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Users' Perspective of the Implementation of District Health Information System Version 2 (DHIS2) In Nigeria

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Abstract: *Health information system (HIS) is an integral and major thrust of the health system in Nigeria as recognized by the 2006 National Health Policy. In 2010, Nigeria adopted the use of web-based software District Health Information System, Version 2 (DHIS2) as the platform for the National Health Management Information System. The research aim at implementation of DHIS2 in Nigeria while identifying the barriers and facilitators to implementation of DHIS2 in Nigeria A cross-sectional study was conducted on 107 primary healthcare workers across Nigeria. The sample was obtained by a simple random sampling technique. Qualitative data were obtained by a convenience sample selection of DHIS2 leads and focal persons at the LGA, state, and national level for key informant interviews (KII) and Fisher's Exact test to compare impact measures with respondents' characteristics The perspective of the DHIS2 was based on the individual impact of the DHIS2; organizational impact; perception of DHIS2 information quality; perception of DHIS2 system quality; user's satisfaction with the DHIS2 platform; and opportunity for capacity improvement. These constructs demonstrated a good level of internal consistency based on Cronbach's alpha (alpha >0.7) measure of reliability except for the information quality which 76.6% reported to be poor. The findings of this research indicated that this system quality is strong, however, information quality was rated poor which could have contributed to low levels of utilization of DHIS2 data for various forms of reporting. Therefore, Further study is hereby recommended to evaluate the reliability and completeness of data reporting since the operationalization of DHIS2 in Nigeria.*

KEYWORDS: health information, DHIS2, healthcare, facilitators, impact

INTRODUCTION

In the modern world, a Management Information System (MIS) is an integrated system that manages databases, provides computation, offers information to assist operations and management, and provides users with a range of decision-making tools. A MIS uses data analysis to provide information. It uses a variety of academic fields to analyze the data. These include the ideas, concepts, and theories from human behavior, psychology, and management science, which increase its efficacy and utility. These academic fields are employed in the development of decision support systems for modeling and decision-making, as well as in the design of MIS. According to Lippeveld et al. (2000), a health information system is a collection of parts and processes arranged with the goal of producing data that will enhance health care management choices at all levels of the health system. The development of health information systems has seen considerable activity and innovation over the last ten years, largely due to technical advancements and the interest these advancements have sparked in the health sector. Designing solutions that satisfy the requirements of patients and healthcare professionals has advanced.

Successful development and implementation of health care information systems can increase the efficacy and efficiency of healthcare. However, there is sometimes resistance to its implementation, which leads to failure. Finding strategies to make it easier for healthcare businesses to integrate IT is still a significant challenge. An HIS's objective is to enable decisions to be made in a clear, evidence-based manner. Data generation, compilation, analysis and synthesis, and communication and usage are the four essential roles of the HIS. Data from the health sector and any other relevant sector is gathered by the HIS. It transforms the data into information for health-related decision-making after analyzing it and certifying its full value, significance, and timeliness (WHO 2008). Information system is not to query how people do their work rather, to assess the ability of the system to produce valid, reliable, timely, and reasonably accurate information for use by planners and decisionmakers. patients and health workers.

According to Kiber et al. (2014) & Dehnavieh et al. (2024), District Health Information Software (DHIS2) is an open-source, web-based platform that is most frequently utilized in Health Management Information Systems (HMIS) for data collection, validation, analysis, and distribution for all health programs at all levels of the health system. The University of Oslo created it in 1994. More than 76 Low- and Middle-Income Countries (LMICs) currently use it (Braa et al., 2017). By enabling health professionals to use their data to assess their service delivery levels, forecast service requirements, and track and assess health program indicators, it is intended to facilitate decentralized decision-making and health care management (WHO 2010). Therefore, it has been demonstrated that the simple aggregation of health services-related data using DHIS2 supports efficient strategic planning, priority setting, and decision-making in developing nations (AbouZahr, 2005). Health experts found DHIS2 more effective than the paper-based approach, according to data from Bangladesh and Kenya. Instant monitoring, cross-checking, setting priorities, and decision-making are now possible thanks to the deployment of DHIS2, whereas the paper-based approach

required a lot of time (Stansfield et al., 2011). According to Byrne & Seabo (2022), using DHIS2 data for MNCH information management in Sri Lanka has also enhanced the standard of care. The successful implementation of DHIS2 is hindered by a number of issues, including inexperienced health professionals, a lack of technical support, inadequate infrastructure, frequent changes to DHIS2 versions, maintaining both manual and electronic systems side by side, and limited use of data for local-level decision-making (Begum et al., 2020)

Founded in 2010, HMIS is the most popular information platform used in Nigeria to track health service consumption statistics. Since then, it has worked to enhance the standard of data that is routinely gathered from FCHVs and community-level health workers in all of the nation's health institutions (Baral et al., 2021). In 2014, the Ministry of Health implemented web-based online data entry and DHIS2. All district (public) health offices began using the DHIS2 platform for HMIS online reporting in 2016. Similarly, in order to accommodate the most recent federal structure, HMIS online reporting via DHIS2 platforms expanded to several local levels in 2019. While it is currently expanding at the health post levels, almost all local levels have begun reporting through the DHIS2. DOHS (2023).

