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THE IMPORTANCE OF MENTAL HEALTH CONSEQUENCES IN TERRORISM RISK ASSESSMENT

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Managing public responses to terrorism is a particularly challenging pursuit. While the field shares the challenges of hidden actors, evolving tactics, and uncertain policy measures with the field of criminal justice, it has additional challenges in the extreme nature of the events, both in terms of scale and unlikeliness. Still, understanding the threat of terrorism is an important first step to adopting appropriate security measures. (Willis 2005, Willis 2007, Rose 2009)

The level of attention that terrorism gets from the government and the public doesn't match with expert assessments of the risk. Most assessments of terrorism suggest that the average number of deaths per year is small, numbering in 10s per year in developing countries. (Willis 2007; Mueller and Stewart 2011; 2012; Weiss 2015; Sageman 2016) For advanced economies such as the United States, terrorism kills relatively few people per year on average and has little economic damage compared to more commonplace risks. (Beall 2006; Peleg et al. 2011; Meierrieks and Gries 2013; Stewart and Mueller 2013; Gaibulloev, Sandler, and Sul 2014; Arce 2019) This is hard to reconcile with the political concern over terrorism. In the 20 years since 2001, terrorism has been viewed by the public as one of the biggest concerns. (Pew Research Center 2016) Some experts even describe terrorism as an existential threat, focusing on the potential for a massively disruptive attack with a weapon of mass destruction. (Ignatieff 2004; Allison 2005; Partnership for a Secure America 2008; Torres 2018)

To some extent, this reflects the public overestimating the risk of terrorism. There is a well-established literature documenting the heuristics that bias public perceptions of risk. Kahneman describes how there are two ways of thinking about risk—slow, deliberative, analytical perceptions used by experts and fast, instinctual, emotional perceptions used by the public. (Kahneman 2011) Thinking using this "fast" approach overestimate very rare risks, risks that are unknown, and risks associated with dreaded characteristics. (Fischhoff, Slovic, and Lichtenstein 1982; P. Slovic 1987; Brun 1992; P. Slovic and Weber 2002; Paul Slovic et al. 2004; McMorrow 2009)

Risk analysts are more likely to focus on quantitative methodologies and that can be limiting in examining terrorism. (Fischhoff, Slovic, and Lichtenstein 1982; Lazo, Kinnell, and Fisher 2000; Kahneman 2011) As psychological harms are hard to quantify, it is often overlooked. A National Academy of Sciences panel noted that most risk analyses used by DHS focus either on a single consequence (usually lives lost) or combine multiple consequences into a single factor (usually in terms of dollars). (Committee to Review the DHS's Approach to Risk Analysis and National Research Council of the National Academies 2010) Mental health concerns are often not included, either because they are difficult to measure, difficult to collect, or difficult to integrate into a single measure. This is an important concern. The defining aspect of terrorism is terror. As the intended audience of a terrorist attack are those who view the attack, the physical harm is not the point. Terrorism is asymmetrical, where terrorists use fear to affect change when their actual effects cannot. While the actual physical aspects of terrorism are accordingly small, the psychological aspects are significantly more important.

This paper will attempt to estimate the extent to which psychological harms drive the consequences of one type of terrorist event- bombings.

Literature

The psychological harms associated with terrorism present an important but underexplored area of study. In their list of 150 un- and under-researched terrorism topics, Schmid and Forest identify on several issues associated with terrorism and the public, including the impact of terrorism on various

segments of the population and psychological and economic consequences for actors other than the direct victims. (Schmid and Forest 2018)

