

TECHNOLOGY ADOPTION USING MEDICAL IMAGE PROCESSING TOOLS IN GLOBAL HEALTH SECTOR DEVELOPMENT

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Abstract

Medical Imaging is a major development in the field of medicine for past 100 years. The tool helps the physicians not only to detect the diseases but also the intensity of the disease can be captured. The paper discusses about the prevailing health system and insurance schemes, the treatment facilities for disease like cancer. The availability of medical imaging tools like x-ray, mammogram, ultrasound, CT and MRI scans and its innovations for the public health diagnosis the diseases in various methods with the aid of modern machines and techniques. The techniques vary in terms of cost, methodology in detecting the diseases and even the accuracy. The people could not continue the treatment because of high cost and sometimes scarcity of medicines. As the treatment are costlier irrespective of various classes of people approach the social security organizations and because of continuous usage the equipments worn out. Though these tools are considered as boon in the field of medical imaging each has its own drawback. The result of the paper states that the physicians can detect the early stage of disease with the aid of these tools and can come up with treatment that will avoid serious health issues or sometimes death. Also the government of concern country is responsible for all the public and seek opportunity for developing health sector often.

Keywords: Medical imaging, insurance, refurbishing products, image intensity, global health sector

Introduction

In this world everyone wish to lead a happy, contented and healthy life. The Ministry of health is responsible for all the public and private sector activities related to health, but many countries differs from one other by combining the medical education with ministry of health. Because of this integration there arise many disputes and still the arguments for integration remain unsolved. Though there is chaos the people in the country are well protected under health insurance system. Various insurers (Fig.1) like social security

organizations, medical service insurance organizations, military personnel insurance organizations, benefit the employees of private sector, public sector, military and uninsured poor respectively. Latest survey of WHO states that cancer is the third deadly disease after cardiovascular diseases and unintended accidents and it is also the pervasive disease. The most widespread cancers in are gastric cancer in men and breast cancer in women [14]. Countries has their own cancer curing centre's and the government offer grant for its healing, but rapid growth of this disease and increasing cost in other hand has made governmental support futile, particularly because of the inflation treatment system of these centers and hindered their development [13]. Technology offers many equipments and services and medical imaging tool is one such field which diagnosis and give early treatment to the patients. The story of medical imaging started while Wilhelm Rontgen finds out x-ray which paved the way for number of medical imaging applications and various innovators in this field. In 1895, Wilhelm Rontgen was testing with ejection of electrical current in 'Crookes' tube, he noticed that barium platinocyanide screen was glowing though it is placed inside the cardboard. During the experiment he observed that strange rays passed through his hand and captured outline of his bones in the screen [8].

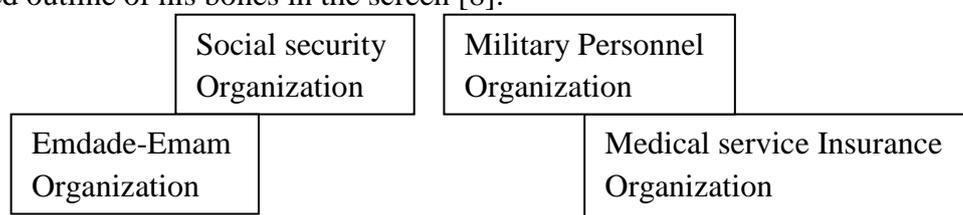


Fig. 1 Types of Insurers

Medical Imaging is the method and procedure used to produce images of the human body for medical procedures in quest to disclose, analyze, or scan ailment to afford treatment. The major tests that are used in medical imaging are MRI (Magnetic Resonance Imaging), CT (Computed Tomography) scans, ultrasound, mammography, x-rays, and nuclear medicine studies [2]. The usage of technical computer aided equipments for the purpose of observation, documentation and early precautions are vital features that are recognized for day to day activities in the hospitals. These equipments and various tests support the hospitals for diagnosing the patients and for appropriate medication. The CT scans, MRI's, ultrasound, mammography, x-rays are the different testing techniques used for the diagnosis of patients. The scanning is a method of testing that combines with x-ray devices and computers to capture multiple images of the body for diagnosing and treatment. These scans produce cross sectional view of the organs and blood vessels that are for study. So once the tests are finished the images can be printed or stored in a CD. A small controlled amount of X-ray is being passed through the body and thus various parts absorb the radiation at various rates and the image of the body is captured when film rays are exposed to absorb these rays.

