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## DATA ANALYTICS IN HEALTHCARE INDUSTRY

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#### Abstract

Health is the most integral part of life. In the healthcare industry a vast amount of data is generated from different segments of healthcare organizations such as payers and providers. However, like other sectors ranging from retail to banking, who have already leveraged the potentials of big data, the healthcare industry has not yet fully explored the importance of big data in deriving valuable insights from such vast amount of data at hand. For example, Grocery stores determine the loyalty of their customers by identifying the sales patterns, giving discounts and special offers, having a mix of products which not only improve their profits but also, increases their customer satisfaction. Claims providers and payers, the pharmaceutical industry has now only utilized big data to tackle issues such as changes in the quality of healthcare services, reducing fraud and abuse of claims, improved care. Due to the intricacy and a large amount of data, it poses a huge challenge in analyzing these medical data and its applications in a practical healthcare environment. According to the National Health Expenditure Accounts (NHEA), the healthcare expenditure in the U.S increased by 4.3 percent in the year 2016 which is \$3.3 trillion. Healthcare claims data can provide a great deal of information on healthcare services and the types of drugs provided. Approximately 95% of physicians in the United States use Electronic Health Record (EHR) systems to collect, store and analyze health data. With the use of big data, blockchain and IoT in healthcare will allow healthcare claims providers to get time to time access to billing data, patients' clinical outcomes.

The aim of this research paper is to discuss how big data analytics is used in the healthcare industry and how it allows the way doctors, claims providers, payers can make decisions. How predictive analytics is used to detect the disease a patient is prone to have beforehand which can reduce the healthcare cost. To determine the length of the patient, stay at the hospital or the rate of readmission. Further, what are the applications of IoT in Healthcare using connected care or sensor-based devices to monitor health?

To conclude the paper discusses the case study by Roche Diagnostics on how they used Microsoft Azure IoT platform to know how vitro diagnostics can assist in detecting diseases, what are the causes, effectively monitor patients' health and progress. Another case study of 365mc who developed an M.A.I.L system which stands for Motion Capture and Artificial Intelligence assisted Liposuction System which uses AI along with Microsoft Azure IoT solution and Microsoft Azure Machine Learning to increase the accuracy and safety during the liposuction process.

Keywords: Fraud Detection; Medicare; Healthcare; Clinical Trials; Drug discovery

## **Data Analytics in Healthcare Industry**

Making basic healthcare services available and affordable all the time is the main issue around the world. Health being one of the most important aspects of human life, it is crucial to know how big data, predictive analytics and the Internet of Things can help address such issues. Thus, it is important to understand how these technologies can help detect diseases a person is prone to develop just by determining the signs and symptoms, what medicines or drugs would be best suitable for the treatment also how to detect fraud and abuse of insurance claims. According to Dallas Thornton et al. (2013). Predicting Healthcare Fraud in Medicaid: A multidimensional data model and analysis techniques for fraud detection, the author mentions that in U.S healthcare system approximately \$700 billion is lost due to fraud and abuse. In recent years the medical claims fraud has increased as it is difficult to track the low-income population of patients, disabled people and due to lack of communication. To detect fraud of health insurance claims, he mentions using "Sparrow's" fraud type classification models to build a multidimensional schema and using predictive analytics techniques to predict the activities which are fraudulent. With this Sparrow model, it aims to detect medical claims for unnecessary medical services etc.

Kuo et al. (2014). Health big data analytics: current perspectives, challenges, and potential solutions, in this paper the authors mention that today the healthcare systems can generate a vast amount of health data nearly exabytes of patient's healthcare data every year which is termed as "health big data". With the large amount of health data available today, many doctors and health experts believe that it is possible to derive many valuable insights from the data which will help in improving health services provided to the patients, increasing the patient safety and insurance providers will be able to give specific insurance plans according to the patient's needs. The purpose of the paper is to provide the insights from the healthcare data, what challenges lie ahead and solutions to address those issues.

