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OnIntegration of ICT in National Healthcare Delivery System

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Abstract

Today's healthcare systemsin Nigeria are fragmented, uncoordinated and inefficient. Patients may travel far and wide, but knowledge of their health, welfare and medical conditions do not readily follow them. Within localities, hospitals and doctors rarely talk to one another nor share information about patients. Administrative costs of managing Healthcare systems are enormous. About 25%r of the $4 trillion global healthcare industry goes on just managing the system. The global task ahead is to contain those crippling administrative costs while raising the quality and variety of services. The benefits gained from applying information and communications technology in a wider and more comprehensive manner from the management of healthcare to its delivery—much as it's been done so successfully in finance, business, communications and most other walks of life—could be truly enormous. This paper believes thatif there exists a more integrated flow of medical information, plus instant access to relevant data, healthcare planners could eliminate many of the redundancies in the system, cutting costs and improving efficiencies all round. The paper thus proposes comprehensive electronic diagnostis and preventive healthcare delivery in Nigeria.

1.0. INTRODUCTION

The benefits gained from applying information and communications technology in a wider and more comprehensive manner from the management of healthcare to its delivery—much as it's been done so successfully in finance, business, communications and most other walks of life—could be truly enormous. If there exists a more integrated flow of medical information, plus instant access to relevant data, healthcare planners could eliminate many of the redundancies in the system, cutting costs and improving efficiencies all round.The modern trend involves digitizing all aspects of the patient's medical history, treatment regimen and clinical outcomes in the form of electronic health records (EHRs), which will enable planners to be able to apply "data-mining" techniques borrowed from the credit-card industry to assess the true needs of patients—and thus be able to plan for future capacity with far greater precision.

Although e-healthcare is still in its infancy, already important gains are being identified elsewhere in the world. Denmark, for instance, has found that electronically referring patients from primary to secondary care saves the nation €1m ($1.2m) a year—a small sum, admittedly, but a worthwhile beginning. In Nigeria, however, there is lack of well organized practical healthcare scheme and one of the reasons for this deficiency could be attributed to lack of database that details the medical history of patients. The much touted national insurance scheme is predicated on an effective database or electronic healthcare records for its successful realization.One of the aims of this proposal is to create in Nigeria an effective database for diagnostic, therapeutic and preventive Medicare, in the form of electronic healthcare records (EHR) which will not only be useful in e-healthcare system or national insurance scheme but Government can also access it for planning cost effective healthcare delivery for the citizens.

The vision for e-healthcare promises far more than just financial savings. The unwieldy bureaucracy behind most of today's healthcare systems is responsible for not only runaway costs, but also a lot of bad medicine. Unnecessary duplication and ignorance of the latest medical procedures contribute substantially to current levels of sickness and death.

In November 2005, Britain's National Audit Office—a government-run financial watchdog—released a report that illustrated this very point. Entitled "A Safer Place for Patients: Learning to Improve Patient Safety", the report noted that the average UK patient faced a one-in-ten chance of being involved in a medical accident during a stay in hospital. It found that half of such incidents had happened before—and should therefore have been easily avoidable.Eliminating unwarranted risk to life and limb within the healthcare system itself does not require rocket science. All it needs is that patient data be gathered together in a virtual repository—so that clinical approaches can be compared and standardized. From that, it becomes possible to establish sets of best practices that ensure greater quality and equity of healthcare all round.Then it is only a small step to building expert databases, linked nationally by broadband communications, that allow doctors to take the "right decisions" based on the latest clinical know-how. In the future, such tele-consultations will be used to help train medical students and assist less-experienced surgeons to perform tricky operations, even when the instructor is thousands of miles away.

All this, however, presupposes a fundamental shift in the way healthcare systems deal with their primary product—the patient. Even in the best of hospitals, the patient today tends to be sidelined and subordinated to the needs of the system. In the proposed e-healthcare system, however, the patient will have to become the hub of the healthcare network.In such a patient-focused system, the lines of connectivity will stretch out beyond the confines of conventional institutions of healthcare delivery—the hospital, the local clinic and the general practitioner's office—and reach into people's homes, cars, schools and workplaces. To do its job properly, healthcare needs to be incorporated into people's daily lives and be on tap 24 hours a day, 7 days a week and 52 weeks a year. A decade or so ago, that would have been a hopeless dream. Today, it is within our grasp. In a decade or two, it should be common practice, in civilized world.A welcome bonus of having healthcare online and on tap is that, with it, should come more comprehensive forms of preventive medicine—which, in turn, could promote healthier lifestyles for the population as a whole.When the latest developments in mobile and portable health-monitoring systems are plugged into healthcare's "information superhighway", all manner of personal accessories (from smart mobile phones to even smart watches) will keep the pulse and vital data of patients. The aged and the chronically ill will then spend less time in hospitals and more in the actual community. As a consequence, healthcare costs ought to reduce drastically.

