

# Data Visualization for Accelerated Business Intelligence in the Indian Health Care Sector using Tableau

Brijesh R. Sharma, Sachin Deshmukh

**Abstract:** Purpose Big data analytics capability is the new source of competitive advantage. This is very axiomatic and it is also known that this capability covers the domain of descriptive, diagnostic, predictive and prescriptive analytics. Apart from the capability of managing data coming with high velocity, huge volume, and high variety the capability to analyze data with the same or more speed is a not only a hygiene factor but a compulsion for any organization. Ease of use of data visualizing tools which help in describing the data is driving the consumption of visualization tools and Tableau has taken a clear lead, and is witnessing mass adoption. The paper is a detailed account of creating a interactive visualization of health care infrastructure data using Tableau Publix as a business intelligence tool. Methods: The Visualization is done on data taken from Open Government Data (OGD) Platform India. The paper is a demonstration of the use of visualization for exploration of data, generation of relevant questions and thereafter finding the right answers.

**Result:** The papers explores the data and does the following through visualization

1. Maps the geography (Indian states) with total number of patients)
2. Maps the state name with segregated number of patients suffering from acute and chronic disease.
3. Maps the state name with segregated number of patients suffering from chronic disease.
4. Maps the state name with segregated number of patients suffering from acute disease.
5. Builds all the above in an interactive dashboard.

**Keywords:** Business Intelligence, Data Visualization, Health Care Analytics, , Interactive Dashboards, Tableau.

## I. INTRODUCTION

Data visualization is the process of exploring the data and formulating software driven mechanism to create static and dynamic representation of the data consistent with the requirement of the end user. The current reality of automating transaction, use of sensors is creating an avalanche of data. The universal truism of data carrying in it the insight of the phenomenon it was created from is forcing companies to relook at their analytical capabilities. Evidence of companies looking at ramping analytical capabilities in a big way is plenty. Huge volume of data comes with the attendant problem of how to decipher the data. Rapidly exploring the data and more appropriately visually exploring the data is a necessity which precedes deep analytical process. The speed

and the ease of exploring the data is powered by specialized visualization tools is helping decision makers at level in the organization in decision making. Quantitative exploration of the data helps the decision maker and seeker of knowledge to generate and refine question from the data. In the tradition research where objective and the subsequent question which precedes data collection, visualization help in understanding and presenting the data and also generate more questions from the data. The skill required of analyzing data and the skills required to explore and present the data in a more compelling way are more or less inconsistent, in a way that the latter requires more imagination and creativity. Data visualization brings to life to otherwise sterile data. As pointed by Nathan Yau “Data can often be Sterile”. If we present in a different way the same data may become fertile and may yield insight (Yau 2009). Data visualization makes “stories visible and brings them to life” (Few 2009a). Data visualization as a name suggest is a process to represent the data in a visual form to explore, examine and also communicate the live stories hidden in the data (Few 2009a). Unless there is a compelling reason to present data in a tabular form, the presentation of data in rows and columns. A visual representation allows us to process the interrelation between many variable concurrently. Human mind is programmed to lean visually to spot patterns and trends. The concept of visualization is old and it has been aided by the recent advances in computing technology.

## II. LITERATURE REVIEW

There is diversity in health care practices and procedures and this diversity is creating a data of huge volume and variety. The diversity is because of the diversity in the patient profile and procedures adopted to treat the patients. Rapid and accurate analysis of the ensuing data can help in bringing effectiveness and efficiency. At a macro level the analytics can be performed on the availability of the health care facility and the general health of the population. Availability of adequate healthcare infrastructure and its effective utilization of the infrastructure require an IT intervention. It was seen the COVID situation, a dashboard depicting the availability of different types of bed saved many lives. The inadequate integration of the health care system and healthcare information system is impeding the efforts of the U S health care to convert IT investment into value to the patient (Bodenheimer, 2005; Grantmakers In Health, 2012; Herrick et al., 2010; The Kaiser Family Foundation, 2012).

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\* Correspondence Author

**First Author Name - Dr. Brijesh R. Sharma\***, General Management and Analytics, VES Business School, Mumbai, India. Email: brijeshrsharma@gmail.com

**Second Author Name - Dr Sachin Deshmukh**, Dean - PGDM Program Chair – Business Analytics, VES Business School, Mumbai, India. Email: Sachin.deshmukh@ves.ac.in

