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The Effects of Substance Use on Offender Crime Scene Behavior

ABSTRACT: Substance use has an effect on an individual's propensity to commit acquisitive crime with recent studies showing substance users more likely to leave forensic material at a crime scene. An examination of acquisitive crime solved in Northamptonshire, U.K., during 2006 enabled 70 crime scene behavior characteristics to be analyzed for substance and nonsubstance use offenders. Logistical regression analyses have identified statistically significant crime scene behavior predictors that were found to be either present at or absent from the crime scene when the offender was a substance user. Most significant predictors present were indicative of a lack of preparation by the offender, irrational behavior, and a desire to steal high value, easily disposed of, property. Most significant predictors absent from the crime scene were indicative of more planning, preparation, and execution by the offender. Consideration is given to how this crime scene behavior might be used by police investigators to identify offenders.

KEYWORDS: forensic science, forensic psychology, drugs of abuse, crime, psychology

Substance use* is rising among today's population, with experimentation more common than not, particularly during adolescence (1). U.K. policy studies suggest that heavy users of heroin, cocaine, and crack-cocaine (HCC) are equally heavily involved in acquisitive offending and/or drug dealing (2). In the U.K., by age 13, 80% of youths drink occasionally and by age 18 *c*. 80% drink regularly, peaking between 17–22 years (3) with acute consumption particularly associated with incarceration (4). Use of prohibited drugs varies with both age and substance, typically cannabis earlier in adolescence and HCC later. In the U.K., it is a priority for many police forces and forensic investigators to reduce drug-related crime by apprehending persistent and prolific offenders, who often have substance-related issues (5).

In a recent study, Bond and Sheridan (6) reported that more than 50% of acquisitive crime (also known as property crime) and over 30% of burglary and vehicle crime reported in Northamptonshire, U.K., between 2000 and 2005 were committed by substance users. They also reported that the range of acquisitive offense types committed by substance users was higher than for nonsubstance users, with substance users statistically more likely to commit two or more types of offense. Of particular interest to the current study is Bond and Sheridan's findings that crimes committed by substance users were significantly more likely to be solved by DNA or fingerprint material left behind at the crime scene. For domestic burglary and theft of motor vehicles, they demonstrated that the percentage of reported crimes solved by DNA or fingerprints was over 17% for substance users, compared with <1% for nonsubstance users. This difference was found to be statistically significant. They concluded that the crime scene behavior of substance users might be different from nonsubstance users in that substance users leave more forensic material at the crime scene because, for whatever reason, they are less concerned about being apprehended.

Bennett and Holloway (7) reported that, of those arrested with a history of substance use, 27% thought that prohibited drugs affected their judgment and made them more likely to commit offenses. Seddon (2) suggested there are different connections between different types of crime and different patterns of substance use among different groups of people; consequently there are variations in substance use-related crime. Häakkänen and Laajasalo (8) found substance use offenders to behave very differently to other offenders. This highlights the need to identify substance user offender characteristics and crime scene behavior, which could aid investigations.

Explanations for this include the "enslavement" model, which suggests that substance users may commit offenses with little control over their actions (9). In support of this, psychopharmacological theories of drugs and crime describe the way in which the chemical properties of drugs interact to produce specific behavioral outcomes (10). Bennett and Holloway (10) suggested users become more excitable, impatient, and irrational, which, in turn, can lead to an increased likelihood of criminal behavior. The most relevant substances are alcohol, barbiturates, and phenylcyclohexylpiperidine (PCP), followed by cocaine and heroin at later stages of withdrawal. Bean (9) suggested this model can be extended to property offenses.

There is indirect evidence to support this from the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV-TR), the standard reference text for psychiatric diagnoses (11). The physical, behavioral, and mental consequences of substance-induced intoxication/withdrawal are broad ranging, with substance-related diagnoses including: deliriums, memory disturbance, and psychotic, mood, and/or anxiety disorders. Changes associated with intoxication may also include cognitive impairment, mood dysfunctions, reduced judgment, psychomotor retardation, confusion, increased adrenalin leading to excitement, in-coordination, and euphoria. Those associated with withdrawal include hallucinations, tremors, anxiety, anger, restlessness, and agitation. It is therefore unlikely that these behaviors would lead to "clean" crime scene behavior.

