

The Immediate Effects of Suicide Attacks: Israel, 2000-2003

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Abstract

The paper analyses the outcomes of 103 suicide attacks in Israel over a recent three-year period. The effectiveness of the attacks, measured by the number of casualties resulting, was highly variable. The figures suggest that women have proved more proficient assailants than men, that carrying explosives about an attacker's person into places frequented by civilians has resulted in many more victims than other techniques, and that the action of bystanders could reduce the number of victims substantially. Hamas appears to have evolved a more effective modus operandi in carrying out suicide attacks than the other militant factions, after controlling for the choice of location or target and the fact that Hamas has not used female attackers.

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It is said that suicide attacks are highly effective at killing people. The problem is that a violent action that aims to kill creates a risk to the agent, but it is hard to make the agent safer without making the victims safer too. The solution is an agent who is willing to die in order to kill with relatively high probability. This is reflected in the casualties associated with suicide attacks. Worldwide, suicide attacks account for only 3 per cent of all the terrorist incidents that took place between 1980 and 2001, but almost half of the deaths resulting from terrorism over the same period, excluding the unusually heavy casualties of 9/11 (Pape 2003, p. 346).

When we study suicide attacks in more detail we find that their effectiveness is highly variable. The catastrophic scale of 9/11 when four coordinated blows by 19 men killed nearly 2,800 people is at one extreme. At the other extreme we will see that many suicide attacks injure no one but the perpetrator. In between there is a wide spectrum of variation. This suggests that the common perception that suicide attacks invariably result in widespread death and injury, while founded in reality to a considerable extent, also reflects a selection bias: we are more likely to recall the attacks that succeeded than the ones that failed.

The application of simple statistical techniques to this question appears to be overdue. Krueger and Maleckova (2002), Pape (2003), and Sayre (2003) have shed significant light on the wider strategic considerations that appear to influence the timing and frequency of suicide attacks. The factors influencing their immediate effects have received little or no attention. The purpose of the present paper is to make a first pass at this problem, using the data provided by suicide attacks in Israel from November 2000 to November 2003. Part 1 of the paper sets out some general issues of a methodological nature. Part 2 describes the main features of the dataset that I employ. Part 3 engages in some simple multivariate analysis. Part 4 concludes.

1. The Process of Violence

In principle what we mean by the effectiveness of political violence rests on the standard of valuation that we choose. Death and injury are only the most immediate effects of violence. From the point of view of the instigators the casualties are likely to be no more than a means to some wider objective, for example to punish, deter, or provoke an adversary by evoking terror in its ranks. For present purposes I do not reckon with the wider purposes of political violence, only with the deaths and injuries that are its proximate effects. If suicide attacks did not have victims they could not instil terror, so it seems reasonable to use the number of victims to measure the immediate effects. Among the victims I will count deaths and injuries equally since, from the point of view of spreading terror in society, the influence of shocked and maimed survivors seems likely to be as terrible and durable as the influence of deaths.

I will count military and civilian victims equally for three reasons. It is true that, for particular reasons that went beyond the particular operation, for example, the varying state of high-level negotiations between the Israeli government and Palestinian authority, the organising faction may have preferred to attack a military or civilian target. In practice, when soldiers were the main victims it is sometimes difficult to tell whether that was the intended result since an operation aimed at civilians could easily be interrupted while under way and brought to a premature conclusion by the actions of soldiers. Second, soldiers could become accidental victims of an operation aimed at civilians because they mixed with civilians and were

found with them at a given place and time. Third, a humanitarian calculus suggests equal weights for soldiers and civilians since soldiers are just as much a part of society as their civilian friends and relatives.

The problem of soldiers versus civilians raises a wider issue: in general the number of casualties arising from an operation was endogenous on a series of choices made by the attacker that influenced, but did not predetermine, the time and place of the attack. For present purposes I do not try to model these choices. Also, I do not seek to explain the variation in the frequency of attacks through time, which also resulted from a wide range of influences and a calculus of choices that we can only try to estimate indirectly (e.g. Sayre, 2003). Rather, I seek to establish the consequences of the choices once made.

What makes the outcomes of suicide attacks vary? In each case a faction that initiates and organizes the operation, with its own *modus operandi* or “technology”, interacts with a volunteer who carries the operation out, the vulnerable population that forms the target, and the security forces responsible for counter-measures. Finally there is luck, good and bad. Thus the number of victims V arising from the i th incident in a series depends on the locally vulnerable population Q multiplied by the probability p that each will be victimized:

$$V_i = p_i \cdot Q_i \quad (1)$$

The vulnerable population is conditioned by the place and time of the attack, for example a military checkpoint, an open-air market, or a crowded building. It also depends on behaviour and choices which, under some circumstances, could be thought of as endogenous; for example, after a tourist resort has been attacked the visitors choose to go elsewhere for a time. In the present case anecdote suggests that the behaviour of residents is less volatile than that of tourists for a number of reasons: the average resident (1) is poorer than the average tourist and so has fewer choices (2) may arrive at a more accurate evaluation of the (generally very low) risks of unchanged behaviour and (3) may be more strongly motivated towards defiance of a terrorist threat in the spirit of “business as usual”.

