



# Development of a Framework for Computerized Health Management Information Systems in Nigeria

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## ABSTRACT

A framework for Computerized Health Management Information Systems for the nine countries under the International Institute for Communication and Development (IICD) in Africa and Latin America was proposed in 2007 in a research work carried out by Nicole Archangel in collaboration with IICD. Since technology can be acquired and adapted, countries in Africa need to adapt and develop their own information systems based on their local needs and structures, applying local methods and practices. This research is carried out to propose a standard operational framework for Health Management Information System (HMIS) in Nigeria based on the framework for IICD countries with special adaptation to Nigeria HMIS. This research, building on the existing system proposes a health management information system framework with emphasis on a patient centric system interface and participation. Another major issue addressed is the provisioning of multi-lingua platform translation for illiterate indigenous patients to interact with the health management information system. The results obtained from the application developed on the proposed framework shows a novelty of multi-language support; which enables anyone to use the system in a preferred language (most probably the user's mother's tongue). The implication of this design is that any language can be added in the future to open accessibility and usability to more users from different ethnic community.

**Keywords:** *Health Management Information Systems (HMIS), Computerized, Patient Centric System, Multi-lingua platform translation, Framework*

## 1. INTRODUCTION

Health is an intrinsic human right as well as a central input to poverty reduction and socio-economic development<sup>1</sup>. Health management information incorporates all the data needed by policy makers, clinicians and health service users to improve and protect population health. Few countries in the world today have effective and comprehensive systems in place to gather this data<sup>2</sup>

International Institute for Communication and Development (IICD) aims at improving the health of populations in small urban centres and remote rural areas through ICT. IICD operates in nine countries in Africa and Latin America and has been supporting projects in Mali, Tanzania, Uganda and Zambia. Nigeria is however not included. A framework for countries under IICD was proposed in 2007 in a research work carried out by Nicole Archangel in collaboration with IICD. Many information system developers have made several efforts to develop a computerized health management information system. It must be noted however that most of these were done without a proper standardized approach that takes care of all the detailed relevant information and requisite steps. Furthermore the technological level, infrastructure as well as human and social factors were not thoroughly considered. This has led to rejections by the users as a result of non functionality and non performance. Following the principles of technology transfer and adaptation, several developed frameworks were studied

and evaluated and a new framework was proposed to be adapted to the Nigeria HMIS context with the peculiarities of Nigeria taken into consideration.

## 2. A REVIEW OF LITERATURE

Nicole (2007) opines that the introduction of information systems in healthcare has been with failures and successes. What has become apparent is that the introduction of such a system many times fails because of issues related to the organization itself<sup>3</sup>

However, there are a number of reports on full or partial failure of information systems (IS) in developing countries<sup>4</sup>

From the study of different HMIS developed in some developing countries the strengths, limitations, success and failure of the systems were discovered. First is the HMIS designed for Limpopo in South Africa designed to install a computerized integrated hospital information system which failed at the point of implementation. This was due to the infrastructure, application, and organization of the implementation process. The second is HMIS in Tanzania designed to identify standard datasets for the hospital, establish standardized data collection, reporting tools and routines, customizing the District Health Information System (DHIS) in order to meet the hospital's information requirements and provide extensive training to users<sup>5</sup>. The limitations and challenges which were encountered during the design and implementation include low participation from the workers due to non



understanding of the relevance and usage of the system, insufficient computer systems, computer illiteracy, incorrect and inconsistent data, poor information culture etc. Then came the HMIS developed in Vietnam which according to Heywood<sup>6</sup> also failed due to lack of awareness, computer systems, supervision, internet access etc.

Asangansi and Shaguy<sup>7</sup> evaluated HMIS in Nigeria. First they identified four components in the Nigerian Health Management Information systems. These components include the people working in the system, the tools they use, the data involved and the processes used to handle these data. Soriyan<sup>8</sup> launched the Made in Nigeria Primary and Hospital Information System (MINPHIS) package. It was developed in Nigeria by Nigerians for managing the healthcare information systems in Teaching and Specialist hospitals. Soriyan<sup>8</sup> stated that Nigeria's requirement for telecommunications and other ICT facilities is enormous and the required resources (time, human, and capital investments) needed to actualise the millennium goals are daunting.

### 3. CURRENT HEALTH MANAGEMENT INFORMATION SYSTEM FRAMEWORK AND THEIR LIMITATIONS

The HMIS mentioned previously were built on a particular framework. This research work is an improvement over the previous ones. The research is to be

adapted to Nigeria context. Minimizing failure rate and maximising success rate at the implementation stage are major goals.