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*In this context, we have taken substance use to mean the use to excess of alcohol or the consumption of drugs prohibited under the U.K. Misuse of Drugs Act, 1971 (http://en.wikipedia.org/wiki/Misuse_of_Drugs_Act_1971).

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White and Gorman (12) listed several potential neurological changes resulting from drug intake, all of which could lead to possible reasons why substance users would leave more forensic material at crime scenes and why they might have a more disorganized approach to crime scene behavior. This is enhanced at times of withdrawal when sleep deprivation and psychopathological personality disorders are worse (7,10).

Bartol (13) reported that one-third of American burglaries do not involve forced entry; rather offenders gain entry through unlatched windows or doors, or hidden keys in obvious places. Two-thirds of burglaries were reported as residential, usually occurring during the day or at weekends. Commercial burglaries were more often committed at night. This is not surprising given the passive nature of the crime; offenders want to select times and places where they are least likely to meet their victims. This also reduces the likelihood of the need for violence and use of a weapon, which reduces the penalties if caught. Bartol found the most popular entry methods were sliding through open doors, popping out doors with screwdrivers, and removing then replacing windows. This is quick, quiet, and reduces the risk of owners being alerted to the fact that they have been burgled.

The research of Bartol (13), Bean's (9) enslavement model, and Bennett and Holloway's work (7,10) might suggest that the behaviors of substance use offenders at crime scenes will be consistent with a lack of planning, preparation, and execution of the offense. In addition, previous research from psychiatric and psychological perspectives has found that substance users support the realization of more risky behavior (e.g., 14) and are more impulsive (15) than nonsubstance users. Further, Morgan et al. (16) demonstrated that substance users show reduced attention to possible losses, as well as gains, suggesting serotonergic dysfunction might undermine the processing of aversive (prison) as well as appetitive (drugs) cues in risky decisions. However there are problems in associating impulsivity to substance abuse as the direction of the causal relationship may be hard to find. Although these studies taken as a group do not provide direct support for substance users leaving more forensic traces at crime scenes, they do suggest a greater likelihood of more disorganized behavior, which may, in turn, lead to a greater chance of leaving forensic evidence. This view coincides with Bond and Sheridan's "indiscriminate behavior hypotheses" (6).

De Agra's (17) comparison with other deviant lifestyles suggested that the drugs/crime complex reveals the worst psychophysiological, emotional, and cognitive functioning structure. He argues that such individuals demonstrate difficulties in organizing information based on behavioral surroundings, and have problems with cognitive processing. This results in irrational decisions and behavior, and an increased likelihood of apprehension. Häakkänen and Laajasalo (8) reported the crime scene behaviors of substance users to be very similar to that of schizophrenics. They suggested in the majority of cases, substance users committed the offenses to finance their use and often provided anxiety avoidance, as associated with withdrawal. Alcohol-related offenses were found to be more related to impulsivity. They concluded that linking crime scene behaviors to offender characteristics is a complex issue because of the involvement of impulsivity, and sometimes the apparent lack of motive in theft cases. Thus, it may be impossible to estimate whether activity at a scene occurred because of the offender's characteristics, victim's reactions, or other situational factors.

Bernasco and Nieuwebeerta (18) investigated 548 Dutch burglaries and found burglars selected their locations according to a number of criteria: absence of a guardian, close to home, easy to enter, appearance of high-value items, and low risk of apprehension. This is in support of Taylor and Nee (19) and in line with the "Rational Choice Theory," in that burglars maximize rewards by purposefully selecting targets from a set of alternatives, with the notion that they may sometimes act impulsively and need not be aware of the law that drives their behavior (18). Mawby (20) suggested most burglaries are planned, rational acts and only rarely represent unplanned opportunistic acts. Mawby proposed that offenders think about the risk of being seen, the presence of inhabitants, ease of entry, and wealth of the property, when selecting their targets. Alternatively, Brantingham and Brantingham (21) suggested burglars follow a spatially structured, sequential, and hierarchical decision-making process when selecting targets.