Civilized world are spending (and possibly making) fortunes to realize this vision of e-healthcare system and developing countries cannot just keep quiet or sit on fence:

• The European Commission is using its eTen programme to subsidise the building of a trans-European health network. The project will collate public health data, Europe-wide, and monitor the rapidity of the continent's reactions to health threats (such as avian 'flu). The commission has also invested in the development of EHRs in the form of digital "smart cards". By 2004, the EU had spent €500m on the smart-card project.

• In April 2004, President Bush announced that all American patients should possess an EHR by 2014. To support the initiative, the Bush Administration created the National Health Information Infrastructure. Financial incentives are being offered to healthcare providers to encourage them to meet the deadline.

• Earlier in 2005, the British government launched its "NHS Connecting for Health", the world's most ambitious e-healthcare project to date. This involves building a healthcare information network to link 100,000 doctors, 380,000 nurses and 50,000 other health professionals with 300 hospitals up and down the country by 2015. The medical data of all NHS patients are currently being converted into digital format. To date, some £40 billion ($70 billion) has been committed to the project.

1.2. Realities

The sheer size and scale of these various initiatives are breathtaking. But the world has come to the realization that the future of Medicine lies in the integration of Information and Communications Technology in Healthcare system despite the difficulties that lie ahead. In November 2005, the British government was forced to admit that its plan to provide electronic booking facilities for all hospital referrals by December 2005 would not be met as scheduled. Similarly, reports from America suggest there has been only a 25% uptake of EHRs by physicians to date. Such delays have been caused in part by the complexities of the task at hand. Sending a scanned image of an appropriately high resolution "down the wire" implies robust computing, advanced image compression, and high-speed communications. Such things are widely available in the commercial world, but at a price that is not exactly trivial.Meanwhile, getting a general practitioner's computer to talk to one in a hospital assumes a common medical language—and many doctors continue to be computer-phobic. However, the time is more than ripe for healthcare in developing countries to join the rest of the world and start to reap the obvious benefits that ICT can bring.Besides, the world and the future won't wait. As Newt Gingrich, a former speaker of America's House of Representatives and founder of the Centre for Health Transformation (an organization that promotes the use of "intelligent healthcare" through the application of information technology), has pointed out: "It took us 20 years to transform our welfare system. We don't have 20 years to get our healthcare system in order. We have to start work on it now."

1.3. The Purpose of E-Healthcare

As pointed out above, the civilized countries are doing everything to realize the national e-healthcare system to modernize healthcare delivery through the use of Information Technology, and Nigeria being an emerging economy, cannot just sit on the fence. A healthy nation, they say, is a wealthy nation.This paper proposes theestablishment, within the existing tertiary medical institutions in Nigeria, of an Integrated Electronic Healthcare centres based on IT-Medicare for diagnostic, therapeutic and preventive healthcare delivery and the eventual implementation of a national EHR uptake in Nigeria by Government. The proposed Integrated Electronic Healthcare Delivery (IEHD) shall help in:

a) reduction of prenatal, perinatal and postnatal mortality rates through early detections by electronic means.
b) Reduction of mortality rates at all levels of life through early detection and expert counseling for prevention.
c) Improving the healthcare delivery by application of ICT, thereby improving the quality of life of citizens, hence, improving their live expectancy.
d) Creating database for prevailing diseases and disease states common in the country which would be available to healthcare policy makers in Nigeria.
e) Creating databases of patients health history so as to provide efficient health information to citizens and their doctors, - a precursor to creation of NEHR.
f) Encouraging the Nigerians in the Diaspora with relative Medical and IT know how to join the initiative for the good of our Country.
g) Reducing the number of Nigerians going abroad to seek complex medical services, since the latest modern facilities and know how would be available in the proposed IEHC. Thus curtailing the foreign exchange drain from the country.
h) Attracting foreign exchange earnings from our neighboring countries whose citizens may avail themselves of such modern healthcare services.
i) Inculcating into our people the culture of electronic medical screening for themselves and hence encourage preventive rather than curative medicine.
j) Provide advanced medical technology to the people at affordable cost.

