it as prudent to first clarify definitional issues and further situate the need for research on lone-actor terrorism.

Defining Terrorism

Data on terrorism for this project come from the Global Terrorism Database (GTD) (LaFree and Dugan 2007). We consider only the subset of incidents in the GTD taking place on U.S. soil. According to the GTD, a terrorist attack must be an intentional act or threat of violence whose perpetrators are sub-national actors. Additionally, two of the following three criteria must be met: there must be a political, economic, religious or social goal, the perpetrators must be trying to coerce or intimidate a group larger than the immediate victims of the attack, and the event must not be an act of legitimate warfare.

When referring to lone-actor terrorism we have in mind individuals motivated by ideological concerns and engaged in political violence "…whose *modi operandi* are conceived and directed by the individual without any direct outside command or hierarchy (Spaaij 2010, 857)."[1] The key element distinguishing lone-actor terrorism from other forms of terrorism is that lone actors operate without organizational support and are not influenced by organizational dynamics (McCauley, Moskalenko, and Van Son 2013; Moskalenko and McCauley 2011).[2]

Extant Literature on Lone-actor Terrorism

Not all scholarship uses the same definition, but in tandem with the concerns expressed by politicians and intelligence officials, a definable corpus of academic research has formed around the idea of the 'lone-actor terrorist,' although far more empirical work still exists on terrorist organizations and group-based terrorism. Importantly, few studies have compared lone-actor terrorism to other kinds of violence, political or otherwise (Borum, Fein, and Vossekuil 2012; Eby 2012; Gruenewald et al. 2013; McCauley, Moskalenko, and Van Son 2013; Spaaij 2010). Much of the literature that does exist on lone-actor terrorism focuses on psychological factors (Eby 2012; McCauley, Moskalenko, and Van Son 2013; Moskalenko and McCauley 2011; Victoroff 2005) and specifically, individual personal or dispositional factors associated with lone-actor terrorism (Borum, Fein, and Vossekuil 2012), but there is very little quantitative analysis and less comparison of lone-actor terrorism to other kinds of violence (Gruenewald et al. 2013). There is some research from other perspectives like game theory and economic analysis (Phillips 2011), but others dispute the ability to apply a rational actor model to lone-actor terrorism (Nijboer 2012).

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[1] For other definitions of lone wolf terrorism, see Eby (2012), Nijboer (2012) and Spaaij (2010).
[2] We further refine our definition of lone-actor terrorism below when presenting our empirical findings. We should acknowledge that there is a long and ongoing debate on what "terrorism" actually "means" (Asal et al. 2012). For the purposes of this project we are accepting the definition used by the Global Terrorism Database (LaFree and Dugan 2007), the source for data on the lone-actor attacks in our analysis.

The existing literature entails little consensus on what drives lone-actor terrorism. Eby argues "…that [there is] no single dispositional profile of a lone-wolf terrorist…" but that certain similar characteristics do exist (Eby 2012). In an effort to advance our understanding of lone-actor terrorists, McCauley, Moskalenko, and Van Son (2013) argue that they may be similar to assassins and school attackers, who also tend to act alone, and so examine previous studies on the characteristics of assassins and school attackers to see what we might learn about lone actors who use violence. They identify four common characteristics – "perceived grievance, depression, a personal crisis ('unfreezing'), and history of weapons use outside the military" – and allege that these characteristics may be useful in distinguishing lone actors from group-based terrorists (McCauley, Moskalenko, and Van Son 2013, 4).

As mentioned above, there are few works that analyze related questions using quantitative methods. One of the few quantitative analyses of lone wolf terrorism compares it to far right homicide and finds that individuals who perpetrated lone wolf terrorism were more likely to have military experience, to be younger, to be alienated from a partner, and to have suffered mental illness (Gruenewald et al. 2013). Gill et al. (forthcoming) also find that lone-actor terrorists were more likely to be socially isolated but connected in some way to "wider pressure groups."

In the present study we compare lone-actor terrorism with two related types of behavior – group-based terrorism and violent hate crimes. The comparison with group-based terrorism seems warranted because lone-actor terrorism and group-based terrorism are each, by definition, ideologically motivated (Asal and Rethemeyer 2008). However, prior work often assumes that lone actors operate differently with respect to targets and tactics (for an excellent review of how lone wolves are assumed to differ from other actors see Gruenewald et al. 2013), yet this is rarely empirically demonstrated.   For example Hewitt's work suggests, at least in the U.S. context, that lone wolf actors will be more lethal than other types of terrorists (2003). Spaaij (2011) also points out that lone wolf terrorists are different from other types of terrorists in their choice of weaponry with a preference for firearms as opposed to bombings. We think time is well spent conducting quantitative analyses that examine whether lone-actor terrorism is indeed so distinct from terrorism perpetrated by organizations with a hierarchical structure.

