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Towards Implementing a Nationwide Electronic Health Record System in Nigeria

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Raouf N.G. Naguib, Coventry University, UK
N. Wickramasinghe, RMIT University, Australia

ABSTRACT

The World Health Organization identified inadequate Health Information Systems as a challenge in Nigeria. Many developed countries have either implemented or are in the process of implementing an Integrated Electronic Health Record (EHR) system because of its potential benefits. Pilot projects in many developing countries like Kenya, Malawi, Peru, and Haiti are demonstrating the viability of EHR in resource constrained areas. This study shows that the health system in Nigeria is pluralistic and complex with Federal, State and Local Governments, Health Related Agencies, Non-Governmental Organizations, private healthcare providers, patients, and researchers as the major stakeholders. The drivers for adoption of a nationwide EHR include the need to report data; improve patient safety, improve work place efficiency; comply with government reforms aimed at reducing the cost and increasing access to health services. Corruption, poor coordination among stakeholders, and lack of constant supply of electricity are some of the barriers to a successful implementation of a nationwide EHR. Factors considered critical to a successful implementation of a nationwide EHR include enforceable legislation, a trained and motivated workforce, and significant and sustainable funding.

Keywords: Health Care, Health Services, Health Information Systems, Implementation, Nigeria

1. INTRODUCTION

Nigeria, with a population of over 140 million is the most populous country in Africa. It lies in the Gulf of Guinea in West Africa and runs a presidential system of government. It is made up 774 local government areas divided into 36 states and a Federal Capital Territory. According to the national statistics, there are 17,068 health facilities, out of which 151 (representing less than 1%) are owned by the Federal Government, 1,385 (8.1%) by the State Governments, 7,580 (44.4%) by Local Government Areas, 579 (3.4%) by communities and religious organization, while the remaining 7,373, or 43.2%, are privately owned (National Bureau of Statistics, 2007). Public expenditure on health is under $10 per capita compared to the $34 recommended internationally. Private expenditure is estimated to be over 70% of the
total health expenditure with most of it coming from out-of-pocket expenditures in spite of the endemic nature of poverty in Nigeria (Federal Ministry of Health, 2004).

Despite its growing income from the rising cost of crude oil in recent years, which is the mainstay of the Nigerian economy, its health indices have remained abysmally poor. The World Health Report 2000 ranked Nigeria 187 out of 191 countries for health service performance. No significant improvement has occurred since then. For instance, Infant Mortality Rate has in fact deteriorated. It was 85 per 1000 live births in 1982, 87 per 1000 live births in 1990, 93 per 1000 live births in 1991 and 110 per 1000 live births in 2007 (World Health Organization, 2008).

Part of the challenges facing the Nigerian health system as identified by the World Health Organization (WHO) is an inadequate health information system for monitoring and analysis of health indicators (WHO, 2009b). The existing health information system in Nigeria, as described by the NHMIS Policy Document, is characterized by extensive duplication of data collection, entry and analysis (no fewer than 50 data forms are in use at the Federal level alone); multiple data pathways; lack of standard case definitions; lack of clarity with regards to data submission and responsibilities; inadequate quality control measures; inadequate and ineffective staff training in data analysis, interpretation and use at all levels; misreporting of conditions, poor understanding, low confidence and acceptability; weak monitoring, evaluation and managerial capacity at the periphery and the absence of a strong central coordinating institutional framework (Federal Ministry of Health, 2006).

As evidence continues to emerge of the ability of EHR to radically transform medical practice, many developed countries have either implemented or are in the process of implementing an integrated EHR system because of its potential to improve the safety and quality of healthcare, reduce costs and enhance efficiency. Even some developing countries have pilot projects of implementation going on. For instance, the District Health Information System (DHIS), a flexible, open source, free software developed for public health management information systems by the international HISP group, has been piloted in South Africa, Mozambique, Tanzania, Malawi, Ethiopia, Vietnam and India (World Health Organization, 2010).

A nationwide health information system will, among other benefits, enable data to be accessed and shared at multiple sites, backed up automatically at more than one site, and extend the possibility of debugging and upgrading of remote sites over the internet without physically visiting the site (Fraser et al., 2005). Other benefits, not necessarily linked to the wide area network, include the promotion of evidence-based practice, reduction of medical errors, promotion of knowledge sharing and reduction in cost of health services through increased efficiencies and collaboration (Gailmard, 2009). However, the rate of EHR adoption is generally considered very low, partly because of a dearth of reliable evidence on its benefits, few success stories of large scale implementation and the associated cost. With the viability of such projects in developing economies now being demonstrated (Fraser et al., 2005; Williams and Boren, 2008), the rapidly growing coverage of mobile telephone services (Pyramid Research, 2010), the emerging low cost information and communication technologies, perhaps Nigeria should begin to look to a nationwide electronic health record to help integrate the health system and generate the much needed reliable health data for research, budgeting and allocation of resources as well as monitoring and evaluation of intervention programmes.

