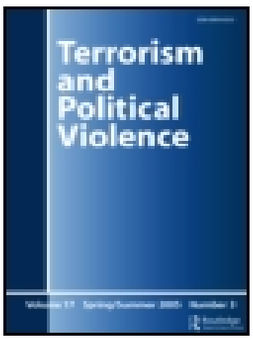

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Disaggregating Lone-actor Grievance-fuelled Violence: Comparing Lone-actor Terrorists and Mass Murderers

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ABSTRACT

Research suggests that lone-actor terrorists and mass murderers may be better conceptualized as lone-actor grievance-fueled violence (LAGFV) offenders, rather than as distinct types. The present study sought to examine the extent to which these offenders could (or could not) be disaggregated along dimensions relevant to the threat assessment of both. Drawing on a Risk Analysis Framework (RAF), the offending process was theorized as interactions among *propensity, situation, preparatory, leakage* and *network* indicators. We analyzed a dataset of 183 U.S. offenders, including sixty-eight lone-actor terrorists and 115 solo mass murderers. Cluster analysis identified profiles within each of the components: *propensity* (stable, criminal, unstable), *situation* (low stress, high stress (social), high stress (interpersonal), *preparatory* (fixated, novel aggression, equipped, clandestine, predatory, preparatory), *leakage* (high leakage, low leakage), and *network* (lone, associated, connected). Bi-variate analysis examined the extent to which the profiles classified offenders previously labeled as lone-actor terrorists or mass murderers. The results suggest that while significant differences may exist at the periphery of these dimensions, offenders previously classified as lone-actor terrorists or mass murderers occupy a noteworthy shared space. Moreover, no profile classifies a single "type" of offender exclusively. Lastly, we propose a dynamic, interactional model of LAGFV and discuss the implications of these findings for the threat assessment and management of LAGFV offenders.

KEYWORDS

Lone-actor; terrorism; mass murder; lone-actor grievance-fueled violence; risk analysis framework; threat assessment

Introduction

Lone-actor grievance-fueled violence (LAGFV) describes different types of offenders, including mass murderers, lone-actor terrorists, school shooters, and other types of demonstrative violence. Research suggests that these offenders may share a common genesis.[1] Therefore this type of violence may be better conceptualized generally, rather than as distinct "types."[2] In the Washington Post, Leiter and Sheehan[3] advised that we should "treat mass shootings the way we treated terrorism," calling for fusion organizations and an intelligence-gathering approach to combatting this threat. Recently, the Department of Homeland Security (DHS)[4] announced the

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Supplemental data for this article can be accessed here.

establishment of a new office for Targeted Violence and Terrorism Prevention. Hence there is an impetus for research and policy to reconceptualize these offenses as LAGFV, rather than as different types. Establishing the extent to which these offenders share commonalities could inform a general threat assessment framework that may benefit analysts and other practitioners. The present study aims to identify *if* and *how* these offenders differ, and offer insights into *why*.

Studies have examined the conceptual boundaries between different LAGFV offenders. These include comparisons of suicide terrorists with rampage, workplace and school shooters,[5] suicide terrorists with mass shooters,[6] ideologically and non-ideologically motivated mass shooters,[7] political and nonpolitical murderers in Northern Ireland,[8] adolescent targeted school attacks with jihadi terrorists in Germany,[9] both far-right homicides,[10] and European lone-actor terrorists with "common" homicides,[11] and lone-actor terrorists with mass murderers.[12] These studies consistently report similar profiles of psychological and social characteristics, providing evidence for reconceptualizing these offenders as LAGFV offenders.

Studies examine a number of factors associated with LAGFV, singly. This is the basis of much important research which forms the rationale for our study. However, we suggest a more nuanced understanding may be garnered from considering the relevance of *patterns* of indicators. Thompson, Stewart & Dennison[13] demonstrate just this. In a content analysis of forty-three stalking court transcripts, the authors found that combining multiple risk factors provided a more sophisticated understanding of stalking violence than considering indicators independently. We suggest that such an approach is appropriate here, and thus adopt a strategy to examine *configurations* of indicators, which previous research has demonstrated to be multifinal.[14]

We utilize cluster analysis to examine the extent to which an aggregate dataset of mass murderers and lone-actor terrorists, can (or cannot) be disaggregated. Hence, we examine the usefulness of these labels in describing what previous research contends are different presentations of the same phenomenon. Rather than presuming two a priori categories and comparing them, we aggregate two existing datasets and inductively extract patterns embedded within the data. We examine 115 mass murderers and sixty-eight lone-actor terrorists. We conceptualize the offending process as interactions among *propensity, situation, preparatory, network*, and *leakage* factors. We use cluster analysis to detect sets of cases that share attributes and examine the extent to which these profiles classify offenders previously labeled as lone-actor terrorists or mass murderers. Next, we use bivariate analysis to establish the extent to which the theorized components are associated, and propose a model of LAGFV. We find support for conceptualizing these offenses generally. At the periphery, we note significant differences, however many of these offenders occupy a shared space across multiple dimensions directly relevant to threat assessment.

Background

First, we describe the analytical framework adopted as theoretical guidance; the Risk Analysis Framework (RAF). Second, we describe how we conceptualized the offense process and draw from the established evidence base. Lastly, we detail the rationale for adopting the present analytical strategy.

The RAF draws on Situational Action Theory (SAT) and opportunity theories to hypothesize multilevel mechanisms that underlie causal processes in pathways to extremist

violence.[15] A detailed presentation of the RAF is beyond the scope of this paper (see[16] for a detailed discussion). However, the framework, which synthesizes causal models of terrorism and radicalization previously developed by Bouhana and Wikström,[17] was developed to articulate relations between causal factors and processes at multiple levels of analysis, across each phase of an extremist event.

The RAF conceives of the offense process as the outcome of the interaction between individuals with action-relevant propensities and terrorism-supportive criminogenic settings, whose features support these individuals' perception of their own capability to offend, leading to the emergence of situations that trigger and sustain actors' motivation to commit an act of terrorism. As a general, interactionist framework, the RAF articulates key mechanisms and processes, as opposed to discrete indicators, which are theorized to be context-dependent, and therefore unstable ground for risk assessment.[18] While the RAF has so far been used to guide research on lone-actor terrorists, it is a general framework for the analysis of offending risk. It is therefore an appropriate framework for a comparative study of both mass murderers and lone-actor terrorists.

