**Ethiopian Public Health Institute**

**Early Warning and Surveillance Directorate**

**Evaluating DHIS2 Utilization for Disease Surveillance Among Trained Health Officers in Ethiopia: A mixed-methods approach**

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# Introduction

## Background

District Health Information Systems (DHIS2) is a customizable and flexible open-source software platform that enables managing and analyzing health data. Its flexible design empowers users to incorporate new features and functionalities that suit their unique needs. DHIS2 supports data collection, analysis, and reporting at all levels of the health system, from individual health facilities to national ministries of health. It includes a variety of tools and features for managing health data, such as data entry forms, data validation rules, data quality reports, data visualization and analysis tools.

In light of the growing importance of digitization within the public health sector, DHIS2 is considered as the main platform to systematically documenting data collected across all public health facilities within the country. In Ethiopia, the implementation of DHIS2 is pivotal for enhancing the surveillance system, with the aim of enhancing the country's public health system. The launching of DHIS2 in Ethiopia was back to 2018 but was not intensively used until the end of 2021. However, there has been a notable improvement in utilization since November 2021. The low utilization in the earlier years can be attributed to several factors including the fact that the initial platform for DHIS2 data entry was designed according to the Ethiopian calendar and was monthly based. This made it difficult for public health emergency management (PHEM) data entry as it follows the WHO weekly epidemiological reporting system. Additionally, the Ethiopian public health institute (EPHI) did not have full authority to customize accordingly. In addition, COVID-19 pandemic also presented significant challenges in moving forward with the rollout and cascading of DHIS2.

Despite the improved utilization of DHIS2 in the country, its overall application is still considered limited. There is a clear need to advance its use further to achieve optimal benefits. It is essential to ensure that healthcare professionals are proficient in using DHIS2 to unleash its full potential. Trained health officials equipped with the necessary knowledge and skills are crucial to the successful implementation and utilization of this data management tool. They play a vital role in not only entering and analyzing health data accurately but also using DHIS2 for real-time reporting, monitoring, and strategic planning.

The aim in this assessment is to examine the strengths and operational challenges associated with the implementation of DHIS2 in Ethiopia. By thoroughly examining these aspects, the overarching goal is to identify areas for improvement and optimization, ultimately leading to a more robust surveillance system that can effectively address the nation's public health needs. The result of this assessment can help identify gaps in health facilities and PHEM administration and trained health officials. This, in turn, will create a more resilient and responsive healthcare information infrastructure.

## Objectives of the assessment

The primary objectives of this assessment are as follows:

* To determine potential strength & bottlenecks in utilization of DHIS2
* To assess DHIS2 usage among trained health personnel
* Landscape analysis of other existing reporting tools
* To generate recommendation to improve the implementation of DHIS2 at health facilities

# Methodology

## Study samples

For this assessment, we specifically targeted respondents from a pool of 668 DHIS2 trained health professionals. Utilizing the finite population correction (FPC) formula, we derived an optimal sample size of 245. Employing a stratified proportional allocation strategy, we ensured representation from all regions. We excluded Addis Ababa from the assessment because the infrastructure for DHIS2 utilization in the city administration is relatively better, given that it is the capital. Including Addis Ababa could introduce bias into the evaluation process.

The detailed sampling procedure is described in Figure 1.

**No of DHIS2 Trainee**

Tigray:

83

Oromia:

155

SWE:

82

Somali:

18

SNNP:

33

Harrar:

36

Afar:

|  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
|  |  |  |  |  |  |  |  |  |  |  |
|  |  |  |  |  |  |  |  |  |  |  |

10

Amhara: 142

BG:

16

DD:

24

Gambella:

14

Sidama:

55

Afar:

4

Amhara:

52

BG:

6

DD:

9

Gambella:

5

Harrar:

13

Oromia:

57

Sidama:

20

SNNP:

12

Somali:

7

SWE:

30

Proportionally allocate study sample size

Tigray:

30

Randomly select study individuals

Total = 245 number of study individuals

Figure 1: Sampling procedure

For the data collection, a structured questionnaire (Annex A), encompassing both closed and open-ended questions, were administered to the selected health professionals through the EPHI’s 8335 integrated call management system (ICMS). The questionnaire covers aspects such as DHIS2 usage, challenges faced, skill levels, and perceptions toward data management.

Among the selected sample health professionals, data was successfully gathered from 240 individuals, constituting a robust response rate of 97.9%. Those remaining few respondents are not included in the final dataset due to their various mitigating factors. As a result, the analysis in this assessment is conducted based on the effective sample size of 240 respondents.

The respondents comprised individuals who had received formal training on DHIS2, ensuring they possessed the necessary knowledge and skills to utilize the platform effectively. The results of the survey indicate that the trained coverage is fairly representative of the broader population of public health professionals in Ethiopia, Figure 1a. That is, from Amhara 24%, Oromia 20.4%, Tigray 12%, South West Ethiopia 11.66%, SNNPR 7.5%, Harrar 5.14%, Sidama 7%, Dire Dawa 4.16%, Benshangul gumuz 3.33%, Somali 2.08%, Afar 1.66%, and Gambella 1.25%.

# Result

## Descriptive analysis

### Socio-economic characteristics

The socio-economic status of the respondents in this study provides a comprehensive understanding of the demographic profile of the trained public health experts involved in the implementation of DHIS2 in Ethiopia.

