

Assessing the Performance of Routine Health Information Systems in Low-Resource Settings: Insights from Ethiopia

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Abstract

Background: It is critical to regularly monitor and evaluate the effectiveness of the health information system (HIS), strengthening efforts to support a country's ability to plan and directing health initiatives, providing evidence to support decisions on policies and programs, and promoting better health outcomes. This case study documents Ethiopia's journey in developing, testing, and revising and HIS performance measurement tool to be applied in resource limited setting.

Methods/design: The process of tool development and revision involved four stages across six years (2016 - 2021): 1) formation of the technical team; 2) Design of the HIS measurement tool (tool development); 3) implementation of the HIS tool; and 4) revision of the HIS measurement tool. Tool development was an iterative and consultative process involving a desk review of relevant national documents, repeated meetings of Technical Working Groups (TWGS), and workshops with key stakeholders. The tool revision process took place in a workshop setting. Drawing on lessons from initial implementation, the TWG, along with other public health experts with policy and ground-level experience was engaged in the process. The revised measurement tool was reviewed and approved in a two-day workshop involving a total of 48 experts.

The tool: The HIS measurement tool covers three major domains of HIS: i) HIS structure and resources, ii) data quality, and iii) data use. Each domain was assigned a percentage range based on a 100-percentage point scale: HIS Structure and Resources was assigned a score of up to 30 points, and Data Quality was assigned a score of up to 30 percentage points, and Data Use was assigned a score up to 40 points. The tool was used to assess health facilities' HIS performance across these three domains at regular time intervals, Based on their respective HIS performance scores, health institutions were classified as "Emerging", "Candidate (low and high)", "Model", and "Demonstration" institutions.

Lessons learned: This case study demonstrates that it is possible to develop a HIS performance measurement tool that can be applied regularly to monitor and evaluate the effectiveness of HIS strengthening efforts in low-resource settings. This exercise also showed that regular revision of a measurement tool according to practical experiences, national priorities, and ongoing developments in the health information system, is essential. [*Ethiop. J. Health Dev.* 2024; 38(SI-2)]

Keywords: HIS performance, tool development, measurement, Information revolution, Ethiopia, low resource settings, data use

Background

Health Information Systems (HIS) enable the production of high-quality information to meet the decision-making needs of the health sector at all levels (1). Designing and implementing appropriate information systems that generate quality data and foster evidence-based decision-making to inform health programs have been a challenge in resource-limited countries (2-4). The situation is no different in Ethiopia, where a limited portion of data collected at the facility level has been interpreted and used for decision-making. Furthermore, the focus has been on a one-way data transmission from facilities to higher levels of the health system, undermining the use of collected data for decision-making at the point of care (5).

It is critical to regularly monitor and evaluate the effectiveness of HIS strengthening efforts to support a country's ability to plan, and direct health initiatives, provide evidence to support decisions on policies and programs, and promote better health outcomes (1). The Performance of Routine Information System Management (PRISM) tool (6), created under MEASURE Evaluation, is designed to assess the broad context in which routine health information systems operate. Despite its comprehensiveness, full implementation of PRISM for routine monitoring is

resource and time- intensive and requires expertise to carry out (9).

Ethiopia has traditionally monitored data quality and use through nationally adapted routine data quality assessment (RDQA) (10) and data quality review (DQR) tools (11). However, these assessments were not designed to provide a composite value/index that measures the state of data quality and use for immediate monitoring and comparability across time and geography. Moreover, these assessments have been conducted irregularly over the years and in limited settings, providing only a narrow view of the data quality and data use status in the country. This highlights the need for a simple, comprehensive tool that can be applied at scale for regular monitoring of HIS performance and aligns with national priorities.

This case study documents Ethiopia's journey (experiences) in developing, testing, and revising and HIS performance measurement tool that can be regularly applied in resources limited setting.

Ethiopia's national health administrative system is structured with the Ministry of Health (MOH) at the top, followed by regional health bureaus (RHBs), Zonal Health Departments (ZHDs), and Woreda Health Offices (WoHos). The country's health service delivery

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is divided into three tiers. These comprise primary care, which is mostly provided at primary hospitals, health centers, and health posts; second-tier care, which is provided at general hospitals; and third-tier care, which is provided at specialist referral hospitals (12).