Canter (22,23) suggested that psychological profiling should analyze connections between crime scene behavior and offender characteristics using statistical methods. When predicting offender characteristics such as substance use on the basis of crime scene behavior, Canter assumes that the characteristics reflect the behaviors and that there is variation in them, but also that there is some stability in the way individuals commit their offenses. However, this can be problematic as external events, such as the presence of a victim, can affect offender behavior. Santtila et al. (24) found it possible to predict certain offender characteristics on the basis of burglary crime scene behavior, thereby supporting the theoretical assumptions underlying profiling.

A criminal's modus operandi (MO) is comprised of choices and behaviors that are intended to assist in the completion of the crime. Thus to the criminal profiler, it is relevant because it can provide an array of information about the offender (25). Turvey (25) suggested a criminal's MO is comprised of learned behaviors that can evolve and develop over time, as the offender becomes more experienced and confident. However, they can also become less competent and skilful over time resulting from deteriorating mental state and/or increased use of substances. Thus substance users may become more careless and more likely to leave forensic evidence. Further, evidence of chaotic or disorganized behaviors at the crime scene may allow a profiler to consider the hypothesis of a substance using offender (alongside alternative hypothesizes such as mental disorder and psychoticism).

In this study, we examine in more detail Bond and Sheridan's findings that crimes committed by substance users were significantly more likely to be solved by forensic material (DNA or fingerprints) left by the perpetrator at the crime scene. From a consideration of acquisitive crime solved in Northamptonshire, U.K., during 2006, logistical regression analyses have been employed to evaluate 70 different crime scene behavior predictors. The significance of these predictors is then examined to provide further insight into the singular crime scene behavior of substance users. Finally, we consider how the crime scene behavior of substance users might be used as a means of offender profiling.

Method

Data were taken from acquisitive crime recorded in Northamptonshire, U.K., during 2006. Following previous work (6), acquisitive crime was taken to mean any offense that would normally be examined by a Crime Scene Examiner for forensic material in which the offender was hoping to acquire property for their own use or for monetary gain. Only crimes that were recorded as "solved" were included because information about offenders was required for this analysis.

Of the 2100 solved acquisitive crimes in the above definition for Northamptonshire in 2006, just over 45% were committed as a result of substance use by the offender. In order to consider the

combined influence of a number of predictors on the effect that substance use has on offender crime scene behavior, logistical regression analyses were performed using an equation of the form:

$$P(y) = \frac{1}{1 + e^{-(b_0+b_1X_1+b_2X_2+\cdots+b_nX_n+\varepsilon)}}$$

where $P(y)$ is the probability of y occurring given known values of x_i, b_0 is the y intercept, and b_i is the regression coefficient of the corresponding variable x_i. ε represents a residual term (26).

Here, values of x (predictors) were based around the following four predictor categories:

- Method of entry to the crime scene by the offender (*Entry method*).
- How the offender behaved and their actions in the crime scene (*Scene activity*).
- Different types of property stolen from the crime scene by the offender (*Items stolen*).
- What type of forensic material the offender left at the crime scene (i.e., fingerprints or DNA) and whether they displayed forensic awareness (i.e., by wearing gloves) (*Forensic predictors*).

All of the predictors were categorical, that is, they had values of 1 or 0 (equivalent to true or false) depending on whether the condition they represented was met at a particular crime scene or not. For example, if the offender spoke to the victim then this predictor (*Speech*) was assigned a value of 1 and if they did not speak to the victim was assigned 0. For each predictor category, the list of predictors are shown in Tables 1–4.

These predictors were selected as the data were readily available for all offenses and also because it was felt that they represent a range of characteristics likely to influence offender crime scene behavior.

