Title: Relating target hardening to burglary risk: Experiences from Liverpool.

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Abstract

This paper explores the relationship between the allocation of target hardening and burglary risk based on recent research in the City of Liverpool. Individual property-level data from a range of sources was collated for each residential property in the city using a unique property reference number. This produced a rich data set enabling burglary and target hardening activity to be analysed through time at both the individual property-level and across a variety of spatial units (e.g. super output areas, wards and regeneration areas). The results highlight an imperfect alignment between target hardening and burglary risk locations largely attributable to the influence of Liverpool's area based regeneration initiatives. The paper makes the case for prioritising properties for target hardening based on a combination of the prior burglary history of individual properties, the burglary risk of an area, and existing levels of target hardening protection.

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Short Biographies

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Michelle Rogerson is a Senior Research Fellow at the Applied Criminology Centre, University of Huddersfield. Michelle joined the centre in 1998 from the Data Archive, University of Essex. She completed a BA in Sociology at Durham University and an MSc in Social Research Methods at the University of Surrey. Michelle is currently registered for her PhD on the prospective identification of emerging crime trends. Her research interests include: Technology, crime and crime prevention; Crime, fear of crime and quality of life; Regeneration and crime; and Repeat victimisation.

Alex Hirschfield is Professor of Criminology and Director of the Applied Criminology Centre at the University of Huddersfield. His research interests include environmental criminology, situational and technological approaches to crime reduction, urban regeneration, policy evaluation and health impact assessment. He has secured research funding from ESRC, EPSRC the Home Office, Department of Health, Department of Transport, the Office of the Deputy Prime minister(ODPM) and numerous regeneration partnerships. His other research work is in public health and in 2006 he was elected a Fellow of the Faculty of Public Health.

Relating target hardening to burglary risk: Experiences from Liverpool.

1.0 Introduction

Target hardening is a term used to describe the process of increasing the security of a property to make it more difficult to burgle, thereby increasing the effort needed by the offender to gain entry to a property. The intended outcome is ultimately to deter the offender from burgling an individual property. It is a well established strategy within the situational crime prevention literature (Clarke, 1997, Cornish and Clarke 2003) that has arisen from a number theories around crime opportunity (including routine activities theory and rational choice perspective), and ultimately aims to reduce opportunities for offending through a range of measures. Target hardening has been employed internationally, and has been widely cited as an effective strategy for burglary reduction (Weisel, 2002, Hirschfield, 2004, Millie and Hough, 2004, Hamilton-Smith and Kent, 2005).

This paper examines the use of target hardening in the City of Liverpool. It stems from research commissioned jointly by Liverpool Citysafe and the Liverpool Housing Market Renewal Initiative[1] (HMRI).The objective of the study was to evaluate the impact of target hardening in the area, and to inform future prevention strategies. It is important to emphasise that the term target hardening used in this paper refers to a range of measures used by Liverpool Citysafe and includes all strategies which they themselves refer to as 'target hardening'. These include the fitting of new door and window locks, installation of alarms, the fitting of movement detection lighting, and fitting chains to doors. The authors acknowledge that some of these may not be viewed as strictly target hardening strategies as they do not reduce the physical vulnerability of a property to attack).

Before the impact of target hardening on burglary could be examined, a key initial step was to assess the relationship between the occurrence of burglary and the allocation of target hardening. This required the generation of new data by combining information on burglary and target hardening at the individual property level. It also raised a number of questions about how target hardening was prioritised, the criteria used for selecting which individual properties to protect, what funding streams were available for target hardening, how resources were distributed across the case study area, and whether there were any additional or alternative objectives beyond burglary prevention for allocating target hardening. This paper, therefore, focuses on the relationship between the allocation of target

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[1] http://www.liverpool.gov.uk/Housing/Housing_Market_Renewal_Initiative/index.asp

hardening and burglary risk, as opposed to the actual impact of the target hardening on levels of burglary in the area. Note there is an important distinction between risk and vulnerability (Millie, 2008) and this is likely to have implications for the allocation of resources. This will be touched upon again in the discussion at the end of this paper.

This paper will first briefly discuss the established literature on both domestic burglary and the use of target hardening for burglary prevention. It will review the established body of knowledge around burglary prevention and the relative successes demonstrated in the use of target hardening. It will suggest potential reasons why target hardening may be less successful, and will highlight the importance of allocating target hardening to properties most 'at risk'. It will then consider what happens to the link between protection and vulnerability to victimisation when alternatives to burglary risk (e.g. regeneration potential, housing demand) are used as the primary rationale for target hardening.

The paper will then outline the background and context to this project and the primary research questions to be explored. This will include a brief description of Liverpool City and its housing structure followed by a discussion of the data collected for this research and the methods used. The findings are then discussed, highlighting some of the mismatches evident between the allocation of target hardening and burglary risk and how far there have been any changes in this over time. An explanation of these patterns is then attempted paying particular attention to the priorities used by the City Council to determine the allocation of target hardening measures and the evidence base that has been available (e.g. data on prior burglary risk and prior target hardening at the individual property level) to inform such decisions. The paper concludes with suggestions for future policy and recommendations for further research.

2.0 Research Questions

The research questions focus on the relationship between target hardening and burglary risk, how this changes over time and how this might be explained, more specifically:

- To what extent does the allocation of target hardening relate to burglary risk?

- How has the relationship between burglary and target hardening changed over time?

- What potential reasons can be identified to explain overlap or mismatch between target hardening allocation and burglary risk?

- How far was target hardening distributed appropriately, given the distribution of populations and burglary risk across Liverpool?

3.0 Domestic Burglary and Target Hardening

The reduction of domestic burglary has remained high on the agenda of government and law enforcement policy for a number of years (Hamilton-Smith and Kent, 2005), and there have been a number of large scale national measures aimed at reducing domestic burglary. These have coincided with a long term trend of reductions in levels of burglary in England and Wales (Kershaw et al, 2007). Large national programmes aimed at tackling domestic burglary include the Safer Cities Programme (Ekblom et al, 1996) and the Crime Reduction Programme (CRP) (Homel et al, 2004). The Reducing Burglary Initiative[2] (RBI) was perhaps the largest initiative within the CRP, over three rounds 240 locally targeted projects received grants totalling in excess of £25 million (Kotz el al, 2004). In parallel to this funding, a large volume of research into burglary prevention has evolved. This has identified a range of factors or characteristics that are known to increase burglary risk, and, as a result of a number of large scale evaluations, has created a broad evidence base of potential measures for effective burglary reduction.