Nicole<sup>9</sup> based his research work on the contributions of Van<sup>10</sup>, Kuhn<sup>11</sup>, Kiu<sup>12</sup>, Gladwin<sup>13</sup>, Berndt<sup>14</sup> and Chetley<sup>15</sup>. In collaboration with IICD. Nicole came up with a framework created to help identify the factors affecting the introduction and success of HMIS in nine (9) countries in Africa and Latin America. The developed framework suggests moving from healthcare to integrated care, meaning, the merging of hospitals and individual practices into larger integrated healthcare networks. This, according to Bossert<sup>16</sup>, is called a decentralized network of healthcare delivery. This framework is created to help identify the factors affecting the introduction and success of HMIS in developing countries<sup>11,12,13,14&15</sup>.

The developed framework identifies the following to be key factors in building an HMIS.

- (i) Objectives
- (ii) Planning and strategy
- (iii) Stakeholders' roles and responsibilities
- (iv) Social and cultural aspects
- (v) Technology
- (vi) Human capacity development
- (vii) Participation and awareness
- (viii) Financial aspects, sustainability

Based on the framework by<sup>17</sup> the stakeholders involved are represented in figure 1.

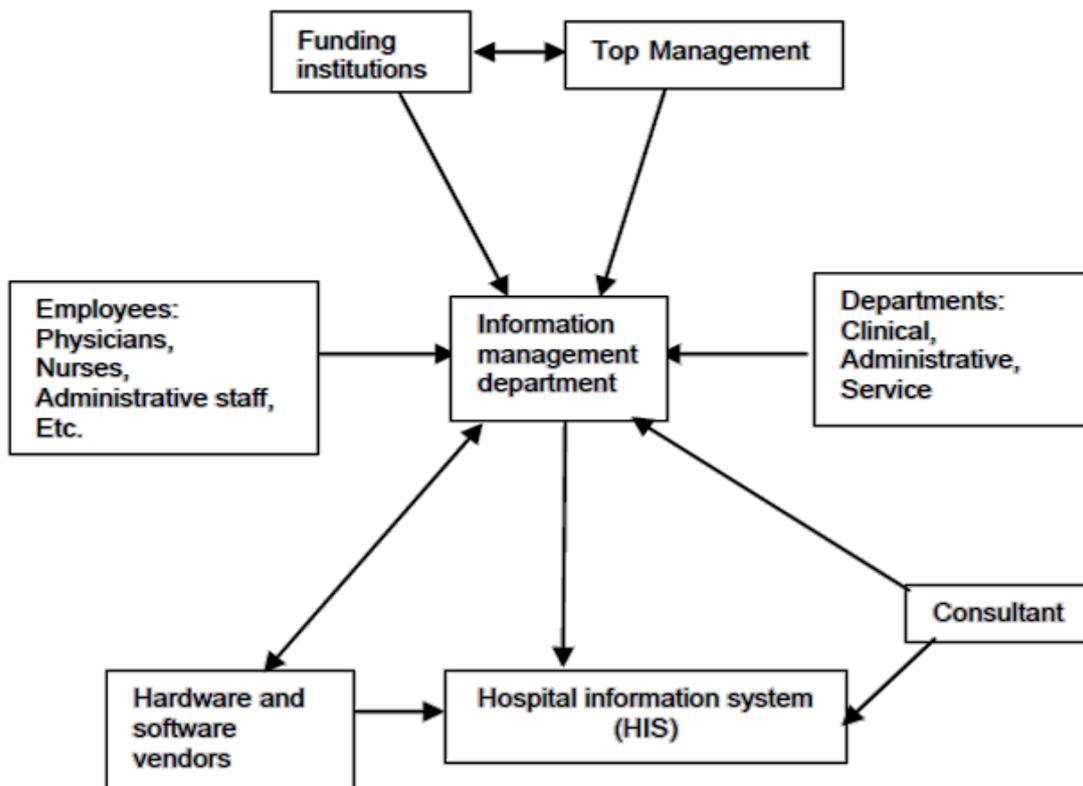


Figure 1: Stakeholder and the Information Flow (Winter et al., 2003)