Health care organizations are looking for implementing high quality IT intervention to capture the flood of both structured and unstructured data in way to analyze it in a very real time basis. This will allow the organization resource optimization and provide high quality patient experience and consequently secure revenue flow to the organization (Agarwal et al., 2010; Goh et al., 2011; Ker et al., 2014). Big data analytics is the new tool which helps the optimization of resource usage for value creation to customer. Business intelligence and decision support system have advanced and evolved into big data analytics which helps in analyzing data coming at high velocity and high volume and high variety from customer touch point and healthcare networks. This interconnection is helping making evidence based decision making (Watson, 2014; Raghupathi and Raghupathi, 2014). Big data analytics help value creation and value capturing in the healthcare by integrating all the clinical information and also the various customers touch points. This integration and consequent analysis helps in improving the quality of healthcare and also look into the future value creation and value capturing (Jiang et al., 2014; Murdoch and Detsky, 2013; Wang et al., 2015). Computer scientists have decoded the technological aspects of big data analytics (Wamba et al., 2015) but healthcare organization, apart from being skeptical about big data technologies, are far away from exploiting these advances inspite of having made huge investment in implementing big data intervention (Murdoch and Detsky, 2013; Shah and Pathak, 2014). Empirical studies show that in their decision making only 42% of health care organization use analytics. Only sixteen percent have width and depth in their analytical team across the spectrum of function they perform (Cortada et al., 2012). From the above it is abundantly clear that health care professionals do not realize the potential value creation, big data analytics can do for their organizations (Sharma et al., 2014). Big data analytics has a very high potential and can be a game changer for any organization. This has to be realized and exploited by health care practitioners. Our cognitive capacity is more attuned to visual representation and we can process complex data if put in visual and non verbal forms. "Visual representations not only make the patterns, trends, and exceptions in numbers visible and understandable, they also extend the capacity of our memory."- Stephen Few Tableau: As a visualization and dash boarding software, Tableau gives the user a unique capability to blend the data, explore the data by query the data at different level of aggregation, the exploration and discovery leads to appropriate question which triggers a round of further probing and analysis. Tableau enables the user to present the story in the data in a very compelling way at different levels of aggregation. The ease of the menu driven point and click and drag and drop feature of the software has democratized the visualization and the dash boarding skill. Tableau has shifted the responsibility of creating visualization and dashboard from the IT team to the end user. Tableau has created a community of users who are not having the deep statistical background but still doing a superior job of understanding the data and the uncovering the interesting stories in the data. The reasons to use Tableau as a tool to do visualization and dash boarding is

1. The drag and drop feature is very easy to learn and experiment. The tool enables the learner to import data in xlsx and other format to import easily and then experiment out with the data. The learning curve in

Tableau is not steep as in other programming software like R and Python.

2. The automatic recommendation of the chart types to be used frees immense amount of cognitive ability of the user which can be utilized to create and refine a compelling story out of the data.
3. The cost of ownership of Tableau is less as compared with other visualization software.
4. There is huge community of users and this helps the learner in solving problem which crop up during learning.

Based on the reports published by Gartner 2016 on Business Intelligence and analytics, Tableau is ranked in the Leaders category for the past four successive years. This is one of the reasons among other reasons to choose Tableau as visualization software (Nair and Shetty 2016). The Desktop application allows the user to connect online with a real time dataset and do visualization and simultaneously the switch to the data saved in the computer to do the necessary visualization and dash boarding. Utilization of color, form and spatial position and motion makes Tableau versatile visualization software Few S (2009). The default setting of color, form, spatial position and motion in Tableau allows the user to construct captivating and gripping visualization and subsequent visualization (Few 2009b, 35–49). The auto recommendation in the show card section of Tableau is a testimony of the user friendliness of the software. The capability of the user is enhanced by the date algorithm which allows the data artist to adjust the time series by day month quarter or year. The twin features required by any visualization software, and which is present in plenty is Tableau, is the clear and accurate representation of the data and the ease with which designer can explore and interact with the data to figure out the plot and the story hidden in the data (Few 2009a, 55). Data can be sorted variables can be added and filtered with utmost ease in Tableau. Tableau provides the flexibility to blend data from disparate sources e.g., a Microsoft Excel spreadsheet or Access database. Using tableau Desktop Professional data may be extracted and manipulated from multiple sources, including Oracle, Microsoft SQL Server, MySQL, PostgreSQL, Google Analytics, or any ODBC Version 3.0 compliant system (Tableau Software 2013). This provides the potential for real-time (or close to real-time) analysis. In the category of completeness of vision and the ability to execute Gartner annual report 2019 continues to rank Tableau as a leader in both the category (Gartner, 2019) (see Figure 1). It has been reported by a company in the health care industry that use of Tableau has saved thousands of man hours in doing needless data analysis (Tableau, 2015). Another company in the healthcare industry reported that, "With Tableau, we have eliminated more than 10,000 hours of work (Tableau, 2017b)."





Figure 1

### III. OBJECTIVE

The objective of the research paper is to develop a visual exploration of the data using multiple dimensions on which data was collected.

