Burglary, Victimisation, and Social Deprivation

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The spatial nature of repeat burglary victimisation has received research interest recently as it has been recognised that preventing repeat incidents can have a dramatic effect on crime rates. Much work has gone into the accurate identification of repeat events. While several researchers have noted the time course of repeat incidents, there has been little research that addresses the spatial variation in repeat incidents. In an attempt to explore and understand the differences between locations that are vulnerable to repeat attacks, and those sites that are victimised only once, this article uses an areally-weighted approach to measure the level of social deprivation in the immediate vicinity of burgled locations in South Nottinghamshire, UK. The paper shows that this approach is important in avoiding the distributional problems that can occur if point data is aggregated to enumeration district level. The two-year study shows that locations in deprived areas are more likely to be the victims of repeat burglaries than those in affluent areas. A number of hypotheses concerning this phenomenon are discussed.

Key Words: Repeat burglary; social deprivation; spatial interpretation; areally-weighted approach

Introduction

Recent studies have demonstrated how important an understanding of repeat victimisation is in the delivery of effective crime prevention.[2] The research has shown that target prevention at repeat victimisation locations can reduce crime, though rapid identification of the locations is important as victimisation tends to occur soon after previous events.[3] Greater comprehension of the mechanisms of repeat victimisation is often hampered by difficulty in the extraction of repeats from the mass of crime data available to researchers and the police.[4] The IT revolution taking place within the police service has improved the range of data available electronically. Most police forces now georeference their crime data,[5] and with the aid of geographical information systems (GIS) rapid retrieval of repeat locations is now possible.[6]

Most of the research has focused on burglaries, and a number of the studies have identified a time course in burglary repeat victimisation which shows that the greatest risk of a repeat is in the time immediately after a burglary.[7] This risk interval rapidly drops off and after a few months returns to a hazard level similar to the general background rate. This repeat time course has received much of the attention, but although the links between crime and social factors have been a popular area of investigation, the relationship between social patterns and repeat victimisation has been largely ignored.

Research linking general crime distribution and certain social conditions such as unemployment is common amongst the criminology literature.[8] Relationships between deprivation and certain types of property and violent crime have also been identified.[9] The link between crime and the social structure of an areal unit has received attention in Liverpool, where both crime risk and proximity to underprivileged areas were examined,[10] along with a principal component analysis of social deprivation and crime distribution.[11] Like similar census-based studies, this work aggregated crime locations by enumeration district and used the enumeration district boundary as the areal limit of examination.

This paper aims to improve the spatial interpretation of areal data around crime event locations and seeks a determination of the significant spatial social patterns in the immediate vicinity of repeat victimisation sites. Locations associated by repeat domestic burglary victimisation are compared with points victimised by a lone burglary event against a background of social deprivation, to identify any differences in social fabric of the areas immediately surrounding the burgled premises. The emphasis in this study is on the individual location and not the number of incidents that have occurred at a particular site. In this way, it may be possible to elicit information about the vulnerability of buildings within the social deprivation context of the immediate area surrounding these insecure premises.

A previous use of GIS to identify repeat victimisation[12] within a small study area in Nottinghamshire identified a repeat time-course graph similar to that of other studies. This background work to the current study also identified a minor relationship between the repeat locations and a measure of social class. This relationship was tested through the method outlined in this paper, using the Department of the Environment (now the Department of the Environment, Transport and Regions) *Index of Local Conditions*[13] derived from census data associated with enumeration district boundaries. The small test area, using crime and ILC data from a suburban area south of Nottingham, found a definite increase in the number of repeat victimisations occurring in socially deprived areas. To discover whether the effect occurs in a more heterogeneous area, the analysis in this paper enlarges the study region from the single suburban area to an entire police division with a broad rural/urban mix and encompassing a wider variety of deprived and affluent areas.