From the summary in **Table 1**, a significant majority of the respondents, 88.75%, fall within the age range of 25 to 45 years. This indicates that the workforce utilizing DHIS2 is predominantly young to middle-aged, which may reflect a dynamic and adaptable demographic. Most respondents possess a Bachelor of Science (BSc) or Bachelor of Arts (BA) degree, comprising 54.58% of the total respondents. Respondents predominantly have between 5 and 10 years of work experience, making up 47.08% of the total.

PHEM officers represent the largest group among the respondents, accounting for 49.16%. However, DHIS2 training was predominantly provided to experts working in hospitals, with 145 respondents (60.41%) reporting hospital-based training. This may indicate the necessity of balancing between health facilities or office in providing training.

Table 1: Socio-Demographic Characteristics

|  |  |  |  |
| --- | --- | --- | --- |
| Variables | *Category* | Frequency | Percentage |
| Age | *<25* | 10 | 4.17 |
| *25-45* | 213 | 88.75 |
| *>45* | 17 | 7.08 |
| Educational status | *Diploma* | 54 | 22.50 |
| *BSc/BA* | 131 | 54.58 |
| *MPH/MSc* | 53 | 22.08 |
| *Medical degree (MD)* | 2 | 0.83 |
| Position/ role | *HIT* | 84 | 35.00 |
| *PHEM* | 122 | 50.83 |
| *Other* | 34 | 14.16 |
| Position Change | *Yes* | 73 | 30.41 |
| *No* | 167 | 69.58 |
| Work experience | *< 5 years* | 44 | 18.33 |
| *5- 10 years* | 113 | 47.08 |
| *>10 years* | 83 | 34.59 |
| Facility during training | *Health center* | 44 | 18.33 |
| *Hospital* | 145 | 60.41 |
| *Regional PHEM office* | 9 | 3.75 |
| *Other* | 42 | 17.50 |

### DHIS2 and other data submission systems

The assessment of DHIS2 utilization among different groups involved in the submission of PHEM weekly data (See **Figure 3**) reveals varied levels of engagement. Among the HITs, a substantial majority, 76 out of 84 (90.47%), have utilized DHIS2 at least once for submitting PHEM weekly data. In comparison, PHEM officers show a slightly lower utilization rate, with 91 out of 122 officers (74.59%) having used DHIS2. Other experts exhibit a DHIS2 utilization rate of 27 out of 33 (81.81%).

**Figure 4:** Expert's DHIS2 utilization by position

Respondents provides valuable insights into the implementation of DHIS2, the training adequacy, and the usability of the system. From the summary in **Table 2**, out of the total 240 respondents, 235 (97.92%) informed the system they used for submitting weekly data. Among the various systems available (Excel, DHIS2, Paper, SMS, etc.), DHIS2 emerged as the preferred choice for most respondents (83/235=35.31%). This preference underscores the system's acceptance and perceived efficiency among public health experts. The preference for Excel, SMS/telegram and paper/other is 17.02%, 22.97%, and 24.68%, respectively.

Looking into the time since last training, a significant majority of the respondents (88.65%) received their DHIS2 training within the last two years. This recent training ensures that the users are up-to-date with the latest features and functionalities of the system. However, while 57% of the respondents rated the training as adequate, the rest indicate the need for improvement.

Among those 96 who took training recently (<1 year), majority (56/96=58.33%) were from Amhara and Tigray region. The utilization of DHIS2 among recently trained experts is low (22/96=22.91%). In fact, apart from providing continuous training, a close follow-up might be necessary to improve the utilization.

When assessing the complexity of DHIS2, most respondents 215 out of 233 (89.58%) said the system is very or moderately user-friendly. Only 18 respondents (7.59%) found the system not user-friendly. The overwhelming majority labeled it as very or moderately user-friendly, indicating that the system is generally well-received and accessible to trained personnel. Although specific suggestions were not detailed in the summary, it is noted that various suggestions, including inadequate training, DHIS2 not lunched yet, lack of support, infrastructure limitation, etc. were provided for the non-adoption of DHIS2.

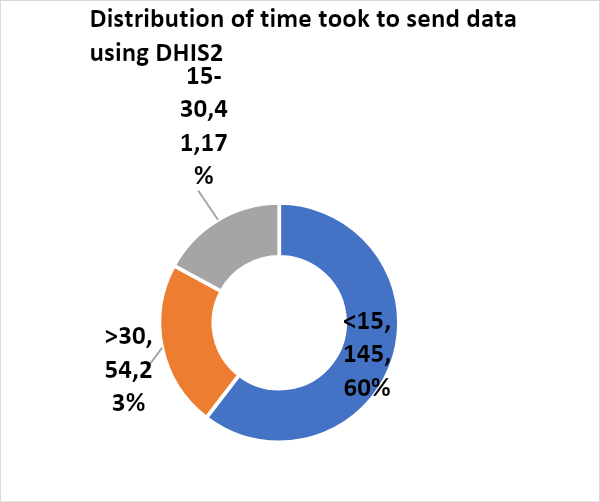
Overall, the feedback highlights a strong preference for DHIS2 among public health experts, a positive reception of the system's usability, and recent training efforts. However, there is a clear need to extend the training duration to address concerns about training adequacy and to consider suggestions for improving adoption rates.