The significance of health management information systems for evidence-based planning at many levels, including the local level, has been emphasized in several national health policies. In a similar vein, Nigeria's constitution gives local governments the sole authority to formulate policies, plan, make decisions, etc. As a result, both the availability and usage of data at the local level have improved and there has been a considerable demand for data. There have been few studies on the HMIS and DHIS2 despite years of use as a recording and reporting tool in the national health system's HMIS. Additionally, published research shows that the experiences of health professionals with DHIS2 and its data utilization are not well explored in relation to DHIS2 use at the local level. This study investigated the obstacles and enablers to DHIS2 adoption at all levels of Nigerian health systems in order to close these gaps.

METHODOLOGY

Study area

The study area Nigeria is a country in West Africa. It is geographically situated between the Sahel to the North and the Gulf of Guinea to the South in the Atlantic Ocean. Nigeria stretches through 923,769Km^2 with a population of over 211 million. Nigeria has 6 geopolitical zones comprising 36 states and a Federal Capital Territory. In 2013, the 56th NCH resolved to have a NHMIS and one instance for reporting routine health data-DHIS 2. The NHMIS has been implemented into primary, secondary and tertiary health institutions across the 36 states of the nation including the FCT. This study was conducted across the six geo-political zones in Nigeria and the FCT.

Study Population

Data was collected from states that use DHIS2 directly from their health facilities. One state in each geo-political zone and the FCT was selected, the highest reporting LGA was selected from each senatorial district, and 3 health facilities were selected from each LGA. A total of 9 health facilities were randomly selected from each state and 3 from the FCT. The randomly selected states,

Sampling Method

A simple random sampling technique was used to select one state from each geo-political zone and the FCT, three (3) LGAs from each of the states, and three (3) health facilities from each LGA respectively. The randomly selected states, LGAs and health centres. The qualitative method complements the quantitative component of the study to gain in-depth understanding of the implementation of the Nigerian Health Management Information System on District Health Information System 2 (DHIS2) using Key Informant Interview (KIIs).

Ethical consideration

An ethical approval was obtained from Federal Capital Territory (FCT, Nigeria) Health Research Ethics Committee (FCT HREC). The FCT HREC has determined that this research qualifies for expedited review pursuant to the National Code of Health Research Ethics. This approval is valid from 07/04/2022 to 06/04/2023. The participants were assured of their privacy and confidentiality and the information provided throughout the study process.

Qualitative Method

A convenience sample of DHIS2 leads and focal persons at the LGA, state and national level were selected for Key informant interviews (KII). KII was conducted with partner organizations (NPHCDA) and key staff members at all levels to help the researchers understand strategies and best practices related to the implementation of the Nigerian Health Management Information System on District Health Information System 2 (DHIS2). To prepare for the KIIs, a two-day training on qualitative method was organized for participants. Data collectors and supervisors had learnt how to conduct effective KII (including how to probe for additional information), how to prepare for qualitative data collection and how to moderate and manage the interview. Participants observed some mock interviews and practice conducting interviews. This training also included basic elements of qualitative data analysis. A professional transcription service was used to transcribe field notes and recordings of KIIs. Transcripts were reviewed initially by the principal investigator and then by two additional team members. The analysis was first conducted manually, coding and themes were organized in an Excel file.

RESULTS

A total of 107 respondents out of the estimated sample size of 144 completed survey questionnaire yielding a response rate of 74%. Data were collected electronically using the Open Data Kit (ODK) platform. The data were abstracted as a Microsoft Excel document, sorted, cleaned, and loaded into the Statistical Product

and Service Solutions (SPSS) version 23 for final analysis. Key Informant Interview was used in this study to explain the quantitative data collected using questionnaires.

