

“One of the things we really focus on is to make –to avoid a steep learning curve because for some people who are not technically skilled it’s really a big step to go from the safe old paper form. And one of the things we do to ensure that is we try to copy the form as exactly as possible to the system so that they feel comfortable at once...” - Int014

5.9 Funding, Infrastructure and Other Resource Requirements

Getting the use of DHIS2 at optimal levels, especially at health facilities, is very closely linked to availability of funding to support various resources including computing and internet infrastructure, data collection tool, adequate staffing levels and training. The informants were wary of the country’s seemingly over-reliance on donor funding in support of these resources.

“..maybe the government needs to put a lot of funding [aside] so that we don’t also have over reliance of DHIS coming from partners; because otherwise they [health workers] may not have the motivation. But if the directive comes from the government and DHIS is fully supported as a government tool, then nobody will resist it.” - Int005

5.10 Health Worker Orientation & Training

All the informants interviewed had a lot to say about the need for adequate training of health workers if at all they are ever going to use DHIS2 as envisaged. And it is very important that this training be packaged properly depending on the cadre of users who are targeted. The question of just how long the training should be was found to be complex, with some asserting that the one week standard training period is less than adequate, especially considering that most of them will not have had much interactions with computers before hand. The need to rethink the protocol to follow when training the managers was also touched on, primarily because such personnel will neither appreciate being trained by their juniors nor sitting in the same class as their juniors. All were in agreement that when the workers are well trained and sensitized on the benefits of using the system, then this contributes directly to how well they use the system both for their routine work as well as in generation of information products that can aid in relevant decision making. In the words of one of them:

“I think at national level we did not train people, it was a one-two hour presentation of this is DHIS, you can view data here, and you can do maps. Most of the training was done understandably at the facility and for direct users, but then at national level we should have had a more tailored presentation, training and sensitization on exactly what you would expect them to do in DHIS.” - Int001

5.11 Assuring the Information Security

The informants expressed concern about whether Kenya has put in adequate measures to ensure security of the data collected and processed through DHIS2. In particular informants were concerned by the fact that this data is available through open access to any interested party from

any part of the world as soon as it had been entered at the district and health facility levels. This despite the reality that some of the data keyed in is erroneous and has not been validated by the data owners. Some interviewees however informed the researchers that the ministry was in the process of setting up a web-portal that will only contain the validated version of DHIS2 data. In the meantime it was noted that some researchers were already using the available data and misrepresenting the Kenya health situation at international conferences. In the words of one informant:

“...again if you are allowing people to access this data you should be very sure about that data because I went to one meeting and a professor was using DHIS data from Kenya. The guy is from outside the country and he was making a presentation on Kenya in a conference we were in and it was on brucellosis - and he was bringing forth the magnitude of brucellosis in Kenya. In the open access you need to be very careful because people outside Kenya from all over know [think] that is the true situation .You have posted it there, it’s open access so they take that data and they use it. I’m telling you they use it in conferences to [erroneously] project what is happening in Kenya...” - Int007

5.12 Institutional Capacity and Staffing Levels

One of the challenges that continue to plague the health care sector in Kenya is the issue of high workload and low workforce, especially in the lower level health facilities. This compounds the challenge of trying to scale up use of DHIS2 in the country because some rural health facilities have one clinical staff who is expected to attend to several clinical roles in addition to finding time to collect and collate the health information. The situation is not much better at the higher health facilities where the resident HRIO is expected to support roles which are seen as more important than data management, such as patient registration. These challenges are even more complicated by the fact that the managers in charge of these health facilities are in most cases not fully aware of the role of DHIS2 and how it can assist them in their day to day work. Infrastructural challenges in many Health Facilities (HFs) means that even the most proactive ones are unable to access DHIS2 directly for data entry and information use. In the words of an informant:

“..apart from even the skills, the staff are few. So you find like the facility is run by one nurse, she’s a nurse, she’s a pharmacist, she’s everything; it becomes quite hectic for such a facility” - Int020

5.13 Performance Enhancement and Value Addition

Those who have had a chance to interact with DHIS2 agree that the system adds real value to the country’s health data management scene, especially when compared with previous HIS systems. The range of values includes the ease of access to the health information and the timeliness with which that information is available. It also has to do with the ease of report generation especially for the standard charts and reports that are already inbuilt in the system. The added fact that the system is for the most part friendly and easy to use is like an added bonus. Despite the fact that the system was

initially only targeted to report on routine service delivery data from the HFs, DHIS2 has since been used innovatively to report on malaria commodities. This has led to such improved reporting rates that quantification of malaria medicines can now be done based on consumption data. Subsequently, one of the stakeholders affiliated with the malaria program made this comment:

"I would recommend this [DHIS2] for other commodities management as well because the data is in a timely version, you can drill down to the facility level and check which facilities are stocked out and which are not stocked out, in which district or county. I would recommend it for this mostly because it will improve reporting rate and again availability and timeliness of the data." - Int002

However, it also emerged that most of the targeted users are unaware of this value addition and hence are not benefiting as they should from DHIS2. In this regard one informant had this to say:

"The value of DHIS2 for managers has to be promoted aggressively, and the moment that managers see this as directly affecting their work, whether it is resource allocation, making some policy-type decisions and all that, they'll actually start using it and actually start interacting with it. But for as long as they feel like this is a system to be used by health records and information officers, they won't use it." - Int024

5.14 Policy and Legislation on HIS Reporting

The majority of the informants interviewed were very categorical on the need for there to be some form of policy and legislation to guide the issue of health information reporting in the country. They were aware that only when considered holistically can the health information be used effectively for planning and improving public health services in the country. In particular they emphasized the need for the private and Faith Based Organizations (FBO) sectors to be legally bound to provide data on the minimum dataset agreed upon by the Ministry of Health (MoH). Paradoxically, the informants were not sure whether such legislation is in existence already or not, and some clearly stated that if it exists, then it is certainly not being enforced. A few of the informants thought making reporting mandatory might be counter productive, either by causing some to report erroneous data, or to simply be defiant and refuse to report. In the words of one informant:

"It's only a bill ,a health bill put in place that can help us because if we put a bill in place which says that all facilities irrespective of private or non-private ,they are supposed to report so that we can have a clear picture of what is happening in the country , .. if we have a health bill which is emphasizing on health information and reporting, that will bail us out, because as for now even if you go tell private hospitals you are supposed to report ,there is no bill ,you cannot quote any .." - Int003

5.15 Sensitization and Advocacy at Management Level

The key selling point for DHIS2 is not just the fact that it is capable of collating and aggregating reports from all service delivery points in a speedy manner, but more so the fact that health care workers at all levels can be able to access and use this information for appropriate decision making. Yet according to this research's informants, very few healthcare managers were sensitized on this aspect of DHIS2, with most viewing it as a tool for the HRIOs and the program M&E officers. The situation is more dire now with the establishment of the county government. If the governors and County Health Executives are not sensitized on the role of DHIS2, they may view it as a tool for the central government and not embrace it as expected. Given their administrative roles, training and sensitization for the management teams needs to be handled with care to ensure observation of all protocols. Some words of wisdom from one informant emphasized this point as follows:

"I think it's just a matter of engaging the leadership and telling them we have a system like this and you are the people who are supposed to be using your own data so please make sure all the reports are uploaded, people are analyzing their data and using their data. You just need to sensitize them." - Int013

5.16 Technology Enhancement, Hosting and Clarity of Roles

While acknowledging that there is a lot of value add and performance enhancement achieved by using DHIS2 even in its current status, a lot of informants were of the opinion that there is still a lot of enhancements that can be added to the system. Among other suggestions, these ranged from improving the DHIS2 user interface, to rethinking the datasets currently defined in the system, to encouraging and improving the automated data analysis within the system; and to using some appropriate technology to eliminate the need for intermediary reporting for the health facilities. Inevitably these suggestions were also linked to the question of whether local capacity exists at the Division of HIS to support these enhancement requirements. Another issue that caused a lot of concern among the informants is the question of where the DHIS2 server for Kenya's data should be hosted. Some were concerned that hosting this outside of the country would be going against the country's e-health policy and probably be a source of security risk for the data. Others argued that these security fears were unfounded, and pointed out that since the hosting was moved to a local Mobile Service Network Operator's cloud after initial hosting abroad, the system has undergone service degradation both in terms of access bandwidth and information processing capacity. Finally some informants were uncomfortable with some aspects of the manner in which the MoH and its implementing partners are collaborating, calling for more openness and clarity of roles. To quote two comments on this subject:

"..as DHIS grows everyone is seeing the potential, we are even moving commodities management into DHIS. The national level probably needs to rethink on how they are

managing DHIS. I think currently we haven't thought about who manages DHIS in the sense that the HIS team expects health programs to be looking at their data [to detect data entry errors]; but even as HIS what are they doing in terms of managing DHIS data quality? Do they have an internal system in place to say so-and-so is in charge of commodity data and so should make sure they know what is happening, and to prompt program or prompt facility when they notice data errors..." - Int001

"...the local Mobile Service Network Operator can say yes we have the cloud computing but it doesn't meet the requirements of the client... To me it was better [when running in the other cloud] in the sense that it was providing us with high speed you don't have internet down times, everything was running smoothly so that means as a provider, they were really adhering to the client, but if you have a provider who is giving you half baked products you cannot sustain the business..." - Int023

6. Discussion

Research on user acceptance and use of ICT has been done extensively over the past decades. Such research has generated many competing models originating from different theoretical disciplines such as psychology, sociology and information systems, as well as different sets of determinants perceived to influence acceptance or use of ICTs. The most popular technology acceptance models based on social psychology perspective have identified some common determinants of acceptance of technology, looked at from each individual's perspective [18–20].

Though user acceptance studies especially in the health sector have mostly been done in developed countries, this research confirmed that many of the identified technology acceptance determining factors are indeed still relevant in the developing countries' context. Additionally there are some determinants that are unique to the developing countries context and some just for the Kenya context alone. Table 1 summarizes the factors that were found to be pertinent in influencing acceptance and scale up of use of DHIS2 in Kenya. The factor names and definitions are adapted from the Unified Theory of Acceptance and Use of Technology (UTAUT)[20].

Table 1: Pertinent Factors that Determine DHIS2 Acceptance and Scale-up in Kenya

Pertinent Factors	Role in Acceptance and Scale up of DHIS2 in Kenya
Performance Expectancy – defined as degree to which an individual believes that using DHIS2 will enable him or her to attain gains in job performance	For them to accept DHIS2, targeted users need to be sensitized on value-add they may expect from using the system. Some value-add items identified include: <ul style="list-style-type: none"> Use for mandatory data entry and reporting Facilitation of decision making based on service delivery data in the system e.g. a health facility could review its workload as reported in DHIS2 to inform its decision on hiring of additional health workers;

	<ul style="list-style-type: none"> Enabling facilities, sub-counties and counties to make decisions on need for commodities based on prior consumption and patient load as recorded in the system
Effort Expectancy - defined as the degree of ease of use associated with the use of DHIS2	DHIS2 is easy to use and this should encourage easier adoption of the system. There is however need to ease the web navigation process especially for new users
Computer Anxiety – defined as the degree to which anxious or emotional reactions are evoked when using computer technology	Intensity of this anxiety was found to be influenced by age as well as the level of prior computer experience among the intended users. Thus exposing targeted users to practical sessions on general computer use before introducing DHIS2 could serve as a mitigating factor.
Social Influence – defined as the degree to which an individual perceives that his or her peers, supervisors, and important others believe he or she should use DHIS2	Social influence was found to play a key role in user acceptance of DHIS2, manifesting itself in the form of: <ul style="list-style-type: none"> Culture among health workers that causes them to follow their leaders almost blindly Practice of passing on information orally instead of recording it Habit of delaying performance of activities till the very last minute e.g. preparation of monthly report Emphasis on the need to have a champion(s) that health care workers can look up to in using the system
Training Adequacy – defined as the degree to which an individual believes that the training he or she received is enough to enable him or her use DHIS2 effectively.	Perceived adequacy of Training was sited as a key determinant of the actual use of the system. Some aspects of adequate training as identified in this study include: <ul style="list-style-type: none"> The need for the trainers to be selected appropriately as not everyone can make a good trainer Adequate duration of training
Organizational Facilitating Conditions – defined as the degree to which an individual believes an organizational or technical infrastructure exist to support use of DHIS2	Facilitation that can support faster adoption and scale up of DHIS2 use includes: <ul style="list-style-type: none"> Provision of appropriate computing infrastructure and internet access Conclusively addressing the issue of high workload and low workforce in most health facilities

Factors such as performance expectancy, effort expectancy, training adequacy and organizational facilitating conditions have been tested and found to be pertinent for acceptance of technology in developed countries as well. However training adequacy and computer anxiety may be more salient in Kenya and other developing countries' context because of the prevalent challenges of lagging behind in computerizing of health systems in these countries. Perhaps as recommended by some of the informants, it would be better that training on basic computing skills is integrated into all pre-service training curriculums for healthcare workers.

