangladesh's health information system (HIS) was paper-based and built in a disorganised manner around the unique needs of different programmes and organisations. Today, Bangladesh is the largest DHIS2 deployer in the world. The reporting rate is on average 98%. Routine health information is now available in a timely manner, in a format accessible to all."

Contents

Executive Summary

Ten years ago, Bangladesh's health information system (HIS) was paper-based and built in a disorganised manner around the unique needs of different programmes and organisations. Today, Bangladesh is the largest DHIS2 deployer in the world. The reporting rate is on average 98%. Routine health information is now available in a timely manner, in a format accessible to all. The system now connects central, divisional and district levels with sub-district health facilities and over 13,000 community clinics. DHIS2 has been a vehicle for data systems improvement and other areas of health systems strengthening overall.

This is a compelling story to be learnt from. In August 2018, UNICEF conducted over 50 key informant interviews to collect knowledge from the Ministry of Health, key supporting partner organisations, health workers at all levels of the health system and community members, to develop a case study for critical learning.

This case study document outlines:

The way in which the DHIS2 system was implemented at-scale in Bangladesh

Analysed in retrospect, there have been five phases of DHIS2 implementation so far:

- An initial phase, in which the need for improving HIS was defined, Government commitment was established, a situation analysis was carried out, DHIS2 was chosen as the best tool for Bangladesh's context and necessary technical and financial support was secured.
- An implementation phase, in which a digital infrastructure within Ministry structures was built, a reliable online national data warehouse was set-up and 'buy-in' to set-up and use DHIS2 across Ministry programmes was established.
- An expansion phase, in which the focus was on improving the data reporting rate: datasets from multiple programmes migrated to DHIS2, DHIS2 was expanded to the community level and individual health records were introduced.
- A capacity building phase, in which the focus was on the 'human factors' of DHIS2 implementation to improve the quality and use of the data: ownership and increased capacity for DHIS2 was created at all levels of the health system, efforts were made to improve transparency and accountability of the system, patients, families and communities were engaged with and DHIS2 was used for emergency response.
- A sustainability and policy phase, in which DHIS2 was included in the health operational plan and information and learning on the implementation experiences were shared nationally and internationally.

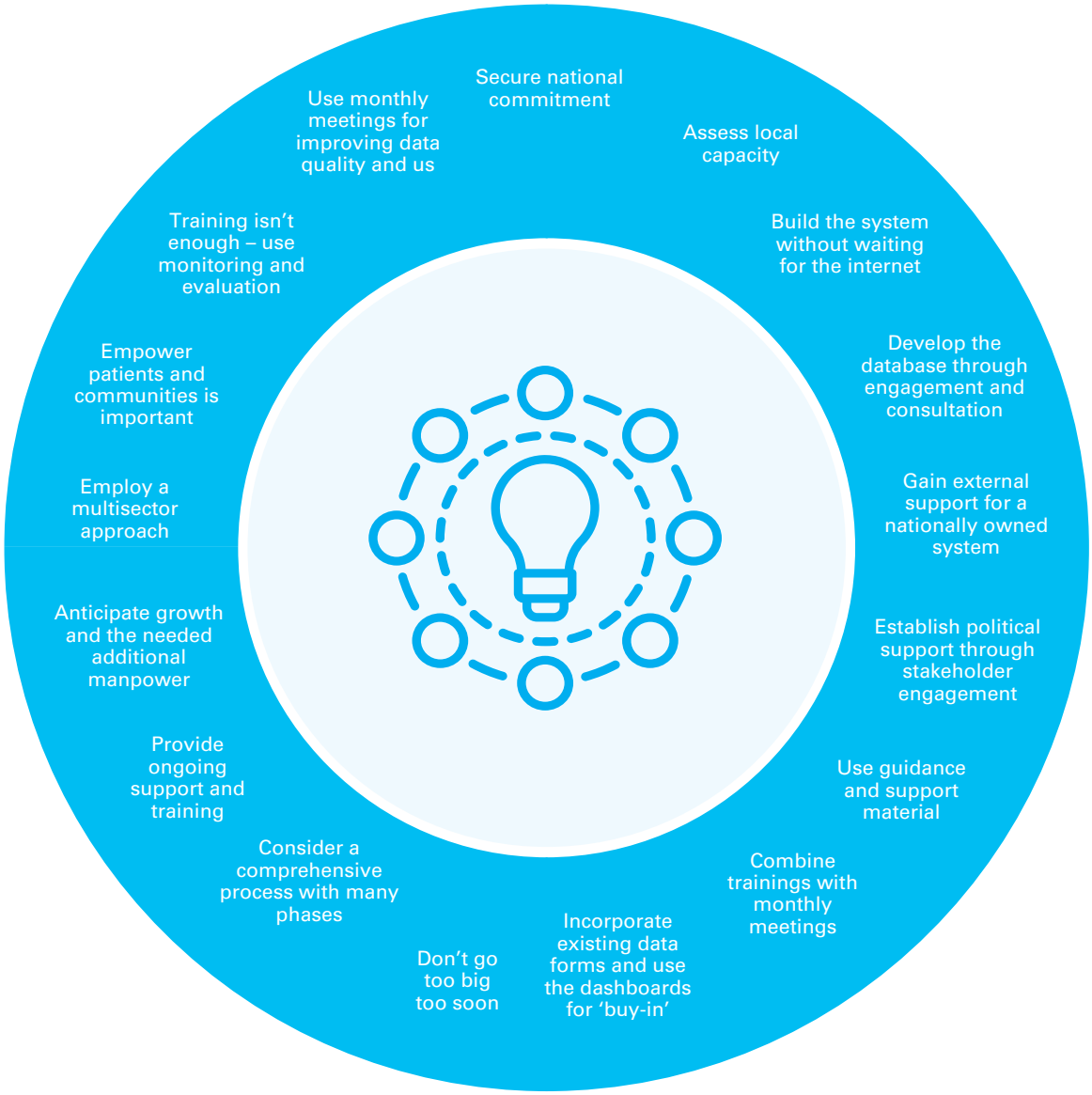
This case study documents the key actions taken in each phase.

The key lessons learned in each phase

The Ministry of Health and its partners learned as they worked through each phase. In this case study document, these are described within the relevant phase. In all, there were 17 key lessons.

"This is a compelling story to be learnt from. In August 2018, UNICEF conducted over 50 key informant interviews to collect knowledge from the Ministry of Health, key supporting partner organisations, health workers at all levels of the health system and community members, to develop a case study for critical learning."

Summary of key lessons learnt



The main benefits of DHIS2 implementation

For Bangladesh, DHIS2 implementation has provided benefits across the whole health system, in terms of:

Efficiency	• Helping people make better decisions for health programme planning • Dramatically reduced administrative burdens • Increasing the efficiency and effectiveness of health managers • Enhancing multisector collaboration: Development of DHIS2 core committee (2015) • Improving health system design
Accountability	• HIS available to everyone, everywhere • Improved feedback and supervision
Sustainability	• Strengthening resilience and emergency response capacity • Health system adaptability and sustainability
Quality	• Empowering communities to have ownership and participate in decisions and actions and integrating community-based systems with different levels of the health system • Using the patient experience to inform quality care provision
Equity	• Introduction of the individual tracker

Key bottlenecks and opportunities for the future

Broader health systems challenges in relation to DHIS2	• Low data coverage
	  • The need for further engagement with the private sector, NGOs and city corporations
	  • The need to collect and use data from the Directorate General of Family Planning
	• Shortages in trained health workforce at all levels
	  • Workforce for data analysis and use
	  • Workforce for data entry

Opportunities for broader health systems improvement	• Further advocating for DHIS2 within and outside the Ministry • Addressing shortages of skilled health workforce • Improving DHIS2 data collection
Challenges at the level of implementation	• Tradition and resistance to behaviour change • Lack of accountability and monitoring in follow-up to trainings • Poor role delineation at the health facility level • Hardware and software at the community level

Opportunities at the level of implementation	• New opportunities to help reinforce the "backbone" of DHIS2 functionality in the future
	  • Advancements in internet connection, servers and equipment
	  • Managing updates of DHIS2 version
	  • Improving the individual tracker
	• Improving the quality and use of DHIS2 data: Key opportunities
	  • Improving the analytical skills and interest of health managers and other decision-makers
	  • Providing more knowledge and skills to the health workforce
	  • Pushing role delineation
	  • Introducing new scorecards, dashboards and software

Recommendations to other countries, based on the experience in Bangladesh

- HIS should be led by continuous government leadership, committed to at least 5 years
- In the absence of a policy roadmap, adopt a pragmatic approach bringing together multiple stakeholders
- Take a comprehensive approach that goes beyond software and infrastructure
- When designing the system - predict future health needs
- Assess the capacity of the people on the ground: use your local strengths
- Commit to long-term capacity building with monitoring and accountability
- Be flexible and respond to changing needs
- Ensure collective responsibility and positive organizational behavior
- Engage with patients, families and the community
- Adopt a multi-stakeholder approach, led by the government for sustainability

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Introduction

Transforming the health information system in Bangladesh through the implementation of DHIS2

Case study documentation on the "how" in moving towards Universal Health Coverage

Ten years ago, Bangladesh's health information system (HIS) was paper-based and built in a disorganised manner around the unique needs of different programmes and organisations. Health data remained confined to programme silos with almost no use to policy-makers and health programme planners. At the decentralised level, the information sent from the community clinics, Upazila Health Complex' and district level health facilities, to the divisional and central levels could take up to three months. There were heavy paperwork burdens and the quality of the data was poor.

There was a clear need to improve governance and decision-making through implementing an efficient and effective routine HIS, suitable for Bangladesh's context. DHIS2 was chosen because it is a free, open source software that encourages interoperability between programme data, making it a viable solution for the fragmented HIS landscape in Bangladesh.

In just 10 years, Bangladesh has become the largest DHIS2 deployer in the world. Routine health information is now available in a timely manner, in a format accessible to all. The comprehensive and collaborative approach to HIS strengthening in Bangladesh has generated a revolution in the collection and use of data. The system now connects central, divisional and district levels with sub-district health facilities and over 13,000 community clinics. In just four years, the reporting rate has increased from 10 per cent at the community clinic level in 2014, to on average 98 per cent in August 2018. Furthermore, DHIS2 has been a vehicle for data systems improvement and other areas of health systems strengthening overall.

The importance of a comprehensive approach to strengthening health information systems

"In just 10 years, Bangladesh has become the largest DHIS2 deployer in the world."

Why HIS?

A well-functioning health system requires a well-functioning health information system (HIS). HIS are the "invisible backbone of any country's health system." Accurate and timely information is required for countries to monitor population health in real-time and to know whether or not health care is accessible, people-centred and provided with quality, to target interventions accordingly. HIS allow us to track emerging threats and to monitor progress towards health targets such as the 2030 Sustainable Development Goals (SDGs). Ultimately, a strong HIS reduces the gap between what public health professionals know and what they need to know to improve people's health.

The performance of a HIS relies upon more that data; it depends also upon an enabling environment with the right policies, advocacy, administrative and organisational structures, as well as many key human factors to implementation such as health worker skills and knowledge, individual motivation, good leadership and collaboration of multiple partners. Dissemination and communication are also vital aspects of a HIS, to ensure the information is valued by multiple users including policy-makers, health managers, healthcare providers, community and individuals.

Bangladesh has taken multiple actions in moving towards strengthening the health system on the pathway towards Universal Health Coverage (UHC). Part of this strategy has been to improve governance and decision-making through implementing the next generation District Health Information System (DHIS2), in 2009. The DHIS2 aims to increase the use of quality information for decision-making at all levels of the health system. This has been encouraged by Honourable Prime Minister Shaikh Hasina's vision towards achieving 'Digital Bangladesh by 2021', technological progress and continuous capacity building of the workforce.

In just 10 years, Bangladesh has become the largest DHIS2 deployer in the world. This is a compelling story, exploring not only how DHIS2 has been implemented for a stronger HIS, but also how DHIS2 has been a vehicle for data systems improvement and other areas of health systems strengthening overall, including community empowerment. This story can be used for shared learning in health systems strengthening across the region and indeed the world.

A simple tool with huge impact: story from the frontline

After driving for over an hour from the Ramu Upazila Health Complex, through the beautiful fields and hills sloping down towards the ocean by Cox Bazar, we finally pull over on to a small path which leads us down to the Barobil Community Clinic. The clinic is a tidy three roomed building nestled amongst the rice paddies, which is kept relatively cool in the shade from an overhanging tree.

Mr. Rezaul Karim, the Community Health Care Practitioner greets us with a wide smile. He leads us inside the clinic, whose modest exterior contradicts the innovation happening inside. The walls are draped with educational posters on warning signs for common illnesses, as well as maps of the nearby local villages that the clinic serves, with red crosses over the households with pregnant mothers or new-born children. There are a few women and children waiting in the corridor, but it is 11.00am and the clinic is not busy.

The clinic was built in 2001. Mr Karim has been provided primary health care services to the surrounding population (approximately 1000 people) since 2011, along with the healthcare assistant and family welfare assistant who provide weekly community outreach services and collect information from households, which is brought back to the clinic.

He is also supported by the community health support group who meet monthly to discuss any issues or updates. He said, *"we try our very best to give the patients quality treatment, patients come here when they have a fever, cold, allergy and for diagnosing malaria. We also receive pregnant mothers and provide immunisations".*

Mr Karim explains how he sees 40 patients daily, of whom 10 – 15 are usually pregnant women. He explains that one of the biggest challenges is providing continuous care for pregnant women and new-born children, who often live far and do not want to visit the health facility. But with a smile he expressed how this challenge is lessening;

"In the past, it was very difficult to track these patients. We were working with paper-based system, I didn't know about the situation in the remote houses, it was impossible to track everybody. But now we have a computer and wireless modem from the Government, and we input the patient's information and contact details when they come to see us in the clinic. If a person takes one vaccine, and then misses or dropouts of the second, we can see that patient has missed the visit from our new system. Then, we can contact that person through the health assistant, and inform them and ask if they can come to the clinic to take the next vaccination. It makes all the difference to our work. It means I can reach more patients, who I could not before".

The new system has enabled more accurate population data; the health assistant and family welfare assistant are now able to collect information and bring this back to the clinic, which is then uploaded into DHIS2. He explained, *"it makes us more aware of our local health challenges, which we can discuss together in the community meeting".*

Background

Bangladesh context

Health and health care in Bangladesh

With an estimated population of 162 million people living in a territory of only 147,570 square kilometres, Bangladesh is one of the most densely populated countries in the world. Despite rapid urbanization, most Bangladeshis continue to live by subsistence farming in rural villages. Bangladesh has achieved impressive improvements in population health status since independence in 1971: The country achieved Millennium Development Goal 4 (MDG 4) by reducing child death ahead of the 2015 target , and has rapidly improved other key indicators including life expectancy at birth, which has risen to 72 years, reduction in maternal death and improvements in immunization coverage (97 per cent DPT, 94 per cent measles).

Despite these gains, however, many pressing health challenges remain. Access to antenatal care is low and although there has been a rise in births attended by skilled staff (from eight per cent in 1997 to 42 per cent in 2014), this number of births at home remains low compared with neighbouring countries. Malnutrition also remains a concern, with 32 per cent of children under the age of five estimated to be underweight and 36 per cent estimated to be stunted.In addition, like most countries, Bangladesh is in an epidemiological transition, with a rise in non-communicable diseases (NCDs) such as heart disease and diabetes, which will require more resources on an already strained health system.

The national health system structure

Bangladesh's health system is pluralistic with four key actors that define the structure and function of the system: government, private sector, nongovernmental organizations (NGOs) and donor agencies.

The system remains highly centralised, with the Ministry of Health and Family Welfare (MOHFW) responsible for overseeing, managing and regulating health, family planning and nutrition programmes countrywide. The MOHFW holds two Directorates; the Directorate General of Health Services (DGHS) and the Directorate General of Family Planning (DGFP). These two Directorates both provide general health and family planning services through district hospitals, Upazila Health Complexes at sub-district level, Union Health and Family Welfare Centres at union level, and community clinics at ward level. Family planning services are often managed and delivered separately from DGHS services, using different health workers and facilities at all levels of the system.

While the MOHFW directly oversees primary healthcare (PHC) facilities in rural areas, the Ministry of Local Government, Rural Development and Cooperatives (MOLGRDC) is responsible for the provision of urban primary healthcare services. The Ministry does not always have its own network of healthcare facilities. This often results in NGOs or other private providers delivering PHC services to urban residents. 11 city corporations and 321 municipalities also have influence over health service delivery through Government clinics and non-governmental organization clinics in urban areas.