This does not mean that the psychological consequences of terrorist attacks have not been studied. Examinations of the psychological repercussions of terrorist events have flourished since the events of Sept. 11th. It is recognized that psychological consequences are a normal part of the grieving process, although more severe conditions can develop both in general and in specific, more highly exposed sub-populations. In their meta-analysis of studies of mental health and terrorism, Paz Garcia-Vera et al. identified 599 mental health-relevant articles from 1990 to 2014. (Paz García-Vera et al. 2016) This literature is sufficiently developed to support multiple meta-analyses on specific harms, including PTSD (DiMaggio and Galea 2006, Neria et al. 2008, Paz García-Vera et al. 2016), depression (DiMaggio and Galea 2006, Salguero et al. 2011), and substance abuse (DiMaggio et al. 2009) as they relate to terrorism. Some research has even considered the mental health effects among the public reached indirectly through media exposure or other means. (Galea and Maxwell 2009) Hopwood and Schutte considered 18 studies in a meta-analysis of mediated exposure to violent events, finding that media exposure to an event of large-scale violence led to large-scale negative effects on mental health. (Hopwood and Schutte 2017)

However, there is still much to be studied to make this literature policy-relevant. This literature is largely clinical, identifying the prevalence of mental health consequences in isolation. This research is limited in that it is heavily biased towards Western concerns and a strong plurality deal with the events of Sept. 11th itself, an outlier event. Research on the effects of smaller events is far less common.

Methods

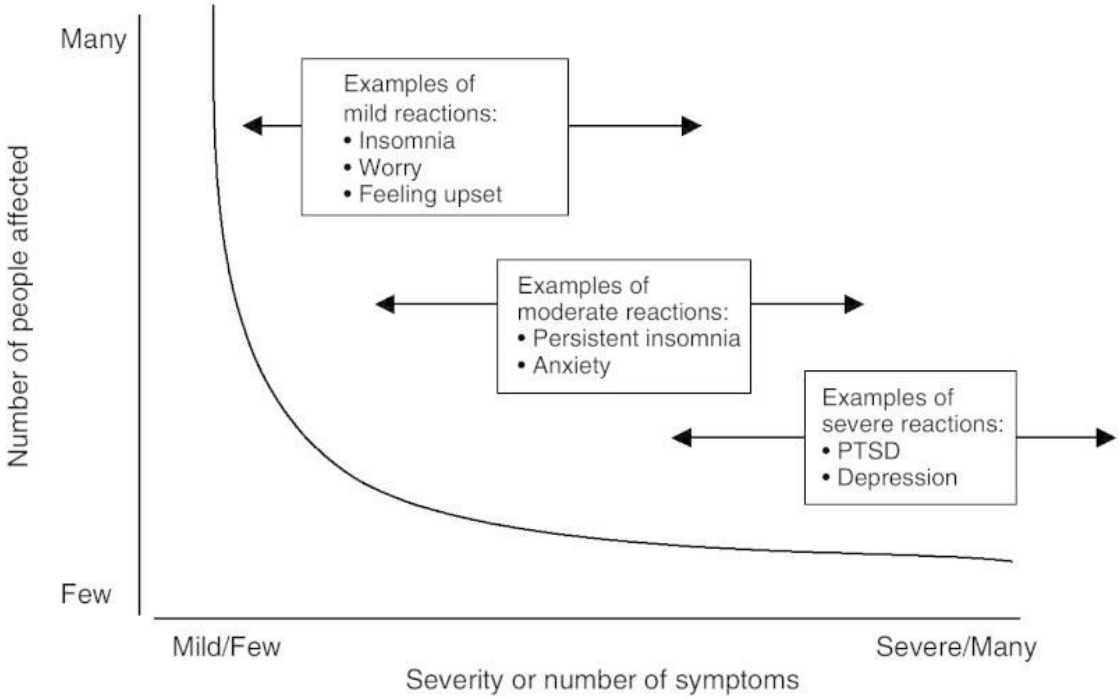
This paper follows the approach of Arce (2019). (Arce 2019) Arce considered the harms for a generalized terrorist attack using a number of different scenarios. The use of scenarios allowed Arce flexibility in the estimates of risk; rather than estimating the most likely expected value, he presented a range of plausible estimates. Unlike most considerations of homeland security risk, Arce did not only consider the lives lost from a bombing but expanded the consideration to those who were injured. His estimates included not only physical harms but psychological ones as well. However, those psychological harms were identified only for those victims that were at the location and only PTSD and severe depressive disorder were included.

