Investigating homicide offender typologies based on their clinical histories and crime scene behaviour patterns

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Abstract

The purpose of this paper is to identify offender typologies based on aspects of the offenders' psychopathology and their associations with crime scene behaviours using data derived from the National Confidential Enquiry into Suicide and Safety in Mental Health concerning homicides in England and Wales committed by offenders in contact with mental health services in the year preceding the offence (n = 759). The authors used multiple correspondence analysis to investigate the interrelationships between the variables and hierarchical agglomerative clustering to identify offender typologies. Variables describing: the offender's mental health history; the offenders' mental state at the time of offence; characteristics useful for police investigations; and patterns of crime scene behaviours were included. Results showed differences in the offender's histories in relation to their crime scene behaviours. Further, analyses revealed three homicide typologies: externalising, psychosis and depression. Analyses revealed three homicide typologies: externalising, psychotic and depressive.

These typologies may assist the police during homicide investigations by: furthering their understanding of the crime or likely suspect; offering insights into crime patterns; provide advice as to what an offender's offence behaviour might signify about his/her mental health background; findings suggest information concerning offender psychopathology may be useful for offender profiling purposes in cases of homicide offenders with schizophrenia, depression and comorbid diagnosis of personality disorder and alcohol/drug dependence.

Empirical studies with an emphasis on offender profiling have almost exclusively focussed on the inference of offender demographic characteristics. This study provides a first step in the exploration of offender psychopathology and its integration to the multivariate analysis of offence information for the purposes of investigative profiling of homicide by identifying the dominant patterns of mental illness within homicidal behaviour.

Offender profiling, Mental illness, Psychopathology, Multivariate analysis, Homicide, Crime scene analysis, Crime scene behaviours, Investigative advice

Introduction

Offender profiling and behavioural investigative advice

Traditional offender profiling has entailed predicting the likely socio-demographic characteristics of an offender based on crime scene information (Almond *et al.*, 2007). However, in the last 20 years, a broader definition of offender profiling has emerged in the UK: behavioural investigative advice (BIA) (Alison *et al.*, 2003). This consists of a more integrated multidisciplinary approach that recognises the range of reliable, tested and transparent evidence-based methods by which psychologists might provide advice to law enforcement during the course of an investigation (Alison *et al.*, 2007). The BIA approach has involved a focus on the bidirectional collaboration between academics and practitioners (Alison *et al.*, 2010).

Received 31 March 2019
Revised 25 June 2019
Accepted 31 July 2019

Behavioural investigative advisors are a professional group of individuals with extensive experience of serious crime and the knowledge to integrate their behavioural advice into an investigation (Rainbow, 2008). They provide advice and investigative support based on knowledge from behavioural sciences (Vettor, 2012). Further, BIA not only involves what is typically considered to be offender profiling, but also contributes to other aspects of the investigative process by aiding: suspect prioritisation, crime linkage, geographical profiling, the interview process and risk assessment of offenders in clinical settings.

A hypothesis, that is, central to offender profiling and consequently to the provision of BIA refers to the possibility that an offender will have some characteristic similarities in the manner she or he carries out a crime, and that variations in such will relate to the individuals who commit them (Canter, 2000). There are two main assumptions underlying the hypothesis at the heart of offender profiling (Alison *et al.*, 2002).

The two assumptions underpinning offender profiling

Two central assumptions need to be met in order for offender profiling to be valid and useful: behavioural consistency and homology (Alison *et al.*, 2002). The behavioural consistency assumption holds that the variations in behaviours of an offender across their offence series must be less than the variation in behaviour between offenders (Salfati and Bateman, 2005). That is, intraindividual behavioural variation across offences is smaller than interindividual behavioural variation. The homology assumption requires the variations between crimes to be related to variations in offender characteristics; criminals who exhibit similar crime scene actions will also possess similar background characteristics (Doan and Snook, 2008; Mokros and Alison, 2002). For example, two homicide offenders that are married have the same previous convictions to each other and a history of drug abuse should be more likely to offend in the same way than an offender who is single has different previous convictions and no history of drug abuse.

These two assumptions are used to validate the "profiling equation", abbreviated as the "A → C equation" (Canter, 2000). In this equation, the A(ctions) in an offence are used to derive inferences about the C(haracteristics) of the offender. The assumption of behavioural consistency is not dependent upon the assumption of homology being met since consistent behaviour across offences does not require similarity of characteristics across offenders (Alison *et al.*, 2002). However, if the assumption of homology is found to be valid then the behavioural consistency assumption would be valid as well due to the implication that offenders' actions have to remain consistent for similarities to be identified between their characteristics and behaviour (Mokros and Alison, 2002). If these assumptions are invalid, advice given to the police may potentially mislead a criminal investigation, resulting in both human and financial costs (Gudjonsson and Copson, 1997).

It has been suggested that the homology assumption (i.e. the direct link between offender characteristics and offence behaviour) is too simplistic since it fails to consider the influence of situational factors on offence behaviour (Alison *et al.*, 2002). Mokros and Alison (2002) state another possible explanation may be that crime scene behaviours are only moderately related to offenders' demographic characteristics. Indeed, most offender profiling studies attempting to test the consistency and homology assumptions have focussed exclusively on the inference of the offenders' demographic information (Laajasalo, 2007). However, Alison *et al.* (2002) argue that it is futile to try to predict demographic features of the offender from crime scene behaviour since psychological theory would not predict such a link. Focusing on other possible differences between perpetrators that commit the same type of crime in different ways may prove a more successful route (Alison *et al.*, 2010; Laajasalo, 2007; Woodworth and Porter, 2000). For example, some researchers suggest that the offenders' psychopathology may represent a more promising approach (Häkkänen, 2007; Laajasalo, 2007).

The effect of psychopathology on crime scene behaviour

Investigating relationships between the offenders' psychopathology and crime scene behaviours may yield more interesting results for offender profiling (Häkkänen and Laajasalo, 2006; Häkkänen, 2007). Indeed, some studies have reported that individuals with mental disorders

show more consistent offence behaviour than individuals without such disorders (Santtila *et al.*, 2008; Woodhams and Komarzynska, 2014). Information on how offenders with differing mental illnesses vary in their homicide offence behaviour could be used to generate offender profiles that may assist police investigations (e.g. with suspect prioritisation or developing interviewing strategies) (Häkkänen and Laajasalo, 2006; Woodworth and Porter, 2000). An influential study that was derived from a request for a behavioural analysis (i.e. an offender profile) highlighted that "what is occasionally needed is advice on whether the case includes any behaviour prone to offenders with a mental illness" (Häkkänen, 2007, p. 76). Further, if mental illness results in greater consistency in offence behaviour, this could improve crime analysts' abilities to link offences by individuals with mental illness.

For it to be possible to profile offenders' psychopathology from crime scene information there must be a relationship between the behaviour displayed at the crime scene and the offender's mental illness. Unfortunately, there is a paucity of recent studies investigating whether offender psychopathology is related to specific homicide crime scene behaviours. However, early research suggests violence in psychiatric patients is related to their underlying psychopathology (Blaney and Millon, 2008; Krakowski *et al.*, 1986; Schlesinger, 2007), with some studies demonstrating a significant association between specific violent offending behaviours and certain types of mental disorder (Häkkänen and Laajasalo, 2006; Monahan, 1992; Steury and Choinski, 1995; Taylor *et al.*, 1993). Personality psychology suggests there might be theoretical support for such relationships.

