Comparing Gang Crime Patterns of Two Different Land Uses with Intensity Value Analysis in Winston-Salem, NC

by

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Abstract

Currently in crime analysis, specifically spatial crime analysis, there are a number of spatial data analysis procedures used to show clustering of offenses in the vicinity of facilities and locations, for example, schools, bars, bus stops, pawn shops, and other. This case study includes 30 middle and high school in Winston-Salem, NC. The gang crime data include all offense crimes flagged by the WSPD in 2012. For the comparison land use, 500 tax parcel locations in Winston-Salem, NC were selected from the WS tax parcel database using SPSS's random selection procedure. The resulting intensity values are plotted into a histogram where the differences in clustering can be easily identified. Also, a t-test of the null hypothesis is used to identify if the two groups are significantly different in term of clustering of offenses.

According to the 2010 National Survey of American Attitudes on Substance Abuse, a large amount of gang activity takes place in schools, for instance, more than a quarter of public middle and high schools students say both gangs and drugs are present on their campuses. Forty-five percent of high school students expressed that there were gangs or students who consider themselves part of a gang in their schools. Thirty-five percent of middle-school students expressed that there were gangs or students who consider themselves part of a gang in their schools. The differences between public and private schools were significant. While 46% of students in public schools reported the presence of gangs and gang members at school, only 2% of private school students did (National Center on Addiction and Substance Abuse, 2010).

The same survey found that public schools with gangs were twice as likely to report drug use on campus as public schools without gangs. The survey also found that students in schools with gangs were 12 times more likely to use tobacco, three times more likely to drink alcohol, and five times more likely to have use marijuana than students from schools without gangs (National Center on Addiction and Substance Abuse, 2010).

According to the School Crime Supplement of the National Crime Victimization Survey (2014), during the 2009–10 school year, 16% public schools reported gang activities on their school campus or in the surrounding area. This represents a decrease in the percentage of students reporting gangs on/around campus from 20% in 2007-08. In fact, there has been a steady reduction in the number of students reporting gang activity annually since 2005 (i.e., 24%). Schools in urban areas appear to be the most affected by the presence of gangs: 18% of urban students reported gangs, versus 11% of suburban and 7% of rural students in 2013. In the same year more students (as a percentage) reported gang activity at public than private schools (i.e., 13% vs. 2%, respectively). Regarding race/ethnicity, Latino/Latina represented the higher percent of students involved in gangs with 20%, followed by African American with 19%, Asians with 9%, and whites with 7%.

In Winston-Salem, NC the number of gang-related offenses at public schools has been on the rise. In 2009, there were 14 incident charges reported, 26 in 2010, 61 in 2011, and 92 in 2012 (WSPD, 2013).

Currently in crime analysis, specifically spatial crime analysis, there are a number of spatial data analysis procedures used to show clustering of offenses in the vicinity of facilities and locations, for example, schools, bars, bus stops, pawn shops, and other. Some researchers theorize that these locations or facilities are criminogenic (or crimogenic).[1] That is, crime may cluster or group around more in certain locations or facilities, or crime may exhibit less clustering in other locations. Usually, in the spatial crime analysis these clusters are known as hotspots. The main goal of the paper is to show an alternative to hotspot analysis. Intensity Value Analysis (IVA) offers a more precise method than the alternative methods available. IVA offers to increase the identification, measurement, and comparison of crime clustering. Also, IVA would allow for a more effective response by law enforcement agencies.

In their article McCord and Ratcliffe (2009), suggested that IVA is an improvement over other methods of clustering analysis. IVA calculates the intensity of clustering around desired locations. IVA estimates the intensity of crime points into a single, inverse distance-weighted valued based on the cumulative contiguity of all crime offenses that occurred within a buffer in the vicinity each location. This procedure assigns lower values to crime points that are farther away from the targeted location, and vice-versa. Therefore, when all values are added to a single value for each location, it results in a more accurate estimation of spatial patterning than (for example) hotspot analysis.[2]