1.4. Advantages of early detection and treatment of diseases as against late detection.

Statistics show that one person dies of lung cancer every 30 minutes. But an early detection of this disease through TC spiral and its early treatment gives a survival rate of five years in all patients. However, when detected late only 15% of the patients treated has a chance to survive.Also, prostrate cancer patients detected early and treated have brighter survival outlook than those of late detection. Similarly, early detection of breast and cervical cancers in women through mammography and pap tests as well as other investigative devices such as MRI give wonderful improvements as against same when symptoms and metastases (spread to distant organs and tissues) occur. Treatment instituted at this stage is not only very unsuccessful but, most times, reduces the patients to a mere vegetable. It should not be forgotten that chemotherapy and radiotherapy which are some of the treatments instituted at this stage are also deleterious to healthy tissues and organs. Early detection and treatment reduces the man-hours lost in prolonged hospitalization. It also reduces the agony to patients and relations as well as hospital costs. It enhances their productivity as they return quickly to productive life. This in return gives a boost to the GNP which is necessary for the overall improvement of national economy.

2.0. SOME AREAS COVERED BY THE MODERN IT-MEDICINE

2.1. Heart Surgery

Everyone knows that the heart is a vital organ. Indeed we cannot live without our hearts. A beating heart is a vital sign that someone is alive. It beats thousands of times each day, every day, for your entire life.The normal human heart is a hollow, cone-shaped, strong muscular pump that is a little larger than a fist, located between the lungs and behind the sternum (breastbone). Two-thirds of the heart is located to the left of the mid-line of the body and 1/3 is to the right. The average weight of a female human heart is about 270 grams and a male's is 280 grams. The heart comprises less than 0.5% of the total body weight and can simply be described as a pump. A complex and important one, yes, but still just a pump. As with all other mechanical pumps, the associated pipes or tubes (in the form of arteries and veins) can become clogged, break down and need repair. If one of these outer arteries ruptures or gets blocked, normal blood flow is impeded and this causes a heart attack or a stroke (due to lack of oxygen to the brain cells which may lead to reversible or irreversible paralysis). A blockage like this is normally caused by fatty deposits that build up in the heart's arteries over the course of many years. Everything you hear about fat in the diet, “cholesterol“, “coronary artery disease” and "clogged arteries" is focused on this one problem -- it turns out that blocked heart arteries and the heart attacks and strokes they cause are the leading killer disease of the adult human population.Each day an average heart “beats” (expands and contracts) 100,000 times and pumps about 2,000 gallons of blood. But this does not mean that a human body contains as much as 2000 gallons (or 40 barrels!) of blood! Indeed the heart, arteries, veins and various organs it services form a closed circulatory system containing only five litres of blood, or a little over one imperial gallon, which is circulated around the body continuously. In a 70-year lifetime, an average human heart beats more than 2.5 billion times. The circulatory system is the network of elastic tubes that carries blood throughout the body. It includes the heart, lungs, arteries, arterioles (small arteries) and capillaries (very tiny blood vessels). These blood vessels carry oxygen- and nutrient-rich blood to all parts of the body. The circulatory system also includes veins. These are the blood vessels that carry oxygen and nutrient depleted blood back to the heart and lungs. If all these vessels were laid out end-to-end, they would extendfor about 60,000 miles. That's enough to encircle the earth more than twice. The circulating blood brings oxygen and nutrients to all the body's organs and tissues, including the heart itself. It also picks up waste products from the body's cells. These waste products are removed as they are filtered through the kidneys, liver and lungs.If diet and exercise are not effective in treating heart disease, medication is usually prescribed. If the heart disease still persists in causing pain, an invasive procedure is usually performed. Indeed when one of the heart's arteries gets blocked and a person has had a heart attack, one common procedure is to perform heart surgery and sew in a new piece of blood vessel to bridge or bypass the blockage.There are several types of procedures that may be used to improve blood supply to the heart. To locate the arterial blockages, "coronary arteriography" (mapping of the coronary arteries) is done using a procedure called "cardiac catheterisation". One possibility is called "percutaneous trans luminal coronary angioplasty" (PTCA), also known as angioplasty (an operation to repair a damaged blood vessel or unblock a coronary artery), or simply balloon angioplasty. Another possibility is a "coronary artery bypass graft" surgery. A surgeon takes a healthy blood vessel from another part of the body (usually the leg or inside the chest wall) and uses it to construct a detour around the blocked coronary artery. One end of the vessel is grafted (attached) right below the blockage while the other end is grafted right above the blockage. As a result, blood can flow to the heart muscle again. In many cases, the surgeon will fix not only the immediate problem, but also other arteries on the heart that are starting to look blocked. If the surgeon repairs three of the arteries, it is called a triple bypass. If four arteries are repaired, it's a quadruple bypass. The blood vessel used to create the bypass is taken from the chest or the leg -- the body has several redundant vessels that can be removed without doing harm. Indeed, any surgery where the chest is opened and surgery is performed on the heart is called open heart surgery. The term "open" refers to the chest, not the heart itself (which may or may not be opened, depending on the type of surgery).Open heart surgery includes surgery on the heart muscle, valves, arteries, or other structures. Minimally invasive surgery and robotic-assisted heart surgery are still referred to as open heart surgery. A heart-lung machine (also called cardiopulmonary bypass) is usually used to help provide oxygen-rich blood to the brain and other vital organs during the surgery. It pumps, supplies oxygen to, and removes carbon dioxide from the blood and also provides anaesthesia to keep the patient asleep during surgery.There are some new surgical procedures being performed that are done with the heart still beating. These procedures are referred to as minimally invasive heart surgery or "limited access coronary artery surgery". These procedures are being evaluated in several medical centres as an alternative to the standard open heart methods using the heart-lung machine.