Table 1: Sociodemographic characteristics of Key Informant Interviewees

Variable(s)	Frequency	Percent (%)
Age (years)		
Sex		
Male	2	40.0
Female	3	60.0

N=7

Evaluation of NHMIS on DHIS2

Individual Impact

To measure the impact of DHIS2 on respondents' performance, a 4-item questionnaire based on a 5-point Likert scale was used. Scores ranged from Strongly Disagree scored 1, through Disagree scored 2, Neutral scored 3, Agree scored 4, and Strongly Agree scored 5. The aggregate score for the 4-item instrument ranged between 1 and 20. A score between 16-20 was defined as a "Positive Impact" while a score below 16 is considered a "Negative Impact". (25.2%) of the respondents indicated that the DHIS2 system impacted negatively on their performance while the majority indicated a positive impact (73.8%) of the system on their performance (Figure 1).

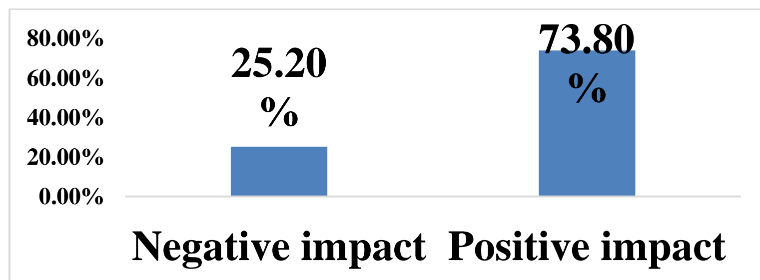

Figure 1: Impact of DHIS2 on Individual Performance

Organizational Impact

A 7-item instrument measured on a 5-point Likert scale was used to evaluate the organizational impact of DHIS2. Respondents who score between 1 and 35 points with an aggregate score between 21 and 35 were considered a "Positive Organizational Impact" whereas a score below 21 was defined as a "Negative Organizational Impact". The majority of the respondents (97.2%) reported that the DHIS2 impacted the organization positively (Figure 2).

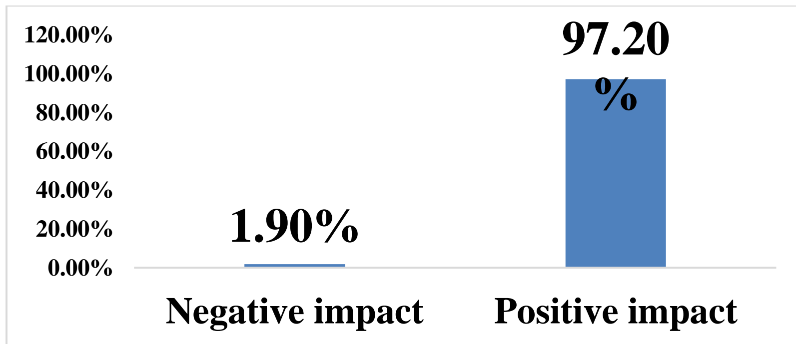

Figure 2: Organisational Impact of DHIS2

Information Quality

Information quality was evaluated similarly with a score between 32 and 45 defined as "good information quality" while a score <32 denotes "poor information quality". It is important to state that the Likert scales were scored based on the summative method. An estimated 76.6% of the participants reported good information quality of the DHIS2.

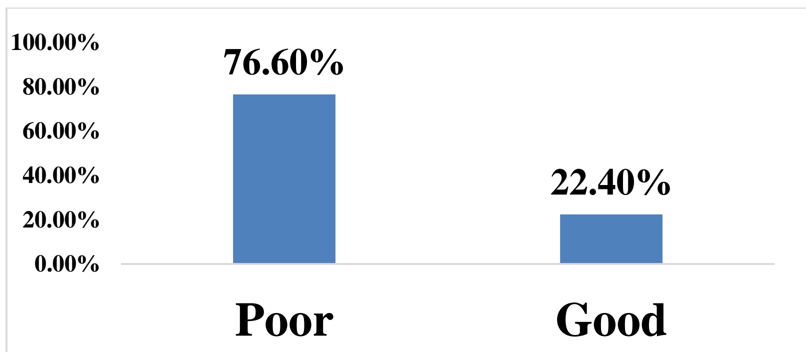

Figure 3: Information Quality of DHIS2 System

System Quality

System quality was evaluated similarly with a score between 32 and 45 defined as "strong system quality" while a score <32 denotes "weak system quality". Generally, 97.2% affirmed to the DHIS2 system quality (Figure 4).