### IV. RESEARCH DESIGN

The research is a quantitative exploration of data through visualization using Tableau. The research can be also classified as descriptive research using visualization.

### V. ABOUT THE DATA

The data used for the demonstration of visualization is a secondary data. The data is an outcome of a survey done in India by the government of India. The Empowered Action Groups states like Rajasthan, Bihar, Uttar Pradesh, Chhattisgarh, Odisha, Jharkhand and Assam Madhya Pradesh and Uttarakhand were involved in the survey. The nine states are chosen because of these states account for 48 percent of the total population. These states witness higher fertility and mortality states and hence are the focus states for the study. Apart from this these states account for 62% of maternal death in the country and 75% and 70% of the death under the age of 5 years and infant death respectively. These states witness 59% of birth during the same period. The survey christened as Annual Health Survey was launched in the Empowered Action Group States by the Ministry of Health and Family Welfare Government of India along with the Registrar General of India. The surveys objective was to measure and evaluate the impact of various schemes run under National Health Mission in 284 districts in these Empowered Action Group States to reduce the Maternal Mortality Ratio at the regional level and Fertility Rate and Infant Mortality Rate at the district level.

### VI. DATA PREPARATION

Since the secondary data was in different excel files and visualization was intended on the dimension of location, total number of patients and also number of patients suffering from chronic and acute illness. These dimension were extracted from the various excel and incorporated in one excel. Since

the data was taken from Open Government Data (OGD) Platform India there was no problem of missing values.

### VII. DATA VISUALIZATION

The following steps was followed for creating the final dashboard

1. Importing the excel sheet.
2. Creating the first visualization: Worksheet 1 renamed as State and patient. The variables pulled in the rows, columns and marks card are shown in exhibit 1. This worksheet connects the state data (Dimensions) and the total number of patients (measures) suffering from chronic and acute disease.
3. Creating the second visualization: Worksheet 2 renamed as acute and chronic disease. The variables pulled in the rows, columns and marks card are shown in exhibit 2. This worksheet connects the state data (Dimensions) and the breakup of number of patients (measures) suffering from chronic and acute disease.
4. Creating the third visualization: Worksheet renamed chronic disease. The variables pulled in the rows, columns and marks card are shown in exhibit 3. This worksheet connects the state data (Dimensions) and the total number of patients (measures) suffering from chronic disease.
5. Creating the fourth visualization: Worksheet renamed acute disease. The variables pulled in the rows, columns and marks card are shown in exhibit 4. This worksheet connects the state data (Dimensions) and the total number of patients (measures) suffering from acute disease.
6. Creating the dashboard: Dashboard 2 created by taking all the four worksheet created in the previous step in one place.

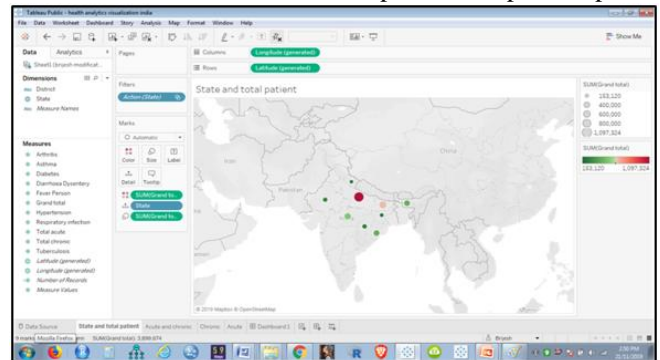


Exhibit 1

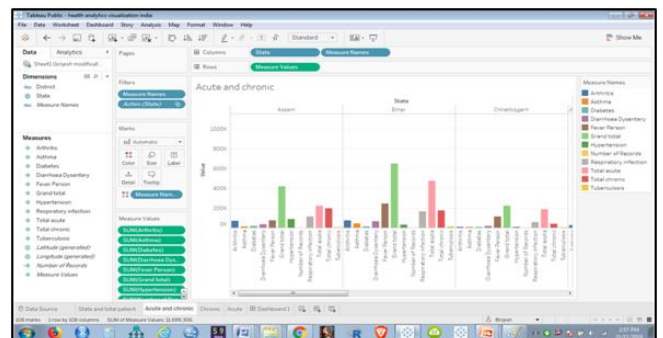
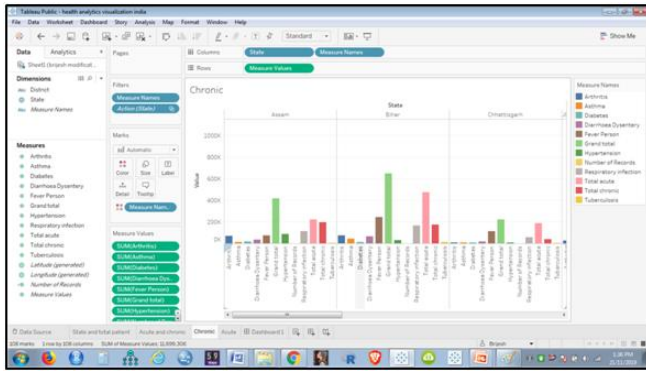
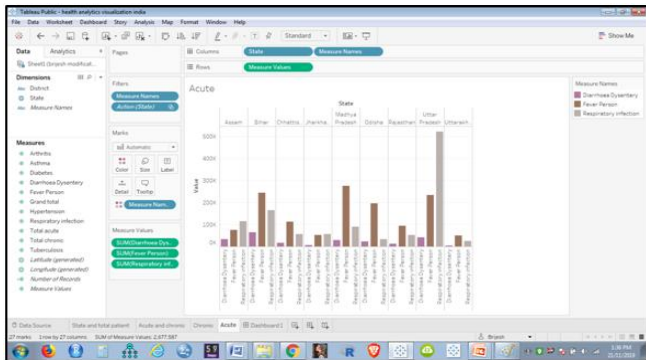