Table 1: Issues Per Phase

	<b>Phase 1: Planning</b>	<b>Phase 2: Implementation</b>	<b>Phase 3: After implementation</b>
Objectives	Define objectives	Check objectives	Monitor objective
Planning and strategy	Define planning and Strategy	Implement strategy	Monitor strategy
Stakeholders roles and Responsibilities	Responsibilities and Communication flow	Register and check roles and responsibilities	Monitor and check roles and responsibilities
Social and cultural Aspects	Identify participation	Check participation	Monitor participation
Technology	Identify: Tools; Connectivity; Design	Implement technology needed	Maintenance
Human capacity Development	Identify capacities; Develop needed Training	Give training	Achieve long term sustainability
Participation and Awareness	Identify needed participation and awareness	Do Awareness raising Get participation	Monitor participation
Financial aspects, Sustainability	Identify financial input	Guard input and output	Monitor input and output

#### 4. RESEARCH METHODOLOGY

A qualitative research approach was employed in the realization of the objectives of this research. Study of existing related works were carried out. A deeper analysis of peculiar factors to the Nigerian situation was done. Interviews were conducted in hospitals and local areas. A vivid comparison among the existing related works were carried out. Based on findings from the developed framework for IICD countries and comparisons with the peculiarity of Nigeria situation, appropriate approaches to Health Management Information Systems (HMIS) development in Nigeria were developed.

The scientific approaches adopted in the research are:

**Framework design:** framework design was done to determine application architecture framework. Requirement Definition and Infrastructural Model Architecting and Development were carried out.

**Applications Development:** applications were deployed to test the framework.

**System Test-running with live data:** The framework developed was implemented in an application and tested with live data to determine the relevance of the work to the current state of HMIS development as well as predicting or forecasting the future direction of new research along this area.

**Evolving Overall System Architecture:** Figure 2 is an illustration of the overall system architecture. The diagram shows how the components are logically and functionally related. The design is such that the patient logs on to the HMIS with his surname as username and file number as password. Authentication is done at this stage, and if the patient entry does not match, access is denied and will thereafter be directed to register at the reception. If the data match, then the user is given an option to select his tribe and language from a list of Nigerian languages. On selecting a particular language, all the services from the point will be displayed in the chosen language. This enables the illiterate patient to use system to full capacity without being limited by language barrier.