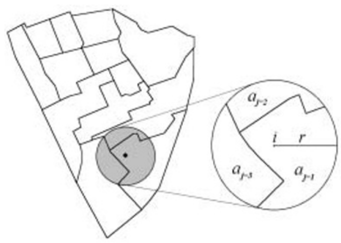
Deriving data for the current study

The selected study area was Trent police division of Nottinghamshire Constabulary, which covers most of the South and East of Nottinghamshire and mixes affluent suburbs, council estates and rural villages within one division. Domestic burglary data was drawn from the force computerised crime recording system and covered the period from April 1995 to April 1997. From this source data, 3,549 separate locations were identified as being the victim of a lone burglary during the study time, and 519 locations were identified as having at least one repeat incident. The method of extracting the repeat victimisation locations is described by Ratcliffe and McCullagh in the previous study.[14] The ILC data measures relative levels of deprivation in ward and enumeration districts across England based on six variables from the 1991 population census of England and Wales.[15] When mapped to the relevant Trent police division boundaries, 499 enumeration districts have boundaries within the study area. It should be noted that, somewhat surprisingly, an increasing positive value indicates an increasing level of social deprivation. Examples at the district level demonstrate the range of values across the UK: Newham and Tower Hamlets in the deprived East End of London have district deprivation values of over 35, Slough and Hereford exhibit values close to the national mean (0.0), and districts such as Stratford-on-Avon (-25.35) and the Cotswolds (-26.03) are amongst the most affluent (negatively deprived) regions in the country.

Mapping a point-data-based variable by aggregation within census boundaries is a technique used when the count of points within the boundary is required for later comparison or mapping with associated census variables. The technique does not account for the proximity of a point to the edge of a boundary and the possibility that it could be extremely close to, and influenced by, another polygon within the boundary set. An extreme example of this problem would be a point internal to, but at the end of, a peninsula of one polygon, almost surrounded by a different polygon with significantly different census characteristics. The position of a point within a polygon becomes an important factor when calculating the data value to be assigned to the point on the basis of an aggregation of areal data surrounding the point.

In this study the overlay capabilities of a GIS are used to isolate a region of areal data surrounding a point and extract the interpolated value of a variable based on its areally-weighted contribution. Figure 1 shows an example study area similar to a collection of enumeration district boundaries. Located with these is a target investigation point that might be the location of a criminal incident. In a simple aggregation process, the point would be placed in the bottom right polygon, and any contribution from the variables of other neighbouring regions would be lost. An alternative approach is to use the ability of a GIS to cut out all polygon fragments within a circle of some significant radius centred on the crime. The regions that remain within the circle are isolated and the contribution of each region as a proportion of the circle area measured. The final value of the variable for this location is based on the areally-weighted average of the separate polygons within the circle, here called the *Vicinity* value (*V*) as in Figure 1. When used with crime locations and the ILC, we are able to match exactly the deprivation index for the location instead of using the location's single enumeration district social deprivation value. The question arises of how big a circle should be for this type of analysis. The choice of radius for the analysis was considered relative to the average size of the enumeration districts in the study area. An upper limit could be a circle with a radius of about 750 metres, as this would approximate the same area as the average enumeration district within Trent division. There is a considerable variation in the size of enumeration districts in the division owing to its mixed rural and urban nature. A smaller value would be essential in urban areas to reduce averaging of areally small enumeration district values, with possibly very different deprivation characteristics. The radius chosen must also be sufficiently large to ensure that any misplacement of the crime due to standard recording difficulties is adequately allowed for; perhaps up to a distance of 100 metres. In addition, in urban areas the radius needs to be large enough to allow for the peninsula location problem described previously. The process is designed to provide a reasonably continuous distribution of deprivation index values based on the values in the vicinity of the test location. Five different radii of 0, 100, 200, 350 and 500 metres were examined to see if distance affected the outcome of the analysis.

Figure 1



Note: The variable influence of enumeration districts in calculating the social deprivation index for an individual burglary location from census data. A fictional ward showing 13 enumeration districts and a single burglary location, identified by the black diamond, together with a circle of size sufficient to reflect local influences on the burglary, and possible uncertainties in its location. The circle includes enumeration districts other than the one that contains the burglary. The parts of enumeration districts lying within the circle are isolated using a polygon overlay operation and a weighted average social deprivation index, calculated with the values for each enumeration district being weighted proportionally to the area that each district occupies in the circle as a whole.

The 0 metres buffer returns the exact deprivation value for the polygon in which the crime lies, and was included to test whether the radii-based *Vicinity* solution was generating vastly different and possibly unreasonable values. As expected, the data extremes are reduced by the weighted averaging process compared with the exact values for a zero metre buffer, and are eroded steadily as radius increases. The *Vicinity* calculation was performed in MapInfo (a commercially available GIS package) using the '*Vicinity*' program written by the authors in the MapInfo programming language, MapBasic. At each of the chosen radius levels there is a noticeable difference in the mean calculations for the *Vicinity* results, with the mean levels for the repeat victimisation locations (repeats) appearing to be more positive (ie deprived) for all analysis scales.