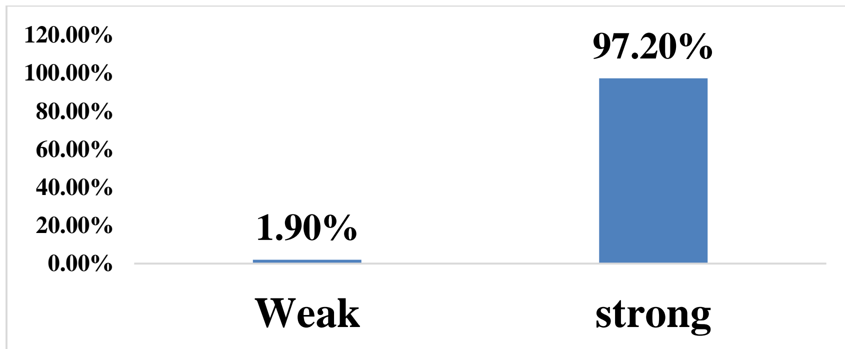

Figure 4: System Quality of DHIS2

satisfaction Level

The satisfaction level of the DHIS2 system was evaluated and as high as a frequency of 103(96.3%) of the respondents were seen to be satisfied with the DHIS2 system. The female respondents recorded higher satisfaction 60 (98.4%) than the male respondents 43 (95.6%).

Improvement Level

The overall improvement of NHMIS by DHIS2 was evaluated and a frequency of 103(96.3%) of the respondents perceived a good capacity improvement opportunity by DHIS2. There is a slight difference between the female respondents who came up with a frequency of 59(97.8%) and their male counterparts with a frequency of 44(96.7%) with no significant difference between the two.

Data Analysis

The comparison between impact measures with respondents' characteristics was tested using the Chi-square test of independence. For variables that violate the assumption for a chi-square test, the Fisher's Exact Test was used in its stead. We hypothesized that satisfaction with dhis2 functionality and performance will be influenced irrespective of the impact measure.

Impact of DHIS2 on Individual Performance

Bivariate analysis indicated a statistically significant relationship ($p<0.05$) between sex, frequency of DHIS2 utilization, and impact of the DHIS2 system on individual performance. More females rated the positive impact than males; the closer the frequency of use, the more likely an individual would report a positive impact of the DHIS2 (Table 2).

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Table 2: Association between key Construct with Respondent's Characteristics

	Impact of DHIS2 on individual performance		
Variable(s)	**Negative impact**	**Positive impact**	**p-value**
Age (years)			
Sex			
Male	21(46.7%)	24(53.3%)	0.001*
Female	6(9.8%)	55(90.2%)	
X2=18.504; df=1			
Years of activation of dhis2 in the facility			
< 1 year	0(0%)	8(100%)	0.081
≥ 1 year	27(28.1%)	69(71.9%)	
FET=3.039; df=1			
Years of experience using dhis2			
< 1 year	0(0%)	9(100%)	1.000
>1 year	2(2.1%)	95(97.9%)	
FET=0.189; df=1			
Frequency of use of DHIS2 platform in the facility			
Once weekly	0(0%	23(100%)	0.001*
Once fortnightly	0(0%)	4(100%)	
Once monthly	24(35.8%)	43(64.2%)	
Once annually	3(27.3%)	8(72.7%)	
FET=14.799; df=3			
Designation/Cadre			
OIC	7(23.3%)	23(76.7%)	0.603
M&E officer	5(26.3%)	14(73.7%)	
HMIS recorder	3(14.3%)	18(85.7%)	
CCO	4(30.8%)	9(69.2%)	
RI provider	8(34.8%)	15(65.2%)	
FET=2.811; df=4			

CCO=Cold Chain Officer; OIC=Officer-in-Charge; M&E=Monitoring & Evaluation; RI=Routine Immunization; FET=Fisher's Exact Test; X2=Chi Square Test; df=degree of freedom; *Statistical significance (p<0.05)

Impact of DHIS2 on the Organization

More males indicated the positive organizational impact of the DHIS2 system compared to females. Additionally, there is no significant difference in the impact of DHIS2 on the organization regardless of the duration of activation or even the duration of use of the platform (p>0.05) (Table 3).

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Table 3: Relationship between the organizational impact of DHIS2 and respondent's characteristics

Variable(s)	Impact of DHIS2 on organization		
	Negative impact	**Positive impact**	**p-value**
Age (years)			
Sex			
Male	0(0%)	45(100%)	0.507
Female	2(3.3%)	59(96.7%)	
FET=1.504; df=1			
Years of activation of dhis2 in the facility			
< 1 year	0(0%)	8(100%)	1.000
≥ 1 year	2(2.1%)	94(97.9%)	
FET=0.170; df=1			
Years of experience using dhis2			
< 1 year	0(0%)	9(100%)	1.000
>1 year	2(2.1%)	95(97.9%)	
FET=0.189; df=1			
Frequency of use of DHIS2 platform in the facility			
Once weekly	2(8.7%)	21(91.3%)	0.129
Once fortnightly	0(0%)	4(100%)	
Once monthly	0(0%)	67(100%)	
Once annually	0(0%)	11(100%)	
FET=6.100; df=3			
Designation/Cadre			
OIC	1(3.3%)	29(96.7%)	0.876
M&E officer	0(0%)	19(100%)	
HMIS recorder	1(4.8%)	20(95.2%)	
CCO	0(0%)	13(100%)	
RI provider	0(0%)	23(100%)FET=2.536; df=4	

