Original Article

Sustainability of Health Information System Changes in Capacity-Building and Mentorship Programs: A qualitative analysis of Barriers and Facilitators in the Targeted Woredas of Southern Ethiopia

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Abstract

Introduction: Although Ethiopia has made great progress in putting health information systems (HIS) in place, and short-term achievements in HIS are documented, the influence of contextual factors such as infrastructure and leadership, and program design such as mentorship continuity on the sustainability of HIS remains underexplored. This study aimed to explore barriers and facilitators for the sustainability of changes in health information system implementations among health facilities in Woredas targeted by the Capacity-Building and Mentorship Program in southern Ethiopia.

Method: A phenomenological design was employed in health facilities of Woredas in the Southern Ethiopia Region from September 23 to November 20, 2021. Data were collected through in-depth interviews with 44 key informants and three focus group discussions involving 19 participants. Purposive sampling was used, and data analysis was conducted using the Consolidated Framework for Implementation Research (CFIR) model, focusing on four domains: outer setting, inner setting, individual characteristics, and processes. The analysis was performed using ATLAS.ti Version 17.

Results: The study explored both facilitators and barriers to the sustainability of HIS in four CFIR

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domains. In the outer setting, external support and existing policy systems emerged as facilitators, while electric power and network interruptions and a shortage of standardized medical recording tools were barriers. Within the inner setting, organized institutional structure, effective leadership, and capacity-building activities were facilitators, but negligence, dissatisfaction, and negative attitudes among staff were noted as barriers. At the individual level, knowledge and willingness to engage with HIS were facilitators; resistance and lack of commitment were barriers. In the process domain, regular supportive supervision, mentorship, and review meetings were facilitators, but irregularities in monitoring and evaluation were barriers.

Conclusion: The study explored that external support, strong policies, leadership, and regular supervision contribute to HIS sustainability, but challenges like power outages, resource shortages, staff resistance, and inconsistent monitoring hinder progress. Addressing resource gaps, improving staff training and motivation, and ensuring consistent monitoring are important to sustain HIS activities

Key words: Health Information System; Sustainability; Facilitators; Barriers; Implementation Science; Mentors; Ethiopia

Introduction

Sustainability is defined as the enduring utilization of an innovation beyond its initial adoption phase. As a key component of implementation science, it underscores the sustained efficacy and adaptability of public health interventions in the face of evolving circumstances (1, 2).

Globally, 60% of health programs continue post-funding, yet 20% discontinue due to systemic challenges, particularly in low- and middle-income countries (LMICs) where weak health systems and resource constraints exacerbate sustainability risks (3, 4).

In LMICs, 90% of health facilities in developing countries face institutional gaps, including unclear goals, poor management, and inadequate technical capacity, undermining Health Information System (HIS) effectiveness (5)

Ethiopia exemplifies these challenges, with only 15% of health facilities having reliable electricity and 10% with internet-enabled computers, limiting data-driven decision-making. Additionally, 32.7% of HIS reports lack accuracy, and only 24.3% of healthcare decisions are based on data, weakening the system (6). Over 66% of healthcare facilities face power and internet shortages, further hindering HIS adoption and maintenance (7).

Despite the increasing implementation of HIS programs in developing countries, they often fail to produce the desired impact due to barriers such as unreliable infrastructure, financial instability, workforce shortages, and weak governance (5, 6). In Ethiopia, electricity shortages, limited HIS training, and fragmented leadership further undermine sustainability. The long-term use of HIS is important for achieving its full benefits, such as high-quality data generation and evidence-based decision-making (8). To achieve this, effective implementation strategies are essential to ensure the adoption and sustainment of HIS innovations within healthcare settings.

Despite notable progress in HIS, Ethiopia continues to face sustainability challenges due to persistent gaps in institutional structures, leadership effectiveness, and capacity-building efforts. Low digital literacy, high staff turnover, poor infrastructure, inadequate training, resistance to change, and limited data utilization further weaken HIS sustainability. In response, Hawassa University, in partnership with the

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Ministry of Health (MoH) of Ethiopia and regional health bureaus (RHBs), integrates academic expertise with program implementation and intervention research to enhance HIS sustainability. Therefore, the study explores the barriers and facilitators affecting HIS sustainability in the Capacity-Building and Mentorship Program (CBMP)-targeted health facilities in the woredas of Sidama and the Southern Nations, Nationalities, and Peoples' Region (SNNPR), southern Ethiopia.