Through its Health Management Information System (HMIS), the Ethiopian healthcare system generates routine data. In contrast, healthcare professionals (at the health facility level) and health extension workers (at the community level) provide day-to-day healthcare services. HMIS data are collected from individual health and medical records, as well as registries at both health facility and community levels (12).

Ethiopia has made a significant effort to reform the routine HMIS based on principles of simplification, standardization, integration, and institutionalization since 2008. The MOH included the Information Revolution (IR) as one of the transformation agendas in its Health Sector Transformation Plan (HSTP I), which ran from 2015/16-2019/20, and it remains an agenda in the second iteration of its HSTP-II (2020-2024) (13). The IR was devised to bring advancement in data collection, compilation, and analysis processes by focusing on improving the use of information, digitization, and governance of the health system. A Connected Woreda strategy (13) has been implemented since 2016 to operationalize the IR agenda. Since 2017, the Ethiopia Data Use Partnership (DUP) - a joint initiative between the MOH and JSI Research and Training Institute Inc. (JSI) - has been supporting the government of Ethiopia in its endeavor to transform its health information system and foster a culture of data use (14).

The Connected Woreda strategy has been implemented in place for the last six years to operationalize the IR agenda at the woreda level and create the model and connected woredas in HMIS implementation. The program is believed to have catalyzed the operationalization of the IR at both woreda and higher levels. However, its implementation has faced various challenges, and the quality and use of information in the country has been insufficient to support effective decision-making at all levels of the health system.

Methods

Followed procedures for developing and revising the HIS measurement tool

To address the need for a HIS tool that routinely monitors attributes of HIS performance, data quality and use, the MOH, in partnership with DUP, created an HIS measurement tool. The development and revision of this involved four stages across six years (2016 - 2021): 1) technical team formation; 2) Designing the HIS measurement tool (tool development); 3) HIS tool implementation; and 4) HIS measurement tool - revision as described below.

Technical Working Group (TWG) formation (2016)

To ensure the credibility and acceptability of the measurement tool, the TWG was formed from a collaboration of 41 experts purposefully selected from

diverse stakeholder groups, including public health experts from the MOH, regional health bureaus, local universities, implementing partners, and other partners who are currently working on HIS. Experts from the MOH spearheaded the overall process with support from the DUP.

Designing the HIS measurement tool (2016)

The tool development was an iterative and consultative process involving two workshops among the TWG members. The first stage of tool development aimed to understand locally available strategies and practices. A desk review of relevant national documents such as the HSTP-I (13), IR roadmap (15), Connected Woreda strategy (16), and data quality, use, recording, and reporting procedure manuals (13) was conducted to understand available resources and needs for HIS measurement thoroughly.

The resulting consensus from the stakeholder workshops and desk review led to the creation of an electronic Excel-based measurement tool (Supplementary file 1), developed mainly by adapting existing HIS performance measurement tools used in Ethiopia. These tools included the RDQA tool (10), the Data Quality Audit (DQA) tool (11), and the PRISM tools (6-7). National priorities and experiences were also taken into consideration when designing the HIS measurement tool.

Purpose of the HIS measurement tool

The purpose of the HIS measurement tool is to determine the overall level of HIS performance of assessed health facilities sites and woreda health offices. This includes the availability of HIS structures and resources, and status of data quality, and the use of information. The tool also aims to regularly monitor the progress of IR agenda implementation and other HIS interventions to inform the planning, design, and implementation of strategic interventions.

