SPATIAL ANALYSIS OF CASES OF HIV/AIDS BALI IN THE YEAR 1987 - 2018

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ABSTRACT

Based on data from the Bali Provincial Health Office in 2019 shows that people with cumulative HIV/AIDS is likely to increase in every year, with a total of 7,107 cases. This requires the handling of related parties to take steps to prevent that this case does not continue to rise. One effort to map the incidence of HIV/AIDS in Bali, the risk factors that influence and that data can be displayed using Geographic Information System (GIS). From this background, further research is needed on the spatial analysis of cases of HIV/AIDS in Bali using GIS. The method of research used descriptive method with the research subjects across the case of HIV/AIDS in Bali in 1987 - 2018. The data were collected using observation and documentation. Analysis of the potential distribution data using clustering techniques and methods of regression and mapping the spread of cases using spatial analysis with ArcView 3.3 software. Results showed the high potential areas Denpasar spread of HIV/AIDS, followed Badung and Jembrana. Based on the age group, the most vulnerable are aged 30-39 years were the highest spread through heterosexual amounted to 73.25%. In conclusion the spread of cases in Denpasar supreme because some districts are Hot Spots such as South Denpasar in Sanur Danau Tempe, East Denpasar in Pasiran and Padang Galak as well as a significant link HIV/AIDS with key populations that support distribution with a significant value (Sig) < 0:05.

***Keywords**: SIG, Clustering, Regression, HIV/AIDS, Spatial Analysis*

INTRODUCTION

Human Immunodeficiency Virus (HIV) is a virus that spreads through certain body fluids that attacks the immune system, particularly the CD-4 cells, or often called T-cells In the development of this virus can destroy immune cells in the human body so that the body will experience health problems, such as body unable to fight off infection from diseases that attack it. HIV can't be cured and until now some experts are still doing research to find drugs that can deal with this virus. In contrast to HIV, AIDS, or Acquired Immune Deficiency Syndrome is a symptom of a disease caused by the decline in immunity caused by infection with HIV that infect humans. This will certainly result in decreased immunity then that person is so very susceptible to various infections and can be fatal.

Bali is an area that became the center of world tourism. Not infrequently Bali used as a place for a vacation by tourists both domestic and foreign. Therefore, some positive and negative effects arise in people's lives in Bali, especially in the health field. Based on data from the Bali Provincial Health Office in 2019 obtained data on the spread of HIV/AIDS each year has increased significantly. With the total number of cases from 1987 to 2018 reached 7,107 cases. This of course requires the attention of the parties concerned in order to take steps to prevent early as possible.

One effort to do that is by mapping the location of which has a high spread potential, assessing factors that cause the spread, makes a database of cases that can be connected with all the relevant agencies such as the health service. It is expected to make particular information about HIV/AIDS into a door or a single source so that it becomes more effective and efficient. One method used is a Geographic Information System (GIS), this system combines elements of technology, computerization, hardware, software, data-based spatial mapping (geography).

ISBN: 978-602-53420-4-2

Thus from the above background, further research is needed to analyze the spatial mapping of HIV/AIDS in Bali using GIS.

METHODS

Data Research

The data in this study were divided into two parts:

1. Spatial Data
   a. Map of Bali Administration from the map Spatial Plan (RTRW) in 2011-2031 from the Regional Development Planning Agency (BAPPEDA) of Bali
   b. Coordinate data Hot Spot in Bali, as a potential location points the location of the spread of HIV/AIDS were analyzed kartometrik (spatial) using Google Earth Pro.
2. Non-Spatial Data
   a. Data HIV/AIDS cases in 1987 - 2018 were obtained from the BPS Bali through the data in Figures 2019 Bali Province.
   b. Data Re-estimation of the key population of HIV/AIDS cases in 2014 Bali Province

Research Support Tool

The device used in this research are as follows:

1. Hardware and specifications used:
   a. ASUS laptop x200ca
   b. OS Windows 8.1 Pro
   c. Core Intel Celeron Processor 1007U CPU @ 1.5 GHz
   d. 4:00 GB RAM
   e. 500 GB hard drive
2. Software used:
   a. ArcView GIS 3.3
   b. SPSS 17.0
   c. Microsoft Excel 2013
   d. Microsoft Word 2013
   e. Microsoft Visio 2007

Implementation Research

As seen in Figure 1, flowchart study consists of several stages including the preparation stage, the stage of data collection, data processing stage and the stage of conclusion. The explanation is the following stages:

1. Data Collection

Bali provincial administration map data containing zoning districts, the boundaries, the location of the road, the name of the city, and others that will be obtained from BAPPEDA this map will be used to analyze the spatial SCARA using GIS. While data of cases of HIV/AIDS in Bali consisting of new cases and cases accumulated from years 1987 - 2018 are analyzed cases districts, area, population, gender, age of affected cases, the causes and the important things more supported Data analysis of cases of HIV/AIDS. While the 2014 population data key linkages analyzed using SPSS regression method, data such as the location of the area of spatial nature, potential locations for distribution of cases will be searched for coordinates using of Google Earth and the results of the coordinates are stored in Microsoft Excel for use in research support.

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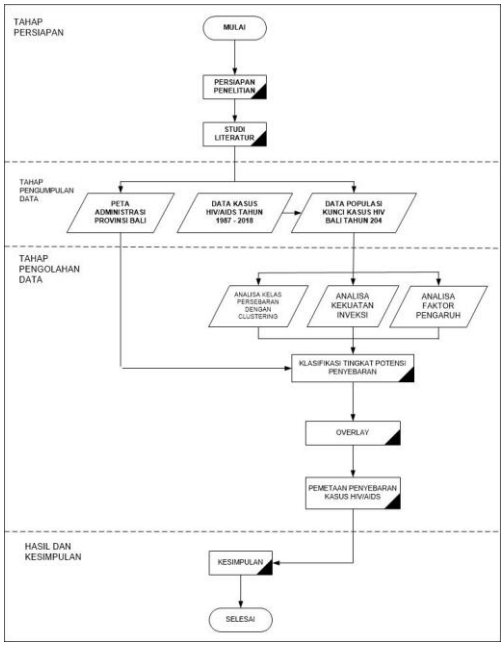

Figure 1. Flow Research

2. Data Analysis

After obtaining the necessary data followed by data analysis. The stages of the process of data analysis are as follows:

a. Mapping

Stages of mapping the spread of HIV/AIDS cases carried out after obtaining previously analyzed data with the help of ArcView 3.3 software. For factors that need to be assessed and deemed to affect the vulnerability of the potential spread of case analysis and calculation using Bivariate analysis (Regression). The factors that are considered to have a relationship, especially in the districts of the highest HIV/AIDS cases it is the data from key populations. These data will be analyzed statistically and the results are classified with the administrative map, then the results of analysis used as inputs in support overview map creation potential spread of HIV/AIDS region or districts in Bali.

b. Clustering Analysis of Potential Areas Distribution

After the process of making a map, map results are then analyzed to assess the level of potential vulnerability classification spread of HIV/AIDS cases by using the district region analysis Interval Grade determination. In determining the class interval would use a formula that looks as follows [5]:

$$Ki = \frac{Xt - Xr}{k} \text{ .... (1)}$$

Information :

Ki : Class Interval

xt : Top Data

xr : Lowest Data

k : Number of the desired class

c. Influence Factor Analysis

Analysis of influence factors used to know influence of factors - factors considered to influence the spread of a potential HIV/AIDS, especially in areas that have a high level cases. The analysis used the statistical analysis Regression. Factors thought to affect as data on the number Female Sex Workers Direct (WPSL), Female Sex Workers Indirect (WPSTL), Injecting Drug Users (IDUs), Sex and Men Love Men (MSM). The formula for Simple Linear Regression used is as follows [4]:

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Y = a + bX ..... (2)
Information :
Y = Subjects who predicted the dependent variable (number of cases of HIV/AIDS)
a = constant regression to X = 0
b = coefficient regression direction
X = independent variable / Predictor (Population Lock)

The magnitude of the constants a and b searched using the equation:

$$a = \frac{(\sum Y_i)(\sum X_i^2) - (\sum X_i)(\sum X_i Y_i)}{n\sum X_i^2 - (\sum X_i)^2}$$

$$b = \frac{n\ (\sum X_i\ Y_i) - (\sum X_i)(\sum Y_i)}{n\sum X_i^2\ - (\sum X_i)^2}$$

Where n is the number of data

FINDINGS AND DISCUSSIONS

After analysis of data both primary data and secondary data obtained the following results.