"Bangladesh has achieved impressive improvements in population health status since independence in 1971: The country achieved Millennium Development Goal 4 (MDG 4) by reducing child death ahead of the 2015 target , and has rapidly improved other key indicators including life expectancy at birth, which has risen to 72 years, reduction in maternal death and improvements in immunization coverage (97 per cent DPT, 94 per cent measles)"

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DHIS2 implementation in 5 phases

"As a motivating idea 'Digital Bangladesh by 2021' was wildly successful, however without an overarching policy or operational plan, the adoption to IT was rushed and disorganised."

Initial phase

- Bangladesh's previous HIS
- Defining the need for improving HIS
- Establishing Government commitment
- Carrying out a situation analysis
- Selecting a tool for the data warehouse: Why DHIS2?
- Securing necessary support

Implementation phase

- Building a digital infrastructure within Ministry structures
- Setting up a reliable online national data warehouse
- Establishing 'buy-in' to set-up DHIS2

Expansion phase

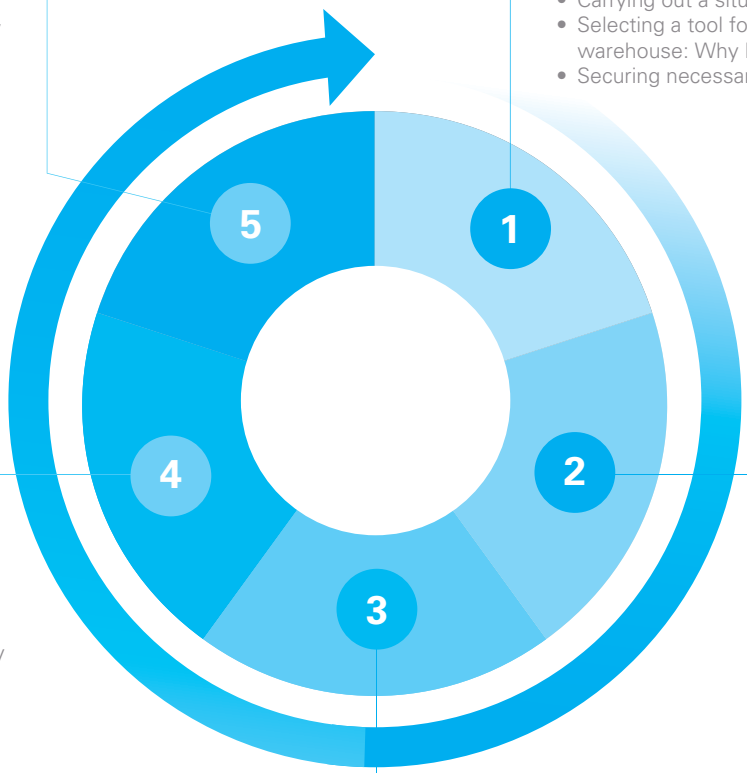
- Rolling out the initiative: Datasets from multiple programmes migrate to DHIS2
- Further expansions to the community level: Introducing individual record data

Capacity building phase

- Creating ownership and increased capacity
- Influencing behavior change and motivation
- Supporting transparency and accountability
- Focusing on resilience
- Engaging with patients, families and communities
- Making DHIS2 available to all

Sustainability and policy phase

- Including DHIS2 in the health operational plan
- Sharing information and learning from experiences nationally and internationally



This case study documents how DHIS2 was implemented in Bangladesh. It describes the key actions taken over five phases.

1

Initial phase

Key actions

- **Building a digital infrastructure within Ministry structures**
- **Establishing 'buy-in' to set-up DHIS2**
- **Carrying out a situation analysis**
- **Setting up a reliable online national data warehouse**
- **Establishing Government commitment**
- **Securing necessary support for implementation**

Looking into the past: Bangladesh's previous health information system

In the past, Bangladesh's HIS was a case of extreme fragmentation. It had been built in a disorganised manner around the unique needs of different programmes and organisations. Health data remained confined to programme silos, with large amounts of overlapping data and little to no engagement between the public and private sectors. This lack of overview on service coverage meant the data had almost no use to policy-makers and health programme planners at the national level who needed timely, complete and reliable data for evidence-informed decision making. Instead, policy-making was dependent on periodic population surveys, such as the Bangladesh Demographic and Health Survey, conducted every three to five years. This time-gap between the surveys limited decision-makers capacity to make timely decisions.Furthermore, amongst competing priorities in the health budget, the Management Information Systems (MIS) unit under the DGHS was not valued or given priority.

At the decentralised level, the one-way routine HIS also obstructed the efficient management of health services. Each HIS collected data from the district and Upazila (sub-district) levels through their siloed channels, involving different formats ranging from paper, Excel sheets and Word documents.

"A snapshot of Bangladesh's routine HIS before the digital revolution"

Well into the new millennium, the collection of routine health information in the public sector in Bangladesh was done manually, using paper forms which would be completed by health workers at a decentralised level and submitted upwards, through the administrative hierarchy, until they eventually reached Dhaka. The main features of this system included:

- **Parallel systems.** In keeping with its bifurcated structure, the MOHFW had two main management information system (MIS) units – one in the Directorate General of Health Services and one in the Directorate General of Family Planning – each responsible for collecting routine data about the health services it provided, as well as logistics (i.e. equipment and supplies) and personnel. There were also smaller MIS units embedded into vertical programmes. These multiple systems operated independently of one another and the information which they collected was not combined, even at the highest levels.
- **Overlapping reporting requirements**. Facilities and field workers were responsible for collecting certain types of routine data using standardised reporting formats. These forms, however, were not harmonised, with the result that the same information would often be collected multiple times (sometimes according to different definitions) by different departments and programmes. This resulted not only in a heavy paperwork burden, but also in data of questionable quality, as field workers struggled to keep up with the reporting demands of multiple, poorly coordinated sub-systems (Munshi et al., 2009).
- **Paper forms and ledgers.** Data collection systems were paper-based, with aggregate data being captured electronically at certain levels of the system. Hard copies of reports would be sent to the next highest administrative level where they would be combined with similar data from other facilities, sent to the next higher level, and so on, until they reached the national level (Munshi et al., 2009).
- **Slow channels of communication.** Communication between levels of the public health system relied on the postal system, land lines and fax machines. Generating an answer to even a relatively simple data request was extremely time consuming, as letters had to be sent by post from one administrative level to the next and back again. Not only was this inefficient, but there were chances for mistakes at every step, as data was continuously being compiled and forwarded up the chain.
- **Insufficient manpower.** The MIS unit in the Health Services directorate was understaffed (160 out of 660 sanctioned posts were vacant in 2009) and had few personnel with the knowledge and experience needed to modernise the existing paper-based system. Statisticians – the category of employees responsible for gathering, compiling and submitting reports – were overwhelmed by data entry tasks. Beyond this, most did not have statistical training which could be drawn upon in designing research or surveys, undertaking data analysis or preparing reports about various health issues (Munshi et al., 2009).

The information sent from the community clinics, Upazila Health Complex' and district level health facilities, to the divisional and central levels could take up to three months. By the time it arrived it was no longer relevant, and there was little capacity for feedback to the decentralised levels. These vertical hierarchies "did little to empower facility managers or local health planners to use data to improve outcomes in their facilities".

Defining the need for improving HIS

Between January 2007 and June 2008, a group of experts under the MOHFW joined forces with the WHO's Health Metrics Network to assess the status of Bangladesh's HIS – and the context in which it operates – against a set of international standards.

"The results were sobering: only three of the six main components (i.e. indicators, data sources, information products) were assessed as being 'adequate' or 'highly adequate;' two (i.e. resources, dissemination and use) fell into the category of 'present, but not adequate;' and one component, data management, received a score of 0 – 'not at all adequate' (Munshi et al., 2009)."

Establishing government commitment

To try and address this complex situation of extreme fragmentation, the Bangladesh Ministry of Health in collaboration with international development partners launched the Health, Nutrition and Population Sector Programme (HNPSP) in 2008.

Later, in December 2008, the Government of Bangladesh introduced the vision of 'Digital Bangladesh by 2021' – a call to action to mainstream information technology (IT) in all areas of society to improve transparency and promote development. From 2009 onwards, the groundwork for digitizing the existing HIS began, led by the MIS unit.

Resource: Questions to assess the current HIS in a country

Assessment questions included [7] :

- Is there a national plan for HIS?
- What are the current HIS resources? Including legislative, regulatory and planning frameworks underpinning the system, and the resources – workforce, financing, logistics support, information and communications technology, and coordinating mechanisms – to allow it to function.
- What are the core set of indicators and targets for monitoring and assessing changes in determinants of health; health system inputs, outputs and outcomes, and health status?
- What are the current population-based and facility-based data sources which allow for tracking of indicators and targets?
- What data management processes, ranging from data collection, storage and quality assurance to transfer, processing, compilation and analysis?
- What information products are available to translate data into evidence and knowledge for decision making?
- How is information disseminated and used currently?

There was a boom in eHealth projects within the MOHFW, the infrastructure within the Ministry (from national to decentralised levels) was built up to become digital, which included the development of a MIS Data Center to host a new web-based server, an IT laboratory for health workforce training, a web portal to store Health Services directorate content and an Internet mail server that provided each health facility under the Health Services directorate jurisdiction with a unique email address for more rapid communications. Furthermore, by April 2009, hardware including computers and wireless modems had been distributed to approximately 800 hospitals and health offices from the national to sub-district levels.

As a motivating idea 'Digital Bangladesh by 2021' was wildly successful, however without an overarching policy or operational plan, the adoption to IT was rushed and disorganised. By late 2009, seven new MIS had appeared and were operating in the Ministry. The new MIS were not integrated within MOHFW, nor in the Ministry as a whole. Other large health providers – including the Urban Primary Health Care Project at the Ministry of Local Government, as well as private sector and NGO healthcare providers were developing their own MIS solutions. In short, the digital health landscape remained fragmented and the data was still disconnected from being helpful for evidence-based decision-making.

The Government identified the need to improve governance and decision-making through implementing one overarching routine HIS, suitable for Bangladesh's context. The Government of Bangladesh asked the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) to support the Ministry towards HIS strengthening.

With this in mind, the GIZ launched the Data Management Information System (DMIS) project in March 2009, with the aim to strengthen information support to HNPSP through more effective integration of information flows and systems using a centrally managed data warehouse.

A comprehensive approach was adopted to strengthen the HIS, with four key areas:

- Systems development and implementation: Putting in place appropriate IT software and hardware for data collection and data management, and maintaining, managing and further developing these systems;
- Capacity development: Building local expertise to maintain and manage the HIS, including its technical aspects;
- Use of information: Making information available, in accessible formats, to all stakeholders, while instilling a culture of evidence-based decision making, and;
- Governance: Systems and processes for managing the country's HIS, including coordination mechanisms, strategic plans, and policies.

Carrying out a situation analysis

A first step in the DMIS initiative was to map the current situation of different information flows and deployment models, to collect the list of data elements being used and the data that had been collected for the previous three years. Initially, the focus was on the systems of four key stakeholders:

- Director General of Health Services (DGHS).
- Directorate General of Family Planning (DGFP).
- National Nutrition Programme (NNP).
- Second Urban Primary Health Care Project MIS (UPHCP).

Selecting a tool for the data warehouse: Why DHIS2?

After conducting the situation analysis, the next step was to select the tool for the data warehouse. In 2009, Professor Abul Kalam Azad, then Director of the Management Information Systems (MIS) unit of the DGHS, and now director of the DGHS, in collaboration with GIZ, began exploring different options of collecting routine data from health facilities.

One of the options considered was the creation of an application from scratch using the skills of the overseas consultants attached to the DMIS project. However, this was too costly and timely for Bangladesh's context. Instead, in 2008, the DMIS team leader on a visit to India (whom had implemented DHIS in 2000) came to meet HISP India to see DHIS in use and to learn if it could be a suitable solution for Bangladesh. It was a good example of regional scaling of DHIS2.[8]

Following this visit to India, the DHIS2 was chosen because it is a free, open source software that encourages interoperability between programme data, making it a viable solution for the fragmented HIS landscape in Bangladesh. It is also user-friendly and customizable, which was important in Bangladesh's context with a health workforce with low skills in IT. DHIS2 is also innovative and highly scalable, "thousands of concurrent users and hundreds of millions of data records could be supported through a single web server". This made the software suitable for Bangladesh's large population.

"For a huge country, with a large number of health infrastructures across the country, the paper-based system was in vain, it was not efficient, it was simply a waste of money. We needed a simple, affordable, scalable, sustainable IT based solution. I truly believed in DHIS2 as this solution…"

"…In 2009 the infrastructure was not ready and the capacity for IT was not strong, it was very weak. It was also difficult to develop a software, due to the poor capacity in the MIS office as well as in Bangladesh. Money was also a factor. We needed more money for the hardware and for providing trainings, rather than developing software. We explored different software, and we found the DHIS has already been made by the University of Oslo, it was the best solution to the challenges we were facing." (DGHS Director General, Professor Azad).

Securing necessary support for implementation

The visit to India led to the creation a Memorandum of Understanding (MoU) with HISP India to provide technical support in the development of a national data warehouse. This technical support included the customizing the software, importing all the available legacy data into the DHIS2 database and carrying out the required training and capacity building of both GIZ and Ministry staff.

During the period 2008–2010, the MoU was successfully implemented, leading to the national ministry taking to decision to adopt DHIS nationally.

Key lessons learnt from initial phase

Securing national commitment

Bangladesh's HIS achievements have been linked with the determined and focused leadership of Professor Abul Kalam Azad, Director General of Directorate General of Health Services, guiding the robust coordination of all stakeholders. Simultaneously to this commitment, the country had made a broader commitment to 'Digital Bangladesh by 2021'. The DGHS MIS jumped on this opportunity of political commitment to implement DHIS2.

For other countries with a less mature HIS, and without a centralised motivation, developing a pragmatic approach across bringing together multiple stakeholders, a management strategy or taking increased leadership to implement HIS will be key.

Assessing local capacity before moving forward

The situation analysis revealed alarming results in the detached parallel data flows between and within Ministry Directorates. An assessment was also made on the technical capacity and available human resources at central and decentralised levels. Based upon this knowledge, DHIS2 was chosen because it is open source, highly scalable and relatively easy to use, which was ideal for Bangladesh's context.

Carrying out a situational analysis is useful to reflect on the need and demand in the particular country

2

Implementation phase

Key actions

- **Building a digital infrastructure within Ministry structures**
- **Setting up a reliable online national data warehouse**
- **Establishing 'buy-in' to set-up DHIS2**

Building a digital infrastructure within ministry structures

From 2009 onwards, several actions were taken to build the digital infrastructure of the Ministry. These included a rise in eHealth projects within the Ministry (a telemedicine centre was established; electronic attendance systems to monitor staff punctuality at health facilities were set-up; mobile phone-based medical consultations for patients at district and sub-district levels were established; and a nationwide patient complaint system was set-up), building a data centre with a backup generator (to host the web-based server); setting up an IT lab for IT training; establishing a web portal for DGHS information to be uploaded into; creating an Internet mail server with its own domain and providing it to each health service with a unique email address for faster communications; and providing health services with suitable hardware: i.e., computer equipment and wireless modems.

