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When Suicide Kills: An Empirical Analysis of the Lethality of Suicide Terrorism

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Why are some suicide terrorist attacks deadlier than others? Suicide bombers, unlike stationary bombs, are self-guided human weapons; they can deliver and detonate explosives at a specific time and place with precision. Coding and analyzing new data on over four hundred suicide terrorist incidents from all around the world between 1998 and 2015, this paper argues that the number of fatalities resulting from suicide attacks is a function of strategic choices made by the perpetrators, such as where to attack and whom to target. Results of this analysis show that suicide attacks that seize targets of opportunity are the most lethal. Specifically, suicide attacks that target civilians in enclosed and easily accessible places, and that are undertaken by multiple perpetrators result in the highest numbers of fatalities. Understanding these strategic tactical attributes of suicide terrorism is fundamental to devising effective counterterrorism strategies that aim at hardening soft targets and minimizing the lethal impact of these attacks.

Keywords: suicide terrorism, lethality, tactical attributes

Introduction

Suicide terrorism is distinguished from other terrorist attacks by the manner of execution. To be successful, suicide attacks require the self-destruction of a politically motivated perpetrator along with the victims. Hence, the role of the suicide bomber is crucial in any suicide operation: they are "guided bombs with eyes and a brain" knowing where to go and whom to attack in order to do the most substantial damage and kill their intended targets (Roberts 2006). To an outsider, the choice of suicide terrorism might seem an absurd and irrational decision. However, many people still aspire to become suicide bombers and a growing number of terrorist organizations recruit and invest in suicide bombers by indoctrinating them, training them, and funding their missions. Despite all the new technology and innovative weapons systems, suicide terrorism still remains a very attractive tactic to terrorist organizations worldwide. This is because suicide terrorism is fatally attractive. In other words, suicide terrorism is a popular choice among perpetrators because it is an extremely effective strategy for terrorizing by killing. When the global trends are examined, one can see that, even though suicide attacks constitute a very small percentage of terrorist incidents worldwide, they generate larger numbers of fatalities than do non-suicide attacks. As Figure 1 shows, from 1970 to 2015, only 3 percent (4,771) of the 156,772 terrorist attacks globally were suicide terrorist incidents.

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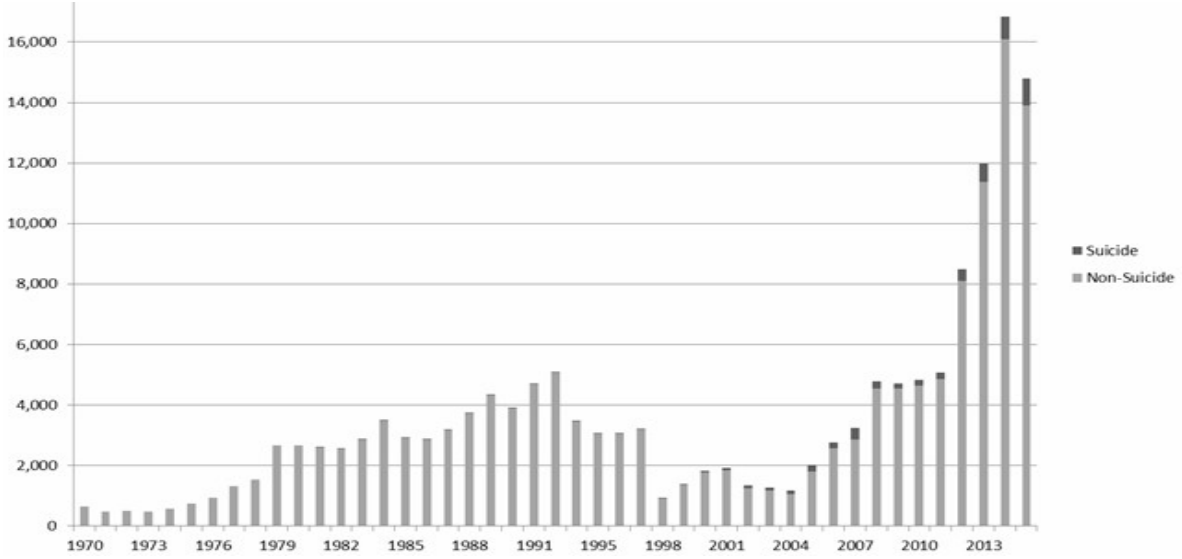
Figure 1: Suicide and non-suicide terrorist incidents, 1970–2015

