

**An Analysis of Terrorist Attack Perpetrators in England and Wales: Comparing Lone
Actors, Lone Dyads and Group Actors**

Jonathan Kenyon, HMPPS

Jens F. Binder, Nottingham Trent University

Christopher Baker-Beall, Bournemouth University

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Abstract

Three types of terrorist attackers, sentenced between 1983 and 2021, were compared using a sample of 143 individuals convicted of extremist offences in England and Wales. Attackers were classified as either lone actors, lone dyads, or group actors, and these groups were compared in relation to socio-demographics, ideological affiliation, mental health status, online activities, plot characteristics and assessments of risk. Data were obtained from coding the content of specialist risk assessment reports. Key findings include lone actors and lone dyads were significantly more likely to present with mental health issues than group actors. Attackers affiliated with the Extreme Right Wing were more likely to commit attacks alone or in pairs, in contrast to Islamist extremists who were more likely to attack as a group. In terms of trends over time, lone-actor attacks have become increasingly prominent, whilst the opposite is true for group attacks. The Internet was also found to play an important role in radicalisation pathways and attack preparation for lone actors and lone dyads, but a lesser role for group-based attackers. No differences were found between attacker groups in assessments of risk by professionals. Gaining an increased understanding of those assuming attacker roles can help guide counter-terrorism approaches and future policy.

Keywords: Lone actor, Terrorist, ERG22+, Lone Dyad, Extremist

Public Health Significance Statement

Public security and collective wellbeing is significantly threatened by terrorist attacks. The findings presented here are based on standardised risk assessments and provide a basis for a robust comparison of different attacker types, enabling us to further develop ways of countering attacks and to manage risks associated with different attacker types.

According to data by the UK Office of National Statistics, there were 93 deaths due to terrorism in England and Wales from April 2013 to 31st March 2021 (Allen et al., 2022). Yet, a terrorist attack has a far greater impact than just loss of life and grief to families of victims that it causes. Terrorist attacks are intended to terrorise populations and cause fear and uncertainty, placing a considerable psychological burden on the wider public (Butler, 2003). There are also considerable economic costs of terrorist acts both nationally and globally (Johnston & Nedelescu, 2005). One way of protecting the public more effectively against terrorist violence is to develop insight to support identification of potential attackers and evaluate risk more effectively. Whilst all terrorist attackers pose operational challenges for law enforcement and intelligence agencies, types of attackers have been differentiated based on the degree of social connection when committing their offences. There are those who act alone, those who offend in pairs, and those that commit attacks along with others as part of a broadly cohesive, identifiable group.

Starting with lone-actor terrorism (see Kenyon et al., 2021 for a discussion of the term's ambiguity), attacks of this type have multiplied over recent years (Lloyd & Pauwels, 2021). In the UK, following a third attack in seven months by those seemingly acting alone, then Home Secretary Priti Patel highlighted the increasing threat of lone-actor terrorists in Parliament (Wright, 2020). The attacks included the murder of two people by Usman Khan in London in November 2019, the knife attack on two individuals by Sudesh Amman in Streatham in February 2020, and mass stabbing in Reading by Khairi Saadallah in June 2020. Next to radical Islamist-driven lone-actor violence, recent UK cases of terrorists affiliated with extreme right-wing ideals who perpetrated attacks alone have ensured this threat has remained a complex concern for policymakers.

Despite a recent surge in research on lone-actor terrorism (Kenyon et al., 2021), gaps remain in our understanding of how lone actors can be differentiated from group actors, both

theoretically and empirically (see Dhumad et al. 2022; Gruenewald et al., 2013). In addition, typologies beyond simply the lone versus group-actor dichotomy have been suggested (Dhumad et al., 2022). A useful comparison to lone and group actors may be offered by lone dyads. In the terrorism field, researchers have referred to an upsurge in violent attacks by pairs of individuals who have undergone a shared process of radicalisation (see O'Connor et al., 2018). A high profile example of such a lone dyad attack in the UK includes Michael Adebolajo and Michael Adebowale, jointly convicted of murdering British Army Fusilier Lee Rigby in 2013 (Kelly, 2014). In the US, the Boston Marathon bombing in 2013 by brothers Tamerlan and Dzhokhar Tsarnaev provides another example (BBC, 2015). Lone dyads are important to study as they are not only characterised by member attributes, but also possess unique characteristics in terms of their interaction with one another.

The primary aim of this study is to compare lone-actor terrorists with lone dyads and group actors. In doing so, this study also aims to empirically test a number of themes identified in earlier work, especially through a recent systematic review of literature on lone-actor terrorism (Kenyon et al., 2021). To achieve these aims, this study draws from a database of 490 individuals convicted of extremist offences in England and Wales, developed as part of wider research on extremist offending and radicalisation processes (see Kenyon et al., 2022a). This database accounts for nearly every individual convicted of extremist offences in England and Wales between late 2010 and December 2021, but also includes some individuals convicted and sentenced prior to these dates. Data were obtained from 488 Extremism Risk Guidance (ERG22+) reports and two Structured Risk Guidance (SRG) reports completed for all individuals. Since 2011, the ERG22+ has been used throughout His Majesty's Prison and Probation Service (HMPPS) to assess every individual convicted of terrorist or terrorist-related offences.

Along with a consideration of a range of socio-demographic, online activity and offence type variables, this study is the first to compare three attacker groups using assessments of risk by trained professionals within a clearly defined assessment framework and within one legal jurisdiction. This way, the current study addresses earlier criticism of lone-actor terrorism research in particular, namely the use of open-source databases with unverified levels of accuracy or completeness, potentially missing key cases and misrepresenting extent of threat (Spaaij & Hamm, 2015).

Background

Comparisons between lone actors, lone dyads and group actors

Most previous work has compared lone actors and group-based terrorists, with studies reporting marked differences. In such comparisons, lone actors have been found to be more likely to be older, single, unemployed, with higher educational attainment, or poorer financial status (see Gill et al., 2014; Gill et al., 2021; Horgan et al., 2016). Most recently, Schuurman and Carthy (2023) compared 58 group-based and 45 lone-actor terrorists from across North America and Europe. Lone actors had fewer criminal antecedents, poorer social skills, had typically radicalised at a later age and had lower exposure to environments enabling group-based participation in terrorism. Other studies, however, have concluded lone and group actors to be indistinguishable from one another in terms of many demographic variables, along with their motivation and attitude towards terrorism. For example, Dhumad et al (2022), in an Iraqi sample, found both groups to be similar regarding age, geographical location, prior arrests, marital status, and perceived financial status. Nevertheless, lone actors were less likely to be unemployed and group actors more likely to have exhibited juvenile risk behaviours.

A select number of studies have focused on lone dyads specifically. Of note, lone dyads can include non-kin dyads, spousal dyads and sibling dyads. O'Connor et al. (2018) found lone dyads to be unique compared to lone actors and group actors because of their relational composition and the consequences for their radicalisation and attack preparation. Whilst cases of dyadic violent radicalisation are rare, commonalities and distinct features have been identified when compared with lone actors. For example, like lone actors, dyads are not completely isolated from broader radical milieus and networks, and their radicalisation pathway can be analysed through their online and offline engagement with these social environments. Yet, in contrast to lone actors, the intense relationship between the individuals forming the dyad generates a powerful internal dynamic that shapes radicalisation processes. Gill et al. (2014) reported that isolated dyads were significantly more likely to interact online with co-ideologues than those who committed attacks alone. In another study, Corner et al. (2016) considered the rates of recognised mental disorders across five attacker groups, including lone dyads, lone actors and group actors. The likelihood of mental health problems increased with increased isolation of an individual in terms of number of co-offenders and support networks.

Another important feature of dyad cases is the frequent imbalance of internal power, with one dominating and the other taking a more passive role. McCauley and Moskalenko suggest that such power disparities render the weaker of the two an “extension of the stronger [rather] than an equal partner” (2017, 255). Due to the unique features of lone dyads, O'Connor et al. (2018) argue such cases should be considered as located within a broader spectrum of radicalisation ranging from lone actors to small groups.

In summary, although lone-actor terrorists have previously been compared with group-based counterparts, few empirical studies have compared lone actors with lone dyads or, indeed, lone dyads with group actors. The subsequent sections will therefore focus

primarily on studies exploring lone-actor terrorism and the core themes identified in this area (Kenyon et al., 2021). Where appropriate, reference will be made to studies comparing lone actors with group-based terrorists.