Setting up a reliable online national data warehouse

In 2009, the starting point was to bring together data from multiple, parallel MIS into a useful whole. GIZ supported MOHFW in planning to create a national data warehouse, an electronic data repository that bridged various computerised databases, making them interoperable. Eight existing databases (EOC, nutrition, IMCI, urban primary healthcare project, hospitals, immunization, TB, family planning) were to be integrated, making it possible for the first time to access and analyse data from different vertical programmes through a single interface.
Key actions to establish this data warehouse included:

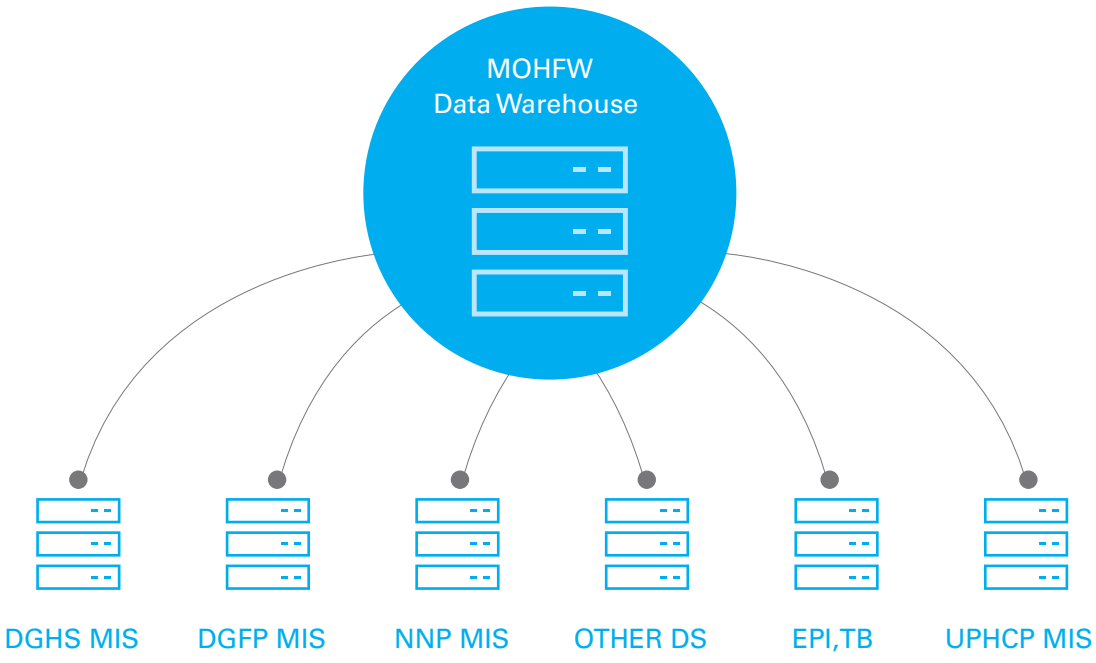
- Creating a list of metadata concepts: Workshops were carried out with different Directorates in the Ministry, to create a detailed list of metadata concepts (organisational units, data elements and datasets).

- Populating the metadata concepts into DHIS2: A mapping of these metadata concepts was stored in an Excel sheet which provided a linkage between the DHIS2 and the various data collection systems. Within a short period of time, over five million data values from the different legacy systems representing the different directorates was imported into the DHIS2, either using a onetime ad hoc script or through the use of ETL (Extract, Transform and Load) tools.
- Capacity building district and Upazila health staff on the use of DHIS2: After importing data from the different sources in to DHIS2, various training programmes were conducted at the national level with district and Upazila health professionals. These training programmes aimed to increase professional's knowledge on and use of the DHIS2. They also aimed to raise awareness of potential data quality issues and methods to analyze the information at the national level. Multiple workshops were conducted involving DMIS team and representatives from the different directorates from the Ministry.
- Strengthening the visualization of the data: The HISP team customized the GIS module of the DHIS2 using shape files representing the Upazila boundaries. The indicators generated from the DHIS2 could then be displayed using maps.

Establishing 'buy-in' to set-up DHIS2

"First, we needed to change people's mind-set. People needed to believe in one single system and to see the inefficiency in parallel systems." (Dr Abu Sadat Mohammad Sayem, UNICEF).

Data transferred from different data sources



In 2010, DGHS MIS installed DHIS2 on its servers and Bangladesh joined the ranks of countries utilizing the product. Shortly after, the MIS unit began encouraging different departments and programmes across the directorate to move from vertical programme-based datasets to an integrated HIS at the national level based on DHIS2. At first, not everybody inside and outside the MOHFW was convinced about the benefits of DHIS2. The owners of various MIS systems were reluctant to share their data and to release it into the central repository. They were also worried about being held responsible if their data were no longer available in the longer term. Key factors that led to 'buy-in' to use DHIS2 included leadership, DHIS2 demonstrations, global and national recognition of its success, technical support, and a collaborative multi-stakeholder approach.

Key factors getting DHIS2 on the agenda:

Leadership and advocacy

The actions previously described to lay the groundwork for digitization and recognition for the need for a new HIS were pivotal first steps. Building from this foundation, Professor Azad emerged as a champion for transforming HIS in the Bangladesh health sector. When Professor Azad started work at the Ministry, there was no internet access, paper registers were being used. DHIS2 was originally being used in the Directorate for Family Planning, however the team did not warm to the software. Professor Azad remained determined to improve HIS through DHIS2, and took particular strategic actions to push the agenda forward:

Key actions:

- High level attention: Professor Azad would present DHIS2 data to national conferences and workshops, identifying the different programmes using the system, the reporting rates across the country and how he was using the data, attained through 'one click' to inform his everyday work.
- Advocacy within the Ministry: The professor took it upon himself to spend many days and hours personally carrying out significant advocacy and training for the software within his own team, and then expanding outwards to different Directorates in the Ministry.
- **Raising awareness at the decentralised levels:**
  - Professor Azad spent a lot of time at the districts and Upazila health centre levels, raising awareness of the importance of the system by showing health managers the dashboards in workshops.
  - Every workshop the DG went to, despite it being based upon HIS, he would present DHIS2 to show the importance of the tool and its possibilities.
  - Every Monday morning the DG would hold a videoconference with health managers from a range of health facilities in the districts and Upazila health centres, asking them questions on the data.

As the current Director of the MIS unit warmly reflected: *"It was his courage. This was a big challenge, for 160 million people with no connectivity. He formed strong teamwork and collaboration with different Ministries, with the Prime Minister's office, with different donors, developing partners, and with the private sector. It was about teamwork with a common vision."* (Director, DGHS MIS, Dr. Ashish Kumar Saha).

Demonstrations of DHIS2 software

To build support and momentum for implementation of DHIS2, the DGHS MIS unit demonstrated the potentials of DHIS2 to health managers and programme leads. This process involved lengthy back-and-forth discussions with programme managers, particularly around decisions about what data to collect. The particular features of DHIS2 that were appealing to programme managers included:

The flexible data platform, configuration and customization for a range of organizations

In 2009, a lot of programmes were running their own MIS. Professor Azad explained that by joining DHIS2, the programme leads would not only be able to see their own data more efficiently, but they would also be able to draw off other programmes data too. This was found to be a strong 'buy-in' factor. Another key factor to 'buy-in' was that programme managers, initially, did not have to change their indicators that had been used in the previous paper-based data collection, making it an easier transformation to online reporting.

Simple, user-friendly open source software

The fact DHIS2 was free and simple made it a viable solution in Bangladesh where financial resources were low and IT skills were poor in the health workforce. The simplicity of the software was a 'buy-in' factor to health managers with low IT skills.

"Initially, people could not believe that in a country where there is little IT across the people, where it is slow, that ordinary people could use IT solutions. But we made them understand it is possible. We did not adopt complicated solutions. Rather, very simple solutions that are easy to use" (DGHS Director General, Professor Abul Kalam Azad).

Online dashboards

Health managers were particularly impressed with the speed of DHIS2. At that time, to get data from the sub-district level could take up to three months. Once programme managers heard of the success of DHIS2, especially the ability to see performance through the online dashboards in 'one click', they wanted to use the software.

"Professor Azad was always sending me everywhere, show the graphs, people were impressed by seeing the data directly online. That was the magic, going to different line directors and different partners, how to collect the data." (Dr Abu Sadat Mohammad Sayem, UNICEF).

DHIS2 community providing technical support

DHIS2 has a strong online community for software support, which has helped reinforce implementation. Key actions taken by MOHFW with the support of this online community include:

- Developing an in-house technical and troubleshoot support unit in Dhaka, who are available to all users of DHIS2, making it more accessible and attractive to health managers who were not as familiar with IT.
- Training health staff on DHIS2 use at all levels of the health system.

Recognition from global and national stakeholders

In 2011, the honourable prime minister was awarded the 2011 United Nations "Digital Health for Digital Development" award for outstanding contributions to the use of information and communications technology (ICT) for health and nutrition.
This was only two years after DHIS2 had been conceptualised. Furthermore, when the health managers could see they would be able to show their real time data to other people, that they would be recognised for their achievements, this was a motivation to them.

"Recognition of this was a motivation for people, it was encouraging to see this success." (DGHS Director General, Professor Abul Kalam Azad)

A multi-sector, comprehensive approach, led by the Government

"Alone I can run fast, together, we can run far" (Director, DGHS MIS, Dr. Ashish Kumar Saha)

Over the course of 10 years, since 2008, DHIS2 has fostered dynamic collaboration and partnerships. At first, GIZ provided incremental support. Since 2014, there have been many more partners engaging in this process including HISP Bangladesh, ICDDR,B, UNICEF and WHO.

"DHIS2 is working in a sustainable manner in Bangladesh because it was conceptualised from the very beginning that it would be institutionalised in government system". (HISP Bangladesh, Mr Muhammad Abdul Hannan Khan).

The comprehensive approach adopted by all partners and led by the Government from the start has been key to sustainability. This has included training for capacity building, attention to governance and software and infrastructure support. Furthermore, when the health sector operational plan (2011 – 2014) was introduced, this gave further prominence to the importance of DHIS2. Specified budget was allocated to DHIS2 training.

Key lessons learnt from implementation phase

Building a digital infrastructure and setting up a reliable online national data warehouse

Building the system without waiting for the internet

The speed of the internet was not a bottleneck for Bangladesh. Although during the time of implementation, the internet speed and connection was very poor, especially in the community areas, the system was put in place with the understanding that the internet speed would improve with time. Instead of focusing on this immediate challenge, efforts were placed on how to make DHIS2 work more effectively, for instance through customising the existing software in the country context.

- Do not wait for high-speed internet to be functioning at all levels of the system to implement an online HIS. When DHIS2 was first implemented in Bangladesh, 2G was only available in some areas. Then 3G came, and now 4G is available across the whole country.

Developing the database through engagement and consultation

Start by capturing all the data elements you want to capture. These are core building blocks of the database. Also consider and identify the organisational hierarchy in locating health facilities both geographically and in the administrative level. Engaging with district health managers will be key to this.

Gaining external support for a nationally owned system

Implementation support from GIZ was crucial in the deployment stage for customising the software to make it configurable and generic.

- Bangladesh was able to recognise the strengths and weaknesses in the health workforce. Strengths included an enthusiastic and motivated health workforce at over 13,000 community clinics in the country. Weaknesses included a lack of experienced individuals who could support configuration of DHIS2. This resulted in seeking support from the University of Oslo and GIZ.
- The training of national staff was crucial to ensure there are DHIS2 experts on the ground and that the Government is not reliant on external support. However, this initial external support was transformational to be able to 'hit the ground running' in the implementation phase.
- Certification of DHIS2 experts could be considered in the future to encourage training and local expertise.

Key lessons learnt from implementation phase

Establishing 'buy-in' to set up DHIS2

Establishing political support through stakeholder engagement

Some technical aspects of implementation were - although long - generally easy for DGHS MIS, through the support of GIZ. The difficulty was in ensuring ongoing political support and 'buy-in' from programme managers, who were very resistant to the technology at first.

- It is important to carry out stakeholder engagement form the very begin. DGHS MIS had to personally visit and spend many long hours discussing the software with each individual line director, so they fully understood its purpose and could trust it would be useful for their work.
- DHIS2 was treated as a national information system, instead of a short-term donor-driven intervention. This was an important selling factor to policy-makers and programme managers.

Incorporating existing data forms

To encourage 'buy-in' from all the programme managers, all of their dataset forms were included in DHIS2, to make it easier for them to transition from paper-based to online reporting.

Although this was successful in that it encouraged increased use of DHIS2, there are now too many forms. Substantial resources are now being used to reduce the online forms, which is more difficult now that they are fully implemented.

- Engage with stakeholders from the very beginning so they are involved in the design and construction of the online forms. This may improve ownership and 'buy-in', despite the fact a couple of forms may slightly alter.

Using the dashboards for 'buy-in'

Programme managers were not interested in 'starting from scratch' in terms of data reporting. The use of data dashboards was a big win as programme managers were able to see how quickly and easily their data could be pulled and how it could be visualised clearly.

- From this learning experience, fill out the dashboards before discussing the use of DHIS2 with programme managers and policy-makers. Blank dashboards would not encourage buy-in. Visualising the data can make people believe it is possible.
- The use of dashboards also shows how the data will be accessible to the masses, which is a selling factor for programme managers who want to be accountable and show their successes to a wider audience.

3

Expansion phase: Improving data completeness

Between 2009 – 2014, efforts were made to improve systems and software, build local capacity to maintain and use the HIS infrastructure, promote a culture of information use at all levels of the health system, and strengthen HIS governance.

Key actions

- **Rolling out the initiative: Datasets from multiple programmes migrate to DHIS2**
- **Improving data reporting: Training and capacity building**
- **Further expansions to the community level: Introducing individual record data**

Rolling out the initiative: datasets from multiple programmes migrate to DHIS2

Key actions:

Attaining the first three datasets (2010 - 2011)

Different datasetswere migrated to DHIS2 in an incremental manner. The monthly Emergency Obstetric Care (EOC) dataset, the monthly dataset on Integrated Management of Childhood Illnesses (IMCI) and the monthly hospital bed statement dataset were the first three aggregate datasets to use DHIS2 up to the sub-district level, from 2010 onwards.

Moving from three datasets to 33 datasets in three years

Between 2011 – 2014, interest in DHIS2 snowballed, both from public sector programmes and NGOs. This was because programmes and departments within the MOHFW saw the benefits of having their data integrated into the National Data Warehouse and were attracted to the simplicity and functionality of DHIS2. This increase in migration of datasets was initially driven by the owners of the datasets rather than the owners of DHIS2. The datasets grew from three in 2011 to 33 datasets in early 2014. This represented the vast majority of health services being provided in the Health Services directorate, down to the sub-district level. Initially, the aggregated data was collected monthly, sent from the Upazila Health Complex. Today there are over 70 datasets in DHIS2.

Expanding DHIS2 beyond the Ministry to city corporations, NGOs and the private sector

The DHIS2 is now well-known in the Ministry of Local Government, Rural Development and Cooperatives. Between 2006 -2013, the Urban Primary Health Care Project used its own customized software to collect monthly reports from the providers it contracts, on behalf of the Ministry, to deliver an essential services package to residents of ten city corporations. However, from 2013 onwards, the Urban Primary Health Care Project announced that in future partnership agreements with service providers, regular monitoring data will begin to be reported into DHIS2, starting with immunization data. DHIS2 has slowly building momentum for use with all city corporations under the Urban Health Care Project, and currently EPI, IMCI, EmOC and nutrition data are all being fed into DHIS2.

How? Between 2011 – 2013, DGHS MIS with key support from GIZ developed an Urban HMIS package to be used for all Urban Facilities including City Corporations and NGOs. This HMIS package is free for everyone to adopt following the standards of MIS DGHS. A dedicated server was provided by DGHS for Urban HMIS. Key support was provided to city corporations individually. Currently UNICEF is working very closely with relevant health departments, NGOS, public and private facilities to expand DHIS2 data collection in city corporations even further.
In 2014, e-health standards and an inter-operability framework were established. The aim of these standards and the framework was to bring together database systems under the MOHFW and other Ministries, as well as other health organizations and programmes of the NGOs, development partners and private organizations. Many previously vertical programmes are now using DHIS2 (such as TB control and HIV-AIDS). This has undoubtedly reduced the data collection burden on MOHFW staff and has improved standardization of data collection across HIS. There are now over 15,600 active users of DHIS2.

Ensuring Government ownership of the data

As of 2018, the MOHFW is positioned in the lead role to administer HIS initiatives through its implementing entities, i.e., DGHS, DGFP, Directorate General of Drug Administration (DGDA), National Institute for Population Research and Training (NIPORT), and Directorate of Nursing Services. Many national and international organizations are also working with these government entities to strengthen HIS in alignment with their own donor-specific mandates.