The comparison with violent hate crimes seems equally prudent. On the surface it appears that lone-actor terrorists and hate crime offenders share certain tendencies. Hate crime offenders are rarely part of an organization, and hence perpetrators are not embedded in a hierarchical structure, akin to lone-actor terrorists. Each type of behavior also expresses a prejudice against the target or what the target stands for, and each transpires with intent to intimidate a broader group. Further, and like lone-actor terrorism, some scholars argue that hate crimes have been strongly tied to the white supremacist movement in the United States (Hamm 2002). In addition, some white supremacist leaders view hate crimes as a component of leaderless resistance (Michael 2012, 47), which again shares an affinity with lone-actor terrorism. Finally, some researchers argue that hate crimes should fundamentally be thought of as terrorism given their politically motivated nature, though others disagree (Forst et al. 2011; Simi 2010).

In the end we have an empirical question – is lone-actor terrorism distinct when compared to violent hate crimes or group-based terrorism? We think answering this question has notable implications. For instance, if lone-actor terrorism is becoming more common but remains less deadly than group-based attacks, are we then better off redirecting scarce intelligence resources toward fighting other types of threats? And on that note, are claims about the rise of lone-actor terrorism warranted based on available data? Also, if lone-actor terrorists are akin to hate crime offenders, then are the same law enforcement tools used to counter hate crimes, e.g., deterrence, the most effective options for countering lone-actor terrorism? We cannot definitively answer each of these questions, but we shed light on these issues in the following analysis.

Data Sources and Integration

This project necessitated the integration of several data sources that had to be organized at both the county and national levels over a period of nineteen years (1992-2010). Our analysis begins in 1992 because this is the first year in which hate crime data were available, and we end with the year 2010, the last year for which the raw hate crime data were available at the beginning of this project.

Violent Hate Crime

The original source of the hate crime data was the Federal Bureau of Investigation's (FBI's) annual hate crime statistics files. For data collection purposes the FBI defines "a hate crime… [as] a criminal offense committed against a person, property, or society that is motivated, in whole or in part, by the offender's bias against a race, religion, disability, sexual orientation, or ethnicity/national origin." Law enforcement agencies throughout the United States have been asked to submit counts of hate crime incidents in their respective jurisdictions, and to the extent possible, record information on the nature of the offense, the characteristics of the victim (e.g., person, business), offenders (e.g., race, if known), and location, among other data pertinent to the offense under the Hate Crime Statistics Act (HCSA) of 1990. Under-reporting of incidents has been a problem since the onset of the data collection endeavor, particularly in the early years of the reporting program. However, participation by local law enforcement agencies has steadily improved over the life of the program, and if due caution is given to reporting differences across agencies, then the data can be useful for our purposes. As explained below, our analysis takes into account hate crime reporting tendencies in counties.[3]

The FBI provides summary statistics for each year on its website, yet our inquiry required more finely grained temporal units than annual estimates. Accordingly, we retrieved the raw data from the Inter-University Consortium for Political and Social Research (ICPSR). These incident-level hate crime files include the date and place of the incident, which allowed us to create a dataset that contains information on every county in the United States for each year between 1992 and 2010. The geographic identifiers in

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[3] For more on hate crime reporting issues, see McVeigh et al. 2003 and King 2007.

the hate crime data also allowed us to merge these data with the GTD data on terrorist attacks taking place on U.S. soil. This merger resulted in a dataset that includes information on hate crimes, lone-actor terrorism, and group-based terrorism by county and by year for a period of nineteen years.

In this report we focus on violent hate crimes. The raw FBI data include offense codes, and we classify a crime as violent if it falls into one of the following categories: murder, non-negligent manslaughter, justifiable homicide, kidnapping or abduction, forcible rape, forcible sodomy, sexual assault, fondling, robbery, aggravated assault, or simple assault. We do not include the categories of 'intimidation' if no additional violence was reported. Among the violent categories the overwhelming majority (more than 90%) were aggravated or simple assault. Violent hate crimes account for approximately 40% of all hate crimes occurring between 1992 and 2010. We chose to focus on violent hate crimes since these crimes are most likely to share similar characteristics to terrorism since terrorism, by definition, includes the threat or use of violence.

Terrorism

Our terrorism data is derived from the GTD, which was originally assembled from data collected by Pinkerton Global Intelligence Service (PGIS) on terrorist activity worldwide between 1970 and 1997. The construction of the current GTD began in 2002 when a team of researchers digitized the data originally collected by PGIS, and since 2005 the National Consortium for the Study of Terrorism and Responses to Terrorism (START) has updated and maintained the GTD, which is currently the most comprehensive unclassified database on terrorist attacks in the world (LaFree and Dugan 2007).