In healthcare, machine learning models are proving to be useful in revealing significant insights from the huge amount of health data of patients. In many cases, due to the large size of the data, the old machine learning algorithms or tools are insufficient to provide valuable information. To overcome this issue and to effectively handle such large volumes of data a high dimensional big data analytics tools are required. The paper, Risk adjustment of patient expenditures: a big data analytics approach describes the use of big data technologies such as MapReduce to implement risk adjustment model to determine the patients' healthcare expenditures. It uses "divide and conquers" strategy to improve the accuracy of the model to fully exploit the data to gain valuable information. With this model it aims to predict health costs for the patient based on associated risk, future cost and utilization rate, resources for the provider to manage the different population of patients and their needs, predict future health claims, patterns of cost and effective health plan prices. (Li et al; 2013).

IoT Healthcare Analytics: The Importance of Anomaly Detection in this paper, the authors mention that healthcare data contains much important information which is related to patient survival data. It describes the importance of analyzing the patient's healthcare data which can help to make better decisions in medical with chances of saving patient life and providing improved quality care. It further discusses how IoT can be useful in the healthcare industry to detect an anomaly in healthcare data. With IoT devices such as smartphones, wearables devices which are enabled with sensors can help to provide many health-related benefits which include predicting disease, early

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epidemic alerts, drug discovery, preventing fraud health insurance claims and remote health monitoring. It mainly discusses the anomaly detection, it's applications and role to determine how to make healthcare system efficient and robust, increase the survival rate and make healthcare affordable (Ukil et al.,2016)

#### **IoT Applications in Healthcare**

With the growing old age population affording the basic healthcare services will become difficult and would lead to people becoming prone to chronic diseases. Although it is impossible to prevent the aging population and to completely stop the occurrences of the chronic diseases even with the technology, it can at least help to reduce the healthcare cost making it affordable to everyone. Internet of Things (IoT) would be the technological advancement in the healthcare industry which would help to reduce the hospitalization rates if the patients are provided with the proper diagnosis. It could reduce the patients visit even for general checkups from hospital to patients' home using sensor-based devices such as Fitbit, pills enabled with sensors, sensor-based smart pill bottles, ambulances fitted with sensors, monitoring devices. Some applications of IoT in healthcare are listed below:

#### **Remote Monitoring Devices**

The remote health monitoring devices such as wearable devices with sensors are used to monitor a patient's vital health symptoms and signs. It gathers data to send it to healthcare insurance providers for solutions who would be based in different locations for medical assessment. Using remote monitoring devices reduces patient's readmission rates, allows patients to monitor their own health and reduces the time required to travel to hospitals. The various remote monitoring sensor devices are:

1) **Glucose Sensor:** Blood glucose monitoring sensor devices for diabetes patients can be very useful as it continuously checks the glucose levels in the blood of a diabetic patient in their interstitial fluids. The blood glucose devices can be inserted into the body of the diabetic patient in the skin or it can be used as a device integrated with sensors such as optical, infrared and ultrasound.

2) **Pressure Sensor:** Blood pressure sensors can be crucial for patients with high blood pressure problems as high bp can lead to heart failures and strokes. It requires continuous monitoring because blood pressure changes every minute. Devices such as wearables with sensors which used pulse wave eliminate the old way of going to the doctor for blood pressure check by giving the accurate reading of the blood pressure.

3) **Sweat Sensor:** Sweat sensors are used by many athletes or patients to monitor their body fluid levels as they provide valuable information on sodium level, chloride, glucose, amino acids and potassium which can help in the early diagnosis of the disease like cystic fibrosis. This can be monitored using sensor-enabled wearable devices.

#### **Ambulance with Sensors**

Many times patients lose their life while inside an ambulance due to the inadequate support available in the ambulance, also it becomes hard to perform the treatment until the patient arrives at the hospital. This lead to the development of Ambulance Telemetry which sends the measurements and transmits patient's vital data wirelessly to the doctors at the hospitals or healthcare centers when inside an ambulance. This technology captures data from

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sensors in the ambulance and sends to medical centers which help to make the decisions related to the treatment to be provided to the patients who are still inside an ambulance. It uses various technologies such as Polycam which are connected to the network lines or TV at the medical centers/ ambulance which continuously monitors the patient's vital health signs which includes heart rates, pulse rate etc. This helps to get consultations from the doctors at the remote locations to provide proper treatment to the patient.