Case Study: Gang Crime and Schools

This case study includes 30 middle and high school in Winston-Salem, NC. The gang crime data include all offense crimes flagged by the WSPD in 2012 (N = 353). For this study a bandwidth of 800 feet was used. For the comparison land use, 500 tax parcel locations in Winston-Salem, NC were selected from the WS tax parcel database (N = 93,248) using SPSS's random selection procedure.[3]

This study uses the Buffer Intensity Calculator (Ratcliffe, 2007) to estimate and compare the intensity value ranges from the two different land uses. The procedure is to create two groups of intensity values, one for the schools and another for the random points. The resulting intensity values are plotted into a histogram where the differences in clustering can be easily identified. Also, a t-test of the null hypothesis is used to identify if the two groups are significantly different in term of clustering of offenses.

Results

To first understand how crime values differed from each group, the gang-related crimes intensity values for the 30 schools and 500 random points were plotted into a cumulative distribution graph or histograms (see Figure 1 and 2). Approximately 87% of the random points had zero intensity values indicating no gang related crimes occurred within 800 feet (see Figure 1). By contrast, only 57% had zero intensity values (see Figure 2).

Figure 1. Cumulative percent count of the gang-related crimes intensity values for the 30 middle and high schools.

Figure 2 about here

Figure 2. Cumulative percent count of the gang-related crimes intensity values for the 500 random points.

For each group IVA was performed, the table below shows the mean intensity value for the 30 schools and the 500 random points, the mean value for the schools was 0.992 (2.153 SD) and the mean value for the random points was 0.126 (0.492 SD). These results indicated a greater clustering of gang crimes around schools.

Table 1:Descriptive Statistics for the Intensity Values of the Schools and the Random Points

Location	N	M (SD)	SE
School	30	.99 (2.15)	.39
Random	500	.13 (.49)	.02

While a one-sample t-test (used due to differences in sample/population sizes), it was determined that the difference in intensity values was statistically significant at the $p < .05$.

Table 2: One-Sample t-Test for the Intensity Values of the 30 Schools

	t	df	P	Mean Difference
Intensity	2.52	29	0.02	0.99

According to the independent samples t-test, the hypothesis that the groups have equal variances can be rejected. Since the significance value of the t-test is significant ($p < .001$), the average of .866 (ie. intensity value) is not due to chance alone.

Table 3: Independent Samples T-Test for the Intensity Values

	Levene's Test for Equality of Variances				
	F	P			
Equal Variances Assumed	108.52	<.000			
	T-test for Equality of Means				
	T	DF	p	Mean Diff.	Std. Error Diffs
Equal Variances Assumed	6.62	528	<.000	.87	.13
Equal Var's Not Assumed	2.20	29.18	.036	.87	.39

Conclusions and Implications

The case study of middle and high schools using IVA showed a higher concentration of gang-related offenses around their campuses than the 500 random points around the city. IVA is a relatively new technique that falls into the place-based theory that comes from the ecological theories of crime. Place-based theory or place-focus procedures in recent years have helped crime researchers find new explanations to crime clusters in urban settings. The old procedure of just counting crimes at different locations has been shown not to be sufficient to examine the criminogenic characteristics of different land uses (or locations). According to McCord and Ratcliffe (2009), even though IVA is only the first step in this process, it offers a more realistic base rate for comparison between crime clusters around criminogenic facilities with some other facilities (or locations). What this means is that IVA offers measurements that can be compared with different facilities, land uses, types of crime, and locations.

The possibility of measuring and analyze crime clustering more accurately may be very helpful in crime prevention. For instance, making comparisons using IVA between difference types of places, such as, bars, bus stops, or pawn shops, just to name a few, may help pinpoint hidden behaviors or activities that may increase the opportunity or promote crime. This information could be very helpful to law enforcement, school administrators, and any researchers interested in detecting characteristics and activities of locations associated with different crime levels.

References

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End Notes:

[1] Adjective meaning: producing or trending to produce crime or criminality.

[2] For each location a single intensity value is calculated, which shows the cumulative structure of crime points located around it using distance instead of density (as other methods do).

[3] This sampling procedure in SPSS is performed without replacement; so, the same case cannot be selected more than once.