Distribution of Spreading HIV / AIDS Cases between 1987 - 2018 in Bali

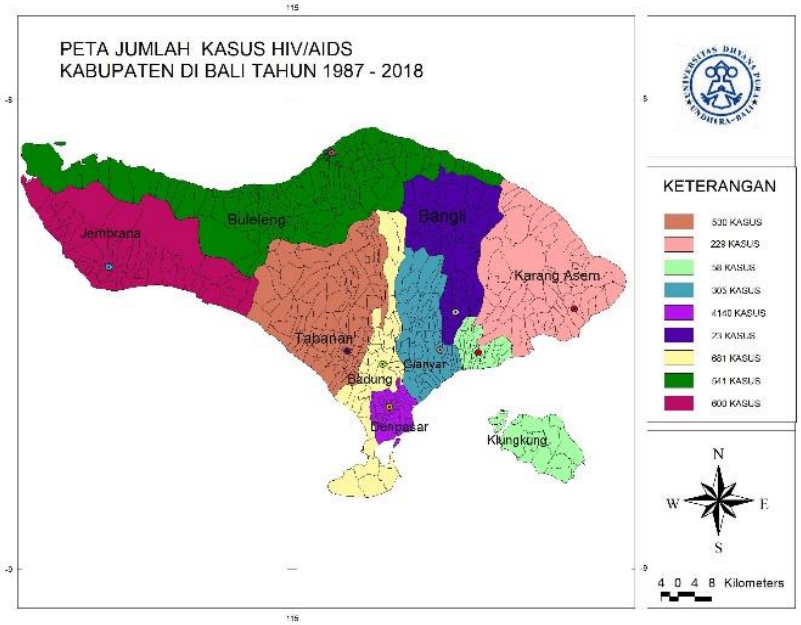

Figure 2. Mapping of HIV / AIDS cases in Bali Year 1987-2018

As seen in Figure 2. The data showed the spread of HIV / AIDS cases highest in Denpasar with 4140 cases, followed by Badung 681 cases, 600 cases Jembrana, and the lowest is Bangli with 23 cases.

Potential Areas Spreading

Determination of classification levels of potential vulnerability of the spread of HIV / AIDS cases by using the district region determination analysis Interval Grade (Formula Kingma). By using the formula (1) is obtained:

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Table I. Range of Grades

Class	Class name	Value (cases)
1	Low	≤ 1372
2	moderate	1373 - 2745
3	High	≥ 2746

The class ranges obtained from the data potential spread of HIV / AIDS County and City in Bali as shown in Table II below.

Table II. Potential Spread of HIV / AIDS cases of the Year 1987 - 2018

Class	Class name	District / City
1	Low	Bangli, Tabanan, Gianyar, Karangasem, Beleleng, Klungkung, Jembrana, Badung
2	moderate	-
3	High	Denpasar

As seen in Table II, the area that has the potential spread of HIV / AIDS into the high grade is Denpasar many as 4140 cases. The high case in Denpasar influenced by their point Hot Spot deployment location area, such as South Denpasar in Sanur Danau Tempe, Lake Poso, East Denpasar Padang Galak, as well as North Carik Denpasar and Lumintang, as seen in Figure 3. This also according to the research Lestari (2013) about the potential location of the spread of HIV / AIDS cases in Denpasar Bali. It also discussed about the number of sex workers (FSW), which reached 4,000 people who transact at the point of Hot Spot locations, either directly or indirectly.

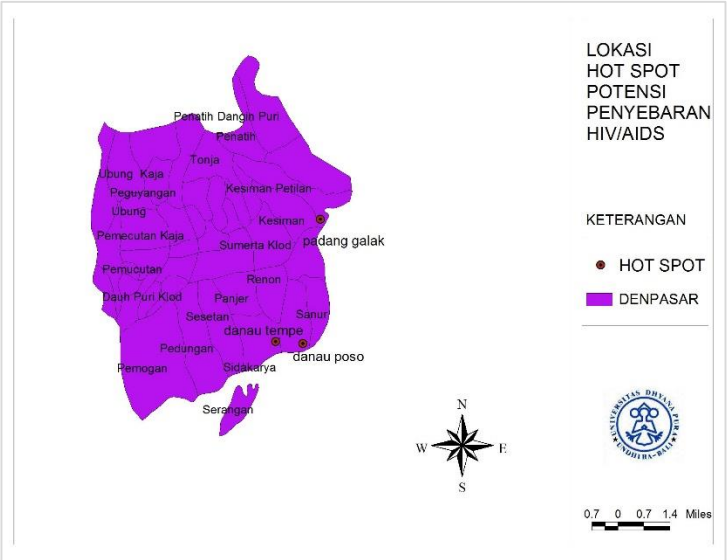

Figure 3. Location of Hot Spot in Region Denpasar

In Table III for cases of HIV / AIDS in 2019, Badung enroll in classes and Denpasar potential spread was still a high-potential region in the spread of cases.