A nationwide EHR which is an integrated patient-centric health record will provide a longitudinal view of an individual’s key health history and care, including physician visits, hospitalizations, diagnostic images and reports, laboratory test results, prescribed drugs and immunizations (Canada Health Infoway, 2008). Its nationwide implementation brings to the forefront further challenges such as data exchange standards, data security and confidentiality issues.
2. Methodology

The research is an exploratory study which uses a multiple case design with replication logic by considering each case study to be a separate sub-inquiry. It uses the different components of the Nigerian Health System (the Federal, State and Local Governments, Private and public healthcare providers, health insurers and Non-Governmental Organizations) to gather data from different sources while trying to unravel the complexities and the contextual sensitivities of adopting and successfully implementing a nationwide electronic health record in Nigeria.

2.1. Participants

Participants were recruited based on their use or generation of health records and a perceived knowledge of the subject. Some participants were designated by their organizations to speak to one of the authors (JP), while others were recruited by other participants and through the network of the author’s friends and colleagues gathered over nine years of practice as a physician in Nigeria. An introductory letter from Coventry University was expedient in gaining access to some organizations.

2.2. Sample Size

There was no predetermined sample size prior to the start of the study. Participants were strategically selected before seeking access to them. All those who consented were interviewed within a set time frame. A total of 39 participants were involved in the study. These are outlined in Table 1 and included 13 physicians, 2 pharmacists, 4 nurses, 5 laboratory scientists, 8 data managers (Disease Surveillance Notification Officers, Health Planning Officers, Medical Record Staff, HMIS Officers) and 7 patients. Table 2 gives the number of respondents at each level of the healthcare system.

Six national documents were reviewed including:

1. National Health Management Information System: Revised Policy – Programme and Strategic Plan of Action;
4. The National Health Bill 2008;
5. National Policy for Information Technology; and

2.3. Data Collection

Data collection for this study was carried over a three-month period between February 2010 and April 2010, using a range of data collection methods and a number of data sources. Data collection started with the review of policy documents related to the health information system and e-health in Nigeria.

<table>
<thead>
<tr>
<th>Designation</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physicians</td>
<td>13</td>
</tr>
<tr>
<td>Pharmacists</td>
<td>2</td>
</tr>
<tr>
<td>Nurses</td>
<td>4</td>
</tr>
<tr>
<td>Laboratory Scientists</td>
<td>5</td>
</tr>
<tr>
<td>Data Managers</td>
<td>8</td>
</tr>
<tr>
<td>Patients</td>
<td>7</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>39</strong></td>
</tr>
</tbody>
</table>
The main method of data collection was semi-structured interview which ranged between 1 to 2 hours with triangulation from JP’s observations during the interview session and a review of policy documents and data collection tools. The first few interviews were used as a pilot study after which questions which were considered repetitive and ineffective to lead meaningful discussion were identified.

To confirm or clarify some view points, multiple people within the same organization were interviewed and further information was verified by going through their records and documents such as data collection instruments and newsletters.

### 2.4. Data Sources

Multiple sources of evidence during the data collection process were used to gather converging evidence. These include: documents; records; interviews and direct observations.

### 2.5. Ethical Consideration

The project was reviewed and approved by Coventry University. Each participant was assured of the confidentiality of their personal data.

### 3. FINDINGS

#### 3.1. Major Stakeholders for an Electronic Health Record

The stakeholders identified for the implementation of the Nationwide Electronic Health Record in Nigeria include the Federal, State and Local Governments, Non-Governmental Organizations and the private sector which include the private clinics and hospitals, faith-based healthcare providers and traditional healers.

##### 3.1.1. The Federal Government

The Federal Government through the Federal Ministry of Health ensures the development and implementation of national health policy, the adherence to norms and standards in the training of health workforce, the monitoring and evaluation as well as analysis of health status, and performance of the functions of all aspects of the National Health System. It also conducts and facilitates health systems research in the planning, evaluation and management of health services as well as ensures the provision of tertiary and specialized hospital services through its various agencies and departments.

### Table 2. Number respondents at each level of the healthcare system

<table>
<thead>
<tr>
<th>Level of health system that employs respondent</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Primary Health Facility</td>
<td>4</td>
</tr>
<tr>
<td>Secondary Health Facility</td>
<td>8</td>
</tr>
<tr>
<td>Tertiary Health Facility</td>
<td>5</td>
</tr>
<tr>
<td>Private Health Facility</td>
<td>3</td>
</tr>
<tr>
<td>State Health Related Agency</td>
<td>2</td>
</tr>
<tr>
<td>Federal Health Related Agency</td>
<td>4</td>
</tr>
<tr>
<td>State Ministry</td>
<td>1</td>
</tr>
<tr>
<td>Federal Ministry</td>
<td>1</td>
</tr>
<tr>
<td>Non-Governmental Organization</td>
<td>4</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>32</strong></td>
</tr>
</tbody>
</table>

*Total is 32 due to 7 patients not being represented in this table.*
These Agencies and Departments include: Federal NHMIS branch, National Health Insurance Scheme (NHIS), National Primary Health Care Development Agency (NPHCDA), National Pharmacovigilance Centre; National Population Commission (NPC) and National Bureau of Statistics (NBS).

