Cluster Analysis as a Tool for Examining Crime-Scene Criteria and Childhood Correlates in Serial Killers: Can this help with Identifying Risk Factors and Interventions?

Taylor S*, Martin V and Workman L

Psychology, University of South Wales, UK

*Corresponding author: Sandie Taylor, Psychology, University of South Wales, Pontypridd, Wales, CF37 1DL, UK, Email: sandra.taylor@southwales.ac.uk

Abstract

The statistical procedure of cluster analysis has enabled researchers to differentiate serial killers based on various clusters of co-occurring traits. This has helped forensic psychologists to uncover connections between types of crime and associated criminal behaviour with potential risk factors. Here we first outline three risk factor models that have been developed to explain the extreme antisocial behaviour of offenders before moving on to consider our previous use of cluster analyses of serial killers. Finally, we present a new cluster analysis of 50 serial killers by considering the co-occurrence of crime scene and childhood traits.

Keywords: Cluster Analysis; Serial Killers; Risk Factors; Interventions

Abbreviations

GLM: Good Lives Model; RNR: Risk-Need Responsivity; ICAP: Integrated Cognitive Antisocial Potential; CL: Conventional-limited; HM: Home-instability; MP: Multi-risk persistent; FBI: Federal Bureau of Investigation; MO: Modus Operandi.

Introduction and Literature Review

A preponderance of published research into forensic psychology has focused on offender factors that might have an impact on the success rate of treatment and rehabilitation interventions. Based on this research, a number of different models have been developed to account for criminal behaviour and the relationship between criminality and the success rate of various forms of intervention. A study by

Porter, et al. [1], showed that sex offenders scoring high on measures of psychopathy (i.e. the PCL-R) were more likely to be successful in their applications for conditional release (2.43 times more so than non-psychopathic sex offenders). Non-psychopathic sex offenders, however, had a more successful release spending twice as many successful days out of prison (that is, they were less likely to reoffend). Why psychopathic sex offenders are more likely to be released than their non-psychopathic counterparts' rests on the very nature of an ability to dupe others and show a facade conforming to authority expectations. Farrington, et al. [2] found that age plays a significant role in antisocial behaviour. They claimed that crime figures for serious violent offences peaks in early adulthood whereas serious theft peaks during adolescence. Both of these studies demonstrate that there are key factors, such as personality disorders and age respectively, which can

impact on the type of crimes committed.

Importantly Gottfredson and Hirschi [3] differentiated between 'criminality' (i.e. a propensity to offend) and 'crime' (i.e. an event contravening the law) and offered insight to how traits such as low self-control and being criminally minded become activated when illegal opportunities arise. Gottfredson and Hirschi relate poor self-control to inadequate childrearing and socialisation. Children failing to attach to their caregivers are most at risk of developing poor self-control mechanisms which can lead to a lack of diligence, tenacity or persistence. Lacking in these qualities can help to promote a risk-taking and thrill-seeking disposition best suiting a criminal lifestyle. These findings suggest that such traits might be prevalent during childhood and act to facilitate antisocial behaviour ranging from juvenile delinquency to serial killing in adulthood. These traits can be considered as risk factors for antisocial behaviour and have been taken into consideration in risk assessment, offender needs and risk management. Different risk assessments concentrate on different factors. For example, static factors such as age, sex, parental upbringing and childhood background cannot be changed through treatment or rehabilitation interventions. Dynamic factors such as associating with delinquent friends and criminal colleagues can be altered simply by breaking ties. Blackburn [4] for example, classified risk factors into four categories:

- Historical (i.e. offence history and onset and lifespan patterns of violence)
- Dispositional (i.e. cognitive and emotional dispositions involved in reactions to social situations and problem-solving).
- Clinical (i.e. mental disorders linked with violent behaviour).
- Personality disorder (i.e. a personality condition linking with antisocial behaviour such as antisocial personality disorder).

Many of these points raised by Blackburn have been incorporated into models considering risk factors which will be considered next.