Methods/Various Medical Imaging Tools

X-Rays

The X-rays are two dimensional images that are widely used to spot early stage of cancer in chest or lungs or other areas of the ribs. These are also called as radiographs and many techniques came in advance with modern techniques and equipments.

Mammography

In recent days many women come across the deadly breast cancer and mammogram is a technique used to diagnose the tumors in such areas. The mammography technique is capable enough to detect the changes before a patient or doctor suspects for cancer or any

other abnormalities. The detection technique uses either a digital detector or conventional film to capture the mammograms. Thus the mortality rate has been decreased to great extent since this technique emerged.

Ultrasound

The high frequency sound waves that are not audible to human beings but can do wonder in tissues and internal organs are called ultra sound or sonography. The high frequency creates echoes which in turn produce image (Fig.2) called sonogram. The ultrasound technique is used to differentiate between solid tumors and cyst with fluids. The ultrasound has efficiency to penetrate and identify the tumors in uterus, rectum or esophagus and also recognize whether the cancer cells have spread into blood vessels. With the help of ultrasound the physicians can give therapies for liver, prostate and other type of cancers too. The ultrasound is used to evaluate the lumps that are hard to identify or describe on a mammogram. These high frequencies are also used widely for radiation therapy for determining the correct location of tumors and thus the tumors are correctly targeted.



Fig. 2 Ultrasound
Source: binqammash.com

Computed Tomography

The Computed Tomography scan or a CT scan deploys computer intensive reconstruction techniques to produce images of the body from the X-rays. The radiograph and CT scan are similar but transmit different information. The CT scans are the images that are represented in cross sectional form of the body and thus the data from these images are more accurate and vibrant as depicted in Fig.3 than a plain radiograph. These images not only say the presence of tumor location but also the depth of the tumor is located. The technical advancement improved the CT called multi slice scanning which captures images in a spiral motion thus eliminating the gaps between the slices thus improving the readability and accuracy of the images. The rate of current computer processors permit the oncologist to restructure the “image view” of the patient in any plane for demand and use any slice width to construct a more ultimate analysis of the patient’s sickness. CT scans are among the most common imaging technologies used in diagnosing cancer, as well as in planning and monitoring cancer treatment; especially in detecting cancer of the liver, pancreas, lungs, and bones. CT is also important in providing information on cancer in the stomach, intestines, and brain [10].



Fig. 3 Computer Tomography
Source: BatteryPark.Tv

Magnetic Resonance Imaging

Magnetic Resonance Imaging (MRI) uses radio frequency (rf) waves where the strong magnetic field is passed through the MRI machine where the patient lies thus the tissues emit the radio waves of their own with the help of the radio frequency. Based on their chemical composition the tissues and tumors emit signals and thus the pictures of the organs can be restructured and displayed. The functioning of MRI and CT scans is similar but the MRI scans differentiates well about the structure of soft tissues. The MRI detects the cancer well in the area of head, neck, bone and muscles [1] and it is also useful for determining the status of tumor and the response of the patient for treatment can be evaluated [9]. The sample image is shown in Fig.4.