The HIS measurement tool covers the three major domains of HIS, including i) HIS structure and resources, ii) data quality, and iii) data use.

i. HIS structure and resources: this domain assesses the availability and status of HIS resources. It captures the availability of functional medical record units, HIS budget allocation, supportive supervision, capacity needs assessment, and the implementation of electronic information systems.

ii. Data Quality: this domain quantifies the status of data quality in terms of data availability, reporting completeness, timeliness, and accuracy. It also assesses the level of data quality assurance processes that are practiced at the sites and the availability of key documents and resources for data quality.

iii. Data Use: this domain measures how data and information are used to monitor performance, guide daily activities, draw lessons learned, and improve service delivery at the point of care. Specifically, the tool examines whether discussions are regularly held to review performance targets across key

indicators, whether performance gaps are identified and prioritized, whether root cause analyses are conducted, whether any decisions have been made around key performance metrics based on HIS data, whether an action plan has been developed, and whether follow-up action have been taken. The tool also assesses whether feedback mechanisms are in place, data is visualized and regularly disseminated, and whether data-oriented meetings are organized.

Data collection methods

The HIS measurement tool is intended to be used at health facilities, including health posts, health centers, hospitals, as well as at woreda health offices. A version of the HIS measurement tool was created for each site type to account for the specific context at that level (Supplementary file 1).

The tool was designed to be self-administered by HMIS professionals working in health facilities and woreda health offices every six months. The tool is completed by reviewing source documents (e.g., registers, tally sheets, etc.), paper and/or electronic HIS reports, PMT meeting minutes, and through observation. The HIS measurement tool includes a scoring rubric for each HIS domain, developed by the TWG and embedded into the Excel-based tool, along with automated analysis functions to assist health facilities and woreda health offices in easily determining their HIS status. Health institutions are instructed to develop and update tailored action plans based on the findings from the assessment. Three-day training on the measurement tool is recommended before its application.

Results validation from the higher level also takes place using the HIS measurement tool. For example, when a Woreda health office reports reaching a high level of HIS performance status (i.e., “Model institution”) at both the Woreda Health Office (WoHO) and health facility level through the HIS measurement tool self-assessment, the Regional Health Bureau (RHB) and MOH verifies using the same tool during verification visits.

HIS measurement tool scoring and performance status

In order to objectively measure HIS performance, the TWG created a scoring rubric that provides a score for each HIS domain (and sub-domain parameter) of the tool. The scoring system is based on a 100 percent scale, with each domain assigned a percentage range that adds up to 100 percent (i.e. maximum possible score across all three domains is 100 percent). Domain 1, HIS Structure and Resources, was assigned a scoring range between zero and thirty percent. Domain 2, Data quality, was assigned a scoring range between zero and thirty percent, and domain 3, Data Use, was assigned a scoring range between zero and forty percent. The domain scores are calculated by summing up the scores assigned to parameters under each domain. For more information on scoring, see Supplementary files 1&2.

Facilities and Woreda health offices then receive a HIS performance classification based on the overall score from the HIS measurement tool. The classifications are as follows.

- **Emerging:** A health institution (including WoHO) that meets less than 65% of assessment criteria.
- **Candidate:** A health institution that meets 65%–90% of assessment criteria.
- **Model institution:** A health institution that meets > 90% of assessment criteria.
- **Model woreda:** When all health institutions in the woreda are accredited as “Model institutions” and are accessing and sending data offline.

HIS measurement tool implementation (2019 - 2020)

The HIS measurement tool was implemented in two different program settings over two years. The tool was applied several times throughout the two-year testing period, and all versions of the tool (i.e., tools specific to each facility type and/or management unit) were tested during this time across both settings.

Capacity Building and Mentorship Program experience:

The HIS measurement tool was implemented in the 36 woredas (across 11 regions) participating in the Capacity Building and Mentorship Program, a collaborative program between academic institutions and the MOH that focuses on realizing the country’s IR agenda (17). A total of 252 sites (179 health centers, 37 hospitals, and 36 woreda health offices) were assessed using the HIS measurement tool under the CBMP program. The measurement tool was applied three times between 2019 and 2020, in January 2019, December 2019, and June 2020, to measure HIS performance.

Learning Woreda experience: Eight woredas, across five regions,¹ were selected by the MOH and designated as “Learning Woreda”. Within these woredas, RHBs, in collaboration with DUP, implemented a set of intensive HIS interventions with the aimed testing these interventions, iterating on their design, and documenting and sharing lessons across Ethiopia to promote the uptake of successful HIS interventions (18). The HIS measurement tool was implemented twice between 2019 and 2020, in these eight woredas, once in November 2019 and again in May 2020. The assessment was conducted at 79 sites (8 woreda health offices, 41 health facilities, and 30 hospitals).

