

THE ROLES OF OPERATIONAL SEX RATIO AND YOUNG-OLD RATIO  
IN PRODUCING SUICIDE ATTACKERS

by

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## ABSTRACT

Demographic factors influence the intensity and duration of conflicts and collective violence is more common where there are high numbers of young men to older men, and where there are more marriageable men to women. The notion that young, unmarried men are more likely than other cohorts to be unattached risk-takers explains these findings. This dissertation investigates whether these same demographic factors increase the likelihood a country will produce suicide attackers.

Information on individual attackers was assembled from three earlier studies and corroborated using LexisNexis searches of major world news publications. Personal information, including age, sex, and country of origin, was collected for 1,208 individual suicide attackers who acted between 1981 and 2007. This information was then used to create a second dataset to make comparisons between countries and regions that produced suicide attackers and those that did not. Thirty-three of the 219 countries and regions analyzed produced suicide attackers, and those that did had higher numbers of marriageable men to women, higher polygyny rates, higher percentages of Muslims in their populations, and larger populations overall. Counter to the hypothesis, countries with higher numbers of young men to old were *less* likely to produce suicide attackers. It may be that the older men in polygynous societies create an even greater scarcity of marriageable women, making it more difficult for young men to marry. Faced with

relatively few reproductive and perhaps other alternatives, these young men are more prone to become suicide attackers.

To Dad, Mom, Jenny, Maura, Todd, Conner, and Nick

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## CHAPTER 1

### SUICIDE MISSIONS: A HISTORY OF IDEAS

#### Introduction and Roadmap

The goal of this dissertation is to provide a small but significant contribution to the understanding of suicide missions and predict where they might emerge. The paper follows the spirit of the following quote

Selectionist logic suggests that high risk behaviors, such as terrorism, are more common in high fertility populations (e.g. Daly and Wilson 1988). We are not aware of any research that links terrorism, religiosity, and fertility decisions, but this would be a worthwhile pursuit. (Sosis and Alcorta 2008:11).

Violence and aggression have long been of interest to evolutionary researchers, and this paper extends on their earlier work. A detailed discussion of how evolutionary theory applies to suicide missions comes later, but the point must be made now that while sociocultural factors account for much of what people do, evolved psychological and behavioral traits do, too; and while evolutionary theory cannot completely account for all behaviors, violence included, it can independently fill gaps left by cultural and materialistic explanations.

The next few paragraphs describe how this paper is organized. Since there is no unanimously accepted definition of “suicide terrorism”, a section on definitions and semantics follows this one; then comes a brief overview of the use of suicide missions in

both historic and modern contexts; this is followed by a detailed discussion of the evolutionary approach used throughout the paper; a section detailing the proposed explanations for suicide missions follows that. Much of the research on suicide attacks is contentious, making it difficult to issue, or justify, generalizations about it; therefore, this overview takes a conservative approach when discussing a “root cause” of suicide missions since it has become clear that monocausal explanations do not satisfactorily explain them all. Finally, a discussion of the differences between men’s and women’s motivations for suicide attacks is followed by an overview of which explanations for suicide mission are best supported empirically.

Chapter 2 outlines the hypothesis to be tested, along with methods of data collection and analysis. The majority of the incidents examined here came from previously published reports, so methods of selection and verification are also discussed. The chapter offers a justification for using information criteria (e.g., Akaike’s Information Criterion) in place of stepwise regression or  $R^2$  for selecting the models presented subsequently.

Chapter 3 presents the results of the analysis; tables of descriptive and univariate statistics are followed by additional discussion of model selection methods, and then, the full multivariate models. The analysis supports the hypothesis that operational sex ratio and young-old ratio are correlated with the likelihood a country or region will produce male suicide attackers; a discussion intended to establish causation in this correlation follows. The results are then used to develop a predictive model showing which of the world’s countries are most likely to produce suicide attackers in the future.

Chapter 4 closes the dissertation with a summary of the results and possible proscriptions for curbing the appeal of suicide terrorism. These include “offshore balancing” (placing naval power near conflicts instead of building permanent military installations in foreign countries), negotiating with insurgent leaders, encouraging people to stop supporting groups who use suicide terrorism, and improving women’s social and economic status.

#### Definitions and Semantic Origins

The aphorism, “One man’s terrorist is another man’s freedom fighter” (Seymour 1975), illustrates why there are dozens of definitions of “terrorism.” Context matters: terrorism does not occur in a vacuum and the social, political, philosophical, religious, and moral justifications for its use are important to its definition. “Terrorism,” according to The United Nations General Assembly (1994:3) constitutes “criminal acts intended or calculated to provoke a state of terror in the general public.” While useful in some contexts, this definition presents a problem for research on suicide missions because, as of 2005, no “clear evidence” showed that the now defeated Liberation Tigers of Tamil Elam (LTTE or Tamil Tigers) used suicide missions to directly attack, and therefore terrorize, citizens (Hopgood 2005:44). Although many Sri Lankans died in LTTE attacks on important financial and military targets, these deaths were arguably incidental or “collateral.” That said, in 1997 the United States Department of State designated the LTTE a “Foreign Terrorist Organization” (FTO). Was the LTTE a terrorist organization prior to this? If not, did the 2006 bombing that killed 60 civilians, including 15 children make them one (Shelby 2006)? How might these definitions change if an ethnic Tamil

made them, or a Belgian, or a Lithuanian? These questions are not intended to make light of the situation in Sri Lanka; rather, they are meant to illustrate the difficulty of defining terrorism. This paper avoids the “terrorist” label, not only because of the issues with its definition, but because doing so does not distract in any way from the analysis; whether a suicide attacker is a “terrorist” is irrelevant here.

Researchers also do not agree on what to call those who purposefully kill themselves in the midst of military or insurgent actions; they have been called “suicide attackers,” “suicide terrorists,” and “suicide bombers.” Hafez (2007) and Pape (2005) use these terms interchangeably, while Gambetta (2005:6) refers only to “suicide missions,” which he defines as “violent attack[s] designed in such a way as to make the death of the perpetrators strictly essential for its success.” Hafez (2007:6) defines “suicide terrorism,” as “a premeditated attack by an individual who willingly uses his or her body to carry or deliver explosives to attack, kill, or maim others.” While this definition explicitly mentions explosives, it is consistent because Hafez’s dataset does not include the 9/11 attacks. Pape (2005:10), says a suicide attacker, “does not expect to survive the mission and often employs a method of attack (such as a car bomb, suicide vest, or ramming an airplane into a building) that requires his or her death in order to succeed.”

Gambetta’s definition is used here, along with the terms “suicide attackers” and “suicide attacks,” primarily because this definition is broad enough to encompass those given by Pape and Hafez, but also because Gambetta offers additional details about the types of targets suicide attackers go after, like military personnel, civilians, symbols, and military installations or equipment. In summary, all the suicide attackers described here

succeeded in killing themselves while attempting to kill others or render useless symbolic, military, or other property belonging to their stated enemies.

### Historical and Modern Uses of Suicide Missions

Suicide attacks are not are not a new phenomenon; Jewish Sicarii used them nearly 2000 years ago, as did 11<sup>th</sup> century Muslim Hashishiyun, or “Assassins.” Highly skilled members of these groups infiltrated their targets’ inner circles, often lying in wait for years before using daggers or swords to kill them.

The invention of dynamite in 1867 extended the potential of suicide attacks. For assailants who came after this, long-term intimacy was no longer a prerequisite for success; small bombs could kill with a high degree of certainty, and do so in spite of bodyguards. The first suicide bombing occurred on March 13, 1881, not long after the invention of stable, portable, high explosives. On that day, Ignaty Grinevetsky exploded a bomb near himself and Czar Alexander II of Russia, killing them both along with several others (Goldman et al. 2003). Grinevetsky, a member of the group *Narodnaya Volya* (The People’s Will), became the first of several anarchist suicide bombers to act in prerevolutionary Russia (Kalyvas and Sanchez-Cuenca 2005).

Suicide attacks saw widespread use in World War II after 1944. More than 3,800 Japanese Kamikaze pilots intentionally crashed bomb-laden planes, submarines, and boats into Allied targets, and at least two American pilots crashed into enemy ships although doing so was reportedly unnecessary (Hill 2005). Shortly ahead of the assumed allied invasion of the Japanese mainland, the Imperial Japanese Army trained foot

soldiers to slip under tanks while wearing backpack bombs, but the tactic did not see use in the war (BBC 2005).

Kamikaze pilots began their missions with full fuel tanks and were encouraged to return to base if they could not find sufficient targets: their missions were well thought out and deliberate. Like the suicide attackers of today, most Kamikazes were young, unmarried men. Of one graduating class of Japanese pilots, 99 percent indicated a willingness to participate in Kamikaze attacks (Hill 2005). Interestingly, one outspoken dissenter tore up his volunteer form and said “I have a sweetheart and I want to marry her when this war is over (Yokota 2000:21).

After a nearly 35 year absence, the “modern era” of suicide attacks emerged in the early 1980s with Lebanese attacks against French, Israeli, and American targets. Late in the 1980s, Liberation Tigers of Tamil Eelam (LTTE or Tamil Tigers) adopted the tactic for use in Sri Lanka and India. In the 1990s, suicide missions came into widespread use in the Palestinian-Israeli conflict and were also used by the Kurdistan Worker’s Party in Turkey. The 21st Century saw continued use of suicide attacks by Palestinian groups and the LTTE and their spread into Russia as part of the Chechen separatist movement. With the attacks of September 11, 2001, suicide attacks infamously arrived on American soil. The Iraq War witnessed widespread use of suicide attacks by insurgents against US and coalition forces. At the same time, the tactic came to use in less obvious places, including China and Bangladesh. The modern age of suicide missions has been aided by the advent of the internet, which organizers use to recruit members and disseminate ideological writings and technical information (Atran 2010).

### The Absence of Suicide Missions

Relative to the number of conflicts the world has witnessed over the last two millennia, suicide missions appear to occur rarely: Is this evidence of absence or absence of evidence? It may be that historical accounts did not include cases of suicidal attacks, or that the lack of instantaneous media dissemination left them relatively unknown; which is the case remains unresolved.

Hopgood (2005:73) provides an intuitive rationale for why groups might employ suicide attacks, saying

At the group level, the benefits [of suicide missions to the group using them] are clear: rather than allowing the ‘natural heroes’ to emerge under battle conditions (for which we might see the award of bravery medals as an indicator, many Victoria Cross holders in Britain having received them posthumously for acts of ‘suicidal’ courage), why not pre-select them, train them, and position them with the kind of explosives or other weapons with which they can hope to fully realize their military goal.

Following this logic, suicide missions make strategic sense. Groups engaged in collective violence might select their most heroic members for premeditated attacks, rather than waiting for them to rise to the top in the heat of battle.

Today, suicide attacks constitute less than two percent of all terrorist incidents, and most of these are perpetrated by a “handful” of groups (Kalyvas and Sanchez-Cuenca 2005:209; RAND Corporation 2003). Relative to conventional tactics, suicide attacks have had extraordinary success at inflicting casualties (Atran 2006): So why are they not used more often? Kalyvas and Sanchez-Cuenca (2005) suggest several reasons for their absence. First, people may simply not have thought of the technique, or they lacked the technology for its implementation. The fact that early 19th century Russian anarchists were the first to use suicide *bombings* suggests that the invention of powerful explosives

facilitated the use of suicide missions. Second, organizations that might otherwise employ suicide missions may operate within societies morally opposed to their use. The Irish Republican Army (IRA), for example, did not use suicide missions; perhaps because suicide is expressly forbidden by the Catholic Church, regardless of the justification. Third, suicide missions may be counterproductive in the face of local, national, and international reactions; if such sanctions outweigh the benefits suicide attacks bring, it may be best to avoid them. Fourth, suicide attacks may be prohibitively expensive in both financial and human terms. Although modern suicide missions are inexpensive, World War II kamikaze attacks were costly since they often sacrificed well-trained officers along with their aircraft (Hill 2005). Fifth, there may be a lack of people willing to participate in suicide missions; laser guided bombs do not have freewill; human beings arguably do.

Since their inception, suicide missions have come and gone in warfare. Following World War II, they were absent the world for more than three decades; yet they have occurred every year since 1981. What the Molotov cocktail was to 19th century revolutionaries, the suicide attacker may be to those of the 21st: an effective, inexpensive, and pervasive weapon of insurrection.

### Applying Evolutionary Theory to Suicide Missions

Biologists, sociologists, and anthropologists have long assumed that scarcity, whether natural or man-made, is the chief catalyst for both social competition and social conflict (Hudson and Boer 2004:36).

The following four sections show how psychological, social, and demographic characteristics can interact to generate competition and violence between men. The

relatively new field of “demographic security” focuses on predicting and preventing such violence. Cincotta (2004), notes that while “demography is not destiny,” there are several population-level factors associated with conflict, including: 1) a youth budge (Mesquida and Weiner 1999); 2) rapid urban population growth (Fuller and Pitts 1990); 3) low levels of cropland or water per person (Cincotta et al. 2003a); 4) a population decline of working-aged adults (Cincotta et al. 2003b); 5) differential growth rates between neighboring ethnic or religious groups (Grammich 2002); 6) migration (UN Population Division 2001); 7) aging and population decline (DaVanzo and Grammich 2001); and 8) a high sex ratio (Hudson and Boer 2004). From an ecological and demographic standpoint, it is clear that aggression and violence stem, at least in part, from competition over a wide array of resources. While the present research focuses on the first and last of the causes above, a youth bulge and high sex ratio, the others may also motivate suicide missions.

The majority of suicide attackers are young men (Hafez and United States Institute of Peace 2007; Pape 2005; Ricolfi 2005); possibly because they are more prone to risky behavior than any other sex or age class (Daly and Wilson 1985). Males have high reproductive variance compared to females, so in the competition for a relatively limited number of reproductive opportunities, some males will have many children or mates over a lifetime, while others will have none (Trivers 1972). Violence is not the only possible outcome of this scenario; across the animal kingdom cuckoldry and “sneaker” strategies are alternatives (Kokko and Jennions 2008; Queller 1997), but human violence is at times motivated by reproductive competition (Chagnon 1988). The following sections carry this argument further and provide detail on how “Young Male

Syndrome,” operational sex ratio, and young-old ratio might interplay to produce suicide attackers.