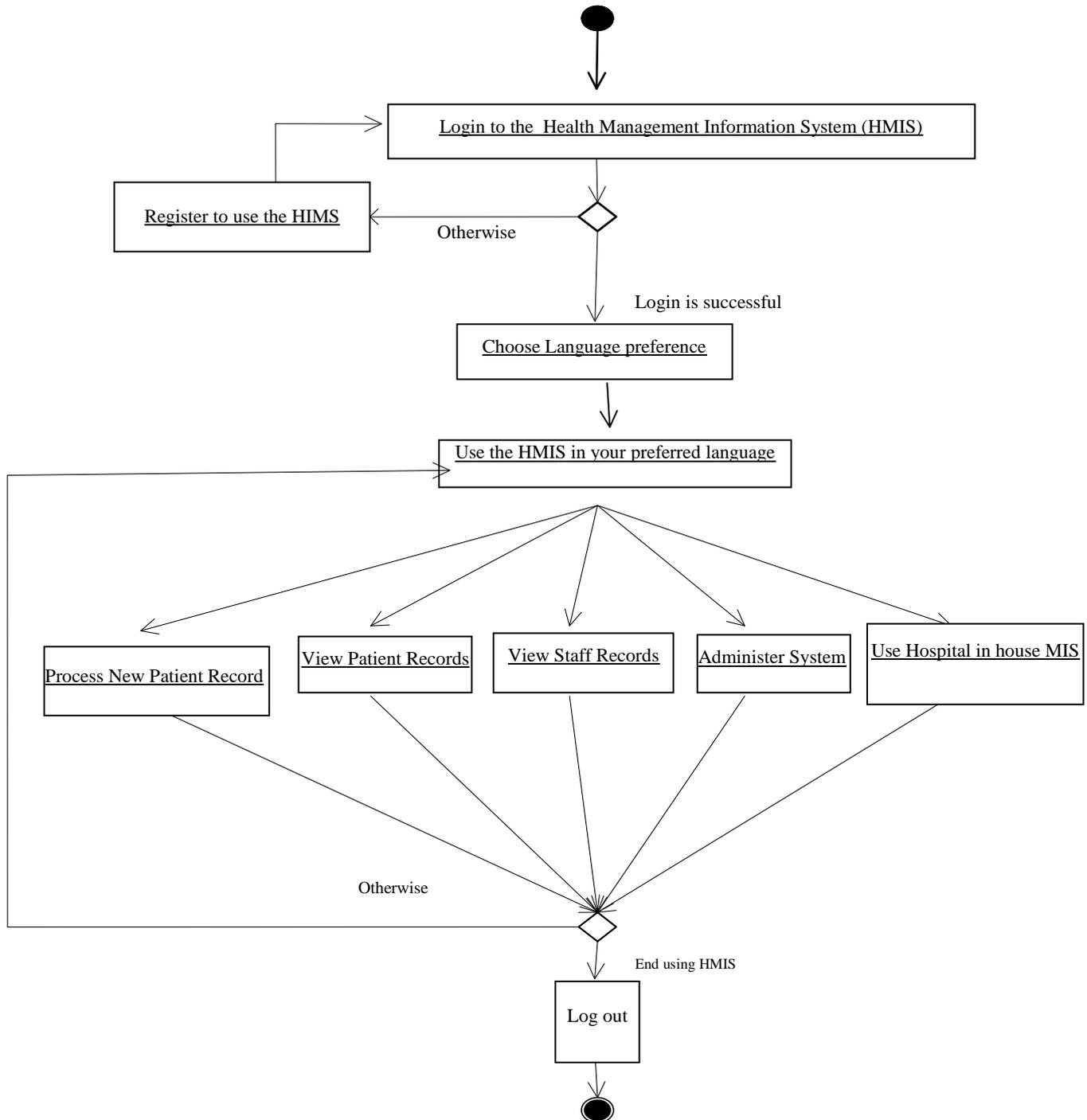


Figure 2: Model of the Proposed Multi-Lingual Health Management Information System Framework

## 5. RESULTS AND DISCUSSION

The proposed framework identifies the key factors (Fig 3 and Table 2) in building HMIS with special

emphasis on the patient as a stakeholder and Multilanguage support for indigenous patients

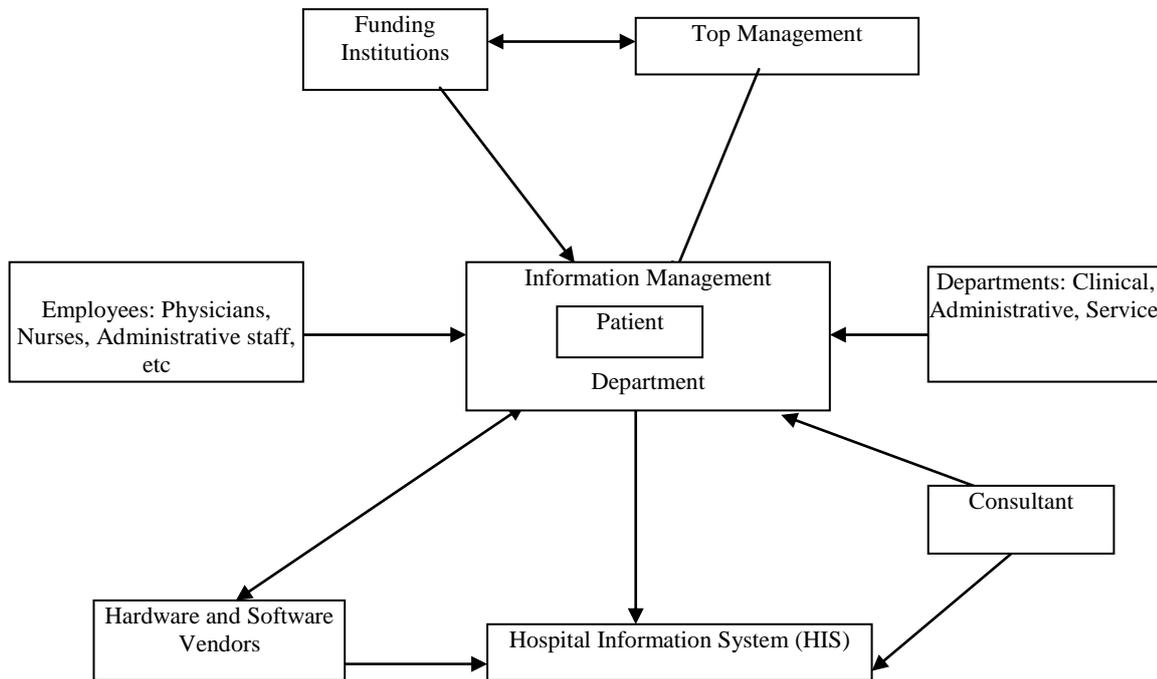


Figure 3: Stakeholder (Patient Centric) and the Information Flow

The factors and related issues were used for integration into the framework (Table 2). The chosen stages for the framework are stage 1, stage 2 and stage 3.

