Implications of Computer Technology for quality of services in HealthCare Organizations

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Introduction

Computer plays a vital role in almost every sphere of life. A computer has become an essential commodity in every hospital. It facilitates storage of huge amounts of data, they enable speedy processing of information and they possess an inbuilt intelligence. Everything is carried out efficiently and effectively by the computer.

The purpose of any healthcare delivery is to prevent and cure disease. Today health care sector is most challenging and fastest care is a wide and most flourishing service industry, which covers hospitals, health insurance, medical software's, health equipments, pharmacy, Pathology Clinics, Blood Banks, emergency services like Ambulances, Online Medical growing service sector in India.

There has been a rapid expansion of use of computers in healthcare industry recently in the world. Computers can now be seen being used in pretty much every area of a hospital: in back offices as well as wards, reception areas, treatment rooms and operating theatres. Even corridors are frequently used as make-shift touchdown points. The reason are availability of high speed and wireless connections, decreasing cost, demands for increased quality of care and documentation, and improving medical education. The earliest use of computers in health care was in administration. Healthcare units use computerized budgeting and financial planning; Computers are the excellent means for storage of patient related data. Computers can keep track of prescriptions and billing information. Medical journals, research and diagnosis papers, important medical documents and reference books can best be stored in an electronic format. Using information system in healthcare has become one of the best solutions for hospital management to decrease cost, increase patient satisfaction, to improve hospital processes and to provide high quality patient care.

Many of the modern-day medical equipment have small, programmed computers. Many of the medical appliances of today work on pre-programmed instructions. The circuitry and logic in most of the medical equipment is basically a computer. The functioning of hospital-bed beeping systems, emergency alarm systems, X-ray machines and several such medical appliances is based on computer logic.

Advances in hardware and software development have allowed more and better techniques in order to building applications in the health area, by using computational concepts and methods. On the other hand, this area also has searched for computational aids, providing new topics of investigation and, consequently, demanding new computational techniques development. In general, the applications explore different domains of computer science, like database, image processing, distributed systems, graphics computer, virtual reality, software engineering, among others. Also the applications integrate several new techniques to construct systems like Computer Aided Diagnosis, Information Visualization, Computer Aided Surgery, Telemedicine, Procedures Simulation and Phobias Treatments.

Various Computer Applications in Health Care Industries.

Database in Health –

- **Electronic health record (EHR):** An electronic health record (EHR) is a systematic collection of electronic health information about an individual patient or population. EHRs were originally envisioned as an electronic file cabinet for patient data from various sources A patient's data mostly includes patient demographics, progress notes, problems, medications, vital signs, past medical history, immunizations, laboratory data and radiology reports etc.

Electronic materials management (EMM): Health care organizations use EMM to track and manage inventory of medical supplies, pharmaceuticals, and other materials. This technology is similar to enterprise resource planning systems used outside of health care.

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- **E-prescribing** involves prescription orders that clinicians input electronically, which are then transmitted to the pharmacy. Decision support to the clinician, such as drug interaction flags and allergy-related information, is usually included. E-prescribing eliminates hard-to-read handwritten prescriptions, as well as errors in dispensing (such as wrong drug or contraindicated drug).
- **Electronic clinical notes systems** include information on a patient's demographics, medical history, physician/ nurse notes, and/or follow-up orders.
- **Electronic lab orders and results C**omputerize ordering of lab tests. **Electronic lab results** may allow quicker receipt and review of results by clinicians; this process usually includes decision support, such as highlighting results out of the normal range.

Artificial Intelligence in Health

Artificial intelligence is not a new concept, yet it has been accepted as a new technology in computer science. It has been applied in many areas such as security, education, business, medical and manufacturing.

To improve the efficiency of treatments and reduce costs by minimizing the risks of false diagnosis, it is important to integrate Artificial Intelligence tools in everyday medical applications. Computer program or software developed by emulating human intelligence could be used to assist the doctors in making decision without consulting the specialists directly. The software was not meant to replace the specialist or doctor, yet it was developed to assist general practitioner and specialist in diagnosing and predicting patient's condition from certain rules or "experience".

A basic AI computer used today in clinical practice could be visualized to be applied for automation of routine tasks and for other functions listed below:

- **Alerts and reminders** - In most general forms of AI integration, the machine scans a patient's lab results, drug orders, and updates the patient with an appropriate reminder. In this manner for generating alerts and reminders, more advanced AI programs can be directly interfaced with a patient monitor and used for detecting changes in a patient's condition.
- **Therapy fore-planning** - Specific conditions that require elaborate treatment plans could benefit from AI tools during therapy planning. By incorporating an AI system that can automatically formulate plans based on specific conditions would add certain value to the physicians as well as patients.
- **Information Retrieval -** Similarly, software search agents can be created for complex medical applications that are much more efficient than current generation web-crawling agent's performance. This aids in information retrieval and upgradation of data automatically.
- **Image Interpretation** - Multiple medical images can be instantaneously identified, from plane X-rays through to highly complex images like angiograms, CT, and MRI scans. Such systems for image recognition and interpretation have increasingly been adopted for clinical use.
- **Scientific Research** - The process of scientific research through applying expert systems and decision support systems. Such systems are programmed to learn, i.e. to aggregate & retain vast amounts of patterned data for specific purposes.
- **Generating alerts and remin*der*** - In so-called real-time situations, an expert system attached to a monitor can warn of changes in a patient's condition. In less acute circumstances, it might scan laboratory test results or drug orders and send reminders or warnings through an e-mail system.
- **Diagnostic assistance.** - When a patient's case is complex, rare or the person making the diagnosis is simply inexperienced, an expert system can help come up with likely diagnoses based on patient data.
- **Therapy critiquing and planning.** - Systems can either look for inconsistencies, errors and omissions in an existing treatment plan, or can be used to formulate a treatment based upon a patient's specific condition and accepted treatment guidelines.

