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The Spatial Relationship between Drug Abuse and Home Burglaries: Northeast District of Penang

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ABSTRACT: This study to identify the relationship between dependent and independent variables as well as the spatial correlation between drug abuse cases and home burglary cases in Northeast District of Penang. The OLS regression was used to examine the relationship between the home burglary cases and drug abuse as well as the spatial correlation of drug abuse and home burglary cases based on Moran's I. The increase of home burglary cases was proportional to the increase the number of cases in local drug abuse. In spatial context, the drug abuse and home burglary cases showed a positive correlation. Plus, this indicated that the spatial relationship between the two cases were proportional. The use of GIS application helps the authorities such as AADK, PDRM and local authorities to understand crime and drug abuse in time-space context. The space elements emphasized the issues related to drug and crimes, and assisting relevant authorities in strategy planning to reduce crime index and drug problems. GIS is used to conduct research on locations or spaces and new approaches to assist authorities in making decisions and strategies related to crime and drugs.

KEYWORDS: Burglary, Drug abuse, Moran's I, OLS, p-value,

INTRODUCTION

Drug abuse and crimes are quite relative and closely linked to each other. They also show a close relationship between substance abuse and an increase in crimes (theft, robbery, burglary, and others). Drug abuse accounts for almost 50% of criminal cases in the country and there is a clear observation between criminal behaviour and drug abuse (Abdullah, 2016).

According to the United Kingdom Minister of Strategy Unit (2003), 56% of crimes occur due to drug abuse; 85% involving shoplifting, 70% from burglary cases and 54% from robbery. This indicates that drug abuse contributes to street crime (UK Strategy Unit Drugs Report, 2003). The number of drug users is nearly 200 million people, mostly for personal drug use only (Costa, 2008).

GIS applications in crime mapping are used to make it easier for authorities to understand analyse the crime scene patterns and making decisions on strategies and crime prevention measures. Crime mapping using the Geographic Information System (GIS) enables crime analysts to identify hot spots, along with other trends and patterns (ESRI, 2018) which is a key component of crime analysis.

According to Craddock et al., (1994), various offenses were committed due to the misuse of drugs according to the positive gender. The highest incidence was related to the crime of trafficking and drug use of 79% for men, while women were at least 85% prostitution. For men, house-breaking was the second-highest crime rate of 68% and for women, distribution and consumption were 79% (Table 1). This shows that home-based offenses and drug abuse are related and are among the highest offenses.

Drug abuse carries a big impact on society as criminal activity increases with the involvement of the drug addict. The previous study revealed that drug abuse was linked with property crime. The study has been conducted at the rehabilitation center showed that 74% of the criminals continue to commit crimes to maintain their habit, while only 26% were able to control drug problems without committing crimes. From 74%, 70% of the crimes were associated with the property while 4% was associated with violent crimes. The study deliberated that drug addict involved in crimes just to meet their needs (Buntat and Rahmat, 2015). According to Mumola and Karberg (2007), based on the record of drug addicts, some crimes were committed such as violent crimes of 49.6%, property crimes 64%, drug offenses (distribution and use) 71.9% and serious crimes of 49.3%.

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Table 1. Positive Drug Offenders by Gender in United States

Offense	Percentage of Positive Drugs (%)	
	Male	Female
Sale / Ownership of Drugs	79	79
Housebreaking / Building	68	63
Robbery	65	76
Thieves	64	58
Parole Offenses	61	60
Theft of Property	58	74
Fraud	56	51
Fights / Escape / Warrants	52	66
Others	51	46
Armed	49	62
Public Order	48	61
Suicide	48	65
Wounding	48	50
Prostitution	47	85
Property Damage	45	57
Traffic Error	42	48
Household Error	40	38
Sex Offenses	37	68

(**Source:** Modified from Craddock et al., 1994)

Table 2. Total number of drug addicts according to states in Malaysia

Year	2010	2011	2012	2013	2014	2015	2016	2017
Penang	3,753	2,747	2,286	3,043	2,780	4,280	5,081	3,844
Selangor	3,548	2,026	1,690	2,226	2,051	2,987	3,176	2,375
Kedah	2,507	1,859	1,535	2,702	2,535	2,945	3,862	2,655
Terengganu	2,377	2,443	599	641	579	1,022	1,676	2,044
Kelantan	2,360	1,475	942	895	1,399	1,994	3,233	3,700
Perak	2,296	2,215	1,549	2,789	2,716	3,106	2,639	1,557
Johor	2,091	1,918	1,729	1,874	1,992	2,541	2,565	2,108
FT Kuala Lumpur	1,344	1,013	1,098	1,841	1,698	1,328	1,695	1,655
Pahang	1,198	1,363	1,423	1,621	1,903	2,066	2,419	2,088
N. Sembilan	921	840	816	1,008	951	1,050	1,172	1,012
Sabah	517	440	262	513	940	898	1,044	1,047
Perlis	354	293	337	374	499	781	692	654
Melaka	176	538	496	675	845	944	930	613
Sarawak	145	333	312	650	854	658	534	440
FT Putrajaya	45	25	26	20	16	32	47	39
FT Labuan	10	3	1	15	19	36	79	92
Total	**23,642**	**19,531**	**15,101**	**20,887**	**21,777**	**26,668**	**30,844**	**25,922**

(**Source:** AADK, 2017)

From 2010 to 2015, Penang recorded the highest rate of drug abuse compared to other states in Malaysia (Table 2). Penang also recorded the highest number of accumulators in Malaysia from 1988 to 2014 with 49,742 people with a ratio of 30 residents per 1,000 while the lowest was recorded by the Federal Territory of Putrajaya at 148 with a ratio of 2 residents per 1,000 (AADK, 2014).

