

# An Assessment of Spatial Dimensions of Police-reported Crime and Sub-regional Characteristics in Akwa Ibom State, Nigeria.

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## Abstract

This research explores the spatial distribution of crime and sub-regional characteristics in Akwa Ibom State using geo-statistical technique and multiple regression analysis. The analysis is based on police-reported crime data from 2013 crime incidents. In general, results support the conclusion that the investigated crime types are associated with the distribution of sub-regional attributes such as population, poverty level, and unemployment and illiteracy level. Results point to significant differences in the sub-regional characteristics in the study area. Population density and poverty level were strongly associated with kidnapping, murder and armed robbery while illiteracy and unemployment were weakly correlated.

*Keywords:* population distribution, crime, poverty dimensions, hot-spot technique

## 1 Background of the study

One of the major challenges confronting law enforcement agents in crime control is lack of adequate grasp of the geographical qualities of crime and the possible socio-economic conditions encouraging it. Crime mapping and spatial analysis of crimes have proved to be powerful tools for the study and control of crime, due to the fact that crime maps help identify crime problematic areas. Crime maps have been used to reduce errors of inclusion and exclusion during deployment of patrol teams thereby helping to maximize resources.

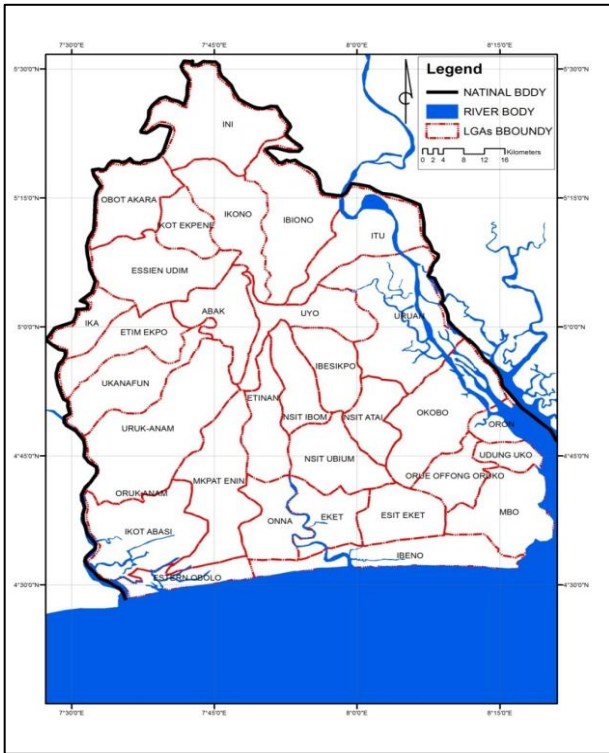
The crime situation in Nigeria is notably problematic, with serious negative economic and socio-political consequences (Olajuyigbe et al, 2016). Ayo et al (2016) concluded that crime constitutes major threats to security and development of Nigeria and that lack of organized system of data collection, storage and analysis has been the major problem confronting the Nigeria Police in combating all forms of criminal activities in the country (Gupta, et al, 2012). The traditional ways of intelligence policing and criminal record management that rely heavily on pen and paper has failed to yield the desired result in the present crime scenario. The need for a robust and effective technique and technology to manage crime data therefore becomes imperative. GIS application in crime mapping offers effective way of mapping, analysing and visualizing spatial and temporal patterns of crime along with possible crime explanatory variables. GIS technology has the capacity to use geography and computer-generated maps as an interface for integrating and accessing massive amounts of location-based data. This can help crime officers determine potential crime sites by integrating and examining complex

geographical qualities of crime and displaying them in a graphical, layered, spatial interface as documented by Chainey and Ratcliffe, (2005). Most of these mapping techniques have been subject to several reviews considering their best use cases and drawbacks (Chainey, 2002; Eck et al. , 2005). A robust and holistic approach to crime data gathering and analysis that includes data on both incidents of crime and their geographical and socio-economic contexts provides the bedrock for an informed and proactive crime control decisions. Frequently however, most crime researchers have focused mainly on the type and numerical counts of crime with little attention to its spatial context and the possible enabling factors. In the current study, we bring an insight into crime analysis by analysing the spatial contexts of crime together with the crime incidents using police-reported crime and sub-regional variables affecting crime in Akwa Ibom State and deploying hot spot analysis and multiple regression techniques.