There is an established body of research into factors likely to increase a given property's risk of burglary. Perhaps the two most salient of these are the importance of repeat victimisation as a predictor of future victimisation (Pease 1998), and the fact that properties without home security measures run the highest risk of burglary (Nicholas et al, 2005).

Repeat victimisation generally refers to repeatedly victimised targets (individuals or properties). There is an established literature on repeat victimisation and this is summarised well in a chapter by Farrell (2005). It is highly relevant to burglary prevention as the re-victimisation of properties has been shown to be swift, within a known time period, and tends to be highest in high crime areas. An additional concept coined is that of near repeats (Townsley et al, 2003) which suggests that properties near to burgled properties have a higher risk of burglary within a defined time period and distance (within

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[2] http://www.crimereduction.homeoffice.gov.uk/bri.htm

400m up to two months, Johnson and Bowers, 2004). This finding was particularly true for more affluent areas.

There is a growing evidence base on the characteristics of a property and its occupants that may increase burglary risk and these include; household composition (for example, single parent households, head of households aged 16-24, Budd 1999); property characteristics (for example, terraced properties and a lack of security measures (Nicholas et al, 2005); and the type of street/area were a property is located (for example, rear garden gates, footpaths to shops, and being adjacent of open land, Armitage 2000).

As stated earlier, target hardening has been widely employed as a burglary reduction strategy. It was used in many of the RBI areas and was demonstrated to be a highly effective tool for burglary reduction. However, across the different RBI areas the success of target hardening varied (Hamilton-Smith and Kent, 2005) and success was found to be dependent on a combination of the particular content of interventions and the methods used to allocate preventative measures. Targeting strategies varied from the less successful 'first come first served', which risked response bias and funds becoming exhausted before the most at risk properties were protected, to strategies targeting properties deemed most vulnerable either based on their occupancy (e.g. elderly residents) or prior experience of burglary. Two key issues raised were the importance of getting the dosage of targeting right (Millie and Hough, 2004) in terms of the number of properties to protect (effectiveness could be limited if too narrow a group of households were targeted) and the challenge of identifying the most vulnerable properties (those that are both actually 'high' risk, and high risk 'at the time' of target hardening installation).

It is argued that whilst many studies have addressed the effectiveness of target hardening, there are relatively few studies that have examined the criteria that should be used to decide which properties to target. This paper seeks to highlight the importance of this, particularly when this target selection is set against the political and resource constraints facing those mandated with reducing burglary. This paper builds on concepts developed by Hirschfield and Newton (2008) which assessed the synergy between crime prevention interventions and crime risk at the ward level. Hirschfield and Bowers (2000) discuss a number of philosophical and political stances that underpin decisions about how to allocate and prioritise resources. Questions arise around the scale of targeting (for example which

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individuals or properties, or groups of individuals or properties should be targeted). Furthermore temporal considerations such as when to target, and the spatial dynamics of targeting (where to target, when, and for how long) are also highly relevant. Moreover, the decisions over targeting may evoke a series of dilemmas around equity and fairness (for example, highly vulnerable properties within low crime areas may not receive any target hardening whilst low risk properties in high crime areas are given protection).

Existing studies have produced recommendations for the allocation of target hardening. Hirschfield and Bowers, (2000) suggest targeting households simultaneously at three levels based on burglary risk of the property (previous burglary), the area (for example is it a deprived or high burglary area?) and social characteristics of the occupants (are they high risk?). Indeed, in Merseyside, such an approach was adopted over 10 years ago (Bowers et al, 2001) and was shown to be effective. The criteria for target hardening were for properties to be located in a regeneration area, for the burglary to be a repeat, and for the occupants to be categorised as socially vulnerable. It is perhaps useful to highlight that this system is no longer employed, that the regeneration area and funding no longer exist, many of the individuals central to driving this policy no longer operate in the area, and one of the key organisations no longer exists. Another study (Anderson et al, 1995) suggests that prior victimisation should be used to assess risk, (not the characteristics of the individual victim), that early intervention should be emphasised, and that a number of interventions exist and are well established. This advocates that prioritisation should be related to cost (the most expensive measures should be reserved for those most at risk, and with highest chances of offender detection). They identify gold, silver and bronze standards against which to prioritise burglary prevention measures.

## 4.0 Research Context and Description of Study Area

This study examined burglary and target hardening in the City of Liverpool for the three year period January 2005 to December 2007. Liverpool has a population of 436,100 (ONS 2006 mid year estimate) living in 210,366 households (Liverpool Local Authority, 2007). Administratively, it is divided into five Neighbourhood Management Areas (NMAs), Alt Valley, Central, City & North, Liverpool East and Liverpool South, each containing around 20 per cent of Liverpool's households. Households are distributed relatively evenly across the 30 Liverpool wards.

The City has undergone an intense programme of regeneration in recent years, with over 40 per cent of households located within the boundaries of an area based initiative. Current programmes include the Housing Market Renewal Initiative (HMRI) which aims to tackle problems of housing market failure. There are seven Neighbourhood Renewal Areas (NRA) funded under the Neighbourhood Renewal Fund[3] (NRF) and all, with the exception of Garston NRA, are situated within the boundaries of the HMRI.

Figure 1 depicts the main administrative areas in Liverpool. The location of the five NMAs is demarcated by the red boundary lines, and the shaded beige area shows the Housing Market Regeneration Initiative area. The NRA areas are also highlighted (in blue), and the wards are shown by the light grey boundary.

Around a third of Liverpool's households are situated within postcodes classed as 'Urban Prosperity' by the ACORN Classification[4], 28 per cent are classified as 'Comfortably Off', while 18 per cent are classified as 'Hard Pressed.' The majority of Liverpool housing (72%) is privately owned (including owner occupied and privately rented dwellings), 20 per cent of homes are managed by registered social landlords and the remaining 8 per cent are owned by Liverpool City Council[5]. The majority of residential properties in Liverpool (78%) are in Council Tax bands A or B.