Choice of radius

The question remains as to which radius should be chosen to represent deprivation scores at a given crime location. A Kruskal-Wallis test of all the unique burglary locations showed that there was no significant difference between radii choices in terms of calculated deprivation value. The calculated chi-square of 2.46 calculated from the five radius distributions based on the entire burglary data, with four degrees of freedom, and with $p = 0.65$, did not allow rejection of the null hypothesis of similarity between the deprivation statistics for different radii. Interestingly, when the test was repeated without the 0 metre radius data the calculated value of χ^2 dropped to 0.85 with $p = 0.84$. This indicated that the homogenising effect of the radius-controlled areal-weighted average calculation of deprivation generated very similar data sets to each other for different radii, but were marginally different from the 0 metre radius set. The reason for this difference lies in the spatial nature of the data, which has at least as much importance as the statistical parameters of the data. Occam's Razor would suggest the non-spatial application of the 0 metre set should be preferred over the 100-500 metre circle sets, but the need to avoid the distributional problems of point locations mentioned earlier demands the acceptance of a spatially-averaged, smallest reasonable, non-zero radius tested at 100 metres.

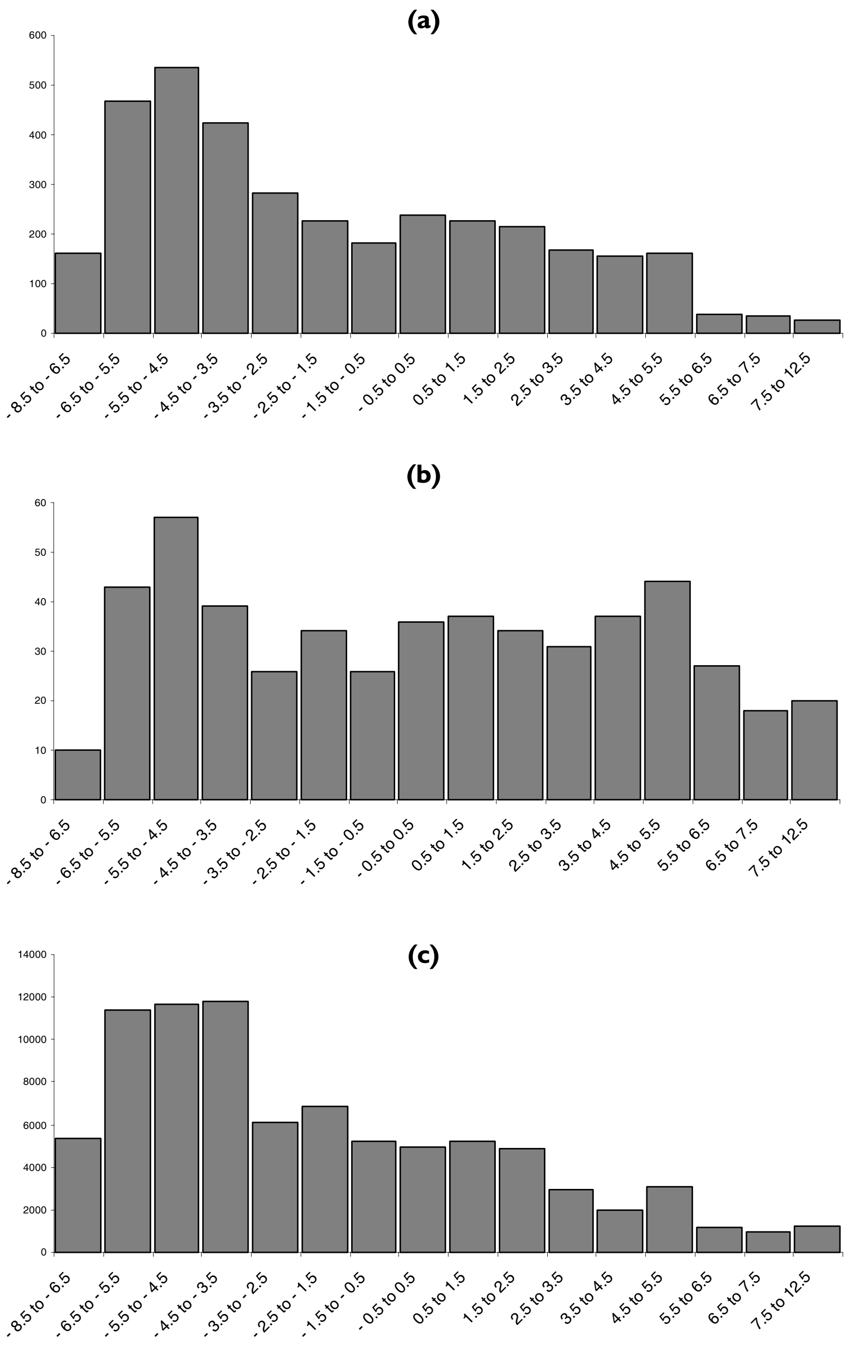
Separation of unique and repeat burglary distributions