Models Considering Risk Factors

The Good Lives Model (GLM)

As forensic psychologists are moving towards an integrative approach in the assessment of risk, offender needs and how risk is managed, both static and dynamic risk factors are considered. For example, Laws and Ward [5] consider that internal and external change is required for sex offenders to desist from committing further sexual offending. To achieve this, they propose that treatment should follow an appropriate rehabilitation infrastructure enabling sex offenders to make the necessary adjustments to their

behaviour. This, they suggest, can be achieved using the Good Lives Model, Ward and Gannon [6] This psychological approach operates on the principle that offending behaviour prevents the offender from leading a 'good' and personally meaningful life. Hence, the objective here is to replace rather than remove the antisocial behaviour by providing social support through a well-structured programme. This enables the offender to take advantage of the support provided which, in turn, encourages desistance. Ward and Stewart [7] claimed that the attainment of, "friendship, enjoyable work, loving relationships, creative pursuits, sexual satisfaction, positive self-regard, and an intellectually challenging environment" (p.142) should be the aims of offenders and be incorporated into rehabilitation. If these can be achieved, they argue that the criminogenic needs of offenders become attenuated. Not all researchers agree with this approach.

The Risk-Need Responsivity (RNR) Model

Andrews and Gannon [8] claimed that criminogenic needs in assessments of risk are good predictors of recidivism. In contrast to the GLM, they propose the Risk-Need Responsivity (RNR) Model. Andrews, et al. [8] introduced three levels of risk assessment in their RNR model: risk principle, need principle and responsivity principle. In the case of the risk principle the intervention programme is matched to the level of determined risk. The need principle targets the functions that behaving criminally serves for the offender. The responsivity principle considers aspects of the offender's abilities and learning style which are matched to appropriate intervention programmes. These principles are important because they provide insight into which offender traits promote the successful completion and positive outcome of treatment / rehabilitation interventions. Andrews et al. argue that the RNR Model subsumes GLM, because GLM is primarily a frustration-aggression model of crime. When an offender is prevented from achieving their primary goods (goals) (e.g. friendship, enjoyable employment and interesting hobbies), they become frustrated. In effect it is the offender's criminogenic needs that are blocking their ability to attain their primary goods. The RNR Model takes into consideration factors such as motivation. Moreover, Andrews et al. [9] believe that by targeting criminogenic needs of offenders directly, the likelihood of reducing criminal behaviour outweighs the chance of enhancing primary good attainment and still maintaining a criminal outlook. RNR provides offenders with an outlook that promotes alternatives to favouring the continuation of criminal activity. Offender risk/need factors play an important role in the success of RNR-based approaches. Eight central risk/need factors have been identified:

- History of antisocial behaviour
- Antisocial personality pattern
- Antisocial cognition
- Antisocial associates

- Family/marital circumstances
- School/work
- Leisure/recreation
- Substance abuse

In addition to focusing on these central risk/need factors, RNR offers individualised assessments designed to identify minor risk factors. These can be used as the centre of focus for a more offender 'tailored' intervention approach.

The Integrated Cognitive Antisocial Potential (ICAP) Model

The Integrated Cognitive Antisocial Potential model ICAP; Farrington [10] considers the offender's antisocial potential in the short- and long-term. This takes into consideration a multitude of factors accounting for an individual's propensity to commit crime (i.e. the antisocial potential) and the situational factors providing the opportunities to offend. Many demographical and personal traits impacting on the individual's perception of the virtues of leading an antisocial lifestyle have been identified over decades of psychological research (for example failure at school, unemployment, gains by illicit means, life events, attachment and socialisation, impulsiveness and cognitive processing). ICAP is a profound model which considers many different factors conducive for a criminal lifestyle.

The ICAP model allows for interventions which target both long-term and short-term factors that can impact on antisocial behaviour. Long-term interventions can focus on cognitive-behavioural skill training geared towards managing problematic behaviours such as impulsivity and anger as well as increasing problem-solving ability. Parental education involves improving nurturance skills such as discipline, supervision and moral understanding – hence socialisation skills. Importantly in this context, early intervention programmes can be implemented to reduce the risk of future problematic behaviour such as antisocial behaviours that involve cruelty to others and animals. These interventions can address hyperactivity and impulsivity. Other long-term interventions can include social and economic factors such as improving education, improving family dynamics/relationships and ensuring appropriate relationships, treating substance misuse and providing employment opportunities. More immediate short-term interventions can focus on reducing the risk of offending by making changes to the home and social environment. Again cognitive-behavioural programmes can be employed to make individuals more alert to the consequences their antisocial actions can cause. There are programmes designed to modify the perceived rewards and punishments received as a consequence of their actions – such as reducing peer approval for bad behaviour and enforcing legal penalties. Situational crime prevention can be useful in designing an environment

to placate antisocial behaviour through effective surveillance and target hardening.

