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Development of an Interactive Tableau Dashboard for Visualizing BPJS Participant Visit Patterns in Tasikmalaya City, 2024

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Abstract

Research Objective: Static reports may limit rapid interpretation of healthcare utilization data. This study aimed to develop a prototype interactive Tableau dashboard for visualizing BPJS Kesehatan sample visit data in Tasikmalaya City during 2024 and to describe visit patterns according to month, sex, age group, and diagnosis. **Methodology:** This descriptive quantitative study used anonymized secondary BPJS Kesehatan sample visit records from January to December 2024. Data preparation included duplicate checking, missing-value assessment, standardization of date and demographic variables, and verification of diagnosis codes using the International Classification of Diseases, 10th Revision. The cleaned data were imported into Tableau and displayed through summary cards, monthly trend charts, demographic visualizations, diagnosis charts, and interactive filters. Dashboard totals were cross-checked against descriptive calculations from the final dataset. **Results:** The final analytic dataset contained 889 participant visits. The dashboard displayed visit patterns by month, sex, age group, and diagnosis. December had the highest number of visits, with 210 visits, while January had the lowest, with 39 visits. Female participants accounted for a greater proportion of visits than male participants. Higher visit frequencies were observed in selected productive-age and older-adult groups. Fever, classified under ICD-10 category R50, was the most frequently recorded diagnosis, with 59 visits. **Conclusion:** The prototype dashboard provides an interactive presentation of BPJS Kesehatan sample visit data and facilitates descriptive exploration of temporal, demographic, and diagnostic patterns. Because the dashboard was developed using historical sample data and was not evaluated through formal usability testing, its findings should not be interpreted as representing all BPJS utilization in Tasikmalaya City. Future development should include automated data updating, end-user usability testing, and integration with more complete service-utilization data.

Keywords: *BPJS Health; interactive dashboard; visit patterns; data visualization; Tableau*

INTRODUCTION

Universal Health Coverage is a major foundation for equitable and sustainable access to health services. In Indonesia, this effort is implemented through the National Health Insurance program managed by BPJS Health. The continuing expansion of BPJS membership has increased the volume of service-use data generated by health facilities, including data on participant identity, visit time, type of service, diagnosis, and demographic characteristics. These data have strategic value for monitoring disease trends, evaluating service utilization, planning health resources, and improving health service quality.

The expansion of national health insurance produces increasingly large volumes of administrative and clinical service data that may support monitoring, resource planning, and service-quality improvement when appropriately managed and analyzed (Puji et al., 2022; Khanra et al., 2020).

The large volume and complexity of health service data create challenges for health information management. Static tabular reports are still commonly used in many health facilities, but they are often less effective for rapid interpretation, comparative analysis, and management decision-making. When visit data are presented only in tables, decision makers may need additional time to identify patterns such as peak visit periods, dominant age groups, sex distribution, and leading diagnoses.

Health dashboards provide a visual interface for summarizing indicators, identifying trends, and supporting rapid interpretation of complex healthcare data. Interactive visualization may improve users' ability to compare time periods, demographic groups, and clinical categories without repeatedly processing data manually. Previous studies have demonstrated the use of Tableau for visualizing patient experience data, clinical datasets, disease distributions, and health-service monitoring indicators (Kemp et al., 2018; Ko & Chang, 2017; Rizki et al., 2024). However, the usefulness of a dashboard depends not only on visual appearance but also on data accuracy, appropriate indicator selection, user requirements, usability, and clearly defined decision-support purposes (Rabiei & Almasi, 2022).

Interactive visualization offers a practical solution to these challenges. Business Intelligence tools such as Tableau can transform raw data into dashboards that display trends, proportions, and distributions in a format that is easier to understand. Previous studies have reported that Tableau is useful for visualizing health care data, patient experience data, disease mapping, and quality improvement indicators. In the context of BPJS Health, a dashboard can help summarize participant visit patterns and support evidence-based decision-making at both the health facility and district/city health management levels.

In Tasikmalaya City, BPJS participant visit data represent an important source of information for understanding service utilization. However, the data require systematic preparation before visualization, including cleaning, duplicate removal, variable standardization, and diagnosis-code adjustment. This study therefore addressed the following research question: how can BPJS Health sample visit data for Tasikmalaya City during January-December 2024 be processed and presented in an interactive Tableau dashboard to support monitoring of participant visit patterns across health facilities.

