Patient e-health system for emergency management

[1]Anazia Eluemunor Kizito (PhD), [2]Ashie John Azuka

Department of Information System and Technology
Delta State University of Science and Technology
Ozoro, Delta State, Nigeria

***Abstract*: Medical care is one of the most essential services needed to sustain human existence. Three major factors are identified as a major obstacles that has prevented people from obtaining proper medical cares and treatments. They are deficiency of medical staff/equipment, increase in the number of patients/elderly and geographical separation between the medical personals and patients. e-health has provided solutions to some of the health challenges facing mankind most especially during emergencies. Information and Communication Technologies has become an important infrastructure upon which several domains are built in order to achieve more effective solutions in health care delivery known as e-health system. The incorporation of ICT into the medical discipline is currently available to most patients and elderly across the globe though without some limitations. The importance of monitoring, diagnosing and treatment of a large number of patients distributed over different territories, together with the lack of medical resources, makes the patient e-health system for emergency management inevitable for the future healthcare services.**

***Keywords*: e-health, Telemonitoring, Telemedicine, Telehealth and Information and Communication Technology (ICT).**

Introduction

e-health is a new and evolving part of Medical Care system which was given birth as a result of the emergence of internet technology. It encompass Medical Information, Public Health, and Information Technologies. In recent years, the scarcity of medical personnel persist and the migration of people from one place to another has increased due to civilization, there was need to bridge the gap mostly people with chronic/deadly diseases and the elderly. Patients with protracted disease and the elderly may suffer constant attracts and which usually leads to frequent hospitalization in the hospital/medical facilities as a result of negligence and shortage of medical personal [1]. Prompt detection of these illnesses will aid in positive intervention like treatments and stabilising the health of the patient as well as cost reduction.

It was observed that when patients with these type of diseases need to see a specialist or continue to see a specialist even when the patient is physically away from the medical personal or during emergencies, it becomes a very difficult which may create complications or lead to loss of life. This was what gave birth to this medical field known as e-health. The system is a combination of Medical care and Information Communication Technology. e-health can also be defined as the application of emerging information and communication technology, especially the Internet and ICT components, to improve or enable health and healthcare services thereby enabling stronger and more effective connections among patients, doctors, hospitals, payors, laboratories, pharmacies, and suppliers [2]. They further opined that e-health is making healthcare services more efficient and flexible, while allowing patients and medical professionals to interact with each other by overcoming the barrier of distance.

e-health as a form of electronic medical services provided over the Internet, which includes informational, educational and commercial "products" to direct services offered by professionals, non-professionals, businesses or patients [3]. The “E or e” in the e-health stands for electronic that has been used previously in words like e-mail, e-banking, e-transaction etc. which is used to refer to any activity or proceedings that takes place over the internet with the support of information and communication technologies.
The unavailability of medical services and practitioners becomes worst during pandemics and natural disasters and e-health system has been so helpful by filling the gaps that was created. Most of the patients that could not be reached or those that needed urgent attentions will have access to various medical service through E-health platforms and applications. It is observed that in the recent past, the volume of Emergency Department (ED) visits has steadily grown which has resulted in continued ED crowding and considerable delays prior to ED evaluation and treatment with the associated adverse effects on patient outcomes. One of the major ways of proffering solution to this impending threat to patient’s life and delay to deploy medical services is to expedite emergency care in the face of growing demand is to embrace e-health service. e-health can be broadly classified into three, namely; Telemonitoring, Telemedicine and Telehealth.

Telemonitoring is defined as the process of continuously or non-continuously monitoring of a patient’s health conditions from a remote position by a medical professional in other to share information generated for further treatment or decision making either by the same medical practitioner or other practitioners [4]. This includes taking vital signs, blood level, sugar level etc. Telemonitoring ends with taking readings of patient’s records and health conditions, it does not deal with diagnosis, prescription and treatment of patients.
Telemedicine can be seen as an extension of telemonitoring with an additional work of drug prescription and treatments via ICT devices from a remote site. Telemedicine is seen as the use of ICT-based devices for the acquisition of medical information from a patient (telemonitoring) and physician’s clinical encounter/ assistance remotely [5].
Telehealth is a term used to describe all medical services made available to patients from a remote position. The provision of health care services like generation of patient medical records, diagnosis and prescription of drugs to patients via remote technologies [6].

e-health is a broader term that is used to describe the activities of telemonitoring, telemedicine and telehealth. WHO defines e-health as the application of healthcare services, where distance is a critical factor, by all healthcare personnel using information and communication technology devices for the exchange of valid information for diagnosis, treatment and prevention of disease and injuries, research and evaluation, and for the continuing education of health care providers, all in the interests of advancing the health of individuals and their communities. These ICT devices includes personal computers, telephones/hand-held devices, visual display units, cameras, medical wearable devices, internet facilities, other computer peripherals and multimedia devices.
The major importance of e-health system during emergency situations like chronic diseases, terminal diseases, pandemic, accident amongst others includes to provide clinical support, overcome geographical barriers, connecting users who are not within the same physical locality, improve health services etc. through the application of ICT based devices.

