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The Relationship Between Deprivation and Forensic Opportunities with Stolen Vehicles

ABSTRACT: Collection and interpretation of forensic intelligence (primarily through DNA and fingerprint identifications) is an integral part of the investigation of criminal offenses ranging from burglary and vehicle crime to major crime. The forensic contribution depends not only on the successful recovery of material, but also the ability to identify potential offenders and apply this intelligence to solve the crime. This study examines burglary and vehicle crimes investigated by Northamptonshire Police (U.K.) by analyzing relationships between deprivation of a crime location and the recovery and identification of DNA and fingerprint material. The results show that, for stolen vehicles, although significantly more forensic material (both DNA and fingerprints) is recovered and identified in more deprived neighborhoods, this does not lead to a corresponding increase in solved cases. These findings are considered in relation to previous studies, which have advocated the prioritization of resources at crime scenes most likely to yield forensic material.

KEYWORDS: forensic science, criminalistics, DNA, fingerprints, deprivation, crime scenes

The importance of forensic intelligence (primarily DNA and fingerprint identifications) is now well established as a standard technique for investigating and solving a wide variety of offenses from burglary and vehicle crime to serious and major crime such as rape and murder (1,2).

Clearly, successful generation of forensic intelligence requires the efficient use of police resources to both examine crime scenes for forensic material and to then process that material. Successful processing of this forensic material will result in the identification of a suspect (known as forensic intelligence) that will lead to their arrest and a police interview. During this interview the suspect will be asked to account for why their DNA or fingerprints were found at the crime scene and failure to provide a satisfactory explanation can lead to the suspect being charged and the crime considered solved to the suspect.

Much has been written about the deployment of Crime Scene Investigators (CSIs) to crime scenes since Saulsbury et al. (3) highlighted inconsistencies in CSI attendance across U.K. police forces in 1994. Two years after this, Tilley and Ford (4) found that requests for CSI attendance at crime scenes were rarely refused, irrespective of any criteria for attendance or opportunities to recover forensic material.

In the same year, a joint report by the U.K. Association of Chief Police Officers and the Forensic Science Service (5) recommended that CSIs should attend only those crime scenes most likely to yield forensic material. The report noted that one U.K. police force had implemented a *full attendance* policy for CSIs but conceded that the *value for money to crime investigation* of this approach required further study. Two further studies in 2000 and 2002 (1,2) recommended that U.K. police forces review their CSI attendance policies and focus CSI resources on those crime scenes most likely to yield forensic material.

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More recently, Adderley and Bond (6) considered the influence of deprivation on the actions of CSIs at both burglary and vehicle crime scenes. They found that whilst deprivation had no influence on the time spent by a CSI examining a crime scene, it did influence the recovery of both DNA and fingerprint material. By aggregating deprivation into eight distinct bands, crime scenes in more deprived areas were shown to yield more DNA and fingerprint material for burglary and vehicle crimes considered together. This correlation was shown to be statistically significant only for DNA material recovered, although fingerprint recovery showed a similar trend as deprivation increased. The study offered no explanation for these findings, other than to comment that they were contrary to the expectations of CSIs (6).

In both Adderley and Bond's study and this current work, deprivation was derived from an Index of Multiple Deprivation (IMD) produced by the U.K. government (http://www.communities.gov.uk/index.asp). The IMD contains seven domains of deprivation: income deprivation, employment deprivation, health deprivation and disability, education, skills, and training deprivation, barriers to housing and services, living environment deprivation, and crime, each of which are combined to yield the aggregate measure of deprivation (the IMD). The IMD is presented at Super Output Area Lower Layer (LSOA), each LSOA having an average population of 1500 people and a geographical boundary constraint used in the 2001 U.K. Census (http://www.neighbourhood.statistics.gov.uk/dissemination/Info).

In this paper, we examine in more detail Adderley and Bond's findings (6) by considering the recovery of DNA and fingerprint material for each crime type separately, and also for each LSOA rather than aggregated bands of deprivation. We relate this recovery to the subsequent identification of a suspect, that is, the generation of forensic intelligence and then to the conversion (or otherwise) of this forensic intelligence to the identification of the offender that enabled the crime to be solved. We consider our findings in relation to previous studies that have recommended focussing CSI attendance on crime scenes most likely to yield forensic material. Such an analysis is of interest for operational policing as, for example, stolen vehicle crime is a continuing problem in both the U.K.