Although previous studies have applied dashboards to various healthcare datasets, limited published evidence describes the systematic preparation and visualization of BPJS Kesehatan sample visit data at the local level. In particular, previous reports have provided limited detail regarding data-cleaning procedures, ICD-10 verification, dashboard architecture, interactive filtering, and validation of dashboard totals against the source dataset. Therefore, the present study focused on developing a research prototype that transparently presents BPJS visit patterns while recognizing the limitations of sample secondary data.

This study aimed to develop a prototype interactive Tableau dashboard for visualizing BPJS Kesehatan sample visit data in Tasikmalaya City during January–December 2024. Specifically, the study aimed to: (1) prepare and standardize the secondary dataset for visualization; (2) design dashboard components for monthly, demographic, and diagnosis-based analysis; (3) describe visit patterns according to month, sex, age group, and diagnosis; and (4) verify agreement between dashboard outputs and descriptive calculations from the cleaned dataset.

METHODS

This study employed a descriptive quantitative design combined with dashboard prototype development. The descriptive component summarized BPJS Kesehatan sample visit patterns, while the development component transformed the cleaned dataset into an interactive visualization prototype. The dashboard was intended as a research visualization tool rather than a fully implemented operational or real-time decision-support system.

The study used anonymized secondary BPJS Kesehatan sample data containing participant visits recorded in Tasikmalaya City from January to December 2024. The dataset was obtained from BPJS participant visit records contained in the sample dataset for Tasikmalaya City. The unit of analysis was one participant visit record rather than one unique participant. Therefore, one participant could contribute more than one visit if multiple service encounters were recorded during the study period. The dataset covered 889 recorded visits during 2024. The data were used exclusively for academic analysis

and dashboard development. No direct identifiers, including names, identification numbers, addresses, or telephone numbers, were included in the analytic dataset.

Records were included when they represented visits occurring between January 1 and December 31, 2024, contained a valid visit-date field, and included the minimum variables required for analysis, namely sex, age or age group, and diagnosis or ICD-10 code. Records were excluded when the visit date was outside the study period, when essential analytical variables were missing and could not be verified, or when duplicate records represented the same service encounter.

Data processing was conducted before dashboard development to ensure that the dataset was suitable for visualization. The stages included data cleaning, duplicate removal, standardization of variable names and formats, adjustment of diagnosis codes based on ICD-10, and selection of variables relevant to the research objectives. This process was essential to reduce the risk of inaccurate interpretation caused by duplicate records, incomplete data, inconsistent date formats, or non-standard diagnosis coding.

The processed data were imported into Tableau. The dashboard was designed to display monthly visit trends, total visits, sex distribution, age distribution, and dominant diagnoses. Interactive filters were added to allow users to select specific periods, age groups, sex categories, and diagnoses. Data analysis was performed descriptively by summarizing frequencies, identifying the highest and lowest visits by month, and describing dominant patterns across variables. Separate worksheets were developed for total visits, monthly visit trends, sex distribution, age-group distribution, and leading diagnoses. The dashboard used a line chart for temporal patterns, categorical charts for sex and age distributions, ranked bars for diagnoses, and summary cards for total visits. Interactive filters were configured for month, sex, age group, and diagnosis. Selecting a filter updated all related dashboard components. The visualizations were selected to support four intended tasks: identifying changes in visit volume over time, comparing demographic distributions, identifying leading diagnoses, and exploring selected subgroups. The intended users were health-information personnel, researchers, and health-service managers requiring descriptive summaries of the sample data.

This study used secondary and anonymized data. The research was conducted in accordance with ethical principles for health data use, including confidentiality, privacy protection, and responsible reporting. Ethical approval was obtained from the relevant ethics committee; however, the approval number and date should be completed by the authors before submission.

Table 1. Variables included in the dashboard

Variable	Definition	Format/category	Dashboard use
Visit date	Date of healthcare encounter	Date	Monthly trend
Visit month	Month derived from visit date	January–December	Filter and line chart
Sex	Recorded participant sex	Male/female	Demographic chart and filter
Age	Age at visit	Numeric	Age categorization
Age group	Group derived from age	Insert exact intervals	Demographic chart and filter
Diagnosis	Recorded diagnosis label	Text	Diagnosis profile
ICD-10 code	Standard diagnosis code	ICD-10 format	Diagnosis validation and grouping
Visit count	Number of records	Calculated count	Summary card and charts

The visit-count indicator was calculated using the number of visit records. Visit month was derived from the visit-date variable. Age-group categories were generated using predefined age intervals. Diagnosis frequency was calculated by counting records within each validated ICD-10 category. Filters were applied consistently across all dashboard worksheets to ensure that selected month, sex, age-group, or diagnosis criteria produced synchronized outputs.

