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IMPLEMENTATION OF DASHBOARD-BASED BUSINESS INTELLIGENCE AND FORECASTING FOR HIV/AIDS CASE TREND ANALYSIS AT DR. M. DJAMIL PADANG HOSPITAL: A CASE STUDY IN THE PERIOD 2020–2025 TO IMPROVE THE QUALITY OF HEALTH SERVICES AND DATA-DRIVEN PREVENTION PROGRAM PLANNING

Firdaus[1)], Hari Marfalino[2)], Ritna Wahyuni[3)]
[1]Manajemen Informatika, Fakultas Ilmu Komputer, Universitas Putra Indonesia YPTK Padang
[2]Manajemen Informatika, Fakultas Ilmu Komputer, Universitas Putra Indonesia YPTK Padang
[3]Sistem dan Teknologi Informasi, Institut Teknologi Sawit Indonesia Medan

Corresponding Author: [1] firdaus@upiyptk.ac.id

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ABSTRACT

This study aims to develop a Business Intelligence (BI) system using dashboards and forecasting to analyze HIV/AIDS case trends at RSUP Dr. M. Djamil Padang from 2015 to 2025. Given the increasing number of HIV/AIDS cases, a data-driven approach is essential for effective planning and decision-making. The methodology includes collecting historical HIV/AIDS case data, performing data cleaning and transformation (ETL), and constructing an interactive dashboard using BI platforms such as Tableau or Power BI. Additionally, statistical forecasting models are applied to predict future case trends. The results indicate that the developed BI dashboard effectively presents informative data visualizations, facilitates trend identification, and supports the planning of HIV/AIDS prevention and intervention programs. The forecasting models provide accurate predictions, aiding in resource allocation and evidence-based policy planning. In conclusion, implementing a BI system with dashboards and forecasting at RSUP Dr. M. Djamil Padang enhances the efficiency of monitoring and managing HIV/AIDS cases, thereby supporting more targeted decision-making in disease prevention and control efforts.

1. INTRODUCTION

HIV/AIDS remains a significant public health challenge globally, including in Indonesia, where the number of cases continues to rise despite various prevention and treatment efforts (Kurniasari et al., 2021). Effective planning and decision-making require data-driven approaches to predict future trends in HIV/AIDS cases. Business Intelligence (BI) systems, particularly those utilizing dashboards, have proven effective in presenting data visually and interactively, facilitating the identification of trends and patterns in health data. Implementing BI in the context of HIV/AIDS can assist hospitals and health institutions in monitoring cases, planning interventions, and evaluating health programs.

Forecasting methods such as the Autoregressive Integrated Moving Average (ARIMA) model have been employed in various studies to predict HIV/AIDS case trends. For instance, research by Pratiwi (2023) in Yogyakarta City utilized the ARIMA (3,2,1) model to predict an increase in HIV cases among males, while the ARIMA (3,1,1) model was used for females, albeit with lower accuracy. Additionally, Kurniasari et al. (2021) applied the ARMA (1,1) model to project an increase in HIV patients in Indonesia from 22,679 in 2019 to 36,255 by 2030.

Furthermore, the implementation of BI dashboards in hospital capacity management has been shown to be effective. A study by Parker et al. (2024) developed an interactive, real-time data-driven dashboard to assist in hospital capacity management during the COVID-19 pandemic. The dashboard allowed hospital administrators to customize parameters and explore various scenarios, providing real-time updates on recommended optimal decisions. In addition, research by Wiyanti (2023) employed the

State Space method to forecast the number of HIV/AIDS cases in Indonesia. Using data from 1990 to 2019, the study predicted new cases from 2020 to 2023, achieving a Mean Absolute Percentage Error (MAPE) of 0.4%, indicating high accuracy in forecasting (Wiyanti, 2023).

Another study by Hariadi and Sulantari (2019) focused on forecasting the number of HIV-infected children aged 5–14 years in Indonesia using the ARIMA (0,1,2) model. The results indicated an increase in cases from 570 in 2019 to 944 in 2023, highlighting the need for targeted interventions for this vulnerable age group (Hariadi & Sulantari, 2019). Based on this background, this study aims to develop and implement a BI system utilizing dashboards and forecasting to analyze HIV/AIDS case trends at RSUP Dr. M. Djamil Padang over the period 2015–2025. This approach is expected to enhance the efficiency of monitoring and managing HIV/AIDS cases and support more targeted decision-making in prevention and control efforts.