(7) and U.S. (8). Data from the Insurance Information Institute for 2006 revealed that over one million vehicles were reported stolen in the U.S. at a value of nearly $8 billion with less than 13% of stolen vehicle offenses resulting in arrests (http://www.iii.org/media/hottopics/insurance/).

Method

The data used in this study was crime scene activity information recorded by Northamptonshire Police (U.K.). The data comprised crime scenes attended between April 2007 and March 2008. The categories of crime used for this study were burglary dwelling, theft from a motor vehicle (TFMV), and theft of a motor vehicle (TOMV). The dataset consisted of a total of 8702 crime scenes. The distribution across the three categories of crime type was 1958 burglary dwelling scenes, 3919 TFMV offenses, and 2925 TOMV entries.

Data was retrieved from the Northamptonshire Police electronic database in a series of distinct files, each representing recorded data relating to a different category of volume crime. For each of these categories of volume crime, the following information was obtained:

- The IMD score of each crime scene.
- The number of fingerprint exhibits recovered by CSIs from each crime scene as recorded in the database. This included both fingerprints recovered from a crime scene (''finger lifts'') and fingerprints found on items that were recovered from the scene and processed subsequently in a chemical laboratory.
- The number of DNA exhibits recovered by CSIs from each crime scene as recorded in the database.

The above information was used to determine whether the IMD score of a crime scene, for each of the above crime types, predicted the recovery of fingerprints or DNA material. The following additional information was then retrieved from the database for any crime types that showed a significant relationship between IMD and forensic material recovery:

- Whether fingerprints recovered from the scene were subsequently identified to a suspect for the crime.
- Whether DNA material recovered from the scene was subsequently identified to a suspect for the crime.
- Crimes that were subsequently solved as a result of the forensic material recovered.
- Crimes that were eventually solved by means other than identification of a suspect from the forensic material recovered.

The analysis of the relationships between variables in the data was performed using SPSS (SPSS, Inc., Chicago, IL) and Microsoft Excel (Microsoft Corp., Redmond, WA), which allow large-scale datasets to be organized, cleaned, manipulated, and analyzed in an efficient manner. All of the information retrieved from the database and described above was downloaded into Excel format which could then be easily transferred into SPSS for further analysis. Before any analysis could be carried out, the information contained in the data files had to be checked for completeness, and any database entries that did not contain a full complement of information had to be excluded from the analysis. This can be a common occurrence when dealing with data that is not recorded for research purposes, and deletion of cases with missing information is an acceptable solution for large datasets (9).

Results

A number of distinct relationships were analyzed in this study, and the findings for each are discussed in turn.

IMD Score and Fingerprint Recovery

The relationship between IMD score and fingerprint recovery was investigated for each crime type separately. The relationship to be tested in this section was based largely on interpretation of the findings in a previous study by Adderley and Bond (6) and can be summarized as whether the IMD score of a crime scene would predict the recovery of fingerprints for each crime type in turn (burglary dwelling, TFMV, and TOMV).

In order to determine whether the deprivation of the crime scene is a useful predictor of whether fingerprint material will be recovered, logistic regression was used. Logistic regression is an appropriate technique in this case because the outcome variable is dichotomous (material recovered yes/no) and the predictor variable (IMD) is continuous (10).

A logistic regression was run in SPSS using fingerprints recovered (yes/no) as the outcome variable and IMD score as the predictor variable. At the 95% confidence level the regression models indicated that IMD score predicted fingerprint recovery only for TOMV offenses. The models were not improved for burglary dwelling and TFMV with the introduction of IMD score as a predictor.

This finding supports the previous research (6).

IMD Score and DNA Recovery

Similar to the IMD–fingerprint relationship, the relationship between IMD score and DNA material recovery was investigated for each crime type separately. The relationship to be tested in this section was also based largely on findings in a previous study by Adderley and Bond (6) and can be summarized as whether the IMD score of a crime scene would predict the recovery of DNA for each crime type in turn (burglary dwelling, TFMV, and TOMV).

The same approach was taken for this relationship as described above in the case of fingerprint evidence. The logistic regression in this instance had similar results with IMD score predicting DNA material recovery only in the case of TOMV offenses (at the 95% confidence level). IMD score was not a significant predictor of DNA recovery for burglary dwelling or TFMV offenses when introduced into the regression model.

