

Changing Health-Related Behaviour Leveraging Data Analytics

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Abstract

This paper accentuates Data Analytics as a broad term that encapsulates the issues in processing of a large structured and unstructured data in clinical healthcare. The paper explores the potential of Data Analytics in Changing Health Behavior (CHB), especially amongst the youth with regard to biomedical and well-being informatics, which plots the essential attributes of Big Data and delineates the relations among restorative and well-being informatics. The translational bio-informatics, sensor informatics and clinical diagnosis help a person in effective management of their wellness and prosperity. Data Analytics has the potential to harness diagnostic information not only to obviate morbidity to a great extent, but also bring down the expenses on therapeutic and/or clinical diagnosis, intervention and management.

Keywords: Data Analytics, Big Data, Changing Health Behaviour, Health Informatics, Medical Imaging, Medical Informatics, Health Enhancing Behavior

1. Introduction

The terms Data Analytics and Big Data have of late become quite popular and are often used interchangeably. Although, it has existed for a long time, its application in healthcare research and management has been a recent phenomenon which has been a surprise for everyone. **Data analytics** refers to a set of qualitative and quantitative techniques and processes used to enhance productivity and business gain. It involves a set of processes-- inspection, cleansing, transformation and modeling of data-- to elicit useful information and support decision-making. **Data analytics, data** is extracted and categorized to identify and analyze behavioral **data** and patterns. The techniques may vary according to organizational requirements.

Big Data refers to the massive high-speed, complex and inconstant information that need advanced techniques to enable its capture, storage, dissemination, management and analysis. In healthcare, Big Data refers to huge and complex electronic data-sets that are practically not manageable with traditional software or hardware or common data management tools and techniques or methods (*A Frost & Sullivan White Paper, 2012*). In healthcare, it is enormous due to its volume, diversity of data types and the speed at which it needs to be managed (*A Frost & Sullivan White Paper, 2012*).

In healthcare, Big Data may be collected from diverse sources such as Electronic Health Records (EHRs), Physicians' Prescriptions/Notes, Clinical Decision Support Systems (CDSS), Computerized Physician Order Entry (CPOE), government sources, diagnostic centres, laboratories, pharmacies and medical insurance firms in various formats (flat files, text, .csv, relational tables, etc.) Apart from this, Big Data may also be sourced from the Web and Social Media, Smartphone Apps and the like, Readings from Remote Sensors, Medical Insurance Claims and billing records (available in semi-structured and unstructured formats), Biometrics (finger prints, retinal scans, diagnostic images, genetics, blood pressure, pulse and pulse-oximetry readings, and the like (*Transforming Health Care through Big Data: Strategies for leveraging big data in the healthcare industry, 2013*))

Needless to say, Big Data can be harnessed to change one's health behaviour and promote and induce health enhancing behaviour (HEB) amongst the masses; especially the youth; by prevention, early detection, timely intervention and optimal management in an efficient and sustainable way.

The youth, adolescents or teens, are the future of this planet and their health-related behavior, when analyzed, reflects a pattern different from others. However, the pattern of health-related behaviors in the youth has received only limited empirical attention. The adolescent engagement in health-related behaviors may reflect a coherent lifestyle, and its investigation is an essential aspect. However, the health-related lifestyles in adolescence have significant implications on mortality and morbidity. "Morbidity" refers to the condition of being ill, diseased, or unhealthy, while mortality refers to the death rate. Hence, it has significant implications for adolescence health-related behavior. (*Kimm, S.Y.S., Glynn, Nancy W., Kriska, Andrea M. et al, 2002*)

Changing Health-related Behaviour (CHB) refers to the motivated and voluntary acts of gradual withdrawal from Health-Compromising Behaviors (HCBs) and subsequent adoption and continuation of Health-Enhancing Behaviors (HEBs). Changing Health-related Behaviour is thus the effort made by an individual to change one's habits to prevent diseases. According to the "3-4-50 Framework"; originally developed by the Oxford Health Alliance in response to global concerns about chronic disease; 3 behaviors (poor diet, little to no physical activity and smoking) alone lead to 4 types of diseases (heart disease/stroke, diabetes, cancer, pulmonary disease) that in turn account for 50% of the deaths worldwide.