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Statistics showed that drug abuse cases were high in big capital cities such as Penang, Perlis, Federal Territory of Kuala Lumpur, and Kedah. In addition, most cases of drug abuse are found to occur in Penang.

In addition, statistics show that the majority of drug abuse are youths (Table 3). patterns of drug abuse cases showed a decrease from 2010 until 2012, while from 2013 to 2016 showed an increase in cases. however, in 2017 showed a decrease in drug abuse cases. This decrease is likely due to measures related to the prevention and eradication in reducing drug involvement among the people, especially the youth (AADK, 2017).

Table 3. Drug Abuse Cases by Ages

Year	<13	13-15	16-19	20-24	25-29	30-34	35-39	≥40	Youth	Total
2010	3	83	2,610	5,467	4,993	3,002	2,720	4,240	18,792	23,642
2011	15	55	1,425	4,729	4,490	3,378	2,244	3,043	16,266	19,531
2012	0	28	855	2,836	3,038	2,711	2,024	3,575	11,464	15,101
2013	0	18	847	3,212	3,968	4,022	3,191	5,629	15,240	20,887
2014	0	28	1,173	3,751	4,154	3,961	3,247	5,463	16,286	21,777
2015	0	45	1375	4,986	4,977	4,936	3,976	6,373	20,250	26,668
2016	0	85	1,595	5,572	5,719	5,849	4,715	7,309	23,450	30,844
2017	0	72	1300	4706	4735	4820	3884	6405	19445	25,922

(**Source:** Modified from AADK, 2017)

According to Mohd Reduan (1990), the close relationship between addicts and criminal activity was due to the ability to be unwilling to work or use energy on their own. The addict committed crimes (theft, robbery, burglary and other criminal activities) plainly to obtain money to buy drugs. The increasing number of drug users among Malaysians affecting the society moral values.

Most of the criminal cases reported in Malaysia generally involved in violent crime and property crime. 80% of reported cases involved property crimes while the remaining involved in violent crimes (Kanyo and Md Nor, 2007). Violent crimes included murder, rape, armed robbery, unarmed and aggravated robbery, while property crimes included burglary, vehicle theft, motorcycle theft, robbery and other theft (State Economic Planning Unit, 2013).

Property crime cases recorded from 2011 to 2016 showed that home burglaries were among the third-highest cases followed by vehicle theft (van/truck, car, and motorcycle), robbery and others. The total number of house-breaking cases recorded from 2011 to 2016 was 134,854 with the number of cases decreased from 2011 to 2015 by 9250 cases (DOSM, 2014). The decline in house-breaking cases probably due to public security awareness through ongoing campaigns as well as increased surveillance and patrols by local authorities such as the PDRM, local authorities, and the community.

The total number of property crimes cases from 2011 to 2016 was 656,560 cases, while the total number of home nirglary cases from 2011 to 2016 was 134,854 cases, which is 20.54% of the total property crime cases. Home burglary cases were the main agenda of NKRA in reducing crime. In 2015, home breaking cases continued to decline by 1,393 cases, to 19,286 cases, a decrease of 6.74% compared to 2014's total of 20,679 cases. The decrease of 526 cases was 2.73% in the year 2016 to 18760 cases (DOSM, 2017).

LITERATURE REVIEW

Mohd Ekhwan et al. (2015) had conducted space-time assessments of drug addiction using Multivariate and GIS analysis in Terengganu. The data covered 10 continuous years of drug abuse cases from 2004-2013. The multivariate analysis showed Cluster 1 (moderate level) in Besut and Terengganu. On the other hand, Cluster 2 (low level) identified in Dungun, Marang, Setiu, and Hulu Terengganu, while Cluster 3 with a high density of drug addicts were identified at Kemaman.

Linton et al. (2014) states that knowledge of clustering incidences was able to help by building health and social services in particular areas. Space-time statistical method was used to identify statistically significant clusters using 2003 drug data. The results

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indicated that high potential of cluster relocation in the city of Baltimore. This study suggested that space-time statistics can be used in the future to detect policy flaws in drug addict activities.

OLS regression analysis was performed to identify significant explanatory variables related to alcohol sales and violent crime in one of Oklahoma City. Global regression has been used to analyze the spatial relationship between violent crime, socio-cultural characteristics of neighborhoods, and alcohol sales environment. The result showed the effects of neighborhood characteristics combined with the availability of alcohol sales and violence outcomes 63% of the violence was explained using the neighborhood variables and alcohol availability. This study provided crucial evidence of the effect of alcohol sales on violence in the environment. These findings have important policy implications in addressing public health issues and alcohol-related violence in the local context (Daikwon and Dennis, 2013).