TABLE 1—*Scene activity predictors.*

Predictors	Description
Property stolen	Items were stolen from the scene
Offender known	The offender was known to the victim (i.e., a relative or acquaintance)
Food or drink consumed	Food or drink was consumed at the scene
Speech	The offender spoke to the victim
Sleeper or sneak thief	The victim was asleep or in the house at the time of the offense
Offender identified	The offender was found while committing the offense and identified by the police or a witness
Property damaged	Property was damaged during the offense (i.e., a door was forced)
Offender disturbed	The offender was disturbed while committing the offense
Road traffic accident	A stolen vehicle was involved in an accident
Burnt out or abandoned	A stolen vehicle was left abandoned or was burnt out
Vehicle interference	The exterior of the vehicle was interfered with, i.e., the license plate, mirrors, or wheels
Window or door interference	The door or window was interfered with on a vehicle or property
Steering lock/cowling/ ignition interference	The steering lock, cowling, and/or ignition was interfered with to attempt to start a vehicle
Caught on close circuit television	The offender was seen on close circuit television
Violence at the scene	Violence occurred at the scene
Used in offense	A stolen vehicle was used in the offense (i.e., a robbery)
Weapon used	A weapon was used in the offense
Type of search	The search method used by the offender was either tidy (false) or untidy (true)

TABLE 2—*Entry method predictors.*

Predictors	Description
Secure property	Was the property left insecure (false) or secure (true)
Used instrument	An instrument was used to enter the vehicle or property
Key used or lock forced	A key was used to gain entry or a lock was forced
Deception or distraction	Deception or distraction was used to gain entry
Glass broken	Glass was broken to gain entry
Climbed up or over	The offender climbed up or over something to gain entry
Failed entry	The offender failed to gain entry after a visible attempt
Reached in	The offender just reached in and took something, such as through an open car window
Method not required	An entry method was not required and therefore no method was needed to gain entry, typically for motorcycles or theft from the outside of a car
Gate/shed/ garage	Access was gained via a gate, garage, or shed
Door	Access was gained through a door
Window	Access was gained through a window
No entry gained	No visible attempt was made to gain entry (i.e., a person was found acting suspiciously in the garden of a domestic dwelling)
Forced entry	Entry was gained through force (i.e., the victim was pushed out of the way so that entry could be gained)

Results

Logistical regression analyses were performed with substance user-related crimes as the dependent variable (yes = 1, no = 0) and the above categories of crime scene behavior predictors as the independent variables. The analysis was repeated for each of the four categories of predictor, the results being shown in Tables 5–8 for Scene activity, Entry method, Items stolen, and Forensics, respectively. These tables include only predictors that were shown to be statistically significant in the model. For each analysis, the assumption of multicollinearity was satisfied through the assessment of eigenvalues, variance proportions, and VIF and tolerance measures, as recommended by Field (26). In each of these tables, the value of Exp(B) shows, for each predictor, the odds of the outcome variable changing when the predictor changes from false to true. As the outcome variable is also dichotomous, Exp(B) is effectively showing the change in odds of a crime being related to substance use when that predictor changes from false to true. For Exp(B) > 1, the predictor is more likely to be true when the offender is a substance user and, conversely, Exp(B) < 1 indicates a predictor more likely to be true when the offender is not a substance user.

Table 5 shows independent variables that significantly predict whether a crime is related to substance use for scene activity variables. For example, if an offender was identified at a scene (*Offender identified*), then they were 3.05 times more likely to be a substance user than a nonsubstance user. Furthermore, if the steering lock/ignition/cowling was interfered with on a vehicle, then the offender was 2.87 times more likely to be a substance user.

Table 6 shows independent variables that significantly predict whether a crime was committed by a substance user for entry method data. If no visible attempt was made to gain entry, the