Lessons from Phase One: The lessons garnered during the first phase of HIS measurement tool implementation were gathered through feedback and observations by tool implementers (e.g., HMIS professionals) during routine tool implementation, regular discussions with health institutions during mentorships and supervision visits, during review meetings, and feedback gathered from experts.

Routine measurement and continued improvement of data quality and data use are possible. Woreda health offices and health facilities were able to routinely measure their HIS performance and work towards filling the identified gaps. Tool users noted that the tool was relatively easy to use, and it was observed that the HIS measurement tool could be used by mid-to low-level health workers at the primary healthcare level could effectively use the HIS measurement tool. In several cases, it was observed that the tool and its findings could be adapted and used for supportive supervision, verification, and mentorship, indicating the tool's usefulness and adaptability.

There is a need to revise parts of the HIS measurement tool. Even though the assessment tool was observed to be comprehensive, several notable gaps were highlighted during the implementation period. For example, the completeness of patient information recording forms (e.g., registers and patient charts) was initially overlooked and not included in the data quality domain. Users and subject matter experts also noted that, in addition to data quality and use, health outcome parameters are essential for understanding HIS performance and should be included in the measurement tool.

In terms of filling out the tool, concerns about subjectivity were raised regarding to the lack of detailed instructions on how to fill out each parameter, leading data collectors to interpret questions in their way. Additionally, some parameters were not well defined and/or were not applicable or feasible to collect in some cases. For example, parameters under the data use domain, such as “displaying performance within the community” or “preparation and dissemination of information materials such as brochures, newsletters,” were not applicable at the health center level.

While most parameters were deemed to be weighted appropriately, it became clear during the implementation period that some weights did not align with efforts required to achieve them and/or with their significance for realizing the IR agenda. An example of this was the relatively low weight initially allocated to having a functioning DHIS-2.

The tool also lacked a trend analysis feature, preventing facilities could track their HIS performance progress. Instead, the tool required facilities to open a new, blank file each time they started a new assessment, which did not retain information, making users feel as though they were starting over without anything to compare against overtime. The initially recommended assessment frequency of every six months was found to be too long of a period between assessments.

Revising the HIS measurement tool (2021)

The tool revision process was mainly conducted in a workshop setting. Taking the lessons from initial implementation, the TWG, along with other public health experts with policy and ground-level experience, engaged in a two-day deliberative

workshop to review and revise the measurement tool. A total of 48 experts participated in the workshop.

During the workshop, participants were grouped into teams of four and reviewed the lessons learned against the initial measurement tool. Before revision, consensus was reached on criteria for the inclusion of new parameter into the measurement tool as follows:

- *Feasibility* of implementing the activity to be assessed at certain levels of the health system (e.g., expecting advanced data analytic practice at a PHCU level is not feasible).
- *Applicability*: The parameter should be applicable to the site of interest (e.g., register completeness is applicable at the facility level but not at the administrative level).
- *Measurability*: The parameter has data sources and can specifically be measured on a routine basis.
- *Relevance/importance* to national plans and strategies: Significance of the intervention in improving data use, thereby resulting in improvement in health outcomes.
- *Universality*: The parameter should be applicable to most of the sites (e.g., The presence of a performance monitoring team is expected in all sites, while interventions such as holding a data day or other such forums are optional).

Accordingly, the team of experts revised the measurement tool (Supplementary file 2). The revisions included : adding/removing measurement parameters; adjustment of scoring for parameters; including an additional tool for the regional level; revising status categorization and definition including a tailored definition for different settings in the country; incorporating the trend analysis feature, introducing the weighted score for each parameter, and developing a composite score for administrative levels, as described in detail below.

Adding and removing parameters

Changes in the data quality domain included adding data completeness for recording formats such as registers and individual medical records; checking the consistency of data between registers and recording formats (such as registers and patient cards); and monitoring actual scores in addition to measuring practice (e.g, reporting accuracy score).

