

Data Visualization as Effective Tool for Clinical Data Analysis in Healthcare

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Abstract

Data visualization is extensively used in many important data fields such as finance, banking, HRM, education, agriculture, Microbiology, Informatics etc. Now a days, it is used in healthcare industry in many different areas like analyzing patient data, disease database, health record data, pathology data, clinical trials data etc. Data visualization can be used for analyzing medical data in terms of different disease parameters, various treatment plans, healthcare survey reports, insurance data, data of critical diseases, even for personalized patient cares. In this paper researchers considered some uses of data visualization and through a survey, these uses have been verified for their effectiveness for data analysis in healthcare.

Keywords patient data, health record, visualization, healthcare, clinical data

Introduction

In today's busy life schedule clinicians face difficulties in complete understanding of the patient's data. And unable to draw conclusions about patient health with respect to a particular disease or health condition of the community, finding a treatment plan for this in limited time. To overcome this problem many researches are emerging to analyze this clinical data in easy to understand form. One way to facilitate this is visualization of data. There are many ways to visualize healthcare data like bar charts, pie charts, graphs, histograms, frequency polygons, tables, maps, diagrams etc.

In this research, responses from 46 doctors from Pimpri-Chinchwad were collected. Then by analyzing this data, usefulness of clinical data analysis is evaluated in terms of time and cost for treatment plan, patient education, treatments for large number of patients, management of critical patients.

For this a literature survey has been conducted to check different parameters of the data analysis in healthcare. Accordingly, the questionnaire had been formulated and responses had been collected.

Objective of the Study: To understand different uses of data visualization in healthcare data analysis.

Literature Review

Jonathan P. Wanderer, Sara E. Nelson², Jesse M. Ehrenfeld, Shelby Monahan & Soojin Park in their research paper titled, “Clinical Data Visualization: The Current State and Future Needs” enlist the constructs which are evaluate as best practices in the area of data analysis. They had considered the visualizations of clinical data in the domain of cardiac data, pulmonary data, chemistry data, microbiology data, medication data and integrated speciality-specific data. [1]

Mohammad Ahmad Alkhatib, Amir Talaei-Khoei, Amir Hossein Ghapanchi, in the research paper, “Analysis of Research in Healthcare Data Analytics” enlisted some tools and techniques of data analytics that were used in the past to improve healthcare performance in many areas like decision making, medical operations, reports, also prediction and prevention system. And the systematic review showed demographic of fields of publication, research approaches, and outlined some of the possible issues and reasons associated with healthcare data analytics. [2]

Jens Schrodte, Aleksei Dudchenko, Petra Knaup-Gregori & Matthias Ganzinger in the research paper, “Graph-Representation of Patient Data: a Systematic Literature Review”, had investigated in the systematic literature review current research in the field of graphs which represents and process patient data. Some prominent databases searched and based on the PRISMA statement guidelines the articles were evaluated using full-text analysis. Most of the articles use graphs to represent temporal relations. Only few papers report that the graph data were further processed by comparing the patient graphs using similarity measurements. Graphs representing individual patients are avoided in this research. The use of such patient graphs could be a promising technique to develop decision support systems for diagnosis, medication or patient treatments in various kinds of analysis. [3]

Research Methodology

An explorative study has been conducted by authors to understand the use of data visualization of clinical data and analyzing it in Pune and Pimpri-Chinchwad geographical region. Therefore, clinicians and doctors from Pune and Pimpri-Chinchwad were considered as respondents for this study. Survey method with random sampling is used to collect the primary data.

Data Collection

Primary data has been collected from 46 valid respondents out of total 47 respondents. Data is collected by using Questionnaire Technique. This questionnaire is designed by considering various uses of clinical data analysis like time saving, cost saving, patient education, formulating treatment plans, community treatments, critical patient management. Samples are selected from Pune and Pimpri- Chinchwad area is as follows:

Use of Data Visualization	Sample Number	Percentage
Time Saving	46	100%
Cost Saving	38	82.60%
Patient Education	34	73.91%
Formulating Treatment Plans	46	100%
Community Treatments	41	89.13%
Critical Patient management	23	50%

Table 1: Selected sample in Pune and Pimpri-Chinchwad area

The above table shows that, most of the respondents were agreed the listed uses of the data visualization. And most of them think that data visualization will be proven very beneficial in future to resolve many issues in data analysis of healthcare data.

Following bar graph depicts this uses in a graphical format to interpret the views of respondents.