Table 2: Issues Per Phase

	Stage 1: Planning	Stage 2: Implementation	Stage 3: Post Implementation
Objectives	Define objectives	Check objectives	Monitor objective
Planning and strategy	Define planning and Strategy	Implement strategy	Monitor strategy
Stakeholders roles and Responsibilities (patients)	Responsibilities and Communication flow	Register and check roles and responsibilities.  Patient Register personal data.	Monitor and check roles and responsibilities  Monitor and check Health status and Medical Records  Ask questions and make requests
Social and cultural Aspects	Identify participation  Identify different language paradigms	Check participation  Implement multilingual inter-phase.	Monitor participation  Monitor effects of indigenous language inter-phases. Incorporate other indigenous languages.
Technology	Identify: Tools; Connectivity; Design	Implement technology Needed	Maintenance
Human capacity development	Identify capacities; Develop needed Training	Give training	Achieve long term sustainability
Participation and	Identify needed	Do Awareness raising	Monitor participation

awareness	participation awareness	and	Get participation	
Financial aspects, sustainability	Identify financial input		Guard input and output	Monitor input and output

### 4.1 Screen Shots Illustration

Multilanguage support is emphasized in this work. Users can utilize the same resources irrespective of

the chosen language. Right from the log-in page (Figure 4), the user is given a list of languages from which to select (Figure 5).



