International Journal of Advances in Engineering and Management (IJAEM)
Volume 4, Issue 11 Nov. 2022, pp: 159-166 www.ijaem.net ISSN: 2395-5252

A Model of ICT Based Network System for Medic-Care Support for Patients with Lassa fever

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Submitted: 01-11-2022 Accepted: 12-11-2022

ABSTRACT
One of the real difficulties in giving proper care and treatment of suspected LASSA FEVER case in Nigeria is lack of fast and accurate information system that can connect them to the appropriate medical support center with a specialist. Information is very vital in planning, budgeting and decision making. Getting the right set of data has to be collected over a period of time in order to get error free information. Many researchers have done tremendously well but still need improvement in terms capturing patient records from anywhere. The World Health Organization, puts the overall case-fatality rate as 1%. Observed case-fatality rate among patients hospitalized with severe cases of Lassa fever to be 15%. Early supportive care with symptomatic care generally improves survival rate. The major constraint is in having a comprehensive data of people infected with Lassa fever, allocating them to healthcare centres for proper care. Considering the very dynamic nature of Nigeria's population, the database is continuously updated to meet requirements. According to the National Centre for Disease and Control (NCDC) there was over 3079 suspected cases of Lassa fever as of when this report was compiled. Thus, this research work developed a model of ICT based network for medic-care support for LASSA FEVER patients. The system uses a web application interface to allow users access services by registering and monitoring the health status of the suspected persons. The C# programming language, SQL Server and Visual Studio 2010 were adopted in building the system in order to help in monitoring, allocating and supporting patients with Lassa fever.
KEYWORDS: Lassa Fever, Database, Patient Allocation, Medical SupportCenter, Information and Communication Technology

I. INTRODUCTION

Lassa fever is a rodent-transmitted viral haemorrhagic disease of global health concern. The disease is endemic in West African and responsible for recurrent epidemics of acute haemorrhagic fever in parts of West Africa as well as sporadic disease in Europe, Asia and America(Monath, 1975). Lassa fever is an acute viral hemorrhagic disease of 2 to 21 days that happens most frequently in West Africa. The illness was discovered in 1969 when two missionary nurses died in Nigeria (Lecompte et. al., 2006). The Lassa virus is a likely agent of bioterrorism, with capacity for person to person transmission and potential to cause hospital outbreaks with attendant morbidity and mortality among health workers(Khan et al., 2008). Lassa fever is also associated with occasional epidemics, during which the case-fatality rate can reach 50% (Asogun et. al., 2012). The number of Lassa virus infections per year in West Africa is estimated at 100,000 to 300,000, with approximately 5,000 deaths. Unfortunately, such estimatesare crude, because surveillance for cases of the disease is not uniformly performed (Amorosa et.al., 2010) People with severe ailments like Lassa Fever often do not have the same access to treatment for physical health conditions nor do they experience the same life expectancy as other people in the community. According to World Health Organization (WHO, 2017), the overall case-fatality rate is 1%. Observed case-fatality rate among patients hospitalized with severe cases of Lassa fever is 15%. That early supportive care with rehydration and symptomatic treatment improves survival. According to the week 10, 2022 report on suspected cases of Lassa Fever from the National Centre for Disease Control (NCDC, 2022) that a total of 3079 cases have been reported in 23 states including the Federal Capital Territory. According to the report there is an increase of suspected cases,