Given that, the probability of victimization depends on the technology employed, A , and whether or not civilian bystanders or security personnel challenged the attacker or precipitated the attack by a challenge, C :

$$p_i = (A_i, C_i) \quad (2)$$

Bear in mind that the “technology” of a suicide attack, broadly defined, embraces the mechanical means, for example a car bomb or an explosive belt, the contractual techniques that recruit, motivate, and commit the attacker psychologically, the techniques for concealment that allow the attacker to infiltrate the target location under cover, and finally, the personal characteristics of the attacker in so far as they bear upon the willingness and ability to execute the attack effectively. The inclusion of concealment in our concept of the technology of an attack suggests that the choice of technique and the probability of a challenge are not independent; strictly speaking,

$$C_i = C(\tilde{A}_i) \quad (3)$$

where \tilde{A}_i is a measure of mismatch between A_i , the actual technology chosen, and the most efficient choice given the attacker’s objective. More simply, \tilde{A}_i stands for the attacker’s mistakes that render an attack vulnerable to disruption. However, concealment cannot be perfect so the probability of a challenge is positive even when \tilde{A}_i is zero.

Technology in this broad sense must include knowledge that is partly explicit and partly tacit. Not all of the knowledge required to organise a suicide mission can be

learnt through passive study. Acquisition of the tacit component requires individuals to engage in learning-by-doing and an organization to store the lessons of experience and pass them on. This is confirmed by the fact that suicide attacks are rarely if ever mounted spontaneously by individuals; there is almost always an organization involved. Worldwide, at any given time only a handful of organizations are engaged in suicide terrorism. For present purposes, therefore, the technology of a suicide attack of a given date comprises the personal characteristics of the attacker a using the mechanical means M , the common knowledge K acquired from all previous incidents up to that date, and the private knowledge and resources F gained from the previous incidents sponsored by the specific faction,

$$A_t = a_t \left(M_t, \sum_1^{t=i} K_{t-1}, \sum_1^{t=i} F_{t-1} \right) \quad (4)$$

but we do not know the shapes of the learning curves or the areas under them.

To summarise,

$$V_i = p \left\{ a_i \left(M_i, \sum_1^{t=i} K_{t-1}, \sum_1^{t=i} F_{t-1} \right), C(\tilde{A}_i) \right\} \cdot Q_i \quad (5)$$

2. What The Data Show

The on-line database of the International Policy Institute for Counter-Terrorism, Herzlia, Israel (ICT 2003) provides details of 103 suicide attacks in Israel over the period from November 2000 to November 2003. The incidents are characterized by the place and date of the attack; the numbers of casualties and perpetrators; the organizational affiliation, age, and sex of each perpetrator; the mechanical means employed; and whether or not the attacker was challenged in the course of the attack. The main outlines of the data are described in Table 1.

Table 1. Suicide Attacks, November 2000 to November 2003: Observed Characteristics

Incidents, total	103
Victims, total	3516
Of which, Deaths	440
Injuries	3076
Casualties per incident	34.1
Perpetrators, total	112
Of which, Male	100
Female	7
Not known	5
Average age of perpetrator where known, years	21.7
Number of perpetrators whose age not known	15
Casualties per perpetrator (“adjusted” casualties)	31.4
Mechanism of attack:	
Personal means	87
Car	14
Boat	2
Target of attack:	
Civilian	76
Military	10
Uncertain	17
Number of incidents where perpetrator was challenged	40
Number of incidents where attack was prevented	2
Where not prevented, place of attack:	
Street	32
Checkpoint	16
Travel Stop	15
Bus	14
Café	14
Store	7
Offshore	2
Residence	1

Source: ICT (2003). “Personal means” was a bag, belt, or vest carried on the attacker’s person. I have adjusted the database records in two respects (1) I have entered the double incident of 18 May 2003 as two separate incidents because, whether or not coordinated, they took place in different locations (2) I have recorded the attacker of 19 May 2003 as female rather than male, based on an independent press report (Ghazali 2003).