Dashboard totals were compared with independently calculated descriptive frequencies from the final cleaned dataset. Validation included the overall visit total, monthly totals, sex distribution, age-group distribution, and diagnosis frequencies. Any discrepancies were reviewed by checking filter settings, category definitions, missing values, and calculated fields. The final dashboard total agreed with the analytic dataset total of 889 records.

Formal end-user usability testing was not conducted in the present study. Therefore, the dashboard should be interpreted as a prototype whose usability, clarity, and usefulness require evaluation in future research using representative users and a standardized instrument such as the System Usability Scale. Ethical approval was obtained from the Health Research Ethics Committee of Poltekkes Kemenkes Tasikmalaya

RESULTS

Dashboard design and main components

The study produced an interactive dashboard using Tableau to visualize BPJS Health participant visit patterns in Tasikmalaya City. The dashboard converted complex visit data into visual information that could be explored dynamically by users. Its main components included a monthly visit trend chart, filters for year and month, summary cards, demographic distribution charts, and diagnosis-based visualizations.

Table 2. Main components of the Tableau dashboard

Component	Visualization/Feature	Purpose
Monthly visit trend	Line chart	Displays the increase and decrease in BPJS participant visits from January to December 2024.
Interactive filters	Year, month, age, sex, and diagnosis filters	Allows users to explore visit patterns according to specific analytical needs.
Summary card	Total visit indicator	Shows the total number of visits and selected totals after filtering.
Demographic distribution	Categorical charts	Displays visit distribution by sex and age group.
Diagnosis profile	Diagnosis and ICD-10 visualization	Identifies the most frequent diagnoses among BPJS participants.

Visit trend and participant characteristics

The dashboard showed that BPJS participant visits fluctuated during 2024. A total of 889 visits were recorded. The highest number of visits occurred in December, with 210 visits, while the lowest number occurred in January, with 39 visits. These differences indicate that service use varied across months and that health facilities may experience changes in workload throughout the year.

The dashboard also showed differences in visits according to participant characteristics. Female participants had a higher number of visits than male participants. Based on age distribution, the productive age group and older adult group were dominant users of health services. Participants aged approximately 25-35 years showed substantial visit numbers, while participants aged approximately 55-60 years also had high utilization, indicating that both productive-age and older participants require attention in service planning.

The diagnosis visualization showed that fever, coded as R50 in ICD-10, was the most frequent diagnosis in 2024, with 59 cases. Fever cases were distributed across several months, with the highest monthly count occurring in June, at 10 cases. Fever was found among both male and female participants and occurred across several age groups, particularly productive-age groups.

Table 3. Key findings from the interactive dashboard

Indicator	Finding
Total visits in 2024	889 BPJS participant visits
Highest monthly visits	December, 210 visits
Lowest monthly visits	January, 39 visits
Sex distribution	Female participants had more visits than male participants
Dominant age pattern	Productive age group and older adults showed high utilization
Most frequent diagnosis	Fever, ICD-10 R50, 59 cases
Highest monthly fever cases	June, 10 cases

Interactive analysis capability

The dashboard enabled users to apply filters by month, age, sex, and diagnosis. When a filter was applied, all visualization components adjusted automatically according to the selected data. This feature allowed more flexible and specific analysis without requiring manual reprocessing in a separate application. Overall, the dashboard presented visit trends, participant characteristics, and diagnosis patterns in a clear and systematic manner.

DISCUSSION

The findings demonstrate that preparing health data before visualization is a crucial step in producing reliable information. Health service datasets often contain missing values, duplicate records, inconsistent dates, non-uniform variable formats, and diagnosis-code differences. If these issues are not addressed, the resulting dashboard may display attractive visuals but provide misleading information. In this study, data cleaning, duplicate removal, variable standardization, and ICD-10 code adjustment were necessary to ensure that the dashboard reflected valid information. Data preparation is essential because inaccurate, duplicated, or inconsistently coded data can lead to misleading visualizations and inappropriate interpretations (Khanra et al., 2020; Rabiei & Almasi, 2022).

The interactive dashboard developed in this study supports the principles of health information management because it transforms raw health service data into information that can be used for monitoring and planning. The dashboard made it possible to identify the highest and lowest visit months, observe demographic differences, and recognize the leading diagnosis. These functions are important for BPJS Health, health offices, and health facilities because service planning requires timely and understandable information.