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confirmed cases and death confirmed cases in 2022 against 2021. The government has set up National Emergency Operations Centers(NEOC) and Public State Emergency Operations Centers across the states for treatment of LASSA FEVER. Suspected cases data capture are done only in the designated Emergency Operation Centers(EOC). i.e the suspected victim must travel to the center. Connecting to the Emergency Operation Centers(EOC) is time consuming Information and Communication Technology(ICT) is a rapid growing scientific, technological and engineering discipline that influences every human life. They played salient roles in health handling and exchanging information for patient and doctors. ICT stands for "Information and communication technology". It refers to technologies that provide access to information through telecommunication(K. Ratheeswari, 2018). The role of Information and Communication Technology in health sector is not a rocket science and that cannot be overemphasized. The ICT helps in connecting people, improving health in other developed countries like United State but Nigeria which is one of the developing nations is having a difficulty in connecting or reaching out to victims of LASSA FEVER in the rural areas. When there is an outbreak of LASSA FEVER in the rural areas, the relatives will send the suspected case to any nearby chemist or pharmacy or primary healthcare center and even to any hospital either big or small all in the name of seeking medical attention to save a life. The victim may die in the process as a result of seeking medical attention in wrong places. At the local government area level, there is no information system for suspected cases of LASSA FEVER through which government can provide medical care and as well in planning, budgeting and decision making.Based on the above, government required a model of ICT based network system for medic-care support for patients with LASSA FEVER that will capture data of suspected cases with strong ailments like Lassa fever and other related sicknesses that are very difficult to cure. More so government will connect and allocate them through the information system to different special medical support centers (Emergency Operation Centers(EOC)) with specialist at their local government area depending on their health cases as to help them and also promote health condition of the people. This information system will also allow parent or relatives of the patient to locate him/her where ever they are been hospitalized.

II. RELATED WORKS

Jeffrey et al., (2019) proposed "A medical records and data capture and management system(DCMS) for Lassa fever in Sierra Leone: Approach, implementation, and challenges. DCMS challenges included weak specificity of the Lassa fever suspected case definition, limited capture of patient survival outcome data, internet costs, lapses in internet connectivity, low bandwidth, equipment and software maintenance, lack of computer teaching laboratories, and workload fluctuations due to variable screening activity. DCMS are the backbone of international research efforts and additional literature is needed on the topic for establishing benchmarks and driving goal-based approaches for its advancement in developing countries.Drawback is that it does not allocate patient to specialist at the medical support centers from a distributed database system.

Devyet al., (2019) proposed "Diagnostic applications for Lassa fever in limited resource settings" they said Currently available LASV diagnostic methods are difficult to implement in low-resource health centers and may be less sensitive to detecting all known or emerging LASV strains. To prioritize diagnostic development for LASV, they assessed the diagnostic applications for case detection, clinical management, surveillance, outbreak response, and therapeutic and vaccine development at various healthcare levels. Diagnostic development should prioritize point of-care and near-patient diagnostics, especially those with the ability to detect all lineages of LASV, as they would allow for rapid detection in resource-limited health facilities closer to the patient.

Enesi et al.,(2018) proposed "A Diagnosis System For Lassa Fever And Related Ailments Using Fuzzy Logic" The system was designed and implemented using MATLAB R2013a version. Their diagnosis system allows users to select symptoms from the symptoms interface page that display when the application is launched. But it does not handles allocation of suspected cased to specialist at medical support center in an LGA

Vanessa Raabeet al., (2017) proposed "Laboratory Diagnosis of Lassa Fever" they said an early identification of Lassa fever is crucial for maximizing the benefit of available antiviral therapy, as treatment efficacy rapidly decreases following the clinical onset of the disease.

Ansari et al., (2016) proposed "Application of chronic care model for self-management of type 2 diabetes: focus on the middle-aged population of Pakistan" The system

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highlights the variations of chronic care model and the evidence for its efficacy and elaborating the elements of the model that are used in primary health care. The features of Chronic Care Model (CCM) have been highlighted including the socio-ecological approach to diabetes self-management and community-based partnership for improving chronic disease management. The two components of the chronic care model such as patient self-management support (SMS) and delivery system design (DSD) have been proposed for type 2 diabetes patients in the middle-aged population of rural area of Pakistan to see the effectiveness of their intervention in improving the patient quality of life, risk behavior and knowledge and adherence to treatment. The chronic care model offers an ideal framework to support diabetes self-management education and support because it provides a sound basis on which to promote self-management.