The criminal activity was often distributed unevenly across space. Studies showed that crime incidents were often concentrated in certain neighborhoods and associated with socioeconomic and criminal opportunity factors. This study explored the patterns of property and violence crimes across different socioeconomic layers and spaces by examining the socioeconomic conditions of the neighborhood and the individual characteristics of crimerelated offenders in the city of Toronto. Spatial techniques such as Local Moran's I was used to analyze the spatial distribution of crime activity. Crime distance was measured to explore the spatial behavior of criminal activity. Ordinary least squares (OLS) regression was conducted to explore the ways in which individual and neighborhood demographic characteristics were related to crime rates in the neighborhood. Geographical Weight Regression (GWR) was used to further the understanding of the varying relationships between crime and the independent variables included in the OLS model. Property and crime violence over the three years of the study showed the same distribution of large crime hotspots in central, northwest, and end of town. The OLS model showed offenders related demographics (i.e. age, marital status) were important predictors for both types of crime, but in different ways. Neighborhood contextual variables were measured by the four-dimensional OntarioMarginalization Index. The GWR was the most suitable model for describing variations in property crime rates observed across different regions. It also identified spatial non-stationarity relationships. This study has implications through a better understanding of crime patterns and factors for crime prevention and security. Given the need for safe neighborhoods, they were built not only by the law enforcement sector but also by the various sectors of social and economic services (Lu et al., 2019).

The Toronto police had conducted a study related to crimes in the city using GIS applications. OLS analysis was used to analyze the relationships between socioeconomic and violent crime. In this case, violent crime acts as a dependent variable while average income as an explanatory variable. This analysis showed the highest significant levels in low-income areas were associated with higher crime rates (red areas). The standard deviation of the residuals for the red areas indicated the standard deviation greater than 2.5, which means that there was a significant relationship between the two variables. Based on the results of the study, the area with the highest crime rate holds the lowest average income. Moran's I analysis was used to analyze the relationship between variables to examine the spatial correlation. Results showed that the relationship between the two variables was highly significant (Jordan and Tyler, 2013).

STUDY AREA AND METHOD

The capital border of Penang located in the northeast region was chosen as the study area (Figure 1). Penang is among the fastest-growing states and has a high population density in Malaysia. However, Penang is also among the highest number of drug abuse cases in Malaysia as well as the sixth highest crime rate compared to the other states.

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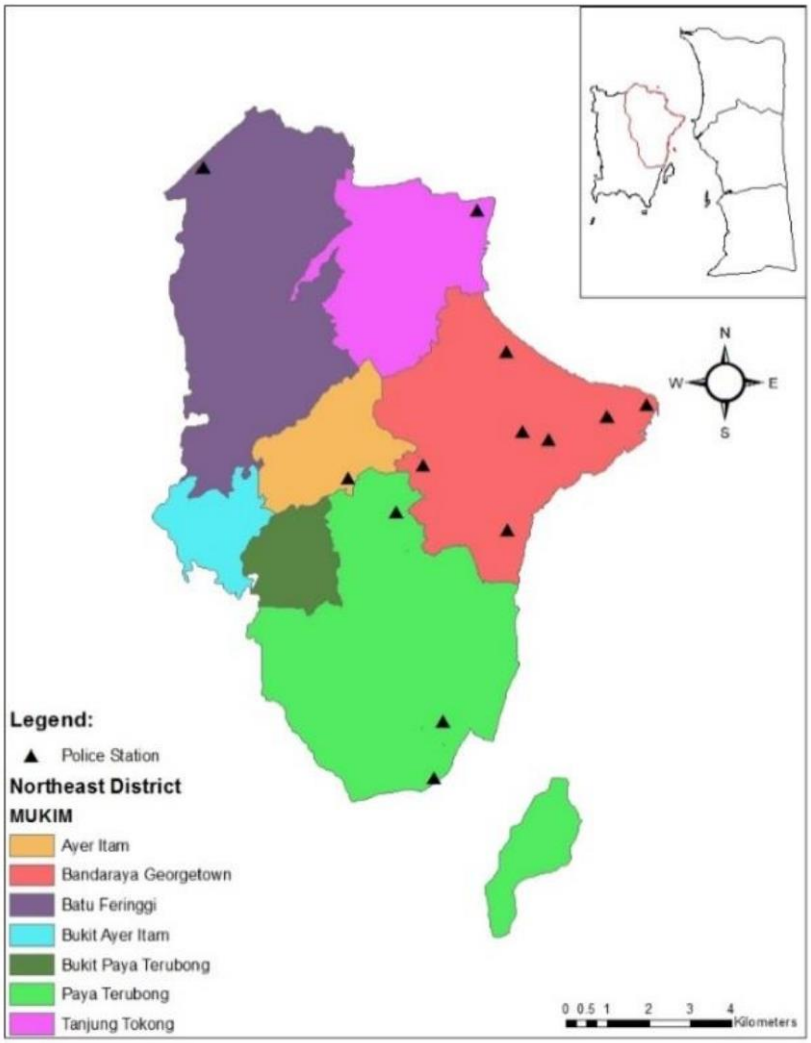

Figure 1. Study Area

The rates of drug abuse cases and home burglary cases were used to conduct OLS regression analysis. The OLS result, which is the Standard Residual values then used to carry out Moran's I analysis to determine the spatial correlation between the two cases.

Ordinary Least Squares (OLS) regression is a global regression method (ESRI, 2018). It allows the data to be modeled, analyzed and explored in spatial relationships to understand spatial factors. The OLS regression analyzes the variables depending on the relationship to a set of independent variables. The continuous relationship between the dependent variable (Y) and the independent variable (X) can be represented using the best straight line, where Y is predicted, at least slightly, by X. If this relationship is linear, it may be best represented using a linear equation 'Y = α + βx' (Figure 2), the relationship between Y and X is α which shows the value of Y when X equals zero (also known as the criterion) and β shows the slope of the line (also known as the regression coefficient). The β regression coefficient describes the change in Y associated with the unit change in X and the confidence interval can be calculated as β ± 1.96 (Hutcheson, 2011).

