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BIG DATA AND ELECTRONIC HEALTH RECORD IN PHARMACY: A SYSTEMATIC REVIEW

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ABSTRACT

As technology is advancing in medicine, the form in which medical data are treated has also changed over time. Big Data are huge data sets that are very big and complicated that it is difficult to compile, exchange and analyse them. Big data is reliable and helps in better decision making, reduced costs and improved organizational skills. Big data is classified as 'variety, volume, velocity, value, and veracity'. Electronic Health Record (EHR) the whole is known to be big data. EHR is essentially large due to the complexity and number of patients and the amount of information on each patient and is gathered for a variety of purposes, such as clinical care, accounting, auditing and quality control. Pharmacy information is an integral part of the electronic health record (EHR) data and can directly influence the quality of treatment and the safety of patients. From data related to pharmacy which is introduced by the patients in the course of visits to the data put down by the provider and submitted to drug store, this information plays an important part in delivering good treatment to the patients. In this article, we provide an outline on big data with EHR in Healthcare Pharmacy and how it helps in informed decision making, improved care delivery and quality performance measurements in pharmacy.

Keywords: Big Data, Electronic Health Records, EHRs, EMR, Healthcare.

1. INTRODUCTION

Healthcare is being increasingly interconnected with the approach of innovative drugs, the advancement of supply workers, payment models and improvements in regulation, and creativity in healthcare knowledge [1]. EHR is a type of healthcare innovation in use by suppliers, also the patients that want to view or trace medical data. Most of our electronic instruments have reliable means to access and manage healthcare data. EHRs also offer integrated capacities; multiple programs which can be seen through a similar program giving comprehensive viewpoint on the patient's medical history. Big data, like Pharmacy data is often used in analysis to monitor various new technologies and the efficacy of different medications [2].

Different people benefit from the concept of Big Data and EHR pharmacy data. Different people benefit from the Big Data and EHR Pharmacy Data idea. This method has a variety of users in healthcare administration, such as doctors, nurses or clinical pharmacists, with patients as key users. Certain people who benefit from this system are mostly researchers, the quality management team and policy makers. People like data administrators, data analyst and IT health professionals often work with such information [2].

Electronic Health Record (EHR) also can be considered as 'big data', therefore refers to the processing and use of data found inside EHR [3]. Big data provides the healthcare industry with the potential of massive EHR data study on results, patterns, temporary trend, and associations. Some assume that emergence of Big Data technology would be using EHRs database to shift us from one level to another level [4, 5]. The increase in operating evidence available on medical disorders, health complications, medicines and methods of treatment is high. But individual's ability to read, comprehend, and store information is limited. Computer based techniques for organizing, deciphering and perceiving designs from this information are therefore needed [4]. We need to develop new methods for collecting and disseminating this information to meet the ongoing and prospective health needs [6]. Pharmacy data is one such need. Just like other sector, pharmaceutical companies are generating data at a high pace that poses both benefits and

obstacles at the very same moment. In this overview, we address the importance of Big Data and Electronic Health Records (EHR) to pharmacy.

2. BIG DATA

The term 'Big Data' is described as a large database that is so complex that it's far beyond the ability to collect, assimilate, store and analyse data within an appreciable time through any traditional data tool [7]. Big Data can be further defined by three main components, namely data volume, which is a vast amount of structured and unstructured data, data variety, which refers to various types of structured and unstructured data that any organization or system might gather, and data velocity, which indicates the speed or rate of data collection and makes it available for further study [7, 8]. Big Data is the product of the fast grasping of structured information, is massive in bytes size and comes from several different sources. Big Data collects and preserves healthcare results arising through technological developments, therapies and surveys, it sends such data very easily to database systems [1].