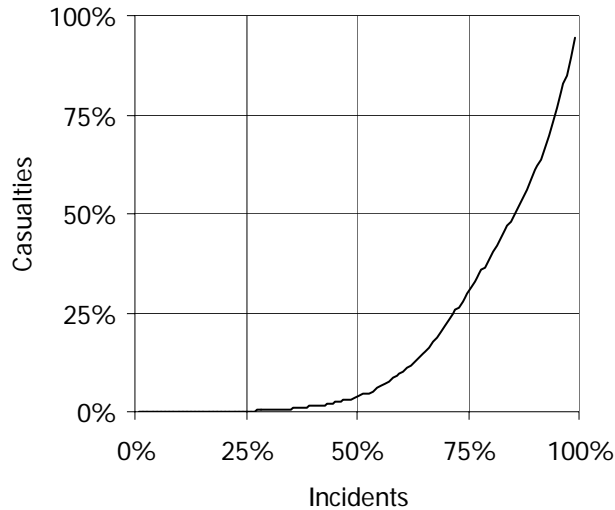
2.1. How Effective are Suicide Attacks?

On average each incident recorded in this dataset caused 4.3 deaths and 29.9 injuries, making 34.1 for the total of victims of an average incident. The number of deaths is therefore below the worldwide average of 13 per incident for suicide attacks over the period from 1980 to 2001, excluding 9/11, but above the average of less than one per incident for all kinds of terrorism over that period (Pape 2003).

The attacks that we are looking at were highly variable in effectiveness: just 15 attacks caused half of the more than 3,500 combined deaths and injuries, while 22 killed nobody but the perpetrator. The incidents may be ranked in increasing order of

the number of casualties (deaths plus injuries). Figure 1 charts the cumulative percentage of casualties against the cumulative percentage of incidents. It is a Lorenz curve of the kind often used to measure inequality. If all attacks were equally effective, the result would be a diagonally rising straight line. In fact the relationship is highly curved and this reflects the variation in effectiveness.

Figure 1. Casualties and Incidents:
Cumulative, Per Cent of Totals



Technically speaking the sample is truncated by selection of those incidents that came to the attention of the Israeli media. The true number of attacks that resulted in zero casualties was probably higher, taking into account those that were aborted at an earlier stage of preparation as a result of the attackers' decisions or covert or pre-emptive intervention by security personnel.

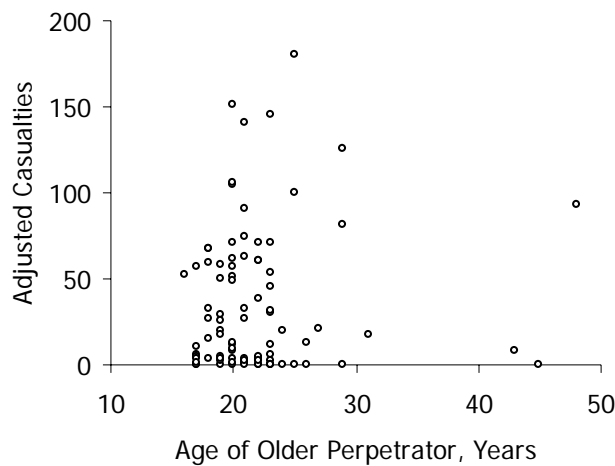
2.2. Sole Attackers Versus Accomplices

In most of the 103 incidents that are included in the dataset the perpetrator worked alone but in nine cases two assailants coordinated their actions. Working together, did two achieve more or less than they would have done separately? At first sight returns were diminishing. If the number of casualties is divided by the number of attackers, then "adjusted casualties" are 31.4 per perpetrator, somewhat less than the average of 34.1 per incident. Correspondingly, the average number of victims of two assailants working together was 47.6 compared with 32.9 for one, so only about half as much again.

2.3. The Attackers: Age and Sex

Age is reported for 98 of the 112 attackers. Their average was 21.7 years. There was limited variation around this figure, the youngest being 16 and the oldest 48, but 88 of the 98 were aged between 17 and 26. Given the lack of variation in age it is not surprising to find that the relationship between the number of victims of a suicide attack and the age of the attacker was essentially flat. This is illustrated in Figure 2; in the small number of cases where more than one attacker was involved I have used the age of the older on the assumption that the more mature person took the lead.

Figure 2. Casualties and Age of Older Perpetrator



Only a few attackers were women, 7 out of 112. Of the remainder 92 were male, leaving 4 for whom sex is not reported; one supposes that these too are likely to have been men. The female attackers are surprisingly few given the often sensational publicity for their role in the media.

There is a large difference in the number of casualties resulting when women were involved. The average number of victims of an attack by a woman was 60.4, compared with 33.6 when the attackers were male. In all cases women worked alone.