CCO=Cold Chain Officer; OIC=Officer-in-Charge; M&E=Monitoring & Evaluation; RI=Routine Immunization; FET=Fisher's Exact Test; X2=Chi Square Test; df=degree of freedom; *Statistical significance ($p<0.05$)

Information Quality

Fisher's Exact Test revealed evidence for the relationship ($p<0.05$) between respondent's designation and perspective on dhis2 information and quality. The majority of the M&E officers had a poor perception of the information quality followed by HMIS recorders. However, there were no significant interaction between age, years of activation and use as well as frequency of use of the dhis2 platform and perception on dhis2 information quality (table 4).

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Table 4: Association between DHIS2 information quality and respondents' characteristics

Variable(s)	Information quality Poor	Good	p-value
Age(years)			
Sex			
Male	35(77.8%)	10(22.2%)	0.929
Female	47(77.0%)	14(23.0%)	
FET=0.008; df=1			
Years of activation of dhis2 in the facility			
< 1 year	7(87.5%)	1(12.5%)	1.000
≥ 1 year	75(78.1%)	21(21.9%)	
FET=0.389; df=1			
Years of experience using dhis2			
< 1 year	7(77.8%)	2(22.2%)	1.000
>1 year	75(77.3%)	22(22.7%)	
FET=0.001; df=1			
Frequency of use of dhis2 platform in the facility			
Once weekly	18(78.3%)	5(21.7%)	0.856
Once fortnightly	4(100%)	0(0%)	
Once monthly	50(74.6%)	17(25.4%)	
Once annually	9(81.8%)	2(18.2%)	
FET=0.972; df=3			
Designation/Cadre			
OIC	27(90.0%)	3(10.0%)	0.019*
M&E officer	10(52.6%)	9(47.4%)	
HMIS recorder	14(66.7%)	7(33.3%)	
CCO	11(84.6%)	2(15.4%)	
RI provider	20(87.0%)	3(13.0%)	
FET=11.339; df=4			

*CCO=Cold Chain Officer; OIC=Officer-in-Charge; M&E=Monitoring & Evaluation; RI=Routine Immunization; FET=Fisher's Exact Test; X2=Chi Square Test; df=degree of freedom; *Statistical significance (p<0.05)*

System Quality

Fisher's Exact Test revealed evidence for the relationship ($p<0.05$) between respondents' designation and perspective on DHIS2 system quality. The majority of the M&E officers had a good perception of the system quality followed by HMIS recorders.

However, there was no significant interaction between age, years of activation and use as well as the frequency of use of the DHIS2 platform and perception of the DHIS2 system quality (table 5).

Table 5: Association between DHIS2 system quality and respondent's characteristics

	System quality		
Variable(s)	**Poor**	**Good**	**p-value**
Age (years)			
Sex			
Male	0(0%)	45(100%)	0.507
Female	2(3.3%)	59(96.7%)	
FET=1.504; df=1			
Years of activation of dhis2 in the facility			
< 1 year	0(0%)	8(100%)	1.000
≥ 1 year	2(2.1%)	94(97.9%)	
FET=0.170; df=1			
Years of experience using dhis2			
< 1 year	1(11.1%)	8(88.9%)	0.163
>1 year	1(1.0%)	96(99.0%	
FET=4.521; df=1			
Frequency of use of dhis2 platform in the facility			
Once weekly	1(4.3%)	22(95.7%)	0.129
Once fortnightly	0(0%)	4(100%)	
Once monthly	0(0%)	67(100%)	
Once annually	1(9.1%)	10(90.9%)	
FET=6.100; df=3			
Designation/Cadre			
OIC	0(0%)	30(100%)	0.082
M&E officer	0(0%)	19(100%)	
HMIS recorder	2(9.5%)	19(90.5%)	
CCO	0(0%)	13(100%)	
RI provider	0(0%)	23(100%)	
FET=4.733; df=4			

*CCO=Cold Chain Officer; OIC=Officer-in-Charge; M&E=Monitoring & Evaluation; RI=Routine Immunization; FET=Fisher's Exact Test; X2=Chi Square Test; df=degree of freedom; *Statistical significance (p<0.05).*

Satisfaction with DHIS2

An estimate of 99% of the respondents using DHIS2 for over 1 year were satisfied with the system; likewise, respondents utilizing the system once fortnightly and on monthly basis. This was statistically significant (p<0.05).