Again, the GTD defines terrorism as *the threatened or actual use of illegal force and violence by a non-state actor to attain a political, economic, religious, or social goal through fear, coercion or intimidation.*[4] This project only used terrorist attacks that took place on U.S. soil. Attacks were categorized as lone-actor terrorism or group-based terrorism using both the information in the GTD as well as other sources. First, the GTD has information on the name of the group carrying out an attack. Some groups are listed as "unknown," and other are listed as "individual." If the GTD identified an attack as carried out by an individual, then it was considered a lone-actor attack in our dataset. Next, attacks that might be carried out by specific individuals or by entities that could consist of individuals or groups, for example, anti-abortion attacks, were examined as potential lone-actor terrorist attacks. In cases where the name of the individual, or in some cases the duo or trio,[5] carrying out the attack was known, we searched for information linking that individual to a known terrorist organization. We utilized both data in the

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[4] For a detailed description of how terrorism is operationalized in the dataset please see the codebook, which is available at: http://www.start.umd.edu/gtd/using-gtd/. Also, although the GTD does not include plots, conspiracies, or hoaxes, it does include attacks that were attempted but ultimately unsuccessful. The minimum threshold for inclusion of unsuccessful attacks in this sense is that the perpetrators have taken action toward carrying out the attack. In other words, they were "out the door" intending to imminently attack their target (LaFree, Dugan, and Miller 2012).

[5] There were some cases of duos or trios acting together with no evidence of organizational support. These acts were considered lone-actor terrorism. The largest "group" committing lone-actor terrorism consisted of three individuals.

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Terrorism and Extremist Violence in the U.S. (TEVUS) database and Google searches for evidence of these links. If no evidence was found, then it was assumed that the individual was involved in a lone-actor attack. Also, if the individual's name was unknown, we researched the actual terrorist event to determine if a terrorist organization was ever linked to it.

Our analysis also made use of several variables provided in files from the U.S. Census Bureau and the FBI. Among the variables examined in concert with terrorism and hate crime data are the violent crime rate,[6] population structure, median household income, unemployment, urbanicity, racial demographics, and property ownership. These data, like all other information, were integrated into the master file using county-specific Federal Information Processing Standards (FIPS) codes and year variables.

Analysis

We used summary statistics and regression models to examine three types of violence: lone-actor terrorism, group-based terrorism, and violent hate crimes. The summary statistics provide general information on the timing, location, methods, and targets of each type of violent activity. The regression models provide more detailed information about the characteristics of the communities where each type of violence is likely to occur. We make one caveat though before reporting our findings. This analysis is probabilistic rather than deterministic. Akin to the study of earthquakes in the geological sciences, we can point to risk factors, but predictions are inherently difficult and highly error prone. That is, we can point to geographic areas that have historically been at higher risk of lone-actor terrorist attacks, and we even know something about the 'aftershocks' when a lethal attack occurs (see Deloughery, King and Asal 2012; King and Sutton 2013). We can also state with confidence that lone-actor terrorist attacks follow a "power law distribution"– i.e., less lethal attacks occur with greater frequency than those resulting in numerous fatalities. But we detect no linear pattern in the data that would enable us to predict the time and place of lone-actor terrorist attacks with certainty. With this caveat in mind, we still think knowledge of risk factors along with an understanding of similarities and differences between hate crimes, group-based terrorist attacks, and lone-actor terrorist attacks can be useful from an intelligence perspective and inform strategies for prevention, such as target hardening or law enforcement deployment.

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[6] Violent crimes include murder and non-negligent manslaughter, forcible rape, robbery, and aggravated assault. Property crimes include burglary, larceny-theft, motor vehicle theft, and arson. The combined total, often referred to as Part I offenses or index crimes, was divided by the total population and then multiplied by 100,000 to calculate the index crime rate for each county. The FBI uses an imputation algorithm to adjust for incomplete reporting by some law enforcement agencies. For more information and an assessment of the FBI imputation procedures, see Lynch and Jarvis (2008). We also note that some violent and property crimes that were motivated by hatred or bias (i.e., hate crimes) may be included in the index crime rate, but hate crimes constitute such a small proportion of index crimes that their inclusion does not introduce significant bias into statistical models. For instance, in 2008 there were approximately 11.2 million violent and property crimes and 7,783 hate crimes reported across the nation, and thus only a fraction of a percentage of the reported violent and property crimes were hate crimes.