Based on previous actuarial research and prediction, the ICAP model has incorporated findings which show how different offender traits play a causal role in criminality. Actuarial prediction is based on the premise that an offender who has the same factors as other offenders is likely to behave in the same way.

The research of Del Bove and Mackay [11] for example, identified three fire-setting clusters based on personal risk factors such as:

- Motives
- Clinical problems (e.g. conduct disorder and attention deficit hyperactivity disorder)
- Developmental limitations including school difficulties
- Behavioural deficits in social competence, (self-control and antisocial behaviour)
- Family related risk factors (e.g. parental supervision and involvement, appropriate discipline and evidence of child abuse, neglect and parental psychopathology)
- Fire-specific factors (e.g. interest in fire, history of fire-setting, handling of fire materials, fire-setting motives, fire-setting severity and fire-setting recidivism)

All of these factors and traits were analysed using the statistical cluster analysis procedure in Del Bove and Mackay's study. The three mutually exclusive clusters identified contained clusters of factors / traits that had occurred together. From performing cluster analysis, Del Bove and Mackay [11] were able to devise a profile for each cluster:

- Conventional-limited (CL) - Least fire interest and fire-setting events; lowest sources of ignition and number of targets; oldest age of onset and mental health contact; most contact with parents; least abuse; highest academic achievement and social skills; least behavioural problems; antisocial motivations in 20%
- Home-instability (HM) - More fire-setting events than CL but more than MP; increased fire interest, source attainment and targets than CL but equal to MP; younger onset age than CL but older than MP; lowest parental contact but highest abuse in care; mental health contact when young; 86.5% have mothers with mental health problems; more social/behavioural problems than CL but less than MP; poor academic achievement
- Multi-risk persistent (MP) - Highest level of fire interest, source attainment, targets and fire-setting; youngest onset; 97% in contact with welfare organisations; live with parents; more abuse than CL but less than HM; mental health problems; most social/behavioural problems; antisocial motivations in 41%.

As we can see the statistical approach of cluster analysis is an effective method of finding connections between types

of crime and associated criminal behaviour with potential risk factors. In previous studies we have made use of cluster analysis in order to examine the typologies of serial killers.

Serial Killers and Cluster Analysis

To be considered as a serial killer, the Federal Bureau of Investigation (FBI) state that there has to be two or more victims unlawfully killed at different times and in different locations. This number, however, is often disputed where academics claim this should be at least three. Serial killers have received much attention since the introduction of psychological profiling (now known as offender profiling) by

Robert Ressler and his team in 1986 [12]. Ressler introduced the notion of the organised and the disorganised serial killer as two separate typologies describing differences in the way killings are carried out or the modus operandi (MO). Ressler and his team worked as part of the FBI – hence this type of profiling is often referred to as the FBI approach (see Box 1). In 1985 Holmes and De Burger introduced typologies based on the motives and motivations driving the behaviour of serial killers. Four typologies were introduced known as visionary, mission, hedonistic (lust, thrill and comfort-oriented) and power/control (see Box 1).

Box 1: Serial killer traits

FBI Organised and disorganised traits

Organised: Personal attributes - socially competent and adequate; egotist; charming; controlled mood, masculine image; high IQ; geographically mobile and lives with a partner. Crime scene attributes – targets a stranger; selects submissive victims; controlled crime scene and planned offence; aggressive acts; uses restraints; removes weapon; moves body; little physical evidence; identifiable MO.

Disorganised: Personal attributes – sexually inadequate; lives alone; crime scene is near home and workplace; low hygiene; low IQ; unskilled work; anxious mood during killing and changes behaviour. Crime scene attributes – victim known; chaotic crime scene; spontaneous event with extreme violence; no restraints; depersonalises victim; body, weapon and physical evidence is left at scene; necrophilia; unplanned no obvious MO.