These are some of the agencies in Nigeria that collect health data in the discharge of their statutory responsibilities. They often have to have their own manpower or a dedicated focal person in the different organizations or facilities they require health records from in order to ensure that they get reliable data. There is a consensus among all respondents from all the three tiers of government, through which data flow, that data reporting is inconsistent, often discrepant and unreliable.

3.1.2. The State Government

The State Government is responsible for the provision of secondary health services in the country. Through its Ministry of Health, the State Governments partner with the Local Governments to ensure the provision of services and the reporting of the same to the national level.

3.1.3. The Local Government

The Local Governments with support from the State Governments are responsible for the provision of primary health services.

3.2. Data Flow

Data reporting to the Federal Ministry of Health through the Federal Health Management Information System is captured using six forms and reported to the appropriate authorities. Figure 1 shows a schematic representation of the data flow.

3.3. National Initiatives and Policies

There is currently no nationwide Electronic Health Record in the public health system in Nigeria. However, the study identified a non-governmental organization involved with a specific disease intervention programme which has a wide area network connecting about 12 health facilities across the country. One tertiary health centre visited has a local area network through which health summaries and demographics of patients can be accessed at multiple points within the facility. This hospital is however yet to have the laboratories connected to the network and does not share data with any outside organization. Many standalone applications used for storage and retrieval of health data are springing up in some public and private health facilities.

This study did not identify a specific policy on electronic health records. However, there is a National policy for Information Technology with one of its stated objectives as improving the healthcare delivery system through the provision of a national databank for online national healthcare information administration and management at primary, secondary and tertiary levels. The National Health Bill before the National Assembly contains about patient confidentiality, access to health records, protection of health records and what constitutes unauthorized access to health records when they are stored electronically.

3.4. Major Drivers for a Nation-Wide EHR in Nigeria

The major drivers for the adoption of a Nationwide Electronic Health Record in Nigeria include the need for patient safety, increased access to services, disease notification and surveillance, improved efficiency in the delivery of health services, meeting requirements of funding organizations, health sector reform programme, research purposes, the need to reduce the cost of health services, pressures from international development partners and regional organizations.

3.4.1. Need to Improve Patient Safety

Although there are no records kept of medical errors or near misses, most of the respondents agree there are several cases of human errors of omission and commission. These errors,
according to the respondents, range from mis-filing laboratory results of patients, through missing test results, to even doubtful and fake test results. There are even cases of one medical record being used by many family members. For example, one respondent describes how a patient not covered by the National Health Insurance Scheme presented with the folder and case notes of his relative who was covered by the scheme in a bid to avoid the cost of the services.

Some respondents also identify the ability of colleagues to easily seek second opinion, the ease of access to previous records and its contributions in decision making as some reasons why EHR should be implemented.

3.4.2. Need to Improve Efficiency in Health Service Delivery

Patients spend a lot of time in the hospital but very little of that time is spent on consultation with a doctor or undergoing a procedure or test. These inefficiencies result from repetitive tasks such as having to give their personal data at every point of care or test, coming to the hospital for follow up only to discover their test result is not ready, having to wait for their folders or test results to be traced, time spent by health personnel filling forms and making documentations and frequent interruptions of health personnel who spend part of their time making clarifications or responding to enquiries from patients and colleagues.
One of the respondents described how an issue with a prescription order will require him leaving his station to trace the doctor that gave the prescription order just to resolve the issue because of lack of communication equipment or inability to identify who ordered the prescription.

3.4.3. Pressures from Programme Sponsors

Sponsors of disease specific interventions require data for monitoring and evaluation of their intervention programmes and as a requirement for continued sponsorship of the programme. This has caused the fragmentation of the health records of patients into the different disease programmes or health centres visited by the patient. For example, one respondent acknowledged that the immunization history of a child is often not reliable, especially when that child is brought to the hospital by any person other than an educated mother. Meanwhile the records of such a child are held up at locations where they have very little value as far as making decision that directly affects that child is concerned.

3.4.4. Health Sector Reform Programme

Programmes like the National Health Insurance Scheme, Pharmacovigilance, birth and death registration and an integrated disease surveillance and notification system were either established or reinvigorated as part of the health sector reform. These programmes generate, manage and share health data for decision making, policy formulation and allocation of health resources.

3.4.5. Need to Reduce the Cost of Health Services

Many of the respondents believe the implementation of a nationwide EHR system will reduce the cost of health services to the payers by reducing the need for repeat tests or procedures, reducing medical errors and their attendant costs, as well as reducing the cost of unnecessary hospital visits.