3. ELECTRONIC HEALTH RECORD (EHR)

The EHR documents the outcomes of clinical and administrative experience between a physician, a pharmacist, a nurse or others and a patient that are present during patient care episodes. It is an electronic version of the medical history of patients that the provider can store over time. Data is circulated between networks, business data system and several different network and data exchange. Electronic health records contain variety of data, with demographic information, family history, medications and allergy reports, immunization lists, lab test reports, radiology pictures, clinical measurements, individual statistics such as age, weight, height and account details. Providers incorporate data from patient records across their care management systems to optimize health outcomes. The use of different sources of information from health records in the database has allowed doctors to classify and categorise the patients which are critically ill. EHRs might also increase standard of healthcare by incorporating database and technological insights to reduce patient hospitalization [9].

EHR system is developed to contain and store the database efficiently and monitor the individual's condition over the period. It minimizes the work to monitor the medical history of patients and helps ensure accuracy and readability of the data. It minimizes the chance of duplication of data since there is a single editable document that guarantees that the document is up-to-date, eliminating the chances of loss of papers. EHRs are more useful in gathering medical data to examine potential developments and abiding improvements in the patient, since digital records can be displayed in a single file. The widespread use of EHRs can also facilitate population-based analyses of medical records.

The implementation of electronic health records (EHRs) through pharmacies has had an impact on the approaches used by health care practitioners to care for their patients. However, it is not often understood that pharmacists are often consciously using advanced technology within the EHR. As important members of the health care team, pharmacists make use of several different features of the EHR.

Several different individuals benefit from the safe medication use and with the preservation of Electronic Health Records. Doctors, nurses, clinical pharmacists and other health care team members along with patients are central users in the drug administration process. Other users like academics, administrators of quality improvement, policy makers might utilize pharmaceutical data for treatment of patients without directly contacting them. Also, data managers, health IT technicians and pharmacy data analysts are further engaging with Pharmacy EHR data.

4. TYPES OF ELECTRONIC HEALTH RECORDS IN PHARMACY

The two major types of EHR data in pharmacy, they are, medication history and patient allergy data. They are vital to patient security and the quality of data.

4.1. Data of patient allergies

During a look up in the office, patient allergy data are recorded. When the patients enter for the first time, details on allergy of him are entered in the digital device by him at the reception or in the electronic health records by the healthcare personnel. The system offers a drug allergies interaction data to allow allergy tests to begin when new prescription for patients is inserted in the records [2].

4.2. Data of patient's medication history

This is the information of drugs was discussed during a routine visit to the office. It includes the summary of drugs that patient is either taking or already been taking. The number of available drugs, quantity of drug,

duration of medication that is used, and the route of administration are all selected from the list in system. Most of the EHR systems allow previous history of drugs to be checked by healthcare personnel. External prescription history is the information drawn from the other distributors, like retail pharmacy, into EHR. Reviewing the background of external medications may aid in accuracy of the details inserted in the system during situations in which the patient might not know the precise name of the drugs they are taking [2].

5. UTILIZING BIG DATA AND EHR IN PHARMACY

The use of big data has reformed ventures, such as telecommunications, advertising, health care and finance. As a result, pharmacy is also making progress in increasing the use of vast knowledge. The creation of big data in this sector helps to smooth out the various confused business approach and increase productivity, no matter how you look at it. Subsequently, speculators from healthcare providers and drug companies poured a large amount of money into big data. The use of EHR and big data in the pharmaceutical industries gives rise to following applications:

5.1. Research and Development

Big data proves to be helpful to research and development in the pharmaceutical industry. Pharmaceutical companies are gathering vast amounts of data produced at various stages of the projects, from drug development to actual use. Pharmaceutical companies rely mainly on the R&D department to create new products or services. And the use of big data tools saves time and costs, which is a major problem for these organizations in the field of R&D. The strategies developed using big data in R&D will produce results with the highest accuracy and minimize repetitive work. For all this, pharmaceutical companies must identify relevant sources of clinical data and introduce these data into their data base. As a result, different business leaders will link contrasting data sets to enhance research and development processes. The ability to access large data sets of patents, scientific papers and data on clinical trials can help promote the discovery of new medicines by allowing researchers to analyse previous test results. The use of predictive analytics for search parameters can allow them to acquire relevant information and also provide insight into which sections are likely to deliver the best results [10].

