Lapai Journal of Applied and Natural Sciences

LAJANS Vol 11(1): 46-56

RESEARCH PAPER

Spatial Analysis and Hotspot Detection of Firearm Data Reported in Abuja, Nigeria

***[1]Abdullahi, U., [1]Musa, Y.M., [1]Adeyemi, R.A., [1]Oguche, S.M., & [2]Abdullahi, I.M.**

[1]*Department of Statistics, Federal University of Technology, Minna, Nigeria*
[2]*National Board for Arabic and Islamic Studies, Niger State Office, Nigeria*

ABSTRACT

The increased availability of crime data in the Federal Capital Territory (FCT), Abuja, has made firearms a major topic of debate and research. Improving the understanding of the factors that contribute to gun violence in Abuja is critical to law enforcement to abate violent crime. This study conducted a spatial analysis of firearm and crime management and other pertinent factors reported cases across FCT, Abuja, from 2020 to 2024. Applying data sourced from the Nigeria Police Force Headquarters, FCT command Abuja, the National Bureau of Statistics (NBS), and reports from Non-Governmental Organizations (NGOs), the study examined the presence of spatial autocorrelation, determine whether firearm occurrences were statistically dependent on their geographic location, and detected statistically significant clusters of illegal firearm possession and recoveries over time using hotspot mapping methods. The result showed that FCT has an average of 2.80 firearm possession per theft involving a firearm. The result also revealed that firearm recoveries are close to where they were illegally possessed. Locally Made Guns (LMGs) were illegally possessed more than any other type of firearm and were more commonly used in the commission of crime in FCT. Furthermore, results from hotspot analyses of crime over time revealed that crime clustering varies dramatically from year to year. This research recommended that crime cases should be recorded in detail alongside geographical coordinates of the crime incidence spot so as to allow hotspot analysis at the spot level rather than the street level.

Keywords: Firearm, Spatial Analysis, Crime, Hotspot

INTRODUCTION

Firearm Act Laws of the Federal Republic of Nigeria (1990) defined a firearm to mean “any lethal barreled weapon of any form through which any shot, bullet, or other missile can be discharged. Crime has been a challenge to humanity across the world. Countries have struggled to tame the rising incidence of homicide, armed robbery, Kidnapping, drug trafficking, sex trafficking, illegal gun running, and other forms of crime. A criminal having a weapon means the unlawful acquisition of a weapon by an individual. Many nations, both past and present, have place restriction on what forms of weaponry citizens are allowed to purchase, own, and carry in public. These types of crimes are public order crimes and are termed as mala prohibita, in that the possession of a weapon in and of itself is not evil; the intent for use in acts of unlawful activities, such as violent crimes, creates a perceived need to regulate them (David, 2014).

One of the sophisticated technologies employed in the analysis of firearms and crime management in the advanced world is the use of Geographic Information Systems (GIS) in the generation of crime information and ultimately a decision support system (Katamalundu, 2004). Unfortunately, in Africa, especially in Nigeria, the use of GIS as a tool for the police in crime control and management is very rare (Adejumobi et al., 2009).

Until recent time most applications of GIS have been concentrated on studies like site selection,

Received 3 February, 2026
Accepted 30 March, 2026
Address Correspondence to: u.abdullahi@futminna.edu.ng; Tel. +234 7061645509

cadastral, and infrastructure management rather than criminal investigations. The past studies include the work of Alamu and Ejiobih (2002); Kufoniyi (2002); and Akintoye and Oguntimehin (2002). Crime analysis in the past has been through the use of hardcopy maps or an analogue method.

Balogun, (2014) studied crime mapping in Nigeria using the Geographical Information System (GIS). The study used the application and utilization of GIS in crime management and in security situations for effective and efficient community policing in Nigeria, using Benin has his case study. The study revealed that the position of the police station with reference to public reach is very bad hence, citizen tend not to report most of the crime incidents.

Ayuba, (2016) studied Geo-Spatial Analysis of Crime in Kaduna. The study found that the occurrence of crime does not have a particular pattern in the landscape. It is clustered in some places and dispersed in other places. Okeke, (2018) worked on identifying and mapping the spatial distribution of different categories of crimes in Abuja, the federal capital city of Nigeria in 2017. The study used five spatially-geo-statistical models (Akaike's Information Criterion, Jarque Bera Koenker Statistics, Max Variance Inflation Factor and Global Moran's I) were used to model crime incidences and determine the significant of each crime type,.

Although spatial analysis on firearm and crime management plays a crucial role in crime research, studies conducted in Nigeria have predominantly concentrated on specific regions. Although these studies provide insight into crime patterns in local areas, they do not encompass the wider context needed to understand the overall spread of firearms and the crime situation in a state or country. The high rate of crime in the Federal Capital Territory FCT), Abuja, has made firearms a major topic of debate and research. The lack of understanding in this area hinders the progress of creating comprehensive prevention measures that effectively tackle the gun violence trends throughout the entire FCT.

In an attempt to tackle this gap, this study investigated the background of spatial analysis of firearm and crime management and other pertinent factors reported cases across FCT, Abuja. The objectives are to establish the spatial distributions of firearms in FCT, examine the presence of spatial autocorrelation, determine whether firearm occurrences are statistically dependent on their geographic location, and finally, to identify statistically significant clusters of illegal firearm possession and recoveries over time.

