Original Article

DISTRICT HEALTH INFORMATION SOFTWARE 2 (DHIS2) AS A DECISION SUPPORT TOOL FOR HEALTH SERVICE MANAGEMENT: EVIDENCE FROM A NATIONWIDE STUDY IN BANGLADESH

Md. Nazmul Hassan Refat[1], Baizid Khoorshid Riaz[2], ANM Shamsul Islam[3], Taufique Joarder[4], Mahmuda Khandaker[5], Md. Mainul Hassan[6]

ABSTRACT

Background: District Health Information Software 2 (DHIS2) is the world's largest open-source health management information system, adopted in Bangladesh since 2011 for decentralized online reporting. While widely used, evidence on its scopes and utilities for decision-making by health managers remains limited. This study aimed to explore how DHIS2 is being applied as a decision support tool for health service management at the sub-district or Upazila level in Bangladesh.

Methods: A nationwide convergent mixed-methods study was conducted among Upazila Health and Family Planning Officers (UH&FPOs) designated as Upazila or sub-district health managers in Bangladesh from January to December 2018. For the quantitative part, all (n = 482) UH&FPOs were included, and data were collected using a pre-tested semi-structured questionnaire distributed via official group email, with postal returns accepted where necessary. For the qualitative part, focus group discussions and key informant interviews were conducted with UH&FPOs to better understand their experiences and practices. Quantitative data were analyzed using descriptive and inferential statistics, while qualitative data were thematically analyzed.

Results: Among 482 UH&FPOs approached, 428 responded, yielding a response rate of 88.8%. The mean age was 47.1 (±6.3) years; 93.9% were male, and 31.1% had received DHIS2 training. Most respondents reported satisfactory use of DHIS2 for maternal health (75.7%) and neonatal and child health service (68.9%) monitoring, as well as immunization service (86.2%). However, application was lower for inpatient preparedness (63.6%), major equipment management (47%), and referral tracking (58.2%). Importantly, nearly three-quarters (74%) of UH&FPOs reported that DHIS2 has made their managerial responsibilities easier. Training was significantly associated with higher use of DHIS2 for coordination meetings, planning, and supportive management functions ($p < 0.05$). Qualitative findings highlighted challenges of complex datasets, fragmented training, and over-reliance on statisticians, but also proposed expansions such as drug databases, laboratory service reporting, and financial reporting modules.

Conclusion: DHIS2 is a valuable tool for health service management at the Upazila level in Bangladesh, though its decision-making potential remains limited by gaps in data-use capacity and functional coverage. Strengthening managers' ability to use DHIS2 data, and expanding managerial modules could enhance its effectiveness as a national decision-support platform and support progress toward Sustainable Development Goal 3.

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1. *Assistant Professor, Department of Public Health and Hospital Administration & Head, Department of Public Health Informatics, National Institute of Preventive and Social Medicine (NIPSOM), Mohakhali, Dhaka.*
2. *Professor & Ex- Head, Department of Public Health and Hospital Administration, NIPSOM, Dhaka.*
3. *Professor & Head, Department of Public Health and Hospital Administration, NIPSOM, Dhaka.*
4. *Associate Professor, SingHealth Duke-NUS Global Health Institute, Duke-NUS Medical School, Singapore.*
5. *Associate Professor & Head, Department of Microbiology, Shaheed Monsur Ali Medical College, Uttara, Dhaka.*
6. *Clinical Staff, Department of Orthopaedics, Square Hospital, Panthopath, Dhaka.*

***Correspondence**: Md. Nazmul Hassan Refat, Assistant Professor, Department of Public Health and Hospital Administration, & Head, Department of Public Health Informatics, National Institute of Preventive and Social Medicine (NIPSOM), Mohakhali, Dhaka. Contact: +880-1711-305535, nazmulhassanrefat@gmail.com*

INTRODUCTION

Health information systems (HIS) are the backbone of modern health sector management, providing the evidence base required for planning, monitoring, and policy decision-making. The World Health Organization emphasizes that a functional HIS must generate, compile, analyze, synthesize, and communicate reliable and timely data to inform health-related decisions.[1] Despite this recognized importance, many low- and middle-income countries (LMICs) continue to struggle with fragmented, paper-based systems that delay reporting, reduce accuracy, and ultimately hinder effective health service management.[2] In response to these challenges, electronic platforms such as the District Health Information Software 2 (DHIS2) have been developed and widely adopted.

DHIS2 is a free, open-source, web-based health management information system, implemented at the national scale in more than 69 countries by the end of 2022.[3] In Bangladesh, the Ministry of Health and Family Welfare (MoHFW) initiated major HIS reform as part of the national health sector digitalization initiative. With technical assistance from GIZ, the Directorate General of Health Services (DGHS) customized DHIS2 beginning in 2009, and decentralized online data entry was introduced in 2011.[4] This transformation enabled routine health data previously delayed by handwritten forms to be reported electronically from Union-level facilities and Upazila Health Complexes (UHCs), aggregating data into a National Data Warehouse.[4]

Today, DHIS2 covers approximately 98% of all public health facilities in Bangladesh, making the country one of the largest global deployers of the system.[5] According to UNICEF and related sources, reporting rates averaged 98%, increasing from just 10% among community clinics in 2014 to nearly universal coverage in subsequent years.[6] Further, DHIS2 has expanded to encompass more than 14,000 public health facilities, from community clinics to tertiary hospitals.[7] This widespread adoption has enabled near real-time data flow across administrative levels.

The UHC, headed by the Upazila Health & Family Planning Officer (UH&FPO), is a critical administrative unit providing both indoor, outdoor, and domiciliary services. As such, the UHC level plays a pivotal role within the national HIS. Managers at this level are responsible for timely data reporting through DHIS2, which supports Health System Strengthening (HSS) scoring, facility performance monitoring, and resource distribution. Moreover, routine facility data reported through DHIS2 are widely used to generate national dashboards and performance monitoring indicators that inform health system planning and policy decisions.[8]

While studies have highlighted limitations of DHIS2 in Bangladesh, such as insufficient training, challenges in customizing indicators, and data quality issues.[9,10] So, a comprehensive understanding requires assessing the extended scopes and practical applications of DHIS2. The platform has evolved from a mere data entry system into a decision-support tool used in diverse domains: planning maternal, neonatal, and child health services; monitoring immunization coverage; preparing for outbreaks; forecasting facility readiness; and supervising community clinics. In many Upazilas, DHIS2-generated reports guide coordination meetings, action planning, and accountability mechanisms. The system's flexibility supports integration of modules into existing datasets; automated dashboards and summary reports further position DHIS2 as an indispensable managerial tool.[11]

Globally, experiences from countries such as Uganda, Kenya, Tanzania, and Sri Lanka demonstrate how DHIS2, when backed by infrastructure, training, and political support, can transform district-level health management.[12-15] In Bangladesh, DHIS2 adoption was aligned with the Health, Population and Nutrition Sector Program, which prioritizes HIS strengthening, and supports the country's monitoring of Sustainable Development Goals (SDGs), especially SDG 3 on health and well-being[16].