Identification of Lone-Actor Terrorist Profiles

Many studies have attempted to establish a lone-actor terrorist profile to understand who is most susceptible to go on to commit violent terrorist acts (see Khazaeli Jah & Koshnood, 2019). However, the general consensus within the literature is that lone actors do not share a single profile, only some common characteristics (Lloyd & Pauwels, 2021; Kenyon et al., 2021). These include lone actors typically being male (Gill et al., 2014; Gruenewald et al., 2013), in their 30s (Gill et al., 2014; Perry et al., 2018), relatively highly educated (Gill, 2015; Liem et al., 2018) and inclined toward extremist ideologies (de Roy van Zuijdewijn & Bakker, 2016; Spaaij, 2010); at the same time, they have often dropped out of school or university, are unemployed, and have grappled with a personal crisis prior to committing their attack (Clemmow et al., 2020).

When comparing lone-actor terrorists across ideologies, differences have been found with Islamist extremists being typically younger than right-wing extremist actors (de Roy van Zuijdewijn & Bakker, 2016; Gill et al., 2014). A trend towards older supporters of right-wing extremism among lone actors has also been noted more recently (Hall, 2022; Wells, 2023). Wells (2023) references five recent UK attacker cases, with each individual involved described as committing their offences alone, being over the age of 47, and having limited or no connection to the organised extreme far-right.

Relevance of Mental Illness, Neurodiversity and Personality Disorder

A key theme identified in the review by Kenyon et al. (2021) was the higher prevalence of mental illness and personality disorder for lone actors compared with group-

based terrorists and the general population. Studies investigating the prevalence of mental health issues include Gruenewald et al. (2013), who found that 40% of a US sample of 70 lone-actor terrorists affiliated with the extreme right wing had mental disorders. Gill et al. (2014) also reported significantly greater rates of mental illness in a lone-actor sample compared with those belonging to organised groups. Similarly, Corner and Gill (2015) found that the odds of a lone-actor terrorist having a mental illness was 13.49 times higher than that of a group actor.

When investigating specific types of mental illness and disorders among lone-actor terrorists, Corner et al. (2016) reported substantially higher prevalence rates of schizophrenia, delusional disorder and autism spectrum disorder for lone actors compared to group actors and the general population. However, the recent study by Dhumad et al. (2022) on an Iraqi sample found no significant differences in prevalence when comparing lone and group actors. This may indicate geographical differences between prevalence rates within European and US samples, and those in other countries, although the variability in definitions used for lone-actor terrorism may also account for such inconsistencies.

Role of the Internet

In relation to lone-actor terrorism, the Internet has been considered variously as a driver of the threat, an accelerator, and as a surrogate community, a social environment in which lone actors feel they belong (see Kenyon et al., 2021). However, there is a general absence of empirical evidence concerning how lone actors have used the Internet and importantly, how this may differ from the online activities of group-based terrorists (Pantucci et al., 2015).

Hamm and Spaaij (2015) highlighted the important role of the Internet in radicalisation pathways for lone-actor terrorists in a US sample; prior to 9/11, radicalisation

was largely associated with previous membership in an extremist group, whilst post 9/11, the source of radicalisation had gradually been replaced by the Internet and online social networks. Gill et al. (2016) likewise reported an increased prominence of the Internet in attack planning when comparing lone actors from 1990 to 2005 with those from 2006 to 2013. In more recent studies, the lone actor's path to carrying out a terrorist attack was found to commonly include prior participation in online activity, including the consumption, interaction with, and distribution of extremist messages on social media platforms (Bright et al., 2020; Holbrook & Taylor, 2019; Wolfowicz et al., 2021). When comparing lone actors with group-based terrorists in the UK, Gill et al. (2017) found lone actors were 2.64 times more likely to learn online than group-based terrorists. The authors suggested those operating alone would not benefit from the resources available in groups, so would go online to gain knowledge and upskill.

There has been debate as to whether the Internet plays a more prominent role in radicalisation, but a lesser role in attack planning. Gill et al. (2017) found evidence of online activity related to either radicalisation or attack planning in 61% of cases in their UK sample. In contrast, Zeman et al. (2017) argued the Internet plays a limited role for lone actors during attack preparation, a view echoed by Mueller and Stewart (2015) who suggested that crucial information for attack planning is typically communicated face-to-face.

Operational characteristics and attack planning

Investigating the modus operandi of lone-actor terrorists may provide useful knowledge for counter-terrorism activities. Accordingly, weapons, targets, victims, frequency of attacks, and number of attackers have all been investigated previously (see Kenyon et al., 2021). Notable findings include lone actors generally having a longer lifespan as terrorists than group-based actors (see Smith et al., 2015). Lone actors are also more likely to target

civilian or 'soft' targets due to their relative weakness compared to terrorist groups (Becker, 2014), and typically engage in cruder, smaller scale attacks than group actors (Ackerman & Pinson, 2014).

Lone actors have also been found to favour firearms over other weapons in their attacks, yet this largely depends on legal gun ownership status within countries (Kenyon et al., 2021). Other studies have shown lone-actor terrorists typically make use of tools they have at hand, as evidenced by Bartal (2017), who found Palestinian lone actors used knives and vehicles when committing terror attacks in Jerusalem as these were easily accessible. Age differences have also been found, with under-age lone actors more likely than adults to use less lethal weapons, such as knives (Sela-Shayovitz et al., 2022). Another difference from the same study was a third (32.5%) of under-age lone-actor terrorists carried out attacks with a partner, thus potentially qualifying as lone dyads, compared to 6.2% of adult terrorists.

Another aspect of lone-actor attack behaviours is frequent attack signalling or information leakage, i.e., the intentional or unintentional leaking of information about own violent intentions. For example, Ellis et al. (2016) found that 46% of their lone actor sample showed such behaviours. In the study by Gill et al. (2014), 64% revealed their tendencies to engage in terrorist activities to their families and friends. Kenyon et al. (2021) suggest that, as a consequence, lone actors typically have poor operational security. As an explanation, Bouhana et al. (2018) suggested that a desire to be affiliated with an extremist milieu, coupled with the benefits of status, a sense of belonging or fame, outweighs more practical principles of escaping detection.

The present study

This study compares lone actors, lone dyads and group actors across demographic variables, ideological affiliation and offending history. Key areas for investigation are the

prevalence of mental illness and other conditions within the three attacker groups; their online activities, including radicalising influences and attack preparation; operational characteristics and attack planning; and plot features including types of weapons used, plot progression and completion or failure.

Importantly, whilst the risk presented between attacker sub-groups has generally been inferred previously by the severity of offences, here, the presenting risk is based on professional risk assessments. This includes overall ratings of engagement with an extremist group or cause at the time of offending, along with ratings of intent and capability to commit offences with potential to cause serious and significant harm. These ratings feature within ERG22+ reports and have not previously been used to compare threat levels posed by these attacker groups.

Materials and Methods

Sample

The data source for this study included 488 ERG22+ reports and two SRG reports completed from October 2010 to December 2021. The SRG was the predecessor to the ERG22+ and was only applied to a small number of cases prior to September 2011. Report subjects were individuals convicted of either terrorist offences (falling under UK terrorism legislation) or terrorist-related ones (falling under non-terrorism legislation, but with a notable terrorist connection) in England and Wales. Sentencing dates of individuals within the dataset ranged from 1983 to 2021 (with 99% sentenced from 2000 onwards). The reports included all that were retrievable for research.

Report authors were either qualified Probation Officers or Registered Psychologists, employed by HMPPS. All authors had undertaken the same two-day national training to use the assessment. When compiling reports, authors had access to a range of restricted

documentation, and in many cases conducted interviews with the report subjects to receive first-hand accounts of their pathway and offending. Report length ranged in between 146 and four pages, with an average length of 20 pages.

Kenyon et al. (2022b) summarised past criticism directed at the ERG22+, including the absence of some risk factors of interest and limited incorporation of the politico-societal context (see Herzog-Evans, 2020; Knudsen, 2018). However, Kenyon et al. (2022b) also highlighted that such criticisms reflected a degree of unfamiliarity with how the ERG22+ is applied in practice. Since its introduction in 2011, the ERG22+ has proved useful for understanding offending trajectories, assessing risk, and informing risk management plans.

Of the 490 cases within the sample, the focus was on those who assumed the role of attacker within the context of their offending. Within this study, ‘attackers’ are defined as those who either committed an extremist attack themselves on another person or property, or were in the process of attack planning and implementation at the point of arrest/disruption. Further, individuals had to be classifiable as either lone-actors (where they committed the attack alone), lone dyads (where the attack was committed as a pair) or group actors (where three or more attackers were involved). Classification was inferred by the authors from the information contained within the reports. This procedure led to 143 individuals in the final sample, with basic demographics provided in Table 1.

