

Analysing person-exposure patterns in lone-actor terrorism: Implications for threat assessment and intelligence gathering

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Research Summary

The lone-actor terrorist population can be extremely heterogenous and difficult to detect. Intelligence is key to countering this threat. This study devises a typology of person-environment interactions which could serve as a framework for intelligence-gathering and risk assessment. We use cluster analysis and a previously-developed Risk Analysis Framework (RAF) to identify relations between three components: propensity, situation and network. The analysis reveals four person-exposure patterns (PEPs): solitary, susceptible, situational and selection. The solitary PEP lacks common indicators of a propensity to pursue terrorist action. What indicators are present may not manifest until late in the offending process. The susceptible PEP suggests a style of interaction whereby cognitive susceptibility, manifesting as mental illness, is a key factor in the emergence of the propensity/motivation to commit a terrorist attack. This configuration typifies cases where radicalisation may occur in a short time span. The situational PEP demonstrates how situational stressors may act as warnings of acceleration towards violent action; the challenge being to capture evidence of these stressors and their effects. Lastly, the selection PEP demonstrates higher frequencies of leakage and antecedent violent behaviours. These offenders may be known to the community or other agencies, suggesting specific opportunities for detection and disruption.

Policy Implications

Our findings have two key policy implications. First, given the multifinality of terrorism risk indicators, we suggest a move towards a structured-professional judgement approach to the risk analysis of lone-actor terrorists. Second, we present the PEP typology as a framework for intelligence-gathering. Existing frameworks predominantly focus on mobilisation indicators. We suggest expanding data collection to include propensity and situational indicators, as operationalised here, and utilising the PEP typology to inform decisions about the emergence of the motivation to commit an attack. To do so, it is necessary to pursue a multiagency approach to intelligence-gathering.

Keywords

Lone-actor, terrorism, risk analysis, threat assessment, intelligence-led policing

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Introduction

Post 9/11, counterterrorism policing has evolved towards an intelligence-led model of policing (ILP). Threat assessment, defined as “the application of the collection and analysis of information related to crime,” is one of the key principles of ILP, (Capellan & Lewandowski, 2018, pg.17). The lone-actor terrorist population can be extremely heterogenous and a challenge for law enforcement to detect, and so a framework for guiding the threat assessment of these offenders may serve as a beneficial tool for ILP. Typologies can be a useful way to conceptualise complex, heterogeneous offending populations and crime events. Various studies of a range of crimes have evidenced the usefulness of typologies in terms of increasing arrest rates (Fox & Farrington, 2015), decreasing recidivism (Carbajosa, Catalá-Miñana, Lila, & Gracia, 2017), and predicting violence risk (Mohandie, Meloy, McGowan, & Williams, 2006). We argue that disaggregating an empirical typology of lone-actor terrorism can have a similar practical utility, specifically, as a framework for guiding the threat assessment of these offenders within the context of an ILP approach to counterterrorism.

Detecting and disrupting lone-actor terrorist attacks is a central focus of policing, globally. Intelligence-gathering, defined as “a process that involves the collection and transformation of data into knowledge and finally actionable and useable recommendations for courses of actions,” (Kebbell & Porter, 2012, pg. 213, see also Ratcliffe, 2008) is key. Threat assessment involves making intelligence- and evidence-based decisions about the allocation of limited resources and the responses of appropriate agencies, (Tusikov & Fahlman, 2009). Hence, ILP places a great emphasis on acquiring, evidencing, and actioning appropriate intelligence. Kebbell & Porter (2012) describe the need for a framework to guide intelligence gathering. Specifically, they identify the need for clarity regarding what intelligence to collect, as well how to operationalise intelligence in decision-making. The

authors conceptualise this as a “risk-based, intelligence-led approach to counter-terrorism.” (Kebell & Porter, 2012, pg. 224). A typology that disaggregates and articulates the relations between common risk indicators and ties these to causal mechanisms, may provide the necessary guidance for a risk-based intelligence-led approach to countering this threat.

Disaggregated analysis became a research agenda for terrorism scholars, in part, following the publication of a unique insight into far-right homicide in the US. Gruenewald, Chermak and Freilich (2013) analysed data from the Extremist Crime Database, looking at differences in characteristics such as race, mental illness, weapon-use, and victim-offender relationships. They found differences between right-wing inspired homicide offenders and group-based offenders. These results had a significant impact on the field by tangibly demonstrating the heterogeneity of extremist offending populations. The need to disaggregate terrorist populations has been called for and demonstrated empirically (Gill, 2015; Gill & Corner, 2013; Horgan, Gill, et al., 2016; Horgan et al., 2018; Horgan, Shortland, et al., 2016; Perliger, Koehler-Derrick, & Pedahzur, 2016).

Typologies of a range of equally complex offending populations demonstrate the utility of a more rigorous, quantitative approach to disaggregating these populations. For example, Gruenewald and Kelley (2014) disaggregated a population of anti-LGBT homicides by characteristics of victim selection and conceptualised two types; predatory and responsive homicide, (see also Gruenewald, 2012). Their analysis compares differences across a number of characteristics of the offence process, including offender, victim, situational, attack, and aftermath characteristics. The focus on situational characteristics of bias homicide stems predominantly from Tomsen’s (2002) work on antihomosexual homicide in Australia, which has particular relevance here. Often, explanations of lone-actor terrorist behaviour focus predominantly on individual-level characteristics and neglect the role of the individual’s context, or situation. We argue it is necessary for a typology of lone-actor terrorists to

articulate the relations between a person and their environment to better inform judgements of risk, conceptualised here as person-exposure patterns (PEPs).

Current typologies of lone-actor terrorists predominantly differentiate offenders along a single behavioural dimension, such as social connectedness (Pantucci, 2011), risk aversion (Phillips & Pohl, 2012) or ideology (Simon, 2013). This approach is evident across work with other types of terrorists and includes factors such as recruitment (Brzica, 2017), the variables that limit an organisation's activities (Ganor, 2008), suicidal motivation (Lankford, 2014), personality disorders (Miller, 2006), target group (Merari, 1978), and individual differences such as motivation (Hacker & Hacker, 1976) and personality differences (Strentz, 1988). Terrorism can be extremely heterogenous and so the function of these typologies is often to 'bring order to this chaos', (Merari, 1978, pg. 331). However, for the purposes of guiding intelligence gathering, disaggregating populations along a single dimension may inhibit the detection of patterns of behaviour that exist naturally within the data.

Moreover, these dimensions are largely constructs identified by the researcher, which are then retroactively applied to a set of cases. Deductive typologies, such as these, are often based on detailed analyses of case studies, drawn from established theory, or from inferences based on the existing literature. These typologies serve an important function in terrorism research however their external validity may be limited given the use of predominately qualitative methods. For the purposes of threat assessment, we argue that more rigorous, quantitative methodologies and an inductive approach to typology development, may be more appropriate.

To address many of these issues, Horgan, Shortland, and Abbasciano (2018) used multidimensional scaling methods (MDS) to disaggregate terrorist involvement and proposed a behavioural typology of violent extremist offenders. Drawing on methods from investigative psychology, this approach offers an alternative to deductive typologies, in that

types are not organised around predefined dimensions. The present study aims to disaggregate lone-actor terrorists in a similar way. We seek to detect multidimensional subtypes that are embedded within the data, while conserving the benefits of theory-informed approaches through interpretative guidance from an explicit analytical framework. Such an ambition has been called for elsewhere (Borum, Fein, & Vossekuil, 2012), but remains largely untested empirically (see Gill, 2015 for an exception).

In forensic psychology and criminology, techniques such as cluster analysis have been used to derive empirical typologies of a range of criminal behaviours. These typologies are multidimensional, polythetic, and span the offence trajectory. Researchers have drawn from theories of crime to hypothesise causal mechanisms across multiple offending components, at multiple levels of analysis of the crime-commission process. One notable design uses two-step cluster analysis informed by developmental theories to deduce typologies of sexual offenders (Proulx, Bearegard, Lussier, & Leclerc, 2014). These typologies are equated to pathways, which demonstrate how different styles of interaction between offence components can be involved in criminal offending.

Likewise, the present study employs two-step cluster analysis and a previously-developed Risk Analysis Framework (RAF) of lone-actor terrorism to a dataset of 125 offenders. We set out to uncover person-environment interactions that could meaningfully typify the relationship between the individual propensity, situation, and network components of the attack process. The results suggest that four PEPs characterise the interaction between individual-level propensities and situational factors in the process of lone-actor terrorist violence. We go on to discuss the implications of these findings for the threat assessment of these offenders, in the context of an ILP approach to counterterrorism.

Analytical approach

Background

The case has been made that an individual-level, static, profile-based approach is not sufficient to understand how some people come to pursue extremist violence, and therefore counter it (Horgan, 2008). To move forward and enhance prevention and disruption, it has been argued that it is necessary to investigate the mechanisms, as well as their associated indicators, which underpin the interactions between personal and environmental factors in extremist violence (Bouhana & Wikström, 2011; Wikström & Bouhana, 2016).

A concrete step in this direction is the development of empirically-derived typologies, which identify patterns in offender development and the associated behavioural indicators. Such studies conceptualise the offence process into distinct components and use cluster analysis to detect meaningful groupings of indicators within each. These groupings can be inferred as relating to mechanisms that underpin the process of committing a crime. A second cluster analysis combines these cluster solutions to identify interactional patterns across the offending trajectory. An explicit theoretical framework allows researchers to infer causal mechanisms in pathways leading to crime, producing comprehensive and meaningful types that have implications for the risk assessment and management of these offenders.

For example, this analytical strategy has been used to develop a typology of child molesters. Beauregard, Proulx, and Leclerc (2014) sought to address two issues in existing typologies of child molesters. First, most typologies neglect some aspect of the offending process, such as modus operandi. Second, drawing on work from situational crime prevention and child molestation (Wortley & Smallbone, 2006), the authors aimed to operationalise situational factors in sexual offending. The offending process was theorised as involving five components operationalised using observable indicators. These were: personality characteristics, general lifestyle during adulthood up to one year prior to the index offence,

sexual lifestyle up to one year prior to the index offence, pre-crime factors in the year prior to the index offence, and modus operandi. Two-step cluster analysis of 64 convicted extra-familial child molesters identified profiles within each of the components. A second two-step cluster analysis combined these into three trajectories: the non-coercive deviant, the coercive deviant, and the coercive non-deviant pathways.

Beauregard et al. (2014) discuss their findings in relation to existing typologies of child molesters and refer to theoretical models of child molestation to contextualise their empirical types. For example, the non-coercive deviant pathway is characterised as *total problem* (a pattern of general lifestyle problems including social isolation and poor self-image) within the general lifestyle component, *hypersexual deviant* (deviant sexual fantasies) within the sexual lifestyle component, *lonely* (loneliness and low self-esteem) within the pre-crime component, and *non-coercive* (deviant sexual fantasies, premeditation, non-coercive and favours male victims) within the modus operandi component. These offenders have dependent-avoidant personalities, low self-esteem, and avoid socialising with adults. This precipitates loneliness and a proclivity for engaging in professional and social activities with children (i.e. babysitting). Their offenses are typically fuelled by their deviant fantasies and they select vulnerable victims from dysfunctional backgrounds. These offenders are largely non-coercive in order to simulate intimacy with their victims, who are often male. Features of this type are evident in typologies of sex offenders in general, as well as in other typologies of child molesters.

This analytical strategy has been used further to develop typologies of a range of offenders, including non-serial sexual killers (Stefanska, Carter, Higgs, Bishopp, & Beech, 2015), sex offenders who target marginalised victims (Horan & Beauregard, 2017), extrafamilial sexual aggressors against women (Proulx, Beauregard, Lussier, & Leclerc, 2014), intrafamilial child sex offenders (Leclerc, Beauregard, Forouzan, & Proulx, 2014),

extrafamilial sexual aggressors against adolescents (Brouillette-Alarie & Proulx, 2014) and marital rapists (Proulx & Beaugard, 2014). Hence, there are grounds to believe that this strategy can be applied to develop a meaningful typology of person-environment interactions that span the lone-actor terrorism offending process. It is important to note that this typology is not intended to classify different ‘types’ of people. Instead, as a typology of interactions, it is intended to classify groups of indicators, or markers, for processes that underpin trajectories to solo terrorist violence.

Analytical rationale

First, it is necessary to conceptualise the lone-actor terrorist attack process into distinct, but analytically-related components, and to relate these components to meaningful, observable indicators. To do so, the purposely-built RAF, developed for the PRIME project, is adopted as theoretical guidance. The RAF has been applied to the modelling of various aspects of lone-actor terrorist events (Schuurman, Bakker, Gill & Bouhana, 2017; Corner, Bouhana & Gill, 2018; Bouhana, Corner, Gill and Schuurman, 2018), though it should be noted that nothing precludes the RAF from being applied to other types of offences. A detailed presentation of the RAF is beyond the scope of this paper. However, the framework, which draws on Wikström’s (2010) Situational Action Theory and opportunity and social ecological theories of offending, was developed to articulate the relations between causal factors and processes at multiple levels of analysis, (individual, situational, social ecological, systemic) across each phase of the lone-actor terrorist event (radicalisation, attack planning and preparation, attack) (see Bouhana et al., 2016 for an in-depth discussion).

In summary, the RAF synthesises causal models of terrorism and radicalisation previously developed by Bouhana and Wikström (2010; 2011; Wikström and Bouhana, 2017). The lone-actor terrorist offence process is conceived of as the outcome of the

interaction between individuals with action-relevant propensities and terrorism-supportive criminogenic settings, whose features support individuals' perception of their own capability to offend, successfully. This can therefore lead to the emergence of situations that trigger and sustain actors' motivation to commit an act of terrorism. Individuals differ in their susceptibility to environmental influences that are capable of inducing moral change, of which radicalisation is a special case. This susceptibility is conceived as rooted in their pre-existing morality (commitment, or lack thereof, to context-appropriate, action-relevant moral rules), their executive functions (cognitive control of behaviour), and their capacity for self-regulation (self-control).