3.4.6. Improved Access to Health Services

Many of the respondents declared that some patients have to travel some distance in order to access health services in the hospital in which they are registered or where their records are kept. Some of these services, such as refill of drugs, can easily be delivered at their locality or closer to them if their records can be accessed.

3.4.7. Disease Notification and Surveillance and Health Data Reporting

This study identifies over 30 different forms for the collection of data including Disease Notification Forms, forms for capturing immunization services, family planning services, laboratory request forms for various disease-specific programmes, summary forms for reporting data of various disease-specific programmes, forms for reporting consumables, birth and death registrations forms, referral forms, etc. Most of these forms have different formats and a health worker may have to fill several of these forms for a single patient.

The various health data sources identified include: Vital Events Registers, data from routine health services in health facilities, Epidemiological Surveillance data and data from specific-disease registers.

3.5. Perceived Barriers to a Successful EHR Implementation

The barriers to a successful implementation identified by the study include: misappropriation of funds, corruption, tribalism, lack of funds, difficulty in getting all stakeholders consent, lack of constant supply of electricity and the lack of a conducive work environment.

Respondents described how tangible infrastructure projects such as buildings and roads are preferred by politicians as they are
more popular with the electorate than service improvement projects whose benefits are not obvious to everyone. Funds meant for projects are often frittered away by corrupt public officers and nepotism manifested in appointments and postings in public service, under the guise of ensuring a fair representation of all the regions of the country, instead of professionalism and competence.

Budget implementation is often problematic and funding of projects can be delayed or suspended due to competing priorities, weak procurement processes, corruption or a lack of capacity to implement the budget.

Supply of electricity is epileptic and many public institutions can only afford a few hours of electricity on generators each workday.

The private healthcare sector is largely unregulated and private healthcare providers, although under obligations to report health data are not sanctioned for failing to do so. For example, in one of the States used in this study, only 58.3% of the health facilities within the State, mostly government owned, report data to the State Ministry of Health regularly.

3.6. Critical Success Factors for EHR Implementation in Nigeria

A summary of some of the factors considered critical for the successful implementation of a nationwide EHR system by most of the respondents is as follows: a trained and motivated workforce; the political will by government and managers of the health system; significant and sustainable funding; IT equipment and infrastructure; security of infrastructure; a conducive work environment; a legislative and regulatory framework that prescribes a transparent procurement process; incentives for the adoption of EHR and sanctions for failing to adopt EHR or meeting set standards.

Some respondents raised concerns of how previous government programmes have failed shortly after implementation at significant cost to the government for various reasons such as nepotism, corruption and poor project management. Other issues raised include sabotage by those considered to be in opposition to the management or government of the day, a weak procurement process that allows those awarding contracts to hijack such contracts and deliver a poor quality job without serious sanctions, and failure of successive governments to fund projects not initiated by them.

4. DISCUSSION

The multiple stakeholders in the Nigerian health sector especially the activities of many Federal Government ministries, departments and agencies (MDAs), and the non-governmental organizations appear uncoordinated and have led to the emergence of disparate information systems. This is compounded by the lack of national standards and legislative framework for the implementation of Electronic Health Records in Nigeria.

While there is a Revised National Health Policy, the absence of a National Health Act that will give legal backing to the policy has led to a situation where the absence of proper delineation of responsibilities among the three tiers of government leads to extensive overlap of functions, duplication of efforts and a waste of scarce resources.

The existing health information system in Nigeria is characterized by extensive duplication of data collection, entry and analysis; multiple data pathways; lack of standard case definitions; lack of clarity with regards to data submission and responsibilities; inadequate quality control measures; inadequate and ineffective staff training in data analysis, interpretation and use at all levels; misreporting of conditions, poor understanding, low confidence and acceptability; weak monitoring, evaluation and managerial capacity at the periphery and the absence of a strong central coordinating institutional framework (Federal Ministry of Health, 2006).

Even though this description preceded the implementation of the Integrated Disease Surveillance System, this study found that very little has changed since then. For instance,
the harmonization of multiple data collection instruments of different stakeholders at the instance of the Federal Ministry of Health into six major NHMIS reporting forms and less than ten programme-specific registers still leaves over 20 others forms for data collection at the facility level. The harmonized reporting forms are now made up of multiple pages and many data elements with many of the information on the forms redundant. This discourages the filling of these forms and makes the extraction of relevant data for analysis cumbersome.

In a study conducted by Taraba State Health System Development Project II, out of a total of 48 sampled health facilities across the State, only 28 (representing 58.3%) reported data regularly to the State Ministry of Health (Taraba State Ministry of Health, 2009). Similarly, the 2009 Analysis of State Report submitted to the Federal Ministry of Health shows that only 20 States and the Federal Capital Territory (FCT) submitted data to the Federal Ministry of Health in the first semi-annum (January – June) of 2007, representing 74%. However, only 11 States out of the 21 (52.4%) that submitted data had reports from all the LGAs in the State (The National Health Management Information System (NHMIS) Branch, FMOH, 2009).