The most radical possibility is when a transplant of the heart or a part of the heart is needed. When a healthy person dies, the heart can still be used. The patient's diseased heart is removed and the healthy donor heart is then attached. The operation is complicated because so many blood vessels have to be detached and re-attached. While the operation is taking place, the patient is connected to a heart-lung machine that keeps the blood circulating. After the operation, there is still a risk that the patient's systems may reject the new heart. Tissue types have to be perfectly matched in order for the transplant to be successful. As a result, the number of transplants performed is quite low.

Recent reports indicate that surgeons may soon be able to operate on a beating heart. **Motion compensation software** that synchronises the movement of robotic surgical tools with that of the heart will make it possible to operate without stopping or even slowing the heart down. The computer software, developed by George Mylonas at Imperial College London, has been designed for use with a type of surgical robot called "da Vinci" to perform procedures such as arterial bypass surgery.The software first constructs a three dimensional model of the heart by tracking the surgeon's eyes as they move over the organ. Then it creates a real-time moving image by recording the changes in the surgeon's focal point as the heart beats. The endoscope is calibrated to move forwards and backwards in time with this image, after which the heart appears stationary to the surgeon viewing it through the two cameras. The surgical instruments are also calibrated to follow the heart by moving in synchrony with the beating heart, removing the need to constantly move them back and forwards, and allowing the surgeon to concentrate on performing the operation.The software has so far been successfully tested on an artificial silicone heart using a robotic arm. Aggarwal presented the system last January 2006 at the Medical Device Technology conference in Birmingham, UK.

The above details show how far medical science has progressed. Such feats could not have been possible without the integration of ICT and Medical Science. Such modern IT assisted medical devices shall be present in the proposed E-Healthcare Centre to be used by expert surgeons.

2.2. Kidney Cure

The kidneys are fist-size excretory organs, each about 11 cm long and about 5 cm thick and weighing about 150 grams. As part of the urinary system, the kidneys filter wastes (especially urea which is an organic compound of carbon, nitrogen, oxygen and hydrogen) from the blood and excrete them, along with water, as urine. The medical field that studies the kidneys and diseases affecting the kidney is called *nephrology*. In humans, the kidneys are located in the abdominal cavity behind the stomach and intestines. There is one on each side of the spine just below the liver and spleen. The right kidney usually lies slightly lower than the left in order to accommodate the liver. Situated above each kidney is an adrenal grand that secretes hormones which control the heart beat rate, blood pressure, and metabolism. One of the hormones, DHEA (Dihydroepiandrosteron) produced by the adrenal gland is a precursor to virtually every hormone the body needs. Indeed, DHEA is a key determinant of physiological age and resistance to disease. DHEA also acts as a buffer against stress related hormones (such as cortisol) which is why as one gets older and make less DHEA one is more susceptible to stress and disease.The basic functional unit of the kidney is the *nephron (*which is where actual filtering and excretion happens), of which there are more than a million in each normal adult kidney. Nephrons regulate water and soluble matter (especially acids, bases and salts) in the body by first filtering the blood, then reabsorbing some necessary fluid and molecules while secreting other, unneeded molecules and the final solution is then excreted as urine. Among other functions, the kidneys:

- Remove wastes and toxins from the blood.
- Regulate the level of some chemicals in the blood such as *hydrogen*, *sodium*, *potassium* and *phosphate*. The chemicals are measured out and returned to the blood.
- Make hormones that regulate blood pressure and produce red blood cells.
- Activate vitamin D to maintain the health of bones
- Help maintain water balance in the body

The prime function of the kidneys is of course waste removal. As blood flows into the kidneys, these organs trap waste products, chemicals and excess water. All of this collects as urine in the middle of the kidney in an area called the *renal pelvis*. The urine in the renal pelvis drains from each kidney through a long tube (called the *ureter*) and into the bladder, where it is stored until released through urination. Filtering prevents waste substances from building up in the blood and causing nausea or damaging the body. The kidneys also remove excess water from the blood, which has three benefits:

- Keeps blood pressure from rising too high
- Prevents the heart from becoming overloaded with fluid
- Allows chemicals in the blood to remain undiluted and in balance