Personality psychology and offender profiling

According to Alison *et al.* (2002), traditional offender profiling has been largely based upon personality and trait approaches, which propose that personality should result in the stability of an individual's behaviour over time and across situations (i.e. non-situational and based on context-free dispositional constructs) (Pervin, 2002). Indeed, for many decades, the study of behavioural consistency has been an essential part of personality psychology (Woodhams and Bennell, 2014). Early dominant theories of personality psychology measured trait indicators (e.g. behaviours assumed to represent the underlying trait of aggressiveness) often through questionnaires, over multiple time intervals or across situations with the expectation that the individuals' scores would remain the same. However, research findings suggested the opposite (Shoda and Smith, 2004). Personality psychologists considered these findings were a result of their study design failing to exclude what was assumed to be "error" (i.e. the influence of the situation) (Epstein, 1980). This inconsistency between theory and empirical findings was referred to as the personality paradox (Woodhams and Bennell, 2014).

Rather than viewing either the person or the situation as influential, some researchers have suggested a shift in focus to the interaction of the person and the situation in producing behaviour (Mischel, 1973). This is referred to as interactionism in personality psychology (Griffo and Randall Colvin, 2009). Similarly, within offender profiling, rather than viewing the offender characteristics or crime scene aspects as a direct relationship, Alison *et al.* (2002) suggest also considering the influence of situational factors in producing offence behaviour. The concept of interactionism was formalised in Mischel and Shoda's (1995) cognitive-affective personality system (CAPS) personality model.

Mischel and Shoda's CAPS

The CAPS model has frequently been cited in the crime linkage literature for its ability to provide useful predictions as to when behavioural consistency and distinctiveness (i.e. the two main assumptions underpinning crime linkage) are most likely to be observed (Woodhams and Bennell, 2014). These predictions can then be empirically tested to determine their applicability to criminal behaviour and their relevance to offender profiling and crime linkage practice. Mischel and Shoda's (1995) model proposed a behaviour generation process in which behaviour is produced when a person's mental representations (or cognitive-affective units) are triggered by situational features that are psychologically salient to the individual. The mental representations or units included within CAPS are constructs of the self, people and situations; expectancies and

beliefs; affects; goals and values; competencies and self-regulatory plans (Woodhams and Bennell, 2014). Within each individual, there is a rich system of relationships among these cognitive and affective units; it is when these units interact and influence one another that plans, strategies and behaviours are activated (Mischel and Shoda, 1995). The pattern of activation is unique to each individual and depends on his or her accumulated learning experiences, expectations and interpretation of situational cues. For this reason, a person's CAPS can evolve with time as they encounter new experiences and situations, allowing for interindividual differences.

There are two systems included within CAPS. The first one, a "hot" emotional system, is specialised for quick emotional processing and responding based on conditional or unconditional trigger features. The second one, a "cool" cognitive system is specialised for complex spatiotemporal and episodic representation and thought (Mischel, 2009). The two systems are in relative balance and constant interaction. According to Woodhams and Bennell (2014), behaviours that are more impulsive and automatic are likely to show greater consistency over time and across situations.

According to Mischel (2009), the model predicts consistency in behaviour when an individual encounters psychologically similar situations; situational features in these situations will trigger similar patterns of activation producing the same behaviour. Mischel also explains that interindividual variation in behavioural responses to the same situation is a result of differences in how the same situation is perceived and processed. Further, characteristics of the individual such as attributional biases (e.g. interpreting hostility from ambiguous cues), response tendencies (e.g. broad response tendencies) and discriminative faculty may predict interindividual differences. For example, a person with broad response tendencies may have difficulty with responding to situational differences and thus behave consistently across different situations (Mischel, 2009). Further, personality psychology also reports that individuals with psychopathology, such as social information processing deficits or deficits in discriminative faculty, behave more consistently across situations (Eaton *et al.*, 2009; Walters, 2000).

Applying CAPS to criminal behaviour by individuals with mental illness

As mentioned above, the CAPS model makes useful predictions as to when greater behavioural consistency might be expected in criminal behaviour. For example, offenders who can exert more control in a crime (e.g. target selection) are likely to increase situational similarity which may lead to greater consistency. Additional research suggests greater consistency may in part be due to the offender's form of psychopathology (Tonkin, 2014).

Some research suggests that various forms of psychopathology may affect behavioural consistency by influencing the behavioural responses available to the individual, as well as how they select, attend to and process situational cues (Eaton *et al.*, 2009). These deficits in social information processing may result in consistent behaviour across different situations, suggesting offenders may show behavioural consistency in the manner they commit an offence despite changes in situational features (Woodhams and Bennell, 2014). Indeed, according to Eaton *et al.* (2009), cognitive and affective distortions associated with personality disorder may prevent the individual from differentiating between situations effectively leading to consistency in psychologically different situations. Further, individuals with personality disorders may have a more limited behavioural repertoire, which can result in indiscriminate responses.

Research also highlights the potential for bizarre behaviour within offenders with schizophrenia to assist offender profiling through the differentiation of offenders (Woodhams and Komarzynska, 2014). Such behaviours are more likely to be displayed when the offender is actively psychotic at the time of the offence. In the case of homicide, research has reported that up to 90 per cent of homicide offenders with schizophrenia experience psychotic symptoms at the time of the crime.

The CAPS of individuals with depression can be greatly influenced by similar constructs of the self (e.g. I am worthless), people (e.g. other people dislike me) and situations, which may result in the individual recreating the same situation over time (Woodhams and Bennell, 2014). Indeed, according to Mischel and Shoda (1995), people will select and recreate situations that suit their personalities. In summary, the presence of mental illness may affect the degree of behavioural

consistency displayed by an offender at the crime scene. Furthermore, greater consistency can also be expected in crimes that are characterised as stressful, mainly interpersonal offences, such as homicide (Woodhams and Bennell, 2014). For this reason, this study focuses on the interpersonal crime of homicide committed by individuals with mental illness. In addition, homicide is one of the serious types of crime where offender profiling is often conducted (Tonkin *et al.*, 2009).

Previous research on homicides by individuals with mental illness

The idea of violence being qualitatively different in relation to the type of mental illness of the perpetrator has been relatively ignored in studies of homicide made for offender profiling purposes (Häkkänen, 2007). Prior research on homicide committed by people with mental illness has mainly focussed on three aspects. First, homicide crime scene behaviours: these studies investigate information concerning victim type (Shaw *et al.*, 2004; Large and Nielssen, 2011), method of homicide used (Rodway *et al.*, 2009; Catanesi *et al.*, 2011), location of the homicide (Canter, 2007), circumstance or motive (Francis *et al.*, 2004; Putkonen *et al.*, 2001) and crime scene behaviours (Häkkänen and Laajasalo, 2006; Salfati and Park, 2007; Santtila *et al.*, 2001). Second, offenders' mental state at the time of the crime: these studies report on the offenders' psychiatric diagnosis (Fazel and Grann, 2004; Golenkov *et al.*, 2011; Schanda *et al.*, 2004), symptoms at the time of the offence (Joyal *et al.*, 2004; Peterson *et al.*, 2014; Rodway *et al.*, 2009; Taylor, 1998) and level of intoxication at the time of the crime (Montanez, 2000; Putkonen *et al.*, 2001). Third, differences among the offenders' socio-demographic and background characteristics: such as offenders' age, sex, employment and marital status.