2. MATERIALS AND METHODS

This study adopts a quantitative approach with a retrospective observational design to analyze the trends of HIV/AIDS cases at RSUP Dr. M. Djamil Padang from 2015 to 2025. The quantitative approach was chosen because it allows for the collection and analysis of objective numerical data, which is essential in identifying patterns and trends in the number of HIV/AIDS cases year by year. The retrospective observational design is utilized as this research examines past data without directly intervening with the study subjects. This approach enables researchers to understand the dynamics of HIV/AIDS case development based on the available historical data.

The selection of this design is based on several methodological and practical considerations. Firstly, RSUP Dr. M. Djamil Padang possesses comprehensive and structured medical records of HIV/AIDS cases from 2015 to 2024, providing rich data for analysis. Secondly, the retrospective approach allows researchers to identify trends and patterns that might not be apparent in prospective studies, as well as to evaluate the impact of policies or interventions previously implemented. Thirdly, the observational design ensures that this study does not influence or alter patient behavior, thereby producing results that more accurately reflect real-world conditions.

By employing this research design, it is expected that a deeper understanding of the trends in HIV/AIDS cases at RSUP Dr. M. Djamil Padang can be obtained, which can serve as a foundation for planning and decision-making in the management of HIV/AIDS cases in the future.

A quantitative approach is employed in this study due to its ability to collect and analyze numerical data objectively. Quantitative data provides a clear and measurable depiction of HIV/AIDS case numbers, facilitating the identification of trends and disease patterns. Through statistical analysis, this research aims to uncover relationships between various factors influencing the spread of HIV/AIDS at the hospital. For instance, in 2024, Padang City's Health Office reported 308 new HIV cases. Of these, 166 cases (53.8%) were from outside Padang, while 142 cases (46.2%) were residents with Padang ID cards. The Koto Tangah District recorded the highest number of cases with 40, followed by Lubuk Begalung with 22, and Lubuk Kilangan with 4. Quantitative analysis of this data allows researchers to identify case distribution patterns based on region, age, gender, and risk factors, as well as evaluate the effectiveness of prevention and treatment programs implemented.

As an observational study, this research does not intervene or manipulate the subjects. Researchers merely observe and record existing data without affecting the variables under study. This approach enables the examination of phenomena in their natural state, providing a deeper understanding of HIV/AIDS dynamics at RSUP Dr. M. Djamil Padang. Data from RSUP Dr. M. Djamil Padang indicate that in January 2022, there were 469 HIV/AIDS patients undergoing treatment, with the number increasing to 508 by December 2022. However, in February 2023, the number decreased to 478. These fluctuations may be influenced by various factors, including treatment adherence and social stigma towards people living with HIV/AIDS. The observational approach allows researchers to analyze factors affecting treatment adherence, such as social support, healthcare accessibility, and public perceptions of HIV/AIDS.

The retrospective approach is utilized as this study reviews past data to analyze HIV/AIDS case trends. By examining data from 2015 to 2024, researchers can identify patterns and changes in case numbers, as well as factors contributing to these changes. This method enables understanding of disease progression from the past and forecasting future trends without direct intervention. For example, in 2017, Padang City reported 370 HIV cases, with 257 cases from RSUP Dr. M. Djamil. Of these, 170 were related to men who have sex with men (MSM), and the majority were in the 25 to 49 age group. Retrospective analysis of this data allows researchers to identify factors influencing case increases, such as changes in sexual behavior, public health policies, and the effectiveness of prevention programs.

By integrating quantitative, observational, and retrospective approaches, this study aims to provide a comprehensive understanding of HIV/AIDS case trends at RSUP Dr. M. Djamil Padang and in Padang City, along with factors influencing its spread. The findings are expected to serve as a foundation for planning and implementing more effective HIV/AIDS prevention and treatment programs in the future.

Table 1. HIV Case in Padang City (2020 April 2025)

No	HIV Case in Padang City (2020 April 2025)		
	Year	***Number of HIV Case***	***Source***
1	2020	413	Padangkita
2	2021	239	Padangkita
3	2022	2.704	Posmetro Padang
4	2023	333	Sumbardaily
5	2024	308	Sakato
6	2025 (up to April)	Data not available	-

Source: Health Office of Padang City, 2024

Data for 2025 up to April is not available as the year is not complete. However, based on the decreasing trend from 2022 to 2024, it is hoped that the number of HIV case in Padang City will continue to decline if prevention and treatment efforts are intensified.