Methods and materials

Study setting and population

The MoH introduced the CBMP in partnership with six universities and RHBs, with Hawassa University collaborating in the Sidama and SNNP region (the former region). This study focused on health centers, hospitals, and woreda health offices (WoHOs) in the CBMP operating areas of the southern region, involving various personnel such as WoHO heads, health center (HC) heads, HMIS focal persons, Hospital CEOs, and maternal and child healthcare (MCH) coordinators.

Study Design and Period

A phenomenological study was conducted from September 23 to November 20, 2021, to explore the experiences of the participants related to sustainability and identify the facilitators and barriers to the sustainability of HIS.

Sample size and Sampling procedure

The sample size was determined independently for each health institution, resulting in 44 participants for KII. These KIIs included WoHO heads, Planning and MCH focal persons, HC heads, hospital CEOs, hospital quality officers, and hospital HMIS focal persons. Participants were selected using purposive sampling to ensure representation from various levels of healthcare facilities and roles critical to HIS implementation. Each KII was conducted in a private setting to ensure confidentiality, with interviews lasting approximately 45–60 minutes. Focused Group Discussions (FGDs) were conducted, involving 7, 6, and 6 participants, totaling 19 individuals. FGD participants were selected to represent different levels of healthcare facilities, including HMIS focal persons, health center staff, and hospital administrators.

Data collection tools and procedures

The study initially identified HIS change sustainability factors, employing the Consolidated Framework for Implementation Research (CFIR) model (9), including four of its five domains: outer settings, inner settings, individual characteristics, and processes, with relevant constructs guiding the research questions. Intervention characteristics were excluded as they couldn't be measured pre-intervention. The outer setting included external support, political interference, policy issues, and educational curriculum. The inner setting involved infrastructure, network and communication, leadership, culture, and capacity-building. Individual characteristics comprised staff skills, knowledge, beliefs, self-efficacy, understanding, negligence, readiness, responsibility, engagement, satisfaction, and attitudes. The process domain emphasized action plan implementation, execution, and monitoring and evaluation systems.

Each KII was conducted in a private setting to ensure confidentiality, with interviews lasting approximately 45–60 minutes. A semi-structured interview guide, developed based on the CFIR, was used to explore facilitators and barriers to HIS sustainability for the key informant interview. All interviews were audio-recorded with participants' consent, and detailed notes were taken to capture non-verbal cues and

contextual information. Each FGD was facilitated by a trained moderator, with an observer present to document group dynamics and non-verbal interactions. The FGDs were conducted in a neutral, comfortable setting and lasted approximately 90–120 minutes. A structured discussion guide, aligned with the CFIR framework, was used to ensure consistency across groups. All FGDs were audio-recorded, and transcripts were later translated into English for analysis. Field notes were used to supplement the recordings and provide additional context.

Data Quality Control

To assure data quality, the researcher considered a different set of criteria to focus on the credibility, dependability, transferability, and conformability of the study. Accurate records were kept for all interviews and interactions with participants, as the careful recording of data is crucial to the study. The trustworthiness of the study has been further enhanced by other researchers in the field by asking them to review the interviews and the coding process. They checked the transcripts of interviews and codes by themselves.

Data processing and analysis

Data analysis was conducted using ATLAS.ti Version 17. Transcripts were initially created in the interview language or local language: Amharic and Sidamigna, and then translated into English for analysis. Word-by-word transcription from audio tapes was supplemented with field notes for clarification. Transcription accuracy was verified for 10% of the tapes. The research team entered transcripts into Microsoft Word as they were collected and later imported into ATLAS.ti7 for data structuring and management. A systematic organization with assigned codes for key ideas was developed, and a coding scheme was generated and refined as needed. From these codes, categories and subthemes

were constructed. In the theoretical analysis phase, relationships between the core category and its sub-categories were established and described.

Results

Background characteristics of the study population

In this study, four CBMP-supported woredas of the southern region were involved. A total of 63 study participants (44 key informants and 19 FGD members) were involved. The majority of study participants were HC heads (32%) and HC HMIS focal (30%). All FGD members were HMIS focal of HFs in each respective woreda (Table 1). Regarding the gender mix, 61 of the 63 study participants (97%) were male. The mean age $\pm$ SD of the participants was 31 ± 8.4 years (Table 1).