### “Young Male Syndrome”

This dissertation revolves around young men and their propensity for risk taking behavior. Daly and Wilson (1985) call this tendency as “Young Male Syndrome” (YMS). “Young Male Syndrome” was devised to explain sex-biased homicide rates in Detroit, where males committed 422 of the 512 (82.4 percent) murders recorded there in 1971 (Daly and Wilson 1985). The majority of both victims and perpetrators were young, unmarried men, and over half of the homicides resulted from “trivial altercations” (Daly and Wilson 1985:63) involving personal attacks on “face” or social status (Daly and Wilson 1985:1).

Daly and Wilson’s work suggests that protecting status is a central cause of violence between young men. If a reputation is worth dying over, is a piece of land, a friend, an ideology, or a religion? Wilson and Wrangham (2004:234) suggest that gang violence is at times motivated by territorial concerns, but that “the principal biological influence on collective violence is the male’s concern for status.” Citing Vigil (1988), they continue, saying that older gang members are “more likely to be involved in alternative ways of achieving status, such as employment or gain-associated crime, than in violence” (Wrangham and Wilson 2004:238).

In gangs, direct participation in physical violence is the domain of young men. It may be that in some conflicts, young men find a lack of political, economic, and reproductive opportunities humiliating which compels some to become suicide attackers.

Support for this is evident in the literature, where “humiliation” is regularly cited as a motivation for participation in suicide missions (e.g., Atran 2003a; Atran 2006; Gill 2007; Kruglanski and Golec 2004).

### Young-Old Ratio

Young male syndrome may explain why most suicide attackers are young men, but why is it that some regions of the world produce more of them than others? Mesquida and Weiner (1999) suggest a link between young male syndrome and young-old ratio (YOR), the number of men aged 15-29 years in a population relative to the number of men over 30 in the same population. Theoretically, the amount of risk young men are willing take to access resources varies according to local conditions. For example, as the ratio of young males to old in a population increases, so should competition for reproductive and other resources. This explains why populations with youth bulges have more conflict; they are comprised of relatively high numbers of young, unattached men who are more likely than any other demographic cohort to take risks.

Conceptually, populations with high YORs (i.e., many young men relative to old) are more susceptible to conflict than those with low ratios. In the words of Mesquida and Weiner (1999:183)

Competition for mates is greatest just before the usual age of marriage; young males must compete for connubial resources among themselves, and also with older males who control the political and economic resources of society. It is therefore possible that war efforts are instigated by young, unmarried men, for purely selfish reasons. This, in fact, would go a long way in explaining why violent intergroup conflicts are executed almost exclusively by young males, often under the supervision of older, more established leaders. Political leaders, contrary to what is traditionally assumed, may not actually foment wars. But because they are themselves threatened by the young men, they may attempt to divert the coalitions against other targets.

Populations with high YORs do, in fact, experience longer and more severe conflicts than those with low (Mesquida and Weiner 1999). Youth bulges have traditionally been mitigated by effectively removing some young men from populations using conscription, religious service, repression, or emigration (Cincotta 2004). While speculative, it may be that these institutions, which are often created by older men, encourage group harmony.

### Operational Sex Ratio

The fact that females generally invest more than males in offspring is called “Bateman’s Principle” after the idea’s namesake who conducted a series of experiments with fruit flies (*Drosophila melanogaster*), later generalized to humans, showing how anisogamy, sexual selection, and reproductive effort are related (Bateman 1948). Bateman suggested that, since they produce larger gametes than males, females should be objects of competition for men. Recent advances in sexual selection theory indicate that Bateman’s Principle is not universally applicable to human populations and that sex ratio, sex specific mortality rate, mate encounter rate, and additional factors contribute to how “choosy,” “coy,” or “competitive” each sex should be (Kokko and Monaghan 2001). In addition, reproductive success in human populations differs according to mating system, being highest in polygynous societies and lowest in monogamous ones (Brown et al. 2009).

Trivers (1972), expanded on Bateman’s Principle, saying that, after they give birth, females should continue investing more than men in offspring since they have “sunk” more effort into their development. The assumption that anisogamy necessarily leads to greater postpartum investment for females has come under fire for committing

the “Concorde Fallacy” (i.e. it is better to continue investing in the future if you have invested in the past) (Dawkins and Carlisle 1976; Kokko and Jennions 2008). Trivers’ logic is potentially fallacious because there comes a point at which an individual is economically better off cutting their losses and beginning anew, rather than sinking further resources into a bad investment. Female mammals, therefore, are not necessarily obligated to invest in offspring just because they have invested in larger gametes. That said, Trivers (1972) noted that female mammals usually invest more than males, suggesting men should compete with each other for reproductive opportunities with women.

Emlen and Oring (1977:215) paraphrase Darwin (1871), saying

When one sex becomes a limiting factor for the other, the result is an increase in intrasexual competition among members of the available sex for access to mates of the limiting sex.

Again, although the “competition” to which this quote alludes may imply violence, it is not the only possible strategy. For males, alternatives include extra-pair copulations and other “sneaky” strategies, and there are good theoretical reasons to expect these; after all, why should an individual increase its chance of injury or death by fighting in an already risky environment? By this logic, risky conditions might actually select against risky behavior (Kokko and Jennions 2008; Queller 1997). For human males, however, violence can have both direct and indirect payoffs. Group members can benefit from violence and seem interested in it, suggesting it generates an audience effect. In at least some cases, violence begets social and reproductive rewards for men (Chagnon 1988).

Operational sex ratio (OSR) is “the average ratio of fertilizable females to sexually active males at any given time” (Emlen and Oring 1977:197). Researchers in

evolutionary biology and anthropology have used this simple metric to address questions on sexual selection, costly signaling, and parental investment. Authors define OSR in different ways; some derive it using the original female to male calculation, while others use male to female, possibly because it is how primary and secondary sex ratios are traditionally reported. This paper opts for the latter definition (where male-biased populations have higher OSR) because it is most common in the current literature and continues under the assumption that high, or male-biased, OSR leads to increased competition between males over female investment in offspring. Populations with especially high OSRs may be more likely to produce suicide attackers compared to those with low OSRs.

#### Kin Selection and Hamilton's Rule

From an evolutionary perspective, suicide attacks appear irrational because they sacrifice the actor's life along with their potential to reproduce. Other "altruistic" acts in nature also seem irrational; but many are actually "selfish" in the Darwinian sense, especially when their benefits fall on family members (Dawkins 1976). Hamilton (1963; 1964) theorized that individuals should act altruistically if the cost incurred to them by their actions is outweighed by the benefit they provide to kin. He formulated this relationship in an equation known as "Hamilton's Rule"

$$C < rB \tag{1}$$

where  $C$  is the cost of the action,  $r$  is coefficient of relatedness of the actor to the beneficiary, and  $B$  is the benefit of the action to all related parties. Hamilton's Rule has become the basis for an entire body of literature known as inclusive fitness theory.

If suicide attacks are, in part, motivated by kin selection, they must satisfy the above inequality. In other words, the potential reproduction given up by an attacker must be recouped by their kin, which becomes more likely the more close family members they have. One of the initial goals of this project was to test the hypothesis that suicide attackers come from larger than average families, but the data to do so were simply unavailable. Fortunately, Hamilton's Rule still has theoretical value here, but making the most of it requires moving focus from benefits to costs.

As the value of  $C$  in Hamilton's Rule decreases, so do the values of  $r$  and  $B$  needed to satisfy it. Theoretically, the less likely a suicide attacker is to reproduce, the lower the reproductive cost of his or her actions. OSR and YOR can proxy male-male competition because higher values mean greater numbers of men competing for a limited number of reproductive resources. In other words, the average male in a high OSR or YOR population has lower reproductive prospects than the average male in a low OSR or YOR population; this fact rebalances Hamilton's inequality and may lead to increased male risk taking, and thus more suicide attackers, in high OSR and YOR populations.

While they may increase the odds that a population produces suicide attackers, demographic characteristics cannot explain all suicide missions. A glance at the raw data show high OSR and YOR in regions of Central Africa, the Middle East, and Southern Europe. If the demographics were enough to generate attackers, those regions should see high rates, but they do not. Instead, high OSR and YOR may work in conjunction with other factors to push populations to a "tipping point" of attacker production.

Rather than the simple measure of OSR used here, which takes into account the number of reproductively aged men to women in a population, some researchers use a

modified calculation that takes into account the average woman's "time in" and "time out" of the reproductive pool; this assumes women are reproductively unavailable when married or pregnant. To maximize sample size, this dissertation assumes all reproductively aged women are available throughout their reproductive years; however, the analysis includes polygyny rate as a control variable. While not the primary focus of this research, polygyny plays a hypothetical role in suicide attacker production because it reduces the number of reproductively aged females in a population. Regions with high polygyny rates may be more likely to produce suicide attackers relative to those with lower rates.

#### The Timing, Goals, Effectiveness, and Targets of Suicide Attacks

There are logical reasons for why groups might use suicide missions; if such attacks work better than conventional means to garner concessions, recruit people, and kill or terrorize enemies, they could win favor over traditional tactics (Bloom 2005; Pape 2005). There is evidence that suicide missions are particularly effective at inflicting casualties: on average, they kill more people per attack than traditional methods (Atran 2006; Pape 2005). In terms of destructive potential, suicide missions are an effective tactic of modern warfare.

Judging the political effectiveness of suicide missions requires knowing the goals of the groups employing them. Since such organizations are comprised of individuals who may have different opinions, they must organize their membership around some central goal or purpose, just like any political or religious group. Individual opinions about how to best achieve goals may vary, but people show their commitment to "the

cause" by maintaining membership. Overall, members of groups using suicide missions share the opinion that suicidal violence is the only means to achieve their goals (Bloom 2005). In a way, these people are not unlike revolutionary Marxists, who believe true socialism can only be realized through the overthrow of a capitalist system.

Pape (2005) explains that that suicide missions might give the weaker party in a conflict more leverage than they might otherwise have, leading to concessions. This speculation should, however, be framed as a hypothesis and tested against data; reasonableness does not make something so. Pape (2003; 2005) contends that the primary goal of groups using suicide attacks is expelling foreign occupation from what the group perceives as their ethnic or national homeland. If Pape is correct about this, seven of the 13 (54 percent) suicide attack campaigns that occurred between 1980 and 2003 were successful (Pape 2005). This rate of success is "remarkable," according to Pape (2005), who speculates it would be closer to 30 percent suicide attacks absent.

Since Pape's analysis was published, however, three of the longest running and most studied suicide campaigns have failed to repel occupation: the Liberation Tigers of Tamil Eelam fell to Sri Lankan troops in 2009; American troops remain stationed throughout the Middle East; and Palestinians continue living sanctioned, marginalized, and occupied. While foreign occupation may cause some suicide attacks, such tactics may not be more successful than traditional methods of repelling foreign forces.

According to Pape (2005) and Bloom (2005), suicide attackers generally appear in the second iteration of a conflict. There were no suicide bombings during the Gulf War, for example, yet the Iraq War has seen hundreds. Suicide attackers were absent the First Chechen War and the first Palestinian Intifada, but came into use during the second

iterations of each (Bloom 2005; Crenshaw 2007). Suicide missions do not appear to be a tactic of last resort though, emerging only after conventional means are exhausted. The Tamil Tigers, for example, began using suicide missions in response to a need to reach difficult targets (Hopgood 2005).

Pape (2005) says that, because they are easily swayed, suicide campaigns *only* target liberal democracies. Since authoritarian regimes might show no respect for human rights or tolerance for political dissent, they might simply eliminate troublesome populations that produce suicide attackers. The data do not agree, however; while Pape argues that attacks in Morocco and Saudi Arabia actually targeted the US, the same cannot be said for those in Bangladesh and China. When Jackson and Reiter (2007:344) reevaluated Pape's claim that suicide attacks only target liberal democracies, they found only "quite modest" support for it and much stronger support for "[population] size, Islam, and the past global experience with suicide terrorism" as causes.

This section gave a synopsis of the timing, goals, and effectiveness of suicide missions. While they are an effective means of killing people, suicide attacks are not a foolproof means for expelling foreign occupiers; and while they may give weak actors more leverage in conflict than they would otherwise have, there is no steadfast way to predict their emergence. The paper now turns to the strategic, individual, social, and demographic causes of suicide missions.

### Proposed Causes of Suicide Attacks

Suicide missions are a complex phenomenon; and like any human behavior, many factors contribute to their presence. Unfortunately, the literature on suicide attacks is no

stranger to supposition and unsupported logical leaps, making it difficult to separate truth from speculation. Too often, authors fail to establish causation in phenomena that correlate with suicide missions. This section discusses the proposed causes of suicide attacks along with relevant criticism of them: it is an attempt to weigh the evidence for the causes of suicide missions using empirical evidence for substantiation. This section introduces causes in roughly chronological order, according to when they were proposed in the scientific literature.

Researchers typically discuss the causes of, and motivations for, suicide attacks at three interrelated levels: strategic, social, and individual. Strategic causes can be thought of as ultimate goals, like nationalism and political self-determination; they are typically applied to organizations. Social causes include competition between rival political groups for membership and funding; they are generally applied to organizations along with the local populations they operate within. Individual causes include personal motivations like revenge and humiliation; they are applied to single members of a population. The current naming convention is unwieldy and future researchers could benefit by disentangling types of motivations from the relative number of people they influence. It is plain to see how a motive like nationalism might at once be a strategic motive for individuals, insurgent organizations, and an entire society; yet this distinction is rarely noted.

While a piecemeal approach is often useful for developing insight on relatively new and complex topics, researchers have failed at times to “see the forest through the trees” when discussing suicide attacks. There is no “magic bullet” explanation for all suicide missions, although many have been proposed. The “root causes” of suicide

missions often ally with the research interests of the authors suggesting them. For example, Pape's (2005) explanation that nationalism is the "taproot" of suicide missions stems from his field of political science. Many criticize Pape for being too forceful with his stance that suicide attacks are rooted in nationalism (see below), especially since he has had the ear of policymakers in Washington DC on more than one occasion (Ashworth et al. 2008; Atran 2006; Atran 2010; Crenshaw 2007). It is clear that individual, social, and strategic factors all have a hand in producing attackers; denying this is a disservice.

Early Explanations: Psychology, Poverty, and  
Lack of Education (1993-2003)

The persistent stereotype of suicide attackers as uneducated, poor, crazed, religious fanatics is tired: sufficient evidence shows this is not the case. In fact, the idea that suicide attackers are irrational and random only increases their effectiveness as a weapon of psychological warfare (Atran 2003b). Suicide attackers generally better educated than the local average, sane, often middle-class, and they may or may not be religious (Atran 2003a; Atran 2003b; Atran 2004a; Atran 2004b; Atran 2004d; Atran 2006; Bloom 2005; Hudson 1999; McDermott 2005; Pape 2003; Pape 2005).