The use of predictive analytics can lead to even more significant changes. Most of the time, medication prescription is made utilizing the trial-and-error process, where doctor examines the patient's symptoms and then prescribes a drug which appears to resolve the issue and continues to monitor all of effects occurring on individual. The development of innovative therapies is revolutionizing the application of electronic health records and big data. Combining both, data scientists observe trends in prescription medications, the outcomes of these treatments, and the patient's genetic profile. Subsequently, doctors will be capable of understanding before time that gene variants suggesting the existence of the disorder, with the particular health history of the patient, and allow use of a more precise medication which is more successful in care. If data analysts are able to build simulations which forecasts the performance of the product or predict advent of emerging technological breakthrough, companies would be capable of preparing the research project through predicting where the demand will be without relying on a prospective study of the things that have succeeded previously.

5.2. Clinical Trials

Clinical trials are used to determine whether a particular medication is successful and safe for human subjects. This process requires a variety of steps until the final examination of the FDA. The whole process of clinical trials is complex and time-consuming. These trials are expensive and time-consuming to conduct, and businesses want to ensure that they have the correct patient mix for the trial. Pharmaceutical firms are losing a great deal of money because of this. In addition, clinical trials have failed as it is very difficult to attract patients for the trial. For this reason, doctors must specifically review the list of qualifying patients, which can be costly and time-consuming [11].

Big data lets you gather a large amount of data from a number actual sources of data like genetic profiles, EMRs, mHealth devices, phenotypic data and more. With potential automating of technologies in order to compile this unorganised, legitimate data by various platforms, arrange in compatible forms, interpret it and envision findings, this allows to gather proof of known test variables to be retrieved and information to be examined for unknown trends and factors. It can help select patients using data such as genetic information, personality characteristics, and disease status. As a result, doctors will understand all the medical information of each patient and analyse whether or not a patient is

suitable for a clinical trial. It can help determine the right patients to participate in the study (by examining demographic and historical data), remote patient tracking, evaluating past clinical trial incidents, and even helping to identify possible side effects before they become a fact. This helps pharmaceutical firms conduct shorter and cheaper clinical trials. Even, with help of big data, doctors can use the EHR as well to reduce errors in data entry and accelerate the medical treatments [12-14].

5.3. Drug Discovery

Researchers are implementing a repetitive method of physical examination of different animal and plant components in discovery of new drugs. This leads to the discovery of drugs requiring an enormous amount of time and money, which can be inconvenient for patients suffering from life-threatening diseases, particularly during epidemics. The cost of producing such drugs can also be very costly. Pharmaceutical companies thus invest in compounds that are most likely to be accepted in clinical trials and have low manufacturing costs.

By incorporating big data in industries which belong to pharmacy, scientists may make use of predictive models for discovery of new drugs. This might allow scientists to determine drug toxicity, drug inhibition and drug interactions. In such times, simulations and advanced statistical methods are used by predictive modelling which helps predict how given compound or drug will interact with the patient's body. These may also incorporate past statistical data obtained from previous diagnostic tests, clinical trials and post marketing observation.

Having refined tools and techniques, researchers will work towards making the process of selecting a drug candidate much easier and using the large amount of data available to give a better perception. Big Data could even help collect details from a number of sources as well as provide facts to facilitate better decision making. Big Data might play an important role by:

- Management of Clinical Trials and data survey. It is a very difficult and time-consuming process to perform large population trials of huge diversity and across several cities. From study design, patient registration, data collection and other items involved, it becomes a sluggish task. The introduction of big data here helps to break down unwanted measures and make the job much simpler.
- Selection and development of a medicine candidate. Recognizing a small amount of drug prospects from database of millions to screen for one single disease is very troublesome thing. Use of algorithm which is quite complex can help to scan vast datasets containing chemical, clinical and biological information which might work in sorting various test candidate shortlists. Modern analytics could assist to analyse the clinical firm and product profile to build a drug research route for industries.
- Rare diseases, drug repurposing and orphan drugs. Throughout a clinical trial, some prospects may not be proven to be successful but may be particularly effective in a specific population with a range of genetic, ethnic or other common threads. Big Data Analytics could assist to classify particular populations where those medications can still be effective. Such pattern of drugs repurpose would be highly relevant for people suffering from rare or inherited disease, which might not be typical in the production of an allocated medication.