The changes to the data use domain included, but were not limited to, removing parameters on data display within the community because of practicability challenges, conducting and disseminating assessment findings, and printing and disseminating information materials such as brochures and newsletters because of feasibility challenges in health facilities. The domain added parameters such as data review at the department level, practice of updating the DHIS2 dashboard, monitoring the quality of health care delivery process, and improving health outcomes using patient-level data.

Measuring the change in health outcomes resulting from data used for decision-making remains a challenge. Nevertheless, the tools include the parameter “availability of documented performance change in any of the indicators (e.g., coverage, quality, and equity) after analysis and action within six months” as a parameter in the data use domain. This is intended to indicate whether processes of use of data for action are genuinely changing health outcomes. Adding this parameter provides a complete picture of the data use cycle, which includes the process of decision-making and the effects of decisions on health outcomes.

Scoring adjustment

Once the parameters were updated and set, the next step was to review the scores allocated to each domain, and each parameter. Initially, a group consensus was reached to keep the score of the three domains unchanged. However, due to changes (additions, deletions, modifications) to the parameters and reevaluation of the proportionality of the previously allocated scores, the weights were rectified and distributed. Accordingly, the weight for each parameter and its subcomponents was allocated in a structured manner.

During the workshop, each expert allocated weight to the final list of parameters, considering the magnitude of the parameter (i.e., the effort required in terms of resources such as time, finance, and effort) and its level of significance (i.e., contribution to the result). Ultimately, each group came up with an average value for each parameter and its sub-component. The average value of the teams was taken as the final weight of each parameter.

Another major change was the elimination of unnecessary categorization as sub-components and introduction of direct calculations by assigning weights to parameters. This enhances the accuracy of scoring of achievements (rather than giving the same score to facilities that fall within a range), resulting in greater precision.

Revising the level and frequency of assessment

The initial measurement tool was developed to assess HIS performance at the hospital, health center, health post, and WoHO levels. During the revision, two additional tools were included for zonal and regional health bureaus, aiming to assess HIS performance status at all levels. In addition, the recommended frequency of assessment is agreed to be done on a quarterly basis instead of six months.

Revising status categorization and definition

The categories and definitions of an institution’s HIS performance status was revised based on lessons learned during the first round of implementation. Revisions included dividing of the wide candidate category into two (low candidate and high candidate), and the addition of another category named “Demonstration site” in which health institutions and administrative levels that excel in implementing HIS. Details of the categories are presented below.

Emerging

A health institution, including a facility (i.e., health post, health center, or any hospital) or administrative health office, i.e., woreda health office, zonal health department, or regional health bureau), that scored less than 65% of the assessment criteria specific to each type of health institution or administrative health office is classified as emerging.

For a woreda, zone, or RHB (the health office and its health facilities), an emerging level is defined as having a composite score of less than 65% (*see composite scoring below*). Similarly, for a Primary Health Care Unit (PHCU) i.e., a health center and its satellite health post, an emerging level is defined as a PHCU that has a composite PHCU score of less than 65%. This is the lowest level in the IR-Model woreda creation pathway and requires a special focus on HIS strengthening actions. At this level, the major emphasis will be capacity building to capacitate M&E infrastructure and improve processes.

Candidate

This level is for those health institutions that score from 65% to 90% of the assessment criteria. For a woreda, zone, or RHB to be classified as a Candidate, it should have a composite IR score of 65% to 90%. Similarly, for a PHCU, a candidate level is defined as a PHCU that has a composite PHCU score of between 65% and 90%. At this level, health institutions are expected to have basic M&E infrastructure in place and room for improvement in data quality and use. The overall focus for interventions at this tier is continued capacity building, particularly in the areas of data quality and use.

The interval for this level has been wide, and health facilities were observed to remain at this level for an extended period because of the long duration. Thus, the candidate level is divided into two stages:

Low candidate level: An institution that scored between 65% and 80% of the assessment criteria and.