Many, including former President G.W. Bush, have assumed a connection among poverty, lack of education, and terrorism; however, there is little evidence for this (Pape 2005). If such a relationship did exist, sub-Saharan Africa might be a hive of terrorist production, but it is not (Krueger 2007; Piazza 2006).

While the "conventional wisdom" that poverty leads to suicide attacks has failed to withstand scientific scrutiny, whether income inequality does has yet to be tested.

While there is no link between income inequality and *non-suicide* terrorism (Krueger 2007; Piazza 2006), an attempt is made here to look for links between it and suicide missions.

### Common Factors in Modern Suicide Missions

The dismissal of psychological abnormalities, poverty, and lack of education as causes of suicide attacks has opened the door for new explanations. Gambetta (2005) identifies six commonalities of suicide missions and the groups who use them; these are provided here as primer for the history of ideas to follow. First, suicide attackers are rarely, if ever, lone actors; rather, they are members of groups who act within organized conflicts. Second, the goals and behaviors of groups who use suicide missions vary widely; some are religious, some are fiercely nationalistic, and so on. Third, suicide missions are always used in conjunction with other military tactics like sabotage and armed resistance. Fourth, groups employing suicide missions either exist within societies that support “radical tactics,” or they operate outside any *single* community (Ricolfi 2005:260). Hezbollah, for example, exists within a single society that supports radical actions. Al-Qaeda, on the other hand, operates *across* many communities and is less influenced by the attitudes of any one in particular. The point is that “there is no radical organization linked to a moderate community that has used [suicide missions]” (Ricolfi 2005:260); either local communities support suicide missions, or the attacks are ordered by leaders who do not heed local norms since they operate outside them. Fifth, the weaker sides of asymmetric conflicts are generally the first to use suicide missions; but while many portray them as weapons of last resort, this is not always the case. The Tamil

Tigers adopted suicide missions in the late 1980s, more than 10 years after the organization was founded and nearly two decades before its defeat. Last, Gambetta suggests that suicide attacks are *only* directed at democracies, extending Pape's (2005) claim that suicide *campaigns* (series of attacks designed to garner concessions) target democratic states solely. The evidence contradicts this point, though; suicide attacks in Morocco, Saudi Arabia, Russia, Bangladesh, Sri Lanka, and by rival Iraqi insurgents against each other show that being a democracy is not a prerequisite for being targeted. In fact, up to one third of suicide attacks from 1980 to 2006 may have targeted nondemocracies (Pedahzur 2006). Nevertheless, the majority of suicide attacks do target democracies, probably because nondemocracies may have relatively little regard for human rights and may take a heavy handed approach to deal with dissenters (Pape 2005). Ethnic Kurds, for example, used suicide attacks against Turkey, but not against Saddam Hussein in Iraq, probably because of his demonstrated contempt for Kurdish human rights.

#### Religion (Early 1990s - Present)

Groups that use suicide missions and the individuals that take part in them are differently motivated, so overgeneralizing about them is dangerous. While Pape (2005) is dismissive of religion's role as a "root cause" of suicide missions, Atran (2006:130) is skeptical and calls Pape's analysis "outdated," "sometimes deeply misleading," and says there are "clear and profound differences" between secular groups motivated by nationalism and religious groups motivated by global jihad. Atran (2006) cites Stern (2004), whose interviews with jihadis indicate they are motivated by feelings of

resentment and humiliation stemming from what they perceive as Western imperialism in Muslim lands. The goals of jihadist groups, like al-Qaeda, who fight decentralized global battles against cultural domination should not be conflated with those of nationalist groups, like Hamas, who seek liberation of perceived ethnic homelands.

Recognizing this fundamental split in motives is essential to explaining suicide missions comprehensively; too often researchers and policy makers have suggested a singular cause for them, and in doing so, they may have misguided efforts to stop them. There are, in fact, secular nationalists and global jihadis, but there are not secular jihadis or global nationalists. Jihad is religiously justified conflict (note that this does not necessarily mean religiously *motivated*), while nationalism is based on the actors' perceived rights to a piece of land. Global jihadis see the entire world as a battlefield, not just a single territory or county (Atran 2010).

The trouble with understanding the role of religion in all of this is that it blurs the lines between group and individual motivations and it is correlated with a wide range of non-religious cultural beliefs and practices at the individual and societal levels. But is this something unique to religion? Secular movements like Marxism blur these lines, too, but according to Atran (2010), not as well as religion since they lack a transcendent supernatural component that places the struggle in a universal context.

In the absence of research focused on untangling how religious belief, terrorism, and other cultural factors covary, it seems best to consider the utilitarian role religion plays in conflict. Weisner (1998) suggests that indoctrination leads people to pay less attention to kinship loyalties, meaning they are more likely to make group sacrifices. Following this line, Atran (2002; 2003a; 2004c) calls attention to the role of fictive

kinship in motivating altruism: militaries encourage “bands of brothers,” and parishioners call each other “brothers and sisters,” all “children of God,” their collective “Father.” Such psychological primes might encourage altruism between unrelated group members *via* the same psychological mechanisms that generate it between biological kin (Atran 2003a).

Sosis and Bressler (2003:228) found that religious communities survive longer than secular ones. Drawing on Rappaport (1971; 1979; 1999), they explain that religious beliefs are unfalsifiable and since they “cannot be verified logically, believers verify them ‘emotionally.’” Religion binds believers and separates the sacred from the profane in ways secular ideologies cannot and is “the means by which terrorists translate a political struggle into a cosmic war” (Sosis and Alcorta 2008:107). A reliance on the supernatural expands the scope of religious movements beyond that of secular ones, like environmentalism.

Religion is useful for organizing and justifying protracted transnational conflicts because it clearly defines group membership across national, racial, and ethnic lines. It also transforms a conflict’s timeframe from something possibly quite short into something everlasting (Sosis and Alcorta 2008). Such transcendence means that al-Qaeda members might not view themselves as nationals, but as soldiers struggling for all humanity, for all time (Atran 2006). Since they are unified by religion, not citizenship, they do not fear “earthly” retaliation because they have no homeland which can be retaliated upon (Atran 2006).

Although not all suicide attackers are Muslim, Islam is the only religion now “directly involved” with suicide missions (Gambetta 2005:261). This has not always

been the case, though, as the Jewish Sicarii mentioned in the introduction to this paper show. Islam's current involvement may, however, have more to do with the way the religion is organized than with any particular piece of religious doctrine. Sunni Islam, in particular, lacks a strict hierarchy, so its teachings are arguably more open to interpretation than those of other religions. Even if the majority of Muslims believe otherwise, a religious leader (*imam*) may issue a declaration (*fatwa*) justifying actions, even suicide missions. Islamic scholars with varying degrees of religious esteem have issued rulings both denouncing and supporting the use of "martyrdom operations" and "terrorism" in general. It is difficult, then, to say that "Islam supports" or "causes" something like terrorism when the fundamental organization of the religion makes it so different from more hierarchical faiths. To say that "Islam" supports something is simply not the same as saying "the Vatican" does since there is no Islamic analogue to the Pope. American Evangelical Christians face a similar situation; with no infallible human figurehead to dictate dogma, they are also open to extremist actions from group members.

The role of religion as a potential cause of suicide missions remains hazy and further research is desperately needed in this area. What is clear is that some groups use it to rally support and justify their actions; but on its own, religion cannot explain all suicide missions.

#### Nationalism (2003 – Present)

Pape (2005) published what was, at the time, the most complete and systematic analysis of campaigns using suicide missions. The goal of this section is not to discount Pape's contention that nationalism causes suicide attacks: it certainly does, but not in all

cases. Pape is very forceful in his sentiment that nationalism is *the* root cause of suicide missions, and he downplays the importance of other factors. Furthermore, he does not deal sufficiently with the fact that many occupied countries, like those of colonial Africa, have not produced suicide attackers.

Pape's methodology has been criticized by Crenshaw (2007:142), who suggests Pape uses an "arbitrary" definition of "military campaign" to purposefully leave out "incidents that could be inconvenient to explain." This criticism is not unfounded: at times, Pape provides little justification for calling some attacks "isolated" while grouping others as parts of "wider campaigns." Crenshaw (2007) points to a 1995 truck bombing in Egypt as an example: although the bombing was very likely part of a larger campaign by Egyptian Islamic Jihad, Pape claims it was isolated.

Additionally, Pape sometimes combines disparate groups together under single campaigns, implying they are driven toward the same goals. In reality, insurgent groups fighting in the same conflict may have vastly different objectives. Some Iraqi insurgent groups have used suicide attacks with the goal of expelling coalition troops, but others have used them against each other in attempts to gain political, social, and financial "market share" (Crenshaw 2007).

The crux of Pape's research lies with the idea that that foreign occupation precipitates suicide missions. He defines "occupation" as "the exertion of political control over territory by an outside group" (Pape 2003:85), and continues, saying

My hypothesis is that the taproot of suicide terrorism is nationalism – the belief among members of a community that they share a distinct set of ethnic, linguistic, and historical characteristics and are entitled to govern their national homeland without interference from foreigners (2005:79).

The use of suicide missions in Palestine and Sri Lanka supports this hypothesis. In both cases, the ethnic homeland of the group using suicide missions is physically occupied by outside forces. Not every case is so clear-cut though: according to Pape, al-Qaeda has targeted the US over its “occupation” of Saudi Arabia. While American troops have held positions on the Arabian Peninsula since the beginning of Operation Desert Storm in 1990, no American military effort has been directed at the leadership or citizens of the country, and yet 15 of the 19 September 11, 2001 hijackers were Saudi (McDermott 2005). If such an “occupation” causes suicide attacks, the term must be interpreted broadly, as Atran (2006) notes

It is quite a stretch to identify the common thread [of the world’s suicide attacks] as a secular struggle for foreign occupation of a homeland, unless ‘secular’ covers transcendent ideologies, ‘foreign occupation’ includes tourism, and ‘homeland’ expands to at least three countries (p. 134).

Critics note that Pape does not list Germany, Japan, or South Korea in his list of occupied countries (Ashworth et al. 2011). Is it occupation or the *perception* of occupation that matters? Pape (2003; 2005) argues for the latter, contending that al-Qaeda views the American military presence in Saudi Arabia as occupation. Good evidence for this comes from Osama bin-Laden himself, who issued a statement titled “A Declaration of War against the Americans Occupying the Land of the Two Holy Places” (1996), in which he decries the Saudi establishment for allowing US bases on the Arabian Peninsula.

Perception cannot explain every case where suicide missions are used, though. The Iraq War, for example, saw insurgent groups using suicide attacks against each other (Crenshaw 2007). This presents a problem for the hypothesis that they are always directed at foreign occupiers. Additionally, Pape’s dilution of the definition of

“occupation” to include perception weakens value as a predictor of suicide missions because perceptions are difficult to quantify.

To his credit, Pape notes that a religious *difference* between occupied and occupying forces encourages suicide missions, but he downplays its significance as a prime motivator, suggesting instead that its main use is to solidify group affiliation (Pape 2005). Such divisional tactics are common in human conflicts (Keeley 1996), but Atran disagrees about the importance of religion in suicide missions, saying

Most suicide terrorists today are inspired by a global jihadism which, despite atavistic cultural elements, is a thoroughly modern movement filling the popular political void in Islamic countries left in the wake of discredited Western ideologies co-opted by corrupt local governments (2006:139).

Atran’s retort is a reminder that investigators cannot lose track of the wider circumstances in their search for a “root cause” of suicide missions. It seems fair to say that if some people can be motivated to die for “sacred” soil, others can be motivated to die for transcendent political, filial, or spiritual reasons; this is explored in further detail later.

A closing comment on Pape’s notion that nationalism is the root cause of suicide attacks: because he makes rigid claims about the quality of his dataset, which he says includes “the universe” of suicide attacks, Pape sets himself up for withering criticism. The issue with sampling “the universe” of any behavior, especially a rare one, and then issuing a “root cause” for it is that the sample will grow and change, making revision necessary as new cases come to light. Ashworth (2011) notes that were Pape’s data gathered in 1986, being a member of a Shi’a Muslim group would have been a “necessary condition” for using suicide missions because Hezbollah was the only group

known to use them up to then. In 1987, the Tamil Tigers adopted the tactic, thus changing conditions “necessary” to spark suicide missions. Ashworth notes

So being Shi’a, or Muslim, or even religious is not a necessary condition for carrying out a suicide attack after all. And who is to say what groups will take it up in the future? Indeed, Pape’s own argument suggests that we should not expect to find any stable necessary condition for suicide terror. One of his main claims is that suicide tactics are spreading in a process of social learning (2011:4).

Pape may be judicious with his selection criteria for occupied countries; he may also overstate the claim that occupation is a necessary condition for generating suicide attackers; but even his harshest critics, like Atran (2006), acknowledge that nationalism has a hand in producing attackers. The secular LTTE fought under the banner of nationalism for the liberation of their ethnic homeland, Tamil Eelam: this point is not under dispute; but to say al-Qaeda is likewise motivated to end the pseudo-occupation of the Arabian Peninsula is to go a step too far. A stated goal of al-Qaeda is to rid Muslim countries from Western influence, whether or not they are “occupied.” Religion may not be the primary reason al-Qaeda fights the West; rather, it may be what bonds its sympathizers in doing so.

#### Durkheimian Theory (2003 – Present)

Following the dismissal of psychological pathology as a cause for individual participation in suicide missions, some researchers looked to Durkheim’s classic typology of suicide for insight into the phenomenon. Durkheim (1952) contends that people who are especially over- or under-integrated socially are most likely to commit suicide. He separates their motivations into four types; egoistic, anomic, altruistic, and fatalistic. Egoistic suicides occur in societies that value individuality and generate weak

social ties. Those who commit suicide in these groups are likely to be outcasts lacking the individuality valued by society; they have difficulty getting support because of society's weak bonds. Altruistic suicides happen in societies that are excessively socially integrated, where the good of society is placed before that of the individual. In these cases, tremendous pressure to conform and sacrifice leads to suicide. Anomic suicide happens in changing societies where individuals lose social integration; those who cannot adapt become disengaged outsiders prone to suicide. Dismissing it as relatively insignificant, Durkheim mentions fatalistic suicide only in a footnote; it occurs where social regulations are so pervasive and heavy handed that that individuals feel no purpose or hope in their lives (e.g., slavery).