Table 1: Background characteristics of the study participants

Roll of respondents (n=63)	Frequency (%)
WoHO head	4 (6)
WoHO planning focal	4 (6)
WoHO MCH focal	4 (6)
HC heads	20 (32)
Hospital CEO	4 (6)
Hospital quality officers	4 (6)
Hospital HMIS focal	4 (6)
HC HMIS focal	19 (30)

Barriers and Facilitators for the sustainability of HIS changes

This study identified barriers and facilitators affecting the sustainability of Health Information System (HIS) changes across four key domains: outer setting, inner setting, individual characteristics, and process.

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1. Outer Setting

Government policies and external support, particularly from Hawassa University's Capacity-Building and Mentorship Program (CBMP), were key facilitators in sustaining HIS. As one respondent noted, *"Continuity of the change is due to the government-led transformation agenda in the area of data quality and use." (KI23, Male, 38).* However, the absence of HIS-related courses in health science curricula was identified as a major barrier, limiting sustainability (Annex 1).

2. Inner Setting

A well-structured institutional environment, effective leadership, and a strong working culture supported HIS sustainability. Participants highlighted that geographic accessibility and committed leadership played a role in maintaining progress. However, shortages of medical recording tools, budget constraints, power outages, network failures, and insufficient transportation significantly hindered HIS implementation. One participant stated, "We face power failures most of the time and use offline data entry, but reports are still expected on time." FGD participant (Annex 1).

3. Individual Characteristics

Skilled and motivated healthcare workers contributed positively to HIS sustainability. However, limited training, high staff turnover, resistance to change, negligence, and low staff satisfaction emerged as critical barriers. One respondent emphasized, "We have well-capacitated professionals on HMIS: KI41; Health center head, but frequent staff rotation makes sustainability difficult." KI16: Hospital HMIS focal person. Additionally, language barriers affected health extension workers' ability to engage with HIS effectively (Annex 1).

4. Process

Supportive supervision, mentorship, and regular performance monitoring facilitated HIS sustainability. Monthly review meetings helped ensure accountability, as one respondent noted, *"We monitor performance regularly, and when gaps are identified, we take action."(KI5, Male, 35).*

However, irregular monitoring and evaluation, inconsistent mentorship, and weak follow-up from higher authorities were key challenges that affected long-term sustainability (Annex 1).

Discussion

This study explored four CFIR domains (outer setting, inner setting, characteristics of individuals, and process) as barriers and facilitators. With the same domain, both facilitators and barriers were explored independently.

Findings from the outer settings explored that government policies and external support, notably from Hawassa University's Capacity-Building and Mentorship Program (CBMP), were identified as crucial facilitators. Respondents emphasized the role of government-led transformation agendas in enhancing data quality and use. The possible explanation for this finding might be due to the strong government policies and external support that provide the necessary structure, resources, and supervision to ensure the sustainability of HIS. The CBMP initiative, through training, mentorship, and material support, has played a key role in enhancing data management practices and motivating healthcare workers to use HIS effectively. Additionally, government-led transformation agendas promote accountability and data-driven decision-making, reinforcing HIS sustainability (12).

However, the absence of HIS-related courses in health science curricula emerged as a significant barrier, limiting the sustainability of HIS improvements. This might be due to without

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foundational training in HIS at the pre-service level, health professionals may encounter difficulties in data management, interpretation, and system utilization, leading to problems in data quality and reporting.

The findings from the inner setting explored that strong institutional structures, leadership commitment, and a positive working culture create an enabling environment for HIS sustainability. Geographic accessibility ensures timely supervision and support, while effective leadership fosters accountability and adherence to HIS practices. However, resource limitations such as shortages of medical recording tools, budget constraints, and infrastructure failures (e.g., power outages and network disruptions) hinder HIS sustainability. A study in Pakistan revealed that many healthcare professionals in developing countries lack the essential infrastructure for HIS, including computer hardware, software, communication channels, Internet access, and skilled human resources (14).

The findings from individual characteristics explored that skilled and motivated healthcare workers play an important role in sustaining HIS. However, limited training and high staff turnover hinder the sustainability of HIS. It was also explored that resistance to change and negligence hinder effective system adoption and low staff satisfaction, often due to inadequate incentives or workload pressure, further block HIS sustainability. The MoH HIS user manual also emphasized that HIS implementation is affected by health workforce behavior, including attitude, motivation, and data use culture (15,16). Similarly, a study in Northwest Ethiopia found that valuing data, staff training, and supportive supervision were key facilitators in sustaining HIS implementation.