Conversely, when the body becomes dehydrated, the kidneys conserve water by excreting less of it into urine. About 227 litres (or 50 gallons) of blood passes through the kidneys daily. The kidneys remove about 2 litres (or 4 pints) a day of waste products, toxins and excess water in the form of urine. Urine collects in the kidneys, then travels out of the kidneys through the *ureters*, and ends up in the bladder. Once the bladder fills with urine, the walls are ready to contract and push the urine through the urethra and out of the body during urination. The kidneys use several mechanisms to keep certain chemicals in the blood in balance. The kidneys perform this chemical balancing act by excreting excess chemicals into the urine, and conserving other chemicals when they are lacking in the blood. The kidneys are also responsible for releasing three key hormones:

- *Renin*. Released when blood pressure is low, it causes blood vessels to constrict and brings the pressure back to normal.
- *Erythropoietin (EPO)*. Directs bone marrow to make red blood cells. These cells carry oxygen throughout the body.
- *Calcitriol*. The active form of vitamin D, it helps maintain calcium for the bones

2.2.1 Kidney diseases and disorders

Kidneys can malfunction because of affliction with disease, birth defects and injuries. In particular, diabetes frequently leads to a slow deterioration of the kidneys known as *diabetic nephropathy*. The end result of nephropathy is kidney failure. More than 40 percent of all new cases of kidney failure are attributed to diabetes. Nephropathy is more common in patients with type 1 diabetes (caused by decreased production of insulin), but also occurs in patients with type 2 diabetes (the more common form, arising from decreased sensitivity of body tissues to insulin),

The damage associated with kidney disease occurs in and around the *glomeruli*, the tiny, spherical vessels that serve as the blood–filtering units of the *nephrons*. If the filtering efficiency of the glomeruli diminishes, then key blood proteins (needed by the body) are lost to the urine. As the disease progresses, the kidneys lose their ability to remove waste products, including creatinine (which is the break down product of *phosphocreatin*e, an important energy store in skeletal muscle) as well as blood urea nitrogen (BUN) from the blood. Much of this damage can happen without the patient's awareness. Symptoms often don't appear until the late stages of the disease, when kidney failure is a clear and present danger. There are three kinds of kidney failure:

- *Acute renal failure.* The kidneys cease functioning properly because of a sudden illness, a medication or a medical condition. In some cases, this may go away on its own, with patients recovering within a few days. How long the illness lasts depends on the cause of the kidney problem.
- *Chronic renal failure.* Kidney function gradually declines, usually over a period of years. It is most often the result of illnesses such as diabetes, uncontrolled high blood pressure (hypertension) or chronic kidney inflammation.
- *End-Stage Renal Disease (ESRD*). Kidney function declines until the point where the person will die without dialysis or a kidney

transplant. This is usually the result of longstanding chronic renal failure, but can also follow acute renal failure.

2.2.2 Treatment Options for Renal Failure

Treatment options for renal failure could be medical or surgical:
If kidney damage becomes severe enough, patients may require that either a kidney undergo dialysis treatment or transplant. There are two types of dialysis – peritoneal and haemo-dialysis. While peritoneal dialysis works by principle of osmosis, in haemo dialysis an artificial kidney is created.

2.2.3 Kidney transplantation

Kidney or renal transplantation is the organ transplant of a kidney in a patient with chronic renal failure or some renal tumours. The main types are deceased and living donor transplant. In the former, the kidney originates from a cadaver or deceased person. In the latter, the kidney is being donated by a living organ donor.

2.2.4 Kidney donation now made easier.

The average cadaver kidney lasts about six to eight years. Living donor kidneys are better than cadaver kidneys because they last more than twice as long. The alternative to finding a living donor is to wait for a transplant from someone who has died. Kidney donation is one of the few ways a living person can give an organ to someone else for transplant, but it used to require a 10-inch incision and a six-week recovery time. A procedure called *laparoscopic nephrectomy* (involving key-hole surgery) has made kidney donation easier, and a new study shows that once people find out about it, they are more eager to give.

2.2.5 What are the prospects for a complete reversal of kidney failure?

Currently, reversing kidney failure is not possible. However organ donation between identical twins remains today, the one reliable sure route to kidney failure reversal. But an overwhelming proportion of kidney patients are not twins, let alone being identical. However, it seems that modern technology may provide some means of reversing kidney failures. For example, a drug already licensed to treat bone fractures appears to reverse long standing kidney damage. The bio-artificial kidney currently in development and its key component, called the *renal tubule assist device*, may substitute for dialysis and is hoped to help people with acute kidney failure live longer. The device is used outside the body and helps the kidney filter toxins.