High Candidate level: An institution that scored between 81% and 90% of the assessment criteria

Model health institution

This is a stage in which the health institution has scores equal to or greater than 90% of the assessment criteria. For a woreda, zone or RHB, i.e. an administrative office and public health facilities in the level, is considered as a model if the composite IR score of the level is to 90% or more. Similarly, for a PHCU, a model level is defined as a PHCU that has a composite score of 90% or more. For model level health institutions, the focus will be sustaining the status, sharing or diffusing best experiences and innovations to other woredas using existing platforms.

Moreover, the development team recommended tailored definitions for different settings in the country to accommodate existing differences in structure and HIS infrastructure among agrarian, urban, and pastoralist settings.

Composite measures to determine the HIS performance of health institutions

To monitor the progress of the woreda or zone as a whole, including the performance of the health offices, primary hospitals, health centers, and health posts, a composite score is necessary. Similarly, to measure the performance of a PHCU (i.e., the performance of the health center and its satellite health posts), a composite measure is needed to allow continuous measurement of the PHCU as a unit. As such, the following composite measures with their scoring are suggested. There is a need to use composite measurement to monitor the progress of woredas, i.e., a composite measure to track

the performance of all institutions in a woreda. Continuous composite score measurement is recommended to allow measuring for tracking of both woredas as a woredas health system and PHCU as well.

PHCU composite score: this score measures the performance of the PHCU as a whole, including the performance of the satellite health posts and the health center. Based on the score of each facility, the composite score calculation for the PHCU will be as follows (Table 1)

Table 1: Composite score for PHCU

Component	Weight for all three settings		
	Agrarian woreda	Urban woreda	Pastoral woreda
Health posts	50%		50%
Health centers	50%	100%	50%
Total	100%	100%	100%

Woreda composite score: this score measures the performance of the woreda as a whole, including the performance of the woreda health office and the facilities it supervises. Based on the scores of each facility, the composite score for the woreda will be calculated as shown in table 2-3 depending on whether there here are primary hospitals in the woreda (Table 2-3).

Table 2: Woreda composite score weights for woredas with primary hospitals

Component	Agrarian woreda	Urban woreda	Pastoral woreda
Health posts	25%		25%
Health centers	30%	45%	30%
Primary hospital	25%	30%	25%
Woreda health office	20%	25%	20%
Total	100%	100%	100%

Table 3: Woreda composite score weights for woredas without primary hospitals

Component	Agrarian woreda	Urban woreda	Pastoral woreda
Health posts	30%		30%
Health centers	45%	70%	45%
Woreda health office	25%	30%	25%
Total	100%	100%	100%

Application of the revised HIS measurement tool

Below is an example of how to calculate the HIS performance status of a woreda.

Example: Woreda X, which is located in an agrarian set up, has four health centers and 20 health posts and does not have a primary hospital. In a given quarter, if the average health center's IR score is 70%, and average health posts- IR score is 80%, and the woreda health office's IR score is 75%. Then, the values for each level will be calculated as follows.

Woreda health office score = $(75\%)(25\%) = 18.75\%$

Health centers score = $(70\%)(45\%) = 31.5\%$

Health posts score = $(80\%)(30\%) = 24\%$

Thus, the woreda composite score is $18.75\% + 31.5\% + 24\% = 74.25\%$, which is under a *low candidate* category.

Zonal Health Department composite score: this score measures the performance of the zonal health department as a whole, including the performance of the woreda health offices, hospitals, creation of demonstration woreda and ZHD score (Table 4).

Table 4: Components of a model zone

Criteria	Score
Proportion of model woredas*	40%
Hospitals under the zone should be model	20%
One demonstration woreda (one woreda per zone)	20%
ZHD/RHB IR with the maximum threshold of 90%**	20%
Total	100%

*If a zone has 80% of model woredas, it will get the maximum weight of the score.

** If a zone IR score is 90%, it will get the maximum weight of the score.

Below is an example demonstrating how a composite score for ZHD will be calculated.

Example: Zone X has 10 woredas, 2 hospitals administered by the ZHD, and has established one demonstration woreda and an IR score of 80%. If 8 of the woredas and 1 of the hospitals were models, what would be the IR score of the zone?