Statement of Problems

The application of e-health system in the Emergency Department (ED) and in the handling of chronic diseases has been a slow process in the world even in the developed countries where the technology has been available for decades. It is of recent that e-health system is being adopted and applied in most western countries like United States and Europe. Factors impeding the adoption of e-health system are reluctance of the medical community to adapt to new technology, governmental regulation, patient awareness and lack of financial incentives or loans for use of telemedicine [7]. This gap that was created by the underutilization of the e-health was publically aware during the outbreak covid-19 pandemic when medical service ran out of service throughout the world.

In this research work, the following problems that are related with e-health system during emergency management was highlighted; Inability of patients in emergency conditions and chronic diseases to access healthcare services from remote locations without going to the hospital thereby delaying treatment, inadequate information storage and retrieval system in healthcare facilities to support prompt access to patients' medical history during emergency situations, inability of doctors from different hospitals to share patients' medical information on real-time when patients are referred from one hospital to another during emergency situations thereby delaying treatment, inability of medical staff to diagnose, prescribe and treat patient during emergencies and increased possibility of losing patients in emergency situations due to either negligence, poor diagnosis and delayed treatment.

Objectives of the Study

The application of e-health system no doubt will help in improving healthcare services by making medical services available to patients in critical conditions, decongest emergency departments in our medical facilities, optimizes providers' services, potentially reduces costly medical requirements, and may increase the pool of providers available during unwanted times due to ability to provide care from home or other remote settings. The objectives of the proposed e-health system during emergency are highlighted below; to provide a system that will enable patients in emergency situations to access healthcare services from remote locations without having to visit the hospital, to provide a system that will ensure adequate storage and retrieval of health records in healthcare facilities to support quick access to patients' medical history during emergency situations and to provide a system that will enable doctors from different hospitals to share patients' medical history on real-time when they are referred from one hospital to another during emergency situations.

Review of Related Study

Due to the increased rate of death and limited availability of medical services in recent times, computer and internet has made it possible for millions of people to access proper medical services through technology based medical care known as e-health system [8]. The increased use of computers in healthcare led to the design and implementation of numerous computer-based systems like computerized medical Diagnostic system for chronic diseases, electronic health record, (HER), medical wearables etc [9]. Also, with the proliferation of Information communication technology devices and increased adoption in different branches of medical fields, healthcare services have been revolutionized using different technologies, systems and applications directed towards enhancing the qualities of healthcare services and patients' health in general. IT application in healthcare comes in different forms namely Mobile Health (m-health) applications, healthcare monitoring systems, smart patient health tracking systems just to mention but a few [10]. It was opined that the need of taking care of a very large number of patients distributed over the territory, together with the lack of medical resources, makes the adoption of Information Communication Technologies (ICT) crucial for the future healthcare services [11]. It was observed that in the recent years a large variety of E-health services and Apps for professional medical users have been developed for different scenarios. Patient's mobile health tracking apps are commonly used in healthcare system and they have gained widespread popularity facilitating the maintenance of health and management of chronic and emergency situation, allowing the sharing of clinical information over distances. One of the obvious benefit of e-health system is that it has empowered patients to contribute to their own well-being and affordability, accessibility and convenience to health services during emergencies and crisis of chronic diseases [12]. In the Global Observatory Survey on the development of e-health and its role on achieving Universal Health Coverage (UHC) by WHO in the year 2016, it was observed that UHC cannot be achieved without the support of E-health system. Many countries reported at least an e-health (mobile Health) initiative being implemented in the country and the survey results clearly demonstrate that there has been impressive growth in some developed countries [13]. Due to their findings, most countries are considering e-health system as fundamental means to strengthening the health system and innovation.
However, it was pointed out that the process of embedding e-health everywhere still has a long way to go, in terms of coverage and functionality [11]. The procedures of full implementation is still in progress which is been influenced by factors from different national priorities and politics. They further advised that to increase health App use efficacy, user-cantered mobile health tracking Apps should be made more flexible and available to the masses. Generally there has been an increased in various applications for e-health system though many of them are designed for specific objectives and functions [14]. These Apps are designed for diabetics,