Table 2: DHIS2 related training

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Variable | Category | System used to submit weekly data  (most time) | | | | Total Frequency | Total Percent |
| Excel | DHIS2 | SMS/ telegram | Paper & other |
| Duration since DHIS2 training | < 1 year | 18 | 22 | 22 | 34 | 96 | 40.33 |
| 1-2 Years | 22 | 47 | 25 | 21 | 115 | 48.32 |
| > 2 years | 0 | 13 | 7 | 7 | 27 | 11.34 |
| Adequacy of DHIS2 training | Yes | 26 | 48 | 28 | 32 | 134 | 57.02 |
| No | 14 | 35 | 26 | 26 | 101 | 42.98 |
| Reasons for inadequate training | Tool complexity | 2 | 3 | 1 | 4 | 10 | 10.10 |
| Short duration | 26 | 8 | 20 | 15 | 69 | 69.69 |
| Trainer limitations | 2 | 4 | 1 | 3 | 10 | 10.10 |
| Other reason | 4 | 1 | 3 | 2 | 10 | 10.10 |
| User-friendliness of DHIS2 | Very user-friendly | 21 | 46 | 25 | 29 | 121 | 51.05 |
| Moderately user-friendly | 16 | 37 | 22 | 19 | 94 | 39.66 |
| Not user-friendly | 2 | 0 | 6 | 10 | 18 | 7.59 |
| Reasons for non-adoption of DHIS2 for PHEM data | Inadequate training | 1 | 0 | 0 | 4 | 5 | 11.36 |
| Insufficient support and/or Platform complexity | 2 | 0 | 1 | 3 | 5 | 11.36 |
| Infrastructure limitation | 2 | 0 | 2 | 1 | 5 | 11.36 |
| DHIS2 not launched | 9 | 0 | 5 | 6 | 20 | 45.45 |
| Other reasons | 3 | 0 | 3 | 3 | 9 | 20.45 |
| Grand Total | | 40 | 83 | 54 | 58 | 235 | 97.92 |

Among the experts who preferred DHIS2 for data submission, the majority were those perceived the training was adequate. This correlation is illustrated in Figure 2a, suggesting that adequate training significantly influences the preference for DHIS2 over other systems.

Additionally, Figure 2b shows the average time that experts spend to submit data using DHIS2. Most (60%) took only a maximum of 15 minutes to submit data while others took more time.



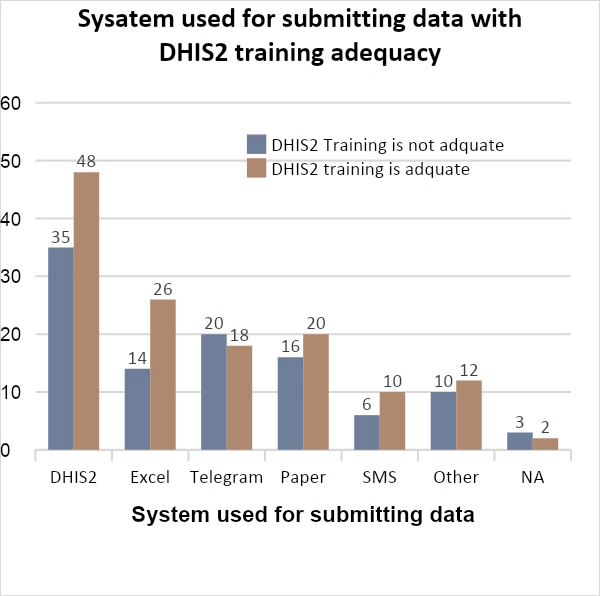


Figure 2a: DHIS2 training adequacy with system use to Figure 2b: Average time (in min) took to submit data use to submit data using DHIS2

### Expert turnover

Respondents were asked about the status of their role since received DHIS2 training, which provided data to calculate the turnover rate among the different regions. The turnover rates vary significantly across regions, indicating differences in workforce stability.

Looking into the turnover rate, Dire Dawa region has shown the largest turnover rate, with 80% of respondents indicating they have changed roles since their training. This high turnover rate suggests potential issues with external factors impacting workforce stability in the region. In contrast, the Benishangul-Gumuz region has the lowest turnover rate at 0%, indicating that all trained respondents have remained in their roles.

All regions were ranked based on their turnover rates, as shown in **Table 3**. This ranking provides a comparative view of workforce stability across different areas, highlighting regions with potential challenges or successes in retaining trained personnel. Among the 240 respondents, about 73 (30.41%) were changed their role since they took the training.

**Table 3**: Regions turnover ranking

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Region | Total number of respondents | Changed Role | | Turnover % |
| No | Yes |
| Dire Dawa | 10 | 2 | 8 | 80.0 |
| Gambella | 3 | 1 | 2 | 66.7 |
| Afar | 4 | 2 | 2 | 50.0 |
| Oromia | 49 | 25 | 24 | 49.0 |
| Harari | 13 | 7 | 6 | 46.2 |
| South West Ethiopia | 28 | 19 | 9 | 32.1 |
| Amhara | 57 | 41 | 16 | 28.1 |
| Somali | 5 | 4 | 1 | 20.0 |
| Sidama | 16 | 13 | 3 | 18.7 |
| Tigray | 29 | 27 | 2 | 6.9 |
| SNNPR | 18 | 17 | 1 | 5.6 |
| Benishangul-Gumuz | 8 | 8 | 0 | 0.0 |
| Grand Total | **240** | **166** | **74** | **30.8** |

### Infrastructure accessibility

In Table 4, we summarize the available gadgets among the respondent’s health facilities or offices. In the table, we provide a detailed overview of the types and availability of gadgets across various health facilities. This includes desktops, laptops, tablets, and smartphones which can be used for reporting. The devices status (Shared or not) is also described.