Catherine et. al (2015) proposed "The Program of All-Inclusive Care for the Elderly (PACE)" which is a United State model of service provision and financing that aims to reduce use of hospital and nursing home care. The model focuses on elderly people attending day centers, uses an interdisc

iplinary team for care management, and integrates primary and specialist medical care. The key feature of this model is integration of acute and long-term care services. This allows frail older people with multiple problems to receive care from a single service organization. This is one of a number of similar health insurance provider initiatives in the US, but the PACE Model has been more well documented than most. While there are numerous descriptive assessments of the PACE model, we found little high quality evidence about its effectiveness. One comparative analysis suggested that PACE reduced hospital admissions compared to usual care, but increased the use of nursing homes.

Gee et al., (2015) proposes "The e-Health Enhanced Chronic Care Model: A Theory Derivation Approach" Chronic illnesses are significant to individuals and costly to society. When systematically implemented, the well-established and tested Chronic Care Model (CCM) is shown to improve health outcomes for people with chronic conditions. Since the development of the original CCM, tremendous information.
management, communication, and technology advancements have been established. An opportunity exists to improve the time honored CCM with clinically efficacious e-Health tools.

III. METHODOLOGY

The proposed system is a web-based system that will capture patient records with strong ailments such as LASSA FEVER in a local government and assign them to special medical center with specialist to take care of them.The new system is Information and Communication Technology based. It is an information system that takes record of some suspected cases of LASSA FEVER.The proposed system is hosted on the cloud against the existing system that was centrally situated at the KGH. The proposed system allows suspected cases to register from anywhere at their comfort zone and loved ones of the suspected case can checked on them through our proposed system. This system has admin features and user features. Admin can view options at back end and change settings and add new options to system. User will have limited features.**Admin:** Admin can register patients, search special hospital, assign patients to special hospital, view/update/delete patient details and view all hospital details, logout.

User module: This module contain users of the system i.e Admin, Patient, Ministry of Health, Health Agency like National Centre for Disease and Control (NCDC). Users get access to the system using an internet connection.

Data Capture Layer: This module captures patient profile like firstname, lastname, email, username, password, state of origin, local government area, hometown, type of sickness, starting date, community chief, cdc chairman, photo upload then submit to the database.

Data Processing Layer: This module is designed to process the data captured.

Allocation Layer: This module assigns patient to any medical support center(MSC) with a specialist available for enrolment, admission, hospitalize then outreach.

LGA: This module contain local government area where the medical support center is situated.

Medical Support Center(MSC): This module shows different support centers for lassa fever with a specialist that can manage the patient professionally.

Internet: Users access the portal on the internet by entering the web address in the uniform resource locator(url) i.e www which means world wide web.

Database: This is the storage container where all the data information are stored. Patient, doctor, admin, ministry of health official, non-governmental organization information are stored.

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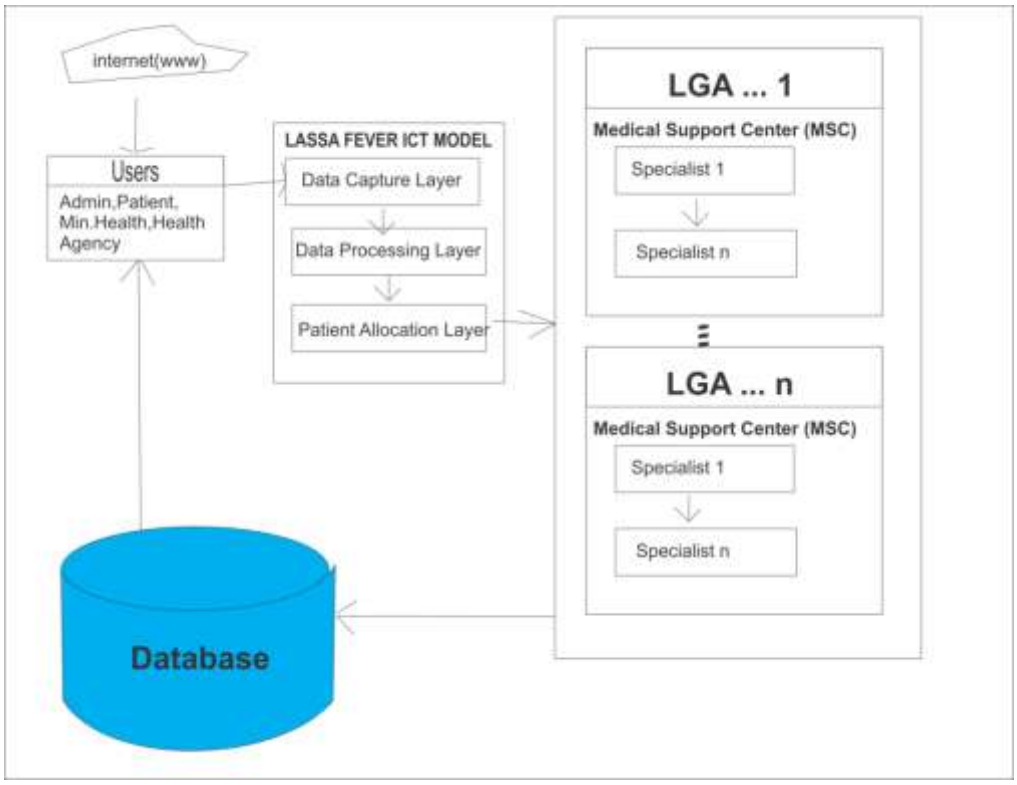