blood pressure monitoring, for dermatological problems, for mental health or surgery, for therapy, for cancer patients etc. It was also averred that the large number of existing e-health systems application focused on the treatment/management of a single pathology, while most patients are affected by multiple pathologies and that a real-time monitoring including information sharing and methods for the validation of the acquired information operated by medical personnel staff [11]. In order to accomplish the major objectives of staying healthy which is to preserve the health of individuals, the use of ICT based devices for preventive measures, patient's monitoring, longevity education and sports health have been defined by combining ambient and wearable devices [15]. e-health can also be applied for health investigations which will help to achieve the appropriateness of the primary health care system, the justification of healthcare cost, the reduction of complications and disability with consequent improvement in the quality of life of people. Finally, the implementation of the proposed Healthcare System is projected to reduce the cost of healthcare services which includes reduction of inadequate access to hospital's accident/emergency room and drop in mortality and disability resulting from poor adherence to the prescribed therapy. e-health interventions and services has facilitated in plummeting waiting times, waiting lists, and unwanted appointments for patients who want the services of a specialist for outpatient and emergency services. They also pointed out that e-health services have expanded from providing medical services at hospitals, outpatient departments, specialist offices, as well as between health care personnel, to deliver care at patients' homes.

It was observed that the reasons to define requirements to guide in early detection of deterioration in chronic disease using Tele-monitoring systems [1]. The objective of the work is to provide the guidelines for identifying the up-to-date status of managing and treatment of chronic diseases; and to define the requirements for an ideal early detection monitoring system. The implementation of telemedicine has emerged as a positive strategy for reducing re-admissions, improving health and reducing healthcare costs for patients. It was opined that in some of the health facilities where e-health is implemented, death rate has reduced by 34% why hearth failure has reduced declined by 23% while re-admission has reduced drastically. They went further to state that a reduction in total hospital days, overall hospitalizations and length of stay without increasing outpatient visits and urgent care with the support of home e-health system integrated into the healthcare system. Since the adoption of e-health system in some countries, healthcare provision in rural and remote towns has improved through the development of cost-effective models that remain similar in quality to physician-staffed services. Deploying a two-way computer based and communication technology enhances synergy through mobile devices via videoconferencing consultations between the initial hospital that the patient is referred from to the hospitals where the patient is being referred from which may reduce secondary over triage and optimise patient management within community hospitals [19]. It was also observed that the reduction in morbidity and mortality rates, hospital admission time and cost of patient care. Furthermore, e-health services enables patients to take charge of their healing processes, encourages patients, and makes patients to be involved in the management of their health diagnosis and treatment. The importance of monitoring a large number of patients distributed in different locations, sustaining patient's assistance requirements and meeting up with the inadequate of healthcare resources makes the implementation of ICT in medicine very important for the healthcare services [11].

Types of e-health

Technologically, e-health can be viewed under three major headings; which includes Store-and-Forward, Remote Monitoring and Real-Time Interactive e-health system. Both of them has advantageous role to play in general healthcare system and when implemented adequately, will be beneficial to a large extent for both medical personnel and patients alike [20].

Store-and-Forward

Store-and-forward e-health surpasses the need for the medical practitioners to meet in person with a patient. This system allows data such as medical multimedia files or bio-signals will be shared among specialists when necessary after it has been generated from the patient. This process is often used among medical practitioners like pathologist, dermatologist and radiologist. With proper structure and care, this technique will be faster and gives medical personnel the opportunity of giving patients and the generally their best. However, this approach depends largely on the medical history and documented information in the form of multimedia or otherwise, rather than one on one physical examination on patient, which may usually lead to eventual complications such as misdiagnosis.

Remote Monitoring

Remote Monitoring is usually referred to as self-monitoring or self-testing, this approach of e-health system relies on ICT devices to monitor medical and clinical signs in patients from a remote position. This is extensively used in the management of chronic diseases such as cardiovascular disease, diabetes mellitus and asthma. Benefits of remote monitoring include cost effectiveness, more frequent monitoring and greater patient satisfaction. Some of the drawback of the approach is that there may be chances of inaccurate tests conducted by the patients themselves may be inaccurate, but the outcomes are generally thought to be similar to professional-patient tests.

Real-Time Interactive Services

This approach of e-health system can provide fast and speedy advice to patients who require medical services. Real-Time Interactive Services is being deployed via different platforms of ICT devices over the internet which includes various mobile devices and hand-held devices as well as home visits. A medical information and consultation like taking vital signs and symptoms, which is preceded by the physical assessment like the ones normally done during face-to-face appointments. An example of Real-Time Interactive Services is the tele-based neuropsychology telemedicine which includes neuropsychological consultation and assessment over the mobile devices with patients that are diagnosed with cognitive disorder. Standard evaluation techniques are designed for patient's accessibility via ICT devices that are multimedia enabled.