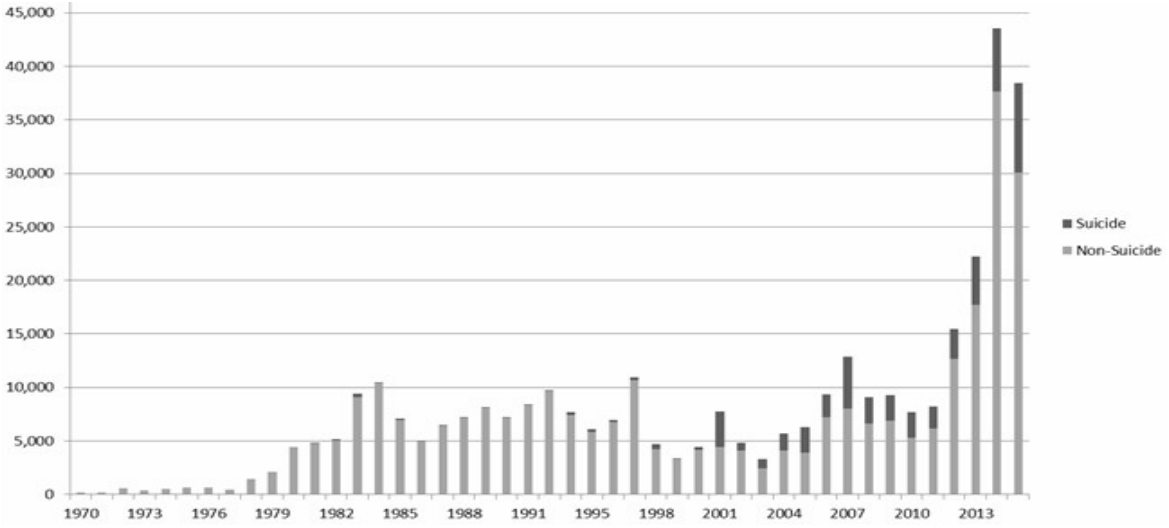


Source: National Consortium for the Study of Terrorism and Responses to Terrorism (START) (2016)

However, despite the relatively small proportion of suicide terrorist incidents overall, the number of fatalities from suicide terrorist incidents is remarkably high compared to non-suicide terrorist attacks. Figure 2 shows that suicide terrorism–related fatalities make up about 14 percent of total terrorism-related deaths across the world from 1970 to 2015. When only the most recent period from 2010 to 2015 is considered, the figure rises to an astonishing 19 percent.

Despite its simplicity, suicide terrorism generates deadly and psychologically devastating consequences not only for the immediate victims, but also for populations at large (Sprinzak 2000; Ganor 2002). As Bruce Hoffman (2003, para. 1) put it:

Figure 2: Fatalities from suicide and non-suicide terrorist incidents, 1970–2015



Source: National Consortium for the Study of Terrorism and Responses to Terrorism (START) (2016)

"First you feel nervous about riding the bus. Then you wonder about going to a mall. Then you think twice about sitting for long at your favorite café. Then nowhere seems safe." Lethal suicide attacks are particularly effective in instilling fear, making people wonder if they might be present when the next suicide bomber strikes. While it is extremely difficult to know who the next victims will be, it is possible to understand the kinds of decisions perpetrators make in order to enhance the lethality of their attacks. Gaining insights into which suicide attacks are most deadly and why is crucial to protecting civilians, and ultimately to preventing future attacks.

While suicide terrorism does tend to kill more people than other types of terrorism, not all suicide attacks are equally fatal. There is in fact wide variation in the fatality counts. This paper seeks to understand why this is the case: Why are some suicide attacks deadlier than others? Using newly coded data, this study argues that the lethality of suicide terrorism is a function of the strategic choices made by the perpetrators concerning how, where, and whom to attack. The tactical advantages of suicide terrorism derive from the presence of human bombs and the considerable control that perpetrators have over their attacks. However, some human bombs are deadlier than others precisely because of the strategic choices they make in terms of target selection, attack location, weapon choice, and involvement of multiple perpetrators. The evidence from this study suggests that the lethality of suicide terrorism depends strongly on these strategic choices.

This is not to say that all suicide terrorist attacks are lethality-driven or that the main goal of all suicide terrorism is to maim and kill indiscriminately. In fact, certain suicide attacks are designed to be discriminate, such as when a suicide bomber is sent on a mission to deliver and detonate explosives near a high-profile target. The assassinations of Indian Prime Minister Rajiv Gandhi and Sri Lankan President Ranasinghe Premadasa represent two examples of discriminate suicide bombings. However, the existence of such cases does not change the importance of understanding lethality in and of itself, or the fact that differences in lethal outcomes of suicide terrorist attacks remain a function of strategic and tactical decisions.

Existing studies that examine terrorism as a strategy generally grapple with the issue of effectiveness. Specifically, they seek to understand whether resorting to terrorism helps terrorist groups achieve their policy objectives and stated goals (Abrahams 2006; Lutz and Lutz 2009; Gould and Klor 2010). The problem with measuring effectiveness against the stated goals of terrorist organizations is that there are almost always many ambiguous and conflicting goals, which change over time. Terrorist groups may be driven by economic motives, political and social issues, or a religious ideology. Their ultimate goals may vary from forcing the target government to make certain concessions to establishing a homeland, or forcing foreign troops out of territory they claim as their own. Some of these goals may exist simultaneously. In other words, motivations can be hard to know and difficult to quantify.

This is one reason that this study chooses to focus on lethality as its primary outcome. Lethality is a reliable measure of effectiveness: unlike the stated goals of organizations that are subject to change, lethality is precise and less subjective. In addition, lethal attacks serve important functions as far as perpetrators are concerned. They signal greater resolve and commitment by imposing significant costs on the other side, they attract more media attention and generally lead to severe economic consequences (Kydd and Walter 2006; Nacos 2000; Krugman 2004; Clauset, Young, and Gleditsch 2007). This is why many scholars argue that accomplishments of terrorists should be defined in terms of the magnitude of the violence they inflict (Mohanty 2006; Sjoberg and Gentry 2009). In other words, lethality matters for suicide terrorism.

Second, previous studies on terrorism examined terrorist attacks in general, which limits their ability to account for the variation within the phenomenon (Crenshaw 2007). This study will contribute to the existing literature by looking at the relatively less studied form of suicide terrorism. Instead of treating suicide terrorism as monolithic, it will look at the variation within suicide terrorist attacks in terms of strategy and lethal outcomes.