The study was small, but its results were "compelling and relatively unexpected," write the researchers. The bio-artificial kidney is currently being tested on 100 patients, who will be hooked up to the device for a longer period of time (up to 72 hours). "The long-term goal, if this shows effectiveness in patients with end-stage renal disease, is to build a fully implantable device," says Humes in a news release.Medical researchers have for a long time now held out high hopes that stem cell research has the potential to change the face of human diseases by being used to repair specific tissues or to grow organs. Stem cells are primal *undifferentiated cells* (hence having no specialised structures or functions) which retain the ability to transform into other cell types. This ability allows them to act as a repair system for the body, replenishing other cells as long as the organism is alive.Stem cell research often throws up surprises. The latest not only suggests a quick cure for kidney failure, but also challenges our ideas of how stem cells could help repair kidneys. Kidney failure as we have seen often proves fatal, but now a trial in rats suggests that stem cells can stabilise and repair these damaged organs. The problem is, scientists don't quite know how. It is the intention of this project to encourage fundamental research in medical science and biotechnology including genetic and stem cell researches in the proposed research and development department. All the machines necessary for the early and the late detections of most of these kidney diseases would be available at the centre.

2.3. HIV Test

The general public seems not to be sure about the difference between HIV and AIDS. Whereas HIV (the acronym for Human Immunodeficiency Virus) is the underlying cause of AIDS on the one hand; on the other, AIDS (the acronym for Acquired Immune Deficiency Syndrome) is just the collection of symptoms and infections associated with the resulting deficiency of the immune system caused by HIV. By killing or damaging cells of the body's immune system, HIV progressively destroys the body's ability to fight infections and certain cancers. People diagnosed with AIDS may get life-threatening diseases called opportunistic infections, which are caused by microbes such as viruses or bacteria that usually do not make healthy people sick. HIV is spread most commonly by having unprotected sex with an infected partner. The virus can enter the body through the lining of the vagina, vulva, penis, rectum, or mouth during sex. HIV also is spread through contact with infected blood. Before donated blood was screened for evidence of HIV infection and before heat-treating techniques to destroy HIV in blood products were introduced, HIV was transmitted through transfusions of contaminated blood or blood components. Today, because of blood screening and heat treatment, the risk of getting HIV from such transfusions is extremely small.

HIV frequently is spread among injection drug users by the sharing of needles or syringes contaminated with very small quantities of blood from someone infected with the virus. It is rare, however, for a patient to give HIV to a health care worker or vice-versa by accidental sticks with contaminated needles or other medical instruments. Women can transmit HIV to their babies during pregnancy or birth. Approximately one-quarter to one-third of all untreated pregnant women infected with HIV will pass the infection to their babies. HIV also can be spread to babies through the breast milk of mothers infected with the virus. If the mother takes the drug AZT during pregnancy, she can significantly reduce the chances that her baby will get infected with HIV. If health care providers treat mothers with AZT and deliver their babies by caesarean section, the chances of the baby being infected can be reduced to a rate of 1percent. Although researchers have found HIV in the saliva of infected people, there is no evidence that the virus is spread by contact with saliva. Laboratory studies reveal that saliva has natural properties that limit the power of HIV to infect. Research studies of people infected with HIV have found no evidence that the virus is spread to others through saliva by kissing. Scientists also have found no evidence that HIV is spread through sweat, tears, urine, or faeces. Studies of families of HIV-infected people have shown clearly that HIV is not spread through casual contact such as the sharing of food utensils, towels and bedding, swimming pools, telephones, or toilet seats. HIV is not spread by biting insects such as mosquitoes or bedbugs. Many of the problems faced by people infected with HIV results from the failure of the immune system to protect them from certain opportunistic infections and cancers.Political pressure has finally seen the price of antiretroviral therapy for HIV slashed in poorer countries. But a lack of cheap, simple diagnostics to enable doctors to use these complex treatments remains a stumbling block.