Propensity is understood as the outcome of the developmental interaction between an individual's differential susceptibility and their exposure to terrorism-promoting settings. Individuals are exposed to these settings through processes of self- and social selection. Terrorism-promoting settings are characterised by a terrorism-supportive moral context (terrorism-supportive moral rules and norms, and ineffective law-relevant deterrence), opportunities to create attachments to radicalising agents (which matters for radicalisation), and features which afford the perception of temptations or provocations, leading to the emergence of the motivation to act (which matters for terrorist action). Inasmuch as situational features also contribute to the perception that the individual has the capability to carry out the intended action successfully, motivation may be sustained long enough for the action to be completed (or attempted). As a general, interactionist framework, the RAF is organised around these key mechanisms and processes, as opposed to discrete indicators, which are theorised to be subject to change and therefore unstable ground for risk assessment on their own (Bouhana et al., 2016; Corner, Bouhana, & Gill, 2018).

To operationalise the RAF's analytical guidance in a way that would be compatible with the present analytical strategy and with the practical demands of threat assessment, the

lone-actor terrorist offending process was divided into three components: propensity (operationalised by proxy indicators of susceptibility and action-relevant propensity), situation (operationalised by proxy indicators of motivation, capability, and the features that support their emergence and maintenance), and network (operationalised by proxy indicators for exposure processes, notably relational). These components map well onto the kinds of factors and processes researchers have prioritised in their investigation of terrorism. This is to be expected as the RAF emerged from the synthesis of that literature (Bouhana & Wikström, 2011; Wikström and Bouhana, 2017; Bouhana et al, 2016). It is also important to note that no claim is made that we are producing actual estimates of propensity, which would require rather more direct measurements than are feasible in this space. Rather, we are using theory to inform the selection of specific proxy indicators. The RAF is designed to enable the operationalisation of theoretical models and these are the kinds of indicators which operational analysts can realistically access. While the procedure is admittedly crude, our argument is that imperfect analytical guidance is better than no guidance at all.

As stated, propensity refers here to a person's disposition to engage in acts of terrorism and is conceptualised as the outcome of the radicalisation process; hence, as a product of the causes of causes of terrorism (Schmid, 2013). This process of development of a terrorist propensity has been established as an important component of the offending process. Radicalisation has been modelled extensively (Borum, 2003; Moskalenko & McCauley, 2011; Neo, 2016; Sageman, 2008; Silber & Bhatt, 2007; Veldhuis & Staun, 2009). Furthermore, conceptual models of pathways to terrorism consistently refer to a 'radicalisation' phase (Dean, 2007; Gill, 2008; Holbrook & Taylor, 2017; Moghaddam, 2005; Moskalenko & McCauley, 2011; Precht, 2007; Taylor & Horgan, 2006; Wiktorowicz, 2004). Past empirical studies have examined factors thought to influence a person's propensity to engage in terrorism, such as national identity and attitudes (Miller, 2011; Tausch & Karoui,

2011), belonging and autonomy (Crone & Harrow, 2011), religious attitudes, beliefs and ideologies (Loza, 2011; Loza, Abd-El-Fatah, Prinsloo, Hesselink-Louw, & Seidler, 2011), religious identity, political attitudes, and suicidality (McCauley & Scheckter, 2008), and other 'risk factors' associated with radicalisation (Smith, 2018).

The second component, situation, relates to an offenders' context in the build-up to lone-actor terrorist violence. These include behaviours involved in attack planning and preparation, as well as behaviours related to operational security, which have increasingly been examined empirically (Gill, 2015; Gill, Horgan, & Deckert, 2014; Hamm & Spaaij, 2017; Horgan, Gill, Bouhana, Silver, & Corner, 2016; Sageman, 2004, 2011; Schuurman, Bakker, Gill, & Bouhana, 2018; Smith, Damphousse, & Roberts, 2006; Spaaij, 2010; Spaaij, 2011). These proximal factors have important implications for the risk assessment of these offenders, as they can signal the emergence and maintenance of a motivation to pursue terrorist violence (Meloy & Gill, 2016).

The final component, network, refers to ties to other extremists, groups or wider movements. The question 'how alone are lone-actors?' has been empirically examined, with findings largely indicating that they are not as lone as is often believed (Bouhana et al., 2018; Borum, 2013; Borum, Fein & Vossekuil, 2012; Gill & Horgan, 2012; Hamm & Spaaij, 2017; Holt et al., 2019; Hofmann, 2018; Schuurman, Lindekilde, et al., 2018; Smith et al., 2015). However, some actors do appear to act in relative isolation, even if they do not make up the majority of cases. Conceptualising network as a component operationalises some of the factors hypothesised to sustain offender perception of capability (i.e. support received from others) and therefore their motivation to act. It may also, it is hoped, contribute to the ongoing debate about the 'loneness' of lone-actor terrorists and its implications for threat assessment.

Method

Data

This study makes use of a pre-existing dataset of 125 lone-actor terrorists (Corner et al., 2018). Each lone-actor terrorist was coded based on a behavioural codebook of over 200 variables derived from the wider research literature (Gill et al., 2013). The data were compiled from open sources, including sworn affidavits, court reports, first-hand accounts and news reports, obtained predominantly via LexisNexis searches. Additional sources, such as biographies and scholarly articles, were used where available and relevant. First, three independent coders coded the objective absence or presence of a behavioural indicator. Second, the three coders engaged in a two-stage reconciliatory process. First, coder A reconciled observations of behaviours with coder B. Where differences were apparent, the original source documentation was checked for veracity. Second, coders AB were reconciled with coder C. Again, coding disparities were resolved by one of the principal researchers, who revisited the original sources and factored in the reliability of the documents when making decisions.

This decision-making was guided by a 'continuum of reliability', where each source was plotted along a scale from 'most reliable' to 'least reliable'. Sources such as court transcripts and associated documents, for example, were considered the most reliable. Competency evaluations, sworn affidavits, and indictments, were deemed reliable. Statements (verbal or written) made by the offenders or affiliated groups, were deemed somewhat reliable, as well as warrants and expert witness reports (which may be subject to unreliability and bias). Separately, media sources were also plotted along a reliability continuum where 'least reliable' were sources such as personal opinion blogs and 'most reliable' were non-tabloid newspapers.

The defining criterion for assigning the label ‘lone-actor terrorist’ to an individual was whether subjects carried out or planned to carry out, alone, an attack in service of some form of ideology, for which they were convicted or died in the attempt. The lone-actor terrorists in our sample can operate with or without command and control links. Some operated autonomously and independently of a group (e.g. in terms of training, preparation and target selection). Within this group, some may have radicalised towards violence within a wider group, but left and engaged in illicit behaviours outside of a formal command and control structure. Those with command and control links, on the other hand, were trained and equipped by a group, which may have also chosen their targets, but attempted to carry out their attacks autonomously. All individuals planned their attack in the US, Europe or Australia between 1990 and the end of 2015.

Procedure

Offending process variables

As stated, the lone-actor terrorist attack process was broken down into three analytically-meaningful components: propensity, situation, and network.

Propensity. The propensity component was operationalised with 23 dichotomous variables: (1) university experience; (2) victim of physical abuse during childhood/adolescence; (3) perpetrator of domestic abuse in adulthood; (4) victim of bullying during childhood/adolescence; (5) previous criminal convictions; (6) first espoused violent extremist ideology in prison; (7) individual grew up in a religious household; (8) individual underwent a religious conversion; (9) evidence of thrill-seeking behaviour; (10) evidence of low self-control; (11) problems with anger management; (12) inflexibility/inability to adapt to change; (13) over-confidence/grandiosity; (14) individual required support (short of

involvement with social services) as a child; (15) violent behaviour in childhood; (16) evidence of crisis before first exposure; (17) psychological distress; (18) history of substance abuse; (19) pattern of self-isolation; (20) first exposure was online; (21) chronic stress; (22) lived alone at the adoption of an ideology; (23) diagnosed mental illness.

Situation. The situation component was operationalised with 33 dichotomous variables. These indicators were coded as present if they occurred in the build-up to an attack. For example, ‘angry leading up to the event’ here, differs from ‘problems with anger management’ at the propensity component. The latter is a distal indicator of a predisposition whereas the former is a situational indicator of an offenders’ context: (1) produced letters/public statements; (2) made verbal statements to friends/family; (3) made verbal statements to a wider audience; (4) others were aware of their grievance; (5) others were aware of their ideology; (6) evidence of a specific event warning; (7) changed address prior to the event; (8) recently unemployed; (9) sought legitimisation from public/religious figures; (10) proximate life change; (11) altered their appearance; (12) denounced others who shared their ideology; (13) received training for the attack; (14) learnt through virtual sources; (15) engaged in dry-runs; (16) evidence of bomb manuals in their home; (17) recent work stressor; (18) interrupted in working on a proximate goal; (20) victim of an injustice; (21) experienced being disrespected; (22) experienced being ignored; (23) someone important to them demonstrated they did not care; (24) victim of a verbal or physical assault; (25) experienced being a helpless victim; (26) problems with personal relationships; (27) financial problems; (28) angry leading up to the event; (29) escalating anger; (30) expressed a desire to hurt others; (31) recently under elevated stress; (32) travelled to engage in preparatory activities; (33) violent behaviour unrelated to their attack.

Network. The network component was operationalised with 14 dichotomous variables: (1) spouse/partner part of a wider movement; (2) face-to-face interactions with

members of a wider network; (3) virtual interactions with members of a wider network; (4) others involved in the procuring of weaponry/technology; (5) others involved in the building of IED devices; (6) someone else knew about their research/planning prior to the event; (7) evidence of control and command links; (8) member of a small militant group; (9) tried to recruit others; (10) claims to be a part of a wider group/movement; (11) rejected from a political group (12) read propaganda from a wider movement; (13) read literature on other lone-actor terrorists; (14) read the propaganda of other lone-actor terrorists.

Analytical strategy

Developing the typology proceeded in two phases. First, two-step cluster analysis was used to identify profiles within each of the components of the attack process. The two-step cluster analysis function in Statistical Program for Social Sciences (SPSS) version 25 (IBM Corp, 2017) was used to conduct the analyses. Two-step cluster analysis identifies homogenous groups of cases, where the grouping is not known. The objects of the clusters are the cases and the attributes by which they are clustered are the variables. The result is homogenous groups of cases that share a set of attributes. First, two-step cluster analysis forms pre-clusters. This reduces the size of the matrix of distances between all possible pairs of cases. In this way, two-step cluster analysis is capable of handling large amounts of data, quickly. The data were categorical and so the log-likelihood distance measure was used. Second, the nature of the clusters is determined by a hierarchical clustering algorithm. Hierarchical clustering computes solutions from 1 to n, whereby at n solutions each case is a cluster. The optimal number of clusters is determined by Shwarz's Bayesian Criterion (BIC).

The second analytical phase identified patterns of indicators across the components of the attack process. Bi-variate analysis established if the clusters identified at the proposed components were significantly associated. Only significantly associated components were

submitted for further analysis. Lastly, two-step cluster analysis was performed on cluster membership. This allowed for the identification of person-exposure patterns that traverse the offending process. One way to measure the quality of the cluster solution is the silhouette measure of cohesion and separation. A description of this measure is provided in the model summary and output generated by the two-step cluster analysis procedure in SPSS. This measure articulates how cohesive the clusters are within themselves and how separate they are from one another. Potential values range from -1 to +1. The values are summarised as poor, fair or good by the model summary. A value summarised as fair, for example, would indicate a fair degree of separation (the clusters are fairly distinct from one another) and cohesion (the clusters are fairly homogenous within themselves).

Results

The clusters identified at each component were labelled by interpreting the presenting patterns of indicators, guided by the RAF. Indicators appear in order of their salience and importance to the overall cluster solution, as determined by the algorithm. Highlighted in bold, are the most salient features of each cluster.

Propensity

Cluster analysis of the propensity component identified two clusters (see Table 1). Given the variables that made up these clusters, they were labelled *unstable* (n = 40) and *stable* (n = 85). The silhouette measure of cohesion and separation was .3, which is fair.

(INSERT TABLE 1 HERE)

The *unstable* cluster is characterised by high frequencies of variables that, when used as proxies, may indicate cognitive susceptibility traditionally associated with persistent offending and other behavioural problems (Robbins & Bryan, 2004; Steinberg et al., 2008; Wikström & Treiber, 2016; Windle, 1991). The most salient features of this cluster are low self-control or impulsivity (85%), difficulties with anger management (80%), inflexibility or inability to adapt to challenges (62.5%), psychological distress (82.5%), and diagnosed mental illness (70%). This cluster suggests a pattern of instability, including a history of childhood and/or adolescent violence (17.5%), domestic abuse (17.5%), and social isolation (67.5%).

The *stable* cluster is characterised by lower frequencies of these indicators, although 37% of these offenders had a diagnosed mental illness and 30.6% demonstrated psychological distress. Frequencies of co-occurring developmental issues, cognitive vulnerabilities, social isolation, and historical violence are significantly lower, compared to the *unstable* cluster. Hence the *stable* cluster are stable relative to the *unstable* cluster.

Situation

Cluster analysis of the situation component detected three clusters (see Table 2). These were labelled *low leakage low stress* (n = 28), *high leakage high stress* (n = 36), and *high leakage low stress* (n = 61). The silhouette measure of cohesion and separation was .2, which is fair.