It is necessary to conceptualize the offending process into distinct components and operationalize these with observable indicators. Decisions about how existing indicators mapped onto components of the offense process were guided by the RAF. This has been done previously[19] and although by no means perfect, has the advantage of being theoretically guided, rather than ad hoc. Based on prior research, we theorize LAGFV risk as emerging from the interaction between *propensity*, *situation*, *preparatory*, *network* and *leakage* indicators.

Propensity

Propensity is understood as the outcome of the developmental interaction between an individual's differential susceptibility and their exposure to violence-supporting settings.[20] Factors related to the emergence of a violent propensity in LAGFV have been researched extensively. Research on mass murder has examined sociodemographics,[21] mental illness,[22] social isolation,[23] chronic strain,[24] and previous criminality[25] as factors relating to relative risk of engaging in mass violence. There is also significant research into these factors in lone-actor terrorism.[26] However, no stable profile of these characteristics exists. Hence, their predictive utility is limited. However, interactions among these factors may allude to the emergence of a propensity for LAGFV, and therefore this is important to consider.

Situation

Situation relates to immediate behavioral influences, such as stressors and negative life experiences, in the buildup to an attack. A transitional period of acute stress is often described in pathways to LAGFV. For example, Silver and colleagues[27] explored the role of strain, both chronic and acute, in trajectories to mass murder. Similarly, Lankford[28] examined situational stressors in suicide terrorists and rampage shooters. The role of situational stressors has been examined in lone "wolf" violent offenders,[29] in a comparison of German jihadi and school attackers,[30] adolescent mass murderers,[31] mass murderers at school,[32] and U.S. mass murderers.[33] These indicators may signal the emergence and maintenance of a motivation to pursue LAGFV, and so are important to consider here.[34]

Preparatory

Preparatory indicators relate to how offenders prepare for an attack. In contrast to single homicide events, terrorist and mass murder events appear more purposive in that they typically involve a period of planning.[35] The preparatory behaviors of lone-actor terrorists have been studied extensively,[36] so too of mass murderers.[37] Previous comparisons of mass murderers and lone-actor terrorists report significant differences in the way these offenders prepare for an attack.[38] Hence these factors are pertinent to consider.

Leakage

Leakage is the extent to which offenders communicate their intent and/or capability to third parties prior to the offense. Research on both mass murderers and lone-actor terrorists demonstrates that these offenders do so either by directly communicating a threat or by exhibiting warning behaviors.[39] These indicators are particularly important to the threat assessment of LAGFV, as they may provide an opportunity for detection and intervention.

Network

Lastly, we consider network connectivity. The extent to which lone-actor terrorists are "lone" has been debated widely.[40] Much of this research concludes that these offenders are not as "lone" as the moniker implies. In fact, recent research calls for an "end to the lone wolf" typology.[41] Some may act in complete isolation, however this does not reflect the majority of cases. Malthaner and Lindeklide[42] analyzed lone-actor pathways to radicalization from a relational perspective. They argue that not only do lone-actor terrorists vary in the degree of isolation within which they operate, but also with respect to how they interact with others (i.e. militants, radical milieus, or virtual communities) along pathways to radicalization. This is relevant to disaggregating LAGFV offenders as research that examines the differences between ideologically and non-ideologically motivated attacks has found that connections to others, or the lack thereof, are a significant difference between these types of offenders. Next we detail the analytical strategy adopted.

Previous research on crime uses analytical strategies such as cluster analysis, or latent class analysis, to detect sub-groups in offending populations. Populations are disaggregated upon a number of variables in order to identify un-measured class membership. The different classes are often conceptualized as types in a typology. Researchers developed typologies of a range of offenders, including non-serial sexual killers,[43] sex offenders who target marginalized victims,[44] extrafamilial sexual aggressors against women,[45] intrafamilial child sex offenders,[46] extrafamilial sexual aggressors against adolescents,[47] and marital rapists,[48] using cluster analysis. Latent class analysis has been used to develop profiles of burglars,[49] sexual burglary,[50] participants in drug treatment court,[51] and dating violence.[52] Recently, Clemmow, Bouhana and Gill[53] developed a typology of person-exposure patterns in lone-actor terrorism. Hence this may be an effective strategy to disaggregate LAGFV. We use cluster analysis to examine the extent to which an aggregate dataset of mass murders and lone-actor terrorists can be disaggregated.

Method

Data

This study employs two existing datasets of lone-actor terrorists[54] and mass murderers.[55] Lone-actor terrorists were identified if cases met the following criteria: offenders carried out or planned to carry out an ideologically motivated attack, alone. Within the sample, offenders can operate with or without command-and-control links. Some operated autonomously and independently of a group, however, some may have radicalized toward violence within a wider group. Those with command and control links may have been trained and equipped by a group — which may also choose their targets — but attempted to carry out their attacks autonomously. Subjects were either convicted for their offenses or died in the commission of an attack. Offenses occurred between 1990 and 2016. To ensure a consistent context, only U.S. lone-actor terrorists were included (n = 68).

Mass murderers were identified if cases satisfied the following criteria: offenders killed at least four victims (excluding the offender) at one (or multiple but geographically close) locations, over a short period of time. Only mass murderers who committed an attack alone were included (n = 115). Acts identified as state-sponsored, domestic, or gang and/or organized crime-related, were excluded. Offenses occurred between 1990 and 2014. The final dataset included 183 offenders.

The data were compiled from open sources, including sworn affidavits, court reports, and news reports, obtained via LexisNexis searches. Additional sources, such as biographies, were used where available and relevant. First, three independent coders coded the objective absence or presence of an indicator. Second, coders engaged in a two-stage comparative process. First, coder A compared observations with coder B. Where differences occurred, a senior researcher reviewed the original documentation and considered the reliability of source documents. Second, coders AB compared with coder C. Again, differences were resolved by a senior researcher. Decision-making was guided by a "continuum of reliability," whereby each source was plotted along a scale from "most reliable" to "least reliable." This has been done previously in studies utilizing open-source data[56] as well as when constructing open-source databases such as the U.S. Extremist Crime Database.[57] Components of the offense process were operationalized with existing indicators (see Online Appendix A for the full codebook).

Procedure

Analytical strategy

Cluster analysis identified groups of related cases within each of the components. The two-step cluster analysis function in Statistical Program for Social Sciences (SPSS) version twenty-five was used. Clusters were identified within all five components: *propensity, situation, preparatory, network* and *leakage*. One way to measure the homogeneity of the cluster solution is the silhouette measure of cohesion and separation. 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. In a perfect solution, the within-cluster distances are small and the between-cluster distances are large. The values are summarized as poor, fair, or good in the model summary.