The study also explored facilitators and barriers from the process component of the CFIR framework. Supportive supervision, mentorship, and regular performance monitoring facilitated HIS sustainability. Monthly review meetings ensured accountability and timely intervention when gaps were identified. However, irregular monitoring and evaluation, inconsistent mentorship, and weak follow-up from higher authorities like the woreda, regional health office were identified as barriers to the sustainability of HIS implementation.

Regular performance monitoring is essential for identifying both successes and challenges in program implementation, guiding timely decision-making, and ensuring that health workers integrate monitoring and quality improvement into their routine responsibilities (17, 18).

Conclusion

The present study explored barriers and facilitators to the sustainability of Health Information System (HIS) changes in Sidama and SNNPR, Ethiopia, using the CFIR framework. Key facilitators included government policies, external support (especially from Hawassa University's CBMP initiative), and strong leadership. Barriers included the lack of HIS courses in health curricula, budget constraints, infrastructure issues, and shortages of recording tools. Addressing resource gaps, improving staff training and motivation, and ensuring consistent monitoring are important to sustain HIS implementation.

Acknowledgement

Ethical considerations

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This study was performed following relevant guidelines and regulations and approved by the Institutional Review Board (IRB) of Hawassa University, College of Medicine and Health Sciences, Hawassa Reference Number. IRB/097/13, Date 23/03/2021. Permission was also obtained from each participating facility. In addition, a written informed consent was obtained from each study participant.

Data availability statement

Data will be available upon reasonable request from the corresponding author.

Conflicts of interest

All authors declare that they have no conflict of interest.

Funding statement

References

1. Rogers E.M., Diffusion of Innovations. 5th ed. New York: Free Press; 2005;429.
2. Maher L., Gustafson, D., Evans, A. Sustainability model and guide. NHS Institute for Innovation and Improvement; 2007.).
3. Shediac-Rizkallah MC, Bone LR. Planning for the sustainability of community-based health programs: conceptual frameworks and future directions for research, practice and policy. Health Educ Res. 1998;13(1): 87–108.
4. Pluye P, Potvin L, Denis J-L. Making public health programs last: conceptualizing sustainability. Eval Prog Plann. 2004;27(2):121–33.
5. Kiberu VM, Mars M, Scott RE. Barriers and opportunities to implementation of sustainable e-Health programmes in Uganda: A literature review. African journal of primary health care & family medicine. 2017;9(1):1-10.
6. Cohen JF, Coleman E, Abrahams L, editors. Use and Impacts of E-health Within Community Health Facilities in Developing Countries: A Systematic Literature Review. ECIS; 2015.
7. Proctor EK, Powell BJ, McMillen JC. Implementation strategies: recommendations for specifying and reporting. Implementation Science. 2013;8(1):139.
8. Ross J, Stevenson F, Lau R, Murray E. Factors that influence the implementation of e-health: a systematic review of systematic reviews (an update). Implementation science. 2016;11(1):146.
9. Damschroder LJ, Reardon CM, Lowery JC. The consolidated framework for implementation research (CFIR). Handbook on implementation science. 2020 May 21:88-113.
10. FMOH. Health Sector Transformation Plan, HSTP, 2015/16 - 2019/20 Addis Ababa: The Federal Democratic Republic of Ethiopia, Ministry of Health; 2015.
11. Vital Strategies. Data Impact Program:Health Information System (HIS) Policy Toolkit. 2019.
12. Ecoregional Assessment and Biodiversity Vision Toolbox:Engage key internal and external partners and stakeholders throughout the process February, 2006.
13. Federal Democratic Republic of Ethiopia Ministry of Health. Connected Woreda Implementation Strategy. August 30, 2016;1.0.
14. Barriers in Adoption of Health Information Technology in Developing Societies,. (IJACSA) International Journal of Advanced Computer Science and Applications,. 2011;2(8).
15. Federal Democratic Republic Of Ethiopia Ministry Of Health Policy Planning And Monitoring & Evaluation Directorate.

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Information Use Training Module. June 2018.