METHODOLOGY

Study area

The Federal Capital Territory (FCT) in Abuja is located in North Central Nigeria. It lies between latitude 8° 25′ 00″ N and 9°25′ 0″N and longitude 6°45′0″E and 7° 45′ 0″ E. It shears the boundary with the following state. Niger State in the West and North, Kaduna State to the North East, Nasarawa State to the East and South, and Kogi State to the Southwest. The FCT is made up of six local councils comprising the city of Abuja and five local government areas, namely Abaji, Kuje, Bwari, Gwagwalada, and Kwali, as shown in Figure 1.

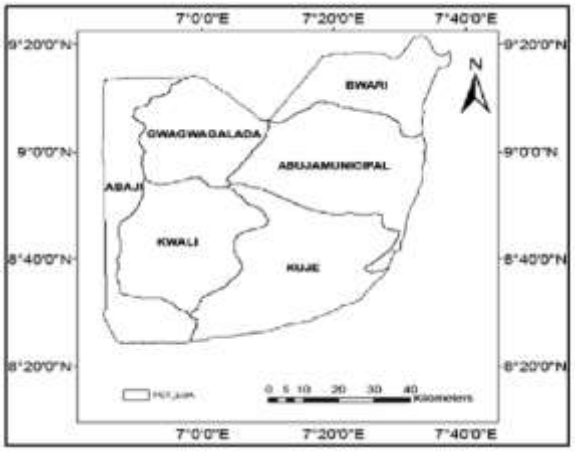

Figure 1: Map of Federal Capital Territory Showing Local Councils (National Space Research and Development, 2019)

While the capital city covers about 250 km^2, the entire FCT area has a landmass of approximately 8000 km^2 and is situated in the savannah region with moderate climatic conditions (FCTA, 2019). This study will cover all six local councils.

Data Used

Data were derived from a unique database on crimes developed by the Nigeria Police Force Defense Headquarters, Abuja, and from the National Space Research and Development Agency (NASRDA). All statistical data was initially arranged in Microsoft Excel and then imported into ArcGIS 10.4.0 software from the Environmental Systems Research Institute (ESRI).

Data Source

The data used in this study were collected from the Nigeria Police Force Headquarters, FCT Command, Abuja; the National Bureau of Statistics (NBS); and reports from Non-Governmental Organizations (NGOs). The data covered the period from 1st January 2020 to 31st December 2024.

However, this study is subject to limitations inherent in crime data analysis. The accuracy and completeness of data can be affected by reporting biases and limitations in data collection methods.

Reconnaissance Survey

To minimize underreporting and spatial bias, a field reconnaissance survey of the study area was carried out. The aim of this was to obtain detailed information on firearms illegally possessed and recovered with crime records, and also identify all the police area commands in the Federal Capital Territory. This survey has also provided names and numbers of various police stations under each area command in the study area. This information was used to draw the crime map of the study area under every police command in the FCT.

Data Needed

The data needed for this research is depicted in Table 1

Table 1: Data needed

Needed	Description
Firearm possessed	All firearms possessed by individuals in the FCT
Firearms possessed illegally	All firearms possessed without a license
Stolen firearms	All firearms stolen in the FCT
Stolen recovered	All firearms stolen in the FCT that were recovered
Recovered firearm	All firearms recovered in the FCT, regardless of theft
Recovered stolen	All firearms recovered in the FCT that were originally stolen
All gun-related crimes	All crimes involving a firearm in the FCT
Violent crime	All homicides, assaults, robberies, and rape in FCT
Property crimes	All theft and vandalism in the FCT
Drug-related crimes	All crimes involving any type of drug in FCT

Source: Author's work, 2025

Data Analysis

To describe the state of illegal firearm possession in the FCT, tables, figures, and spatial maps were generated from the collected data. ArcGIS was used to calculate the values within the tables, figures, and maps. Subsequently, hot spot analysis was conducted on the prepared data; three maps were created using the cluster and outlier analysis tool. Each map depicts firearm possession normalized by a different variable: Property crime, all crime, and population. This shows the area of clustering and the type of clustering: High-High, High-Low, Low-High, Low-Low, and Not Significant.

Data Normalization

In ArcGIS, normalization analysis is used to scale data either by raster pixel values or vector attribute fields to a common range, typically 0 to 1. In this study, a raster normalization dataset was used to adjust the values based on the minimum and maximum values within that raster given by:

$$\text{Normalized Raster} = \frac{\text{Raster}-\text{Min}}{\text{Max}-\text{Min}} \qquad (1)$$

Spatial Autocorrelation Techniques

This study examined whether the spatial distribution of firearm crime in FCT showed clustering, dispersal, or randomness during 2020-2024 using Moran's Index, Geary's C, and Anselin Moran's Index statistic. Along with their corresponding z-scores and p-values, were tested to show the significance of the spatial distribution of clustering, dispersal, or randomness. We assumed that the crime locations were randomly distributed across the area councils.