Key Findings

Descriptive Comparisons

We begin with some descriptive information about the two forms of terrorism and violent hate crimes over time and across states to assess whether common patterns emerge in their respective temporal and spatial distributions. Figure 1 shows the raw numbers of violent hate crimes along with the number of lone-actor and group-based terrorist attacks by year between 1992 and 2010. During this period, a total of 525 terrorist attacks occurred. Of those attacks, 101 were carried out by lone actors while 424 were group-based terrorist attacks. Violent hate crimes were a much more common phenomenon with over 46,000 events taking place during the same time period. We think two points are noteworthy. First, when we look at the aggregate numbers over time without considering the geographic or social locations of the attacks (i.e., the population characteristics of the places where they occurred) there is no apparent correlation between lone-actor terrorism and violent hate crimes. The yearly count of violent hate crimes stayed pretty constant over the observation period with perhaps a slight decline since 2001, when a wave of hate crimes followed the September 11, 2001 attacks. In other words, we caution against using trends in one behavior to forecast or make predictions about the other, at least with respect to national levels over time. Second, we find a moderate correlation between group-based and lone-actor terrorism (Pearson correlation is 0.41 over this 19-year period). This indicates that trends in lone-actor attacks are not entirely distinct from group-based terrorism. This does not imply that they have the same causes, targets, or tactics, but that temporal fluctuations are similar.

Figure 1. Terrorism and Violent Hate Crimes by Year
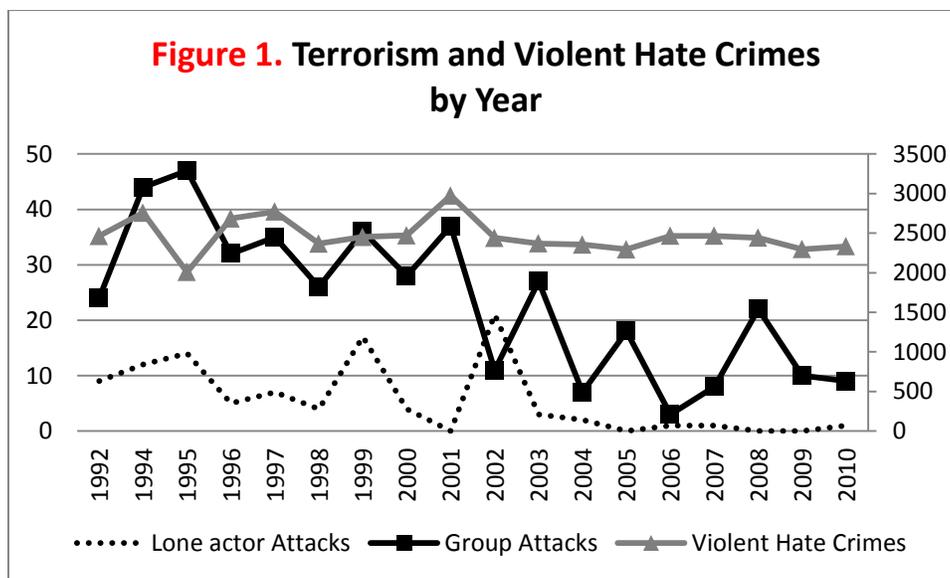
Source: Global Terrorism Database and FBI Uniform Crime Reports

We next looked at the distribution of terrorism and violent hate crimes across states. Table 1 shows the rank order of states based on the number of terrorist attacks or violent hate crimes perpetrated during

our time period of interest, as well as the number of attacks that occurred in each of these states. California leads in all three categories, largely because of the state's incredible size – about one in every eight people in the country reside in California. A close look at the listing of states shows that lone-actor terrorism is distinct in its general geography. New York, which is second to California in the number of group-based terrorist attacks and third in violent hate crimes (trailing Michigan by fewer than 40 violent hate crimes), does not appear in the ten states that have experienced the most lone-actor terrorist attacks.

Also noteworthy is the relationship between the population of the states and the types of violent crimes they experience. Each of the ten states that experienced the most violent hate crimes is among the 15 most populous states in the nation, and this is true for eight of the ten states that experienced the most group-based terrorism. Yet this is true for only three of the ten states with the most lone-actor terrorism. We return to this in our report summary, but a provisional explanation may be that opportunity drives many violent hate crimes (mindful that we're looking at raw numbers; not rates in this table) and that population centers may be attractive to groups that target major businesses, government buildings, or seek to cause mass carnage. However, it may be the case that lone actors on average seek different types of targets that more often appear in sparsely populated states (e.g., New Mexico, Nebraska, Iowa) or that the motivations associated with lone-actor terrorism correlate with distinct characteristics of the populations in those states. We return to the latter issue below when discussing targets.