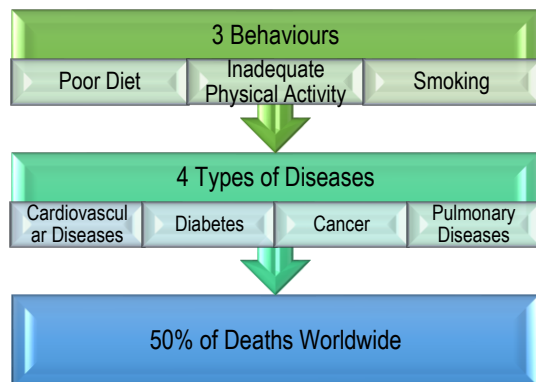


Exhibit-1: The 3-4-50 Framework

It is for this reason that in public health interventions, emphasis has been on “changing behaviors” or early interventions so that the negative or harmful consequences that follow such health compromising or risky behaviors get minimized. Some prominent health compromising or risky behaviors are Usage of Tobacco and Tobacco products, Lack of Physical Activity/Regular Exercise, Unhealthy Dietary Habits, Not Maintaining close to recommended Body Mass Index (BMI), Unhygienic Practices (like open defecation, sharing of hankies/towel, etc.), Irresponsible waste/garbage disposal, Not using of Disposable Syringes and disposable razor/blades, Unsafe Sex, and the like.

2. Advantages of Big Data Analytics in Healthcare

Data analytics can substantially change the aspects of healthcare and the way human health services utilize advanced innovations to gain knowledge from clinical and other sources of information. The concept of Big Data explores the broad execution and utilization of data analytics over the health industry.

The advantages of its application in the healthcare sector can be viewed from the developmental changes. Digitalization through Big Data makes access to information viable at various levels, ranging from single doctor operating independently to multi doctors operating at a clinical set-up. The technology enables detection of infections at prior stages more effectively and adequately. Various researches have authenticated the potential benefits of application of **Data analytics**.

According to McKinsey, the measures of information can empower more than \$300 billion available for later finances each year in U.S. Considering clinical activities and R&D are two of the most noteworthy aspects.

Clinical Tasks: Comparative viability research to decide all the more clinically essential and cost-effective approaches to analyze treatment.

Research and Development: There is continuous attempt for an effective and more focused R&D with regards to drugs and devices. The innovative devices and technologies have speeded up and drastically improved clinical structures.

Public Health: There lie active efforts to improve the public health by analyzing varying disease pattern and identify effective responses. Making use of large amount of data to identify and serve the requirements of the people. (*Raghupathi, Wullanallur & Raghupathi, Viju, 2014*)

3. Linkages Between Physical Activities in the Youth with the Integration of Big Data

The behavioral epidemiology constructs explore two major issues; first, the issue of physical activity amongst children and adults and second, the physical activity during childhood and adolescence has an impact upon their adulthood health. These issues can be studied under the factors of disease and risk of disease. The major results are Obesity, Cardiovascular Disease (CVD), Psycho-social Outcomes, Type-II Diabetes and Skeletal Health. (*Biddle, Stuart J.H., Gorely, Trish & Stensel, David J., 2004*)

Cardiovascular Diseases

Though Cardiovascular Diseases (CVD) are usually evident at the adulthood or at the old age, its emergence sets in during childhood, primarily during adolescence, due to inappropriate behavioral factors like unhealthy food habits, lack of physical activity and exercise. It is important to stop the occurrence of CVD at an early age. During adolescence, CVD exhibits risk factors such as High Blood Pressure and Cholesterol. The influence of exercise and physical activity helps in limiting the blood pressure. In addition, behavioral scientists argue that adequate physical activity is essential for maintaining a conducive health behavior.

Obesity

Obesity in the youth is related to their wellbeing conditions, for example, Dyslipidemia and the primary cause of the danger of Type-II Diabetes (*Stensel, D. J., King, J. A. and Thackray, A. E., 2016*). Youth obesity is additionally considered as a solid indicator for it (*Whitaker, R. C., Wright, J. A., Pepe, M. S., Seidel, K. D., Dietz, W. H., 1997*) which, therefore is related with the medical issues during their adulthood (*Must, A, Jacques, P. F., Dallal, G. E., Bajema, C. J., Dietz, W. H., 1992*).