Pedahzur et al. (2003) suggest a hybrid classification (fatalistic-altruistic) for Palestinian suicide attackers, meaning they: 1) hail from excessively regulated groups whose members put the good of society ahead of the individual; and 2) feel personally trapped by pressures outside their control. Evidence supporting the first point comes from the fact that relatively high numbers of Palestinian suicide attackers have had formal religious training in highly regulated groups emphasizing group sacrifice (Pedahzur et al. 2003). The fact that young, unmarried men comprise the demographic group most likely to produce suicide attackers supports the second point; Palestinian political decisions are not typically guided by young men's desires, yet this group is still subject to the repercussions of these decisions, especially those dictating war and peace (Pedahzur et al. 2003).

Zevallos (2006) questions whether Durkheim's framework is applicable to suicide attacks, primarily because they cause the death of both actor *and* others. This implies,

questionably, that making the decision to not kill others while killing oneself is diagnostic of “typical” suicide. Zavallos does not develop this argument further, apart from saying that since Durkheim did not mention suicide attacks, his framework is not applicable to them; but is this reason enough to discount Durkheim? Does it matter if someone who commits suicide *unknowingly* puts another in danger? How much danger must a suicidal person put someone else in before they are excluded from classification? These questions remain unanswered.

Moving past the general applicability of Durkheim’s model to suicide missions, Zavallos (2006) argues that suicide attackers do not fit fatalistic-altruistic classification forwarded by Pedahzur et al. (2003) because many Palestinian attackers have been motivated by personal slights or traumas, suggesting an anomic component to their actions.

Zavallos also suggests that societal support for Palestinian suicide attacks is overestimated because terrorist groups, not civilians, often construct murals and makeshift shrines for “martyrs.” If true, this means that the strong societal ties that precipitate altruistic suicide may be weaker than Pedahzur et al. (2003) propose. It may, however, also be that such social support comes from members of the attacker’s group rather than from local society.

Durkheim’s classification of suicide types has been applied to people who participate in suicide missions. It has given credibility to the idea that altruism motivates some individuals to volunteer for such attacks, which will be explored in greater detail momentarily.

### Marketing and Outbidding (2005 – Present)

Social support might be due to a variety of factors: religion, a mixture of religion and nationalism, foreign occupation in general (defined narrowly or broadly), specific practices of opposing governments (for example, excessive brutality and civilian casualties), deliberate cultivation by political organizations, the failure of other organizations to effectively counter the tactic, or long experience of suffering and deprivation (which could be related to the length and severity of the conflict and perhaps to the failure of alternatives). We do not know how much weight to accord each factor or how we might measure them (Crenshaw 2007:153).

In many societies, the individual act of suicide is perceived as taboo and as such marked out as a prohibited behavior. However, when a community at large perceives itself to be suffering discrimination, oppression and/or marginalization over an extended period of time, a shift can develop in the psychological connotations around the act of suicide, when it is presented as countering the situation of suffering (Sheehy-Skeffington 2009:6).

The preceding quotes summarize the current understanding of how social support influences suicide missions. Many researchers concur that the tactic is rarely used if deemed unacceptable or repugnant by local norms (Atran 2010; Bloom 2005; Kalyvas and Sanchez-Cuenca 2005; Pape 2005; Sheehy-Skeffington 2009). As Crenshaw (2007) notes, however, just how much support is necessary, and where it must come from, is unclear. A lack of social support may explain the absence of suicide missions in places where suicide is patently unacceptable. It cannot, however, explain the emergence of the tactic everywhere: 87 percent of Pakistanis say suicide bombings are “never justified,” while only 17 percent of Palestinians agree (Horowitz 2009), yet suicide attackers hail from both places.

Like any political or religious group, those using suicide missions compete with each other for popular support, and losing local “market share” means missing out on the social and monetary benefits that come with it. Some suicide attacks may, essentially, be

marketing tools used to recruit people and gain resources (Bloom 2005). Suicide attackers show a willingness to die for a cause that some find attractive (Atran 2006); because of this, they may recruit more adherents than they sacrifice (Bloom 2005).

Kalyvas and Sanchez-Cuenca (2005) say that the relationship between the social support and the use of suicide missions is U-shaped, meaning that very high or very low support encourages them. Late 19th and early 20th century Russian Anarchists, for example, operated on the fringes of society and were uninfluenced by local social norms. They used suicide missions despite the fact that they lacked social support because they were not reliant on the larger society for resources (Kalyvas and Sanchez-Cuenca 2005). The case is probably the same for al-Qaeda, which, as a transnational organization, operates outside local norms that might dissuade them from using suicide attacks.

Kalyvas and Sanchez-Cuenca (2005:218) also say, “Most terrorists and insurgent organizations depend on more or less active support of a pool of supporters.” It is these supporters who supply the resources to keep such groups going. Additionally, “a trade-off exists between the intensity of killing or the selectivity of violence on the one hand and popular support on the other” (Kalyvas and Sanchez-Cuenca 2005:219). This means groups must balance their propensity for violence against their supporters’ tolerance for it. According to Kalyvas and Sanchez-Cuenca (2005), the ETA (Euskadi Ta Askatasuna, the leading Basque separatist organization) is, at the organizational level, more violent than its supporters, which leads it to temper the use of indiscriminate tactics. Since suicide missions are often indiscriminate, the ETA does not employ them.

Like the ETA, The Irish Republican Army (IRA) is dependent on local resources and is thus sensitive to local attitudes. The organization has avoided suicide attacks and

made many overt attempts to warn authorities of impending bombings; ostensibly saving civilian lives in order to preserve their own social esteem. In the case of suicide missions, such early warnings would be counterproductive since stealth is key to their success (Kalyvas and Sanchez-Cuenca 2005).

Societal attitudes change, of course, which can affect the “approval ratings” of groups using suicide missions. In some cases, social pressures have had a direct effect on the use of suicide attacks: the Kurdistan Worker’s Party (PKK) and Armed Islamic Group of Algeria (GIA) stopped using them after public support for them waned (Kalyvas and Sanchez-Cuenca 2005; Wyne 2005).

Depending on the size and structure of the organization, social support can influence the use of suicide attacks. For smaller, localized organizations, a high level of support encourages suicide attacks; while larger, transnational, agencies seem less influenced by social support. This is not to say that large groups are immune to public sentiment: in the Muslim world, al Qaeda lost social support, and probably a great deal of financial backing, following the 2004 Beslan school massacre which left 334 civilians dead, 186 of them children (Bloom 2005).

#### Parochial Altruism and Other Individual Factors (2010 - Present)

Echoing the “fatalistic-altruistic” classification of suicide attackers forwarded by Pedahzur et al. (2003), Gambetta (2005:270) suggests suicide missions are motivated primarily by altruism, saying they, “belong to a family of actions in which people go to the extremes of self-sacrifice in the belief that by doing so they will best further the interests of a group or the cause they care about and identify with.” Gambetta does not

address the issues inherent in explanations invoking altruism as a motivation (e.g., cheating and collective action problems), but he does circle them, continuing

Even though we instinctively think of altruism as doing purely good deeds, altruism and aggression are not antithetical – in warfare you risk your life to help kin, comrades, and country also by killing enemies (p. 270).

Atran (2010) refines Gambetta's notion by qualifying suicide missions as cases of "parochial altruism," or altruism that benefits one's own group through "hostility" toward an outgroup (Choi and Bowles 2007). According to Atran (2010:297), parochial altruism is predicated on fictive kinship, which encourages sacrifice between unrelated people by coopting psychological mechanisms originally designed to incite altruism between genetically related kin. Atran says that societies must "cooperate to compete" and that individual sacrifices that benefit the group are rewarded. There is evidence that this is the case; indigenous groups are known to confer social rewards, like high status, on good warriors and hunters (Chagnon 1988; Hawkes and Bird 2002).

The problem with applying such logic to suicide missions is that they nearly guarantee the actor will die taking part in an action that could otherwise garner social praise. Atran (2010:303) suggest that this may be caused by a psychological "misfire" created when people become so close to non-relatives that they make sacrifices for them, which, elsewhere in the animal kingdom, would be reserved for kin.

Parochial altruism is a newcomer to the list of causes for suicide attacks; it may offer an underlying framework for understanding how feelings of helplessness, marginalization, humiliation, loyalty, indoctrination, revenge, and kinship (fictive and real) coalesce to generate suicide attackers.

A final note: Bloom (2005) calls the Israeli-Palestinian conflict a “blood feud,” driven by revenge; this raises the specter of “cultures of honor” *sensu* Nisbett and Cohen (1996). It may be that suicide attackers are more likely to come from places where “an eye for an eye” is the norm and their feelings are stoked by parochial altruism. Whether they do remains unanswered, but if they are, this could further cloud the role of religion as a motivation suicide attacks because religion and honor are tightly intertwined, especially in the Middle East (Lewis 1998; Lewis 2001).

### Establishing Causality

It has been difficult for researchers to establish “root” causes of suicide attacks. The challenge is largely affected by the complexity of establishing causality between the presence of suicide missions and its correlates. Things are further complicated by the trouble of identifying and using proper control samples. If nationalism, religion, or any other independent factor hypothetically causes suicide missions, a meaningful statistical analysis requires sufficient controls; yet these are not always available. Both secular and religious groups, for example, use suicide missions; unfortunately, even ostensibly secular groups operate within religious societies and are likely comprised of religious individuals. This fact makes teasing out the effects of religion on suicide missions particularly vexing since the world has no non-religious societies to use in a control sample (Purzycki and Gibson 2011). Religion also covaries with ethnicity, culture, and geography; further obfuscating the roles each play in causing suicide attacks (Purzycki and Gibson 2011). Furthermore, aside from appeals to the supernatural, there is nothing about religion that cannot be found in sports teams, gangs, fraternal organizations, and so

on. While religion may facilitate suicide missions (by denoting group affiliation, etc.) it is not clear it *causes* them (Atran 2010; Purzycki and Gibson 2011). Perhaps the easiest way to illustrate this point is to consider whether suicide attacks could exist if there were no religion in the world. They certainly could: as with violence in general, there are many causes of suicide attacks; so suggesting only one thing, like religion or nationalism, leads to them is an exercise in futility. This practice is widespread, however; Dawkins (2006) suggests in press and on paper that religious faith is the *only* thing that could have motivated the 2005 London Underground suicide bombers. Some secular groups use suicide missions though, which undermines Dawkins's stance. Suicide attacks are politically and emotionally charged events and their causes have garnered wide speculation from experts, politicians, and the media. One of the central roles of science is to establish causation in correlated events, and doing this means framing statements like Dawkins's as hypotheses, not facts, then testing them against data (Purzycki and Gibson 2011).

Which of the causes discussed earlier are empirically supported? According to verifiable sources and data, suicide attacks kill more people per attack than conventional terrorism; they are relatively inexpensive and allow groups to target individuals and installations that might otherwise be impossible to access; they also demonstrate a profound willingness to die for a cause that may result in increase recruitment.

Suicide missions can be an effective part of military campaigns, but there is no consensus on whether they are more effective than traditional means; they have been used in campaigns that successfully repealed occupiers, but this is probably not the goal of all groups that use the tactic. Suicide attacks are often, but not always, used after

traditional methods of “terrorism” or guerilla warfare have been exhausted; they exist as compliments to other tactics and are used as parts of organized political and military conflicts.

For relatively small groups pursuing nationalistic goals, local social support is important; but for large, multinational groups, the whims of their member’s neighbors are less important influences on their actions. Nationalism is a significant motivator for suicide missions, although religious and political ideologies, such as Salafism and anarchism also encourage them. Religion plays a role in suicide missions, but not in a simple way: as it does in other types of conflict, religion draws strong divisions between groups and offers a moral justification for killing. Religion often covaries with race, ethnicity, and language, and it is probably be the case that in a world absent of religion, some other physical or cultural characteristic would assume its role as divider. How exactly religious, nationalistic, and political factors intermingle as causes of suicide attacks remains unclear and likely differs according to which group or conflict is under study.

There is no single diagnostic for who becomes a suicide attacker. A wide age range of men and women of various nationalities, ethnicities, religions, and cultural backgrounds have participated in suicide missions. The majority of attackers, however, are young men who are possibly influenced by small group dynamics such as friendship and fictive kinship along with larger ideological goals.

In light of the evolutionary expectation that young men are the most risk prone sex and age demographic in humans, the point of this dissertation is to test whether

populations with male-biased operational sex ratios or high numbers of young men to old are more likely than others to produce suicide attackers

#### A Note on Female Suicide Attackers

Fourteen percent of the suicide attackers identified in this study were women, a figure nearly identical to Pape's (2005) figure of 15 percent. Although the majority of suicide attackers are young men, the ratio of male to female attackers differs by conflict (Hafez and United States Institute of Peace 2007; Pape 2005; Ricolfi 2005) largely because conservative religious groups bar female participation while Marxist groups encourage female attackers to portray the socialist ideal (Pape 2005).

Female attackers enjoy some pragmatic advantages over men; they can wear more clothing, fake pregnancies to conceal explosives, and arouse less suspicion in general. Many women have participated in Kurdistan Worker's Party (PKK), LTTE, and Chechen suicide missions; but they represent the minority in most campaigns, especially those spearheaded by religiously conservative groups.

Anecdotal evidence suggests female attackers are motivated more by personal affronts and revenge than nationalism or religion. In last wills and testaments, many have cited the death of a loved one or rape as justifications for their actions (Bloom 2005; Pape 2005); men, on the other hand, more often point to political or nationalistic motivations (Atran 2010). Where rape victims face especially strong social stigmas, the individual costs of suicide missions might rebalance in the face of diminished reproductive and marriage prospects. Of female Black Tigers, Gunawardena (2006:4) writes "Acting as a

human bomb is an understood and accepted offering for a woman who will never be a mother,” and also notes that married Black Tigers are “extremely rare.”

Pape (2005:209) found that the 261 Hezbollah, Palestinian, LTTE, Chechen, and PKK female suicide attackers he identified were significantly older than their male counterparts, although they still averaged less than 30. He suggests that these older women may have had fewer opportunities to marry, making them more likely to volunteer for suicide missions. As compelling as these accounts of female suicide attacks are, much more research is needed to get to the root of the phenomenon. The current state of the literature is highly speculative and lacks quantitative evidence.