Five Harms

This research includes psychological harms as well as physical injuries and deaths. National Academies of Science describes a distribution of harms associated with terrorism events (Figure 1). PTSD and severe depressions are the most harmful but are only one concern. Many people have milder reactions. Research has focused largely on those severe reactions—they are more noticeable and, due to their severity, viewed as more important and therefore attract more attention. However, there are so many more people experiencing mild reactions that their consequences should not be overlooked. The total harm for a level of severity is the amount of harm at that level times the total number of people at that level. (For instance, the total harm associated with severe reactions would be the number people with severe reactions times the amount of harm per person). At one extreme, the harm is great but the number of people is small; at the other extreme, the harm is small but the number of people is extreme. This makes it unclear which population represents a greater amount of harm-- the many people with

minor reactions or the few people with large reactions. In this research, I identify five types of harm: death, injury, severe psychological harm, moderate psychological harm, and mild psychological harm.

Figure 1- Theoretical Distribution of Mental Health Harms from Homeland Security Events (from National Academies, 2003)



Quantifying the amount of harm is done using Disability-Adjusted Life Years Lost (DALLs). This is a common approach in Burden of Disease studies and Cost Benefit Analyses that use them. Each condition is represented by a level of harm associated with life function lost. Death is an all or nothing condition; death is a complete loss of function so its Disability Weight (DW) is 1 (complete loss). A spinal cord lesion involves only a partial loss of function and its DW is 0.589. Estimated DW for these and other conditions, including mental conditions, are drawn from well established research. (Salomon et al. 2015; Arce 2019) The DW per year is multiplied by the number of years of harm to generate the Disability-Adjusted Life Years Lost.

Five Subpopulations

The amount of harm per person needs to be multiplied by the number of people with that condition. However, it is not clear how many people are in these severe, moderate, or mild categories. If we were to know the shape of this distribution of harm then we could calculate the total harm as the area under the curve but we do not know the shape of this distribution. The distribution put forward by the National Academies of Sciences panel is only descriptive; we do not know how many people have severe, moderate, or mild reactions respectively for events.

Identifying the amount of harm and the number of people having that amount of harm is another challenge. Only a very few events have been studied enough to have estimates at multiple levels and these represent extreme events (such as Sept. 11th) and may not be useful to describe a distribution representative of most events. Instead of understanding the distribution of harm for the overall population, studies tend to focus on subpopulations. The mental health consequences for those who

were in Manhattan on September 11th, 2001 are very different from the mental health consequences of those who were in other parts of the nation. As a result, psychological studies tend to examine coherent subpopulations rather than the nation at large.

This research follows this perspective in identifying subpopulations that have been studied to identify specific harms. Arce focused his consideration on those who had been victims of the attack, not the members of general public. While this was an important advance in the research, it is not enough. Having an estimate for only severe reactions for people who were present and had a physical injury omits the overwhelming number of cases. Terrorism is performative violence, where the psychological impact is directed not at those victims who were targeted but at the general population; omitting the general population will miss the larger picture. Five specific subpopulations were identified for use in this study: present victims, present non-victims, rescue workers, non-present friends and family, and non-present people exposed only through the media.

Table 1- Categories of Harm for Terrorist Attacks including Psychological Harms

Deaths		N/A	N/A	N/A	N/A
Physical		N/A	N/A	N/A	N/A
Mental Severe					
Mental Moderate					
Mental Mild					
	Present victims	Present non-victims	Semi-present, Rescue Workers	Not present, friends and family	Not present, mediated

Seven Cases to Describe Bombings

This research estimates the amount of psychological harm for the population for seven different cases. This follows the approach of Arce in the use of cases to distinguish between different kinds of threats. Examining the harm across a range of plausible scenarios allows this research to reflect the inherent uncertainties in these estimates. While this research will try to adopt appropriate parameters, to some extent these parameters are highly uncertain and any single point estimate is vulnerable to being overly precise.

