



Business Intelligence to produce Vulnerability System Based on Communicable Disease Data Analytics in Semarang City

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Abstract. This study aims to visualize communicable disease data analysis so that it provides benefits in policy making. In research applying Business Intelligence (BI) using the Tableau data analysis tool to develop a Health Area Vulnerability System based on communicable disease data in the City of Semarang. Routine patient data from 37 Community Health Centers from 2020 to 2022 is used as a source of information. Using this approach, an analysis is carried out with a focus on visualizing the spread of communicable diseases by region (district, sub-district, and public health centers), time period (month, year), type of disease, age group, and gender. The visualization results in the form of detailed maps and graphs show the distribution of communicable diseases throughout the city of Semarang. This information provides an in-depth view of stakeholders at the district, sub-district, and public health center levels, to formulate decisions related to communicable disease control. The BI approach provides a better understanding of trends and patterns of communicable diseases, enabling more precise and effective measures to address public health problems.

Keywords: Business Intelligence, Tableau, communicable Diseases, Vulnerability System.

1 Introduction

In the era of information technology, understanding data is very important in various fields. Technology enables effective processing and interpretation of data to be essential for informed decision making. In health care management, effective decision making depends on accurate and timely information. Moreover, decision certainty cannot be automatically guaranteed by clean technological innovation. This problem has been widely described in various papers[1]. Business Intelligence (BI) is a solution to create systems for processing and analyzing data sources that can be used to make the right decisions. It is believed that the term "Business Intelligence" was

first used in the 1980s by H. Dressner of Gartner Group. However, some say that since 1958, H.P. Luhn uses this term to describe data analysis tools [2]. BI stands for the synergy of data, information, processes, tools and technologies for data mining and multidimensional analysis, So it can represent a new generation of decision support systems aimed at transforming specific data into information and knowledge [3].

Using business intelligence techniques, it needs a data visualization tool to provide information for decision makers. Data visualization is a tool of data literacy: “Data visualization is the graphical representation of information and data. By using visual elements like charts, graphs, and maps, data visualization tools provide an accessible way to see and understand trends, outliers, and patterns in data” [4]. Data visualization helps the researcher identify relationships in data and enhances a presentation in the same way as a thousand words while taking up less space [5].

Tableau is software that can help users explore and understand their data by creating interactive visualizations [6]. Tableau visualization to transform data analysis into visual representations such as charts, graphs, and histograms to make it easier to consume data. The use of Tableau has significant benefits. These tools create interactive visualizations that make it easy to understand complex data. These visualizations play a key role in helping research identify patterns, trends, and relationships in infectious disease datasets, and Tableau's in-depth analysis capabilities facilitate further exploration of the data. The comprehensive analytical tools allow researchers to dig deeper information from various dimensions, such as geographic location, type of disease, and age group [7].

However, using Tableau also has limitations. Licensing costs and using advanced versions can be a barrier, especially for research on a limited budget. In addition, initial technical competency may be required to master the tool, which can be time and resource intensive, while Tableau does a good job of processing and describing data, advanced statistical analysis requires additional tools. This can be a limitation if the research requires deeper analysis [8].

The results of the BI system can display the spread of diseases at various geographic levels (district, sub-district, and public health center), time periods (months and years), types of diseases, age groups and gender. The result of visualizing the research lies in its potential to provide data analytics to stakeholders at the district, sub-district, and health center levels with actionable insights on communicable disease trends. With detailed visualization of results via maps and graphs, the results help build effective strategies for disease control. The ability to identify trends and cases of communicable diseases provides a stronger foundation for decision makers to design proactive interventions.

To provide a comprehensive understanding, this introduction places research within the broader context of health management, highlighting the importance of BI in data-driven decision-making. Given the current state of research, this research fills an important gap not only by highlighting the limitations of previous methods, but also by introducing a new approach that combines Business Intelligence with analytics. The following section provides a comparative analysis of related research efforts and describes the unique contributions of this research to improving health decision-making.