Now scientists from two New York universities believe they have the solution: a hand-held sensor that checks the health of a patient's immune system in seconds. At the moment it can take a week to get the same results back from the labì, and that's if they don't get lost. The sensor measures the quantity of key immune cells called $CD4^+$ cells in the blood. A gradual depletion of $CD4^+$ cells, which orchestrate the immune response to tumours and infections, is a sure sign that HIV is damaging a person's health: some clinical definitions of AIDS say that once a person's $CD4^+$ count falls below 200 cells per microlitre of blood, he or she has developed the immune response condition. Doctors rely on $CD4^+$ measurements to decide when to start drug treatments and to gauge whether a patient is responding to them."It is the first step towards a hand-held, simple, inexpensive device that will measure the number of $CD4^+$ cells in human blood without the need for extensive infrastructure," says James Turner, a biophysicist at the University at Albany, who led the research.There are also other initiatives in the US towards the development of a home test for HIV that could make testing for HIV as simple as a pregnancy stick test. Thus a quick swab of your gums, and 20 minutes later a thin red line on the device could be the difference between a healthy life and coping with a deadly disease. One such test called OraQuick Advance and made by *OraSure Technology* of Bethlehem, Pennsylvania, is already being used in clinics in the US. Recently the US Food and Drug Administration (FDA) started debating whether the kit should be available for people to test for HIV in their own homes, potentially drawing out the estimated 300,000 or more Americans who live with the infection but don't know about it. These people are the cause of 65 per cent of all new HIV infections in the US each year. People who know they are infected are 50 per cent less likely to transmit HIV than those who do not.The HIV test device detects antibodies (or proteins that fight infections) produced in response to HIV. The person has to swab the upper and lower gum lines with a collector device that resembles a pregnancy test stick and then insert the absorbent end into a special solution for 20 minutes. When used in clinics, the device accurately detects antibodies 99.3 per cent of the time. Initial trials carried out by the Centres for Disease Control and Prevention (CDC) in Atlanta, Georgia; suggest that members of the public can use OraQuick successfully, though further trials will be required for FDA approval. If approved, the OraQuick Advance test could encourage the development of similar at-home tests for diseases such as syphilis, hepatitis C and influenza. Douglas Michels, OraSure's chief executive officer, says the company is already working on a rapid home test for hepatitis C.

This HIV test kit is essential in Nigeria and other African Countries for early detection and prevention of the deadly disease. The fact that people infected with HIV can pass on the virus within just a few weeks of picking it up, even before they develop the earliest flu-like symptoms, argues strongly in favour of making home HIV testing kit affordable and widely available. "If we can catch infected people during the first weeks when antibody tests are still negative, we can help them avoid spreading HIV to their husbands, wives, unborn children or other intimate partners," says Christopher Pilcher, at the University of North Carolina. And the sooner antiretroviral treatment starts, the better the patient's prognosis, according to Pilcher.These new technologies will form part of the proposed E-Healthcare centre in Nigeria.

2.4. Diagnostic MRI

MRI, or magnetic resonance imaging, is a household acronym these days; many people know somebody who has had one (if not themselves) when needing to be diagnosed for a serious disease. But in the 1970s, it would have seemed like a device out of TV Star Trek. To see inside a living human body in fine detail, without the harm of X-rays, was a doctor's impossible dream then; but today it is a reality. And it is going to get better.

As far as Nigeria is concerned, the impact of medical technology on clinical medicine is still rudimentary and the number of MRI and CT scanning equipment in the country could probably be counted on the fingers of both hands at most. Although some people may argue that the priority should now be in favour of the supply of affordable unadulterated drugs to the general public, yet when one considers the number of patients trooping annually to Europe and the US for routine medical procedures and even check-ups, then the federal government may consider making some substantial investment in medical imagery equipment. Government could, for example, invest in the proposed centre and establish well equipped referral medical diagnostic unit in this centre.

3.0. SCOPE OF THE PROPOSED PROJECT

The long term scope of the e-healthcare centre is to offer some of these sophisticated IT assisted micro and macro surgical procedures and reduce the number of Nigerians rushing abroad for avoidable medical intervention. The initial phase is to assist in the early and accurate diagnosis of these diseases by developing effective accessible databases or electronic medical records for patients and the next phase is to initiate a national EHR uptake for the Nigerian population. Offering special advice to patients and patient's doctors and possible reference to other centres appropriate for the handling of such cases shall also be undertaken at the centre. Thus, emphasis are laid on finding and treating the causes of diseases rather than symptoms which have hither-to prevailed in many of our health institutions, not because of doctors' inefficiency but because of lack of supporting modern equipments necessary for identifying the root causes of most diseases.A typical example to illustrate this fact is the case of CEREBROVASCULAR ACCIDENT (CVA OR STROKE), THE CAUSES MAY BE ISCHEMIC (lack of adequate blood supply to brain cells due to narrowing or occlusion of the brain blood supplying vessels) or May be HAEMORAGIC (Rupture of brain blood supply vessels and the accumulation of such blood and consequent compression of the brain cells). The clinical manifestations may appear similar in it's broad setting while the causes and management necessary for the patients survival are different.

The use of modern technology enables a quick and more accurate diagnosis, and hence, a more accurate management of healthcare delivery. This also enables effective administration of Medicare by doctors and saves the patients and their relations from some possible embarrassment arising from conflicting diagnostic results emanating from different health institutions based on presenting symptoms, some of which the doctors may have misinterpreted due to human factors.