Table 1: Basic demographics for the 143 attackers included within the analysis.

Demographic		Frequency	Percentage (%)
Gender	Male	129	90
	Female	14	10
Age (at time of sentencing)	Under 20	11	8
	20-29	82	57
	30-39	38	26
	40-49	10	7
	50+	3	2
Place of birth	UK	102	71
	Non-UK	38	27
	Not Reported	3	2
	Of Non-UK cases:		
	Europe	4	11
	Africa	11	29
	Asia	23	61
Ideology/cause	Animal Rights	9	6
	Extreme Right Wing	28	20
	Islamist Extremist	93	65
	Other Political	13	9
Typology	Radicalised Extremist	141	99
	Prison Recruit	2	1
Social connectivity (when committing offence)	Lone actor	44	31

	Lone dyad	20	14
	Group actor	79	55
Presence of mental illness/neurodiversity/PD	Not Present	90	63
	Partly Present	13	9
	Strongly Present	29	20
	Omitted	11	8

Of the 143 individuals, 90% were male and 10% female. Those aged 20-29 made up 57% of the sample. The majority (71%) were born in the UK. Of the 27% born outside the UK, 61% were born in Asia, 29% in Africa and 11% in Europe. Islamist Extremism was the most prominent ideological group (65%), followed by Extreme Right Wing (20%). Other Political (a category to reflect a number of individuals described as anti-establishment or supporting a far-left ideology, along with those affiliated with nationalist or separatist movements) accounted for 9%, and the remaining 6% were Animal Rights activists.

Based on Silke's (2014) typology of prison-based extremists, 99% were 'Radicalised Extremists', defined as individuals who entered prison already holding extremist views and engaged in extremist actions in the outside world, and 1% were 'Prison Recruits', defined as 'ordinary decent' individuals who had been radicalised within prison, possibly as a result of contact with extremist prisoners. In terms of social connectivity when committing the offence, 31% were lone actors, 14% lone dyads and 55% group actors. Regarding the presence of mental illness, neurodiversity or personality disorder, 29% were assessed within reports as having some degree of mental illness or other condition.

Procedure and coding

The study received HMPPS National Research Committee (NRC) approval in September 2021, which was a requirement as the data related to convicted individuals incarcerated in England and Wales. All SRG and ERG22+ reports were manually reviewed by the lead author, extracting variables of interest relating to demographics, mental health status, radicalisation pathway, online activities and attack plot features. Also extracted were professional ratings of overall levels of engagement, intent and capability to reflect an individual's risk level at the time of offending. Variable definitions, with instructions and examples of how to apply the coding frame were provided within an accompanying codebook. The lead author applied the coding frame to all reports, before the two co-authors independently coded a number of test cases for all variables of interest. This process was followed to ensure clarity and ease of use of the coding frame. Where differences in coding were apparent, the three coders reached a consensus through discussion, leading to further refinement of the coding frame. The revised coding frame was then used to finalise coding.

Identified attackers were coded as either lone actors, lone dyads or group actors. Within each group, individual socio-demographics were inspected, including sex (coded as 'Male' or 'Female'), age at sentencing (specific ages were coded, as well as 'Up to and including 25' and 'Over 25'), place of birth (coded as 'UK' or 'non-UK', with continents recorded for those not born in the UK). Details of convicted offending history and convicted violent offending history were also obtained (coded as 'Yes' or 'No evidence').

Another variable of interest was ideology/cause (coded as 'Animal Rights', 'Extreme Right Wing', 'Islamist Extremist' or 'Other Political'). It is acknowledged that applying this label to attackers within the sample can appear overly simplistic. Individuals become involved in terrorism for a multiplicity of reasons. Coding someone as an Islamist Extremist

or Extreme Right Wing case, for example, is not suggesting the individual is motivated solely by radical Islam or far-right ideals. Ideological labels can stand for a mere association with a particular type of terrorism, so those sharing online extremist content relating to Daesh, for example, would be classified as an 'Islamist Extremist' within this study. The use of such labelling is only intended to provide a starting point from which to examine the data further.

For mental illness and other conditions, including neurodivergence and personality disorder, coding options were 'Strongly Present', 'Partly Present', 'Not Present' or 'Omitted'. This was coded with reference to the corresponding ERG22+ factor 'Mental health', where ratings are based on impairments or disorders diagnosed according to an official nosological system or standardised assessment (HMPPS, 2019). Where mental illness or other conditions were rated as present at least to some extent, the type of illness or disorder was recorded if referenced in the report. Where multiple disorders/difficulties were referenced within a report, this was also recorded.

To investigate the role of the Internet, radicalisation pathways were determined. This concerned whether individuals had primarily radicalised online, offline or via both online and offline influences (coded as 'Internet', 'Face to face', or 'Hybrid' respectively). Further, online activity variables were coded, including three types of online facilitative behaviours (1. Learnt from online sources, 2. Interact with co-ideologues online, and 3. Dissemination of extremist propaganda), and three types of online planned action behaviours (1. Attack preparation, 2. Target choice, and 3. Signalling intent). Coding options for online activity variables were either 'Yes' or 'No evidence'.

The coding of attacker plot variables included three main categories. The first was type of plot to reflect the weapon used by the attacker. Coding options included 'IED', 'Arson', 'Firearm', 'Bladed weapon', 'Vandalism/criminal damage', 'Vehicle', 'Unarmed

assault’, ‘Poison’ and ‘Hammer’. The second category was to reflect progress of plot, with ‘Moved to execution stage’ and ‘Completed plot’ coding options. The third category was how plot was thwarted to understand what prevented plots from being successful. Coding options included ‘Police/security services’, ‘IED did not detonate’, ‘Lost nerve’, ‘Missed target’ and ‘Public’.

To consider risk, the attacker groups were compared based on the three risk dimensions defined by the ERG22+: engagement (defined as a growing interest in, association with, and increasing commitments to an extremist group, cause and/or ideology) at time of offending, intent (defined as readiness to support and/or use illegal means and/or violence to further the goals of an extremist group, cause or ideology) and capability (defined as the ability to cause harm, offend or perpetrate violence on behalf of a group, cause and/or ideology) to commit offences with the potential to cause serious and significant harm. These ratings were available within most ERG22+ reports and were based on assessments by the report authors. For engagement and intent dimensions, rating options included ‘High’, ‘Moderate-High’, ‘Moderate’, ‘Low-Moderate’, ‘Low’ or ‘Not reported’. Rating options for the capability dimension included ‘Significant’, ‘Significant-Some’, ‘Some’, ‘Some-Minimal’, ‘Minimal’ and ‘Not reported’.

Analysis

Statistical comparisons of frequencies and percentages of all variables of interest were conducted for the three attacker groups. Pearson’s chi-squared tests were conducted where possible to test for statistically significant relationships between attacker group membership and variables of interest, with Fisher’s exact test used as an alternative where statistical assumptions for chi-square tests were not met. To compare overall levels of engagement,

intent and capability, ratings were treated as ordinal data and Kruskal-Wallis tests were applied.

Results

Table 2: Demographics of the three attacker groups shown as percentages.

Demographic		Lone actors (n = 44) Percentage (%)	Lone dyads (n = 20) Percentage (%)	Group actors (n = 79) Percentage (%)
Sex	Male	93 (41/44)	75 (15/20)	92 (73/79)
	Female	7 (3/44)	25 (5/20)	8 (6/79)
Age (at sentencing)	Up to and inc. 25	52 (23/44)	45 (9/20)	38 (30/79)
	Over 25	48 (21/44)	55 (11/20)	62 (49)
Place of birth	UK	80 (35/44)	85 (17/20)	63 (50/79)
	Non-UK	18 (8/44)	15 (3/20)	34 (27/79)
	Not Reported	2 (1/44)	0 (0/20)	3 (2/79)
Ideology/cause***	Animal Rights	5 (2/44)	0 (0/20)	9 (7/79)
	Extreme Right Wing	41† (18/44)	25‡ (5/20)	6†‡ (5/79)
	Islamist Extremist	48† (21/44)	65 (13/20)	75† (59/79)
	Other Political	7 (3/44)	10 (2/20)	10 (8/79)
Convicted offending history ^a	Yes	40 (17/43)	45 (9/20)	35 (28/79)
	No	60 (26/43)	55 (11/20)	65 (51/79)
Convicted violent offending history ^b	Yes	29 (12/42)	15 (3/20)	24 (19/79)
	No	71 (30/42)	85 (17/20)	76 (60/79)

Note: Chi-squared tests (both 3x2 and 3x3) were used for overall associations, except for Ideology/cause where Fisher's exact test was used due to low expected cell count.