Fig. 4 Magnetic Resonance Imaging
Source: howstuffworks.com

Results and Discussions

The study reveals some unexpected results that majority of the patients stop the treatment in the middle because they couldn't bare such cost of treatment. They also face both psychological and financial problems and even they were in debt. Though government helps the patients with insurance policies many not cover all the medicine schemes and sometimes lack of purchase of the medicines became scarce in the market. As the costs of medicines are high the patients do not prefer to go for private centre's and due to this the centre's are closed mostly [13]. So majority of the people irrespective of high/low/middle class approach the social work centre's creating huge crowd leading to lag of medicines. Also the physicians who work all through the day to manage the crowd are much worried about the overloading of machines [13]. The separate rooms for radiotherapy were built with high cost now remains as store room for the worn out devices and purchase of new devices are

impossible. Since the government cannot afford new devices it can choose the option of refurbished products. Refurbishing of medical device refers to restoring used equipment or systems into a condition of safety and effectiveness similar to new including actions such as repair, rework, update and replacement of worn parts with original parts. This refurbished medical equipments are under great demand and primarily driven by innovation, globalization and more acceptance in developing countries. The price factor ranges between 30-50% of the price of original equipments. This low price factor and enhanced access to replacement part drive this market. Among refurbished imaging-monitoring-diagnostic devices, Computed Tomography (CT), Ultrasound and fixed & mobile MRI (Magnetic Resonance Imaging) contribute 60% to the market and fixed & mobile MRI (Magnetic Resonance Imaging) is expected to grow robustly in the coming years. An annual report from SEC Filings shows the market share analysis of the medical image equipments (Fig 5)in which majority of the market share is held up by third party refurbisher’s followed by Striker, Johnson and Johnson [12].

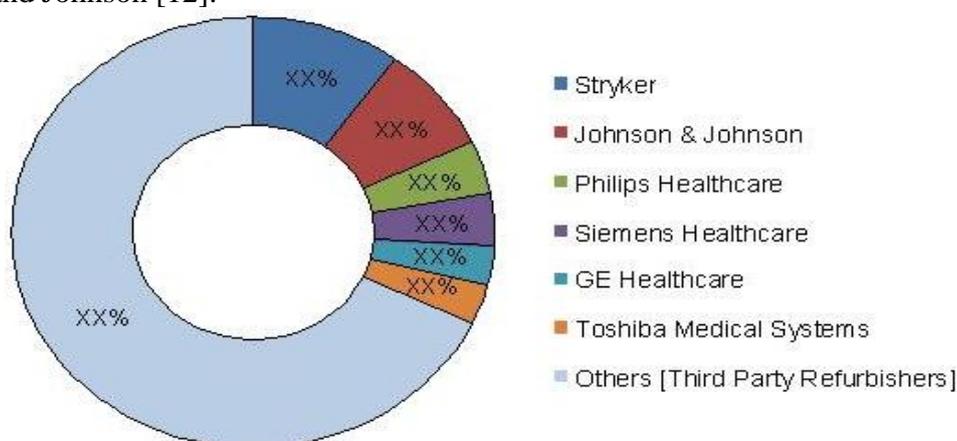


Fig. 5 Market Share of Refurbished medical equipments
Source: Annual Report, SEC Filings

The essential services for cancer surgeries and also the allied medicines (except the nuclear medicines for cancer diagnosis) are not under permit currently. But the usage partly covers radiotherapy tools and some military devices (like radars) have made the endorsement focused on these devices. Some radio therapy devices though paid the delivery of the equipment may take long time. These problems make long queue and the treatment centre’s become crowd with more patients in waiting list. In order to avoid this long queue the government can set up more social centre’s and can create awareness about the disease. When the people have knowledge about the cause and effect of the disease they will take some precautionary steps, because of this awareness people may avoid queue in the social centre’s. The bcc research [7] has given current consumption and forecast of medical image equipment of global market Fig. 6. The government can encourage domestic insurance providers or it can own subsidy for framing new insurance schemes which cover major treatment for cancer. The government can afford help from the equipment manufacturing giants like Toshiba, GE, Siemens, Philips, Mitchell to exempt from taxes for importing these costlier medical application tools. The medical image application tools are widely used for the detection of fractures, cancer and other ailments. With the advancement of these techniques the mortality rate can be reduced to great extent. The physician’s burdens are reduced and even they can detect the diseases and start treatments at an initial stage.