Overall, most of these studies have only investigated direct associations between a single aspect of the offender's clinical or criminal history and a single crime scene behaviour. To date, there has been no study examining patterns in clinical histories of homicide offenders with different mental illnesses and how these could associate with the aspects surrounding the day of the homicide. The aim of this study was threefold. First, using a sample of homicides in England and Wales we will examine the interrelationships between various characteristics of the offenders' mental health history in order to identify any salient patterns and explore how these associate to aspects surrounding the day of the homicide. Second, to identify distinct homicide typologies based on the associations identified. Finally, to explore the use of information relating to offender psychopathology for offender profiling purposes.

Method

The data collection

All homicide characteristics, socio-demographic and offender criminal and clinical history information were obtained from the National Confidential Enquiry into Suicide and Safety in Mental Health (NCISH). NCISH collect and maintain clinical data on homicides and suicides by mental health patients in the UK (NCISH, 2018). Data collection occurred in three stages. First, notification of homicide and details of the perpetrator were provided by the Home Office to NCISH. Second, psychiatric reports were obtained from Her Majesty's Crown Courts. Finally, details of the perpetrators were sent to NHS Trusts and Health Boards in the perpetrator's district of residence to identify previous contact with mental health services. If contact was identified, a questionnaire was sent by the NCISH to the consultant psychiatrist in charge for the patient's care and treatment. This database is not replicated by any other national or international research group or organisation (Flynn *et al.*, 2016). The standard NCISH methods are described in full elsewhere (Appleby *et al.*, 2016).

The sample

There were 10,473 homicide convictions in England and Wales between 1997 and 2014. Homicides are defined as murder, manslaughter or infanticide under the Homicide Act (Elliott, 1957). Our sample included a NCISH 17-year consecutive case series of convicted homicide offenders (1 January 1997–31 December 2014) in England and Wales. The sample included

patients who had been in contact with mental health services in the year before committing a homicide. Data on the offenders' clinical history were obtained via a questionnaire from the clinician responsible for the patient's care. Information on offenders' mental state on the day of the offence was obtained from psychiatric reports. The final sample consisted of 759 patients who had been in contact with mental health services in the year preceding the offence and for whom a psychiatric report was available.

Among the 759 offenders, 685 (84 per cent) were male and 123 (16 per cent) were female. The mean age of the offenders was of 33.8 years (SD = 11.5). Compared to other homicide perpetrators in the general population (i.e. non mental health patients) ($n = 9{,}174$), patients who committed homicide were less likely to be male (OR = 0.71, 95% CI [0.517, 0.979]), to have been in employment (OR = 0.428, 95% CI [0.292, 0.626]), but more likely to be living alone (OR = 1.53, 95% CI [0.1.17, 2.01]) and have had a history of alcohol misuse (OR = 1.36, 95% CI [1.07, 1.72]) or drug misuse (OR = 1.67, 95% CI [1.30, 2.15]).

Definition of variables

First, a list of 12 variables describing offenders' clinical and criminal histories were selected for inclusion in the present study. The variables capture aspects of the offenders' history preceding the homicide that have been identified as relevant from previous studies (Brewer-Smyth and Burgess, 2008; Fazel and Grann, 2004; Flynn, 2013; Flynn *et al.*, 2016; Geddes, 1999; Meehan *et al.*, 2006; Nielssen *et al.*, 2007; Oram *et al.*, 2013; Shaw *et al.*, 1999). The variables included psychiatric diagnosis; duration of illness; last contact with mental health services; short term risk of violence rated by clinicians; contact with GP in the month preceding the offence; history of self-harm (SH); history of alcohol misuse; history of drug misuse; history of violence; history of childhood abuse; history of imprisonment; and missed last appointment with mental health services. Table I presents the categories for each of these 12 variables.

Second, in order to explore associations between the offenders' clinical histories and the homicide offence, 18 variables describing aspects surrounding the homicide were divided into three groups: homicide crime scene behaviours known prior to identifying the offender: categories of victim age, victim gender, method of homicide and circumstance of homicide previously identified as relevant in describing the patterns of homicide within this sample (identifying reference); mental state of the offender on the day of the homicide (Oram *et al.*, 2013; Shaw *et al.*, 2006); and offence and offender characteristics useful to police with identifying the offender (Santtila *et al.*, 2003). Table II presents the variables and categories included in each of these groups. Victim and offence information was obtained from the Homicide Index. Data on the mental state of the offender at the time of the offence were obtained from psychiatric reports. Offender socio-demographic information was obtained from the homicide questionnaire.

Statistical analyses

Descriptive analyses of the entire sample were performed (e.g. offender and victim age, gender) (see Table I and Table II for frequencies of variables). Next, a three-step approach was adopted to empirically identify typologies of patients that differed with regard to patterns of clinical histories, and their associations to aspects surrounding the homicide. In the first step, we performed a multiple correspondence analysis (MCA) on the active variables in Table I and the supplementary variables in Table II. MCA allows exploring the principal dimensions and interrelationships between the categories within the data set. Only active variables contribute to the construction of dimensions in the graph. In this first step, we only examined the structure of the graph of active categories (i.e. offenders' clinical and criminal histories).

The second step consisted of identifying associations between the active and supplementary variables: homicide crime scene behaviours; mental state of the offender on the day of the homicide; and offence/offender characteristics useful to police in homicide investigations. This was undertaken by projecting the supplementary categories from Table II onto the MCA graph of active categories. Three separate MCA graphs are presented, one for each respective set of supplementary variables. It is important to remember that supplementary variables do not contribute to the construction of dimensions but are used to assist interpretation.

Table I Active categories of offender's clinical histories

Offender's history preceding the homicide	*N = 759*[a]	*%*
Psychiatric diagnosis		
Schizophrenia/otherdelusional disorders	260	36
Bipolar affective disorder	32	4
Depressive illness	67	9
Alcohol dependence	75	10
Drug dependence	74	10
Personality disorder	130	18
Other diagnosis	85	12
Missing	36	5
Duration of illness	*n* = 701[b]	
< 12 months	146	21
> 12 months	555	79
Last contact with MH services	*n* = 746	
< 7 days before the offence	214	29
1–13 weeks before the offence	339	45
Over 13 weeks	193	26
Immediate violence risk at last contact	*n* = 627	
No risk/not considered	301	48
Low risk	266	42
Moderate/high risk	60	10
Contact with GP in month preceding the offence	66 of *n* = 532	12
History of SH[c]	305 of *n* = 739	53
History of alcohol misuse	488 of *n* = 734	66
History of drug misuse	485 of *n* = 728	67
History of violence	397 of *n* = 742	54
History of childhood abuse	27 of *n* = 115	23
History of being in prison	246 of *n* = 578	43
Missed last appointment with services	275 of *n* = 705	39

Notes: All variables were obtained from questionnaire sent to psychiatrist in charge of the patient's care. This table presents valid percentages. [a]*N* equals total size of the sample; [b]*n* equals individuals with available information for each category; [c]self-harm

In the third step, hierarchical agglomerative clustering (HAC) was performed on the principal dimensions obtained from the MCA to determine the number and nature of distinct profiles of homicide offenders with similar histories and homicide circumstances. A similar multimethod approach has been previously used in homicide thematic classification (Goodwill *et al.*, 2014) and studies defining offender subgroups (Joyal *et al.*, 2011).