While identifying the potential for value-addition to be derived from use of DHIS2, respondents were of the opinion that the system is currently being used sub-optimally, mostly for mandatory reporting. There is therefore need for targeted users to be sensitized and trained on data demand and information use (DDIU) aspects, and for advocacy efforts to be made to cause a change in behavior of health workers in this aspect.

The role played by immediate supervisor or regional managers in motivating or de-motivating the use of DHIS2 among health workers is recognized as very important. Lack of appreciation for the system by these higher cadres of staff will trickle down and negatively affect other health workers' acceptance of the system. The senior health workers can be influenced to appreciate the system by sensitizing them on the expected benefits of using DHIS2. Similarly, it is important to ensure that those planning scale-up of DHIS2 improve on the sensitization and training of health workers by selecting appropriate trainers and undertaking pre and post training evaluations to capture participants' perception of training adequacy

As much as possible, health facilities should be empowered to key in their data directly rather than the current practice of delivering manual reports for sub-county HRIOs to enter in DHIS2. A sense of ownership and actual use of DHIS2 data would be encouraged if this facilitation was adequately provided. Other facilitation that needs to be enhanced is the issue of prompt provision of technical support as and when required.

There was divided opinion on the role of gender in acceptance and use of DHIS2. Divergent views were also expressed on whether use of the system should or should not be made mandatory for all healthcare workers. It would be interesting to empirically test the contribution of these and other factors in a future study.

On the issue of the inadequacy of local technical support for the DHIS2, the University of Nairobi, School of Computing and Informatics is currently building an adequate level of technical skills to mitigate this shortcoming. This process of capacity development is being facilitated by the USAID AfyaInfo project and the Ministry of Health.

Finally proper legislation needs to be enacted and enforced to ensure that reporting on a select number of national and international health indicators is done consistently from NGO, Private and Public sectors, as well as from the 47 counties. In addition, there is need to put in place a data governance framework to manage issues such as data security, sharing and access.

7. Conclusion

Implementation of DHIS2 in Kenya has presented an opportunity for the country to move from the era of unreliable and fragmented HIS systems to the more ideal situation of availability and use of quality health information for decision making. This potential can only be realized if the identified challenges are addressed, starting with the need for the health managers in the country to take up proactive leadership in demand for and use of DHIS2 data

for decision making. Instigating a culture change that will cause health managers throughout the system start to use the DHIS2 data directly for informed decision making, rather than assuming the system belongs to the Health Records officers is long overdue.

The other challenges that call for urgent attention include the inadequate infrastructure especially at the health facility level, generally low computer proficiency among some health workers, inadequate health facility staffing levels, as well as the still unmet demand for better quality and more complete health data. The DHIS2 in-country technical support capacity will need to be strengthened to make it more responsive and efficient, and capable of addressing new user needs and technology enhancement requirements that emerge with increased use of the system. Additionally there is need to ensure that the DHIS2 data accessible to end users is validated and verified to avoid making erroneous representation of the country's health status. And while recognizing the need for the country to feel secure concerning the hosting of its routine health information, the benefits of local hosting need to be weighed against any degradation in access and performance of the system, two factors that have the potential to derail the scale up of DHIS2 in the country.

The ongoing implementation of devolved systems and services in the country can prove advantageous if the opportunity is seized to proactively sensitize the county health management teams on how DHIS2 can facilitate their monitoring, evaluation and reporting on best practice health indicators. The buck stops with the national and county governments to ensure that proper legislation is enacted and enforced to ensure health reporting and accountability by all players in the health sector.

8. Future Scope of the Study

This study was undertaken as a first phase in investigating the determining factors of computer technology acceptance and use by health workers in Kenya. In the next phases of the study, a conceptual model based on the Unified Theory of Acceptance and Use of Technology (UTAUT) is developed to explain the complex relationships between these factors. The model will subsequently be tested and validated using Structural Equation Modelling (SEM) and a large enough sample size to enable generalization of the findings and the recommendations.

9. Acknowledgement

The authors would like to thank the respondents who generously extended their time for the interviews and openly shared their opinion on the subject matter. Without them it would have been impossible to accomplish this work. In addition we acknowledge support for our work received from the Ministry of Health's Division of Health Informatics and M&E and from USAID AfyaInfo project, the key stakeholders in implementing and institutionalizing the DHIS2 in Kenya.

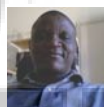
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