#### **Pills Enabled with Sensors**

Sensor-enabled pills are the ingestible pills which can provide some valuable information on how to deal with chronic diseases. This pill will allow doctors or physicians to decide what treatment will be best for individual patients. Whenever the patient consumes the pill, it will capture the data about patient's vital health signs and then sends it to the connected wearable devices. This data is further passed on as health report to the cloud which allows the healthcare providers to diagnose the disease a person is prone to have and to identify what effects the medicines will have on the vital body organs. It also allows the providers to monitor a patient's health, provide appropriate health plans and track their health activities.

#### **Smart Sensor based Pill Bottles**

Often chronically ill patients and even elders miss their medicine dosage or forget to take it which can lead to various health problems. One solution to tackle this issue is to use sensor embedded smart pill bottle which helps to determine when the patient or an elderly person has missed their pill dosage. This sensor enabled bottle gives real-time data to the healthcare providers or the caregivers whenever a patient misses the medication. The sensor-enabled pill bottles are integrated with the mobiles phones which provide patients with alerts on when is the right time to take the medication along with the amount of dose to be taken. This real-time monitoring helps to keep the patients on track and it gives alerts on mobile via call or text or just by directly blinking the light on the pill bottle. The sensor can also provide information such as what time the bottle was opened, and the number of pills taken by the patient.

According to the article published by WNS, it discusses how IoT can help the healthcare insurance providers to set the dynamic prices for the insurance policies with the real-time and risk data collected by the IoT enabled sensors devices and wearables. This will allow health insurance providers to give personalized and automated processes as per the customer needs. The article mentions about the Fitbit, a sensor-enabled wearable fitness devices maker partnered with the healthcare insurance provider United Health Group, the U.S. which decided to include Fitbit a fitness tracker into their health insurance program which gives employees the option to wear Fitbit at work. This would track their employees' health activities and the data collected from this can then be analyzed by the health insurance provider companies to give their employees or customers with some health-related credits. By offering this type of wellness program the company aims that they would have to process less number of healthcare insurance claims since people would adapt to a better and healthier lifestyle. This initiative might also help the insurance providers can provide better insurance plans to their customers through the valuable insights they gain from the IoT data which is gathered through customers wearables devices. This will also, allow them to combine the data from social media and other disparate sources with the data available from various IoT sensors enabled

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devices and thereby enhance their customer profile in different ways. Thus, IoT can prove to be the edge healthcare insurance providers need at this stage as it would increase their sales directly and provide customers with a better conversion rate. It will also help the insurance providers with two important aspects which are the smart pricing of their insurance policies and to determine the risk associated.

#### **Case Study on applications of IoT**

#### 365mc

The case study discusses a Korean health insurance company 365mc which developed an "M.A.I.L" system which is known as Motion Capture and Artificial Intelligence assisted Liposuction System. It is an obesity-care organization and gives various diet plans and liposuction therapy to patients. The M.A.I.L technology integrates the liposuction with the artificial intelligence technology where it gathers the surgeon's hand movements while performing the liposuction surgery or process. It helps to flush out the fat from the body by inserting cannula inside which has sensors enabled on it. This procedure of removing fat from the patient's body is complex and care needs to be taken while inserting the cannula into the patient's body. It should properly be able to reach the fat tissues which lie between the skin and the body muscles otherwise it could damage the tissue. Also, if the cannula is not injected thoroughly it will result in fat not being removed properly which could lead to "skin necrosis". To overcome the issue of uniformly moving the cannula inside the patient's body the company came up with the system M.A.I.L which was implemented with the help of Microsoft Azure IoT platform solutions accelerators along with Microsoft Azure Machine Learning technology. This system helps to gather, store and analyze real-time data collected from the sensors to derive valuable insights. It uses cannula enabled with motion sensors which track the surgeon's hand movements during the procedure. It uses MS Azure IoT to store the vast amount of data generated by the sensors and further utilizes MS Azure Machine Learning to derive information on the pattern of hand movements and different actions. This analysis helps the surgeons to keep a track on the accuracy of the procedure when the surgery is over and to compare the surgical outputs with the sensors data.