As an initial step, I adopted six bomb scenarios used by Arce—confined space, open space, suicide, vehicle delivery, structural collapse, and structural fire. These were used to present a consistent picture with Arce. I added a seventh scenario reflecting the attacks of Sept. 11th, 2001 as well. Given the fat-tailed distribution around terrorist fatalities, extremely rare but high consequence attacks are important to understanding terrorism risk and should therefore be included.

Data

This research involves the integration of an extensive number of papers from the psychological literature. Many papers have examined the psychological harm associated with a particular condition in a particular subpopulation associated with a particular event.

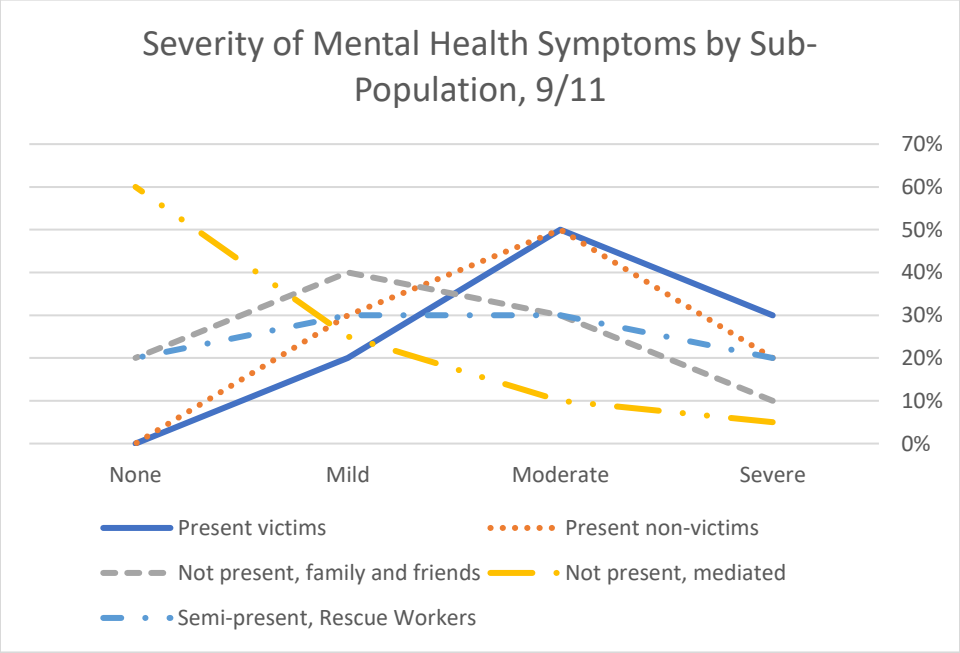
I draw on the wider psychological literature to get estimates for the distribution of harms in a given subpopulation. In the surviving victims population, I rely on Arce. (Arce 2019) DiGrande et al (2011) followed up with people who were in the WTC towers but who successfully evacuated. Among those

people, 95.6% had at least one symptom of PTSD and 15% were viewed as likely to have levels reaching a diagnosis for PTSD 2-3 years after the attack. (DiGrande et al. 2011)

In addition to victims, there are rescue workers. They were physically present but not necessarily under direct threat. They were exposed to more trauma than the general population but they were also more prepared for it, more resilient. I drew on Mao et al.'s review of nine articles that considered psychological consequences for nonprofessional volunteer rescue workers.(Mao et al. 2018) Overall, they found a range of concerns, of which PTSD was the most prevalent.

Members of the public can also be exposed to psychological trauma if they know about it. Neria et al. (2011) conducted a review of studies for psychological issues related to 9/11 an found that the rates for stress reactions varied based on the amount of time that passed since the event. Studies were found that reported a stress reaction for up to 44% of the public a month or two after the event to 5.8% six months after. (Neria, DiGrande, and Adams 2011; Schuster et al. 2001; Silver et al. 2002)

Figure 2- Distribution of Psychological Harm by Sub-Population for Sept. 11th



Overall, the estimates of psychological harm for the general population do follow the theoretical distribution laid out by the National Academies, with most people having no symptoms, some having mild symptoms, and progressively fewer and fewer having moderate or severe symptoms. This is not true of those who were targeted in the attack; both those who were physically injured and those who were not experience higher psychological trauma when they were targeted.