2.4. Choice of Mechanism

We shall see that the choices between alternative mechanisms, military versus civilian targets, and available locations of an attack were not fully independent.

In most incidents, 87 out of 103, the attacker's weapon of choice was a bag, belt, or vest laden with explosives and carried on their person. In 14 cases a car bomb was used, and in two cases explosive were loaded onto a boat. The number of casualties that resulted varied strongly. The average number of casualties in an incident involving an attacker using a personal device was 38.7, compared with 10.2 victims of the average car bomb and only 2.0 where a boat was used.

2.5. Character of the Target: Military Versus Civilian

The majority of attacks, 76 out of 103, were clearly aimed at civilian targets. In 10 cases the intended target appears to have been armed security personnel; for example an attacker deliberately detonated explosives beside a military vehicle or a police station. In the remaining 17 cases the intended target was unclear, usually because the attack was triggered by a security operation, or interrupted or prevented in some way. In most of the "uncertain" cases the security forces took the force of the attack but may not have been the intended victims and in some cases their assessment after the event was that the attacker had been en route to some other intended target.

Not surprisingly, the figures suggest that civilians provided a more vulnerable or "softer" target. The average number of casualties of attacks clearly aimed at civilians was 45.9, compared with 1.8 casualties in attacks aimed at military or armed security personnel, and 0.6 casualties in those attacks that could not be classified.

2.6. Location of Attack

The outcome of an attack varied strongly with its location. Descriptions provided in the ICT database allow us to classify each incident by whether it occurred in the street

or a bus, in a crowd collected at a bus stop or train station, in a store or café, or at a checkpoint or roadblock. Two incidents occurred offshore when terrorists directed a boat loaded with explosives against a naval vessel. One occurred when an attacker broke into a settler's home. Finally, two incidents were physically prevented and thus did not take place anywhere.

Table 2 shows that the most frequent location was the street and the average street incident resulted in 31.2 casualties. The second most frequent location was a roadblock or checkpoint, but there casualties were typically low. In general a condition for high casualties appears to have been the crowding of people in a street market or shopping mall, or for purposes of public transport; casualties were raised where the explosion was contained within a structure such as a bus or a building. The deadliest location was a café or restaurant, where the average incident resulted in 68.3 casualties.

Table 2. Suicide Attacks, November 2000 to November 2003: Number of Incidents and Casualties per Incident, by Location of Attack

	Number of incidents	Casualties per incident
Cases where attack was prevented	2	0.0
Where not prevented, place of attack:		
Street	32	31.2
Checkpoint	16	1.2
Travel Stop	15	41.3
Bus	14	50.5
Café	14	68.3
Store	7	30.3
Offshore	2	2.0
Residence	1	1.0
All incidents	103	34.1

2.7. The Role of Bystanders

In a surprisingly high proportion of incidents, 40 out of 103, those affected were not passively victimized but one or more of them intervened in the process of the attack and may have influenced its outcome.

Intervention took several forms. Civilian witnesses or security personnel became suspicious and intervened to challenge or restrain an attacker, or called the security forces. Security personnel challenged attackers by acting on suspicion or information. Routine security measures at checkpoints or roadblocks sometimes uncovered terrorists who may have been en route to other targets, or intended specifically to target the military personnel at the checkpoint concerned, or may simply have formed the intention to proceed until challenged. Of the 16 incidents at checkpoints or roadblocks 9 were the result of challenges, but this also means that most challenges took place in other contexts.

The result of a challenge was almost always to trigger the attack; only in two cases was an attack actually prevented. On the other hand a challenge is likely to have had the effect that the attacker lost the initiative and became unable to choose the time and place of the attack. While the person who intervened often became a victim it was sometimes claimed that many lives were saved as a result. Thus a security guard was killed preventing an attacker from entering a Jerusalem café on 8 September 2003. Afterwards his brother said: "I'm sure he knew he was stopping a terrorist. He saved at least 30 lives." This repeated a similar incident at the entrance to a shopping mall in Afula on 19 May when two security guards saved "countless lives"; one was killed and the other severely injured. On 19 June 2003 an Israeli

shopkeeper confronted a young man who had entered his store carrying explosives; the police concluded that the intended target was a nearby bus stop and stated: “We have no doubt that the store owner paid with his life to save others.”

The statistics lend *prima facie* support to this hypothesis. The average number of casualties in an incident that was interrupted by bystanders was 16.9, compared with 45.1 when the attacker was allowed to carry out the operation without distraction. There is a possible source of bias, however: if the operation killed all the nearby witnesses then any challenge would have gone unreported, leaving us with an exaggerated impression of the lives saved by mounting a challenge.