Privately owned health facilities comprise about 43% of all health facilities in the country (National Bureau of Statistics, 2007) yet remain largely unregulated and contribute very little to reported national data.

Furthermore, errors on data capture forms require the consent of all the stakeholders these forms serve. Some respondents also reported cases of shortage of supply of some of these forms, resulting from the lack of ownership of the data gathering process.

The number of identified stakeholders for a nationwide electronic health record is an indication that the health system depends on vertical programmes by concentrating on a few well-focused interventions as an effective way to maximize the effect and time response of the available resources rather than waiting for changes in the health system so that the delivery of better services can be viable (Atun, Bennet, & Duran, 2008).

However, achievements of vertical programmes will ultimately be constrained by overall health systems bottlenecks, making integrated health systems strengthening a more sustainable option. For instance, this study found over ten vertical health programmes with no structures that will ensure integrated care for the clients or patients they deal with.

Even though attempts have been made to reform the health sector, an integrative health system will help reduce the pressure to keep creating agencies for specific interventions with each organization having to invest resources in mechanisms for its health data generation.

The absence of a unique national number for the identification of patients in such a pluralistic health system, coupled with the high mobility of patients from one service or facility to another, leads to the duplication of health records. This makes the data generated from such a system unreliable and invariably contributes to the poor data use culture.

There seems to be an enthusiasm for the introduction of the EHR system by many of the respondents. However, there are concerns raised by a few of the respondents about the likelihood of failure due to the present system, which is "less complex", having already failed and, as such, a “more complex” system such as the EHR is also likely to fail.

Although an EHR may look more complex than the present system and has been shown to initially increase the time spent to achieve a task, if a properly designed EHR is able to ensure accuracy by enforcing constraints during data entry, then this will enhance the quality of data entered and reduce harm to patients due to a reduction in medical errors (Gailmard, 2009).

A nationwide implementation of EHR will no doubt come at a cost and this has been identified as a barrier to its implementation by many of the respondents. However, the lack of basic infrastructure in Nigeria also makes the current system equally expensive. In one State, LGA HMIS Officers are given motorcycles.
to go round the health facilities in their local government in order to summarise the health data from the facilities. However this system has suffered setbacks since Local Government Councils do not maintain the motorcycles as expected.

While the initial cost of investment is high, recent evidence suggests that over a long term, there are benefits of interoperable EHR implementation (Chen et al., 2009; McVeigh, 2008). Additionally, the use of free open source software and the emergence of low cost Information and Communication Technologies have greatly reduced the cost of implementation of EHR as demonstrated in many pilot projects in developing countries (Blaya, Fraser, & Holt, 2010; Clifford et al., 2008).

Some of the projects which have leveraged open source technologies in some developing countries that have been reported include: CAREW are in Uganda, Vietnam and Zambia, (The President’s Emmergency Plan For AIDS Relief, 2006); OpenMRS in South Africa, Kenya, Tanzania, (OpenMRS, 2010); SmartCare currently deployed in Zambia, Ethiopia, and South Africa. (Smartcare, 2010) and DHIS which has been piloted in South Africa, Mozambique, Tanzania, Malawi, Ethiopia, Vietnam, India, etc (World Health Organization, 2010).

Some of the challenges that have to be surmounted before a successful EHR implementation in Nigeria include epileptic electricity supply, corruption, low internet penetration, lack of skilled manpower and the lack of political will to drive the implementation process, resistance by some health professionals, concerns about data security, lack of EHR and clinical terminology standards, high cost of implementation and maintenance of EHR.

Electricity supply in Nigeria is mainly from hydroelectric power stations which are affected by low water levels in the dry season. Rapid growth in the economy has also seen rising supply of electricity being overwhelmed by demand, leaving many organizations running several hours on generating plants at very high costs (Sambo, 2008).

Public sector corruption (Transparency International, 2009) contributes to the weak health system with multiple disease-specific intervention programmes and complex reporting structures and practice guidelines that will make implementation of a nationwide EHR very complex.

Many projects are not driven by the need for service improvement but for many other reasons from political too selfish, and either end up being abandoned half way into the project or are poorly executed. Physical structures tend to attract more funding than service improvement projects and when there is a change of government, projects of the previous government tend to suffer from poor funding.

Even though mobile telephone services have now reached a critical mass with about 50% teledensity, internet usage data services are still very low (Pyramid Research, 2010). The convergence of telecommunication technology may drive the demand for data services for healthcare and education and a good regulatory and legislative framework will help sustain reforms in the telecommunication industry.

The cost savings and other benefits of a nationwide EHR are seen to be more beneficial to the beneficiaries of health services and payers than to the providers. Therefore, without motivation for its adoption, health professionals are likely to resist its use. Some will resist its implementation due to their unwillingness to learn new skills in order to perform their jobs, others because of the added demand in the use of the system or inflexibility of the system, especially if there are little programming glitches at the initial implementation phases. There are also those who, for fear of losing their jobs, will refuse its adoption and will try to frustrate the implementation process.