## CHAPTER 2

### HYPOTHESES AND METHODS

#### Hypotheses

Male reproduction is constrained by the number of reproductively aged females and competing males in a population. Where the operational sex ratio is high, male reproductive prospects are relatively low, which lowers the individual fitness cost of suicide missions because reproduction is less likely for the individual. High young-old ratio indicates greater young male-male competition and lower reproductive prospects for these men. Under these theoretical assumptions, the following four hypotheses are tested here:

- 1) suicide attackers are more likely to come from areas with higher operational sex ratios than from areas with lower ratios,
- 2) among those areas that do produce suicide attackers, those with higher operational sex ratios produce more than areas with lower ratios,
- 3) suicide attackers are more likely to come from areas with high young-old ratios than lower ratios, and
- 4) among those areas that do produce suicide attackers, those with higher young-old ratios produce more than areas with lower ratios.

### Data Collection

This dissertation uses two datasets; the first contains information on individual suicide attackers, the second on the countries that produced them, along with data for control countries that did not produce any. Creating the “individual” dataset required piecing together three smaller samples from Pape (2005), Gambetta and Tzvetkova (2005), and Hafez (2007). Pape, Gambetta, and Tzvetkova summarized attacks, while Hafez described individual attackers.

The Gambetta and Tzvetkova dataset was used as a starting point because it was the best available at the commencement of research. By one estimate, the “universe” of attacks assembled by Pape (2005) overlooks about 50% of incidents (Ricolfi 2005), and Hafez’s full dataset is unpublished, so I requested and received a copy in the Fall of 2010. Hafez investigated 2,095 attackers who acted from 1981 through 2008, Gambetta and Tzvetkova described 598 attacks from 1982 to 2006, while Pape looked at 315 incidents from 1980 to 2003. The dataset presented here contains information on 1,208 suicide attackers who acted from 1981 to 2007.

Each attack was verified with news reports from LexisNexis. These varied in completeness, and included such information as: the number of attackers present; their ages; sexes; names; nationalities; and current residences. Where LexisNexis failed to return results, Google searches were used; however, these were only added to the data if they came from a credible news source like a daily newspaper. A website (<http://www.tamilnation.org/>) listing the names, biographies, birthdates and death dates for 240 Black Tigers was used to corroborate LTTE attacks. The dataset includes a citation for each source for each attack. This dataset on individuals was used to construct

another with information on the countries of origin of attackers; it contains the following information.

### Dependent Variables

#### Suicide Attacker Production

The suicide attacker production variable is binary and indicates whether each of the 219 nations and regions in the dataset produced one or more suicide attacker between 1981 and 2007.

#### Suicide Attacker Production Rate

This variable is the logged rate of suicide attacker production per 100,000 people in the population for the years 1980 to 2007. It was calculated using the total population of each country as of July, 2010.

### Independent Variables

#### Operational Sex Ratio and Young Old Ratio

Operational Sex Ratio (OSR) is the number of reproductively aged men (20-55 years old) in a population relative to the number of reproductively aged women (15-40 years old) in the same population. Young old ratio (YOR) is the ratio of “young” (15-29 years old) to “old” (30 years and older) men in the same population.

Values for OSR and YOR were computed for 217 countries and two smaller regions (the West Bank and Gaza) using population data from the US Census Bureau International Database (IDB) (US Census Bureau 2010) .

OSR and YOR are dynamic, and since the dataset includes attacks occurring from 1981 to 2007, multiple values were computed and averaged for those countries or regions that produced more than one attacker. In other words, the values figured for each attack reflected the OSR and YOR of the attacker's origin country during the year of the attack. OSR and YOR values for the control countries were calculated for 2009, the most recent year available.

Values for the control countries could have been figured using a rolling average, but there was no clear way to determine which years to include in the average for each country. If, for example, attackers hailed from Country A from 1990 to 1995 and Country B from 1993 to 1997, would control Country C reflect 1990 to 1995, 1993 to 1997, or 1990 to 1997? When the control group includes every country in the world that has not produced suicide attackers, things quickly become paralyzingly complicated. To mitigate these issues, the control sample relies on the law of averages for all countries that did not produce attackers up to 2007.

#### Muslim Percent

This variable describes the percentage of Muslims in the total population of each of 232 countries and regions as calculated by the Pew Research Center. It is included here as a control for the possible influence of Islam on the production of suicide attackers. The measure was developed using "about 1,500 sources including census reports, demographic studies, and general population surveys" (Pew Research Center 2009:1).

### Polygyny Scale

The WomanStats project includes McDermott's 2010 rating of polygyny practices for 176 countries. It is included here as a control for the effects of polygyny on suicide attacker production. McDermott rated polygyny on an ordinal, five point scale; it can be found in the WomanStats project as the variable "PW SCALE 1."

### Democracy Index

The Economist Intelligence Unit produces the Democracy Index, a measure created from 60 variables including voter freedom, voter security, influence of outside governments on national affairs, and so on. It is included here to control for the role of democracy, or lack thereof, on attacker production. The Democracy Index ranges from zero to 10, with North Korea ranking lowest, at 1.08, and Norway ranking highest at 9.8 (Kekic 2007). The 2006 Democracy Index used here contains values for 167 countries.

### Gini Index

The Gini Index indicates how much the income of an average citizen or household differs from parity. A score of zero indicates perfect equality, while a score of 100 represents perfect inequality. As of 2009 Sweden and Namibia have the world's highest and lowest Gini scores, at 23 and 70.7, respectively (National Foreign Assessment Center (U.S.) and United States Central Intelligence Agency 2010). The 2009 Gini Index is used here to control for economic disparity in 134 countries.

### Population

To control for the fact that larger populations might have more people willing to volunteer for SMS, the dataset includes the total populations of 218 countries. Estimates from July 2010 were used (National Foreign Assessment Center (U.S.) and United States Central Intelligence Agency 2010).

### Gross National Product (GNP)

GNP is the value of all monetary production by the citizens of a country. To control for the possibility that poor countries might be more apt to produce suicide attackers, the 2010 gross national products (GNPs) of 203 countries are included in the analysis (National Foreign Assessment Center (U.S.) and United States Central Intelligence Agency 2010).

### Gross National Product (GNP) Per Capita

GNP per capita is the GNP of a country divided by the total population of that country. It is included for 199 countries here as an additional control for the effects of individual wealth on suicide attacker production and was calculated by dividing GNP by population.

### Latitude

To control for the possibility that regional cultures or conditions factor into suicide attacker production, the latitudinal midpoint of 219 countries was included as a control (National Foreign Assessment Center (U.S.) and United States Central

Intelligence Agency 2010). For reasons discussed later, this variable was dropped from the final analysis.

#### Suicide Rate (Male and Female)

To control for the possibility that suicide attackers come from populations where suicide is common, the suicide rate per 100,000 individuals was included for 99 countries (World Health Organization 2003). Rates are from the nearest available year up to 2003 and include separate variables for men and women. For reasons discussed later, this variable was dropped from the final analysis.

#### Statistical Tests and Techniques

This research examines two dependent variables. The first, the presence of suicide attackers, is binary and indicates whether a country produced an attacker from 1982 to 2007. The second variable is continuous and describes the number of suicide attackers produced by a country per 100,000 people for the same timeframe. These dependent variables require two types of analysis; binary logistic regression using maximum likelihood for the former and linear regression for the latter. All statistics were figured with Stata 11 (StataCorp 2009).

#### Model and Data Selection

Traditional model selection involves testing different sets of independent variables against data in a theoretically informed way, and then choosing the model which best fits the data. This method can leave good models untested, though, because

even a relatively small number of independent variables can be combined in dozens of ways. For example, there are  $2^{11}$ , or 2,048 possible combinations of this study's independent variables.

Stepwise regression fills this gap, but the technique is widely criticized as an atheoretical, “data mining,” approach. Since stepwise regression compares all possible variable combinations, no theory is needed to choose the “best” model. Furthermore,  $R^2$  is generally used to compare stepwise models and those with higher  $R^2$  considered “best.” There are issues with this reasoning, however, because  $R^2$  generally rewards models with more independent variables. It is not always best to reward complex models in light of the fact that more parsimonious models may best reflect reality (Johnson and Omland 2004).

Since the 1970s, information criteria (IC) like Akaike's Information Criterion (AIC) and Bayesian Information Criterion (BIC) have become popular model selection tools in many disciplines. Essentially, these IC return Occam's Razor to model selection. Figure 4, adapted from Burnham and Anderson (2002), illustrates the theory of parsimony, upon which these IC are based.

Models with too few parameters may be biased, and those with too many may lead to spurious results (Burnham and Anderson 2004). AIC and BIC work by penalizing models for including more variables, and thus more variance or “noise.” In addition, BIC rewards larger sample sizes.

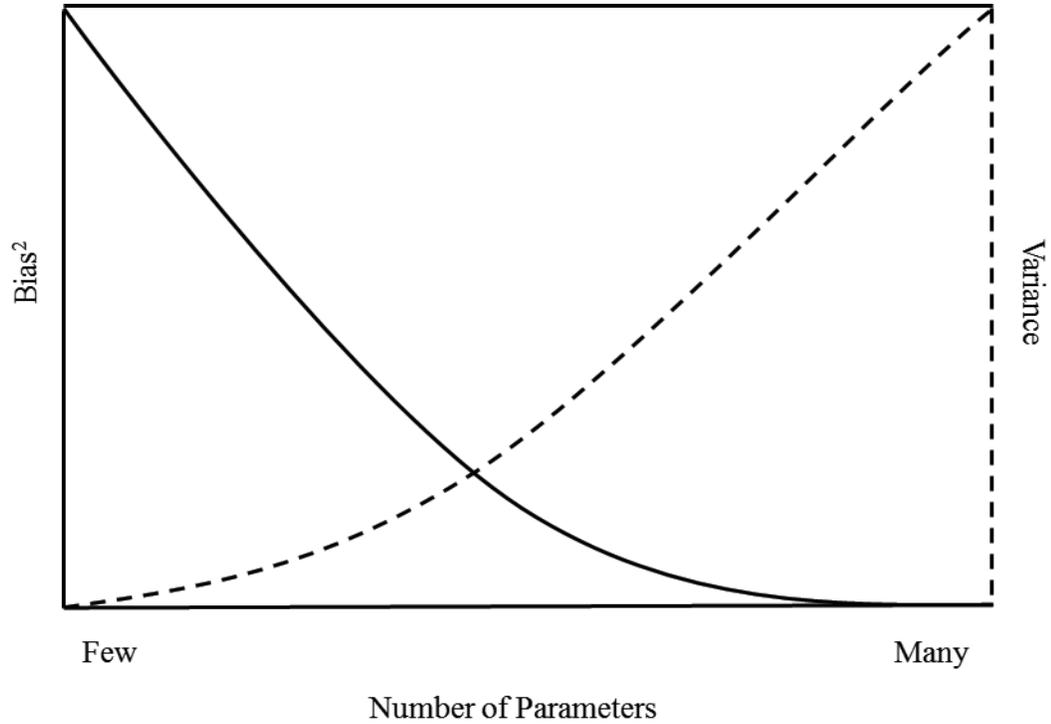


Figure 1

## Bias-Variance Tradeoff

The equations used to calculate AIC and BIC are

$$\text{AIC} = -2 \cdot \ln(L) + 2 \cdot k \quad (2)$$

$$\text{BIC} = -2 \cdot \ln(L) + \ln(N) \cdot k \quad (3)$$

where  $L$  is likelihood,  $k$  is the number of parameters estimated in the model, and  $N$  is the number of observations (Akaike 1974; Shtatland et al. 2001; StataCorp 2009). Models with IC values closer to zero are favored. AIC is becoming the *de facto* IC in studies of

ecology and evolution, so it is used here (Johnson and Omland 2004). Additionally, AIC and BIC agree in all but one of their “picks” of the forthcoming models.

Information criteria can be used to compare two or more models given that: 1) maximum likelihood is calculated; and 2) the models use the same dataset. The second requirement brings up an important point regarding missing data. Consider a hypothetical situation familiar to many anthropologists; a dataset with ten independent variables and 100 cases, some with missing data. Eight variables contain complete data, one variable is missing data for five cases, and one is missing data for 25 cases. Assuming no systematic bias in the missing data, a researcher using stepwise regression might overlook this in order to maximize sample size. Alternatively, they might drop cases with missing data in favor of a more consistent dataset, but at the cost of a smaller sample. In the latter scenario, do the resultant data (with 75 cases) constitute a separate dataset from the original, 100 case one? Technically, yes: which means IC should not be used to compare against one another results generated by these datasets.

Put differently, if all 10 independent variables were evaluated against a dependent variable using the complete dataset (with 10 variables and 100 cases, some missing data), any model that used an independent variable with missing data would be tested on a technically different dataset. Many smaller models would use all 100 cases, but any one that included an independent variable with missing data would drop from five to 30 cases; five for one variable with missing data, 25 for the other, and up to 30 combined. Since this would cause sample size ( $N$ ) to vary, the IC generated by the models would not be comparable. Using IC thus forces choices not only of models, but of datasets.

Datasets that maximize sample size while maintaining important independent variables should be favored.

Here, the full dataset contains 11 independent and two dependent variables, many of which are missing data. Making the data complete requires either keeping all variables and dropping all cases with missing data, or dropping variables with missing data, then dropping the remaining cases with missing data. Where some variables are theoretically less sound, the latter method makes more sense because it maximizes the number of cases left in dataset. The next chapter details data selection on a case by case basis.

## CHAPTER 3

### RESULTS

#### Descriptive and Univariate Statistics

##### Suicide Attackers

Table 1 describes 1,208 suicide attackers who acted from December 15, 1981 to November 22, 2007. Statistics are grouped by sex and given in total;  $n$  varies with missing data. The variables “OSR Origin” and “YOR Origin” indicate the values of OSR and YOR for the attacker’s country of origin, while “OSR Location” and “YOR Location” indicate the representative values of YOR and OSR in the places attacks occurred.