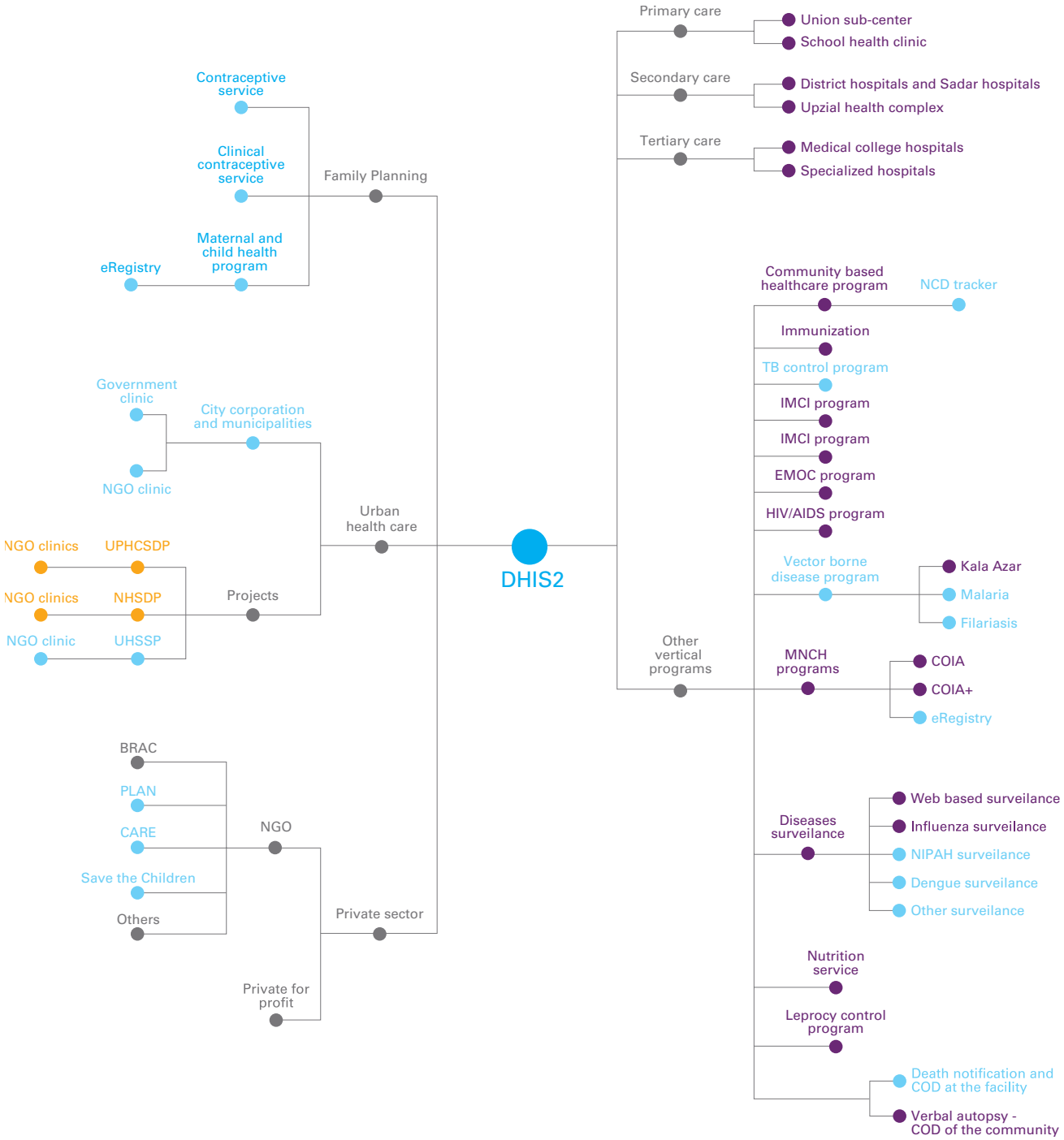
Further expansion: introducing of individual record data

Additional data sources were also added to expand DHIS2 data entry from sub-district to community levels. In 2013, UNICEF supported GIZ to upgrade DHIS2 to version 2.12, which came with a 'patient tracker' function. This allowed tracking of individual patients through case-based records in which details from patients' appointments can be captured and subsequently retrieved. Patients can also be tracked over time, and if they miss an appointment or are due for a vaccination, the system can send an automatic text message reminder.

This is particularly useful for the tracking of pregnant women and young children, for whom continuity of care is critical. Simultaneously in 2013, the Commission of Information and Accountability for Women and Children (COIA), supported by WHO, started an initiative aimed at collecting information from pregnant women and new-born children at community clinics. This required going beyond aggregate data into individual reporting, through 11 indicators.

In April 2014, 13,000 laptops, 20,000 table PCs and wireless modems were distributed in phases to community clinics countrywide [9] to implement the COIA initiative through the individual tracker version of DHIS2. At the same time, health assistants working from the clinics received tablet computers to capture data during household visits.

HIS initiatives reporting into DHIS2 in Bangladesh (August 2018)



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Coxs Bazar Sadar community committee working to support DHIS2 in the Community Clinic

Less than a month after the Ministry started delivering the equipment, 3,500 community clinics were already reporting data using DHIS2. Three different types of individual records were introduced at the community level: a maternal register, containing information from pregnant women's antenatal visits, a registry for child health checks and a registry for under-five child health.

Improving data reporting: capacity building the workforce (2010 – 2014)

By 2014, DHIS2 had been implemented from the central level to public health facilities at the sub-district level. In June 2010, the DGHS MIS, with the support of GIZ, started training the workforce on DHIS2. The MIS unit were given on-the-job training to build their understanding of DHIS2 and how to manage and maintain the servers. Beyond the national level, in February 2011, 128 statisticians, two DHIS2 focal points from each of Bangladesh's 64 districts, came to Dhaka for a three-day training programme. In the new HPNSP 2017 – 2022 health sector plan, budget for trainings on DHIS2 and OpenMRS (hospital data collection) is over $500,000 USD from DGHS MIS core funding.

Initial challenges in data reporting

However, in 2014, UNICEF conducted a rapid assessment in three hard-to-reach districts across Bangladesh. The assessment found that the system was not fully utilized, and the reporting rate was minimum (10 per cent) in the intervention areas. Issues included low workforce capacity; at the national level, only one – three people were assigned to solve DHIS2 issues. At the district and sub-district level, managers were not oriented to the system and were not checking the data, causing a lot of incorrect data to be filtered through to the central level.

Hardware was also an issue; it was estimated that 20 – 30 per cent of the laptops were not working, and hardware issues were managed by private agencies from whom the laptops were purchased making troubleshooting and buying of new equipment out of the Governments authority and control. There were also issues in poor data quality and use; the data quality was not up to standard as there was no validation procedure and most of the data was not used by anyone.

"We started reporting into the online system in 2014. At the beginning, I was scared to work, we were not given enough training on how to use the laptops or any security for the laptop. I was scared to leave the laptop in the clinic or carry it home"

Raspati Rani Dey, community health care practitioner, community clinic, Coxs Bazar Sadar.

At the community level when the community health care practitioners (CHCPs) started entering data there were many other challenges that hindered data flow and quality. These included low skills for using the laptops and software and for analysing and interpreting the data; worries over security of the equipment in the community; poor-quality equipment; slow internet and DHIS2 malfunctions, and; unmanageable demand for the IT department from the creation of user IDs for 13,000 clinics and 20,000 health assistants.

As one CHCP from Cox Bazar explained: *"We started reporting into the online system in 2014. At the beginning, I was scared to work, we were not given enough training on how to use the laptops or any security for the laptop. I was scared to leave the laptop in the clinic or carry it home"* (Raspati Rani Dey, community health care practitioner, community clinic, Coxs Bazar Sadar).

In summary, by 2014 DHIS2 has expanded from central level to every community clinic in the country. Significant resources had been spent on training and the provision of hardware. However, data reporting rates, the quality of the information and the use of data for evidence-based decision making were significant challenges, calling for a new approach to implementation. This approach from 2014-onwards was more orientated around the 'human factors' of sustainable implementation: changing the mind-set of health professionals to want to use online data systems, improving their capacity to analyse and interpret data, and engaging with individuals and communities to improve ownership and accountability of the health system.

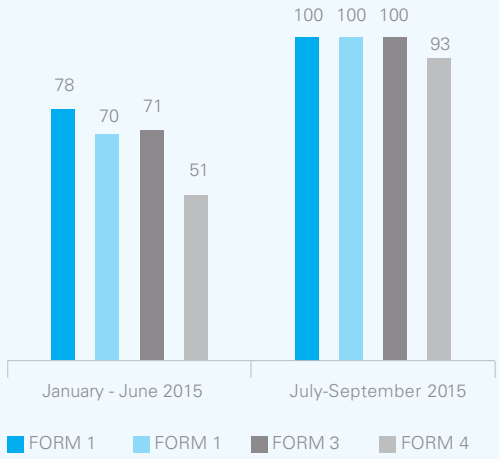
Key lessons learnt from expansion phase

Combining trainings with monthly meetings

Despite exclusive trainings for community health care practitioners and other community health workers, in some districts the monthly online reporting and individual recording did not increase as expected due to problems with poor network coverage, laptop problems or lack of commitment of service providers.

- Case example: Innovative steps have been taken, for instance in Taranganj district, where the health manager noticed the CHCPs visited the Upazila Health Complex on the 1st or 2nd day of each month. With this opportunity, he instructed all CHCPs to come with the relevant paperwork and laptops at 09.00 on the 1st or 2nd day of the month to complete the online reporting. The CHCPs received a payment once they completed the online reporting. HMIS consultants, supervisors and statisticians were provided to support the CHCPs with the completion of the reports. Simultaneously to this, the Upazila Health Managers and statisticians received two days exclusive training on monitoring & planning of online community HMIS which helped them to monitor community clinic performance by using different functionality of DHIS2 (online service data entry software of health).
- These coordinated steps had good results, increasing the reporting rates significantly. The average reporting rate (July to September 2015) increased to 100 percent for Form -1, Form-2, Form-3 and 93 percent for Form- 4.
- In areas with poor internet coverage, official arrangement of one working day per month for data entry and reporting is very useful.
- Award-based incentives can be useful to motivate health professionals to report the data. The 'best performer in the Upazila' and the 'best performing Upazila' were two awards given annually in Bangladesh.

Average reporting rates (%) in Taranganj district, 2015



Key lessons learnt from expansion phase

Providing implementation guidance and support material

A manual was produced and shared with all stakeholders who were implementing DHIS2 in their facilities. A support network was established with HISP Bangladesh and the national server team, who are available around the clock to provide support for technical issues, such as a modem going down or issues with DHIS2 software. This is particularly important due the evolving nature of DHIS2 software with frequent updates, so the users feel they are able to talk through the changes and be up-to-date.

Don't go too big too soon

DHIS2 implementation started with three datasets, which expanded slowly over time.

- This allowed for a so-called 'piloting phase' to improve the experience of the end-users of DHIS2, including data entry form designs, the usability of the data entry functionality, content of reports and other analysis tools, the feasibility of network connectivity and the national server configuration with regard to performance and up-time.

When rolling out - consider a comprehensive process with multiple phases

The expansion phase was successful in its objective to improve the reporting rate into DHIS2 to nearly 100 percent, however the quality and use of the data remained poor. After achieving high reporting rates, the country's efforts moved to improving data quality and use, as can be seen in the next capacity building phase.

Provide ongoing support and training through HMIS consultants

HMIS consultants at the community level are vital in Bangladesh to continually push for timely data entry through training.

- Data reporting depends heavily on appropriate user training. Training workshops with a variety of health professionals including Upazila health centre and community data entry staff, district managers, health programme managers and civil surgeon office staff were very effective in Bangladesh.
- Training combined with hands-on practice was key. HMIS consultants would ask health professionals to bring their data to monthly meetings, to discuss any issues.
- On-the-job training was also very important, especially at the community level. HMIS consultants visited community clinics individually to provide on-the-job training, and to build a trusting relationship with the community workers, who would seek support from them with any technical issues moving forward. This was important for community staff to ask their specific questions, or to sort out any individual challenges in relation to hardware. It was also found to boost the motivation and ownership of community workers.

Anticipate growth and the needed additional manpower for analysis

DHIS2 grew organically in Bangladesh, expanding exponentially in three years between 2011 – 2014. At the central levels, there are human resources for data analysis, however as the usage grew, there was need for more human resources to cope with the demand.

- Anticipate this growth and if possible have human resources prepared to review data and provide feedback to decentralised levels. This feedback was found to be key for improving the motivation and satisfaction of staff at district and sub-district levels.

"DHIS2 grew organically in Bangladesh, expanding exponentially in three years between 2011 – 2014. At the central levels, there are human resources for data analysis, however as the usage grew, there was need for more human resources to cope with the demand."

4

Capacity building phase: Focus on the 'human factors' for improving information use and quality

Key actions

- **Creating ownership and increased capacity for HIS at district and sub-district levels**
  - HMIS consultants
  - HISP
- **Influencing behaviour change and motivation to use HIS**
  - Improving the capacity of health managers
  - Providing and/or updating workforce with knowledge and skills
  - Using financial incentives at the community level
  - Supporting DHIS2 use with software updates and upgrades
  - Improving data quality through data audit and validation
- **Making DHIS2 available for every citizen**
  - Monitoring for equity
  - Making DHIS2 available for every citizen
  - Monitoring for equity
- **Supporting grea ter transparency and accountability**
  - Increasing access to information
  - Making health information available to everyone, everywhere
  - Improving feedback and supervision
- **Focusing on resilience**
  - Strengthening resilience and emergency response capacity
  - Ensuring sustainability through a coordinated, multi-sector approach
- **Engaging with patients, families and communities**
  - Empowering communities to have ownership and participate in decisions and actions, and integrating community-based systems with different levels of the health system
  - Using patient experience to inform quality care provision

"In 2014 UNICEF hired three health management information system (HMIS) consultants, to cover three districts; Bandarban, Cox Bazar and Netrokona. In 2015, on request from Professor Azad who wanted to expand the HMIS consultants' reach across the country, UNICEF expanded from three to 11 HMIS consultants to support strengthening HIS in 10 districts and national level."

In acknowledgement of the challenges to data collection and quality in 2014, MIS DGHS, in collaboration with key partners including ICDDR,B, HISP Bangladesh and UNICEF, began new efforts in 2014 to improve the completeness of reporting, as well as the quality of the data across all levels of the health system. These efforts put more focus on the 'human factors' of sustainable implementation, aiming to change the mind-set of health professionals to want to use online data systems, to improve their capacity to analyse and interpret data, and to engage with individuals and communities to improve ownership and accountability of the health system.

Creating ownership and increased capacity for HIS at district and sub-district levels

Below the divisional level, there has been a great need to create ownership of HIS and improve capacity to solve information related technical issues in a quicker manner. In response, HMIS consultants and HISP Bangladesh were established:

Introduction of health management information system (HMIS) consultants

In 2014 UNICEF hired three health management information system (HMIS) consultants, to cover three districts; Bandarban, Cox Bazar and Netrokona. In 2015, on request from Professor Azad who wanted to expand the HMIS consultants' reach across the country, UNICEF expanded from three to 11 HMIS consultants to support strengthening HIS in 10 districts and national level.