During the outbreak COVID-19 disease in the year 2020, a unique challenges was presented to the medical system in the world. Specifically, lack of medical personnel, equipment and the threat of medical personal/ care givers being infected due exposure and

physical contacts patients [21]. At this point e-health system was proposed to fill in the gap of shortage of health personal and equipment. With the deployment of the e-health system, there will be a reduction of physical contact as much as possible, by professionals who interact with the affected patients. Those who could benefit from the services includes registration personnel, nurses, social workers, advanced practice providers (APP), and language translators [22]. Furthermore, the extensive regulatory changes regarding telemedicine use in the United States present medical personnel with the chance of exploring new adaptations of the science and technology. In the situation where there are new innovations, emergency medical delivery system will need to promptly adapt to the changing technological landscape and incorporate telemedicine into routine care system.

Analysis of the proposed E-health System During Emergencies

The surge in medical emergencies and global pandemic has significantly strained the medical services and equipment around the globe. This new trend has gave birth to a novel approaches in healthcare services which has led to the implementation e-health system to support the already over-stretched medical system. Information and communication technology based devices and the internet (computer hardware and software components) have been playing a major role in introducing automated systems known as e-health from which several domains and services can benefited [23]. Several benefits which include increasing operation reliability, accuracy and efficiency, time, cost are achieved by the application of computer based medical system. Other medical services which usually depends on the remote distances and other location effects. People in the rural or difficult areas are thus able to access medical services.

The strengths of e-health application has helped the health sector to meet the medical necessities of patients and have proven to be one vital approach in managing the crisis in our public health system. The research methodology deployed in analysis and developing the proposed system is known as the Waterfall Software Methodology.

In Waterfall Model, each phase must be completed before the next phase can begin and there is no overlapping in the phases. The proposed system is a web based e-health System for Emergency Management. It will enable medical facilities and personnel bridge the gap created by time and space between medical employees and patients via information and communication technology devices. The system will enable medical staff to interact directly with patients during emergencies. The will system will also support patient monitoring, diagnosis, prescription, treatments, surgery etc to order for patients have access to medical services within the shortest possible time irrespective of geographical separation, time and otherwise.

The proposed system is a web-based solution developed with tools that support web solutions. In this case, ASP.Net, Bootstrap 4.5 (Control mobile devices of different size) JQuery, JAVA Script, C# and CSS are used as the front end tool while SQL Server serves as the backend tool for storing the operation information. An Operating System (Window 10 Operating System) and Microsoft Visual Studio 2017 (Front end). Most hardware only has operating system requirements or compatibility. An E-health system for emergency management is a three tier- architecture that comprises of the Participants, Medical Services and Information and Communication Technology Devices.

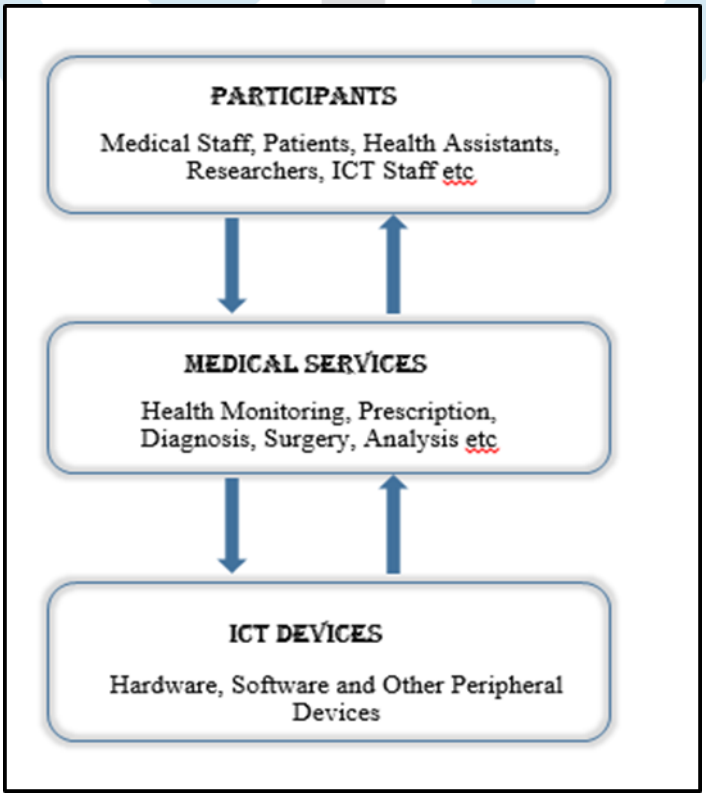

Fig 1: The architecture of the patient e-health system for emergency management

Participants
These are all the users who that are involved in the development and application of E-health system for emergency management. They include medical staff, patients, health assistance, ICT application developers etc.

Medical Services
Medical Services are any kind of service or assistance that can be derived from an e-health system for emergency management. They include health monitoring, diagnosis, testing, testing/result analysis, prescription, surgery etc.