Table 6: Comparison between respondent's characteristics and satisfaction with the DHIS2 platform

Variable(s)	Satisfaction with dhis2 Not satisfied	Satisfied	p-value
Age (years)			
Sex			
Male	2(4.4%)	43(95.6%)	0.573
Female	1(1.6%)	60(98.4%)	
FET=0.741; df=1			
Years of activation of dhis2 in the facility			
< 1 year	0(0%)	8(100%)	1.000
≥ 1 year	3(3.1%)	93(96.9%)	
FET=0.257; df=1			
Years of experience using dhis2			
< 1 year	2(22.2%)	7(77.8%)	0.019*
>1 year	1(1.0%)	96(99.0%)	
FET=13.449; df=1			
Frequency of use of DHIS2 platform in the facility			
Once weekly	1(4.3%)	22(95.7%)	0.023*
Once fortnightly	0(0%)	4(100%)	
Once monthly	0(0%)	67(100%)	
Once annually	2(18.2%)	9(81.8%)	
FET=8.766; df=3			
Designation/Cadre			
OIC	0(0%)	30(100%)	0.163
M&E officer	1(5.3%)	18(94.7%)	
HMIS recorder	2(9.5%)	19(90.5%)	
CCO	0(0%)	13(100%)	
RI provider	0(0%)	23(100%)	
FET=4.352; df=4			

*CCO=Cold Chain Officer; OIC=Officer-in-Charge; M&E=Monitoring & Evaluation; RI=Routine Immunization; FET=Fisher's Exact Test; X2=Chi Square Test; df=degree of freedom; *Statistical significance (p<0.05)*

Opportunity for capacity improvement

Respondents using dhis2 for over 1 year (99%) perceived the system as an avenue for capacity improvement. Similarly, frequency of use interacted statistically significantly with the opportunity for capacity improvement ($p<0.05$) (Table 7).

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Table 7: Relationship between respondent's characteristics and opportunity for capacity improvement using the DHIS2 system

	Opportunity for capacity improvement		
Variable(s)	**Poor**	**Good**	**p-value**
Age(years)			
Sex			
Male	1(2.2%)	44(97.8%)	1.000
Female	2(3.3%)	59(96.7%)	
FET=0.105; df=1			
Years of activation of dhis2 in the facility			
< 1 year	0(0%)	8(100%)	1.000
≥ 1 year	3(3.1%)	93(96.9%)	
FET=0.257; df=1			
Years of experience using dhis2			
< 1 year	2(22.2%)	7(77.8%)	0.019*
>1 year	1(1.0%)	96(99.0%)	
FET=13.449; df=1			
Frequency of use of dhis2 platform in the facility			
Once weekly	0(0%)	23(100%)	0.002*
Once fortnightly	0(0%)	4(100%)	
Once monthly	0(0%)	67(100%)	
Once annually	3(27.3%)	8(72.7%)	
FET=12.840; df=3			
Designation/Cadre			
OIC	1(3.3%)	29(96.7%)	0.439
M&E officer	0(0%)	19(100%)	
HMIS recorder	2(9.5%)	19(90.5%)	
CCO	0(0%)	13(100%	
RI provider	0(0%)	23(100%)	
FET=3.439; df=4			

CCO=Cold Chain Officer; OIC=Officer-in-Charge; M&E=Monitoring & Evaluation; RI=Routine Immunization; FET=Fisher's Exact Test; X2=Chi Square Test; df=degree of freedom; *Statistical significance ($p<0.05$)

Key Informant Interview

For the Key Informant Interview (KII), participants were asked open questions in a specific order to adequately share their perspective on DHIS2. This questioning sequence enabled the participants to give insights into their experiences using DHIS2 for data management. In this way, participants were primed with a perspective type-type response before being asked to recall specific previous experiences that were encountered while using the DHIS2 platform

Outcome of Key Informant Interviews

Qualitative interviews demonstrated critical perspective of DHIS2 implementation in Nigeria. A total of eight (8) themes emerged as described here under.

DHIS2 utilization is a prerequisite to effective NHIMS and by far the most important. Respondents emphasized that "… involved in the training of HCWs, performing data analysis and providing feedback to stakeholders specifically for routine immunization data".