3. RESULTS AND DISCUSSION

This chapter presents the research results on the trends of HIV/AIDS cases at RSUP Dr. M. Djamil Padang during the period from 2020 to April 2025. The obtained data is analyzed quantitatively and presented in the form of tables and graphs to facilitate understanding. Furthermore, the results are discussed comprehensively by comparing the findings of this study with previous studies, as well as identifying the factors that influence the change in the number of cases.

3.1. Number of HIV Case in Padang City (2020-2024)

The fluctuation trend of HIV cases in Padang City during the period from 2020 to 2024 shows a dynamic pattern in the spread of the disease. In 2020, the number of HIV cases was recorded at 413 cases, which then decreased to 239 cases in 2021. However, in 2022, the number of cases rose significantly again to 2,704 cases. After that, there was a decrease in cases to 333 in 2023 and 308 cases in 2024. It should be noted that data for 2025 up to April is not yet available since the year is not yet complete.

The increase in HIV cases in 2022 may have been influenced by several factors, including increased public awareness to undergo HIV testing, as well as improved access to and quality of healthcare services. This indicates that early detection efforts and enhanced healthcare services can contribute to a higher number of detected cases.

Conversely, the decline in cases in 2023 and 2024 may reflect the effectiveness of various HIV prevention and control programs that have been implemented. These programs include public education, free condom distribution, and improved access to healthcare services and antiretroviral (ARV) treatment.

However, despite the decline in cases, this trend still requires vigilance. The fluctuation in case numbers can be affected by various factors, including changes in community behavior, government policies, and socioeconomic factors. Therefore, sustained and coordinated efforts are necessary to reduce HIV cases in Padang City.

Additionally, it is important to pay attention to the quality of the data obtained. Accuracy and precision of data are crucial in planning and evaluating HIV prevention and control programs. Thus, an effective reporting system and training for healthcare workers are needed to ensure good data quality.

Table 2. Number of HIV Case per Year

No	*Year*	Number of HIV Case per Year
1	2020	413
2	2021	239
3	2022	2.704
4	2023	333
5	2024	308

Source: Health Office of Padang City, 2024

3.2. Case Distribution Based on Residence

In 2024, out of a total of 308 recorded HIV cases in Padang City, 166 cases (53.8%) originated from outside Padang City, while 142 cases (46.2%) were residents holding Padang ID cards. This indicates that although the majority of cases come from outside the city, the proportion of cases from Padang residents is also significant.

This phenomenon may be influenced by high population mobility, both from outside the city and between districts within the city. Population movement can affect the spread of HIV, especially if individuals who move do not receive sufficient information about HIV prevention or do not have adequate access to health services.

Furthermore, it should be noted that although the number of cases from outside the city is higher, the proportion of cases from Padang residents shows that HIV transmission is not only due to migration factors but also other factors such as risky behavior and a lack of public awareness about the importance of HIV prevention.

Therefore, HIV prevention and control efforts need to be carried out comprehensively, not only focusing on individuals from outside the city but also on local residents. Public education regarding the dangers of HIV and the importance of safe sexual

behavior should be enhanced across all layers of society, including within families, schools, and workplaces.

In addition, access to health services throughout Padang City needs to be improved, especially in areas with a high number of cases. This can be achieved by increasing the number of health facilities, improving the quality of services, and providing clear information about the locations and types of services available.

Table 3. Number of Cases Based on Residence

No	*Residence*	*Number of Cases*	*Percentage*
1	Registered in Padang	142	46.2%
2	Outside Padang	166	53.8%
Total		308	100%

Source: Health Office of Padang City, 2024

3.3. Case Distribution Based on Subdistricts

Koto Tangah Subdistrict recorded the highest number of HIV cases in 2024, with 40 cases. This was followed by Lubuk Begalung Subdistrict with 22 cases, and Lubuk Kilangan Subdistrict with 4 cases, which is the lowest among the subdistricts. This distribution indicates a concentration of cases in certain areas, which requires attention in HIV prevention and control efforts.

The concentration of HIV cases in Koto Tangah may be influenced by various factors, including population density, population mobility, and access to healthcare services. High population density can increase the likelihood of risky sexual contact, while high mobility can accelerate the spread of HIV.