The survey assessed telecom coverage, revealing that 78.8% of the respondents' health facilities have adequate telecom coverage. This is a critical factor for ensuring consistent data submission and communication within the health system.

Additionally, connection access was evaluated, with 66.25% of the respondents indicating they have reliable internet or network access. Increasing the level of connectivity is necessary for the effective use of DHIS2 and other online health information systems.

Table 4: Availability of ICT facilities and Telecom Infrastructure

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Variable | Category | | Number | Percentage |
| No of HFs with Gadgets available | Desktop | | 196 | 81.66 |
| Laptop | | 109 | 45.41 |
| Tablet | | 82 | 34.16 |
| Smartphone | | 161 | 67.08 |
| Not available | | 9 | 3.75 |
| Status of devices | Desktop | Shared | 125 | 71.83 |
| Dedicated for PHEM | 42 | 24.14 |
| Personal | 7 | 4.02 |
| Laptop | Shared | 19 | 35.18 |
| Dedicated for PHEM | 13 | 24.07 |
| Personal | 22 | 40.74 |
| Tablet | Shared | 7 | 31.81 |
| Dedicated for PHEM | 11 | 50.00 |
| Personal | 4 | 18.18 |
| Smartphones | Shared | 5 | 5.20 |
| Dedicated for PHEM | 2 | 2.08 |
| Personal | 89 | 92.70 |
| Ethio-telecom coverage at least 2 hours on most days | Yes | | 186 | 78.81 |
| No | | 50 | 21.18 |
| Internet connectivity in your facility | Yes | | 159 | 66.25 |
| No | | 81 | 33.75 |
| Rate electricity availability in your facility | Always available | | 127 | 53.14 |
| Often – some electricity most days | | 75 | 31.38 |
| Sometimes – most electricity about 50% of days | | 30 | 12.55 |
| Rarely – no electricity most days | | 7 | 2.92 |

Figure 5: Gadget availability distribution by regions

#### Test of association with DHIS2 utilization

In this section, we conduct test of association using a chi-square to see the association between different factors with DHIS2 utilization (yes or No) and that of system preference for data submission.

Based on the chi-squar analysis **Table 5**, variables that significantly associated with utilization of DHIS2 for data submission are Age of experts, total work experience, the tool simplicity, the time spent to submit data, time since the last training, telecom coverage, internet connectivity and availability of gadgets.

On the other hand, variables that showed significance association with system preference to submit data are DHIS2 simplicity, time since the last training, data analysis skill, telecom coverage, internet connection and electricity availability.

Table 5: Test of association between factors and utilization of DHIS2 & other systems

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  |  | | Use DHIS2 to send  PHEM data | | System used to  submit data | |
|  | **Factors** | | **Chi-sqr value** | **P-value** | **Chi-sqr value** | **P-value** |
| Socio-economic factors | Education status | | 2.9884 | 0.393 | 21.0033 | 0.137 |
| Age | | 13.390 | 0.001\*\* | 14.1195 | 0.168 |
| Focal Role | | 5.9097 | 0.052 | 13.7401 | 0.185 |
| Experience | | 9.8791 | 0.007\*\* | 18.0925 | 0.053 |
| System related factor | DHIS2 user-friendly | | 28.6263 | 0.000\*\*\* | 19.0456 | 0.040\*\* |
| Time takes to submit to DHIS2 | | 11.0694 | 0.004\*\* | 9.4684 | 0.488 |
| DHIS2 related training factors | DHIS2 Training Adequacy | | 3.3693 | 0.066 | 2.7886 | 0.733 |
| Time since training | | 28.6041 | 0.000\*\*\* | 23.4126 | 0.009\*\* |
| Data analysis skill | | 6.8697 | 0.076 | 26.8600 | 0.030\* |
| Additional training necessity | | 0.5247 | 0.469 | 2.5640 | 0.767 |
| Infrastructure  related factors | Telecom coverage | | 5.3937 | 0.020\*\* | 11.6495 | 0.040\*\* |
| Internet connectivity | | 14.3007 | 0.000\*\*\* | 29.2275 | 0.000\*\*\* |
| Electricity availability | | 3.8893 | 0.274 | 26.5628 | 0.033\*\* |
| Availability of desktop/  tablet/smartphone/Tablet | | 6.8059 | 0.033\*\* | 5.6660 | 0.843 |
| Gadgets Status:  shared/not | Desktop | 4.7778 | 0.092 | 10.2910 | 0.415 |
| Laptop | 0.7559 | 0.685 | 4.3091 | 0.932 |
| Tablet | 2.4992 | 0.287 | 10.8615 | 0.210 |

Based on the binary logistic analysis, Table , variables that significantly associated with utilization of DHIS2 are time since the last training, internet connectivity and Availability of gadgets. The Odds ratio associated with the significant variables are very high, which indicates the relevance of enhancing DHIS2 utilization.