Table 1. **Ten States with Most Reported Lone-actor Terrorism, Group-based Terrorism, and Violent Hate Crimes, 1992 – 2010**

Lone-actor Terrorism	Group-based Terrorism	Violent Hate Crimes
California (16)	California (75)	California (10,364)
New Mexico (9)	New York (43)	Michigan (2,885)
Nebraska (7)	Washington (24)	New York (2,649)
Oklahoma (6)	Oregon (22)	Texas (2,566)
Oregon (6)	Florida (22)	Illinois (2,270)
Iowa (5)	Michigan (16)	Massachusetts (1,966)
Virginia (5)	Illinois (15)	Florida (1,921)
Colorado (4)	Arizona (15)	New Jersey (1,599)
District of Columbia (4)	Texas (13)	Arizona (1,549)
Florida (4)	District of Columbia (11)	Ohio (1,540)

Sources: Global Terrorism Database and FBI Hate Crime Statistics.

A third comparison looks at the two types of terrorism with respect to targets (see Table 2). We do not include hate crimes in this table because the FBI uses a different system of categorization and hence the target types are not directly comparable. An important difference between the targets of the two types of terrorism is apparent in the first row of the table – between 1992 and 2010, lone-actor terrorism was far more likely than group-based terrorism to have abortion-related targets (48% of lone-actor attacks

compared to 17% of group-based attacks). Similar percentages of lone-actor and group-based terrorist attacks had private citizens and property as their targets (roughly 20%), but group-based terrorism was more apt to target government entities and businesses (40% combined). By comparison, fewer than 15% of lone-actor attacks had governments or businesses as their targets. This is not to say that lone actors do not act out in response to government actions or express grievances against governments. The recent Boston bombings are a case in point. Yet the targets of lone actors tended to be private citizens and abortion facilities. We cannot discern in this research whether lone actors chose these targets because they suited the lone actors' motivation or because they lacked the sophistication to attack more secure government or business facilities. It is also worth noting that lone-actor attacks against abortion clinics tended to happen earlier in the time period covered by the sample. Anti-abortion attacks peaked in the early 1990s with 32 attacks occurring between 1992 and 1994. After 1994, there was only one year, 1999,[7] with more than five anti-abortion terrorist attacks. Therefore, this pattern may be changing over time.

Table 2: **Target by Type of Terrorism (Group-based vs. Lone-actor)**

Target Type	Group-Based Terrorism	Percent of Group-based Attacks	Lone-actor Terrorism	Percent of Lone-actor Attacks
Abortion-related	73	17%	49	48%
Private Citizens & Property	80	19%	22	22%
Government (General)	53	13%	8	8%
Business	112	27%	6	6%
Religious Figures/Institutions	18	4%	6	6%
Educational Institution	28	7%	3	3%
Military	8	2%	2	2%
Other	6	1%	2	2%
Airports & Airlines	3	1%	1	1%
Government (Diplomatic)	2	<1%	1	1%
Other	35	8%	1	1%
Total	**418**	**100%**	**101**	**100%**

Source: Authors' compilation from Global Terrorism Database.

Another way to compare violent behaviors is by looking at the method of attack, e.g., armed assault, hijacking, bombing. Here again the FBI and GTD data do not allow for useful comparisons because of differences in the way data are recorded. However, evidence suggests that very few violent hate crimes

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[7] There were seven anti-abortion attacks in 1999.

involve weapons. Specifically, when looking at weapons violation offenses in the FBI hate crime data we see that approximately one-tenth of one percent of violent hate crimes entail weapons charges.[8] Many hate crimes may be violent, but fists and blunt objects are more commonly the weapon of choice. By comparison, weapons and explosives are far more common in terrorist attacks, and in this respect group-based attacks and lone-actor attacks are generally similar (see Table 3). Between 1992 and 2010, roughly half of group-based and lone-actor attacks involved facility or infrastructure attacks[9] and about 10% of each were armed assaults. A slightly higher percentage of group-based attacks were assassinations, although assassination is rare for either type of terrorism (6% and 2%, respectively). Also notable is that lone-actor attacks were more likely (36%) than group-based attacks (26%) to use explosives or bombings.

Table 3: **Attack Method by Type of Terrorism (Group-based vs. Lone-actor)**

Attack Method	Group-Based Terrorism	Percent of Group-based Attacks	Lone-actor Terrorism	Percent of Lone-actor Attacks
Facility/Infrastructure Attack	216	53%	49	49%
Bombing/Explosion	105	26%	36	36%
Armed Assault	40	10%	9	9%
Assassination	23	6%	2	2%
Unarmed Assault	13	3%	2	2%
Hijacking	4	1%	0	0%
Hostage Taking (Barricade Incident)	2	0%	1	1%
Hostage Taking (Kidnapping)	1	0%	0	0%
Total	**404**	**100%**	**99**	**100%**

Source: Authors' compilation from Global Terrorism Database.