(INSERT TABLE 2 HERE)

These clusters differentiate by the degree of leakage, the influence of situational stressors, and by indicators of a pre-existing propensity for violence. Leakage refers to the degree to

which the offender signalled their intentions prior to the attack. High stress refers to a transitional period, characterised by a pattern of experiences such as encountering prejudice or unfairness, recent unemployment, being degraded or disrespected, and financial problems. The *low leakage low stress* cluster exhibit relatively lower frequencies of leakage behaviours, as well as lower frequencies of situational stressors. In fact, these offenders demonstrate low frequencies across all of the situational indicators. The most frequently occurring behaviours were changing their address (42.9%), evidence of bomb-making manuals (53.6%), learning through virtual sources (32.2%) and unrelated pre-attack violence (35.7%).

The *high leakage high stress* cluster demonstrate relatively higher frequencies of leakage behaviours and situational stressors, including experiencing prejudice or unfairness (63.9%), recent unemployment (72.7%), experiencing being degraded (50%), financial problems (63.9%), being disrespected (55.6%), being ignored by someone important (30.6%), escalating anger (61.1%), and acute stress (61.1%). The *high leakage low stress* cluster exhibit high frequencies of leakage behaviours, low frequencies of stressors, and relatively high frequencies of indicators of a pre-existing violent propensity. These include expressing a desire to hurt others (82%) and non-terrorist violence unrelated to their event (50.8%).

Network

Cluster analysis of the network component detected two clusters (see Table 3). These were named *lone* (n = 78) and *connected* (n = 47). The silhouette measure of cohesion and separation was .4, which is fair.

(INSERT TABLE 3 HERE)

The *connected* cluster demonstrate higher frequencies of behaviours that indicate ties to other extremists. Over 76% of actors in the *connected* cluster claimed to be part of a wider movement, and 25.5% showed evidence of direct command-and-control links. In contrast, the *lone* cluster demonstrate lower frequencies of these indicators. Nine percent of these lone-actor terrorists had face-to-face interactions with members of a wider network, and none showed any evidence of command-and-control links.

The second phase of the analytical strategy sought to identify patterns across the three components of the attack process. Bivariate analysis tested the strength of the association between the proposed components, (Cramer's V). Propensity was significantly associated with situation ($V = .24, p < .05$), which was significantly associated with network ($V = .38, p < .00$). Propensity was not significantly associated with network. This makes theoretical sense from the perspective of the RAF. Propensity would be a direct determinant of some of the indicators which make up the situation component (e.g. pre-attack violence), but would be more distantly related to network (through, for example, mediating selection effects). A second cluster analysis was performed on cluster membership across all three components. The analysis detected four distinct PEPs: the solitary PEP ($n = 23$); the susceptible PEP ($n = 40$), the situational PEP ($n = 22$), and the selection PEP ($n = 40$) (see Table 4). The silhouette measure of cohesion and separation was .5, which is good.

(INSERT TABLE 4 HERE)

The solitary PEP classified 18% of the sample ($n = 23$). These lone-actor terrorists are *stable* at the propensity component, *low leakage low stress* at the situation component, and *lone* at the network component. The susceptible PEP classified 32% of the sample ($n = 40$). These offenders are *unstable* at the propensity component, 47.5% were *high leakage high*

stress and 52.5% were *high leakage low stress* at the situation component, 65% were *lone*, and 35% were *connected* at the network component. The situational PEP classified 18% of the sample ($n = 22$). One hundred percent of these lone-actor terrorists were *stable* at the propensity component, 95.5% were *high leakage high stress*, and 4.5% were *high leakage low stress* at the situation component. These offenders were marginally more frequently *connected* (52.4%) than *lone* (47.6%) at the network component. The selection PEP classified 32% of the sample ($n = 48$). These lone-actor terrorists were *stable* at the propensity component, *high leakage low crisis* at the situation component, and both *lone* (47.5%) and *connected* (52.5%) at the network component.

Discussion

The present study detected four patterns of person-environment interactions (PEPs) in a population of lone-actor terrorists. It is important to reiterate that the PEPs are not intended as a typology of ‘types of people’; rather, they represent how different individual-level characteristics, notably those which are propensity-related, interact with situational factors to result in violent extremist action. First, to further interpret the meaning of the PEPs, the results are discussed with guidance from the RAF. Second, we consider the practical implications of these findings.

The solitary PEP

This PEP would seem to lack a salient pattern of common indicators of a propensity to pursue terrorist violence. This style of interaction was classified as *stable, low leakage low stress*, and *lone*. Yet, at some point, these 23 lone-actor terrorists became motivated to commit acts of terrorist violence. When interpreting this cluster, it should be noted, first, that the clusters are not absolute types. For example, the *lone* cluster is lone relative to the

connected cluster. Few of the indicators occur at frequencies of zero, and so it is possible that this particular analytical approach has overlooked a subtler style of interaction. For instance, 14% of the *low leakage low stress* cluster did in fact experience a recent stressor in the build-up to an attack. Therefore, it is not to say that the solitary PEP characterises a style of interaction that is undetectable or devoid of any indicators of risk. Rather, the causal mechanisms sustaining this trajectory have likely not been detected by this analytical strategy.

Second, the study was limited in its ability to operationalise interactions beyond the individual and situational levels. To operationalise some of these interactions, proxies that were not designed for this purpose were used. These were subject to the availability bias that characterises much of the data in this space, (Dugan, 2011; Jongman, 1993; LaFree & Dugan, 2007, Safer-Lichtenstein, LeFree & Loughran, 2017). It is possible that interactions beyond these levels underlie more crucial causal mechanisms or that different proxies were required to detect propensity markers in these individuals. Due to availability, these may be biased towards traditional cognitive or affective, rather than moral, indicators.

However, the RAF, grounded as it is in situational and ecological theories of criminality, allows for person/situation interactions whereby a violent act can be committed absent of a pre-existing violent propensity, under situational pressures. It would also be consistent with the RAF for an individual to be high on moral violent propensity markers, but low on cognitive (e.g. low self-control) underlying features. Such an individual could hold terrorist violence to be legitimate but possess such high executive functioning that they would be tightly behaviourally controlled and, therefore, not exhibit behaviours that are violent, antisocial, denote excessive affect, intention leakage, and so on.

However, if valid, we may have identified a less commonly considered route to lone-actor terrorism with specific implications for threat assessment. The most salient feature of

this style of interaction is the pattern of indicators that demonstrate low frequencies of leakage indicators and dynamic stressors. This could pose a unique challenge for threat assessment professionals. For example, The Terrorist Radicalisation Assessment Protocol (TRAP-18) is an investigative framework for lone-actor terrorist threat assessment, utilised in the UK, US and Canada. It consists of 8 proximal warning behaviours (pathway, fixation, identification, novel aggression, energy burst, leakage, last resort and directly communicated threat) and 10 distal characteristics (personal grievance, ideology, failure to affiliate, dependence on the virtual community, thwarting of goals, changes in thinking, failure of pair bonding, mental disorder, creativity and criminal violence) that distinguish between static and dynamic indicators of risk (Meloy & Gill, 2016). However, the solitary PEP is broadly lacking in high frequencies of any of these proximal warning behaviours, bar some evidence of pathway warning behaviours and novel aggression.

Pathway warning behaviours include planning, preparation, and committing an attack, and are late-stage indicators of the risk of terrorist violence. As conceived of in the TRAP-18, novel aggression is thought to be a way for lone-actor terrorists to test their resolve to commit violence, and likely occurs in the late stages of attack preparation. Here, the most salient indicators of mobilisation occur at the penultimate stages of the attack process. The window for detection is therefore likely much shorter, and the opportunities for detection more limited. To the extent that these offenders may be 'watched', there might be a danger that intelligence-gathering would not be escalated to active risk management, due to the low prevalence of dynamic risk indicators.

Likewise, the prevalence of leakage behaviours has been reported extensively throughout the literature, (Gill & Corner, 2016; Gill et al., 2014; Schuurman, Bakker, Gill, & Bouhana, 2017) and is central to threat assessment (Meloy & Gill, 2016; Meloy, Mohandie, Knoll, & Hoffmann, 2015). The solitary PEP demonstrates much lower frequencies of these

indicators and therefore it may be necessary for practitioners to consider a trajectory of warning behaviours absent of any leakage indicators, as still posing a credible threat.

Lastly, this style of offending is characterised by low frequencies of network connections. As previously discussed, the ‘loneness’ of lone-actor terrorists is often debated. However, these results are comparable to previous findings. For example, in a temporal and geospatial analysis of lone-actor terrorists, Smith, Gruenewald and Damphousse, (2015) disaggregated lone terrorists by their group affiliations and level of assistance in preparing for an attack. They reported that only 6% of their sample of 267 offenders were categorised as ‘loners’; where loners had no group affiliations, no help committing an attack, and no help committing precursor acts. The solitary PEP, although not devoid of indicators that suggest connections to others, is comparable to Smith et al.’s (2015) loners, and so there is evidence for considering the solitary PEP as a valid configuration of person-exposure patterns. To exemplify this style of interaction further, Figure 1 presents a behavioural sequence of Loris Doukaiev’s pathway to attack; an offender from the present dataset of lone-actor terrorists.

(INSERT FIGURE 1 HERE)

This sequence demonstrates a trajectory absent of many of the common indicators associated with the risk of lone violent extremism. There is some evidence of pathway warning behaviours, such as gathering bomb manuals and stockpiling weapons. However as discussed, this likely occurs in the penultimate stages of attack planning and therefore does not allow a substantial window for detection. It could be suggested that detection in this instance was possible, had the relevant agencies received and actioned the appropriate intelligence. However, it could equally be argued that, on the basis of this behavioural

sequence, there was little evidence in the first instance to warrant the active risk management of this offender. Arguably, further investigation is required to facilitate a deeper understanding of this style of interaction.

The susceptible PEP

The susceptible PEP suggests a route to lone-actor terrorism characterised most saliently by a pattern of instability at the propensity component. Here, cognitive susceptibility indicators suggest a relative level of vulnerability to moral change. Social- and self-selection factors may lead to sustained exposure to radicalising settings and the eventual development of a terrorist propensity and/or of the motivation to commit an act of terrorism. This particular configuration resonates with crime and delinquency research. Previous work has identified an association between impairments in executive functioning, specifically low self-control, and exposure to criminogenic environments in the internalisation of antisocial moral norms and in the emergence of criminal motivation (Pratt, 2016).

In the terrorism field, previous research has reported elevated rates of mental disorders in lone-actor terrorists versus group actors (Corner and Gill, 2015; Fein & Vossekuil, 1999; Gill et al., 2014; Gruenewald, Chermak, & Freilich, 2013a; Gruenewald, Chermak, & Freilich, 2013b; Hewitt, 2003; Liem, van Buuren, van Zuijdewijn, Schonberger & Bakker, 2018). However, these findings are aggregated. Disaggregating the dataset, the *unstable* cluster presents a profile of lone-actor terrorists where 70% had at least one diagnosed mental illness and 82.5% exhibited signs of psychological distress. All of the lone-actor terrorists classified along the susceptible PEP are unstable at the propensity component. However, it should be noted that Corner et al. (2018) examined the multifinality of a number of behavioural indicators in this dataset and demonstrated how different indicators can play different roles at different points along trajectories to lone-actor terrorism.

However, the susceptible PEP suggests a style of interaction whereby cognitive susceptibility, in the form of mental illness, is a key factor in the emergence of the propensity and/or the motivation to commit a violent terrorist attack. A comorbidity of impulsivity, violence and psychiatric disorder is widely reported, (Bjørkly, 2013; Chamorro et al., 2012). Meloy and Pollard (2017: pg. 1) also discuss the role of impulsivity in lone-actor terrorism, where they note the “pathway became a runway,” as impulsivity seemed to prompt an irrational, premature attack despite careful planning and preparation in a number of case studies. Therefore, this style of interaction may pose a very different challenge to threat assessment.

An offender who exhibits impulsivity and psychiatric disorder may progress from radicalisation to a violent attack more rapidly than would otherwise be expected. The RAF's interactive logic suggests an inverse relationship between susceptibility and exposure (i.e. the higher the susceptibility to moral change, the lower the exposure required for propensity change). Hence, the susceptible PEP could characterise someone who 'radicalises quickly', making these offenders more difficult to detect. Although, an offender characterised by this degree of psychiatric disorder is likely to come into contact with mental health practitioners, providing an early opportunity for intervention. This suggests that mental health practitioners could play a key role in the threat assessment of lone targeted violence (Weine, Eisenman, Jackson, Kinsler, & Polutnik, 2017). In other words, a better understanding of *how* mental illness interacts with other individual susceptibility and situational factors, could aid policy makers, analysts, and practitioners, in devising more effective, targeted interventions.

Interestingly, the fact that most of these offenders are classified as *lone* (65%) may provide further evidence for the notion of selection effects in lone-actor terrorists with mental health issues. Organised terrorist groups seek recruits who can contribute to the operational success of the group and so those affected by mental illness may be less likely to be targeted.

This selection effect may account for the elevated rates of mental illness observed in lone-actor terrorist populations and is further evidenced here, (Corner, Gill, & Mason, 2016).

Relational analyses of radicalisation have also shown that loneliness is not always a choice, but that individual characteristics affect the actors' ability to form and maintain relationships with others in an extremist milieu (Malthaner & Lindekilde, 2017).

Furthermore, lone-actor terrorists classified by this PEP are equally *high leakage high stress* and *high leakage low stress*. This could be interpreted as further evidence that the locus of action stems from the propensity component. The patterns of behaviour observed at subsequent phases of the attack process vary from case to case but seem to originate from a core cognitive susceptibility to environmental influence. Figure 2 exemplifies a behavioural sequence that demonstrates the susceptible PEP.

(INSERT FIGURE 2 HERE)

The sequence illustrates the trajectory of convicted terrorist, Frederique de Jongh. First, there is evidence of a distal cognitive susceptibility, dominated by mental health issues, which precedes the adoption of an extremist ideology. As suggested by this PEP, the observable, pervasive pattern of indicators relating to impaired executive functioning is likely a key factor in the emergence of the motivation to commit a violent attack. Second, de Jongh, as described by the susceptible PEP, leaked his intent in the build-up to the attack. An intelligence analyst who had information relating to de Jongh's propensity for terrorist violence (relating to impaired executive functioning), alongside evidence of leakage behaviours, potentially could have identified a legitimate threat here.