TABLE 3—*Items stolen predictors.*

Predictors	Description
Keys	Keys to vehicles were stolen
Vehicle	Vehicles were stolen
Vehicle—small	Small vehicles such as motorcycles were stolen
Vehicle—parts or accessories	Vehicle parts or accessories such as Satellite Navigation Systems, radios or license plates were stolen
Cash	Cash was stolen
Documents	Documents such as credit cards, cheque books, passports were stolen
Purse or wallet	Purses or wallets were stolen
Bags	Bags such as handbags or luggage were stolen
Phones	Mobile phones were stolen
Small electricals	Small electrical items such as MP3 players were stolen
PCs and equipment	Computers, games consoles, or games were stolen
CDs/DVDs/ videos/cassettes	CDs/DVDs/videos/audio cassettes were stolen
Radio/cassette/ CD player	Radio, cassette, or CD players were stolen
TV/DVD/ video player	TV, DVD, or video players were stolen
Clothing/footwear and accessories	Clothing, footwear, or accessories were stolen
Jewelry	Jewelry was stolen
Tools	Tools were stolen
Sports equip.	Sports equipment was stolen
Toys or games	Toys or games were stolen
Food or drink	Food or drink was stolen
Drugs or alcohol	Drugs or alcohol was stolen
Weapons	Weapons were stolen
Consumables	Consumables were stolen (i.e., cosmetics)
Garden or household items	Garden or household items were stolen (i.e., mirrors, lawn mowers)
Cigarettes/tobacco/ lighter	Cigarettes, tobacco, or cigarette lighters were stolen
Stationery/photos/ prints/posters	Stationery, photos, prints, or posters were stolen
Other	Other items were stolen (i.e., works of art)

TABLE 4—*Forensic predictors.*

Predictors	Description
Forensics	Were forensics left at the scene?
Awareness	Were there signs of forensic awareness? (i.e., glovemarks and a lack of forensic material)
Glovemarks	Were there glovemarks at the scene?
Property	Did the offender leave any personal property?
Fingerprints	Did the offender leave any fingerprints?
Footwear	Did the offender leave any footmarks?
Blood	Did the offender leave any bloodstains?
Cigarettes	Did the offender leave any cigarette butts?
Gum	Did the offender leave any chewing gum?
Cellular	Did the offender leave any cellular material? (also known as touch or contact DNA where there is no visible stain but a suggestion that the offender may have transferred their DNA through touch)
Saliva	Did the offender leave any saliva samples?

offender was 3.65 times more likely to be a substance user. If entry was gained through a window, they were 2.41 times more likely to be a substance user while if no entry method was required (*Method not required*), such as theft of a motorcycle, then the offender was significantly more likely not to be a substance user (Exp[B] = 0.24).

From the items stolen by the offender, Table 7 shows independent variables that significantly predict whether a crime was committed by a substance user. If jewelry was stolen, the offender was

TABLE 5—*Logistic regression model for scene activity predictors.*

			95% CL for Exp(B)		
	b_0	SE	Lower	Exp(B)	Upper
Offender identified	1.11	0.11	2.45	3.05***	3.81
Offender known to victim	0.61	0.21	1.22	1.83**	2.76
Offender disturbed	−0.29	0.14	0.56	0.75*	0.99
Vehicle burnt out, abandoned	−0.30	0.15	1.01	1.88*	3.51
Vehicle exterior interference	0.60	0.28	1.05	1.82*	3.17
Steering lock/ignition/ cowling interference	1.06	0.15	2.15	2.87***	3.84
Search method	0.39	0.10	1.21	1.45***	1.81

Note: R^2 = 0.11 (Hosmer–Lemeshow), 0.15 (Cox–Snell), 0.20 (Nagelkerke). Model $\chi^2(19) = 332.171$ ($p < 0.001$).
*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

TABLE 6—*Logistic regression model for entry method predictors.*

			95% CL for Exp(B)		
	b_0	SE	Lower	Exp(B)	Upper
Secure property	−0.34	0.16	0.53	0.72*	0.97
Used instrument	0.40	0.14	1.13	1.49**	1.98
Climbed up or over	0.49	0.22	1.05	1.63*	2.52
Method not required	−1.45	0.51	0.09	0.24**	0.64
Window	0.88	0.18	1.71	2.41***	3.39
No entry gained	1.30	0.44	1.53	3.65**	8.72

Note: R^2 = 0.06 (Hosmer–Lemeshow), 0.08 (Cox–Snell), 0.11 (Nagelkerke). Model $\chi^2(16) = 183.65$ ($p < 0.001$).
*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

TABLE 7—*Logistic regression model for items stolen predictors.*

			95% CL for Exp(B)		
	b_0	SE	Lower	Exp(B)	Upper
Keys	0.37	0.19	1.01	0.85*	2.09
Vehicles	−1.12	0.15	0.24	0.33***	0.44
Small vehicles	−1.26	0.28	0.16	0.28***	0.49
Documents	0.49	0.19	1.14	1.64**	2.36
Phones	−0.48	0.18	0.43	0.62**	0.88
Jewelry	0.99	0.20	1.82	2.68***	3.95
Garden, household items	−0.57	0.28	0.33	0.57*	0.98
Other items	−1.21	0.47	0.12	0.30**	0.75