The spatial weight matrix is a key quantity in the computation of many spatial indices like Moran's I, Geary's C, Getis-Ord statistics, and Join Count Statistics. The concept of a spatial weight is used to describe neighbour relations between area councils on a map. If crime location m is a neighbour of crime location n, then $w_{mn} \neq 0$ otherwise $w_{mn} = 0$. Usually (though not always), we do not consider an area council to be a neighbour of itself so $w_{mm}= 0$. These coefficients are encoded in the spatial weight matrix given by:

$$w = \begin{pmatrix} w_{11} & w_{12} & \cdots & w_{1P} \\ w_{21} & w_{22} & \cdots & w_{2P} \\ \vdots & \vdots & \vdots & \vdots \\ w_{P1} & w_{P2} & \cdots & w_{PP} \end{pmatrix} \quad (2)$$

where P is the number of area councils under consideration.

Moran's I

Moran's I, is the basic extension of global indices of local autocorrelation. The similarity between area units m and n is defined as the product of the respective difference between y_i and y_j with the overall mean divided by the sample variance as:

$$I = \frac{k}{S_0} \cdot \frac{\sum_{m=1}^{k} \sum_{n=1}^{k} w_{mn}(y_m)(y_n)}{\sum_{i=1}^{n} (y_m)^2} \quad (3)$$

where $y_{(m)}$ represents the deviation of a feature's attribute from the mean, w_{mn}, denotes the spatial weight between features m and n, k stands for the total number of features, and S_0 signifies the sum of all spatial weights.

The value of Moran's I varies in the interval [-1, 1]. We can interpret the value as similar to Moran's I, which will be positive, and when the neighbouring regions have dissimilar values, then Moran's I will be negative.

Geary's C

Geary's C statistic (Geary 1954) is based on the deviations in responses of each observation from one another. We can calculate Geary's C value as:

$$C = \frac{k-1}{2S_0} \cdot \frac{\sum_{m=1}^{k} \sum_{n=1}^{k} w_{mn}(y_m - y_n)^2}{\sum_{i=1}^{n} (y_m)^2} \quad (4)$$

where y_m, w_{mn}, m, n, k and S_0 follow the same definition in Equation (3).

The value of Geary's C lies in the range [0, 2]. The value of 1 means there is no spatial autocorrelation. Values less than 1 indicate there is increasing positive spatial autocorrelation, and values higher than 1 illustrate increasing negative spatial autocorrelation. There is an inverse relationship between Geary's C and Moran's I, but they are not identical.

Moran's I, is a more global measurement and more sensitive to extreme values of y, while Geary's C is more sensitive to local spatial autocorrelation. They both are asymptotically normally distributed as n increases (Cliff and Ord, 1981). In general, Moran's I and Geary's C result in the same conclusion regarding spatial autocorrelation; however, Moran's I is more powerful than Geary's C (Cliff and Ord, 1981; Cliff and Ord, 1975).

Anselinl moran's I

Anselin's local Moran's I statistic of spatial autocorrelation is calculated as

$$I_m = \frac{y_m}{s^2{}_m} \sum_{n=1, n\neq m}^{k} w_{mn}(y_n) \quad (5)$$

where y_m and $\bar{y}$ are the attribute of the feature m and the mean of the corresponding attribute respectively. w_{mn} is weight matrix.

$$s^2{}_m = \frac{\sum_{n=1, n\neq m}^{k} (y_n)^2}{k-1} \quad (6)$$

$$\text{and } Z_{I_m} = \frac{I_m - E[I_m]}{\sqrt{V[I_m]}} \quad (7)$$

where

$$E[I_m] = -\frac{\sum_{n=1,n\neq m}^{k} w_{mn}}{k-1} \quad (8)$$

$$V[I_i] = E\left[{I_m}^2\right] - E[I_m]^2 \quad .. \quad (9)$$

Hotspot analysis

This study applied the Getis-Ord G_m statistic to pinpoint statistically significant locations with concentrated high values (hotspots) and low values (cold spots) of firearm-reported cases in 2024 across the study area. The z-scores and corresponding p-values determined the statistical significance of these clusters. High G_m values identified hot spots, while low G_m values indicated cold spots. The mathematical formula for Getis-Ord G_m is given by:

$$G_m = \frac{\sum_{n=1}^{k} w_{mn}x_n - \bar{X}\sum_n w_{mn}}{s\sqrt{\frac{k\sum_{n=1}^{k} w^2 mn - (\sum_{n=1}^{k} w^2 mn)^2}{n-1}}} \quad (10)$$

where x_n represents the attribute value of feature n, w_{mn} signifies the spatial weight between features m and n and k represents the total number of features.

RESULTS

Descriptive Statistics

Table 2: Descriptive data for illegal firearm possession, 2020- 2024

Measure	Value
Illegal firearm possession	747
Thefts involving a firearm	267
Average number of firearms illegally used per theft	2.80
Average value of an illegally possessed firearm	*#34,990,000.00*
Total firearms illegally possessed and recovered	*514 (68.80%)*

Between January 1st 2020, and December 31st 2024, there were a total of 747 firearms illegally possessed and reported to the FCT command (Table 2). On average, more than two firearms were used per theft reported. Finally, more than half of the firearms illegally possessed and reported to the Nigerian police were recovered.