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| Use DHIS2 to send PHEM data | | Odds Ratio | z | P>z | [95% | CI] |
| Socio-economic factors | **Educational status** |  |  |  |  |  |
| BSc/BA | 1.087199 | 0.08 | 0.938 | 0.131 | 8.993 |
| MD | 1 |  |  |  |  |
| MPH/MSc | 1.215064 | 0.15 | 0.881 | 0.095 | 15.595 |
| **Respondent Age** |  |  |  |  |  |
| 25-45 | 10.287 | 1.57 | 0.117 | 0.558 | 189.668 |
| <=24 | 1 |  |  |  |  |
| **Respondent role** |  |  |  |  |  |
| HIT | 0.3309555 | -0.91 | 0.363 | 0.031 | 3.581 |
| PHEM officer | 2.53572 | 0.86 | 0.39 | 0.304 | 21.156 |
| **Work experience in year** |  |  |  |  |  |
| 3--6 | 2.096307 | 0.76 | 0.446 | 0.312 | 14.072 |
| <3 | 1 |  |  |  |  |
| System related factor | **DHIS2 user-friendly** |  |  |  |  |  |
| Moderately user-friendly | 8.219135 | 1.6 | 0.111 | 0.618 | 109.343 |
| Very user-friendly | 2.574485 | 0.74 | 0.46 | 0.209 | 31.678 |
| **Time take to submit PHEM data** | 1.083798 | 1.63 | 0.104 | 0.984 | 1.194 |
| DHIS2 related training factors | **DHIS2 Training Adequacy** |  |  |  |  |  |
| Yes | 1.14681 | 0.16 | 0.871 | 0.220 | 5.969 |
| **Time since last training** |  |  |  |  |  |
| 1- 2 Years | 26.3569 | 2.85 | 0.004\* | 2.768 | 250.928 |
| > 2 years | 1.713693 | 0.44 | 0.658 | 0.157 | 18.660 |
| **Data analysis skill** |  |  |  |  |  |
| Excellent | 0.609723 | -0.29 | 0.77 | 0.022 | 16.719 |
| Fair | 0.1454767 | -1.06 | 0.288 | 0.004 | 5.105 |
| Good | 0.8643899 | -0.09 | 0.926 | 0.039 | 18.939 |
| **Additional training necessity** |  |  |  |  |  |
| No | 20.78996 | 2.55 | 0.011\* | 2.016 | 214.398 |
| Infrastructure related factors | **Telecom coverage** |  |  |  |  |  |
| Yes | 0.6852645 | -0.35 | 0.725 | 0.083 | 5.648 |
| **Internet connectivity** |  |  |  |  |  |
| Yes | 32.75838 | 2.9 | 0.004\* | 3.106 | 345.464 |
| **Electricity availability** |  |  |  |  |  |
| Always available | 0.3820824 | -0.43 | 0.67 | 0.005 | 31.786 |
| Often | 0.1386979 | -0.88 | 0.379 | 0.002 | 11.304 |
| Sometimes | 2.941306 | 0.45 | 0.656 | 0.025 | 340.107 |
| **Availability of gadget** |  |  |  |  |  |
| Abundant | 0.0656161 | -1.85 | 0.065 | 0.004 | 1.183 |
| Moderate | 10.93983 | 2.39 | 0.017\* | 1.533 | 78.060 |
| Gadget status | **Desktop status** |  |  |  |  |  |
| Dedicated for PHEM | 0.2006676 | -0.87 | 0.385 | 0.005 | 7.541 |
| Shared | 0.1302081 | -1.46 | 0.146 | 0.008 | 2.028 |
| **\_cons** | 0.0276804 | -0.95 | 0.34 | 0.000 | 43.894 |
| Logistic regression Number of obs = 145  LR chi2(25) =52.69  Prob > chi2 =0.001  Log likelihood = -33.63 Pseudo R2 = 0.4392 | | | | | | |

Table 6: Test of association between factors and utilization of DHIS2 & other systems

The following key challenges were identified from the analysis of open-ended questions:

* Participants frequently reported a lack of essential infrastructure, which was a primary challenge. Specific issues included insufficient computing devices (desktops, laptops, tablets), unreliable internet connectivity, and frequent power outages. Poor internet connectivity emerged as a recurrent obstacle. Many sites experienced weak Wi-Fi signals or intermittent access, leading staff to resort to using personal devices for data submission due to the lack of official internet access. Problems with data synchronization between offline and online systems, coupled with the lack of dedicated devices for specific tasks, resulted in resource sharing and further delays.
* A significant shortage of trained personnel dedicated to DHIS2 tasks was noted, resulting in an excessive workload for existing staff. The absence of specialized roles for managing DHIS2-related activities further exacerbated this issue.
* Substantial gaps in the training and skills of DHIS2 users were identified. Limited access to training programs and refresher courses left many users inadequately prepared to navigate the system’s interfaces.
* Poor leadership follow up and inadequate prioritization of DHIS2 tasks were reported as critical issues. Poor coordination between hospital, zonal, and regional levels led to delays in receiving feedback and support from higher authorities.

Other issues included difficulties in accessing and utilizing the system due to outdated equipment, challenges in system updates and maintenance, and security concerns related to data management and user access.

The responses regarding improvements or additional training needed for DHIS2 mainly focus on Data Analysis. The identified areas for improvement include the need for more detailed explanation, practical training, and frequent updates on data analysis. There is also a need for training on dashboard utilization, validation rules, key indicators, and quarter reporting. In addition, there is a focus on Data Entry, especially when new PHEM guidelines are updated and additional variables and indicators are added. Participants have mentioned that data analysis and dashboard use are the areas needing the most improvement, followed by data entry. Some participants suggested that additional training on software and tools would be helpful, along with general data management skills.

# Discussion

The purpose of this assessment was to investigate the factors influencing user experience in using DHIS2, as well as the strengths and challenges of the platform, and provide recommendations for its better implementation.