Note: R^2 = 0.09 (Hosmer–Lemeshow), 0.12 (Cox–Snell), 0.15 (Nagelkerke). Model $\chi^2(28) = 238.48$ ($p < 0.001$).
*$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

TABLE 8—*Logistic regression model for forensic predictors.*

			95% CL for Exp(B)		
	b_0	SE	Lower	Exp(B)	Upper
Forensics present	−0.89	0.19	0.29	1.42***	0.60
Signs of awareness	−0.31	0.13	0.57	0.73*	0.95
Fingerprints	0.52	0.15	1.26	1.68***	2.23
Blood	0.77	0.24	1.35	2.17***	3.49
Cigarettes	1.36	0.31	2.12	3.91***	7.21

Note: R^2 = 0.02 (Hosmer–Lemeshow), 0.03 (Cox–Snell), 0.04 (Nagelkerke). Model $\chi^2(11) = 62.15$.
*$p < 0.05$, ***$p < 0.001$.

2.68 times more likely to be a substance user. Perhaps surprisingly, stealing cash was not a significant predictor, $p > 0.05$. If large or small vehicles (*Vehicle*, *Vehicle—small*) or items other than those specifically listed were stolen (*Other items*), then the offender was significantly more likely not to be a substance user (Exp[*B*] = 0.33, 0.28, and 0.3, respectively).

Table 8 shows independent variables that significantly predict whether a crime was committed by a substance user or not from the forensic material recovered from the crime scene. If fingerprints, blood, or cigarettes were found at a scene, then the offender was 1.68, 2.17, and 3.91 times more likely, respectively, to be a substance user. The only significant predictor in this category with Exp(*B*) < 1 was *Signs of awareness* with Exp(*B*) = 0.73.

Discussion

This study has examined a large number of crime scene behavior predictors that were considered likely to vary between substance users and nonsubstance users for acquisitive crime. Of the 70 predictors examined, 26 showed statistical significance. Of these 26, the 10 that produced the five largest and five smallest values of Exp(*B*) (and hence the largest predictor variation between substance use and nonsubstance use offenders) are illustrated in Fig. 1.

It could be inferred that all of the predictors in Fig. 1 for substance use are consistent with a lack of planning, preparation, and execution of the offense by the offender. For example, an offender being identified or apprehended at the crime scene suggests a lack of awareness of the presence of other people at the crime scene. This is consistent with Bartol's (13) theories, Bean's (9) enslavement model, and the work of Bennett and Holloway (7,10).

The lack of a visible attempt to gain entry to the crime scene suggests substance users are more opportunistic and therefore try to gain entry to a number of potential target scenes hoping to gain entry to a few. Possibly, due to substance intoxication, they have tried to gain entry but are physically/mentally incapable of completing the job. Alternatively, due to their impulsiveness and clumsiness, they were disturbed and then abandoned their attempt to gain entry. This could also be true of steering lock/ignition/cowling interference, which indicates a less than sophisticated attempt to start a vehicle. Interestingly, the value of Exp(*B*) for the stealing of vehicle keys (*Keys*) at 0.85 would suggest that nonsubstance users were more likely to use keys as a method of starting a vehicle. These findings are consistent with Bartol's (13) theories, and the work of Bennett and Holloway (7,10).

Stealing jewelry, which represents a high value and easily converted to cash commodity, was significant and is consistent with the findings of Bartol (13); however, stealing cash was not significant, $p > 0.05$. This may be because all offenders (both substance use and nonsubstance use) take cash from scenes, or that they cannot find it, or it is hidden and they do not search for it. Intuitively, it would be reasonable to expect an offender to take cash if they found it.

