Strengthening Ethiopia's Health Information System: A Journey to Unified DHIS2

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Abstract

Background: Since 2008, the Ethiopian Ministry of Health (MOH) has used a Health Management Information System (HMIS) for evidence-based decision-making. However, having two different HMIS versions created significant challenges due to a lack of integration and interoperability, leading to data confusion and analysis complications. To address these challenges, the FMOH transitioned to Digital Health Information Software 2 (DHIS2) in 2017 to improve data integration and analysis across all regions and programs.

Objective: This case study presents the pathways the MOH and its strategic partners have traveled to implement unified DHIS2 in Ethiopia's health sector.

Methods: Implementing a unified national health information system demands a strong commitment and collaboration among all stakeholders. Key success factors for implementing DHIS 2 in Ethiopia include the selection and customization of tools, stakeholder engagement, building strong institutional capacity, and establishing effective governance mechanisms at all levels.

Results: Challenges such as inadequate infrastructure, a shortage of trained personnel, poor data quality, and the integration of various health programs into DHIS2 persist and need to be addressed for the sustainable implementation of a unified DHIS2 within the health system. [*Ethiop. J. Health Dev.* 2024; 38(SI-2)]

Keywords: DHIS2, HMIS, HIS, Health Sector, Ethiopia

Introduction

The Health Information System (HIS) is fundamental in providing reliable and timely health-related information (1). An effective HIS informs program decisions, shapes national health policies, plans and strategies, and tracks the effectiveness of initiatives(2). Recognizing this, developing countries like Ethiopia have focused on strengthening their HIS. Governments, international agencies, non-government organizations, donors, and other development partners have all increased efforts to enhance healthcare through improved HIS (3).

Since 2008, the Ethiopian Ministry of Health (MOH) has implemented the Health Management Information System (HMIS) to establish a comprehensive and standardized national framework for evidence-based decision-making across all levels of the healthcare system(4, 5). HMIS is a vital component of effective health programs in many low-income countries, capturing and providing essential core data for planning and monitoring health systems performance(5, 6).

However, Ethiopia faced challenges due to the implementation of two distinct types of HMIS: one developed with support from Tulane International University and the other, with support of JSI. This disjointed implementation of two desktop based, proprietary systems resulted in significant interoperability issues and hindered effective data analysis and utilization (7).

Moreover, not all health institutions in the country submit data to the HMIS. Instead, data is drawn from service delivery and administrative records maintained as part of routine transactions at health facilities and management offices. Additionally, the lack of standardization in HMIS reporting forms has made it difficult to compare information across different locations (7). Implementing two versions of HMIS in different regions has hindered integration and hampered effective decision-making and support to meet regional demands.

Early attempts to digitalize HMIS reporting and improve the data use culture for decision-making were unsuccessful due to various technological, organizational, and behavioral factors(8, 9). Therefore in 2017, the Ethiopian Ministry of Health (MOH) decided to transition from the disparate eHMIS systems to Digital Health Information Software 2 (DHIS2) to strengthen the integration and interoperability of data from all regions, systems, software, and programs. This shift aimed to enable harmonized data use and analysis throughout the health sector (10).

DHIS2 is an open-source, flexible software for collecting, validating, analyzing, and presenting data tailored to manage integrated health information (9, 11, 12). Implementing DHIS2 as a national health management information system platform is one of the transformational shifts under the Information Revolution (13). This paper presents the pathways undertaken by MOH) and its strategic partners to implement unified DHIS2 in Ethiopia's health sector successfully.

Method

In this paper, the methods section outlines the approaches taken by the Ethiopian MOH and its strategic partners to transition from two desktop-based, proprietary eHMIS solutions to DHIS2. The

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critical transitions and challenges of managing fragmented HIS in Ethiopia are presented as follows.