16. Tilahun et al. Level and contributing factors of health data quality and information use in two districts in Northwest Ethiopia: social-ecological perspective. BMC Medical Informatics and Decision Making. 2021; 21(373).

17. Lani Marquez and Linda Kean. Making Supervision Supportive and Sustainable: New Approaches to Old Problems. 2002. Contract No.: 4.

18. Biwott T; Egesah O; & Ngeywo J. Importance of Monitoring and Evaluation in the Sustainability of Constituency Development Fund (CDF) Projects in Kenya. (ISSN 2455-2267). IRAInternational Journal of Management & Social Sciences 2017;7(1).

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ANNEX I: Barriers and Facilitators for HIS Change with its Domain, summarized from the participants response

Domains	Family	Barriers to sustaining HIS changes	Good opportunities
Outer setting	**External support**		CBMP support; Partner support
	Educational curriculum	Missing HIS course for medical students	
Inner setting	**Structure of institutions**	Absence of eMCS in MRU; absence of adequate power supply for HMIS unit; absence of adequate computer and printer; Absence of internet connection; absence of LAN installation; lack of budget ;staff turnover; high work load; shortage of HMIS materials; Trained staffs turnover; having HP without HEW; low salary of HEWs and HIT; shortage of professionals; shortage of standard Registers and tally sheet stock out; case team coordinator replacement; DHIS2's interruption; case team leaders needs incentives during meeting	Having back up shelves in MRU; availability of budget; Having adequate staff; allocate sufficient budget for printing; appropriate person assignment; availing resources properly; having capacitated case team leaders; having organized units and workforce; having generator; having separate and organized HMIS office; HIS tools availability; presence of trained professional; presence of strong health post health center linkage
	Network and communication system	Absence of electric power; Absence of Internet infrastructure; absence of transportation to support HEWs;	
	Leadership	lack of strict follow up among leaders; HC head not influence PMT members to attend meeting; stakeholders' unavailability; PMT meeting irregularity	Having committed leader; creating conducive environment for trained professionals; higher officials' commitment; good support from Woreda; PMT members being a management team that helps to make decision when needed; creating team work to ensure sustainability
	Working culture	lack of commitment; false reporting; not doing correction based on feedback; doing work as a campaign; staff rotation and turnovers	Doing self-assessment regularly; formal and informal sharing of ideas; Having good working culture; having regular communication with HFs; proper completing of tally sheet, registers and all the requirement; looking HIS work as routine activity
	Capacity	lack of training for new	Having on job training; provision of

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	building actions	employees; not having HEW support; not having refreshment training	orientation for new comers; having basic training on HIS
Characteristics of individuals	**Staff skill and knowledge**	Lack of knowledge on CHIS; skill gap among new comers; luck of skilled among case team leaders; Knowledge and skill gap in quality and equity indicators assessment; skill and Knowledge gap on doing LQAS; Knowledge gap about reporting among HEWs	
	Self-efficacy	Negative perception towards HMIS activities; using DHIS2 computer for watching movies; Being dependent; luck of experience; lack of commitment;	Being cooperative;
	Progress of understanding	Gap on understanding how to do LQAS; language barrier	Having common understanding on HIS among staffs
	Negligence	reluctance in reporting; luck of commitment among staffs; negligence among staffs	Giving attention on HIS work; having commitment
	Staff readiness and responsibility	attitude of the staff is another problem; lack of commitment	understand roles and responsibility; Professionals willingness to accept additional burden; having good commitment;
	Staff engagement	Luck of motivation; luck of engagement	Being collaborative; having commitment; presence of dedicated staff; staff motivation
Process	**Action plan implementation**		
	Execution of actions	Luck of continuity; not doing in daily base; problem of responding on time	Establishment of PMT; having functional PMT; [Improved analysis capacity
	Monitoring and evaluation system	Luck and interruption of supportive supervision; lack of transportation; interruption of mentorship; Not having review meeting at regional level; irregularity of PMT meeting	Having monitoring chart at case team level; checking report completeness. and timeliness regularly; conducting quarterly board meeting; Cross checking for data quality; doing LQAS regularly; conducting strict follow up; provision of continuous orientation on HMIS; data evaluation through comparison; report evaluation and feedbacks provision to HPs; conducting PMT meet monthly; conducting regular supportive supervision for HC and HPs; conducting review meeting monthly; provision of Feedback during SS; presence of platform to cross check data;

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