Third, empirical research on terrorism is still in its infancy, mainly because data collection on new terrorist incidents, perpetrators, and their characteristics is still ongoing. Even though researchers work continuously to expand the scope and breadth of the existing databases, current versions of these

databases may simply lack the attributes of interest for answering certain research questions. In this context, one major contribution of this study is the coding of new data concerning the tactical attributes of suicide terrorism attacks. By supplementing the Global Terrorism Database (2016) with new variables, this study attempts to build on and enrich a major existing data source for scholars in the field.

While many existing studies descriptively acknowledge the benefits of using suicide terrorism (in terms of the degree of control perpetrators have over the location, timing, and targets of the attack), the link between execution of strategy and resulting lethal outcomes is yet to be tested with rigorous empirical research. That is exactly what this study does.

1. Understanding the Lethality of Suicide Terrorism

In order for a suicide mission to be successfully executed, a determined suicide bomber who is committed to kill and die simultaneously is required. Hence, studies that seek to understand the lethality of terrorist attacks in general, and suicide attacks in particular, treat terrorist organizations as the unit of analysis and look at the motivational and structural factors that precipitate recruitment and execution of attacks. As a result, some of the most popular explanations for lethal outcomes are the catalysts for individual commitment, such as a religious or political ideology, debilitating socio-economic conditions, a hierarchical organizational structure that demands uncompromising respect and loyalty to the leader, and ongoing financial support. The strength of ideology, be it religious or political, is one of the most popular explanations in the literature for the willingness of suicide bombers to maim large groups of civilians (Stern 2001; Bukay 2006; Asal and Rethmeyer 2008).

Along with the rise of Islamic extremism, scholars have attributed the lethal outcomes of suicide attacks to the commitment-driven religious ideology embraced by terrorist organizations. It has been argued that religious groups would surpass their secular counterparts in terms of lethal consequences because they are less concerned about winning the hearts and minds of the larger audience, and more concerned about receiving afterlife rewards. As Asal and Rethmeyer (2008) argue, terrorist organizations whose primary motivation is otherworldly are more likely to justify killing larger numbers of people than secular organizations, which are much more inhibited in terms of their target selection. Hence, a deep commitment to a religious ideology that the perpetrators believe justifies violence for a greater cause, is crucial for the level of bloodshed.

Other scholars argue that unstable political and economic conditions that undermine social harmony and solidarity (widespread poverty, economic inequality, high unemployment, and a pervasive lack of civil rights and freedoms) can be used to justify acts of political violence on a massive scale (Gurr and Ruttenburg 1967; Gurr 1970; Krueger and Maleckova 2003; Krueger and Laitin 2008). Within this context, an absence of social, political, and economic opportunities causes resentment among populations at large, mobilizing them against perceived injustices. While there is mixed evidence on the link between poverty and participation in terrorism, a lack of civil liberties is found to be strongly associated with higher participation in terrorism (Krueger and Maleckova 2003). Overall, terrorist groups that have a broader political agenda, seeking national self-determination, political independence, and eradication of social and economic injustices can more easily justify launching violent attacks for the common societal good. These groups then also find larger numbers of available recruits at their disposal, who are willing to carry out suicide attacks on their behalf. Hence, a strong commitment to a political cause or a religious ideology can increase the number of available mentally and physically committed recruits, thereby increasing the chances of deadly suicide attacks.

Besides ideology, the organizational structure of these groups may also have an impact on the lethal outcomes of terrorist attacks (Kilberg 2012; Asal and Rethmeyer 2008). The way in which power is distributed in a given organization might create different incentives for commitment especially for those at the bottom of the organizational pyramid. Compared to factionalized structures with competing leaderships, hierarchical organizational structures with a single leader at the top not only strengthen solidarity among the members, but also increase the willingness of recruits to terrorize. Attachment to a strong leader as well as embracement and internalization of

organizational values may motivate the members of the organization to fully commit to their assigned duties, thereby potentially increasing the lethality of their missions.

While all these studies make valuable contributions to our understanding of why suicide attacks are deadlier, none of them acknowledge the importance of the choice of tactics in a systematic fashion. These tactical choices pertain to the location of an attack, specific targets, weapons used, and number of perpetrators sent on suicide missions. Differences in these choices will ultimately lead to differences in lethal outcomes. While the explanations presented above are all valid and important, so are these basic attributes of control and influence on fatalities.

Almost all articles on suicide terrorism start with a definition of the term and then present a list of tactical advantages that suicide attacks provide for their perpetrators (Sprinzak 2000; Hoffman 2003; Pedahzur 2005; Dolnik 2003). The premise of this study is that lethality is a consequence of the strategic choices made by the organizations and individual perpetrators each time a suicide mission is executed. In her statement denouncing the horrific suicide bombing at the Manchester Arena, British Prime Minister Theresa May acknowledged how the tactical advantages of suicide terrorism had been utilized to cause maximum damage: "We now know that a single terrorist detonated his improvised explosive device near one of the exits of the venue, deliberately choosing the time and place to cause maximum carnage and to kill and injure indiscriminately.... The explosion coincided with the conclusion of a pop concert which was attended by many young families and groups of children" (Maidment 2017, para. 5).

From a purely tactical perspective then, suicide missions are versatile operations that can take different forms according to the objective of the mission at hand. If the goal is to kill indiscriminately, multiple suicide bombers will be sent to hit soft targets in enclosed spaces such as busy malls, popular restaurants, or concert arenas, which in turn will affect the lethality of these attacks. If the goal is to kill a specific person, suicide missions can still be adopted but with a less lethal impact. Even though such advantages of suicide terrorism are heavily referenced in the current literature (Bloom 2005; Pedahzur 2005; Hoffman 2006), there has yet to be an empirical test of the validity of this intuitive assumption, which is what this study turns to next.