A significant majority of the workforce using DHIS2 falls within the age range of 25 to 45 years. This suggests that the users are predominantly young to middle-aged, reflecting a dynamic and adaptable demographic. In a separate study conducted in southwest Ethiopia, it was also found that individuals aged 30 and under utilize DHIS for decision-making purposes.(1)

The results reveal a strong willingness to report for PHEM through DHIS2. Among Health Information Technicians (HITs), Ninety percent of the respondents have utilized DHIS2 at least once for submitting weekly PHEM data. In comparison, PHEM officers have a slightly lower utilization rate, 74.59% of them having used DHIS2.

This indicates that both HITs and PHEM officers use DHIS2 for PHEM purposes, though there is a discrepancy in utilization rates. HITs demonstrate slightly more dedication to using the platform, suggesting that both professions can benefit from increased use of DHIS2 for data utilization. This utilization can help address the shortage of PHEM officers at facilities. The professional difference in DHIS2 utilization highlights the need for assigning appropriately skilled personnel or establishing a clear mandate to manage DHIS2. By ensuring that the right personnel are assigned to manage and use the system, health authorities can improve data collection, analysis, and overall health information management. This will ultimately contribute to better health outcomes in Ethiopia.

DHIS2 was the top choice for most respondents (83 out of 235, or 35.31%). This indicates that public health experts widely accept and perceive the system as efficient. The preference for using Excel, SMS/telegram, and paper/other was 17.02%, 22.97%, and 24.68% respectively. This is consistent with a study in Sierra Leone, where users found that the system improved their day-to-day work compared to using paper-based systems. Users indicated that using the system for data entry was more convenient than filling out paper forms. This suggests that the effective use of DHIS2 depends on users' perception that the system enhances their job performance.(2)

One notable observation is that even among the respondents who reported the DHIS2 training as adequate, a significant number are still using alternative systems for data submission. For instance, 14 out of the 35 respondents who said the DHIS2 training is adequate are still using Excel, and 16 out of 20 are using paper-based systems. This suggests that the perceived adequacy of the DHIS2 training does not necessarily translate directly to the user's choice of data submission platform.

Conversely, there are also respondents who indicated that the DHIS2 training is not adequate, yet they are still using the DHIS2 system for data submission. Specifically, 48 out of the 83 total respondents felt the DHIS2 training was inadequate, but a portion of them (35) are still utilizing the DHIS2 platform. This discrepancy between the perceived training adequacy and the actual system usage points to the influence of other factors beyond just the training program.

These findings suggest that user preferences, familiarity, and organizational requirements may play a significant role in determining the choice of data submission systems, even if the users' perception of the DHIS2 training does not fully align with their actual practices. It is possible that users may be more comfortable or have a stronger preference for certain systems, regardless of their assessment of the DHIS2 training.

Furthermore, the data highlights the need for a more nuanced understanding of the factors influencing user behaviors. The disconnect between perceived training adequacy and actual system usage suggests that the DHIS2 training program may have limitations in fully addressing the specific needs and preferences of all users. Tailoring the training or providing more personalized support could help bridge this gap and encourage more consistent and widespread adoption of the DHIS2 system.

Among the 240 respondents, about 73 (30.41%) were changed their role since they took the training. The highest turnover reported from Dire Dawa city administration, with 80.0% of the trainees changed their role after the training. Followed by Harari region with next higher turnover rate. Overall, the high turnover rates in the top-performing DHIS2 regions of Dire Dawa and Harari are noteworthy, but if these regions are able to quickly backfill the vacant DHIS2 roles, it may actually be a learning lesson for other regions on the mechanisms to fill these gaps. This responsiveness to manage transitions in the health workforce will be a key factor in sustaining effective DHIS2 reporting across Ethiopia. It represents a learning opportunity for other regions on mechanisms to fill gaps created by employee turnover. A study conducted in Lebanese, discusses similar challenge of staff turn-over and redeployments occurred commonly at data sources and the newly recruited staff lacked knowledge and training.(3) That said, a refresher training component should be considered in future plans, to account for the observed turnover rates and ensure continuous capacity building for DHIS2 reporting. Maintaining a skilled and stable workforce will be crucial to the long-term success of the DHIS2 program.

In our study, one frequently mentioned issue was the significant shortage of trained personnel dedicated to DHIS2 tasks. This resulted in an excessive workload for existing staff. The absence of specialized roles for managing DHIS2-related activities further worsened this problem. An interesting approach to addressing this issue and strengthening the system was noted in Guinea’s DHIS2 implementation journey. They included DHIS2 training in the Field Epidemiology Training Program (FETP). Participants were not only taught about DHIS2 but were also required to use the system in their daily work and FETP assignments. For instance, one of the assignments of the FETP-Frontline required participants to produce a weekly epidemiological bulletin using data from DHIS2. Similarly, one of the assignments of the FETP-Intermediate required students to analyze a 5-year database for a specific disease. They were required to identify all available data for their chosen disease, consolidate them in DHIS2 if not already done, and use the DHIS2 database for the analysis.(4)

DHIS2-related training factors were also examined, including training adequacy, time since training, data analysis skills, and the need for additional training. For DHIS2, the time since training and data analysis skills were significant, with more recent training and better data analysis skills being associated with higher DHIS2 usage. The system-related factors included DHIS2 user-friendliness and the time it takes to submit data. DHIS2 user-friendliness and faster submission times were both significant positive factors for DHIS2 usage. Another study in Bangladesh,(5) highly suggest the training provided needed to be more comprehensive across various levels and the significant demand for refresher training at the local level, and the need to update the existing training package was emphasized.