While the presence of blood, cigarettes, or fingerprints at the crime scene was significant, the most significant predictor (*Cigarettes*) is indicative of a nervous offender (to be smoking a cigarette) who is then also careless (by leaving it at the crime scene). The *Signs of awareness* predictor has Exp(*B*) < 1, which suggests that forensic awareness displayed by the offender is indicative of a nonsubstance use offender and supports these findings for forensic predictors. White and Gorman (12) listed several potential neurological changes resulting from substance use, all of which could lead to possible reasons why substance users would leave more forensic material at crime scenes and why they may have a more disorganized approach to crime. This is enhanced at times of withdrawal when sleep deprivation and psychopathological personality disorders are worse (7,10). These findings are in line with the previous research of De Agra (17) and Häakkänen and Laajasalo (8).

Three of the five most significant predictors for nonsubstance use (*Vehicle*, *Vehicle—small*, and *Method not required*) can be related to vehicle crime, which suggests that this is an area of criminality not preferred by substance users, possibly because the proceeds from the crime are less easily converted to cash than, say, jewelry and the crime requires more sophisticated execution (i.e., the need to start and drive a vehicle) than burglary, theft, or robbery. Stealing garden, household, and other items not listed specifically here would, again, be indicative of more planning and preparation by the offender and, possibly, "stealing to order" by targeting premises. Such preparation is not uncommon when stealing high performance and expensive motor vehicles or works of art. This distinction between substance users and nonsubstance users is consistent with the findings of Kinlock et al. (14), Brotchie et al. (15), and Morgan et al. (16).

Findings from the current study can pave the way for further developments in the areas of offender profiling with regards to crimes committed by offenders who have used drugs. It has been demonstrated that this type of offender demonstrated a lack of planning, preparation, and execution of the offense. Thus details of their MO may suggest a profile of a suspect who has a history of

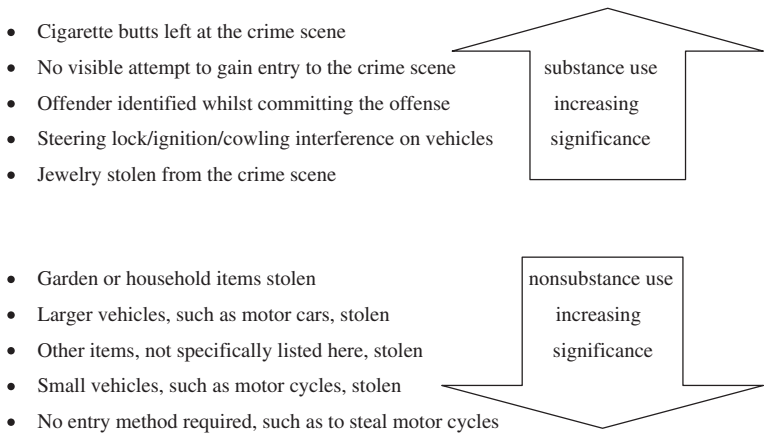

FIG. 1—*Most significant crime scene behavior characteristics for crimes committed by substance use and nonsubstance use offenders.*

substance use. This is particularly true if the crime scene behavior appears to deteriorate over multiple crimes, as the substance user becomes more careless and more likely to leave forensic evidence (25). Alternative hypotheses of other forms of mental disturbance will also always have to be considered in such cases.

These current findings provide further evidence to support previous work that has shown substance use to have an effect on offender crime scene behavior. Such research has practical uses for police investigators as it can assist in the identification of potential offenders through their crime scene behavior. This may be particularly useful when an individual is committing a large number of offenses, leaving DNA or fingerprints, but they are not on an offender database. The crime scene behavior of the individual may help in identification if the police have up-to-date information about an offender's substance use. It would also be useful for police interviewers to be aware of this.

An understanding of this from an investigator's perspective could aid in the apprehension and conviction of offenders (25). This is particularly useful as substance-related crimes are a principal concern and priority for many U.K. police forces. The reduction of substance-related crime through solving cases and reducing the number of prolific offenders, who often have substance-related issues, is a priority for the U.K. police service (5).

In conclusion, future research needs to explore relationships between substances, physical/mental effects and crime, and the causal effects. This could usefully include interviews with current and rehabilitating offenders to establish how their crime scene behavior varied depending upon their level of substance use and state of intoxication at the time of an offense. More research is also needed on the relationship between substance use and offense type and the effect it has on the recovery of forensic material from the crime scene (27).