Information and Communication Technology Devices.
These are Information and Communication Technology gadgets that are used in an e-health system either from the participants end or that supports its functionality. These gadgets includes the following, computer system, monitors, servers, hand-held devices, wearables, internet and others medical gadgets associated with e-health system for emergency management.

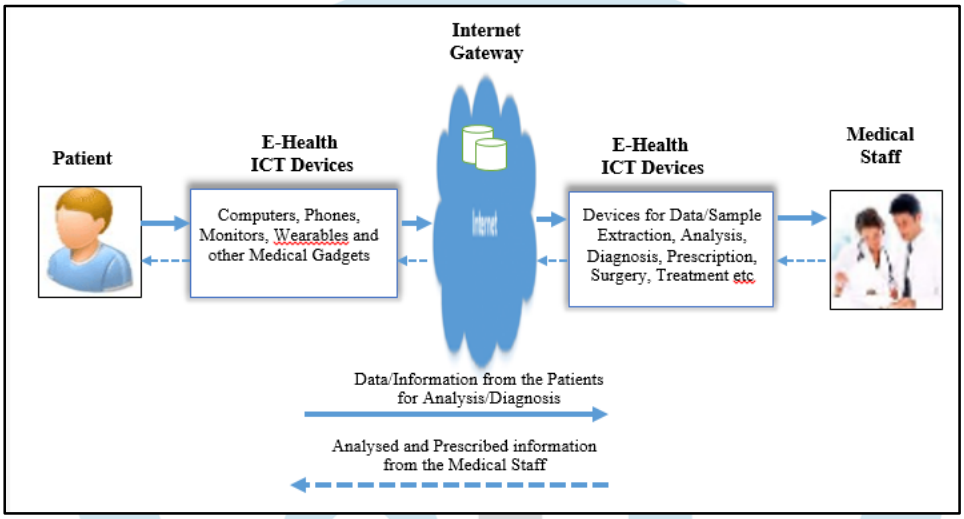

Fig 2: The flow of communication of the patient e-health system for emergency management

In figure 2, the above diagram shows how e-health system for emergency management works and the internal communication flow. The system creates a communication link between the medical staff and patients during emergencies regardless of distance and time through the use Information and Communication Technology gadgets via the internet. The medical personnel like doctors, nurses, physician, pharmacist, laboratory technologist can connect to their patients during emergencies or attack and carry out the necessary medical services/assistance via the internet and Information and Communication Technology gadgets in real-time. The system supports health monitoring, diagnosis, testing, testing/result analysis, prescription, surgery etc. hence the patients may not need the medical personnel physically mostly when either of them are far from each other during emergencies and crisis. Photos shots/result sheets are obtained by the patients and the medical personnel via their mobiles devices and stored in the database server. These information can be assessed and retrieved by both parties when needed. Also a third party medical staff can assess the medical history and information of a patient from the database on the internet if given the necessary permission and commence the required health services and assistance on the patient when the initial medical staff is not reachable.

Output of the e-health System for Emergency Management.
The diagram shows the output page of the e-health system for emergency management. The diagram shows the medical staff (physician) page. On this page the physician interacts with the patient and renders the needed medical services and assistance. While the second diagram is the patient's page. The patients answers questions from the medical personnel and receives medical services and assistance.