2. Hypotheses

Suicide attacks are low-cost operations whose execution is relatively simple. Most of the bombs used for suicide operations are homemade devices made of fertilizers that are cheap to obtain and easy to assemble. The estimated "cost of a typical Palestinian suicide operation, for example, is about one hundred fifty dollars" (Hoffman 2006, 133). So the cost of a suicide attack does not necessarily correlate with its potential deadliness. While many terrorist attacks require sophisticated weapons, funding, and high levels of expertise and training, a typical suicide attack can take place in the absence of these factors and may still be able to kill more victims. In fact, terrorist groups often refrain from using sophisticated, high-tech weapons because they are much more difficult to assemble and use than their low-tech counterparts (Lewis 2012). Instead, they imitate the guidance systems of the most advanced weapons available by using "*suicide bombers*" who offer "*the best of the both worlds*" (Lewis 2013). By effectively turning their bodies into bombs, suicide terrorists can in fact produce precision and sophistication comparable to even the most complex technologies. Thus, in many ways suicide terrorism contradicts the established superiority of high-tech weapons over low-tech.

Second, suicide terrorism is the most human-contingent form of terrorism, which gives the designated perpetrators the leverage to carry out the attack at the most favorable time and the busiest location, targeting densely populated locales such as shopping malls, cafés, movie theaters, or subways during rush hour. Suicide attacks offer more structured and controlled ways of killing than remote-controlled bombs. They are also very difficult (though not impossible) to thwart once the suicide bomber is en route to the target. This is not to suggest that all counterterrorism measures will fail in the face of suicide bombings. There are studies that discuss the effectiveness of different counterterrorism measures in thwarting prospective suicide attacks such as increasing the severity of punishment, freezing the assets of terrorists, or eliminating key members of terrorist

organizations (Atran 2003, 2011; Lum et. al. 2006; Zussman and Zussman 2006). However, these studies have mixed results, and the point that suicide terrorism is difficult to stop still remains.

As long as the detonator works properly, at least some damage is achieved. Partial success occurs when a suicide bomber detonates a bomb earlier than originally planned but still causes civilian deaths and injuries: "Conventional bombers depend on the unwitting cooperation of their targets to carry out their missions. The bomb itself is stationary.... The suicide attacker by contrast is a smart bomb with a human guidance system. He can vary the timing and vector of his attack to improve his chances of hitting his target and maximizing his intended effects" (McCormick and Fritz 2010, 136). In addition, suicide bombers retain ultimate control over the choice of weapons, which may impact lethality. Weapons used range from package bombs to suicide vests, or explosive-laden vehicles. While some suicide bombers wear suicide belts, others carry bags with explosives hidden inside to detonate at the site of the attack. Motorized weapons such as car or truck bombs are also frequently used in suicide missions. In fact, a considerable number of recently executed suicide attacks involve perpetrators driving explosive-laden vehicles into areas crowded with pedestrians, or detonating car bombs in the middle of rush hour traffic or busy streets. Examples include a suicide attack targeting the UN offices in Mogadishu in July 2016, or the detonation of a suicide car bomb on a crowded square at the heart of a Shiite-majority neighborhood in Baghdad in January 2017 (Guled 2016). According to Lutz and Lutz (2013, 31), motorized weapons such as car bombs benefit the perpetrators in one obvious way: "They can easily blend with a large number of similar vehicles on a street or in a parking facility." Depending on the choice of the suicide weapon, the resulting damage and casualties may vary.

It is also believed that suicide attacks taking place in confined areas or enclosed spaces increase the lethality of these attacks, which again can be controlled by the perpetrators. If the suicide bomber detonates the bomb in an open area or an outdoor place, the blast is much less effective as the waves of the explosion dissipate through space. However, if the attack takes place in an indoor location such as inside a bus, an enclosed terminal, or a coffee-shop, almost everyone in the immediate proximity of the attacker, within 10 to 15 feet of the blast, is killed within seconds (Patel et. al. 2012). In addition, the victims who survive an indoor explosion are usually severely wounded by glass shards, nails, and shrapnel, or they are thrown against hard surfaces such as walls or concrete floors.

Given their simplicity and cost-effectiveness, suicide missions are well suited for both discriminate and indiscriminate killings (Sprinzak 2000; Sandler and Enders 2011; Crenshaw 2007). Assuming that the attack is successful, the suicide bomber does not need a second chance or a complicated rescue mission, and can easily be assigned to assassinate well-protected high-value targets such as political leaders, military commanders, and ambassadors. With regard to suicide terrorism, offense is superior to defense, because offense only needs to be successful once: One contact with the high-value target is all it takes for the target and the perpetrator to be killed, whereas defense has to be successful against every potential attack.

Third, the use of multiple suicide bombers also potentially increases the lethality of suicide attacks. When suicide attacks are carried out by multiple perpetrators in sequence, the second bomber usually supplements the mission of the first by targeting those who arrive at the scene to help the survivors of the first attack. Hence suicide attacks that involve multiple perpetrators are likely to produce more fatalities than those undertaken by a single perpetrator. Given these expectations, the present analysis will test the following hypotheses pertaining to the tactical advantages of suicide terrorism that can be grouped into four main categories:

2.1. Location-Specific Attributes and Lethality

Hypothesis 1: Suicide attacks that take place outdoors but cause indoor damage will produce higher fatalities than those that take place exclusively indoors or exclusively outdoors.

Hypothesis 2: Suicide attacks that are carried out in easily accessible locations will produce higher fatalities than those that take place in locations requiring multiple layers of security checks.