It is sometimes suggested that women have been used in suicide attacks because they are less likely to be challenged than men. The data do not support this view. Of the seven female attackers four were challenged, which means that they were challenged with higher frequency than men.

There are some things that we cannot tell from the data. From the point of view of understanding the wider impact of terrorism on society it would be interesting to know the number of false positives associated with challenging “suspicious” persons, i.e. how frequently young people were stopped and searched although they were innocent of any harmful intention. The dataset is silent on this issue since it records only guilty acts. It would be interesting to study the effectiveness of security operations in deterring or disrupting attacks before they could be mounted, but the truncated nature of the sample means that we have no data on this.

2.8. Modus Operandi and Learning: the Faction

Three factions carried out the great majority of the 103 operations. Table 1 shows that 94 attacks were carried out by just three organizations: Hamas (the Islamic Resistance Movement), the Martyrs of al-Aqsa Brigade (the terrorist wing of Fatah), and Palestinian Islamic Jihad. Of the others two were carried out by Fatah itself, one by Fatah Tanzim, and one by the Popular Front for the Liberation of Palestine. Five are unattributed; this could mean either that no organization was involved or that the organization involved is not known; the balance of probabilities lies with the latter.

Table 3 shows that there was considerable variation in the casualties associated with incidents sponsored by the different organizations. On average, each attack sponsored by Hamas resulted in 46.1 casualties compared with 28.7 casualties when the Martyrs of al-Aqsa Brigade claimed responsibility and 22.8 when the attack was attributed to Palestinian Islamic Jihad. As a result Hamas, which mounted 43 per cent of the attacks, was responsible for 56 per cent of the injuries and 69 per cent of the deaths. The proportion of deaths in total casualties was correspondingly higher for Hamas attacks than for others.

These differences were associated to some extent with variations in the distinct modus operandi that each organization developed. But the variations are not large. Table 4 shows that the factions did not differ much in their preference for a mechanism, usually “personal means” (a bag, belt, or vest), or for a civilian target. There was a substantial difference in their propensity to provoke a challenge: less than one quarter of attacks by Hamas were challenged compared with half or more of those mounted by the Martyrs of al-Aqsa or Palestinian Islamic Jihad.

Table 5 sheds some light on each faction’s preference for the location of an attack. Hamas attacks were aimed at cafés, buses, and travel stops more frequently than the norm. Attacks mounted by the Martyrs of al-Aqsa were more than normally likely to take place in stores or in the open air, at checkpoints or in the street. The frequency of those attributed to Palestinian Islamic Jihad does not show much variation from the norm.

Table 6 shows that the volunteers recruited by the factions varied little in make-up, most being young and male. Hamas did not recruit women, and the volunteers accepted by the Martyrs of al-Aqsa Brigade were slightly younger than average.

Table 3. Casualties from Suicide Attacks, November 2000 to November 2003, by Faction

	All Incidents	Hamas	Martyrs of al-Aqsa Brigade	Palestinian Islamic Jihad	Other or not known
Incidents	103	43%	25%	23%	9%
Deaths	440	69%	16%	13%	2%
Injuries	3076	56%	22%	16%	6%
Casualties	3516	58%	21%	16%	6%
		} % of row totals			
Deaths, % of casualties	13%	15%	9%	11%	5%
Casualties per incident	34.1	46.1	28.7	22.8	21.9

Table 4. Suicide Attacks, November 2000 to November 2003, by Faction: Observed Characteristics

	All Incidents	Hamas	Martyrs of al-Aqsa Brigade	Palestinian Islamic Jihad	Other or not known
Incidents, total	103	44	26	24	9
Per cent of column total					
Personal means	84%	86%	85%	79%	89%
Car	14%	11%	15%	17%	11%
Boat	2%	2%	0%	4%	0%
Column total	100%	100%	100%	100%	100%
Of which:					
Civilian target	74%	77%	69%	79%	56%
Attacker was challenged	39%	23%	58%	50%	33%

Table 5. Suicide Attacks, November 2000 to November 2003, by Faction: More Observed Characteristics

	All Incidents	Hamas	Martyrs of al-Aqsa Brigade	Palestinian Islamic Jihad	Other or not known
Attack took place at or in:					
Street	31%	20%	38%	29%	67%
Checkpoint	16%	14%	23%	8%	22%
Travel Stop	15%	18%	12%	17%	0%
Bus	14%	25%	0%	13%	0%
Café	14%	16%	12%	17%	0%
Store	7%	2%	15%	4%	11%
Offshore	2%	2%	0%	4%	0%
Residence	1%	0%	0%	4%	0%
Attack was prevented	2%	2%	0%	4%	0%
Column total	100%	100%	100%	100%	100%