Figure 1   Map of Liverpool key administrative areas

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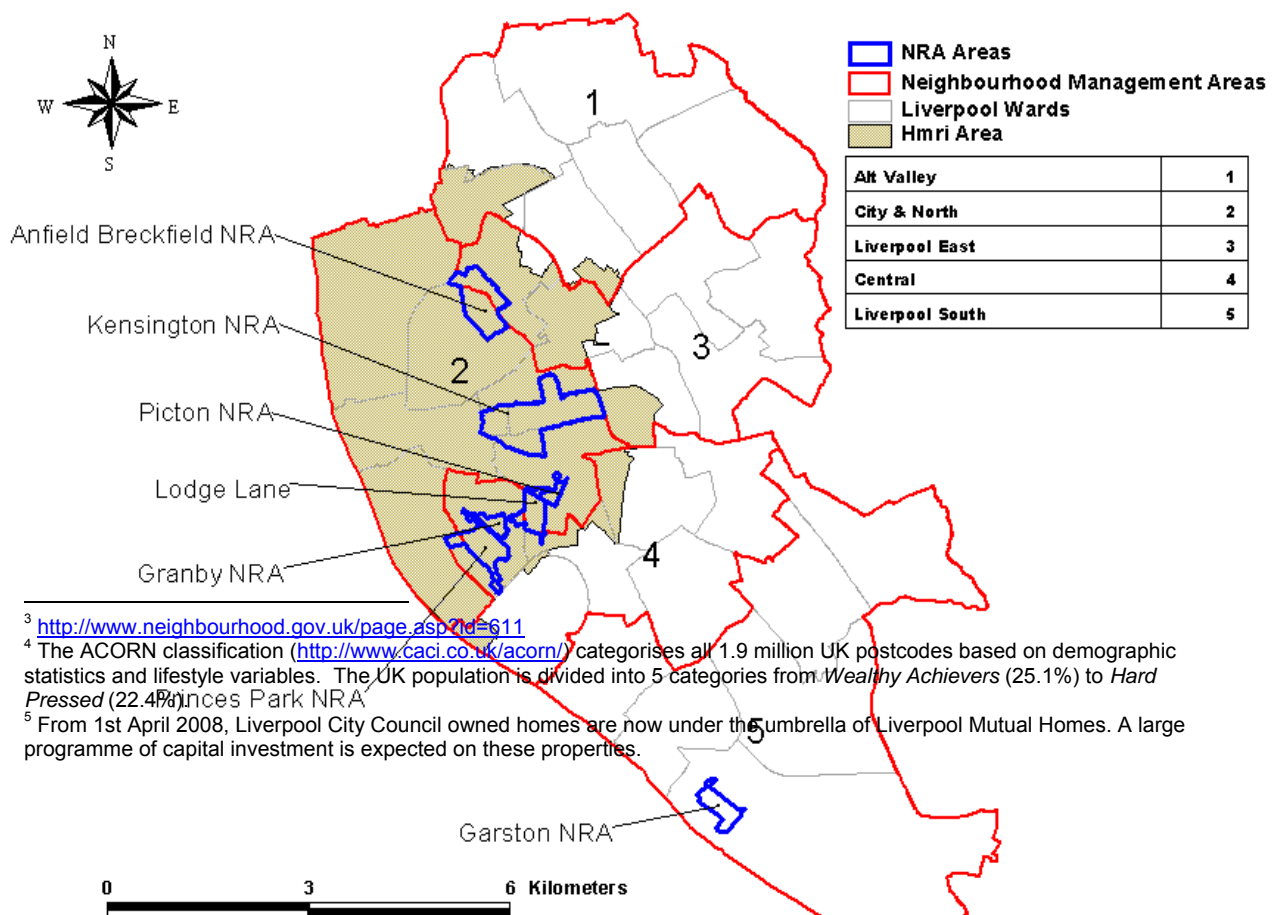
[3] http://www.neighbourhood.gov.uk/page.asp?id=611
[4] The ACORN classification (http://www.caci.co.uk/acorn/) categorises all 1.9 million UK postcodes based on demographic statistics and lifestyle variables. The UK population is divided into 5 categories from *Wealthy Achievers* (25.1%) to *Hard Pressed* (22.4%).
[5] From 1st April 2008, Liverpool City Council owned homes are now under the umbrella of Liverpool Mutual Homes. A large programme of capital investment is expected on these properties.

4.1 Target Hardening in Liverpool

Funding for target hardening came from a number of different sources but predominantly through Liverpool Citysafe, the HMRI and the NRF. Target hardening delivered through different funding streams was carried out with different objectives, for example in the HMRI target hardening was not aimed solely at reducing burglary, but rather was conducted to increase residents' feelings of safety, and to retain residents within the community whilst regeneration takes place around them. Some of the target hardening installed in order to prevent crime was aimed at reducing domestic violence and criminal damage, and not primarily burglary. Furthermore, target hardening may have been introduced by private owners of households, and this is not included in the analysis, nor the findings presented in this Report.

5.0 Data and Methodology

Various data sets were captured for this research including information on domestic burglary, target hardening, housing tenure and other characteristics of individual properties, regeneration schemes, and social and demographic characteristics of Liverpool neighbourhoods. These data were cleaned and merged together into a Geographical Information System (GIS), which was then combined with a statistical programme (SPSS), to produce a number of new variables that were necessary for the research. This brought together information on burglary, target hardening, and household characteristics for each individual property. Without this preliminary stage of data processing and data linkage this analysis would not have been feasible. The data was geo-coded where necessary and the accuracy of this was tested. A final stage was to identify the number of burglaries and target

hardening episodes for each individual property. This was achieved by assigning to each address a unique property reference number (URPN) generated using the National Land Property Gazetteer (NLPG). This was used not only to identify repeat victimisation but also, repeat episodes of target hardening

Hot spot maps were produced to help visualise the relationship between the distribution of burglary and target hardening. The distribution of burglary was examined by producing kernel density estimate (KDE) surfaces (hot spot maps) in CrimeStat III (see Levine, 2004 and Chainey and Ratcliffe, 2005 for more details of this hot spot technique, which is currently widely used by police forces to produce hot spot maps). The new research step here was to overlay this map with information on the location, timing, nature and cost of target hardening. A map was also produced to compare the location of target hardening with the location of repeat victimisation.