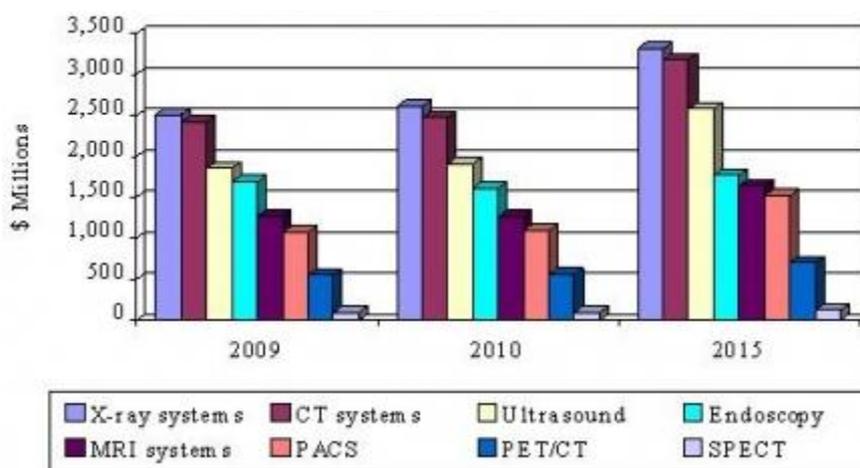


Fig. 6 Medical Equipment Market
Source: bcc research.com

Problems and Prospects in Application of Medical Image Processing Tools in Global Health Sector

There are several misconceptions that the penetration of X-rays is harmful for human beings. Early days the exposure to radiation causes scars and even it may lead to death since proper precautions are not followed. The x-rays are less effective compared to CT and MRI scans since the dimensional view of the images vary. The CT scanners are advanced compared to x-rays and less advanced compared to MRI. In MRI the images are represented in various cross sectional view either helical or spiral manner. Among these CT scanners are simple in technology and cost effective compared with MRI but the CT scanners face the problem of ionization of radiation when exposed to patients. When compared with CT scanners the MRI scanners analyze well and diagnose the tumor cells or tissues. With the help of MRI angiogram the blood flow can be detected without the use of marker agents and the layers in the organs can be transferred on x-ray or CT scans thus without exposing the patients to radiation. Though technologically advanced the MRI scanners are expensive compared with other techniques. Another drawback with CT and MRI scanner is the patients are requested to lie inside the machine and the scanner generates the image. This often causes problem with the patients who are very fat or suffer from the disease called claustrophobia. Open-magnet MRI scans serves as better solution for this problem.

Scope for Future Study of Image processing application tools

In near future a computer program that diagnosis disease from the captured images can be developed, but rationally this kind of resolution is likely to persist to be made by doctors for the anticipated prospect. The design of hardware and software is potential enough to expand the IGT (Image Guided Technique) which renders great help for the neurosurgeons with the aid of three dimensional models. The scope of the applications for image-guided surgery in the future is more; while the patient undergoes radiotherapy, with the help of IGT the physician can ensure that the beams converge only on the tumor cells and cause less damage to surrounding areas. Research is going on about the early detection of tumors for breast cancer with the three dimensional representations of MRI. This helps the doctors to analyze the size, position and location of tumors at an early stage.

Conclusion

The advancement of modern machineries and techniques though cause harm to few extent but they really play a major role in the field of medicine. The medical imaging techniques and tools like x-rays, ultrasound, mammogram, CT and MRI scans are widely

used for detection of cancer cells and diseases related to bones, brain, lungs, pancreas and other internal organs. These medical imaging tools has both positive and negative effect as ionizing of radiation are of great harm to other cells of the body. These treatment with the aid of these techniques are little costlier but it saves lives if the detection of disease is at early stage. The paper concludes by stating that it is in the hand of government to take necessary steps to fill the need for this image application equipment by adopting refurbishment method also the people can be best served with various insurance schemes which cover medical services for costlier medicine and at the same time the need for creating awareness among public is also must which will greatly reduce the effect of disease with this medical image application equipments.

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