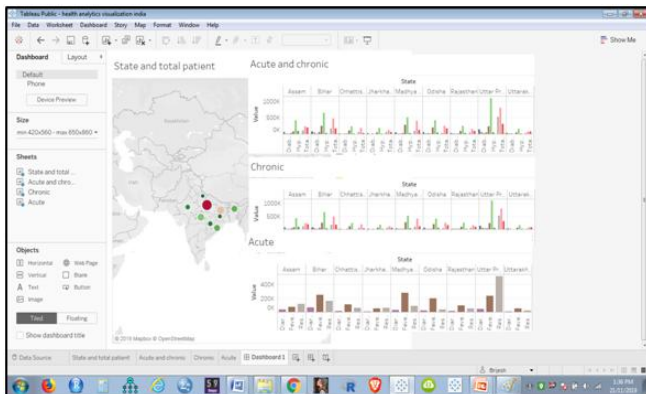
Exhibit 2



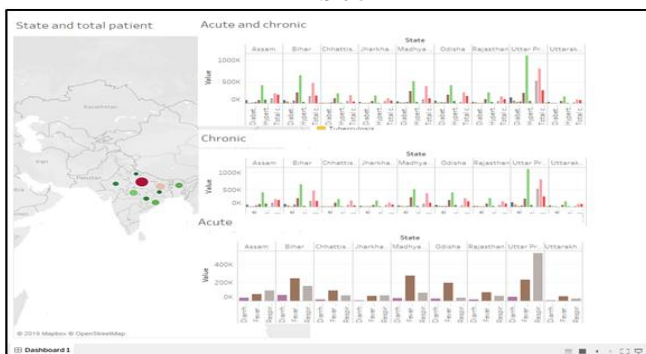
**Exhibit 3**



**Exhibit 4**



**Exhibit 5**



**Exhibit 6**

## VIII. CONCLUSION

Use of visualization in data exploration has become very easy because of many data visualization software. This ease and the steps has been demonstrated, in the paper using data from the health sector. The creation of different visualization like such as tables, heatmaps, maps, bar charts, treemaps, line charts, bubble charts, and so on as well as customizations, such as radar charts and the dashboard is easy and can be done in Tableau.

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## AUTHORS PROFILE



**Dr Brijesh Sharma** is a seasoned faculty teaching in the field of management education, guiding and mentoring post graduate students of business management for the last 11 years. He is approved faculty of University of Mumbai. He is currently associated with VES B School. Prior to his academic engagements he has been an industry professional with 15 years of rich experience in fermentation industry. Dr Sharma did his PhD (Management) from Mumbai University. He did his MBA/MMS (Marketing) from Mumbai University and cleared UGC-NET (Management). He has done his Diploma in Management Studies from Mumbai University and Bachelors Degree in Microbiology from Mumbai University. He has published papers in numerous national and international journals.



**Dr Sachin Deshmukh** is currently working with Vivekanand Education Society Institute of Management Studies and Research; Research, Mumbai. He has 20 years of industry and 15 years of teaching experience at the post-graduation and doctoral level in management. Dr Sachin Deshmukh has published a number of national and international research papers consumer behaviour and data analytics. His publications also include articles on Big Data. He and his team have worked on projects like “Customer Attrition in a Bank” and “Understanding the Perceptions of Customers of National and International Markets Using Regression Model and Factor Analysis. His recent projects are in the field of Human Resources Analytics wherein he is working on Talent Acquisition and Talent Management. He has interest in Internet of Things (IoT) and Block Chain Technology. Dr Sachin has conducted a number of FDPs and international conferences on Data Analytics. He has delivered a number of guest lectures on varied topics of Analytics in seminars and conferences.