## 2 Location of study area

Akwa Ibom State is situated in South Eastern Nigeria. It lies between latitude 4° 30'N and longitudes 7° 03' and 5° 30'E (Figure 1). This location is within the equatorial region. Akwa Ibom State has 31 Local Government Areas, 119 Clans and 2,664 villages. Uyo is the State capital. Akwa Ibom State covers a total land area of 7,249 sq kilometres. The State is bounded on the West by Rivers State, on the East by Cross River State, on the North by Abia State and the South by the Gulf of Guinea. Map of the state is shown in figure 1

Figure 1: Map of Akwalbom State  
Source: Akwalbom State Ministry of Urban Planning



### 2.1 Objectives of the study

The main objectives of the study are:-

- To assess the spatial dimensions of police-reported crime across various LGAs in Akwalbom State
- To identify crime hotspots in Akwalbom State
- To examine the factors responsible for the spatial dimensions of crimes in the study area.
- To suggest ways of contending with crime in the study area.

### 2.2 Data, Materials and Method

The data sets for this study were obtained from secondary sources. These include administrative map of the study area. The Administrative map of Akwalbom State was used to determine the political boundary of the study area. The 31 administrative units(LGAs) provided the minimum mapping unit for the current study.

### 2.3 Crime Data

Data on crime comprises the numerical crime counts in each of the 31 LGA of the state. The data covered 3 types of crime in the study area. The data was analysed to determine the current spatial pattern of crimes in Akwalbom State. Data was entered into the GIS database for modelling and analyses.

### 2.4 Sub-Regional characteristics Data

The sub-regional socio-economic characteristics data used for this study was obtained from the Ministry of Economic Development. The data covered a range of socio-economic characteristics namely: population, illiteracy level, poverty level, and unemployment figures. Analogue data sourced from ministry of Economic Development and Police Headquarters Uyo, was converted to a digital GIS-readable database and made ready for analysis. Details of the datasets are given in table 1.

### 2.5 Data Analysis

First, numerical counts of crime incidents were geocoded and aggregated into sub-political units (LGAs). Crime data was subsequently normalized into rates (per capita) using the corresponding population figures. Normalization of the crime data enabled a comparison of crime rate across the entire study area and provided the input for running Hot Spot Analysis (Getis-OrdGi\*) using Spatial Statistics tool in ArcGIS 10.5. The integration of spatial and non-spatial data into the GIS database provided the framework for the production of a variety of maps required for this study. Further, a hot spot analysis was carried out on each of the normalized crime types (robbery rate, kidnapping rate and murder rates). The Hot Spot Analysis tool in ArcGIS 10.5 identifies spatial clusters of statistically significant high or low attributes values. Given a set of weighted data points, such as the number of crimes per unit area, and operating under the expectation that data values are randomly distributed across the study area, this tool delineates clusters (of political units) with higher or lower than expected crime incidents. The units with higher or lower than expected values are known as hot or cold spots respectively.

Table 1: Crime data and Sub-regional socio-economic characteristics of 31 LGAs in Akwalbom State