Against this backdrop, the present study evaluates the scopes and utilities of DHIS2 as a decision support tool for health service management in Bangladesh. Rather than focusing on barriers, this paper highlights how DHIS2 is leveraged by Upazila health managers across services, explores emerging opportunities for expansion, and examines its potential to institutionalize data-driven decision-making at the sub-district level. By doing so, the study contributes both to the global evidence base on DHIS2 and to policy-relevant discourse on strengthening health service delivery through comprehensive HIS integration in Bangladesh.

METHODS

Study Design

This study was a convergent mixed-methods design, combining a nationwide cross-sectional quantitative survey with a qualitative section through a focus group discussion (FGD) and key informant interviews (KIIs). This design allowed triangulation of findings and deeper insights into the scopes and utilities of DHIS2 in health service management.

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Quantitative Section

The cross-sectional quantitative survey was conducted among all UH&FPOs of Bangladesh between January and December 2018. The study population included all UH&FPOs (n = 482) posted as regular, current charge, or in-charge during the study period. Data were collected using a pre-tested semi-structured questionnaire, developed from a literature review and consultation with experts in hospital administration and health information systems. HSS scores were extracted from the DGHS national dashboard, where each facility is automatically scored monthly based on completeness, timeliness, and consistency of DHIS2 reporting across service domains. The mean scores over the preceding 12 months from October 2017 to September 2018 were used for analysis.

The questionnaire was distributed via the official group email of UH&FPOs (alluhfpo@uhfpo.dghs.gov.bd). Respondents from facilities lacking scanning or internet facilities were requested to return hard copies by post. Personal contact information of UH&FPOs was obtained from the Management Information System (MIS) of the DGHS. Assistant chief statistical officers designated for the eight divisions posted at MIS, DGHS were engaged in monitoring the data collection process.

Completed questionnaires were checked, coded, categorized, and cleaned prior to analysis. Data were compiled and tabulated according to key variables and functional assessment scoring. Missing data were handled using listwise exclusion; responses with missing values for specific variables were excluded from the corresponding analyses, which resulted in variation in sample sizes across tables and figures. Quantitative data were analyzed using SPSS version 23. Descriptive statistics summarized socio-demographic and functional variables. Bivariate associations were examined using chi-square tests for categorical data and Pearson correlation or ANOVA for continuous variables. Statistical significance was set at $p < 0.05$.

Qualitative Section

To complement the survey findings, a qualitative component was conducted. One FGD was conducted with eight UH&FPOs using homogeneous purposive sampling to ensure professional similarity and facilitate open interaction. The FGD was held in Cumilla Civil Sugreon office following a scheduled coordination meeting of Upazila Health Managers to facilitate participation. Participants were encouraged to share their personal experiences, challenges, and suggestions regarding DHIS2 use in health service management. The session lasted approximately 90 minutes and was audio-recorded with prior consent. Notes were also taken to capture non-verbal cues and contextual details. At the end of the discussion, key points were summarized and validated with participants to ensure accuracy and reliability of the responses.

KIIs were conducted with six UH&FPOs purposively selected to represent variation in gender, age, professional qualification, and HSS score ranking. Semi-structured guidelines, developed from literature review and expert consultation, were used to facilitate discussions and interviews. All tools were prepared in both English and Bengali. Sessions lasted 35–90 minutes, were audio-recorded with prior consent, and later transcribed verbatim.

Data were analyzed thematically using both inductive and deductive approaches. The analysis process included familiarization with transcripts, development of a coding framework, coding, categorization, and interpretation. Themes were generated around data elements and datasets, reporting formats, training and skills, applications in service management, proposed scopes, and limitations of DHIS2. Representative quotes were included to illustrate key findings. Data saturation guided the final sample size.

Ethical Considerations

Ethical approval for the study was obtained from the Institutional Review Board (IRB) of the National Institute of Preventive and Social Medicine (NIPSOM), Dhaka (approval date: June 28, 2018). Written informed consent was obtained from all participants. Confidentiality and anonymity were maintained throughout the study by removing personal identifiers and ensuring restricted access to research data.

RESULTS (Quantitative Part)

A total of 428 UH&FPOs participated in the study, giving a response rate of 88.8%. The mean age of respondents was 47.1(±6.3SD) years, with the largest proportion (29.2%) belonging to the 41–45 year age group, followed by 24.8% in the 46–50 year group. A small proportion (2.6%) were under 35 years, while 12.4% were aged 56 years or older. The majority of respondents were male (93.9%), with only 6.1% female. Most participants held an MBBS degree (88.8%), while a small fraction (5.1%) had an additional Master of Public Health (MPH), and 6.1% reported other qualifications.

Regarding job experience as UH&FPOs, the mean duration was 1.9 (±1.6SD) years. The largest group (39.2%) had between 1.01 and 2 years of experience, followed by 20.7% with less than or equal to one year.

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Only 3.5% had five or more years of experience in their current post.

Training exposure to DHIS2 was limited. Out of 428 respondents, only 133 (31.1%) reported having received training on DHIS2, while the majority (68.9%) had not. This reflects a significant gap in formal orientation, despite their central role in data reporting and decision-making (Table-1).

Table 1: Socio-demographic Characteristics of Respondents (n = 428)

Characteristics	Categories	Frequency (n)	Percentage (%)
Age group (years)	Under 35	11	2.6
	36–40	52	12.1
	41–45	125	29.2
	46–50	106	24.8
	51–55	81	18.9
	56 and older	53	12.4
Sex	Male	402	93.9
	Female	26	6.1
Educational level	MBBS	380	88.8
	MBBS + MPH	22	5.1
	Others	26	6.1
Job experience as UH&FPO	≤ 1 year	88	20.7
	1.01–2 years	167	39.2
	2.01–3 years	81	19.0
	3.01–4 years	47	11.0
	4.01–5 years	28	6.6
	≥ 5.01 years	15	3.5
Training on DHIS2	Yes	133	31.1
	No	295	68.9

Among 423 UH&FPOs, 59% reported using DHIS2 satisfactorily to present health-related activities in coordination meetings, while 29% used it very little, and 12% were not clearly oriented about its application. This indicates that although a majority are successfully applying DHIS2, a considerable proportion still underutilize or lack adequate orientation for effective use (Figure-1).