References

1. McMurran M. Drug and alcohol programmes: concept, theory, and practice. In: Hollin CR, Palmer EJ, editors. Offending behaviour programmes: development, application and controversies. Chichester: Wiley, 2006;179–207.
2. Seddon T. Drugs, crime and social exclusion. Br J Criminol 2006;46:680–703.
3. McMurran M. Substance use and delinquency. In: Hollin CR, Howells K, editors. Clinical approaches to working with young offenders. Chichester: Wiley, 1996;209–35.
4. Chermack ST, Gianola PR. The relationship between alcohol and aggression: an integrated biopsychosocial conceptualization. Clin Psychol Rev 1997;1:621–49.
5. Home Office. National policing plan 2005–08. London: Home Office, 2004.
6. Bond JW, Sheridan L. The relationship between the detection of acquisitive crime by forensic science and drug dependant offenders. J Forensic Sci 2007;5:1122–8.
7. Bennett T, Holloway K. Drug use and offending: summary findings of the first two years of the NEE-ADAM programme. London: Home Office, Research Findings No.179, 2004.
8. Häakkänen H, Laajasalo T. Homicide crime scene behaviours in a Finnish sample of mentally ill offenders. Homicide Stud 2006;10:33–54.
9. Bean P. Drugs and crime. Devon: Willan, 2002.
10. Bennett T, Holloway K. Understanding drugs, alcohol and crime. Berkshire: Open University Press, 2005.
11. American Psychiatric Association. Diagnostic and statistical manual of mental disorders. 4th ed. Text Revision. Washington, DC: American Psychiatric Association, 2000.
12. White HR, Gorman DM. Dynamics of the drugs-crime relationship. Crim Justice 2000;1:151–218.
13. Bartol CR. Criminal behaviour: a psychosocial approach, 4th ed. London: Prentice-Hall International, 1995.
14. Kinlock TW, Battjes RJ, Gordon MS. Factors associated with criminal severity among adolescents entering substance abuse treatment. J Drug 2004;34:293–318.
15. Brotchie J, Finch E, Marsden J, Waller G. Impulsiveness and psychopathology among substance-abusing offenders on drug treatment and testing orders. J Forensic Psychol 2003;14:266–79.
16. Morgan JM, Impallomeni LC, Pirona A, Rogers RD. Elevated impulsivity and impaired decision-making in abstinent ecstasy (MDMA) users compared to polydrug and drug-naïve controls. Neuropsychopharmacology 2006;31:1562–73.
17. De Agra C. The complex structures, processes and meanings of the drugs/crime relationship. In: Brochu S, de Agar C, Cousineau M, editors. Drugs, crime and deviant pathways. Aldershot: Ashgate Publishing, 2002;9–32.
18. Bernasco W, Nieuwbeerta P. How do residential burglars select target areas? A new approach to the analysis of criminal location choice. Br J Criminol 2005;45:296–315.
19. Taylor M, Nee C. The role of cues in simulated residential burglary. Br J Criminol 1988;28:396–413.
20. Mawby RI. Burglary. Cullompton: Willan, 2001.
21. Brantingham PL, Brantingham PJ. A theoretical model of crime site selection. In: Krohn MD, Akers RL, editors. Crime, law and sanctions: theoretical perspectives. Beverly Hills: Sage, 1978;105–18.
22. Canter D. Psychology of offender profiling. In: Bull R, Carson D, editors. Handbook of psychology in legal contexts. New York: Wiley, 1995;343–55.
23. Canter D. Offender profiling and criminal differentiation. Legal Criminol Psychol 2000;5:23–46.
24. Santtila P, Ritvanen A, Mokros A. Predicting burglar characteristics from crime scene behaviour. Int J Police Sci Manage 2003;6:136–54.
25. Turvey B. Criminal profiling: an introduction to behavioural evidence analysis. London: Elsevier Academic Press, 2002.
26. Field A. Discovering statistics using SPSS. London: Sage, 2005.
27. Bond JW, Hammond CJ. The value of DNA material recovered from crime scenes. J Forensic Sci 2008;53:797–801.

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