Traits of Holmes and DeBurger's four typologies

Visionary: This serial killer murders as a result of the voices heard and the hallucinations seen compelling them to kill. David Berkowitz was told by his neighbour's dog to kill people. These serial killers experience episodes of psychosis.

Mission: This serial killer has a goal or a mission to eliminate specific individuals. They could be sex-workers, women or people of a specific faith. The Boston Strangler killed women due to a hatred of them.

Hedonistic: Underlying the three subtypes (lust, thrill and comfort-oriented) is the element of seeking to derive self-gratification and pleasure – hence hedonism. In the case of lust, it is sexual gratification; thrill it is the gratification of committing the kill and for comfort-oriented pleasure is derived from attaining money. Harold Shipman murdered his elderly patients to gain money from their wills by altering the content in his favour.

Power/control: By controlling and overpowering their victims these serial killers attain gratification. They like to dominate their victims during and after the crime. Theodore Bundy felt gratified through his actions of control and overwhelming his victims.

Taylor, et al. [13] adopted the statistical approach of agglomerate hierarchical cluster analysis in their examination of profiling serial killers. The aim of Taylor et al. was to identify crime scene criteria (such as restraints used, gagging or chaotic scene) and victim (such as known or a relative) and serial killer (such as being mobile or taking trophies) traits that co-occurred-a number of clusters were found. Based on the FBI organised-disorganised dichotomy (study 1) and Holmes and De Burger's typologies (study 2) it was found that clusters were formed but each cluster contained 'rogue' crime scene criteria (or traits).

These rogue traits were out of place with the majority of traits comprising either the organised or disorganised

dichotomy. In other words, there were rogue traits present in each cluster resembling a mixed category synonymous with Douglas and Munn's 1992 mixed offender classification. Taylor et al. concluded that there is a generic organised element to most murders committed by serial killers and that it might be more effective to classify serial killers according to disorganised traits present. In 2017 Taylor, Cahillane and Workman compared North American with European serial killers using the same methodology but adopting the FBI organised-disorganised dichotomy only.

Two clusters were found for both North American and European serial killers but again there were rogue traits present. By excluding the rogue traits from all four clusters,

cluster 2 and cluster 1 for North American and European serial killers respectively contained organised traits and cluster 1 and cluster 2 for North American and European serial killers respectively contained disorganised traits. The inclusion of rogue traits again supported the notion of a generic organised presence in most serial killings. Interestingly, however, by removing the rogue traits and using a greater than 16 percentage cut-off point as a frequency of trait occurrence differential, differences between North American and European serial killing was shown (Tables 1 & 2).

North America	Disorganised Traits	Europe	Frequency of Occurrence Differential (> 16%)
4%	removal of body parts	28%	24%
8%	mutilation	24%	16%
16%	dehumanisation of body	36%	20%
56%	spontaneous event	28%	28%
16%	multiple stabbing	36%	20%
60%	killer stable	80%	20%
56%	unclothed body	11%	45%
28%	vulnerable victim	48%	20%

Table 1: Disorganised traits collapsed across cluster and location (from Taylor et al. 2017).

North America	Organised Traits	Europe	Frequency of Occurrence Differential (> 16%)
36%	killer mobile/ transit	16%	20%
32%	shooting	8%	24%
64%	process focused	40%	24%
72%	rape	48%	24%
24%	body transported	8%	16%
48%	restraints	20%	28%
44%	bondage	16%	28%

Table 2: Organised traits collapsed across cluster and location (from Taylor et al. 2017).

Both studies by Taylor, et al. [13,14] show that it is possible, by adopting the cluster analysis approach, to examine co-occurrence of crime scene criteria in relation to serial killers'

criminal behaviours, motives and modus operandi. This approach can also be used to examine risk factors specific to serial killers while using crime scene criteria such as a selection of traits from the FBI organised-disorganised dichotomy and Holmes and De Burger typologies. Taylor [15] discusses the importance of a socio-developmental approach as a means to understanding the positive and negative factors enveloping the developing child occurring within its environmental surroundings.