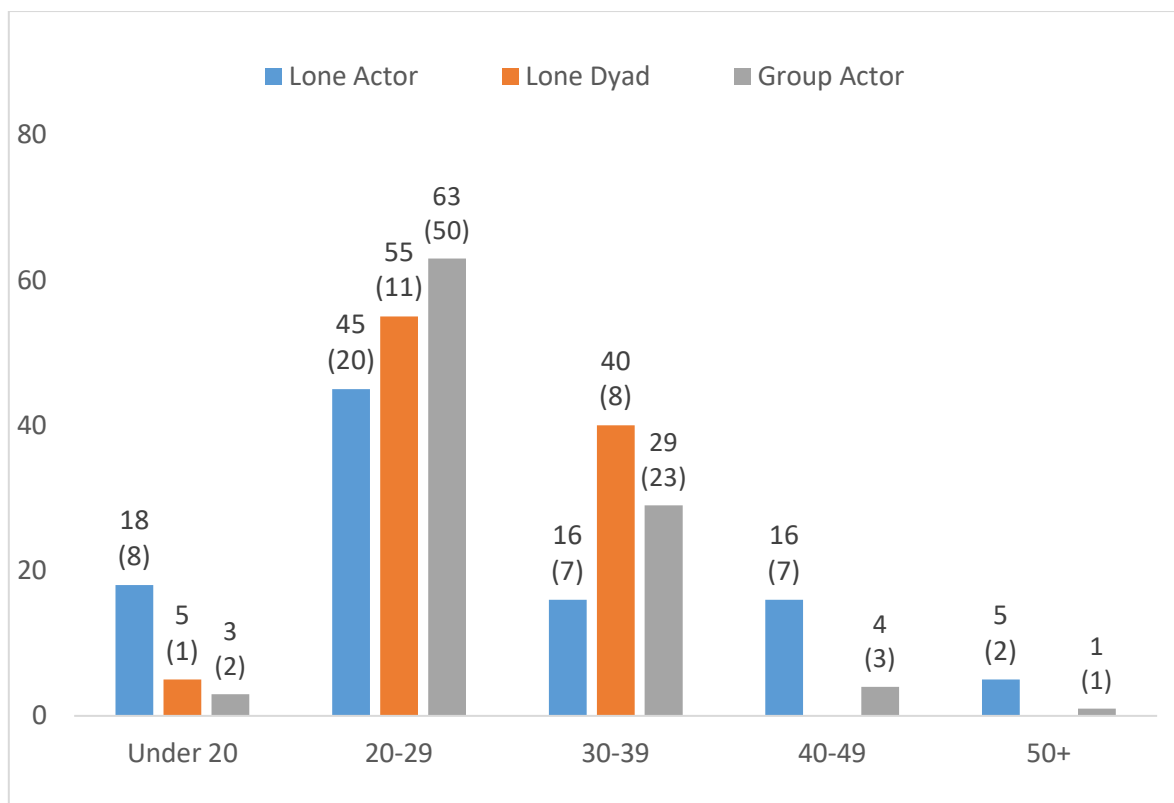
***significant association with attacker group at $p < .001$. †,‡: significant pairwise post hoc comparisons, Bonferroni-adjusted, at $p < .05$; in each row, same indices indicate a difference in proportions.

^aConvicted offending history based on 43 lone actor cases.

^bConvicted violent offending history based on 42 lone actor cases.

In total, 44 lone actors, 20 lone dyads and 79 group actors were identified in the sample (see Table 2). For lone actors, several common characteristics were noted. Similar to previous studies (Gill et al., 2014), lone actors were typically male (93%), which is also true for group actors (92%), but less so for lone dyads (75%). However, no significant differences were found between attacker groups in terms of sex. For age at sentencing, lone actors were skewed towards younger ages, with 52% within the 'up to and including 25' age category. Most lone actors were under 30 years old when sentenced (63% - see Figure 1), contrasting with previous studies where lone actors were typically in their 30s (see Gill et al., 2014; Perry et al., 2018). Most lone dyads and group actors were also under 30 when sentenced (60% and 66% respectively), with no significant differences found between groups.

Figure 1: Age of sentencing for all three attacker groups, shown as percentages (frequencies in brackets).



When comparing place of birth, a similar majority of lone actors and lone dyads were UK born (80% and 85% respectively). For group actors, a smaller majority were born in the UK (63%). No significant differences were found with respect to place of birth, however. For the eight lone actors born outside the UK, half were born in Asia (50%), with 38% from Africa and 13% from Europe. For the 27 group actors born outside of the UK, the majority were born in Asia (64%). In contrast to lone actors and group actors, for the three lone dyads born outside the UK, the majority were born in Africa (67%).

For lone actors, the two most prominent ideological groups were Islamist Extremists (48%) and Extreme Right Wing (41%). For lone dyads, whilst the two most prominent ideological groups were also Islamist Extremists (65%) and Extreme Right Wing (25%), this was more heavily weighted towards Islamist Extremists. In contrast, the most prominent ideological groups for group actors were Islamist Extremists (75%), Other Political (8%) and Animal Rights Activists (7%). Group-based attackers affiliated with the Extreme Right Wing

were least represented, accounting for only 5%. Significant differences were found between attacker groups when comparing ideology (Fisher's exact test, two-tailed $p < .001$), with attackers affiliated with the Extreme Right Wing significantly more likely to be lone actors or lone dyads than group actors. It was also found that Islamist Extremist attackers were significantly more likely to be group rather than lone actors.

Most lone actors did not have a prior convicted offending history (60%), with only 29% having prior violent convictions. This supports findings of previous studies (see Ellis et al., 2016; Khazaeli Jah & Khoshnood, 2019). In comparison, 55% of lone dyads and 65% of group actors had no previous convictions. Further analysis found no significant differences between attacker groups in terms of convicted history and prior convicted violent history, which contrasts with the recent comparative study by Schuurman and Carthy (2023) in which lone actors were found to have fewer criminal antecedents than group actors.

Presence of mental illness and other conditions

Of the 143 attackers in the sample, as already stated, 29% had some degree of mental illness, neurodivergence or personality disorder based on ratings of the corresponding factor within the ERG22+ assessment. If removing the 11 attackers where this factor was omitted due to a lack of information, the percentage increases to 32%.

Table 3: Presence of mental illness/neurodiversity/PD for all three attacker groups shown as percentages (frequencies in brackets).

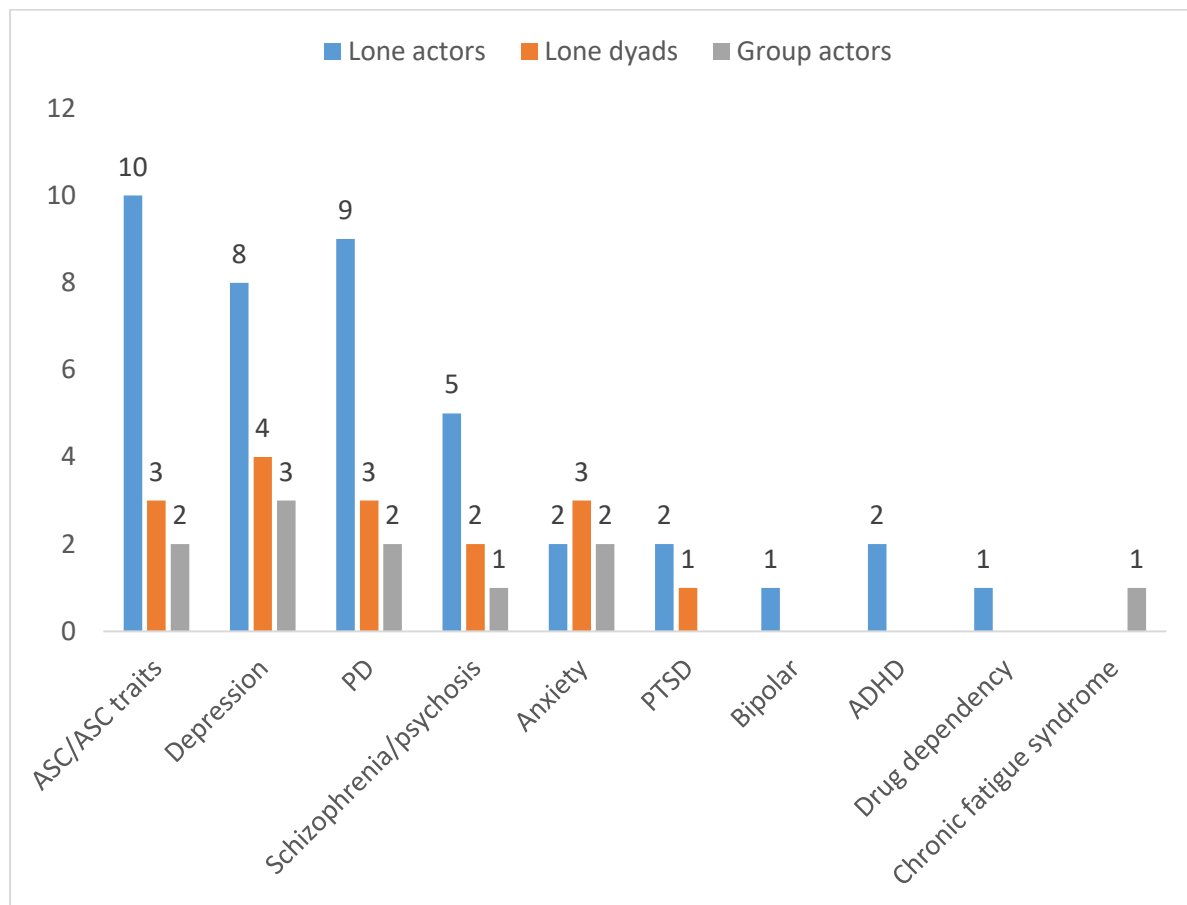
		Lone actors (n = 44)	Lone dyads (n = 20)	Group actors (n = 79)
		Percentage (%)	Percentage (%)	Percentage (%)
Mental illness/	Present	57 [†] (25/44)	45 [‡] (9/20)	10 ^{†‡} (8/79)
Neurodiversity/PD	Not Present	36 [†] (16/44)	40 [‡] (8/20)	84 ^{†‡} (66/79)
	Omitted	7 (3/44)	15 (3/20)	6 (5/79)