Spatial Distribution of Illegal Firearm Possession in FCT

Table 3: Illegal firearm possession in FCT, by Local Council, 2020 to 2024

Local Council Area	Total firearms illegally possessed	Percentage (%)
Abaji	67	8.97
Abuja Municipal	254	34.00
Bwari	149	19.95
Gwagwalada	89	11.91
Kuje	127	17.00
Kwali	61	8.17
Total	**747**	**100**

Table 3 shows the percentages of illegal firearms possession in FCT, Abuja Municipal, having the highest possession of 34.0% illegal firearms. Next to the highest is Bwari with 19.9% illegal firearms, followed by Kuje, having 17.0% illegal firearms possession. While Gwagwalada, Abaji, and Kwali having 11.9%, 8.97%, and 8.17 % illegal firearms possessions respectively.

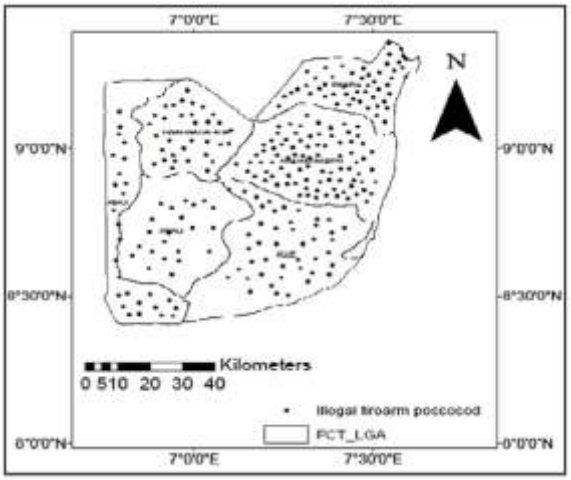

Figure 2: Illegal firearm possession in FCT 2020 to 2024.

Illegal firearms possession was shown in two ways by point data in Figure 2 and by choropleth Figure 3. Figure 2 shows the actual location of illegal firearm possession and does not account for the number of firearms used per theft. A visual analysis reveals that illegal firearm possession occurred across the entire FCT.

Figure 3 shows the total number of illegally possessed firearms in a choropleth. This map shows that firearm is a bigger issue in the Abuja

Municipal Area Council of the FCT, with probability (78% to 91%).

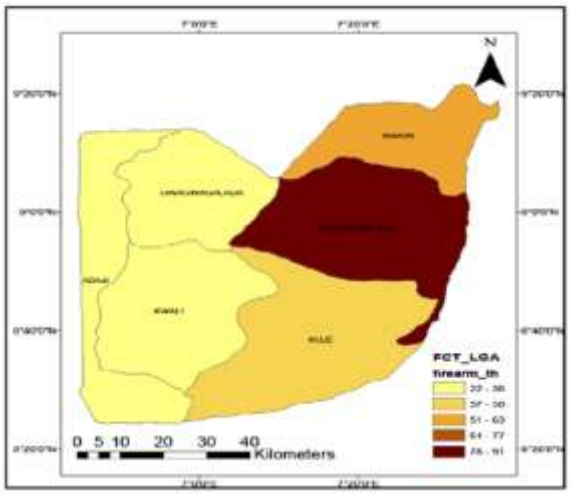

Figure 3: Spatial map of all illegal possession in FCT from 2020 to 2024.

In spatial crime mapping, the regions with probabilities above 80% are considered as high-risk regions (Weisburd, 2021).

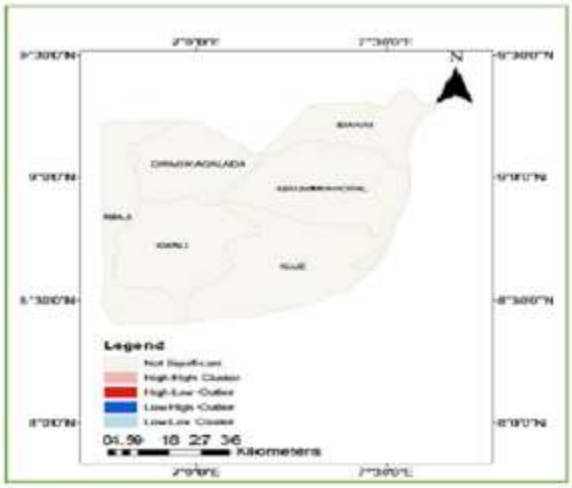

Figure 4: Cluster analysis of illegal firearm possession normalized by all crimes in FCT 2020 to 2024.

Figure 4 shows the level of significant clustering of illegal firearm possession compared to all crimes across the FCT. This map suggests that illegal firearm possession has no significance compared to all crimes committed in the FCT. The analysis did not reveal anywhere with low-low or high-high clustering.