2 Methods

This study applies data analysis using Business Intelligence (BI) tools provided by Tableau to develop a Health Area Vulnerability System based on communicable diseases data analytics in Semarang City. It uses an understanding of patterns and trends in communicable diseases, and provides a sound basis for health decision-making.

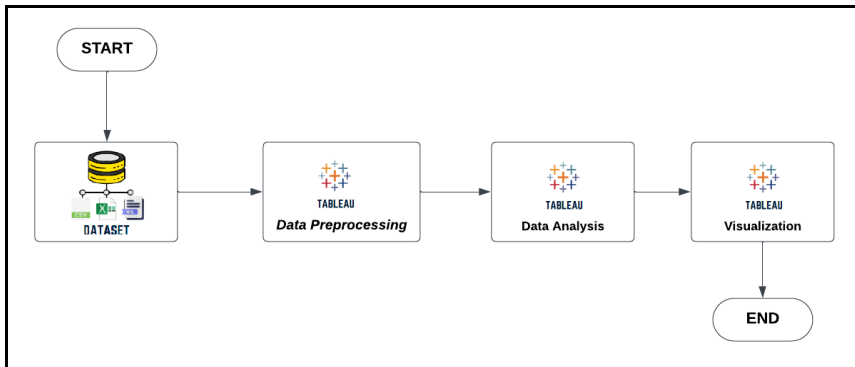


Fig.1. Research process flow

All routine patient data from 37 public health centers in Semarang City collected by SIMPUS (System Information and Management for Public Health Center) between 2020 and 2022 was taken as a data source [9]. This data includes information on disease type, geographic location, age group, gender, and time period. The data obtained is then processed with the preprocessing stage, including data cleaning, eliminating duplication, and filling in missing values and coding diagnoses. The data is also converted into a suitable format for further analysis.

Tableau's analytical tools are used to analyze communicable diseases data. Visualization of maps and graphs is built based on various dimensions, such as geographic area (district, health center, and village), time period (month, year), type of disease, age group, and gender. Analysis results are translated into clear and informative visualizations, including detailed infectious disease distribution maps and charts depicting trends and patterns. This visualization provides better information about the vulnerability of communicable diseases in Semarang City.

The visualization results are interpreted to identify significant patterns and trends. The information will assist stakeholders at the district, sub-district, and public health center levels in making informed decisions regarding communicable disease control. This method allows researchers to carry out in-depth analysis of existing infectious disease data and produce a better understanding of the dynamics of communicable diseases in Semarang City. By integrating Business Intelligence and data analytics, research contributes to efforts to improve decision-making in the health sector.

3 Results and Discussion

3.1 Results

By applying data analysis methods using the Tableau Business Intelligence (BI) tool, this research succeeded in creating a Vulnerability System Based on Communicable Diseases Data Analytics in Semarang City. The results obtained from the data analysis provide an overview of the distribution and characteristics of infectious diseases in Semarang City area.