Resource: Actions of HMIS consultants to improve divisional capacity

The strategies to improve divisional capacity through HMIS consultants included;

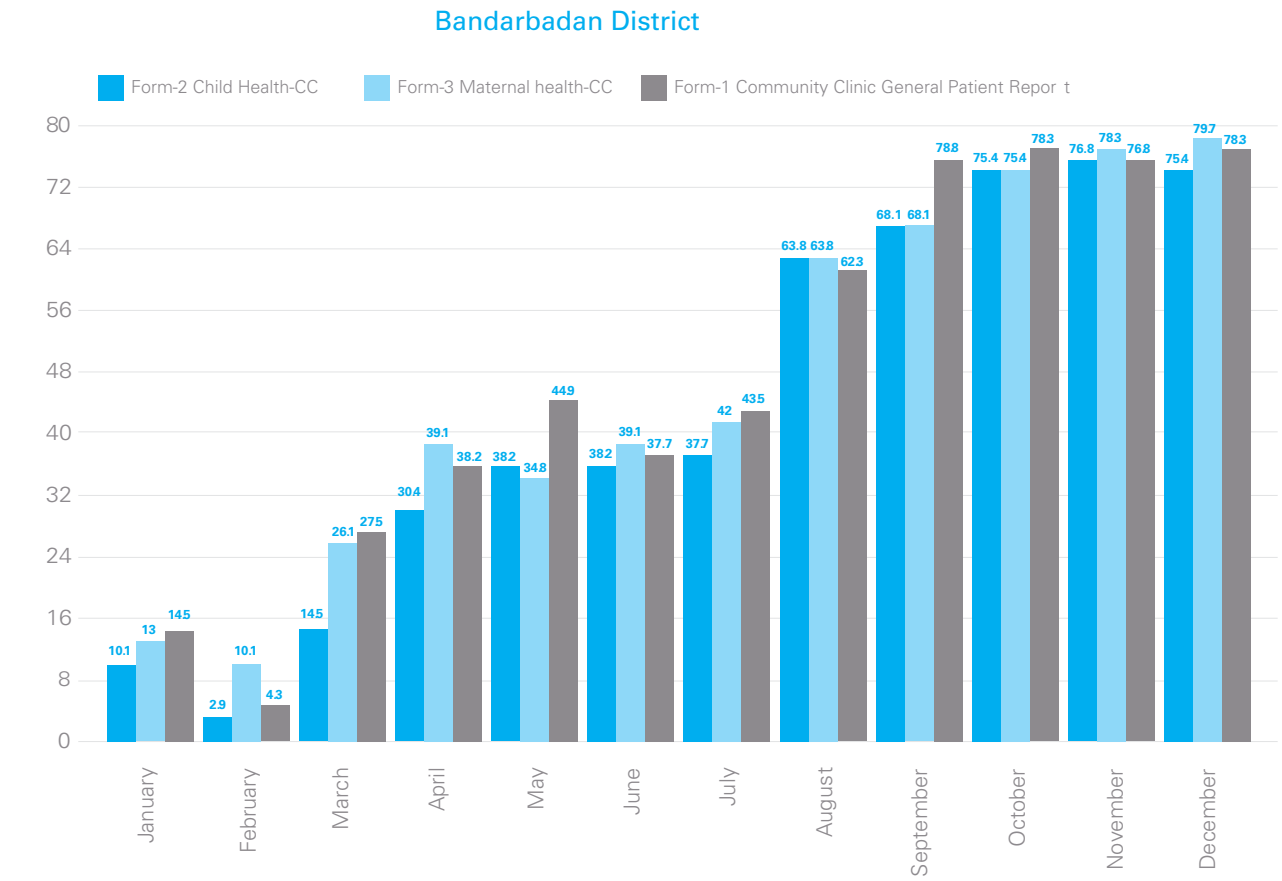
- improving the capacity of managing DHIS2 related problems;
- improving capacity for measurement and evaluation;
- providing quarterly data dissemination workshops for public health planning (using DHIS2 data) at the divisional level;
- linking with the national team and supporting the districts through regular feedback on data and performance.

Introduction of HISP Bangladesh

More technical support also came in 2014 when HISP Bangladesh was founded through a mandate from the University of Oslo. The two key aims of HISP Bangladesh are to build local capacity inside the government and to provide technical support on DHIS2 to both donors and the Government.

In correlation with these new focused efforts, between January – December 2014, the reporting rate to DHIS2 increased rapidly.

Reporting rates in (%) Bandarbadan District January to December 2014



SOURCE - DHIS2 DGHS

Influencing behaviour change and motivation to use HIS

Many actions have been taken to influence behaviour change of health professionals to be more motivated to use DHIS2 data. Motivating factors have included:

Improving the capacity of health managers

There was need to increase the number of professionals who are able to put information and knowledge to use to improve health. Several actions have been taken to improve motivation and change the mind-set of health professionals to become more data driven, as well as to improve technical and analytical skills. For instance, health informatics trainings (2013 onwards) [10], leadership and governance courses (2017 onwards) [11], at the district, sub-district and community levels, HMIS consultants also support quarterly data dissemination meetings, monitoring visits with corrective actions, 4-day workshops on monitoring and evaluation, 6-monthly data quality checks and 3-day trainings on specific programmes including COIA and Maternal Perinatal Death Surveillance and Response (MPDSR).

Furthermore, since 2015 there have been annual 5-day long workshops for health professionals below the divisional level [12], which include a 'training of the trainers' model to provide a focal point on DHIS2 in each district, as well as sensitisation trainings.

The focal person has taught health managers, doctors and statisticians how to enter data with quality, how to analyse data, how to make a graph and how to interpret data and visual information.

Providing and/or updating the workforce with knowledge and skills

IT training is an incentive for use of DHIS2, as health workers wanted to become technology 'savvy'. As an example of training, an online e-learning platform for DHIS2 was introduced in 2017, with the financial support of ICDDR,B and the technical support of ICDDR,B, UNICEF and HISP Bangladesh. Training has already been provided, and a few statisticians have already been enrolled and past their first exam. They get automated system generated certificate.

In addition to the district-level workshops, UNICEF HMIS consultants also provided six-month trainings for the community healthcare practitioners at the community clinics (2014 – 2015). This was an incentive for the younger generation of community practitioners who are excited to learn and use new software.

UNICEF also ran a three-day HMIS workshop in Cox Bazar in 2017, with all of the HMIS district and divisional staff from across the country, as well as external partners including ICDDR,b, GIZ, UNFPA and WHO. Professor Azad provided support for the whole workshop. The workshop increased the HMIS district committees' capacity for data analysis.

Upazila health manager in Cox Bazar who use DHIS2 data for health planning every month. His walls are full of DHIS2 data.

At the community level, monthly meetings and key trainings have been carried out with CHCP at Upazila Health Complexes by the HMIS consultants.

Using financial incentives at the community level

To increase DHIS2 reporting coverage, many sub-district health managers have put in place financial incentives and motivations for health-seeking behaviour. These incentives have been aimed at both healthcare users and healthcare providers. For instance, financial incentives to mothers to encourage them to take care at the clinic across the continuum of care around pregnancy, and financial incentives for community healthcare practitioners to reach targets on individual data entry monthly.

Supporting DHIS2 use with software updates and upgrades

Upgrading the DHIS2 system (2014 – 2018): Led by MIS DGHS, UNICEF is providing support to upgrade the DHIS2. This made the system more functional; faster and easier to use. When DHIS2 was first introduced in Bangladesh, it was using version 2.10. The current version being used is 2.29.

Introduction of ICD10 into DHIS2 (2017): WHO, with the support of UNICEF, introduced the ICD10 coding. Previously, there had been challenges in that there was different coding for different diseases, causing duplication or overlap. ICD10 helped overcome this challenge. Health workers were trained on ICD10 coding, including how to search, because there are over 14,000 codes. Challenges still remain on the coding of diseases, due to challenges such as lack of understanding and the lack of categorization of diseases.

Improved data visualisation (2014): It was necessary to make the data dashboards simple and easy to visualise, so all health programmers could understand and interpret the data. In 2015, DHIS2 dashboards were improved under the leadership of DGHS MIS and supported by multiple development partners. These dashboards facilitate routine performance monitoring and review. UNICEF has provided support through updating the software to improve the visualisation of the data. For instance, the GIS mapping was introduced and quickly became very popular, allowing different districts facilities and upazila health centres to show in different colours (red, orange or green), based on their reporting.

"In such a way, DHIS2 also improves the timeliness of data, by making it immediately apparent when a report is overdue. Front-line health workers responsible for submitting reports can see, when they log into the system, whether they are up-to-date with their reporting"."

This was also used as an incentive for the use of the data, and an inspiration for new techniques of data visualisation. By strengthening the dashboards, health managers and civil surgeons were empowered to take lead on their own data, making them more accountable.

DHIS2 data visualisation integrated with tableau (2017): Tableau is one of the leading data visualisation software in the world. This is the official data visualisation product for UN agencies.

Improving data quality through data audit and validation (2018)

"The accuracy of data captured in DHIS2 is enhanced by the use of data validation rules, such as the designation of minimum and maximum values for specific fields, which trigger warnings when data is entered which falls outside the given range. By automatically aggregating data from lower-level facilities, DHIS2 also greatly reduces the opportunities for data entry errors.

DHIS2 inbuilt data checking capabilities also help to improve the completeness of reports. Data entry fields designated as mandatory must be completed before a report can be submitted to the server and tracking the proportion of facilities which have submitted required reports can now be done with the click of a button. Statisticians at the MIS unit of the Health Services directorate responsible for monitoring data begin each day by running 'completeness reports' which show the status of reports due the previous day. A colour-coded 'traffic light' system is used to indicate the reporting status, and the statisticians follow up with emails or phone calls to inquire about missing reports and incomplete data."

In such a way, DHIS2 also improves the timeliness of data, by making it immediately apparent when a report is overdue. Front-line health workers responsible for submitting reports can see, when they log into the system, whether they are up-to-date with their reporting".

Furthermore, in previous years health professionals were able to login to DHIS2 to update the information at any time. The new software now reduces the time available for edits, and records user login and data updates, in efforts to increase accountability and quality of data entry. There is also an option of an approval system. UNICEF is also supporting through data quality audit systems.

Supporting greater transparency and accountability: increasing access to information

Making health information available to everyone, everywhere

The annual Health Bulletin is based on the accumulated data fed into DHIS2 from approximately 14,000 community clinics, all Upazila Health Complexes, all district hospitals and all specialized hospitals. The document is one of the most frequently downloaded resources on the MOHFW's website and is used by many stakeholders and development partners. The MIS unit also prepares annual newsletters on topics such as the Integrated Management of Childhood Illnesses, based upon information derived from DHIS2.

Furthermore, local health bulletins, which contain detailed information about the services provided in a given facility, as well as key routine health information from DHIS2, are published annually by hospitals and civil surgeon's offices. These local bulletins are available for download and are often printed and distributed locally, helping to ensure the transparency of the services and improve the quality of the data. An online web-portal or 'public dashboard on health' has been developed in 2015 by DGHS MIS, with key support from ICDDR,B, bringing all the information from DHIS2 into one place. At first, the web-portal was only accessible to people with a username and password. This came with challenges, as health managers who lost the password were unable to view the data. In response, in 2016, the platform became open to the public without a password.

The web portal is accessible here: http://dashboard.dghs.gov.bd/

Improving feedback and supervision

From 2011, there was an emphasis on using health data for decision-making and informed programme planning. In response, DGHS MIS introduced and now hosts an annual MIS conference and mandatory monthly meetings for health managers to both showcase their data and respond to questions on rates. Digital equipment was disseminated to health managers and civil surgeons to further enable information exchange through online video conferences in 2016. At the annual conference, health managers and organisations both present and publicly defend the local health bulletin data.

In DGHS MIS there is a national monitoring group of statisticians who monitor the national level data daily and provide feedback where necessary. DGHS MIS, UNICEF and ICDDR,B supported the strengthening of feedback systems at the divisional level through the creation of divisional HMIS groups. Furthermore, UNICEF have provided guidelines on how health managers can use the data on DHIS2 to make decisions and provide feedback. These guidelines started to be used in 2015/2016.

At the community level, inspired by the Health Minister Howard and led by WHO with support from DGHS MIS, ICDDR,B, HISP Bangladesh and UNICEF, a monitoring system for scoring community clinics was developed in 2015 to increase transparency of daily visit rates. The intention is to incentivise increased reporting. The community clinic has a target of seeing 40 patients per day. With existing indicators, a mechanism was created to automatically score health facilities against one another on a monthly based, based on performance. The indicators were based upon the 'six building blocks' of the strong health system model. The scoring system was updated in 2017 so that every time the community health care practitioner reports into DHIS2 they receive a score. From 2017, this information became linked with DHIS2 data.

Resource: Actions to implement and run monthly meetings

These monthly meetings had been in-built in the system since 1985, originally focusing only on EPI. This structure was an enabling factor to attendance at the meetings, as it was already a part of the health service culture. Slowly, from 2011 onwards, the meeting agendas started to expand to discuss EPI, IMCI and EOC. From 2014 – 2015, the central level Government sent a letter to all hospitals and civil surgeon offices across the country, requiring them to arrange another meeting called the 'hospital management committee' (HMC) meeting. The letter contained the agenda for the HMC meeting, which includes DHIS2. An outline of the agenda for the meeting is below, sent out from the central Government. The health facilities monthly scoring rate is publicly accessible here: http://103.247.238.81/webportal/pages/hss_scoring_facility_detail.php?facility_code=10001001&year=2018&month=6&level=28&rank=1

Key agenda items for these monthly meetings. All the data being discussed is collected from DHIS2.

1. Community Clinic activities (Prime Minister Priority Project)
2. HMIS report, analysis and action
3. EPI report
4. MPDSR status
5. Quality Improvement
6. Tuberculosis report
7. Malaria report
8. Sanitary and food safety report
9. Hospital infrastructure renovation status
10. Hospital management status
11. Any other business

Focusing on resilience

Strengthening resilience and emergency response capacity

In 2017, DHIS2 was updated to show real-time data for emergency response, including data on floods; dengue incidence rates across Bangladesh and major incidents such as the cold wave between 1 November 2017 and 13 March 2018, where the country experienced low temperatures causing an onset of health issues including ARI, diarrhoea and COPD. The real-time health emergency center dashboard is available for public viewing here: http://103.247.238.81/webportal/pages/dghs_controlroom_menu.php

In August 2017, violence erupted in Rakhine State in Myanmar, targeting the Rohingya people, a stateless Muslim minority. More than half a million people fled to Bangladesh, triggering one of the fastest growing humanitarian crises in the world.

There are an estimated 905,000 FDMN who have been driven into Bangladesh (as of August 2018). Over half of them are children. Approximately 170,000 women are currently pregnant. There was and remains a critical need for quality information, to be able to provide timely short- and long-term people-centred quality care, from both the Government and implementing partners.

DHIS2 was set up immediately at the beginning of the crisis, in just 9-days, to capture all of the data from over 200 partners daily. This shows both the flexibility and user-friendliness of DHIS2, as the team were able to customise the forms quickly and to train partners to use DHIS2 in a one-day timeframe. The real-time data is available on a web-portal accessible to the public here: http://103.247.238.81/webportal/pages/controlroom_rohingya.php

Ensuring sustainability through a coordinated, multi-sector approach

By 2015 there was a real need to enhance capacity at all levels of the health system, as well as at individual and institutional levels, for evidence-based policy making. The importance of teamwork and collaboration, instead of a 'piecemeal' approach between partners and government was emphasised. A core committee group was established at the central level, with participants including representatives from MOHFW, DGHS MIS, UNICEF, WHO, ICDDR,B, Save the Children, Bloomberg, and Management Sciences for Health (MSH), as well as other key partners.

"Empowering communities to have ownership and participate in decisions and actions, and integrating community-based systems with different levels of the health system."

Engaging with patients, families and communities

Empowering communities to have ownership and participate in decisions and actions, and integrating community-based systems with different levels of the health system

When DHIS2 was launched in the community clinic level, monthly-meetings were set up between the community healthcare practitioners and the sub-district managers to discuss DHIS2. As this was linked to community outreach, population coverage and service delivery, these monthly meetings have been found to directly engage the community with sub-district decision-making, based on local knowledge, which was previously left to management staff.

Furthermore, the introduction of hardware, including computers and internet modems was seen as empowering to communities and as a motivator to come together and take ownership of their own health. Each community clinic has a committee who come together every month to discuss health issues, including quality of DHIS2 data and its use for surveillance and essential medicines and supplies.

Using the patient experience to inform quality care provision

Data on the patient's experience can be sent through DHIS2 through a 'grievance' mechanism. This information is analysed at the central level, and feedback is then given to the health facility.

To add to this, citizens are now taking part in ensuring health service delivery through an exciting innovation of healthcare users sending in complaints and suggestions via SMS. This has been possible through introduction of a SMS-based complaints-suggestions box. In each public hospital, display boards describe how to send complaints or suggestions by SMS for improving services. Patients, their relatives and visitors of those hospitals who are not satisfied with the services, could send SMS linked to a web portal, ultimately informing MOHFW assigned staff. These personnel call back to the senders of the SMS to understand more about the real situation and then talk to the local authority to implement immediate solutions to the problem. The difference between the traditional and this new system of suggestions or complaints box is that the suggestions or complaints are seen by the central authority directly, and therefore, corrective measures can be taken with stronger effects.

Making DHIS2 available for every citizen

Monitoring for equity

In recent years, DHIS2 has started to be used for equity-focused planning, to ensure there is effective coverage of health programmes and initiatives for those who need them most. In 2017, the equity-based tool named 'EQUIST' was introduced, using DHIS2 data. EQUIST-for decision making is a powerful web-based analytical platform for developing equitable strategies to improve health and nutrition for the most vulnerable children and women.

Bangladesh is the first country using DHIS2 data for this equity-based planning. Based upon this data, UNICEF carried out a study in two divisions on the equity of resource allocation, how to find the most disadvantaged children, based upon real-time data.

Interventions for health issues recommended by the Lancet are available through the EQUIST tool, from published articles over the past 20 years. This information is aimed at health managers, for effective solutions to bottlenecks. The cost estimation is included in the analysis.

Key lessons learnt from capacity building phase

Employing a multisector approach

Despite strong external support from various partners including the University of Oslo, UNICEF, HISP and ICDDR,B, as well as private sector organisations, there has never been confusion or competition in the coordination of DHIS2 implementation activities.