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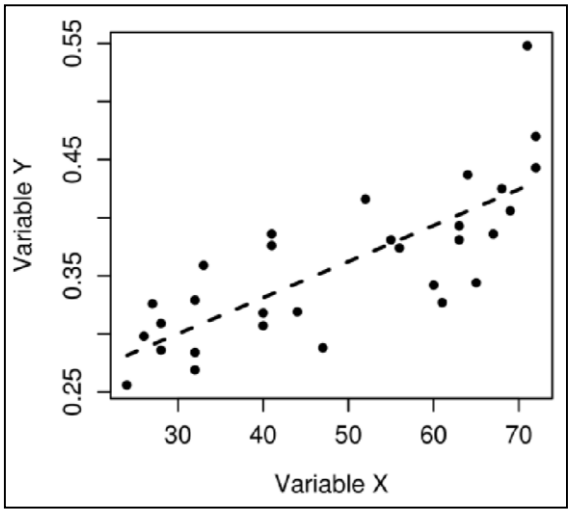

Figure 2. OLS Linear
(**Source:** Hutcheson, 2011)

To determine which model is perfect, some indicators of OLS analysis should be taken into account. A positive coefficient value indicates a positive relationship. A negative coefficient value indicates a relationship between the variable and the dependent variable is negative. However, significant values was showed by "probalility" and "Robust_Prob" values, and the non-significant values indicate that the resulting model is biased. The adjusted value R2 (adj_R^2) indicates how much of the variance in the dependent variable has been explained by the model and the value of R^2 is from 0 to 1.0. Generally, a good R^2 value is rank 0.5 or higher, but the value depends on the modeling studied (White, 2007). The adjusted R^2 value (adj_ R^2) is also used to assess the strength of the model produced. The high adjusted R^2 value (adj_ R^2) describes the independent variable from the dependent variable. Low adjusted R^2 values indicate that the model does not explain the dependent variables as a whole (Choate, 2015).

Statistical values of Jarque-bear determine the randomness of the regression model. Significant Jarque-berth indicates that the regression model is not random, either it was clustered or dispersed. This also indicates that the regression model is "biased". The null hypothesis for this analysis is that it is randomly distributed. If the Jarque-bear statistic values show statistically significant results, then the spatial autocorrelation analysis should be performed to ensure that regression data are random. Significant groupings of statistical values indicate that other variables are missing in the model (ESRI, 2018).

Moran's I method is also used to determine the relationship between variables in the study area. This method measures the spatial autocorrelation developed by Patrick Alfred Pierce Moran. Space autocorrelation is characterized by the relationship location surround the space and more complex than one-dimensional autocorrelation because the spatial relationships are multi-dimensional and diverge (Li et al., 2007).

Table 4. *Moran's I* statistics

Statistic formula	Description
$I = \frac{1}{s^2}\frac{\sum_1\sum_j(y_{i-}\bar{y})(y_{j-}\bar{y})}{\sum_1\sum_j Wij}$	• s^2 is a sample variance • i and j are unit index units • y is the variable value of each specific location • y_i dan y_y are the total min • W_{ij} is the weighting location index for the associated i

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$\bar{y} = \sum_{i=1}^{n} y_j / n$	• $\bar{y}$ is a mean for y • n is the total number of polygon points

(**Source:** Modified from ESRI, 2016)

Autocorrelation analysis can determine the degree of strength of the relationship of each object or polygon with others around the space. It also has a Moran's Index value of I = -1 to +1. If the correlation coefficient value is less than or close to -1 then the scatter pattern is produced. And, if the correlation coefficient value is close to or greater than +1 then the cluster pattern is produced. Whereas if the correlation coefficient value is 0 then it has a random pattern indicating that no spatial autocorrelation is produced (Buyong, 2007).

The statistical significance of Moran's I index method is determined by the z-score and pvalue. The null hypothesis whether rejected or accepted is based on the z-score and p-value, if the p-value shows a statistically significant value of p <0.05 and a positive z-score then the null hypothesis is rejected (ESRI, 2016).

The null hypothesis states that each feature is random and has no autocorrelation with each other. Autocorrelation statistics can determine the significance of the grouping of variables even with the same aggregate polygon. For example, the theft cases and road accidents in the United States in 2002 showed that there was a correlation in high road accidents are recorded in areas with high vehicle theft cases. High group values were recorded in the southern United States while low grouping values were recorded in the northern United States. This significance was further supported by Moran's I value of I = 0.65 (Ratcliffe, 2005).

RESULT AND DISCUSSION

The results of the OLS regression for adolescent drug abuse and home burglary cases in 2013 are shown in Figure 3. The OLS regression values for drug abuse and home burglary cases in 2013 are y = 62.930138-5.342462x, the coefficient value for this regression model is 5.342462x, while the constant value is 62.930138. Intercept values indicate that the relationship between x and y is a positive 62% (Table 5).