5.4. Drug Reactions

In certain cases, medicines can have adverse effects on the health of the patient, known as adverse drug reactions (ADRs). This has been a complex topic that has gained a lot of attention from different medical centres. The use of big data helps to track adverse effects due to its high volume. Big data has become a valuable resource in the registration of adverse reactions and drug-related risk factors. Public health forums and social media have gained a great deal of attention from the public health sector on the basis of positive public perception focused on pharmacovigilance. Patients that post on side effects or adverse reactions mostly share their negative reactions. This lets researchers evaluate the texts in finding the ADRs. This knowledge is used in the pharmacovigilance practice of clinical pharmacists. These programs rely primarily on regulatory reports issued by pharmacists, physicians or clinicians. Pharmaceutical firms are browsing social media sites or medical patient analysis forums. With this strategy, various organizations are gaining insights into the ADRs. The method of checking ADRs could be streamlined with use of big data in pharmaceutical industries [15].

5.5. Precision Medicine

Precision medicine is a disease treatment and prevention approach that sees individual gene, environment, and lifestyle variability for each individual. This helps clinicians and researchers to predict more effective treatment and prevention methods for a specific illness that would work with which groups of people. It follows a one-size-fits-all strategy that establishes disease

management and prevention methods for the average person [16].

Big Data enables the use of precision medicine where the treatment of diseases is conducted using relevant data on the patient's genetic make-up, environmental influences and behavioural trends. As a result, pharmaceutical companies will create customized drugs that are ideal for the patient's body and lifestyle. It also helps to predict the sensitivity to such diseases and increases their identification. This helps patients to obtain effective treatment compared to traditional medicines.

5.6. Sales and Marketing

Using big data in pharmaceutical industry helps in boosting its marketing and sales program. With big data, businesses will analyse the locations that offer the highest quantity of pharmaceutical drugs promoted. It lets the industry evaluate data volumes, customer conduct, the effects of advertisements and customer retention. Analysing the success of sales and testing the feedback received from sales, moving forces during consumer visits and using them efficiently will enable pharmaceutical companies to gain a competitive advantage. With such data, they choose to increase the number of products supplied in these areas. Pharmaceutical companies strive to obtain critical data from various sources, allowing them to make crucial decisions in marketing and sale strategies [17].

With growing competition from generics, the pharmaceutical industry is becoming more intelligent in the study and productivity of its sales and marketing processes. Using various kinds of data and machine learning, companies conduct predictive analysis to obtain patterns within the available data and to make accurate predictions about pharmacy trends. Using such methods will help them make important decisions and be prepared for possible pharmaceutical developments.

5.7. Medication Adherence

Medication adherence is commonly defined as whether patients are taking their medication on a prescription basis, as well as whether they are continuing to take the prescribed medication. Non-adherence to medication is a growing problem for pharmacists, doctors and health care facilities due to evidence that it is widespread and associated with adverse effects and higher care costs.

Big data is well used to encourage adherence to medications. With the aid of its CVS tracks prescription filling patterns, Pharmacy benefit management, mainly for chronic diseases [18]. Through communicating to consumers via text, phone calls and e-mails, an automated filling application aims to facilitate prescription refills. Notifications are sent to the patient when his prescriptions are not filled, and though the consumer goes to the drug store for another drug, they will be notified [19, 20].

5.8. Medication Reconciliation

During the drug reconciliation process, the pharmacist checks the accuracy and correctness of the history of the product and conducts systematic interviews with patients to collect additional details. Pharmacists use the EHR to compare and contrast drug lists, relate drugs to patient conditions, assess efficacy and adverse drug effects (ADEs) and make recommendations in the documentation to include a full history of patient medications. Drug-reconciliation tasks are highly dependent on information technology, and drug-reconciliation may benefit greatly from exchanging drug lists between organizations. They can only have lists of possible medicines that patients are taking; thus, reconciling drugs also involves interviews with patients to determine how they are currently taking their drugs, and this is a task that is well suited to pharmacists [19, 21].