2.2. Target-Specific Attributes and Lethality

Hypothesis 3: Indiscriminate suicide attacks that target large groups of civilians will result in higher fatalities than discriminate attacks that target military personnel or a specific person or entity.

2.3. Perpetrator-Specific Attributes and Lethality

Hypothesis 4: Suicide attacks that are carried out by multiple perpetrators will be deadlier than attacks carried out by a single perpetrator.

Hypothesis 5: As the number of perpetrators involved in a suicide attack increases, the lethality of suicide attacks will also increase.

2.4. Weapon-Specific Attributes and Lethality

Hypothesis 6: Suicide attacks that involve the use of motorized weapons such as explosive-laden vehicles, car or truck bombs will be deadlier than those that do not.

3. Data and Operationalization of Variables

To examine whether the specific decisions about how to carry out a suicide mission really matter for the lethality of a given mission, this study uses newly coded data that supplement the University of Maryland's Global Terrorism database (2016). For an incident to be included in the Global Terrorism Database(GTD) of domestic and international terrorist events worldwide from 1970 through 2015, it should satisfy three criteria: "The incident must be intentional, it must entail some level of violence or threat of violence and the perpetrators must be sub-national actors" (GTD Codebook, 2017, 9–10) For this study, a random sample of 447 suicide terrorist incidents from 1998 through 2015 across all regions of the world was selected from this database, stratified by year and gender of perpetrator. The reason for limiting the time period to 1998 to 2015 is because the narrative descriptive summaries of the incidents were only available for attacks that occurred after 1997. This information is crucial for coding the new variables that account for the tactical attributes of suicide terrorism, which is the main purpose of this study.

In the attack information section of the GTD, *suicide attack* exists as a binary variable that is coded as 1 for cases where there is evidence that the perpetrator(s) did not intend to escape from the attack alive, and 0 for those where such evidence does not exist. The dependent variable of this study is the *lethality* of suicide terrorist attacks, which is the sum of persons killed for each attack.

There are six main independent variables in this study. The first variable of interest is *enclosure*, which captures whether the attack took place outdoors, indoors, or outdoors with an indoor impact. Because the original dataset does not include such a variable, a new categorical variable was coded using the narratives of the suicide terrorist attacks provided in the original dataset. It was coded 1 for outdoor locations, 2 for indoor locations, and 3 for outdoor locations with indoor damage. If a suicide attack took place at an outdoor location such as an open air market, or in a park targeting a symbolic monument or a bridge, the variable received a value of 1. If the explosion took place indoors, in an enclosed space such as inside a store, coffee shop, or movie theatre, it received a value of 2. Besides indoor and outdoor locations, there are also incidents in which a suicide bomber detonates explosives at the entrance of a building or drives an explosive-laden truck into the walls or gates of a structure causing harm to the external surroundings as well as killing people inside. Because a simple outdoor-indoor dichotomy would not appropriately capture these cases, these are coded separately and assigned a value of 3. The only criterion used in this coding was where the narrative said the incident actually took place, not what the intended attack location was, as this was unknown. For instance, if the intention was to detonate the explosives inside, but the detonation happened outside, the attack was coded as an outdoor attack. The expectation is that terrorist attacks that occur in outdoor locations but cause most of their damage inside will be the deadliest of all, because physical damage is caused both internally and externally. If a suicide attack takes place right outside the entrance of a building, the exterior of the target building is damaged, windows are shattered, roofs may collapse, and victims are found inside and outside. Where the

narratives were unclear, online sources with images of the attack location were used to determine how a specific incident should be coded.

The second variable that measures a location-specific attribute is the *accessibility* of an attack location. This was coded as low, medium, or high, accounting for the ease or difficulty of entering a specific location. Locations that are easily accessible were coded 3. These are places where people have unrestricted access, such as public parks, buses, and open-air markets. Locations that are not easy for unauthorized visitors to enter were coded as low accessibility locations and given a value of 1; examples include highly secured business centers, military bases, and government buildings. Medium accessibility locations, which were coded 2, are areas most people can enter freely but have to go through revolving doors, or pass security checks, such as shopping malls, or checkpoints.

To look at the effect of target-distinction on lethality, a *targets* variable was coded, which also received one of three values. If a suicide attack specifically targeted a high-profile individual with a name and a title, such as a government minister, a general, or a senior executive, this variable was coded 1. If an attack was launched against a military target such as a military convoy or personnel, it was coded 2. Finally, for suicide terrorist attacks that indiscriminately targeted civilians such as people in a shopping mall or a supermarket, or children riding the school bus, the variable was coded as 3. As the target distinction moves from discriminate VIP killings to civilian attacks, the fatalities are expected to rise.

Two different variables account for the perpetrators: *multiple perpetrators* and *the number of perpetrators*. The first of these, *multiple perpetrators*, is a dichotomous variable that measures whether a single perpetrator (0) was involved in a given attack, or there were multiple perpetrators (1). Attacks that involve multiple perpetrators are expected to be deadlier than those perpetrated by a single suicide bomber. *The number of perpetrators* is a discrete variable that corresponds to the actual number of perpetrators involved in a suicide attack. The range of this variable goes from a single perpetrator to nine perpetrators per attack. As the number of perpetrators increases, the resulting fatalities would likely increase.

The last independent variable of interest is *motorized weapon*, which was coded as a binary variable capturing the difference between motorized and non-motorized weapons. If a suicide attack used motorized weapons such as vehicles packed with explosives such as car bombs or truck bombs, this variable was coded 1; otherwise, it was coded 0.