In addition to mapping the spatial distribution of target hardening and burglary at individual property level, the GIS was used to identify which properties fell into which of the various administrative zones and policy priority areas used by the City Council. Once this had been achieved the total number of burglaries and target hardened properties could be identified for each administrative and regeneration area. This allowed correlations to be generated between burglary and target hardening across a number of spatial units (census output area and ward area, and housing renewal areas) and across different time periods.

An Index of Dissimilarity was constructed to identify the co-alignment between the location of the burglaries and that of the target hardened properties by quarterly periods. This revealed the alignment between proactive target hardening and areas with the greatest burglary risk. The use of the Index of Dissimilarity has a long tradition in urban sociology and social geography as a means of comparing the spatial distributions of two distinct populations (Duncan and Duncan, 1955, Timms, 1971). It measures the percentage of one group (e.g. black residents) who would have to move location to make its spatial distribution identical to that another group (e.g. white residents). It has been used to compare the spatial distribution of social classes, occupational groups (for example professional workers and manual workers), populations in different ethnic and country of birth categories and by gender across a given group territorial units (for example census zones and wards). It has also been

used to compare the spatial distribution of a single population at two different points in time (for example, the residential location of black people between 1991 and 2001 Population Census).

An innovative feature of this research is its use of the Index of Dissimilarity to compare the spatial distribution of target hardening to that of burglary. This was examined at both ward and super output area level. The formula for calculating this is:

$$\sum_{i=1}^{n} \frac{(x_i / \sum x_i) - (y_i / \sum y_i)}{2}$$

Where x_i is the number of burglaries, and y_i the number of target hardened properties in area i. Both of these are then divided by the total number of burglaries ($\sum x_i$) and the total number of target hardened properties ($\sum y_i$) across all zones in the city.

5.1 Research Limitations

There are some caveats to the research. The research only includes publicly-funded target hardening activity directed through Liverpool Citysafe. This data excludes any target hardening activity conducted and funded separately by householders or landlords of privately owned properties. It also uses police recorded data on domestic burglary which is known to be subject to under-reporting (Kershaw et al, 2007). This under-reporting may not be uniform by geographic area or social group. Additionally, the monitoring period creates an artificial time window through which burglaries are analysed; burglary events prior to the monitoring start date may have influenced future burglary and target hardening activity in ways which it is not possible to gauge. Further, burglary outcomes occurring post 2007 are not included in the analysis. There was a 99% success rate in the geo-coding of target hardening properties, and a 94% success in the unique property matching. However non-matched burgled properties (6%) are excluded from the individual property analysis.

One final potential limitation is the influence of the Modifiable Areal Unit Problem (MAUP) (Openshaw and Taylor, 1981). This may occur because spatial analysis can be sensitive to the definition of the units for which data are aggregated. By altering the shape and size of the boundaries used, the outcome of an analysis may also be altered. However, the research has considered a number of administrative areas (ward, super output area, and output area), and examined burglary and target hardening at the individual property level to minimise the potential impact of this.

6.0 Results

6.1 Burglary and Target Hardening in Liverpool

A total of 15,089 burglaries were recorded in Liverpool during the period January 2005 to December 2007. The average annual burglary rate was 23.6 burglaries per 1000 households. This has reduced over the three year time period from 24.9 to 21.5, a reflection of a wider trend (in all of Merseyside this figure has reduced from 17 to 13). Of the properties burgled in Liverpool during the monitoring period, 14 per cent were burgled two or more times (the average for England and Wales is 13%).

Liverpool East NMA experienced the highest rate of burglary with 27 burglaries per household per year. The City and North and Central NMAs both experienced near equivalent rates of 26. The lowest rate was identified in Liverpool South where 19 burglaries were recorded per 1000 households per year. Forty four per cent of burglaries committed during the analysis period were located within the boundaries of area based regeneration initiatives. The average annual burglary rate in these zones was 27, marginally higher than the average for Liverpool.

Altogether, 1739 properties were target hardened between July 2005 and December 2007 from the above funding streams, at a total cost of £911,715; a rate of 8 per 1000 households. This is three times lower than the burglary rate, thereby demonstrating the scarce nature of target hardening resources compared to burglary risk. The average (median) spend on target hardening was £478 per property, with a maximum of £2746 and a minimum of £11. Fifty percent of target hardened properties received installations costing between £159 and £680. The majority of properties received one episode of target hardening. A total of 219 properties received two separate target hardening installations during the monitoring period. Eight properties received three or more target hardening installations. The most frequent type of work carried out was the installation of PIR movement detecting lighting; this was fitted in 64 per cent of installations. Improvement to door security was the second most common intervention with 50 per cent of installations involving the fitting of door locks or bolts.

With a total of 210,366 households and an allocated spend of £911,745 it would not have been feasible, nor cost-effective, to target all Liverpool homes. Were burglary the only objective behind target hardening, protecting every previously burgled home would have diluted the spend on target hardening to just £77 per property. This highlights the necessity of 'rationing' the intervention by effectively targeting those homes that stand to benefit most from its implementation.

Following best practice and concentrating the intervention solely on those properties repeatedly victimised during the monitoring period would allow an average spend of £550 per property. However, given the broad objectives behind target hardening in Liverpool, burglary has been only one of the factors directing the targeting of the intervention. The analysis that follows contains an assessment of the extent to which target hardening resources in Liverpool have been directed towards the locations of greatest burglary risk.

6.2 To what extent does the allocation of target hardening relate to burglary risk?

The spatial distribution of burglary during the period July 2005 to December 2007 is depicted in Figure 2. This map shows hot spots of burglary represented by the dark black areas, and less intense hot spots in the light browns and red areas. This map was produced using the kernel density estimation method mentioned previously. The spatial distribution of target hardening across Liverpool during the monitoring period is also overlaid on Figure 2 in which all properties target hardened during the monitoring period are depicted using the blue circles.