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Table III. Potential spread of new cases of HIV / AIDS 2019

Class	Class name	Value (cases)	territory
1	Low	≤ 102	Jembrana, Tabanan, Gianyar, Klungkung, Bangli, Karangasem, Buleleng
2	moderate	103-205	naughty
3	High	≥ 206	Denpasar

Based on the data obtained, the high potential for the spread of HIV / AIDS in Denpasar influenced by the spread of risk factors, as seen in Table IV below.

Table IV .Cause Risk Factors in Denpasar Bali

Estimated Risk Factor	HIV / AIDS		
	Male	Female	Total
Bisexual	25	0	0
Heterosexuals	2081	1259	3340
Homosexual	252	7	259
IDU (Injection Drug Use)	254	20	274
Perinatal (Pregnancy)	114	65	179
Not known	51	12	63
Total	2777	1363	**4140**

Heterosexual be the highest risk factor in Denpasar with a total of 3340 cases, where male and female 2081 cases in 1259 cases. This is according to research Munijaya (1999) that one of the main causes of the spread of HIV / AIDS in Indonesia is through sexual intercourse often change partners.

Age Group Cases for HIV / AIDS patients in the city of Denpasar can be seen in Table V.

Patients Age Group Table V. HIV / AIDS cases in Denpasar

Age Group (years)	AIDS		
	Male	Female	Total
<1	15	7	22
1-4	62	39	101
5-14	14	11	25
15-19	20	34	54
20-29	662	405	1067
30-39	858	364	1222
40-49	461	181	642
50-59	183	54	237
> 6 0	45	13	58
Not known	457	255	712
Total	2777	1363	**4140**

ISBN: 978-602-53420-4-2

As seen in the table above, the most vulnerable age group is aged 30-39 years with 1222 cases. This is in line with research Daughter (2018) in the field of HIV / AIDS that age who are vulnerable to HIV / AIDS are of childbearing age 25-34 years.

Influence Factor Analysis Results the Spread of HIV / AIDS in Bali

The high potential for the spread of HIV / AIDS in Denpasar based on statistical regression analysis obtained by the weak strong factors influence key populations by the spread of HIV / AIDS. By using SPSS 17.0 was obtained a summary of the simple linear regression analysis as shown the following table.

1. Key populations WPSL

Table VI. Result Simple Regression Analysis for Key Populations WPSL

variables	Koef. Regression (B)	t - count	Sig. t	Information
constants	205 622	2,782	0027	
WPSL (X1)	3,549	17 965	0000	Significant
R Square	0979			

Regression analysis results can be written above equation becomes:

Y = 205 622 + 3,549 X1

A constant value of 205 622, this means that the number of cases of HIV / AIDS will amount to 205 622 if WPSL amount equal to zero. This can be explained that the HIV / AIDS cases would be declining if no WPSL.

Variable number WPSL (X1) has a positive effect on the number of cases of HIV / AIDS, with a regression coefficient of 3549 showed that when the amount of WPSL increased by 1 percent, the number of cases of HIV / AIDS will be increased by 3,549 percent, assuming other variables constant. Significant value (sig) of 0.000, this value is much lower than 0.05, then the effect of the number of cases of HIV / AIDS on WPSL is a significant amount.

The coefficient of determination R2 of 0979, which means 97.9% of the variation in the dependent variable number of cases of HIV / AIDS can be explained by variations in the independent variable WPSL number.

2. Key populations WPSTL

Table VI. Result Simple Regression Analysis for Key Populations WPSTL

variables	Koef. Regression (B)	t - count	Sig. t	Information
constants	-1955	- 0:07	0027	
WPSTL (X2)	2,023	4894	0000	Significant
R Square	0774			

Regression analysis results can be written above equation becomes:

Y = -1955 + 2023 X2

Constant value of -1 955, this means that the number of cases of HIV / AIDS will be at -1955 if WPSL amount equal to zero. This can be explained that the HIV / AIDS cases would be declining if no WPSTL.