- The design and implementation of a core committee for DHIS2 implementation was key in Bangladesh for coordinated activities and discussion.

Empowering patients and communities is important

The community clinic team, with the assistant of family planning workers, are able to reach the whole population to ensure quality care is offered to all.

- The engagement of community leaders and groups has been key to DHIS2 implementation due to increased motivation for reporting in community areas. Community groups have taken ownership of the data and now in many areas have monthly meetings to discuss any issues from it.

Training isn't enough – use monitoring and evaluation

Despite extensive training, there are still large challenges in health workforce capacity for analysing and interpreting the data, particularly at district and sub-district levels. On reflection of Bangladesh's experience, there is a need for more trainings with follow-up and monitoring, to assess how behaviour changed following capacity building initiatives.

Using monthly meetings for improving data quality and use

Now data reporting has increased in Bangladesh, there is a strong demand to shift the focus of trainings and discussions to improving the quality of the data.

- Once high data reporting is achieved, there needs to be a shift in the focus on monthly meetings with civil surgeon staff and health managers to provide them with more skills for data analysis and knowledge of how to use the data for programme planning.

5

Sustainability and policy phase

" These efforts put more focus on the 'human factors' of sustainable implementation, aiming to change the mind-set of health professionals to want to use online data systems, to improve their capacity to analyse and interpret data, and to engage with individuals and communities to improve ownership and accountability of the health system."

Key actions

- **Including DHIS2 in the health operational plan**
- **Sharing information and learning from experiences nationally and internationally**

In acknowledgement of the challenges to data collection and quality in 2014, MIS DGHS, in collaboration with key partners including ICDDR,B, HISP Bangladesh and UNICEF, began new efforts in 2014 to improve the completeness of reporting, as well as the quality of the data across all levels of the health system. These efforts put more focus on the 'human factors' of sustainable implementation, aiming to change the mind-set of health professionals to want to use online data systems, to improve their capacity to analyse and interpret data, and to engage with individuals and communities to improve ownership and accountability of the health system.

Including DHIS2 in the operational plan

When DHIS2 was first introduced, there was no overarching policy framework or operational plan, efforts were instead coordinated across programmes and partner organizations by strong leadership from the Ministry. After intense advocacy from DGHS MIS unit, DHIS2 was included in the 2011 – 2016 Health, Population & Nutrition Sector Development Program (HPNSDP) operational plan.[13] In 2011, although DHIS2 was mentioned, it was very brief and only emphasised in three forms.

However, reflecting the shift and change in importance given to DHIS2 at the central level, DHIS2 has been extensively and comprehensively featured in the 2017 – 2022 HPNSDP operational plan , where designated budget has been allocated for more training workshops. This plan contains evidence-based information for using DHIS2 for routine health information.

Sharing information and learning from experiences nationally and internationally

To improve and strengthen the HIS, national and international conferences have been organized for sharing experiences, best practices and opportunities for future learning:

The first Regional Health Informatics Conference for South Asia in Dhaka, June 2014

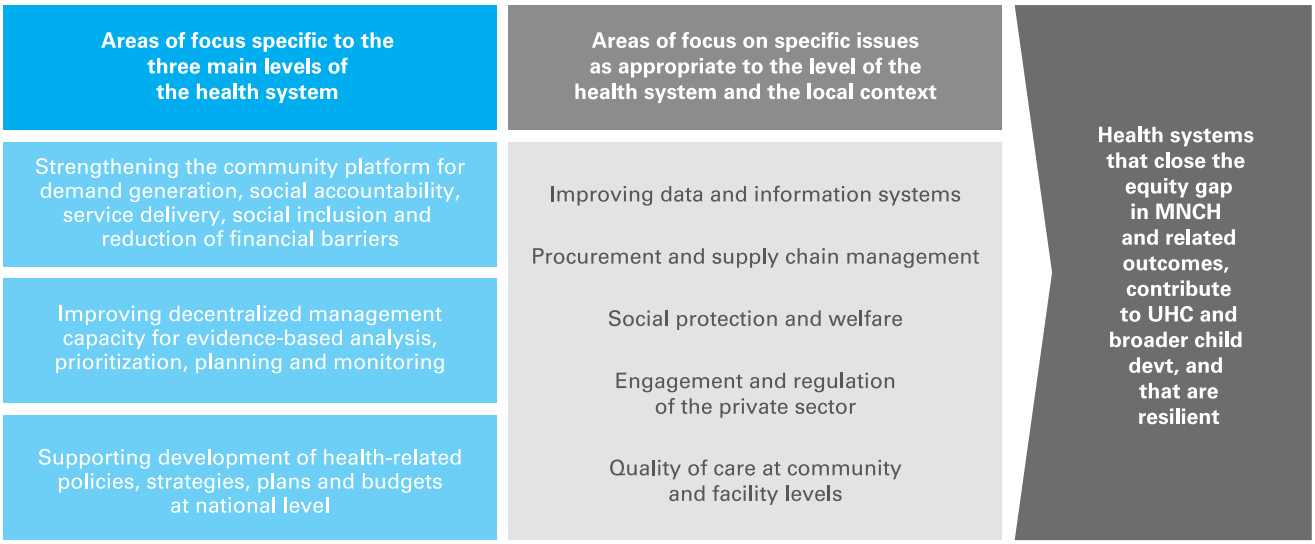
GIZ in collaboration with WHO and the UBS Foundation supported the MOHFW to host the first Regional Health Informatics Conference for South Asia. The meeting, which focused on the theme of mHealth, brought together more than 200 experts in health informatics and eHealth from local, regional and international organisations to discuss current innovations, policy frameworks, infrastructure issues and the role of public-private partnerships, among others.

'Measurement for Accountability' (MA4Health 2016) and 'Data for Decision-making' (D4D 2017)
By the end of 2016, data reporting had reached 95 per cent. The question was how to improve the quality and use. In response, two international conferences were organised to showcase Bangladesh's success and to learn from best practices from other countries; firstly, 'Measurement for Accountability' (MA4Health 2016) and secondly, 'Data for Decision-making' (D4D). The conferences were organized by MIS DGHS, USAID, HISP Bangladesh, UNICEF, ICDDR,B, and other partners.

Key lesson learnt overall

Incorporating the system-wide approach of health systems strengthening
From 2016 onwards - the focus was on incorporating a system-wide approach of health systems strengthening to the implementation of the DHIS2. This was in line with UNICEF's system wide and issue-specific approach to HSS. To summarise the capacity building phase, the figure below demonstrates the linkages between the UNICEF approach and Bangladesh's implementation approach.

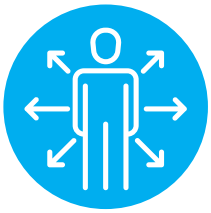
Schematic representation of UNICEF's system wide and issue-specific approach to HSS



Representation of Bangladesh's approach to DHIS2 implementation from 2016 onwards

UNICEF ROSA/ThomasNybo2014

Current situation and plans for the future



"The key successes of DHIS2 implementation have been arranged around five key attributes of a strong health system: efficiently, quality, equity, accountability, and sustainability and resilience."

Key successes: DHIS2 - a vehicle for health systems strengthening

Bangladesh is the world's biggest deployer of DHIS2. Implementation has been a huge success in that Bangladesh has now reached a point where routine health information is available in a timely manner, in a format accessible to all. As of August 2018, the monthly reporting rate at the community clinic level is on average 98 per cent, the IMCI and EmOC programmes' reporting rate remains over 80 per cent, and the EPI reporting rate is 100 per cent.

The HIS in Bangladesh has the potential to be a cornerstone of quality UHC, with DHIS2 as a key vehicle for success due to its popularity, it has shown value to key stakeholders and it has availability and reach to all levels of the health system.

The key successes of DHIS2 implementation have been arranged around five key attributes of a strong health system: efficiently, quality, equity, accountability, and sustainability and resilience. Each of the five dimensions has been strengthened through DHIS2 implementation, as will be explained. All aspects are inter-related, and many belong to more than one health system attribute.

Key successes: DHIS2 - a vehicle for health systems strengthening

- **Improving health system efficiency**
  - Helping people make better decisions for health programme planning
  - Dramatically reduced administrative burdens
  - Increasing the efficiency and effectiveness of health managers
  - Enhancing multisector collaboration: Development of DHIS2 core committee (2015)
  - Improving health system design
- **Improving health system accountability**
  - HIS available to everyone, everywhere
  - Improved feedback and supervision
- **Improving health system resilience and sustainability**
  - Strengthening resilience and emergency response capacity
  - Health system adaptability and sustainability
- **DHIS2 - a vehicle to improving health system quality**
  - Empowering communities to have ownership and participate in decisions and actions and
  - Integrating community-based systems with different levels of the health system
  - Using the patient experience to inform quality care provision
- **DHIS2 - a vehicle to improving health system equity**
  - Introduction of the individual tracker

1

Improving health system efficiency

"DHIS2 is widely recognised as a useful vehicle to push data systems and decision-making at all levels of the health system."

Efficiency is about maximizing output from the resources available, ensuring that services are provided in the most cost-effective setting with the right balance between health promotion, prevention, and in- and outpatient care and avoiding duplication and waste of resources. In Bangladesh, DHIS2 is a tool that has improved and is continuing to improve the efficiency of the health system in many direct and indirect ways, including through dramatically reduced administrative burdens, more efficient and effective health managers, enhanced multisector collaboration, improved health system design and better use of DHIS2 data for evidence-based decision making.

Despite these successes, the emphasis is still largely placed on reporting rates rather than pushing action from the data. There is a need to improve data quality and to motivate individuals to use the data for evidence-based decision making.

Helping people make better decisions for health programme planning

DHIS2 is widely recognised as a useful vehicle to push data systems and decision-making at all levels of the health system. Prior to 2014, evidence-based planning and bottleneck analysis had been informed by survey data. 2015 was the first year where real-time data from DHIS2 was used to inform health planning. This was the beginning of a new era, which incentivised health managers and planners to move from monitoring to use of data.

Examples of how data is currently used

Governance, which includes decision-making at all levels of the health system has been identified as a key, interacting lever of health system strengthening.[14] Currently the central government have authority over what information and knowledge is valued, and in turn generated upstream from health facilities. At the central level, aggregated data was found to be useful to monitor health targets and to compare performance between facilities, districts and divisions. The emphasis was still largely placed on reporting rates rather than pushing action from the data.

In contrast to this, health professionals working in health facilities at community, sub-district and district levels all explained their need for stronger individual data reporting systems and experiential knowledge to make locally-appropriate and responsive decisions. Despite multiple trainings and a push from the central levels, using the data from DHIS2 at these levels was found to be based upon individual choice rather than systematic or mandatory, often constrained by weak internet and poor equipment. Decisions for health interventions were still largely based upon experience and informal networks (staff feedback in facilities). This next section provides examples of how the data from DHIS2 is currently being used at national, divisional, district, sub-district and community levels.

National level

At national level, DHIS2 is being used as an important tool for programme planners and managers at the central level to track outputs and results at the local level. As the Professor Azad explained; *"Virtually, almost every day I see many kinds of data. During the field visits, people may want to know the number of resources, the immunisation coverage… I can collect this data with one click. For maternal mortality, child mortality, immunisation coverage, vitamin A distribution, hospital inpatient, outpatient, emergency, and many more, we use DHIS2 and we make decisions based upon this."* (DGHS Director General, Professor Abul Kalam Azad)

Routine health data being fed into DHIS2, as well as survey data, is being used at the national level to monitor health-related SDG indicators, including maternal mortality, new-born and child mortality, communicable diseases, NCDs and mental health, substance abuse, road traffic injuries, sexual and reproductive health and UHC. A dashboard has been created to visualize the data from more the 14,000 public health facilities in Bangladesh.

Other uses of DHIS2 data at the national level include for the annual health bulletin, logistical management and diagnostics and procurement.

Furthermore, *"DHIS2 data is complementing existing disease surveillance systems in Bangladesh and helping officials to identify spikes in endemic diseases, such as malaria, as well as potential outbreaks of new diseases."* The real-time availability of information has been particularly useful in emergency settings, such as the cold-wave in 2017 and the influx of forcibly displaced Myanmar Nationals in 2017 – 2018, for which DHIS2 is now the main HIS to support coordinated response from over 70 organizations.

Divisional, district and sub-district levels

Monthly district and sub-district level meetings are informed by DHIS2 real-time data. Health facility managers, statisticians and IT focal points are responsible for summarising and presenting the data in each meeting. Whilst it is encouraged to discuss the data and any issues found, currently these meetings are centred around the reporting rates and any challenges in reporting.

Special care new-born units (SCANU) at district hospitals started reporting into DHIS2 in 2014 - 2015. SCANU initiated the individual level recording system in hospitals. All 850 hospitals with SCANU are now using DHIS2. Individual records on maternal health and nutrition have now been launched at the hospital levels. DHIS2 data on bed occupancy rates is used in the allocation of food at hospital facilities.

The digital reporting has also increased the ability for the health system to capture causes of death all the way down to community clinic facilities, which was previously difficult through paper records.

In addition, in 2016, MPDSR was introduced in alignment with the global Maternal Death Surveillance and Response (MDSR). This was a part of the government's national scale up to establish a comprehensive surveillance and response system to address maternal and newborn deaths. Healthcare providers at the community, sub-district and district levels are now reporting maternal and neonatal deaths and stillbirths into DHIS2. This data is sent to the divisional level where it is reviewed and the cause of death is determined. This data is then used for reduction of future maternal and neonatal deaths in Bangladesh.

Community level

"At a community level, coordination and planning around maternal and child health has been greatly enhanced by the introduction of individual records in DHIS2. The three different types of health workers working out of community clinics (i.e. affiliated to the Health Services and Family Planning directorates) now meet weekly to review cases and to make a shared action plan for the coming week. As each pregnant woman and infant is individually identified and entered into a shared electronic register, gaps and instances of 'double counting' which used to be common are slowly being reduced."

Dramatically reduced administrative burdens

DHIS2 has dramatically reduced administrative burdens on health workers through the digitisation of administrative duties. The MOHFW has distributed 13,000 laptops, 20,000 table PCs and wireless modems to health facilities countrywide to enable them to communicate electronically. Requests for health information that previously took months to compile and analyse can now be completed with just one click. This availability of routine data allows programme planners and health managers to use DHIS2 data to monitor specific indicators and make necessary interventions accordingly, accelerating administrative processes.

Increasing the efficiency and effectiveness of health managers

At the divisional, district and sub-district levels, DHIS2 ahas indirectly been a vehicle for improving health managers' capacity for evidence-based planning, supervision and monitoring of priority interventions, including for children and women through extensive training, conference and meeting discussions and frequent knowledge pulses from the national level.

Enhancing multisector collaboration: Development of DHIS2 core committee (2015)

The establishment of the core committee group in 2015 at the central level, with participants including representatives from MOHFW, DGHS MIS, UNICEF, WHO, ICDDR,B, Save the Children, Bloomberg, and Management Sciences for Health (MSH), as well as other key partners, was essential to successful implementation of DHIS2, and ongoing support for improved data quality and information use. Led by the Government, the group reduced any confusion or competition over the coordination of DHIS2 implementation, working together as one rather than individual entities with multiple projects.

Improving health system design

Implementing DHIS2 was found to be a vehicle for improving the design of the health system through making information flows interoperable. Due to DHIS2 being an open source, easy-to-use interface with useful data visualisation features, more and more health programmes changed their reporting to use DHIS2, in turn standardising reporting systems, reducing vertical programmes and siloed data and enhancing the health systems approach.

Originally, aggregated data was only collected on a monthly basis from the upazila health complex level. DHIS2 increased the data collection from sub-district level all the way down to community clinic, broadening the HIS design down to community level, which is key to population coverage information.

In 2014, e-health standards and an inter-operability framework were established. The aim of these standards and the framework was to bring together database systems under the MOHFW and other Ministries, as well as other health organizations and programmes of the NGOs, development partners and private organizations. Key advocacy activities and partnerships are now being taken forward to increase data input from private health facilities, NGOs and city corporations.

Furthermore, Bangladesh is the only country in the world who has integrated the entire EPI supply chain along with routine EPI data into DHIS2 (2016). Bangladesh is also the first country in the world where cold chain information system has been integrated into DHIS2. Also, there is no parallel system for immunization supply chain information system.

2

Improving health system accountability

"The annual MIS conference and monthly meetings for health managers have been a great motivator for transparency and improving the quality of the data as well as capacity for using it."