Figure 2   **The spatial distribution of burglary and target hardening in Liverpool (2005 – 2007)**
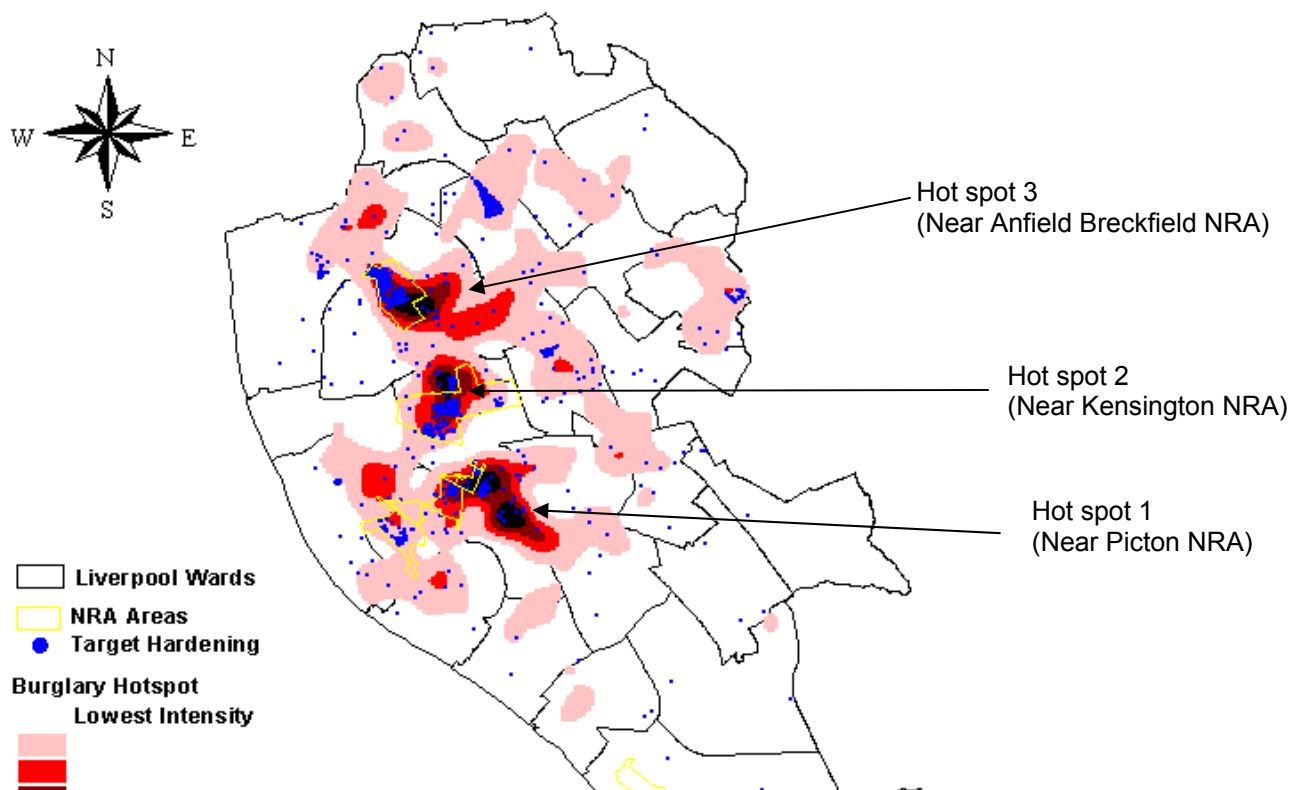
Three main burglary hot spot areas can be identified from the Figure. This southern most hot spot area (hot spot 1) has two distinct zones, one inside the City and North NMA and one that falls in the Central NMA. A second hot spot (hot spot 2) is identifiable further in the City and North NMA. Further north, the final major hot spot (hot spot 3) is again within the City and North NMA (NMAs are not on this map). With the exception of the most southerly hot spot (hot spot 1) these high burglary locations have received a large proportion of target hardening. Less intense hot spots can be identified to the west of hot spot one and north of hotspot three. These areas have received little target hardening.

Overall it is noticeable that the majority of target hardening has occurred in hot spot areas, although it is evident that much target hardening falls outside of the hot spot areas. This target hardening is not concentrated in particular areas but spread out across the whole of Liverpool, and reflects the targeting decisions made by Liverpool Citysafe to target individual properties it has identified as high risk.

It is important to note that the hot spots produced in this figure are for the entire period July 2005 to December 2007 and can be considered relatively stable hot spots. However, hot spots do change in both location and intensity over time. Thus for particular time periods other areas may have been hot spots for a shorter duration.

Table 1 summarises the geographical distribution of burglary and target hardening by the five administrative NMAs. The table presents the number, percent and cumulative percent of burglary in Liverpool NMAs ranked by number of burglaries. This is compared to the proportion of properties target hardened and the proportion of households in each ward. The table demonstrates that target hardening was far more concentrated than burglary, with half of all target hardening concentrated on just one quarter of Liverpool's properties. In comparison burglary was relatively evenly distributed across the City.

It was noted above that the Liverpool East, City and North and Central NMAs all displayed comparable rates of burglary. This is not the case for target hardening. City and North NMA experienced a quarter of the City's burglaries but received over half of the target hardening. Consequently, levels of target hardening in the remaining NMAs are disproportionably low compared to levels of burglary.

Table 1   Resource targeting table, burglary, and target hardening by Neighbourhood Management Area in Liverpool (2005 – 2007)

Neighbourhood Management Area (NMA)	Number of Burglaries	% Liverpool Burglaries	Cumulative % Burglaries	% Properties Target Hardened	Cumulative % Target Hardening	Cumulative % Liverpool Households
City & North	3803	25.2	25.2	51.1	51.1	23.3
Liverpool East	3401	22.5	47.7	27.1	78.2	43.1
Central	3160	20.9	68.7	14.2	92.4	62.1
Alt Valley	2526	16.7	85.4	6.4	98.8	81.4
Liverpool South	2175	14.4	100	1.2	100	100

At the level of NMAs a very strong positive correlation was identified between frequency of burglary and the number of target hardening installations. This relationship was also identified at the ward level confirming that the wards with the highest level of burglary had the highest levels of target hardening. A weaker, but still statistically significant relationship was identified when the locations of target hardening and burglary were examined at the more detailed Super Output Area level. Correlations between burglary *counts* and target hardening were higher than those for burglary *rates*. This suggests that target hardening has been directed towards burglary hot spots without taking into account the underlying population levels. Correlation coefficients for each level of analysis are summarised in Table 2.