The responses regarding improvements or additional training for DHIS2 primarily focused on the need for detailed explanations, practical training, and frequent updates in data analysis and dashboard use, which were the most frequently mentioned areas needing improvement. Training on data entry, especially when updates occur, such as new PHEM guidelines or the addition of new variables and indicators, was also highlighted. Additionally, some participants suggested training on additional software and tools to enhance general data management skills.

The findings from the present assessment highlight the critical role of technological infrastructure and resources in the effective implementation of the District Health Information Software 2 (DHIS2) system within the health facilities. The survey revealed that 78.8% of the respondents' health facilities have adequate telecom coverage, which is a crucial factor in ensuring consistent data submission and communication within the health system. Additionally, 66.25% of the respondents indicated they have reliable internet or network access, underscoring the need to increase connectivity for the effective use of DHIS2 and other online health information systems. However, the study also identified a concerning finding, where approximately 18.33% of the total respondents reported that their facility lacks either a desktop, laptop, or tablet, with the available devices being shared, PHEM dedicated, or personal.

These findings are consistent with the challenges reported in previous studies conducted in other regions, such as Tanzania, Nepal, Lebanon, and Uganda.(3,6–8) Researchers in these settings have highlighted the barriers posed by inadequate ICT infrastructure, including limited access to internet services, poor connectivity, and insufficient electronic devices, which have hindered the effective implementation of DHIS2 and other health information systems. The present study's findings further corroborate the importance of addressing these infrastructure and resource gaps in order to ensure the successful and sustainable deployment of DHIS2 within the health facilities.

Addressing these technological barriers will be crucial in enhancing the use of DHIS2 and other online health information systems, which can ultimately lead to improved data collection, management, and decision-making within the healthcare system. The development of a comprehensive implementation plan that addresses the identified infrastructure and resource gaps should be a priority to ensure the effective and sustainable integration of DHIS2 within the health facilities.

This assessment finds weak leadership and inadequate prioritization of DHIS2 tasks were reported as critical issues. Respondents reported poor coordination between different administrative levels - hospital, zonal, and regional - which led to delays in receiving timely feedback and support from higher authorities.

This finding aligns with previous research from Sierra Leone, which demonstrated that top management support was a significant factor influencing the effective use of DHIS2 (2). Strong leadership commitment and willingness to allocate time, resources, and encouragement for the use of the information system are crucial for creating a conducive environment for DHIS2 adoption.

Similarly, a study in Sri Lanka found that the lack of proper understanding of the DHIS2 system among senior managers was identified as the most important obstacle to its usage (9). When leadership lacks familiarity and commitment to the health information system, it can undermine efforts to drive effective utilization at the frontline levels.

To address these challenges, Ingebrigtsen et al. identified seven key leadership behaviors associated with successful outcomes in Health Information Technology adoption (9): Communicating clearly about visions and goals, providing support, establishing a governance structure, establishing training, identifying and appointing champions Addressing work process change and following up. Implementing these leadership practices can help create a conducive environment for the effective adoption and utilization of the DHIS2 system.

In conclusion, this assessment underscores the multifaceted nature of DHIS2 implementation and user exprience, highlighting the need for tailored training, robust infrastructure, strategic personnel management, and strong leadership to enhance the system's efficacy and sustainability within Ethiopia's public health emergency management frame work. Additionally, addressing huma resource, ensuring continuous capacity building, and fostering an engaging organizational leadership are crucial for the long-term success of DHIS2.

# Recommendation

This assessment identifies factors influencing user experience, strengths, and challenges of the DHIS2 platform in Ethiopia, aiming to provide recommendations for better implementation. The analysis reveals key areas of improvement, encompassing workforce demographics, training adequacy, infrastructure, leadership, and technological resources. The goal is to enhance DHIS2 utilization, thus improving health data management and overall health outcomes in Ethiopia.

* Address Workforce Demographics: Address the lower utilization rate of DHIS2 among PHEM officers compared to HITs by providing targeted training and support to increase their engagement and usage.
* Enhance Training Programs: Comprehensive and Practical Training: Develop detailed training programs that include practical sessions on data entry, analysis, and dashboard usage. Update training content regularly to incorporate new PHEM guidelines and variables.
* Implement periodic refresher training to address high turnover rates and ensure continuous capacity building. Additionally, offer tailored training and support to meet the specific needs and preferences of different user groups. This can bridge the gap between perceived training adequacy and actual system usage.
* Strengthen Technological Infrastructure: Address the shortage of desktops, laptops, and tablets by providing adequate electronic devices to health facilities. Prioritize ensuring that these devices are dedicated to DHIS2 tasks to avoid overburdening staff.
* Foster Strong Leadership and Coordination: Encourage top management to support DHIS2 by allocating time, resources, and encouragement for its use. Leadership should clearly communicate visions and goals related to DHIS2.
* Create governance structures to oversee DHIS2 implementation, ensuring clear mandates and roles for personnel involved in DHIS2 tasks.
* Adopt Proven and successful strategies from other regions and countries.
* Regular feedback mechanisms to gather user input on DHIS2 training and system usage. Use this feedback to continuously improve training programs and system functionalities.
* Regularly monitor and evaluate DHIS2 implementation to identify areas for improvement and measure the impact of implemented changes on system utilization and health outcomes.