The dashboard structure is consistent with previous health-dashboard studies that used trend charts, indicator cards, demographic visualizations, and interactive filtering to facilitate rapid data exploration (Ko & Chang, 2017; Kemp et al., 2018; Sanjaya et al., 2023). However, the present study differs in its use of BPJS Kesehatan sample visit data and its combination of monthly, demographic, and ICD-10-based diagnosis views within a single prototype. The contribution remains primarily descriptive because formal usability and decision-impact evaluations were not conducted.

The finding that visits fluctuated throughout the year suggests that health facility workload is dynamic. The high number of visits in December may be related to seasonal factors, end-of-year health service utilization, or changes in community health needs. Although this study did not test the causes of the increase, the dashboard provides a practical tool for identifying such periods and preparing service capacity, staffing, and resource allocation. December had the highest number of recorded visits in the sample dataset. The present descriptive study did not examine the causes of this increase. Possible explanations may include seasonal disease patterns, differences in facility reporting, or end-of-year service utilization; however, these possibilities remain hypotheses and should not be interpreted as confirmed explanations. Further analysis using multiple years and facility-level variables would be required.

The higher number of visits among female participants may indicate differences in health-seeking behavior and service use between men and women. Women may access health services more frequently due to greater health awareness, routine health needs, or specific services used more often by female participants. Meanwhile, the high utilization among productive-age participants and older adults suggests that health service planning should address both acute conditions among active populations and routine care needs among older adults.

Fever (R50) was the most frequent diagnosis, with 59 cases, indicating that acute symptoms remain an important reason for BPJS participant visits. The dashboard showed that fever cases were not limited to one sex and appeared across age groups, especially productive-age groups. This information can support facility preparedness for common acute conditions and can help monitor changes that may relate to seasonal disease patterns. Female participants accounted for a larger proportion of visits in the sample dataset. Previous studies have reported that healthcare utilization may differ by sex because of differences in health needs, health-seeking behavior, and service accessibility (Puji et al., 2022). Nevertheless, the current dataset did not contain sufficient variables to explain the observed difference. Therefore, the finding should be interpreted descriptively rather than causally.

The dashboard also has practical implications for evidence-based decision-making. Compared with static tables, the interactive dashboard allows users to explore data more rapidly and flexibly. For example, managers can filter data by month or diagnosis to examine workload, identify priority conditions, or compare service use among demographic groups. Therefore, this dashboard can support more responsive health service planning in Tasikmalaya City.

The results describe only the BPJS Kesehatan sample records included in the analysis. Because the sampling design, facility coverage, and representativeness of the dataset were not established as reflecting the entire Tasikmalaya City population, the findings should not be generalized to all BPJS participants or all healthcare facilities in the city.

This study has several limitations. First, it used a secondary sample dataset and may not represent all BPJS Kesehatan participants or healthcare facilities in Tasikmalaya City. Second, the analysis was descriptive and did not investigate determinants of healthcare utilization. Third, several potentially important variables, including facility type, referral level, service category, comorbidity, and repeat-patient identification, were unavailable. Fourth, the dashboard used historical data and required manual updating; therefore, it did not provide real-time monitoring. Fifth, formal usability testing, task-based evaluation, and assessment of management impact were not conducted. Future research should employ more complete longitudinal data, evaluate the dashboard with intended users, and examine interoperability with operational health-information systems.

CONCLUSION

This study developed a prototype interactive Tableau dashboard for presenting BPJS Kesehatan sample visit data from Tasikmalaya City during 2024. The dashboard displayed monthly trends, sex and age-group distributions, and diagnosis frequencies through summary indicators, charts, and interactive filters. The final dataset contained 889 visits, with the highest number recorded in December and the lowest in January. ICD-10 category R50 was the most frequently recorded diagnosis category.

The dashboard provides a structured method for exploring historical sample data, but its usability, operational effectiveness, and management impact were not evaluated. The findings should not be generalized to all BPJS participants in Tasikmalaya City because the analysis was based on a sample secondary dataset. Further development should include user-based usability testing, automated updating, broader facility coverage, and integration with routine health-information systems.

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Informed Consent Statement: This study used anonymized secondary data; therefore, individual informed consent was not required. The use of data followed ethical approval and confidentiality principles.

Data Availability Statement: The data used in this study are not publicly available due to privacy and institutional restrictions. Data may be available from the corresponding author upon reasonable request and with permission from the relevant institution.

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Conflicts of Interest: The authors declare no conflict of interest.

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