The situational PEP

The most salient interaction of the situational PEP is the pattern of situational stressors observed at the situation component. The role of stress exposure in criminal offending is well-established and often debated with reference to General Strain Theory (GST); a life course theory which conceives of crime and terrorism as an outcome of exposure to various strains (Agnew, 2010; Agnew & White, 1992; Eitle & Turner, 2003). In the context of lone-actor terrorism and as suggested by the RAF, the effects of stress are likely to be multifinal (Corner et al., 2018). Sixty-four percent of these offenders experienced prejudice or unfairness alongside other dynamic stressors such as financial problems, recent unemployment, and being disrespected. While such experiences can be interpreted as motivational, in an interactionist framework they could also contribute to exposure. For example, anger at experiences of discrimination may lead to involvement in a civil organisation which happens to be connected to a social network containing a radicalising agent, or, unemployment may lead to relocation to a neighbourhood where an extremist organisation is active.

The situational PEP is characterised as *stable* at the propensity component, and so may not attract attention early in the event process. However, there may be an opportunity to intervene in the build-up to an attack, as high frequencies of leakage behaviours occur alongside a pattern of multiple dynamic stressors. Vossekui, Fein, and Berglund (2015) observed that over half of a sample of individuals involved in an attack, or attempted attack, on US public figures, had difficulty coping with dynamic stressors in the build-up to their offence. As a result, it was suggested that threat assessment inquiries should attend to patterns of dynamic stressors, the feelings these stressors invoke (e.g. desperation), and a person's coping mechanisms. In addition, Silver, Horgan & Gill (2019) identified findings similar to the situational PEP, when they examined the role of strain, in the context of Cumulative Strain Theory (CST), across the trajectories of mass murderers and lone-actor

terrorist offenders. Hence, there is evidence to suggest the situational PEP is a legitimate route to lone-actor terrorist violence.

Considering the threat assessment of these offenders, the TRAP-18 describes the proximal warning behaviour, last resort, as evidence of impending violent action, signalled by desperation or distress. Experiencing multiple dynamic stressors may trigger last resort thinking and signal an acceleration towards violent action. Subjects of interest being ‘watched’ who demonstrate this pattern of dynamic stressors may warrant escalation to active risk management in light of these findings. The situational PEP suggests that detecting and addressing stress and poor coping skills, among other factors, may be a valid approach to the risk management of some lone-actor terrorists. Figure 3 exemplifies a behavioural sequence that demonstrates the situational PEP. The sequence details the trajectory of terrorist Jim David Adkisson.

(INSERT FIGURE 3 HERE)

Of note, prior to adopting an extremist ideology, Adkisson demonstrates a propensity for violence. In the build-up to the attack, and as suggested by the situational PEP, there is an observable pattern of dynamic stressors, alongside a number of leakage behaviours. Here, Adkisson’s trajectory demonstrates how a pervasive pattern of strain could be a factor in the emergence of the motivation to commit a violent terrorist attack. Again, this may warrant analysts attending to patterns of dynamic stressors, alongside other mobilisation indicators, to enhance the detection of offenders demonstrating the situational PEP.

The selection PEP

Finally, the selection PEP delineates a route to offending influenced chiefly by a crime- and violence-supportive propensity at the situation component. These offenders appear *stable* at the propensity component and espouse their grievances widely, with little evidence of dynamic stressors at the situation component. They are equally *lone* and *connected* but are characterised most distinctively by behaviours indicative of crime-supportive propensity at the situation component. This is in terms of the violence-supportive belief dimension of propensity, more than in terms of executive functioning, as seen in the susceptible PEP. This propensity can result in self-selection, as these offenders would have an increased preference for engaging with likeminded individuals in criminal and/or extremist settings. When provoked to action, this criminogenic propensity, for violence in particular, makes the pursuit of violent action more likely, when for others the moral context of the settings they encounter might discourage pursuing violent terrorism.

This style of offending most resembles the predatory offender identified by typologies of a range of homicides, including anti-LGBT homicides (Fisher & Salfati, 2009; Tomsen, 2009, Kelley & Gruenewald, 2015) and mass murderers (Declercq & Audenaert, 2011; Meloy, 1992; Langman, 2009). Langman (2009) for instance, describes a three-category typology of rampage shooters; psychopathic, psychotic, and traumatised. The psychopathic offender is characterised by narcissism, a lack of empathy, and sadism. The selection PEP demonstrates some of these traits with higher frequencies of violence, unrelated to terrorism, in the build-up to an attack, higher frequencies of espousing grievances widely, and higher frequencies of expressing a desire to hurt others.

The selection PEP could pose a different challenge to practitioners in terms of their capability. Most of these lone-actor terrorists do not suffer from mental illness or other impairments of higher order functioning and are not experiencing a distress-invoking period of dynamic stress. Therefore, they may be more capable of carrying out a successful terrorist

attack. In terms of threat assessment and management strategies, drawing from the experience of handling violent, personality disordered individuals, may be of benefit. These lone-actor terrorists expressed a desire to hurt others in over 80% of cases, demonstrated high frequencies of leakage behaviours, and over half of them committed acts of violence unrelated to their attack in the build-up to the event. Therefore, it is likely that these offenders will be known to the community as dangerous individuals, as well as to other agencies, suggesting specific opportunities for detection and disruption.

Furthermore, the selection PEP is equally *lone* and *connected* at the network component, as is the situational PEP, suggesting that the locus of action is internal. Gill (2015: pg. 76) asked the question, ‘Why go it alone?’, which relates to a broader need to understand the differences between group actors and lone-actor terrorists. Perhaps an important difference between these categories of terrorists lies in the locus of action. The least salient feature of the PEPs is the network component. This could be taken as an indication that the behaviour of these lone-actor terrorists is more essentially self-sustained, compared to group actors who take direction from the collective. To further demonstrate the selection PEP, Figure 4 exemplifies the behavioural sequence of Omar Abdel Hamid El-Hussein.

(INSERT FIGURE 4 HERE)

El-Hussein demonstrates a violence-and-crime supportive propensity, typical of the selection PEP, that precedes the adoption of an extremist ideology, including multiple arrests, a period of imprisonment, and acts of non-terrorist violence. Once radicalised, El-Hussein mobilises to attack preparation, leaking his intent, and seeking help from others to procure weapons.

Attending to a pattern of historical violence and criminal engagement, alongside other mobilisation indicators, may be key in identifying a credible threat here.

Limitations and further research

The present study is not without limitations. First, the data are open source. It is necessary to acknowledge the potential limitations of relying on secondary source data, over primary sources, such as direct assessments. Open source data has been criticised for having the potential to be unreliable, subject to bias, and incomplete (Spaaij & Hamm, 2015). Yet the nature of terrorists as a subject of study has required researchers to rely on secondary data collection methodologies in order to progress. As such, open source data has been the source of a range of important findings, (Corner & Gill, 2015; Gill & Corner, 2016; Gill & Horgan, 2012; Gill et al., 2014; Gruenewald et al., 2013). Robust data collection methodologies and provisions to ensure inter coder reliability can mediate many of these concerns, as in the present study.

Second, much of the data in this space is characterised by missing data and biases with regards to the nature of what is missing (the availability bias). Safer-Lichtenstein et al. (2017) summarise much of this debate and conclude that researchers and policymakers should be transparent about the assumptions made about missing data and the effects of missing-values on policy recommendations (see also Crenshaw & LaFree, 2017). Given the nature of the data, there is likely to be some underreporting of certain types of indicators. For instance, as discussed with reference to the solitary PEP, the proxies necessary to detect the processes that underpin this trajectory were most likely unavailable. However, the present research does not rely upon single indicators to make causal statements. Rather it articulates assumptions, grounded in theory, based upon patterns of multiple indicators. Whilst certainly

not exempt from the availability bias, this approach may be somewhat more resilient to its effects.

Third, it is important to consider the treatment of missing data. When relying on open-source reporting, it is sometimes difficult to decipher between missing data, and data that should be coded as 'no' or 'not present'. The authors of these sources, such as journalists, are unlikely to report at great length, the absence of potentially infinite indicators that may be of interest to researchers (Gill et al., 2017). For instance, in the present dataset, it was rare to encounter a definitive 'no' answer. This occurred most often in instances where corrections were printed in response to previous reporting errors. Hence, each variable in the analysis is treated dichotomously, where the response is either a 'yes' or not enough information to suggest a 'yes' and, therefore, a 'no'. Previous research on attempted assassinations of public figures, fatal school shootings, and targeted violence affecting higher education institutions and terrorism, have employed similar strategies (Fein and Vossekuil, 1999; Gill et al., 2014; Gruenewald et al., 2013a; Vossekuil, 2002).

Lastly, cluster analysis is not temporal. The PEPs are not sequential and although it could be reasonably inferred that indicators related to propensity may logically precede situational indicators, there is no way to account for this with this model. Further research is needed to explore the way these behavioural interactions may evolve over time. It is also of interest to consider if the PEPs have implications for terrorist-decision making, including target selection and attack style.

Policy implications

The PEP typology has policy and practical implications for countering the lone-actor terrorist threat. In general, the lone-actor terrorist population has been shown to be extremely heterogenous. This poses a unique challenge in itself. A typology, such as the PEP typology,

can be useful to policymakers when dealing with heterogenous populations as it can provide a framework for developing tailored responses as opposed to broad, generalised policies, (Holt, Freilich, Chermak, Mills & Silva, 2019). For instance, the susceptible PEP demonstrates a style of interaction that may benefit from an intervention designed to address an offender's mental health needs. Whereas the situational PEP identifies a configuration of dynamic stressors, where interventions should attend to an offender's stress response and coping skills. Conversely, the selection PEP may require a response more similar to the treatment of violent, personality disordered offenders, such as in general forensic populations. More specifically, this section will discuss two key implications of the present findings. First, we discuss the implications of the PEP analysis with regard to the threat assessment of these offenders. Second, we propose suggestions for intelligence-gathering and decision-making, and conclude with commentary on the need to continue to pursue multiagency intelligence sharing.

Threat assessment

The current practice of lone-actor terrorist threat assessment is predominantly carried out by utilising risk assessment tools. These tools aid decision-making by providing estimates of relative risk based on the prevalence of a range of risk indicators. These include the ERG22+ utilised by the UK government's PREVENT program (Lloyd & Dean, 2015), the Violent Extremism Risk Assessment (VERA-2) utilised in prisons and by probation services (Pressman, Duits, Rinne & Flockton, 2016), and the IR46, a multiagency Dutch risk assessment tool used in policing. These tools are designed to help practitioners gauge an individual's risk of engaging in violent extremism. However, a static, indicator-orientated approach to risk assessment may be problematic given research that has demonstrated the

instability and the multifinality of these indicators, (Schuurman, Bakker, Gill, & Bouhana 2017; Corner, Bouhana & Gill, 2018).

The case has been made that structured professional judgement could be one way forward, in that it brings together consideration of indicators with experience- and theory-informed judgement within a structured clinical process (Logan & Lloyd, 2018; Monahan, 2012; 2015). However, this begs the question of the source of that structure. How is experiential and theoretical knowledge to be organised, systematised, and, ultimately, made communicable, generalisable, as well as testable, beyond the clinical or investigative case under consideration and the ability of the individual analyst? How can general guidelines be formulated, if, as the earlier work of Corner et al. (2018) and the present PEP analysis suggests, risk indicators are context dependent to such an extent? We would suggest that to operate this step-change in terrorism risk assessment, we need to move from the *assessment* to the *analysis* of risk in this space. An analytical framework, which clearly articulates the interaction processes between the individual and situational levels of explanation, such as the RAF, operationalised here, could provide the generalisable structure needed to inform professional judgements about lone-actor terrorism risk across ideological, temporal and geographical contexts.

Intelligence gathering

To effectively counter the threat of lone-actor terrorism, intelligence is key. Community-level intelligence, as well as an efficient network of multiagency intelligence sharing, is vital to detect and disrupt this type of threat, (Bettison, 2009; Brown, 2007, Carter & Chermak, 2012; Oliver, 2006, Nasser-Edine, Garnahm, Agostino & Caluya, 2011; Pickering et al, 2007). McGarrell, Freilich and Chermak (2007) suggest that an ILP approach to counterterrorism is relevant as, first, these events are rarely spontaneous, and often involve

a lengthy planning stage, and second, terrorism is often a local problem. In fact, Marchment, Bouhana and Gill (2018) demonstrated the distance-decay effect in a sample of lone-actor terrorists when examining the residence-to-attack journeys of this type of offender. Hence, the lone-actor terrorist threat is theoretically detectable, given the appropriate intelligence.

However, some have argued that law enforcement agencies have been overwhelmed with intelligence data (Carter & Chermak, 2012). A framework for guiding intelligence gathering may be of substantial benefit to counterterrorism policing. Frameworks such as the Nationwide Suspicious Activity Reporting (SAR) Initiative (NSIS, 2016; NSI, 2018) employed in the US by the Department of Homeland Security, the Intelligence Handling Model (IHM), and the Risk, Credibility, Actionability and Proportionality (RCAP) frameworks, employed by MI5 in the UK (Anderson, 2017), serve as a guide for collection, analysis and decision-making, based on suspicious behaviour data. The potential of frameworks, such as the NSI, to provide analysts with a tool for the risk assessment of terrorists has been empirically demonstrated (Gruenewald et al., 2019). The present typology could serve as an additional framework for guiding the collection and analysis of intelligence data that relates to the emergence of the motivation to commit an attack.