MCA is a statistical method of visually conceptualising the multivariate associations between more than two categorical variables (Joyal *et al.*, 2011; Greenacre, 2006). MCA can be seen as analogous to principal component analysis when the variables to be analysed are categorical instead of quantitative (Abdi and Valentin, 2007). MCA is used to "uncover" relationships between categories in order to reveal structure in the data (Greenacre, 2013) without needing to meet the underlying distributional assumptions required in other techniques of categorical data analysis (e.g. χ^2 and Fisher's exact test) (Abdi and Valentin, 2007; Costa *et al.*, 2013). The aim is to extract the main dimensions of the space that capture as much as possible of the inertia (similar to variance explained) (Dumais *et al.*, 2011). MCA provides a visualisation of the associations between categorical variables in the form of a graph of categories (Greenacre, 2013). Two dimensions are usually retained for ease of interpretation of the MCA graph (see Abdi and Valentin, 2007). Each point in the graph represents a category of the variables in the analysis. Categories which appear in close proximity to one another are considered to be relatively more similar than categories placed far apart; this may indicate theoretically meaningful patterns (Husson and Josse, 2014). Additionally, MCA performs a *v*-test for each supplementary category. This test follows a Gaussian distribution: a value below –2 or above 2 has a coordinate significantly different to 0. This means that the category in question has a positive or negative significant value in each dimension (Husson and Josse, 2014).

Table II Supplementary categories describing aspects of the day of the homicide

Characteristics on the day of the homicide	*N = 759 (%)*[a]	*v-test* *Dimension 1*	*Dimension 2*
Crime scene behaviours known prior to identifying the offender[c]			
Victim gender			
Victim was male	312 (41)	*–5.620*	*2.322*
Victim was female	447 (59)	*5.620*	*–2.322*
Victim age groups			
Victim age 0–14 years	51 (7)	*5.570*	–0.314
Victim age 15–24 years	86 (11)	*–2.297*	1.182
Victim age +55 years	195 (26)	*3.431*	*–4.302*
Method of homicide			
Drowning/suffocation/asphyxiation	35 (5)	*4.130*	–1.006
Kicking/hitting	89 (12)	*–3.093*	0.716
Strangulation	51 (7)	1.623	1.014
Poisoning	15 (2)	–1.740	1.702
Circumstance preceding the offence			
Child abuse	20 (3)	*2.407*	1.456
Domestic dispute	82 (11)	*4.274*	*2.837*
Irrational act	179 (23)	*4.041*	*–10.905*
Fights/arguments/long-running disputes	158 (21)	*–6.150*	*4.379*
Mental state on the day of the homicide[d]			
Alcohol on day	258 (54 of *n* = 482[b])	*–10.394*	*10.469*
Drugs on day	140 (29 of *n* = 478)	*–9.939*	–1.33
Mental illness at time of the offence	380 (56 of *n* = 678)	*8.746*	*–10.817*
(Hypo)mania	10 (1 of *n* = 701)	1.086	*–2.434*
Depression	140 (26 of *n* = 691)	*10.261*	*4.390*
Delusions/hallucinations	273 (40 of *n* = 684)	*2.909*	*–14.811*
Other psychotic symptoms	110 (16 of *n* = 680)	1.781	*–8.643*
Characteristics useful with identifying the offender			
Gender[e]	*N* = 759		
Male	636 (84)	*–4.086*	*–4.016*
Female	123 (16)	*4.086*	*4.016*
Age group[e] (years)			
> 25	180 (24)	0.202	1.551
25–34	263 (35)	*–3.817*	–0.247
35–44	179 (23)	–1.199	–0.735
45–64	126 (17)	*4.553*	–0.664
+65	11 (1)	*4.561*	0.146
Marital status[e]	*n* = 734		
Married	184 (25)	*5.392*	*3.843*
Single	429 (58)	*–4.647*	*–4.223*
Divorced/widowed	121 (16)	0.130	1.131
Employment status[e]	*n* = 713		
Employed	230 (32)	*8.966*	–0.596
Unemployed	483 (68)	*–8.966*	0.596
Living circumstances[e]	*n* = 704		
Alone	270 (38)	*–7.490*	–1.224
With parents	145 (21)	*3.196*	–1.892
With partner (with or without children)	179 (25)	*5.638*	*3.838*
With children only	22 (3)	1.378	*2.176*
Other	88 (13)	–0.825	*–2.071*
Offender–victim relationship[d]	*n* = 307		
Son/daughter	17 (5)	*5.858*	0.003
Parent	45 (15)	*4.287*	*–6.679*
Current/former lover/partner	58 (19)	*10.203*	*4.415*
Other family	19 (6)	0.586	*–2.175*
Friend/acquaintance	100 (33)	*–14.066*	*2.787*

(continued)

Table II

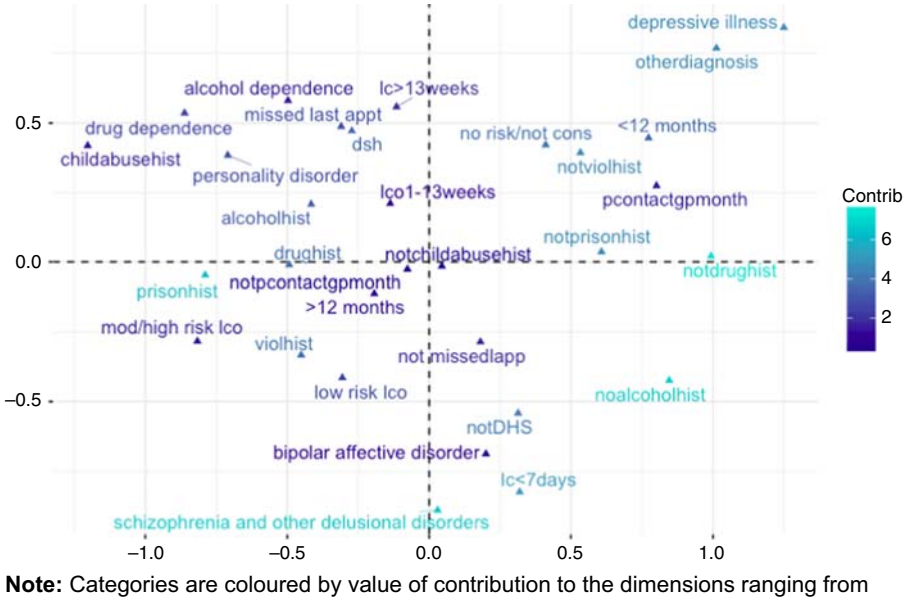
Characteristics on the day of the homicide	*N = 759 (%)*[a]	*v-test* *Dimension 1*	*Dimension 2*
Stranger	33 (11)	−1.536	*−3.547*
Other	35 (11)	1.562	−0.613
Place of homicide[d]	*n = 265*		
Offender's home	32 (12)	−1.548	1.155
Victim's home	77 (29)	*−13.100*	*−2.786*
Offender–victim shared home	83 (31)	*14.331*	0.050
Public place	54 (20)	−1.165	*−4.533*
Other	19 (7)	0.149	−1.706