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# Annex A

DHIS2Trained Health Officer Assessment Questionnaire

This is an introductory paragraph that will be used by the interviewers.

ጤና ይስጥልኝ ወ/ሮ/አቶ/ዶ/ር. XX

ከኢትዮጵያ ህብረተሰብ ጤና ኢንስትዩት [XXX] እባላለሁ። የ DHIS2 አጠቃቀምን በሚመለከት ዳሰሳ እያረግን እንገኛለን፡፡ DHIS2 ከሠለጠኑ ባለሙያዎች መካከል አንዱ ሆነው ለዚህ ቃለ መጠይቅ ተመርጠዋል። በዚህ ቃለ መጠይቅ ውስጥ ያለዎት ተሳትፎ ሙሉ በሙሉ በፈቃደኝነት ላይ የተመሰረተ ነው፡፡

መጠይቁ ከ15 ደቂቃ የማይበልጥ ይሆናል፡፡ ቃለ መጠይቁ የ 6 ክፍሎችን ያቀፈ ነው እና በ DHIS2 አጠቃቀም ላይ ጠቃሚ መረጃ ለመሰብሰብ ያለመ ሲሆን መረጃው ለውስጣዊ ግምገማና ማሻሻያ ዓላማዎች ብቻ የሚውል ነው፡፡ በዚች ቃለ መጠይቅ ላይ ለመሳተፍ ለምታደርጉት ትብብር እናመሰግናለን።

Section 1: Participant Information

|  |  |  |
| --- | --- | --- |
| Section 0: Respondent sociodemographic Information to be filled earlier to interview | | |
|  | ID:  Region:  Woreda: | Sex:  Previous responsibility/role:  Facility Type (during training): |
| Section 1: General information | | |
| 1 | Have you changed the position/role of working as DHIS2 focal or related activity? | If yes:  And for how long you worked in the position? |
| 2 | In which range is your Age: | <=24; 2545 ; >45 |
| 4 | What is your position/Role (current): | PHEM officer HIT Office Other, specify: |
| 5 | Education Background (highest educational qualifications): |  |
| 6 | Work experience in years |  |
| 7 | Facility Type (current): | Hospital, Health Center, Regional PHEM Office Other, specify: |

Section 2: DHIS2 training

|  |  |  |
| --- | --- | --- |
| 1 | How long since you took the training | < 1 year 1 2 Years > 2 years |
| 2 | Do you think that the training was adequate enough to utilize DHIS2 | Yes No |
|  | If no, what could be the possible reasons; (Probs; tool complexity, short training duration, trainer delivery limitation, …. ) | |
| 3 | what improvements or additional training would you recommend to enhance the training (Specify which part of the DHIS2: data entry, analysis, dashboard use,…)? | |
| 4 | How do you find DHIS2s userfriendly? | Very userfriendly  Moderately userfriendly  Not userfriendly |
| 6 | Have you ever used DHIS2 to send PHEM data?  if not, what are the reasons for its nonadoption?  *(Prob: Inadequate training, the platform complexity, Insufficient support, no direction from leadership, Resource constraints, Resistance to change)* | |

Section 3 Date submission system

|  |  |  |
| --- | --- | --- |
| 1 | Through which system do you submit the majority of your weekly data | Paper  SMS /Telegram  Excel  Other |
| 2 | Do you prefer submitting the data by Excel compared to DHIS2? If yes, why? |  |
| 3 | How long does it take to submit the PHEM weekly data into DHIS2? |  |
| 4 | Who do you believe should send DHIS2 data? (PHEM officer, HIT, or dedicated personnel for DHIS2) |  |

Section 4: Trainee general perception and skill of data utilization

|  |  |  |
| --- | --- | --- |
| 1 | How would you rate your skills in data analysis? | Excellent  Good  Fair  Poor |
| 2 | Did you take any other training that used for data management or analysis? | If yes: List |
| 3 | Do you think additional data management training is needs to help to utilize DHIS2? | If Yes; List |

Section 4: Availability of ICT facilities and Telecom Infrastructure

|  |  |  |
| --- | --- | --- |
| 1 | What types of devices are accessible at your health facility for tasks related to both data entry and analysis? | No of Desktop  No of Laptop  No of Tablet  No of Smartphone  Not available |
| 2 | Regarding each device mentioned in the previous question, is the device shared, dedicated to a specific team or personal belonging? | Desktop : shared    /dedicated for PHEM /Personal  Laptop : shared    /dedicated for PHEM /Personal  Tablet  : shared    /dedicated for PHEM/Personal  Smartphone: shared    /dedicated for PHEM/Personal |
| 3 | Do you currently have Ethiotelecom coverage at least 2 hours on most days? | Yes/No, |
| 4 | Do you have internet connectivity in your facility? | Yes/No,  If yes, list: Wifi, broadband, Data package |
| 5 | How do you rate electricity availability in your facility? | Always available  Often – some electricity most days  Sometimes – most electricity about 50% of days  Rarely – no electricity most days |

Section 5: Challenges and recommendation

|  |  |
| --- | --- |
| 1 | What challenges have you generally encountered in utilizing the DHIS2 system?  (DHIS2 tool complication, Leadership, infrastructure scarcity, Skill gap, Human resource shortage, Work load, Not priority …) |
| 2 | Could you share any recommendations you might have to enhance the effective utilization of DHIS2? |