The burglary data includes two different sets: the unique burglary locations, and those at which two or more burglaries have been committed within the two-year data set. The result of a Mann-Whitney U test was used to determine whether the populations of the unique and repeat sets were significantly different (Figure 2). The analysis showed that the mean rank of the repeat victimisation locations of 2502.7 is consistently greater that the equivalent mean rank for the unique 'burgled once only' locations of 1966.0. The calculated Mann-Whitney U of 6777987.5 approximated to a Z of -9.72, which indicated that the null hypothesis of similarity could be rejected with considerable certainty ($p \approx 0.000$). It can be concluded from this that the weighted deprivation index for the area in the immediate vicinity of Trent division repeat victimisation locations indicates significantly more deprivation than for the area in the vicinity of unique burglary events.

Vicinity frequency distributions

Higher positive numbers indicate greater deprivation. The differences between the data sets are reinforced when the histograms of the *Vicinity* distance-weighted deprivation indices are displayed. While the histograms in Figures 2a and 2b only show the frequency distribution of the 100 metre vicinity buffer, the distributions for the 200, 350, and 500 metre radii were almost identical. The unique burglary histogram in Figure 2a shows a positively skewed curve, with many occurrences in the more affluent left side areas. The repeat burglary histogram in Figure 2b (different vertical scale) exhibits the same initial peak in the more affluent regions, but maintains an almost uniform frequency as the level of deprivation increases.

Figure 2



Note: *Vicinity* deprivation scores, based on 100 metre radii, for unique (a) and repeat (b) burglary locations. Note that the end classes were compressed in analysis to compensate for low frequencies. Total households in Trent division by ILC deprivation index shown in (c).

A chi-square test was employed to examine the null hypothesis that the differences in the frequency distributions in Figures 2a and 2b between the unique burglary and repeat burglary analyses were not significant, and a test statistic of 163.64 (with 15 degrees of freedom) was calculated. This involved collapsing two of the lower classes into one class, and also the top five classes into one, owing to small observed/expected numbers in those parts of the histograms.[16] As the test statistic is greater than the tabled critical value of 37.7 at a significance level of 0.001, the null hypothesis is comprehensively rejected. The differences in the frequency distributions are significant and a measure of a real difference in the distributions of the two groups.

There is therefore a significant difference in the distribution of repeat and unique burglaries in terms of deprivation score for the enumeration districts lying within the Trent division. It would appear that the occurrence of repeat victimisation is found much more extensively in enumeration districts with a high deprivation index. The question remains as to which of the two distributions, unique or repeat burglary sites, more closely matches the distribution of the number of households by deprivation index. If unique burglary by deprivation index is a better fit to the household distribution, this implies that the repeat locations are differently distributed and must be considered biased towards either being more present in affluent or in deprived areas.

Figure 2c shows the distribution of households by deprivation index for the Trent division. There is a notable visual similarity between this histogram and the distribution of unique burglary locations in Figure 2a. Whereas the fit between these two histograms is not exact, it appears that the underlying model may well be similar, and quite different from that of repeat burglaries in Figure 2b. A series of regression models were employed to test the significance of a linear regression fitted to the original data, and to look for significant differences between the slopes of the various regression lines. The data sets were derived from the enumeration districts containing unique, repeat, and combined locations respectively. Burglary per household was the independent variable, and the deprivation index generated by *Vicinity* was the predicted variable. There was a considerable difference in the number of enumeration districts included in the three data sets, from a low of 235 for the data set of EDs containing the location of at least one repeat burglary, through 439 for EDs where either at least one unique or one repeat (or both) took place, to 488 EDs that were found from the census information to include at least one household. According to the police crime records some domestic burglaries occurred in EDs with no households or resident population — this was probably due either to locational errors in the crime database or perhaps to the 1991 census data not being representative of new housing developments. Unique and repeat burglary rates were calculated for all three data sets as the percentage of houses burgled in each ED during the two-year crime data set window. The results of linear regressions between the unique and repeat burglaries and deprivation index are given in Table 1.