6. CHALLENGES

Although big data and EHR are set to revolutionize pharmacy, several challenges exist:

- Patient confidentiality, as a large number of data collections are stored online, cyber-attacks may occur, causing financial loss and reducing consumer trust. Health organizations must track patient information carefully by recruiting trained health informatics experts to ensure the protection of patient databases. It is vital to ensure that the data do not fall under the wrong authority. Holding data secure and shielding it from the wrong authority would be another tough step for big data and EHR to take. While the advantages of big data are immense, the challenges of coexisting as a consequence of abuse will bring another opposite major issue [7].
- There are large numbers of separate databases Most of them are difficult to determine the source, reliability, availability and efficiency of the data. In addition, highly useful data can exist in a semi-structured and unstructured form, e.g., health records and scientific literature. For structured data, there is sometimes a difference in the format of the data, i.e., the same type of data may be presented in different formats or

similar data fields using the same language may have different meanings [13].

- Human limitations, ensuring the pharmaceutical records are up-to-date and managed has its problems. Such as lack of big data and analytical knowledge, are perceived to be the most difficult measures in the use of big data in healthcare. Organizations and pharmacies are dealing with a lack of trained data scientists to make use of big data. Primary skills, such as expertise of big data technology and platforms and secondary skills, including applied mathematics and statistics, predictive analytics and decision-making models, are currently lacking in the training of healthcare professionals. This may affect the development of the implementation of big data in pharmacy practice [13].

While big data and EHR are here since many years, it's system and working doesn't seem to be well operated and there are several challenges. Some of them are, limits on ability of processing [20], lack of consistency and interworking [19, 22, 23], precision and completion of data [24], expense [25], protection and privacy issues [12], and failure to obtain useful data [26].

7. FUTURE OF BIG DATA AND EHR IN PHARMACY

The McKinsey Global Institute reports that the strategies with big data will produce up almost $100 billion in income for the healthcare system. The capacity of pharmaceutical companies to find new potential drugs can be enhanced by using Big Data/EHR and quickly transforming them into successful medicines. Predictive modelling of biological processes and drugs that function safely and efficiently on biological targets. This can be achieved effectively by exploiting the variety of molecular and clinical data available. More efficient real-time monitoring for the clinical trial may be in place and therefore increase the effectiveness of clinical pharmacists. In addition, adverse events and excessive delays can be prevented and tests are tracked in real time to detect protection or troubling operational signals. Instead of static, difficult-to-use data silos, information collected by electronic means and moves seamlessly between clinical development and drug discovery and to foreign collaborators like doctors and contracted research agencies [27].

As shown in Table 1, health care is expected to shift progressively towards digital modelling and thus Big Data and EHR plays a crucial role in the clinical pharmacy service. We have summarized the potential help available to pharmacists and the potential benefit that patients may derive from Big Data and EHR involvement in healthcare.

Table 1: Benefits of big data in health care system

Benefits for Pharmacists	Benefits for Patients
Accelerated clinical trials	Reduced hospitalisation
Real time patient monitoring	Personalised medicine
Population adverse drug events	Prevent ADRs
Population health statistics	Improve compliance
Optimised medication supplies	Optimizing Drug Usage
Updated clinical guidelines	Prevent hospital readmission

8. CONCLUSION

Big Data and EHR are created by quick incorporation of technologies through a range of tools, ranging from basic to advanced materials, and information is used by both commercial organizations and consumers for a broad variety of uses, varying from the design of clinical strategies and guidelines for clinical practice to healthcare environment and hospital systems. Health system pharmacy executives need to consider Big Data and EHR to find out ways to use their components in order to enhance the pharmaceutical practice. The effects of drug use can be predicted by EHR, given that a plan for its application is in place. As health care information grows and advances, Big Data and EHR can be a useful and powerful method for improving the pharmaceutical service for patients.

Conflict of interest

The authors have no conflicts of interest.

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