Before moving on, we think the available evidence requires us to pause and think twice about claims of a "growing threat of lone wolf terrorism" (this quote is the title of Chapter 1 in Simon, 2013). Terrorism of any kind is threatening, and our collective endeavor as social scientists and practitioners is to understand the nature of the threat in order to address it. But Figure 1 above indicates that lone-actor terrorist attacks were extremely rare between 2005 and 2010, with either zero attacks or one attack occurring per year. To be clear, one attack is one too many, but statements about the growing threat are true in that

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[8] The FBI hate crime files are organized by incident, but a single incident may have multiple offenses. For example, a robbery may be perpetrated with a stolen weapon, and hence three offense codes could be included (robbery, theft, and weapons violation). We included the first three offenses when counting weapons violations.
[9] Facility and infrastructure attacks are attacks where the damage is directed towards non-human targets. Usually buildings, monuments, and transportation infrastructure are targeted in these attacks.

they can *only* go up from 2005-10 levels. There are two important caveats to this statement. First, our data only go through 2010. It is possible that evidence from 2011, 2012, and 2013 may show that the number of lone-actor attacks is increasing, not only compared with the 2005-2010 level, but also during this three-year span we have not examined. Second, our dataset only contains open source information on terrorist attacks. Therefore, we may be missing lone-actor attacks that were stopped by law enforcement in early stages of planning. This is worth noting because of a second and related point. Group-based terrorism tends to be more lethal. For example, more people were killed in the September 11, 2001 attacks than in all lone-actor terrorist attacks during our observation period combined. The September 11, 2001 attacks were the most lethal group-based terrorist attacks in U.S. history, killing almost 3,000 people. The most lethal lone-actor attack on U.S. soil was the Oklahoma City Federal Building Bombing in 1995. In contrast, 168 people died in that attack. Pulling those two outliers out of the sample, between 1992 and 2010 lone-actor terrorism averaged 0.125 fatalities per attack while group-based terrorism averaged 0.211 fatalities per attack. Again, we do not want to minimize the threat of lone-actor terrorism, and it's plausible that claims about the growing threat posed by lone-actor terrorists are accurate. But such speculation must be balanced against the available data and the lethal capabilities of lone actors relative to groups.

County-Level Factors Associated with Terrorism and Hate Crimes

The next step in this project was to merge census data with the respective datasets on violent hate crimes, violent crime more generally, and group-based and lone-actor terrorist attacks. Integrating these data enables us to (1) determine whether the population and economic characteristics of counties may be risk factors for experiencing violent hate crimes or terrorist attacks and (2) determine whether the models predicting these behaviors look similar. Table 4 below shows the coefficients from a random effects negative binomial regression model. Social scientists often use regression analysis when assessing the effects of multiple variables simultaneously, and since the 'negative binomial' estimator is designed to model numbers of events and assumes non-negative numbers, it is well suited for our variables of interest (violent hate crimes, group-based terrorism, and lone-actor terrorism). A 'random effects' model simply allows the researcher to consider that there are random characteristics of the year or county that are unobservable, and thus unmeasured in our data. The coefficients of these models allow us to examine how each of these characteristics affects the level of violence. We note that each model controls for the year that violence took place, although to conserve space these results are not shown in the table.[10] We show the results of nearly identical models side-by-side in Table 4, with perhaps the most notable difference being the inclusion of the hate crime law compliance measure in Model 1. This variable indicates the percentage of the population in a given county covered by local law

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[10] Negative binomial regression models assume that the dependent variable (violent hate crimes, group-based terrorist attacks and lone-actor terrorist attacks here) is a non-negative integer, such as the number of attacks in a given county and year. The model allows us to account for the 'at risk' population by including what is known as a "population offset" or "exposure parameter" in the model. This is typically included as the natural log of the number of persons at risk of the behavior in question. In model 1 of table 4 we use the total population as the offset. We note that other models examining more specific attacks, such as anti-black hate crimes, with more specific exposure parameters, such as the log of the black population in the county, yielded remarkably consistent results.

enforcement agencies that complied with the Hate Crimes Statistics Act (HCSA 1990) by submitting data (either zero or 1+ hate crimes) to the FBI. This variable, which as expected is positive and statistically significant, helps control for reporting differences across counties and over time. However, this variable is not included in Models 2 and 3 since it should not have explanatory power related to the number of terrorist attacks.