This study found that participants leveraged DHIS2 platform to perform monitoring and evaluation functions. For instance, respondents reported that "…I have a lot of experience using DHIS2. The platform has enabled me to carry out data analysis and visualization for immunization data to disaggregate clients by gender, age, and the due date for the next appointment for vaccination exercise.

Although the need for further training appears to be a pressing need for DHIS2 operators, respondents affirmed the ease of use of the platform. More specifically, findings revealed that "… seem user-friendly compared to other analytical software, and quite easy to use for analysis.

Furthermore, capacity support and training emerged in the KII. Interviewees reported that "…. have received a couple of certificate training on the fundamentals of DHIS2 with other technical support from development partners and consultants on the use of the systems. These are the major opportunities that aid my use of the DHIS2 platform, even though there are no training manuals (Male participant, North). 'Requires competences in terms of using Excel for analytics (Female participant, National). This was followed by a lack of adequacy of the workforce to manage the DHIS2 as reflected with "…lack of sufficient officers on the ground to help resolve data related issues has increased the workload on me…".

Challenges of DHIS2 were reported to include downtimes, poor internet connectivity, and data tools. "… visualization of records for some health facilities for a day or weeks proceed without any issue, but when the process is repeated for a longer period, say, a month, we do see huge discrepancies between the record on DHIS2 and the call-in data which the same facilities report; and sometimes data for periods that have not been reached…". I escalate the issue to the DHIS2 consultants, which take them about 2-3 weeks to resolve the issues…". 'Frequent downtime, poor internet connectivity', data quality dimension cannot be directly addressed by the DHIS2 itself, lack of data tools to complete data entry'.

Dissemination of DHIS2 data "… do you share data from the DHIS2?... Yes, we do share the data from DHIS2 after visualization with the team during weekly and monthly data synchronization meetings". Yes, I report the data at relevant meetings for feedback'. "How do you share it? 'Through phone calls, emails, and meetings''.

Opportunities for enhancing usage "… we need training on how to create the organizational unit". Conduct of advocacy to supply data and work tools (laptops)'

The key Informant review showed that DHIS2 is utilized in performing data analysis and providing feedback to stake holders specially for routine immunization data. There have been a lot of experiences in using DHIS2 for monitoring and analysing data. The platform has enabled me to carry out data analysis and visualization for immunization data to disaggregate clients by gender, age, and the due date for the

next appointment for vaccination exercise (Male participant, north). In the ease of use, the review showed to be user-friendly compared to other analytical software, and quite easy to use for analysis. In terms of capacity support and training, the review showed that the respondents have received a couple of certificate training on the fundamentals of DHIS2 with other technical support from development partners and consultants on the use of the systems. A male participant from the North reported that there are major opportunities that aid my use of the DHIS2 platform, even though there are no training manuals (Male participant, North). This requires competences in terms of using Excel for analytics (Female participants, National). Adequacy of the workforce was seen as a problem as there was lack of sufficient officers on ground to help resolve data related issues and has invariably increased the workload on some selected few. some challenges of DHIS2 reported were huge discrepancies between the record on DHIS2 and call-in data which the same facility reports, some other challenges seen were frequent downtime, poor internet connectivity, data quality dimension no being directly addressed by the DHIS2 itself, lack of data tools to complete data entry. The dissemination of DHIS2 data was done either through phone calls, emails, and meetings; and this was done during weekly and monthly data synchronization meetings. The opportunities for enhancing usage was reported by conducting training on how to create the organizational unit; conduct of advocacy to supply data and work tools (laptops).

Theme Qualitative Results

Individual impact: Respondents were in agreement that DHIS 2 was so far the best health information system they had used. It had improved effectiveness since decisions were now based on better-quality data. However, most said that some areas in DHIS 2 needed improvement.

Organisational impact: Respondents agreed that DHIS 2 had made improved decision-making at their respective districts leading to improved health outcomes. It is now easier to track the progress of each health facility. However, the effectiveness of DHIS 2 is hampered due to some facilities not having computers and/or reliable internet connections.

Information quality: Respondents were not positive about the Information Quality of DHIS 2. Respondents noted huge discrepancies between content from DHIS 2 and the call-in data reported by the same facility which are often due to delays in entering data at the facility level and lack of data tools to complete data entry

System quality: Respondents stated that DHIS 2 was user-friendly and found the dashboard and data visualizer particularly useful. However, respondents emphasized the need for a dedicated helpdesk to address user problems promptly

Satisfaction level: Respondents stated that DHIS2 makes it easy for them to disseminate data after weekly and monthly data synchronization meetings. They also commended the system for impacting on their personal abilities. The user-friendly nature of the software when compared to other analytical tools was also commended.