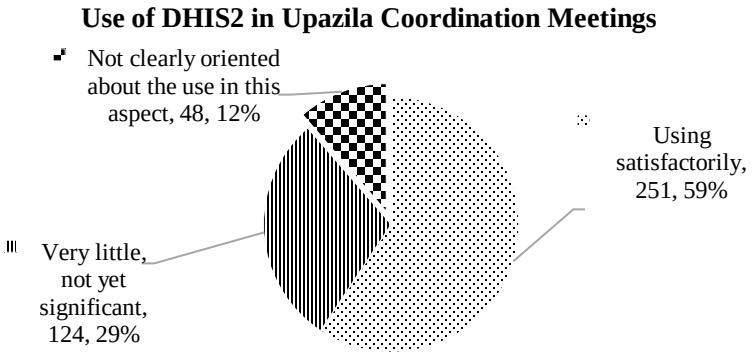

Figure 1: Distribution of UH&FPOs Using DHIS2 in Upazila Coordination Meetings (n = 423)

Use of DHIS2 to assess facility preparedness varied across divisions. Overall, Figure-2 shows 56.9% of UH&FPOs reported satisfactory use, with the highest in Khulna (66.7%) and the lowest in Rajshahi (43.1%). Between 27–35% of respondents across divisions reported very limited use, while around 10–15%

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remained not clearly oriented. These findings indicate uneven adoption, with certain divisions, particularly Rajshahi, lagging behind in applying DHIS2 for preparedness planning (Figure-2).

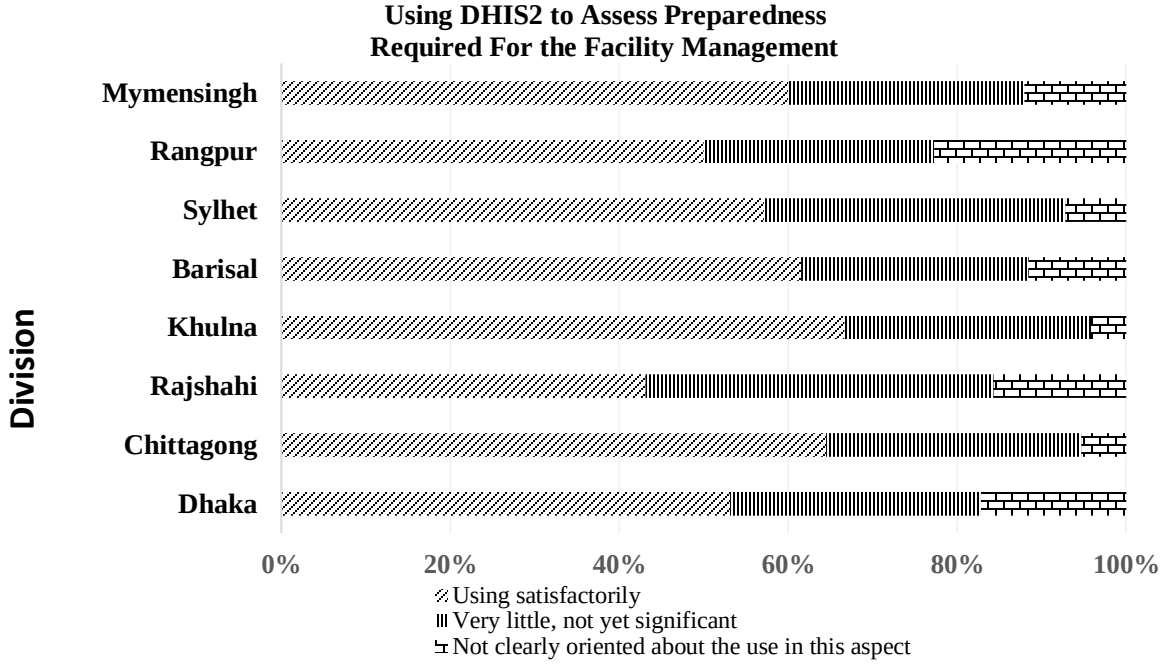

Figure 2: Distribution of UH&FPOs using DHIS2 to assess preparedness requirements for facility management (n = 363)

Among UH&FPOs, 75.7% reported (Table-2) satisfactory use of DHIS2 to monitor maternal health services, including ANC, delivery care, and PNC, while 24.3% were unable to use it effectively. The highest satisfactory use was observed in Barishal division (88.0%), followed by Sylhet (82.1%) and Khulna (79.2%). In contrast, Rajshahi (69.2%) and Mymensingh (73.1%) reported relatively lower utilization. These findings suggest that while DHIS2 is widely applied for maternal health monitoring, divisional variations persist, with some areas lagging behind (Table-2).

Table 2: Distribution of UH&FPOs, Using DHIS2 to Monitor Maternal Health Services (n=366)

Name of the Division	Effective Use of DHIS2		Total
	Yes	No	
Dhaka	50 (75.8%)	16 (24.2%)	66 (100%)
Chattogram	57 (74.0%)	20 (26.0%)	77 (100%)
Rajshahi	36 (69.2%)	16 (30.8%)	52 (100%)
Khulna	38 (79.2%)	10 (20.8%)	48 (100%)
Barishal	22 (88.0%)	3 (12.0%)	25 (100%)
Sylhet	23 (82.1%)	5 (17.9%)	28 (100%)
Rangpur	32 (72.7%)	12 (27.3%)	44 (100%)
Mymensingh	19 (73.1%)	7 (26.9%)	26 (100%)
Total	**277 (75.7%)**	**89 (24.3%)**	**366 (100%)**

Out of 366 respondents, 68.9% reported (Table-3) satisfactory use of DHIS2 for monitoring neonatal and child health services, including nutrition and counselling, while 31.1% were unable to apply it

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effectively. Divisional differences were evident: Sylhet showed the highest satisfactory use (82.1%), followed by Khulna (77.1%) and Chattogram (74.0%). In contrast, Barishal (56.0%) and Mymensingh (57.7%) had the lowest satisfactory use, with nearly half of the UH&FPOs in these divisions still unable to utilize DHIS2 effectively for child health monitoring (Table-3).