Notes: [a]*N* equals total size of the sample; [b]*n* equals individuals with available information for each category; [c]information was obtained from Homicide index; [d]information was obtained from psychiatric reports; [e]information was obtained from homicide questionnaire sent to consultant psychiatrist. Values in italic are significantly different to zero and related to each dimension ($p < 0.05$)

However, the two-dimensional graph from MCA provides no information about the position of the categories in the other dimensions. MCA analysis and HAC are complementary tools to explore and enrich description of the data (Husson *et al.*, 2010). Thus, HAC was applied to the first dimensions identified as carrying significant data. The clusters offer some information about the position of the categories in the other dimensions "outside of the first plane" (first plane is shown in Figure 1) (Husson *et al.*, 2017). The number of dimensions retained was defined using the FactoInvestigate package with R (Thuleau and Husson, 2017). Ward's criterion was used as it allows for minimising the reduction of the inertia (Husson *et al.*, 2010). The number of clusters retained was determined using the dendrogram (hierarchical tree). This step grouped participants with similar characteristics. All analyses were performed using the FactoMineR package (Husson *et al.*, 2019), a package for multivariate data analysis with R (R Development Core Team (Venables and Smith, 2015)).

Missing data were treated using the missMDA package for the R system, which performs MCA on incomplete data sets (Josse and Husson, 2016) obtaining graphical representations despite

Figure 1 Multiple correspondence analysis of active categories describing offender's clinical histories



Note: Categories are coloured by value of contribution to the dimensions ranging from dark blue for low contribution to teal for high contribution

missing values. The package missMDA performs missing value imputation that takes into account similarities between individuals and relationships between variables (each missing entry of the original data set is imputed with the most plausible category) (Josse and Husson, 2012).

Results

Sample characteristics

Background, demographic and offence information are presented in Table II. The mean age was 33.8 years (SD = 11.5), 729 (97 per cent) homicides involved one victim, 19 (2 per cent) homicides involved two victims, 3 (0.4 per cent) involved three victims and < 3 involved four victims. Out of 759 victims, 447 (59 per cent) were male and 312 (41 per cent) were female victims. The mean age of the victims was 42.2 years (SD = 19.6).

Multiple correspondence analysis

Step 1: we performed a two-dimensional MCA on the 12 clinical and criminal history variables (active) in Table I and the 18 homicide variables (supplementary) shown in Table II. The overall model fit of the MCA was acceptable, accounting for 23 per cent of the total inertia. In this step, we examined the structure of the active categories only. Figure 1 shows the graph of active categories on the first plane (first two dimensions). The square correlation ratios of variables of the two dimensions indicate that the categories that contribute the most to the construction of the dimensions are.

Dimension 1 (see Figure 1 from left to right): individuals who have a history of violence, drug/alcohol misuse, prior convictions and a personality disorder opposed those with no violence, substance use or prison history and a depressive illness diagnosis. This dimension explains 14 per cent of the inertia.

Dimension 2 (see Figure 1 from bottom to top): individuals with no history of SH, attendance at last appointment with services, assessed as low risk, last contact with services in the seven days before the homicide and a diagnosis of schizophrenia opposed those who have a history of SH, missed their last appointment with services, assessment of no risk or risk was not considered, last contact with services more than 13 weeks before the offence and no violence history. This dimension explains 9 per cent of the inertia.

Associations with supplementary categories describing aspects surrounding the offence

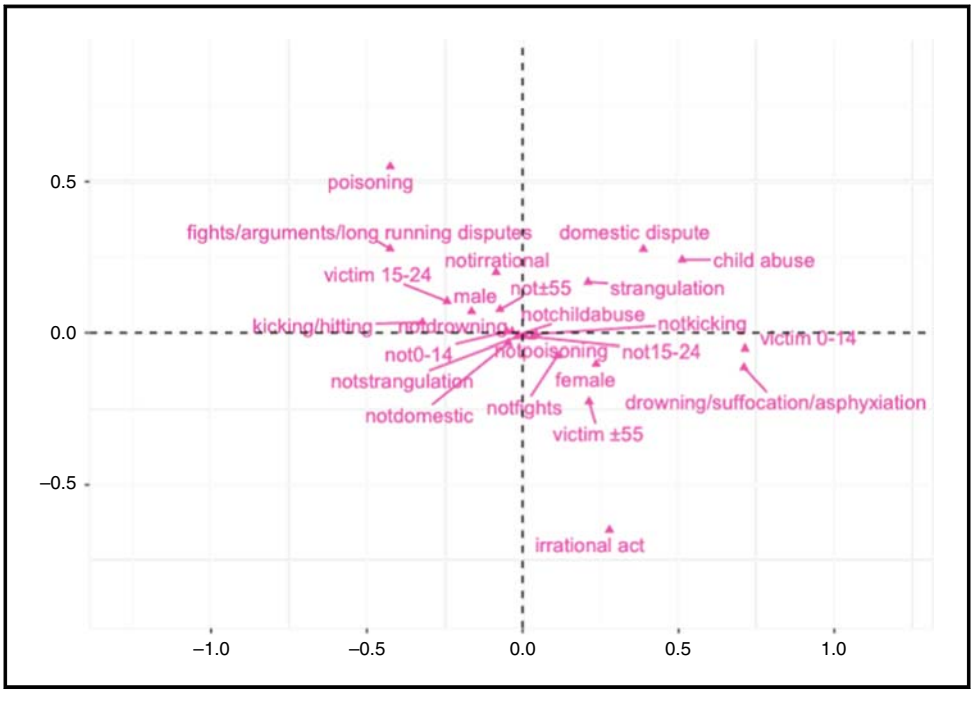
Step 2: the second step in the analysis was to investigate associations between the active (i.e. offenders' histories) and supplementary categories (i.e. aspects surrounding the day of the homicide). The MCA analysis performed a *v*-test statistic for each supplementary category corresponding to three different groups: homicide crime scene behaviours; mental state of the offender on the day of the homicide; and offender characteristics and crime scene information useful to police in homicide investigations. The *v*-test value for each supplementary category is presented in Table II. Additionally, the supplementary variables were plotted onto the MCA graph of active categories.

For ease of interpretation, three separate graphs were produced, one for each group of supplementary variables.

Homicide crime scene behaviours. Figure 2 displays the spatial analysis involving the first group of supplementary categories. Combination of the *v*-test statistic and the supplementary analysis graph indicates three associations.

An association between a male victim between 15–24 years killed by kicking/hitting in the context of fights/arguments/long running disputes and histories of offenders with a personality disorder diagnosis. A second association between a female victim between 0–14 years killed by drowning/suffocation/asphyxiation in the context of a domestic dispute or child abuse and histories of offenders with a depression diagnosis. A third association between victims of more than 55 years killed in the context of an irrational act and histories of offenders with schizophrenia.