This study also includes a number of control variables. *Democracy* was included as a control variable. The Freedom House Index was used to account for the regime type across countries listed in the Global Terrorism Database (2016). Freedom House ranks countries as "free," "partly free," or "not free" on a scale from 1 to 7 corresponding to how they perform in terms of political rights and freedoms, where 1 indicates the most freedom, and 7 the least freedom. In the Freedom House Index, countries whose average rating in political rights and civil liberties falls somewhere between 1 to 2.5 are designated as "free," between 3 and 5 as "partly free," and between 5.5 and 7 as "not free" (Freedom House; Freedom in the World Country Scores 2017). Based on these three categories, the democracy variable received a value of 1 when the Freedom House Index designated a country's status as "not free," a value of 2 when the status was "partly free," and a value of 3 when the status was "free." From the World Bank Data, *the gross national income per capita based on purchasing power parity (log-transformed)* was included as a control variable to account for economic development. Finally, *year and country fixed effects* were also included in the analysis as controls.

All the new variables coded for this study were coded multiple times by the author for quality control. Each coding generated similar values for the attributes under consideration, and deviations were minimized across the multiple coding efforts. Where the narrative descriptions of the suicide incidents were too brief, or not clear enough to code the tactical attributes of interest, additional information was collected from other sources including online accounts, magazine articles, and newspaper reports. Descriptive statistics for all variables in the analysis are presented in Table 1.

Table 1: Descriptive statistics for suicide attacks from 1998 to 2015

Variables	Number of observations	Mean	St. Dev.	Min.	Max.
DV: Lethality	443	11.58	15.19	1	121
Location-specific					
Enclosure	447	2.02	.885	1	3
Accessibility	445	2.29	.750	1	3
Target-specific					
Targets	445	2.50	.663	1	3
Perpetrator-specific					
Multiple perpetrators	447	.230	.421	0	1
Number of perpetrators	434	1.35	.944	1	9
Weapon-specific					
Motorized weapon	447	.328	.470	0	1
Controls					
Democracy	447	1.46	.612	1	3
Logged GNI[a]	447	6.49	1.708	0	7. 98

[a] Gross National Income (log-transformed)

4. Method and Results

The unit of analysis in this study is the incident of suicide terrorism. As the dependent variable is the count of the number of people killed in each suicide attack across all regions of the world from 1998 to 2015, a Poisson regression is applied for the analysis. There are six main hypotheses concerning the location, target, perpetrator(s), and weapon-specific tactical attributes.

Corresponding to each of these attribute categories, a different model is applied. Hence, the first model only regresses lethality on location-specific variables with controls, the second model on target-specific variables with controls to demonstrate the effect of a range of targets on lethality, the third model looks at the independent effect of type and number of perpetrators on lethality, and the fourth model regresses lethality on the weapon-specific attributes with control variables. The fifth model is the full model that includes all variables. Table 2 reports the results from these five Poisson regression models.

While the coefficients from Poisson models are informative, they can be difficult to interpret. Therefore, the marginal effects were estimated for each variable to allow for a clearer interpretation of the results. Specifically, predictive margins were used to compute the expected count of fatalities corresponding to specified values of the key attributes of the suicide attacks, holding all other variables in the models at the average values. For instance, what is the expected lethality of an otherwise typical suicide attack if the ease of access for the location was high (3), medium (2), or low (1), or if that attack was carried out against civilian targets (3), military targets, (2) or VIP targets (1)? Table 3 reports these marginal effects.

Table 2: Effects of tactical attributes of suicide terrorism on lethality

	(Model 1) Fatalities	(Model 2) Fatalities	(Model 3) Fatalities	(Model 4) Fatalities	(Model 5) Fatalities
Location-specific					
Enclosure	0.268***				0.214***
	(0.018)				(0.019)
Accessibility	0.131***				0.100***
	(0.021)				(0.024)
Target-specific					
Targets		0.402***			0.271***
		(0.026)			(0.030)
Perpetrator-Specific					
Multiple perpetrators			0.440***		0.406***
			(0.050)		(0.051)
Number of perpetrators			0.0947**		0.105***
			(0.020)		(0.021)
Weapon-specific					
Motorized weapon				0.0189	-0.0745
				(0.036)	(0.039)
Control variables					
Democracy	0.00443	0.0242	0.0771	0.0842	0.0112
	(0.070)	(0.068)	(0.068)	(0.068)	(0.070)
Logged GNI[a]	-0.0477***	-0.0588***	-0.0607***	-0.0621***	-0.0487***
	(0.011)	(0.010)	(0.011)	(0.010)	(0.012)
Constant	1.647***	1.717***	2.149***	2.577***	0.820***
	(0.167)	(0.164)	(0.168)	(0.157)	(0.191)
N	441	441	431	443	429
AIC	5689.3	5725.0	5528.5	5992.4	5132.9

Standard errors in parentheses. Year and country fixed effects are included in all models.

[a] Gross national income (log-transformed)

* p < 0.05, ** p < 0.01, *** p < 0.001.