Figure 4: Log-in Page of the Patient-centric HIMS

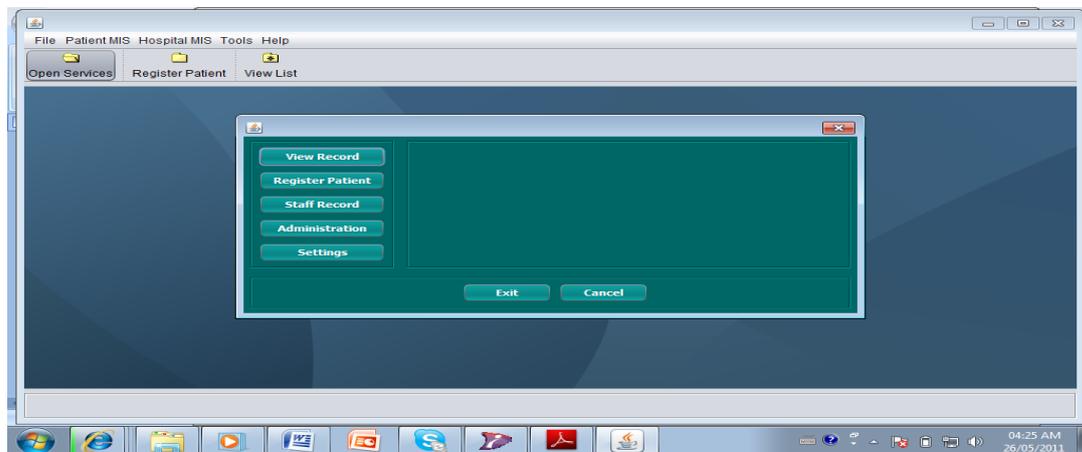


Figure 5: Interface of the Services in the HMIS

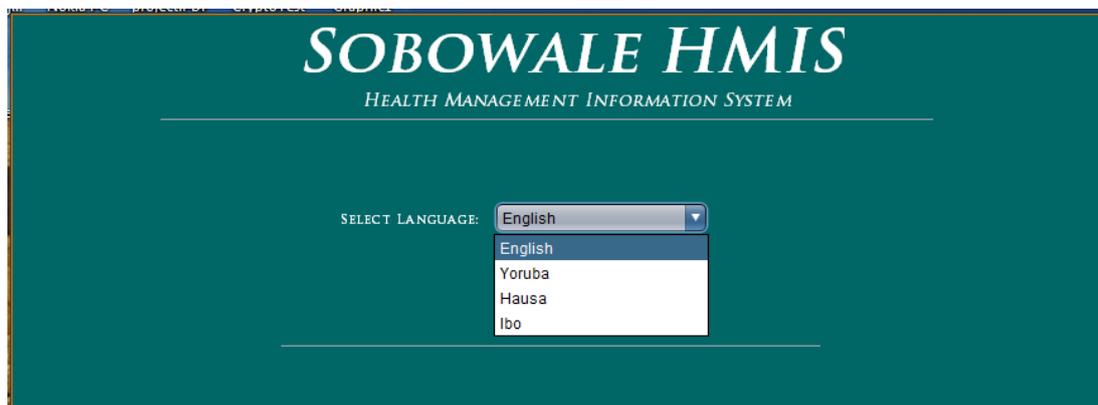


Figure 6: English Interface of Some Services in the HMIS

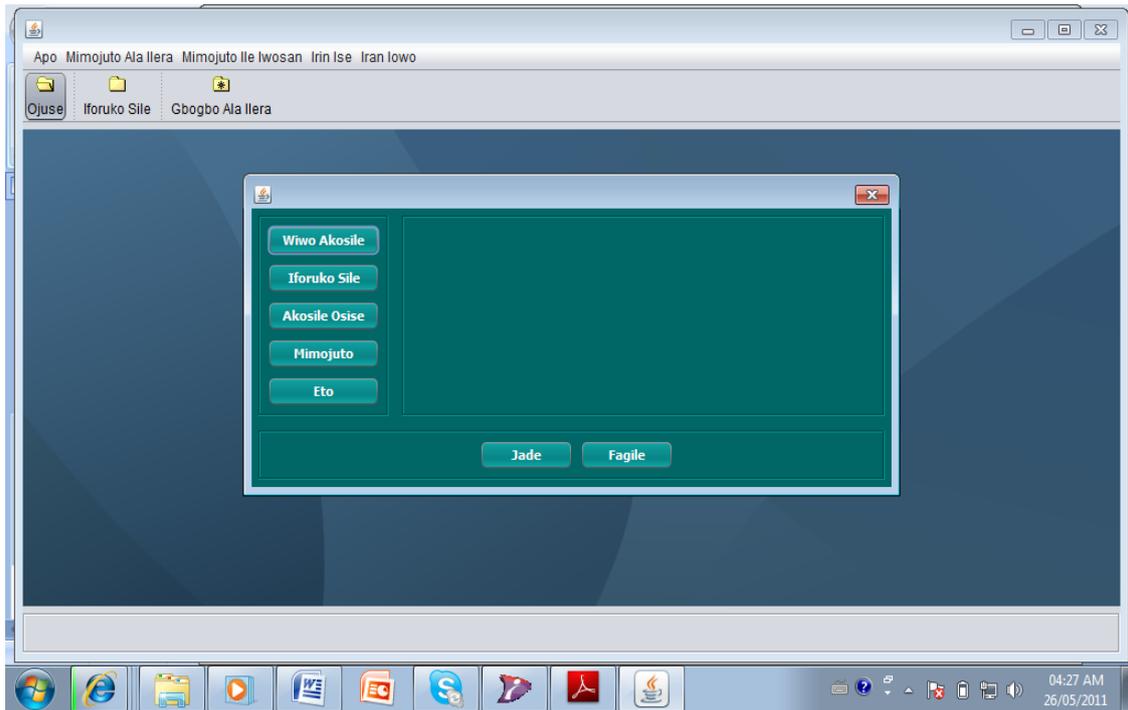


Figure 7: Yoruba Interface of the Services in the HMIS

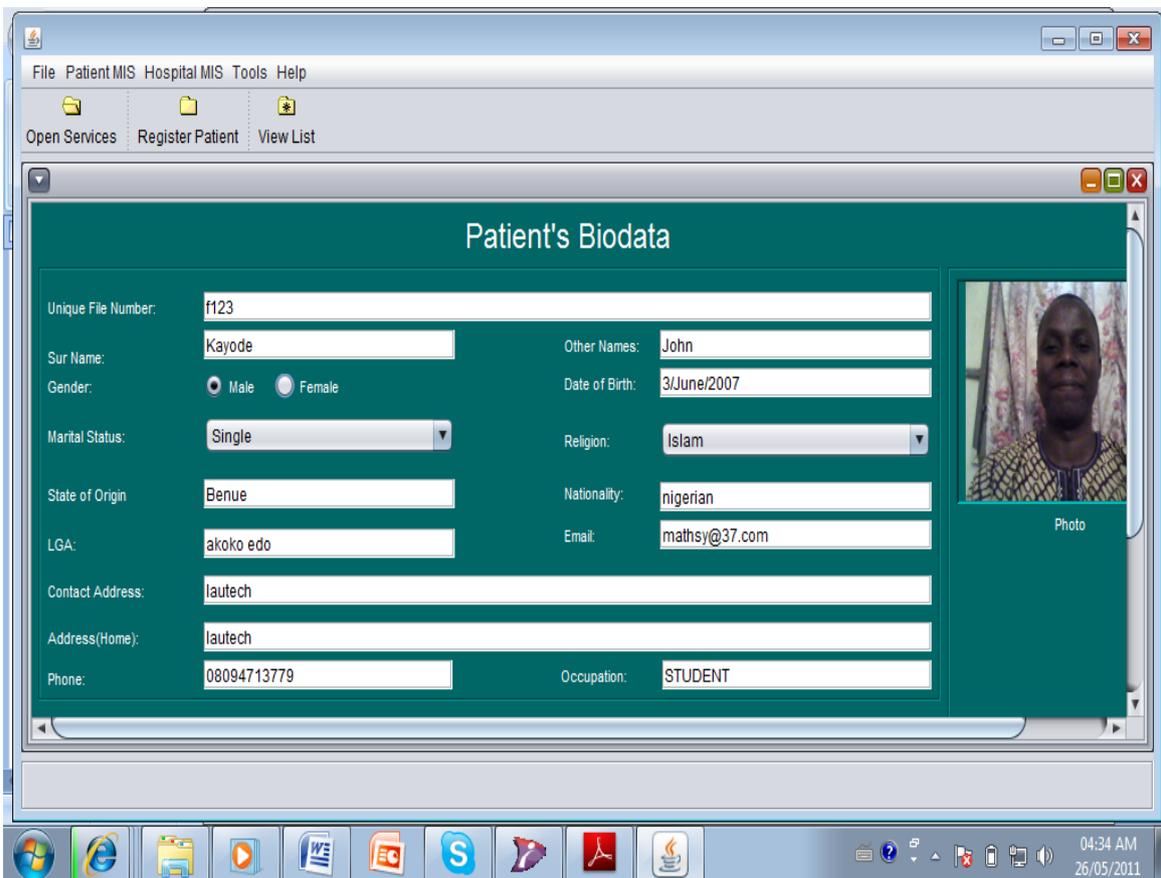


Figure 8: Record of a Patient

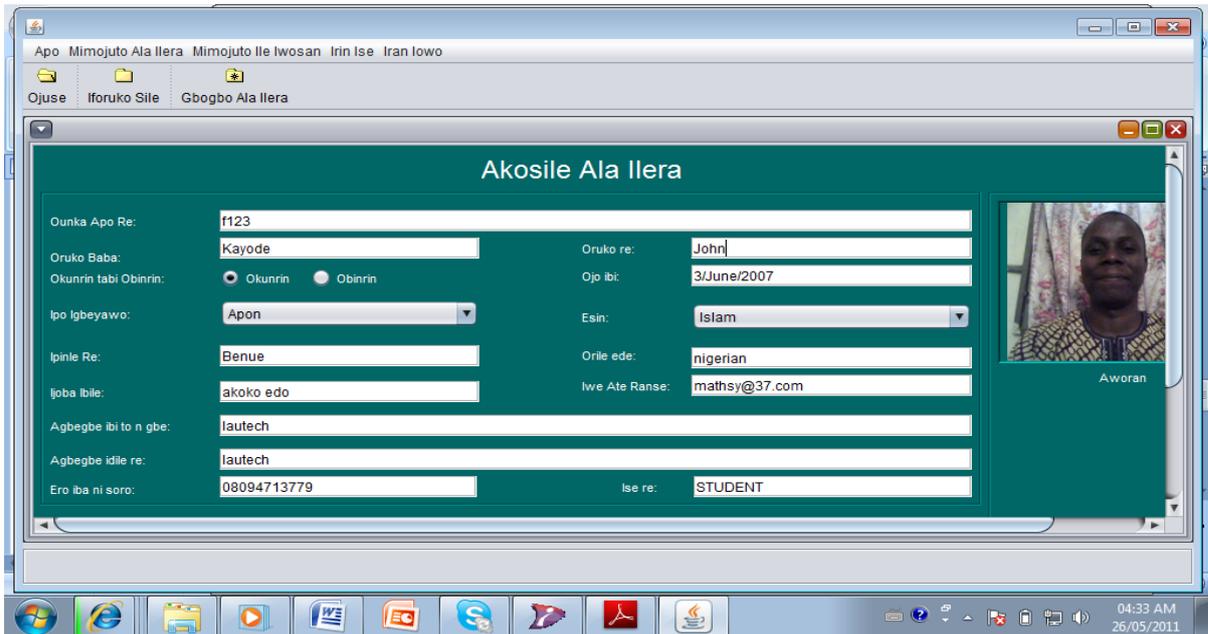


Figure 9: Yoruba Interface of Record of a Patient

### 4.2 System Test-running with Live Data

The system was tested with real live data to demonstrate the capability of the design. Figure 10 show the list of records processed with the system. The table contains the following information about the patient: File No, Name, Gender, Date of Birth, Medical History, Age, Blood Group, Height, Occupation, Phone Number,

Contact Address, E-mail Address, Local Government Area (LGA), State, Religion and Status. The information captures very essential and necessary information (personal and medical).