The results of cluster analysis are summarized as models which include the number of clusters and the frequencies of the indicators upon which they are disaggregated. The clusters are labeled by researchers who interpret the patterns of indicators observed. These can be subjective, hence we draw upon the RAF for theoretical guidance, as well as the extensive literature which we cite above. The clusters are labeled relative to each other, and therefore are not absolutes. It is useful to interpret these dimensionally, rather than categorically. Post-hoc z-tests compared the column proportions to determine the extent to which the clusters classified lone-actor terrorists or mass murderers. Bi-variate analysis established associations among the theorized components and a model of LAGFV was proposed.

Results

In the following tables, indicators appear in order of their salience and importance to the overall cluster solution. Highlighted in bold are the most salient features of each cluster. It is important to note that the clusters are not presented as "types of people," but rather as patterns of indicators to be interpreted as styles of interaction.

Propensity

We identified three clusters, (see Table 1). Given the variables that made up these clusters, they were labeled, *criminal, stable*, and *unstable*. The silhouette measure of cohesion was .2, which is fair. The *criminal* cluster typifies criminality. All (100%) of these offenders had previous criminal convictions and 71.9% were previously imprisoned. The nature of this criminality is likely severe, given the rate of imprisonment. These offenders were less educated where only 12.5% had some university education, and just 1.6% demonstrated exceptional academic achievements. Approximately 20% were arrested as juveniles and 53.1% experienced chronic stress. This resonates with previous findings about multiple homicides, whereby 30% of offenders were classified as habitual criminals before their final event.[58]

Table 1. Prevalence of propensity factors by cluster membership (most salient features of each cluster are in bold).

	Criminal	Stable	Unstable
Propensity factors	*n* = 64	*n* = 55	*n* = 64
Criminal convictions	**100.0%**	**25.5%**	**9.4%**
Chronic stress	**53.1%**	**0.0%**	**92.2%**
Previously imprisoned	**71.9%**	**7.3%**	**1.6%**
Previous military experience	9.4%	**29.1%**	1.6%
Unemployed	35.9%	**10.9%**	48.4%
Juvenile arrest	**20.3%**	1.8%	3.1%
Mental illness	40.6%	32.7%	**67.2%**
University experience	**12.5%**	36.4%	43.8%
Rejected from military	4.7%	5.5%	**25.0%**
Socially isolated	21.9%	31.9%	51.6%
Children	42.2%	25.5%	17.2%
Exceptional educationally	1.6%	18.2%	15.6%
Married	21.9%	20.0%	9.4%
History of substance abuse	46.9%	30.9%	37.5%
Combat experience	7.8%	7.3%	1.6%
Born outside of US	17.2%	27.3%	28.1%

The *stable* cluster demonstrated lower frequencies of propensity factors typically associated with the emergence of LAGFV. For instance, 25.5% had previous criminal convictions. The criminality here is likely petty, as only 7.3% of these offenders were imprisoned. Fewer of these offenders were unemployed (10.9%) or experienced chronic stress (0%), and 32.7% had a diagnosed mental illness. Of note, 29.1% had previous military experience.

A review of previous research found that lone-actor terrorists were more likely to have military experience than the general population.[59] Ellis and colleagues[60] suggest that military experience and combat training may relate to a person's ability to carry out a successful attack, and perhaps a more lethal attack. Furthermore, the RAF suggests that an offender's perception of their own capability may sustain their motivation to act. Hence military experience may be an important proxy for capability when considering the threat assessment of these offenders.

Lastly, the *unstable* cluster was characterized by high frequencies of diagnosed mental illness (67.2%) and chronic stress (92.2%). Only 9.4% had previous criminal convictions and just 1.6% had been imprisoned. They were more often socially isolated (51.6%) and interestingly, 25.0% had been rejected from the military. The pervasive pattern of instability, including mental illness, may offer an insight into why.

We examined the extent to which cluster membership was associated with actor type. The relationship was significant, X^2 (2, N = 183) = 20.28, p < .000, V = .33. Post-hoc z-tests compared the column proportions, (see Figure 1). A significantly higher proportion of lone-actor terrorists were classified as *stable* (47.3%) compared to mass murderers (19.1%), p < .000. There was no significant difference between the proportion of mass murderers (36.5%) and lone-actor terrorists (32.4%) classified as *criminal*. A significantly higher proportion of mass murderers (44.4%) than lone-actor terrorists (19.1%), were classified as *unstable*, p < .000.

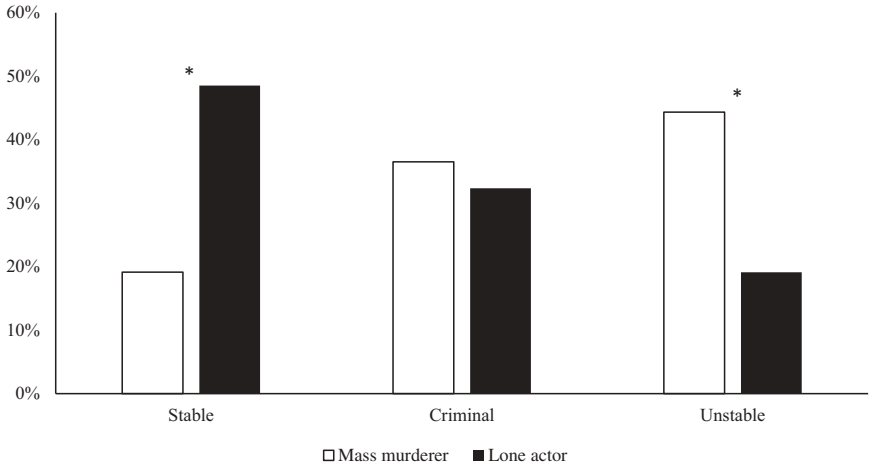

Figure 1. Percentage of offenders classified by propensity clusters. * significant difference between column proportions, p < .05.

Situation

We identified three clusters labeled *low stress, high stress (social)* and *high stress (interpersonal)* (see Table 2). The silhouette measure of cohesion was .3, which is fair. The clusters differentiate by gradations of situational stressors, as well as between different types of stress, here classified as *social* or *interpersonal*. Stress refers to a transitional period of acute stress in the buildup to an attack. The *low stress* cluster demonstrated lower frequencies of these indicators where 0% were ignored by someone important to them, 0% had someone important to them demonstrate they did not care, and 9.6% experienced being degraded.