Note: Chi-squared test (3x3) was used for overall associations. ***significant association with attacker group at $p < .001$. [†],[‡]: significant pairwise post hoc comparisons, Bonferroni-adjusted, at $p < .05$; in each row, same indices indicate a difference in proportions.

In the next part of the analysis, the three attacker groups were compared in terms of the presence of mental illness, neurodiversity or personality disorder (see Table 3). Lone-actor terrorists, when compared with lone dyads and group actors, are most likely to have mental illness, neurodivergence or a personality disorder based on percentages (57% of cases, compared to 45% and 10% respectively). Significant differences were found in presence of mental illness, neurodiversity and personality disorder between lone actors and group actors, and between lone dyads and group actors ($\chi^2(4, N = 143) = 36.47, p < .01$). Specifically, group actors were significantly less likely to show any symptoms than the other two attacker groups.

Figure 2 provides a breakdown of types of mental illness and other conditions for all three groups (based on 42 cases where the corresponding ERG22+ factor was assessed as present at least to some extent).

Figure 2: Frequency breakdown of mental illness, neurodivergence and personality disorder when comparing attacker groups.



NB: For eight lone actors, four lone dyads and one group actor, multiple disorders/difficulties were reported.

For lone actors, the most common types of mental illness or conditions were Autism Spectrum Condition (ASC - 10 individuals), depression (8 individuals) and personality disorder (PD - 9 individuals). Similar was found for lone dyads, where depression (4 individuals), ASC/ASC traits (3 individuals), PD (3 individuals) and Anxiety (3 individuals) were most common. For group actors, most common was depression (3 individuals), ASC/ASC traits (2 individuals), PD (2 individuals) and Anxiety (2 individuals).

These results support the assertion that lone actors typically present with higher rates of mental illness and other conditions than group actors (see Gill et al., 2014; Corner & Gill,

2015; Kenyon et al., 2021). It is unsurprising to see ASC and associated traits most commonly reported for lone actors, a group often found to lack real-world social connections (Kenyon et al., 2021), given frequently reported difficulties by those with ASC in forming social connections with others (Al-Attar, 2020). These findings provide at least partial support for the study by Corner et al., (2016) who found substantially higher levels of schizophrenia, delusional disorder and ASC for lone actors. A notable insight from this analysis is evidence that depression and personality disorder may also be more prevalent for lone actors compared to other attacker groups.

Changes over time in terms of attacker groups

Table 4: Prominence of attacker groups over time based on sentencing dates, shown as percentages (frequencies in brackets).

		Lone actors (n = 44)	Lone dyads (n = 20)	Group actors (n = 79)
		Percentage (%)	Percentage (%)	Percentage (%)
Date of sentence***	Pre-2010	27 (10/37)	3† (1/37)	70† (26/37)
	2010-2015	15†‡ (9/62)	19† (12/62)	66‡ (41/62)
	2016-2021	57† (25/44)	16 (7/44)	27† (12/44)

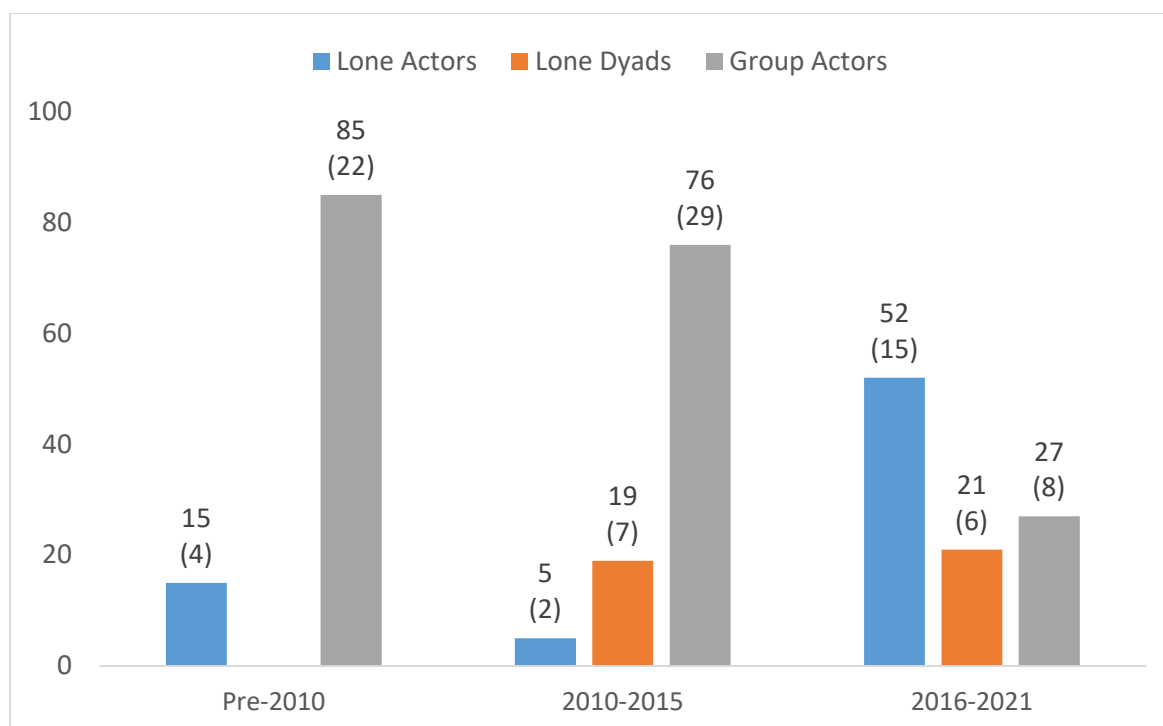
Note: Chi-squared test (3x3) was used for overall associations. ***significant association with attacker group at $p < .001$. †,‡: significant pairwise post hoc comparisons, Bonferroni-adjusted, at $p < .05$; in each row, same indices indicate a difference in proportions.

The three attacker groups were compared in terms of their prominence over time based on individual sentencing dates and significant differences were found ($\chi^2(4, N = 143) = 29.03, p < .001$). Those most likely to assume the role of an attacker pre-2010 were group actors (70%), then lone actors (27%), with lone dyads accounting for the remaining 3% (Table 4). A significant difference was found between group actors and lone dyads. By

2010-15, group actors continued to be most prominent (66%), with a slight reduction in prominence of lone actors (15%), whilst at the same time, an increased emergence of lone dyads (19%) took place. A significant difference was found between lone actors and lone dyads, and lone actors and group actors. By 2016-21, attackers were most likely to be lone actors (57%), with lone dyads remaining fairly constant (16%), but a smaller proportion of group actors as attackers (27%). To summarise, a 30-percentage point increase can be observed for lone-actor terrorists from pre-2010 to 2016-21, whilst a 13-percentage point increase is evident for lone dyads. Across the same time period, a 43-percentage point decrease is observed for group-based attackers.