Table 1

Significance of slope, unique and repeat slope differences	Valid EDs [n = 488]			Unique EDs [n = 439]			Repeat EDs [n = 235]		
	b_0	b_1	t	b_0	b_1	t	b_0	b_1	t
Unique [h_0: Ub_1=0]	-2.71	0.15	2.70*	-3.87	0.34	5.82**	-3.61	0.38	4.94**
[h_0: Ub_1=Rb_1]			3.30**			7.26**			6.10**
Repeat [h_0: Rb_1=0]	-2.83	1.16	7.82**	-3.30	1.39	9.83**	-3.54	1.46	7.35**
[h_0: Rb_1=Ub_1]			27.23**			32.03**			24.77**

Note: The relationship between the slope of a variety of linear regressions is shown for different types of burglary, using burglary rates calculated per household to predict the *Vicinity*-calculated deprivation index. Significance of t indicated by: * $p < 0.01$, ** $p < 0.001$.

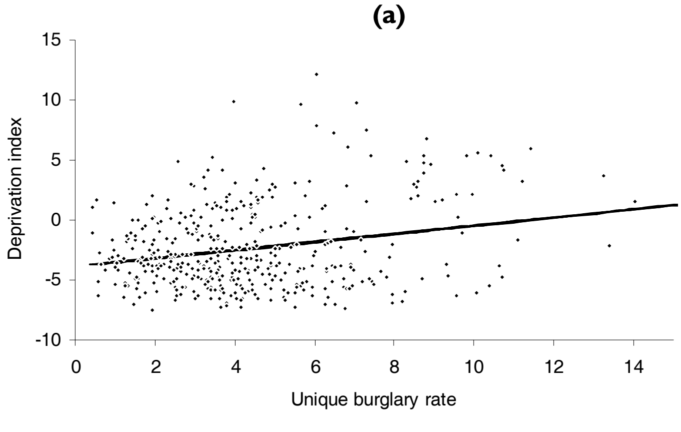
All the regressions were significant at least at the p = 0.01 level, and all the regression slope coefficients were significantly different from zero. All slopes showed a positive correlation between the number of crime events and an increase in deprivation index. In addition, the slopes of the unique crime regression were always significantly different, and flatter than those for repeat burglary regressions for the same ED data set. The first set, valid EDs in Table 1, showed the lowest slopes of the three sets because of the inclusion of many EDs where households existed, but showed either no burglary at all (47 cases), or alternatively no repeat burglary (253 cases). As negative burglary is not a viable concept, the linear regression, although still very significant, is in this case biased by an over-large set of zero burglary entries, leading to a lower regression slope parameter for both unique and repeat cases than might otherwise be expected.

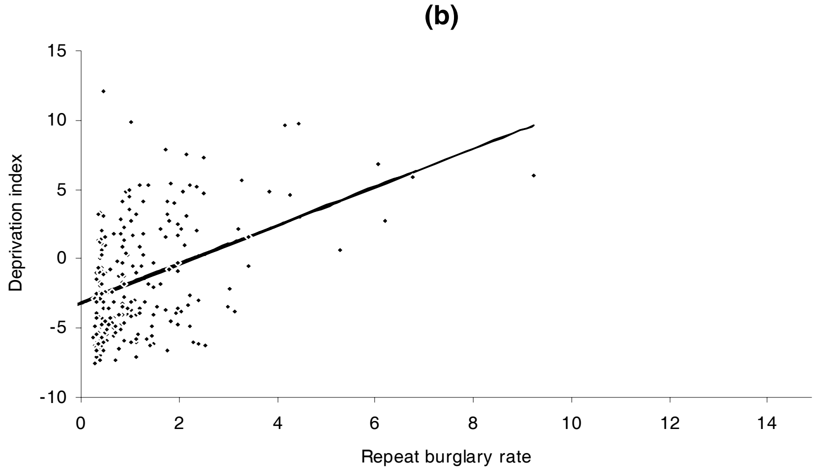
It is clear that the values of the regression slopes have stabilised once EDs with no burglaries have been omitted, as seen in the unique and repeat sets in Table 1. These two sets show great consistency and separability of slope value. The slope of the regression for repeat victimisation occurrences is about four times steeper than that for unique events. The increase in deprivation index as unique burglary numbers increase is definite but much less rapid. The slope values in Table 1 would indicate that, although unique occurrences of burglary are widespread throughout Trent division, there is a definite but limited relationship to increasing social deprivation. Increasing numbers of repeat victimisation cases, on the other hand, are clearly indicative of rapidly increasing social deprivation. Area deprivation value increases slowly with a rise in the unique event rate, but skyrockets with rising repeat victimisation.