#### **Roche Diagnostics**

Roche is a China-based Pharmaceuticals company which develops the in vitro diagnostics devices (IVD) and it estimates that approximately 60% of the decisions in the medical are done with the IVD. Their IVD solutions help to detect diseases, their cause, also allows clinicians to monitor their patient's health progress. They have different products such as devices which can be used in clinical chemistry, urinalysis etc. To address the rapidly growing demand for this IVD and to offer the best possible prices, Roche partnered with Cleidon and Microsoft to provide better healthcare service that uses IVD. Using IoT solutions, it allowed the company to gather real-time operational data namely location from these IoT enabled devices. It helped them to monitor the IVD health data, address the device issues and troubleshoot them. Cleidon used Microsoft Azure IoT platform to develop and deploy a maintenance model for Roche Diagnostics. Once the required amount of data is collected about operations it would allow them to enhance the company's ability to provide reliable systems and better medical services to their customers. Thus, Roche's partnering with Cleidon and Microsoft has given them various benefits in terms of improving their customer value which is namely: fixed assets monitoring, better supply management, predicting

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maintenance of the devices required in the future and provide with important visualization to make informed medical decisions.

## **Future Scope and Conclusion**

Big data analytics and applications of IoT in the healthcare industry though has the potential to provide the edge needed to make the healthcare services easily available and accessible it still can be challenging to implement at early stages. In the future, big data and IoT will have a wide use in various healthcare sectors ranging from insurance providers to clinical trials to make better decisions. The most important purpose would be to focus on minimizing claims fraud and abuse, early detection of disease etc. Further, it can be helpful in recognizing image patterns and signals from various health metrics which could be an interesting topic for the medical experts or clinicians.

## References

- 1. 365mc improves the efficiency and safety of Liposuction with data analysis based on Microsoft Azure IoT solution accelerators and Machine Learning. (n.d.). Retrieved from https://customers.microsoft.com/en-us/story/365mc-azure-iot-suite-machine-learning-korea-en
- 2. Cashing in on IoT: Time for Insurers to Change the Blueprint? (n.d.). Retrieved from https://www.wns.com/insights/articles/articledetail/516/cashing-in-on-iot-time-for-insurers-to-change-the-blueprint
- 3. Driving digital transformation for in vitro diagnostic medical devices with IoT. (n.d.). Retrieved from https://customers.microsoft.com/en-us/story/roche-diagnostics
- 4. Kuo, M. H., Sahama, T., Kushniruk, A. W., Borycki, E. M., & Grunwell, D. K. (2014). Health big data analytics: Current perspectives, challenges, and potential solutions. International Journal of Big Data Intelligence, 1(1/2), 114. doi:10.1504/ijbdi.2014.063835
- Li, L., Bagheri, S., Goote, H., Hasan, A., & Hazard, G. (2013, 10). Risk adjustment of patient expenditures: A big data analytics approach. 2013 IEEE International Conference on Big Data. doi:10.1109/bigdata.2013.6691790
- Mathew, P. S., Pillai, A. S., & Palade, V. (2017, 12). Applications of IoT in Healthcare. Cognitive Computing for Big Data Systems Over IoT Lecture Notes on Data Engineering and Communications Technologies, 263-288. doi:10.1007/978-3-319-70688-7\_11
- NationalHealthAccountsHistorical. (2018, January 08). Retrieved from https://www.cms.gov/Research-Statistics-Data-and-Systems/Statistics-Trends-and-Reports/NationalHealthExpendData/NationalHealthAccountsHistorical.html
- Thornton, D., Mueller, R. M., Schoutsen, P., & Hillegersberg, J. V. (2013). Predicting Healthcare Fraud in Medicaid: A Multidimensional Data Model and Analysis Techniques for Fraud Detection. Procedia Technology, 9, 1252-1264. doi:10.1016/j.protcy.2013.12.140
- Ukil, A., Bandyoapdhyay, S., Puri, C., & Pal, A. (2016, 03). IoT Healthcare Analytics: The Importance of Anomaly Detection. 2016 IEEE 30th International Conference on Advanced Information Networking and Applications (AINA). doi:10.1109/aina.2016.158

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