Table 5. Result OLS regression of drug abuse and home burglary cases, 2013 to 2015

Year	**2013**	**2014**	**2015**
Intercept	62.930138	61.251086	62.876918
Probability	0.000001*	0.000000*	0.000000*
R-squared (R^2)	0.065899	0.075995	0.094219
Adjusted R-squared (Adj_R^2)	0.042546	0.052894	0.071575
Jarque-bera values	0.000000*	0.000000*	0.000000*

(*) significant values

Significant probability value for this analysis is p <0.01 and the significance of the probability value indicates the significance of the intercept value for this regression. The resulting probability value for 2013 is 0.000001*, explaining that the intercept for 2013 is significant. The OLS regression analysis that year shows that the R-squared (R^2) value is R^2 = 0.065899 (6.5%), while the adjusted R-squared (adj_ R^2) is adj_R^2 = 0.042546 (4.2%). R^2 values indicate that home burglary cases affected 6.5% of drug abuse cases in the study area, while 93.5% are caused or explained by other factors. The statistical significance of Jarquebear statistics for the analysis of drug abuse cases among youth and home burglary cases for 2013 is <0.01.

This shows that the residual standard values are normally distributed and the regression model is biased, while the null hypothesis is that the distribution of cases is normally distributed. So, the null hypothesis is rejected. Based on the OLS regression analysis for 2013, the Jarque-bear statistical value is 0.000000 *, indicates that the model is biased. If the regression model is biased, then the spatial autocorrelation analysis is carried out to determine whether the spatial correlation does not exist or influence the

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regression model. Figure 6 (A) shows the Standard_Residual values for the OLS regression model of drug abuse among youth and home burglary cases in 2013.

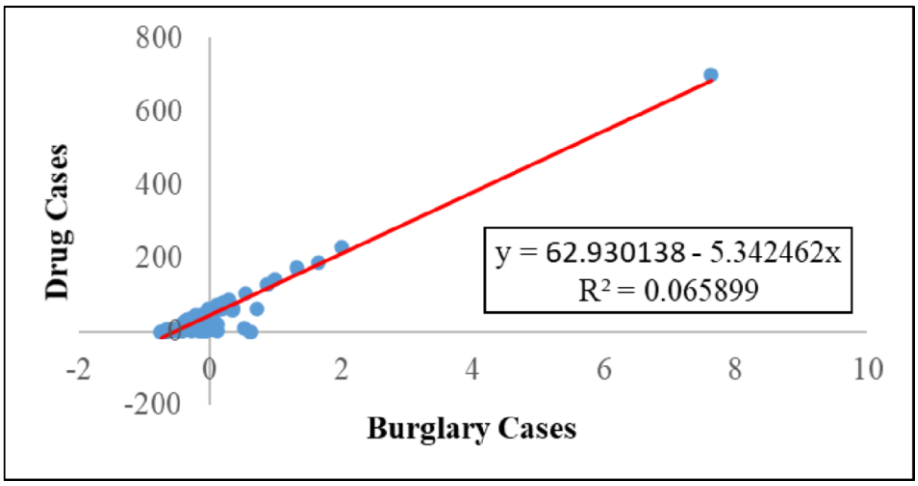

Figure 3. Regression model of drug abuse among youth and home burglary cases in 2013

Figure 4 shows the results of the OLS regression analysis of drug abuse among youth and home burglary cases in 2014. The relationship between independent and dependent variables was y = 61.251086 - 2.715673x. The coefficient for this regression model is -2.715673x, while the constant value is 61.251086. Intercept values showed that the relationship between x and y was a positive 61% (Table 5). Increasing cases of drug abuse among youths have led to an increase in home burglary cases and it showed a positive relationship. The significant probability value of this analysis was p <0.01 and the significance of the probability value indicates the significance of regression coefficient values. The resulting probability value for 2014 is 0.000000 *, explaining that the intercept for 2014 is significant.

Based on the OLS regression analysis, the R-squared (R^2) value is R^2 = 0.075995 (7.5%), while the adjusted R-squared (adj_ R^2) is 0.052894 (5.2%). R^2 values indicate that home burglaries are affected by 7.5% of drug abuse during the year, while 92.5% are caused or explained by other factors. Based on the OLS regression analysis for 2014 showing a significant Jarque-bear statistical value of 0.000000 *, this indicates that the regression model for 2014 is biased too. Figure 6 (B) shows the Standard_Residual values for the OLS regression model of drug abuse among youth and home burglary cases in 2014.

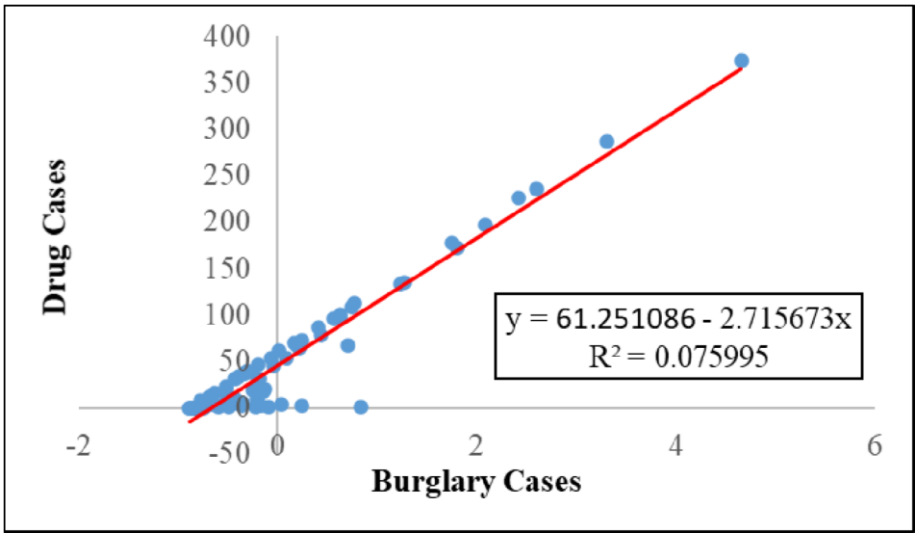

Figure 4. Regression model of drug abuse among youth and home burglary cases in 2014

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Figure 5 shows the results of the Ordinary Least Square (OLS) regression analysis of drug abuse among youth and home burglary cases in 2015. The relationship between independent and dependent variables is y = 62.876918 - 3.599908x, indicating that the coefficient value is -3.599908x, whereas the constant value, 62.876918 shows that the relationship between x and y is positive by 62% (Table 5). Increased cases of drug abuse among youths have led to an increase in cases of home burglary and showed a positive relationship.