Table 2 Correlations between burglary and target hardening

|	Burglary Rate		Burglary Count	
Level of Analysis	Number of Installations	Total TH Spend	Number of Installations	Total TH Spend
Neighbourhood Management Area (n=5)	.703**	.669**	.925**	.895**
Ward (n=30)	.436**	.401**	.626**	.598**
Super Output Area (n=250)	.157**	.130*	.202	.196

As outlined above the most significant predictor of a future burglary is a prior burglary. It therefore appears surprising that of the 1739 properties target hardened only eleven per cent were identified as having been burgled prior to target hardening. Only one per cent of Liverpool's burgled properties received target hardening during the monitoring period. Analysis revealed that the average time elapsed between a burglary and receipt of target hardening was 261 days; suggesting that even in these cases target hardening was not implemented as a direct response to a prior burglary.

Future burglary risk increases with the number of prior burglaries experienced. Repeat victimisation should therefore be central to the targeting of crime prevention interventions. Again targeting of repeat victims is lower than would be expected. Of the 1663 homes which experienced two or more burglaries over the analysis period only 82 (5%) have been target hardened.

Figure 3 displays the geographical distribution of target hardening with the distribution of repeatedly burgled properties (those properties victimised more than once during the analysis period). The map shows that repeats located in the Anfield Breckfield and Kensington NRAs overlap or at least are in close proximity to target hardening activity. However, repeats distributed elsewhere in the City do not appear to have been responded to with target hardening. The average spend per property was greatest for properties that had not been burgled, (£560.91) compared to those that had been burgled (£349.60), there was no difference in average spend between repeatedly victimised properties and those properties experiencing one burglary. Although expenditure is a measure of the level of target hardening allocated to an individual property, it is not a measure of the actual effectiveness of the intervention as for some housing less expensive measures might actually be more effective.

In summary, an area-level analysis suggested that target hardening and burglary locations were strongly aligned but a more detailed examination (at an individual property level) revealed that a number of high risk burglary properties were not protected by target hardening interventions.

Figure 3   Repeat victimisation and target hardening in Liverpool (2005 – 2007)
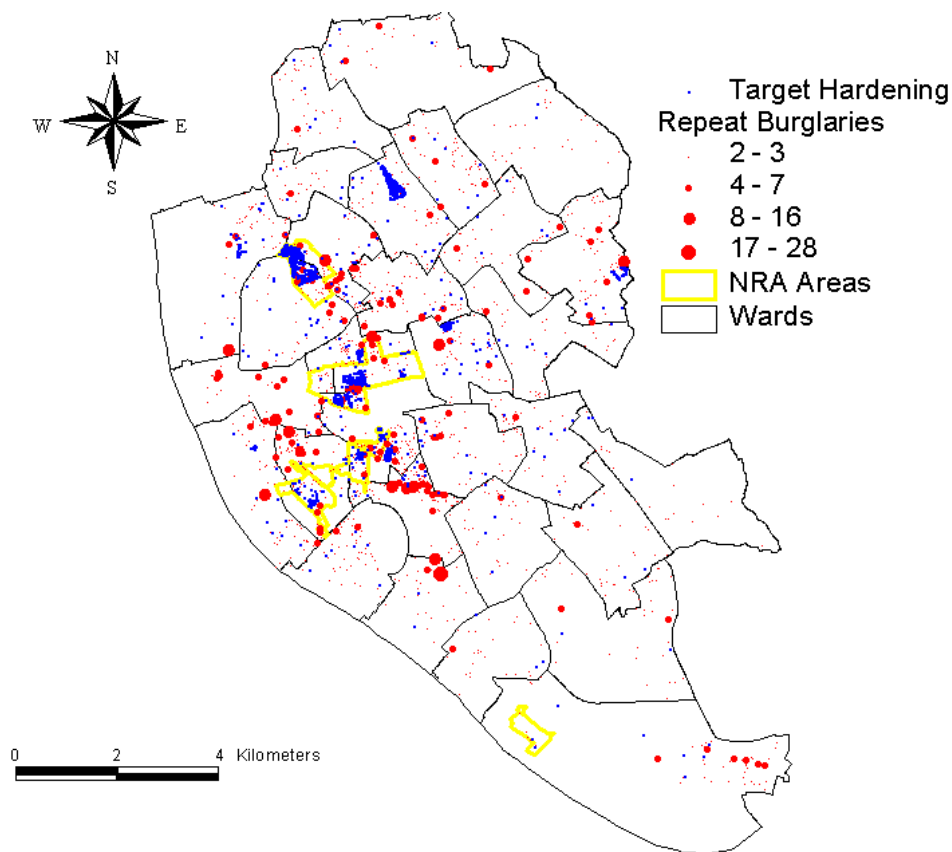
6.3 How has the relationship between burglary and target hardening changed over time?

The relationship between target hardening and burglary locations did not remain stable throughout the monitoring period. The Index of Dissimilarity (IOD) compares how far the spatial the distribution of one variable compares to that of another (see above). In this case it compares how far target hardening matches the distribution of burglary. It produces a single value that can be used to relate burglary with target hardening. The value of the IOD ranges from 0.1 (least dissimilarity) to 1.0 (maximum dissimilarity). IOD values were calculated over ten quarterly time periods to identify the alignment of

target hardening to burglary and how this was changing over time. The results of this are shown in Figure 4. The IOD is examined for two different areas, at ward level, and at Super Output Area.