Critical transitions and challenges of managing fragmented HIS in Ethiopia

The Ethiopian health information management tools and practices have evolved alongside technological advancements and changes in the health environment(14). The HIS system in the country has undergone three key phases. **First**, the period of HMIS reform (2007-2010) included paper-based data capture and reporting standardization, responding to the growing demand for data. **Second**, from 2010-2016, two separate HMIS systems were implemented by MOH with support of different partners, leading to lack of interoperability. The systems were owned by partners and vendors. **Third**, the DHIS 2 Era (2017-present) marked the period for integration and interoperable systems (see **figure 1**).

However, the transitions were not as easy as described above. Therefore, it was essential for MOH to implement a careful transition strategy that would minimize disruption to existing data collection and usage processes. Partners like the Ethiopian Data Use Partnership (DUP) played a significant role in addressing challenges and facilitating sustainable changes in the health system during the transition period (14).

During the transitional periods, MOH decided to identify and select one reliable information management system from either the legacy HMIS versions or DHIS2, based on its ability to accommodate the revised indicators and data elements. Teams from the by-then Planning, Policy, Monitoring, and Evaluation Directorate (PPMED), the Health Information Technology Directorate (HITD), and other interested parties participated in the assessment (15).

The assessment team recommended DHIS2 as an upgrade to the eHMIS, advocating for its use as a unified tool for data capture, analysis, and reporting to enhance the country's HIS system. Following this recommendation, the MOH management team commissioned experts from SA and DH to customize and pilot-test the envisioned DHIS2 system. The pilot test, as proof of concept, indicated that DHIS2 has significant capabilities to improve quality and timeliness, with necessary customizations, including the Ethiopian calendar for the country's HIS'. Additionally, the software is free, open-source, and easily customizable to the local context.

Additionally, according to the taskforce's evaluation in 2018, unique features of DHIS2 were identified that make it more suitable for the Ethiopian context compared to the existing eHMIS solutions. (**Table 1**). These features are presented in Table 1.

Table 1: **Features of the Legacy eHMIS Tools Vs DHIS2**

Legacy eHMIS Tools	DHIS2
It is not web- based – not online	It is a web-based- online
Standalone – installed individually	It can also be deployed in groups with offline mode
Not easy to install	Easy to install
Not flexible to update indicators etc	Flexible to fix/update indicators, data elements, organization units, etc
Hard -coded- changing indicators, data elements, and other components requires programmers	Can be updated with no need to change code level
The programmer owns the source code; this means the data is not the property of the ministry.	The Ministry owns the source code;

The DHIS2 Era

The implementation of DHIS2 and engagement in capacity building, as well as the use of data for planning and decision-making, were among the recent efforts by the Ethiopian government to enhance HIS implementation (16). The DHIS2 implementation interventions involved MOH's senior management, regional agencies, and partners at various levels. From the outset, the process included careful landscape analysis, benchmarking, proof of concept, readiness assessments, governance mechanisms, and other prerequisites.

After thorough deliberation on the implementation modality, stakeholders agreed to implement DHIS2 at all applicable levels: regions, zones, woredas, and facilities. This was an ambitious move, but the commitment of all stakeholders, along with existing governance and coordination mechanisms - the national HIS Steering Committee (SC), HIS Technical Working Groups (HIS-TWGs), Core Customization Team (CCT), National Implementation Team (NIT, and Regional Implementation Teams) - made it possible (Figure 1).