There are also growing public concerns over data security and confidentiality when health records are stored and shared electronically, which have to be assuaged for a successful implementation of a nationwide EHR.

In order to prevent the emergence of disparate inoperable systems and ensure a
truly integrated health system that will support continuity of patient care, there has to be a standardization of clinical terminologies, protocols and practice guidelines.

While it is true that the cost of implementation of a nationwide EHR can be prohibitive for most developing countries, the use of low cost technologies have been demonstrated to be sustainable in many such countries (Boucher, 2007).

The healthcare industry presents an opportunity for the creation of jobs. It forms the largest employment sector in many developed economies. Healthcare spending averages about 8.9% of GDP across the most developed countries (WHO, 2009a). For instance, the NHS in the UK employs over 1.7 million people (NHS, 2010). In Nigeria, however, government spending is put at just 3% of the GDP as against the recommended minimum of 5% of the GDP for developing countries by the WHO. This has resulted in the poor quality of services and a low confidence in the system with under utilization of its resources.

A successful EHR implementation will therefore increase the efficiency of health institutions and the quality of services delivered by them which will in the long term reduce the cost of those services, make data available for planning, allow for proper budgeting and allocation of resources and consequently increase the patronage of health services with a positive impact on the life expectancy of citizens and the productivity of the country.

4.1. A Framework for EHR Implementation

Keshavjee et al. (2006) and Holbrook et al. (2003) describe a framework which consists of success factors operational over a three-phase implementation period, namely: pre-implementation, implementation and post implementation phases which has some semblance with the WHO’s Electronic Health Record Manual for Developing Countries (Keshavjee et al., 2006; Holbrook et al., 2003; World Health Organization, 2003). In addition, Wickramasinghe and Schaffer (2010) developed an e-health preparedness grid to assist governments and/or organisations how best to become prepared and ready to move forward in their specific e-health solution and thus ensure a successful and satisfactory result.

However, irrespective of what framework is used for EHR implementation, the following have been the most prominent features of many implementations, according to (Keshavjee et al., 2006): 1) EHR implementations proceed gradually over time, 2) Implementations involve people, processes and technology, 3) Implementations are prone to failure if there is poor governance and leadership, 4) Negotiation and dialogue between different stakeholders and between stakeholders and technology is quite prominent, 5) EHR implementations are dynamic processes which evolve as learning occurs and new problems and opportunities are discovered, 6) Technology reliability and usability play important roles.

In Keshavjee et al. (2006) framework, factors can overlap from one phase to another. These factors (People, Process and Technology) interact in the three phases of implementation.

4.1.1. Pre – Implementation Phase

The pre-implementation phase consists of the following components:

4.1.1.1. Governance

This involves management activities and should involve members of the administration, health information management, potential users from the medical and nursing services, representatives from the financial and IT services and all other stakeholders in order to identify the current situation, anticipate and address likely problems and assess the readiness of users for the proposed changes.

4.1.1.2. Project Management Leadership

The two distinct roles of a Project Manager and a Project Champion are necessary to ensure
the project is delivered on time, budget and to specification and that it easily gets acceptability by the end users.

4.1.1.3. Stakeholder Involvement

Early involvement of stakeholders will help to build up the requirements of end users and help reduce resistance to change. It will also help identify the pressing issues that have to be addressed prior to implementation, as well as identify the expectations and align them to realities of funding, manpower and technology. Care must however be taken to ensure that all concerns are captured within a realistic scope and not allow changing user requirements to derail implementation.

4.1.1.4. Self Benefits

The perceive benefits of EHR should be identified and communicated to stakeholders as much as possible.

4.1.1.5. Software Selection

Before selecting the necessary software, it is important to address the requirements of a nationwide EHR which in this study were identified as in Tables 3 and 4. The team responsible for selecting the EHR needs to determine whether they want to build their own EHR system, buy or lease one from a reputable vendor. Building one’s own system could be time-consuming and expensive but should enable the organization to design one to meet their specific needs. The factors to consider in selecting an EHR include: cost, user friendliness, information integration capacity, and vendor issues such as maturity and viability. A well defined selection process, which should involve an iterative sequence of review of EHR specifications and features, live product demonstrations, site visits, and negotiations with vendors, increases the chance of success (Holbrook et al., 2003). Leasing an EHR system would enable access to software applications that are managed off-site. While the initial costs of leasing an EHR system might be lower than buying or building one, it may prove more costly over a long period of time. A thorough cost-benefit analysis should therefore be conducted to compare the following three options: 1) purchase off-the-shelf software; 2) lease software through subscription; 3) develop and build bespoke software.

4.1.1.6. Pre-Load Integration

The aim is to have the EHR integrate with existing systems or have the old data loaded into the new system. Integration provides access to existing data and increases accuracy and system efficiency. It is important to decide how to manage the old data at this stage.

