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Laboratory Information Services: a brief review

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Abstract Laboratory information services are software services which aid the recording, archiving as well as retrieval and processing of patient records. The use of electronic health/medical record has reduced the duration of hospital stay and mortality. A basic awareness and knowledge of informatics as well as information management topics can go a long way in meeting the challenges of holistic laboratory management.

Introduction

Laboratory information services (LIS) are software services which aid the recording, archiving as well as retrieval and processing of patient records. While data with meaning is called as information, informatics has been described as the science of information [1]. The use of electronic health/medical record (EHR/EMR) has been aimed at enhancing the rapport and interaction between and within the organisation regarding various aspects of patient handling. It has been shown that the use of electronic media for patient record purpose has significantly reduced the duration of hospital stay and mortality. This may be due to quick requisition of investigations as well as interventions/drugs and speeding up of the sequence of steps required in the discharge process. [2] EHRs can facilitate access to patient's health information as and when needed. It ensures coordinated care and ensures better follow up advice. According to ISO/DTR 20514 "Integrated Care EHR" is, therefore, defined as "a repository of information regarding the health of a subject of care in computer-processable form that is able to be stored and transmitted securely, and is accessible by multiple authorized users". So it is digital format of the personal health record of individuals. It enables safe and confidential access to patient-related health information in real-time to facilitate clinical decision-making. [3, 4]

A number of guidelines have been established to ensure uniformity and maintain standards. The medical and hardware used should satisfy the specifications from ISO, BIS, NEMA, CE, RoHS, EnergyStar. Adequate backup of preserved data must be ensured considered. Data security as well as hardware should be planned and audited. To ensure single electronic health record for a lifetime, telecommunications using Internet, WAN, WAP, LAN, GSM, Cloud Computing should be used. The chosen connectivity medium should be practical, affordable, reliable and with good speed to enable data exchange with privacy and security. [3, 4]

Evolution

The idea of using informatics in the handling of data from laboratory dates back to as early as 1945.[5] During the 1950s and 60s the first primordial LIS was established.[6] In early 1960s the earliest version the now existing forms of LIS came into being. [7] In 1970s the 'data base

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management systems(DBMS)' and 'relational DBMS' came into being which revamped the front of data management systems. Structured Query Language (SQL) a structured way to handle and manipulate data evolved and the progressive enhancement in the semiconductor manufacture largely enhanced the feasibility of LIS use. Though these upcoming technologies were expensive, they had a very user-friendly interface. During this time LIS was readily integrated with the use of patient health care services. [8, 9] With the use of World Wide Web, there has been a lot of ease in the LIS functionality. The web-based applications have revolutionised the data formatting technologies. [10]

The need for the use of computational technology in the laboratory services originates from the ever increasing load of data and volumes of patient related information. Though the older versions of the LIS technology were programmed to use automation for data reduction generate from elementary clinical investigations. Progressively they were developed to handle more complex and intricate details needing higher end technology. Over a period of time they were used in full fledged manner for the large voluminous data storage and retrieval. [11]

Components and Outlay of LIS

There are four layers required for the use of informatics in pathology namely infrastructure, operational, business support, and executive. Each must function in its unique but integrated manner. [12] It requires the hardware, Operating Systems and Related Software, Database Management Systems (DBMS) and the LIS application.

Hardware includes all the tangible and physically existing elements which electronically interface with the LIS application. Operating systems form the customised interface between the human computer interactions for various purposes. They are of two classes: where there is human interaction and data storage, networking, web interface and others interventions. A database is a digitised aggregate of data while DBMS is a system to handle and manipulate the same. Every DBMS has a model which enlists what it can do. The LIS application is that interface with which the pathologist/technician. They include worksheets, interfaces with or without dictionaries. Functionally LIS is divided into the pre-analytic, analytic and post-analytic phases. Information security, test ordering, specimen collection, accessioning, and processing, analytic phase, result entry and validation, result reporting, notification management, data mining and cross-sectional reports, method validation are all essential components of LIS functioning.[7]

Need for modern LIS

LIS has enabled easy data analysis, quick synoptic report typing and archival, error free and non laborious way of data transfer, access to delta check and look at other investigations done at a glance for correlation. Due to use of cloud and server, the need for a physical space as for printed reports is mitigated.[7] This makes research activities, data retrieval as well as quality control much more simplified and researcher friendly. As most of the functions are carried out with the help of a unique bar-code representing a sample identification number, the likelihood of transcription errors is minimised. [10] In picture archiving and communication system (PACS), one has multiple stored images which are retrieved by physicians on need. [13]

Challenges

LIS establishment comes with the challenges of regulatory issues, technological challenges in the form of system failure and server maintenance, financial burden and time taken with implementation.[14] Dictionary building is a challenging part LIS development particularly in histopathology.[15] Storage of voluminous laboratory data holds substantial privacy risk. To prevent unauthorised access and breach in confidentiality de-identification and exclusive login identification number and password at

selected interfaces should be ensured. Other challenges include the integration of heterogeneous data into a unified database system. [13]

Conclusion

A well planned and executed laboratory information system alongside a robust back up of data can enable timely and accurate communication of reports. [16] A basic awareness and knowledge of informatics as well as information management topics can go a long way in meeting the challenges of holistic laboratory management. [17]

Authors' Contribution

All authors contributed equally to design, conception, writing and editing of this manuscript.

Conflict of Interests

None

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