Table 3: Expected fatalities associated with low, medium and high values of key attack attributes

	Model 1, 2, 3 and 4			Full Model		
Variable	Low (1)	Medium (2)	High (3)	Low (1)	Medium (2)	High (3)
Enclosure	8.5 (8.1, 8.9)	11.1 (10.8, 11.4)	14.5 (14.02, 15.1)	8.7 (8.2, 9.2)	10.8 (10.4, 11.1)	13.3 (12.8, 13.9)
Accessibility	9.7 (9.1, 10.3)	11.1 (10.7, 11.4)	12.6 (12.2, 13.1)	9.8 (9.2, 10.56)	10.9 (10.57, 11.2)	12.1 (11.5, 12.5)
Targets	6.2 (5.6, 6.7)	9.2 (8.8, 9.6)	13.8 (13.3, 14.3)	7.3 (6.6, 8.08)	9.6 (9.2, 10.09)	12.6 (12.2, 13.1)
Multiple perpetrators	10.1 (9.6, 10.4)	N/A	15.6 (14.3, 16.8)	10.1 (9.7, 10.5)	N/A	15.2 (14.03, 16.4)
Number of perpetrators	10.7 (10.3, 11.09)	N/A	22.8 (16.1, 29.6)	10.7 (10.3, 11.07)	N/A	24.8 (17.2, 32.4)
Motorized weapon	11.5 (11.08, 11.9)	N/A	11.7 (11.1, 12.3)	11.5 (11.1, 12.03)	N/A	10.7 (10.1, 11.3)

95-percent CIs are reported in parentheses below each estimate

The first three columns of Table 3 report the expected fatalities based on the first four models. The predictive margins for the enclosure and accessibility variables were generated based on Model 1, those for the target variable based on Model 2, those of the perpetrator-related variables based on Model 3, and the predictive margins for motorized weapon based on Model 4. The predictive margins of the second three columns in table 3 are based on the full model. While enclosure, accessibility, and target variables received values from 1 to 3 corresponding to low, medium, and high accessibility, or VIP, military, and civilian targets, the binary variables such as multiple perpetrators and motorized weapon received values of either 1 or 0 (thus, medium values are not applicable here). The number of perpetrators was a discrete variable whose values ranged from one to nine perpetrators per attack, and only the predictive margins at the lowest and highest levels are included in the table. Overall, results suggest that the location-specific attributes, the choice of targets, and the use of multiple perpetrators are the most important factors explaining variation in the lethality of suicide attacks.

4.1. Location-Specific Attributes and Lethality

Hypothesis 1 was that the level of enclosure will affect the expected fatalities, which is supported by the analysis. Table 3 shows that when enclosure is at its lowest value, meaning when suicide attacks occur in outdoor places or open areas, the average attack kills 8.5 people. In closed spaces, or at medium levels of enclosure, the expected fatalities rise to 11.1 people for an otherwise average suicide attack. Finally, suicide attacks that take place at the main entrances of the buildings leading to both indoor and outdoor damage increase the expected fatalities up to 14.5 people on average. In line with Hypothesis 2, the accessibility of a given location is also a significant predictor of the lethality of suicide attacks, as shown

in Table 3. According to Model 1, suicide attacks that take place in easily accessible locations such as parks, cafes, and restaurants, are likely to generate more fatalities (12.6) than attacks that take place in medium (11.1) and low accessibility locations (9.7) such as checkpoints, military bases, or parliament buildings. In short, both location-specific indicators are strong predictors of lethality of suicide terrorist attacks, and these findings are confirmed in the full model.

4.2. Target-Specific Attributes and Lethality

Hypothesis 3 proposed that suicide attacks that indiscriminately target civilians would be deadlier than attacks that are more discriminate, aiming at military or VIP targets. Model 2 tests the significance of different target choices on lethal outcomes, according to which, target distinction has a statistically significant effect on lethality of suicide attacks. Results from the full model confirm this finding. As anticipated, as targets get more specific, lethality diminishes, controlling for other important correlates of lethality. Table 3 shows that when suicide attacks are directed at VIP targets, 6.2 people are killed on average; when targets are military, the expected fatalities rise to 9.2; finally, when civilians are targeted, the highest fatalities are observed at 13.8.

4.3. Perpetrator-Specific Attributes and Lethality

Model 3 assesses perpetrator-specific attributes: the involvement of multiple perpetrators in a suicide attack, and the number of perpetrators. Results suggest that a typical suicide attack carried out by a single perpetrator kills an expected number of 10.1 people, whereas a suicide attack that is undertaken by two or more perpetrators kills an expected number of 15.6 people, controlling for all other variables in the model. The use of multiple perpetrators is also statistically significant in the full model, which supports Hypothesis 4. In addition, the number of perpetrators is also statistically meaningful and positively correlated with the predicted numbers of fatalities. As Table 3 shows, in a suicide attack carried out by a single perpetrator, the predicted number of fatalities is 10.7, whereas for incidents that involve nine suicide bombers at a time, this number goes up to 22.8. The full model shows consistent results, supporting Hypothesis 5.

4.4. Weapon-Specific Attributes and Lethality

The final hypothesis concerned the relationship between choice of weapon and lethality, and is assessed through Model 4. Unexpectedly, the use of motorized weapons such as explosive-packed vehicles or truck bombs does not generate higher fatalities than the use of other weapons. Based on Model 4, the difference between motorized and stationary weapons is negligible. More importantly, in the full model, the relationship between the use of motorized weapons and fatalities is not only insignificant but negative. Predicted values for the full model in Table 3 show that suicide attacks that involve the use of stationary bombs kill 11.5 people on average, whereas this number goes down to 10.7 for suicide attacks that involve the use of motorized weapons. Hence, suicide attacks that involve the use of vehicles are on average less deadly than attacks using stationary bombs. This might be because when suicide bombers use their bodies to deliver explosives, they have more control over the precise timing of the attack, and have more options to choose from when it comes to the location of an attack as opposed to a suicide bomber in an explosive-packed vehicle, who may be more limited in terms of these choices.