The IOD is consistently lower for wards than for Super Output Areas. This suggests that burglary and target hardening are better aligned at ward level but less so across smaller areas. In other words, the apparent inter-ward similarities between target hardening and burglary are not reproduced at the intra-ward level that is, when comparing burglary and target hardening across the Super Output Areas within wards. At both ward and Super Output Area level, levels of burglary and target hardening were most aligned in quarter one (i.e. most similar). Over time, at both Super Output Area and ward level, the IOD has increased, thus the distribution of burglary and target hardening has become more dissimilar (i.e. less well aligned).

Figure 4   **Index of dissimilarity between burglary and target hardening by ward and Super Output Area (2005-2007)**
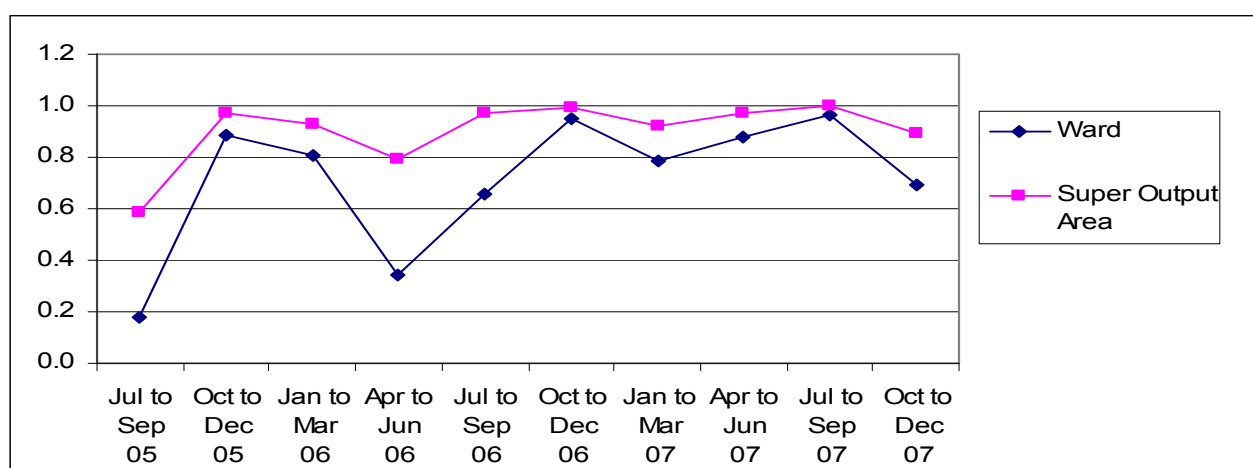
Time Period	Jul to Sep 05	Oct to Dec 05	Jan to Mar 06	Apr to Jun 06	Jul to Sep 06	Oct to Dec 06	Jan to Mar 07	Apr to Jun 07	Jul to Sep 07	Oct to Dec 07
IOD (Ward)	0.2	0.9	0.8	0.3	0.7	1.0	0.8	0.9	1.0	0.7
IOD (SOA)	0.6	1.0	0.9	0.8	1.0	1.0	0.9	1.0	1.0	0.9

6.4 What reasons can be identified to explain the overlap or mismatch between the allocation of target hardening and burglary risk?

There are several reasons that underpin the imperfect alignment of target hardening resources to burglary risk: the challenges of implementing this intervention in the private sector, the prioritisation of certain localities as a condition of funding and the broader non crime specific objectives of target hardening.

Although the majority of burglaries in Liverpool (72%) occurred in privately owned dwellings (including both owner occupied and privately rented) they received only 51 per cent of the target hardening,

17

whereas properties of Registered Social Landlords experienced 17 per cent of Liverpool burglaries and 30 per cent of target hardening. This probably reflects the fact that it is more straightforward for authorities to implement change in properties over which they have more direct control (for example, local authorities do not require the consent of occupiers to undertake security upgrades to homes under their direct control, and that legislative powers provides some leverage to ensure homes managed by Registered Social Landlords meet certain standards). Implementing target hardening interventions in the private sector presents greater challenges, not least gaining the involvement of landlords and homeowners. The relatively low level of installations within private homes is also likely to reflect the smaller proportions of such properties found within the City's regeneration zones.

Liverpool's area-based regeneration programmes probably had the strongest influence on the allocation of target hardening within the City. These initiatives provided most of the resources but restricted their spending to a few well defined areas. Consequently, 78 per cent of Liverpool's target hardening installations were concentrated within two of the NRA areas, yet these areas experienced only 48 per cent of Liverpool's burglaries.

Area-based initiatives such as the HMRI and NRAs inevitably involve prioritising some communities at the expense of others. A problem inherent in area targeting is where to draw the boundary as there are typically more households in need outside of priority areas than within them (Deakin and Edwards, 1993). The concentration of target hardening within NRAs in Liverpool is a reflection of the dilemma about how best to target scarce resources and one from which crime prevention is not immune (Hirschfield and Bowers, 2000). This is brought into sharper focus when target hardening and burglary risk are compared. However, it is also the case that the additional funding for regeneration in Liverpool has enabled more properties to be protected through target hardening than otherwise might have been the case.

Table 3 demonstrates that within these regeneration areas target hardening activity was concentrated within the Anfield Breckfield NRA. While this NRA had a high level of burglary, it was not the highest. The over-representation of target hardening in this area reflects the timetable of housing renewal activity for which Anfield Breckfield is amongst the first phases along with Kensington NRA, the area receiving the second highest level of target hardening.

Table 3   Resource targeting table, burglary and target hardening in six of the Liverpool Neighbourhood Renewal Areas (2005 – 2007)

	Number of Burglaries	% Liverpool Burglaries	Cumulative % Burglaries	%Properties Target Hardened	Cumulative % Target Hardening	Cumulative % Liverpool Households
Kensington	700	4.6	4.6	14.9	14.9	3.5
Anfield Breckfield	506	3.4	8.0	36.4	51.3	5.7
Princes Park	201	1.3	9.3	3.2	54.5	7.1
Lodge Lane	181	1.2	10.5	2.6	57.1	8.0
Picton	123	0.8	11.3	2.1	59.2	8.5
Granby	44	0.3	11.6	0	59.2	8.9
Rest of Liverpool	*13299*	*88.1*	*100*	*40.8*	*100*	*100*

The high levels of target hardening activity in the City and North NMA identified in Table 1 is also attributable to the concentration of neighbourhood renewal activity, with all but one of the NRAs and the majority of HMRI activity sited within its boundaries.