HIS available to everyone, everywhere

Improving accountability is a prerequisite to strengthening a health system. DHIS2 has strengthened the HIS in Bangladesh through supporting greater transparency and accountability by increasing access to information, for all stakeholders, as well as by promoting the use of the data.

Through the annual Health Bulletin, local health bulletins, and the public dashboard on health data has been made more accessible to health managers, partners and NGOs, in turn empowering and increasing the efficiency of managers from easier utilization of data, and increasing the accountability of the system, the effectiveness of DHIS2 in sharing data faster, as well as the quality of the data as partners were able to provide feedback quicker.

The annual MIS conference and monthly meetings for health managers have been a great motivator for transparency and improving the quality of the data as well as capacity for using it. Health managers have developed competition or friendly rivalry to have the best reporting rates and knowledge on DHIS2 information at the conference. However, health professionals are often frustrated that the monthly meetings remain focused on reporting rates, instead of using the time to discuss data analysis or interpretation to build skills and knowledge. This could be an opportunity for improvement in the future.

Improved feedback and supervision

In the past, health managers and those working with health data were disempowered and demotivated as they rarely received feedback on their health data from higher levels in the system. Conscious of this, the architects of DHIS2 were determined to empower staff by giving them access to the information they are generating, at any moment. They were also committed to opening up the aggregated data to actors outside the system, from anywhere in the world, at any time. Both of these principles have been realised in Bangladesh.

3

Improving health system resilience and sustainability

"DHIS2 information is important for sustainability, by ensuring health-based decisions are timely and responsive to the reality on the ground."

Strengthening resilience and emergency response capacity

Strengthening the capacity of health actors, institutions and populations to prepare for, and effectively respond to, public health crises and emergencies is key for a resilient and sustainable health system. DHIS2 information is important for sustainability, by ensuring health-based decisions are timely and responsive to the reality on the ground. DHIS2 is being used in Bangladesh to withstand and recover from shocks, including the cold wave between November 2017 and March 2018, and the Forcibly Displaced Myanmar Nationals crisis from 2017 onwards.

Health system adaptability and sustainability

Other actions to make the health system sustainable include long-term planning and learning from the experiences of other countries, to further improve and strengthen the HIS, and therefore the health system overall. The collaborative approach is also a sustainability mechanism.

4

DHIS2 - a vehicle to improving health system quality

"Evidence shows that community participation and accountability in health service delivery can lead to improved health outcomes."

Empowering communities to have ownership and participate in decisions and integrating community-based systems with different levels of the health system

Strong health systems need safe, effective and timely care that responds to people's comprehensive needs and are of the highest possible standards. This means that care is coordinated around people's needs, respects their preferences, and allows for people's participation in health affairs.

The Government recognised that to be able to monitor population health in Bangladesh, the HIS needed to go beyond healthcare facilities into the communities. Hence in 2014, following the COIA initiative, DHIS2 was pushed to all community clinics in the country. This has had many subsequent benefits on improving the quality of care, through DHIS2 as a vehicle for community ownership of health and participation in decisions and actions based upon DHIS2 data.

Evidence shows that community participation and accountability in health service delivery can lead to improved health outcomes.[15] Emerging evidence also suggests that community mobilization can be a cost-effective way to substantially reduce mortality and improve the health of new-born infants, children and mothers. [16] It can also improve the quality of health services to meet community needs.

Community meetings on DHIS2 data have created community ownership over health outcomes, for instance, through designing community outreach services to bring more pregnant mothers to the community clinic over the continuum of care. This has been found to increase the accountability of local health and community leaders for the key determinants of health and for health outcomes. It is also a bridge between community knowledge and sub-district level decision-making, whereby community members can share their local knowledge which had previously been left to management staff.

Using the patient experience to inform quality care provision

DHIS2 also enables engagement of health user perspectives through the grievance mechanisms and SMS-based complaints and suggestions. Learning from the experiences and satisfaction of patients, families and communities is important to both evaluate current practices, ensure mutual accountability, and to incentivize sustainable and people-centred action for quality health service delivery.

5

DHIS2 - a vehicle to improving health system equity

"By using the contact information contained in patients' individual records, health facility workers can contact patients who have missed appointments or immunizations, can ask them why, and if appropriate, motivate them to visit the clinic."

Equity means that everyone, everywhere can access the quality health services they need, when and where they need them. At its core, equity is essential in implementation research to ensure that disadvantaged groups, including vulnerable children, are gaining or will be able to gain at least as much as those who are better off in health systems strengthening programmes and initiatives, rather than having to wait and catch up as that goal is eventually approached [17]. DHIS2 continues to push equity in Bangladesh's health system, firstly, through the non-discriminatory data collection, and secondly, through being able to identify where care is weak or lacking.

The individual patient record function improves coverage and quality care

The introduction of individual patient records into DHIS2, all the way down to community clinics, has given health workers a valuable tool for tracking and following-up with patients who require continuous care. This is especially important for groups of people who live far from health services in rural areas, who can now be tracked and reached through DHIS2 tracker used by community health care practitioners, Health Assistants and Family Welfare Assistants.

By using the contact information contained in patients' individual records, health facility workers can contact patients who have missed appointments or immunizations, can ask them why, and if appropriate, motivate them to visit the clinic. This is a huge development on the previous paper-based system, which relied upon Health Assistant's visiting patient's households. The health managers from sub-district and district levels can also monitor this online and provide timely direction to the community clinics to ensure adequate maternal and child services.

This is also helping to improve the health literacy of these populations who may have previously not had continued contact with health service provision, as well as their capacity for informed decision-making about whether to attend the clinic, for maternal and child services and immunizations, for instance. Every pregnant mother and under-five child is registered online using the laptops provided at the community clinics. The health professionals are able to make a unique list of pregnant mothers and under-five children on a weekly basis.

Furthermore, community engagement is also likely to impact the trust of patients and communities with the health system, to respect and protect their privacy and confidentiality in the HIS more. Community engagement is key from the onset for this.

Current challenges and opportunities for improvement

Although it is widely recognised that DHIS2 is a useful tool with a lot of potential, there is still concern at all levels of the health system over the quality of the data being collected. Health facility managers, officials from the MOHFW and stakeholders from partner organizations all concede that despite the efforts explained, data quality needs improving. Furthermore, despite continual trainings, there is widespread consensus that health professionals at all levels of the system need further support to be able to use the data for evidence-based programme planning. These challenges are seen as interlinked, as low-quality data has lowered its use, but simultaneously without using the data, there is lack of motivation to improve the quality. People are only motivated to collect good quality data when they know that it is being used by others.

Key bottlenecks and opportunities for the future

- **Broader health systems challenges in relation to DHIS2**
  - **Low data coverage**
  - The need for further engagement with the private sector, NGOs and city corporations
  - The need to collect and use data from the Directorate General of Family Planning
  - **Shortages in trained health workforce at all levels**
  - Workforce for data analysis and use
  - Workforce for data entry
- **Opportunities for broader health systems improvement**
  - Further advocating for DHIS2 within and outside the Ministry
  - Addressing shortages of skilled health workforce
  - Improving DHIS2 data collection
- **Challenges at the level of implementation**
  - Tradition and resistance to behaviour change
  - Lack of accountability and monitoring in follow-up to trainings
  - Poor role delineation at the health facility level
  - Hardware and software at the community level

Key bottlenecks and opportunities for the future

- **Opportunities at the level of implementation**
  - **New opportunities to help reinforce the "backbone" of DHIS2 functionality in the future**
  - Advancements in internet connection, servers and equipment
  - Managing updates of DHIS2 version
  - Improving the individual tracker
  - **Improving the quality and use of DHIS2 data: Key opportunities**
  - Improving the analytical skills and interest of health managers and other decision-makers
  - Providing more knowledge and skills to the health workforce
  - Pushing role delineation
  - Introducing new scorecards, dashboards and software
- **DHIS2 - a vehicle to improving health system equity**
  - Introduction of the individual tracker

1

Broader health systems challenges in relation to DHIS2

Low data coverage

The need for further engagement with the private sector, NGOs and city corporations

Although DHIS2 has grown and is used by most of the MOHFW health programmes and services, it is not possible to get population coverage data without bringing private providers, NGOs and city corporations (who operate under a different Ministry) into a unified system. DHIS2 is slowly building momentum for use within city corporations, who are already reporting EPI, IMCI, EmOC and nutrition data into DHIS2. The further development of HIS and DHIS2 use will depend to a large degree on the extent to which stakeholders from the private sector and NGOs buy in to using the software.

The biggest challenge is to encourage the private sector to use the unified data system. In Bangladesh, the private sector provides over 70 per cent of health services. Future development and efficiency of DHIS2 will depend largely on engaging with stakeholders beyond the public sector through continued advocacy for DHIS2.

The need to for further engagement with the Directorate General of Family Planning (DGFP)

Historically there has been an information divide between the MOHFW's two main directorates, the DGFP and DGHS. The DGFP has now signaled its decision to use DHIS2 as an integrated platform to collect routine data, however at the national level this step has not yet been taken. To improve the efficiency of the HIS and the coverage of family planning data in DHIS2 from community levels, this will be an important step in the future.

Lack of hospital coverage

Currently a software known as OpenMRS is operating in 11 hospitals. However the software is very costly and not integrated with DHIS2 or between hospitals themselves. In the future, emphasis will need to be placed on either improving OpenMRS or implementing a new software for collecting and analysing hospital data, integrated with DHIS2.

Shortages in trained health workforce at all levels

Bangladesh's health workforce is defined by chronic shortages, inappropriate skill mixes and an inequitable distribution across servicesError! Bookmark not defined.. Vacant posts for healthcare professionals have been slowly growing for the past decade. The current shortages in the health workforce at all levels is a hindrance on DHIS2 functionality. There are over 60% vacant posts in the system.

Innovative workforce at the central level

At the central level, there is need for a health workforce with innovative ideas, who are skilled, not only in IT expertise, but also with public health knowledge and experience in DHIS2. Within the MOHFW, it would be useful to also have workforce with skills in implementation science, such as anthropologists or sociologists, with dedicated time for exploring behaviour chance – the 'how' in changing mid-level professional's behaviour with DHIS2, and HIS more widely.

Workforce for data analysis and use

At the national and divisional levels, there is not sufficient staff to be able to review, analyse and provide feedback and support decentralised levels. At the health facility level, there is also a shortage in trained manpower for data analysis and interpretation.

"When you ask the health manager or civil surgeon to present the data, they may only be reading the data from a sheet. Unfortunately some staff are still unable to interpret the data" (ICDDR,B, Dr A.T.M. Iqbal Anwar).

At the decentralised levels, high staff turnover is a challenge. For non-permanent staff, there is a lack of motivation to be accountable through DHIS2 reporting, and for health managers, it is demotivating to train a workforce that frequently moves between health facilities.

At the community level, the minimum requirement for CHCP is an undergraduate and post-graduate degree (in any subject), and three-months medical training. The initial role of the CHCP was to be a support for a trained health professional, however due to the lack of manpower the CHCPs are now running the whole clinic.

Workforce for data entry

At the district and upazila levels, challenges to data use include shortages in the health workforce available to enter data, including the lack of trained statisticians at the local level. Often, the statistician's role has been filled by office clerks or nurses, who do not have training in statistical analysis, basic courses exposing them to concepts such as numerators and denominators, ratios, proportions, rates, and indicators. This extra workload on data entry was found to be particularly burdensome for nurses and other already over-burdened health staff, who had to both do manual reporting and spend hours uploading information into DHIS2, which was often unavailable due to slow internet connection or faulty equipment.

2

Opportunities for broader health systems improvement

"Evidence shows that community participation and accountability in health service delivery can lead to improved health outcomes."

Further advocating for DHIS2 within and outside the Ministry

DGHS needs to advocate for DHIS2 use with other areas of the MOHFW, including the Directorate of Family Planning, as well as with the private sector, NGOs and city corporations. This will require continuous advocacy under MIS leadership in order to strengthen the quality of the data.

Addressing shortages of skilled health workforce

It will be important to establish a transition plan for technical human resources at the divisional, district, sub-district and community levels, as UNICEF HMIS consultants contract end in December 2018, with no plan of replacement. This will be essential for sustainability of DHIS2.

In the future there may be an opportunity to improve the quality of the data at the community level through a new health workforce called the "Multi-purpose health volunteers". This new initiative will assign five more staff to each community clinic, which should help improve rural health coverage rates, in turn improving the quality of the data at the community level.

Improving DHIS2 data collection

In the future, when the hardware issues are resolved, it will be important to analyse the type of information DHIS2 is collecting. There will be opportunities to widen data collection to report on NCD data as well as to gather outpatient information. This will be a lot easier when the individual level reporting becomes more functional.

It will also be important to find a solution of coordinating individual patient information between health facilities, at different levels of the health system. Currently, when patient data is referred there is no opportunity for the health provider to provide information on that patient, which is a clear patient safety issue if the patient is taking medications or has allergies, for example. Health providers at the community levels said this opportunity would be motivating for them to use DHIS2 more, especially if there was a way to get feedback or a notification from the health facility that a patient had been referred to, on the health outcome.

3

Challenges at the level of implementation

"There are huge gaps in front-line human resources. Many health workers do not have the skills to analyse the data. We need a better system for the workers to receive feedback too, especially from the sub-district level to the community clinics"

Dr. Hari Kishna Banskota, UNICEF)

Tradition and resistance to behaviour change

Establishing a culture of local-level analysis and planning has been a challenge at the local levels. This is partly a result of tradition and resistance to behaviour change – traditions on decision-making formed through years of working with surveys and working from experience rather than evidence.

Furthermore, aside from the health professionals who are actively engaged with DHIS2, at the district-level, mid-level professional's mind-set remains a challenge. Often, these professionals are either unaware of DHIS2 or do not see it's value.

"Some mid-level professionals do not understand the importance of DHIS2. The "how" is the question we are looking for. How to change their mind-set to be information minded. We need to involve anthropologists and sociologists in MOHFW", (Dr A.T.M. Iqbal Anwar, ICDDR,B).

Lack of accountability and monitoring in follow-up to trainings

Although monitoring has been initiated, it needs to be continued with more emphasis on follow-up. Trainings and workshops on data quality and use are useful, but without continuous follow-up and monitoring over the changes made from the trainings, health managers often revert back to their previous behaviours. This was despite the decision-makers being aware of the benefits of using routine information for evidence-based planning.

Poor role delineation at the health facility level

Role delineation at the health facility level on who is responsible for data quality improvement remains unclear, with some health managers taking responsibility, whereas others seeing it more the role of the statistician, ICT focal point, or the professional entering the data (often a nurse or office clerk).

Hardware and software at the community level

At the community level, challenges in hardware include slow internet connection, which is making online reporting time consuming, and poor-quality equipment. There are also challenges with DHIS2, including the individual record function was not working properly, as well as frequent software updates causing difficulties in the compatibility of the system with older equipment (laptops and computers). Some CHCPs complain that when they download files from DHIS2 they are unrecognizable to their computers.

The lack of feedback from upazila level to the community clinic is a de-motivating factor for data use, as CHCP's need more guidance for data analysis and use.

"There are huge gaps in front-line human resources. Many health workers do not have the skills to analyse the data. We need a better system for the workers to receive feedback too, especially from the sub-district level to the community clinics" (Dr. Hari Kishna Banskota, UNICEF).

With these practical challenges on DHIS2 and the supporting hardware, in many cases reporting was ultimately left to individual motivation. In two community clinics, the community health care practitioners both told stories about carrying their manual registers home at the end of the day and uploading the data into DHIS2 in their yards in their home time through their own personal laptops.

4

Opportunities for improvement at the level of implementation

New opportunities to help reinforce the "backbone" of DHIS2 functionality in the future

Advancements in internet connection, servers and equipment

Currently, the accessibility of DHIS2 is poor in remote community clinics, due to poor internet connection, slow servers and either broken or damaged equipment.

In August 2018, an offline version of DHIS2 will be launched nationwide, with which health professionals will be able to use DHIS2 without internet access, and the data will upload when internet is available. Furthermore, an android version of DHIS2 was launched in August 2018..

These will be vitally important opportunities to improve the coverage of DHIS2, through the new ability to capture data on android and tracker in the field, and offline. There is potential for this to be the gateway to really improving the quality and use of the data.

It will be important to automatically monitor the impact of these new interventions. Although it is expected that they will have huge impact on the completeness and quality of the data being entered, it will also be interesting to explore how these new innovations can be linked with increased accountability of health managers at all levels of the system.