Table 6. Suicide Attackers, November 2000 to November 2003, by Faction: Observed Characteristics

	All Incidents	Hamas	Martyrs of al-Aqsa Brigade	Palestinian Islamic Jihad	Other or not known
Incidents	103	44	26	24	9
Perpetrators	112	46	28	28	10
Average age of perpetrator, where known, years	21.7	22.8	19.0	23.0	21.9
Females, where known, per cent of perpetrators	6%	0%	11%	11%	10%

Table 7. Casualties and Incidents, November 2000 to November 2003, by Faction

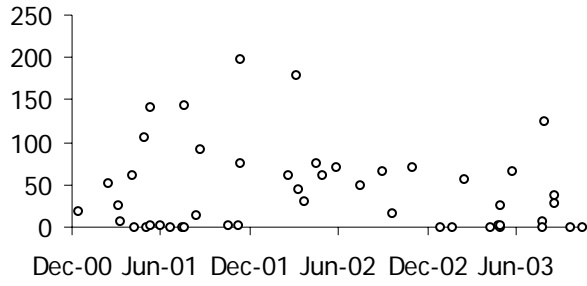
	Hamas	Martyrs of al-Aqsa Brigade	Palestinian Islamic Jihad
Incidents	44	26	24
Casualties per incident	46.1	28.7	22.8

Experience is a possible factor that might contribute to differences in the modus operandi of the various factions. The figures in Table 7 show a direct association between the number of attacks mounted by each faction and the average number of casualties per incident. This suggests the possibility that organized learning-by-doing was a factor that raised the effectiveness of some attacks above others.

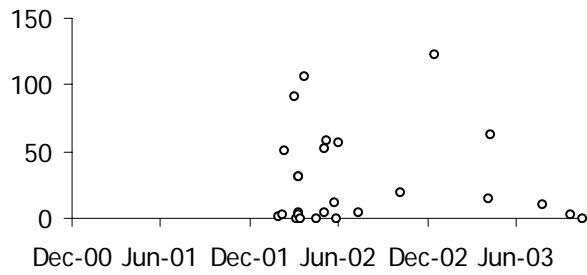
If learning-by-doing was at work we should expect to find a clear upward trend in the number of casualties in each incident that was mounted by a particular faction through time. Figure 4 shows that this is not the case. The trend of casualties achieved by each faction was approximately flat, being slightly upward only in the case of Palestinian Islamic Jihad. In other words, over the period studied the factions did not learn, collectively or privately, to select more effective assailants or mechanisms, higher-value targets, or more effective techniques for avoiding suspicion and escaping challenge. If experience was a factor, it must have been secured before November 2000; it appears that the basic procedures for organising suicide attacks were established in the 1980s in Lebanon by Hezbollah (Merari 1998).

It is possible that Israeli civilians and security personnel were also learning how to disrupt attacks once they were under way. The evidence yields limited support for this view: 27 per cent of attacks were challenged in the period from November 2000 to December 2001, but the proportion challenged rose to 45 per cent in 2002, and then remained roughly stable at 42 per cent in 2003. There was no clear breakthrough in the effectiveness of counter-measures until this year when the Israeli policy turned to the assassination of Palestinian leaders and the construction of a physical security barrier (The Economist 2004).

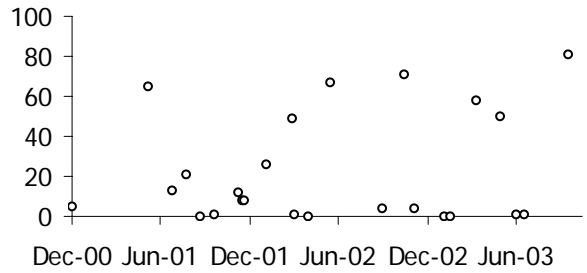
Figure 4. Casualties Through Time, by Faction



Hamas



Martyrs of al-Aqsa Brigade



Palestinian Islamic Jihad

3. Multivariate Analysis

Controlling for variation in other independent variables can shed more light on the roles of the attacker, the faction, and the bystanders in generating casualties. For this I estimate a number of reduced-form regression models using OLS. These are ultimately derived from equation (5) above as follows; i indexes the incident, j the attributes of the attacker, and k the attributes of location:

$$V_i = \alpha_0 + \sum_j \alpha_{1j} \cdot Attacker_{ij} + \alpha_2 \cdot Mechanism_i + \alpha_3 \cdot Faction_i + \alpha_4 \cdot Target_i + \sum_k \alpha_{5k} \cdot Location_{ik} + \alpha_6 \cdot Challenge_i + u_i \quad (5)$$

where u is the random error associated with the probabilistic character of the model.