Results

Using these estimates, I find that the total harms have increased substantially. The approximately 3000 deaths of Sept. 11th represent 120,000 years of life lost. However, the harm associated with the mental health harms was an order of magnitude higher. While the harm experienced by a dead individual

certainly outweighs the harm experienced by an individual who saw the events on television, there were so many members of the public that the harms add up.

Table 2- Disability Adjusted Life Years Lost for Harms in Seven Scenarios

	Confined Space	Open Space	Suicide	Vehicle	Collapse	Fire	9 11
Deaths	160	40	760	200	840	160	120000
Physical Injuries	250	65	280	90	190	255	50000
Mental Severe	865	772	1061	801	948	1030	1859600
Mental Moderate	1188	1117	1355	1131	1259	1329	1215760
Mental Mild	1518	1512	1533	1515	1525	1531	228710

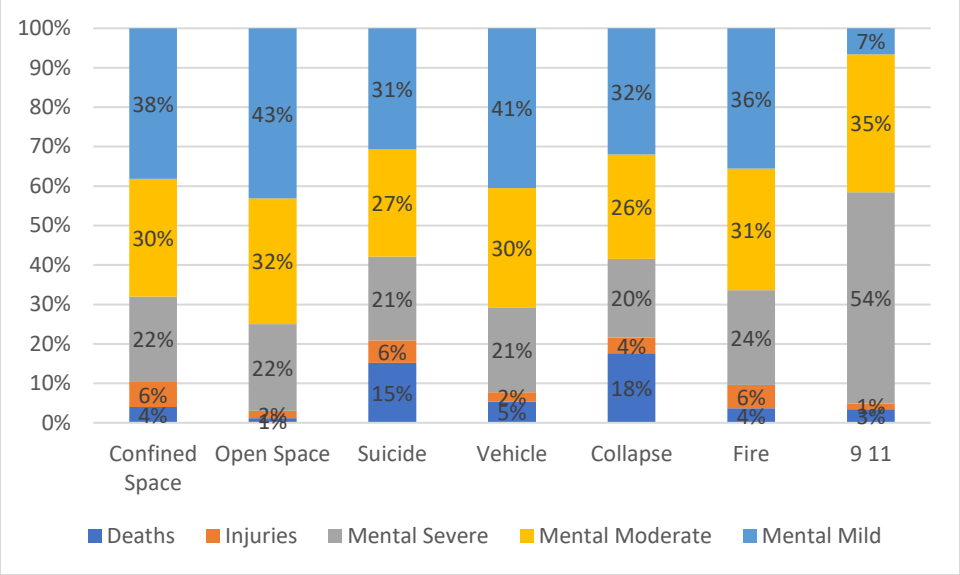
This led to a significant increase in the amount of physical harms associated with terrorism. When consequence estimates expanded to include psychological harms and include the public, the harms were between 6 and 90 times larger than estimates based on deaths alone. If rare events like Sept. 11th are the driving factor for risk assessments then excluding psychological harms could cause risk analysts to overlook nearly all of the consequences of terrorism and significantly underestimate the risk.

Table 3- Harm Multipliers for Including Mental Health and Public Aspects of Risk

	Confined Space	Open Space	Suicide	Vehicle	Collapse	Fire	9 11
MH to Deaths	22.31538	85.04175	5.196197	17.23425	4.443679	24.31313	27.53392
MH to Phys	8.708439	32.39686	3.797221	11.88569	3.623971	9.373735	19.43571
All to Deaths	24.87788	87.66675	6.564618	18.68425	5.669869	26.90688	28.95058
All to Phys	9.708439	33.39686	4.797221	12.88569	4.623971	10.37373	20.43571

The types of psychological harms that contributed the most varied from scenario to scenario. For Sept. 11th, severe mental health consequences to were the largest contribution to harm, representing 53% of total harm. Mild psychological harms only represented 7% of the harm associated with Sept. 11th. These percentages did not hold for lesser events, however; at the other extreme, mild psychological harms were a greater contributor to harms (43% to 22%) for open space bombings as well as other less severe events.