4.1.1.7. Usability Factors

EHR usability issues involve hardware and software usability. Hardware usability is concerned with issues such as location of workstations, use of tablets and other form factors which fit into the clinician’s workspace, workflows, speed of processing, etc. Software usability on the other hand involves user interfaces and how software design supports clinical workflows and work processes.

4.2. Implementation Phase

Implementation could either be full or phased. The readiness of the site and of all users to accept change and the availability of funds for implementation are two of the issues that determine which implementation option to adopt. In an environment with a strong technical infrastructure like a telecommunication infrastructure with fully trained manpower and functional systems, the tendency may be for full implementation where data for all active patients must be uploaded immediately before going live.

A phased implementation which involves implementing one unit at a time is preferred for resource-constrained areas where the resources to tackle all the issues that implementation will raise are not readily available. This gives room
<table>
<thead>
<tr>
<th>Functional Requirement</th>
<th>Rationale</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meet international classification of disease</td>
<td>Regional collaborations in the West African region may go in the way of joint funding or sharing of successful pilot studies, also medical tourism is now a major driver for standardization of health records and vocabulary.</td>
</tr>
<tr>
<td>Ease of use</td>
<td>Low IT skills among health workers.</td>
</tr>
<tr>
<td>Interoperability</td>
<td>To meet data reporting requirements.</td>
</tr>
<tr>
<td>Communication capabilities among health professionals and with patients</td>
<td>To help in decision support, for health workers, training and development as well as delivery of health information to patients in order to promote wellness.</td>
</tr>
<tr>
<td>Clinician prompting and reminder alerts</td>
<td>To help reduce medical errors and improve the quality of care.</td>
</tr>
<tr>
<td>Interface customization to different local languages.</td>
<td>To accommodate various levels of user skills and aptitudes.</td>
</tr>
<tr>
<td>Accommodation of multiple payment options</td>
<td>One patient in one visit can have part of the services paid by insurance, part exempted from payments due to sponsorship and part paid out of pocket.</td>
</tr>
<tr>
<td>Reporting of adverse drug reactions</td>
<td>To help in the fight against fake and adulterated drugs and also in the process of drug trials, licensing and regulation.</td>
</tr>
<tr>
<td>Generation of reports for various stakeholders</td>
<td>To enable timely and accurate data generation and analysis for planning, budgeting, monitoring and evaluation of interventions.</td>
</tr>
<tr>
<td>Multiple point data access and manipulation</td>
<td>To ensure continuity of care and sharing of data with multiple care givers for interdisciplinary care.</td>
</tr>
<tr>
<td>Maintenance of minimal onsite technical expertise</td>
<td>Lack of technical support at multiple sites.</td>
</tr>
<tr>
<td>Data protection and confidentiality</td>
<td>To meet expectations of patients.</td>
</tr>
<tr>
<td>scalability and allowance for incremental developments to incorporate telemedicine and other capabilities as technology for high data transfer becomes cheaper and more widespread</td>
<td>The development can grow with prevalent technology and availability of local technical skills.</td>
</tr>
<tr>
<td>Automatic backup of data</td>
<td>To prevent accidental loss of data through multiple data backups.</td>
</tr>
<tr>
<td>Research support by ensuring aggregate data can be accessed without patient identifiable data</td>
<td>To encourage healthcare research in order to improve service outcomes, best use of resources and patient safety.</td>
</tr>
<tr>
<td>Support of easy referral of patients to other health facilities</td>
<td>To ensure seamless continuity of care.</td>
</tr>
<tr>
<td>Ability to generate e-prescriptions</td>
<td>e-prescriptions will reduce prescription errors and have been shown to be a major criterion for meaningful use of EHR.</td>
</tr>
<tr>
<td>Support the use of mobile devices for data capture and transfer as well as for sending alerts to doctors and patients</td>
<td>The wide network of mobile telephone and data services is a strong driver for the adoption of mobile health services.</td>
</tr>
</tbody>
</table>
4.2.1. Workflow Redesign

Critical to successful implementation is the fitness of staff and physician workflow to that of the EHR functional and usability design constrictions or flexibilities. If the fit is poor, implementation can fail.

4.2.2. Training

Familiarization and training of primary users on the EHR should be both initial and on-going. Training, however, should commence with the more interested and skilled users who will subsequently be used to motivate the others and developed to “super users” to handle most basic hardware and software problems locally.

4.2.3. Implementation Assistance and Support

Any successful implementation requires a strong vendor partnership. The vendor should be responsive and the system flexible enough to allow addressing any system improvements and/or modifications as identified by clinicians or primary users.

4.2.4. Feedback and Dialogue

Opportunities for interaction with other users will create a forum for discussing some of the challenges with the new system and create new knowledge that can be shared to improve user satisfaction.

4.2.5. Privacy and Confidentiality

EHR implementation must meet confidentiality requirements, especially when web-based record systems are used. Confidentiality can be achieved through the use of standardized data exchange protocols, access control, system integrity, network security, clear data ownership, user profiles and audit trails.