Table 3: Distribution of UH&FPOs, Using DHIS2 to Monitor Neonatal and Child Health Services (n=366)

Name of the Division	Effective Use of DHIS2		Total
	Yes	No	
Dhaka	44 (66.7%)	22 (33.3%)	66 (100%)
Chattogram	57 (74.0%)	20 (26.0%)	77 (100%)
Rajshahi	31 (59.6%)	21 (40.4%)	52 (100%)
Khulna	37 (77.1%)	11 (22.9%)	48 (100%)
Barishal	14 (56.0%)	11 (44.0%)	25 (100%)
Sylhet	23 (82.1%)	5 (17.9%)	28 (100%)
Rangpur	31 (70.5%)	13 (29.5%)	44 (100%)
Mymensingh	15 (57.7%)	11 (42.3%)	26 (100%)
Total	**252 (68.9%)**	**114 (31.1%)**	**366 (100%)**

The pie chart (Figure 3) shows that 231 UH&FPOs (63%) reported using DHIS2 reports satisfactorily to assess preparedness for indoor patient service management, based on hospital bed statements and admitted patient records. In contrast, 86 officers (24%) indicated very limited use, while 46 officers (13%) were not clearly oriented about its application. Taken together, more than one-third (36%) of respondents are still unable to utilize DHIS2 effectively for this purpose, highlighting a notable gap in its adoption for inpatient service planning (Figure-3).

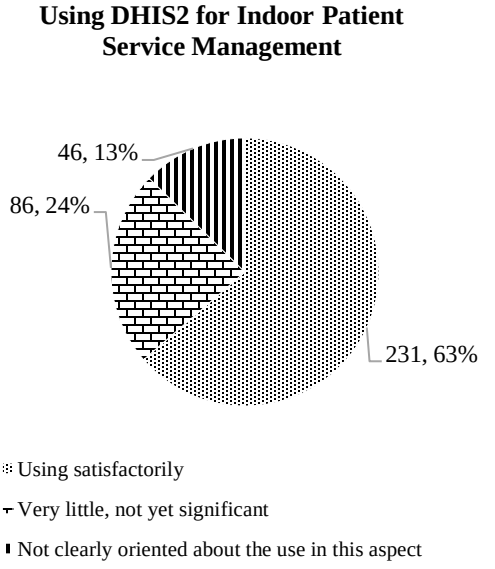

Figure 3: Distribution of UH&FPOs using DHIS2 for Indoor Patient Service Management (n = 363)

The pie chart (Figure 4) shows that 170 UH&FPOs (47%) reported using DHIS2 satisfactorily to monitor and manage major equipment of the UHC, including ambulances. However, more than half of the respondents (53%) were unable to use the system effectively for this purpose. Among them, 97 officers (27%) reported very limited use, while 96 officers (26%) were not clearly oriented about the relevant functions. This indicates that equipment management remains one of the least utilized areas of DHIS2 application, with substantial gaps in awareness and capacity (Figure-4).

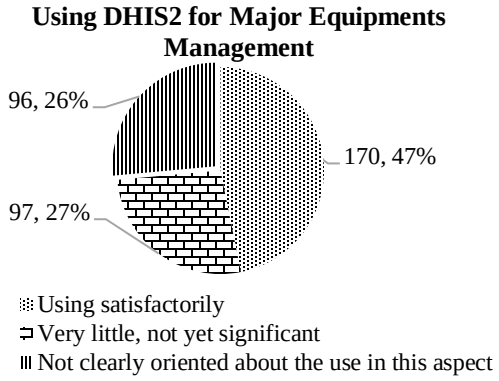

Figure 4: Distribution of UH&FPOs using DHIS2 for Major Equipment Management (n = 363)

The bar chart shows variation across divisions in the use of DHIS2 for understanding disease patterns of indoor patients through ICD-10, particularly to guide preparedness, such as medicine supply. Overall, more than half of the respondents reported satisfactory use, with Khulna division recording the highest proportion

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(74.5%) and Rajshahi the lowest (49.0%). In Barishal, 23.1% of UH&FPOs were still not clearly oriented about this application. These findings suggest that while DHIS2 is being increasingly applied to monitor disease patterns, significant divisional disparities and orientation gaps remain (Figure-5).

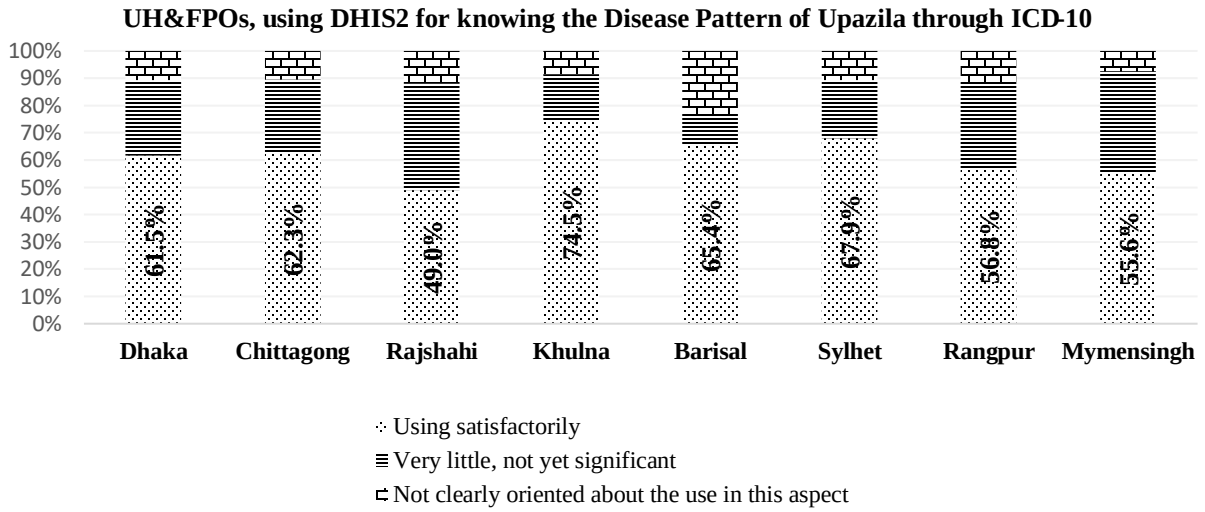

Figure 5: Distribution of UH&FPOs Using DHIS2 to Know Disease Patterns through ICD-10 (n = 365)

The bar chart shows varying levels of DHIS2 use across three key field service areas. For monitoring vaccine coverage under the EPI schedule and obtaining an overall program picture, 86.2% of UH&FPOs reported satisfactory use. For TB and leprosy patient services, 72.1% were able to utilize DHIS2 effectively. In contrast, sanitation activities of the Upazila were less frequently managed through DHIS2, with 58.3% of officers reporting inability to use the system for this purpose. Overall, 38.6% of respondents indicated they were not able to use DHIS2 in any of the three service areas, reflecting an important gap in the system's application for broader field service management (Figure-6).