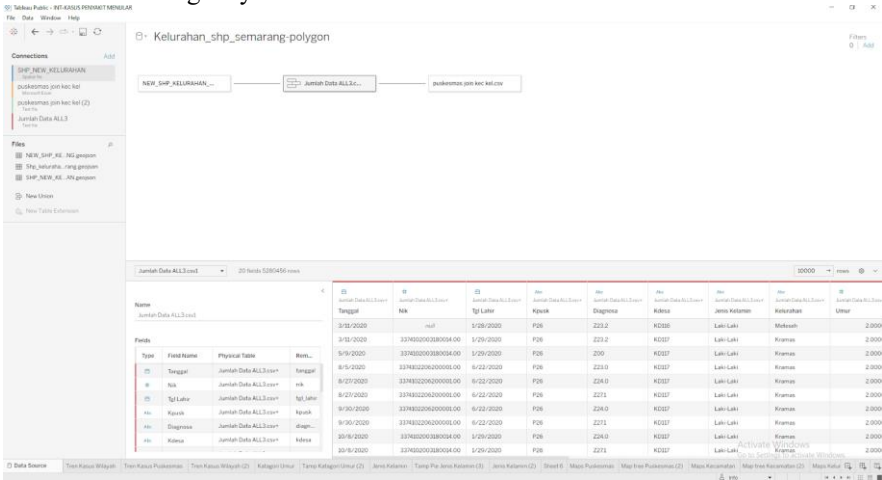


Fig 2. Importing Pre-Processing Data Phase

Data collected from 37 public health centers in Semarang City during the period 2020 to 2022 were examined to identify and correct invalid or incomplete data. The total data used is 157,647 entries. This data covers various aspects, including disease type, geographic location, age group, sex, and time period. The researcher can delete invalid data, handle missing values, or validate with criteria.

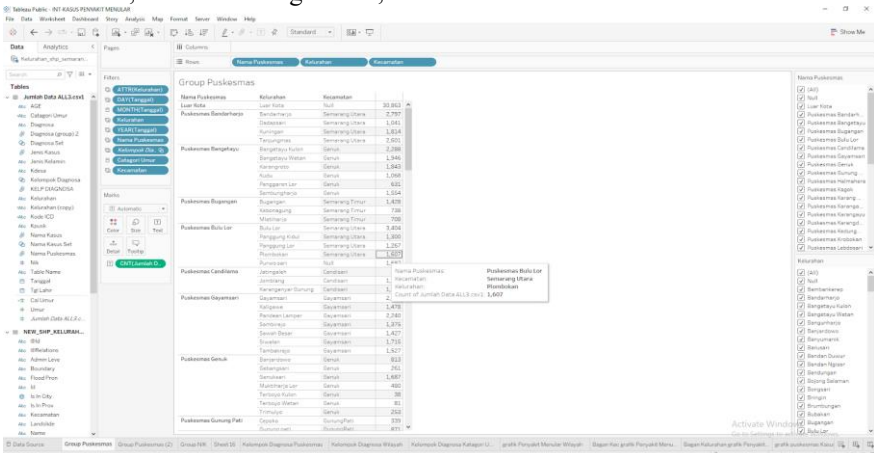


Fig 3. Tableau's Data Analysis Process

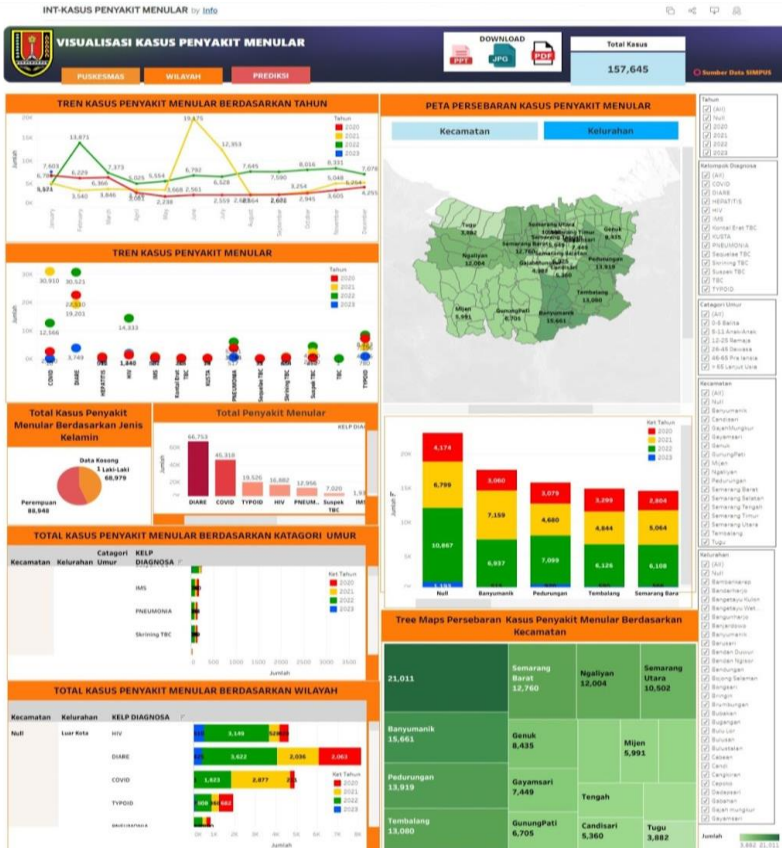


Fig. 4. Appearance Health Area Vulnerability System based on communicable disease data analytics in Semarang City