Improvement level: Respondents stated that there is need for training on how to create the organizational unit. There should also be advocacy to supply data (internet connections) and work tools (laptops)

Discussion

Developing countries like Nigeria are variedly experiencing complex public health challenges under situations of resource and human capital constraints. Nevertheless, strong, and robust health information systems are critical building blocks of any health system and are a particularly useful tool in addressing health challenges thereby improving health service delivery in resource constraint settings. This research sought to investigate users' perspectives of the district health information system-2 (DHIS2) for health data informatics in Nigeria. The perspective of the DHIS2 was based on six key constructions viz.: individual impact of the DHIS2; organizational impact; perception of DHIS2 information quality; perception of DHIS2 system quality; user's satisfaction with the DHIS2 platform; and opportunity for capacity improvement. These constructs demonstrated a good level of internal consistency based on Cronbach's alpha (alpha >0.7) measure of reliability.

In 2010, Nigeria adopted the web-based district health information system 2 (DHIS2) as the official platform for routine reporting of the National Health Management Information System (NHMIS), Shuaib et al., 2019. Since implementation, different states and even health facilities within states commenced implementation at different time points.

In Nigeria, the frequency of data reporting or use of the DHIS2 platform varies with health intervention programme and across health facilities that are predominant users of the system. Unfolding insights from the findings of this research demonstrated that implementing health facilities utilized the DHIS2 platform once monthly. Ideally, facilities document incidence on the manual facility registers on daily basis and thereafter load the data onto the DHIS2 platform latest by the first week of the following month. This could be a barrier to its full implementation as false or incomplete data could be fed into the DHIS2 system. More still, there was strong evidence for the relationship between the frequency of use of DHIS2 platform and its impact on an individual's performance as well as the perception of opportunity for capacity improvement. This suggests that the more frequently the system is being used, the more likely it is to impact positively, and by extension improve the capacity of the user.

Fisher's Exact Test revealed evidence for the relationship ($p<0.05$) between respondent's designation and perspective on DHIS2 information quality. The majority of the M&E officers had a good perception of the information quality followed by HMIS recorders. However, there was no significant interaction between age, years of activation, and use as well as the frequency of use of the DHIS2 platform and perception of DHIS2 information quality.

Satisfaction with DHIS2 platform is well documented. Evidence from Kenya demonstrated that respondents expressed satisfaction with the data entry functionality of the DHIS2 platform similar to a DHIS2 implementation study in Sri Lanka. Manya et al., 2011 and Manoj 2013

This is in line with the findings of this present study which found a high level of satisfaction with the DHIS2 system in light of the poor perception of data quality, Shuaib et al., 2019. The satisfaction compares better with the findings of research conducted among district health information managers in Tanzania which revealed that DHIS2 improved the quality of work of the users. Kimaro ., 2006 and Lungo., 2008.

However, there were potential strategies for improvements brought to light by this research, respondents especially from the key informant interview made it clear various improvement at the National, state and local government level. It was stated that there should be sufficient budget from the national level to drive the implementation and utilization of DHIS2, the government should have a high percentage in the ownership such that they can influence decision making process. Also, the state should be more involved in monitoring and evaluation of the implementation and utilization of DHIS2 across the country. The state should also conduct adequate trainings to combat the low availability of skilled workers. Furthermore, strengthening the technical capacity of staff members at various levels is an ongoing challenge. Staff members across all levels identified improving their overall technical capacity on data collection, analysis, quality, use, interpretation and presentation as a major need.

Interestingly, this study demonstrated that the majority of the respondents had a poor perception of the DHIS2 information quality underpinning the need to explore the user-friendliness and real-time data analytics capacity of the respondents.

CONCLUSION

Perspectives on DHIS2 implementation was favourably good for individual impact, organizational impact whereas perspective on information quality of the DHIS2 system was poor in the light of strong system quality. Satisfaction with DHIS2 implementation was high among the respondents.

Recommendations

The findings of this research indicated that this system quality is strong, however, information quality was rated poor. In Senegal, concerns about information quality have contributed to the low levels of utilization of DHIS2 data for reporting the needs for the national malaria control program. This could be attributed to the fact that, unlike other studies, this research did not ascertain the completeness and reliability of data reporting through the DHIS2 platform in addition to specificity for key programmatic outputs. Further study by researchers is hereby recommended to evaluate the reliability and completeness of data reporting since the operationalization of DHIS2 in Nigeria furthermore, a deeper examination of facility-level zero reporting practices is also warranted as it has been shown elsewhere in sub-Saharan Africa that some facilities fail to report “zero” values in the DHIS2.

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