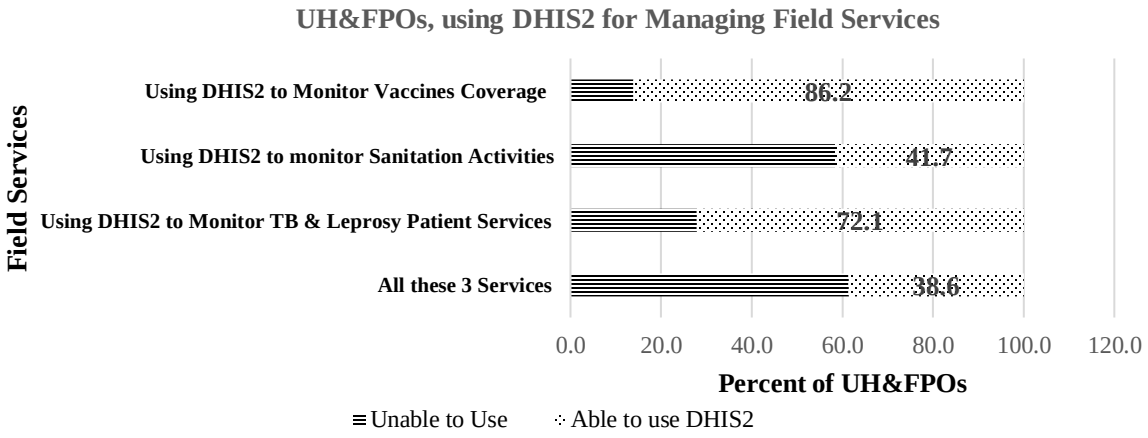

Figure 6: Distribution of UH&FPOs using DHIS2 for Management of Selected Field Services (n = 427)

The bar chart illustrates the extent to which UH&FPOs applied DHIS2 in managing four major service areas of the Community Clinics (CCs). A very high proportion (87.8%) reported successful use of DHIS2 in monitoring the individual performance of Community Health Care Providers (CHCPs) and in managing maternal and child health services, including online registration of pregnant women, newborns, and children. However, performance was relatively weaker in other domains. Only 60.8% of respondents could effectively use DHIS2 to assess the quality of services provided to general patients,

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including health education, while 39.2% were unable to apply the system for this purpose. Similarly, only 58.2% of UH&FPOs reported being able to use DHIS2 to monitor whether patients were properly referred from CCs to the Upazila Health Complex, leaving a substantial 41.8% unable to track referral flows through the system. When all four aspects of management were combined, less than half of respondents (45.8%) reported being able to use DHIS2 successfully, while 54.2% remained unable. (Figure-7).

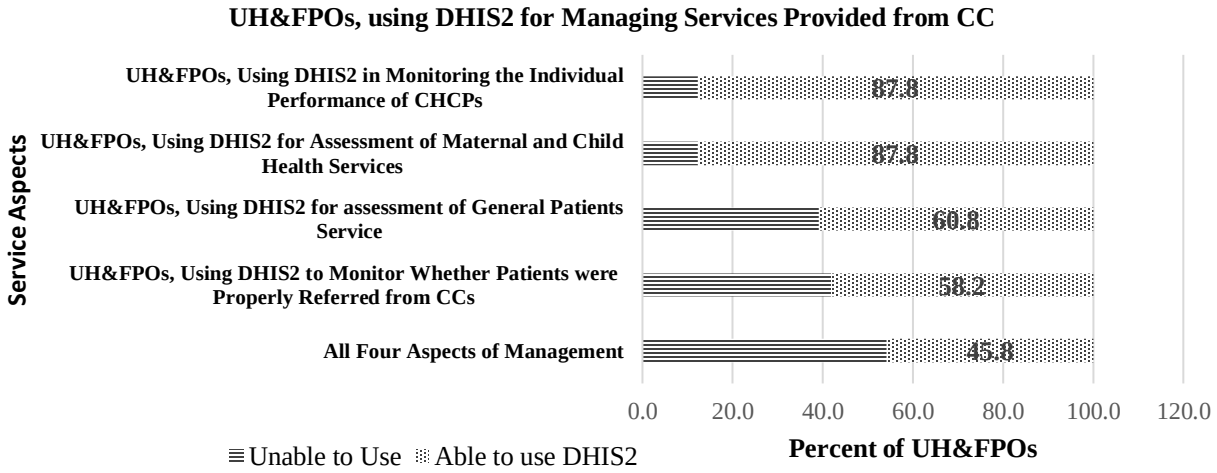

Figure 7: UH&FPOs, using DHIS2 for Management of Services Provided from Community Clinics (n = 426)

The pie chart shows that 238 UH&FPOs (57%) reported satisfactory use of DHIS2 data and reports to prepare future plans for improving overall healthcare services at the Upazila level. However, 133 officers (32%) reported using the system very little in this regard, and 46 officers (11%) were not clearly oriented about its application for planning. These findings highlight that although more than half of UH&FPOs are already integrating DHIS2 into forward planning, a substantial proportion (43%) are either underutilizing or remain unfamiliar with this function, indicating room for strengthening managerial capacity and training (Figure-8).