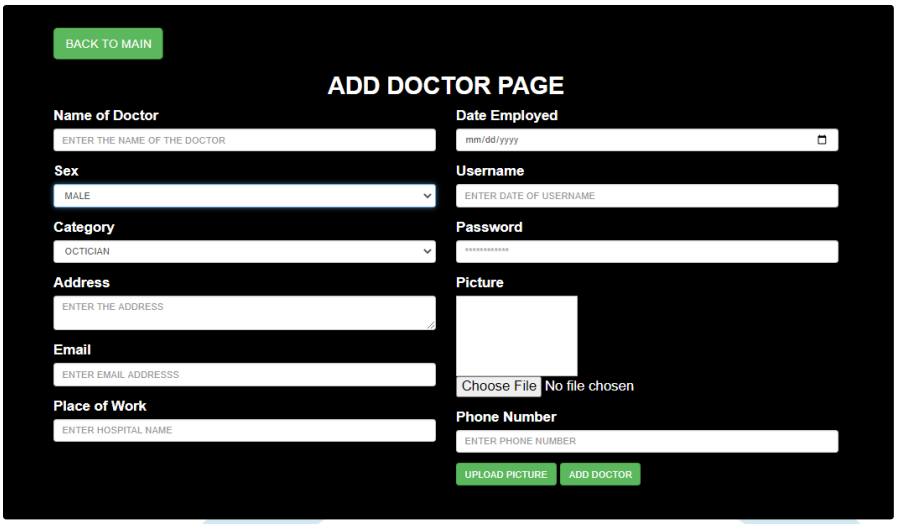

Fig 3: Medical personnel (Physician) Interface

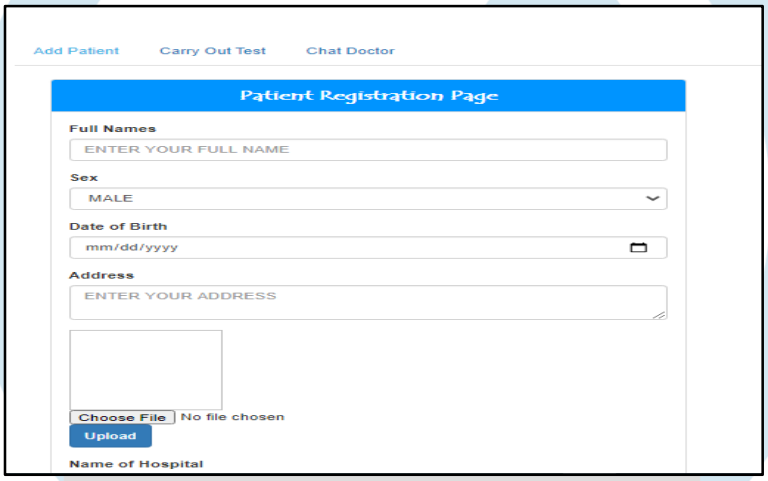

Fig 4: Patient Interface (Physician) Interface

Benefits of e-health During Emergencies

Many countries are moving towards the full realization of e-health system in order to acquire decent and improved medical services for their citizens most especially during emergencies, chronic diseases and the elderly. In achieve order to achieve this task, all of the relevant parties involved have to agree and work with the term and condition guiding the application of the system. The following are some of the advantages of e-health system for emergency management.

Improve Quality Healthcare Delivery System

When the E-health system for emergency management is fully deployed, it will enhance quality and improved health system to the patients and the entire populace. Health crisis/attacks of chronic diseases, emergencies to accidents will be managed due to the availability of medical services real-time irrespective of location. Also patients will have the opportunity to be treated by health specialists that are not available in their locality through the e-health system for emergency management platform.

Improved Health Monitoring System

Since the system works as a real-time application, it will avail patients and medical personnel the opportunity of keep in touch with each and a follow-up with the patient's situation where they are geographically far from each other. This will actually reduce death and deterioration of health condition of patients.

Reduction in Laboratory and Diagnosis Errors

With the use of this system, it means that majority of the laboratory tests and diagnosis are automated. This will reduce human errors associated with laboratory tests and diagnosis and enhance the time for laboratory tests and diagnosis. Also these results and report will be readily available online where medical practitioners with the given permission can have access and make contributions.

Access to Medical Services Irrespective of Location
As a real-time system, medical services on the platform will be accessible by patients and users round the clock irrespective of location. Research has shown that many patients residing in the rural settlements have access to limited medical services either due to shortage of personnel or personnel not willing to work in this remote villages. Also it was noted that some elderly people may not be strong enough to travel to the towns and cities for quality medical service due to their age. But with the deployment of e-health system for emergency management patients, medical services will be made available to different kind of users irrespective of geographic separation.

Improved Medical Research
This new medical care management system will improve medical research procedures by breaking new grounds in medical education and sharing of information. With the use of ICT gargets which the e-health system for emergency management is based on, it will hasten research methods with more accurate result as well shard knowledge and information among researchers that are domiciled in various educational institution and research institute in diverse geographical location.

Sharing of Medical Records/Information among Medical Staff
E-health system for emergency management will improved sharing of patient's medical databanks and collaboration amongst different medical specialist irrespective of their distance apart. This will improve patient's health and save them from death. Even situations where patient are out of town, a new medical practitioner who is within the reach of the patient can commence the treatment while relying on the medical history that is available to via the internet if permission is granted to him.

Improved Protection of the Privacy and Security of Patient Information
Based on the modern privacy and security devices, health record and information of patients have become very secured and accessible. Like Electronic Health Record System (EHRS) that supports H-health system for emergency management, the patients' medical history and information are only made available to only those whose access are given and are directly involved with the treatment of the patient. This will reduced blackmail, stigmatization and abuse of patients with chronic and terminal and the information
Reduced Cost of Health Care Procedures
With the application of simple economics principle which states that increase in availability will reduced cost, shows that since the application of e-health system for emergency management will make health services available and accessible to patients and users, definitely this will force its cost downward. People will not travel to towns and cities for health services and also the triage system will be improved.