The two most prominent ideological groups within this sample, Islamist Extremists and Extreme Right Wing, are compared next. However, it is not possible to test for significant differences due to the comparatively low number of Extreme Right Wing cases. In terms of demographics for the 93 Islamist Extremist attacker cases, 91% were male, 54% were over 25 years of age, with 2% over 40. Furthermore, 68% were born in the UK, 27% had a convicted offending history, with 13% having previous violent convictions.

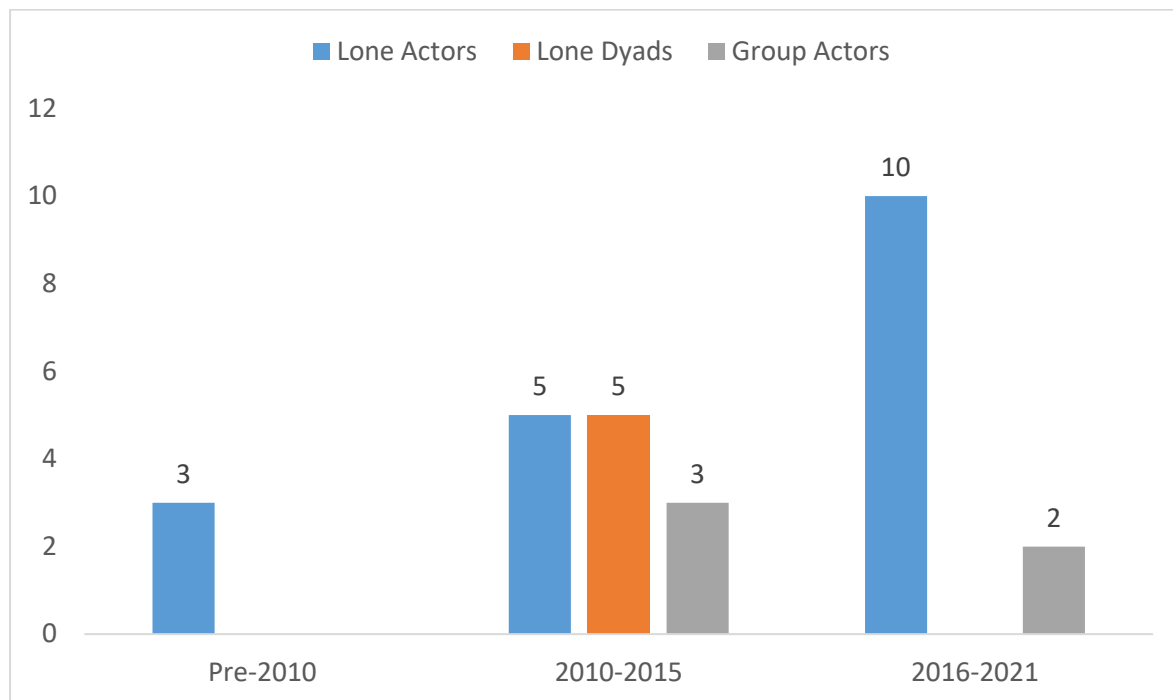
Figure 3: Prominence of attacker groups over time based on sentencing dates for Islamist Extremists (93 cases), shown as percentages (frequencies in brackets).



As displayed in Figure 3, pre-2010, the most prominent Islamist Extremist attackers were group actors (85% - accounting for 22 cases), followed by lone actors (15% - accounting for four cases). By 2010-15, group actors continued to be most likely to perpetrate attacks (76% - accounting for 29 cases), whilst lone dyads started to emerge (19% - accounting for seven cases). For cases sentenced in 2016-21, lone actors were the most common attacker group (52% - accounting for 15 cases), with a large reduction in proportion of group actors observed (27% - down to 8 cases) compared with previous years. The number of lone dyads sentenced in 2016-21 remained fairly constant from those sentenced in 2010-15 (21% - accounting for 6 cases).

For the 28 Extreme Right Wing attackers, all were male (100%), 54% were over 25 years of age, with 29% over the age of 40. In addition, 96% were born in the UK, 68% had a convicted offending history, with 46% previously convicted for violence. Given the smaller number of Extreme Right Wing attackers within the sample, frequencies are presented in Figure 4 rather than percentages.

Figure 4: Prominence of attacker groups over time based on sentencing dates for Extreme Right Wing cases (28 cases), shown as frequencies.



Comparing the three attacker groups over time for Extreme Right Wing cases, the three attackers sentenced pre-2010 were lone actors (100%, see Figure 4). Across 2010-15, all attacker groups are represented with five lone actors, five lone dyads and three considered group-based attackers. For those sentenced in 2016-21, the majority of attackers were lone actors (ten cases), with the two other attackers being group actors.

Role of the Internet in attacker pathways

Table 5: Radicalisation pathways detailing the role of the Internet.

	Lone actors (n = 41) ^a	Lone dyads (n = 20)	Group actors (n = 77) ^b
Pathway***	Percentage (%)	Percentage (%)	Percentage (%)
Internet	37 [†] (15/41)	10 [‡] (2/20)	0 ^{†‡} (0/77)
Face to face	22 [†] (9/41)	30 (6/20)	53 [†] (41/77)
Hybrid	41 (17/41)	60 (12/20)	47 (36/77)

Note: Chi-squared test (3x3) was used for overall associations. ***Significant association with attacker group at $p < .001$. [†],[‡]: significant pairwise post hoc comparisons, Bonferroni-adjusted, at $p < .05$; in each row, same indices indicate a difference in proportions.

^aBased on 41 lone actors as pathway group could not be established in 3 cases.

^bBased on 77 group actors as pathway group could not be established in 2 cases.

For 138 attackers, a radicalisation pathway could be identified to allow an investigation of the role of the Internet. As summarised in Table 5, significant differences were found between attacker groups in terms of their radicalisation pathway ($\chi^2(4, N = 138) = 37.26, p < .001$). Group actors were found to be significantly less likely to be radicalised online compared with lone actors and lone dyads. Significant differences were also found between lone actors and group actors in terms of likelihood of being primarily radicalised offline, with group actors more likely to be radicalised offline.

Next, these distributions were inspected over time for lone actors, lone dyads and group actors. Whilst a percentage comparison was possible across attacker groups, it was not possible to test for significant differences due to low counts when splitting across the three time periods.

Table 6: Prominence of radicalisation pathways over time based on sentencing dates for lone actors, lone dyads and group actors shown as percentages (frequencies in brackets):

	Lone actors	Lone dyads	Group actors
Pathway by time period	(n = 41) ^a	(n = 20)	(n = 77) ^b
	Percentage (%)	Percentage (%)	Percentage (%)
<hr/>			
Pre-2010			
Internet	33 (3/9)	0 (0/1)	0 (0/26)
Face to face	44 (4/9)	100 (1/1)	77 (20/26)
Hybrid	22 (2/9)	0 (0/1)	23 (6/26)
<hr/>			
2010-2015			
Internet	22 (2/9)	0 (0/12)	0 (0/39)
Face to face	33 (3/9)	25 (3/12)	46 (18/39)
Hybrid	44 (4/9)	75 (9/12)	54 (21/39)
<hr/>			
2016-2021			
Internet	43 (10/23)	29 (2/7)	0 (0/12)
Face to face	9 (2/23)	29 (2/7)	25 (3/12)
Hybrid	48 (11/23)	43 (3/7)	75 (9/12)

^aBased on 41 lone actors as pathway group could not be established in 3 cases.

^bBased on 77 group actors as pathway group could not be established in 2 cases.

An increase was found in number of lone actors, lone dyads and group actors who were subject to some degree of online radicalisation, including those who primarily radicalised online and those radicalised through both online and offline influences (see Table 6). For lone actors, 55% of cases were subject to some degree of online radicalisation in pre-2010, 66% in 2010-15 and 91% in 2016-21. For lone dyads, 0% of cases were subject to some degree of online radicalisation in pre-2010, 75% in 2010-15 and 72% in 2016-21. For

group actors, 23% were subject to some degree of online radicalisation in pre-2010, 54% in 2010-15 and 75% in 2016-21.

Having explored the prominence over time of radicalisation pathways relating to Internet use for lone actors, lone dyads and group actors, the analysis focused on comparing the three attacker groups based on a range of online facilitative and planned action behaviours.

Table 7: Comparing attacker groups across a range of online facilitative behaviours.