The models estimated share a focus on the personal attributes of the attacker, the participation of Hamas, and whether or not the attack was disrupted by the action of

bystanders. While I include the participation of Hamas as a relevant variable I do not distinguish the role of the other factions and I do not look further for learning effects.

In more detail, the dependent and independent variables are defined below, with results following in Table 8.

Dependent Variable

Victims The number of casualties reported as killed and injured in an incident.

Independent Variables

The following variables characterise *Attacker*. The default is a lone male. I do not consider the attacker's age given the number of missing observations and the lack of variation in the ages that are observed.

Female Equals 1 when the attacker was reportedly female and 0 otherwise.

Second Equals 1 when an accomplice joined the attacker.

The following variable stands for *Mechanism*.

Vehicle Equals 1 when the mechanism used to carry explosives was a car or boat, and 0 when explosives were carried about the person in a bag, belt, or vest.

The following variable stands for *Faction*.

Hamas Equals 1 when the faction was Hamas and 0 when the faction was the Martyrs of al-Aqsa Brigade, Palestinian Islamic Jihad, or another faction.

The following variable stands for *Target*.

Civilian Equals 1 when a civilian target was attacked and 0 when a military target was attacked or the intended target was uncertain.

The following variables characterise *Location* and are mutually exclusive. The default location is the street; this includes a number of cases where the attacker was prevented from entering a café or store.

Bus Equals 1 for an attack inside a bus and 0 otherwise.

Café Equals 1 for an attack inside a café or restaurant and 0 otherwise.

Checkpoint Equals 1 for an attack at a checkpoint or roadblock and 0 otherwise.

Offshore Equals 1 for an attack offshore and 0 otherwise.

Residence Equals 1 for an attack inside a private residence and 0 otherwise.

Store Equals 1 for an attack inside a store and 0 otherwise.

Travel Stop Equals 1 for an attack at a bus stop or train station and 0 otherwise. Includes some cases where the attacker was preventing from entering a bus.

Finally,

Challenge Equals 1 when the attack was interrupted or precipitated by a challenge and 0 otherwise.

Models 1 and 2 omit the *Target* variable and Model 3 omits *Mechanism* and *Location*. This is because there was a tendency for mechanism and location to be determined by the target: vehicle bombs tended to be used against military targets and checkpoints were inevitably staffed by security personnel. I treat all the other right-hand-side variables as independent of each other.

Table 8. Factors Influencing the Effects of Suicide Attacks, November 2000 to November 2003

	(1)	(2)	(3)	(4)	(5)
Observations	103	103	103	59	42
R-Squared	0.3785	0.353346	0.37038	0.378473	0.324931
F	4.567578 ***	7.415712 ***	11.41223 ***	8.220703 ***	9.385931 ***
Independent Variables:					
Intercept	27.44406 ***	30.80088 ***	-6.87878	-2.53309	11.57527
<i>Female</i>	35.36336 **	34.97814 **	39.98487 ***	39.83925 ***	..
<i>Second</i>	34.15115 **	30.99198 **	32.52936 **	18.65238	..
<i>Vehicle</i>	-14.1393	-19.4615 *	..	..	..
<i>Hamas</i>	15.96307 *	19.59068 **	21.08129 ***	..	..
<i>Civilian</i>	..	..	43.73073 ***	34.43939 ***	50.21505 ***
<i>Bus</i>	14.40781	..	..	..	..
<i>Café</i>	34.22845 ***	28.96044 ***	..	..	..
<i>Checkpoint</i>	-24.0808 **	-27.0437 ***	..	..	..
<i>Offshore</i>	-27.2752	..	..	..	..
<i>Residence</i>	-26.4441	..	..	..	..
<i>Store</i>	0.70168	..	..	..	..
<i>Travel Stop</i>	11.04078	..	..	..	..
<i>Challenge</i>	-18.1733 **	-17.5905 **	-14.9814 *	-7.24811	-31.7258 **

Coverage: (1), (2), and (3) include full sample.

(4) excludes Hamas observations.

(5) includes Hamas observations only but excludes 2 observations where a second attacker took part.

Key: * Significant at 10%.

** Significant at 5%.

*** Significant at 1%.

The results suggest that the main actors and their decisions powerfully influenced the outcome of a suicide attack. The slope coefficients in Table 8 show the marginal contribution to the number of casualties that arises from the existence of each independent factor relative to a base case; all have the expected sign, positive or negative and many are significant. The outcome in the base case is shown by the value of the intercept. The base case for Models 1 and 2 is a lone male not associated with Hamas who detonates a personal device in the street without meeting a challenge, and the number of casualties expected in this case is 27 (Model 1) to 30 (Model 2). The use of a female attacker or an accomplice would each raise the expected numbers of victims by 30 to 35, and an association with Hamas would raise it by 16 to 20. In short, when Hamas promoted an attack higher casualties were likely even when other factors and actions were held constant. Some targets yielded much higher casualties than others; the difference between attacking a café and a checkpoint could be 50 or 60 killed and injured. The intervention of bystanders also made a difference and probably saved 18 casualties on each occasion.