LGA	Population 2015 (projected)	Poverty level 2013	Illiteracy level 2013	Unemployment level 2013	Robbery cases 2013	Murder cases 2013	Kidnappin cases 2013
Abak -	187,895	35.90	1125	349	3	6	3
Eastern Obolo	81,025	32.69	82	13	0	0	0
Eket	233,544	22.88	820	242	0	4	2
EsitEket	85,602	29.84	347	127	0	1	0
EssienUdim	261,108	44.18	1308	261	7	5	4
EtimEkpo	143,110	35.67	570	59	4	0	1
Etinan	228,232	43.86	574	210	1	0	0
Ibeno	101,116	39.91	84	44	0	0	0
IbesikpoAsut	185,271	42.05	660	217	6	0	0
IbionoIbom	254,823	37.63	941	239	7	1	1
Ika	98,322	52.19	492	209	1	0	0
Ikono	177,902	38.58	823	208	0	0	4
IkotAbasi	179,165	30.58	321	176	3	6	1
IkotEkpene	191,056	28.27	446	229	0	0	8
Ini	133,872	49.94	715	109	0	6	1
Itu	172,745	31.93	480	100	14	9	1
Mbo	138,045	35.29	516	202	0	0	4
MkpatEnin	239,540	34.12	862	477	5	4	1
NsitAtai	99,164	45.57	395	67	0	4	0
NsitIbom	146,046	35.87	469	84	1	5	0
NsitUbiom	171,701	37.44	504	150	6	6	4
ObotAkara	198,996	46.82	596	160	2	1	2
Okobo	138,828	34.01	365	163	0	2	0
Onna	166,445	36.71	664	423	0	2	0
Oron	117,827	13.81	129	49	6	11	2
OrukAnam	232,170	41.47	1264	287	2	3	1
UdungUko	71,689	27.54	122	94	3	3	1
Ukanafun	169,526	36.14	1166	298	3	0	1
Uruan	158,306	33.90	610	69	2	5	0
Urueffong/O	95,576	35.52	864	26	0	0	0
Uyo	413,381	23.18	0	248	15	15	27

Source: Ministry of Economic Planning and Police Headquarters, Akwalbom State, Nigeria

These clusters could be evaluated further to provide clues about policy, socio-economic or specific environmental

factors that discourage or encourage crime in area of interest (Bigman and Fofack, 2000, Ekpenyong and Awoka, 2015, and Scott and Warmerdam (undated).

To gain insight into the possible effect of poverty, unemployment and illiteracy rates on the crime types, multiple regression analysis was run for each of the crime types where, population, poverty rate, unemployment and illiteracy rate were the explanatory variables

The multiple regression analysis result of the four set of sub-regional characteristics (population, unemployment, poverty

murder cases, Okobo and Mbo are hot spots ( $p < 0.01$ ) and EssienUdim is a cold spot ( $p < 0.05$ )

The association between crime incidence and sub-regional characteristics is summarized in Table 2. The sub-regional characteristics is positively related to the spatial dimensions of crime incidence in Akwalbom State. Crimes incidence had a strong relationship with population characteristics ( $r = 0.559$   $p < 0.00$ ) followed by poverty with ( $r = 0.219$   $p < 0.7$ ). Illiteracy and unemployment cases are weakly correlated with sub-regional characteristics ( $r = 0.091$ ,  $p < 0.447$ ) and ( $r = 0.061$ ,  $p$

Table2: Coefficients of relationship between sub-regional characteristics and crimes types in Akwalbom State

Coefficients	Parameters			
	Population	Poverty	Illiteracy	Unemployment
<b>R</b>	0.748	0.468	0.305	0.27
<b>R(%)</b>	55.9	21.9	9.3	6.1
<b>Adjusted R</b>	0.51	0.123	-8	-43
<b>Std Error</b>	4873.6	759.1	346.	115.84
<b>F Change</b>	11.414	2.534	0.955	0.9586
<b>Sig F</b>	0.00	0.7	0.442	0.629

Source: Authors' Data Analysis result

rate and illiteracy rate) on the dependent variables (armed robbery; murder cases and kidnapping revealed that the four factors socio-economic characteristics explain crime incidence in the study area. The result is presented in table 2. The four independent factors are found to significantly explain crime types in the study area with high correlation in some cases. The three independent factors explain 55.9%, 21.9.8%, and 9.3% of robbery, murder and kidnapping respectively in the study area as indicated table 2.