As expected, most attackers were young males and attacks by men killed nearly twice the number of people on average as those by women; a figure skewed by the all-male 9/11 attacks, which killed 2,752. The average attacker came from a country with an OSR and YOR on par with the world average of 1.19 and 0.78, respectively; however, male attackers came from regions with significantly higher YORs than female attackers ( $t = 6.12, n = 479, df = 581, p < .0001$ , one-tailed), adding weight to the argument that men and women are differently motivated to participate in suicide missions. Relative to women, males also attacked regions with significantly lower OSRs ( $t = -3.19, n = 948, df = 946, p < .001$ , one-tailed) and higher YORs ( $t = 6.95, n = 948, df = 946, p < .0001$ , one-

Table 1

Descriptive Statistics of Attackers<sup>a</sup>

Variable	<i>n</i>	Mean	Standard Deviation	Minimum	Maximum
Sex	974	0.14	0.35	0	1
Male	835				
Female	139				
Number Killed	790	14.93	100.18	0	2752
By Males	558	17.58	118.82	0	2752
By Females	69	8.80	11.86	0	59
Age at Death	419	22.66	4.73	0	57
Male	319	22.77	4.17	13	55
Female	93	22.90	5.44	16	57
OSR Origin	638	1.16	0.19	0.81	3.10
Male	479	1.15	0.19	0.81	3.10
Female	104	1.24	0.09	0.89	1.39
YOR Origin	638	0.78	0.18	0.26	1.20
Male	479	0.79*	0.19	0.26	1.20
Female	104	0.67	0.11	0.50	1.03
OSR Location	1122	1.11	0.14	0.81	2.95
Male	810	1.11*	0.14	0.81	2.95
Female	138	1.15	0.12	0.87	1.39
YOR Location	1122	0.79	0.21	0.45	1.32
Male	810	0.80*	0.21	0.45	1.26
Female	138	0.67	0.14	0.49	1.32

<sup>a</sup>Total killed in all attacks = 11,793; \*Sex difference of  $p < 0.05$  ( $t$ -test, one-tailed).

tailed), which supports the finding that high YOR is positively associated with conflict (Mesquida and Weiner 1999). Conflict is more common where YOR is high, and male suicide attackers are drawn to these places. If motivated by personal reasons, female attackers may be more likely to stay closer to home.

### Countries

Table 2 shows descriptive statistics for 219 countries and regions of the world. In addition to overall statistics, information for each independent variable is broken down into averages for countries that produced suicide attackers and those that did not.

Countries with large Muslim populations were more likely to produce attackers than those with smaller ones ( $t = -7.57, n = 216, df = 214, p < .0001$ , one-tailed), and 67% of countries with Muslim majorities produced attackers, compared to 7% of countries with Muslim minorities. Attackers were more likely to come from latitudes with significantly higher absolute values ( $t = -2.95, n = 209, df = 207, p = .0018$ , one-tailed). Attackers came from countries where polygyny was more common ( $z = 1.93, n = 176, p = .027$ , one-tailed), and where OSR was higher ( $t = -1.73, n = 216, df = 214, p = 0.043$ , one-tailed). Less democratic countries ( $t = 1.79, n = 167, df = 165, p = 0.038$ , one-tailed) with higher populations ( $t = -4.68, n = 218, df = 216, p < .0001$ , one-tailed) and higher GNPs ( $t = -1.70, n = 203, df = 201, p = 0.045$ , one-tailed) were also more prone to produce suicide attackers.

Table 2

Descriptive Statistics of Countries<sup>a</sup>

Variable	<i>n</i>	Mean	SEM	SD	Min	Max	95% CI Lower	95% CI Upper
Percent Population Muslim	216	24.53		37.36	0.00	99.70		
Attackers Absent	183	17.25	2.31	31.31			12.69	21.82
Attackers Present	33	64.86*	7.43	42.70			49.72	80.01
Latitude	209	19.35		24.28	51.75	72.00		
Attackers Absent	176	17.24	1.91	25.30			13.48	21.01
Attackers Present	33	30.59*	2.32	13.32			25.86	35.31
Polygyny Scale	176	1.59		1.47	0.00	4.00		
Attackers Absent	143	1.49	0.13	1.56			1.23	1.75
Attackers Present	33	2.03*	0.15	0.88			1.72	2.34
Suicide Attacker Present	219	0.15		0.36	0.00	1.00		
Attackers Absent	NA	NA	NA	NA	NA	NA	NA	NA
Attackers Present	NA	NA	NA	NA	NA	NA	NA	NA
Operational Sex Ratio	216	1.19		0.29	0.69	3.10		
Attackers Absent	183	1.17	0.02	0.26			1.13	1.21
Attackers Present	33	1.26*	0.07	0.41			1.12	1.41
Young Old Ratio	216	0.78		0.33	0.24	1.84		
Attackers Absent	183	0.78	0.02	0.34			0.73	0.83
Attackers Present	33	0.79	0.05	0.28			0.69	0.89

Table 2 continued

Variable	<i>n</i>	Mean	SEM	SD	Min	Max	95% CI Lower	95% CI Upper
Democracy Index	167	5.62		2.52	0.00	10.00		
Attackers Absent	136	5.79*	0.22	2.56			5.35	6.22
Attackers Present	31	4.90	0.40	2.23			4.08	5.71
Population (millions)	218	31.00		124.00	0.00	1340.00		
Attackers Absent	186	1.54E+07	2.51E+06	3.43E+07			1.05E+07	2.04E+07
Attackers Present	32	1.21E+08*	5.32E+07	3.01E+08			1.29E+07	2.30E+08
Gini Coefficient	134	40.37		10.23	23.00	70.70		
Attackers Absent	112	40.87	1.03	10.87			38.83	42.91
Attackers Present	22	37.84	1.17	5.51			35.40	40.28
GNP Per Capita	198	11578.52		17722.11	114.00	102605.00		
Attackers Absent	168	11680.11	1411.77	18298.59			8892.90	14467.32
Attackers Present	31	11028.00	2593.91	14442.26			5730.54	16325.47
GNP (billions USD)	203	309.58		1172.84	0.15	14120.00		
Attackers Absent	172	250.29	90.12	1181.87			72.40	428.17
Attackers Present	31	638.55*	194.12	1080.82			242.10	1035.00
Suicide Rate (Male)	99	16.71		16.05	0.00	75.60		
Attackers Absent	84	16.77	1.69	15.47			13.41	20.13
Attackers Present	15	16.38	5.07	19.62			5.52	27.25
Suicide Rate (Female)	99	4.95		4.22	0.00	16.80		
Attackers Absent	84	4.82	0.44	4.01			3.95	5.69
Attackers Present	15	5.68	1.42	5.51			2.63	8.73

<sup>a</sup>\*Significant at  $p < 0.05$ ; One-tailed  $t$ -tests used for all comparisons except "Polygyny Scale" which used ordered logistic regression.

### Multivariate Models

Comparing model IC requires identical datasets. Table 3 describes results from three of the many possible datasets that could have been used in this analysis. The “All Data” dataset ( $n = 219$ ) includes all cases and variables regardless of missing values. The “No Missing Data” dataset is “perfect” and contains no missing data for any of the independent variables of interest; however, it contains only 80 cases. This 37% loss of data is distressing: in order to recover some of the lost cases, three independent variables (latitude, male suicide rate, and female suicide rate) were dropped, creating the “Optimal Dataset” ( $n = 130$ ). These variables were excluded because they were: 1) the least theoretically important to this research; 2) missing data for up to 55% of cases; and 3), in the case of male and female suicide rates, had values not significantly different for attacker-producing and non-attacker-producing countries according to univariate tests. Removing these variables introduced 52 additional cases to the dataset, and is reasonable considering none had significant effects in the full model using either of the other datasets.

To illustrate the effects of these changes, Table 3 shows results of analyses run on all three datasets; BIC and pseudo  $R^2$  are also included to show how their influences. The traditional measure for stepwise regression, pseudo  $R^2$ , favors models with more independent variables (parameters), while AIC and BIC select more parsimonious models for the “Optimal Data” and “No Missing Data” datasets. For the “All Data” dataset, AIC and BIC also favor more complex models because  $N$  and  $L$  increase, but recall that comparing these values is useless, as they are based on different datasets. For the remainder of the paper, only AIC will be reported because it is the most widely used

Table 3

Operational Sex Ratio Model Comparison Using Information Criteria and Pseudo  $R^2$ 

Independent Variable	AIC (All Data)	BIC (All Data)	Pseudo $R^2$ (All Data)	AIC (Optimal Data)	BIC (Optimal Data)	Pseudo $R^2$ (Optimal Data)	AIC (No Missing Data)	BIC (No Missing Data)	Pseudo $R^2$ (No Missing Data)
OSR	186.13	182.88	0.01	118.07	123.84	0.01	69.92	74.69	0.03
+ Polygyny Scale	165.55	175.03	0.06	104.30	112.95	0.15	<b>57.16</b>	<b>64.30</b>	0.24
+ Muslim Percent	141.95	154.59	0.22	95.78	107.31	0.24	59.06	68.59	0.25
+ Gini Index	99.76	114.22	0.25	97.70	112.12	0.24	60.93	72.84	0.25
+ Population	87.43	104.73	0.35	87.43	<b>104.73</b>	0.35	59.14	73.43	0.30
+ GNP	86.49	106.67	0.37	<b>86.49</b>	106.67	0.37	59.37	76.05	0.33
+ GNP Per Capita	88.15	111.21	<b>0.38</b>	88.15	111.21	<b>0.38</b>	61.03	80.09	0.33
+ Democracy Index	89.02	114.83	<b>0.38</b>	89.02	114.83	<b>0.38</b>	62.84	84.28	0.34
+ Latitude	90.98	119.58	<b>0.38</b>	dropped	dropped	dropped	64.80	88.63	0.34
+ Male Suicide Rate	<b>66.79</b>	<b>92.99</b>	0.34	dropped	dropped	dropped	66.79	92.99	0.34
+ Female Suicide Rate	67.36	95.95	0.36	dropped	dropped	dropped	67.36	95.95	<b>0.36</b>

information criterion in studies of ecology and evolution (Johnson and Omland 2004).

The models in Table 3 used the production of suicide attackers as the dependent variable. The simplest model included just one independent variable, OSR, to which independent variables were added, in order of their assumed theoretical importance, until the full model was reached. In Table 3, as in general, a difference in AIC of two or less indicates that the starting model (with the lowest AIC) and alternative models are nearly equally likely to represent the true model. A change in AIC of four to seven suggests substantially less support for the alternative model, and a change of more than this indicates little or no support for the alternative (Burnham and Anderson 2004).

Table 4 shows the best model (AIC = 86.49) using the “Optimal” dataset. Its independent variables are OSR, polygyny scale, percent of the population that is Muslim, total population, Gini Index, and GNP. Of these, all but the last two are significant predictors of suicide attacker production. The remainder of the paper follows this pattern, where a model is chosen using AIC and then presented in full.

Table 5 shows a model comparison using AIC and the “Optimal Dataset.” The selected model, shown in Table 6, includes YOR, polygyny scale, percent of the population that is Muslim, total population, and Gini Index. Of these, YOR, percent of the population that is Muslim, and total population size are significant predictors, although the effect of YOR is marginal at  $p = 0.077$ . Surprisingly, YOR is signed opposite the prediction; countries with *lower* YORs are more likely to produce suicide attackers with the aforementioned controls in place.

Table 4

Logistic Regression of Operational Sex Ratio and Production of Suicide Attackers Using Optimal Data<sup>a</sup>

Variable	Coefficient	SE	Z-Score	P-Value	95% CI (Lower)	95% CI (Upper)
OSR	7.85	2.68	2.93	<b>0.003</b>	2.60	13.11
Polygyny Scale	0.71	0.38	1.88	<b>0.060</b>	-0.03	1.45
Muslim Percent	0.03	0.01	2.68	<b>0.007</b>	0.01	0.05
Gini Coefficient	-0.21	0.04	-0.50	0.616	-0.10	0.06
Population	2.03E-08	7.78E-09	2.61	<b>0.009</b>	5.06E-09	3.56E-08
GNP	-3.82E-04	2.43E-04	-1.57	0.115	-8.58E-04	9.36E-05
Intercept	-12.92	4.40	2.93	<b>0.003</b>	-21.56	-4.29

<sup>a</sup> $n = 132$ ,  $df = 125$

Table 5  
 Selection of Logistic Regression Model for Young-Old Ratio and  
 Production of Suicide Attackers Using AIC

Independent Variable	AIC (Optimal Data)
YOR	118.91
+ Polygyny Scale	106.35
+ Muslim Percent	100.50
+ Gini Coefficient	102.19
+ Population	<b>91.68</b>
+ GNP Overall	92.19
+ GNP Per Capita	93.05
+ Democracy Index	94.17

Table 6  
 Logistic Regression Results for Young-Old Ratio and Production of  
 Suicide Attackers Using Optimal Data<sup>a</sup>

Variable	Coefficient	SE	Z-Score	P-Value	95% CI (Lower)	95% CI (Upper)
YOR	-2.67	1.51	-1.77	<b>0.077</b>	-5.64	0.29
Polygyny Scale	0.45	0.35	1.28	0.201	-0.24	1.14
Muslim Percent	0.02	0.01	2.59	<b>0.010</b>	0.01	0.04
Gini Coefficient	-0.04	0.04	0.97	0.334	-0.12	0.04
Population	1.14E-08	5.20E-09	2.19	<b>0.029</b>	1.20E-09	2.16E-08
Intercept	-0.13	1.48	-0.09	0.930	-3.03	2.77

<sup>a</sup> $n = 132$ ,  $DF = 125$

### Number of Attackers by Country

The results show that OSR and YOR have significant effects on *whether* countries produce suicide attackers, but do these ratios also influence *how many* these regions produce? A word of caution is necessary here: while the data are very clear on whether a country produces attackers, they are much less so about how many they produce. This is because of bias in the information available on individual attackers; many Palestinian groups and the LTTE are open about naming them, but al-Qaeda is not. Sri Lanka and the Palestinian territories are therefore likely overrepresented in the data. Furthermore, this study assumes that OSR and YOR motivate *male* suicide attackers. Technically, this means all females should be dropped from the analysis. Since information on sex was relatively rare, however, regressions were run on the total number of attackers produced. This increased sample size, but introduced some noise into the analysis as about 15% of the attackers in the data were women; mostly from the LTTE (see Table 7). For added redundancy, the regressions were also run after dropping Sri Lanka from the dataset.

The model selection methods used earlier lend themselves to standard least-squares regressions on attacker production rate. Table 8 shows the comparison of models predicting the number of suicide attackers produced by a country or region; in it, the last three models have substantial support relative to each other.