Managing updates of DHIS2 version

The continued updates to different versions of DHIS2 have been challenging as sometimes the DHIS2 software updates quicker than the computer software, causing problems of incompatibility. As a health manager explained:

"The version changes so frequently, sometimes when we download files they can be unreadable as our equipment is too old" (Health Manager, Cox Bazar).

To manage this challenge, for every new release, a small DHIS2 end user manual is released in the local language online. Furthermore, there is an official Facebook page where the user manuals are also released in local languages, and there is online support through Facebook groups.

Improving the individual tracker

When DHIS2 was first implemented in Bangladesh, it had been explicitly designed with the collection of aggregated data from health facilities in mind. However, now the system is in-place, there is need for more patient-specific data for improved quality and use of DHIS2 by health managers and policy-makers. The current system for individual data collection is not being used to its potential. Although the individual tracker function allows for a patient's electronic health record to be moved and reassigned to a different facility, in reality recording individual data at sub-district levels is a challenge due to the hardware (slow internet), as well as lack of time to enter the individual information.

At the community level, often the internet is too slow to search for previously entered patient information, causing duplications of patient records. Improving this function of DHIS2 will lead to more accurate information for health-related decision making.

Improving the quality and use of DHIS2 data: Key opportunities

Improving the analytical skills and interest of health managers and other decision-makers

"If the challenge at higher levels of the system is about changing the engrained approach to data use, the challenge at the lower levels is to establish a culture of local-level analysis and planning. Beyond entering numbers into the reporting formats assigned to a given facility, the heads of those facilities should be working with those numbers to assess the availability, accessibility, utilisation, and coverage of key services in their areas, and to identify gaps or resource constraints which are preventing the attainment of objectives. Such data could prove to be a powerful advocacy tool for facility managers requesting additional resources".

There has been a lot of investment into health managers skills to be able to understand the language of data and be motivated to use it, especially through divisional and district level meetings, workshops and online conferences. However, these initiatives have not been linked to accountability thus far. In the future, it will be important to link health professional training to monitoring, to ask the question, for instance two months after a training – how the training has impacted behaviour and performance.

"We need monitoring for action, not for reporting rates" (Tangail Civil Surgeon Officer).

Health managers and staff are aware of the need for further training to improve the skills of personnel to analyse and act upon this data. Managers have requested for more discussion on data analysis and use rather than on pushing reporting rates during the monthly meetings.

Providing more knowledge and skills to the health workforce

With the new updated versions of DHIS2 and new health workforce, there is an opportunity for continued capacity building and refresher training for DHIS2 at the community, sub-district and district levels. This will be very important to improve the accountability of communities, to be able to use their local data in community management group meetings. Further training will enable these stakeholders to analyse the data and become more involved.

Pushing role delineation

An opportunity for improvement at the decentralised levels would be to emphasise the different roles and responsibilities within health facilities for use of DHIS2. Currently, the use of DHIS2 is linked to individual preference, rather than a mandatory job function for health managers. Frequently, the statisticians, ICT focal points, nurses and office clerks are inputting and analysing the data, which is not seen as their core role. Health facilities should designate staff to DHIS2, and be clear about roles and responsibilities, so HIS are a core part of the practice, rather than a luxurious add on.

Introducing new scorecards, dashboards and software

In the future, there are many opportunities that will make DHIS2 data easier to use for health managers, including a reproductive, maternal, new-born and child health (RMNCH) scorecards. DHIS2 will also be linked with civil registration and vital statistics (CRVS) data, and a software named 'rapid pro' will be launched which will make it easier for two-way information flows with healthcare users, who can input their experience and satisfaction into DHIS2. These new initiatives are exciting opportunities to improve data quality and data use through DHIS2.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Conclusions,key lessons, and recommendations to other countries

Benefits of DHIS2 implementation

The experience documented in this case study can be of value to other countries that are at an earlier stage of implementing a health information system or have not yet started to do so. The experience can be summarised in three crucial elements:

- The full benefits that Bangladesh has seen as a result of DHIS2 implementation
- The key lessons that Bangladesh has learnt during the course of implementation
- Recommendations to other countries, based on the experience in Bangladesh

In just 10 years, Bangladesh has become the largest DHIS2 deployer in the world. Routine health information is now available in a timely manner, in a format accessible to all. Furthermore, DHIS2 has been a vehicle for data systems improvement and other areas of health systems strengthening overall. This has been described in the key successes area of this document, and summarised below:

Efficiency

- **Dramatically reduced administrative burdens:** Requests for health information that previously took months to compile and analyse can now be completed with just one click.
- **More efficient and effective health managers:** DHIS2 has indirectly been a vehicle for improving health managers' capacity for evidence-based planning, supervision and monitoring of priority interventions, through continued capacity building trainings and workshops.
- **Enhanced multisector collaboration:** DHIS2 implementation has promoted and used teamwork and collaboration instead of a 'piecemeal' approach between partners and government was emphasised. A core committee group was established at the central level.
- **Improved health system design:** DHIS2 has made information flows interoperable. More and more health programmes changed their reporting to use DHIS2, in turn standardising reporting systems, and reducing vertical programmes and siloed data.
- **Better use of DHIS2 data for evidence-based decision-making:** DHIS2 is widely recognised as a useful vehicle to push data systems and decision-making at all levels of the health system. 2015 was the first year where real-time data from DHIS2 was used to inform health planning.

Accountability

- **Increased access to information, for all stakeholders:** DHIS2 has empowered staff by giving them access to the information they are generating, at any moment. The aggregated data is also available to actors outside the system, from anywhere in the world, at any time.
- **Greater transparency:** The annual MIS conference and monthly meetings for health managers have been a great motivator for transparency and improving the quality of the data as well as capacity for using it.

Sustainability

- **Enhanced sustainability:** The data is ensuring health-based decisions are timely and responsive to the reality on the ground. DHIS2 is being used in Bangladesh to withstand and recover from shocks, including the cold wave between November 2017 and March 2018, and the Forcibly Displaced Myanmar Nationals crisis from 2017 onwards.

Quality

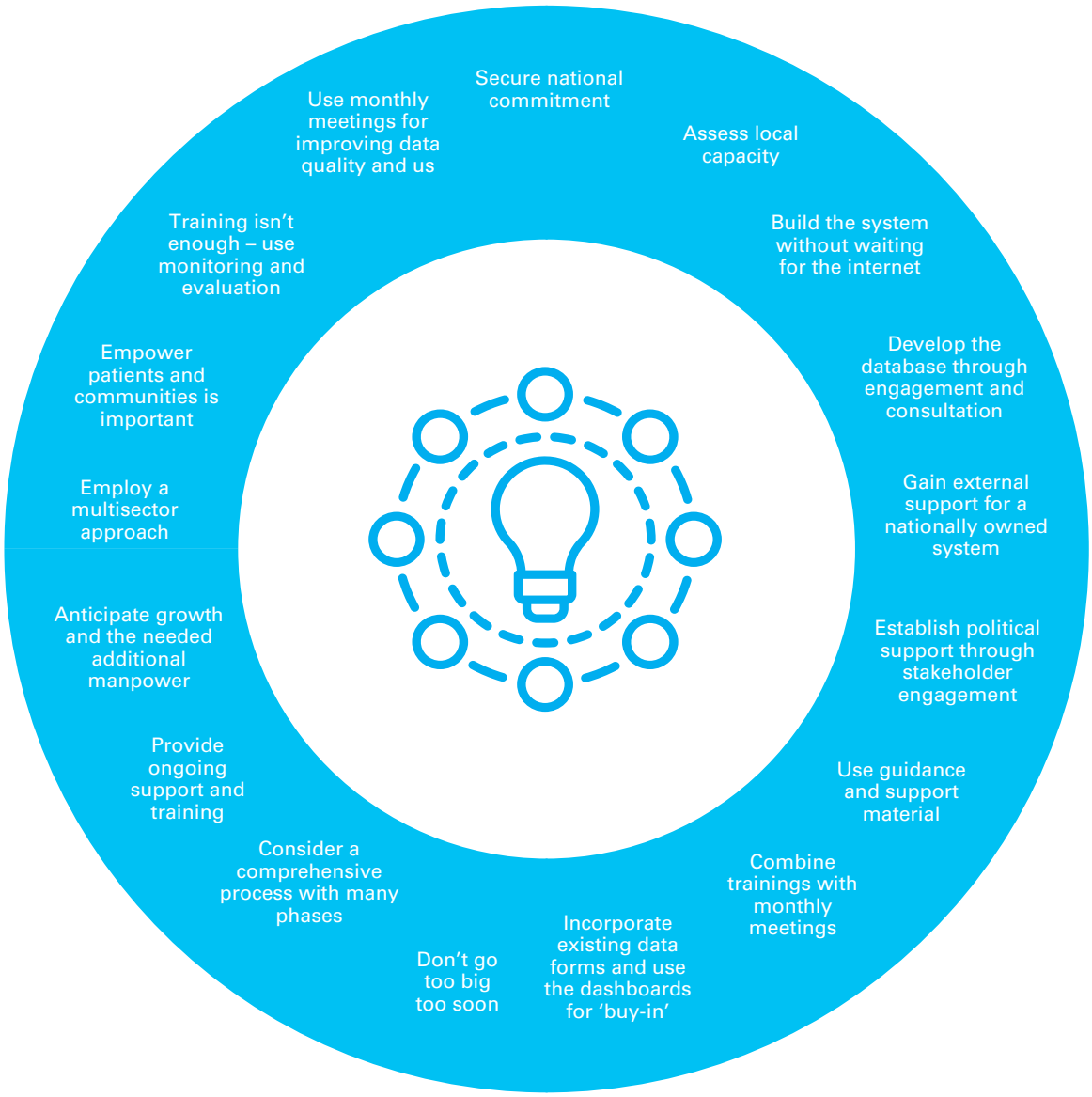
- **A vehicle for improved community engagement:** Community meetings on DHIS2 data have created community ownership over health outcomes, in turn increasing the accountability of local health and community leaders. It is an enabler for community knowledge in decision-making.
- **Incentivised use of the patient voice:** DHIS2 enables engagement of health user perspectives through the grievance mechanisms and SMS-based complaints and suggestions. This is important to evaluate current practices, ensure mutual accountability, and to incentivize sustainable and people-centred action for quality health service delivery.

Equity

- **Non-discriminatory data collection:** The introduction of individual patient records has given health workers a valuable tool for tracking and following-up with patients who require continuous care. This is especially important for hard-to-reach groups who live far from the health clinics. This is also helping to improve the health literacy and informed-decision making of these populations who may have previously not had continued contact with health service provision.

The key lessons that Bangladesh has learnt during the course of implementation

The lessons learned in Bangladesh have been described, phase-by-phase, within this document. They are summarised below:



Recommendations to other countries, based on the experience in Bangladesh

Based on the experience in Bangladesh, we make 10 recommendations for other countries to consider. These are:

HIS should be led by continuous government leadership, committed to at least 5 years

Bangladesh's HIS achievements have been linked with the determined and focused leadership of Professor Abul Kalam Azad, Director General of Directorate General of Health Services, guiding the robust coordination of all stakeholders. For other countries with a less mature HIS, and without a centralised motivation, developing a management strategy or taking increased leadership to implement HIS will be key.

In the absence of a policy roadmap, adopt a pragmatic approach bringing together multiple stakeholders

In the absence of an overarching policy, Bangladesh adopted a pragmatic approach to implementing DHIS2, bringing together multiple stakeholders including the Government, international organizations, development partners, health planners and health professionals. GIZ provided substantial support to MOHFW through setting up the National Data Warehouse, modernising the HIS infrastructure, promoting DHIS2 and providing capacity building between 2011 – 2014. Since 2014, other partners including HISP Bangladesh, ICDDR,B and UNICEF have been pivotal in reforming the HIS from central to grassroots levels, in particular focusing on improving data quality and use.

As Paul Rueckert, the former head of the Support to the Health Sector Programme summarised: "*All of this would have been easier to achieve if a policy was in place, but the experience here has shown that one doesn't always require a traditional policy approach. We had a very narrow horizon at the outset – just one step after another. And at some point, it became faster and faster, and everything began to converge.*"

Take a comprehensive approach that goes beyond software and infrastructure

HIS are linked to all areas of the health system and therefore sustainable implementation requires more than good decisions on software and infrastructure, it requires a comprehensive approach with continuous capacity building at all levels of the health system, attention to governance and ownership of the data by communities and health workers, accountability and transparency practices and regular feedback. A critical success factor in Bangladesh was community HMIS building, in line with the UNICEF health systems strengthening strategy to capacity build through both top-down and bottom-up approaches. In 2014, UNICEF started building the HMIS system in three districts from the community level, which was scaled-up to the national and divisional levels nationwide in 2015. Building community capacity was essential to improving data collection, from 13 percent to over 98 percent in less than a year.

When designing the system - predict future health needs

In Bangladesh, when DHIS2 was implemented there was a focus on the prevalent diseases from 10 years' ago. However, since 2009, Bangladesh has gone through an epidemiological transition with the rise in NCDs and an aging population, and there is a more turbulent landscape of emergencies in Bangladesh. The HIS now needs to reorient to serve the new demand.

Having learnt from the experience in Bangladesh, on reflection Dr Abu Sadat Mohammad Sayem stated; "*First, when implementing a HIS there is need to think about the health needs in 10 years' time. Secondly, I would look at technological transitions too, where is the technology going? Will people be using mobile phones more, what will the connectivity be like? Thirdly, I would strongly consider starting a HIS now with emphasis on individual records rather than aggregated data collection. This was not an option in Bangladesh, but it will be for other countries in the future*".

Assess the capacity of the people on the ground: use your local strengths

Study the people and learn from it. Focus on the local level capacity. In Bangladesh, a strength in the health system is the ambitious and motivated health workforce at the community level, who are excited to learn about new technology and to be educated. This has been one of the biggest advantages when expanding DHIS2 to the community level. Other countries can look at their own strengths and work with them when implementing a new software.

Commit to long-term capacity building with monitoring and accountability

Since DHIS2 implementation, there has been continued emphasis on training DHIS2 data entry, analysis, interpretation and feedback to the health workforce at central and decentralised levels. Despite this, there are still large challenges in health workforce capacity for analysing and interpreting the data, particularly at district and sub-district levels. On reflection of Bangladesh's experience, there is a need for more trainings with follow-up and monitoring, to assess how behaviour changed following capacity building initiatives.

Be flexible and respond to changing needs

There is need for continuous evaluation of priorities and needs, through regular communication between all levels of the health system and multiple partners has been key to implementation. At times, this may mean not providing a quick intervention, but instead learning to slow down to reflect on progress, gaps or bottlenecks that need to be addressed.

Ensure collective responsibility and positive organizational behaviour

In Bangladesh, there has been an added motivation to use DHIS2 because it is understood as a long-term Government initiative, rather than a short-term externally funded initiative by an external partner. The continued motivation from Professor Abul Kalam Azad, and the positive feedback from the central levels is important for a collective belief in the importance of a strong HIS.

This is particularly important when there was resistance to new technology. It was found that making the software user-friendly and/or providing punitive measures to reporting performance was not enough to incentivise good behaviour. A good health information culture is absolutely essential for behaviour change, alongside these other measures.

Engage with patients, families and the community

In a country with a huge population living in hard-to-reach urban areas, accessible only through community ties and outreach, empowering communities to have ownership and participate in decisions and actions and integrating community-based systems with different levels of the health system is essential to DHIS2 implementation and sustainability.

Adopt a multi-stakeholder approach, led by the government for sustainability

Bangladesh's model of implementation has been of national level integration, slowing scaling downwards to decentralised levels. It is a nationally owned initiative, supported by multiple stakeholders. The vision was created by DGHS MIS, and the Ministry is very proud of the DHIS2 achievements. This Government ownership has been key to the sustainability of implementation.

The benefits of implementing a health information system at scale are clear. It is hoped that this case study will help policymakers to apply the learning from Bangladesh in their own countries, so that more of the world's population can benefit.

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We wish Bangladesh all the best as DHIS2 continues to be used and further evolve. Other countries will benefit from your valuable experiences.


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End notes

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United Nations Children's Fund
Regional Office for South Asia

P.O. Box 5815
Lekhnath Marg,
Kathmandu, Nepal

Tel: +977 1-4417082
E-mail: rosa@unicef.org

Websites:
www.unicef.org/rosa
www.facebook.com/unicefsouthasia