Proportion of model woredas=80% [minimum threshold=80%] thus, value= $(80\%/80\%)(40\%)=40\%$ Proportion of model hospital=(50%), thus value= $(50\%)*(20\%)=10\%$ Demonstration woreda=20% IR score of ZHD=80% [minimum threshold=90%], thus value= $(80\%/90\%)*(20\%)=17.8\%$
Thus, the zonal composite score is $40\%+10\%+20\%+17.8\%=87.8\%$, which is under a *high candidate* category.

Regional composite score: this score measures the performance of the regional health bureau as a whole, including the performance of the zones, hospitals, and RHB score. The score for each of the components are presented in table 5.

Table 5: Components of a model region in HIS

Criteria	Score
Proportion of model zones*	40%
Hospitals under the region should be model	30%
RHB IR with the maximum threshold of 90%**	30%
Total	100%

*If a region has 80% of model zones, it will get the maximum weight of the score.

** If the RHB IR score is 90%, it will get the maximum weight of the score.

Below is an example of how to calculate a composite score for RHB.

Example: A Region X has 10 zones, 20 hospitals administered by the RHB, and an IR score of 80%. If eight of the zones and 10 of the hospitals were modeled, what would be the IR score of the zone?

Proportion of model zones=80% [minimum threshold=80%] thus, value= $(80\%/80\%)(40\%)=40\%$ Proportion of model hospital=(50%), thus value= $(50\%)*(30\%)=15\%$ IR score of RHB=80% [minimum threshold=90%], thus value= $(80\%/90\%)*(30\%)=26.7\%$
Thus, the region IR score is $40\%+15\%+26.7\%=81.7\%$, which is under a *high candidate* category.

Discussion/Implications

This case study documented the collaborative process of HIS performance measurement tool development, testing, and revision process in Ethiopia. The country's experience has shown that routine measurement and continued improvement of data quality and use are possible at all levels, of the health system, particularly at lower levels, to enhance the use of routinely collected information for improving access to quality primary health care services.

The process also demonstrated the usefulness and adaptability of the measurement tool. In addition to its role in self-assessment, public health experts adapted it for supportive supervision, verification, and mentorship purposes. This indicates ownership of the tool and presents a potential opportunity for further applications.

Systematic use of data for decision-making can yield not only operational efficiencies but also support improvements of the quality and equity of care delivered. Decisions made at all levels of the health system will be more effective when supported by accurate and timely information. Despite the need to strengthen data informed decision-making in Ethiopia, the quality and use of information remain insufficient for supporting effective decision-making at the various levels of the health system (19).

Health outcome improvement, as a parameter, in addition to the process of data use, should be an important element in a measurement tool. General,

measuring data use by its impact on health outcomes on a routine basis is difficult and must be complemented by research and surveys. Our measurement tool primarily focused on the process of data use, such as key performance indicators, data review forums, performance gap identification, root cause analysis, and action, for decision-making. Linking the processes of data use with their effects on health outcomes and health system improvement remains a challenge. Measuring the change in health outcomes as a result of the data used for decision-making remains a challenge.

In the revised measurement tool, a demonstration site, in where health institutions and administrative levels achieve excellence in implementing HIS, has been included as part of determining HIS performance categories. Establishing site has proven to be a highly effective strategy for expediting testing and expand best practices at scaling within the health sector. Demonstration sites in health care are specialized programs within healthcare institutions. That provides exceptionally high concentrations of expertise and related resources centered on particular medical areas, delivered in a comprehensive, interdisciplinary fashion—affording many advantages for healthcare providers and the populations they serve.

The MOH, in collaboration with stakeholders and partner organizations, developed a revised version of the connected woreda strategy named the “IR implementation guideline” (19), along with this measurement tool. This guideline considers the lessons

from the implementation of the previous connected woreda strategy, and the current priorities and targets set in the HIS strategic plan. The guideline aimed to provide clear guidance on how to operationalize the information revolution agenda with a focus on strengthening routine health information systems at all levels of the health system and administrative level.

Despite the revision, the measurement tool does not assess individual behavioral factors such as knowledge, skill, and attitudes that might affect the performance of the health information system.