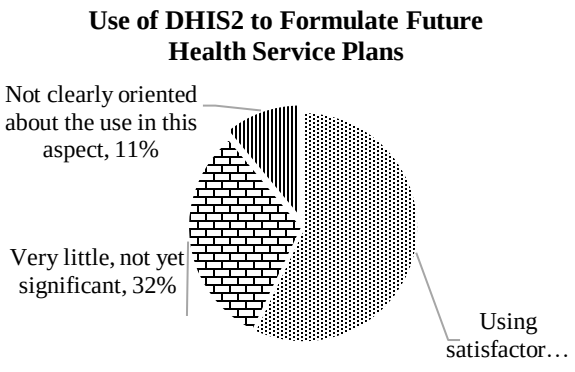

Figure 8: UH&FPOs, using DHIS2 data and reports to formulate future health service plans (n = 417)

The pie chart shows that 313 UH&FPOs (74%) reported that DHIS2 is playing a significant supportive role in making the complex tasks of Upazila health service management easier. Meanwhile, 59 officers (14%) stated that DHIS2 was not yet supporting them to their desired level, and 50 officers (12%) were not clearly oriented about how DHIS2 could help in managerial functions. This indicates that while most respondents recognize DHIS2 as an effective management support tool, a considerable minority still underutilize it or lack sufficient orientation, underscoring the need for additional training and guidance (Figure-9).

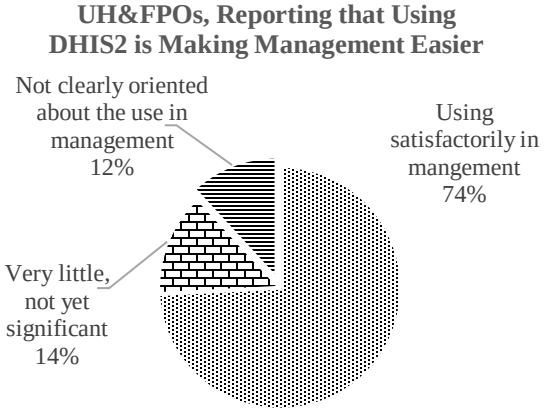

Figure 9: UH&FPOs, reporting that using DHIS2 is making management easier (n = 422)

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The bar chart presents the additional scopes of the DHIS2 application as proposed by 424 UH&FPOs. A large majority, 379 officers (89.4%), proposed the incorporation of a drug database within DHIS2 to ensure the optimum utilization of supplied medicines. Similarly, 353 officers (83.3%) proposed the inclusion of a monthly activities report for individual Health Assistants at the Upazila level. A total of 341 respondents (80.4%) recommended the incorporation of a monthly laboratory service report to assess the utilization of pathological and radiological services. In addition, 336 officers (79.2%) proposed a financial database in DHIS2 for preserving data on health-related income and expenditure of the Upazila, which would support planning for upcoming healthcare programs and management processes (Figure-10).

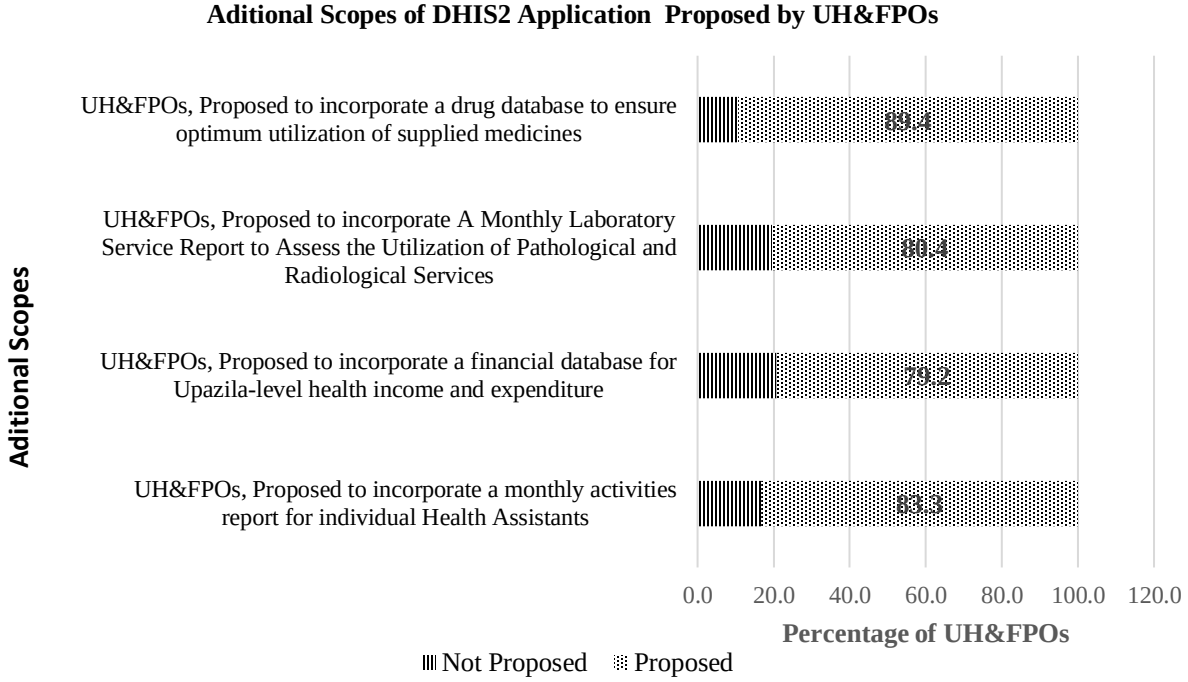

Figure 10: Distribution of UH&FPOs proposing additional scopes of DHIS2 application from a management perspective (n = 424)

The relationship between training status on DHIS2 and its application in different management domains is presented in Table 4. Among 426 respondents, a significant association was observed between training and the use of DHIS2 for decision-making in coordination meetings. Of those who received training, 70.7% reported satisfactory use compared to 57.3% of those without training ($\chi^2 = 6.874$, $p = 0.009$).

Similarly, for formulating future plans to improve overall healthcare services, 64.4% of trained UH&FPOs reported satisfactory use compared with 53.7% of those not trained, showing a statistically significant difference ($\chi^2 = 4.224$, $p = 0.040$).

A comparable pattern was seen when assessing DHIS2 as a supportive tool for making Upazila health service management easier. Among trained UH&FPOs, 80.5% reported satisfactory use, while only 71.5% of non-trained UH&FPOs did so, and this difference was also statistically significant ($\chi^2 = 4.224$, $p = 0.040$).

Overall, the findings indicate that UH&FPOs who had received DHIS2 training consistently demonstrated higher levels of satisfactory use across all three domains: coordination meetings, future planning, and supportive management functions compared with their untrained counterparts. These results emphasize the importance of structured training programs in enhancing the utilization of DHIS2 for decision-making and management at the Upazila level (Table-4).