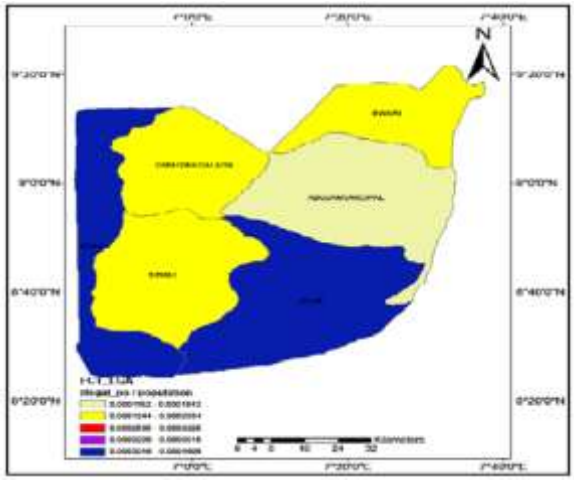

Figure 5: Cluster analysis of illegal firearm possession normalized by population.

Figure 5 displays the relationship between illegal firearm possession and population. Once again, the Abuja municipal area council is shown as a significant area
while illegal firearm possession is generally low as compared with the population in Abaji and Kwali local Councils.

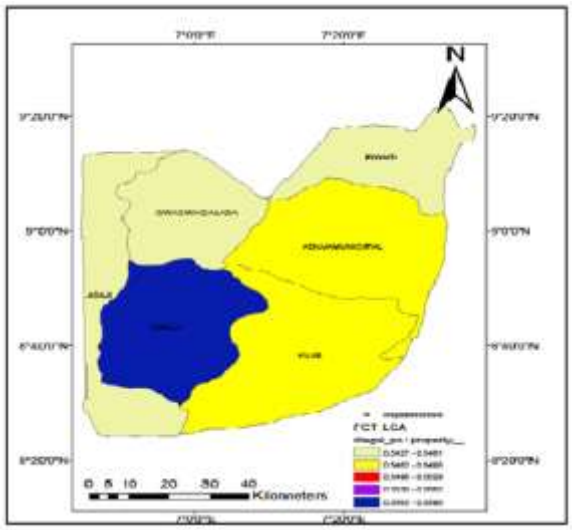

Figure 6: Cluster analysis of illegal firearm possession normalized by property crimes.

Figure 6 displays areas of illegal firearm possession compared with property crimes. Illegal firearm and property crime clustering, unlike the previous two maps, Kwali local council shows low-low clustering, while Abuja municipal and Kuje show high-high.

Table 4: Crimes involving firearm by type of crimes between 2020 and 2024

Types of crime	Total firearms illegally possessed	Percentage (%)
Residence	163	61%
Business	50	18.7%
Automobile	47	17.6%
Storage	4	1.6%
Personal Assault	3	1.1%
Total	**267**	**100**

Table 4 shows the percentages of crimes involved firearm by type of crime. 61% of firearms illegally possessed were involved in residential crime. Followed by business crime, with 18.7% and 17.6% were involved in automobile crime. While 1.6% and 1.1% of illegally possessed firearms were involved in storage and personal assault types of crime

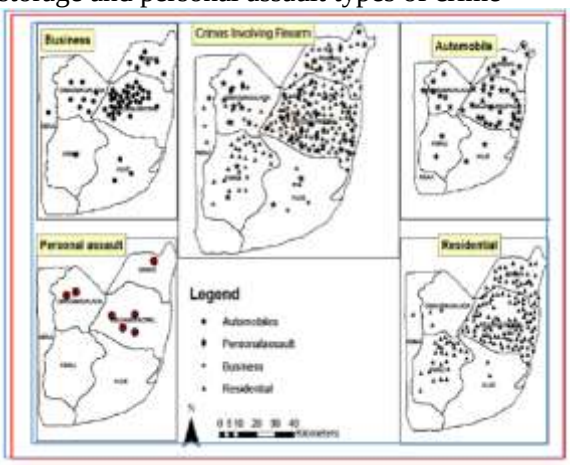

Figure 7: Firearm crimes in FCT by types of crime, 2020 to 2024.

Figure 7 shows the map of firearm crimes in FCT by types of crime. Residential crimes are the single greatest crime involving a firearm. The majority of the remaining firearm crimes were from businesses, personal assaults, and automobiles. It should be noted that, in this study, when a firearm was used to steal a car, the theft was considered an automobile even though, in many cases, the automobile was located in a residential area and sometimes in a driveway. This suggests that firearm crimes occur across the entire FCT. Both residential and automobile crimes have no obvious spatial pattern.

Table 5: Illegal Firearm Possession by Types of Firearm, 2020 – 2024

Types of gun	Total firearms illegally possessed	Percentage (%)
Locally made Gun	611	81.76
English Pistol	54	7.2
AK 47	45	6
Rifle	37	5.04
Total	**747**	**100**

Table 5 shows the percentages of crimes involved firearm by type of firearm. Locally made guns are by far the largest type of firearm illegally possessed, with 81.76%. While English pistols, AK47, and rifles with 7.2%, 6.0%, and 5.04% were respectively types of firearms illegally possessed

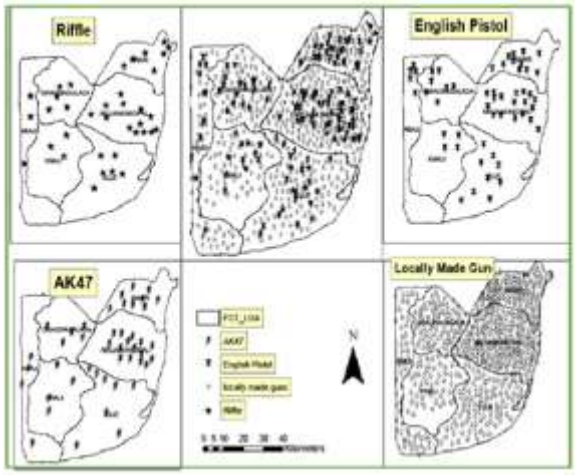

Figure 8: Illegal firearm possessed by types of firearms 2020 to 2024.