The three burglary hot spot areas identified in Figure 1 above overlap with the regeneration zones. All three hotspots fall within the HMRI area, although the most southerly of these three main hot spot areas does extend to outside the HMRI. Hot spot one overlaps with the Picton and Lodge Lane NRA areas, hot spot two with the Kensington NRA, and hot spot three with the Anfield Breckfield NRA.

These hot spot areas have a large proportion of target hardening, especially in the Anfield Breckfield NRA and the Kensington NRA. However, the most southerly hot spot (three) has been afforded less target hardening, potentially as part of it lies outside of the HMRI area. Consequently properties at risk of future burglary are more likely to receive target hardening if they are located within a regeneration zone.

Area based regeneration initiatives in Liverpool have adopted target hardening to meet a number of objectives, not limited to burglary reduction. This includes other crime prevention targets, such as the reduction of domestic violence, hate crime and criminal damage, but also includes wider social targets including 'living through change' and community cohesion.

7.0 Discussion: Was target hardening distributed appropriately, given the distribution of populations and burglary risk across Liverpool?

This research has examined the relationship between the allocation of target hardening in Liverpool and burglary risk, both in location and time. It is evident from this research that although an

examination at ward level suggests those wards with high levels of burglary also experience high levels of target hardening, this relationship becomes less apparent when looking at smaller geographical scales (super output area and individual property level). Indeed only 11% of target hardened properties had previously been burgled. Over time, the distribution of target hardening and burglary have shown increasing dissimilarity. Furthermore, despite the well established research demonstrating the importance of repeat victimisation in predicting future burglary, the target hardening in Liverpool has not been directed towards repeats. This is a missed opportunity to help those properties most at risk

It is suggested that there are a number of potential reasons for the imperfectly aligned relationship between burglary and target hardening. There are perhaps three that can be clearly identified from this research.

- There are a range of priorities (beyond burglary reduction) for which target hardening is implemented.

- A large proportion of the funding is from regeneration activity which has distinct geographical locations and a wider remit than burglary prevention

- There is no clear systematic method for allocating target hardening based on a number of key risk factors. These include burglary risk, prior target hardening, the funding available (incorporating discussion between the RSLs, Citysafe and HMRI), and also potentially the vulnerability of the occupants.

It is evident that the co-alignment between burglary and target hardening has decreased over time. One of the likely reasons for this is that the funding activity within the NRA areas has been phased in over time and has been channelled primarily in two areas during the study period. Although this has increased the volume and dosage of target hardening in the areas that have benefited it has at the same time widened the gap between areas of need, where burglary risk is greatest, and the areas that have been protected that contain only a small proportion of the properties most at risk. This is clearly reflected in the IOD values that show an increasing disparity between the areas most vulnerable to burglary and those best protected against it.

It would have been useful for the purposes of this research to examine target hardening by each of the sources of funding separately to ascertain if there were differences in the relationship between target hardening and burglary risk by funding source. Unfortunately, the available data did not permit this. The next stages of this research, which the authors will discuss in a future paper, will examine the actual impact of target hardening on burglary, and then from this to recommend suggestions for the future strategic deployment of target hardening resources.

7.1 Future Research

This paper has presented an analysis of the spatial distribution of a policy intervention, an area of research which, unlike the analysis of policy problems, has received limited attention from academics. Further development of this approach for other crime prevention contexts is necessary to comprehend the extent to which:

- crime prevention measures are allocated appropriately given the populations at most at risk;
- 'inverse prevention laws' exists (i.e. where areas with lower crime receive more attention, Harvey et al, 1989)
- there is a variation in crime prevention response across communities with similar levels of need;
- improvements in the alignment of prevention with risk are required.

It has been acknowledged that target hardening in Liverpool was implemented to meet a broad range of objectives. Within the scope and remit of this research it was only possible to consider the alignment of resource inputs to locations of burglary risk. Future research should consider the alignment of resources to these other objectives and assess whether different priorities produce complementary or competing registers of at risk properties.

While the impact of target hardening has not been the subject of this paper, previous research has indicated that methods of resource allocation are instrumental factors in the effectiveness of interventions. Where detailed policy data are available future research should compare the impact of variant targeting strategies on outcomes. The analysis of the spatial and temporal distribution of crime prevention overlaid with the corresponding distribution of crime might shed more light on how far crime change can be attributed to policy interventions; the inability to do so being a persistent

dilemma that confronts most policy evaluators (Pawson and Tilley, 1997, Eck, 2005). This approach to policy questions may require the development of refined methodologies for evaluation.

The benefits of policy analysis are not limited to crime and crime prevention, and are eminently applicable to other social policy domains, and notably to investigations into the interactions between policy domains.

7.2 Future Policy and Practice

It has been acknowledged that target hardening is installed to meet a wide range of policy objectives. However, as burglary reduction remains an intended outcome of target hardening it is essential that the highest risk properties are protected. The analysis has shown that to date this has not been the case. There is an indisputable case for prioritising properties on the basis of prior burglary history, area crime levels and existing levels of target hardening protection. The authors are working with Liverpool City Safe to pilot the use of a Property Risk Index which incorporates these three risk factors in order to produce a register of at risk properties.

An additional factor in this is the difference between risk and vulnerability highlighted by Millie (2008), and the implications this has on the how to prioritise target hardening. Should properties in high crime areas be targeted, or those which have been burgled before in high crime areas (highest risk), or those with residents deemed to be more vulnerable, or a combination of some or all of these?

The limitations of geographically-bounded funding streams can result in a 'post code lottery' where high risk cases lying outside funding zones are poorly served. Opportunities for more flexible funding sources should be explored where possible. The current round of HMRI funding offers greater flexibility in providing assistance in that a proportion of funds can now be allocated outside of the regeneration zone.

A clear implication of the research outlined above is the sheer volume and detail of information that would need to be captured on policy interventions such as target hardening, the responsibility for which would fall on a range of agencies and gatekeepers. The centralised approach to data collation adopted by City Safe is valuable offering greater efficiency and economies of scale and the potential to be expanded to a wider range of policy interventions.

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