Online activities		Lone actors (n = 44)	Lone dyads (n = 20)	Group actors (n = 79)
Learnt from online sources***	Yes	89† (39/44)	75 (15/20)	52† (41/79)
	No evidence	11† (5/44)	25 (5/20)	48† (38/79)
Interact with co-ideologue online	Yes	45 (20/44)	55 (11/20)	28 (22/79)
	No evidence	55 (24/44)	45 (9/20)	72 (57/79)
Dissemination of extremist propaganda**	Yes	39† (17/44)	45‡ (9/20)	14†‡ (11/79)
	No evidence	61† (27/44)	55‡ (11/20)	86†‡ (68/79)

Note: Chi-squared tests (3x2) were used for overall associations. **significant association with attacker group at $p < .01$. ***significant association with attacker group at $p < .001$. †,‡: significant pairwise post hoc comparisons, Bonferroni-adjusted, at $p < .05$; in each row, same indices indicate a difference in proportions.

Three types of online facilitative behaviours were investigated: whether individuals learnt from online sources, interacted with co-ideologues online and disseminated extremist propaganda (see Table 7). Significant differences were found between the attacker groups

and whether they had learnt from online sources ($\chi^2 (2, N = 143) = 17.87, p < .001$), with lone actors significantly more likely to have learnt from online sources than group actors.

Significant differences were also found comparing attacker groups in relation to dissemination of extremist propaganda online ($\chi^2 (2, N = 143) = 13.43, p < .01$), with group actors significantly less likely to have disseminated extremist propaganda online than lone actors and lone dyads.

Table 8: Comparing attacker groups across a range of online planned action behaviours.

		Lone actors	Lone dyads	Group actors
Online activities		(n = 44)	(n = 20)	(n = 79)
		Percentage (%)	Percentage (%)	Percentage (%)
Attack preparation**	Yes	66† (29/44)	60‡ (12/20)	30†‡ (24/79)
	No evidence	34† (15/44)	40‡ (8/20)	70†‡ (55/79)
Target choice	Yes	32 (14/44)	20 (4/20)	20 (16/79)
	No evidence	68 (30/44)	80 (16/20)	80 (63/79)
Signalling intent**	Yes	25† (11/44)	15 (3/20)	4† (3/79)
	No evidence	75† (33/44)	85 (17/20)	96† (76/79)

Note: Chi-squared tests (3x2) were used for overall associations. **significant association with attacker group at $p < .01$. †,‡: significant pairwise post hoc comparisons, Bonferroni-adjusted, at $p < .05$; in each row, same indices indicate a difference in proportions.

Further, three types of online planned action behaviours were investigated: whether individuals had engaged in attack preparation online, chosen their target(s) online and signalled attacking intent online (see Table 8). Significant differences were found between attacker groups and whether they had engaged in attack preparation online ($\chi^2 (2, N = 143) = 13.43, p < .01$). Group actors were found to be significantly less likely to have engaged in

attack preparation online than the other two attacker groups. Significant differences were also found between attacker groups in relation to signalling attacking intent online, with lone actors significantly more likely than group actors to use the Internet to signal attacking intent ($\chi^2 (2, N = 143) = 12.34, p < .01$).

Table 9: Percentages of attacker plot-related variables across pathway groups

Attacker variables		Lone actors	Lone dyads	Group actors
		(n = 44)	(n = 20)	(n = 79)
		Percentage (%)	Percentage (%)	Percentage (%)
Improvised Explosive Devices (IED)		59	50	56
Arson		5	20	4
Firearm		14	5	15
Bladed weapon		30	25	19
Type of plot ^a	Vandalism/criminal damage	2	0	9
	Vehicle	9	15	3
	Unarmed assault	0	5	15
	Poison	0	0	1
	Hammer	5	0	0
Moved to execution stage		48	40	53
Completed plot		30	40	41
How plot was thwarted	Police/security services	94	100	79
	IED did not detonate	0	0	9

Lost nerve	3	0	0
Missed target	0	0	13
Public	3	0	0

NB: ^aPercentages under ‘type of plot’ equate to the percentage of plots against the overall number of plots that involved each type of weapon (as some plots involved multiple weapons).

Regarding attack plots, all attacker groups were most likely to have used an IED (lone actors – 59%, lone dyads – 50%, group actors – 56%, see Table 9), with a bladed weapon the second most common weapon choice (lone actors – 30%, lone dyads – 25%, group actors – 19%). Whilst no significant differences between attacker groups were found, some percentage differences were noted, including increased use of firearms by lone actors (14%) and group actors (15%), compared to lone dyads (5%), and a higher percentage of lone dyads having committed arson (20%) or a vehicle attack (15%) than other attacker groups. It was also noted that a higher percentage of group actors perpetrated unarmed assaults (15%).

In terms of plot progress, whilst no significant differences were found between attacker groups, it was interesting to note that group actors had the highest percentage of plots progressing from planning to execution (53%, compared with lone actors – 48% and lone dyads – 40%). It was also noteworthy that lone actors had the lowest percentage of completed plots (30%, compared with lone dyads – 40% and group actors – 41%). Where plots were thwarted, this was typically by Police/security services for all attacker groups.

Risk level

To conclude the comparative analysis, lone actors, lone dyads and group actors were compared in relation to professional assessments of overall levels of engagement to an extremist group, cause or ideology at the time of offending (based on 122 cases), overall levels of intent (based on 124 cases) and overall levels of capability (based on 123 cases) to

commit extremist offences with potential to cause serious and significant harm. No significant differences were found between attacker groups in relation to assessed levels of engagement, intent and capability.

Summary of comparisons

The findings from this study suggest that lone-actor terrorists are different from group actors, with lone dyads similar to lone actors in some respects or positioned in-between the other two attacker groups. Lone actors appear markedly different from group actors in terms of presence of mental health issues, which is also the case when lone dyads are compared with group actors. In relation to ideology, both lone actors and lone dyads differ from group-based attackers, as evidenced by attackers affiliated with the Extreme Right Wing being more likely to commit attacks alone or in pairs, whilst Islamist Extremist attackers more likely to attack in groups. This pattern may change, given the increase of Islamist extremist lone-actor attackers sentenced in 2016-21 compared to previous years. It is also noteworthy that changes over time are evident for all attacker groups, with a marked increase in lone actor attacks, and to a lesser extent lone dyad attacks, from pre-2010 to 2021, and reduction in group-based attacks over this time period.

A key finding is that lone actors and lone dyads are more likely to be radicalised online, whilst group actors are more likely radicalised via offline influences. However, this is caveated by the finding that group actors subject to at least some degree of online radicalisation have also increased over time. Lone actors and lone dyads were found to be more likely to use the Internet for online learning, dissemination of extremist propaganda and attack planning in comparison to group actors. However, only lone actors were markedly different to group actors in willingness to signalling attacking intent online, suggesting they may be most willing to disregard operational security considerations prior to an attack.

Considering the higher numbers of lone actors compared to lone dyads within this sample and a more marked increase in lone-actor attacks over time, yet also considering similarities found, it could be implied that lone dyads are a weaker version of lone-actor terrorists.

Discussion

The findings from this study provide a number of key insights in relation to lone actors, lone dyads and group actors, particularly in light of a number of discernible differences between these attacker groups. One of the key findings supporting and extending previous work (Corner & Gill, 2015; Corner et al., 2016) was that the more isolated the individual in terms of number of co-offenders in the preparation and commission of an attack, as reflected by lone actors and lone dyads in this sample, the more likely they are to have mental illness, neurodivergence or personality disorder.

When considering the relevance of mental illness and other conditions, numerous case reviews indicate lone actors often have a wide range of clinical mental health issues. Yet, despite these difficulties, lone actors have often demonstrated an ability to engage in organised, detailed attack preparation, with a rational motive and basis (Kenyon et al., 2021). It is therefore important to view lone-actor terrorism as more complex than the simple dichotomy of having or not having a psychiatric basis, with a much wider range of factors to be considered, such as social context, propensity for violence, underlying grievance, difficulties with groups and socialisation, access to weapons and opportunity, and willingness to self-sacrifice for the cause.

For all three attacker groups, ASC, depression and personality disorder were the most common types of mental illness or other conditions found. ASC was the condition most commonly reported for attackers within the sample, and for lone actors specifically. One possible explanation for the prevalence of ASC is that terrorist groups are known to target

and groom those they perceive as vulnerable. There have been a number of high-profile cases where individuals with ASC have been radicalised online or reportedly targeted by recruiters and encouraged to commit violent terrorist acts (see UK cases of Lloyd Gunton [Dearden, 2018] and Rhianan Rudd [De Simone & Winston, 2023]).