WPSTL number of variables (X2) has a positive effect on the number of cases of HIV / AIDS, with a regression coefficient of 2.023 indicates that if the amount of WPSL increased by 1 percent, the number of cases of HIV / AIDS will be increased by 2,023 percent, assuming other variables constant. Significant value (sig) of 0.000, this value is much lower than 0.05, then the effect of the number of cases of HIV / AIDS on WPSTL number is significant.

ISBN: 978-602-53420-4-2

The coefficient of determination R2 of 0774, which means 77.4% of the variation in the dependent variable number of cases of HIV / AIDS can be explained by variations in the independent variable WPSTL number.

3. Key populations of IDU

Table VI. Result Simple Regression Analysis for Key Populations IDU

variables	Koef. Regression (B)	t - count	Sig. t	Information
constants	18 457	0050	0961	
IDU (X3)	12 712	3319	0013	Significant
R Square	0611			

Regression analysis results can be written above equation becomes:

Y = 12 712 18.457+ X3

A constant value of 18 457, this means that the number of cases of HIV / AIDS will amount to 18 457 if the number of IDUs is equal to zero. This can be explained that the HIV / AIDS cases would be declining if no IDU.

Variable number of IDU (X3) has a positive effect on the number of cases of HIV / AIDS, with a regression coefficient of 12 712 showed that when the amount of WPSL increased by 1 percent, the number of cases of HIV / AIDS will be increased by 12 712 percent, assuming other variables constant. Significant value (sig) of 0.013, this value is much lower than 0.05, then the effect of the number of cases of HIV / AIDS on the number of IDU is significant.

The coefficient of determination R2 of 0611, which means 61.1% of the variation in the dependent variable number of cases of HIV / AIDS can be explained by variations in the independent variable number of IDU.

4. Key Populations Shemale

Table VI. Result Simple Regression Analysis for Key Populations Shemale

variables	Koef. Regression (B)	t - count	Sig. t	Information
constants	-60 972	- 0.176	0865	
Shemale (X4)	11,778	3,766	0007	Significant
R Square	0670			

Regression analysis results can be written above equation becomes:

Y = 11 778 -60 972 + X4

Constant value of -60 972, this means that the number of cases of HIV / AIDS will amount to -60 972 if the number of Transgender equal to zero. This can be explained that the HIV / AIDS cases would be declining if no Shemale

Variable number Transgender (X4) has a positive effect on the number of cases of HIV / AIDS, with a regression coefficient of 11,778 showed that when the amount of Transgender increased by 1 percent, the number of cases of HIV / AIDS will be increased by 11,778 percent, assuming other variables constant. Significant value (sig) of 0.007, this value is much lower than 0.05, then the effect of the number of cases of HIV / AIDS on Transgender is a significant amount.

The coefficient of determination R2 of 0.670, which means 67% of the variation in the dependent variable number of cases of HIV / AIDS can be explained by variations in the independent variable Transvestite number.

5. Key populations of MSM

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Table VI. Result Simple Regression Analysis for Key Populations MSM

variables	Koef. Regression (B)	t - count	Sig. t	Information
constants	102 143	0289	0781	
LSL (X5)	0439	3,300	0013	Significant
R Square	0609			

Regression analysis results can be written above equation becomes:

Y = 102 143 + 0439 X5

A constant value of 102 143, this means that the number of cases of HIV / AIDS will amount to 102 143 if the number of MSM is equal to zero. This can be explained that the HIV / AIDS cases will decline if there is no MSM.

Variable number of MSM (X5) has a positive effect on the number of cases of HIV / AIDS, with a regression coefficient of 0439 showed that when the amount of WPSL increased by 1 percent, the number of cases of HIV / AIDS will be increased by 0439 percent, assuming other variables constant. Significant value (sig) of 0.013, this value is much lower than 0.05, then the effect of the number of cases of HIV / AIDS on MSM is a significant amount.

The coefficient of determination R2 of 0609, which means 60.9% of the variation in the dependent variable number of cases of HIV / AIDS can be explained by variations in the independent variable number of MSM.

CONCLUSION

The conclusions obtained from this study are as follows:

1. Denpasar become a region with high potential for the spread of cases of HIV / AIDS because there are such hotspot locations in Tempe Lake, Lake Poso and Padang Galak.
2. The spread of HIV / AIDS in Denpasar majority through Heterosexual and vulnerable age are of childbearing age 30-39 years.
3. WPSL number of key populations, WPSTL, IDU, MSM Transgender and significant effect on the potential spread of HIV / AIDS with Sig value of <0.05.

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ISBN: 978-602-53420-4-2