The current practice of intelligence gathering is predominantly focussed on collecting observable, behavioural indicators that may signal mobilisation towards a lone-actor terrorist attack. For example, the National Counterterrorism Center (NCTC) (2019) describes a framework of mobilisation indicators. These are grouped relative to their diagnosticity and include indicators such as ‘preparing and disseminating a martyrdom’, ‘communicating intent to engage in violent extremism’, and ‘suspicious, unexplained, or unusual physical or weapons training.’ Similarly, the Canadian Security Intelligence Service (2018), describes mobilisation indicators that broadly categorise travel preparations (for extremist purposes),

changes in training and physical exercise routines, financial preparations, concealment or deceit, and final preparations, such as making arrangements in the event of death.

Given the present findings, it may of benefit to consider the PEP typology as an additional framework for gathering intelligence relating to the emergence of the motivation to commit terrorist violence. This intelligence, alongside patterns of mobilisation indicators, may be a more robust way to detect legitimate threats from a pool of watched subjects of interest, and better inform decision-making about the allocation of limited resources. The PEP typology disaggregates patterns of risk indicators and draws on the RAF to articulate the processes that these patterns allude to. However, by operationalising perceptible behaviours or experiences, the PEP typology conserves the observability that existing intelligence-gathering frameworks depend upon. Hence, it is suggested that a) data collection should be expanded to include an analysis of propensity- and situation-relevant indicators, as outlined here and b) analysis of this intelligence should attend to patterns of indicators, as outlined by the PEP typology, which may help signal motivation, alongside mobilisation.

Data relating to these indicators is likely to originate from a variety of sources. For instance, mental health practitioners are likely to have access to intelligence relating to the executive functioning of potential lone-actor terrorists. Whereas law enforcement agencies might have information on an offender's criminal history. Furthermore, members of the community may hold intelligence related to situational stressors or leakage of intent. Therefore, multi-agency intelligence sharing, across sectors and including community-level actors, will be key to successfully operationalising these findings. Intelligence hubs such as the fusion centres in the US, the Integrated Security Units (ISUs) ,and the Integrated Threat Assessment Centre (ITAC) in Canada, as well as the safeguarding hubs that operate as part of the UK's PREVENT strategy, are central to such endeavours (Monaghan & Walby, 2010; Home Office, 2018; Pathé et al., 2018). However, in a review of information sharing among

US law enforcement, government agencies, and private sector organisations, Carter (2014) found room for improvement. The findings of the present study provide further evidence to continue to advocate for enhanced, multiagency intelligence sharing, as the most robust tool in countering the lone-actor terrorist threat.

Specifically, the present study has implications for encouraging intelligence-sharing between mental health practitioners and police. For example, there are a number of existing collaborative police-mental health models designed to address the mental health facet of violent extremism. These include the previously described PREVENT strategy, the Netherlands National Police Threat Management Team, and the Queensland Fixated Threat Assessment Centre (QFTAC), modelled on the UK's Fixated Threat Assessment Centre (FTAC) (Pathé et al., 2018).

Within QFTAC, information is shared between the Queensland Police Service (QPS) and Queensland Health. Their Memorandum of Understanding (2016) sets out exemptions to the duty of confidentiality, based on the interests of public safety, that typically inhibits much of the intelligence sharing between these agencies. Given the result of the PEP analysis, specifically with reference to the susceptible PEP, there is cause to advocate further for the adoption of such models, and to legislate in such a way as to facilitate the intelligence-sharing between mental health agencies and police.

Conclusion

The present study applies a process perspective to lone-actor terrorist offending, in an attempt to disaggregate this population alongside analytically coherent, but empirically-derived, dimensions. Our findings reiterate the need to continue to progress away from static profiles of indicators and to pursue a more dynamic, dimensional approach, which, among other things, could help put to rest a contentious definitional debate (Borum et al., 2012). An

alternative to absolute definitions of any criminal behaviour is to reconceptualise definitional elements as degrees along a continuum. As the present study demonstrates, lone-actor terrorists do not have to be defined wholly as lone or connected, or stable or unstable, for example. Adopting a multi-dimensional approach can account for heterogeneity, while maintaining coherence within a general, well-articulated analytical framework. Implementing such an approach could allow researchers and practitioners to progress beyond cyclical definitional debates and engage in more productive discussions about different styles of interaction. Equally, these findings demonstrate the need to continue to disaggregate the offending population, even when considering sub-types of terrorists or events (Gill et al., 2014; Horgan & Morrison, 2011). Doing so has important implications for the study and threat assessment of the lone actor, and quite likely group actors as well.

References

- Agnew, R. (2010). A general strain theory of terrorism. *Theoretical Criminology*, 14(2), 131-153. <https://doi.org/10.1177/1362480609350163>
- Agnew, R., & White, H. R. (1992). An empirical test of general strain theory. *Criminology*, 30(4), 475-500. <https://doi:10.1111/j.1745-9125.1992.tb01113.x>
- Anderson, D. (2017). Attacks in London and Manchester-March-June 2017. *Independent assessment of MI5 and police internal reviews*. Retrieved from https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/664682/Attacks_in_London_and_Manchester_Open_Report.pdf
- Beauregard, E., Proulx, J., & Leclerc, B. (2014). Offending pathways: The role of lifestyle and precrime factors in extrafamilial child molesters. In J. Proulx, E. Beauregard, P. Lussier, & B. Leclerc (Eds.), *Pathways to Sexual Aggression* (pp. 137-155). London: Routledge.
- Bettison, N. (2009). Preventing Violent Extremism - A Police Response. *Policing*, 3(2), 129-138.
- Bjørkly, S. (2013). A systematic review of the relationship between impulsivity and violence in persons with psychosis: Evidence or spin cycle? *Aggression and Violent Behavior*, 18(6), 753-760. <https://doi.org/10.1016/j.avb.2013.08.001>
- Borum, R. (2003). Understanding the terrorist mind-set. *FBI Law Enforcement Bull.*, 72(7), 7-10.
- Borum, R. (2013). Informing lone-offender investigations. *Criminology & Public Policy*, 12(1), 103-112.
- Borum, R., Fein, R., & Vossekuil, B. (2012). A dimensional approach to analyzing lone offender terrorism. *Aggression and Violent Behavior*, 17(5), 389-396. <https://doi.org/10.1016/j.avb.2012.04.003>

- Bouhana, N., Thornton, A., Corner, E., Malthaner, S., Lindekilde, L., Schuurman, B., & Perry, G., (2016). *D3.1 Risk Analysis Framework: Public Version*. FP7 PRIME project, 1-107. Accessed from: http://www.fp7-prime.eu/deliverables/PRIME_D3.1_Risk_Analysis_Framework_Public.pdf.
- Bouhana, N., Malthaner, S., Schuurman, B., Lindekilde, L., Thornton, A., & Gill, P. (2018). Lone-actor terrorism: radicalisation, attack planning and execution. In A. Silke (Ed.), *Routledge Handbook of Terrorism and Counterterrorism* (pp. 138-150). New York, NY: Routledge.
- Bouhana, N., & Wikström, P-O. H. (2011). *Al Qai'da-influenced radicalisation: A rapid evidence assessment guided by Situational Action Theory*. (RDS Occasional Paper 97). London, England: Home Office Research, Development and Statistics Directorate.
- Brouillette-Alarie, S., & Proulx, J. (2014). An exploratory analysis of the offending process of extrafamilial sexual aggressors against adolescents. In J. Proulx, E. Beauregard, P. Lussier, & B. Leclerc (Eds.), *Pathways to Sexual Aggression* (pp. 179-196). London: Routledge.
- Brown, B. (2007). Community Policing in Post-September 11 America: A Comment on the Concept of Community-Oriented Counterterrorism. *Police Practice and Research*, 8(3), 239-251.
- Brzica, N. (2017). Potential Adherents of Radical Islam in Europe: Methods of Recruitment and the Age of Perpetrators in Acts of Terror. *Politička misao: časopis za politologiju*, 54(4), 161-184. doi:<https://hrcak.srce.hr/190342>Canada Security Intelligence Service. (2018). *Mobilization to violence (terrorism) research : Key findings*. Retrieved from https://www.canada.ca/content/dam/isis-scrcs/documents/publications/IMV_-_Terrorism-Research-Key-findings-eng.pdf

- Carbajosa, P., Catalá-Miñana, A., Lila, M., & Gracia, E. (2017). Differences in treatment adherence, program completion, and recidivism among batterer subtypes. *The European Journal of Psychology Applied to Legal Context*, 9(2), 93-101.
doi:10.1016/j.ejpal.2017.04.001
- Carter, J. G. (2014). Inter-organizational relationships and law enforcement information sharing post-September 11, 2001. *Journal of Crime and Justice*. Advanced online publication. DOI: 10.1080/0735648X.2014.927786
- Carter, J., & Chermak, S. (2012). In Lum, C., & Kennedy, L. W. (Eds.), Evidence-based counterterrorism policy (pp. 65-88). Springer, New York, NY.
- Chamorro, J., Bernardi, S., Potenza, M. N., Grant, J. E., Marsh, R., Wang, S., & Blanco, C. (2012). Impulsivity in the general population: a national study. *Journal of psychiatric research*, 46(8), 994-1001. <https://doi.10.1016/j.jpsychires.2012.04.023>
- Corner, E., Bouhana, N., & Gill, P. (2018). The multifinality of vulnerability indicators in lone-actor terrorism. *Psychology, Crime & Law*, 1-47.
doi:10.1080/1068316X.2018.1503664
- Corner, E., & Gill, P. (2015). A false dichotomy? Mental illness and lone-actor terrorism. *Law and Human Behavior*, 39(1), 23. doi: 10.1037/lhb0000102
- Corner, E., Gill, P., & Mason, O. (2016). Mental health disorders and the terrorist: A research note probing selection effects and disorder prevalence. *Studies in Conflict & Terrorism*, 39(6), 560-568. <https://doi.org/10.1080/1057610X.2015.1120099>
- Crenshaw, M., & LaFree, G. (2017). *Countering terrorism: No simple solutions*. Washington, DC: Brookings.
- Crone, M., & Harrow, M. (2011). Homegrown terrorism in the West. *Terrorism and Political Violence*, 23(4), 521-536. doi: 10.1080/09546553.2011.571556

- Dean, G. (2007). Criminal profiling in a terrorism context. In R. N. Kocsis (Ed.), *Criminal Profiling: International Theory, Research, and Practice* (pp. 169-188). New Jersey, NY: Humana Press.
- Declercq, F., & Audenaert, K. (2011). A case of mass murder: Personality disorder, psychopathology and violence mode. *Aggression & Violent Behavior, 16*(2), 135-143. doi:10.1016/j.avb.2011.02.001
- Dugan, L. (2011). The making of the Global Terrorism Database and its applicability to studying the lifecycles of terrorist organizations. In D. Gadd, S. Karstedt & S. Messner (Eds.), *The SAGE handbook of criminological research methods* (pp. 175-198). Los Angeles, CA: Sage.
- Eitle, D., & Turner, R. J. (2003). Stress exposure, race, and young adult male crime. *The Sociological Quarterly, 44*(2), 243-269. <https://doi.org/10.1111/j.1533-8525.2003.tb00557.x>
- Fein, R. A., & Vossekuil, B. (1999). Assassination in the United States: An operational study of recent assassins, attackers, and near-lethal approachers. *Journal of Forensic Science, 44*(2), 321-333. doi: 10.1520/JFS14457J
- Fisher, C., and C. G. Salfati. 2009. "Behavior or Motivation: Typologies of Hate-motivated Offenders." In B. Perry & R. Blazk, (Eds), *Hate Crimes: Volume 4 Hate Crime Offenders*. (pp. 103–35). Westport, CT: Praeger.
- Fox, B. H., & Farrington, D. P. (2015). An experimental evaluation on the utility of burglary profiles applied in active police investigations. *Criminal justice and behavior, 42*(2), 156-175. <https://doi.org/10.1177/0093854814548446>
- Ganor, B. (2008). Terrorist organization typologies and the probability of a boomerang effect. *Studies in Conflict & Terrorism, 31*(4), 269-283. <https://doi.org/10.1080/10576100801925208>

- Gill, P. (2008). Suicide bomber pathways among Islamic militants. *Policing: A Journal of Policy and Practice*, 2(4), 412-422. <https://doi.org/10.1093/police/pan056>
- Gill, P. (2015). Lone-actor terrorists: A behavioural analysis. London: Routledge.
- Gill, P., & Corner, E. (2013). Disaggregating terrorist offenders: Implications for research and practice. *Journal of Criminology and Public Policy*, 12(1), 93-101.
doi:<https://doi.org/10.1111/1745-9133.12015>
- Gill, P., & Corner, E. (2016). Lone-Actor Terrorist Target Choice. *Behavioral Sciences & the Law*, 34(5), 693-705. <https://doi.org/10.1002/bsl.2268>
- Gill, P., Horgan, J., & Deckert, P. (2014). Bombing alone: Tracing the motivations and antecedent behaviors of lone-actor terrorists. *Journal of Forensic Sciences*, 59(2), 425-435. doi: 10.1111/1556-4029.12312
- Gill, P., Corner, E., Conway, M., Thornton, A., Bloom, M., & Horgan, J. (2017). Terrorist use of the Internet by the numbers: Quantifying behaviors, patterns, and processes. *Criminology & Public Policy*, 16(1), 99-117.
<https://doi.org/10.1111/1745-9133.12249>
- Gruenewald, J. (2012). Are anti-LGBT homicides unique? *Journal of Interpersonal Violence*, 27, 3601-3623.
- Gruenewald, J., Chermak, S., & Freilich, J. D. (2013a). Distinguishing “loner” attacks from other domestic extremist violence: A comparison of far-right homicide incident and offender characteristics. *Criminology & Public Policy*, 12(1), 65-91.
- Gruenewald, J., Chermak, S., & Freilich, J. D. (2013b). Far-right lone wolf homicides in the United States. *Studies in Conflict & Terrorism*, 36(12), 1005-1024.
<https://doi.org/10.1080/1057610X.2013.842123>
- Gruenewald, J., & Kelley, K. (2014). Exploring anti-LGBT homicide by mode of victim selection. *Criminal Justice and Behavior*, 41(9), 1130-1152.

