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**EBUS622-Big Data Management Coursework**

**Year: 2021-2022**

**Topic: Crisis and Acute Mental health care services**

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**EXECUTIVE SUMMARY:**

Project report highlights the crisis in NHS mental healthcare. With the demand of mental healthcare increasing every day specially after covid has hit the world it can be observed there is a surge in the demand for mental care.

Critical analysis of the report is done. Using maturity model the stage of the organisation is identified. DELTTA Model is applied to understand the elements in detail. SWOT analysis is done to understand the strength and weakness. Technology and lack of analyst are considered as weakness. Different technologies are discussed which should be encouraged to use. These technologies can aid the analytical capabilities in the organisation.

The use of predictive and prescriptive tools is recommended, and solutions are suggested how these tools can help to resolve this crisis. Finally, reports suggest what can be done to improve the weak factors identified like recruitment of analyst, increase the use to analytical advanced tools which can help to predict patterns and effective treatment can be given to patients or can help prevent any such crisis in future by taking remedial measures.

**INTRODUCTION & BACKGROUND:**

The NHS is a publicly funded organisation established in 1948 as one of the major community reforms after the Second World War. The NHS stands for National Health Service, and it is funded by taxes.

This organisation was established to provide a healthcare system in UK and services to all the citizens without any discrimination. In 2012 NHS went under a major revamp process.2012 Health and Social Care Act was introduced, which divided NHS into multiple organisations that work at both local and national levels.

The NHS was founded with the purpose to provide health care services and amenities to its citizens with a truncated financial burden.

(Dr RogerHenderson,2019)

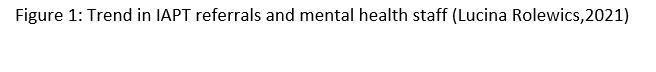
**MAIN PROBLEM STATEMENT:**

The number of mental healthcare staff has decently increased over the period but in contrast, IAPT (Improving Access to Psychological Therapy Services) referrals have rapidly increased. Furthermore, the number of mental health nurses has dipped.

NHS health workforce is fighting to meet the demand for mental health care. Presently there is inadequate mental healthcare staff. Hence, there is an acute crisis to provide mental healthcare services as per the rising demands. (Lucina Rolewicz,2021)

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**COMPLICATION:**

Analytics Maturity Model:

The growth of NHS across various areas of DELTTA elements can be measured using the Analytics Maturity Model. The NHS falls into stage 3 i.e., Analytical Aspiration. The head of the Analytics Unit at NHSX and the head of NHS England and NHS Improvement’s Data, Analysis and Intelligence Service plan have started emphasizing the use of analytics and keen to increase the application and capabilities of generating and using analytics in NHS. However, they have been using some aspects of analytics till now and have 5 yearlong plans in place for analytics for future implementations. (NHS, n.d)

DELTTA Model:

As per DELTTA Model, for insightful analytics, it is very vital that data must be organized, integrated, and should be of high quality. NHS enables an environment that rightly measures all the important elements of data.

NHS is trying to embed an enterprise approach to managing systems, data, and people. However, they must pitch in for a single and consistent perspective for analytics across the organisation. NHS and NHSX have leaders who fully embrace analytics and have the vision to inculcate a data-driven decision-making approach. NHS has put efforts to align its strategic targets by 2023/2024 to expand its mental health support (NHS,n.d) with analytical efforts.

NHS is not able to utilize its data fully due to a lack of human resources with the right analytical skills to draw insights from data collected (NHSx, n.d). They should hire Data professionals like data scientists, who can further train other employees like analytical semi-professionals and analytical amateurs to analyse the data and draw insightful results, which can be used for smart decision making. As technology is continuously evolving it is important to use the right technology which can aid the problem-solving methods of the organisation. For instance, lack of awareness and understanding of the use of open sources (python and R). It can be concluded that analysts and technology are the areas of improvement (NHSx, n.d). Thus, can be considered a weakness.

SWOT Analysis:

Strength: As discussed in the above section, NHS enables an environment that rightly measures all the important elements of data. It is clear from the scenario of COVID-19.

The NHS COVID-19 Data Store helped inefficient decision-making at various levels. They used single integrated data, analysis, and modelling platform, which helped NHS analysts to work on the development of different tools to the helped local system to respond to pandemics like short-term forecasts, supply management capability. By looking at one such case study we can say that data is precise and potentially a strength. (NHSx, n.d)

Weakness: As mentioned in the above section, there is a lack of skilled human resources in the analytics domain. Analysts should be hired, and health care staff should be trained with basic analytics components.

Technically strong healthcare can be a boon for a country only if they invested in the right technology. Using an open-source technology like Python and R can be an asset. Due to a lack of understanding and knowledge, NHS and NHSx is not able to use such technologies. (NHSx, n.d)

Opportunities: Many developed countries in the world have the costliest healthcare system. Not using the right technology and analytical capabilities can add to the burden.

USA, one of the most powerful countries in the world, is known to spend more than other developed nations on healthcare. Of course, there are many reasons for this but, one of the reasons is not able to use analytics to its full capacity, understand the enormous data getting generated, understand the data and the trends of data to predict.

(David W. Bates, Suchi Saria, Lucila Ohno-Machado, Anand Shah and Gabriel Escobar,2014)

While they have started working on the use of Predictive analytics. They have realized that the use of predictive analysis can help to save a lot of money spent on healthcare. (David M. Cutler,2019). On the other side, NHS provides free health care. NHS has emphasized expanding its use of analytics in its long-term plan. (NHS, n.d).NHS is already using Baseline analytics which includes prediction analysis (NHS digital, n.d).