We first point out some commonalities across models. For instance, a handful of demographic indicators are consistently associated with violent attacks across all three models. Each type of violent attack is positively correlated with population size, indicating that larger population centers are generally more at risk of experiencing these types of attacks. Second, we were struck by the consistency of the relationship between these types of violent attacks and the percentage of residents owning and occupying a home. In each case more home ownership is associated with a lower expected number of violent attacks, regardless of whether we look at violent hate crimes, group-based terrorism, or lone-actor terrorism. Also intriguing is that unlike violent crime, which decades of criminological research has shown is more prevalent in places where a larger percentage of the population is non-white, we find the opposite here. Each type of behavior in question – violent hate crimes and the two types of terrorism – is positively associated with the percentage non-Hispanic whites in the county. The hate crimes literature suggests this pattern emerges because there is essentially safety in numbers, so where few minorities are present they are less protected and more prone to attack from majority groups (see Green et al. 1998). We can only speculate as to why this might be the case for terrorism, be it group-based or lone-actor. To further advance understanding of this relationship would necessitate data on the demographics of victims and offenders, which is beyond the scope of this inquiry.

There are also a few noteworthy differences among the models, especially with respect to the model of lone-actor terrorist attacks. For one, lone-actor terrorism is not statistically associated with the percentage of residents living in urban environments, whereas this is a robust predictor of violent hate crimes and group-based terrorism. The numbers of group-based terrorist attacks and violent hate crimes tend to be higher in areas where unemployment is high, but this is not the case for lone-actor terrorism, which tends to occur in areas with lower unemployment. Finally, the age structure of the county – specifically, the percentage of the male population in the county that is between 15 and 24 years of age – shows inconsistent effects. This variable is positive and statistically significant when modeling violent hate crimes and group-based terrorism, but negative and statistically significant when modeling lone-actor terrorism. This means that unlike violent hate crimes and group-based terrorism, which tend to occur more often in areas where a higher percentage of the male population is between 15 and 24 years of age, the opposite is the case for lone-actor terrorism. When considering the unique associations that lone-actor terrorism has with counties with lower percentages of residents living in urban environments and lower percentages of the male population between 15 and 24 years of age, as well as the descriptive work showing lone actors tend to attack in less populated states, we can surmise that lone-actor terrorists may be a more serious threat outside the major population centers than in larger cities.

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Table 4: Models of Violent Hate Crimes, Group-based Terrorist Attacks, and Lone-actor Terrorist Attacks at the County Level, 1992 – 2010

Variable	Model 1 Violent Hate Crimes	Model 2 Group-Based Terrorist Attacks	Model3 Lone-actor Terrorist Attacks
Hate Crime Reporting Compliance	0.023*** (0.0005)		
Violent Crime Rate	0.0014** (0.0014)	0.002 (0.002)	-0.005 (0.013)
Unemployment Rate	0.034*** (0.0068)	0.083** (0.034)	-0.143* (0.085)
Median Household Income	0.0000048** (0.0000019)	0.000019 (0.0000096)	-0.00041* (0.00002)
Population (logged)	0.568*** (0.022)	0.906*** (0.095)	0.666** (.0167)
Percent Owner Occupied Houses	-0.015*** (0.003)	-0.056*** (0.012)	-0.103** (0.027)
Percent on Public Assistance	-0.043*** (0.010)	0.007 (0.048)	0.0797 (0.088)
Percent non-Hispanic White	0.018*** (0.001)	0.0207** (0.006)	0.0311** (0.011)
Percent of Males between Age 15-24	0.019*** (0.019)	0.037** (0.019)	-0.102** (0.044)
Percent Urban	0.009*** (0.001)	0.0126** (0.013)	0.013 (0.010)
Constant	-12.45	-14.18	-4.033
Observations	56,859	56,859	56,859
Log Likelihood	-29,693.51	-1,494.17	-457.17

*** Significant at the 1% level

** Significant at the 5% level

* Significant at the 10% level

Using Predicted Values to Assess Whether Models of Violent Hate Crimes or Group-based Terrorism Better Predict the Levels of Lone-actor Terrorism

Next, we used the information from Model 1 and Model 2 in Table 4 to create predicted values of the levels of violent hate crimes and group-based terrorist attacks by county by year. These predicted values were then used to determine whether the model of violent hate crimes or group-based terrorism better

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predicted the levels of lone-actor terrorism.[11] First, predicted values of violent hate crimes and group-based terrorism were generated using Model 1 and Model 2, respectively. Second, these predicted values were compared to the actual levels of lone-actor terrorism to determine which model best predicted these levels. The model that best predicts the levels of lone-actor terrorism minimizes the sum of the squared values of the differences[12] between the actual levels of lone-actor terrorism by county by year and the levels predicted based on the model.[13]

Table 5: **Sum of Squared Errors between Actual Levels of Lone-actor Terrorism and Levels Predicted based on Models of Violent Hate Crimes and Group-based Terrorism**

	Violent Hate Crimes	Group-based Terrorism
All Lone-actor Terrorism	6.11	70.82
Anti-Abortion Lone-actor Terrorism	5.88	68.13
Non-anti-abortion Lone-actor Terrorism	5.89	68.14

In Table 5, the sum of squared errors between actual lone-actor terrorist attacks and the values predicted by the models of violent hate crimes and group-based terrorism are presented.   When considering all lone-actor terrorism, the model for violent hate crimes does a much better job of predicting the level of lone-actor terrorism in a county. In fact, the model for violent hate crimes is better at predicting the level of lone-actor terrorism by a factor of 10.   This finding continues to hold when we only include counties where at least one lone-actor terrorist attack took place during the course of the year being examined.