- Gruenewald, J., Klein, B. R., Drawve, G., Smith, B. L., & Ratcliff, K. (2019). Suspicious preoperational activities and law enforcement interdiction of terrorist plots. *Policing: An International Journal*, 42(1), 89-107.
- Hacker, F. J., & Hacker, F. (1976). *Crusaders, criminals, crazies: Terror and terrorism in our time*. New York, NY: Norton.
- Hamm, M. S., & Spaaij, R. (2017). *Age of Lone Wolf Terrorism*. New York, NY: Columbia University Press.
- Helfgott, J. B. (2008). *Criminal behavior: Theories, typologies and criminal justice*. Thousand Oaks, CA: Sage.
- Hewitt, C. (2003). *Understanding terrorism in America*. London: Routledge.
- Hofmann, D. C. (2018). How “alone” are lone-actors? Exploring the ideological, signaling, and support networks of lone-actor terrorists. *Studies in Conflict & Terrorism*, 1-22. doi:10.1080/1057610X.2018.1493833
- Holbrook, D., & Taylor, M. (2017). Terrorism as process narratives: a study of pre-arrest media usage and the emergence of pathways to engagement. *Terrorism and Political Violence*, 1-20. <https://doi.org/10.1080/09546553.2017.1341879>
- Holt, T. J., Freilich, J. D., Chermak, S. M., Mills, C., & Silva, J. (2019). Loners, colleagues, or peers? Assessing the social organization of radicalization. *American Journal of Criminal Justice : AJCJ*, 44(1), 83-105. doi:<http://dx.doi.org.libproxy.ucl.ac.uk/10.1007/s12103-018-9439-5>
- Home Office. (2018) *Counter-terrorism Strategy (CONTEST) 2018*. Retrieved from https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/716907/140618_CCS207_CCS0218929798-1_CONTEST_3.0_WEB.pdf.

- Horan, L., & Beauregard, E. (2017). Pathways in the offending process of sex offenders who target marginalised victims. *Journal of Investigative Psychology and Offender Profiling, 14*(3), 213-226. <https://doi.org/10.1002/jip.1481>
- Horgan, J. (2008). From profiles to pathways and roots to routes: Perspectives from psychology on radicalization into terrorism. *The ANNALS of the American Academy of Political and Social Science, 618*(1), 80-94. <https://doi.org/10.1177/0002716208317539>
- Horgan, J., Gill, P., Bouhana, N., Silver, J., & Corner, E. (2016). Across the universe? A comparative analysis of violent behavior and radicalisation across three offender types with implications for criminal justice training and education. U.S. Department of Justice.
- Horgan, J., & Morrison, J. F. (2011). Here to stay? The rising threat of violent dissident Republicanism in Northern Ireland. *Terrorism and Political Violence, 23*(4), 642-669. <https://doi.org/10.1080/09546553.2011.594924>
- Horgan, J., Shortland, N., & Abbasciano, S. (2018). Towards a typology of terrorism involvement: A behavioral differentiation of violent extremist offenders. *Journal of Threat Assessment and Management, 5*(2), 84. <https://dx.doi.org/10.1037/tam0000102>
- Horgan, J., Shortland, N., Abbasciano, S., & Walsh, S. (2016). Actions speak louder than words: A behavioral analysis of 183 individuals convicted for terrorist offenses in the United States from 1995 to 2012. *Journal of forensic sciences, 61*(5), 1228-1237. doi:<https://doi.org/10.1111/1556-4029.13115>
- IBM Corp. (2017). IBM SPSS Statistic for Macintosh, Version 25.0. Armonk, NY: Author.
- Intelligence & Security Committee of Parliamet. (2018). *The 2017 attacks: What needs to change*. Retrieved from

https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/776162/HC1694_The2017Attacks_WhatNeedsToChange.pdf

- Jongman, A. J. (1993). Trends in international and domestic terrorism in Western Europe, 1968- 88. In A. P. Schmid & R. D. Crelinsten (Eds.), *Western responses to terrorism* (pp. 26-76). London, England: Frank Cass.
- Kelley, K., & Gruenewald, J. (2015). Accomplishing masculinity through anti-lesbian, gay, bisexual, and transgender homicide: A comparative case study approach. *Men and Masculinities, 18*(1), 3-29. doi: 10.1177/1097184X14551204
- LaFree, G., & Dugan, L. (2007). Introducing the global terrorism database. *Terrorism and Political Violence, 19*, 181-204.
- Lankford, A. (2014). A suicide-based typology of suicide terrorists: Conventional, coerced, escapist and indirect. *Security Journal, 27*(1), 80-96.
<https://doi.org/10.1057/sj.2012.20>
- Langman, P. (2009). Rampage school shooters: A typology. *Aggression and Violent Behavior, 14*(1), 79-86. doi:10.1016/j.avb.2008.10.003
- Leclerc, B., Beaugard, E., Forouzan, E., & Proulx, J. (2014). Offending pathways of intrafamilial child sex offenders. In J. Proulx, E. Beaugard, P. Lussier, & B. Leclerc (Eds.), *Pathways to Sexual Aggression* (pp. 156-178). London: Routledge.
- Liem, M., van Buuren, J., de Roy van Zuijdewijn, J., Schönberger, H., & Bakker, E. (2018). European lone-actor terrorists versus “common” homicide offenders: An empirical analysis. *Homicide studies, 22*(1), 45-69.
- Lloyd, M., & Dean, C. (2015). The development of structured guidelines for assessing risk in extremist offenders. *Journal of Threat Assessment and Management, 2*(1), 40–52.

- Logan, C., & Lloyd, M. (2018). Violent extremism: A comparison of approaches to assessing and managing risk. *Legal and Criminological Psychology*, 1–21.
<https://doi.org/10.1111/lcrp.12140>
- Loza, W. (2011). The prevalence of the Middle-Eastern extreme ideologies among some Canadians. *Journal of interpersonal violence*, 26(7), 1388-1400. doi:
10.1177/0886260510369133
- Loza, W., Abd-El-Fatah, Y., Prinsloo, J., Hesselink-Louw, A., & Seidler, K. (2011). The prevalence of extreme Middle Eastern ideologies around the world. *Journal of interpersonal violence*, 26(3), 522-538. doi: 10.1177/0886260510363417
- Malthaner, S., & Lindekilde, L. (2017). Analyzing pathways of lone-actor radicalization: A relational approach. In *Constructions of Terrorism: An Interdisciplinary Approach to Research and Policy* (pp. 163-180). Oakland, California: University of California Press.
- Marchment, Z., Bouhana, N., & Gill, P. (2018). Lone-actor Terrorists: A Residence-to-Crime Approach. *Terrorism and Political Violence*, 1-26.
- McCauley, C., & Scheckter, S. (2008). What's special about US Muslims? The war on terrorism as seen by Muslims in the United States, Morocco, Egypt, Pakistan, and Indonesia. *Studies in Conflict & Terrorism*, 31(11), 1024-1031.
<https://doi.org/10.1080/10576100802400193>
- Meloy, J. R. (1997). Predatory violence during mass murder. *Journal of forensic sciences*, 42(2), 326-329. <https://doi.org/10.1520/JFS14122J>.
- Meloy, J.R. (2018). The Operational Development and Empirical Testing of the Terrorist Radicalization Assessment Protocol (TRAP–18). *Journal of Personality Assessment*, 100(5), 483-492.

- Meloy, J. R., & Gill, P. (2016). The lone-actor terrorist and the TRAP-18. *Journal of Threat Assessment and Management*, 3(1), 37. doi: 10.1037/tam0000061
- Meloy, J. R., Mohandie, K., Knoll, J. L., & Hoffmann, J. (2015). The concept of identification in threat assessment. *Behavioral Sciences & the Law*, 33(2-3), 213-237. doi: 10.1002/bsl.2166
- Meloy, J. R., & Pollard, J. W. (2017). Lone-actor terrorism and impulsivity. *Journal of Forensic Sciences*, 62(6), 1643-1646. doi: 10.1111/1556-4029.13500
- Memorandum of Understanding between The State of Queensland acting through Queensland Health and The State of Queensland acting through Queensland Police Service. 2016. Retrieved from <https://www.health.qld.gov.au/publications/clinicalpractice/guidelines-procedures/clinical-staff/mental-health/guidelines/mou-mhcollab-2011.pdf>
- Merari, A. (1978). A classification of terrorist groups. *Studies in Conflict & Terrorism*, 1(3-4), 331-346. <https://doi.org/10.1080/10576107808435418>
- Miller, L. (2006). The terrorist mind: II. Typologies, psychopathologies, and practical guidelines for investigation. *International Journal of Offender Therapy and Comparative Criminology*, 50(3), 255-268. <https://doi.org/10.1177/0306624X05281406>
- Miller, W. L. (2011). Religion, risk and legal culture: Balancing human rights against a 'war on terror'. *The British Journal of Politics & International Relations*, 13(4), 514-533. <https://doi.org/10.1111/j.1467-856X.2011.00453.x>
- Moghaddam, F. M. (2005). The staircase to terrorism: A psychological exploration. *American Psychologist*, 60(2), 161. doi: 10.1037/0003-066X.60.2.161
- Mohandie, K., Meloy, J. R., McGowan, M. G., & Williams, J. (2006). The RECON typology of stalking: Reliability and validity based upon a large sample of North American

- stalkers. *Journal of Forensic Sciences*, 51(1), 147-155. <https://doi.10.1111/j.1556-4029.2005.00030.x>
- Monahan, J. (2012). The individual risk assessment of terrorism. *Journal of Psychology, Public Policy, Law*, 18(2), 167. doi:<http://dx.doi.org/10.1037/a0025792>
- Monahan, J. (2015). The individual risk assessment of terrorism: Recent developments. *Virginia Public Law and Legal Theory Research Paper*, 57, 520 – 534. <https://doi.org/10.2139/ssrn.2665815>
- Monahan, J. (2016). The individual risk assessment of terrorism: Recent developments. In G. LaFree & J. D. Freilich (Eds.), *The Handbook of the Criminology of Terrorism* (pp. 520-534). Hoboken, New Jersey: Wiley.
- Monahan, J. (2018). Predictions of violence. In T. Grisso & S. L. Brodsky (Eds.), *The roots of modern psychology and law: A narrative history* (pp. 143). New York, NY: Oxford University Press.
- Monahan, J., & Walby, K. (2012). Making up ‘Terror Identities’: security intelligence, Canada's Integrated Threat Assessment Centre and social movement suppression. *Policing and Society*, 22(2), 133-151.
- Moskalenko, S., & McCauley, C. (2011). The psychology of lone-wolf terrorism. *Counselling Psychology Quarterly*, 24(2), 115-126. <https://doi.org/10.1080/09515070.2011.581835>
- Nasser-Eddine, M., Garnham, B., Agostino, K., & Caluya, G. (2011). Countering violent extremism (CVE) literature review (No. DSTO-TR-2522). Defence Science and technology Organisation Edinburgh (Australia).
- National Counterterrorism Center. (2019). *Homegrown violent extremist mobilisation indicators: 2019 edition*. Retrieved from

https://www.dni.gov/files/NCTC/documents/news_documents/NCTC-FBI-DHS-HVE-Mobilization-Indicators-Booklet-2019.pdf

Neo, L. S. (2016). An Internet-mediated pathway for online radicalisation: RECRO. In M. Khader, L. S. Neo, G. Ong, E. Tan, & J. Chin (Eds.), *Combating Violent Extremism and Radicalization in the Digital Era* (pp. 197-224). Hershey, PA: IGI Global.

NSI (2018), Nationwide SAR Initiative available at: <https://nsi.ncirc.gov/> (accessed March 29, 2019).

NSIS (2016), "Suspicious activity reporting indicators and behaviors", Nationwide SAR Initiative, available at: https://nsi.ncirc.gov/documents/SAR_Indicators_One-Page.pdf (accessed March 29, 2019).

Oliver, W. M. (2006). The Fourth Era of Policing: Homeland Security. *International Review of Law Computers & Technology*, 20(1 & 2), 49-62.

Pantucci, R. (2011). *A typology of lone wolves: Preliminary analysis of lone Islamist terrorists*. London, England: International Centre for the Study of Radicalisation and Political Violence.