In contrast, the *high stress* clusters demonstrated much higher frequencies of these behaviors. First, the *high stress (social)* cluster demonstrated higher frequencies of injustice and/or prejudice (68.7%), being degraded (65.7%), and being disrespected (65.7%). The nature of these experiences relates more broadly to wider social grievances. However, the *high stress (interpersonal)* cluster experienced being ignored (84.8%), felt not cared for (81.8%), and had problematic personal relationships (93.9%). The nature of these experiences relates to problematic interpersonal relationships and reflects findings about the nature of grievances in mass murder.[61]

We examined the extent to which cluster membership was associated with actor type. The relationship was significant, X^2 (2, N = 183) = 13.24, $p < .01$, $V = .27$. Post-hoc z-tests compared the column proportions, (see Figure 2). A significantly higher proportion of lone-actor terrorists were classified as *low stress* (58.8%) compared to mass murderers (37.4%), $p < .005$. There was no significant difference between the proportion of mass murderers (37.4%) and lone-actor terrorists (35.3%) classified as *high stress (social)*. A significantly higher proportion of mass murderers (25.2%) than lone-actor terrorists (5.9%), $p < .001$ were classified as *high stress (interpersonal)*.

Table 2. Prevalence of situational factors by cluster membership (most salient features of each cluster are in bold).

	Low stress	High stress (social)	High stress (interpersonal)
Situational factors	*n* = 83	*n* = 67	*n* = 33
Ignored	**0.0%**	19.4%	**84.8%**
Not cared for	**0.0%**	17.9%	**81.8%**
Injustice/prejudice	10.0%	**68.7%**	**6.1%**
Tipping point	**25.3%**	**89.6%**	30.3%
Degraded	9.6%	**65.7%**	18.2%
Disrespected	9.6%	**65.7%**	**18.2%**
Problematic relationships	**24.1%**	59.7%	**93.9%**
Escalating anger	24.5%	**62.7%**	18.2%
Recent stressor	**27.7%**	80.6%	54.5%
Experienced being a helpless victim	6.0%	41.8%	0.0%
Angry	45.8%	91.0%	63.6%
Recently unemployed	14.5%	58.2%	45.5%
Financial problems	24.5%	53.7%	39.4%
Work stressor	20.5%	61.2%	42.4%
Proximate life change	8.4%	25.4%	9.1%
Lived alone at the time of event	19.3%	41.9%	34.4%
Victim of verbal/physical abuse	12.0%	23.9%	6.1%
Promise broken	1.2%	9.0%	12.1%
Dropped out of school	6.0%	16.4%	18.2%
Family death	12.0%	6.0%	22.1%

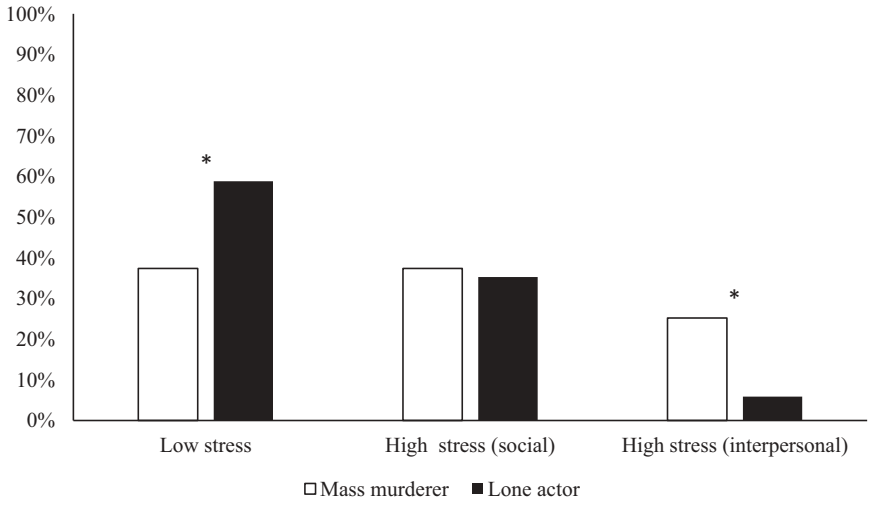

Figure 2. Percentage of offenders classified by situation clusters. * significant difference between column proportions, $p < .05$.

Preparatory

We identified six clusters, labeled *novel aggression, predatory, clandestine, preparatory, fixated* and *equipped* (see Table 3). The silhouette measure of cohesion was .2, which is fair.

The *novel aggression* cluster was characterized by high frequencies of offenders committing acts of violence, unrelated to their attack, in the buildup to the event. *Novel aggression* occurs as offenders prepare psychologically and test their resolve to commit violence.[62] Offenders demonstrated low frequencies of preparatory behaviors such as conducting dry-runs (0%), altering their appearance (0%), and hands-on training (0%). Notably, 69.4% of this cluster had a history with the event location, which may mitigate the need for preparatory behaviors.

The *predatory* cluster were classified by a pattern of novel aggression (97.1%) alongside preparatory behaviors. 23.5% of offenders engaged in dry-runs, 61.8% changed their address in the buildup to an attack, and 61.8% stockpiled weapons. This style of interaction is comparable to the predatory offender in typologies of mass murderers.[63]

Table 3. Prevalence of preparatory indicators by cluster membership (most salient features of each cluster are in bold).