Threat: Even though NHS is using analytics and has an ambitious long term 5-year plan to revamp and boast the healthcare system. There are a lot of data that still can be used to do analysis. While a lot is already in the pipeline, and it will take good time to implement all of this. Already countries like South Korea have one of the best healthcare in the world. South Korea has the longest run fully digitized hospitals setting an example for many. Whereas American primary doctors observe that the burden of data entry and not reliable recommendations.

Lots of unstructured data is generated. Managing unstructured data is huge problem. Managing and storing huge volume of data is itself a problem. Using cloud computing can help reduce the cost. This can be considered a threat. South Korea healthcare has already started using Cloud based systems. (Nature research custom media, SNUH,n.d)

**SOLUTIONS:**

Analytical Capabilities to target:

Predictive and Prescriptive analytics both should be used in the discussed case. Predictive analysis is to predict future outcomes based on analysing the current trend and historical data using statistical algorithms and machine learning techniques. Prescriptive analytics is used to technology to help businesses make better-informed decisions. NHS is facing an acute crisis of mental health care staff as compared to the demand. Prescriptive analytics can be used to provide solutions to this. How and what steps NHS can take to tackle the problem at present. Predictive analytics can be used to first analyse if any such event can happen in the future and if yes, then what solutions can be implemented to prevent this problem to occur.

Layers of Big Data Strategy:

Data Collection Layer: Data can be collected from various social media platforms like Twitter, Facebook, Instagram, and WhatsApp. Nowadays, there are various smart devices like smartwatch, Apps on smartphones to track health like heartbeats, pulse, etc. data can be collected taken from these sources.

Data Storage Layer: Most of the data collected on these smart devices and social media are unstructured. Storing a huge amount of unstructured data can be a tough challenge. Since the data doesn’t have any schema, it is difficult to process and store such data. Cloud can be used to deal with such data. For unstructured data, the cloud is indeed one of the best options to use for storage. Hadoop works on the cloud and can be used to execute different operations on distributed data. (Shaukat Ali,2020). Different cloud options are Microsoft HealthVault, Google Health, Oracle, Exalogic elastic cloud, Amazon’s Web Service plays host to healthcare IT services like Salt Lake City-based Spearstone 's healthcare data storage application

Data Processing /Analysis Layer: MongoDB can use to analyse huge data. After this, genetic algorithm can use to analyse for various mental disorders and then again it can be used to fetch the final data. This way to data mining and getting insightful data can help to reduce the total cost of the treatment. This can help doctors to give accurate treatment at early stages of treatment in less time. (Shaukat Ali,2020).

MongoDB is present in many cloud platforms like AWA, Azure, google

Data Output Layer: Based on the pattern received after analysis. These patterns can be used for decision making.

Analytical Application

Internal Application: Human resources management can be done. Based on the analysed trends and patterns from predictive and prescriptive analytics demand in mental health care can be analysed and mental healthcare staffs can be recruited. Other staffs can be trained like therapies given and therapist care to meet the growing demand.

Analytical tools

The goal of the project is to predict the demand of mental health and accordingly recruit the required personnel. To develop an effective and robust solution is proposed, which consists of two different approaches to predict the demand for mental health. The first approach is to analyse the data from previous years of NHS and develop a regression model based on the data. The regression model uses different data collected from the patients over the previous years and tries to determine the number of patients who need assistance in the coming year or the coming months. The ML algorithms that can be used to develop the regression models are Linear regression, Decision Tree regression and Neural network regression.

The second approach is to collect data from various social media platforms like Twitter, Facebook, etc. And perform a text classification and clustering method to understand and predict the demand of mental health assistance. The demand for mental health assistance can be an effective method to determine the number of staff required or the number of new patients in future. For text classification LSTMs (Long Short-term Memory), Bi-directional LSTMs, Transformers, Hidden Markov Model and other effective deep learning and Machine Learning algorithms can be used.

**IMPLEMENTATION:**

Analytics Architecture:

Data sources will be data from various social media and smart devices. Then data will be stored on cloud. There are cloud platforms which provide ETL tools for data movement from source to target after data cleaning. Major cloud platform also provides Hadoop where map reduce can be used. Further, this data can used for data mining, text analytics to get patterns as final output. This can be used to make smart decisions.

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Figure 2: Analytics Architecture (Sharda, Delen,Turban 121)

DELTTA Model: As identified Technology and Analyst are the weakness in this case. Integration of open-source technologies like python and R should be encouraged. Cloud

Computing can be used. Cloud Computing is very efficient in dealing with huge amount of unstructured data as many applications are based on python and R. MongoDB is also present in major cloud platforms and can give very accurate results in less time. Use of these technologies can be used to get accurate results in less time thereby reduces the infrastructure cost. This will help doctors to take appropriate course of treatment at early stage of disorder and prevent patients from entering advance stages of mental illness.

More analyst professionals should be hired like Data scientist, who can train amateurs and staffs on these skills. They can work on predictive and prescriptive analytics to predict the patterns so that such crisis can be prevented. This will help staff and healthcare to be prepared and equipped to encounter the coming demand.

**CONCLUSION:**

Analytics is a very powerful tool. This can be used to get patterns from the data. These patterns can help in getting insights and taking smart decisions. By analysing the pattern future crisis can be prevented. Implementing analytics right from the basic levels can help organisation save a lot of infrastructural costs. Analytics can also be used to plan strategic moves can after analysis how many mental healthcare staffs to recruit or giving free health service can help.

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