IJISET - International Journal of Innovative Science, Engineering & Technology, Vol. 6 Issue 7, July 2019
ISSN (Online) 2348 – 7968
www.ijiset.com

The Need for Data Analytics Applications in Healthcare

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Abstract

Healthcare analytics is analysis that focuses on the healthcare industry, such as hospital management, patient records, costs, and diagnoses. The purpose of healthcare data analytics is to predict and solve a problem early, to timely assess methods and treatments, and empower patients in their own healthcare. Big data analytics in healthcare shares one functionality: real-time alerting. Electronic Health Records (EHR) are shared through secure information systems which can be accessed by providers. Clinical Decision Support (CDS) software immediately analyzes medical data, providing health practitioners with information to make prescriptive patient healthcare decisions. (UIC) Specific health data of a population (or individual) potentially helps cure disease, prevent epidemics, and decrease costs, etc. Other uses include predictive analytics, developing precision medicine and new therapies, appointment no-shows, patient predictions for improved staffing, preventing suicide and patient self-harm, supply chain management, and fraud reduction and enhanced security. Patients can monitor their own health by using smart devices and use such vital information and other trackable data to identify potential health risks. *In silico* testing is a new method for evaluating new therapies by creating control groups for trials associated with degenerative conditions, such as Huntington's disease, Alzheimer's, and Parkinson's disease.

Keywords: *predictive analytics, descriptive analytics, staffing, patient suicide, supply chain management, fraud reduction, enhanced security, In silico, real-time alerting, EHR*

Introduction

Healthcare analytics is analysis that focuses on the healthcare industry, such as hospital management, patient records, costs, and diagnoses. Big data analytics in healthcare can provide insight from massive data sets to improve outcomes and cost reductions [1]. Combined with data visualization tools and business intelligence suites, healthcare analytics helps the healthcare industry to operate more efficiently by providing real-time data to support actionable decisions [2]. The purpose of healthcare data analytics is to predict and solve a problem early, to timely assess methods and treatments, and empower patients in their own healthcare. Specific health data of a population (or individual) potentially helps cure disease, prevent epidemics, and decrease costs, etc. [3].

The healthcare industry has generated large quantities of data from record keeping, compliance and patient care [1] [4] [5] [6] [7]. Although much data has been stored in hard copy form, but is moving to digitization of these massive amounts of data (known as 'big data') which supports medical and healthcare purposes, such as population health management, disease surveillance, and clinical decision support [4] [5] [6][7].

Real-Time Alerting Using Electronic Health Records (EHRs)

Big data analytics in healthcare offer real-time alerting. Every patient has a personalized digital record to include medical history, demographics, laboratory test results, allergies, etc., in the form of an Electronic Health Record (EHR). EHR are shared through secure information systems which can be accessed by providers. Electronic health records can trigger warnings or issue patient health reminders [8]. Clinical Decision Support (CDS) software immediately analyzes medical data, providing health practitioners with information to make prescriptive patient healthcare decisions [8]. Patient engagement is enhanced by individuals monitoring their own health by using smart devices to permanently record their steps, heart rates, and/or sleeping habits. Such vital information and other trackable data can identify potential health risks.

Predictive Analytics

Healthcare organizations are moving from basic descriptive analytics, which is a preliminary stage of data processing creating a summary of historical data, toward using predictive analytics which estimate the possibility of a future outcome based on patterns in a patient's historical data allowing caregivers to make informed choices about decisions for a patient's care [4]. Early stage treatment models are now guided by data that provide warning signs of serious illness as they occur for prevention and ability to convert it into relevant information that can be used for better patient care [8]. Prediction and prevention can help identify individuals with high risks of developing chronic conditions in the early stage of a disease's progression [9]. Hospitals are subjected to penalties under Medicare's Hospital Readmissions Reduction Program (HRRP). Thus, it is financially pertinent to prevent unplanned returns to hospitals. Predictive analytics can alert caregivers if a patient's risk factors show a high probability for readmission within 30-days [9].

Developing Precision Medicine and New Therapies

Precision medicine and genomics analytics can bolster traditional clinical trials and drug discovery techniques [9]. *In silico* testing is a new method for evaluating new therapies by creating control groups for trials associated with degenerative conditions, such as Huntington's disease, Alzheimer's, and Parkinson's disease [9]. Patient subgroups that require dose adjustments can be identified by incorporating individual physiology and genetics in drug metabolizing enzymes [9]. Predictive analytics play a major role in converting new drugs into precision therapies. Clinical Decision Support (CDS) systems can predict a patient's response to

a particular course of treatment through genetic information matching using results from previous patient groups. By understanding relationships between genetic variations, healthcare providers can use a therapy that has the best likelihood of success [9].

Appointment No-Shows

Electronic Health Record (HER) data can disclose individuals who are apt to no-show using clinic-level data to forecast patient patterns with high accuracy. This can decrease revenue losses and provide the opportunity to offer open appointments to other patients. Data can be used to remind patients of their appointments and/or suggest alternative dates/times [9].

Patient Predictions for Improved Staffing

Using big data in healthcare can help determine how many people should be put on staff at any given time period. Staffing levels need to be adjusted according to patient flow fluctuations. Too many workers run the risk of having unnecessary labor costs and too few workers can lead to poor customer service [2]. Predictive analytics can estimate when a clinic or care site without fixed schedules, such as emergency or urgent care [9]. Inpatient wards should be prepared with beds for admitted patients, and outpatient clinics need to have low waiting times [4].

Preventing Suicide and Patient Self-Harm

Electronic Health Records can provide data to support suicide risk detection. Early identification of people likely to harm themselves can receive the mental healthcare required to avoid suicide. Predictors of a self-harm attempt include substance abuse or mental health diagnoses, previous suicide attempts, high scores on depression questionnaires, and the use of psychiatric medications [9]. Popular mid-day appointment times can create spikes in capacity, while early morning and late afternoon spots go unfilled [9].

Supply Chain Management

The supply chain represents an opportunity for healthcare organizations to improve efficiency and cut unnecessary spending by reducing variation and altering ordering patterns and supply utilization [9]. Descriptive and predictive analytics can help healthcare organizations optimize the ordering process, reduce supply variations, and negotiate pricing.

Fraud Reduction and Enhanced Security

The healthcare industry likely to experience data breaches because personal data is extremely valuable and profitable in black markets [3]. Artificial intelligence and predictive analytics are important to cybersecurity [9]. Analytics tools monitor patterns in data sharing, access, and utilization can provide early warnings changes occur indicating the network has been penetrated [4]. Real-time risks can be avoided by using Multi Factor Authentication (MFA) to block the access for attempts for ransomware [9]. Advances in security, such as firewalls,

encryption technology, and anti-virus software help prevent security threats by identifying behavior that reflects a cyber-attack or change in network traffic [3].

Conclusion

Analytics can ensure anti-fraud security, predict patient suicide risks, optimize supply chain management, improve patient appointment no-shows, improve clinic and hospital staffing, and develop precision medicine and new therapies. Personal patient data is valuable and profitable to black marketers. Multi Factor Authentication (MFA), such as firewalls, encryption technology, and anti-virus software, is a method for blocking access to data. Such security can identify cyber-attacks or changes in network traffic. Big data analytics allows for real-time alerting. Clinical Decision Support (CDS) software immediately analyzes medical data, providing health practitioners with information to make prescriptive patient healthcare decisions. Patients can monitor their own health by using smart devices to gather vital information and other trackable data that can identify potential health risks. Healthcare analytics and big data analytics can potentially transform how healthcare providers utilize cutting-edge technologies to acquire insight from clinical and other data to make informed decisions.

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