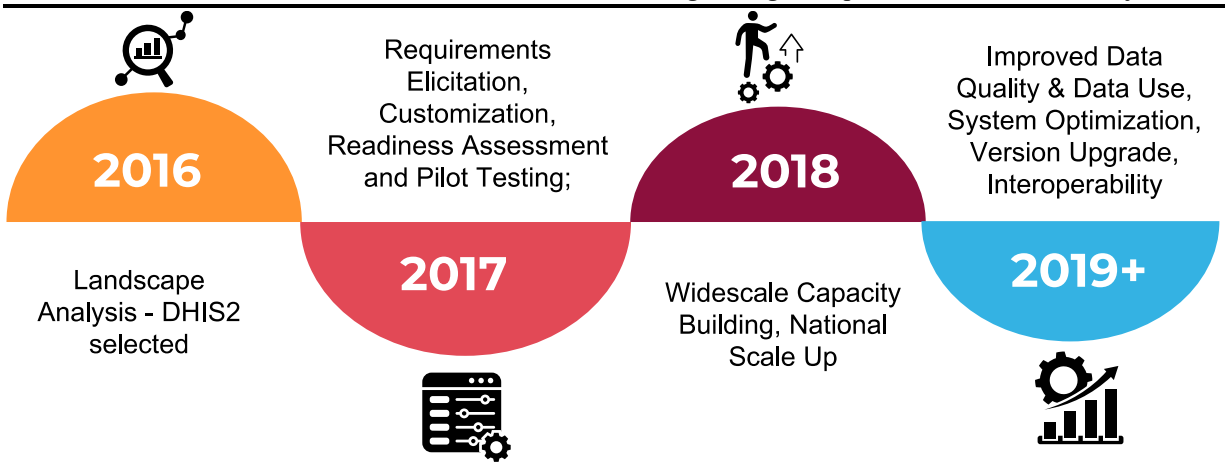

*Figure 1: **Major interventions in DHIS2 implementation***

DHIS2 Customization

According to the MOH report, in September 2017, customization of DHIS2 began and was rolled out in more than 5,300 government health facilities, accounting for more than 95% of the targeted total for the year. In a year, the implementation covered almost all government facilities and more than 5000 private facilities nationwide. This number continued to increase as new health facilities became operational. The DHIS2 customization process has been conducted approximately every two years, with the current operational version being 2.40.

This process involved a team of experts from the Digital Health Executive Office (DH LEO), the Strategic Affairs Executive Office (SA EO), various agencies, selected program teams of the MOH, and the Health Information Systems Program (HISP) at the University of Oslo. Each round of customization included enhancements to the existing features and the addition of demand-driven applications and modules, making DHIS2 a more reliable system.

Additionally, to enhance the identification, aggregation, and sharing of experiences and lessons learned, MOH documented the DHIS2 implementation process across the regions. This documentation captured the detailed steps followed during implementation and has become a valuable resource for informing subsequent improvements.

The regional documentation had three specific objectives: First, to improve the quality and pace of DHIS 2 and HealthNet implementations; to document and present the experiences and lesson learned the regions during the implementation; and to use these insights to enhance ongoing implementations. Learning from these regions provided valuable information on DHIS2 and HealthNet implementation in the regions. Second, to seek the Ministry's Response to questions raised by the RHBs during the implementation of DHIS2. Third, to create reference material for future use for similar engagements. The regions involved in this documentation process gained essential experiences and lessons that helped accelerate the implementation of DHIS2 and similar software.

Alongside the customization and documentation process, the status of HealthNet was also assessed and recorded. Recognizing the difficulty of ensuring proper implementation and use of DHIS2 without Internet access prompted the ministry to expedite the HealthNet implementation. To achieve DHIS2's primary objective of providing access to quality and reliable data in real-time, it was a must for it to be supported by an internet connection. The effectiveness of using DHIS2 entirely depends significantly on the proper functioning of HealthNet.

Additionally, DHIS2 was chosen in part for its versatile capabilities in both offline and online health data recording and reporting. This feature played a key role in its selection. To support this functionality, HealthNet was designed to enhance the software's connectivity. While DHIS2 enables real-time data access, it requires a stable internet connection to fully utilize this capability.

Results

In addition to the generic DHIS2 features that support the common needs of countries and global projects, Ethiopia required a significant modification to the core DHIS2 to meet the health sector's data capturing and analysis needs. The new features include:

- Incorporation of the Ethiopian Calendar and Fiscal Year
- Enhancement of the data entry application's graphical user interface
- Enabling gross event capture – aggregate disease data entry, tailored to monthly reporting instead of the default daily setting.
- Integration of on-the-spot data quality checks,
- Introduction of new data types (e.g., – Last Value, Last Period), analysis of disease burden (Top-n diseases) for any geographical focus and period, and inclusion of custom reporting applications with multiple periods and multiple organization units, etc.