	Novel aggression	Predatory	Clandestine	Preparatory	Fixated	Equipped
Preparatory indicators	*n* = 36	*n* = 34	*n* = 26	*n* = 33	*n* = 31	*n* = 23
Obsessed with an event	**0.0%**	**14.7%**	**3.8%**	**63.6%**	**100.0%**	**0.0%**
Stockpiled weapons	**0.0%**	**61.8%**	**0.0%**	54.5%	22.3%	**100.0%**
Novel aggression	**55.6%**	**97.1%**	**3.8%**	24.2%	**25.2%**	**0.0%**
Traveled to prepare	0.0%	**0.0%**	3.8%	**48.5%**	6.5%	**0.0%**
Address change	**0.0%**	61.8%	**92.3%**	69.7%	41.9%	52.2%
Hands-on training	2.8%	2.9%	7.7%	**54.5%**	**3.2%**	17.4%
Dry-runs	**0.0%**	23.5%	11.5%	**39.4%**	**0.0%**	**0.0%**
History with location	69.4%	47.1%	65.4%	**39.4%**	**100.0%**	47.8%
Cleared bank account	2.8%	0.0%	**23.1%**	9.1%	3.2%	13.0%
Sought legitimization	0.0%	**14.7%**	3.8%	9.1%	0.0%	0.0%
Altered appearance	0.0%	5.9%	15.4%	3.0%	**0.0%**	9.7%
Substance use pre-event	19.4%	14.7%	0.0%	9.1%	16.1%	26.1%

The *clandestine* cluster demonstrated higher frequencies of preparatory behaviors related to maintaining operational security. For instance, these offenders altered their appearance (15.4%), changed address (92.3%), and cleared out their bank account (23.1%). Preparatory behaviors that may increase the likelihood of detection such as traveling to prepare for an attack (2.8%), engaging in dry-runs (11.5%), and novel aggression (3.8%) occurred at lower frequencies.

The *preparatory* cluster demonstrated high frequencies of preparatory behaviors. This cluster is consistent with research on LAGFV which repeatedly identifies patterns of preparatory behaviors in trajectories to mass violence.[64]

The *fixated* cluster is characterized most saliently by an obsession with an event and/or phenomenon in the buildup to the event, where offenders had a history with the event location. In this instance, the event location is likely significant to their grievance. This is comparable to research on paranoid thinking in mass shooters. Offenders who have been rejected from a target group may become obsessed with the status of that group. The offender is framed as an "outsider" and becomes obsessed with their perceived mistreatment.[65] Similarly, Knoll and Meloy[66] found evidence for a violent-paranoid spectrum in mass murderers via the psycholinguistic analysis of communications left behind by a sample of these offenders.

Lastly, the *equipped* cluster demonstrate low frequencies of preparatory behaviors. However, 100% of this cluster had access to a stockpile of weapons. Meloy[67] dispels the common misconception that mass murderers are deranged offenders who "just snap." Mass murderers are consistently found to be methodical in planning and preparation.[68] This is true also of lone-actor terrorists.[69] However, this cluster may classify a group that are more impulsive and act without extensive planning due to their access to weapons.

We examined the extent to which cluster membership was associated with actor type. The relationship was significant, X^2 (5, N = 183) = 39.23, p < .000, V = .46. Post-hoc z-tests compared the column proportions, see Figure 3. A significantly higher proportion of mass

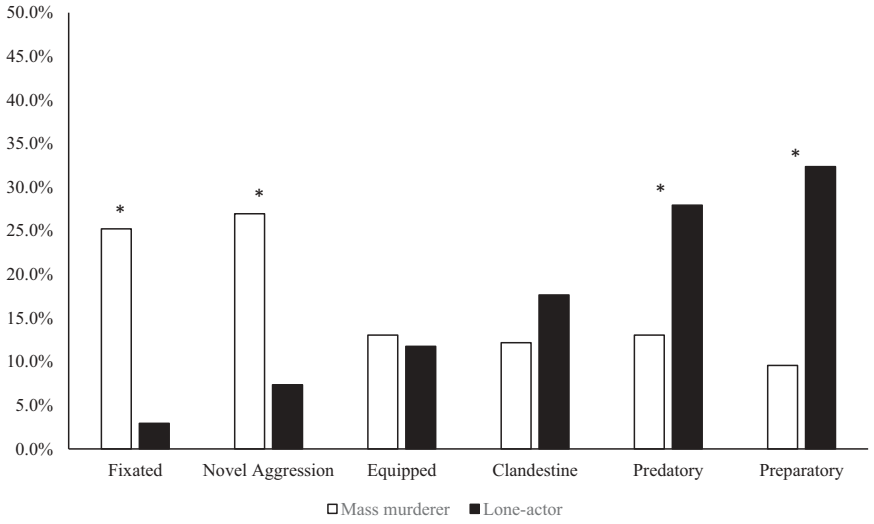

Figure 3. Percentage of offenders classified by preparatory clusters. * significant difference between column proportions, p < .05.

Table 4. Prevalence of leakage indicators by cluster membership (most salient features of each cluster are in bold).

	High leakage	Low leakage
Leakage indicators	*n* = 123	*n* = 60
Others aware of grievances	**86.2%**	**0.0%**
Verbal statements to friends/family	**60.2%**	**1.7%**
Verbal statements to wider audience	**56.1%**	**0.0%**
Expressed a desire to hurt others	**74.0%**	**18.3%**
Others aware of their ideology	**39.8%**	**0.0%**
Produced letters	44.7%	3.3%
Gave an event-specific warning	32.5%	0.0%

murderers (25.2%) were classified as *fixated* compared to lone-actor terrorists (2.9%), $p < .000$. A significantly higher proportion of mass murderers (27.9%) were classified as *novel aggression* compared to lone-actor terrorists (7.4%), $p < .001$. There were no significant differences between the proportion of mass murderers and lone-actor terrorists classified as *equipped* (13% versus 11.8%) or *clandestine* (12.2% versus 17.6%). A significantly higher proportion of lone-actor terrorists (27.9%) than mass murderers (13.0%), were classified as *predatory* $p < .05$. Lastly, a significantly higher proportion of lone-actor terrorists (32.4%) were classified as *preparatory* than mass murderers (19.6%), $p < .000$.

Leakage

We identified two clusters, labeled *high leakage* and *low leakage* (Table 4). The silhouette measure of cohesion was .5, which is good.

The *high leakage* cluster demonstrate higher frequencies of leakage behaviors than the *low leakage* cluster. Leakage of intent is key to the threat assessment of different types of LAGFV. The *low leakage* cluster identifies a subgroup of offenders who do not leak their intent, in contrast to much existing research. Therefore, it may be necessary to consider a trajectory absent of leakage indicators as still posing a credible threat.

We examined the extent to which cluster membership was associated with actor type. The relationship was significant, X^2 (1, $N = 183$) = 11.26, $p < .01$. Post-hoc z-tests compared the column proportions, as can be seen in Figure 4. A significantly higher proportion of lone-actor terrorists were classified as *high leakage* (82.4%) compared to mass murderers (58.3%), $p < .001$. A significantly lower proportion of lone-actor terrorists (17.6%) were classified as *low leakage* compared to mass murderers (41.7%), $p < .001$.