Figure 3- Distribution of Harms Associated with Different Scenarios



The extent to which the harm was felt by the subpopulations varied. In all cases, the harm was most felt by the general public. While the harm to any individual member of the public was less than the harm to an individual member of any of the other populations, there were so many members of the public that the harms added up. The actual victims of the attack experienced between 4% and 23% of the harm while members of the general public experienced between 61% and 92% of the harm. This is consistent with the idea that terrorism is performative violence with violence used not as an end in itself but as a means to terrorize the wider population.

Table 4- Extent to Which Subpopulations Experienced Consequences

	Confined Space	**Open Space**	**Suicide**	**Vehicle**	**Collapse**	**Fire**	**9 11**
Present Victim	13%	4%	23%	9%	23%	12%	5%
Present Non-victim	2%	2%	3%	1%	2%	4%	0%
Responders	2%	2%	3%	4%	3%	3%	1%
Friends and Family	7%	5%	9%	4%	7%	10%	2%
General Public	77%	88%	62%	82%	65%	71%	92%

Discussion

Overall, we find that the results of these estimates are consistent with what is known about terrorism. Terrorism is known to be not a weapon to cause damage but to cause fear; this assessment of terrorism risk shows that the physical consequences of terrorism are only the tip of the iceberg. The psychological consequences of terrorism in this research are much greater than the physical consequences.

Additional research is needed to understand these psychological harms. There is a well-developed literature looking but more needs to be done to bring these studies into comparative risk assessment. The most serious consequences for the most serious events are examined but more needs to be done for the harms associated with lesser harms and/or lesser events. There are a range of questions that

need to be answered—do the psychological consequences relate to the size of the event? As more events happen, do we become accustomed to them and thus have less effect, or do the traumas build up over time and thus have more effect? What are the psychological effects to not only the victims but the general public for other homeland security events such as tornadoes, earthquakes, etc.?

There are several ramifications of these findings. First, psychological consequences need to be included in assessments of terrorism risk. Risk analyses by and large do not include the terror felt by the general public even though this is the defining aspect of terrorism. There are some risk assessments that include terrorism—the THIRA process includes psychological impact using five qualitative levels—but these are rare and not presented in a way that is comparable to physical consequences. These assessments also need to consider attention to the consequences to the general public. The fact that consequences are bigger for the general public than for the victims of the attack is politically incorrect to be sure; no one wants to hear that the deaths from terrorism are just a small fraction of the anxiety of all of us who have to watch it but it is true nonetheless. As the public psychological consequences of terrorism are so much greater than the physical consequences, omitting those psychological consequences is omitting the most important aspects of terrorism risk.

This change in focus from physical damage to psychological damage also presents different options for risk reduction activities. A typical approach to addressing terrorism risk is to reduce the likelihood of an attack succeeding either through interdiction, deterrence, or other means. This directly reduces the risk associated with physical consequences of an attack but if this is just a small portion of consequences then reducing the likelihood may not substantially reduce the risk. If the psychological consequences are strongly correlated with the physical consequences (i.e., if psychological damage is necessarily larger when the attacks are bigger) then reducing the likelihood may also reduce the psychological consequences but more research is needed to know if this is true.

Either way, another approach could be to focus on psychological harms directly. This shift in perspective is related with the change in focus from protection to resilience that occurred in homeland security around 2010 but only those aspects of psychological resilience. More can be done to address the mental health of the public before, during, and after events. This may involve more resources for generalize mental health or specific mental health preparedness.