Figure 8 shows the map of illegal firearms possessed by type of firearm. The map, however, does not suggest that firearm thefts by type of firearm follow any immediately discernible spatial pattern. Close inspection suggests that locally made guns are more clustered in the central area. This is most likely as a result of the large number of locally made guns present in the densely populated Abuja Municipal Area Council.

Spatial autocorrelation of illegal firearm possession and recoveries over time

Table 6: Results of Spatial autocorrelation analyses

Year	Moran's Index	Geary's C statistic	Anselin Moran's Index	Z –Score for Moran's Index	P-value for Moran's Index
2020	0.0144	1.6942	0.0107	1.2822	0.1408
2021	0.0147	1.6950	0.0110	1.3874	0.1229
2022	0.0239	1.7454	0.0202	1.5041	0.0443
2023	0.0251	1.7669	0.0214	1.5886	0.0288
2024	0.0255	1.7921	0.0218	1.6117	0.0252

Table 6 presents the results of spatial autocorrelation analysis for illegal firearm possession and recoveries in FCT from 2020 to 2024. The three indices reveal a modest but interesting pattern: while the values remain low throughout the period, indicating weak spatial clustering, there is a subtle yet consistent increase in all three techniques. For instance, Moran's Index values from (0.0144 in 2020 to 0.0255 in 2024) and Geary's C statistic values from (1.6942 in 2020 to 1.7921 in 2024). While the Anselin Moran's Index values from (0.0107 in 2020 to 0.0218 in 2024). These results suggest a potential strengthening of spatial dependence among illegal firearm possession and recovery cases over the five years.

The analysis reveals a serious shift in 2022, 2023, and 2024. The Moran's Index values in 2020 and 2021 remained statistically insignificant (p-values > 0.10), meaning that the observed spatial patterns could be random, the 2022, 2023 and 2024 values crossed the threshold of statistical significance (p-value < 0.05). This gives a vital turning point, indicating a statistically relevant clustering of illegal firearm possession and recovery cases in 2022, 2023 and 2024. This spatial dependence suggests underlying geographical factors likely influence the distribution of these events, necessitating further investigation into the role of socio-economic disparities, population density variations, or even the presence of organized crime networks in specific area councils.

Hotspot Results

In order to identify statistically significant clusters of illegal firearm possession and recoveries over time, violent crime, and property crime patterns were mapped in addition to illegal firearm possession and recoveries for each year during the study period.