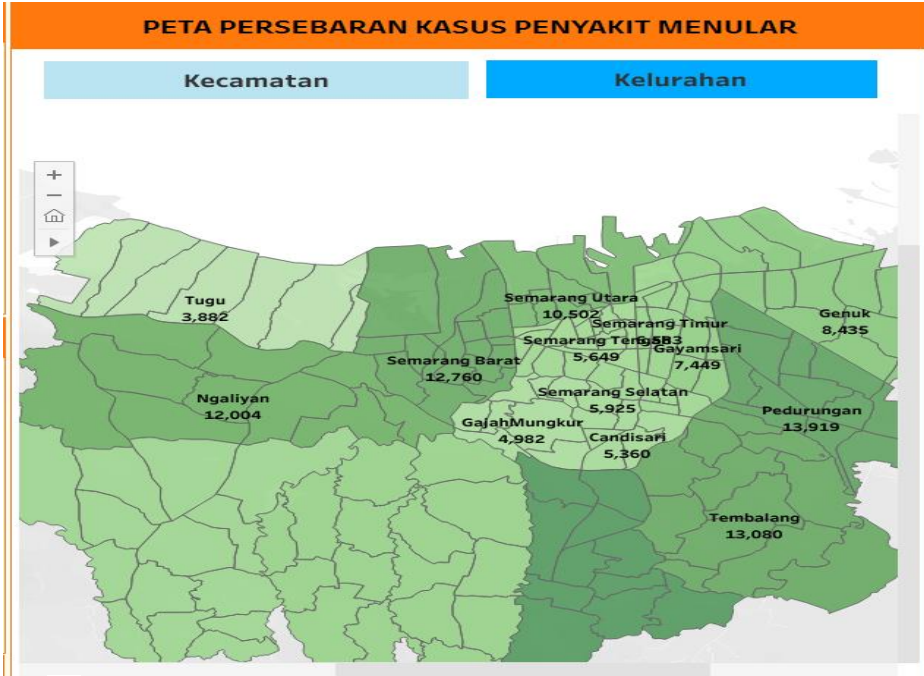


Fig. 5. Distribution of Communicable Disease by sub-district Areas

The visualization of the map shows the distribution of communicable diseases in the sub-district areas of Semarang City, providing an accessible way to see and identify areas that have a higher level of vulnerability. This can also show the distribution by village (Figure A1) or public health center area (Figure A2). This difference allows for an in-depth analysis to determine health program policies down to the lowest level in the community.

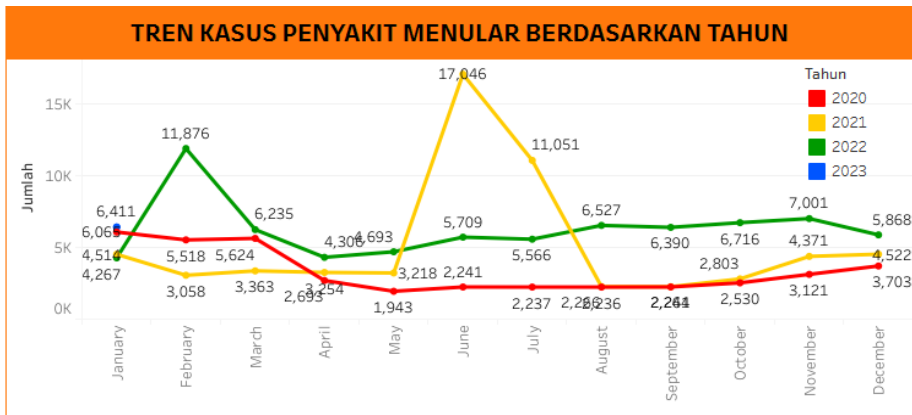


Fig 6. Trends of communicable diseases by month in 2020-2022

Chart above depicting communicable disease trends over time helps in seeing fluctuations and patterns of disease spread from month to month or yearly (Figure A3). Moreover, it can compare the number of cases from year to year in the same month. This can enable stakeholders to find out the reasons for the increase or decrease of cases and take preventive programs.