These positive factors such as a stable and secure family and good attachments to caregivers can promote prosocial behaviours. Negative factors or risk factors such as neglectful and rejecting caregivers can promote antisocial behaviour including criminal activity. Taylor and Workman [16] highlighted how affectional bonds with the caregiver provides an "emotional tie entwined with dependency" (p.95). Moreover, Toates and Coschug-Toates [17] have argued that a taste for murder can develop as a consequence of experiencing toxic attachments in childhood [18,19].

Such toxic attachments involve insecure attachments with caregivers inundated with experiences of neglect, rejection and abuse. Leistedt, Coumans, Pham and Linkowski [20] claimed that many of these murderers have experienced a childhood consisting of physical and psychological violence and family relationships which are dysfunctional and chaotic. It begs the question therefore of whether a profiling approach using crime scene characteristics and childhood correlates can be informative in terms of tailor-made interventions for the likes of serial killers.

The following study explored whether there is a relationship between crime scene characteristics and childhood correlates that can specifically link these traits to effective intervention approaches espoused in the models discussed earlier.

Cluster Analysis of Serial Killers Using Childhood and Crime Scene Traits

The statistical approach of agglomerate hierarchical cluster analysis was adopted as a means of examining the co-occurrence of crime scene (51) and childhood (20) traits. The cluster analysis protocol was very similar to those described in previous studies by Taylor, et al. [13,14]. Agglomerative hierarchical clustering operates through linking variables together into successively larger clusters by using a measure of distance or similarity. All traits start initially as individual clusters but through the agglomeration process crime scene and childhood traits that co-occur (in other words showing a relationship) are merged to form new clusters. This process continues until all traits are combined to form one single cluster. It is the nested clusters within larger

clusters generated through this forward clustering technique Bartholomew, et al. [21] that are more informative. This is achieved by making use of the Squared Euclidean Distance to calculate distances between variables (i.e. traits). By adopting the Ward's method as the clustering algorithm, it is possible to calculate the dissimilarities between the variables or traits enabling the formation of clusters. Furthermore, by analysing the total sum of squared deviations from the mean of a cluster, the algorithm is able to assess cluster memberships. The criterion for fusion of clusters is that it should generate the smallest possible increase in the error sum of squares. This agglomeration process uses the distance statistic known as the 'fusion coefficient' to combine clusters. A solution is provided for every possible number of clusters and the degree of change in the fusion coefficients is used to determine the optimal number of clusters [22].

50 male and female serial killer cases (18-65 years of age; from any country of origin who killed more than twice) were examined for the co-occurrence of crime scene (51 traits) and childhood traits (20 traits; see Tables 3 and 4).

Crime Scene Traits				
Restraints used	Spontaneous event	Victim known	Intoxication	Controlled scene
Stranger targeted	Sudden violence	Chaotic scene	Aggressive acts	Necrophilia
Weapon left at crime scene	Weapon planned	Body not moved	Weapon improvised	Physical evidence left
Gagging	Targeted group/person	Victim a relative	Quick kill	Shooting
Rape	Removal of body parts	Strangulation	Vulnerable victim	Torture
Mutilation	Unclothed body	Penetration with foreign object	Body exposed	Multiple stabbing
Trophy taken	Ritual aspect	Injuries to sexual areas	Sexualised body position	Murdered indoors
Murdered outdoors	Signs of beating	Arson	Killer mobile	Body transported
Disconnection from crime scene	Dehumanisation of body	Covering of face	Bondage used	Staging
Body disposal	Process focused	Act focused	Destruction of body	Removal of sex organs
Poisoned				

Table 3: Crime scene traits

Childhood Traits				
Neglect	Rejection	Abandoned	Physical abuse	Sexual abuse
Animal killing	Death of a family member	Divorce	Adoption	Mental illness
Head injury	Alcoholic parent	Parents are drug users	Over domineering parent	Religious family
Favoured by particular parent	Parents sexually abusing other children	Social outcast	Incest	Raped

Table 4: Childhood traits

The decision to investigate the serial killers selected rested on two criteria:
- Having killed more than two victims at different times and in different places
- The availability of reliable archival information detailing their childhood experience and crime scene characteristics (aka crime scene traits).