Inadequate physical activity is linked to the incidences of diagnosis of obesity in children and young adults. Evidence suggests that children are having significantly less energy these days as compared to youth 50 years ago. (*Durnin, 1992*). Recent evidences also indicated comparatively lower level of physical activity (*Kimm et al., 2002*). Past researches have also indicated that exercise and adequate physical activity during childhood and adolescence are the most effective remedy to counter obesity with proper dietary habits (*Epstein, Leonard H., Meyers, Michelle D., Raynor,*

Hollie A. & Saelens, Brian E., 1998). Physical activity and exercise can be seen as an effective remedy to stop the rising incidences of obesity and other related diseases.

Psycho-Social Outcomes

There is a well-established conviction that physical activity is characteristically best for the youngsters with encouraging psychosocial results. These include confidence, balanced state of mind and cognitive functions. Generally, any sort of sports or activity is viewed as conducive for psychological well-being of an adolescent stepping into adulthood. Exercise apparently also impacts the self-esteem. The probability of a physically fit person suffering from psychiatric disorders is found to be low. *Steptoe and Butler* (1996) in a report emphasized that more than 5,000 British teenagers acknowledged mental prosperity with physical health.

Skeletal Health

Skeletal Health refers to the health of the Skeletal System of the body and the bones and is reflected by the bone density, a low bone density condition clinically being referred to as Osteoporosis. Though Osteoporosis is predominantly under the hereditary control of individuals, there are some behavioral and ecological factors too that regulate its incidences; for example, diet and physical activity (*Ralston, 1997*). In this way, physical activity is significant for the youth and delayed maturity that might be advantageous for catalyzing bone development and consequently forestalling Osteoporosis further down the timeline. Weight-bearing activities like strolling, hopping and weight-lifting, etc. enhance bone mineral thickness in children and adults as it has been shown in intervention trials.

Data analytics potentially can be of significant importance in holding essential data of adolescent health. The cure of diseases like CVDs, Obesity, Psycho-social issues and Type-II Diabetes need considerable informative background. **Data analytics** provides an ideal means or platform to analyze, secure and render informative solutions for such life-style diseases.

4. Data Analytics in Healthcare

Large volumes of data gets generated in healthcare industry through clinical examination, diagnostics and medical or surgical interventions. Earlier, these data were stored in hard copies; however, with massive inflow of data the need for digitization is imperative. This systemization of data through **Data analytics** gives a support in terms of an effective health management. **Data analytics** therefore lends an immense opportunity to manage essential health data, provide diagnosis at a cheaper rate and save lives.

The analytics of Big Data is essentially associated with 4Vs; Volume, Velocity Variety and Veracity. Healthcare industry generates huge amount of data in terms of personal records, genomics, radiology images etc. These significant volumes of data get accumulated rapidly or at a velocity. There lies variable analytics against high volume

of data. However, the huge volume of data collected need to be error-free. Thus, the aspect of dependability or veracity is an essential aspect to Big Data.

The population health has been a priority to healthcare practitioners as it has been perceived as a discipline. The mechanics and working of healthcare industry is more active in industry today. The collection has formed a Big Data base of clinical, pharmacological, diagnostic and economic data along with the supply chain and transaction level cost data etc. These outputs help taking informed decision-making and develop the healthcare systems and processes more effectively and efficiently.

The combination of traditional and new data forms an essential aspect for application of **Data analytics** in healthcare sector on a large scale; including providing multiple perspectives--- clinical, diagnostic, financial and even policy planning.