Other approaches could also be useful to attenuate psychological harms. Here are some examples:

- Censorship: as most of the psychological harm comes from the mediated exposure of the general public, stopping such exposure would attenuate the harms. While the U.S. cannot censor the media, there are aspects of self-censorship that are already done including television avoiding showing the most traumatic aspects of events and providing trigger warnings are two examples.
- Speed of restoration: the United States treats terrorist scenes as crime scenes, secured and maintained in order to identify evidence for trial. Israel, by contrast, seeks to restore an attack site in an expeditious manner to restore a sense of normalcy.
- Framing an event: the prominent message following Sept. 11th was “Never Forget”. While it is reasonable to memorialize those killed it is counterproductive from a psychological perspective. Compare this with the framing following the Boston bombings of “Boston Strong”. This approach focused on the strength and resilience of the community. The stories that people tell

themselves about the event has as much to do with how it is remembered as what actually happened.

- Security theater: There is a perception that the Transportation Security Administration miss too many weapons at airport checkpoints to be effective at stopping terrorism. There may be other justifications (such as deterrence or substitution of methods) by which the TSA may be justified but this perception of security theater still exists. But even if the TSA checkpoints were only theater, the perception of safety could attenuate psychological harms.

There are activities that can be done in every stage of the homeland security cycle to address psychological harms. At the same time, other measures taken to reduce physical harms may also have the effect of amplifying psychological harms. Policies that attempt to reduce terror should be prioritized over those policies that just attempt to reduce terrorism.

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Appendix Tables

Table 5- Disability Weights

	DW
Deaths	1
Injuries	0.5
Mental Severe	0.4
Mental Moderate	0.13
Mental Mild	0.01

Table 6- Estimated Population Exposed

	Confined Space	**Open Space**	**Suicide**	**Vehicle**	**Collapse**	**Fire**	**9 11**
Present Victim	54	14	75	23	59	71	13000
Present Non-victim	100	100	224	72	152	204	20000
Responders	200	200	400	400	400	400	30000
Friends and Family	1040	640	1870	590	1350	1730	230000
General Public	3000000	3000000	3000000	3000000	3000000	3000000	180000000

Table 7- Portion of Population Experiencing Harm Confined Space

Confined Space	**Present victims**	**Present non-victims**	**Semi-present, Rescue Workers**	**Not present, friends and family**	**Not present, mediated**
Mental Severe	30%	20%	10%	10%	0.1%
Mental Moderate	50%	50%	20%	30%	1%
Mental Mild	20%	30%	30%	40%	10%
None	0%	0%	40%	20%	89%

Table 8- Portion of Population Experiencing Harm Open Space

Open Space	**Present victims**	**Present non-victims**	**Semi-present, Rescue Workers**	**Not present, friends and family**	**Not present, mediated**
Mental Severe	30%	20%	10%	10%	0.1%
Mental Moderate	50%	50%	20%	30%	1%
Mental Mild	20%	30%	30%	40%	10%
None	0%	0%	40%	20%	89%

Table 9- Portion of Population Experiencing Harm Suicide Bomber

Suicide	**Present victims**	**Present non-victims**	**Semi-present, Rescue Workers**	**Not present, friends and family**	**Not present, mediated**
Mental Severe	30%	20%	10%	10%	0.1%
Mental Moderate	50%	50%	20%	30%	1%
Mental Mild	20%	30%	30%	40%	10%
None	0%	0%	40%	20%	89%

Table 10- Portion of Population Experiencing Harm Vehicle Bomb

Vehicle	**Present victims**	**Present non-victims**	**Semi-present, Rescue Workers**	**Not present, friends and family**	**Not present, mediated**
Mental Severe	30%	20%	10%	10%	0.1%

Mental Moderate	50%	50%	20%	30%	1%
Mental Mild	20%	30%	30%	40%	10%
None	0%	0%	40%	20%	89%

Table 11- Portion of Population Experiencing Harm Structure Collapse

Collapse	**Present victims**	**Present non-victims**	**Semi-present, Rescue Workers**	**Not present, friends and family**	**Not present, mediated**
Mental Severe	30%	20%	10%	10%	0.1%
Mental Moderate	50%	50%	20%	30%	1%
Mental Mild	20%	30%	30%	40%	10%
None	0%	0%	40%	20%	89%