The model, shown in Table 9, includes OSR, polygyny scale, percent of the population that is Muslim, Gini Index, total population, GNP, GNP per capita, and Democracy Index as independent variables; of these, Gini Index, GNP, and Democracy Index are significant predictors of attacker production rate and polygyny scale is

Table 7

## Number of Suicide Attackers Generated by Country

Country	Total	Known Male	Known Female
Afghanistan	2	2	
Algeria	4	4	
Bangladesh	1		
Belgium	2		
China	2		
Egypt	7	2	
France	2		
Gaza	9	3	
India	6	2	
Indonesia	2	1	
Iran	2		
Iraq	23	5	1
Israel	2		1
Italy	8		
Jordan	5	1	
Kenya	1	1	
Kuwait	7	2	
Lebanon	13	9	5
Libya	3	2	
Morocco	9	1	
Pakistan	1		
Palestine	35	6	4
Russian Federation	14		7
Saudi Arabia	80	18	
Spain	2		
Sri Lanka	297	38	78
Syria	10	4	
Tunisia	1		
Turkey	13	5	5
UAE	1		
United Kingdom	3		
West Bank	62	8	2
Yemen	1	1	

Table 8

Model Comparison of Linear Regressions for Operational Sex Ratio and  
Suicide Attacker Production Rate per 100,000 People<sup>a</sup>

Variable	AIC (Optimal Data)
Operational Sex Ratio	91.95
+ Polygyny Scale	92.11
+ Muslim Percent	94.09
+ Gini Coefficient	93.23
+ Population	75.10
+ GNP Overall	70.80
+ GNP Per Capita	<b>70.27</b>
+ Democracy Index	70.97

<sup>a</sup> $n = 21$

Table 9

Linear Regression Results for Operational Sex Ratio and Suicide Attacker Production  
per 100,000 People Using Optimal Data<sup>a</sup>

Variable	Coefficient	SE	Z-Score	P-Value	95% CI (Lower)	95% CI (Upper)
OSR	1.88	3.12	0.60	0.56	-4.85	8.61
Polygyny Scale	-0.57	0.31	-1.81	<b>0.09</b>	-1.24	0.11
Muslim Percent	0.00	0.01	0.32	0.75	-0.02	0.03
Gini Coefficient	0.31	0.08	4.00	<b>0.00</b>	0.14	0.47
Population	-1.30E-09	1.50E-09	-0.86	0.40	-4.54E-09	1.95E-09
GNP	-1.15E-03	4.45E-04	-2.58	<b>0.02</b>	-2.11E-03	-1.87E-04
GNP Per Capita	7.62E-05	5.91E-05	1.29	0.22	-5.2E-05	2.04E-4
Intercept	-17.56	4.48	-3.92	<b>0.00</b>	-27.23	-7.89

<sup>a</sup> $n = 21$

marginally significant. Surprisingly, though, polygyny and population are negatively associated with the number of attackers a country produces. Dropping Sri Lanka from the analysis preserves only population as a significant, negative, predictor, suggesting Sri Lanka has an overwhelming influence on the model.

Table 10 shows model selection information for the effect of YOR on the rate of attacker production and the full model is shown in Table 11. Since the number of Sri Lankan attackers is overrepresented in the data, Table 12 and Table 13 show the effects of dropping Sri Lanka from the analysis.

This marks the end of hypotheses testing; operational sex ratio and young-old are significant predictors of whether a country produces suicide attackers, although neither predicts the rate at which they do. Lower YOR is unexpectedly associated with greater likelihood of attacker production, while OSR behaves as predicted. These results will be discussed in the final chapter.

### Predictive Model

Paraphrasing Box and Draper (1987:424), “All models are wrong, but some are useful.” It is clear that OSR and YOR are influential in suicide attacker production; but can they usefully predict which countries but might generate them in the future? This section explores this question.

Logistic regression predicts probabilities of group membership as long as all variables contain complete data. Without this, cases enter the regression equation as zeros, causing it to fail. Leaving data “on the table” because of missing cases is disappointing though; in this situation, multiple-imputation (MI) can generate missing

Table 10

Model Comparison of Linear Regressions for Young- Old Ratio and Suicide

Attacker Production Rate per 100,000 People<sup>a</sup>

Variable	AIC (Optimal Data)
YOR	91.96
+ Polygyny Scale	92.33
+ Muslim Percent	94.33
+ Gini Coefficient	93.06
+ Population	75.12
+ GNP Overall	73.73
+ GNP Per Capita	<b>70.85</b>
+ Democracy Index	71.09

<sup>a</sup> $n = 21$

Table 11  
 Linear Regression Results for Young-Old Ratio and Suicide Attack  
 Production Rate per 100,000 People Using Optimal Data<sup>a</sup>

Variable	Coefficient	SE	Z-Score	P-Value	95% CI (Lower)	95% CI (Upper)
YOR	0.08	1.26	0.06	0.95	-2.64	2.80
Polygyny Scale	-0.63	0.33	-1.93	<b>0.08</b>	-1.34	0.08
Muslim Percent	0.00	0.01	0.38	0.71	-0.02	0.03
Gini Coefficient	0.32	0.08	4.10	<b>0.00</b>	0.15	0.49
Population	-1.11E-09	1.51E-09	-0.73	0.48	-4.37E-09	2.16E-09
GNP	-1.11E-03	4.3E-04	-2.47	<b>0.03</b>	-2.00E-03	-1.32E-04
GNP Per Capita	9.67E-05	5.25E-05	1.85	0.09	1.65E-05	2.10E-04
Intercept	-15.98	3.85	-4.15	<b>0.00</b>	-24.30	-7.66

<sup>a</sup> $n = 21$

Table 12  
 Linear Regression Results for Operational Sex Ratio and Production of Suicide Attackers per 100,000  
 People Using Optimal Data, Sri Lanka Dropped<sup>a</sup>

Variable	Coefficient	SE	Z-Score	P-Value	95% CI (Lower)	95% CI (Upper)
OSR	2.20	3.12	0.71	0.50	-4.67	9.07
Polygyny Scale	-0.05	0.46	-0.11	0.91	-1.06	0.96
Muslim Percent	0.00	0.01	0.37	0.72	-0.02	0.03
Gini Coefficient	0.22	0.09	2.34	<b>0.04</b>	0.01	0.43
Population	-4.75E-10	1.54E-09	-0.31	0.76	-3.87E-09	2.92E-09
GNP	-1.2E-03	4.61E-3	-2.49	<b>0.03</b>	-2.17E-03	-1.34E-4
GNP Per Capita	1.18E-04	6.70E-05	1.76	0.11	-2.95E-05	2.65E-04
Democracy Index	-0.25	0.22	-1.14	0.28	-0.72	0.23
Intercept	-15.11	4.57	-3.30	0.01	-25.18	-5.04

<sup>a</sup> $n = 20$

Table 13  
 Linear Regression Results for Young-Old Ratio and Production of Suicide Attackers  
 per 100,000 People Using Optimal Data, Sri Lanka Dropped<sup>a</sup>

Variable	Coefficient	SE	Z-Score	P-Value	95% CI (Lower)	95% CI (Upper)
YOR	-0.77	1.32	-0.58	0.57	-3.62	2.08
Polygyny Scale	-0.28	0.52	-0.53	0.60	-1.41	0.85
Muslim Percent	-0.01	0.01	-0.82	0.43	-0.03	0.01
Gini Coefficient	0.15	0.09	1.60	0.13	-0.05	0.35
Population	-3.21E-09	1.07E-09	-3.00	<b>0.01</b>	-5.53E-09	-8.99E-10
GNP	-4.09E-04	4.25E-04	-0.96	0.35	-1.33E-03	5.09E-04
Intercept	-8.35	2.74	-3.04	0.01	-14.28	-2.42

<sup>a</sup> $\eta = 20$

data using regression.

The nature of MI is speculative, so it was not used to generate formal models throughout this paper, but it is useful in this more exploratory section. Data were imputed for two variables; polygyny scale and Gini Index. OSR was used to impute missing data for Gini Index ( $n = 134$ ,  $F = 50.10$ ,  $p = <.0001$ ,  $R^2 = .2751$ ) and YOR was used for polygyny scale ( $n = 174$ ,  $F = 75.89$ ,  $p = <.0001$ , pseudo  $R^2 = .1562$ ).

As before, model selection is made using AIC. This time, OSR and YOR were included together in the same models as independent variables. This would not have been theoretically prudent before because there was no justification for controlling YOR in tests of OSR or *vice versa*; but the point of this exercise is to predict group membership, not test hypotheses, so including both is now justifiable.

Table 14 shows the model selection results and Table 15, the chosen model. Table 16 lists countries that have a more than one in five probability of producing a suicide attacker according to nonimputed data, while Table 17 shows the same thing for imputed data. In Table 17, countries that appear in predictions with both non-imputed and imputed data are italicized.

Table 17 contains predictions made using data up to 2007. According to the imputed data, the five countries most likely to produce suicide attackers are Qatar, Nigeria, Bahrain, Oman and Azerbaijan. Since 2007, have these countries produced them? As of February 15, 2011 LexisNexis searches of all world newspapers show no evidence of Qatari or Bahraini attackers, but the current unrest in Bahrain may make it fertile territory for them in the near future.

As for the remaining countries, Umar Farouk Abdulmutallab, the Nigerian

Table 14

Model Selection for Prediction of Suicide Attackers<sup>a</sup>

Independent Variable	AIC (Optimal Data)
OSR	118.07
+YOR	119.62
+ Polygyny Scale	105.94
+ Muslim Percent	97.69
+ Gini Coefficient	99.67
+ Population	89.35
+ GDP Overall	<b>88.32</b>
+ GDP Per Capita	89.97
+ Democracy Index	90.89

<sup>a</sup> $n = 132$

Table 15  
 Predictive Model of Suicide Attacker Production<sup>a</sup>

Variable	Coefficient	SE	Z-Score	P-Value	95% CI (Lower)	95% CI (Upper)
OSR	8.94	3.78	2.37	<b>0.018</b>	1.54	16.34
YOR	0.89	2.14	0.42	0.677	-3.30	5.09
Polygyny Scale	0.67	0.39	1.72	0.086	-0.10	1.44
Muslim Percent	0.03	0.01	2.70	<b>0.007</b>	0.01	0.05
Gini Coefficient	-0.02	0.04	-0.52	0.606	-0.10	0.06
Population	2.10E-08	8.01E-09	2.62	<b>0.009</b>	5.31E-09	3.67E-08
GNP	-3.91E-04	2.46E-04	-1.59	0.113	-8.74E-04	9.21E-05
Intercept	-14.83	6.40	-2.32	<b>0.021</b>	-27.38	-2.29

<sup>a</sup> $n = 132$ ,  $df = 125$

Table 16

## Predicted Probability of Suicide Attacker Production Using Non-Imputed Data

Country	Probability	Suicide Attackers Present (2007)
Finland	0.21	<b>No</b>
United States	0.22	<b>No</b>
Albania	0.25	<b>No</b>
Mali	0.28	<b>No</b>
Brazil	0.29	<b>No</b>
Niger	0.29	<b>No</b>
Gambia	0.29	<b>No</b>
Jordan	0.30	Yes
Kyrgyzstan	0.31	<b>No</b>
Bosnia-Herzegovina	0.31	<b>No</b>
Italy	0.31	Yes
United Kingdom	0.32	Yes
Austria	0.33	<b>No</b>
Senegal	0.33	<b>No</b>
Guinea	0.34	<b>No</b>
Belgium	0.35	Yes
Kosovo	0.36	<b>No</b>
Canada	0.36	<b>No</b>
Germany	0.39	<b>No</b>
Tunisia	0.39	Yes
France	0.41	Yes
Yemen	0.42	Yes
Algeria	0.42	Yes
Morocco	0.49	Yes
Azerbaijan	0.51	<b>No</b>
Bangladesh	0.67	Yes
Egypt	0.71	Yes
Russian Federation	0.77	Yes
Turkey	0.78	Yes
Nigeria	0.79	<b>No</b>
Pakistan	0.92	Yes
Indonesia	0.98	Yes
India	1.00	Yes
China	1.00	Yes

Table 17

## Predicted Probability of Suicide Attacker Production Using Imputed Data

Country	Probability	Suicide Attackers Present (2007)
Sudan	0.22	<b>No</b>
Malaysia	0.23	<b>No</b>
<i>Bosnia-Herzegovina</i>	0.23	<b>No</b>
Maldives	0.25	<b>No</b>
<i>Guinea</i>	0.26	<b>No</b>
Brunei	0.26	<b>No</b>
Niger	0.28	<b>No</b>
<i>Kyrgyzstan</i>	0.29	<b>No</b>
<i>Jordan</i>	0.29	Yes
Mauritania	0.30	<b>No</b>
<i>Senegal</i>	0.32	<b>No</b>
Turkmenistan	0.32	<b>No</b>
Somalia	0.34	<b>No</b>
<i>Yemen</i>	0.34	Yes
<i>Kosovo</i>	0.34	<b>No</b>
<i>Gambia</i>	0.35	<b>No</b>
<i>Algeria</i>	0.35	Yes
West Bank	0.36	Yes
Djibouti	0.36	<b>No</b>
Syria	0.37	Yes
<i>Albania</i>	0.39	<b>No</b>
Comoros	0.41	<b>No</b>
Libya	0.41	Yes
Russian Federation	0.43	Yes
<i>United States</i>	0.44	<b>No</b>
Uzbekistan	0.44	<b>No</b>
Iraq	0.46	Yes
<i>Brazil</i>	0.53	<b>No</b>
<i>Azerbaijan</i>	0.53	<b>No</b>
<i>Oman</i>	0.54	<b>No</b>
Bahrain	0.54	<b>No</b>
<i>Tunisia</i>	0.54	Yes
Saudi Arabia	0.54	Yes
<i>Nigeria</i>	0.55	<b>No</b>

Table 17 continued

Country	Probability	Suicide Attackers Present (2007)
<i>Morocco</i>	0.57	Yes
<i>Kuwait</i>	0.59	Yes
Afghanistan	0.65	Yes
Qatar	0.71	<b>No</b>
United Arab Emi	0.73	Yes
<i>Egypt</i>	0.76	Yes
<i>Turkey</i>	0.77	Yes
<i>Bangladesh</i>	0.92	Yes
<i>Pakistan</i>	0.94	Yes
<i>Indonesia</i>	0.98	Yes
<i>China</i>	1.00	Yes
<i>India</i>	1.00	Yes

“Underwear Bomber,” attempted to blow up an American airliner on December 25, 2009 (Whittell and Fresco 2009). On July 28, 2010, a man became the first Omani attacker when he used a suicide boat to attack a Japanese tanker docked in the United Arab Emirates (Coker 2010). On April 30, 2009, an ethnic Azerbaijani with Georgian citizenship killed 12 people before committing suicide at a university in Baku, Azerbaijan (CNN 2009). He had moved to Azerbaijan four years before the attack (Today.az 2009) and an investigation indicated he was not a lone actor, but was involved in a larger, organized, terrorist operation (Azeri-Press Agency 2010). Later in 2009, another Azerbaijani citizen blew himself up with a grenade in an apparent suicide attack, injuring one (Azeri-Press Agency 2009).