Conclusion and recommendation

This case study revealed that it is possible to develop a HIS performance measurement tool that can be applied regularly to monitor and evaluate the effectiveness of HIS strengthening efforts in a low- resource setting. Regular revision of a measurement tool according to practical experiences, national priorities, and ongoing developments in the health information system is essential.

We recommend scaling up the implementation of the measurement tool across the countries to gather more lessons from different settings. We also encourage other countries with similar contexts to test and validate the measurement tool to inform evidence-based decision- making. A qualitative assessment could also help solicit more information that could support the tailoring of HIS intervention.

Supplementary file 1: Initial HIS performance measurement tool, 2016

Supplementary file 2: Revised HIS performance measurement tool, 2021

Declarations

Ethics approval and consent to participate: Not applicable

We conducted consultative research in the form of a workshop through an invitation by the Policy Plan Monitoring and Evaluation Directorate (PPMED) of the Ethiopia Ministry of Health (MOH). Thus we did not acquire ethical approval.

Consent for publication: Not applicable

Availability of data and materials

The datasets used and/or analyzed during the current study are available from the corresponding author upon reasonable request.

Competing interests

The authors declare no competing interest

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References

1. **MEASURE Evaluation. Health Information Systems Strengthening.** MEASURE Evaluation, University of North Carolina. <https://www.measureevaluation.org/his-strengthening-resource-center/his-definitions.html>
2. Braa, J., Hanseth O, Heywood A, et al., Developing health information systems in developing countries: the flexible standards strategy. *Mis Quarterly*, 2007: p. 381-402.
3. Kimaro, H.C. and J.L. Nhampossa, The challenges of sustainability of health information systems in developing countries: comparative case studies of Mozambique and Tanzania. 2004.
5. Krickeberg, K., Principles of health information systems in developing countries. *Health Information Management Journal*, 2007. 36(3): p. 8-20. Kidist Teklegiorgis, Kidane Tadesse, Gebremeskel Mirutse, Wondwossen Terefe. Level of data quality from Health Management Information Systems in a resource- limited setting and its associated factors, eastern Ethiopia. *South African Journal of Information Management*, 2016. 18(1).
6. MEASURE Evaluation. (2019). Performance of Routine Information System Management (PRISM) Toolkit: PRISM Tools. Chapel Hill, NC, USA: MEASURE Evaluation, University of North Carolina.
7. MEASURE Evaluation, (2018). Routine Health Information System Rapid Assessment Tool: Implementation Guide. Chapel Hill, NC, USA: MEASURE Evaluation.
8. MEASURE Evaluation.. Assessing Barriers to Data Demand and Use in the Health Sector: A Toolkit. Chapel Hill, NC, USA: University of North Carolina. 2018
9. Belay, Hiwot & Lippeveled, Theo. Inventory of PRISM framework and tools: application of PRISM tools and interventions for strengthening routine health information system performance. 2013 Retrieved from <https://www.measureevaluation.org/resources/publications/wp-13-138>.
10. Ethiopia FMOH, Routine Data Quality Assessment (RDQA). Health Data Quality Training Module: Facilitators manual. November 2018
11. Ethiopia FMOH/EPHI. Data Quality Assurance (DQA): Health Data Quality Review: Systematic Assessment and Data Verification for selected Indicators. Assessment report. 2018
12. Ethiopia FMOH-PPMED. Ethiopian Health Management Information System: Data Recording and Reporting Procedure Manual. Policy document. September 2021.
13. Ethiopia FMOH. Health Sector Transformation Plan. 2015

14. JSI-Data Use Partnership (DUP). <https://www.jsi.com/project/ethiopia-data-use-partnership/>
15. Ethiopia FMOH. Ethiopian Federal Ministry of Health Information Revolution Roadmap. 2016.
16. Ethiopia FMOH. The Connected Woreda Strategy Implementation Manual (draft). Policy Document, 2016.
17. Ethiopia FMOH. Capacity Building and Mentorship Program of Ethiopia. 2018.
18. Ethiopia FMOH. Annual Performance Report of 2013 EFY. 2021
19. Ethiopia FMOH. Information Revolution Implementation Guideline (2021-2025). Policy Document.