Figure 1. Architecture of the proposed system

IV. RESULTS AND DISCUSSION

The system works in 3 simple steps; (1) Capture patient registration (2) The system search for available specialist based on the LGA and the Medical Support Center. (3) The system assigns or allocate available patient to available specialist. The purpose of the input design is to create new input form which could harmonize the relevant data of the patients so that it can be stored into a single dataset. The output contains the relevant information that will be needed by the local government to give free medical treatment to those that are been affected by chronic ailment. As expected, the input design was done with the output in mind. If the wrong data is inputted into the system, the wrong output will be gotten.

4.1 INTERFACES

4.1.1 User Home page

The interface below shows some screenshots taken from running the application. All the functionalities are explained accordingly. When the user types the web address in the browser, the main page of the application is displayed which has the menu buttons, as shown in Figure 2

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Figure 2. Displaying home page

4.1.2 User Login Page:

The interface contains the username and password of the patient, when the user enter the required username and password then click on the login button, it will redirect to patient profile page. See figure 3 below;

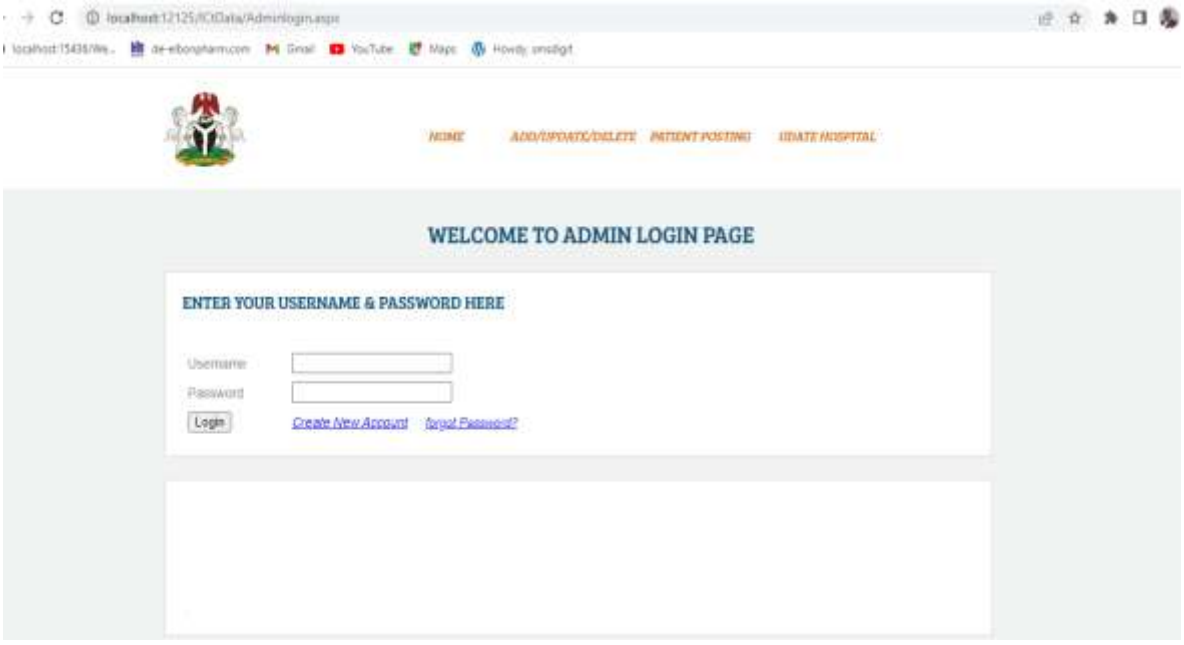

Figure 3 User Login

4.1.3 Patient Registration

The interface contains the patient registration,a new user can register on the site by clicking on the Registration menu link on the home page. when the user enter all the required details then click on the Submit button, it will redirect to login page. See figure 3 below.

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Figure 3. Patient Registration

Table 1: Comparing Cumulative Suspected Cases, Confirmed Cases and Death Cases of 2021 against 2022

Year	Suspected Cases	Confirmed Cases	Death Confirmed Cases
2022	3079	630	112
2021	1211	191	42

Figure 4 below shows that in 2022 the number of suspected cases has increased to 3079 against 1211 in 2021. In 2022, confirmed cases has increased to 630 against 191 in 2021. Death confirmed cases has increased from 42 in 2021 to 112 in 2022.

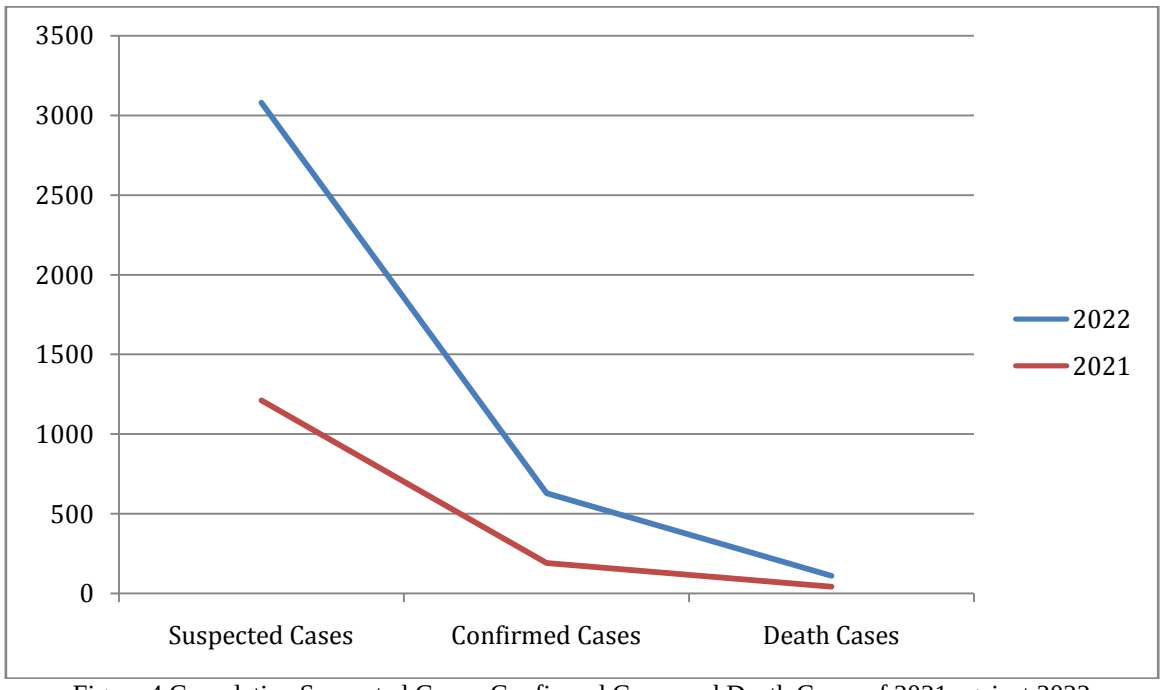

Figure 4 Cumulative Suspected Cases, Confirmed Cases and Death Cases of 2021 against 2022