Clinical Decision support systems

Clinical decision-support systems (CDSS) are generally defined as any computer program designed to help health professionals make clinical decisions. Medical Decision-Support System was designed to help health professionals make clinical decision. The system deals with medical data and knowledge domain in diagnosing patients conditions as well as recommending suitable treatments for

the particular patients. CDSS provides physicians and nurses with real-time diagnostic and treatment recommendations. The term covers a variety of technologies ranging from simple alerts and prescription drug interaction warnings to full clinical pathways and protocols.

DSS technology has been successfully employed in the medical device industry that encompasses cardiac monitoring and automated ECG, medical imaging, clinical laboratory analysis, respiratory monitoring, electroencephalography, and anesthesia.

Scanning, Life Support and Computer Controlled Equipment

Sensors

The area of Intensive Care and Treatment in one with the use of **Intensive Treatment Unit (ITU)** at its core. Patients can be admitted after trauma (e.g. an accident such as car crash or industrial incident) or post operatively where they may have undergone major surgery. Some patients are also referred when an illness or condition escalates in seriousness.

All patients in ITU are in a one to one situation with a nurse to every patient. Sensors linked to computers and alarms constantly monitor the patient - These sensors can be analogue or digital. The readings of the sensors are recorded by computer but for legal reasons, the nurse records the maximum and minimum readings manually. These records are kept for all patients and are shown to the doctor in charge of the case.

Different sensors can measure a number of different body functions such as:

- Temperature
- Pulse
- Blood pressure
- Central venous pressure
- Heart rate
- Fluid level testing
- Blood gases e.g. oxygen in the blood
- Gases as a breakdown of breath
- Brain monitoring measuring brainwave
- activity
- Continual ECG heart monitoring
- Inter cranial pressure (pressure in the skull)

With dedicated computers and sensors for these aspects mentioned above, there is the continual, accurate monitoring of the patients, 24/7. Staff are freed up to perform other tasks. Alarms are set for extreme readings allowing nurses and doctors react to each condition as necessary.

The data can then be turned into information and represented as graphs so the maximum and minimum readings can be easily read. It allows doctors to spot trends in patient care and to look at the effect of administration of drugs and dosage. This is only truly possible with computer records where certain trends can be examined in greater detail enabling closer examination at definite times in the patient's treatment.

Doctors can then act on the input that they are receiving from the equipment. For example, the central venous pressure gives the anesthetist the information to prescribe more or less fluids to ensure the maintenance of fluid levels.

Scanning Devices

- **MRI – Magnetic Resonance Image -**There is a horizontal tube running through the magnet from front to back. This tube is known as the bore of the magnet. Once the body part to be scanned is in the exact centre or centre of the magnetic field, the scan can begin. In conjunction with radio wave pulses of energy, the MRI scanner can pick out a very small point inside the patient's body and ask it, essentially, "What type of tissue are you?" The MRI system goes through the patient's body point by point, building up a 2-D or 3-D map of tissue types. It then integrates all of this information together to create 2-D images or 3-D models.
- **CAT – Computerized Axial Tomography-** Computerized Axial Tomography is a technology that uses computer-processed x-rays to produce tomographic images (virtual 'slices') of specific areas of the scanned object, allowing the user to see what is inside it without cutting it open. It is the process of using computers to generate a three-dimensional image from flat (i.e, two-dimensional) x-ray pictures, one slice at a time.

- **Picture archiving and communications system** (PACS): - This technology captures and integrates diagnostic and radiological images from various devices (e.g., x-ray, MRI, computed tomography scan), stores them, and disseminates them to a medical record, a clinical data repository, or other points of care. The universal format for PACS image storage and transfer is DICOM (Digital Imaging and Communications in Medicine). Non-image data, such as scanned documents, may be incorporated using consumer industry standard formats like PDF (Portable Document Format), once encapsulated in DICOM.
- **Bar coding**: - An optical scanner is used to electronically capture information encoded on a product. Initially, it will be used for medication (for example, matching drugs to patients by using bar codes on both the medications and patients' arm bracelets), but other applications may be pursued, such as medical devices, lab, and radiology.
- **Radio frequency identification (RFID):** -This technology tracks patients throughout the hospital, and links lab and medication tracking through a wireless communications system. It is neither mature nor widely available, but may be an alternative to bar coding.
- **Automated dispensing machines (ADMs):** ADMs are computer assisted systems that perform operations relative to the storage, packaging, dispensing, or distribution of medications, and collect, control, and maintain all transaction information. It automate functions such as dispensing prescriptions, picking imp rest orders, and managing and storing centralized inventory, resulting in a reduction of errors associated with manual stock selection.

Conclusion

Computer technology has been an important factor in improving quality in healthcare units. Many of the hospitals had implemented several IT functions. Another important quality improvement was reduction of medical errors and improvement in patient safety. Some hospitals cited enhanced patient safety as the most important benefit they had observed to date. This category included effects related to error reduction, such as providing more accurate information, flagging abnormal lab results and improving legibility of information. Hospitals reporting greater patient safety as the most important benefit had typically implemented fewer computer technology initiatives than hospitals citing more timely information as the most important benefit. E-prescribing with decision support stood out as relatively common among hospitals that viewed better patient safety as the most important benefit of computer technology.

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