The significant probability value of this analysis is p <0.01 and the significance of the probability value indicates the significance of the intercept value. The result of the probability value for 2015 is 0.000000 *, explaining that the intercept for this regression for 2015 is significant. Based on the OLS regression analysis, the R-squared (R^2) value is R 0.0 = 0.094219 which is 9.4%, while the adjusted R-squared (adj_R^2) is adj_R^2 = 0.071575 (7.1%). R^2 values indicate that home burglary cases are affected by 9.4% of drug abuse cases, while 90.6% are caused or explained by other factors. Based on the OLS regression analysis for 2015, the Jarque-bear statistical value is 0.000000 *, this model shows the regression for 2015 is biased. Figure 6 (C) shows the Standard_Residual values for the OLS regression model of drug abuse among youth and home burglary cases in 2015.

Based on the results, there is a gradually increasing pattern of R^2 values from 2013 to 2015. The value of R^2 in 2013 was 6.5% and increased to 7.5% in 2014. While the value of R^2 in 2015 also shows an increase compared to the previous year to 9.4%. This indicates that increasing drug abuse cases in the study area.

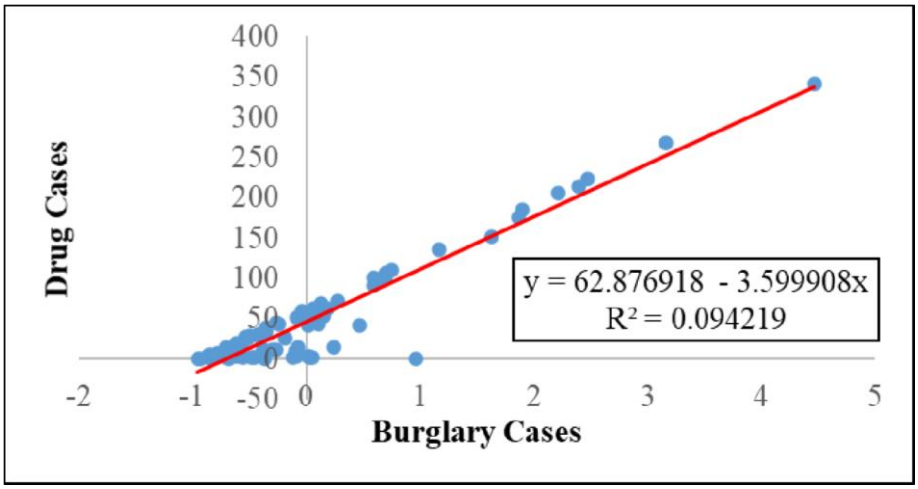

Figure 5. Regression model of drug abuse among youth and home burglary cases in 2015

The OLS regression analysis from 2013 to 2015 shows that areas with high drug abuse cases have also led to increased home burglary cases. This is because drug addicts commit crimes to meet their drug addiction needs (Mohd Reduan Roslie, 1990). Also, most individuals involved in drug abuse commit property crimes such as theft, housebreaking, snatching, robbery, and others. 70% of addicts commit crimes for drug needs and another 4% commit violent crimes (Mohd Sofian Redzuan et al., 2016). The relationship between drug abuse and house-breaking cases is closely linked. The home burglary cases showed a declining pattern of up to 13%. The major factor driving the decreasing crime rate is due to the police have arrested 16,456 drug addicts and drug dealers (Razali and Mohamed Saifuddin, 2018).

According to records, nearly 40% of the prisoner in the country are drug offenders. This proves that there is a disruption to the peace, security, order, and law of the country. Besides, the unity, society development, and country are affected by youth involvement with drugs as these groups are the co-op that will shape the country. If the youths are caught up in drugs, society and the country's economy will soon experience retrogression and chaos (Jamaludin, 2010).