Conservatively, the model predicted 79 percent of the countries with a greater than a “coin toss” (0.50) likelihood of producing attackers; if the nearly successful Umar Farouk Abdulmutallab is included, the figure jumps to 84 percent. Based on these results, the model seems to have real world applicability.

## CHAPTER 4

### DISCUSSION AND CONCLUSION

Those who believe suicide terrorism can be explained by a single political root cause, such as the presence of foreign military forces or the absence of democracy, ignore psychological motivations, including religious inspirations, which can trump rational self-interest to produce horrific or heroic behavior in ordinary people (Atran 2006:144).

There is no one explanation for all suicide attacks or single “necessary” condition for them. Like many human behaviors, they result from a complex interplay of internal and external forces. Prior research has focused on the role of altruism, humiliation, poverty, education, religion, nationalism, and more in suicide missions. This dissertation adds operational sex ratio, young-old ratio, polygyny, percentage of the population that is Muslim, and population size to this list. This section discusses how these factors might interplay to produce suicide attackers and is couched in the notion that a general lack of economic, marriage, and social alternatives leads to suicide missions.

#### Psychology

Populations with higher OSRs are more likely to produce male suicide attackers, a finding anticipated in the curiously titled paper "The Evolutionary Psychological Imagination: Why You Can't Get a Date on Saturday Night and Why Most Suicide Bombers are Muslim" (Kanazawa 2007). The paper suggests that attackers are motivated

by 1) competition between males which is exacerbated by polygyny; and 2) the prospect of 72 virgins in the afterlife.

Kanazawa's paper is speculative and presents no original data, but this dissertation supports his polygyny hypothesis: polygynous countries are more likely to produce suicide attackers, all else equal. High operational sex ratio only adds to the effect of polygyny in reducing the number of available females in these places.

Kanazawa makes what, at times, appear to be outlandish and insensitive statements. He suggests that Muslim suicide attackers are analogous to Western men who spend their Saturday nights home watching pornography. The "Stone Age" minds of these societal and reproductive "losers" do not understand that pixels on a computer screen are not real people or that 72 virgins may not *really* be waiting for them in the hereafter.

It is widely accepted that most humans currently live under evolutionarily novel conditions, yet the pornography analogy seems a stretch. Kanazawa eschews many facts in his argument, among them is that not all places with Muslim majorities and legal polygyny produce suicide attackers; seven of the 22 (32 percent) countries that met both conditions here produced them. This example highlights the recurring problem of over reduction in studies of suicide missions.

Our evolved psychological predisposition to both favor kin and preserve ourselves is a powerful force, but there are situations where other factors overtake rationality: people adopt unrelated children and treat them as they would their own (Gibson 2009); in the West, altruism is a standard component of marriage between unrelated individuals; and friends are more cooperative with each other than strangers (Silk 2003). Populations

with high OSRs, YORs, and polygyny necessarily have relatively high numbers of unmarried men, but that does not mean they are unattached: Atran (2010) and Ricolfi (2005) suggest friendship and peer pressure are key drivers for suicide attackers. Ricolfi (2005), for example, mentions an 11 player soccer team from Hebron that produced eight suicide bombers, suggesting that small group dynamics drive individuals to volunteer for suicide missions.

In militaries all over the world, such bands of brothers form, creating and reinforcing deep emotional bonds between members (Atran 2010). Commitment to one another, in conjunction with the ability for seemingly all humans to dehumanize others based on arbitrary characteristics (*à la* Elliott's classic "Blue Eyes/Brown Eyes" experiment) makes it clear that some are intensely, even easily, motivated to act "irrationally" when sacrificing for comrades. Populations with male-biased OSR have greater numbers of unmarried men, possibly increasing the size of the local "friend pool." Research on the role of friendship in suicide missions is fleeting, mostly because of the difficulty finding suitable subjects, but intergroup competition increases cooperation between male group members in public goods experiments (Van Vugt et al. 2007).

Humans are unique in their ability for high order theory of mind, which gives them the ability to conceptualize and sacrifice for causes far beyond themselves and their kin. They also do irrational things like sacrifice large percentages of their income, disfigure their bodies, and pray to cure diseases rather than seeing a doctor. Clearly, the motivation to sacrifice one's life for a piece of land, or a transcendent political or religious ideal, is predicated on evolved psychological frameworks which are just now being unveiled.

### Economics

A male-biased OSR or lack of reproductive opportunities does not explain all suicide attacks. People gain meaning and purpose from things other than marriage, including work. According to Ricolfi (2005:115), Palestinian suicide missions are often caused by a lack of economic alternatives

In a society in which social life is frozen and horizons and normal careers do not exist, war and the Intifada are not just the only world but the only real *social system*.

[Within this system] the shortest route to the highest position, since it confers prestige and can bestow eternal glory, is indeed that of the martyr.

The real question to ask is: why has glory become so important in Palestine? The answer is as simple as it is disarming: because almost everything else is missing.

From 2000 to 2006, Palestinian unemployment rates and income inequality were correlated with suicide attacks; but not in the most obvious way. When unemployment rose, so did the average age and educational level of suicide attackers (Benmelech et al. 2010). This suggests that Palestinians who might normally be employed are more apt to volunteer for suicide missions when jobless; they are, in turn, better able than less educated and younger attackers to complete their missions (Benmelech et al. 2010). Theoretically, high OSR should increase competition for the types of jobs men do. This competition may be especially fierce where women are limited in the workforce due to gender discrimination. There is surprisingly little literature on the relationship between OSR and unemployment, but a regression analysis using data from the CIA World Factbook (National Foreign Assessment Center (U.S.) and United States. Central Intelligence Agency. 2009) shows no significant relationship in the sex ratio of 15 to 64 year olds and unemployment worldwide ( $n = 195$ ,  $F = 1.92$ ,  $p = 0.167$ ,  $df = 1,193$ ).

Further research into a possible link between OSR, unemployment, and terrorism could be fruitful.

### Politics and Religion

Suicide missions are puzzling, counterintuitive, and people are interested in them. What makes them effective, aside from the capacity to kill, is that they show profound commitment to a cause. It might not be surprising, then, that groups using suicide attacks appear to fall into two camps; those motivated by religion, and those motivated by politics or nationalism: both of which encourage sacrifice and selflessness between likeminded individuals.

Pape's thesis that nationalism causes suicide missions suggests they are caused, in part, by a lack of political autonomy. Less democratic countries are more likely to produce suicide attackers (see Table 2), and this effect holds even after economic and demographic factors like GDP, Gini Coefficient, YOR and OSR are controlled; it fails only after social factors like polygyny and religion are considered. Rather than assuming a single root cause of terrorism, Atran (2010) and others have begun pointing out marked differences between religious and secular perpetrators. Secular groups are motivated by material goals like national and political independence, separation, and revolution (Fine 2008). Religious groups appear to be motivated by these things, and more, because their objectives are couched in spiritual ideals far more transcendent than their secular counterparts. Bin-Laden's stated goals, after all, were to rid the Middle East of Western influence and, secondarily, to return the region to a *Sharia* legal and political system: doing so would require independence, separation, and revolution, both politically and

religiously. This fact circles a point made in the introduction of this paper: it is difficult to say that religion increases a group's propensity to use suicide attacks because there is no non-religious control sample to test the hypothesis that it does, and other factors, like nationalism, appear to motivate people as well (Purzycki and Gibson 2011). While populations with higher proportions of Muslims are more likely to produce suicide attackers, not all of attackers are Muslim, and not all countries with Muslim majorities churn them out. Islam combines religion, culture, politics, and law, making it difficult to distinguish where one begins, another ends, and what influences suicide attacks more. For this reason, it might be best to replace the term "religiously motivated terrorism" with "religiously justified terrorism" as religion seems maximally useful for distinguishing in-group and outgroup affiliations based on transcendent supernatural assumptions. This may give religious groups an edge over secular ones by encouraging prosocial behavior (Sosis and Alcorta 2008), but further investigation is needed to say for sure.

### Demography

Unattached young men are risk takers and populations with relatively high numbers of them are more likely to produce suicide attackers than those without. The finding that OSR increases suicide attacker production supports the notion that a lack of available females leaves more men unoccupied and, perhaps, more open to recruitment and radicalization.

The negative relationship between YOR and suicide attacker production was unexpected and suggests that if male-male competition is a factor in creating attackers, it occurs between age classes, not within them. Cross-culturally, men marry women

younger than themselves (Casterline et al. 1986; Dixon 1971) and populations with relatively large numbers of older men experience a tightening of the marriage market from younger men's perspective. Middle Eastern men marry women averaging about 5 to 10 years their juniors (Casterline et al. 1986); this, coupled with polygyny, leaves large numbers of young men unmarried. In 2007 Saudi Arabia for example, about 40% of men younger than 30 were unmarried compared to about 26% of women; by 35, only about 13% of men and 10% of women were unmarried (United Nations Department of Economic and Social Affairs Population Division 2009). Large marital age disparity and polygyny potentially reverse the tendency for high YOR to propel violence; whether they do is open to further investigation.

### Stopping Suicide Attacks

To generalize, lack of resources for high levels of destruction combined with ample opportunity for low-level and low-risk resistance, an absence of inflammatory rhetoric, and control over the use of violence by local authorities inhibited suicide terrorism (Crenshaw p.147).

Individual, social, and strategic factors all contribute to the use of suicide missions; because of this, a multifaceted approach is needed to stop them. How else can the world allay their appeal? According to Atran (2005), increasing literacy rates and reducing poverty will have no effect on the production of suicide missions and may even encourage the tactic by broadening exposure to radicalism or worsening economic prospects for the middle class if wealth is shifted from their hands. A punitive approach to the problem is also likely to fail because tit-for-tat nature of suicide attacks (Atran 2005). Strategies that might work, in addition to those discussed above, include “addressing and lessening sentiments of grievance and humiliation” and considering

seriously the goals of perpetrating groups, which may mean conceding to them in some capacity (Atran 2005:7; Atran 2010).

Although a singular approach to the issue is unlikely to stop all suicide attacks in all places, things can be done to limit their appeal. Pape advocates “offshore balancing,” or placing military vessels offshore near military hot spots, rather than building traditional military installations and bases. This is consistent with his thesis that the presence of foreign troops on sacred soil is the root cause of suicide missions, but this would not stop all attacks because not all attacks are caused solely by the presence of foreign troops on sacred soil. Atran suggests “changing the motivations of potential recruits, disrupting sponsors’ organizations, and undermining popular support” in order to mitigate suicide missions (Atran 2006:142).

Suicide missions require social support, and those that fail to tailor themselves to local *mores* fail (Bloom 2005). Turning people against them might be possible through marketing. To combat the exaltation of suicide “martyrs,” concerted efforts might be made to show the murderous nature of each attack. A gruesome but effective way to do this might involve publicizing images of children or elderly people killed during suicide attacks.

Profiling, racial and criminal, is a controversial means of stopping terrorism. The problem with profiling should be familiar to any anthropologist; while operatives in small cells may be similar, there are large between group differences, making profiling difficult (Atran 2006). This paper does not show that Muslims are more likely to be suicide attackers, but it does show that countries with higher percentages of Muslims are more

likely to produce them. This important distinction means analysts might do best to look at the countries of origin of potential threats rather than their religions.

Decreasing OSR, tempering polygyny, and decreasing YOR may curb suicide missions. OSR could be decreased naturally by encouraging parental solicitude toward females, or artificially by removing some males from the population through mandatory conscription or emigration (Cincotta 2004). Many might return, but a two or three year absence would effectively remove them from the marriage pool; and, at any one time, fewer men would compete for reproductive opportunities. The two year missionary requirement for members of the Church of Latter Day Saints is conceivably a remnant of the church's polygynous past. Less attractive options for reducing OSR include decreasing parental solicitude for males, or repressing them outright (the latter idea is from Cincotta 2004).

Polygyny has deep religious, social, cultural, and political roots, and it may be difficult or impossible to slow absent massive intervention. Despite this, cross-cultural data show that polygyny is significantly associated with high pathogen stress in state level societies in addition to male mortality in warfare in nonstate societies (Ember et al. 2007). Lowering the number of deaths caused by violence and disease may then decrease instances of polygyny and open the marriage market up to young men, resulting in fewer willing to participate in suicide missions.

Manipulating YOR presents a serious issue: While high values are associated with violence and civil war (Cincotta et al. 2003b; Mesquida and Weiner 1999), low values are linked with suicide attacker production. Civil war kills far more people than suicide attacks, however, so a strategy lowering YOR would net many more saved lives than one

raising it. According to Cincotta et al. (2003b) reducing YOR is possible by promoting demographic transitions through family planning, HIV and AIDS education and awareness, and improving women's educational economic, and legal status.

### Conclusion

One of the most striking things about suicide missions is their relative infrequency; the tactic grabs headlines, but is still uncommon. Over the 26 years sampled here, 1,208 people died as suicide attackers; yet the Global Terrorism Database (2011) reports 70,512 terrorist incidents over the same period. These suicide attacks claimed at least 12,328 lives, making the odds of dying in such a tragedy roughly 1 in 500,000. For comparison, the odds of a US citizen dying from a lightning strike in 2007 were nearly six times this (National Safety Council 2011). This back of the envelope calculation is not meant to diminish the significance of these deaths: it is meant to show how unlikely they are.

This dissertation found a link between OSR, YOR, polygyny, Islam, population size, and whether a country produced suicide attackers from 1981 to 2007. A relationship was also found in the number of attackers produced by a country and polygyny rates, Gini Coefficient, Democracy Index, and GNP. Earlier work found that the presence of foreign troops on sacred soil, religion, nationalism, societal support and economic opportunities all appear to play some role in generating suicide attackers. Future researchers should incorporate OSR, polygyny, and possibly YOR in their analyses. A study including these demographic variables, along with a measure of economic

opportunity, and a variable for foreign presence on ethnic or sacred soil would be the best treatment of suicide attacks yet.

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