The inclusion of 50 serial killers was considered to be an appropriate sample size for increasing the probability of cluster formations showing crime scene and childhood trait linkage. The crime scene traits were selected primarily from informed publications detailing crime scenes by experts such as Ainsworth, Canter, Holmes and Holmes, Leyton, Ressler and Taylor et al. In the case of childhood traits, these were considered from findings from the developmental psychology literature and research such as Ainsworth, Bowlby, Curtis, Farrington, Langstrom and Grann, McKenzie and Moir and Jessel.

Hence the aim was to obtain different cluster formations consisting of specific crime scene and childhood traits

indicative of a typology from Holmes and DeBurger and the FBI organised-disorganised dichotomy. Using Ward's method, the agglomerative hierarchical cluster analysis revealed the nine distinct clusters (C) as follows:

- C1 co-occurring traits supports the power/control typology but with no co-occurring childhood traits. Crime scene traits include victim known; murdered indoors; rape; strangulation; gagging; torture; body transported; weapon improvised; restraints; unclothed body; body disposal.
- C2 co-occurring traits supports the mission typology but there were no childhood traits present. Crime scene traits include quick kill; shooting; weapon planned; murdered outside; stranger. Hence, premeditated.
- C3 co-occurring traits supports a serial killer who experienced parents that sexually abused other children, parents who were drug users and came from a religious family as a child. The crime scene traits include dehumanisation of the body; ritual aspect; covering of the face. These traits suggest a ritualistic serial killer but also fits with a lust/thrill typology given the face covering and dehumanisation of the body.
- C4 co-occurring traits supports a serial killer who experienced an over domineering parent; mentally ill; neglect; rejection as a child. The crime scene traits include weapon left; penetration with a foreign object; staging; physical evidence present; removal of sex organs; victim a relative; poisoned. This cluster implies two types of serial killer under hedonistic - comfort-oriented and lust/thrill typologies. Poisoning, victim a relative and staging with the childhood traits of abuse are indicative of a comfort-oriented typology whereas penetration with a foreign object and the removal of sex organs can be perceived as traits of the lust/thrill typology associated with the sexual gratification element of this hedonistic category.
- C5 co-occurring traits supports a serial killer who experienced adoption; animal killing; signs of beating and being favoured by a particular parent as a child. The crime scene traits include arson; spontaneous event; disconnection from the crime scene; chaotic scene; vulnerable victim indicative of a disorganised serial killer. This type of serial killer also symbolises someone who is angry given the state of the crime scene and who may also have been inclined to killing when a child.
- C6 co-occurring traits supports a serial killer who experienced rape, incest and sexual abuse as a child. Crime scene traits include process focused; sexualised body position, bondage used; trophy taken. These traits are consistent with a hedonistic lust typology (but there is overlap with a power/control typology)
- C7 co-occurring traits supports a serial killer who experienced abandonment and a head injury as a child. Crime scene traits include targeted group/person;

removal of body parts, destruction of body parts; intoxication; necrophilia. These crime scene traits suggest a hedonistic lust typology given that necrophilia could suggest a fear of abandonment just as their parents once did.
- C8 co-occurring traits supports a serial killer who experienced the death of a family member as a child. Crime scene traits include controlled crime scene; body not moved. There is not enough information here to describe a typology, but it can be said that this is an organised serial killer.
- C9 co-occurring traits supports a serial killer who experienced being a social outcast, physical abuse, alcoholic parents; parents who divorced as a child. Crime scene traits include aggressive acts; act focused; mutilation; multiple stabbing; sudden violence; body exposed; killer mobile; injuries to sexual areas. The crime scene traits are indicative of a disorganised serial killer, with a visionary typology