Network

We identified three clusters, labeled *lone, associated* and *connected* (Table 5). The silhouette measure of cohesion was .5, which is good.

The cluster solution disaggregates offenders by their degree of "loneness." In the *lone* cluster, 0% of the 80 offenders demonstrate any network connections. In contrast, the *connected* cluster demonstrates higher frequencies of these behaviors. The *associated* cluster demonstrates associations to others, however largely lacks the connectivity observed in the *connected* cluster.

We examined the extent to which cluster membership was associated with actor type. The relationship was significant, X^2 (2, $N = 183$) = 46.48, $V = .50$, $p < .000$. Post-hoc z-tests

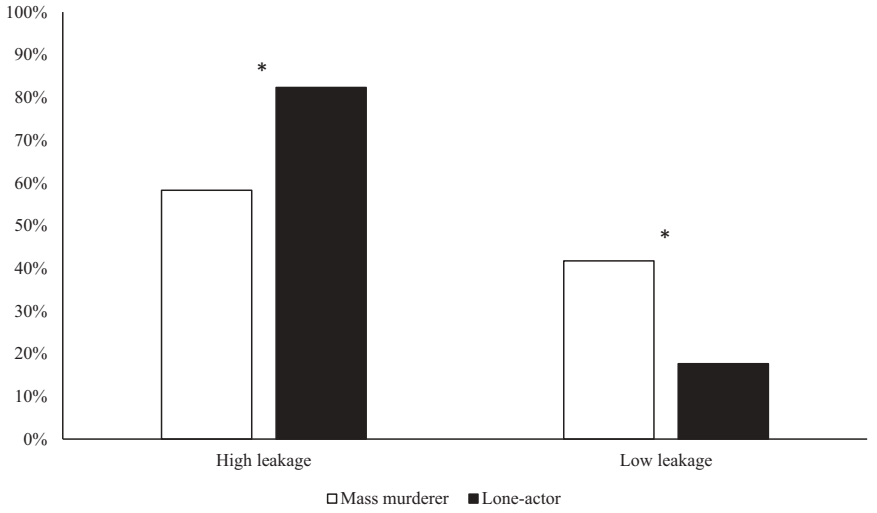

Figure 4. Percentage of offenders classified by leakage clusters. * significant difference between column proportions, $p < .05$.

compared the column proportions, as can be seen in Figure 5. A significantly lower proportions of lone-actor terrorists were classified as *lone* (16.2%) compared to mass murderers (60.0%), $p < .000$. There was no significant difference between the proportion of mass murderers (33.0%) and lone-actor terrorists (42.6%) classified as *associated*. A significantly lower proportion of mass murderers (7.0%) than lone-actor terrorists (42.6%), $p < .000$ were classified as *connected*.

Table 5. Prevalence of network indicators by cluster membership (most salient features of each cluster are in bold).

	Lone	Associated	Connected
Network indicators	*n* = 80	*n* = 66	*n* = 37
Face-to-face interactions	**0.0%**	**4.5%**	**89.2%**
Joined a wider group	0.0%	**0.0%**	**73.0%**
Engaged with group propaganda	0.0%	22.7%	**73.0%**
Claimed to be part of a wider group	**0.0%**	22.1%	**62.2%**
Tried to recruit others	0.0%	4.5%	**35.1%**
Close associates criminal/violent	**0.0%**	**40.9%**	37.8%
Others had knowledge of attack	**0.0%**	**39.4%**	35.1%
Interacted virtually with others	0.0%	7.6%	35.1%
Read propaganda by other offenders	0.0%	15.2%	21.6%
Others involved in procuring weaponry	0.0%	**16.7%**	18.9%
Engaged with stories about other offenders	**0.0%**	10.6%	18.9%
Spouse involved	0.0%	6.1%	13.5%
Command-and-control links	0.0%	0.0%	5.4%

Modeling interactions in LAGFV

Associations between the offending profiles were examined with chi square tests. The propensity offending profiles were significantly associated to the situation offending profiles (X^2 (4, N = 183) = 10.03, V = .17, $p < .05$). The situation offending profiles were associated with

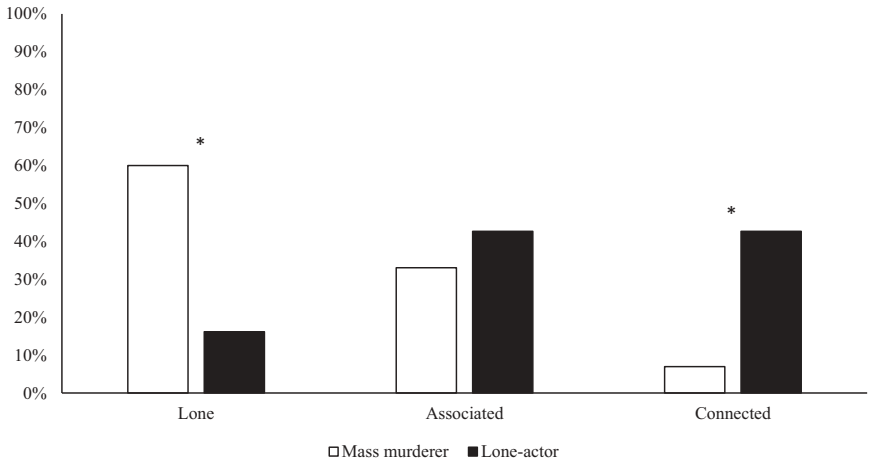

Figure 5. Percentage of offenders classified by network clusters. * significant difference between column proportions, $p < .05$.

the leakage offending profiles, (X^2 (2, N = 183) = 24.77, V = .37, $p < .000$). Leakage profiles were associated with the network offending profiles (X^2 (2, N = 183) 13.78, V = .27, $p < .001$) and preparatory offending profiles (X^2 (5, N = 183) = 14.77, V = .28, $p < .05$). Finally, network profiles were associated to preparatory profiles (X^2 (10, N = 183) = 34.06, V = .31, $p < .000$). All other tests were not significant. Based on these associations, Figure 6 proposes an interactional model of LAGFV.