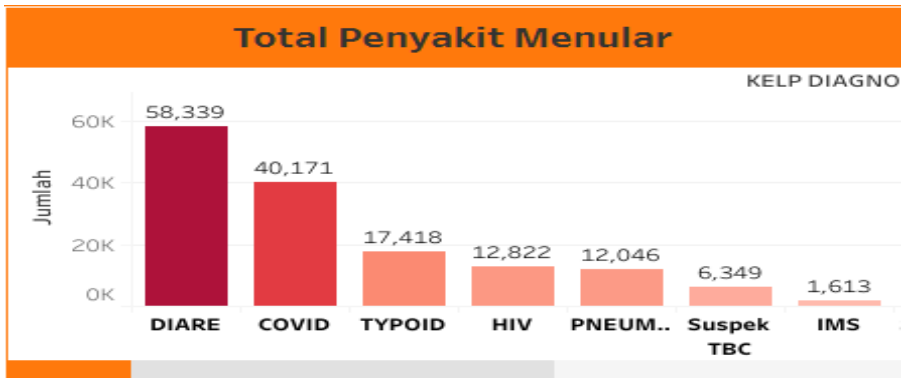


Fig. 7. Analysis Based on Type of Disease

Visualization by disease type allows observers to understand which disease types are predominant and may require further attention.

The big data collected by SIMPUS (System Information and Management for Public Health Center) in Semarang City must be analyzed in an appropriate tool. Using Tableau as an analytical tool, this study presents an in-depth visualization of data exploration of communicable disease transmission. The visualizations provide information about the vulnerability of health areas to communicable diseases in Semarang City. The resulting information is able to provide insight for decision makers at the district, sub-district, and public health center levels in determining programs to control and prevent communicable diseases. By combining data analytics methods and Tableau BI tools, this research makes important contributions to strategies for smarter decision makers.

3.2 Discussion

The results of data analysis using a data analytic approach with the Tableau Business Intelligence (BI) tool in the development of a Health Area Vulnerability System Based on Communicable Disease in Semarang City provide significant information and understanding of public health management. This discussion outlines the interpretation of the results found and relates them to scientific contributions and practical implications.

The communicable disease distribution map provides visualization information about areas with a higher level of vulnerability. This research has the potential to guide decision making in the allocation of resources and the development of health programs that are more specific by region. Time period trend charts reveal fluctuations in infectious diseases over time. This provides important insights for identifying

seasonal trends or potential outbreaks, so decision makers can take more responsive action.

Analysis by type of disease allows identification of diseases that have the most significant impact on society. This understanding can help direct disease prevention and control efforts more effectively. Segmentation by age group and sex allows stakeholders to understand which populations are most susceptible to certain diseases. This information is important in designing a more targeted prevention strategy. However, it is important to consider some limitations in this study. The quality of the data and the completeness of the information can affect the results of the analysis.

In addition, this analysis only includes data from 2020 to 2022, so the long-term picture may not be fully represented. Overall, the merging of BI tools with data analytics has opened the door for a smarter approach to managing public health. The results of the analysis provide a robust view of the dynamics of communicable diseases in Semarang City, assisting decision makers in identifying priority areas for intervention and development of better health policies. This application can lead to the improvement of public health strategies that are more adaptive, effective, and responsive to local needs.

4 Conclusions

In the application of Business Intelligence (BI) to develop a Health Area Vulnerability System Based on Communicable Disease Data Analytics in Semarang City, provide in-depth and informative information about the distribution and characteristics of communicable diseases. Visualization of maps, trend charts and analysis by type of disease provide important insights into the vulnerability of health areas, enabling decision makers to design more targeted health strategies. However, it should be noted that research results depend on the quality of the data collected and the availability of data in the relevant timeframe. By improving data management and more detailed analysis, the use of BI can make policies on controlling communicable diseases more effective in the Semarang city area.