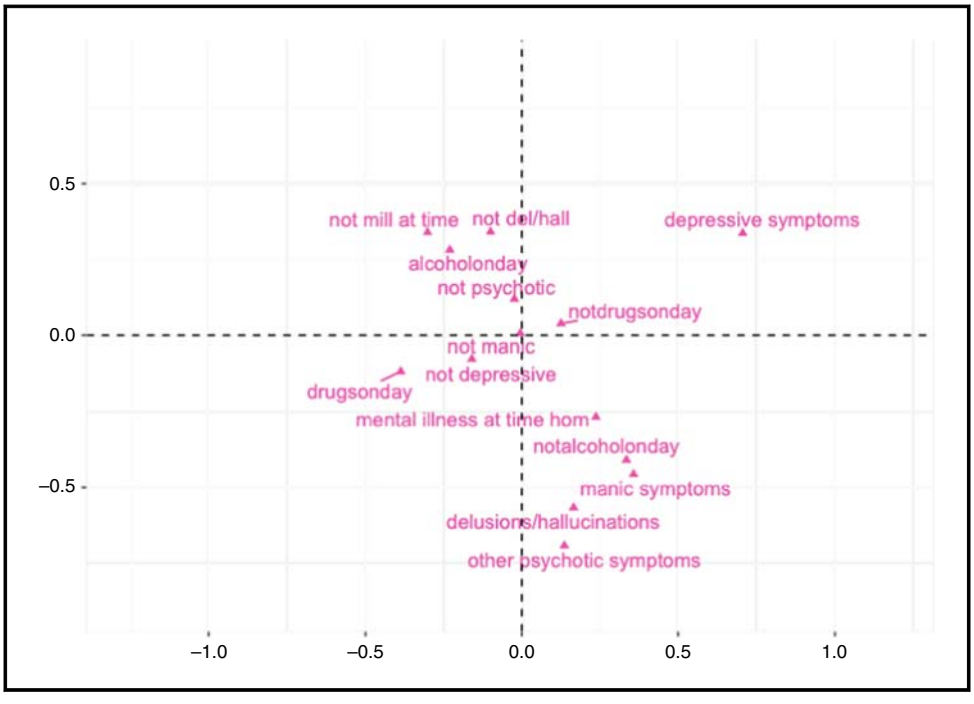
Figure 2 Supplementary analysis of homicide crime scene behaviours



Mental state of the offender at the time of the homicide. Figure 3 displays the spatial analysis involving the second group of supplementary categories. Combination of *v*-test and supplementary analysis graph indicates three associations:

An association between alcohol/drugs consumed on day of the homicide and histories of offenders with personality disorder. A second association between depressive symptoms and

Figure 3 Supplementary analysis of mental state of the offender at the time of the homicide



histories of offenders with depression. A third association between mental illness at time of the homicide, manic symptoms, delusions/hallucinations and other psychotic symptoms and histories of offenders with schizophrenia.

Characteristics useful to police during homicide investigations. Figure 4 displays the spatial analysis for the third group of supplementary characteristics. Combination of the *v*-test statistic and supplementary analysis graph indicates three associations.

An association between a single, unemployed offender between 25–34 years, living alone that committed homicide in the victim's home against a friend/acquaintance and histories of offenders with personality disorder. A second association between a female offender older than 45 years, married, employed, living with parents or partner (with or without children) that committed homicide in the offender's and victim's shared home against a son/daughter or current/former lover/partner and histories of offenders with a depression diagnosis. A third association between a male offender, living with "other" that committed homicide in a public place against a parent or other family member and histories of offenders with schizophrenia.

Hierarchical agglomerative clustering

Step 3: HAC was then applied to the MCA results. The first six dimensions explaining 48 per cent of the total variance in the data were included. The HAC extracted three clusters that were used to generate distinct typologies of offenders with similar clinical, criminal histories and homicide events (see Figure 5). The variables "psychiatric diagnosis", "mental state at the time of the crime", "duration of illness", "living circumstances", "place of homicide" and "relationship between victim and perpetrator" characterised the partition of the typologies the most; each typology was formed by a category of this variable. Information on typologies of homicide offenders with similar characteristics is shown in Table III.

Individuals in Typology I (41 per cent) were more likely to have been in prison (69 per cent), have a history of alcohol misuse (94 per cent), drug misuse (91 per cent) or SH (82 per cent), have a diagnosis of personality disorder (36 per cent), alcohol dependence (20 per cent) or drug

Figure 4 Supplementary analysis of offender characteristics and crime scene behaviours useful to police in homicide investigations

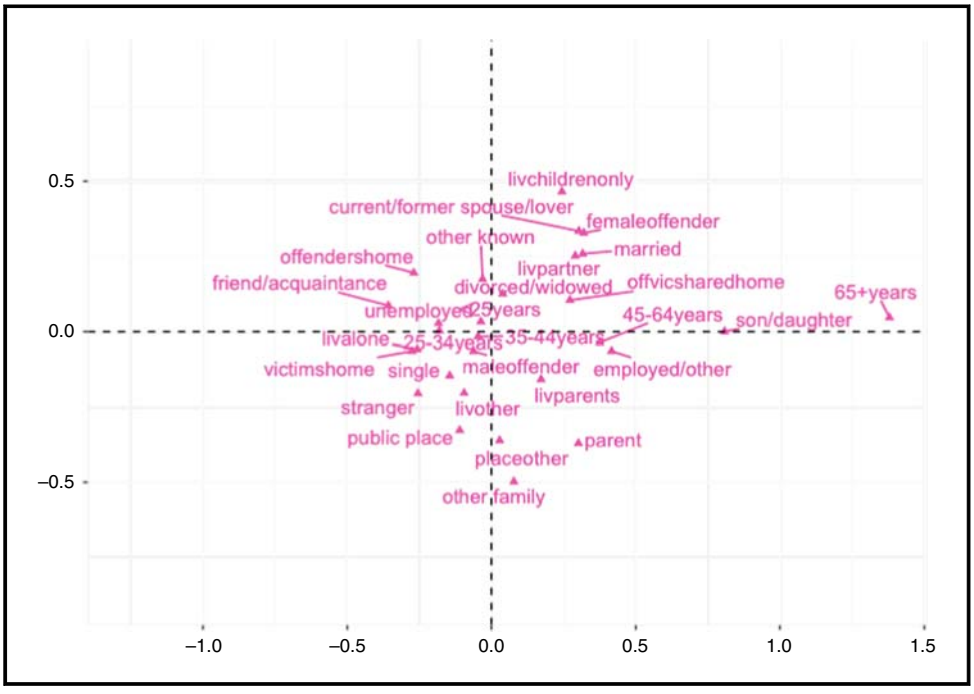
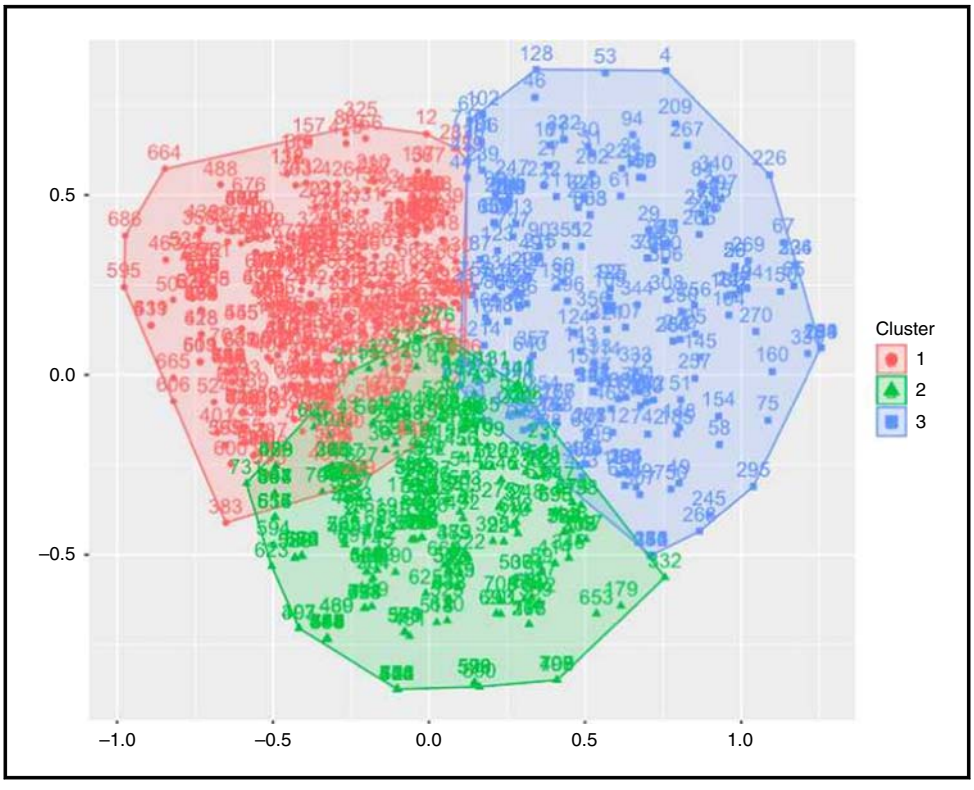