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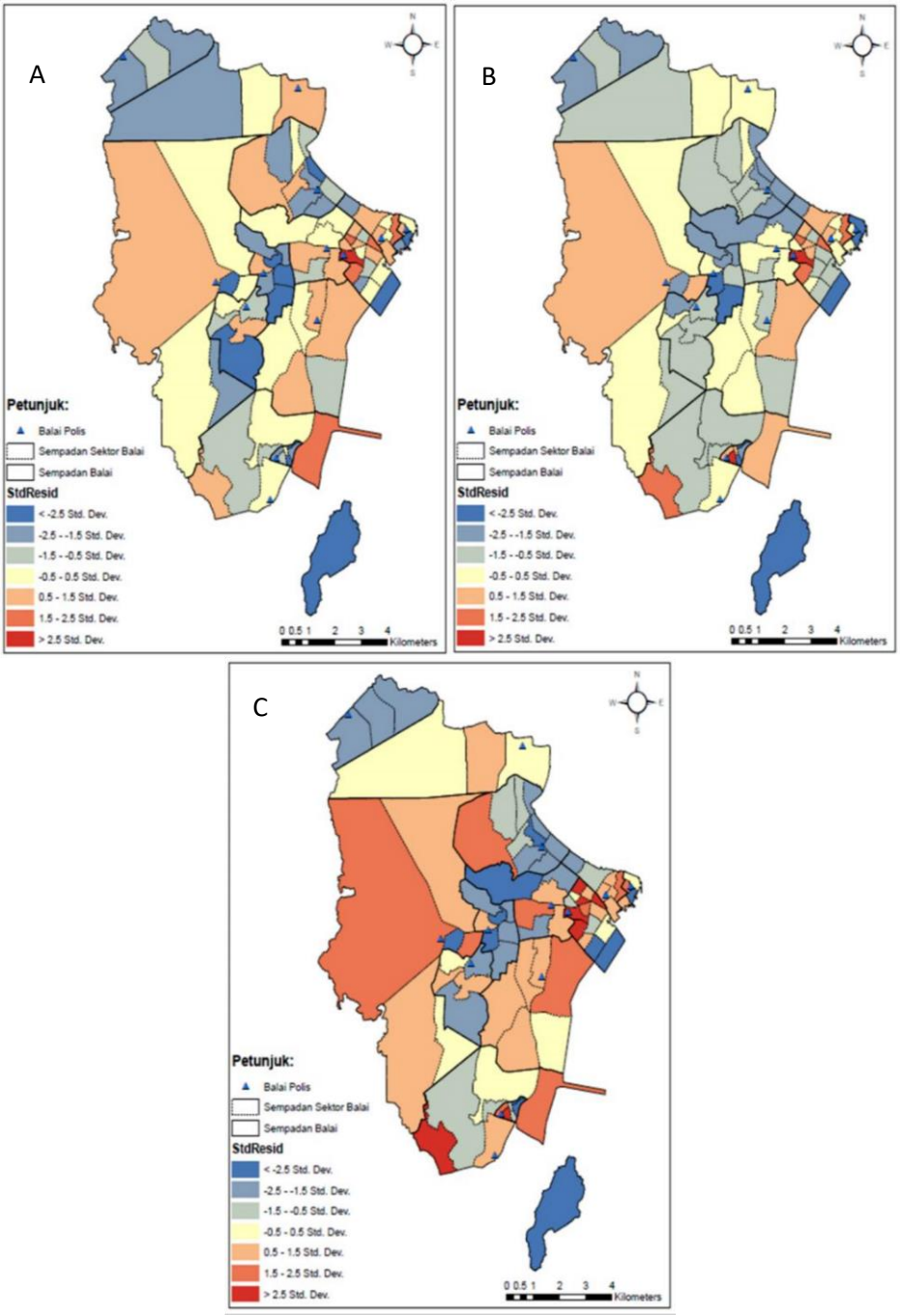

Figure 6. Standard Residual of drug abuse and home burglary cases according to year. A: 2013; B: 2014; C: 2015

Moran's I analysis was performed to determine the correlation of drug abuse cases and home burglary cases based on Standard_Residual values through OLS regression analysis. Table 5 shows the results of the analysis of drug abuse among youth and home burglary cases from 2013 to 2015. Based on the spatial autocorrelation analysis for drug abuse among youth in 2013, Moran's index value was I = 0.091347 and the results of the sample were clustered (Table 5). The results of the Moran index show positive spatial autocorrelation as I value close to +1, indicating an increase in drug abuse cases in line with the increase in the youth

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population. The autocorrelation analysis of that year showed a z-score of 4.253980. The zscore values indicated that the 99% confidence level of the case pattern was clustered. The pvalue of significance at the 99% confidence level was p <0.01.

Moran's I analysis was performed to determine the correlation of drug abuse cases and home burglary cases based on Standard_Residual values through OLS regression analysis. Table 5 shows the results of the analysis of drug abuse among youth and home burglary cases from 2013 to 2015. Based on the spatial autocorrelation analysis for drug abuse among youth in 2013, Moran's index value was I = 0.091347 and the results of the sample were clustered (Table 5). The results of the Moran index show positive spatial autocorrelation as I value close to +1, indicating an increase in drug abuse cases in line with the increase in the youth population. The autocorrelation analysis of that year showed a z-score of 4.253980. The zscore values indicated that the 99% confidence level of the case pattern was clustered. The pvalue of significance at the 99% confidence level was p <0.01.

Table 5. *Moran's I* values for drug abuse and home burglary cases from 2013 to 2015

Year	**2013**	**2014**	**2015**
Moran (*I*) index	0.091347	0.112331	0.105134
z-skor	4.253980	3.990126	3.736486
p-value	0.000021	0.000066	0.000187

Based on the analysis, the p-value obtained was p <0.000021 showed a high significance and clustered pattern (Figure 7). The null hypothesis was a random pattern of drug abuse among youth and home burglary cases while the alternative hypothesis stated that the pattern of drug abuse cases was clustered or dispersed. Based on the z-scores and p–values, clustered patterns were observed. So, the null hypothesis was rejected. This indicated that there is a link between drug abuse among youth and home burglary cases.