Additionally, for each year taken separately (1992-2010) the models' predictions were compared to the true levels of lone-actor terrorism. For each year of the sample, the model for violent hate crimes performs better at predicting where lone-actor terrorism occurs. Similarly, this comparison was performed for each state taken on its own. While the model for violent hate crimes predicts the level of lone-actor terrorism better in some states than others, for each state the model of violent hate crimes predicts the data on lone-actor terrorism better than the model of group-based terrorism does.

Finally, the lone-actor terrorist attacks were analyzed based on whether or not the attacks were anti-abortion.[14] Again, the predictions based on the models of violent hate crimes and group–based terrorism were compared to the actual levels of anti-abortion lone-actor terrorism and other types of lone-actor terrorism. The last two rows of Table 5 show that the model of violent hate crimes better predicts the levels of lone-actor terrorism for both anti-abortion lone-actor terrorism and other forms of lone-actor terrorism. Further, given that the model of violent hate crimes better predicts the levels of lone-actor terrorism across states, years, and types of terrorism, it is safe to assume that a better understanding of

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[11] The predictions in this section are based on the assumption that the models presented in Table 4 are the correct models for violent hate crimes and group-based terrorism.

[12] In econometrics, this value is referred to as the sum of squared errors.

[13] The sum of squared errors was divided by the number of observations to normalize comparisons.

[14] Since anti-abortion lone-actor terrorism accounted for nearly half of all lone-actor terrorism included in this study, it is important to ensure that the findings in this section are not being driven completely by this type of terrorism.

the locations of lone-actor terrorism might be obtained through a study of the locations of violent hate crimes versus the locations of group-based terrorism.

Conclusions

In examining lone-actor terrorism, we took a three-pronged approach. First, we compared descriptive statistics on the timing, locations, methods, and targets of violent hate crimes, group-based terrorism, and lone-actor terrorism. Second, each of these violent attacks was modeled by county and by year to determine which characteristics of an area were likely to be associated with these three types of violence. Finally, models for violent hate crimes and group-based terrorism were used to predict levels of lone-actor terrorism. These predicted levels were compared to the actual levels of lone-actor terrorism to determine which model best predicted the lone-actor data. Some conclusions from this three-pronged approach are detailed below.

1. Lone-actor terrorism is not a mirror image of either group-based terrorism or violent hate crimes. It shares some similarities with each.
2. Year-to-year changes in lone-actor terrorism are moderately correlated with group-based terrorism, indicating that the two seem to ebb and flow together rather than one replacing the other. There is no discernible correlation between violent hate crimes and lone-actor terrorism from year-to-year.
3. Higher percentages of lone-actor terrorist attacks seem to involve explosives compared with violent hate crimes and group-based terrorist attacks. Further, higher percentages of lone-actor terrorist attacks seem to be abortion-related compared with group-based terrorist attacks. Knowing these tendencies could provide local law enforcement with useful information. For instance, knowing the types of targets and means of attack can assist with 'target hardening', which refers to efforts to enhance the security of potential targets in order to make attacks more difficult. The precise means of target hardening may depend on the specific characteristics of a facility.
4. Similar to findings related to violent hate crimes and group-based terrorism, there is evidence that areas with higher rates of home ownership are at a lower risk of experiencing lone-actor terrorism. This is likely for two reasons: (1) home owners may exert more control and surveillance over their immediate neighborhood, and (2) there are likely fewer suitable targets, e.g., fewer businesses, abortion clinics, government buildings, in residential areas with high home ownership rates.
5. Models of violent hate crimes did a better job than models of group-based terrorism at predicting where and when lone-actor terrorist attacks occurred.

In sum, this research has extended the current literature on lone-actor terrorism, a phenomenon which is of great policy importance but which has not been studied extensively in academia. Our results do not call for a specific strategy, but we have made headway by showing tendencies in the data and by

examining the lethality of lone-actor attacks relative to other types of violence (e.g., group-based terrorism). With this information, counterterrorism officials will be better informed about the characteristics of the time and areas where lone-actor terrorism is most likely to occur. Finally, discovering that compared with a model of group-based terrorism, a model of violent hate crimes better predicts where and when lone-actor terrorism occurs increases our knowledge about this phenomenon by comparing it with a type of violence that both academics and practitioners understand more fully.

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