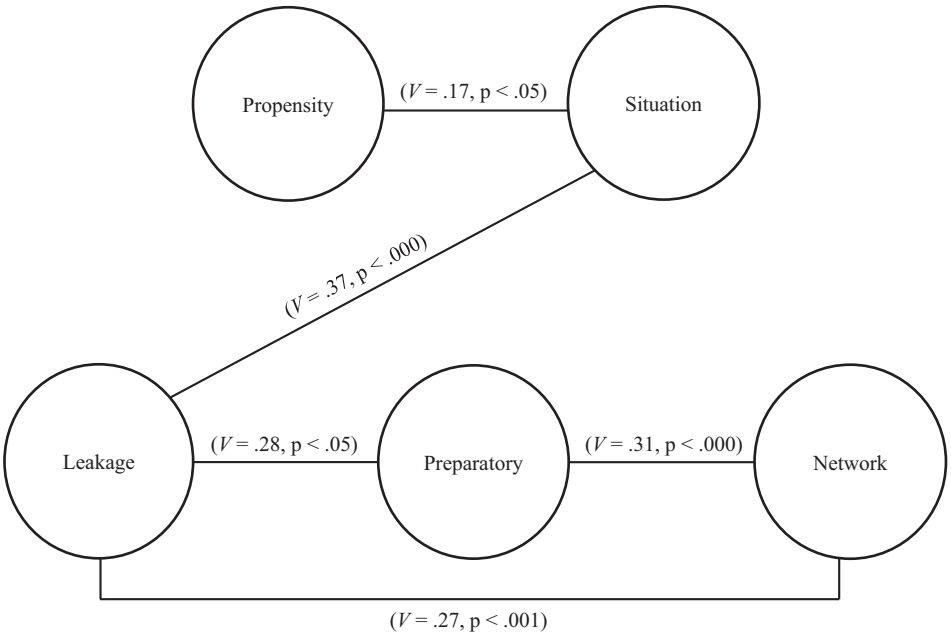

Figure 6. A model of LAGFV. Adjoining lines indicate a significant association.

Discussion

First, we discuss the proposed model. Second, we acknowledge the limitations of the study. Third, we consider the implications of our findings for threat assessment.

Modeling LAGFV

The model articulates relations between the components of the LAGFV offending process. First, the propensity component was significantly associated with the situation component. The clusters identified at the propensity component operationalize differential susceptibilities to LAGFV. For example, an offender classified as *unstable*, exhibiting diagnosed mental illness, chronic stress, and who is socially isolated, likely has a predisposed vulnerability to engaging in this type of violence. Similarly, a career criminal, classified as *criminal*, likely has a different type of predisposition to engage in demonstrative violence. Interestingly the *stable* cluster highlights a profile of offenders who do not exhibit a pattern of indicators most often associated with engaging in LAGFV.

These findings suggest how different patterns of propensity factors may influence the unfolding of differential patterns of indicators at further components. To note, the reported associations are not hypothesized as linear relationships as it is likely that these interactions are more complex and multidirectional. For instance, *high stress (interpersonal)* offenders may be *unstable* because pervasive instability at the individual-level leads to problematic interpersonal relationships. It may also be true that problematic interpersonal relationships negatively impact upon factors such as mental illness and social isolation. Hence, the results demonstrate the importance of considering such factors *dynamically*.

Considering leakage, Meloy and O'Toole (pg. 525)[70] state that "[t]he relationship between leakage and other warning behaviors may be critical for prediction, but this is an empirical question yet to be answered." The present findings go some way to addressing this by demonstrating the dynamicity of leakage as a *process*, rather than as a static indicator. The leakage component was significantly associated to the situation component. Hence, the likelihood of an offender leaking their intent may be related to their antecedent experiences.

The leakage component was also found to be significantly associated to the preparatory component. Again, this reiterates the importance of considering an offender's context. Leakage was also related to network connectivity. Hence, whether an offender leaks their intent may be related to differential experiences of acute stress in the buildup to an attack, the way they prepare for an attack, and their connectivity to others.

Therefore, relying on static profiles of these indicators as measures of relative risk may be problematic. These results reiterate findings that demonstrate the multifinality of risk indicators in threat assessment.[71] Similarly, previous research demonstrates how considering *configurations* of risk factors may provide a more in-depth insight into LAGFV. For instance, Goodwill and Meloy[72] used multidimensional scaling to identify patterns and the co-occurrence of indicators from the Terrorist Radicalization Assessment Protocol (TRAP-18).

Findings such as these provide support for a different approach to the risk analysis of this type of offender. Researchers of school shootings have advocated for a move away from researching individual risk factors, or isolated influences such as gun laws, and toward a more holistic approach that looks at the entirety of what they term "violence-

supporting settings."[73] While the present study only had scope to operationalize factors at the individual and situational levels, these findings demonstrate the potential for adopting such an approach and reevaluating the risk analysis of these offenders.

Lastly, the network component was significantly associated with the preparatory component. This association may account somewhat for the perceived differences between ideologically and unideologically motivated offenders. Research comparing the preparatory behaviors and capability of these types of offenders repeatedly finds significant differences, and therefore often asks, *does ideology matter?*[74] However, the differences between ideologically and unideologically motivated attacks are not necessarily *caused* by an extremist ideology. The causes of these differences may instead be rooted in the underlying processes that direct a person's exposure to different violence-supportive settings.[75]

Conceptual models of radicalization often refer to a "seeking" phase, whereby a cognitive opening as the result of a transitional period of acute crisis and situational interactions, motivates an offender toward a narrative that they perceive addresses their needs and/or grievance.[76] However, a person's context is likely to influence the type of settings they encounter and the types of narratives they are exposed to, through selection processes. For example, mass murderers are often white, middle-class men. Levin and Madfis[77] describe how mass murder is the outcome of a rational choice in light of a discord between an offender's expectations for their lives, and the reality they are faced with after periods of chronic strain and acute strain. Individual characteristics and the availability of violence-supporting settings may determine the nature of the narratives these offenders are likely to identify with, i.e. the mass murderer narrative that invokes fame, notoriety, revenge, or some other resolve for their grievance. In contrast, a second-generation Muslim immigrant living in an area known to contain radicalizing settings is more likely to be exposed to an Islamist-inspired narrative. The subsequent differences observed between the capabilities of these offenders, may be rooted in how identifying with these narratives facilitates wider network connections.