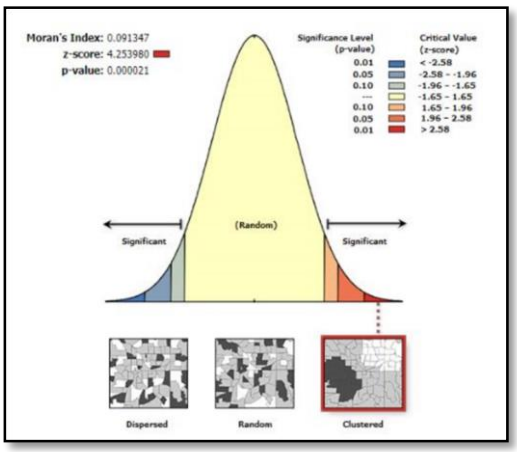

Figure 7. Spatial autocorrelation of drug abuse and home burglary cases in 2013

Based on the spatial autocorrelation analysis for drug abuse among youth in 2014, Moran's index value was I = 0.112331 and the results of the pattern were clustered (Table 5). Moran index showed a positive spatial autocorrelation as I value close to +1, indicating an increase in drug abuse cases in line with the increase in the youth population. The z-score was 3.990126 indicate a 99% confidence level while the p-value was p <0.01. these values indicated a highly significant value and clustered pattern (Figure 8). The null hypothesis indicated that the pattern of drug abuse cases among youths and households was random. Based on the z-scores and p values, the null hypothesis was rejected. This showed that drug abuse among youth and home burglary cases have a spatial correlation.

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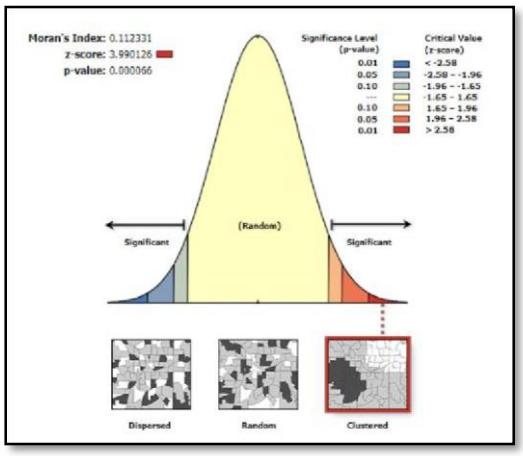

Figure 8. Spatial autocorrelation of drug abuse and home burglary cases in 2014

Based on the spatial autocorrelation analysis for drug abuse among youth in 2015, Moran's index value was I = 0.105134 and the results of the sample were clustered (Table 5). The Moran index showed a positive correlation as I value close to +1, indicating an increase in drug abuse cases in line with the increase in the youth population. The z-score of 3.736486 indicated that the 99% confidence level of the case pattern was clustered, only 1% of the probability of the case pattern was random. The p -value was p <0.01, indicating a high significant value and clustered pattern (Figure 9). The null hypothesis the drug abuse cases among youths and households occurred randomly. Based on the p-value obtained, the null hypothesis was rejected. This showed the relationship between drug abuse among youth and home burglary cases in each sector in the study area showing spatial existence. The close relationship between addicts and criminal activity was probably due to the loss of their ability and self-esteem. The addict committed crimes primarily related to property such as theft, burglary, burglary and other criminal activities in order to obtain money to buy drugs (Mohd Reduan, 1990).

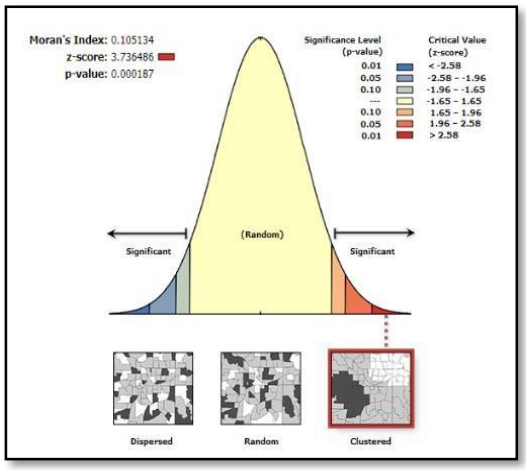

Figure 9. Spatial autocorrelation of drug abuse and home burglary cases in 2015

The drug abuse among youth and home burglary cases from 2013 to 2015 showed a positive correlation with Moran's I index > 1. The spatial correlation also showed a clustered pattern for three consecutive years and was significantly higher for p <0.05. Drug abuse and home burglary cases were closely linked. Drug addicts between the ages of 18 and 49 accounted for 24.7% of

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property crimes, while property crime arrests were mostly drug-positive 68% of male offenders and 63% of female offenders (Craddock et al., 1994). The data on drug abuse and home burglary cases were obtained based on the approval of AADK and PDRM were classified as confidential and related to domestic security. Recent data applications are not approved by the PDRM. As such, the data obtained is only a case study from 2013 to 2015. The Geocoding process is based on the address of the reported incident that needs to be done in the field as well as the address of the incomplete case scenario that needs to be removed from the data. GIS can be used by the PDRM and AADK to conduct crime-related studies to reduce crime index in the country. The use of GIS is one of the enhancements to prevent and prevent crime in the country. Additionally, local authorities are involved in crime prevention and crime reduction strategies.

CONCLUSION

The criminal cases yearly index showed a declining pattern. However, the issue of public fear of criminal cases cannot be ruled out. In addition, involvement in drug abuse cases was often associated with a variety of criminal cases. GIS applications used in analyzing issues related to drug abuse and property crime cases, especially home cases can be prevented and minimized. This is because criminal cases and drug abuse involve elements of location that have not been previously emphasized by researchers. GIS applications can be used more effectively to solve problems related to the location or in the spatial context.

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