### 3 Analysis result

#### Spatial Pattern of Crime

The numerical crime counts for each of the LGAs are shown in table 1. The highest crime count was recorded in Uyo, the state capital, and the most urbanized and populated political unit in the study area. To measure the spatial cluster of the crime types, GetisGi\* Hot spot analysis tool was used in evaluating the crime data. The intuition behind the Gi\* is that for each area (LGA)  $i$  in the analysis, a weighted average is constructed for the variable under consideration, using the value for area  $i$  with a weight of  $i$ , and the values of areas neighbouring  $i$ , weighted by their distance to  $i$ . The resultant weighted average is normalized and can then be interpreted as a z-score of either a hot spot (positive  $z$  is indicative of higher values clustered nearer each other), or cold spot (negative  $z$  is indicative of lower values clustered nearer each other). The result of the hot spot analysis for robbery, murder and kidnapping cases are represented in figures 2, 3 and 4 respectively. Hot spot analysis results show crime incidents are not randomly distributed in the state but have statistically significant spatial clusters. OrukAnam and IbionoIbom LGAs are shown to be statistically significant robbery hotspots ( $p < 0.05$ ) while Mbo and Nsit-Ubium are cold spots. Similarly, Abak and Mbo are statistically significant hot spots for kidnapping ( $p < 0.05$ ) and Mkpat-Enim is a cold spot. For

$< 0.639$ ) respectively. The p-value of population characteristics is  $< 0.05$  for crime incidence in the study area signifying high spatial relationship with these sub-regional variables.

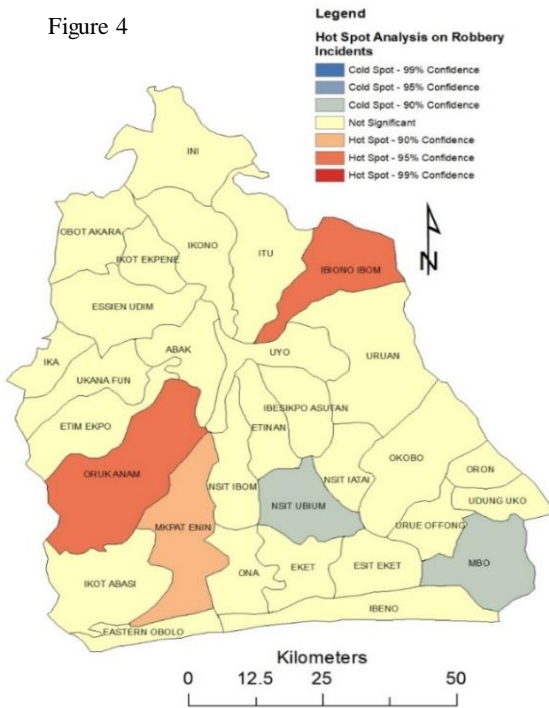
The general pattern of each crime type differs with each LGA suggesting the influence of different socio-economic factors affecting the crime types examined in this study. For instance, while murder crime has a statistically significant hot spot in the south east, the hot spots for kidnapping and robbery tend to be in the central LGAs and then down to the south west. The notion that crime is seldom random within cities has been widely reported in previous studies (Sherman et al, 1989; Brantingham and Brantingham 1982; Fitzgerald et al. 2004 and Wallace, et al 2006). In Akwa Ibom State, much of the reported crime seems to concentrate more in the areas that are close to the city centre and south-eastern parts of the state.