Discussion

C1 traits support the power/control typology where the serial killer receives sexual gratification through the domination of the victim. These serial killers are organised and have preplanned their killings from start to finish. It is interesting that there is no childhood traits found. It is possible that this is because childhood variables played no part in the MO of the killer. According to Holmes and Holmes [23] this type of killer suffers from a personality disorder such as psychopathy (not a childhood trait listed in this study). C2 crime scene traits are strongly indicative of the mission typology. Given that there were no childhood traits present, their killing might have derived from the development of attitudes in later life. C3 crime scene traits are indicative of the lust/thrill typology. The ritualistic element present might have derived from childhood where there could have been ritualistic elements present in their upbringing by the family. Also, witnessing parental sexual abuse towards other children might have crystalised a deviant attitude towards what is sexual gratifying. C4 crime scene traits are indicative of two typologies within the hedonistic category – comfort-oriented and lust/thrill. The majority of crime scene traits in C4 are indicative of comfort-oriented and finds support from the childhood traits. The removal of sexual organs and penetration with a foreign object, however, fits more with lust/thrill. C5 crime scene traits are indicative of a disorganised killer who is angry. Killing animals as a child is often associated with a personality disorder such as psychopathy. It is possible that this type of serial killer is a psychopath but is disorganised (although generally psychopathic serial killers are organised and power/control). It is more likely that this killer is visionary but there is not enough information to support this. C6 crime scene traits suggest a hedonistic lust typology

with an overlap with power/control. Childhood traits show that this type of serial killer has experienced much abuse as a child which has led to a deviant way of looking for sexual gratification. C7 crime scene traits suggest an organised serial killer of the hedonistic lust typology who fears abandonment (as reflected in their MO). The use of alcohol and drugs to intoxicate the victim helps to manipulate the victim. After killing the victim, necrophilia might have led to dismemberment (and even cannibalism as seen in Jeffry Dahmer). What is also interesting is a head injury during childhood which is known to dramatically alter behavioural patterns and even personality and emotions [24]. C8 crime scene traits consist of two – controlled crime scene and the body not moved. This is a very limited cluster, and the crime scene traits appear to contradict in that the crime scene is controlled and yet the body remains unmoved. Alternatively, it could be argued that, given the crime scene is controlled, there would be little if any evidence left by the body and the body could be well hidden. Hence, what appears to be contradictory might not necessarily be the case. The loss of a parent in childhood could have triggered this behaviour but there is so little information here except that the traits suggest an organised serial killer [25-29]. C9 crime scene traits suggest a disorganised serial killer with a visionary typology. The crime scene traits indicate much violence and chaos. Given the childhood traits present this serial killer has experienced a troubled upbringing and appears to have many psychological issues.

Although there is some ambiguity over the typology categorisations, especially among the hedonistic subtypes, the childhood traits have offered some information that could be used as risk identifiers. These, with the crime scene traits can offer some insight to the MO and motives underlying serial killing but more research is required using more childhood traits. These findings can add support to the knowledge about risk factors and the types of risk factors incorporated in both the Risk-Need Responsivity (RNR) [8] model and the Integrated Cognitive Antisocial Potential model (ICAP). Once childhood risk factors for different types of serial killers are identified, it is possible for forensic psychologists for example to devise appropriate tailormade intervention packages which can help to attenuate the associated aberrant thoughts, feelings and behaviours experienced by these individuals. By linking the ICAP model, for example, to the clusters formed in this study, we can see that in the case of C2 where there is a mission-oriented offender, changing attitudes via both long-term and short-term cognitive-behavioural therapy might be useful for setting prosocial goals and by changing the significance of rewards for the consequences of negative behaviour [10]. For C3 offenders, the family dynamics and relationships appeared to be a significant factor in their lust/thrill typology. Here, they witnessed ritualistic elements from childhood and witnessed

their parents sexually abusing other children [30-34]. This nurturance aspect of their childhood was inappropriate. By adopting long-term interventions which help to re-educate the inappropriateness of their socialisation and social relationships with their parents it is possible to reformulate or at least understand why their criminal behaviours are rewarding. Finally, in the case of C6, it appears that these offenders have experienced much childhood abuse and have developed a deviant connection between violence and sex [17]. This link acts towards reinforcing the behaviour by finding it rewarding and 'normalises' it. Introducing short-term and long-term interventions, this offender could receive trauma-informed therapy designed to deal with the childhood abuse experiences within a safe, trustworthy, transparent client-therapist relationship. Here, the offender can regain a sense of control during the healing process within a respectful environment.

In summary, by making use of cluster analysis we are able to differentiate serial killers into various clusters of co-occurring traits. In this study we were able to highlight specific clusters of serial killers by considering the co-occurrence of crime scene and childhood traits.

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