With the strong collaboration between MOH, DUP, the University of Oslo, and other stakeholders, a unique DHIS2 of the Ethiopian version was implemented with notable improvements. Additionally, some of those unique features in Ethiopia's DHIS2 have been adopted

by the University of Oslo in the later versions of the DHIS2 Core, benefiting the global DHIS2 community. Recently, Ethiopia also succeeded in testing and incorporating the Ethiopian calendar into the DHIS2 Core, which significantly eases further customization tasks and ensures long-term use of DHIS2 in the health sector and beyond.

- *Routine Data Entry App - with on-the-spot data quality check features.*
- *Plan Setting App – that separates the Planning part from the Performance Tracking part.*
- *Disease Registration App - with numbers for OPD/IPD, Morbidity/Mortality, and Age Ranges – with validation rules for each disease/condition*
- *Custom Data Set Report App – with multiple org units and multiple period analysis features*
- *PHEM Data Entry – with PHEM Weekly data entry features in Ethiopian Calendar*
- *PHEM Export App – with a feature that converts data in the Ethiopian Calendar into Gregorian (Epi Weekes)*

Figure 2: ***Unique features of Ethiopia's DHIS2 instance***

Therefore, Ethiopia's DHIS2 is arguably the most successful electronic platform in the country's health sector. Indeed, no other electronic system is owned by the government and can capture data from almost all health facilities in the country. Its real-time data capturing capabilities, data visualization and use at all levels, stakeholder collaboration, national and regional support schemes, and governance mechanisms are unparalleled. Between 2018 and 2022, over 95% of government health facilities consistently reported through DHIS2, achieving than 90% completeness and over 70% timeliness on average. Additionally, DHIS2 was chosen in part for its versatile capabilities in both offline and online health data recording and reporting. This feature played a key role in its selection. To support this functionality, HealthNet is designed to enhance the software's connectivity. While DHIS2 enables real-time data access, it requires a stable internet connection to fully utilize this capability.