The statistically significant relationship between IMD score and fingerprint and DNA material recovery for TOMV scenes is represented graphically in Figs. 1 and 2.

Interpretation of Figs. 1 and 2 reveals that for both fingerprint and DNA material there is, on average, three times more material recovered at the highest IMD (most deprived) crime scenes

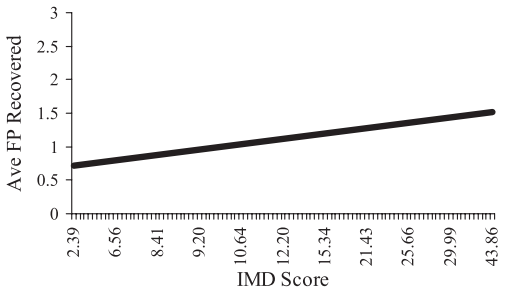

FIG. 1—*Graphical representation of the relationship between the average number of fingerprints recovered from a TOMV crime scene and the deprivation of the crime scene. The relationship is significant at the 95% confidence interval.*

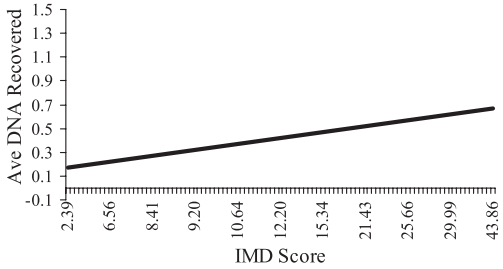

FIG. 2—*Graphical representation of the relationship between the average number of DNA samples recovered from a TOMV crime scene and the deprivation of the crime scene. The relationship is significant at the 95% confidence interval.*

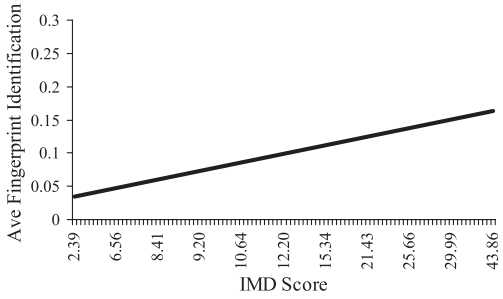

FIG. 3—*Graphical representation of the relationship between the average number of fingerprint identifications from a TOMV crime scene and the deprivation of the crime scene. The relationship is significant at the 95% confidence interval.*

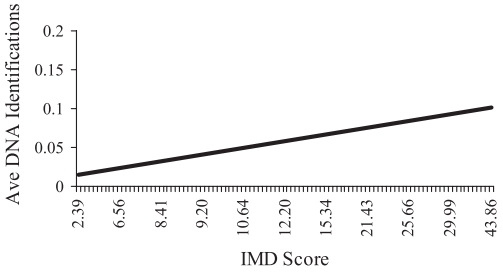

FIG. 4—*Graphical representation of the relationship between the average number of DNA identifications from a TOMV crime scene and the deprivation of the crime scene. The relationship is significant at the 95% confidence interval.*

compared to the average material recovered at the lowest IMD scenes. Having found a statistically significant effect of IMD score on material recovery (both fingerprints and DNA) only for TOMV crime scenes, the following analyses were only carried out for this crime type.

IMD Score and Average Number of Fingerprint and DNA Identifications

The relationships described above indicate that as the deprivation of crime scenes increases, more forensic material (both fingerprints and DNA) is recovered. The next relationship investigated for TOMV offenses was whether IMD score is related to the average number of fingerprint and DNA identifications (forensic intelligence) made from the material collected.

Figures 3 and 4 illustrate the relationship between IMD score and fingerprint and DNA identifications for TOMV offenses. At

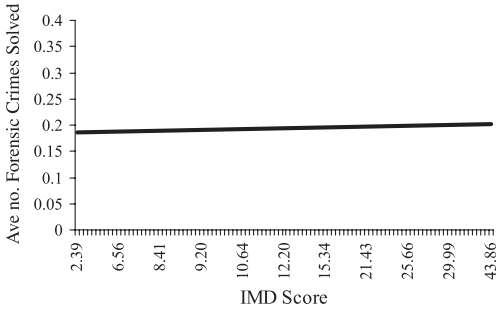

FIG. 5—*Graphical representation of the relationship between the average number of TOMV crimes solved by forensic intelligence and deprivation of the crime scene.*