Pathé, M. T., Haworth, D. J., Goodwin, T. A., Holman, A. G., Amos, S. J., Winterbourne, P., & Day, L. (2018). Establishing a joint agency response to the threat of lone-actor grievance-fuelled violence. *The Journal of Forensic Psychiatry & Psychology*, 29(1), 37-52. doi: 10.1080/14789949.2017.1335762

Perliger, A., Koehler-Derrick, G., & Pedahzur, A. (2016). The gap between participation and violence: Why we need to disaggregate terrorist 'profiles'. *International Studies Quarterly*, 60(2), 220-229. doi:<https://doi.org/10.1093/isq/sqv010>

Phillips, P. J., & Pohl, G. (2012). Economic profiling of the lone wolf terrorist: can economics provide behavioral investigative advice? *Journal of Applied Security Research*, 7(2), 151-177. doi:<http://dx.doi.org/10.1080/19361610.2012.656250>

- Pratt, T. C. (2016). A self-control/life-course theory of criminal behavior. *European Journal of Criminology*, 13(1), 129-146. doi:<https://doi.org/10.1177/1477370815587771>
- Pressman, E., Duits, N., Rinne, T., & Flockton, J. (2016). VERA-2R Violent Extremism Risk Assessment Version 2 Revised: a Structured Professional Judgement Approach. *Utrecht, The Netherlands*: NIFP/DJI.
- Precht, T. (2007). *Home grown terrorism and Islamist radicalisation in Europe*. Retrieved from http://www.justitsministeriet.dk/sites/default/files/media/Arbejdsomraader/Forskning/Forskningspuljen/2011/2007/Home_grown_terrorism_and_Islamist_radicalisation_in_Europe_-_an_assessment_of_influencing_factors_2_.pdf
- Proulx, J., & Beauregard, E. (2014). Pathways in the offending process of marital rapists. In J. Proulx, E. Beauregard, P. Lussier, & B. Leclerc (Eds.), *Pathways to Sexual Aggression* (pp. 110-136). London, England: Routledge.
- Proulx, J., Beauregard, E., Lussier, P., & Leclerc, B. (2014). Pathways in the offending process of extrafamilial sexual aggressors against women. In *Pathways to Sexual Aggression* (pp. 71-109). London, England: Routledge.
- Proulx, J., Beauregard, E., Lussier, P., & Leclerc, B. (2014). *Pathways to sexual aggression*. London, England: Routledge.
- Ratcliffe, J. H. (2008). Knowledge management challenges in the development of intelligence-led policing. *The Handbook of Knowledge-Based Policing: Current Conceptions and Future Directions*. Chichester: John Wiley and Sons, 205-220.
- Robbins, R. N., & Bryan, A. (2004). Relationships between future orientation, impulsive sensation seeking, and risk behavior among adjudicated adolescents. *Journal of Adolescent Research*, 19(4), 428-445. <https://doi.org/10.1177/0743558403258860>

- Safer-Lichtenstein, A., LaFree, G., & Loughran, T. (2017). Studying Terrorism Empirically: What We Know About What We Don't Know. *Journal of Contemporary Criminal Justice*, 33(3), 273-291.
- Sageman, M. (2004). *Understanding terror networks*. Philadelphia, PA: University of Pennsylvania Press.
- Sageman, M. (2008). A strategy for fighting international Islamist terrorists. *The ANNALS of the American Academy of Political Social Science*, 618(1), 223-231.
<https://doi.org/10.1177/0002716208317051>
- Sageman, M. (2011). *Leaderless jihad: Terror networks in the twenty-first century*. Philadelphia, PA: University of Pennsylvania Press.
- Scheffer, Judy. 2002. Dealing with missing data. *Research Letters in the Information and Mathematical Sciences*, 3: 153–160.
- Schmid, A. P. (2013). *Radicalisation, de-radicalisation, counter-radicalisation: A conceptual discussion and literature review*. Retrieved from
https://s3.amazonaws.com/academia.edu.documents/31064974/ICCT-Schmid-Radicalisation-De-Radicalisation-Counter-Radicalisation-March-2013.pdf?AWSAccessKeyId=AKIAIWOWYYGZ2Y53UL3A&Expires=1545136920&Signature=J6i4ADINZR7CN6O011JHbHhchpg%3D&response-content-disposition=inline%3B%20filename%3DAlex_P._Schmid._Radicalisation_De-Radica.pdf
- Schuurman, B., Bakker, E., Gill, P., & Bouhana, N. (2018). Lone-actor Terrorist Attack Planning and Preparation: A Data-Driven Analysis. *Journal of Forensic Sciences*, 63(4), 1191-1200. <https://doi.org/10.1111/1556-4029.13676>

- Schuurman, B., Lindekilde, L., Malthaner, S., O'Connor, F., Gill, P., & Bouhana, N. (2018). End of the lone wolf: the typology that should not have been. *Studies in Conflict & Terrorism*, 1-8. <https://doi.org/10.1080/1057610X.2017.1419554>
- Silber, M. D., & Bhatt, A. (2007). *Radicalization in the West: The homegrown threat* (pp. 1-90). New York: Police Department.
- Silver, J., Horgan, J., & Gill, P. (2019). Shared Struggles? Cumulative Strain Theory and Public Mass Murderers From 1990 to 2014. *Homicide Studies*, 23(1), 64-84.
- Simon, J. D. (2013). *Lone wolf terrorism: Understanding the growing threat*. New York, NY: Amherst.
- Smith, A. (2018). Risk Factors and Indicators Associated With Radicalization to Terrorism in the United States: What Research Sponsored by the National Institute of Justice Tells Us. Retrieved from <https://www.ncjrs.gov/pdffiles1/nij/251789.pdf>
- Smith, B. L., Damphousse, K. R., & Roberts, P. (2006). Pre-incident indicators of terrorist incidents: The identification of behavioral, geographic, and temporal patterns of preparatory conduct. Retrieved from <https://www.ncjrs.gov/pdffiles1/nij/grants/214217.pdf>
- Spaaij, R. (2010). The enigma of lone wolf terrorism: An assessment. *Studies in Conflict & Terrorism*, 33(9), 854-870. <https://doi.org/10.1080/1057610X.2010.501426>
- Spaaij, R. (2011). *Understanding lone wolf terrorism: Global patterns, motivations and prevention*. New York, NY: Springer Science & Business Media.
- Spaaij, R., & Hamm, M. S. (2015). Key issues and research agendas in lone wolf terrorism. *Studies in Conflict & Terrorism*, 38(3), 167-178. <https://doi.org/10.1080/1057610X.2014.986979>

- Stefanska, E. B., Carter, A. J., Higgs, T., Bishopp, D., & Beech, A. R. (2015). Offense pathways of non-serial sexual killers. *Journal of Criminal Justice*, 43(2), 99-107. <https://doi.org/10.1016/j.jcrimjus.2015.01.001>
- Steinberg, L., Albert, D., Cauffman, E., Banich, M., Graham, S., & Woolard, J. (2008). Age differences in sensation seeking and impulsivity as indexed by behavior and self-report: Evidence for a dual systems model. *Journal of Developmental Psychology*, 44(6), 1764. doi:[https://doi: 10.1037/a0012955](https://doi.org/10.1037/a0012955)
- Strentz, T. (1988). A terrorist psychosocial profile: Past and present. *FBI L. Enforcement Bull.*, 57(4), 13-19.
- Tausch, A., & Karoui, H. (2011). Les musulmans: un cauchemar ou une force pour l'Europe? In J.-P. Chagnollaud (Ed.), *Histoire et Perspectives Méditerranéennes*. Paris, France: L'Harmattan.
- Taylor, M., & Horgan, J. (2006). A conceptual framework for addressing psychological process in the development of the terrorist. *Terrorism and political violence*, 18(4), 585-601. <https://doi.org/10.1080/09546550600897413>
- Tomsen, S. (2002). Hatred, murder and male honour: Anti-homosexual homicides in New South Wales, 1980-2000. Canberra: Australian Institute of Criminology.
- Tusikov, N., & Fahlman, R. C. (2009). Threat and risk assessments In J. Ratcliffe (Ed.), *Strategic thinking in criminal intelligence*. Annandale, NSW: The Federation Press
- Veldhuis, T., & Staun, J. (2009). *Islamist radicalisation: A root cause model*. Den Haag, The Netherlands: The Hague, Netherlands Institute of International Relations Clingendael.

- Vossekuil, B. (2002). The final report and findings of the Safe School Initiative: Implications for the prevention of school attacks in the United States. Collingdale, PA: DIANE Publishing.
- Vossekuil, B., Fein, R. A., & Berglund, J. M. (2015). Threat assessment: Assessing the risk of targeted violence. *Journal of Threat Assessment and Management*, 2(3-4), 243. <https://10.1037/tam0000055>
- Weine, S., Eisenman, D. P., Jackson, L. T., Kinsler, J., & Polutnik, C. (2017). Utilizing mental health professionals to help prevent the next attacks. *International Review of Psychiatry*, 29(4), 334-340. <https://10.1080/09540261.2017.1343533>
- Wikström, P-O. H. (2010). Situational Action Theory. In V. F. Cullen & P. Wilcox (Eds.), *Encyclopedia of criminological theory* (Vol. 1, pp. 1001-1008). London, England: Sage.
- Wikström, P-O. H., & Bouhana, N. (2016). Analyzing radicalization and terrorism: A situational action theory. In *The Handbook of the Criminology of Terrorism* (pp. 175-187). New Jersey, NY: Wiley-Blackwell.
- Wikström, P-O. H., & Treiber, K. (2016). Situational theory: The importance of interactions and action mechanisms in the explanation of crime. In A. Piquero (Ed.), *The Handbook of Criminological Theory* (pp. 415-444). New Jersey, NY: Wiley-Blackwell.
- Wiktorowicz, Q. (2004). *Joining the cause: Al-Muhajiroun and radical Islam*. Paper presented at the The Roots of Islamic Radicalism, Yale University.
- Windle, M. (1991). The difficult temperament in adolescence: Associations with substance use, family support, and problem behaviors. *Journal of Clinical Psychology*, 47(2), 310-315. [https://doi.org/10.1002/1097-4679\(199103\)47:2<310::AID-JCLP2270470219>3.0.CO;2-U](https://doi.org/10.1002/1097-4679(199103)47:2<310::AID-JCLP2270470219>3.0.CO;2-U)

Wortley, R., & Smallbone, S. (2006). Applying situational principles to sexual offenses against children. *Crime Prevention Strategies, 19*, 7-35.

Table 1. Prevalence of propensity variables by cluster.

Propensity variables	Clusters	
	Unstable (<i>n</i> = 40)	Stable (<i>n</i> = 85)
History of low self-control or impulsivity	85.0% (<i>n</i> = 34)	12.9% (<i>n</i> = 11)
Difficulties with anger management	80.0% (<i>n</i> = 32)	17.6% (<i>n</i> = 15)
Inflexibility or inability to adapt to challenges/obstacles	62.5% (<i>n</i> = 25)	10.6% (<i>n</i> = 9)
Signs of psychological distress	82.5% (<i>n</i> = 33)	30.6% (<i>n</i> = 26)
History of mental illness	70.0% (<i>n</i> = 28)	27.1% (<i>n</i> = 23)
Victim of bullying as a child/adolescent	30.0% (<i>n</i> = 12)	3.5% (<i>n</i> = 3)
Self-aggrandisement/over confidence	37.5% (<i>n</i> = 15)	7.1% (<i>n</i> = 6)
Lived alone at the time of radicalisation	40.0% (<i>n</i> = 16)	12.9% (<i>n</i> = 11)
Victim of physical abuse as a child	15.0% (<i>n</i> = 6)	1.2% (<i>n</i> = 1)
History of thrill- or sensation-seeking behaviours	47.5% (<i>n</i> = 19)	21.2% (<i>n</i> = 18)
Process of religious conversion	32.5% (<i>n</i> = 13)	11.8% (<i>n</i> = 10)
Pattern of self-isolation/social withdrawal	67.5% (<i>n</i> = 27)	41.2% (<i>n</i> = 35)
Long-term sources of stress	47.5% (<i>n</i> = 19)	23.5% (<i>n</i> = 20)
Prior to first exposure, there was a situation of crisis	70.0% (<i>n</i> = 28)	47.1% (<i>n</i> = 40)
Substance abuse	40.0% (<i>n</i> = 16)	20.0% (<i>n</i> = 17)
Pattern of violence through childhood/adolescents	17.5% (<i>n</i> = 7)	4.7% (<i>n</i> = 4)
Required special attention/care as a child	12.6% (<i>n</i> = 5)	3.5% (<i>n</i> = 3)
Perpetrator of domestic abuse	17.5% (<i>n</i> = 7)	7.1% (<i>n</i> = 6)
University experience	47.7% (<i>n</i> = 19)	29.6% (<i>n</i> = 25)
Raised in a religious household	42.5% (<i>n</i> = 17)	32.9% (<i>n</i> = 28)
First radicalising encounter took place online	22.5% (<i>n</i> = 9)	17.6% (<i>n</i> = 15)
First espoused violent extremist ideology in prison	5.0% (<i>n</i> = 2)	5.9% (<i>n</i> = 5)
Previous criminal convictions	52.3% (<i>n</i> = 21)	46.9% (<i>n</i> = 40)

Table 2. Prevalence of situation variables by cluster.