There exists immense **potential** for Big **Data Analytics in healthcare**. By analyzing the patient characteristics, cost and outcomes of medicare, the most appropriate medical intervention may be identified, thus influencing provider behavior. Advanced analytics may be applied for patient profiling (e.g., segmentation and predictive modelling) and proactive identification of individuals who may be the beneficiary of predictive or preventive medicare or lifestyle changes. Big Data Analytics may also be used for Broad-spectrum profiling of diseases to identify predictive events and support preventive interventions. Medical procedures' data may be collected and published, thereby helping the patients in determining the care protocols that offer the best value. Advanced analytics may also be applied for detection of incidences of fraud and verifying the accuracy and consistency of claims. Further, new revenue streams may be created by aggregation and synthesis of patients' clinical records and claims' data-sets to further provide data and services to third parties, viz., Licensing Data to help pharma companies in the identification of patients for clinical trials' inclusion.

Data analytics technologies can essentially be used to address the mobile health and lifestyle issues like nutrition, physical activity, and sleep. Availability of contextual information is an essential aspect to access influence of the process. **Data analytics** tools can comprehend the existing relation between social and physical behaviors, genetic factors, nutrition and development of any mental/physical diseases. With adaptation of **Data analytics**, there is a possibility of identifying the diseases early and thereby reducing cost of treatment.

Data analytics has the potential to identify healthcare issues before they become ungovernable. Information derived from **Data analytics** is conducive for professional to come up with effective and dependable diagnosis and analysis. It can further reduce flawed insurance claims, thus prevent loss of insurance companies.

Data management, electronic medical records and data analysis are some of the essential tools of **Data analytics** to identify accurate target group. It can effectively access the risk of a certain population group, thus take or suggest early preventive

measures. **Data analytics**, therefore can potentially offer a clearer view of population group enduring any medical problem. Provided, the target groups are identified, the process intervention becomes more efficient.

Pharmaceutical industries, caregivers, retailers and Research and Development (R&D) have all efficiently contributed to the Big Data. There lies a tremendous potential for **Data analytics** to facilitate the identification of new drugs which could be a boon for the pharmaceutical industries and of course the users (*Ramadas, Amutha & Fatt, Quek Kia, 2018*).

5. The Challenges Ahead

Despite the immense potential of Data Analytics in Healthcare, it is not bereft of challenges. There lies significant rift in data collection and processing. The dynamic availability of various data analytics algorithms are to be made accessible at a larger scale for it. The issues of ownership, governance and standards also need to be considered. Big Data application also has problems of standardization and fragmentation, which needs to be addressed. A Big Data analytics must support the healthcare aspect in terms of availability of data, accessibility, ease of using the data and assuring its privacy and security (*Raghupathi et al, 2014*).

The Quality of Big Data research and its applications is going to determine the healthcare in a big way. There appear to be some challenges ahead for **Data analytics** in healthcare, such as:

Under the Data Protection Regulations, it is not easy to analyze data from different healthcare providers and services together.

Unstructured texts form significant portion population health.

There are interoperability, information quality and information reconciliation confinements

There exists problem of scaling the acquired data. Big Data needs handling through advanced statistical application. This will systematize and preserve the data (*Raghupathi et al, 2014*)

Conclusion

Data analytics has the potential to change the way in which social insurance providers utilize it with advanced technologies to gain insights from their data repositories.

With respect to its association with adolescent's health, it can in fact be crucial to maintain a dependable database, which make analyses of disease at later stages. Big Data meta-analysis is substantially used to analyze the sedentary behavior and physical activity of the youth. Big Data captures the complex determinants for evaluation of this behavioral change. Information extracted involves details regarding

sample size, age, gender, socio-economics and ethnicity, etc. Thus, complex data information and its efficient management form an essential aspect to analyze the correlation between sedentary life-style and physical activity in the youth (Pearson, N., Braithwaite, R. E., Biddle, S. J. H., Sluijs, E. M. F. van & Atkin, A. J., 2014).

To succeed, however, Big Data ought to be a user friendly and transparent tool and a platform as well. Now that Big Data Analytics has become prevalent, issues like privacy, security and governance of data, improving the tools and technologies, etc. may require further attention. Although **Data analytics** potentially offers an incredible prospect of data management, there needs to be further efforts in making sure data collected is devoid of any error. The data in fact needs to be dependable, for its long-term application. Though, Application of **Data analytics** in healthcare is still at a nascent stage, rapid developments in platform and tool techniques may boost it which ultimately may be beneficial for each and every stakeholder in the healthcare.

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