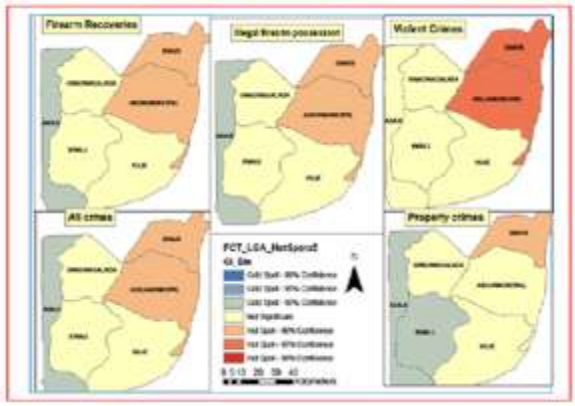

Figure 9: Hot and cold spot analysis of crimes in FCT 2020

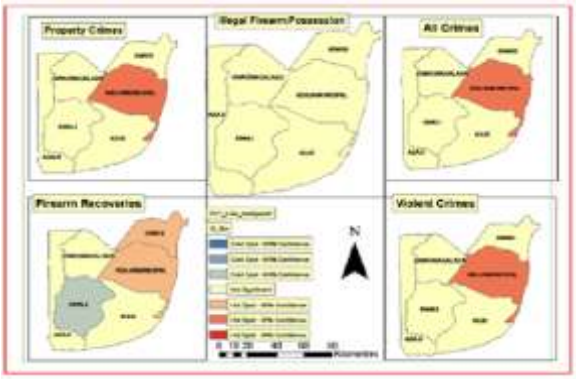

Figure 10: Hot and cold spot analysis of crimes in FCT 2021

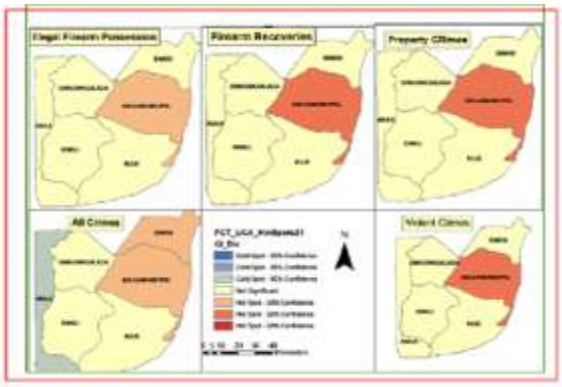

Figure 11: Hot and cold spot analysis of crimes in FCT 2022

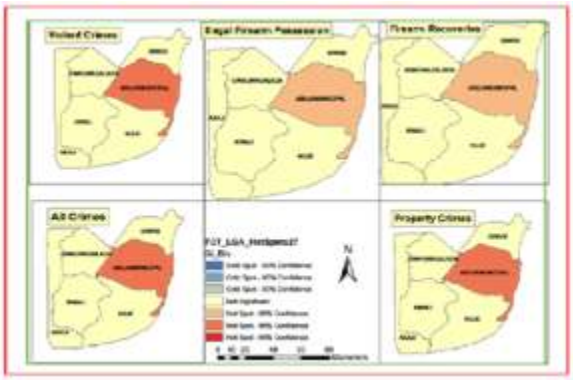

Figure 12: Hot and cold spot analysis of crimes in FCT 2023

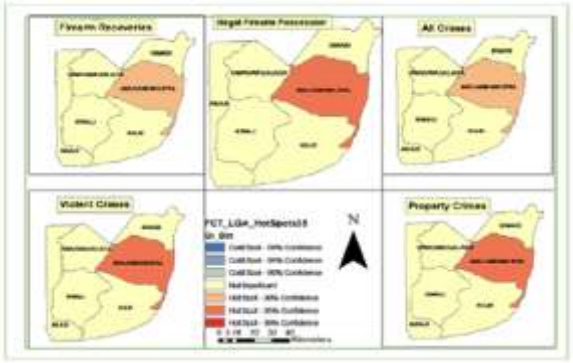

Figure 13: Hot and cold spot analysis of crimes in FCT 2024

The maps for illegal firearm possession and recoveries for each year during the study period are given in Figures 9, 10, 11, 12, and 13. These maps show the results of hot spot and cold spot analysis. It is significant that all crimes, including violent and property crime, predominantly occurred in Abuja Municipal Area Council in each year. Abaji local council either exhibited insignificant levels of crime or, in many cases, is shown as a Cold Spot, which signifies that an area has lower crime levels. These findings are consistent with other research discussed in (Okeke et al., 2018)

DISCUSSION

This study is subject to limitations inherent in crime data analysis. The accuracy and completeness of data can be affected by reporting biases and limitations in data collection methods. While the study areas on firearms, additional manifestations of crime might transpire within the same area council. As a result, forthcoming investigations must encompass various aspects of crime within FCT. This should involve examining the networks of offenders, the social and economic determinants that contribute to criminal behavior, and the efficacy of current preventive measures.

Crime involving firearms has a large amount of variation in spatial patterns from year to year. These large discrepancies from year to year can most likely be explained by one of the following reasons. First, the use of firearms for crime in FCT occurs far less often when compared to other crime types, because carrying guns is not legalized in Nigeria, so crimes involving firearms are very much an opportunistic crime; the opportunities to commit the crime come far less often. Furthermore, because of the infrequency of opportunities to obtain a firearm and concealing it till operation is difficult. Another possible explanation suggests that criminals change their target territories over time. For this reason, criminals may target an area for a limited period of time before moving on to another area so as to avoid arrest.

However, firearm recoveries occur mostly in Abuja Municipal and Bwari local council. These areas are densely populated as a result of satellite towns like Mararaba and Nyanya in Nasarawa state and Zuba, Suleja in Niger state, respectively. These areas have a greater prevalence of firearms and higher levels of other crime types, suggesting a greater concentration of criminals. Finally, results from mapping Abaji and, to some extent, Kwali local council with socio-economic data show that this area is less

economically stable and sparsely populated, maintaining lower levels of crime or having cold spots. This finding is also consistent with the research of Ayuba (2016).

Finally, the hot spot analysis reveals a concerning pattern of firearms and crime concentrated in a particular area council of the FCT, Abuja, thereby informing significant insights into the spatial distribution of firearms crimes in Abuja.

Contributions to Knowledge

The study revealed that FCT has an average of 2.80 firearm possession per theft involving a firearm. The spatial map of all illegal firearms possession showed that the Abuja Municipal Area Council is considered a high-risk area council with a probability value range from (78% to 91%). Locally Made Guns (LMGs) were illegally possessed more than any other type of firearm and were more used in the commission of crime in FCT, with 81.76%. Furthermore, results from hotspot analysis of crimes over time revealed that the clustering of crime changes dramatically from year to year as a result of changes in policy.

The implication of these results is that the study has resulted in an improved understanding of the geography of firearm possession and recoveries and their relation with other crimes in FCT. Law enforcement agencies may employ this information to efficiently allocate resources, establish investigation priorities, and formulate focused prevention strategies to help abate illegal possession of firearms and thereby reduce crime. This research has also set an example of how to collaborate with the police to collect and analyse data.

CONCLUSION

The use of spatial analysis in firearm and crime management in FCT has been applied. With the right conditions and cooperation from relevant authorities, spatial analysis can be used to solve problems by mapping and analyzing crimes and firearm possession with the intent to revealed the factors leading to such crimes and how they can be effectively managed. With spatial analysis, police and other law enforcement agencies can create maps that show scenes of crime. This could be used to forecast and map out strategies for combating crime.