Figure 5 Hierarchical agglomerative clustering of the first six dimensions of MCA results



dependence (20 per cent), illness duration of more than 12 months (87 per cent) and missed their last appointment with mental health services (49 per cent) compared to individuals in other clusters. The homicide victims were usually male (38 per cent), a friend or acquaintance to the perpetrator (38 per cent) and were killed in their own home (65 per cent) in the context of a fight/argument/dispute (32 per cent). The individual was not mentally ill at the time of the offence but consumed alcohol on the day (82 per cent) and was likely to be unemployed (82 per cent). Homicide in this group was more often associated with intoxication and less often with symptoms of mental illness. This cluster was labelled externalising.

Individuals in Typology II (32 per cent) were more likely to have schizophrenia (84 per cent), history of violence (74 per cent), no history of SH (82 per cent), childhood abuse (99 per cent) or alcohol misuse (46 per cent), contact with mental health services less than seven days preceding the offence (48 per cent), illness duration of more than 12 months (87 per cent) and an assessment of low violence risk at last contact (60 per cent) compared to individuals in other groups. The homicide was likely to occur in a public place (15 per cent), against a parent (18 per cent) of over 55 years (34 per cent) in the context of an irrational act (39 per cent). The individuals were more likely to experience delusions/hallucinations (73 per cent) and not depressive symptoms (93 per cent) or consume alcohol on the day of the offence (68 per cent). They were also more likely to be male (91 per cent) and single (71 per cent). This cluster was labelled psychotic.

Individuals in Typology III (27 per cent) were more likely to have no history of violence (82 per cent), alcohol (60 per cent) or drug misuse (77 per cent), no history of being in prison (97 per cent), have a diagnosis of depression (29 per cent), illness duration of less than 12 months (37 per cent) and violence risk assessment of no risk or risk not considered at last contact with services (79 per cent) compared to individuals in the other groups. Homicides were usually against a son/daughter (13 per cent) or former/current partner/lover (40 per cent) in the victim and perpetrators' shared home (74 per cent). The individual experienced depressive symptoms on

Table III Typologies of offenders with similar clinical histories and homicide events characteristics

	Typology I (n = 314) Comorbid with prison history (%)	*Typology II (n = 240) Psychosis with violent history (%)*	*Typology III (n = 205) Depression with no violent or prison history (%)*
History of alcohol misuse			
Yes	*94*	55	40
No	6	45	*60*
History of drug misuse			
Yes	*90*	74	23
No	9	26	*78*
History of SH			
Yes	*81*	18	/
No	19	*82*	/
Alcohol on day			
Yes	*83*	33	42
No	17	*67*	58
History of being in prison			
Yes	*70*	/	3
No	30	/	97
History of violence			
Yes	64	*72*	17
No	36	27	*82*
Mental illness at the time of crime			
Yes	31	*77*	63
No	*69*	23	36
Delusions/hallucinations			
Yes	20	*72*	30
No	*80*	28	69
Other psychotic symptoms			
Yes	7	*29*	10
No	/	/	/
Depressive symptoms			
Yes	13	7	*43*
No	13	*93*	*56*
Personality disorder diagnosis	*37*	3	6
Depression diagnosis	3	0.4	*29*
Other diagnosis	4	0.8	*39*
Schizophrenia diagnosis	13	*83*	17
Last contact less than 7 days before homicide	14	*47*	/
Assessment of no risk/risk not considered at last contact	42	30	*79*
Assessment of low risk at last contact with services	/	*60*	19
Illness duration < 12 months	13	13	*40*
Circumstance of irrational act	11	*39*	/
Homicide in offender and victim's shared home	21	/	*77*
Victim was parent	3	*19*	/
Victim was current/former partner	13	14	*47*
Offender was employed	17	/	*52*

Notes: Categories are in descending order of degree of correlation with each typology. Italic values are significantly correlated to corresponding profile ($p < 0.05$)

the day of the offence (43 per cent) and was likely to be female (28 per cent), employed (50 per cent) and living with partner (40 per cent). A high majority of individuals in this cluster did not consume drugs on the day of the offence (92 per cent). This cluster was labelled depressive.

Discussion

The aim of this study was to seek to identify distinct typologies of offenders based on associations between patterns of offenders' clinical histories and aspects surrounding the

homicide incident. This is the first study to use a combination of MCA and HAC to identify offender typologies based on interrelationships between variables describing the offenders' clinical histories, demographic information and crime scene behaviours in homicides committed by individuals with mental illness.

First, our multivariate approach allowed visualising the interrelationships between various aspects of offenders' histories across psychiatric diagnoses. In the first dimension, we found individuals who were more likely to have a history of violence, drug/alcohol misuse, prior convictions and personality disorder opposed those who were more likely to have no history of violence, substance use or prison and depressive illness. In the second dimension we found individuals who were more likely to have no history of SH, attendance at last appointment with services, assessment of low risk of short term violence, last contact with services in the seven days before the homicide and schizophrenia opposed those more likely to have a history of SH, non-attendance to their last appointment with services, an assessment of no short term risk or risk of violence was not considered, last contact with services more than 13 weeks before the offence and no history of violence.