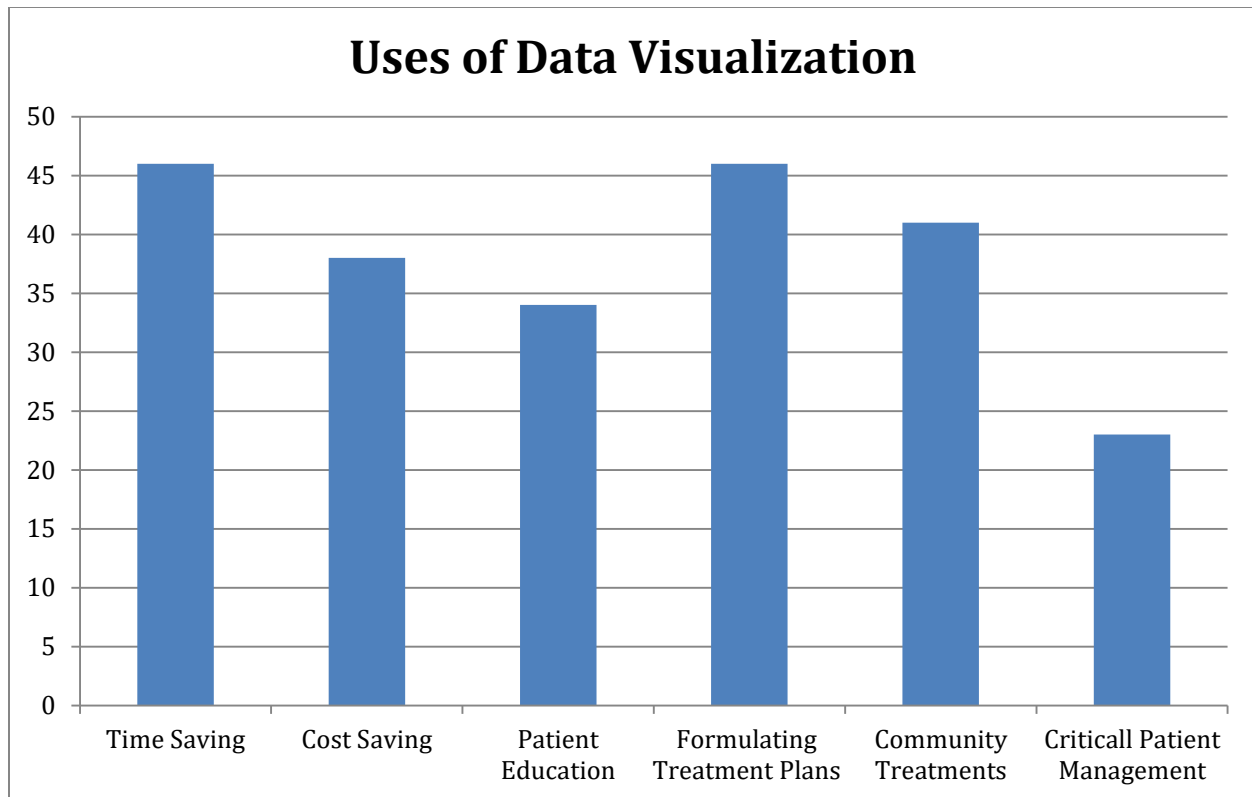


Fig. 1 uses of data visualization in healthcare data analysis

Data analysis

Data is collected through questionnaires by interacting with Doctors in Pune and Pimpri-Chinchwad. This primary data is analyzed to understand the uses of data visualization for analyzing clinical data and its effectiveness in required data analysis. Forty-six valid responses were received from different clinicians. Results are summarized as follows:

- bar graph Fig. 1 shows that, data visualization is time saving confirmed by all 46 respondents i.e all 100% agree that it is time saving.
- The bar graph Fig. 1 represents that, data visualization is cost saving confirmed by 38 respondents i.e. approximately 83% respondents agree that it is cost saving.
- The The bar graph Fig. 1 confirms that, data visualization is useful for patient education as per the perception of 34 respondents i.e. 74% clinicians.

- The bar graph Fig. 1 shows that, data visualization is beneficial in formulating treatment plans confirmed by all 46 respondents i.e. all 100% agree for this.
- The bar graph Fig. 1 represents that, data visualization is community treatments confirmed by 41 respondents i.e. approximately 89% respondents agree that it is beneficial for this.
- The bar graph Fig. 1 shows that, data visualization is useful for critical patient management confirmed by 23 i.e. 50% respondents.

Results

- Almost all uses of data visualization are confirmed by the healthcare providers in Pune and Pimpri-Chinchwad.
- Maximum of the respondents in Pune and Pimpri-Chinchwad agree that data visualization is extensively useful for clinical data analysis in the healthcare domain.
- Data visualization is very effective as a data analysis tool in healthcare.

Conclusion

Data visualization is an effective and efficient tool for clinical data analysis in the healthcare domain which may be proven very essential in future to solve different healthcare data related issues.

References

1. Jonathan P. Wanderer, Sara E. Nelson², Jesse M. Ehrenfeld, Shelby Monahan & Soojin Park, "Clinical Data Visualization: The Current State and Future Needs", *J Med Syst* (2016) 40: 275 DOI 10.1007/s10916-016-0643-x
2. Mohammad Ahmad Alkhatib, Amir Talaei-Khoei, Amir Hossein Ghapanchi, "Analysis of Research in Healthcare Data Analytics", *Australasian Conference on Information Systems*, 2015, Sydney
3. Jens Schrodte, Aleksei Dudchenko, Petra Knaup-Gregori & Matthias Ganzinger, "Graph-Representation of Patient Data: a Systematic Literature Review", *Journal of Medical Systems* (2020) 44: 86, <https://doi.org/10.1007/s10916-020-1538-4>