Expanding the Reach of Health-care professionals
e-health system for emergency management will reduce health-care professionals' administrative burden and other repetitive aspects of their jobs. This will give them more time for actual patient-contact and monitoring. This is particularly important for patients or clinics located in rural areas or for home-care/outpatients for travel is difficult or not recommended. With the aid of digital clinical-grade devices available to patients, they are empowered and oblige to make their health information available to health personnel mostly physician at real time.

Preventive Medical Care System
e-health system for emergency management will help patients to self-manage their health conditions through regular monitoring and tracking of symptoms. More importantly, it is a medium for the early detection of significant changes to disease progression in a patient. e-health platforms are therefore of immense value for emergency cases and chronic disease patients that are classified as 'risk' cases'.

Challenges of e-health System
High Level of Illiteracy
This has been a major setback in the improvement and acceptance of e-health system among the people. Patients residing in the rural settlements that usually have limited access to health services are not educated enough to accept and use the required ICT devices through which e-health system is deployed. Even when E-health is made available to them, either they are not able to use them or they are underutilized.

Poverty
Unlike the conventional method of deploying medical services to patients, e-health system is deployed via ICT devices and platforms which are usually costly. With their present income per capita among patients and the high cost of living, it is almost very difficult for patients to acquire ICT devices that are used for e-health systems. Most cases when patients are actually aware of this facilities, acquiring them becomes a major setback that if not well managed very well it may cause complications and death during emergencies.

Low Internet Penetration
e-health system are largely deployed online which needs internet connectivity. Currently 59.5% of the world population has access to internet connectivity which are basically located in the urban centres while the rural and remote settlements are left out (Joseph, 2022). Most patients in the rural areas can hardly access to e-health system during emergencies and accidents due to unviability of

internet accessibility. Experts had opined that with the present rate of internet connectivity, the full implementation and benefits of e-health system during emergencies and accidents may become very difficult to attain.

Lack of ICT facility
These ICT devices and its peripheral devices through which e-health systems are deployed to users are most times not available to patients due to economic barriers or otherwise. Developing and third world countries are those that are mostly hit by this challenge. In most cases, these ICT devices that available to patients during emergencies are obsolete or very difficult for patients and user to operate.

Lack of Skilled ICT/medical personal
Lack of skilled ICT/ medical personal that will operate these e-health ICT devices has been a major drawback in the full actualization of the importance of the system. Most of these systems are complex that trained personals are needed to manage them. If these personals are available, the financial burden of hiring becomes another hiccup.

Social-Cultural Acceptance
Generally many has some kind of reservation towards technologically-based medical services. Generally the acceptance of e-health systems in the world presently is low. Patients a still use to the conventional method of medical services were medical personnel has face to face contact with patients and users. Some cultures goes as far as forbidding this new trend of treatment and patients are allowed to die or issues become complicated for patients to embrace e-health system.

Legal and Security Issues
Legal and Security Issues has been a major hurdle in making e-health system generally acceptable to medical personnel, patients and users. e-health system needs a legislative and legal backing from the country's legal system. This will make all and sundry to use the system without fear of litigation of any form. Also the safekeeping of the information the platform must be protected else it will be compromised and abused by users and third party.

Government/Private Funding
Most of the e-health system platform could not survive for too long due to lack of financial support during harsh economic situations. Government and private organisations are to assist these medical companies through grants and loans to enable these e-health organisations thrive even under harsh economic conditions.

Unavailability of Medication Record/Information
e-health system works with patients records which most times becomes unavailable during emergencies and accidents. These companies should liaise with patients and other users to generate and update these information from time to time and shared across these platforms with appropriate regulation and security measures.

Conclusion
It is observed that the need to handle a large number of patients with emergency and chronic cases distributed all over the country and the unavailability of medical personnel has made the adoption of information communication technologies (ICT) based medical approach inevitable for the healthcare system to withstand the surging number of emergency cases. This new trend of medical services uses information communication technologies gadgets like computers, handheld device, phones, body-worn and embedded devices. It has improved medicals services and health condition of patients during emergencies in the various ways if fully implemented like improve quality healthcare delivery system, improved health monitoring system, reduction in laboratory and diagnosis errors, access to medical services irrespective of location, improved medical research, sharing of medical records/information among medical staff, improved protection of the privacy and security of patient information, reduced cost of health care procedures, expanding the reach of health-care professionals, preventive medical care system etc. Examples of the challenges facing the full utilization of e-health medical system are high level of illiteracy, poverty, low internet penetration, lack of ICT facility, lack of skilled ICT/medical personal, social-cultural acceptance, legal and security issues, government/private funding, unavailability of medication record/information etc.