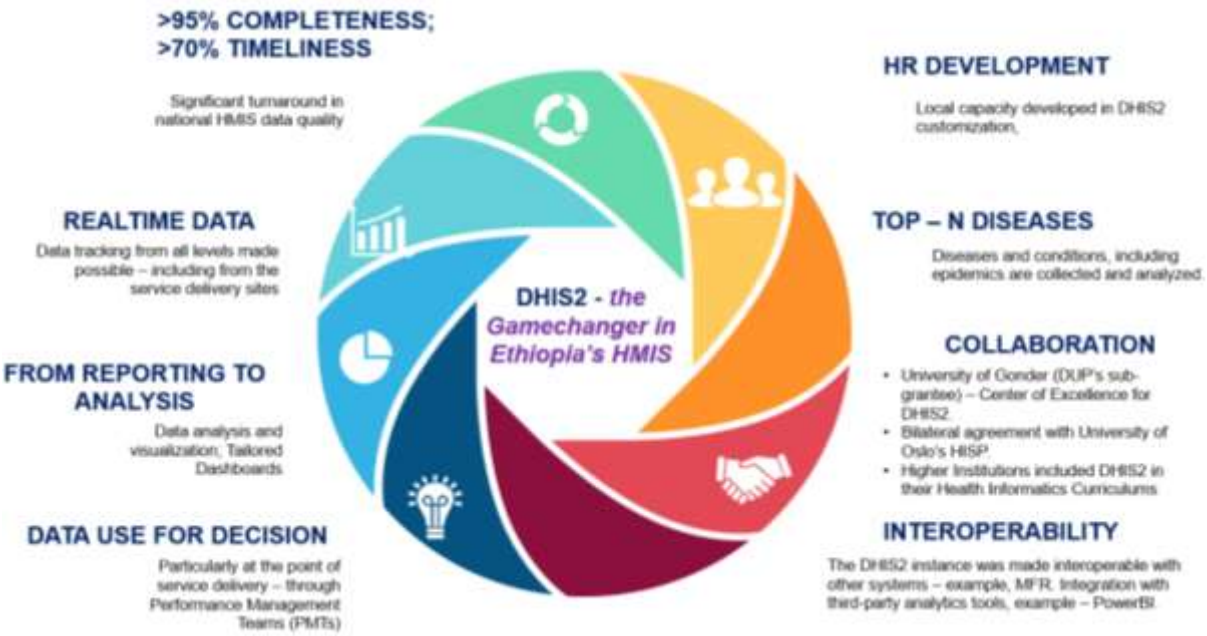

Figure 3: ***DHIS2 – the Gamechanger in Ethiopia's HMIS***

Discussion

This paper outlines the journey of the Ethiopian MOH and its strategic partners in establishing a unified DHIS2 to enhance data quality and evidence-based decision-making in the country. The discussion section highlights the lessons learned and challenges faced throughout this process.

Implementing a unified national health information system requires a strong commitment and collaboration among all sector stakeholders. The MOH took a bold initiative to transform the HMIS by exerting maximum efforts and providing solid political support. Key success factors in implementing DHIS2 in Ethiopia included adopting scientific approaches for tool selection and customization, engaging all relevant stakeholders, building strong institutional capacity, and establishing effective governance mechanisms at all levels.

Another essential lesson from Ethiopia's journey to a unified DHIS2 system is the presence of strong leadership and political will. The MOH plays a strategic and central role in driving the adoption of DHIS2 and ensuring all stakeholders are on board. Moreover, the involvement of development partners such as WHO, DUP, and others through financial and technical support was indispensable.

An additional important lesson was the need for effective capacity building through practical training. Ethiopia invested in training health workers and other stakeholders on proper use of DHIS2, helping the country achieves its intended objectives. Periodic updates and improvements have made DHIS2 responsive to the dynamic needs of the health sector. A well-planned end-user engagement (human-centered design) was employed throughout the system's life cycle, ensuring that DHIS2 meets the majority of users' needs at all levels.

The process also highlights the importance of sustainability. The DHIS2 is fully integrated into the entire Ethiopian health system, and MOH has taken ownership, ensuring its effective use after the withdrawal of partners. Overall, Ethiopia's journey to a unified DHIS2 system demonstrates the potential of Health Information System (HIS) to improve health outcomes when implemented effectively. It also provides valuable insights for other countries considering DHIS2 as their primary data management and reporting tool. However, challenges persist, including inadequate infrastructure, a shortage of trained personnel, poor data quality, and difficulties in integrating different health programs into DHIS2. Addressing these issues is crucial to strengthening the implementation of a unified DHIS2 in the health system.

Conclusions and Recommendations

The identification and customization of DHIS2 involved multiple iterative steps. As outlined earlier, the decision to adopt District Health Information Management Software 2 was based on a comprehensive assessment. Implementing a unified national health information system requires strong commitment and collaboration among all sector stakeholders. Maintaining and updating the unified DHIS2 is an essential. Moreover, periodic updates and improvements made DHIS2 responsive to the evolving needs of the health sector. To maintain sustainability, it is crucial to enhance the capacity of local staff, conduct regular system updates and maintenance, integrate the system with other platforms, and maintain ongoing political support.

Acronyms /Abbreviations:

CCT: Core-Customization Team,
DHIS2: District Health Information System 2,
DHLEO: Digital health Lead Executive Office ,
DUP: Data Use Partnership,
HIS: Health Information System,
HMIS: Health Management Information System,
MOH: Ministry of Health,
NIT: National Implementation Team,
RHB: Regional Health Bureau,
SAEO: Strategic Affairs Executive Office
SC: Steering Committee,
SNNP: Southern Nation Nationalities and Peoples of Ethiopia,
TWGs: Technical Working Groups

Declarations

Ethics approval

The Institutional Review Board of Hawassa University College of Medicine and Health Sciences granted ethical clearance (approval number IRB/213/3).

Consent for publication: Not applicable.

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