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Table 4: Relationship between Training Status on DHIS2 & Its Application in Selected Management Domains

Variable	Category	Satisfactorily Using DHIS2 n (%)	Not Satisfactorily Using DHIS2 n (%)	p-Value
Decision-making in coordination meetings	Training Received	94 (70.7%)	39 (29.3%)	0.009* (Chi-square)
	Training Not Received	168 (57.3%)	125 (42.7%)	
Formulating future plan for improvement	Training Received	85 (64.4%)	47 (35.6%)	0.040* (Chi-square)
	Training Not Received	153 (53.7%)	132 (46.3%)	
Supportive role in making management easier	Training Received	107 (80.5%)	26 (19.5%)	0.040* (Chi-square)
	Training Not Received	211 (71.5%)	84 (28.5%)	

*Significant at $p < 0.05$

Analysis of Health System Strengthening (HSS) Scores in relation to background variables is presented in Table 5. Among 482 UH&FPOs nationwide, only 420 were included in the national HSS scoring system. Of the 428 respondents in this study, 373 were found to be included in the HSS scoring system. Since the mean of the last 12 months (October 2017 to September 2018) was considered for assessing associations, only those UH&FPOs with more than 12 months of service experience were eligible for analysis, which reduced the sample to 281 respondents. The HSS scores ranged from 30.57 to 82.73, with a mean of 62.61 (SD = 12.54) and a median of 62.77.

One-way ANOVA showed no significant differences in mean HSS scores by educational qualification. The mean scores were almost identical across MBBS (61.6), MBBS+MPH (61.6), and other qualifications (60.1) ($F = 0.703$, $p = 0.647$). Pearson correlation analysis between years of service as UH&FPO and HSS scores also revealed a weak, non-significant relationship ($r = 0.037$, $p = 0.480$). These results indicate that neither education nor experience significantly influenced HSS performance among respondents (Table 5).

Table 5: Relationship of Education and Experience with HSS Scores (n = 420)

Variable	Category / Test	Mean HSS Score	Statistical Test	Test Statistic	p-value	Result
Education	MBBS	61.6	One-way ANOVA	F = 0.703	0.647	Not significant
	MBBS + MPH	61.6				
	Others	60.1				
Experience	Correlation (years of service vs HSS score)	r = 0.037	Pearson correlation	–	0.480	Not significant

*Significant at $p < 0.05$

RESULTS (Qualitative Part)

Participant Characteristics

Eight UH&FPOs participated in the FGD (six male, two females; aged 39–53 years; experience 0.3–2.7 years). Six UH&FPOs were included in KIIs (four male, two females; aged 39–50 years; experience 1–2 years). Most respondents had MBBS degrees, with some holding additional postgraduate qualifications. Only a minority had received formal DHIS2 training.

Although no theme explicitly emerged under the label of "decision support," the issues raised by participants were closely linked to the capacity of DHIS2 to function as a managerial decision-making tool. Themes such as complexity of data elements, lack of user-friendly reporting formats, fragmented training, partial application in service domains, proposed extensions, and usability challenges all reflect underlying barriers and facilitators that shape how effectively DHIS2 can support evidence-based decisions at the Upazila level.

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Theme 1: Complexity of Data Elements and Datasets

Participants widely acknowledged the importance of DHIS2 as a supportive tool for health service management. However, they expressed difficulty in navigating the large number of data elements across different datasets, which often complicated timely managerial decision-making.

"It's true that DHIS2 is supporting us in various ways but sometimes we feel that it contains huge data elements; we face difficulties to find the necessary one." (FGD, male UH&FPO)

Several UH&FPOs suggested that DHIS2 should include a management-specific dataset, automatically summarizing key indicators across service areas and highlighting priority issues for decision-making.

Theme 2: Reporting Format and Accountability

The reporting formats of datasets were often perceived as lacking clarity and formality. Respondents emphasized the need for automatic inclusion of facility name, reporting period, and other information relating facility identification to improve the professional appearance of reports.

Additionally, the absence of signature fields for responsible personnel was identified as a limitation, as it reduced accountability. Participants suggested involving relevant consultants (e.g., Paediatrics, Gynae & Obs) and storekeepers in dataset validation, both to improve accuracy and to distribute responsibility across staff.

"It is not wise to give all responsibility to the UH&FPO only. All categories of staff should be assigned officially for monitoring data of DHIS2. If it is possible, then its acceptance will rise significantly." (FGD, female UH&FPO)

Theme 3: Training Gaps and Skills

Training was often described as fragmented, focusing on individual components of DHIS2 rather than comprehensive, management-oriented applications. Participants recommended training of trainers (TOT) programs to expand the pool of trained staff and ensure timely reporting even during staff shortages.

"Training is usually conducted on a single topic of DHIS2… We need extensive training focused on management perspective applications." (KII, male UH&FPO)

Theme 4: Application in Health Service Management

Respondents reported using DHIS2 effectively for EPI and community clinic monitoring. However, its application in hospital services was less satisfactory. A key limitation was that ICD-10 coding was restricted to indoor patients, excluding the much larger outpatient and emergency caseload. UH&FPOs strongly recommended incorporating ICD-10 in outdoor and emergency reports to better capture disease patterns and guide preparedness for medicines and manpower.

"It is not possible to tell about the disease pattern of the Upazila based on indoor reports only. If ICD-10 could be included for outdoor and emergency patients, then it would be more logical to plan for future need." (KII, male UH&FPO)

Theme 5: Proposed Scopes for DHIS2

UH&FPOs proposed several new features to strengthen DHIS2 as a decision support tool:

- **Drug database** for tracking utilization and redistribution of medicines.
- **Store management module** for monitoring reserves and crisis preparedness.
- **Monthly laboratory service reports** to improve transparency in diagnostic services.
- **Financial database** to ensure accountability, transparency, and smoother administrative handovers.
- **Union or staff-based service reports** for monitoring field-level activities of Health Assistants and Inspectors.
- **Unique patient identifier (NID/Birth ID)** to support development of a national health database.

Theme 6: Limitations and Usability Challenges

Despite its strengths, DHIS2 was described as complex and heavily dependent on statisticians. Limited training for other staffs and lack of mobile-friendly dashboards constrained its use as a real-time decision-making tool. Participants emphasized the need for simplified, user-friendly auto generated summary reports, ideally accessible with "one-click" and mobile compatibility.