Second, hierarchical cluster analysis allowed examining meaningful patterns beyond the first two dimensions of the data. Three typologies were identified: externalising, psychotic and depressive. These typologies suggest that factors associated with homicidal behaviour differ across diagnostic groups. Further, each profile provides novel information illustrating which combinations of aspects of an offenders' mental health background are more closely related to a particular mental state at the time of the crime, type of victim and other crime scene behaviours. These findings may be of value to risk assessment of offenders in clinical settings with the identification of the most likely homicide circumstances and potential victim according to the offenders' previous history and diagnosis. These typologies may assist the police during homicide investigations by furthering their understanding of the crime or likely suspect, offering insights into crime patterns and advice as to what an offender's offence behaviour might signify about his/her mental health background. For example, percentages presented in Table III may help with narrowing down the field of suspects, while information on the likely mental state of the offender may aid with developing specific interviewing techniques (Bull, 2019).

Findings of the current study present potential pragmatic usefulness for investigative profiling of homicide in two main ways.

Methodologies used for the study of homicide

The multivariate statistical approach used in this study is novel in that it presents the use of MCA including active and supplementary information (i.e. offender characteristics and crime scene behaviours, respectively, or vice versa) with the aim of examining significant associations between the two types of variables without mutually influencing their position. To illustrate, findings presented in Figure 4 provide advice on the likely offender demographics based on a significance test (i.e. *v*-test) obtained from calculating the coordinates of the supplementary information without affecting the structure of clinical history patterns in the graph. This means the likely inferences about the offender can be made based on his/her background, and are thus useful for police practical work. Moreover, the use of MCA as a preprocessing step for HAC enabled a visual understanding of the classification of homicides and likely offender characteristics into types. This combined multivariate method approach may provide a more empirically based understanding of homicide offences and allow the police to focus on the possible characteristics of the unknown offender by determining similarity between a specific typology identified and the crime under attention.

Integration of information on offender psychopathology

Advice offered by psychologists about the behaviour of offenders with mental illness has been particularly welcomed by the police (Häkkänen, 2007; Gudjonsson, 1993). The present study found offender psychopathology is useful in the context of offender profiling in the identification of the dominant facets of homicidal behaviour from a psychiatric perspective; as contextual information that may allow a richer and deeper understanding of the link between offence and likely offender.

Our study advances knowledge by integrating information commonly outlined in offender profiles (e.g. demographics and criminal history) with more extensive information on offender psychopathology (i.e. clinical history and mental state at the time of the crime) and aspects surrounding the offence (i.e. relationship victim–perpetrator and place of homicide) into the previous analysis of offence patterns and offenders' diagnosis (see Abreu Minero *et al.*, 2018). This comprehensive approach allowed for an improved understanding of the relationship between clinical aspects of the offender's history and the offence itself. For example, a homicide by an individual with a history of alcohol/drug misuse, personality disorder and previous convictions is more likely to involve the use of alcohol/drugs on the day of the offence, a male victim and a violent impulsive homicide method. Inclusion of the offender's mental state at the time of the crime can contribute to the understanding of the offender's decision-making process, while considering the impact of offence contextual variables may help explain the type of relationship and interaction between victim and perpetrator (Crabbé *et al.*, 2008; Salfati, 1998). For instance, homicides consistent with the male conflict homicide pattern are more closely related to impulsive homicides, where alcohol/drug use was present, and in which the victim was killed in his own home and was a friend or acquaintance of the perpetrator. In addition, the police may direct their search to offenders who are more likely to be young, male, single, unemployed, living alone and have previous convictions. This information could help with reducing the pool of possible suspects.

Finally, the finding that specific offender demographics were more linked to a particular typology suggests the offender information more suitable for profiling differs according to the homicide offending pattern. That is, the offender's employment status may be more likely to be inferred in homicides corresponding to the externalising and depressive typologies but not psychotic, whereas the offender's marital status was found to be more related to the psychotic and depressive typologies, but not externalising. It is important to note the gender disparity between the externalising and psychotic typologies compared to the depressive typology. This may be related to the specific psychiatric diagnosis that characterised each typology as research has shown mood disorders are more likely to be present in female homicide offenders compared to male offenders (Flynn *et al.*, 2011). Further research may explore this further.

This study has a number of limitations. First, in order to include information regarding offenders' mental state at the time of the homicide, only offenders with an available psychiatric report were included in our study. Therefore, bias may have been introduced towards offenders with severe mental illness since courts are more likely to request a psychiatric report if there is evidence of a serious disorder. However, data obtained from psychiatric reports allowed the analysis of mental state of the offender at the time of the offence. Second, some offenders with mental illness that commit homicide are not in contact with mental health services preceding the offence (Shaw *et al.*, 1999), therefore, our sample is not representative of all people with mental illness that commit homicide. However, previous studies using broader samples have found similar associations between mental illness and homicide characteristics (see Friedman *et al.*, 2005; Häkkänen and Laajasalo, 2006; Häkkänen-Nyholm *et al.*, 2009; Richard-Devantoy *et al.*, 2016), suggesting offenders in contact with mental health services before the crime may have similar histories to offenders who were not in contact. Third, we were unable to analyse the differences in types of prior criminal convictions and some previously identified risk factors for homicide, such as childhood conduct disorder and domestic violence (Campbell *et al.*, 2007; Kellermann *et al.*, 1993). Finally, the variable "place of homicide" is usually known at the beginning of an investigation and corresponds with the variable set of homicide crime scene behaviours known prior to identifying the offender. However, in the present study, this variable was extracted by NCISH staff from the psychiatric reports prepared for trial after the offender was identified. For this reason, it was considered more appropriate for the "place of homicide" variable to be grouped with offence/offender characteristics useful with identifying the offender. Moreover, two categories of this variable are indicative of offender identity (i.e. offender's home and victim and offender's shared home). Strengths in our study include its methodology and a large sample size; the integration of MCA and HAC analyses allowed for visualisation of patterns and classification of multivariate data, rather than analysing single crime scene variables and single offender characteristics. Another strength is the inclusion of various features of offender psychopathology, such as aspects of clinical history, contact with services

and mental state at the time of the offence. The inclusion of this information offers a more contextualised approach that considers aspects preceding the offence, the offenders' mental processes at the time of the crime and their associations with crime scene behaviours.

Conclusion

This study identified offender typologies based on associations between offenders' clinical history patterns and aspects surrounding the offence. The main objective was to explore the use of offender psychopathology within the context of offender profiling. First, associations identified between offenders' histories and aspects of the offence may contribute to investigative advice by suggesting what type of individual, with which diagnosis and mental health history characteristics is most likely to offend in a specific way. In addition, findings suggest certain offender demographic characteristics may be more associated to the offence depending on the homicide typology. For example, the offenders' employment status was associated with the externalising and depressive typologies, but not with the psychotic type. Second, the three distinct typologies identified (i.e. externalising, psychotic and depressive) suggest that factors associated with risk of homicidal behaviour differ across psychiatric diagnostic groups. This study provides a first step in the exploration of offender psychopathology and its integration to the multivariate analysis of offence information for the purposes of investigative profiling of homicide by identifying the dominant patterns of mental illness within homicidal behaviour.

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