The intercept values in Table 1 are very similar, especially for the more 'reliable' unique and repeat ED trials. The unique trial contains the complete data set for unique and repeat burglary locations without the bias problem caused in the valid ED set and can therefore be used to demonstrate the rate of increase as EDs become more socially deprived. The extent of the data cloud and linear regression line for each data set is plotted in Figure 3. Both lines intercept the deprivation (y) axis within less than one deprivation index unit of each other for zero burglaries. This means that in all cases more affluent (negatively deprived) EDs are those tending strongly to have low burglary rates. At a burglary rate of zero the regression lines are less than one unit apart at a value of about -3.5. Once a 3% unique rate of burglary (found at the lower end of the unique data cloud) has been reached, the expected deprivation score for a given ED will be -2.88 (still affluent), whereas the same 3% rate for repeat victimisation (towards the high extreme of the repeat data cloud) would indicate an ED with a deprivation index of 0.87 (more deprived than the national norm).

Figure 3

(a)





Note: Data cloud and linear regression lines for unique (a) and repeat (b) burglary rates. The difference between the slopes of the two graphs is clearly visible.

Discussion

By focusing on the locations of incidents, this study has determined that the social deprivation in the vicinity of unique burglary sites and repeat burglary sites is significantly different. There is significant difference in the means of the distributions, and also in the frequency distributions. The joint pattern of household and unique burglary locations associated by deprivation index is very clear and shows a significant but slight increase in the rise of burglary risk as the level of deprivation increases. The sites where repeat victimisation has occurred show a marked difference. As social deprivation increases, the relative possibility of being a victim of repeat burglaries increases dramatically. The question arises as to why the occurrences of burglary repeat victimisation are concentrated in the regions of greater social deprivation.

There are a number of possible hypotheses concerning this. The availability (or not) of crime prevention resources is one such explanation. It has been recognised that crime prevention programmes can help to reduce the occurrence of burglaries and repeat incidents,[17] though this is a finite resource. If more deprived areas have higher crime rates (as is often the case), then the available money and assets to conduct preventative work after an initial burglary may be spread between many more locations, or may not be available at all. In more affluent areas, the lack of resources centrally may prompt household owners themselves to invest in crime prevention measures after an initial burglary, an option not financially available to more indigent residents.

Recent work has highlighted the effect that policing style can have on the crime level in an area. There is evidence to suggest that police response to incidents and general policing style are affected by the level of crime in the area.[18] Officers who police busy areas tend to be diverted to the more serious calls and may ignore minor legal infringements that would otherwise be dealt with in a less crime-ridden district. Constant attendance at serious incidents leads the officers in busy areas to conclude that they are in a crime-ridden area and may lead to a belief that a high burglary rate, and a high level of repeat victimisation, is an inevitability in a deprived area. In the more affluent areas, police officers may have a lower crime rate and consequently more time to perform routine patrolling. They may even be able to actively target their patrol routes to keep an eye on recently burgled premises.

Conclusion

There is a significant difference between the social deprivation index of areas in the immediate vicinity of once-only burgled premises and the deprivation index in the vicinity of repeat victimisation sites. Locations that were subjected to repeated attacks during the two-year study were in significantly more deprived areas than the unique burglary premises. There was a marginal difference in the measure of deprivation index at the burglary sites and in the immediate vicinity of the site, and to prevent the effect of 'peninsularisation' the study has stressed the benefit of employing a *Vicinity* approach. This type of analysis uses an areally-weighted average to reduce the effect and is designed to produce a reasonably continuous distribution of the target variable. As a result of the tests, a radius of 100 metres is suggested for urban areas.

A number of hypotheses are suggested concerning the cause of increased repeat victimisation in deprived areas, and these include the lack of crime prevention resources in deprived areas, the possibility of more affluent residents being able to afford to take responsibility for preventative measures, and the difference in policing styles between affluent and deprived areas. Any one or more of these reasons may be the cause, or, more likely, the cause of this phenomenon may be a combination of many factors. The targeting of repeat victimisation in burglary has definite crime reduction benefits, and the possible causes of the phenomenon recorded here are worthy of investigation in the future to attain a better understanding of repeat victimisation and its social characterisation.

Notes

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