First, a collective ideology, central to the terrorist narrative, may foster opportunity for developing relationships with others. Whereas in mass murder, the lack of a group ideology may limit the extent to which these offenders are exposed to opportunities to form connections. Second, conceptualizing network connectivity as a component operationalized some of the factors hypothesized to sustain offender perception of capability and therefore their motivation to act. Hence, offenders who establish connections to others, here predominantly ideologically-motivated offenders, are likely to prepare for an act of mass violence differently, due to heightened, real or perceived, capability. In other words, ideology, per se, does not matter. Rather, it is a complex interaction of multiple, multilevel mechanisms, that relate to an offender's capability and motivation to commit an act of mass violence, that matters.[78]

Limitations

The present study is limited in that the data were not collected for the purpose of the present analysis and were dependent upon the available indicators. Much of the data in this space is characterized by missing data and biases with regards to the nature of what is missing.[79] Given the nature of the data, there is likely to be underreporting of certain indicators, whereby traditional news reporting favors indicators such as mental illness.

This is often a limitation of open source data. However, the present research draws inferences based on patterns of indicators, and while not exempt from the availability bias, may be more resilient to its effects. By operationalizing observable indictors that are available to analysts, while not a perfect solution, we would contend is acceptable.

More generally, the data were open source. Relying on secondary-source data collection methodologies has been criticized for resulting in data that are unreliable, subject to bias, and incomplete.[80] However, conducting research in this space necessitates researchers to make choices, while acknowledging their limitations. Open source data has been the source of a range of important findings which we cite extensively above. Robust data collection methodologies can mediate many of these concerns, as in the present study. In fact, Gill and colleagues[81] demonstrated the present data collection methodology elicited comparable results when using closed sources.

Finally, it is important to consider the treatment of missing data. When relying on open-source reporting it is difficult to decipher between missing data, and data that should be coded as "no" or "not present." The authors of these sources are unlikely to report the absence of potentially infinite indicators that may be of interest to researchers.[82] Hence, each variable 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 targeted violence has employed similar strategies.[83]

Implications for threat assessment

Research widely acknowledges that it is near impossible to accurately predict LAGFV based on static risk factors. This is largely because of low base rates, and a lack of sensitivity and specificity that results in large numbers of false positives.[84] A number of terrorism risk assessment tools exist in current practice. For example, the ERG22 +[85] and the Violent Extremism Risk Assessment (VERA-2).[86] Similarly, there are a number of mass murder risk assessment tools such as the Dallas Threat of Violence Risk Assessment (DTVRA).[87] Beyond the problems of specificity and sensitivity, a static, indicator-orientated approach to risk assessment may be problematic given the present findings, and previous research.[88] Rather, a structured professional judgment (SPJ) approach to mitigating this type of violence has been proposed.[89]

Threat assessment in the U.S. has predominantly been undertaken by separate agencies and employs a range of frameworks. For example, in cases of adolescent school shooters, the Structured Assessment of Violence Risk in Youth (SAVRY) is a SPJ tool that promotes dynamic, clinical judgments of risk.[90] Similarly, the Workplace Assessment of Violence Risk (WAVR-21) is a SPJ tool for assessing the risk of targeted violence.[91] In higher education settings, STEM summarizes four domains of concerning behaviors as guidance for local Threat Assessment Teams (TAMs).[92]

Given the evidence for reconceptualizing these types of homicide generally, our findings suggest an overarching framework for the threat assessment of LAGFV may be feasible. For instance, Meloy and colleagues[93] summarize eight warning behaviors as a SPJ framework for the threat assessment of targeted violence. This typology of warning behaviors appears in practice as part of the TRAP-18,[94] alongside ten specific background characteristics. The present study goes further by articulating *patterns* of indicators of interest to practitioners, and hence may be useful additional guidance to inform a general framework.

Such an approach relies on gathering relevant intelligence and effective decision-making. Post 9/11, counterterrorism policing has evolved toward an Intelligence-led Policing (ILP) model.[95] Given the extensive planning and preparatory behaviors of LAGFV offenders, the threat they pose is theoretically detectable. In fact, Capellan and Lewandowski[96] find encouraging evidence in support of a Secret Service ILP tool in a retrospective analysis of public mass shootings. However, for an ILP approach to be effective, multi-agency intelligence-sharing is key.[97] Relevant intel is likely to originate from a multitude of sources including mental health practitioners, police records, and the community. Hence, it is important to consider policy aimed at enabling efficient networks of intelligence sharing.

In counterterrorism, intelligence hubs such as the fusion centers in the U.S., the Integrated Security Units (ISUs) and the Integrated Threat Assessment Center (ITAC) in Canada, as well as the safeguarding hubs that operate as part of the U.K.'s PREVENT strategy, are central to such endeavors.[98] Carter and colleagues[99] conducted a survey of fusion centers and state, local and tribal agencies (SLT) and found that respondents signaled there was still a long way to go to building an intelligence capacity. Progress has been made, however there is still arguably room for improvement.

Intelligence is key to mitigating the risks of LAGFV and hence the present findings lend further support for developing a more robust intelligence-capability. A key function of these centers and their equivalents is to facilitate information sharing. Chermak and colleagues[100] state that "organizations and individuals must know how to identify relevant threat information, collect it without violating civil liberties, know who the information should be shared with, and must be willing to share it." The present findings specifically, may be operationalized as a tool for identifying relevant threat information, and more generally, may provide further evidence to continue to advocate for effective multi-agency information sharing.

One center notably facilitating intelligence-sharing is the Queensland Fixated Threat Assessment Center (QFTAC), modeled on the United Kingdom's Fixated Threat Assessment Center.[101] Within QFTAC, information is shared between the Queensland Police Service (QPS) and Queensland Health. Their Memorandum of Understanding[102] 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. It is also important to consider existing work being done by a number of agencies on a range of LAGFV offenses. For instance, the United States Secret Service (USSS), the FBI, and the U.S. Capitol Police, have conducted extensive work on targeted violence in schools[103] workplace violence,[104] violence toward members of congress,[105] lone-actor terrorism,[106] and targeted violence in general.[107]

However, the recent establishment of DHS's office for Targeted Violence and Terrorism Prevention signals a move toward implementing existing intelligence-gathering capabilities to better target LAGFV in general, nationally. Our findings could provide empirically based guidance to inform a) what sort of intelligence to collect, and b) aid decision-making in the allocation of limited resources. Since it was established, DHS released the office's strategic framework for countering terrorism and targeted violence. It outlines an enhanced intelligence-capability where DHS states (6)[108] "strong intelligence capabilities allow the Department and its partners to understand the nature of the threat facing the Homeland, allowing DHS to prevent and mitigate threats … ." The findings of the present study may provide a more nuanced understanding of the nature of the threat of LAGFV.

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