The results for the *Attacker*, *Faction*, and *Challenge* characteristics of an incident are robust in the sense that they are present in all the models tested and so can be shown to hold regardless of the exact specification of the remaining characteristics of the attack. Thus Model 1 incorporates detailed information on the *Location* and *Mechanism* of an attack. Some of these characteristics prove not to be significant. When they are discarded in Model 2, the size and significance of the remaining coefficients is broadly unaffected. In Model 3 the *Location* and *Mechanism* characteristics are replaced by the *Target* characteristic. Again the coefficients on the *Attacker*, *Faction*, and *Challenge* characteristics show robust stability.

The base case of Model 3 is a lone male not associated with Hamas who attacks a military target without meeting a challenge. The number of casualties expected in this case is shown by the intercept, which is negative. This is not as it should be and suggests that the model could be mis-specified in some way. On the other hand the value of the intercept is small and is not significantly different from zero. A plausible reading is that a lone male not associated with Hamas who attacked a military target without meeting a challenge tended to succeed only in blowing up himself. The other coefficients are significant, have the expected signs, and have plausible values. In fact the explanatory power of Model 3 measured by its *R-Squared* is about the same as that of Model 1 but it achieves this level of explanation with fewer independent variables; this makes it more efficient and is reflected in its larger *F* statistic.

Since high effectiveness is associated with the use of a female attacker, an accomplice, and the involvement of Hamas, but Hamas used accomplices on only two occasions and did not use female attackers at all, the marginal contribution of a female attacker or an accomplice in incidents not associated with Hamas may be under- or overstated by regressions that include Hamas-linked incidents. Model 4 repeats the exercise of Model 3 using data restricted to incidents not linked to Hamas. This shows almost no change in the estimated size and significance of the marginal contribution of a female attacker, but the coefficients associated with a second attacker and a challenge lose both. Model 5 repeats the regression using data restricted to Hamas-linked incidents involving a lone attacker. Here we find that the effect of a challenge becomes very significant and quite large. It appears that Hamas-sponsored attacks could achieve their above-average effectiveness only when not disrupted by a challenge. Table 4 showed, however, that Hamas attacks were less likely to be challenged than others.

In all the models the *R-Squared* is between 32 and 38 per cent; this indicates that the greater part of the variation in effectiveness remains unexplained. It is not clear whether the unexplained variation reflects omitted variables that could potentially be measured and taken into account, or influences that were intrinsically random and cannot be controlled.

4. Conclusion

In this paper I have conducted a largely descriptive analysis of the outcomes of suicide attacks in Israel over a three-year period. The analysis has shown that the outcomes of suicide attacks were highly variable. It has explained part of the variation by the attributes of the attacker, the mechanism employed, the organization sponsoring the attack, the place of the attack, and the action of bystanders.

The figures suggest that women were more proficient assailants than men, that the infiltration of a person carrying explosives about their body into places frequented by civilians resulted in more numerous victims than other methods, and that the prompt action of bystanders in challenging the attacker significantly reduced the number of victims. They also suggest that Hamas had evolved a more effective modus operandi in carrying out suicide attacks, even after controlling for the choice of target or location and the fact that Hamas has not used female attackers. This modus operandi, if it exists, was evidently developed before the period that we have studied since the effectiveness of Hamas attacks did not rise within the period.

The results raise some interesting questions. One is the nature of the mechanism that motivates the attackers (Harrison 2003, 2004). Another is the motivation of the organizations that sponsor the attacks. Did the factions aim to maximise casualties, or did terrorist operations more often have multiple objectives for which the number of casualties was being traded to some extent? Why do the other factions appear to have used their resources less effectively than Hamas? Why did all the factions invest substantial resources and effort in many operations against targets that were apparently of low expected value? It is possible that they gained by pursuing a mixed strategy: for example, by allocating some resources to unexpected targets they may have retained an advantage of surprise or unpredictability.

The actions of those who challenged suicide attacks that were already in progress also deserve attention. Their role emerges as essentially tragic: by taking the initiative away from the attacker they saved the lives of others but this was likely to be at the cost of their own death or serious injury since the attack was usually precipitated as a result. If it is of interest to study why some die with the purpose of killing, it may also repay study to find out why some die in order to save life.

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