5 Author Contributions

Conceptualization, H.P.S; Methodology, M.A.H.; Writing original draft preparation, H.P.S., S.; writing review and editing, D.N.A.N, P.I.R., S; Visualization, S.; Supervision, H.P.S, D.N.A.N, P.I.R., S. All authors have read and agreed to the published version of the manuscript.

6 Appendix A

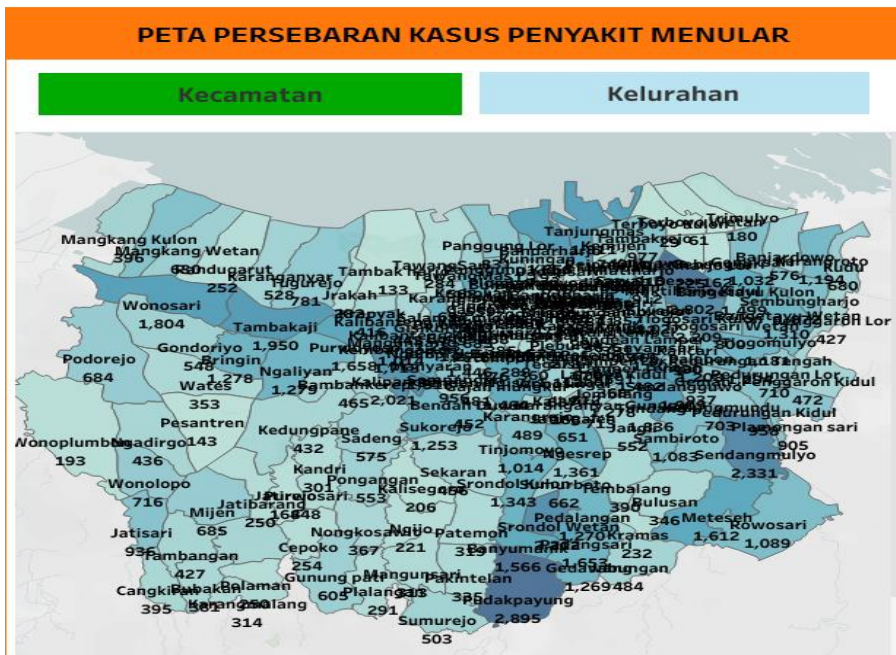


Fig. A1. Distribution of Communicable Disease by Village Areas



Fig. A2. Distribution of Infectious Diseases by Public Health Center Areas

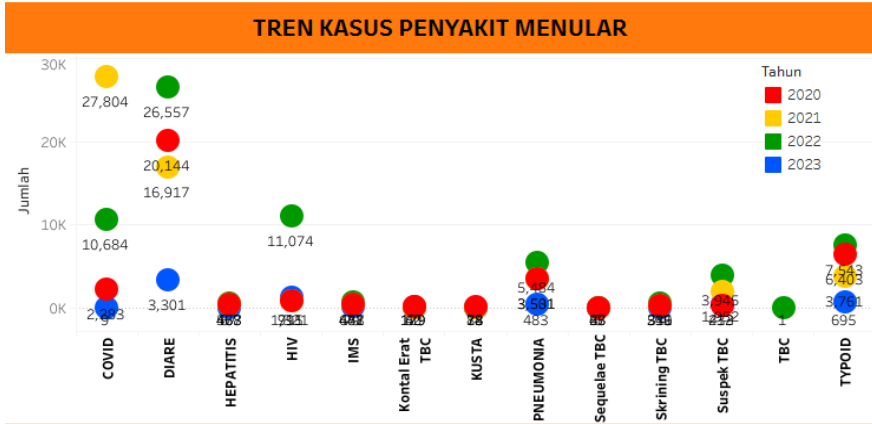


Fig. A3. Trends of communicable diseases by year

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