Situation variables	Clusters		
	Low leakage low stress (<i>n</i> = 28)	High leakage high stress (<i>n</i> = 36)	High leakage low stress (<i>n</i> = 61)
Others aware of their grievance	10.7% (<i>n</i> = 3)	91.7% (<i>n</i> = 33)	93.4% (<i>n</i> = 57)
Others aware of their extreme ideology	7.1% (<i>n</i> = 2)	86.1% (<i>n</i> = 31)	86.9% (<i>n</i> = 53)
Was target of prejudice/unfairness	7.1% (<i>n</i> = 2)	63.9% (<i>n</i> = 23)	6.6% (<i>n</i> = 4)
Recently became unemployed	10.7% (<i>n</i> = 3)	72.2% (<i>n</i> = 26)	13.1% (<i>n</i> = 8)
Made verbal statements to friends	0.0% (<i>n</i> = 0)	83.3% (<i>n</i> = 30)	50.8% (<i>n</i> = 40)
Experienced being degraded	3.6% (<i>n</i> = 1)	50.0% (<i>n</i> = 18)	3.3% (<i>n</i> = 2)
Experienced financial problems	7.1% (<i>n</i> = 2)	63.9% (<i>n</i> = 23)	13.1% (<i>n</i> = 8)
Expressed a desire to hurt others	17.9% (<i>n</i> = 5)	69.4% (<i>n</i> = 25)	82.0% (<i>n</i> = 50)
Experienced being disrespected	10.7% (<i>n</i> = 3)	55.6% (<i>n</i> = 20)	6.6% (<i>n</i> = 4)
Produced letters	10.7% (<i>n</i> = 3)	66.7% (<i>n</i> = 24)	75.4% (<i>n</i> = 46)
Made verbal statements to the public	0.0% (<i>n</i> = 0)	63.9% (<i>n</i> = 23)	54.1% (<i>n</i> = 33)
Experienced being ignored by someone	3.6% (<i>n</i> = 1)	30.6% (<i>n</i> = 11)	0.0% (<i>n</i> = 0)
Angry	21.4% (<i>n</i> = 6)	72.2% (<i>n</i> = 26)	62.3% (<i>n</i> = 38)
Anger was escalating	0.0% (<i>n</i> = 0)	61.1% (<i>n</i> = 22)	36.1% (<i>n</i> = 22)
Evidence of a recent stressor	14.3% (<i>n</i> = 4)	61.1% (<i>n</i> = 22)	26.2% (<i>n</i> = 16)
Experienced not being cared for	3.6% (<i>n</i> = 2)	27.8% (<i>n</i> = 10)	3.3% (<i>n</i> = 2)
Changed address	42.9% (<i>n</i> = 12)	83.3% (<i>n</i> = 30)	45.9% (<i>n</i> = 28)
Experienced a work stressor	17.9% (<i>n</i> = 5)	41.7% (<i>n</i> = 15)	11.5% (<i>n</i> = 7)
Evidence of bomb manuals found	53.6% (<i>n</i> = 15)	16.7% (<i>n</i> = 6)	49.2% (<i>n</i> = 30)
Experienced being a helpless victim	7.1% (<i>n</i> = 2)	27.8% (<i>n</i> = 10)	4.9% (<i>n</i> = 30)
Victim of physical/verbal assault	7.1% (<i>n</i> = 2)	27.8% (<i>n</i> = 10)	4.9% (<i>n</i> = 3)

Interrupted in pursuing proximate life goal	10.7% (n = 3)	27.8% (n = 10)	4.9% (n = 3)
Problematic personal relationships	7.1% (n = 2)	41.7% (n = 15)	27.9% (n = 17)
Proximate upcoming life change	14.3% (n = 4)	22.2% (n = 8)	3.3% (n = 2)
Learnt through virtual sources	32.1% (n = 9)	36.1% (n = 13)	59.0% (n = 36)
Underwent hands-on training	7.1% (n = 2)	36.1% (n = 13)	21.3% (n = 13)
Gave a direct event warning	3.6% (n = 1)	25.0% (n = 9)	29.5% (n = 18)
Engaged in dry-runs	7.1% (n = 2)	33.3% (n = 12)	32.8% (n = 20)
Denounced others who share their beliefs	0.0% (n = 0)	19.4% (n = 7)	14.8% (n = 9)
Travelled for preparatory activities	14.3% (n = 4)	38.9% (n = 14)	19.7% (n = 12)
Un-related violence, pre-attack	35.7% (n = 10)	30.6% (n = 11)	50.8% (n = 31)
Sought legitimisation from community	3.6% (n = 1)	19.4% (n = 7)	13.1% (n = 8)
Altered appearance	7.1% (n = 2)	16.7% (n = 6)	9.8% (n = 6)

Table 3. Prevalence of network variables by cluster.

Network variables	Clusters	
	Lone (<i>n</i> = 78)	Connected (<i>n</i> = 47)
Face-to-face interactions with members of a wider network	9.0% (<i>n</i> = 7)	89.4% (<i>n</i> = 42)
Claims to be a part of a wider group/movement	21.8% (<i>n</i> = 16)	76.6% (<i>n</i> = 36)
Member of a small militant/activist group at any point	7.7% (<i>n</i> = 6)	53.2% (<i>n</i> = 25)
Read literature/propaganda from a wider movement	43.6% (<i>n</i> = 34)	93.6% (<i>n</i> = 44)
Interacted virtually with members of a wider network	14.1% (<i>n</i> = 11)	59.6% (<i>n</i> = 28)
Evidence of command-and-control links with others in this event	0.0% (<i>n</i> = 0)	25.5% (<i>n</i> = 12)
Individual tried to recruit others/form a group prior to the event	6.4% (<i>n</i> = 5)	40.4% (<i>n</i> = 19)
Individual ever rejected from a group prior to the event	1.3% (<i>n</i> = 1)	21.3% (<i>n</i> = 10)
Others knew about the research/planning prior to the event	24.4% (<i>n</i> = 19)	27.7% (<i>n</i> = 13)
The individual's spouse/partner was part of a wider movement	1.3% (<i>n</i> = 1)	12.8% (<i>n</i> = 40)
Others involved in procuring the weaponry/technology	10.3% (<i>n</i> = 8)	27.7% (<i>n</i> = 6)
Evidence of reading the propaganda of other lone-actor terrorists	11.5% (<i>n</i> = 9)	25.5% (<i>n</i> = 12)
Evidence of reading literature/materials of other lone-actor events	20.5% (<i>n</i> = 16)	36.2% (<i>n</i> = 17)
Other individuals were involved in the assembly of IED's	9.0% (<i>n</i> = 7)	10.6% (<i>n</i> = 5)

Table 4. Prevalence of first stage cluster membership by second stage cluster membership.

PEP	Component		
	Propensity	Situation	Network
Solitary (<i>n</i> = 23)	Stable (100%) (<i>n</i> = 23)	Low leakage/ Low stress (100%) (<i>n</i> = 23)	Lone (100%) (<i>n</i> = 23)
Susceptible (<i>n</i> = 40)	Unstable (100%) (<i>n</i> = 40)	High leakage/Low stress (52.5%) (<i>n</i> = 21) High leakage/High Stress (47.5%) (<i>n</i> = 19)	Lone (65%) (<i>n</i> = 26) Connected (35%) (<i>n</i> = 14)
Situational (<i>n</i> = 22)	Stable (100%) (<i>n</i> = 22)	High leakage/High crisis (95.5%) (<i>n</i> = 21) High leakage/Low stress (4.5%) (<i>n</i> = 1)	Connected (54.5%) (<i>n</i> = 12) Lone (45.5%) (<i>n</i> = 10)
Selection (<i>n</i> = 40)	Stable (100%) (<i>n</i> = 40)	High leakage/Low stress (100%) (<i>n</i> = 40)	Connected (52.5%) (<i>n</i> = 21) Lone (47.5%) (<i>n</i> = 19)

Figure 1. A behavioural sequence of an offender who demonstrates the solitary PEP: Loris Doukaiev

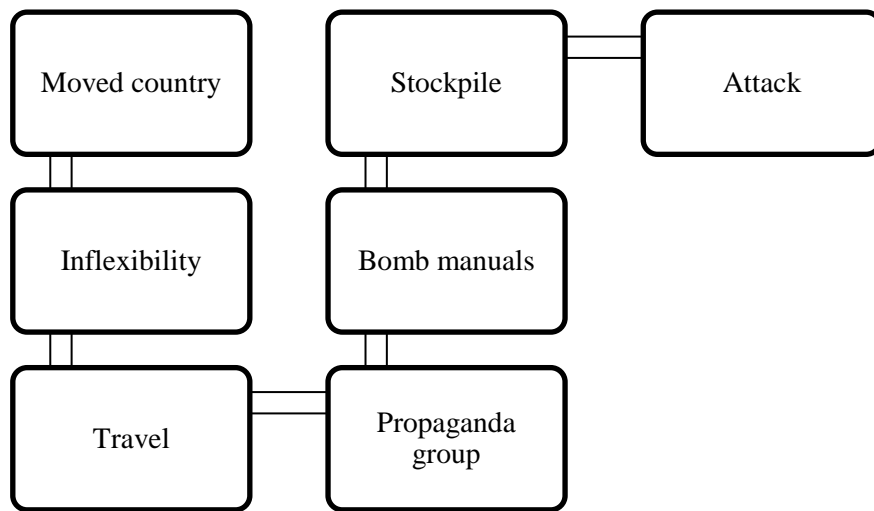


Figure 2. A behavioural sequence of an offender who demonstrates the susceptible PEP:
 Frederique de Jongh

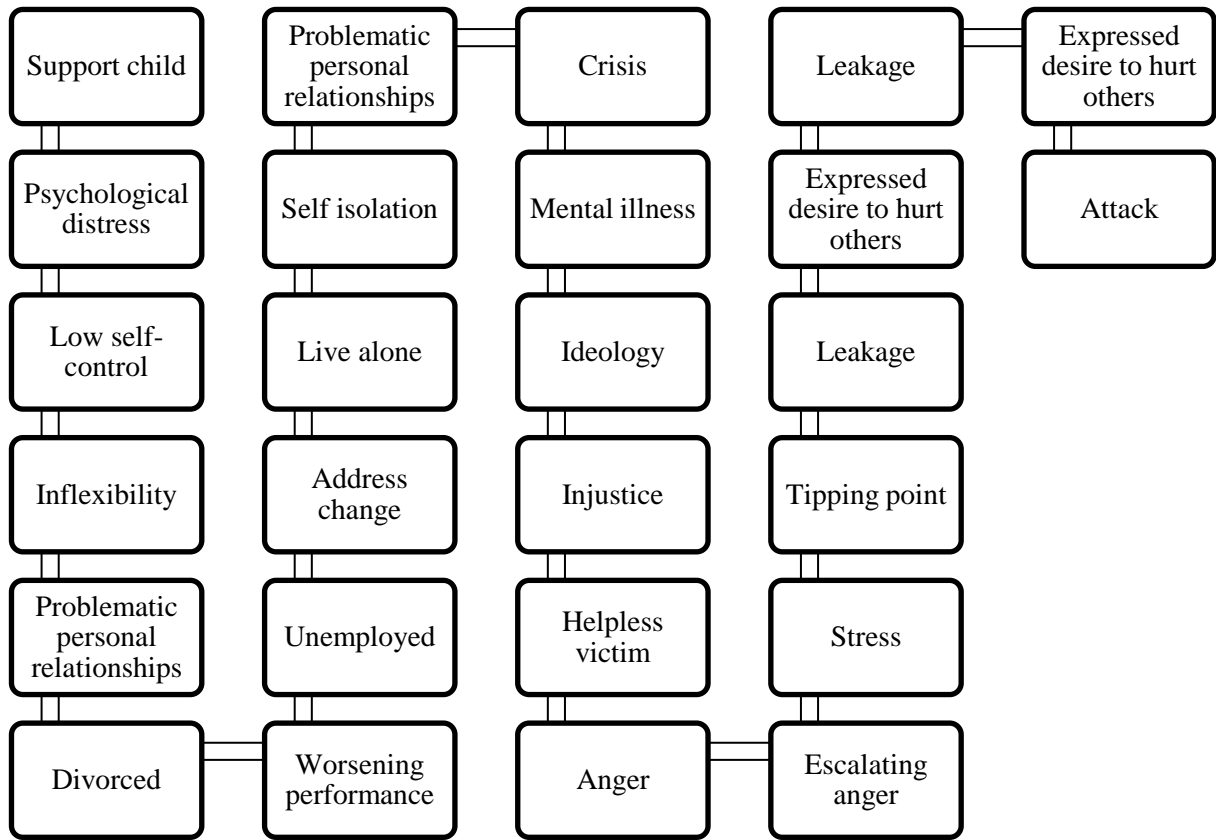


Figure 3. A behavioural sequence of an offender who demonstrates the situational PEP: Jim David Atkinson

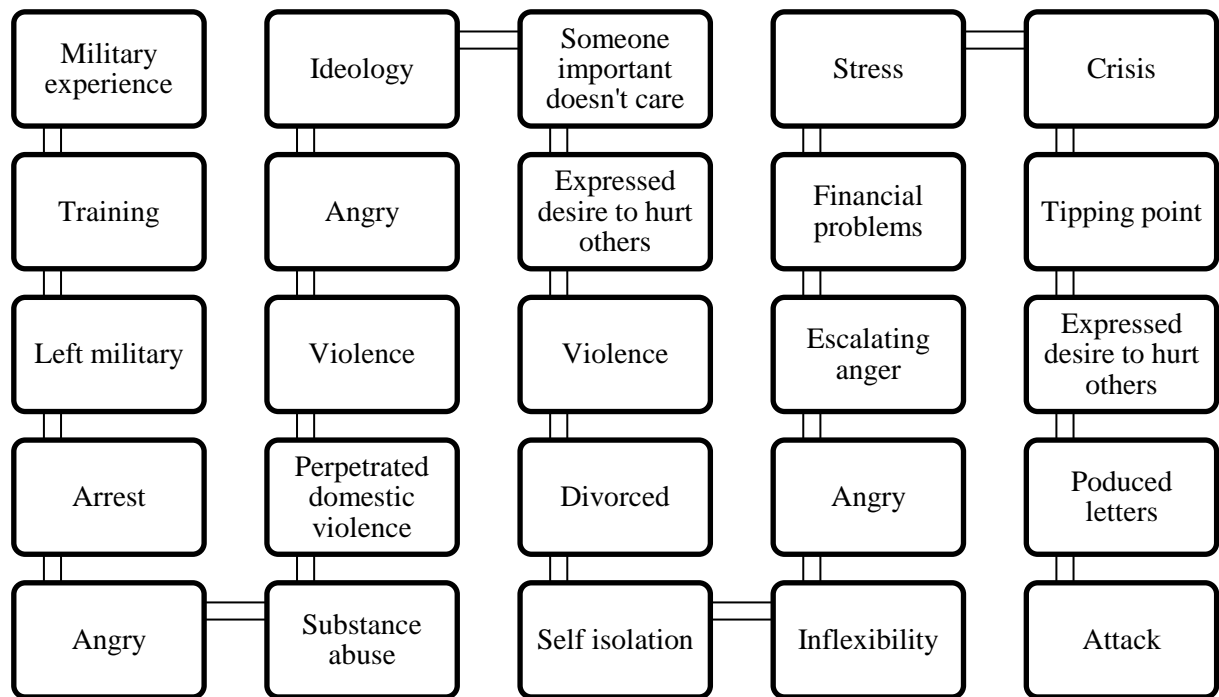


Figure 4. A behavioural sequence of an offender who demonstrates the selection PEP: Omar Abdel Hamid El-Hussein