4.3. Post-Implementation Phase

In order to sustain the gains of the pre-implementation and implementation phases the use of support and user groups, as well as the judicious use of incentives to encourage the adoption to manage changes in small units and transfer lessons learnt to other units. However, initial challenges can offer critics of the system a talking point; affect sustained funding and cooperation of other units.

Table 4. Non Functional requirements and their rationale

<table>
<thead>
<tr>
<th>Non Functional Requirement</th>
<th>Rationale</th>
</tr>
</thead>
<tbody>
<tr>
<td>It should be cheap to develop and maintain with little license and maintenance fees.</td>
<td>The cost will drive wide spread adoption especially by private healthcare providers and primary healthcare centres.</td>
</tr>
<tr>
<td>It should be easily fit into the workspace of doctors and other healthcare workers.</td>
<td>A conducive working environment is a problem and a bulking system will further crowd the workspace.</td>
</tr>
<tr>
<td>It should fit into the work process as much as possible.</td>
<td>Healthcare workers are slow to embrace change and some will resist it because of the time to learn new ways of doing their jobs.</td>
</tr>
<tr>
<td>Equipments used should have little secondary uses that can encourage its diversion for something other than its intended purposes.</td>
<td>It is not uncommon to find equipments meant for providing certain services being carted away by government officials for personal use or for resale.</td>
</tr>
<tr>
<td>It should have low energy consumption and long hours of work without electricity. If possible have support for alternative sources of power.</td>
<td>Constant electricity supply is a challenge especially in rural areas.</td>
</tr>
<tr>
<td>It should increase the convenience for patients.</td>
<td>To make health services patient-centred and across most health facilities.</td>
</tr>
</tbody>
</table>
and sustainability of EHR, are recommended post-implementation strategies.

5. CONCLUSIONS AND RECOMMENDATIONS

This study identified multiple stakeholders for a nationwide implementation of electronic health records in Nigeria who, though obligated to report aggregate statistics to the Federal Ministry of Health or their donors and sponsors, are presently working in an uncoordinated fashion resulting in duplication of efforts, wastage of scarce resources and the creation of a complex reporting structure. These stakeholders include the Federal, State and Local Governments, health related MDAs, Non-Governmental Organizations, private healthcare providers, health workers, patients and researchers.

The major drivers identified for the adoption of a nationwide EHR system include the need to report data to the Federal Ministry of Health, donors and funding agencies; the need to improve patient safety and work place efficiency; the need to comply with the health sector reform programme; and the need to reduce cost and improve access to healthcare.

Some of the barriers to EHR implementation identified by this study include political ideologies of leaders, lack of funds, misapplication of funds, corruption, tribalism, difficulty in getting all stakeholders along, lack of constant supply of electricity and the lack of a conducive work environment. While factors considered as critical to a successful implementation of a nationwide EHR include enforceable legislation, a trained and motivated workforce, the political will by government and managers of the health system, significant and sustained funding and the provision of an appropriate work environment.

Given an appropriate framework, a nationwide EHR in Nigeria can help create an integrated health system that will ensure service improvement, patient safety, continuity of care and assist in bringing down the cost of health services over time.

5.1. Recommendations

1. Fast-track the enactment of a National Health Bill with an appropriate enforcement mechanism that will clearly delineate the duties and responsibilities of all stakeholders, and prescribe appropriate sanctions for not complying with the National Health Policy or any other health related policies.
2. Formulate a National e-health Policy and establish a regulatory agency to oversee its implementation. This should be charged with, among other responsibilities, the preparation of confidentiality, security and privacy policies; development of education and training curricula, materials and programmes; and development of national standards and protocols.
3. Conduct a more expansive needs assessment for a nationwide EHR in order to get acquainted with the issues and challenges of the present system and to serve as a platform for building the requirements for a nationwide EHR and in addition assess the state of e-health preparedness utilising the e-health prepared grid so that the region is as prepared and ready for the e-health solution as possible which will in turn lead to better success.
4. Increase funding of the healthcare sector and insist on functional health records departments in each health facility while making sure that they maintain records in a way that will make transition to an electronic format easy.
5. Initiate the implementation of a unique patient identification system.
6. Incorporate health informatics into the curricula of medical, nursing and paramedical students to increase awareness of the importance of health records among health professionals and prepare them towards the use of EHR.
7. Fund the establishment of pilot sites by giving grants to facilities that show capacity...
for a successful implementation of EHR to national standards.

8. Fast-track the development of an e-health infrastructure, such as internet backbone and satellite technology, as well as the spread of high speed broadband data services.

9. Develop legislative and implementation frameworks for public-private partnerships in the health sector in order to attract private sector investment and ensure the sustainability of the project, while making sure that equity and access to health are not compromised.

We close with a caution that while a nationwide electronic health record system will not be a panacea it does bring with it the potential to provide superior patient-centric healthcare delivery for Nigeria, a country desperately in need of cost effective quality healthcare.

REFERENCES