The research therefore recommended that spatial and GIS methodologies should be integrated in fighting crime, as this will enable the creation of a geo database to reduce ineffectiveness and create automated police field operations, and increase the effectiveness of crime fighting generally.

Crime cases should be recorded in detail alongside the geographical coordinates of the crime incidence spot so as to allow hot spot analysis at the spot level rather than the street level. Finally, more police formations should be created in the Abuja Municipal Area Council and the Bwari Area Council.

ACKNOWLEDGEMENT

The authors of this study acknowledged the Nigeria Police Force, the Defense Headquarters, FCT Command Abuja, and the National Space Research and Development Agency (NASRDA).

REFERENCES

Adejumobi, A., Ilesanmi, F., & Akinwale, T. (2009). Application of geographic information systems in crime mapping in Nigeria. Journal of Environmental Management and Safety, 3(1), 45–56.

Akintoye, A., & Oguntimehin, Y. (2002). Applications of geographic information systems in urban planning and infrastructure management in Nigeria. Journal of Environmental Planning and Management, 45(3), 321–335.

Alamu, J., & Ejiobih, C. (2002). The role of geospatial technology in urban development planning in Nigeria. Journal of Geographic Information Science, 6(2), 101–110.

Arinze, I., & Simon, E. (2016). Illegal guns flooding Nigeria and fueling violence. Daily Trust. http://www.dailytrust.com

Ayuba, B., Mugu, B. A., Tanko, H., & Bulus, S. J. (2016). Geo-spatial analysis of crime in Kaduna metropolis, Nigeria. Science World Journal, 11(4), 1–8.

Balogun, O. (2014). Crime mapping in Nigeria using geographic information systems (GIS). International Journal of Criminology and Sociological Theory, 7(1), 1201–1212.

Chizindu, C., & Mpi, E. (2019). Firearm Act laws of the Federal Republic of Nigeria. Legal Press.

Cliff, A. D., & Ord, J. K. (1975). The choice of a test for spatial autocorrelation. In A. D. Cliff & J. K. Ord (Eds.), Spatial analysis of spatial data (pp. 54–77). Pion.

Cliff, A. D., & Ord, J. K. (1981). Spatial processes: Models and applications. Pion.

David, G. (2014). Using GIS to assess firearm theft, recovery, and crime in Nebraska. University of Nebraska Digital Commons. http://digitalcommons.unl.edu/geography/22

Eck, J. E. (2002). Preventing crime at places. In L. Sherman, D. Farrington, B. Welsh, & D. MacKenzie (Eds.), Evidence-based crime prevention. Routledge.

Federal Capital Development Authority. (2019). The history and geography of Abuja. https://fcda.gov.ng/the-history-of-abuja

Firearms Act. (1990). Laws of the Federal Republic of Nigeria, Chapter 146. Government Printer.

Geary, R. C. (1954). The contiguity ratio and statistical mapping. The Incorporated Statistician, 5(3), 115–145.

Grubesic, T. H. (2006). The application of fuzzy clustering for crime hot-spot detection. Journal of Quantitative Criminology, 22(1), 77–105.

Hull, R., Evans, J., & Davis, S. (2016). Money laundering and Nigeria. Niger Delta Peace and Security Strategy Working Paper.

Katamalundu, B. (2004). Geographic information systems in crime analysis and policing strategies. Journal of Crime Mapping Studies, 2(1), 15–28.

Kennedy, E., & Leslie, W. K. (2004). Using dasymetric mapping for spatially aggregated crime data. Journal of Quantitative Criminology, 20(3), 243–262.

Kufoniyi, O. (2002). Basic concepts of geographic information systems. Surveying and Geoinformatics Journal, 5(1), 1–10.

Okeke, O. J., Nwaogu, C., & Adebayo, A. D. (2018). Identification and spatial mapping of various crimes in FCT-Abuja, Nigeria. ResearchGate. https://www.researchgate.net/publication/331473597

Olarewaju, O. (2019). How Abuja is fast becoming a capital of crime and criminality. News Digest.

Onuoha, G. (2006). Contextualizing the proliferation of small arms and light weapons in Nigeria's Niger Delta. African Security Review, 15(2), 108–114. temporal challenges. In A. R. Piquero & D. Weisburd (Eds.), Handbook of quantitative criminology. Springer.

Stolzenberg, L. (2000). Gun availability and violent crime: New evidence from the National Incident-Based Reporting System. Criminology, 38(4),

Ratcliffe, J. H. (2010). Crime mapping: Spatial and temporal challenges. In A. R. Piquero & D. Weisburd. 1461–1482.

Ukoji, V. N., & Okolie-Osemene, J. (2016). Prevalence of lethal and non-lethal crimes in Nigeria. Nigeria Watch Project.

Weisburd, D. (2021). Hot spots of crime and place-based policing. Oxford University Press.

Weisburd, D., & Lum, C. (2005). The diffusion of computerized crime mapping in policing: Linking research and practice. Police Practice and Research, 6(5), 419–434.

Wright, J. D., & Rossi, P. H. (1994). Armed and considered dangerous: A survey of felons and their firearms. Aldine de Gruyter.