Among the control variables, the gross national income (log-transformed) shows a statistically significant correlation to lethality. Suicide attacks that occur in more prosperous countries are less lethal than attacks occurring in developing countries. This could be because high-income countries have advanced technologies, powerful intelligence, and rich resources to invest in counterterrorism, which seeks to protect soft targets and minimize the lethal impact of these attacks. The democratic nature of a country, however, is not conclusively or consistently linked to the lethality of suicide attacks. The preceding analysis confirms that the lethal attacks do not occur at random or by chance. The expected lethality of suicide terrorism is in fact driven by the use of different attributes of suicide terrorism; suicide terrorist attacks that seize upon locations, targets and perpetrators of opportunity are in fact much more lethal than those that do not.

5. Discussion

This study placed the different attributes of suicide terrorism under a magnifying glass and demonstrated that many of these

choices have a significant effect on lethality. Specifically, the accessibility of an attack's location, the level of enclosure, the choice of targets, and the use of multiple perpetrators significantly influence how many people are likely to be killed in an attack. Contradicting the initial expectations, the specific choice of weapon does not appear to matter as much. These findings are particularly useful for generating new ideas and finding alternative solutions in counterterrorism.

Based on this analysis, the most lethal attacks are coordinated ones that involve multiple perpetrators and that hit easily accessible locations. Hence, increased security measures especially at the time of national holidays, political rallies, or popular events may help improve the safety of the soft targets. As the popularity of social media has increased, so has its use by terrorist groups. There are times that terrorist groups announce not only their willingness to continue fighting or use further violence but also give away pieces of information about their adversaries and potential targets. Critically assessing their tweets and other social media activity may help security specialists and experts assess whether an attack is imminent and take the necessary precautions, which may include raising the terrorism threat level, working to increase situational awareness of individual citizens, or enhancing security measures in key areas (Hudson 2012; Cassidy 2015).

Raising awareness at the societal level through education or public debates shapes people's expectations about the threat of suicide terrorism, eases their adjustment to living with terror, and may help them actively contribute to counterterrorism efforts. For instance, an Israeli security guard prevented a lethal suicide attack by identifying and stopping a suicide terrorist entering a café adjacent to the American embassy building in Tel Aviv in 2002. As soon as the guard saw the wires hanging out of the terrorist's pocket and shirt, he grabbed the hands of the suicide bomber and twisted them. In another case, an Israeli bus driver stopped a suspicious-looking passenger with a duffel bag from getting on his bus thereby preventing the imminent suicide attack (Falk and Morgenstern 2009). As previously mentioned, the success of suicide terrorism depends on the success of human bombs. And humans make mistakes, or plans may go astray because of human error, or external interruptions. It is during these times that public awareness and alertness would be most useful. Ordinary citizens can play an important role in the prevention of terrorism by being attentive to suspicious packages, activities, and individuals, and reporting them in a timely manner.

In addition, many of the most lethal incidents are coordinated attacks where the second suicide bomber usually enters the scene of destruction just minutes after the first bomber has blown himself up. Such coordination ensures that the attack not only kills the first set of victims but also paramedics and other helpers. From the perspective of counterterrorism, it would be useful to develop and improve security precautions for responders (Smith 2015). Also, given that multiple bombers are not uncommon and may wreak havoc in two or more spots in a given city in sequence, it would be wise to consider this possibility when deciding how to allocate government resources efficiently. Sending all or most available rescue teams, police, and ambulances to the first location targeted might prove very dangerous because it makes other targets vulnerable and completely open to similar destruction.

While the present results are important and support most of the stated hypotheses, one limitation of this study is that a comparison between suicide attacks and other types of terrorism cannot be made. While noting at the beginning of the paper that suicide attacks are more lethal than non-suicide attacks, these results do not allow us to see whether the strategic advantage of suicide terrorism is what makes it deadlier than non-suicide terrorism. However, the new data coded here can be used as a guideline when coding the strategic attributes of non-suicide terrorist attacks. Therefore, it presents an important starting point for such a comparison to be made in the future.

This study also contributes to the literature by shifting focus from motivational and organizational explanations to one centered on the decisions of the perpetrators in specific attacks. These findings formalize and confirm an intuitive point on the basis of original quantitative evidence and rigorous analysis. The research presented here represents an attempt to provide a line of empirical evidence to further clarify the strategic advantages of suicide terrorism and test them systematically to see whether and how they influence the expected number of

fatalities. It also accounts for the variation within suicide terrorist incidents in terms of tactical differences and their associations with fatal outcomes. It is a fact that some suicide attacks kill more people than others, and this study sheds light on how and why this is the case.

6. Conclusion

Suicide terrorist attacks are more widespread today than in the past. Especially in the last few years, there have been hundreds of terrorist attacks, the most prominent and deadly of which have been suicide bombings such as the coordinated attacks at multiple civilian sites in France, the triple bombing in Belgium, and the back to back suicide bombings in Turkey. Many of these attacks targeted sites crowded by civilians such as movie theaters, popular avenues, music venues, football stadiums, and restaurants. In face of the psychological mayhem, physical devastation, and lethal consequences of these attacks, the comparison put forth by Pape and Feldman (2010, 5) is more meaningful than ever: "Suicide terrorism is the lung cancer of terrorism." It is the leading cause of death, but has the potential to stay under the radar until its most dangerous, terminal final stage. One of the major challenges in this regard is that it is very difficult to thwart these attacks on a day to day basis. Counterterrorism specialists, scholars, and experts do not have crystal balls to see which attacks are imminent and who is preparing to carry out a suicide mission. However, as this study shows, it is possible to understand the attributes of suicide terrorism that make some of these attacks particularly deadly, which contributes to our ability to devise new counterterrorism strategies.

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