Table 12- Portion of Population Experiencing Harm Structure Fire

Fire	**Present victims**	**Present non-victims**	**Semi-present, Rescue Workers**	**Not present, friends and family**	**Not present, mediated**
Mental Severe	30%	20%	10%	10%	0.1%
Mental Moderate	50%	50%	20%	30%	1%
Mental Mild	20%	30%	30%	40%	10%
None	0%	0%	40%	20%	89%

Table 13- Portion of Population Experiencing Harm 9/11

9 11	**Present victims**	**Present non-victims**	**Semi-present, Rescue Workers**	**Not present, friends and family**	**Not present, mediated**
Mental Severe	30%	20%	20%	10%	5%
Mental Moderate	50%	50%	30%	30%	10%
Mental Mild	20%	30%	30%	40%	25%
None	0%	0%	20%	20%	60%

Table 14- Disability Adjusted Life Years Lost Confined Space

Confined Space	**Present victims**	**Present non-victims**	**Semi-present, Rescue Workers**	**Not present, friends and family**	**Not present, mediated**
Physical	410				
Mental Severe	60	40	40	124.8	600
Mental Moderate	32.5	32.5	26	121.68	975
Mental Mild	1	1.5	3	12.48	1500
None	0	0	0	0	0

Table 15- Disability Adjusted Life Years Lost Open Space

Open Space	**Present victims**	**Present non-victims**	**Semi-present, Rescue Workers**	**Not present, friends and family**	**Not present, mediated**
Physical	105				
Mental Severe	15.6	40	40	76.8	600
Mental Moderate	8.45	32.5	26	74.88	975
Mental Mild	0.26	1.5	3	7.68	1500
None	0	0	0	0	0

Table 16- Disability Adjusted Life Years Lost Suicide Bomber

Suicide	**Present victims**	**Present non-victims**	**Semi-present, Rescue Workers**	**Not present, friends and family**	**Not present, mediated**
Physical	1040				
Mental Severe	67.2	89.6	80	224.4	600
Mental Moderate	36.4	72.8	52	218.79	975
Mental Mild	1.12	3.36	6	22.44	1500
None	0	0	0	0	0

Table 17- Disability Adjusted Life Years Lost Vehicle Bomb

Vehicle	**Present victims**	**Present non-victims**	**Semi-present, Rescue Workers**	**Not present, friends and family**	**Not present, mediated**
Physical	290				
Mental Severe	21.6	28.8	80	70.8	600
Mental Moderate	11.7	23.4	52	69.03	975
Mental Mild	0.36	1.08	6	7.08	1500
None	0	0	0	0	0

Table 18- Disability Adjusted Life Years Lost Structure Collapse

Collapse	**Present victims**	**Present non-victims**	**Semi-present, Rescue Workers**	**Not present, friends and family**	**Not present, mediated**
Physical	1030				
Mental Severe	45.6	60.8	80	162	600
Mental Moderate	24.7	49.4	52	157.95	975
Mental Mild	0.76	2.28	6	16.2	1500
None	0	0	0	0	0

Table 19- Disability Adjusted Life Years Lost Structure Fire

Fire	**Present victims**	**Present non-victims**	**Semi-present, Rescue Workers**	**Not present, friends and family**	**Not present, mediated**
Physical	415				
Mental Severe	61.2	81.6	80	207.6	600
Mental Moderate	33.15	66.3	52	202.41	975
Mental Mild	1.02	3.06	6	20.76	1500
None	0	0	0	0	0

Table 20- Disability Adjusted Life Years Lost 9/11

9 11	**Present victims**	**Present non-victims**	**Semi-present, Rescue Workers**	**Not present, friends and family**	**Not present, mediated**
Physical	170000				
Mental Severe	12000	8000	12000	27600	1800000
Mental Moderate	6500	6500	5850	26910	1170000
Mental Mild	200	300	450	2760	225000
None	0	0	0	0	0