Whilst case numbers limited the comparisons that could be drawn between Islamist Extremist attackers and those affiliated with the Extreme Right Wing, the percentage differences found were indicative of two disparate attacker groups. In this sample, all those affiliated with the Extreme Right Wing were male, compared to 91% of Islamist Extremists. Even though the majority of each sub-group were over 25 years old (both 54%), a greater proportion of Extreme Right Wing attackers were over 40 (29% compared to 2% of Islamist Extremists), providing some support for the recently reported trend of older individuals, supporting far-right extremist ideals, committing serious acts of terrorist violence (see Wells, 2023). This also supports the work by Gill et al. (2014) who found al-Qaeda-related lone actors were on average 10 years younger than lone actors affiliated with the Extreme Right Wing. There is some indication that Extreme Right Wing attackers are more likely than Islamist Extremists to be born in the UK (96% compared to 68%), with a more prolific (68% compared with 27%) and violent (46% compared with 13%) offending history. Within this sample, those affiliated with the Extreme Right Wing appeared more likely to have committed offences alone or as part of a dyad, whilst Islamist Extremist attackers were more likely to attack as part of a group. There is also indication that lone-actor attacks by Islamist Extremists have become increasingly prominent over time.

Changes over time

When considering the prominence of each attacker group over time, it was clear lone-actor attacks have become increasingly prominent since pre-2010 up to 2021. In contrast,

attacks by group-based attackers have become less prominent. Lone-dyad attacks have increased from pre-2010 up to 2015, but have then remained at a broadly consistent and comparatively low level since.

When comparing different ideological groups, the overall trends over time are mirrored for Islamist Extremists, where an increased prominence of lone-actor attacks, and reduction of group-actor attacks from pre-2010 up to 2021 were noted. This is unsurprising given how loosely connected al-Qaeda's global network has now become and increasing promotion of lone-actor attacks within the content of publications such as Inspire. Over recent years, Daesh has also advocated the use of lone-actor style attacks through its magazine publications, speeches, and online propaganda, trying to instigate radicalised individuals in Western countries to launch attacks against home governments. For attackers affiliated with the Extreme Right Wing, however, a different pattern emerges with all attacks, albeit a small number, committed by lone actors pre-2010, and more variation in attack types evident for those sentenced between the years 2010-2015. By 2016-2021, lone-actor attacks have spiked again to become the most prominent attack methodology. This fits with the assertion by Koehler (2016) that lone-actor terrorism is the most prominent tactic for the extreme right.

Role of the Internet

Group actors are significantly less likely to be radicalised online compared with lone actors and lone dyads. However, for lone actors and lone dyads, it is clear neither are fully isolated from broader radical milieu and networks, with radicalisation taking place through online and offline engagement with these social movements (Kenyon et al., 2021; O'Connor et al., 2018). For these attacker groups, a potential benefit of the Internet is the availability of vital information such as bomb making instructions, gaining weapons, or terrorist tactic

guidelines. When investigating online facilitative behaviours, lone actors were more likely to have learnt from online sources than group actors. Group actors were also less likely to have disseminated extremist propaganda online compared with both lone actors and lone dyads. These findings are consistent with previous studies (e.g., Gill et al., 2017), which found lone actors were more likely to learn online than group-based terrorists.

Both lone actors and lone dyads were also found to be more likely to have engaged in attack preparation online than group-based attackers. This finding contrasts with some previous assertions that the Internet plays a limited role during the preparation of lone-actor terrorist attacks (Mueller & Stewart, 2015; Zeman et al., 2017). Lone actors were also found to be more likely than group actors to signal attacking intent online, providing support for previous studies such as Ellis et al. (2016), where lone actors were reported to regularly signal their intentions to others prior to a terrorist act. Such leakages and digital traces may, hopefully, support the early identification of any future lone-actor attackers.

Attacker plot characteristics and risk

Whilst no significant differences were found when comparing the three attacker groups in relation to plot characteristics, percentage differences still offer some insights and indicate areas that may warrant further investigation in the future. In terms of weapon choice, more similarities than differences were noted between attacker groups with IEDs the preferred weapon of choice for all three, and a bladed weapon the second most common choice. Previously, Pauwels (2021) has outlined that explosives are a preferred weapon for both lone actors and terrorist groups, and terrorist groups such as Al-Qaeda and Daesh have in the past called on their sympathisers to start “a knife revolution” (Johnson, 2016). It appears likely attackers will continue relying on weapons such as home-made explosive

devices where designs are published in extremist literature, or use of knives given how easily these can be acquired and concealed.

Although 48% of lone-actor attack plots progressed from planning to execution, only 30% of plots were completed overall. This challenges the common notion that lone actors are hard to detect (Schuurman et al., 2019) and aligns well with the increased likelihood of signalling intent, as already discussed. As an explanation for the low success rate of lone-actor attack plots, previous researchers have also suggested they may be particularly prone to detection during the reconnaissance and planning stage of their attack cycle (see Bakker & de Graaf, 2011). According to Pantucci et al., (2015), this seems a logical conclusion given the presumed illicit activity that lone actors would potentially have to undertake at this stage and their lack of professional training to mask such activities.

Within lone dyads, the literature suggests that each individual supports the process of moving from ideas and abstract plans, towards attack preparation and violent action over an extended period of time. In this study, only 40% of lone-dyad attacker plots progressed from planning to execution, which was comparable to the other attacker groups. One possible explanation for the lack of progress in the majority of lone-dyad plots is poor operational security between the two individuals, either online or offline, which may have rendered their plot vulnerable to detection by the police or those in their immediate social environment (O'Connor et al., 2018). However, of the lone-dyad plots that did progress to execution, it was interesting to note that all were subsequently completed, suggesting plots are difficult to stop once in motion. O'Connor et al. (2018) provide an explanation for difficulties in disrupting lone-dyad plots in the latter stages, suggesting when the trigger for action comes from within the dyadic relationship and not from external, indirect encouragement cues, the timing and target of attacks is less predictable.

Finally, group-based attackers had the highest percentage of plots escalating from planning to execution, and highest percentage of completed plots. This adds some support to previous assertions by Kenyon et al. (2022a) that those who commit extremist offences who now prove hardest to detect are those who conduct extremist activities in primarily offline settings. It is not possible, however, to comment on any differences in assessed risk presented by the three attacker groups as no significant differences were found in terms of their overall engagement, intent and capability ratings at the time offences occurred.

Policy implications

For those concerned with preventing future lone-actor or lone-dyad terrorist attacks, attention should be paid to those with mental health concerns who are expressing support for extreme views, particularly those supporting an Extreme Right Wing ideology. Furthermore, online extremist activity by those identified as potential lone actors or lone dyads, particularly accessing or disseminating extremist content and early signs of attack planning, should be of considerable concern. For lone actors specifically, signalling attacking intent online may be a key indicator of potential attack planning and should be taken seriously. To prevent group-based attacks, the police and security services should pay particular attention to the role of offline influences, particularly when individuals of concern have in-person contacts who are known to espouse a radical Islamist ideology.

Study limitations

Whilst being based on a unique sample and data sources, it is important to recognise some shortcomings and limitations that come with the approach chosen for this study. Most importantly, some individuals who have committed extremist offences in England and Wales would not be included in the sample, including those killed in the commission of offences, those who avoided arrest or those who never came to the attention of the Police. Other

recognised limitations include the variation in length and detail of reports in the sample as well as the potential lack of honesty by report subjects who participated in interviews during the assessment process. There is also an element of subjectivity of interpretations placed by report authors on information provided by report subjects and difficulties in distinguishing between missing data and variables that could reliably be coded as not present. Finally, sample imbalances may have affected some of the outcomes of statistical testing, most notably the smaller number of non-Islamist extremist individuals and lower number of convicted females.

Conclusion

This study has provided key insights into lone actors, lone dyads and group actors who commit terrorist attacks. Further empirical research on terrorist attackers is required to ensure our knowledge is not based on assumptions that prove detrimental to those tasked with detecting, preventing and responding to the threat. Particularly for lone actors and lone dyads, the presence of mental health issues or personality disorder calls for more upstream preventive responses to divert would-be attackers from their intended pathways. It is encouraging that counter-terrorism police in the UK are now working alongside health professionals, with the introduction of vulnerability support hubs across the country, ensuring mental health treatment and support for complex needs is available to those referred into Prevent (Counter Terrorism Policing, 2020). Similar support should also be available to those convicted of terrorist offences to ensure individual needs are met and support rehabilitation efforts. The growing influence of the Internet across all attacker groups, but most notably lone actor and lone dyad pathways, clearly highlights why online counter-terrorism measures should be at the forefront of responses to identify and disrupt potential terrorist attacks.

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