The results shown from the system demonstrates that the data generated from the system can be used for knowledge discovery about a particular patient.

File No	Sname	Othernam...	Gender	Dateofbirth	Med History	Age Range	Blood Gro...	Heigt	Occupation	Phone	Homeadd...	Contactad...	Ema
F001	Olaitan	Gbolahan	Male	4/5/1988	None	21-30	3	1.8	student	08094562...	8, Adeleke...	8, Adeleke...	gbol...
F002	Jamiu	Bukola	Male	17/April/1...	None	31-50	4	1.7	student	07034212...	45, Gbad...	45, Gbad...	jbul...
F003	Ahmed	Ibrahim	Male	17/April/1...	None	31-50	2	1.7	student	07034212...	45, Gbad...	45, Gbad...	anb...
F004	Adejumo	Olabisi	Female	5/May/1982	None	21-30	2	1.6	Trader	08087654...	Danzo	12/Ibrah...	adex
F005	Ambrose	Okon	Male	11/Dece...	TB	1-5	3	1.3	Civil Serv...	08050124...	34, James...	34, James...	okon
F006	Badmus	Fatai	Male	11/July/19...	Migrane	31-50	3	1.3	Civil Serv...	08050124...	57, Fela A...	57, Fela A...	fat2b
F007	Alajiki	Lola	Female	7/Septem...	none	21-30	2	0.9	Student	08076453...	21, Baiyett...	21, Baiyett...	Lolaj
F008	Aramide	Elizabeth	Male	9/May/1981	Migrane	31-50	3	1.3	Civil Serv...	08066513...	67, Liverp...	67, Liverp...	fat2b
F009	Abiodun	Olaoluwa	Male	4/Septem...	none	21-30	2	1.9	Student	08045376...	56, Osanl...	56, Osanl...	Lolaj
F010	Akande	Oluwatosin	Male	6/Novemb...	Migrane	31-50	3	1.3	Civil Serv...	08066513...	12, Giwa A...	12, Giwa A...	tosin
F011	Ajiboye	Oluwaseun	Female	1/January...	None	21-30	1	1.4	student	08183625...	45, Osund...	45, Osund...	jdok
F012	Balogun	Olabisi	Female	10/Septe...	None	31-50	1	1.8	Lecturer	08056423...	98, Adebol...	98, Adebol...	balol
F013	Sobowale	Tanimola	Male	10/Septe...	None	31-50	1	1.8	Lecturer	08056423...	13, Adio Af...	13, Adio Af...	balol
F014	Yomisi	Abdulrah...	Male	6/Decem...	none	21-30	2	1.9	Student	07017253...	89, ahmed...	89, ahmed...	Lolaj
F015	Kupoluyi	Abbas	Male	1/January...	1-5	1	1	1					
F016	Ibraimo	Fatai	Male	8/July/1983	none	21-30	3	1.5	Student	08023465...	19, Under ...	19, Under ...	fat12
F017	Kupoluyi	Abbas	Male	5/May/1981	1-5	1	1	1					
F018	James	Olaitan	Male	5/May/1979	1-5	4	1	1					jamd
F019	Olubukola	Adewuyi	Male	6/June/19...	none	21-30	5	1.2	Student	08023458...	78, Opasso...	78, Opasso...	bukl
f123	ajibade	cletus	Male	3/June/20...	none	16-20	4	1.9	STUDENT	08094713...	lautech	lautech	math

Figure 10: List of Data Processed Using the System



## 6. CONCLUSION

The framework developed in this work has several advantages. Some of these are: (i) Presentation of a patient centred Health Management Information System; (ii) Application systems enabling indigenous patient-to-practitioner interaction; (iii) Provisioning of real-time language translation for indigenous patients to interact with medical practitioners; (iv) Development of a web based HMIS with easy accessibility anywhere, anytime when connected online; (v) Development of a Health registration tool which can be used by the National Health Insurance Scheme for all patients, both literates and illiterates.

The limitations are missing in-built language engine, lack of internetworking of all hospitals in Nigeria, lack of central database, shortage in availability of Computer systems and illiteracy.

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