### 4 Discussion

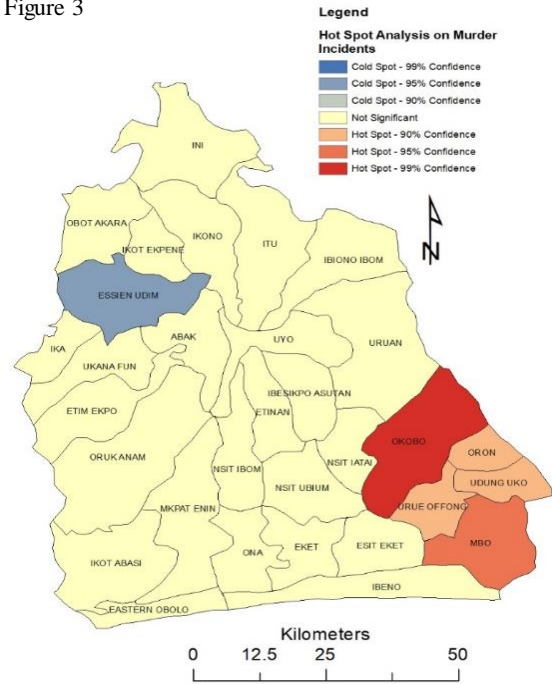
From the spatial analysis carried out and the maps produced in this study, it is obvious that crime in the study area is not randomly distributed but constitute statistically hot and cold spot for different types of crime in different LGAs of the state. As observed from the regression analysis, the observed crime pattern is correlated with certain socio-economic characteristics such as population poverty rate unemployment and illiteracy. Also, population as a variable is shown to be significantly and positively correlated with all the crime types. The implication of this distribution pattern and the association with the socio-economic factors is that Akwalbom State, being a newly developing state, is experiencing a growing influx of people, with potential for more crime as the Population increases.

Figures 2, 3 and 4 showing Hot Spot Analysis results for the three crime types, Robbery, Murder and Kidnapping respectively.

Figure 4



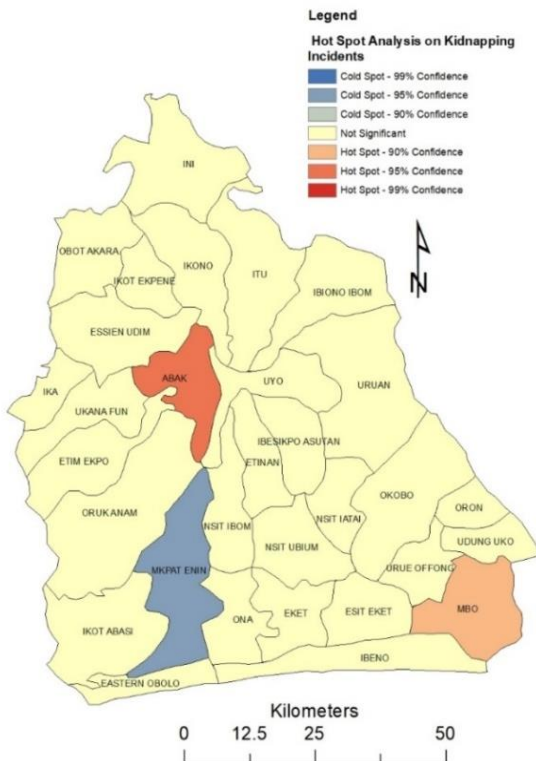
The observed association between population and poverty  
Figure 3



with kidnapping, robbery and murder crime suggests that with improvement in education, employment and population control, the occurrence of crime incidence can be significantly curtailed. There is therefore the need for coordinated approach in combating crime.

## 5 Conclusion

The use of GIS in crime mapping and management has been discussed. Giving the right atmosphere and support from all relevant agencies, it is believed that an intelligence led police service can change the ways many forces operate in this country and this will result in the organizational and cultural changes. The study has demonstrated the importance of proactive analysis of crime-related information in relation to location, manipulated with the aid of Geographic Information System tool. GIS can be used to map and analyse crime occurrences with a view to determining area of threat within the city and how they can be effectively managed.



## 6 Recommendations

Government should utilize GIS capabilities in collecting and analysing crime data in the state to enhance and maximize crime control effort and in the allocation crime fighting resources.

The patrol units should be equipped with GPS so that their locations could be known as often as each unit is "polled," or automatically asked to respond.

Crime data collection can be crowd-sourced using the Web technology. This makes both collection and utilization of crime data accessible for crime control decisions.

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