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Table 2: Comparing Cumulative Confirmed Cases in States and LGAs

Year	States	LGAs
2022	23	87
2021	12	48

Figure 5 below shows that confirmed cases in states has increased from 12 in 2021 to 23 in 2022. Confirmed cases in LGAs have increased from 48 in 2021 to 87 in 2022.

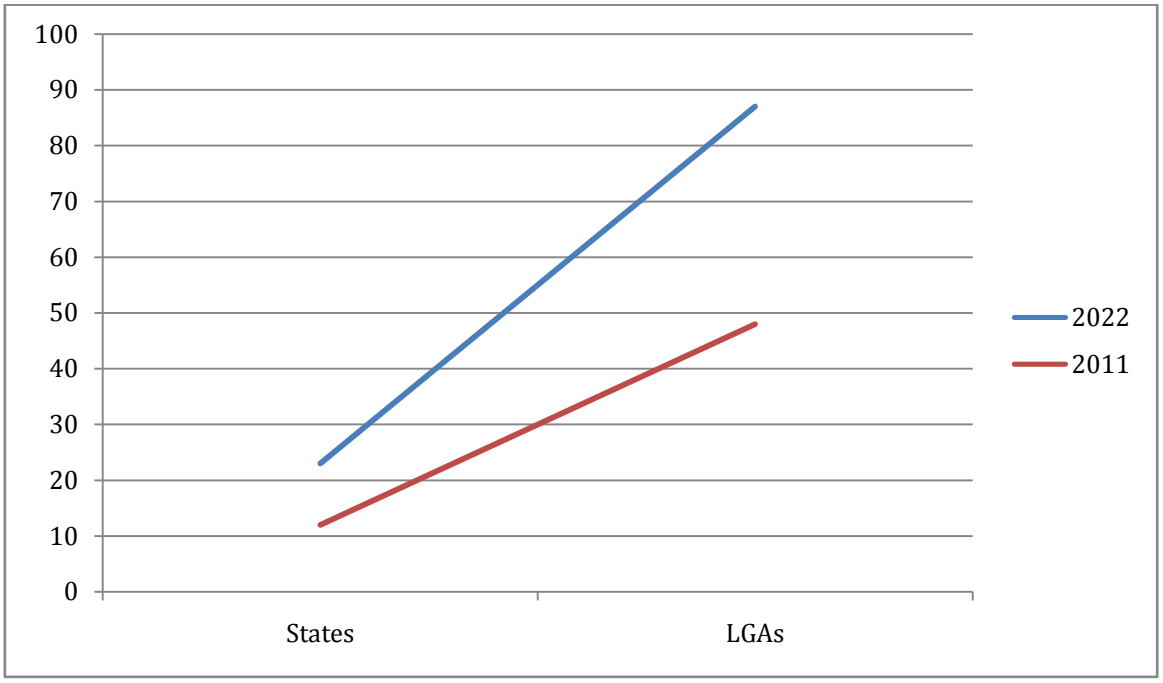

Figure 5.Cumulative Confirmed Cases in States and LGAs

V. CONCLUSIONS

The project work was done to provide a Web-based System that could be used by the government to capture and monitor the progress of patients with strong ailments such as Lassa Fever and to assign them to a special medical care support center. This system involves the process of registration of suspected cases who are indigenes in a Local Government Area that has been victimized by such chronic ailment, and not having the finances to take care of such ailments, and no specialist to treat them. This system improves the Data Capture and Management System(DCMS) solutions by Jeffrey et. al, 2019 such that suspected cases can be register from anywhere and be assigned to a specialist in any medical support center nearer to them in the LGA. The findings of this study were basically done through the use of patient data.

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