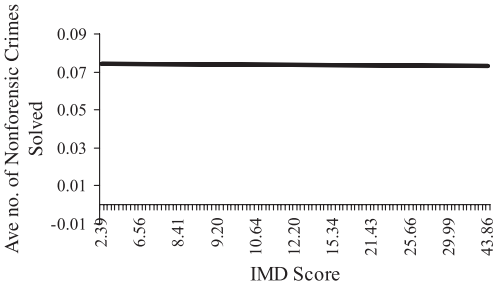

FIG. 6—*Graphical representation of the relationship between the average number of TOMV crimes solved by means other than forensic intelligence and deprivation of the crime scene.*

the 95% confidence level, both positive correlations are statistically significant.

IMD Score and Crimes Solved

The final relationship investigated was that of IMD score and solved crimes for TOMV offenses. The average number of crimes solved was divided into two categories: those that were solved because of forensic intelligence and those that were solved without this forensic intelligence. The crimes that were classified as solved without the forensic intelligence may have been solved for a number of alternative reasons, such as the result of witness identification or the perpetrator being caught at the crime scene. The relationship between IMD score and both types of case resolution were analyzed, and the results are depicted in Figs 5 and 6. As illustrated in the graphs, there was no statistically significant relationship between IMD score and the solving of TOMV crimes by forensic or nonforensic means.

Discussion

The aim of this study was to further investigate the relationship between deprivation and the recovery of forensic material from burglary and vehicle crime scenes. This required more detailed analyses of data similar to that used in previous research by Adderley and Bond (6). By separating the various crime types and using the IMD score for individual crime scenes, the results confirmed the findings of Adderley and Bond with regard to forensic material recovery trends by deprivation. In particular, this study has shown that the relationship between IMD and fingerprint and DNA material recovery was only statistically significant for TOMV offenses.

From an operational perspective, it is not only the potential for recovery of forensic material which is important but also the likelihood of the material producing a match with existing databases in order to identify the perpetrator. The findings of the current study suggest that for TOMV offenses there is an increase in DNA and fingerprint identifications (forensic intelligence) as the deprivation of the scene increases. So, not only do more deprived scenes yield more material, but also more forensic intelligence.

However, the most crucial relationship illustrated in this research is between IMD of the crime scene and the successful resolution of TOMV crimes. These findings suggest that although more material and forensic intelligence is generated at crime scenes in more deprived areas, this does not translate into more solved crimes. This finding conflicts with advice outlined in previous publications (1,2) about how police agencies should prioritize the deployment of CSI resources. This advice emphasized the importance of visiting crime scenes which are most likely to yield forensic material; however, this study has shown clearly that for TOMV scenes this strategy may not result in any increase in crimes solved by forensic intelligence.

Whilst we have not investigated explanations for the relationships highlighted above, there exists evidence in the criminological and forensic psychology literature which may contribute to the understanding of these trends. The increase in fingerprint and DNA identifications in more deprived areas may be due partly to the fact that recovered material belonging to the victim, or people known to the victim, is more likely to match a sample in the police databases. The relationship between socioeconomic status (SES) and crime has been the focus of many criminological and psychological research projects, with most concluding that low SES is a predictor of delinquent behavior (11). It may therefore follow that victims of crime in deprived areas are more likely to have their fingerprints and/or DNA held in police databases as a result of previous involvement with police than victims of crime in less deprived neighborhoods. This explanation can potentially explain both the increase in forensic identifications and the lack of increase in crimes solved as deprivation increases.

Explanations for why more forensic material (in addition to forensic identifications) is recovered from more deprived scenes were also not addressed in this study, and future research should investigate this further. One possible explanation is that there is simply more material to recover due to the cleanliness of the vehicles being examined. Another possible factor is where the vehicle is examined, as in some cases stolen vehicles are recovered to a contracted garage while others are examined by a CSI at the owner's property. Factors relating to where the car is examined such as environmental conditions, time spent examining, and communication with the owner of the vehicle may contribute to the ability of the CSI to successfully recover material which is most likely to belong to the perpetrator. It is not known whether these factors are related to the deprivation of the crime scene; however, future research should investigate these explanations further in order to better understand the relationships outlined in the current study.

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