"It should be more user-friendly, so that we can get a summary report from just about one click." (KII, female UH&FPO)

DISCUSSION

This convergent mixed-methods national study assessed the scopes and utilities of DHIS2 as a decision support tool for health service management in Bangladesh. Findings demonstrate that DHIS2 has

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become integral to routine health management at the Upazila level, supporting functions such as monitoring maternal, neonatal, and child health services, evaluating community clinic performance, and planning resource allocation. However, the study also highlights critical gaps in training, system usability, and comprehensive application.

Quantitative data indicate that more than three-quarters of UH&FPOs use DHIS2 to monitor maternal health services, and two-thirds apply it for neonatal and child health monitoring. These findings align with evidence from other LMICs, where DHIS2 has improved coverage and accountability in maternal and child health programs[17,18]. The system's use in tracking vaccine coverage (86%) further reflects its contribution to strengthening EPI monitoring, comparable to experiences in Kenya and Tanzania.[12,13]

However, the comparatively lower use of DHIS2 for inpatient preparedness (63%) and major equipment management (47%) suggests that certain managerial domains remain underutilized. Similar gaps have been reported in Uganda, where DHIS2 adoption was strong for routine indicators but weaker for logistics and facility preparedness.[11] Qualitative findings reinforce this, as UH&FPOs noted difficulties navigating large datasets and proposed the creation of a "management-specific dataset" to simplify access to relevant information.

Only 31% of UH&FPOs had received formal DHIS2 training, yet training was significantly associated with better use of DHIS2 for coordination meetings, future planning, and supportive management functions. This finding mirrors earlier studies in Bangladesh and Malawi, which identified insufficient training as a barrier to effective HIS utilization.[9,10,19] Qualitative insights revealed that existing training programs are fragmented, often focusing on single modules rather than comprehensive management applications. UH&FPOs strongly recommended a Training-of-Trainers (TOT) model to ensure sustainability and to build a wider pool of skilled staff. The absence of significant associations between Health System Strengthening (HSS) scores and UH&FPOs' educational qualifications or length of service suggests that system performance is less dependent on individual credentials and experience and more likely influenced by functional enablers such as effective utilization of DHIS2 as a decision support tool.

The reliance on statisticians for data entry and analysis further limits DHIS2's role as a managerial tool. As highlighted in the qualitative results, participants emphasized the need for broader staff involvement, including consultants and storekeepers, to validate and take ownership of datasets. This reflects findings from Sri Lanka, where inclusive HIS practices improved data quality and strengthened decision-making accountability.[14]

Respondents identified several potential extensions of DHIS2, including a drug utilization database, store management system, monthly laboratory service reporting, and financial database. These proposals align with global discussions on expanding DHIS2 beyond service coverage indicators to encompass supply chain and financial transparency.[20] The call for a financial reporting module is particularly noteworthy in the Bangladeshi context, where accountability in resource allocation remains a persistent concern. Moreover, the suggestion for patient-specific unique identifiers resonates with WHO's advocacy for integrated digital health systems to improve continuity of care and future preparedness for health insurance schemes.[21]

While DHIS2 has enabled near real-time reporting in Bangladesh, its complexity remains a barrier for many users. More than one-third of UH&FPOs reported difficulty using DHIS2 for inpatient planning and referral monitoring. Qualitative findings further revealed that users desire simplified, one-click summary dashboards and mobile-compatible interfaces. This echoes observations from Tanzania and Uganda, where user-friendliness was identified as a key determinant of DHIS2 sustainability.[11,13] Without addressing usability, DHIS2 risks being seen as burdensome rather than supportive.

Implications for Policy and Practice

The convergence of quantitative and qualitative findings underscores the dual reality of DHIS2 in Bangladesh: it is both a powerful tool for improving decision-making and a system still constrained by training, usability, and incomplete integration. Scaling up comprehensive training, simplifying datasets, and incorporating additional modules could substantially enhance its role as a decision support system. Furthermore, linking DHIS2 with performance-based mechanisms such as HSS scores provides an opportunity to incentivize effective use, although our analysis showed no significant relationship between HSS scores and training, education, or experience. This suggests that broader systemic and organizational factors also shape HIS performance.

Strengths and Limitations

The strength of this study lies in its nationwide coverage of all UH&FPOs, complemented by qualitative insights that contextualize quantitative

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findings. The response rate was high, and the mixed-methods design allowed triangulation of results. However, the qualitative component included a relatively small number of key informant interviews (n = 6), which may appear limited. This was addressed by purposive selection to ensure variation and by continuing interviews until data saturation was achieved, supporting the validity of the findings. In addition, the cross-sectional design captures usage patterns at a single point in time and therefore cannot establish causal relationships.

CONCLUSION

This mixed-methods study shows that DHIS2 functions as an important decision-support tool for health service management in Bangladesh, particularly for maternal, child, and community clinic services. However, its full potential remains limited by gaps in data-use capacity, dataset complexity, and insufficient application in key managerial areas. Strengthening managers' ability to interpret and use DHIS2 data, simplifying reporting systems, and expanding managerial modules could improve its effectiveness. Continued policy commitment and investment are essential to transform DHIS2 into a comprehensive platform for evidence-based decision-making across the health system.

RECOMMENDATIONS

- Strengthen data-driven decision-making capacity: Implement regular DHIS2 training for UH&FPOs and relevant staff, using a Training-of-Trainers (TOT) approach, with emphasis on interpreting DHIS2 data, and applying routine health information for evidence-based decision-making.
- Optimize datasets and decision-support dashboards: Develop management-focused datasets and automated summary dashboards, including mobile-compatible interfaces, to enable managers to quickly access key indicators and support timely evidence-based decision-making.
- Strengthen data governance and accountability: Introduce formal validation, authorization, and digital signature mechanisms, ensuring that responsible personnel from the respective service sections where the data are generated verify and sign the reports before submission, thereby enhancing data accuracy, transparency, and shared managerial responsibility.
- Broaden managerial functionalities within DHIS2: Expand the system's operational scope by integrating databases for drug utilization, laboratory services, store management, and financial transactions to support comprehensive and efficient health facility management.
- Enhance surveillance and service planning: Expand ICD coding through DHIS2 from indoor patients to include outpatient and emergency services, enabling a more comprehensive understanding of disease patterns and supporting evidence-based planning, preparedness, and resource allocation at the Upazila level.

Conflicts of interest

The authors declare no conflicts of interest related to the conduct, analysis, or publication of this study.

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