Recommendation and Further Research
This system is highly recommended for use in medical facilities and outreaches to monitor, diagnose and treat patients' mostly in remote locations and different geographic locations during medical emergencies and crisis. The e-health application system is user-friendly and simple to manage. However, e-health application system for emergencies can be improved to support more information and communication devices, and also upgraded to support multiple users because at present it is limited to about three to five users at a time.

REFERENCES

[1] S.C. Peirce, A. R. Hardisty, A. D. Preece, and G. Elwyn, "Designing and Implementing Telemonitoring for Early Detection of Deterioration in Chronic Disease: Defining the Requirements", Health Informatics Journal, Cardiff University, UK. 2011.

[2] J. A. Blaya, H.S.F. Fraser, and B. Holt, "E-Health Technologies Show Promise In Developing Countries", Health Affairs Journals 29, NO. 2 (2010): 244–251, Project HOPE— The People-to-People Health Foundation, Inc 2010.

[3] M. Wysocki, "What is e-Health?" Suite University. http://www.suite101.com/ article.cfm/9670/57010. 2001.

[4] C. Carlo, P. Gabriele, and P. Giuseppe, "Telemedicine for Developing Countries: A Survey and Some Design Issues" ApplClin Inform, 2016.

[5] M.R. Hassibian, and S. Hassibian, "Telemedicine Acceptance and Implementation in Developing Countries: Benefits, Categories, and Barriers". Razavi International Journal of Medicine [Internet]. Kowsar Medical Institute, 2016.

[6] H. Abid, J. Mohd, P. Ravi, and S. Rajiv, "Telemedicine for Healthcare: Capabilities, Features, Barriers, and Applications", Sensor International Journal, Published by Elsevier B.V,2021

[7] M.H. Joel, G. Chris, S. Mike, M. Setareh, B.T. Linda, W. Eric, and S.Walter, "Telemedicine in The Emergency Department in The Era of COVID-19: Front-line Experiences From 2 Institutions", JACEP Open published byWiley Periodicals LLC on behalf of the American College of Emergency Physicians, 2020.

[8] S. Mahalle, and P. Inogole, "Design and Implantation of Wireless Body Area Sensor Network Based Health Monitoring System", International Journal of Engineering Research and Technology, 2013.

[9] R.M. Gardner, T.P. Clemmer, R.S. Evans and R.G. Mark, "Patient Monitoring Systems Biomedical Informatics", - Springer Publications, 2014.

.

[10] G. Bobrie, N. Postel-Vinay, J. Delonca, and P. Corvol, P. "Self-Measurement and Self-Titration In Hypertension: A Pilot Telemedicine Study", American Journal of Hypertension, Vol. 20, No. 12, 2007.

[11] M. Lorenzo, J. Sara, G. Antonio, P. Elisabetta, and Z. Paolo, "Tele-Monitoring System for Chronic Diseases Management: Requirements and Architecture", International Journal of Environmental Research and Public Health, 2021.

[12] S. Birkhoff, and H. Moriarty, "Interventions Using Smartphone Health Apps Across Various Populations: An Integrative Review of The Literature", Journal Informatics. Nursing, 2016.

[13] World Health Organization. "Global Diffusion of eHealth: Making Universal Health Coverage Achievable; Report of The Third Global Survey on eHealth;World Health Organization" Geneva, Switzerland, December 2016.

[14] K. Santo, S.S. Richtering, J. Chalmers, A. Thiagalingam, C.K. Chow, and J. Redfern,. "Mobile Phone Apps to Improve Medication Adherence, A Systematic Stepwise Process to Identify High-Quality Apps". JMIR Mhealth Uhealth Publications. 2016.

[15] N.M. Berninger, G.A. Ten-Hoor, and G. Plasqui, "Validation of the VitaBit Sit–Stand Tracker: Detecting Sitting, Standing, and Activity Patterns", Sensors Journal Publications, 2018.

[16] L.S. Ronga, S. Jayousi, C. Aragno, M. Bagni, L. Carniato, F. Fongher, "Satellite Integrated Heterogeneous Architecture for Professional Health Services", IET Commun. Journal Publications, 2017.

[17] V.Can, "Web-Based Monitoring of Real-Time ECG Data," Computers in Cardiology", Vol. Journals Publications 27, 2019.

[18] D. Wang, B. Hu, C. Hu C, "Clinical Characteristics of 138 Hospitalized Patients with 2019 Novel Coronavirus–Infected with Pneumonia in Wuhan, China", JAMA Journal Publications, 2020.

[19] J.E. Hollander, and B.G. Carr, "Virtually Perfect? Telemedicine for Covid-19". NEngl Journal Med. Vol. 382, 2020.

[20] K. Ittipong, S. Watsawee, and T. Manachai, "Telemedicine: Meaning, Challenges and Opportunities", Siriraj Medical Journal Publications, Volume 71, No.3. 2019.