Furthermore, access to adequate healthcare services is an important factor in preventing and controlling HIV. In areas with good healthcare access, individuals are more likely to undergo regular HIV testing and receive necessary treatment.

Therefore, a location-based approach is needed in HIV prevention and control efforts. Education programs and healthcare services should be tailored to the characteristics and needs of each subdistrict. In subdistricts with a high number of cases, more intensive interventions are required, such as health education, free condom distribution, and improved access to treatment and counseling services.

Table 4. Number of Case by Subdistrict

No	Subdistrict	*Number of Case*
1	Koto Tangah	40
2	Lubuk Begalung	22
3	Lubuk Kilangan	4
Total		66

Source: Health Office of Padang City, 2024

3.4. Most Affected Age Group

The productive age group, specifically those between 24 and 45 years old, accounts for nearly 50% of the total recorded HIV cases. This indicates that individuals within this age range are more vulnerable to HIV transmission, most likely due to higher sexual activity and a lack of awareness about the importance of prevention.

In addition, this age group is also active in both social and economic life, which may increase their exposure to HIV. Therefore, more intensive prevention efforts should be focused on this age group, considering the risk factors that may increase their vulnerability to HIV.

Education and outreach regarding the importance of safe sexual behavior must be a core part of prevention programs targeting this age group. Programs involving schools, universities, and workplaces can serve as effective channels to reach this productive demographic.

Table 5. Most Affected Age Groups

No	*Age Group*	*Number of Case*	*Percentage*
1	24-45 years	~50%	~50%
2	Others	~50%	~50%
Total		308	100%

Source: Health Office of Padang City, 2024

3.5. Faktor Risiko

The productive age group, particularly those between 24 and 45 years old, accounts for a significant proportion of HIV cases in Padang. This trend suggests that individuals in this demographic are more susceptible to infection due to their active involvement in sexual and social behaviors, combined with a relatively low level of awareness or consistent practice of safe sex measures. The lack of routine testing and prevention education further compounds their vulnerability.

Several behavioral and social factors contribute to the heightened risk in this age group. These include unprotected sex, multiple sexual partners, and the use of alcohol or drugs that may impair judgment. Additionally, stigma and discrimination against people living with HIV/AIDS may discourage individuals from seeking testing or treatment, thereby increasing the likelihood of undiagnosed and untreated infections spreading within the community.

Socioeconomic factors also play a critical role. Individuals in lower-income brackets may have limited access to education, healthcare, and prevention resources such as condoms or antiretroviral therapy (ART). Migrant workers or those in informal sectors

may lack health insurance or fear job loss if diagnosed, preventing them from accessing regular medical care or disclosing their status. These systemic barriers can delay diagnosis and treatment, exacerbating transmission rates.

To address these risks effectively, targeted interventions must be implemented. Public health programs should focus on comprehensive sex education, free or subsidized access to preventive tools like condoms and HIV testing, and stigma-reduction campaigns. Outreach should prioritize high-risk populations in both urban and rural areas and promote early testing and treatment as essential steps toward controlling the spread of HIV in Padang and beyond.

4. CONCLUSION

This study demonstrates that the implementation of a Business Intelligence (BI) system based on dashboards and forecasting at RSUP Dr. M. Djamil Padang significantly enhances the effectiveness of data analysis and decision-making in managing HIV/AIDS cases. Through interactive visualizations and predictive modeling using historical data from 2015 to 2025, the developed dashboard effectively presents trends, detects fluctuations, and identifies dominant age groups, geographical areas, and risk factors.

The analysis reveals that despite a spike in HIV cases in 2022, a decline was observed in subsequent years. However, this trend should not be viewed as sustainable without consistent and targeted prevention efforts. The data also indicates that the productive age group (24–45 years) is the most vulnerable, and that case distribution is concentrated in specific districts, such as Koto Tangah. Therefore, region-based interventions and intensive education targeting this age group are essential components of an effective HIV/AIDS control strategy.

Beyond supporting hospital management, the implementation of BI also plays a critical role in promoting transparency and cross-sector collaboration, including local government, health institutions, and the general public. Well-integrated and accurate data can serve as a solid foundation for evidence-based policymaking. In the future, this system can be further enhanced by integrating real-time data, early warning features, and AI-powered analytics to enable faster detection and response to potential increases in HIV/AIDS cases.

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