4.0. MATERIALS AND METHODS

Such centres established in the existing tertiary health institutions,will gather in a virtual repository,the anagraphy as well as the medical history of patients. Other secondary and primary health institutions will feed the centres as well as receive data already processed and stored when necessary. Databases of patient's medical history available at the centres could be accessed by patient's doctors,their insurance companies and by government policy formulators under conditions allowed by law.The centres will be equipped with sophisticated diagnostic equipment and will undertake investigations on infectious and non-infectious diseases. The results of such investigations will be stored in the centre and made available to appropriate authorities on request.

4.1. Standardized medical records:

Most people out of personal habit tend not to reveal intimate information to the third party even when it concerns their health. The project will include an enlightenment campaign to educate the people on the importance of appropriate and accurate medical records. Accurate medical history is halfway to the diagnosis of most diseases and hence a veritable instrument in the hands of health workers.Such records kept in a virtual repository and accessible by authorised persons, will not only produces a standardized document but saves time on medical administration on patients. This is increasingly important when we realize that most patients arrive to hospitals in almost moribund conditions that don't give room for waste of time employed in accurate medical history.A database of prevailing diseases provides a veritable knowledge and instrument to fight them. Experts in those fields can employ such knowledge to predict future movements of such diseases such as avian and human flu and can offer solutions.Patients with family history of certain diseases will receive better medical counsel on what to do to avoid the evils of such diseases if accurate medical family history is easily available. If, for example, a family history record dictates the prevalence of breast or cervical cancer, all the females of certain age in the family will be advised to undertake such exams as mammography and pap tests while male adults in families with positive history for prostate cancers can get advice for regular serum PSA Levels as well as echography.

4.3. Requirements

A) **Manpower**: Foreign and Nigerian Experts in the relative areas

- Qualified Medical Practitioners, Surgeons and Nurses
- IT and Communications Specialists
- Software developers and database analysts
- Information Systems Managers/Administrators
- Qualified Laboratory Staff and Technicians
- Qualified Radiographers and other instrumentalists

B) Equipment:

Ultrasonographic (Ultrasound) machines
Computerized Axial Tomogram machines
Electro Cardiograph/Echo Cardiograph machines
Electro Encephalographic (EEG).
X-Rays
Toco-cardiograph machines
Arterial Blood Gas Saturation machines
Endoscopic machines
Simple Apparatus for Eyes and Ear Examinations
Magnetic Resonance Imagine (MRI)
Suction Machines
Defibrillators
Echo Doppler
Servers and Desktop Computers
IT and Communications Equipments
Network and Internet facilities
Broad Band Access
Database development software and others
Ambulances (Equipped)
Equipped Laboratory for Bio Chemical Analysis
Hospital Vans and other official cars
Generating Plant for Energy
Fans and Air Conditioners
Office Equipments including Computers
Hospital Beds and Beddings
Others e.g. Syringes, gloves, masks, uniforms etc.
Available and regular water supply
Miscellaneous.

4.4. Required Investments

As we have seen above, the implementation of total e-healthcare system is capital intensive but there is no doubt that this is the trend of modern healthcare delivery in the world today. However, for this project, a modest take off investment of about $64.9 million (N10.4 billion) shall be required.
The required fund could be sourced from one or more of the following:

A) Federal and State Governments support from funds meant for investments in new technologies and Healthcare.
B) Funding from the relevant Ministries
C) Central Bank of Nigeria support for investments and development
D) Support from Oil Companies for development
E) Supports from the Private Sector.

CONCLUISONS

We have seen that the future of medicine shall be governed by integration of Information and Communications Technology to facilitate health care delivery.Nigerians and the Nigerian government should join the rest of the technologically advanced world in embracing the integration of ICT in national healthcare delivery. The new technologies propelled by ICT usher in a new world. A new World where wars are fought with modern, sophisticated and precision weapons. A World where market and banking transactions can be carried out in the comfort of the bed room. A World where one can attend meetings and seminars anywhere in the world from his bedroom. A World where one applies and receives applications for employment and other transactions, upgrades his or her knowledge on any subject of choice from his study room. A World where people are struggling to conquer the space and manufacture cars that can fly to avoid traffic jams. A world where virtually all human parts and organs are changed and transplanted as those of automobiles. In short an ICT-driven World.

Is this the World where Nigerians would still be practicing the immediate post Adam type of Medicine? It's time Nigeria embraced IT-Medicine to improve our national healthcare delivery. Good health has no substitute and no cost is too much to realise it. We therefore call on individuals, corporate bodies and organizations as well as governments at all levels to join hands toward achieving this golden goal. Nigeria is a nation blessed with material and human resources.

Government can employ this to provide electronic healthcare services for Nigerians.Our progress as a nation depends on the choices we make today that will determine our tomorrow. The need for meeting our challenges of tomorrow compels us to join the rest of the world in the race for electronic healthcare system today.

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